Brain and Spine 4 (2024) 103334

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Abstracts of the EANS2024

801

Brain and Spine 4 (2024) 103335

Best Abstract: Structural connectivity of nucleus basalis Meynert stimulation in Alzheimer's disease patients

Pablo Andrade [1], Rabea Schmahl [1], Ricardo Louçao [1], Petra Heiden [1], Juan Baldermann [1], Jens Kuhn [1], Veerle Visser-Vandewalle [1]. [1] *University Hospital Cologne, Cologne, Germany*

Neuromodulation - new advances and indications (Functional Plenary Session), October 14, 2024, 11:00 AM - 12:40 PM

Background: The nucleus basalis Meynert (nbM) contains a large population of cholinergic neurons that project their axons to the entire cortical mantle, the olfactory tubercle, and the amygdala. Its degeneration has been linked to dementia-related disorders like Alzheimer's disease (AD). Since the nbM neuronal loss is not homogeneous and its projections differ depending on the different anatomical divisions within the nbM, we aimed to analyze the network profiles based on the stimulation site and clinical outcome in AD patients that underwent deep brain stimulation (DBS) surgery.

Methods: We analyzed the data of 11 AD patients operated at the University Hospital Cologne for nbM DBS. Clinical data was obtained before surgery and 6, 12 and 18 months postoperatively, including stimulation parameters and cognitive tests Mini-Mental Status Test (MMST) and Alzheimer's Disease Assessment Scale Cognitive Behavior Section (ADAS-cog). For the connectivity analysis, the nbM was segmented following its histological subdivision into anterior, intermediate and posterior as well as medial and lateral for both hemispheres. After this, we calculated the volume of tissue activated and tractography analysis using a normative connectome.

Results: The majority of fibers were located in the intermediate-lateral (IL) subdivision with 43%, followed by the anterior with 10% and the posterior with 4%. For the anterior region, 39% of the fibers projected to the orbitofrontal cortex (OFC), 27% to the dorsolateral prefrontal cortex (DL-PFC), 20% to the temporal region (TR), and 7% to dorsomedial PFC (DM-PFC). For the posterior region, 10% of the fibers projected to OFC, 7% to the DL-PFC, 15% to the TR, and 5% to DM-PFC. For the IL, 33% of the fibers projected to the DL-PFC, 27% to the OFC, 33% to the TR, and 9% to DM-PFC. In each case where the anterior-intermediate-lateral and posterior-intermediate-lateral regions were stimulated, the majority of fibers projected to the fornix and hippocampus. After 18 months, anterior bilateral regions showed a significant clinical negative correlation, while posterior bilateral regions showed a significant positive correlation meaning a slower cognitive deterioration.

Conclusions: Intermediate-lateral stimulation showed a higher connectivity to DL-PFC, DM-PFC and OFC areas simultaneously when compared to anterior and posterior regions. The fornix that has also been used as a DBS target for AD, could be modulated with nbM DBS. DBS of the nbM posterior regions showed a positive correlation associated with a better cognitive outcome.

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559

Brain and Spine 4 (2024) 103336

Best Abstract: Right-sided VNS in epilepsy: an international multicentre review of 27 cases with special focus on safety/efficacy

Marc Zanello [1], Željka Petelin Gadže [2], Goran Mrak [2], Guillaume Penchet [3], Ramesh Chelvarajah [4], Alessandro De Benedictis [5], Riccardo Fornaro [6], Masaki Iwasaki [7], Keiya Iijima [7], Elena Jiltsova [17], Sami Barrit [8], Alessandro Moiraghi [1], Marc Guenot [9], Jason Labuschagne [10], Alexandre Rainha Campos [11], Herbert Rooijakkers [12], Riëm El Tahry [12], Tatiana Von Hertwig Fernandes De Oliveira [13], Amelia Alvarez-Sala [14], Cristina V. Torres [14], Berthold Voges [15], Johan Pallud [1], Romain Carron [16]. [1] *Université Paris Cité, PARIS, France;* [2] *University of Zagreb, ZAGREB, Croatia;* [3] *Université de Bordeaux, BORDEAUX, France;* [4] *University of Birmingham, Birmingham, United Kingdom;* [5] *Bambino Gesù Children's Hospital, ROMA, Italy;* [6] *University Hospital "Maggiore Della Carità", Novara, Italy;* [7] *National Center of Neurology and Psychiatry, Tokyo, Japan;* [8] *Free University of Brussels, Brussels, Belgium;* [9] *Université de Lyon, LYON, France;* [10] *University of the Witwatersrand, Johannesburg, South Africa;* [11] *University of Lisbon, Lisbon, Portugal;* [12] *Catholic University of Louvain, Brussels, Belgium;* [13] *Hospital Universitário Cajuru, Curitiba, Brazil;* [14] *Hospital Ruber International, Madrid, Spain;* [15] *Protestant Hospital Alsterdorf, Hamburg, Germany;* [16] *Université Aix-Marseille, Marseille, France;* [17] *Uppsala University, Uppsala, Sweden*

Neuromodulation - new advances and indications (Functional Plenary Session), October 14, 2024, 11:00 AM - 12:40 PM

Background: Vagal nerve stimulation (VNS) was FDA-approved and CE-marked exclusively on the left side. Vagal branches from each side of the neck serve the heart asymmetrically. In dogs, the stimulation of right vagus nerve subserving the sino-atrial node causes bradycardia which has raised safety concerns for right-sided implantation in humans, even though vagal cardiac innervation varies significantly across species. In rodent epilepsy models, VNS reduced induced generalized seizure severity regardless of the side of electrode implantation According to our recent literature review (Seizure, in press) only 7 right-sided (RS) VNS cases have been reported in human patients so far without conspicuous safety or efficiency concerns. During VNS meetings, it came to our knowledge that many neurosurgeons had in fact implanted one or a few right-sided cases for various reasons. The aim of this study was thus to collate, as exhaustively as possible, all RS-VNS cases implanted worldwide with a special focus on outcome and potential side-effects.

Methods: Screening of VNS expert neurosurgeons with regard to their personal experience with RS-VNS cases was carried out by email. Experts to be reached out to were identified through Livanova database, a previous multicenter trial and literature review. Experts alleging experience with RS-VNS and willing to take part in the study were asked to complete an anonymized .xls spreadsheet comprising 38 items. Main aspects investigated pertained to the etiology of epilepsy, the reason for right-sided implantation and safety/efficacy.

Results: Among the 131 experts from 31 countries who were sent the emails; 39 answered. 18 responded positively. Out of these 18 positive responses, 14 experts from 12 countries reported 27 cases (mean: 2 [1-7], 12 females). The most frequent indication for VNS was combined generalized and focal epilepsy (13 on 27 cases). Twenty-two patients had previously been implanted at earlier revision on the left side. The main reason for RS-VNS were: 13 cases of lead failure, 7 cases of local anatomical contraindications, 5 cases of postoperative infection. Twenty-three patients were investigated with regard to cardiac function prior to the RS-VNS: 10 had an EKG, 8 were investigated with 24h Holter-EKG, 1 had cardiac ultrasonography and 4 with both EKG and Holter-EKG. 2 patients presented postoperative cardiac side-effects. Mean reduction of seizure frequency under RS-VNS was 57.7 + /-17.5%. Out of the 22 patients in whom the clinical efficacy was reported, 19 had a similar benefit, one a worse improvement and two patients had better improvement under RS-VNS.

Conclusions: This multicenter review demonstrates that the current literature significantly underestimates RS-VNS and seems to suggest the absence of an increased risk in terms of cardiac side-effects. Efficacy appears fairly similar to that of the classical left side. Further studies are warranted to better evaluate safety-efficacy of RS-VNS.

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1373

Brain and Spine 4 (2024) 103337

Best Abstract: Surgical versus Conservative Treatment for Odontoid Fractures in the Elderly: An International Prospective Comparative Study

Jeroen Huybregts[1], Samuel Polak[1], Wilco Jacobs[2], Mark Arts[1], Bernhard Meyer[3], Maria Wostrack[3], Vicki Butenschön[3], Michael Osti[4], Cumhur Öner[5], Willem-Bart Slooff[5], Ricardo Feller[6], Gert-Joan Bouma[6], Biswadjiet Harhangi[7,8], Bart Depreitere[9], Øystein Nygaard[10], Clemens Weber[11,12], Kay Müller[13], Jake Timothy[14], Ferran Pellisé[15], Mikkel Rasmussen[16], Erik Van Zwet[1], Ewout Steyerberg[1], Wilco Peul[1], Carmen Vleggeert-Lankamp[1,17]. [1] *University Neurosurgical Center Holland, Netherlands;* [2] *The Health Scientist, The Netherlands;* [3] *Technical University Munich, Germany;* [4] *Academic Hospital Feldkirch, Austria;* [5] *University Medical Center Utrecht, The Netherlands;* [6] *Amsterdam University Medical Center, The Netherlands;* [7] *Erasmus Medical Center Rotterdam, The Netherlands;* [8] *Park Medical Center Rotterdam, The Netherlands;* [9] *University Hospitals Leuven, Belgium;* [10] *St Olavs University Hopital, Norway;* [11] *Stavanger University Hospital, Norway;* [12] *University of Stavanger, Norway;* [13] *University Hospital North Norway, Norway;* [14] *University of Leeds, United Kingdom;* [15] *Vall d'Hebron University Hospital, Spain;* [16] *Aarhus University Hospital, Denmark;* [17] *Spaarne Gasthuis, The Netherlands*

Innovations in spine surgery (Spine Plenary Session), October 14, 2024, 3:00 PM - 4:40 PM

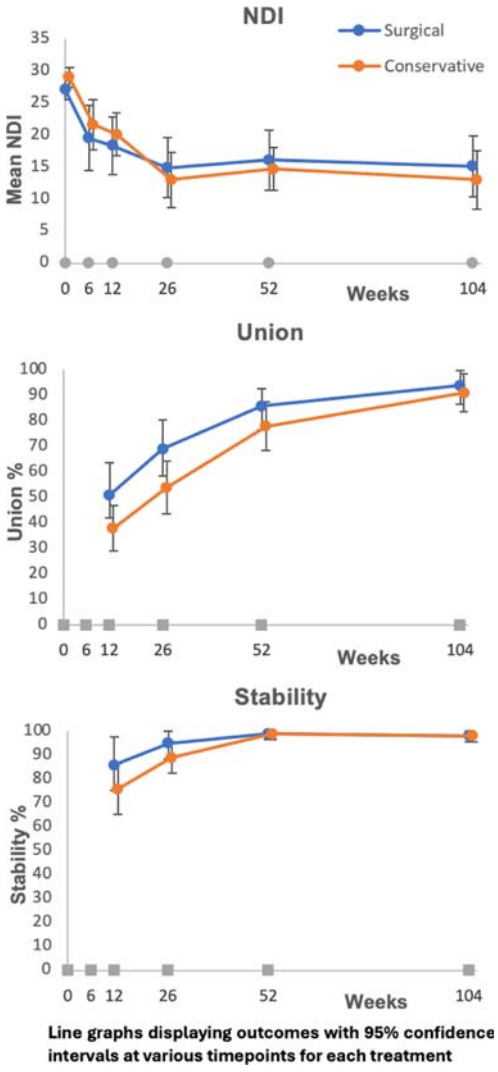
Background: Odontoid fractures are the most common cervical spine fractures in the elderly. The optimal treatment remains debated, while being increasingly relevant to clinical practice in the ageing population. The aim of the INNOVATE trial was to compare clinical outcome and fracture healing between surgically and conservatively treated patients.

Methods: An international prospective comparative study was conducted in fifteen European centers, involving patients aged ≥55 years, with type II/III odontoid fractures, no rheumatoid arthritis/ankylosing spondylitis, and no previous treatment. The attending surgeon and patient made a shared decision on the applied treatment. Five follow-up moments were scheduled between 6-104 weeks. Primary outcomes were Neck Disability Index (NDI) improvement, fracture union and fracture stability at 52 weeks. Secondary outcomes were VAS neck pain, Likert patient-perceived recovery, and EuroQol-5D-3L at 52 weeks. Subgroup analyses considered age, type II and displaced fractures. Multivariable regression analyses adjusted for age, gender and fracture characteristics.

Results: The study included 276 patients, of which 144 (52%) were treated surgically and 132 (48%) conservatively (mean (SD) age 77.3 (9.1) vs. 76.6 (9.7), p=0.56). NDI improvement (decrease) was largely similar between surgical and conservative treatments (mean (SE) -11 (2.4) vs. -14 (1.8), p=0.08), as were union (86% vs. 78%, aOR 2.3, 95% CI 0.97-5.7), and stability at 52 weeks (99% vs. 98%, aOR NA). NDI improvement did not differ between patients with union and persistent non-union (mean (SE) -13 (2.0) vs. -12 (2.8), p=0.78). There was no difference between treatments for any of the secondary outcomes or subgroups.

Conclusions: Clinical outcome and fracture healing at 52 weeks were similar between surgical and conservative treatments. Clinical outcome and fracture union were not associated. Conservative treatment is justified as primary treatment for odontoid fractures, prioritising favourable clinical over radiological outcomes.

Optional Image



Line graphs displaying outcomes with 95% confidence intervals at various timepoints for each treatment

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97

Brain and Spine 4 (2024) 103338

Best Abstract: Lifetime risk for a first ICH or seizure in patients with Familial cErebral cavernous mal-formations (LIFE): A multicenter international pooled patient data analysis

Alejandro Santos Saint Romain[1], Philipp Dammann[1], Ulrich Sure[1], Giuseppe Lanzino[2], Kelly Flemming[2], Helen Kim[3], Rustam Al-Shahi Salman[4], Christian Fung[5], Marco Cenzato[6], Da Li[7], Gary Steinberg[8]. [1] *University Hospital Essen, Essen, Germany;* [2] *Mayo Clinic, Rochester, USA;* [3] *University of California, San Francisco, San Francisco, USA;* [4] *Royal Edinburgh Hospital, Edinburgh, Scotland;* [5] *Freiburg University Hospital, Freiburg, Germany;* [6] *Niguarda Hospital Milan, Milan, Italy;* [7] *Department of Neurosurgery, Beijing Tiantan Hospital, Beijing, China;* [8] *Department of Neurosurgery, Stanford University, Palo Alto, United States*

ICH / Stroke (Vascular Plenary Session), October 15, 2024, 11:00 AM - 12:40 PM

Background: To study the lifelong natural history of patients with intracerebral familial cavernous malformations (FCM).

Methods: As part of a multicenter collaboration, institutional databases from 14 different tertiary referral centers were screened to assess FCM patients. Individuals with complete magnetic resonance imaging data, evidence of suspected or confirmed FCM, baseline clinical features, and follow-up were included. Functional neurological status was assessed using the modified Rankin Scale (mRS) at diagnosis and at last available follow-up. Kaplan-Meier and Cox

regression analyses were performed to determine the cumulative lifetime risk of bleeding and rebleeding and possible risk factors leading to increased bleeding rates. A two-sample Wilcoxon test was performed to evaluate the correlation between mRS and ICH or Seizure.
Results: A total of 1592 FCM patients were included. 869 patients (59.6%) had confirmed FCM disease, 775 (48.7%) had a hemorrhage during follow-up, and 447 (28.1%) experienced at least one seizure. A genetic mutation was confirmed in 47.7% of all patients studied. CCM1, CCM2, and CCM3 mutations were confirmed in 494 (31%), 76 (4.8%), and 30 (1.9%) of screened patients, respectively. The lifetime risk of bleeding was ~80% in this study population. The lifetime risk for seizures was ~45% and this risk remained constant throughout the life course. Patients with CCM3 gene mutation showed more aggressive bleeding behavior compared with patients with CCM1 ($p = 0.04$) and CCM2 ($p = 0.025$). Bleeding and/or seizure events were associated with unfavorable mRS outcomes at last follow-up ($p < 0.001$).
Conclusions: During untreated lifelong follow-up, the likelihood of bleeding and epilepsy increases progres-sively over time. Our results indicate a more aggressive course in patients with CCM3 mutation. Bleeding and/or seizure events were associated with a more unfavorable mRS outcome at last follow-up.

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887
Brain and Spine 4 (2024) 103339
Best Abstract: Less Is More: Fewer Residents Clipping More Aneurysms In The United Kingdom

Abdur Raafay Iqbal [1,2], Federica Pace [2], Suhaib Abualsaud [1], Federica Pace [1], Olamide Akosile [2], Damian Holliman [3], Nitin Mukerji [1]. [1] *The James Cook University Hospital, Middlesbrough, United Kingdom;* [2] *Newcastle University, Newcastle upon Tyne, United Kingdom;* [3] *Royal Victoria Infirmary, Newcastle upon Tyne, United Kingdom*

ICH / Stroke (Vascular Plenary Session), October 15, 2024, 11:00 AM - 12:40 PM
Background: Aneurysm surgery underwent a paradigm shift after the ISAT results and endovascular treatment has become the mainstay of most aneurysms, especially in the United Kingdom (UK). Aneurysms unsuitable for coiling – primarily anterior circulation aneurysms - still need surgical intervention but concerns remain on whether current residents have adequate cerebrovascular experience. Our aim was to describe the changes in operative volumes in anterior circulation aneurysm operations performed by UK residents over a 12-year period.
Methods: Retrospective review of residents' operative electronic logbook data was performed (2011-2022, inclusive). Demographics, year of training, and supervision level of recorded operations were collected. Operations were categorised as either performed or assisted by the resident depending on the supervision level recorded. Statistical analyses were performed on Excel.
Results: In total, 324 residents' (75% male) logbook data was included. During the study period, 4149 clipping of anterior circulation aneurysms were recorded. Recorded operations increased from 106 in 2011 to 513 in 2022, in keeping with increasing number of residents in training and wider use of the electronic logbook. Operations performed per trainee increased significantly from 1.2 in 2011 to 4.8 in 2022. The number of trainees accounting for 50% of all recorded operations increased from 9 in 2012 to 28 in 2019 but fell significantly to 9 in 2022.
Conclusions: Fewer residents now account for half of the recorded clipping of anterior circulation aneurysms compared to recent years. This reflects increasing concentration of cerebrovascular services at fewer units, the fall in aneurysm operative volumes in the remaining units, and disincentivisation of cerebrovascular careers. Although a small cohort of residents report higher volumes, the lack of aneurysm surgical experience in the wider training programme is a concern.

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1400
Brain and Spine 4 (2024) 103340
Best Abstract: Development of an Endoscopic Photogrammetry Atlas

Amedeo Piazza [1,2,3], yhoan Alexander [2,3], Fabio Torregrossa [2,3,4], Luciano Leonel [2,3], Matteo De Notaris [5,6], Carlos Pinheiro-Neto [2,3], Antonio Santoro [1], Maria Peris-Celda [2,3]. [1] *Department of Neurosurgery, Sapienza University, Rome, Italy;* [2] *Department of Neurologic Surgery, Mayo Clinic, Rochester, USA;* [3] *Mayo Clinic Rhoton Neurosurgery and Otolaryngology Surgical Anatomy Program, Rochester, USA;* [4] *Section of Neurosurgery, Department of Experimental Biomedicine and Clinical Neurosciences, University of Palermo, Palermo, Italy;* [5] *Unit of Neurosurgery, University Hospital San Giovanni di Dio e Ruggi d'Aragona, University of Salerno, Salerno, Italy;* [6] *Laboratory of Neuroscience,EBRIS Foundation,, Salerno, Italy*

Transcranial Petrosal approaches (Skull Base Plenary Session), October 15, 2024, 2:10 PM - 3:50 PM
Background: The employment of the endoscope has progressively changed the neurosurgical scenario towards tailored minimally invasive approaches, providing reduced tissue trauma and shorter recovery periods. Nonetheless, the lack of comprehensive visual resources represents a formidable obstacle to handle endoscopic procedures, especially during neurosurgical training. This abstract delineates the conceptualization and realization of an Endoscopic Photogrammetry Atlas (EPA) aimed at mitigating these challenges. Based on cutting-edge photogrammetry methodologies, the EPA offers high-quality three-dimensional renderings of anatomical structures encountered during endoscopic dissections. These models, derived from sequential endoscopic imagery, will furnish meticulous spatial data crucial for both surgical planning and educational purposes.
Methods: Four latex-injected cadaveric specimens have been dissected for this study. Employing both standard and extended endoscopic approaches on each cadaver, a consecutive series of endoscopic maneuvers were executed. Utilizing a rigid endoscope, a total of 600 pictures were meticulously captured at each procedural step. Subsequently, these pictures were processed through Agisoft Metashape to generate interactive three-dimensional models. Further refinement was achieved through model overlapping using Blender software, obtaining high-fidelity representations. These finalized models were then uploaded onto a customized online 3D viewer tailored for this project.
Results: 15 high-resolution (8K) photogrammetric models were generated, based on a database of 9,000 endoscopic pictures. These models, once overlaid and integrated into the custom-designed online 3D viewer, afford users the unprecedented ability to navigate and "dissect" the three-dimensional constructs. This innovative platform enables selective removal of specific bony regions, thereby unveiling the underlying neurovascular structures.
Conclusions: The advent of the EPA represents a seminal stride forward in the realms of surgical visualization and education. Applying photogrammetry and digital technologies to the endoscopic neurosurgical approaches, this pioneering tool holds the promise of enhancing surgical outcomes, training, and perpetuating the trajectory of improvement in minimally invasive interventions. Furthermore, the potential for this atlas to reduce the reliance on cadaveric specimens aligns with the principles of the 3Rs (Replacement, Reduction, Refinement) in biomedical research and education.
Optional Image

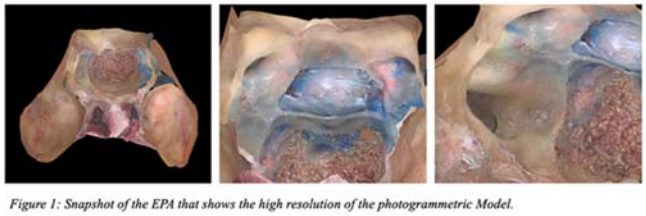


Figure 1: Snapshot of the EPA that shows the high resolution of the photogrammetric Model.

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547

Brain and Spine 4 (2024) 103341

Best Abstract: Exploring The Risk Factors For Facial Nerve Dysfunction After Vestibular Schwannoma Surgery: A Prospective, Multicenter European Study.

Salvatore Chibbaro [1], Francesco Signorelli [2], Giorgio Spatola [3], Antonio Romano [4], Alessandro Melatini [5], Charles-Henry Mallereau [6], Guillame Dannhoff [6], Francois Proust [6], Mario Ganau [7], Smita Khilar [7], Jeyaretna [7], Biagio Roberto Carangelo [1], Alessandro Zalaffi [1], Ludovica Cellini [1], Giovanni Di Pietro [1], Marco Mandala [1], Ismail Zaed [8], Andrea Cardia [8], David Netuka [9], Helene Cebula [6]. [1] *University Of Siena, Italy;* [2] *University of Bari, Bari, Italy;* [3] *Eliambulanza Hospital, Brescia, Italy;* [4] *University of Modena e Reggio Emilia, Modena, Italy;* [5] *Lecce Hospital, Lecce, Italy;* [6] *University of Strasbourg, Strasbourg, France;* [7] *University of Oxford, Oxford, UK;* [8] *University of Lugano, Lugano, Switzerland;* [9] *1st Medical Faculty, Charles University Prague, Prague, Czech Republic*

Transcranial Petrosal approaches (Skull Base Plenary Session), October 15, 2024, 2:10 PM - 3:50 PM

Background: Despite the remarkable improvement in intraoperative neurophysiological monitoring (IONM), iatrogenic facial nerve deficit remains one of the most dreadful complications of vestibular schwannoma surgery. Hence, we designed a prospective multicenter study to gain insights into the predicting factors associated with postoperative facial nerve dysfunction.

Methods: This is a prospective multicenter study involving 9 tertiary neurosurgical center and 2742 consecutive patients undergoing surgery for acoustic schwannoma in a 12-year period (2012-2023). The analysis included: a) preoperative demographics, b) presenting symptoms, c) pre and postoperative imaging and d) postoperative facial nerve and global outcome.

Three variables categories were considered: 1) Tumoral: size, solid/cystic components, extension to the internal auditory canal (IAC), nerve adhesion/distortion and Koos grade. 2) Non-tumoral: age, sex, comorbidities. 3) Surgical: position, approach type, IONM.

A postoperative House-Brackman 1 or 2 score was considered a favorable result.

Results: Our regression analysis indicates that independent key predicting factors for facial nerve outcomes are: 1) tumor extension to the IAC ($p<0.001$), 2) large tumor size> 3cm ($p<0.0032$), Koos grade IV ($p<.0019$), 3) cystic lesions ($p<0.001$). A review of all cases allowed to classify nerve adhesion/distortion into five categories: 1) separated, 2) lightly adherent, 3) adherent, 4) very adherent, 5) not distinguishable/not identifiable, with the last two representing a predictor of poor outcome.

Conclusions: Our data allowed us to create a clinical algorithm to predict clinical outcome following vestibular schwannoma resection based on the extension of the tumor to the IAC, tumor size, Koos grade and presence of cystic lesions. This can prove to be a potentially good generalizability to surgery in Europe.

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1394

Brain and Spine 4 (2024) 103342

Best Abstract: Incremental prognostic performance of pupillary reactivity with GCS: validation of the GCS-Pupil scale in the prospective observational cohort CENTER-TBI

Rick Vreeburg [1,2], Florian van Leeuwen [1], Geoffrey Manley [3], Ewout Steyerberg [1], Paul Brennan [4,5], Thomas van Essen [1,2,6], Andrew Maas [7,8], Wilco Peul [1,2], David Mennon [9]. [1] *Leiden University Medical Center, Leiden, Netherlands;* [2] *University Neurosurgical Center Holland, Leiden & the Hague, Netherlands;* [3] *University of California, San Francisco, United States of America;* [4] *Royal Infirmary of Edinburgh, Edinburgh, United Kingdom;* [5] *Centre for Clinical Brain Sciences, University of Edinburgh, Edinburgh, United Kingdom;* [6] *QEII Health Sciences Center and Dalhousie University, Halifax, Canada;* [7] *Antwerp University Hospital, Edegem, Belgium;* [8] *Antwerp University, Faculty of Medicine and Health Science, Antwerp, Belgium;* [9] *University of Cambridge and Addenbrooke's Hospital, Cambridge, United Kingdom*

At the forefront of continuous optimization in trauma care (Trauma Plenary), October 16, 2024, 11:00 AM - 12:40 PM

Background: The Glasgow Coma Score (GCS) and pupillary reactivity are important prognostic factors in traumatic brain injury (TBI). Combining the GCS and pupil reactivity in the so-called GCS-P score has shown potential to increase information yield compared to using GCS alone while maintaining ease of use. The aim of this study is to analyze the comparative performance of GCS and GCS-P for predicting outcome after TBI in a representative, contemporaneous TBI cohort, and to compare their performance to a model including GCS and pupil reactivity as separate prognostic factors.

Methods: We analyzed patients enrolled between 2014 and 2018 in the Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI). We used logistic regression to quantify the prognostic performances of GCS-P versus GCS according to Nagelkerke's R2. Endpoints were mortality and unfavorable outcome (score < 5 on the Glasgow Outcome Scale-Extended score) at 6 months after injury. We estimated 95% confidence intervals with bootstrap resampling of pooled estimates in improvement of prognostic capability.

Results: Among the 4509 participants in CENTER-TBI, 3521 (78%) met the inclusion criteria. GCS as a linear score had a R2 of 23.9% for mortality and 29.3% for unfavorable outcome in the CENTER-TBI cohort. Pupils as a separate variable improved the CENTER-TBI R2 with 6.3% and 2.5% for mortality and unfavorable outcome, with around half the improvement captured in the GCS-P score (2.7% and 1.4%, respectively).

Conclusions: GCS-P has a stronger association with outcome after TBI than the GCS alone. However, inclusion of GCS and Pupils as two scores in a prognostic model is preferable to the use of a summary score.

https://doi.org/10.1016/j.bas.2024.103342

1033

Brain and Spine 4 (2024) 103343

Best Abstract: Innovations in Peripheral Nerve Surgery: Multimodal Virtual Reality-Based Individualized Preoperative Planning in Complex Peripheral Nerve Surgery

Markus Krogager [1], Thomas Tursø-Finnich [1], Kåre Fugleholm [1], Tiit Mathiesen [1,2,3], Toma Spiriev [4]. [1] *Rigshospitalet, University Hospital of Copenhagen, Copenhagen, Denmark;* [2] *University of Copenhagen, Copenhagen, Denmark;* [3] *Karolinska Institute, Stockholm, Sweden;* [4] *Acibadem City Clinic University Hospital Tokuda, Sofia, Bulgaria*

The ugly duckling (Peripheral Nerve Plenary), October 16, 2024, 2:10 PM - 3:50 PM

Background: Complex peripheral nerve surgery requires three-dimensional (3D) understanding of the pathological- and patient-specific surgical anatomy. Such information is difficult to extract solely from preoperative 2D diagnostic imaging. Anatomical dissections in the lab can be considered gold standard to achieve sufficient 3D understanding of complex anatomy, but this could be limited due to numerous factors. More recent technologies in 3D modelling present alternative methods to develop three-dimensional understanding during preoperative planning.

Methods: We used a database of photorealistic 3D models, created using a photogrammetry algorithm, to display anatomical dissections categorized as peripheral nerve topographic anatomy and associated surgical approaches. 3D models from the database were combined with patient-specific 3D segmentations of nerve tissue and bone anatomy from the fusion of Magnetic Resonance Neurography (MRN) and Computed Tomography (CT). The integrated imaging data were incorporated into a virtual reality (VR) environment.

Results: The methodology allowed incorporation of real patient 3D preoperative radiographic data together with a 3D photorealistic anatomical database for visualization of complex peripheral nerve approaches in the same interactive VR environment for single or multiplayer participation. Integration of these interactive, spatial and immersive modalities via VR into preoperative planning of complex cases could enable improved understanding of relevant individual surgical anatomy and improve decision-making in regards to surgical strategy and indications. Every step of the process was realized using only open-source software platforms.

Conclusions: We present an accessible multimodal VR environment suitable for preoperative planning from the combination of patient specific 3D models and a photorealistic 3D database of complex peripheral nerve dissections. The methods are suitable for improved preoperative decision-making, planning and teaching. The sole use of open-source software solutions allows implementation despite limited resources. We believe that multimodal VR environments in preoperative planning could also be implemented in other fields of neurosurgery or other surgical specialties.

Optional Image



Figure 1: Snapshot showing multiplayer interaction in preoperative planning VR environment with combined 3D anatomical model of transclavicular approach and 3D radiograpic imaging from case of multiple peripheral nerve tumors in the brachial plexus

https://doi.org/10.1016/j.bas.2024.103343

1718
Brain and Spine 4 (2024) 103344
Best Abstract: Nerve transfers for axillary nerve repair in brachial plexus injury: results of 206 adult patients

Pavel Haninec [1], Libor Mencl [1]. [1] *Faculty Hospital Kralovske Vinohrady Prague, Czech Republic*

The ugly duckling (Peripheral Nerve Plenary), October 16, 2024, 2:10 PM - 3:50 PM
Background: Restoration of axillary nerve function is one of the main priorities of brachial plexus surgery. Neurotization, the transfer of a functional but less important donor nerve to a nonfunctional, more important recipient nerve, has recently become a leading treatment option. A variety of donor nerves have been used to reinnervate the axillary nerve with various degrees of success. The aim of this study was to compare the effectiveness of our commonly used donors in brachial plexus injury.
Methods: A group of 206 patients with various types of brachial plexus injury was analyzed. All patients underwent axillary nerve reconstruction performed by the senior author (P.H.) and had a minimum follow-up period of 24 months. The thoracodorsal nerve was used as a donor in 69 patients, the triceps branch of the radial nerve in 25 patients, lower subscapular nerve in 19 patients, long thoracic nerve in 38 patients, intercostal nerves in 27 patients and fascicle transfer from the ulnar or median nerve in 23 patients. The median age was 31 years, and the median time between trauma and surgery was 6 months.
Results: Successful deltoid recovery was defined with muscle strength MRC grade above 3, electromyographic signs of reinnervation and by muscle mass increase. The overall success rate was 75,5% but varied greatly between different types of brachial plexus injury and corresponded to available donors. The donor with the highest success rate was triceps branch of the radial nerve (80%), followed by subscapular nerve (78,9%), fascicle transfer from the ulnar or median nerve (73%) and thoracodorsal nerve (71%). Much lower success rate had long thoracic nerve (36%) and intercostal nerves (22%), which were used in complete brachial plexus injury.
Conclusions: Brachial plexus injuries are complex and variable, and in extensive brachial plexus injuries, there may not be an ideal donor for nerve transfer. Knowing the effectiveness of the less-used donors, formed from different segmental levels of the spinal cord, is of utmost importance. The best success rate was achieved using the triceps branch of radial nerve transfer (80%), lower subscapular nerve (79%) fascicular transfer (74%) and thoracodorsal nerve (71%).

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567
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Best Abstract: Navigating Neurosurgical Practice Solo: Challenges and Innovations in Curaçao and referring islands

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Working in Low-Income countries- how to start the journey (Global Short Plenary Session), October 17, 2024, 10:10 AM - 11:10 AM
Background: Curaçao's unique geographic and demographic setting presents a singular challenge for neurosurgical care, characterized by the lone neurosurgeon's struggle against resource limitations, professional isolation, and the demands of providing comprehensive care in a remote location. This scenario underscores the critical need for innovative solutions to ensure effective patient treatment and care continuity in neurosurgery under such constraints.
Methods: To address these challenges, the neurosurgeon employed several key strategies:
Telemedicine Implementation for remote diagnostics, consultations, and post-operative follow-up, expanding access to specialist care.
Development of Collaborative Networks with off-island specialists to facilitate knowledge exchange and complex case management.
Innovative Resource Management techniques to optimize the use and availability of neurosurgical equipment and supplies.
Community-Based Health Education programs to enhance public awareness on neurosurgical conditions and preventive measures.
Continuous Professional Development to integrate the latest advancements in neurosurgical practices and technologies.
Local Workforce Development initiatives, including mentorship programs and partnerships with residency training abroad aimed at cultivating a new generation of healthcare professionals focusing on neurosurgery.
Results: These methods resulted in improved patient care outcomes, decreased medical referrals abroad, enhanced operational efficiency, and reduced professional isolation. Telemedicine significantly expanded the reach of neurosurgical consultations, enabling timely and effective patient care. Collaborative networks enriched the neurosurgeon's resource pool for complex case management. Resource optimization strategies ensured the sustainability of neurosurgical practices, while health education initiatives led to increased community awareness and early intervention for neurosurgical conditions. Continuous learning efforts kept the practice at the forefront of medical innovation. Importantly, the local workforce development initiatives have begun to lay the groundwork for a more robust neurosurgical service in Curaçao.
Conclusions: The experience of Curaçao's sole neurosurgeon highlights the profound impact of innovative strategies on overcoming the challenges of neurosurgical care in isolated settings. The implementation of telemedicine, collaborative networks with an expansion of the workforce, and community engagement not only mitigated the constraints posed by geographic isolation but also set a precedent for enhancing neurosurgical care in similar contexts. This model demonstrates that through resilience, innovation, and collaboration, high-quality neurosurgical care can be sustained in the most challenging environments, offering valuable insights for neurosurgeons worldwide facing similar hurdles.

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1372
Brain and Spine 4 (2024) 103346
Life after hemispherectomy surgery: a qualitative study of parental narratives

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Functional neurosurgery in children (EANS Pediatric & Functional Joint Symposium), October 13, 2024, 9:00 AM - 11:00 AM
Background: Few studies examine the parental experiences of children with

drug-resistant epilepsy following hemispherectomy in the United States. Little is known about the long-term impact of the hemispherectomy surgery on the patient and family journey. This study aims to describe the themes of lived experiences after hemispherectomy surgery. This information can inform healthcare team and future patients' families navigating life post- hemispherectomy, and help motivate alignment of resources for better support.
Methods: Fifty-one semi-structured interviews were conducted with parents or guardians of children with drug-resistant epilepsy who underwent any anatomical/functional hemispherectomy/hemispherotomy in the US from 1994-2022. Participants were recruited in the US via a post on Pediatric Epilepsy Surgery Alliance social media. Interviews were conducted by telephone, audio-recorded, transcribed and coded using ATLAS.ti 8 using constant comparative method.
Results: 49/51 (96%) participants were female, 43/51 (84%) White, and 22/51 (43%) with graduate degrees. Reported etiologies of drug-resistant epilepsy include perinatal stroke (19/51, 37%), Rasmussen's encephalitis (9/51,18%), cortical dysplasia (8/51, 16%) and hemimegalencephaly (8/51, 16%). 46/51 (90.2%). caregivers reported seizure-freedom after hemispherectomy at time of interview. Parents felt that life after hemispherectomy is not well characterized. Despite feeling that they made informed decisions for hemispherectomy surgery, they encountered multiple sequelae that they felt they did not expect. They felt they navigated these paths on their own, ranging from medical (orthopedic, endocrine, psychiatric sequelae) to financial and educational challenges. Social media has emerged as a vital platform for resources and information for parents after hemispherectomy.
Conclusions: This qualitative study suggests a large part of the lived hemispherectomy journey encompasses challenges after hemispherectomy surgery. Parents report navigating complex health systems with limited resources and support after hemispherectomy surgery. Examining parental narratives of the journey beyond hemispherectomy represents an important opportunity to align resources and healthcare policy, and to define priorities for future research.

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1350
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Factors in parents' decision-making for hemispherectomy surgery in children: a qualitative study of parental narratives

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Functional neurosurgery in children (EANS Pediatric & Functional Joint Symposium), October 13, 2024, 9:00 AM - 11:00 AM
Background: Epilepsy is the most common pediatric neurologic disorder. Epilepsy surgery for well-selected candidates is known to be underutilized. Understanding factors influencing decision-making in hemispherectomy surgery, as a subset, can start to define the journey and help improve the patient and family experience for future patients. Few studies have examined parental experiences in navigating the healthcare system in pursuance of epilepsy surgery. None have examined family experiences in the journey before and after hemispherectomy in the United States. This study aims to describe the existing parental experience as well as factors influencing decision-making around hemispherectomy.
Methods: Fifty-one semi-structured interviews were conducted in the past 6 months with guardians of children with drug-resistant epilepsy who underwent hemispherectomy/hemispherotomy surgery in the US at any time. Participants were recruited via a flier posted on social media and epilepsy advocacy group channels including the Pediatric Epilepsy Surgery Alliance. Interviews were conducted by telephone, audio recorded, transcribed, and coded using ATLAS.ti 8 using constant comparative method.
Results: Interview participants were 96% (49/51) female, 84% White (43/51) with 43% (22/51) having completed graduate work. Thematic saturation was reached. Diagnoses include perinatal stroke (37%, 19/51), Rasmussen's encephalitis (18%. 951), cortical dysplasia (16%. 8/51) and hemimegalencephaly (16%. 8/51). 90.2% (46/51) of caregivers reported seizure-freedom after hemispherectomy at time of interview. Qualitative analysis identified three main themes: (1) The decision to undergo hemispherectomy is emotionally difficult. (2) Respondents felt pre-surgical education and guidance was limited in terms of what to expect long- term. (3) Financial stability, geographic location, and education level of each patient family influenced decision-making when considering hemispherectomy surgery.
Conclusions: The journey to epilepsy surgery, specifically hemispherectomy, has multiple opportunities for improvement. Parent interviews demonstrate a need for more pre-surgical guidance and education including information about what to expect beyond the surgery. Future studies are warranted to explore enhanced interdisciplinary support.

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1276
Brain and Spine 4 (2024) 103348
Factors affecting temperature prediction in essential tremor management using magnetic resonance imaging-guided high-intensity focused ultrasound.

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Functional neurosurgery in children (EANS Pediatric & Functional Joint Symposium), October 13, 2024, 9:00 AM - 11:00 AM
Background: Essential tremor (ET) is a neurological syndrome characterized by involuntary oscillatory movements, predominantly in the upper limbs. The prevalence of ET varies in the general population, being more common in older people. Among the different treatment options, we focused on thalamotomy with MRI-guided high-intensity focused ultrasound. This study aims to evaluate the influence of different parameters, especially anatomical ones, on the accuracy of high-intensity focused ultrasound (HIFU) treatment.
Methods: A prospective database study was conducted including patients with refractory essential tremor undergoing thalamotomy with HIFU at our centre between 2022 and 2023.
Results: 50 patients were selected who received a total of 300 sonications. The mean temperature reached was selected as the dependent variable for the analysis. Once a descriptive and univariate analysis of all the variables were performed, those that were finally selected as having a statistically significant relationship with the mean temperature reached (number of sonications, mean predicted temperature, tissue level, cranial density ratio, active cranial volume, cranial thickness variability and mean power) were included in the final predictive model.
Conclusions: Our study serves to reinforce the fact that it is necessary to delve deeper into the anatomical factors that influence us on the mean temperature achieved beyond the cranial density ratio, as well as the idea that the accuracy of the therapeutic algorithm can be further improved.

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1187
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Minimizing Adverse Neurological Events in HIFU Tremor Treatment: A Study on Cerebral Edema and Predisposing Factors

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Functional neurosurgery in children (EANS Pediatric & Functional Joint Symposium), October 13, 2024, 9:00 AM - 11:00 AM
Background: Our objetive was to analyze whether cerebral edema associated with high-intensity focused ultrasound (HIFU) treatment for essential tremor causes adverse neurological events in patients and to identify predisposing factors, aiming to design the most appropriate therapeutic strategy to maximize clinical benefits while minimizing avoidable side effects.
Methods: An ambispective cohort study was conducted, including 79 essential tremor patients treated with HIFU from November 2022 to January 2024 at the University Hospital Reina Sofia (Córdoba). Seventy-eight variables related to patient characteristics, personal history, procedure-associated factors (power, time, temperature, applied energy, etc.), and edema volume within 24 hours of treatment were collected. Data on immediate adverse events, at 24 hours, and at

3 weeks, as well as clinical improvement according to the CRST tremor scale pre and post-treatment and at 3 weeks, were gathered. A descriptive analysis of all variables was performed, followed by a statistical comparison of edema (analyzed as a dichotomous variable: high ≥P50 and low <P50) against each variable.
Results: 74.4% of patients with high edema experienced adverse events at 24 hours and 3 weeks, compared to only 47.5% and 45% of those with low edema, respectively (p0.015 and p<0.01). Significant differences were also found in motor (38.5% at 3 weeks in high edema group vs. 15% in low, p0.018) and sensory adverse effects (20.5% high edema vs. 5% low, p0.04). The administered power and average temperature in patients developing high edema were 954±124W and 59.1±2.4ºC, respectively, compared to 920±128W and 57.9±2.2ºC in those with low edema (p0.001 and p0.009). Variability in SDR (Skull Density Ratio SD) and mean second cortical intensity (mSCI) were higher in high edema than in low (p0.031 and p0.003, respectively). The volume of the lesion at 24 hours in those with high edema was 0.58±0.19cc versus 0.44±0.16cc in low edema (p<0.001), and 17.9% of high edema patients required corticosteroid therapy compared to 2.5% with low edema (p0.026).
Conclusions: Peritreatment adverse events are associated with a higher edema volume at 24 hours, which in turn predicts such events at 3 weeks. Edema volume appears to depend on patient-specific characteristics, SDR variability, and mSCI, as well as procedure-associated factors like power and maximum average temperature. These findings are useful for defining treatment strategies that minimize edema and adverse events.

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959
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Mild and Moderate Pediatric Head Trauma in Italy: a National Survey

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Challenges and Particularities of Pediatric Traumatic Brain Injury (EANS Pediatric & Trauma & ESPNIC Joint Symposium), October 13, 2024, 12:00 PM - 2:30 PM
Background: As the prevalence of severe traumatic brain injury (TBI) in the paediatric population guidelines for Severe Head Trauma are available. Nevertheless, specific recommendations about the management of mild and moderate paediatric head trauma are sparer and more heterogeneous. In Italy pediatric mild and moderate TBI is mainly managed with local protocol, taking in consideration the specific logistic organizations. Thus a more regional than national directives are available. Aim of the authors is to analyse current practice on this pathology in Italy and foster new researches and algorithm for decision-making.
Methods: The Neurotraumatology and the Paediatric sections of the Italian Society of Neurosurgery designed and distributed a survey among the chairmen and/or directors and/or responsible of neurosurgical units in Italy. Neurosurgery departments without activity for emergencies were excluded
Answers were collected in aggregate form and analysed anonymously. Survey consisted of 10 questions and the presentation of 7 different scenarios, based on severity of trauma from mild to moderate, with different head injuries. Use of Fast magnetic resonance imaging (fMRI), role of seriate CT scans as early follow-up, specific pediatric TBI neurosurgical activity were also investigated.
Results: The response rate was 82.1% (101/123). Pediatric TBI is also managed in non-paediatric hospitals, less for infant age. Treatment and management approaches are heterogeneous among participants, even among specific pediatric neurosurgeons. Most of the hospitals have a Neonatal Intensive Care Unit (NICU) and/or a paediatric intensive care duty. fMRI is used in selected cases. A use of seriated CT scans wider than expected, despite recent recommendations, has been observed in pediatric and adult environment.
Conclusions: The management of mild and moderate paediatric TBI needs to be regulated by more updated recommendations. There is a clear need for develop a national best clinical practice. An effort must be made in this sense.

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803
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Postoperative Nucleus Accumbens/Anterior Limb of the Internal Capsule recordings during deep brain stimulation in obsessive-compulsive disorder patients

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The revival of lesioning - RF and FUS in the DBS era (Functional Parallel Session), Hall 06, October 14, 2024, 8:00 AM - 9:30 AM
Background: Deep brain stimulation (DBS) is an established therapy for movement disorders and for psychiatric patients with therapy resistant conditions, such as obsessive-compulsive disorder (OCD). Although it is generally recognized that the phenomenology of OCD symptoms is rooted in hyperactivity of the prefrontal cortex, the precise neural correlates of obsessions and compulsions are still poorly understood, as are the neurophysiological effects of DBS in OCD. Our aim was to uncover electrophysiological markers of OCD during a paradigm of symptom provocation.
Methods: We recorded bipolar local field potential (LFP) data derived from implanted leads in 6 patients with OCD who underwent Nucleus accumbens/Anterior Limb of the Internal Capsule (Nac/ALIC) DBS, using the Percept PC system (Medtronic). Recordings were performed under a confrontation test condition in which patients were shown patient-adapted pictures with negative-, positive- and neutral-obsession-related content to shortly induce an increase in OCD symptoms. Afterwards, patients were asked to rate if the picture provoked OCD symptoms and their emotional arousal (from 1 to 5) and the valence (from 1 to 5 – negative vs positive). LFPs were synchronized with task triggers aligning LFP signal as well as an EMG signal recorded from the neck with induced stimulation artifacts. This paradigm was conducted during active DBS. Afterwards, OCD-related spectral power LFP was calculated.
Results: Our study showed increase in low-frequency power (2-6 Hz) after stimulus onset (i.e., picture) compared to baseline starting, which lasted around 1000 ms. This low power changes is visible for both conditions (negative- and positive obsession-related pictures) and both hemispheres (p<0.05). Nevertheless, the effect is more pronounced for the left hemisphere compared to the right hemisphere. Moreover, there is a difference between symptom-provoking vs symptom-provoking event-related low frequency power only in the left hemisphere, with more increased power for symptomatic negative-obsession-related content pictures.
Conclusions: The present study is the first to report postoperative LFP data acquired with the fully-implanted DBS system Percept PC in Nac/ALIC DBS for OCD patients. Our findings suggest that an increase in low-frequency activity of a broad area in the Nac/ALIC in patients with OCD may contribute to generation of obsessions and possibly eventually the compulsion and anxiety phenomenology. Increased low-frequency activity before the onset of a compulsion might function as an electrophysiological marker for closed-loop DBS for OCD.

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1442
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Asleep vs Awake Deep Brain Stimulation in Parkinson Disease: Is it worth it?

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The revival of lesioning - RF and FUS in the DBS era (Functional Parallel Session), Hall 06, October 14, 2024, 8:00 AM - 9:30 AM
Background: Traditionally, deep brain stimulation (DBS) surgery of the subthalamic nucleus (STN) in the treatment of Parkinson Disease (PD) is performed under local anesthesia. It is a long procedure and involves discomfort for patients. For this reason, more centers are performing this procedure under general anesthesia, with overlapping clinical results with reported greater patient

satisfaction. The goal is to present our Center initial experience treating PD with DBS surgery under general anesthesia and perform a comparative analysis of both techniques.
Methods: We performed a retrospective analysis of patients undergoing DBS for PD treatment between 2021 and 2023. Sociodemographic and clinical data were collected.
Results: Were included 58 patients: 25 belonging to the LA group and 33 to the GA group. Sociodemographic data regarding phenotype and severity of the disease (Hoehn and Yahr score, preoperative UPDRS-III, and UPDRS-IV scores) weren't statistically different. The bivariate analysis was not significant regarding the difference between pre and postoperative UPDRS-III scores (LA 41.9±11.5; GA 36.7±8.1; p=0.079) nor the reduction in levodopa dose (LA 53.1±23.1; GA 46.9±22.9; p=0.338). The GA group revealed a tendency for shorter surgical time, but without statistical significance (LA 491±69.1; GA 452±76; p=0.056). The occurrence of surgical complications did not differ between the two groups (p=0.671). The postoperative pneumocephalus volume was calculated based on a postoperative CT scan.
Conclusions: As in many other centers and in what has been an increasingly frequent option, these results demonstrate that DBS under GA is comparable to DBS under LA, causing less suffering, and being subjectively more comfortable for the patients. Additionally, there was a tendency to reduce surgical time.

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57
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Revisiting Radiofrequency Thalamotomy - Indications, Method, and Outcome With Tractography Correlation, in the Era of Deep Brain Stimulation (DBS)

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The revival of lesioning - RF and FUS in the DBS era (Functional Parallel Session), Hall 06, October 14, 2024, 8:00 AM - 9:30 AM
Background: Thalamotomy was historically the primary surgical intervention for medically resistant tremors before the prevalence of deep brain stimulation (DBS). While DBS is currently the preferred treatment, it poses challenges such as hardware risks, infections, and the need for frequent battery replacements and adjustments. Radiofrequency (RF) thalamotomy, devoid of these issues, offers favourable outcomes for a specific patient subset and can be conducted under local anaesthesia, making it suitable for individuals in poor health. This retrospective study reviews the extended results of RF thalamotomy in our institution and examines its advantages and disadvantages.
Methods: Methods: In a case series spanning 2016-2021, 14 consecutive RF thalamotomies were performed in Oxford. Three patients were excluded due to unrelated deaths, leaving 8 patients for long-term assessment. Outcome measures included tremor scores, clinical impressions, and efficacy indices, with a median assessment period of 39 months. Postoperative tractography was employed to correlate outcomes. Common indications for thalamotomy over DBS included medical comorbidities, patient preference, age, and previous DBS failure.
Results: Results: 71% of patients experienced tremor abolition or significant improvement, with relapse in 2 cases after 6 months. The Bain and Findlay tremor score significantly decreased from 16.1 preoperatively to 8.5 postoperatively. Adverse events occurred in 43% of patients, with complete or partial resolution in the majority. Notably, wider distance of residual DRT tract fibers from the lesion corelated with sustained outcomes.
Conclusions: Conclusion, RF thalamotomy is an effective long-term treatment for medication-refractory tremors and merits consideration in selectively chosen patients for unilateral tremor control.

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429
Brain and Spine 4 (2024) 103354
Application Of The "Liquid Biopsy" Technique To Detect H3K27M And BRAF V600E Mutations In Patients With Diffuse Brainstem Tumors

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Molecular neuro-oncology - from basic research to clinical applications (Neuro-Oncology Parallel Session), Hall 07, October 14, 2024, 8:00 AM - 9:30 AM
Background: Despite the progress in our understanding of diffuse brainstem tumors pathogenesis, the treatment of these neoplasms is mostly empirical and conducted without genetic verification. Liquid biopsy is a minimally invasive technique that enables the acquisition of information about tumor biology. It is based on the investigation of cell-free nucleic acids in biological fluids with detection of specific mutations. Despite its wide implementation in treatment of extracranial malignancies, it is infrequently applied in neuro-oncology. The aim of our work is to determine the efficacy of this method for detecting H3K27 and BRAF V600E mutations in patients with diffuse brainstem tumors.
Methods: In 30 patients (10 children and 20 adults) with brainstem tumors, cerebrospinal fluid was collected by a lumbar puncture. Cell-free DNA (cfDNA) after the preamplification was used in digital droplet PCR for determination of the H3F3A K28M and BRAF V600E oncogenic missense variants. In 24 patients the investigation of cfDNA was performed in parallel with the analysis of correspondent mutations in DNA derived from tumor tissue.
Results: Amplifiable cfDNA was acquired in all cases, which was confirmed by presence of the wild-type alleles. None of the patients harbors BRAF V600E mutation either in cfDNA or tumor tissue. H3F3A K28M variant was detected in 7 CSF samples and 8 tumor specimens from patients underwent surgical biopsy. Thus, overall concordance in the determination of the H3F3A K28M variant was 96% (22/23). In six cases standard biopsy was not performed. These patients had no detectable mutant copies of the H3F3A gene in the CSF.
Conclusions: Investigation of specific genetic alterations by liquid biopsy serves as a minimally invasive and highly informative technique for the diagnostics of brainstem tumors. Detection of H3F3A K28M mutant allele provides straightforward verification of diffuse midline glioma, H3K27 altered in the majority of cases without standard biopsy.

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359
Brain and Spine 4 (2024) 103355
PSGL-1 and other markers of tumor-associated macrophages and microglial cells exhibit high intratumoral heterogeneity in human glioblastoma tissue

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Molecular neuro-oncology - from basic research to clinical applications (Neuro-Oncology Parallel Session), Hall 07, October 14, 2024, 8:00 AM - 9:30 AM
Background: The human glioblastoma multiforme (GBM) is a highly aggressive tumor with insufficient therapies available. Especially novel concepts of immune therapies fail, due to a complex and immunosuppressive microenvironment, high mutational rates, and inter-patient variations. The intra-tumoral heterogenicity is currently not sufficiently investigated.
Methods: Biopsies from six different locations were taken in a small cohort of 16 GBM patients who underwent surgery. The tissue slides were analyzed utilizing high-content imaging microscopy and algorithm-based image quantification. Several immune markers for macrophage and microglia subpopulations were investigated. Flow cytometry was used to validate key results. Besides the surface marker, cytokines were measured and categorized based on their heterogenicity and overall expression.
Results: M2-typical antigens, including CD204, CD163, Arg1, and CSF1R, showed comparatively higher expression, with GFAP displaying the least intratumoral heterogeneity. In contrast, M1-typical antigens, such as PSGL-1, CD16, CD68, and MHC-II, exhibited low overall expression and concurrent high intratumoral heterogeneity. CD16 and PSGL-1 were the most heterogen antigens. High expression levels were observed for cytokines IL-6, VEGF, and CCL-2, while VILIP-a, sTREM2, BDNF, and IL-18 displayed moderate expression. VILIP-a was revealed to differentiate most in principle component analysis. Cytokines with the lowest overall expression, such as TGF-β1, β-NGF, TNF-α, and TREM1, showed low intratumoral heterogeneity, in contrast to βNGF, TNF-α, and IL-18,

which displayed high heterogeneity despite low expression.
Conclusions: The study showed high intra-tumoral heterogeneity in GBM, emphasizing the need for a more detailed understanding of the tumor microenvironment. The described findings could be essential for future personalized treatment strategies and the implementation of reliable diagnostics in GBM.

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245
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The role of surgery in IDH wildtype diffuse astrocytomas

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Molecular neuro-oncology - from basic research to clinical applications (Neuro-Oncology Parallel Session), Hall 07, October 14, 2024, 8:00 AM - 9:30 AM
Background: Isocitrate dehydrogenase (IDH)1/2 wildtype astrocytomas have high recurrence rates and were classified as CNS WHO grade 4 tumors in the latest WHO classification of 2021. Uncertainty remains towards clinical implications and decision making- especially regarding the role of surgery. The aim of this study is to evaluate the impact of the extent of resection (EOR) of these new CNS grade 4 tumors compared to glioblastoma on overall survival (OS).
Methods: Data acquisition was conducted as a multi-center retrospective analysis at 5 University Hospitals (2016-2020). Patients with IDH 1/2 wildtype diffuse astrocytoma (CNS WHO grade 2-4) were included in our study. Patients presenting with IDH wildtype glioblastoma from one institution served as controls. Primary outcome parameters were EOR (GTR; <5% residual tumor (RT), subtotal resection (STR; 5-75% RT), and biopsy (> 75% RT) and OS.
Results: 160 patients with IDH-wildtype glioblastoma (CNS WHO grade 4) (45.6 % females) and 111 patients with IDH-wildtype diffuse astrocytoma (CNS WHO grade 2-4), (34.2 % females) were enrolled. The median age was 68 years (37-86 years) in the classic glioblastoma cohort and 59 years (20-87 years) in those with astrocytomas. GTR was achieved more often in patients with classic glioblastoma: 58.8% compared to those with diffuse astrocytoma 27.9% ($p = 0.0001$); STR (36.0%, $p = 0.0048$) and biopsy (36.0%, $p = 0.0032$) were more often in astrocytomas. The overall survival was 12.7±10.4 months in classic glioblastoma compared to 18.2±14.8 months in astrocytoma. GTR significantly increased OS in both entities (glioblastoma: 15.3±10.4 months, 95% CI 13.13 – 17.40, $p = <0.0001$; diffuse astrocytoma: 26.7±17.9 months, 95% CI 20.13 – 33.25, $p = <0.0001$). Further, also STR significantly increased OS in glioblastoma (11.46±11.03 months, 95% CI 7.55 - 15.37, $p = 0.0257$) and astrocytoma (18.8±13.54 months, 95% CI 14.47- 23.13, $p = 0.0035$). ROC analysis identified a residual cut-off tumor volume of >20% in the glioblastoma cohort and >60% in the difuse astrocytoma cohort to be associated with impaired OS. Multivariate logistic regression analysis identified age and EOR, not radio-chemotherapy, as independent predictors of OS in diffuse astrocytoma. MGMT methylation had no impact on OS ($p = 0.11$).
Conclusions: The presented data suggests that resection prolongs OS in patients with IDH-wildtype astrocytomas and is of higher value than radio-chemotherapy. Of note, STR also positively influences OS in these patients. These results underline the importance of surgical resection even if GTR is not achievable and thus mark a potential paradigm shift in clinical decision making.

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652
Brain and Spine 4 (2024) 103357
Transcranial Ultrasound Imaging in Intensive Care Management of Decompressive Hemicraniectomy Patients: A Single-Center Retrospective Analysis

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Invasive monitoring in severe non-TBI acute brain injury: interactive session (Trauma Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Patients undergoing decompressive hemicraniectomy frequently need extended intensive care treatment. Computed tomography (CT) is considered the gold standard for regular cranial imaging. However, its frequent use is linked to adverse clinical outcomes. This study aimed to assess bedside transcranial ultrasound (TUS) as an alternative for imaging anatomical structures and pathologies in post hemicraniectomy patients.
Methods: We analyzed 17 patients treated in our neurosurgical ICU from January 1st 2023 to February 1st 2024. Six physicians from our unit (3 former residents and 3 attending physicians) conducted a retrospective evaluation. A total of 152 sessions, including multiple freeze frames and video footages, were analyzed including 7 imaging categories. Ratings were done using a Likert Scale (1 point: very good visualization; 5 points: insufficient visualization), and mean values and medians were compared between both examiner groups.
Results: Ultrasound imaging was performed on average on 9.24 out of 22.15 days (mean inpatient stay) with a mean of 4.31 CT scans per patient and stay. TUS provided lowest Likert scores (mean; median) for imaging categories ventricular size (1.29; 1), midline shift (1.80; 2), subdural space (2.56; 2), intraventricular catheter placement (2.63; 3) and cortical gyration (2.91; 3). In terms of primary conditions, intracerebral hematomas (3.04; 3) could be visualized more effectively than infarct demarcation (4.75; 5) by both groups. In 6 out of 7 imaging categories, former residents reported slightly inferior assessability resulting in higher scores on the Likert scale (0.21 – 0.81 mean difference compared to attending physicians).
Conclusions: Transcranial ultrasound is a safe, cost- and time-efficient method, potentially gaining relevance for imaging post-hemicraniectomy patients in intensive care treatment. In our setting, the method seemed effective in evaluating intraventricular catheter placement, hydrocephalus, midline shift and space-occupying lesions. Further improvement in image quality could potentially reduce the overall number of CT scans in this vulnerable patient collective.

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1025
Brain and Spine 4 (2024) 103358
Increased intracranial pressure in diffuse axonal injury TBI patients - A single-center retrospective study 2007-2022

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Invasive monitoring in severe non-TBI acute brain injury: interactive session (Trauma Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Diffuse axonal injury (DAI) is a traumatic brain injury (TBI) commonly caused by rapid rotational forces to the head, e.g. in high velocity traffic accidents or high fall and is best visualized on magnetic resonance (MR)-tomography. DAI is associated with a worse prognosis than focal injuries at similar severity level, not least in terms of cognitive outcome. The clinical course is often unpredictable, especially regarding intracranial pressure (ICP). The aim of this study was to analyze clinical parameters of DAI patients with a focus on ICP-elevations and its treatment.
Methods: Severe TBI patients receiving ICP monitoring and treated at the neurocritical care unit in Lund between 2007-2022 were analysed retrospectively. To be included in the analysis, lesions indicating DAI should be present on early MRI in e.g. grey-white matter interface, central regions such as the corpus callous, thalamus and/or internal capsule or brain stem. Other inclusion criteria were high velocity accidents and the absence of clinically significant focal injuries (e.g. symptomatic mass lesions such as hematomas or contusions). Severe TBI patients were treated per a specified ICP-targeted protocols in which ICP elevations occurring despite baseline sedation and ventilation strategies, were initially treated by the Lund concept, and as a last tier therapy decompressive craniectomy or high-dose barbiturate infusions were used.
Results: A total of 50 patients (12 women and 38 men) with DAI were identified. All were patients with severe TBIs, with a median GCS of 6 (Range 3 to 8). Motor vehicle accidents (68%) were the most common injury mechanism. ICP-elevations were documented in 18 patients (36%), of whom 6 (33%) were refractory to the "Lund concept" for ICP control, and had to receive additional treatment such as hemicraniectomy.
Conclusions: DAI is a heterogeneous type of TBI and the role of ICP monitoring

in the absence of focal mass lesions has been debated. In the present study, a subset of DAI patients experienced elevated ICP arguing that neurocritical care management including ICP monitoring is mandatory. These results might aid future studies on prognostic factors and ICP management of DAI.

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903

Brain and Spine 4 (2024) 103359

Change of the zero-reference points for intracranial and cerebral perfusion pressure monitoring results in altered management of severe traumatic brain injury patients

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Invasive monitoring in severe non-TBI acute brain injury: interactive session (Trauma Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: The use of an intraventricular catheter for measuring the intracranial pressure (ICP) is common practice in the management of severe traumatic brain injury (TBI). The Lund concept has traditionally used the highest point of the subarachnoid space as ICP zero-reference point and the level of the right atrium as zero-reference point for mean arterial pressure (MAP). In 2017 the zero-reference points for ICP and MAP were both changed to the external auditory meatus (EAM) thus altering the calculated cerebral perfusion pressure (CPP) values. The aim of this study was to compare ICP and CPP from the different zero-reference points and to investigate whether treatment and/or outcome were affected by the change of reference point.

Methods: A retrospective analysis of ICP, CPP, MAP, medical management, mortality and outcome in two different patient cohorts with severe TBI, treated at Skane University Hospital, Lund, Sweden between 2013-2016 and 2018-2022.

Results: Data was obtained from 36 patients treated between 2013-2016 and 41 patients treated between 2018-2022. Both groups were similar with respect to age and injury severity. There was no difference in mortality between the time periods. Mean ICP levels were higher ($p = 0.0009$) and mean MAP levels lower ($p = 0.04$) with EAM as reference point. The use of clonidine (56 % vs. 39%) and metoprolol (39% vs. 12%), integral components of the Lund concept, decreased significantly and the use of norepinephrine increased (44% vs. 95%; $p<0.05$) with EAM as the reference point.

Conclusions: The change of the reference point to the EAM led to higher ICP-values and lower MAP-values, resulting in less use of clonidine and metoprolol and a large increase in the use of norepinephrine in severe TBI. These results show the importance of zero-reference point placement, which should be reported in TBI studies analyzing ICP and CPP management.

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1396

Brain and Spine 4 (2024) 103360

Age-stratified treatment variations in intracranial surgical interventions for traumatic brain injury in Europe: a prospective observational study within CENTER-TBI

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Invasive monitoring in severe non-TBI acute brain injury: interactive session (Trauma Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Traumatic brain injury (TBI) is a multifaceted disease causing 1.5 million hospital admissions and 57.000 deaths in Europe each year. Patient age is a prodigious predictor of outcome and an important factor in surgical decision-making. We aimed to provide insights in the age-stratified treatment variations in neurosurgical interventions in patients sustaining TBI.

Methods: We selected all patients with TBI from the prospective, multicenter, observational Collaborative European NeuroTrauma Effectiveness Research in Traumatic Brain Injury (CENTER-TBI) study that ran from 2014 to 2017. Differences in intracranial surgery, surgery type, timing, between-center variation in surgical likelihood were examined across age categories <15 years old, 15-24 years, 25-44 years, 45-64 years, 65-79 years and ≥80 years old. Random-effects logistic and ordinal regression with appropriate adjustment for confounding were used to describe the associations

Results: CENTER-TBI included 4509 patients of which 1245 patients underwent 2014 intracranial procedures. Decompressive craniectomy (DC) and craniotomy for hematoma evacuation or contusion were the most prevalent acute neurosurgical interventions in all age groups (pooled 14% for <15 years, 25% for 15-24 years, 29% for 25-44 years, 33% for 45-64 years, 39% for 65-79 years and 46% for ≥80 years old). Significant between-center variations in intracranial surgery were observed for all age categories (median odds ratios 2.5 for pediatric, 3.1 for adolescents, 2.2 for young adults, 2.1 for older adults, 2 for elderly patients and 2.9 for octa- and nonagenarians. The odds of acute surgery for epidural hematoma, for acute subdural hematoma (ASDH) or intracerebral hemorrhages (ICH)/contusions respectively decreased with older age (per 10-year increment; aOR 0.78, 95% confidence interval [CI] 0.69-0.88; aOR 0.93, 95%CI 0.86-1 and aOR 0.93, 95%CI 0.84-1, respectively).

Conclusions: There exist large age-stratified differences regarding intracranial surgery type, timing and between-center variability in surgical aggressiveness. These findings offer a foundation encouraging further age-specific research and initiate discussion regarding the substantial discrepancies in clinical practices throughout Europe between younger and older patients with a TBI.

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387

Brain and Spine 4 (2024) 103361

Initial evaluation of a 3D printed model for skills training of navigated, trajectory guided brain biopsies with a focus on biopsy accuracy using real-world technology

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Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Navigated, trajectory guided biopsies of brain lesions are part of the residency curriculum and have to be carried out safely and precisely [1]. Physical and virtual training models are suggested means to improve skills before practicing on specimen, animals or performing supervised surgery [2,3,4].

Methods: Based on an anonymized CT/MRI scan, a model with a replaceable brain module was designed, filled with brain-mimicking gelatine including 4 target lesions [TL] (7-11 ml volume, PpIX 18 mg/l for fluorescence). 36 Biopsies were performed (3-point fixation, Neuronavigation with Biopsy Device, Sedan biopsy needle. A contrast deposit (0.1 ml) was injected at the target point [TP]. The actual contrast deposits in a post-biopsy CT and planned TP's were compared (see Fig. 1).

Results: Standard OR-Setup could be established in all cases. 16 'white matter' and 20 TP biopsies were taken from 5 brain models. 17 (85%) TP samples had a positive microscopic fluorescence under blue light (400 nm). Post-biopsy scans revealed also a correct contrast deposit at the TP in 17 biopsies (85%). Incorrect TP biopsies were analysed and found to be due to a mechanical locking error of the brain module (deviation of up to 5 mm). Task observation showed minor handling problems by less experienced surgeons.

Conclusions: A physical model using real-world technology for biopsy training was successfully implemented - a training scenario which is not commercially available yet. Minor modifications of the model design and test methodology are necessary to perform and validate high precision procedures. This inexpensive training model is mechanically resilient and can be used for other training scenarios as well.

References:

[1] Kamp et al. 2021, PMID: 33881726
[2] Stengel et al. 2022, PMID: 36506289
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[4] www.upsurgeon.com

Optional Image

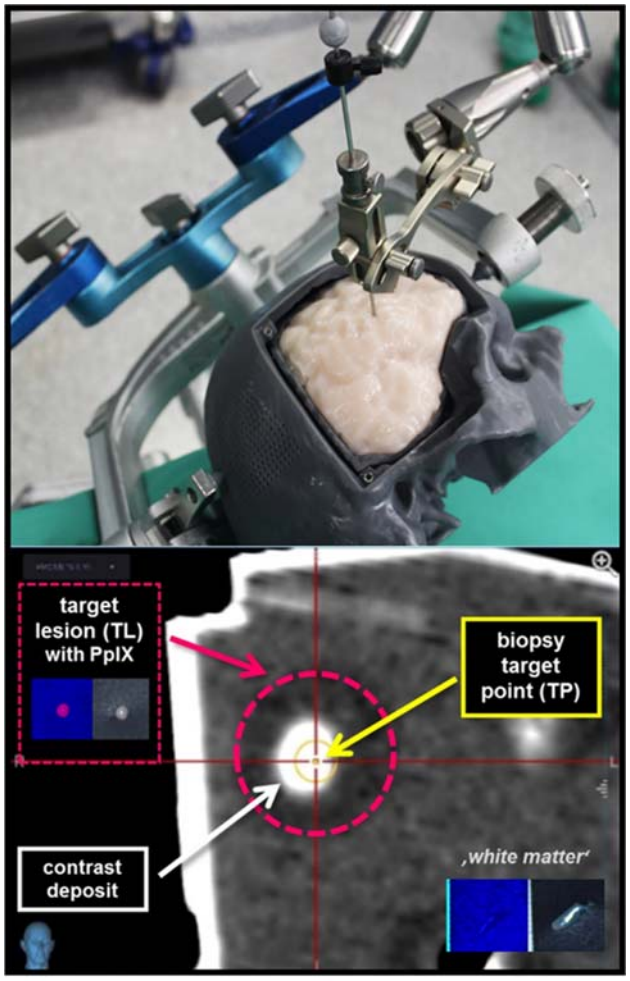


Figure 1. Biopsy setup and analysis of the biopsy samples/ target points (disposable skull part removed)

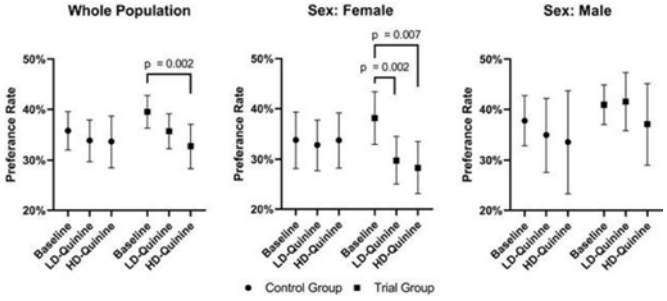
https://doi.org/10.1016/j.bas.2024.103361

223
Brain and Spine 4 (2024) 103362
Radioneuromodulation of the Nucleus Accumbens for Addiction: The First Animal Study

Alperen Sozer [1], Mustafa Caglar Sahin [1], Batuhan Sozer [1,2], Ms Ekin Sozer [3], Pelin Bayik [4], Nil Tokgoz [5], Hakan Emmez [6], Memduh Kaymaz [1], Mesut Emre Yaman [1]. [1] *Gazi University Faculty Of Medicine, Ankara, Turkey;* [2] *No Current Academic Affiliation, Independent Researcher, Ankara, Turkey;* [3] *Gazi University, Ankara, Turkey;* [4] *Baskent University Faculty Of Medicine, Ankara, Turkey;* [5] *Gazi University Faculty Of Medicine, Ankara, Turkey;* [6] *Guven Hospital, Ankara, Turkey*

Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Addiction is acknowledged as a significant challenge for society, worsening daily. Triggered by negative events, even those caused by the addiction itself, cravings are a primary characteristic contributing to the situation's destructiveness. The nucleus accumbens, a critical hub for neural pathways involved in addictive behaviour, has been targeted with DBS or RF lesioning, showing benefits in humans and rodents. However, radioneuromodulation has not been explored until now.
Methods: Using a two-bottle choice intermittent access protocol, an addiction model was established in 36 Long-Evans rats. Radioneuromodulation was executed with a GammaKnife Perfexion unit, delivering 100 Gy at 100% isodose to the bilateral nucleus accumbens. Alcohol preference was assessed through quinine adulteration, with preference calculated as 100x([20% v/v alcohol solution consumed]/[total fluid intake]). A behavioural test battery, including open-field and novel-object-recognition tests, was utilized to evaluate other effects and potential side effects.
Results: Decreases in alcohol preference of 8.4 (2.6-14.1) and 9.8 (4.4-15.3) points were observed in irradiated female rats with low-dose (0.02g/L) and high-dose (0.1g/L) quinine challenges, respectively, unlike the control group, which exhibited no reduction at all. RMANOVA indicated that the preference change under high-dose quinine was significantly different between groups [$F(1,15)=6.850$, $p=0.019$, Partial $\eta 2=0.314$]. Notably, a significant weight-control effect in female rats, reduced thigmotaxis in males, and indications of better recognition of novel objects in male rats were observed.
Conclusions: Gamma Knife irradiation of the bilateral nucleus accumbens significantly reduced alcohol preference in alcohol-dependent female Long-Evans rats compared to controls in the presence of an aversive stimulus, with no evident adverse effects observed. The findings suggest the potential of stereotactic radiosurgery as an alternative therapeutic modality for addiction and highlight the need for further investigations in this direction.
Optional Image



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886
Brain and Spine 4 (2024) 103363
Cerebral Metabolism Analysis for Predicting Response to Radiosurgical Thalamotomy in Tremor Management: A Retrospective Pre-Therapeutic PET-FDG Assessment

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Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Essential and parkinsonian tremor affects 5-7% of individuals over 65 years old. Pharmacological interventions provide clinical benefits in less than 50% of patients long-term. Radiosurgical thalamotomy offers a 70-80% efficacy in tremor reduction after 6-9 months to patients ineligible for deep brain stimulation. In this context, a recent study has suggested specific regional brain metabolic alterations as a potential predictor for Gamma Knife thalamotomy response.
Methods: Fifteen patients with predominant right essential tremor (N=10) or parkinsonian tremor (N=5) underwent cerebral PET-FDG the day before left thalamotomy by Gamma Knife of the ventral intermediate nucleus (GKVIM) at our centre between 02/2020 and 01/2023. A follow-up of at least 6 months (mean: 9±3 months) was accomplished for every patient by a senior neurologist or neurosurgeon. Statistical Parametric Mapping (SPM) T-score maps were compared retrospectively between treatment responders (N=11) and non-responders (N=4) to evaluate the correlation between metabolic heterogeneity and treatment response, as well as between essential tremor patients (N=10, mean age: 78±10 years) and healthy controls (N=54 mean age: 35±9 years) to assess areas involved in essential tremor pathophysiology as a secondary objective. All SPM analyses were corrected for age.
Results: SPM analyses reveal bifrontal and left primary motor cortex hypometabolism ($p<0.001$) in treatment responders compared to non-responders before undergoing GKVIM. Additionally, we observe bilateral temporo-basal, left cerebellar, bilateral basal ganglia, and left primary visual cortex

hypermetabolism, as well as bilateral mesiofrontal, left parietal, right temporal, and right parieto-occipital sulcus hypometabolism ($p<0.001$) in essential tremor patients compared to healthy controls.
Conclusions: These findings highlight interindividual metabolic variability potentially predictive of response to GKVIM for tremor. Furthermore, we confirm and augment the understanding of metabolic variations implicated in essential tremor pathophysiology.
Optional Image

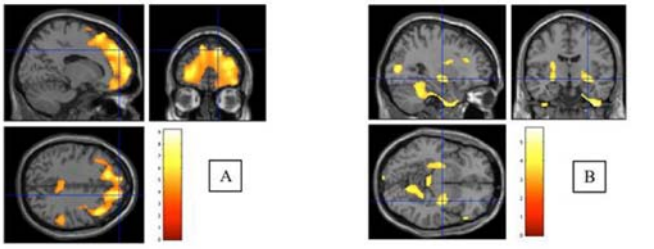


Figure 1.A: Hypometabolism in the bifrontal cortices of responders (N= 11) compared to non-responders (N=4) before GKVIM for tremor, B: Hypermetabolism in the bilateral temporo-basal, left cerebellar, bilateral basal ganglia, and left primary visual cortex of essential tremor patients (N= 10) compared to healthy controls (N=54) before GKVIM for tremor.

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396
Brain and Spine 4 (2024) 103364
Trigeminal nerve electrical activity in patients with trigeminal neuralgia

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Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: In the present work we relate recent advances in experimental studies of an impact of microvascular decompression (MVD) and balloon compression (BC) on electrical activity (EA) in the trigeminal nerve (TN) root and Gasserian ganglion (GG) in patients with trigeminal neuralgia (TGN).
Methods: 15 TGN patients participated in the work. Using irritation on the face, EA in the TN root and GG was investigated before and after MVD and BC. 4 patients with posterior cranial fossa tumors without TGN signs were included in a control group.
Results: In all patients spontaneous EA (without any irritation on the face) in the TN root was not detected, whereas evoked EA in the TN root and GG was registered before MVD and BC in response to superficial or deep irritation on the face. After the surgical procedures (6 patients after MVD and 1 patient after BC) the EA was significantly decreased along with the facial pain. In the remaining patients after MVD (3 patients), evoked EA in the TN root was still identified simultaneously with the pain paroxysms after surgery. In the control group, spontaneous or evoked EA was not determined.
Conclusions: Evoked EA in the TN was detected only in TGN patients in response to irritation on the face. After the surgical procedures postoperative pain relief was associated with EA decreasing in the TN root and GG.

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838
Brain and Spine 4 (2024) 103365
Treatment compliance in mask-based gamma knife radiosurgery: psychological characteristics

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Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Individual psychological characteristics may effect treatment compliance during radiosurgical treatments. Symptom Checklist-90 (SCL-90) and Coping Style Scale (CSS) are commonly used scales to evaluate psychological characteristics and coping mechanisms. The aim of this study was to investigate the relationship between psychological symptoms and coping strategies with stress and treatment compliance of patients undergoing frameless Gamma Knife Radiosurgery.
Methods: 60 patients with various diagnoses were included in the study. Before treatment, Symptom Checklist - 90 (SCL-90) and Coping Style Scale (CSS) were used for evaluating psychological symptoms and coping strategies. The SCL-90 examines an individual's psychological characteristics in 9 factors, including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Coping Style Scale consists of 5 factors: self confident, optimistic, submissive, helpless styles and seeking of social support. The patient's behavior during treatment was recorded for treatment compliance. Instances such as exceeding the normal range of head movements, interruption of treatment, and repetition of CBCT were considered as non-compliance.
Results: Most patients (57,5%) were female, and the median age was 53 (range 23-71) years. Of 60 patients, 30 (50%) had Meningioma, and the remaining patients were diagnosed with AVM (20%), metastasis (18%), vestibular schwannoma (12%). Sub-dimensions of SCL-90 and total number of warnings and reCBCT correlation were examined. Accordingly, somatization ($r=0.326$, $p<.05$), depression ($r=0.334$, $p<.05$), insomnia and eating problems ($r=0.375$, $p<.05$) were associated with reCBCT. Insomnia and eating problems were also correlated with warnings frequency ($r=0.317$, $p<.05$). Patients with a tendency to somatization, high levels of depression, insomnia and eating problems had decreased compliance to treatment. Patients with high scale scores received more reCBCTs during treatment compared to patients with low scale scores. Although there was no correlation with other subscales, the overall symptom score was correlated ($r=0.328$, $p<.05$). Besides, reCBCT was correlated with the optimistic factor ($r=-0.384$, $p<.05$) and self-confident factor ($r=-0.336$, $p<.05$) of the CSS. As expected, optimism and self-confidence, which are coping mechanisms for coping with stress, increased the likelihood of treatment compliance.
Conclusions: According to the outcomes, patients' compliance to GKRS treatment can be influenced by psychological factors. Functional coping mechanisms such as optimistic factor, selfconfident factor predicted treatment compliance.

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829
Brain and Spine 4 (2024) 103366
Is the gammaplan dose optimisation tool efficient enough?

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Functional SRS-Pain (Radiosurgery Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: To investigate the shot usage efficiency of Lightning Dose Optimiser (LDO) used by Leksell Gamma Knife (LGK) GammaPlan for inverse planning in meningiomas (MNGs) planning.
Methods: Four separate inverse planning was performed using LDO algorithm for 17 MNG patients previously treated with manual forward planning. MNGs with target volumes raging from 8.00 cm3 to 15.00 cm3 were selected for these plans. Initially, orginal plans (PO) were made for each target using LDO. Since the shot weights of the orginal plans were different from one to several, normalised plans (PN) were created from orginal plans. From these normalised plans, shot with a weight of 10% or less (PS 10%) and shots with a weight of 20% or less (PS 20%) were removed and 2 different LDO plans were created. For each target, coverage, gradient index (GI), Paddick's conformity index (PCI), selectivity, number of shots, beam on time and V2Gy , V5Gy low doses were compared in 4 different plans created using LDO.
Results: There was no significant difference between the coverages for PO, PN, PS 10% in the plans made for MNGs, while a significant decrease in coverage was observed for PS 20%. For plan quality indexes, no difference was found between GI, PCI, selectivity, number of shots, for 4 different LDO plans. There was also no significant difference between V2Gy, V5Gy low dose volumes of these plans. No significant difference was found for the beam on time values, which constituted the initial aim of the study.
Conclusions: The Lightning Dose Optimiser used by Leksell GammaKnife Gamma Plan uses a larger number of shots than usual, but uses these shots very appropriately. This success of LDO both shortens treatment planning times and shortens patient treatment times, increasing patient comfort and helping to reduce clinical workload. These high quality plans created with LDO contribute greatly to reducing treatment times but a isocenter reduction tool may be

considered in the future.

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681
Brain and Spine 4 (2024) 103367
Frequency Of Abdominal Pain Related To Types Of Shunt Tubing: The difference in the tubing

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"One shunt fits all?" – an update on principles of shunt surgery (Joint Pediatric&CSF Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: A retrospective comparative study looking at the incidence of unexplained abdominal pain relative to peritoneal shunt catheters during the period of 2012 to 2020 was performed in our single-centre unit. It was concluded that Ares peritoneal shunt tubing was associated with a higher incidence of abdominal pain and revision surgery, as compared to Bactiseal, Silverline or plain tubing. We, therefore, subsequently performed a prospective comparative study evaluating the different antibiotic impregnated peritoneal shunt catheters.
Methods: A uniform length of Ares, Bactiseal and Xabo antibiotic impregnated peritoneal shunt catheters were connected to sterile drainage systems, running normal saline continuously at 20ml/hour. Samples were collected from the catheters at 1 week, 3weeks, 5weeks and 8weeks and tested at the Bristol antimicrobial reference laboratory for antibiotic concentrations to discern elution rate. The Antibiotic load and degradation products over time were tested using HPLC-testing method. Antimicrobial activity over time was tested through the zone of inhibition test. The catheters were examined by UCL mechanical engineering team, exploring the rigidity, elasticity and surface microstructure of each catheter using nano-indentation for elastic modulus, 3-dimentional computerised tomography scan and GeminiSEM scanning electron microscope.
Results: The antibiotic elution rates for the various shunt catheters at 1week, 3weeks, 5weeks and 8weeks, respectively, are as follows: Ares (rifampicin level: 0.00392mg/l, 0.0041mg/l, <0.002mg/l, <0.002mg/l; clindamycin level 0.182mg/l, 0.665mg/l, 0.0706mg/l, 0.106mg/l); Bactiseal (rifampicin level: 0.00259mg/l, 0.00263mg/l, <0.002mg/l, <0.002mg/l; clindamycin level 0.0190mg/l, 0.571mg/l, 0.0390mg/l, 0.0544mg/l); Xabo(rifampicin level: <0.002mg/l, 0.0146mg/l, <0.002mg/l, <0.002mg/l; clindamycin level 0.0478mg/l, 0.195mg/l, 0.0265mg/l, 0.0324mg/l. All the catheters differed in internal & external diameter, elasticity, degree of antibiotic impregnation and degree of surface adhesion. The Antibiotic load, degradation products over time and antimicrobial activity were different for the 3 catheters.
Conclusions: Based on these preliminary results it can be concluded that different catheters have different biochemical and physical properties.

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1232
Brain and Spine 4 (2024) 103368
Ultrasonographic assessment of optic nerve sheath diameter in cases of Benign intracranial hypertension (Diagnosis and follow up) in pediatric patients.

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"One shunt fits all?" – an update on principles of shunt surgery (Joint Pediatric&CSF Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: The aim of our study is to assess optic nerve sheath diameter (ONSD) by transorbital ultrasound in pediatric patients with benign intracranial hypertension and to assess its value for diagnosis and follow up.
Methods: our study is prospective observational study held in Mansoura university from January 2022 to June 2024 on patients less than 18 years with benign intracranial hypertension which detects optic nerve sheath diameter (ONSD) by ultrasound in supine position with head elevated 30 degree and ONSD is measured 3 mm from the globe by superficial ultrasound probe to detect its value in diagnosis and follow up and to assess efficacy of medical treatment and surgical intervention
Results: this study included 18 patients with benign intracranial hypertension (11 (61%) females and 7(39%) males) which are followed by transorbital ultrasound to detect optic nerve sheath diameter (ONSD) in Mansoura university neurosurgery department. 12 (66.67%) patients responded to medical treatment and 6 (33.3%) needed lumboperitoneal shunt insertion. ONSD correlated well with opening CSF pressure of lumbar manometry in the left lateral position and also with the severity of clinical manifestations in all cases.
Conclusions: ONSD is a bedside non-invasive tool which could reflect intracranial hypertension efficiently and can be reliable for diagnosis and follow up cases of benign intracranial hypertension

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389
Brain and Spine 4 (2024) 103369
Shunt-Infection Exluding (SHINE) Protocol In Pediatric Patients With Hydrocephalus

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"One shunt fits all?" – an update on principles of shunt surgery (Joint Pediatric&CSF Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Applying of a ventriculoperitoneal shunts is still the first choice of treatment in pediatric patients with hydrocephalus. Unfortunately, this procedure remains associated with an increased frequency of infectious complications. This study introduce a Shunt-Infections-Excluding (SHINE) protocol created to decrease the risk of infections associated with shunt placement surgery.
Methods: This monocentric study included all pediatric patients with hydrocephalus who were treated with CSF shunting procedure in the last eight years in Clinic of Neurosurgery at University Hospital "St. Marina" Varna. The Shunt-Infections-Excluding (SHINE) protocol was developed based on an extensive review of the pertinent literature and implemented in 2019 for shunt implantation in pediatric hydrocephalus cases. This protocol consists of strictly defined steps during the pre-, intra-, and postoperative periods of treatment, such as antibiotic prophylaxis, pre-procedural patient hygiene, double gloving, number of surgeons in the operating theater, and postoperative care and assessments. The study includes two distinct periods: the time preceding the protocol's introduction from 2016 to 2019, and the post-protocol period from 2019 to 2024.
Results: The study summarized 11 patients in the pre- and 42 patients in the post-protocol period. The ventriculoperitoneal shunt was performed in 38 patients with hydrocephalus, and the treatment in one case was with subdural-peritoneal anastomosis. In four (36%) of the patients in the pre-protocol period was detected shunt-associated infection, but after the introducing the SHINE protocol no infections related complications with the shunt system were observed.
Conclusions: The Shunt-Infections-Excluding (SHINE) protocol is a reliable tool for prevention of infection in pediatric patients with hydrocephalus treated with shunt system. The protocol significantly reduces the risk for postoperative infections in pediatric patients with hydrocephalus.

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684
Brain and Spine 4 (2024) 103370
Using Point of Care Ultrasound (POCUS) to evaluate patency of Ventriculo-Peritoneal (VP) Shunt: evaluation of a novel technique

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"One shunt fits all?" – an update on principles of shunt surgery (Joint Pediatric&CSF Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: CSF diversion for Hydrocephalus like Ventriculo-Peritoneal shunt has high complication rates; including shunt obstruction which has devastating consequences. The method to diagnosis like Magnetic Resonance Imaging (MRI) or Computed Topography (CT) to visualize ventricles or the use of radionuclide shunt patency test are costly, invasive, time consuming and not widely available. We devise methods to use Point of Care Ultrasound (POCUS) to assess shunt patency and discuss on its validity and systematic use.
Methods: A prospective, single center cohort observational study done in Kathmandu Medical College Teaching Hospital. Patients with VP shunts; placed

at least 1-month prior were enrolled and assessed using POCUS to analyze patency. We look for CSF flow proximal and distal to shunt chamber and presence of fluid in abdomen; the presence of all suggested a patent flow. This was correlated against CT / MRI / Trans-fontanelle USG for the presence of hydrocephalus as identified by an Evans Index of more than 0.30

Results: Total of 27 patients were enrolled; male 10 (42%) with age ranging from 1 month to 69 years. All had medium pressure VP shunts placed. Patients were treated for Congenital Hydrocephalus (3) or Hydrocephalus secondary to Tumour (with/without) Excision (4), Dandy-Walker Syndrome (1), Post-Traumatic (2), Aneurysm Clipping (3), Meningitis/Ventriculitis (7), Myelomeningocele repair (4), Ischaemic Infarct (2), Porencephalic Cyst (1). 21 patients in this series had patent functioning shunt. Proximal and distal chamber velocities measured averaged 9.7 and 10.7 cm/sec respectively. This along with presence of intraperitoneal collection confirmed patency of shunt with equally significant correlation ($p<0.005$).

Conclusions: We describe a novel technique of using POCUS to assess the patency of VP shunts. It is advantageous as it is quick, safe, performable on outpatient basis and is cost effective.

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672
Brain and Spine 4 (2024) 103371
The learning curve for performance of extradural surgical clinoidectomy

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Modern neuroanatomy perspectives in skull base surgery (Young Neurosurgeons Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: The surgical management of parasellar pathologies represents significant challenges in terms of preservation of neurovascular structures and maximizing the extent of resection of these lesions. The pterional approach is the preferred surgical corridor for access to these lesions. Addition of an extradural anterior clinoidectomy (EdAC) clearly enhances the exposure available with a regular pterional craniotomy but an initiate is often discouraged by venous bleeding and fear of neurovascular injury. We designed a study with the objective of estimating the number the number of procedures necessary for acquiring proficiency in extradural anterior clinoidectomy by fellowship trainees.

Methods: 3 neurosurgical fellowship trainees were allowed to perform 27 EdACs in patients with diverse parasellar pathologies (2018 to 2020, 8 tuberculum sellae meningiomas, 8 clinoidal meningiomas,7 giant pituitary adenomas, 4 craniopharyngomas). Trainee's performance and dexterity of execution were graded both objective methods and subjective methods involving evaluation of surgical videos by blinded experts. The objective criteria included incidences of microscope adjustments, instrument exchanges, time taken and blood loss. The evaluation was scored on a 10 point scale. Additionally, a self evaluation questionnaire was filled by the trainees

Results: (Fig 1)The trainees required an average of 7 (range 5-8) procedures to acheive a score of 7 or above on the performance scale. The mean subjective performance score increased from 3.33 to 8 over 10 procedures. Average number of microscope adjustments needed to successfully execute EdACs declined from 13 to 9 over 8 procedures.Head elevation above 30 degree, dural slit to release of CSF from sylvian cistern and relax the dural compartment, complete division of the orbito-meningeal band along the face of the clinoidal pyramid and epidural exposure upto the maxillary division were adjudged as helpful by the trainees in achieving adequate exposure. Additional time for EdACs declined from mean of 32 minutes to 21 minutes over 7 procedures. No intra-operative neurovascular injury was observed. Injection of fibrin glue into the venous space between the ophthalmic and maxillary divisions during epidural dissection considerably reduced venous bleeding.

Conclusions: About 7 repetitions of EdACs are required by fellowship trainees to acquire proficiency in safe and satisfactory execution of the procedure. The mean additional time taken for adding an EdAC to pterional craniotomy is approx. 20 minutes. Several nuances could be identified which facilitate performance of EdAC by initiates.

Optional Image

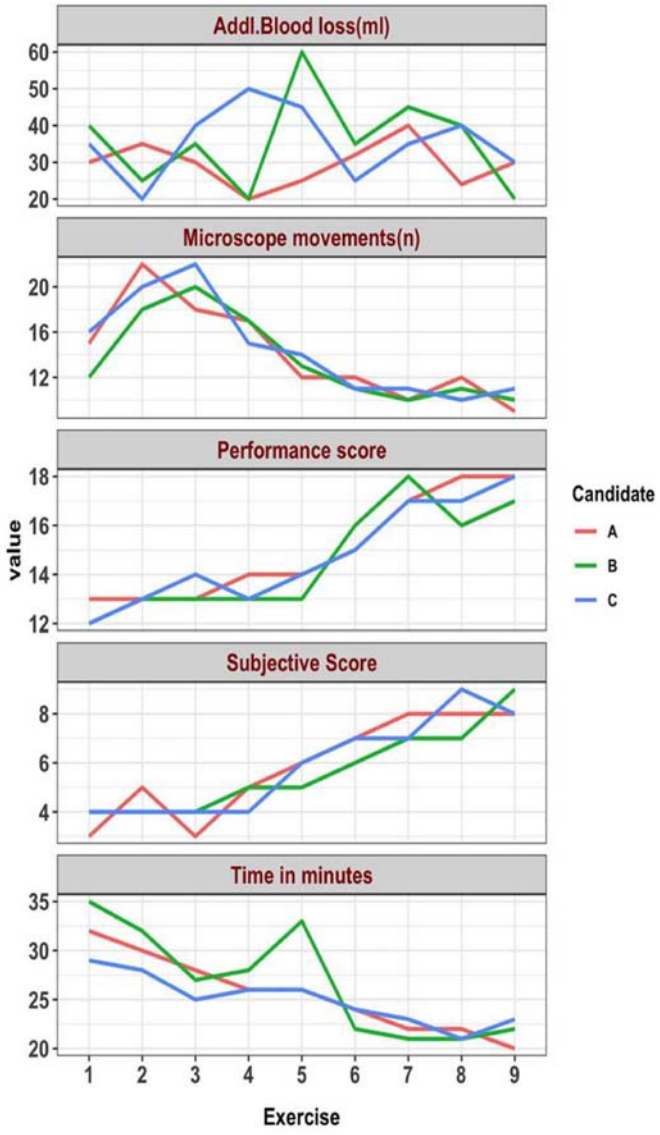


Fig 1: Changes in various parameters of assessment with sequential procedures performed by Candidate A, B and C (surgical fellowship trainees)

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1285
Brain and Spine 4 (2024) 103372
Anterolateral and anteromedial transorbital approaches to the skull base: A quantitative and qualitative analysis.

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Modern neuroanatomy perspectives in skull base surgery (Young Neurosurgeons Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Despite the growing popularity of transorbital approaches there is a lack of comparative studies on their indications. Herein we chose to analyze the

following six: 1) Supraorbital craniotomy through an eyebrow incision (SupraOrb) with its extension (SupraTransOrb), 2) Modified orbitozygomatic craniotomy through an eyebrow incision (ModOzEyB), 3) Modified orbitozygomatic craniotomy through a palpebral incision (ModOzPalp), 4) Lateral orbitocraniotomy through a lateral canthal incision (LatOrb), 5) Purely endoscopic transpalpebral approach or Transorbital NeuroEndoscopic Surgery (TONES), and 6) Tansfrontal orbitocraniotomy through a medial eyelid incision (MedOrb).
Methods: Cadaveric dissections were performed in 6 formalin-fixed heads, namely two sides allocated to each approach. Annotation points with their axial coordinates were taken at the borders of the skull base exposure via image-guidance and illustrative maps were created. Qualitative traits were also thoroughly examined.
Results: SupraOrb provides mainly anterior cranial fossa (ACF) exposure. An anterior clinoidectomy is feasible, but without direct observation of the superior orbital fissure. Partial middle cranial fossa (MCF) access can be attained if the lateral sphenoid wing is drilled, with orbital rim sparing (SupraTransOrb). ModOzEyB provides extensive exposure of both ACF and MCF, while its superior to inferior trajectory like in SupaOrb make them appropriate for pathologies extending contralaterally. ModOzPalp exposes adequately both ACF and MCF, but has a more inferior to superior trajectory, enabling less access to the medial anterior skull base compared to ModOzEyB. LatOrb is more versatile in MCF, whilst ACF exposure is confined in a small area above the sphenoid ridge. The anterior clinoidectomy is performed without direct visualization of the optic canal roof. TONES allows ACF and MCF access but is limited medially by the ipsilateral opticocarotid region. MedOrb excels in ipsilateral anteriomedial base exposure.
Conclusions: Meticulous case selection based on the distinctive characteristics of each approach is essential to safely accomplish the surgical goals.

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1034
Brain and Spine 4 (2024) 103373
3D Venous Segmentation Using Contrast-Enhanced T1 MRI Sequences for Preoperative Evaluation of the Venous Anatomy in the Pineal Region

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Modern neuroanatomy perspectives in skull base surgery (Young Neurosurgeons Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Venous 3D-DSA (v3D-DSA) is considered gold standard for imaging of the venous system but is invasive and not widely performed. In cases without dedicated venous MRI imaging, many surgeons rely on standard T1 and T2 MRI sequences to assess the venous anatomy for preoperative planning in the pineal region. 3D venous segmentation using basic MRI sequences may represent an alternative tool. However, its impact on the preoperative assessment of venous anatomy and prediction of surgical risks are currently unknown.
Methods: Source data from four patients with either standard post contrast T1-weighted sequences, susceptibility weighted imaging/angiography (SWI/SWAN), or time-of-flight (TOF) sequences were analyzed. Two available software packages were used: 3DSlicer (open source) and Elements (Brainlab, Munich, Germany). Volume renderings (VRT) and maximum intensity projections (MIPs) were obtained to assess visualization of tributaries to the Vein of Galen (VoG). Particular attention was paid to smaller posterior fossa veins and the internal occipital veins.
Results: Visualization of main tributaries to the VoG system was possible in all cases, including the ones without SWI or TOF. Smaller contributors were less completely visualized. The difference between the two software was marginal. Post processing with Elements was less time-consuming as data from the PACS system could be used directly, while Slicer required data export and transformation into STL files.
Conclusions: In cases of planned surgery in the pineal region and no dedicated venous imaging, 3D segmentation using standard post contrast T1 data is an alternative tool. However, it may provide less complete anatomical information when compared to SWI and TOF to predict clinical consequences secondary to a compromise or sacrifice of the venous anatomy. More data are needed to accurately assess the necessity of either dedicated vascular MRI sequences such as SWI, TOF or MR-venography as well as v3D-DSA for surgical planning.

Optional Image

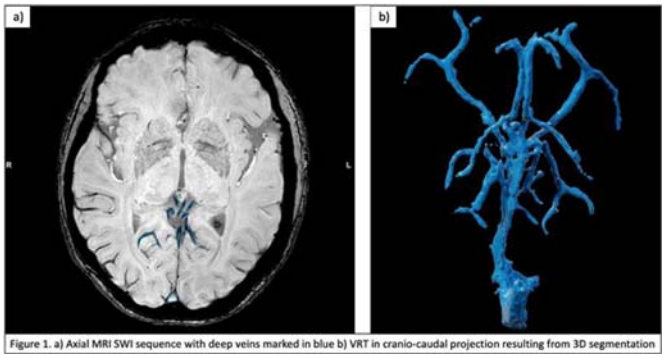


Figure 1. a) Axial MRI SWI sequence with deep veins marked in blue b) VRT in cranio-caudal projection resulting from 3D segmentation

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876
Brain and Spine 4 (2024) 103374
Individually tailored minimally invasive full-endoscopic transnasal resection of large clival chordomas. Decision making in mononostril vs. binostril approaches

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Modern neuroanatomy perspectives in skull base surgery (Young Neurosurgeons Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM
Background: Chordomas are malignant bone tumors. Even though they are slow-growing, local aggressive and invasive behavior can be expected. The mainstay of treatment is surgery. Nevertheless, clival chordomas suppose a big challenge from an anatomical and technical point of view.
With the growing popularity of endoscopic transnasal skull-base surgery, many centers have already adopted these techniques for the resection of those tumors. Unfortunately, some of these tumors are very large and present an inferolateral extension that poses an important challenge even for the experienced surgeon. For those cases, a combined transnasal-transcranial approach is commonly selected.
Methods: In this paper, we describe the concept based on a multicentric experience of a tailored full-endoscopic transnasal approach for the resection of large clivus chordomas.
Results: Central-located tumors of the clivus were mainly approached through a mononostril transethmoidal paraseptal approach. For those expanding inferiorly and laterally to the petrous bone, a binostril approach was commonly adopted. Mucosal destruction was in all cases minimized, nasoseptal flap was used only by a wide dural opening. The middle and inferior turbinates were preserved in all cases.
Conclusions: We demonstrate that a minimally invasive full-endoscopic transnasal approach is safe and feasible even for large and lateral expanding clivus chordomas. Careful selection of an individually tailored approach (mononostril vs binostil) is in our opinion decisive for achieving a radical resection with minimal approach-related trauma of the nasal cavity.

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1417
Brain and Spine 4 (2024) 103375
Training in Skull Base Surgery: from the Lab to the Operative Room

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Modern neuroanatomy perspectives in skull base surgery (Young Neurosurgeons Parallel Session), October 14, 2024, 8:00 AM - 9:30 AM

Background: Neurosurgical training has changed a lot in recent years with the advent of new technologies such as virtual reality, surgical simulators and 3D models. Despite this, these new proposals currently have a role mainly in the initial training of neurosurgery residents. In fact, it is clear that even today the study of anatomy and approaches on cadaver remains the best method of preparation for the neurosurgeon interested in skull base surgery.
Methods: This presentation will explain the training course that can allow the young neurosurgeon to prepare to perform complex skull base surgery, documented with photos and videos of laboratory activities and clinical cases.
Results: The path that allows the young neurosurgeon to become progressively autonomous in skull base pathologies is mainly based on training on a cadaver for a dedicated period of time. This activity must be associated with a period of clinical attendance in reference centers for this surgery, with the aim of understanding the indications and limits of the different approaches learned on the cadaver.
Conclusions: Spending a dedicated period of time in an anatomical laboratory allows the progressive development of technical skills which, combined with active attendance in operating rooms in reference centres, will allow the young neurosurgeon to carry out operations of increasingly greater complexity.

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384
Brain and Spine 4 (2024) 103376
Dorsal and ventral fusion as correction of craniocervical and atlantoaxial instability using O-Arm System versus C-arm procedure – a single centre review of 270 Patients

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: A prospective analysis of the surgical treatment and results of 270 patients with benign and malignant craniocervical, atlantoaxial lesions operated during 12 years period (2011-2022) at our department was performed. The aim of the analysis was to assess, the fusion rate and the clinical outcome in patients after correction of craniocervical and atlantoaxial instability, comparing O-Arm System procedures versus C-arm procedure.
Methods: We analyzed 175 patients with traumatic lesions, 21 patients with inflammatory lesions, and 74 patients with craniocervical tumors. We performed 312 operations. Because of craniocervical/cervical instability we made anterior or/and posterior screw fixation and fusion in all of 270 patients. In order to improve screw placement accuracy, we performed intraoperative O-Arm in 238 cases (88,14%). In 32 cases (11,86%) we used C-arm.
Results: We analysed the significant operative outcome factors: the operative duration was 2h. in O-Arm operations and 4h in X-ray procedures and the blood loss was 220 ml in O-Arm and 500ml in C-Arm procedures. The mean screw length (prognostic fusion rate factor) in C1/C2/C3 vertebras was 30 mm in O-Arm procedures and 24 mm in C-Arm procedures. The most common operative complications were: CSF leak – in 2 cases, postoperative infection – in 8 cases, screw misplacement - in 3 C-arm procedures, and 2 cases of early operative mortality. The 24-monts follow-up of 230 patients showed good recovery in 74% of patients, moderate disabling–14% of patients, severe disabling –5% of patients, vegetative state – 3% of patients, death -4% of patients with malignant lesions or in bad general condition.
Conclusions: Early and emergency correction of craniocervical and atlantoaxial instability facilitated neurological recovery by preserving the existent neurological function. Using of O-Arm increase significant operative screw placement accuracy, and preserve intraoperative nerve and vertebral artery injury. The fusion rate in O-arm procedures is 88% and 71% in C-Arm procedures. The clinical outcome in O-arm procedures is better than C-Arm procedures. The complications rate in O-arm procedures was significantly reduced (6,5%) comparing to C-arm procedures (14%).

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1006
Brain and Spine 4 (2024) 103377
Minimally invasive spinal surgery 10-years experience - lessons learned

Nikolay Gabrovsky, Petar Ilkov, Nikolay Velinov, Maria Laleva.

Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: We present our institutional experience and personal impressions using minimally invasive spine surgery (MISS) techniques, describe our learning curve and how gaining experience influenced different parameters of the surgical procedure.
Methods: From 01.2013 to 01.2023 284 patients were operated in the University Hospital Pirogov using percutaneous posterior transpedicular technique. Patient demographics, type of pathology, blood loss, duration of surgery, radiation exposure, length of hospital stay were reviewed. The cohort was divided into consecutive quarters (71 patients each). Comparison of the results for each quarter and timeline analysis were made.
Results: 252 patients were operated. The average patient age was 51 years (17–81 years), the series included 133 women (47%) and 151 men (53%). Only percutaneous transpedicular fixation was performed in 132 cases, MIS-TLIF in 154 cases, vertebral body replacement in 11 cases. Robotic assistance was used in 49 cases. Average blood loss was 114.3 ml, 116 ml, 106.8 ml and 107.3ml for each quarter, respectively. Average operative time was 154.0 min, 143.7 min, 134.2 min, and 133.6 min. Average time of radiation exposure was 105.3 sec, 85.7 sec, 47.1sec, and 44.8 sec. Differences of the operative time and the time of radiation exposure between the 1st –3rd quarter and the 1st –4th quarter were statistically significant.
Conclusions: When compared to the standard operative approach, the utilisation of minimally invasive percutaneous spinal fixation and gradual improvement of the technique resulted in a less traumatic and equally effective approach. The disadvantages of MISS techniques can be significantly reduced once the learning curve is overcome.

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885
Brain and Spine 4 (2024) 103378
An extended follow up of spinal instrumentation rescue with cement augmentation

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Percutaneous cement augmentation has been reported as an effective salvage procedure for frail patients suffering from spinal instrumentation failures, as screw loosening, hardware breakage, cage subsidence, and fractures within or adjacent to stabilized segments. Favorable results were reported over a median follow-up period of 16 months in a retrospective analysis of 31 consecutive procedures performed in 29 patients. In the present study the long-term effectiveness of this treatment to avoid or postpone revision surgery is reported.
Methods: Clinical and radiological data of our original cohort of patients were retrospectively collected and reviewed, in order to provide an extended follow assessment. The need of revision spinal surgery was assessed as the primary outcome and the radiological stability of the implants of the previously treated segments was considered as the secondary outcome.
Results: An extended radiological follow up was available in 27/29 patients with an average of 50.9 months. Overall, 18/27 (66.7%) patients, originally candidate for revision surgery, avoided a surgical intervention after the cement augmentation rescue procedure. In the remainder patients, the average time period between the rescue cement augmentation and the revision surgery was 22.5 months. Implant mobilization occurred in 2/27 (7.4%) patients, rod breakage in 1/27 (3.7%), a new fracture within or adjacent to the instrumented segment occurred in 4/27 (14.8%) patients and screw loosening in rescued segments in 5/27 (18.5%) patients.
Conclusions: In this cohort, cement augmentation rescue procedure held its effectiveness to avoid or postpone revision surgery during a long-term follow up.

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191
Brain and Spine 4 (2024) 103379
Cervical pedicle screw placement with patient-specific 3d-printed guides: accuracy and safety in a clinical experience

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Cervical pedicle screw (CPS) instrumentation offers significant biomechanical advantages compared to lateral mass or transarticular fixation. Nonetheless, malpositioning complications constitute a relevant concern. Customized patient-specific 3D-printed templates have been developed to improve CPS placement accuracy and safety. The aim of this study is to present our experience with this surgical technique and its accuracy and safety in a clinical setting.
Methods: This single-center retrospective observational study of prospectively collected data included patients undergoing CPS fixation surgery using a patient-specific 3D template guide system. All patients underwent a 3D-volumetric high-resolution CT scan of the cervical spine for preoperative surgical planning. Postoperative CT scans were used to evaluate pedicle infraction, CPS trajectories and deviations between the planned and the actual screw position.
Results: A total of 115 CPS were implanted in 25 patients, with 107 (93.1%) screws completely placed inside the pedicle. Cortical breach within 2 mm was observed in 8 (6.9%) cases, with no cases of more severe pedicle infractions or perioperative neurovascular complication. No differences of CPS accuracies were found between each metameric fusion level, and between monolateral or bilateral templates. Mean total deviations were 0.75 mm vertically and 0.51 mm horizontally at the screw entry point, and 0.72 mm vertically and horizontally at the narrowest pedicle point. Mean total sagittal and transverse angular deviations were 2.94° and 3.04°, respectively.
Conclusions: Cervical pedicle screw instrumentation using patient-specific guides is safe and accurate, supporting the feasibility of this technique in posterior cervical spine fusion surgery.

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699
Brain and Spine 4 (2024) 103380
Evaluation of the SISS Score: Correlation of Clinical Outcomes and Radiological Progression in Spinal Pyogenic Infection

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: The Spinal Instability Spondylodiscitis Score (SISS) was created as a tool in the evaluation of stability in spinal pyogenic infections. Despite spine surgeon growing interest, the correlation between SISS scores and clinical outcomes remains inadequately explored. Moreover, the prognostic significance of initial SISS scores in predicting subsequent radiological progression is of paramount importance for effective treatment planning and prognostication.
Methods: This study involved a retrospective collection of clinical data and evaluation of radiological images from two centers located in the United Kingdom and Germany. The primary outcomes were defined as unfavorable outcomes (modified Rankin Scale, mRS 4-6) and the development of a neurological deficit during treatment. Radiological progression in patients treated conservatively and monitored with MRI was assessed and categorized into minor progression (including endplate erosion or disc collapse) and major progression (encompassing bony destruction, kyphotic or scoliotic angulation, or translation).
Results: The study incorporated 205 cases, 91 of which underwent conservative treatment, while 114 received surgical intervention. The cohort had a mean age of 67 years, with 123 male participants. Patients were categorized based on their SISS scores as stable (23 cases), potentially unstable (147 cases), and unstable (35 cases). Within the stable group, 6 patients (26%) developed neurological deficits. Unfavorable outcomes were observed in 9 out of 23 cases (39%) in the stable group, 54 out of 147 cases (37%) in the potentially unstable group, and 18 out of 35 cases (52%) in the unstable group.
ANOVA variance analysis revealed statistically significant differences in continuous SISS scores between patients with no impairment ($p<0.01$) and those with unfavorable outcomes ($p<0.05$), as compared to other mRS categories. Subfactors 'Spinal alignment' and 'Bone lesion' had the strongest impact on the continuous SISS ($p<0.001$).
The multilevel regression analysis indicated that the strongest predictor of an unfavorable mRS outcome were having a neurological deficit at admission ($p<0.001$), and SIRS at admission ($p=0.04$). The SISS score and location factors did not reach conventional levels of statistical significance in this model.
Major radiological progression involving the development of deformity was present in 47% across all conservatively treated groups.
Conclusions: The findings suggest that, while subfactors like 'Spinal alignment' and 'Bone lesion' are mainly determining SISS, the overall score's impact on mRS outcomes is less clear. Other factors, not included in the SISS, might also be important in determining outcomes. Furthermore, the data also indicates that an assessment of stability via the SISS is reflective of a specific point in time and that neurological impairments can emerge in conjunction with radiological progression. Hence, ongoing clinical and radiological reassessment during treatment is imperative to preemptively identify the risk of neurological deterioration.
Optional Image

	TOTAL	SISS stable		SISS potentially unstable		SISS unstable	
	205	23		147		35	
Admission status							
Pain	182	9	39%	138	94%	35	100%
Neurological deficit	61	5	22%	43	29%	13	37%
SIRS	31	6	26%	21	14%	4	11%
Outcome							
mRS 0-1	76	7	30%	63	43%	6	17%
mRS 2-3	39	7	30%	23	16%	9	26%
mRS 4-5	65	7	30%	44	30%	14	40%
mRS 6 (death)	16	2	9%	10	7%	4	11%
Developing neurological deficit	25	6	26%	15	10%	4	11%
Conservative treatment		4		38		11	
Minor progression		1	25%	6	16%	0	0%
Major progression		2	50%	18	47%	5	45%

Table 1. The table presents a summary of the clinical characteristics and outcomes of patients stratified by their Spinal Instability Spondylodiscitis Score (SISS) status: stable, potentially unstable, and unstable. The table details the distribution of admission statuses such as pain, neurological deficit, and Systemic Inflammatory Response Syndrome (SIRS), as well as the outcomes according to the modified Rankin Scale (mRS) and the frequency of developing a neurological deficit during treatment. Proportions of patients who underwent conservative treatment with radiological follow up and either minor or major progression are displayed below.

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337
Brain and Spine 4 (2024) 103381
Risk factors of screw misplacement by using intraoperative computed tomography image-guided navigation: a series of 1471 screws

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: The aim of this study was to identify potential risk factors for screw

misplacement after using an intraoperative computed tomography (iCT) guided navigation for Screw insertion.
Methods: A retrospective analysis of all patients following iCT navigated spinal pedicle screw placement between October 2015 and March 2022 was performed. Navigated drilling of the pedicle was followed by screw placement (with and without via K-wire). Screw position was checked by a further iCT scan . Screw position was assesed according to the Gertzbein-Robbins classification and the rates of screws actually revised intraoperatively were calculated.
Results: 256 consecutive patients were identified (50,39% male, 49,61% female). A total of 1471 Screws were implanted. Median age was 67 years. The all-over revision rate was 4,49%. Screws were placed in all spinal regions. Degenerative spine disease was the most common diagnosis (43,44%). No significant differences in revision rates were found for gender and age. Lumbar spine (6,25%), thoracic spine (5,86%), tumor (6,40%) and infection (7,98%) diagnosis were associated with highest revision rate. We also found significantly increased revision rates for overweight (BMI 25 to 30) and obesity (BMI > 30) at 4,17% and 7,38%.
Conclusions: The all-over revision rate was 4,49%. The highest revision rates were observed for tumor (6,40 %), infection patients (7,98 %), lumbar spine (6,25 %) and thoracic spine (5,86 %). Overweight and obesity also seems to be a significant risk factor for screw misplacement (BMI<25: 0,46%; BMI 25 to 30: 4,17%; BMI>30: 7,38%). None of the patients suffered from any neurovascular damage. No secondary operation to revise the misplaced screws was required.

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439
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An International Multicentric Evaluation of Septic Patients with Primary Spondylodiscitis – The 2SICK Study of the EANS Spine Section

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Spinal Infections (Spine Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: The management of septic spondylodiscitis presents a clinical challenge, with debates surrounding the timing of surgical intervention. The 2SICK study addresses the gap in knowledge concerning the efficacy of early surgery versus conservative management in these critically ill patients.
Methods: A multicentric, international retrospective cohort study encompassed cases from 2015-2022. Inclusion criteria were a CRP level >200 mg/l and a septic state upon admission. Patients were stratified by treatment modality (early surgery within 3 days of admission, delayed surgery after 3 or more days of non-surgical stabilisation, and conservative therapy). Chi-square tests, univariate analyses, stepwise and regularization-tuned multivariate regression analyses were used to examine outcome differences in mortality.
Results: A total of 189 patients, with a mean age of 69 years, were evaluated. Among these, 36 underwent conservative therapy, 79 underwent early surgery, and 74 received delayed surgery. The subgroup undergoing delayed surgery exhibited the lowest mortality rates, with 4.1%. In comparison, the mortality rates for early surgery and conservative therapy were 28.2% and 27.8%, respectively. The ideal time frame for delayed surgery, in terms of mortality, was found to be between 10 and 14 days from admission. Accounting for confounders, delayed surgery was found to be significantly associated with decreased mortality ($p<0.01$) compared to conservative therapy, and early surgery with increased mortality compared to conservative therapy ($p<0.05$). Positive predictors of mortality were found to be age, reduced GFR, raised creatinine, multiple organ failure, cervical location of the infection, erosion of endplates, presence of psoas abscess and tachycardia at admission ($p<0.05$). Negative predictors were days between admission and surgery and the presence of epidural abscess ($p<0.05$).
Conclusions: Delayed surgery was found to be associated with significantly less mortality compared to early surgery and conservative therapy in patients with septic spondylodiscitis. The likely optimal window for surgery is 10 to 14 days from admission. The strongest predictors of death were early surgery within 3 days of admission, vertebral endplate erosion, and multiple organ failure.

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149
Brain and Spine 4 (2024) 103383
The role of Vitamin D for incidence of and mortality after aneurysmal subarachnoid hemorrhage

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Aneurysms (Vascular Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Aneurysmal subarachnoid hemorrhage (aSAH) has been described as an inflammatory disease. Vitamin D has systemic anti-inflammatory properties and may therefore reduce the risk of development and rupture of intracranial aneurysms (IA). We aimed to investigate the association between vitamin D and the incidence and mortality after aneurysmal subarachnoid hemorrhage (aSAH) using the UK Biobank.
Methods: We retrieved data from the UK Biobank, a prospective population-based cohort study of 502,411 participants, initiated in 2006. Serum 25-hydroxyvitamin D [25(OH)D] levels were analyzed between participants with ruptured IA and the general population. 25(OH)D levels were classified as sufficient (> 50nmol/L), deficient (<50nmol/L) and severely deficient (<30nmol/L). Multivariate logistic regression analysis and Cox regression were performed and adjusted for demographic characteristics and vascular risk factors.
Results: During the 16-year follow-up period (April 2006 - May 2022), 1,447 aSAH were reported. Compared to the general population, aSAH patients had a female preponderance (60.23% vs. 51.71%, $p<0.0001$) with a higher prevalence of smoking (67.09% vs 60.40%, $p<0.0001$) and higher systolic blood pressure (142.7 mmHg vs. 140mmHg, $p<0.0001$). Participants with vitamin D deficiency (<50nmol/L), had a higher incidence of SAH than participants with sufficient 25(OH)D levels (> 50nmol/L; odds ratio (OR) 1.448, confidence intervals (CI) 1.036 – 2.2026, $p=0.0303$). This association was more pronounced in patients with severe vitamin D deficiency vs. sufficient 25(OH)D levels (OR = 2.052, CI = 1.278 – 3.294, $p=0.0029$). Vitamin D insufficiency (hazard ratio (HR) 0.940, CI 0.638 – 1.386, $p=0.7534$) or severe vitamin D insufficiency (HR 0.982, CI 0.565 – 1.815, $p=0.9517$) were not predictive for mortality after aSAH.
Conclusions: Individuals with vitamin D deficiency and severe vitamin D deficiency have a higher risk of aSAH than those with sufficient vitamin D levels, but vitamin D deficiency did not influence mortality outcome after aSAH. Future studies might investigate potential benefits of Vitamin D supplementation in preventing rupture in IA.

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956
Brain and Spine 4 (2024) 103384
Intra-Operative Neurophysiological Monitoring (IONM) Role During Aneurysm Surgery: a Technological Support for a Better Outcome

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Aneurysms (Vascular Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: This observational retrospective study analyzes the value of the Intra-Operative Neurophysiological Monitoring (IONM) during aneurysm surgery. The aim is to identify the correlation between post-operative deficits and IONM.
Methods: Adult patients with unruptured aneurysms treated from September 2019 to August 2023 were included in the study. IONM comprised Motor Evoked Potentials from transcranial (tcPEM) and direct cortical (dcPEM) stimulation with cortical strip. The monitoring was continuous during surgery, and the

amplitude reductions has been divided into reversible and no-reversible type
Results: A total of 47 patients and 49 treated aneurysms were included in the study. The mean age at the diagnosis was 56.9 years, and 39 patients (82.9%) were female. Of 49 aneurysms, 48 (97.9%) were clipped and 1 (2.1%) was trapped and embolized. Rankin modified scale was used for clinical evaluation and 36 patients (76.6%) were pre-operatively free from deficits. Of 49 aneurysms, 20 (40.8%) were of Middle Cerebral Artery, 13 (26,6%) of the Internal Carotid Artery, 10 (20.4%) of the Anterior Communicating Artery, 3 (6,1%) of the Posterior Communicating Artery and 3 (6.1%) of the Anterior Cerebral Artery. An altered IONM drived timing and positioning of temporary clipping.
No IONM alterations were detected in 74.5% of cases; in 6 patients (12.8%) with contralateral approach dcPEM registration was not possible. 2 (4.1%) cases had temporary amplitude reduction; 3 (6.1%) cases had complete disappearance of PEM. 5 cases (10.2%) had intra-operative crisis. Nevertheless, postoperatively 12 cases (24.5%) had new post-operative hypodense areas at cranial CT scan, but only 3/12 (6.1%) developed new post-operative deficits. The mean follow-up lasted 10 months
Conclusions: IONM gives real-time information to surgeons, helping with eloquent areas, ischemic lesions and time of temporary clipping. IONM, flowmeter, doppler, video-angiography/fluorescein is the better technological combination to maximize the aneurysms surgical outcome.

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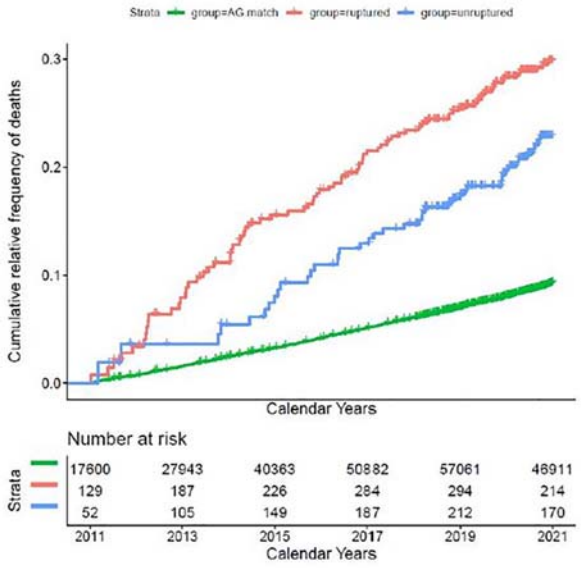
553
Brain and Spine 4 (2024) 103385
Increased mortality, reduced life expectancy and increased cardiovascular co-morbidities in patients with intracranial aneurysms.

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Aneurysms (Vascular Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Population-based statistics may overestimate the life expectancy of patients with intracranial aneurysms (IA). This study aims to investigate potential excess mortality of IA patients and compare it with the survival probability of an age and sex-matched general population. Furthermore, causes of death of IA patients are analyzed and the prevalence of cardiovascular risk factors in IA patients is investigated.
Methods: Survival and cause of death were studied for 896 patients with 1107 consecutive IAs and compared to a sample of the age and sex-matched general population (1:100). Furthermore, presence of cardiovascular risk factors was evaluated in a retrospective register-based approach.
Results: The hazard rate of death upon detection of an unruptured IA was 3.116 [CI 2.291, 4.239] for the study period ($p<0.001$), mean age of death in these patients being 73.9±1.7 years, in comparison to 83.6±0.3 years for the matched general population. In ruptured IAs, the hazard of death was 46.213 [CI 6.391, 334.178] times higher during the first month after IA rupture ($p<0.001$), however, no increased mortality persisted thereafter when compared with unruptured IA patients. Cardiovascular deaths were more common among IA patients (34.3%) than in the matched general population (21.3%). Furthermore, cardiovascular risk factors and co-morbidities are overrepresented in IA patients ($p=0.001$).
Conclusions: Patients with an unruptured IA harbor a threefold increased risk of death upon detection of the IA and they die on average 10 years earlier than the general population. IA rupture is associated with increased mortality during the acute phase, however, after the first month, survivors are at similar risk of death as patients with unruptured IAs. These are important factors to consider when indicating treatment. Furthermore, as cardiovascular risk factors and cardiovascular deaths are over-proportionally represented among IA patients, aggressive management of all cardiovascular comorbidities appears of utmost importance in this patient group.

Optional Image

Figure 1: Kaplan–Meier curves of the cumulative relative frequency of deaths for IA patients (separately for ruptured and unruptured IAs) and matched general population with respect to calendar time. The hazard of death is significantly higher for unruptured IA patients (blue) than for the general population (green) ($p<0.001$) and even more elevated in ruptured cases (red) ($p<0.001$). A slight increase in overall mortality after 2020 probably reflects excess mortality due to the COVID pandemic.



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635
Brain and Spine 4 (2024) 103386
Experimental Comparison of a Rule-Based Approach and Deep Learning to Automatically Assess Knosp Score for Pituitary Adenomas

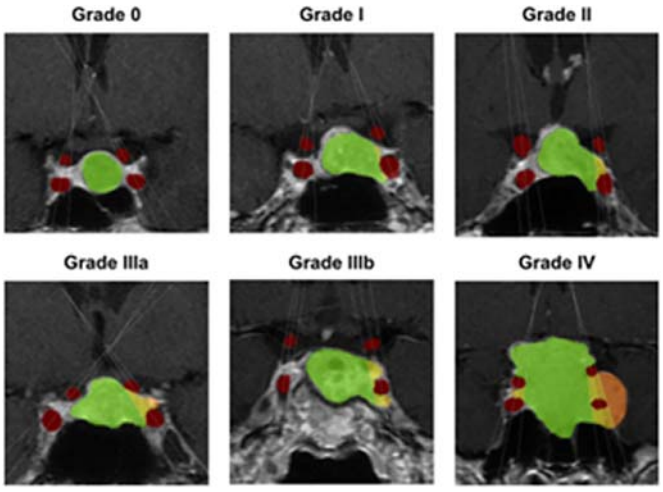
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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: The Knosp grading is a widely used classification system for the characterization of parasellar growth of pituitary adenomas, demonstrated to reliably stratify likelihood of cavernous sinus invasion, gross total resection and endocrinological remission. Currently, determining the Knosp grade depends on the subjective interpretation of MRI scans and suffers from poor inter- and intra-rater reliability. Developing an algorithmic approach for assessing the Knosp grade could enhance both the accuracy and consistency of these evaluations.
Methods: We developed two algorithmic methods of automated Knosp score assessment. A geometric rule-based model followed the manual way of determining the grade based on tumor position relative to limiting lines defined by the internal carotid artery (inner and outer tangents of cross sections and a connecting line of their centers). A deep learning model was not provided with an a priori information how to assess the score; instead, it was optimized on an annotated dataset of 394 MRI scans to derive the rules statistically. The accuracy of both models was compared on a separate dataset of 99 MRI scans.
Results: The geometric model predicted the correct grade in 96.75% and the deep learning model in 95.22% of the slices. Evaluating the accuracy for total

per-patient aggregated grades, the models predicted the correct grade in 79.80% and 73.74% cases, respectively. On binarized predictions of tumor invasiveness (grade 0-2 vs. grade 3-4), the geometric model achieved sensitivity of 98.78% and specificity of 82.35%, while the deep learning model achieved sensitivity of 96.34% and specificity of 76.47%.

Conclusions: The geometric method displayed a higher accuracy rate, more closely aligning with expert annotations. Since being based on exactly defined inference rules, this model also provides explainable conclusions, opposed to the black box-like nature of the deep learning method.

Optional Image



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495
184
Brain and Spine 4 (2024) 103387
Anatomoradiological Comparison between Minipterional and Supraorbital Eyebrow Approaches to the Interpeduncular Region

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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Advances in surgical technology and microneurosurgery have led to increased utilization of so called “minimally invasive” approaches, including the supraorbital eyebrow (SE) and minipterional (MPT) for lesions involving the interpeduncular region. This study aims to describe and compare anatomical landmarks, advantages and disadvantages of the SE and MPT approaches to the interpeduncular region.

Methods: Methods: Ten formalin-fixed, latex-injected cadaveric specimens were used to perform bilateral SE and MPT approaches to the interpeduncular region (fig. 1). The operative depth of each approach to key anatomical landmarks was measured. Forty-five axial thin-slice computed tomography studies were reviewed to calculate the operative angles. A three-dimensional interactive anatomical model generated through the photogrammetry scanning technique was described.

Results: The mean operative depths of the SE and MPT to the interpeduncular fossa were 83.4 ± 1.8 mm and 67.7 ± 3.2 mm, respectively ($p < .001$). The MPT mean angle of approach to the interpeduncular fossa was significantly wider than the one provided by the SE (39.9 ± 5.1° vs. 28.4 ± 3.6°, $p < .001$). The interpeduncular region can consistently be accessed through the carotid-oculomotor triangle with the SE as well as the MPT approaches. However, the SE but not the MPT approach offered adequate access to the interpeduncular fossa through the opticocarotid triangle. The MPT provided direct access to the upper prepontine cistern and anterior mesencephalic zone (AMZ).

Conclusions: The MPT can be employed for lesions of the interpeduncular region with extension to the prepontine cistern and ventrolateral midbrain lesions requiring access through the AMZ. The SE is better suited for ventromedial midbrain lesions requiring access via the interpeduncular fossa safe entry zone.

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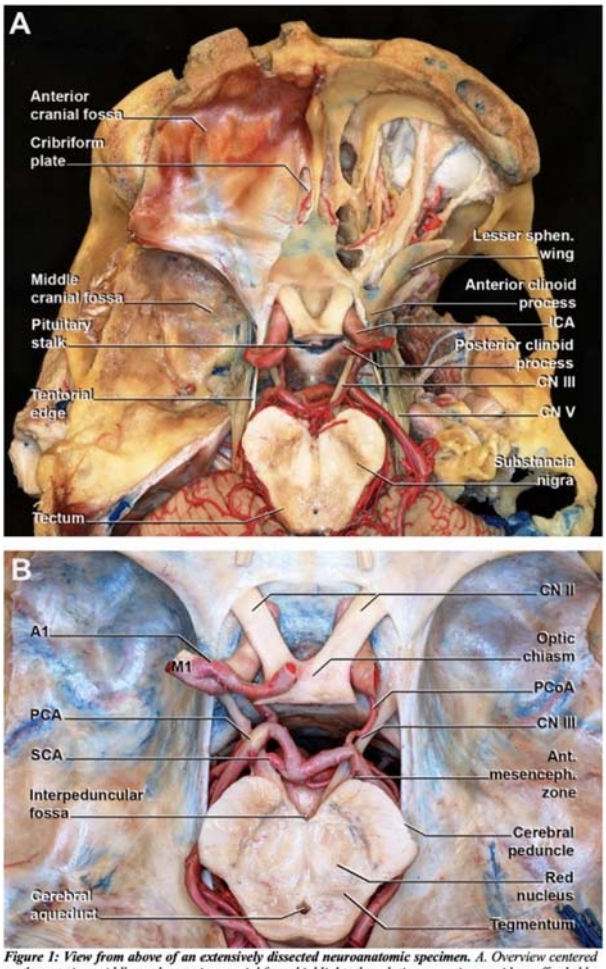


Figure 1: View from above of an extensively dissected neuroanatomic specimen. A. Overview centered on the anterior, middle, and posterior cranial fossa highlights the relative operative corridors afforded by SE and MPT to the interpeduncular region. B. A close-up demonstrates the relevant anatomy. Abbreviations: A1, A1 segment of the anterior cerebral artery; CN, cranial nerve; ICA, internal cerebral artery; M1, M1 segment of the middle cerebral artery; MPT, minipterional; PSA, posterior cerebral artery; PCoA, posterior communicating artery; SCA, superior cerebellar artery; SE, supraorbital eyebrow.

184

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Brain and Spine 4 (2024) 103388
Intraoperative Ruptures of Cerebral Aneurysms During Endoscopic, Endonasal Transsphenoidal Surgery for Pituitary Adenomas. A Single Center Retrospective Study and Review of Literature

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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Intraoperative hemorrhage from rupture of a cerebral aneurysm during endonasal surgery for pituitary adenoma is one of the most severe complications of transsphenoidal surgery. Causes may be associated with a pituitary adenoma aneurysm or iatrogenic injury to the internal carotid artery, resulting in the formation of a pseudoaneurysmal sac.

Methods: We performed a retrospective analysis of 1148 patients with pituitary adenomas who underwent endonasal transsphenoidal surgery at a single clinical center over a period of 12 years.

Results: Out of the 1148 cases included in the study, intraoperative hemorrhage resulting from the rupture of a cerebral aneurysm during endonasal surgery was observed in 5 patients, thus computing an incidence rate of 0.44%. The acute bleeding was quickly contained, and all reported cases survived the surgical intervention. Conventional cerebral angiography was performed immediately after surgery for diagnostic purposes. Subsequently, all patients with confirmed aneurysms were treated endovascularly with coiling and stenting. Only one of the reported patients had a fatal outcome, occurring 13 days after the surgery. The remaining four patients had a favorable outcome without additional complications or disability.
Conclusions: Preoperative planning and risk assessment should rely on comprehensive imaging data and consider specific vascular anatomy features and characteristics of somatotropinomas contributing to aneurysm formation. This retrospective analysis, combined with literature findings from similar studies, will aid in devising a more precise safety strategy for endonasal transsphenoidal surgery in pituitary adenoma treatment.

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297
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Endonasal endoscopic surgery of craniopharyngiomas. Complications and outcomes in single-center series of 132 consequent cases

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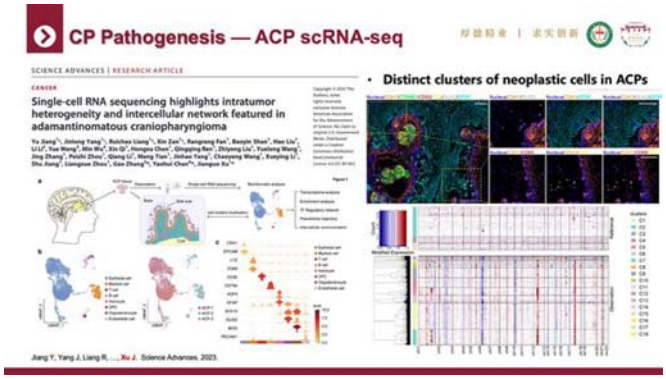
Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Quality of life and tumor control are the main goals of craniopharyngioma (CP) treatment. Endonasal endoscopy is a good challenge for radical and safe surgery for most types of CPs, but preservation of pituitary function is unlikely possible in all cases.This study reviews the outcomes of endonasal endoscopic removal of CPs in regarding the tumor type, radicalism, complications and aspects of surgical technique.
Methods: 132 consequent cases (pts > 16 y.o.) of CPs operated endoscopically in Endonasal Skull Base Dept., Romodanov Institute of Neurosurgery in 2016-2023. 27- mostly infra-, 19 – infrasupra-, 86 - supradiaphragmatic (extended endonasal endoscopy in all cases). Posterior clinoidectomy has been performed used in 17 cases with retrosellar extension. In 3 pts full pituitary transposition, in 12 – cases hemi (partial) intradural pituitary transposition has been performed. In all transposition cases pituitary stalk have been preserved. Furthermore, in 86 supradiaphragmatic cases stalk has been preserved in 54(62,8%), in 32 (37,2%) – sacrificed.
Results: Total and near-total removal - in 97 cases (73.5%), partial - in 30 (22.7%), 5 pts (3,8 %)- biopsy and cyst aspiration only. Endocrine deterioration with hypopituitarism has been observed in all infra – and infrasupra- diaphragmatic cases (n=46), and DI in 35 (76%) of them. Supradiaphragmatic cases with sacrificed stalk had a DI and severe deterioration of anterior pituitary function in all 32 cases. Otherwise, hormonal deterioration has been observed only in 15 cases of 54 stalk-preserved cases (27,8%), with newly developed DI in 10 (18,5%). There were 3 full and 5 partial pituitary transposition pts in this group, but 7 pts with hemitransposition (58.3%, p=0.05) showed satisfactory post-op anterior pituitary function and no newly developed DI. Post-op obesity (13 cases, 9,8 %) corelates mostly with diencephalic invasion and edema on MRI, nether surgical technique. Post-op mortality is 2,3% in our series (2 cases of diencephalic disfunction, 1 meningitis). Overall CSF leakage is 5,3 % (7 cases), with a downward trend in recent years.
Long-term outcome (>24 months) of 8 cases of all 12 irradiated pts with partial removal is available, showing slightly lower endocrine deterioration profile comparing to radical removal cohort.
Conclusions: Endonasal route is an option of choice for all types of CPs in adults excluding Kassam IV tumors. Otherwise, CPs cases are slightly possible for pituitary function preservation and highly risky regarding newly developed deficit, especially within radical surgery. Selected cases of supradiaphragmatic CPs can be challenging for radical surgery with satisfactory endocrine outcome using stalk preservation and intradural pituitary hemitransposition techniques.

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205
Brain and Spine 4 (2024) 103390
Craniopharyngioma — Bed to Bench to Bed

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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Craniopharyngioma (CP) is a common intracranial tumor occurring at the base of the skull, often leading to severe clinical manifestations such as blindness, obesity, hormone disorders, and growth abnormalities due to its deep location near crucial neurovascular structures. Neurosurgeons encounter challenges in managing issues like tumor residue and recurrence, emphasizing the urgent need for understanding its mechanisms and effective adjunctive treatments.
Methods: Whole-genome sequencing analyzed genetic mutations in 26 CP cases and blood samples. Single-cell sequencing characterized major tumor microenvironment cell types. Immunohistochemical staining of B7 family proteins in 132 samples identified B7-H3 as an immunotherapy target. Clinical trials targeted BRAFV600E mutations in CP.
Results: CTNNB1 and BRAFV600E were highly mutated in both ACP and PCP cases, with sporadic mutations in genes like FBXW7, SOX2, and AHNAK. A new CTNNB1 mutation variant was discovered. Integrative analysis of 44,038 single-cell transcriptomes revealed ACP's intratumorally heterogeneity and tumor microenvironment. Four major neoplastic cell states with distinctive expression signatures were defined, which further revealed the histopathological features and elucidated unknown cellular atlas of ACP. Pseudo time analyses suggested potential evolutionary trajectories between specific neoplastic cell states. Increased expression of PD-L1, B7-H3, B7-H4, and VISTA correlated with clinical features, and higher VISTA expression was associated with better survival. A clinical trial targeting BRAFV600E mutations showed promising results.
Conclusions: Multi-omics approaches enhanced understanding of CP's genetic mutations and protein expression. ACP's heterogeneity was detailed at single-cell resolution, along with its tumor microenvironment. B7-H3 was identified as a potential immunotherapy target. The efficacy of targeted therapy for PCP was explored, paving the way for larger clinical trials.
Optional Image



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800
Brain and Spine 4 (2024) 103391
B-RAF and MEK Inhibitor Targeted Therapy in papillary craniopharyngiomas: the results from a French multicenter study

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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Papillary craniopharyngiomas (PCPs) are driven by V600E BRAF mutations in 95% of cases. Recently, adjuvant anti-BRAF/MEK targeted therapy

(TT) has emerged as a potential treatment in aggressive PCPs. Neoadjuvant TT, aiming to shrink large, unresectable tumors before surgical removal, has also been proposed. However, standardized data on large cohorts are still lacking.
Our study aimed to assess the real-life efficacy and safety of neoadjuvant and adjuvant TT in patients with PCPs.
Methods: This was a retrospective, multicenter study involving patients with V600E BRAF-mutated PCPs treated with anti-BRAF/MEK TT in France from April 2019 to July 2023.
Volumetric magnetic resonance imaging analysis, clinical and hormonal assessments were performed before TT, after 3 months, and at the last available follow-up during treatment.
Radiological response was classified as either complete (CR), subtotal (SR, volume reduction $>$ 80%), partial (PR, 30-80%), stable disease (SD, volume decrease $<$ 30% or increase $<$ 20%), or progressive disease (PD, volume increase $>$ 20%).
Results: Sixteen patients (8 females, mean age 50.5 $\pm$ 15.75 years), receiving either neoadjuvant therapy (NEO) for non-resectable tumors (n=6), adjuvant therapy (ADJ) post-surgery (n=8), or palliative therapy (PAL) following multimodal treatment (n=2), were included.
The mean duration of treatment was 8.4 $\pm$ 5.2 months. 15 patients (93.7%) exhibited partial response or higher, with 12 (75.0%) showing SR and 3 (18.7%) PR. A single patient (6.3%) exhibited SD, while none showed either CR or PD. The mean reduction in total tumor volume was 65.1 $\pm$ 23.7% and 81.4 $\pm$ 18.3% at 3 months and at the last follow-up during treatment, respectively.
For NEO, SR was achieved FOR all. The mean volumetric reduction was 88.9 $\pm$ 5.0% for total tumor volume, 77.2 $\pm$ 22.1% and 92.1 $\pm$ 3.6% for the cystic and solid components, respectively. All received radiotherapy at the end after treatment. Median duration of treatment, 5.8 $\pm$ 3.3 months.
For ADJ, 4 (50.0%) achieved SR, 3 (37.5%) PR, while one (12.5%) showed SD. Median treatment duration was 7.5 $\pm$ 3.2 months. Mean reduction in tumor volume was 73.3 $\pm$ 23.4% for total volume, 85.1 $\pm$ 10.1% for the cystic portion alone, and 69.9 $\pm$ 27.2% for the solid component.
For PAL, the median treatment duration was 18.5 $\pm$ 2.1 months. At the last available follow-up during TT, the mean volume reduction was 91.7 $\pm$ 4.3% for the total tumor volume, 91.5 $\pm$ 4.5% for the cystic component, and 100% for the solid portion of the tumor.
For clinical outcomes, all patients reported resolution of headaches, 66,7% of visual disturbances 40% of hypothalamic symptoms but only 14,2% of endocrine deficit.
One patient had adverse effects but did continue the therapy. The occurrence of adverse events led to treatment discontinuation in 5 cases, definitively in 3. The most frequently reported adverse events were fever, asthenia, hepatic cytolysis, and gastrointestinal complaints.
Conclusions: Targeted therapy in PCP patients can induce impressive tumour volume reduction and clinical improvement within few months from treatment initiation. Adverse events are reasonable. Considering those results, a simple biopsy and targeted therapy first before radiotherapy if PCPs should be proposed for invasive CP instead of risky surgeries.

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1352
Brain and Spine 4 (2024) 103392
The experience with the Inside-Out Technique for resection of Craniopharyngiomas during Endoscopic Endonasal Approaches (EEAs)

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Surgery of the sellar region – endoscopic and transcranial approaches (Skull Base Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Craniopharyngiomas are often erroneously approached as extra-axial lesions resulting in microvascular injury and subsequent infarcts causing hypothalamic or visual dysfunction. We discuss the inside-out concept during resection of craniopharyngiomas and present our experience with this technique aiming to facilitate resection while preserving the microvasculature.
Methods: Contrary to an extensive subarachnoid dissection, after a wide exposure the stalk is dissected, but the subarachnoid space is left otherwise intact. Much analogous to vestibular schwannoma resection, after internal debulking from an entry point where the tumor comes to the surface, the dissection plane with the normal stalk is established early and propagated from the inside of the tumor towards the tuber cinereum, hypothalamus, and the chiasm (inside-out). The correct plane usually results in a thin tissue layer left with the suprasellar microvasculature thereby protecting it. The experience with this technique during the last 5 years is presented.
Results: During the last 5 years, 44 consecutive patients with craniopharyngiomas were treated at the University of Pittsburgh Medical Center using the inside-out technique during EEA. 35 tumors were adamantinomatous, 7 were papillary, whereas two were not specified. Gross total resection was achieved in 36 patients. Complete preservation of pituitary function was possible in two patients, whereas partial preservation (either no need for DDAVP or no need for steroids) was possible in 10 additional patients. Two patients had slight visual field deterioration, with one returning to baseline, and no patient had evidence of a hypothalamic infarct on immediate post-operative MRI imaging.
Conclusions: The inside-out technique is safe and effective in treating craniopharyngiomas. This technique facilitates more complete resections as the correct plane can be extrapolated higher in the third ventricle which is harder to reach and increases safety as it decreases the possibility of microvascular injury to the hypothalamus and chiasm.

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1404
Brain and Spine 4 (2024) 103393
Stimulation-Free Concentric-Needle Motor Unit Number Estimate – a potential new biomarker for Nerve Health

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Accurate, rapid, and reliable pre-operative quantification of nerve health is crucial for good outcomes of peripheral nerve surgeries. Of particular importance is the proportion of remaining functional motor units within a muscle. This study introduces Stimulation-Free Concentric-Needle Motor Unit Number Estimate (SFCN-MUNE) as a new quantitative measure of nerve health and correlates it with strength outcomes after nerve transfer surgery.
Methods: We conducted a retrospective study of patients with chronic cervical spinal cord injury who underwent supinator branch of radial nerve to posterior interosseous nerve (PIN) transfer surgery to restore finger extension. Patients were included if appropriate pre-operative EMG recordings, and post-operative Medical Research Council (MRC) muscle grading scores were recorded after 12 months. SFCN-MUNE is calculated using the mean absolute amplitude over a 1s epoch of the EMG signal at maximal voluntary contraction as a surrogate for the compound muscle action potential, with the mean area of a sample of motor unit potentials (MUP) multiplied by an estimate of their mean occurrence rate as a surrogate for mean single MUP size. The SFCN-MUNE measurements were correlated with post-operative MRC outcomes and pre-operative decomposition-based motor unit recruitment counts (DB-AMURC).
Results: 16 nerve transfers in 12 patients were identified. SFCN-MUNE correlated moderately well with MRC outcomes (r=0.63) and well with DB-AMURC (r=0.85). In this cohort, a cut-off of 10 MUPs reliably predicted those who would achieve an MRC outcome of 4 from those who did not.
Conclusions: SFCN-MUNE shows potential as a new rapid, accurate, and reliable measure of nerve health that can easily be implemented within a routine EMG protocol using standard equipment. Automation can easily be achieved using widely available decomposition software, requiring no additional time burden, and maximizing reliability. SFCN-MUNE promises to provide understandable, quantitative, and valuable information for surgical decision-making but requires larger prospective studies.

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505

Brain and Spine 4 (2024) 103394

Combining Electrical Stimulation and Conductive Nerve Guide Conduit: A Promising Strategy for Repair of Sciatic Nerve Gap in A Rat Model

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Peripheral nerve injury occurs at a rate of about 2.2% of trauma cases, and the sciatic is the most commonly affected nerve in the lower limb. Autografts are the gold standard for large gaps. However, it has been reported that the regeneration is limited. In this study, we aimed to evaluate the effect of a conductive nerve conduit and electrical stimulation on the regeneration of the sciatic nerve in a rat model with transection injury.

Methods: A silk-based conduit with a diameter of 1.8 and a length of 12 mm was designed. To increase the conductivity of the scaffold, Au nanoparticles (AuNPs) were used. Collagen hydrogel seeded with GFP + adipose stem cells (ADSCs-GFP +) was used as conduit filler. MTT assay evaluated the cytotoxicity of the scaffold. A 10 mm sciatic section was transected in female Wistar rats, and 12 mm sections of non-conductive and conductive scaffolds, along with electrical stimulation, were secured using 10-0 nylon monofilament sutures. Autotransplantation was used as a control group. The sciatic functional index (SFI) was used for evaluation.

Results: Based on MTT, silk and silk/AuNPs showed no cytotoxicity. SFI assessment showed better functional recovery for conductive scaffolds with electrical stimulation than those without electrical stimulation six weeks after surgery. Immunofluorescent staining shows ADSCs-GFP + remained within the scaffold six weeks after transplantation (green colors). IHC staining and quantification for neurofilament (NF) and S100 demonstrated higher expression in conductive scaffold with ES 6 weeks after surgery compared to other groups. TEM images of the conductive scaffold with electrical stimulation six weeks after transplantation show the development of new axons.

Conclusions: The utilization of a conductive silk-based nerve guide conduit, combined with electrical stimulation, demonstrated a synergistic effect on the functional recovery of sciatic defects in a rat model.

Optional Image

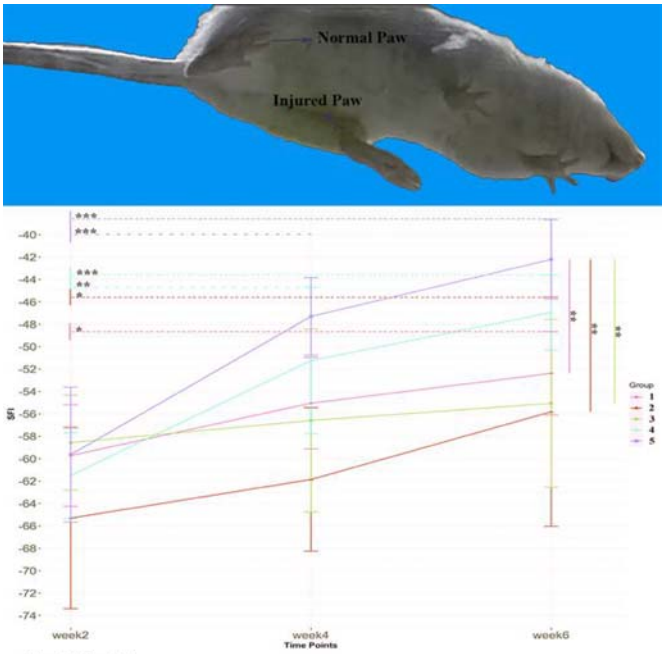


Figure 1. SFI analysis.
Group 1: autotransplantation; Group 2: non-conductive conduit without stimulation;
Group 3: conductive conduit without stimulation; Group 4: non-conductive conduit with stimulation;
Group 5: conductive conduit with stimulation.

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873

Brain and Spine 4 (2024) 103395

Masseteric Nerve to Facial Nerve Reconstructive Techniques – Three-dimensional Anatomical Description Of The Technique

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Masseteric nerve to fascial nerve (V-VII) transfer is a novel reconstructive technique for facial reanimation after complete VII nerve palsy. However, in contrast to most popular technique of XII-VII nerve transfer the V-VII procedure is not very familiar to neurosurgeons. The purpose of the current study is to anatomically describe the technique using 3D surface capturing technology and 3D visualization.

Methods: The anatomy dissections were done at the Panum Institute, University of Copenhagen on fresh human body donors. The facial and the trigeminal nerves were dissected from intra- and extracranial course and the 3D data was obtained with a photogrammetry technology to create photorealistic anatomical models. The resulting 3D models were processed using open-source software (Blender®).

Results: The 3D models provide comprehensive data for the facial nerve course, its branches and masseter nerves. At second stage we transposed the facial nerve and made reconstructive transfer to the masseter nerve using standard microsurgical technique. The 3D models provided enough detail to describe the anatomy and the steps of procedure.

Conclusions: The aim of our study was to improve our knowledge of the surgical anatomy of the masseteric nerve as a donor, beneficial to optimize nerve facial reanimation procedures. The described operative technique is associated with advantages such as ease of surgical dissection, proximity to the facial nerve, low donor site morbidity, a powerful motor impulse, and relatively short reinnervation time. The novel 3D photorealistic visualization can be used to better present this selective procedure.

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433

Brain and Spine 4 (2024) 103396

Hypoglossal-facial nerve (XII-VII) anastomosis for complete facial nerve paralysis: case-series report, accumulated experience and outcome assessment

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Complete facial nerve injury poses significant morbidity, causing severe facial disfigurement and potentially leading to ocular damage. To mitigate this, a surgical technique anastomosing the hypoglossal to the facial nerve has been effectively employed over the last decades. In the present work, we describe the series of patients who underwent XII-VII anastomosis at our department, seeking to assess clinical efficiency in restoring facial muscle innervation and the associated side-effects.

Methods: A total of 48 patients received XII-VII anastomosis at our department between 2000-2023. Clinical records were consulted to collect demographic data, determine the cause of facial nerve injury and evaluate functional outcome, which was assessed using the House-Brackmann (HB) scale, electromyographical evidence of facial re-innervation and subsequent need for ophthalmologic or plastic surgery. Surgical morbidity was also determined.

Results: All patients presented preoperatively complete facial nerve paralysis HB-6 and complete facial muscle de-innervation in electromyography. Average age was 51 years (range: 10-73) and 42% were males. Eighty-nine percent of cases were secondary to vestibular schwannoma surgery, 1 case post-trauma and 3 cases subsequent to brainstem hemorrhage. Clinical improvement of facial muscle function was achieved in 88%±33% of patients, with an average post-

operative HB score of 3,29±1,18 ($p<0.0001$ vs pre-operative state). Electromyographical evidence of facial re-innervation was observed in 93% of patients. Forty-four percent underwent subsequent ophthalmologic or plastic surgery related to facial paralysis. Surgical morbidity was reported by 30% of patients, corresponding to 19% of troublesome lingual paralysis and 11% of eye–tongue synkinesis.

Conclusions: Our results are in line with the reported literature and support the efficacy of XII-VII anastomosis in promoting motor recovery after complete facial nerve injury. Given the severity of facial muscle paralysis, and the important esthetical and functional gain of its improvement, we consider the morbidity rate hereby depicted to be acceptable.

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1403

Brain and Spine 4 (2024) 103397

Electrical Impedance Neurography as a Potential New Biomarker for Nerve Health

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Electrophysiology, particularly nerve action potential (NAP), serves as a standard for intraoperative evaluation of nerve injury. Its utility is constrained by prolonged procedural time, susceptibility to artifact, and subjectivity of interpretation. As an alternative, bioelectrical impedance measurement involves applying small alternating electrical currents through electrodes, with the resulting voltage measured via separate adjacent electrodes. Tissue's resistive, capacitive, and reactive properties contribute collectively to the complex impedance. Non-invasive electrical impedance myography is used for evaluating neuromuscular disorders by providing quantitative metrics for diagnosis, recovery progression, and treatment efficacy. This investigation explores the feasibility of Electrical Impedance Neurography (EIN) as a novel intraoperative method for assessing peripheral nerve health.

Methods: Unilateral crush injuries were induced in three rodent sciatic nerves, while the contralateral side served as a healthy control. NAPs, compound muscle action potentials (CMAP), and motor unit number estimates (MUNE) were collected at three timepoints; before injury, immediately after injury, and one week after injury. EIN measurements were obtained from 3kHz to 1000kHz using a bespoke electrode array placed longitudinally on the injury site and equivalently on the healthy control nerve.

Results: After one week of denervation, Impedance parameters in the 50kHz range shifted. Resistance increased (healthy: 185.4 Ohm; denervated: 232.6 Ohm), while Reactance (healthy: 50.0 Ohm, denervated: 25.8 Ohm) and Phase (healthy: 15.2°, denervated: 6.3°) decreased, leading to an overall rise in impedance ($p<0.05$). These changes correlated with decreased CMAP and MUNE ($p<0.05$).

Conclusions: EIN shows promise as a simple, rapid, and practical measure of peripheral nerve health that might help address an important gap in assessing nerve injury. EIN may represent an "electrical biopsy," informing on both the functional and structural composition of nerve. Studies are underway to validate EIN as a predictor of nerve health through correlation with histology, function, and neurophysiology in different nerve injury types.

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418

Brain and Spine 4 (2024) 103398

Sciatic Nerve Injuries. Surgical Strategies of Management. Experience of City clinical hospital №7 Almaty (Kazakhstan)

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Rare PNS conditions (Peripheral Nerve Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

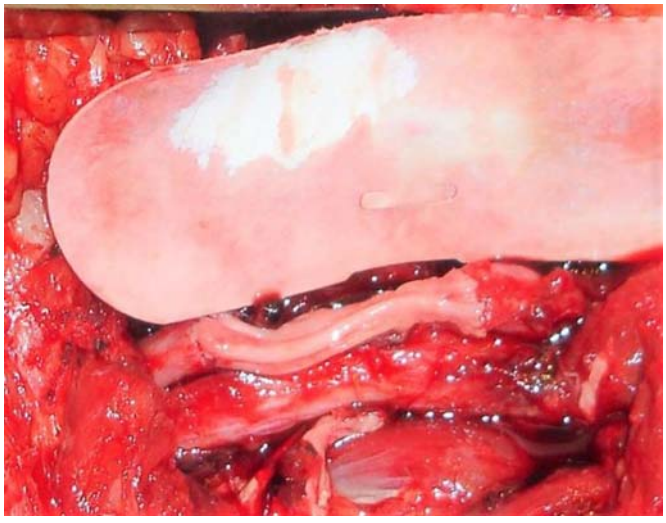
Background: Sciatic nerve injuries are prevalent, leading to prolonged disability among the working-age population. This investigation explores the medical and socioeconomic significance of these injuries.

Methods: The study was conducted at the Neurosurgery Department of KazNMU with the Neurosurgical Center at the City Clinical Hospital 7 Almaty (Kazakhstan). A comparative analysis was performed on two groups with sciatic nerve lesions, specifically those with diastasis exceeding 5 cm. Surgical interventions were carried out on 227 patients from 2013 to 2022, incorporating neurolysis, nerve repair, nerve autoplasty using nerve grafts, and tendon-muscle plasty. The comparison involved the second group from 2003 to 2012, where only reconstructive nerve surgeries were performed.

Results: Out of the 227 cases, 176 demonstrated excellent and good surgical outcomes, 21 were fair, and 30 were poor. The implementation of a two-stage approach for nerve function restoration in patients with diastasis exceeding 5 cm (37 patients) led to significant motor function improvement and walking recovery within 2-3 years for 33 cases. In comparison, previous reconstructive nerve surgeries resulted in lower rates of motor recovery (11 patients) and walking improvement (13 patients), with unsatisfactory outcomes in 6 cases.

Conclusions: This study underscores the importance of addressing extensive sciatic nerve defects through reconstruction. The two-stage restoration approach, incorporating tendon-muscle grafting after signs of conductive regeneration in the tibial nerve, facilitates useful motor recovery and enhanced walking ability, ultimately contributing to improved quality of life for the patients.

Optional Image



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392

Brain and Spine 4 (2024) 103399

Comparison of Photodynamic Effects of Chlorine E6 and Laser Irradiation on Tumor and Non-Tumor Cells in Vitro

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Neurosurgical research from Translational neuroscience to Machine learning and registry based research (Research Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: Glioblastoma (GB) is the most common malignancy among central nervous system tumors with a progressive progredient course. Adjuvant photodynamic therapy (PDT) have been proposed to supplement surgical approaches. PDT includes introduction of a photosensitizer (PS) and its subsequent activation by light rays for a targeted effect on tumor cells, which have greater affinity and selectivity of the PS accumulation (Muller P.J., Wilson B.C., 2006). The purpose is to compare the effect of photodynamic exposure with the use of PS chlorine E6 on cell number and mitotic activity in cultures of the human GB cell line U251 and human embryonic kidney cells 293 (HEK-293) under different modes of laser irradiation (LI) in vitro.

Methods: Groups of U251 and HEK-293 cell cultures were formed, cultivated under the following regimes: 1) standard nutrient medium (MEM with L-glutamine, 1 mM sodium pyruvate, 10% FTS) – control; 2) adding of chlorine E6 (2 μg/ml); 3) without adding of chlorine E6 and subjected to LI (= 650 nm, intensity (0.4 – 0.6) W, dose (10 – 75) J/cm2, continuous or impulse mode); 4) adding of chlorine E6 and subsequent exposure to LI in the above modes. Intravital dynamic observation (light microscopy, staining with a vital dye (0.2% trypan blue solution), morphometric studies (numerical density of cells, mitotic index (MI, %) were carried out.
Results: Chlorine E6 is incorporated into U251 and HEK293 cells with comparable intensity of fluorescence. Under the influence of LI cytodestructive and antimitotic effects in U251 cell culture increase in a dose-dependent manner (significant changes were registered at the lowest dose of LI 25 J/cm2, intensity 0.6 W in impulse mode). The level of cytodestructive and antimitotic effects is significantly lower in the cultures of non-neoplastic HEK293 cells (significant changes were observed at the lowest dose of LI 50 J/cm2, intensity 0.6 W in impulse mode).
Conclusions: An effective mode of photodynamic exposure to achieve a cytodestructive and antimitotic effect in the culture of human U251 GB cells is the combined application of an LI dose of 25 J/cm2, intensity 0.6 W in the impulse mode, with prior incubation of the cell culture with chlorine E6 (2 μg/ml). This mode of photodynamic exposure is not irreversibly destructive for HEK293 cell cultures (reference non-tumor cells), this confirms the greater sensitivity of tumor cells to the PS effects.
Optional Image

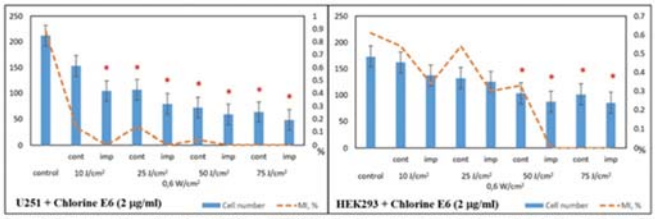


*Figure 1. Diagrams of the cell number in U251 and HEK293 cell cultures (group 4) under the combined effect of chlorine E6 (2 μg/ml, pre-incubation 4 h) and different modes of laser irradiation (0.6 W). * - p < 0.05, compared to the control (Mann-Whitney U-test; cont – continuous mode; imp – impulse mode.*

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357
Brain and Spine 4 (2024) 103400
Implementation Of A Data Analysis Pipeline For Intraoperative fMRI

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Neurosurgical research from Translational neuroscience to Machine learning and registry based research (Research Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Functional MRI (fMRI) can image eloquent functions and is often used to compare pre- and post-surgery brain functionality. Intraoperative MRI allows visualisation of brain networks directly before and after resection of a lesion, offering the option of immediately correcting the surgical result. With the first intra-operative 3T MRI scanner in Austria, we perform T1-weighted anatomical and resting-state fMRI scans before and after resection of a lesion with patients under anaesthesia.
Methods: Pre- and post-resection data of 13 patients and 8 volunteers was used for development of the pipeline. The data was pre-aligned by affine co-registration to the MNI-Atlas. For preprocessing a two-stage approach is used, where a Matlab script provided from the Monash University performs segmentation of the resection area and non-linearly registers the T1-weighted pre- and post-resection scans to MNI-space. The registered anatomical data is then used as input for fMRIPrep, which co-registers anatomical and functional data and performs standard preprocessing steps. Further analysis was done with FSL, where a probabilistic independent component analysis (PICA) was performed on the fMRI data
Results: The automatic segmentation of the resection area gives good results and the registration of pre- and post-resection scans to MNI-space are satisfactory. The output of PICA in pre- and post-resection scans shows that the identification of different networks is possible and allows a qualitative comparison of pre- and post-resection resting-state networks.
Conclusions: The two-step approach in preprocessing gives satisfactory results that enable further analysis of intraoperative fMRI data, such as PICA. However, the used tools might not be powerful enough for co-registration, which is why the evaluation of the registration performance of different deep-learning approaches is planned. More analysis Methods are also planned in the future, so that processes in brain functionality during surgery can be further investigated.

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683
Brain and Spine 4 (2024) 103401
Adverse events in neurosurgery: Validation of the Therapy-Disability-Neurology (TDN) Grade using an international survey-based assessmentpl

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Neurosurgical research from Translational neuroscience to Machine learning and registry based research (Research Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM
Background: Neurosurgical adverse events (AE) are frequent and may have dramatic consequences on quality of life. The lack of a standardized classification of their severity hinders evaluation and improvement of the safety of neurosurgical procedures. The Therapy-Disability-Neurology (TDN) grade was introduced in 2021 and proposed a patient-centered approach that overcomes the limitations of previous grading systems by addressing the severity of neurologic and disabling AEs. It was validated on 6071 interventions and was consistent with clinical and economic consequences of AEs. The aim of the current study is to assess the reliability, validity and applicability of the TDN grade.
Methods: We conducted an online survey among participants with various degrees of expertise in neurosurgery. Participants received 16 case vignettes and had to determine the TDN grade as well as review the validity, interpretability, logicality, simplicity, and usefulness of the grading system.
Results: The inter- and intra-rater reliability of the TDN grade was substantial ($\alpha = 0.66$ and $\alpha = 0.79$, respectively). Most participants recommended to report the TDN grade along its separate dimensions, for which the inter- and intra-rater was substantial to almost perfect ($\alpha = 0.74$ and $\alpha = 0.85$, respectively). The use of online calculation tools significantly increased agreement and participants' score. Among participants, the dimensions of the TDN grade were considered a very valid measure of the severity of AEs, and the grading system was seen as fairly useful, while remaining very logical, fairly simple to use, and to interpret.
Conclusions: The TDN grade demonstrated substantial inter- and intra-rater reliability while being considered very logical, fairly simple to use and to interpret. Neurosurgical AEs should be systematically assessed and reported, and surveyed neurosurgeons recommend the use of the TDN grade along with its separate dimensions for this purpose.

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572
Brain and Spine 4 (2024) 103402
Microthrombi-Mediated Blood-Brain-Barrier Dysfunction after Traumatic Brain Injury

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Neurosurgical research from Translational neuroscience to Machine learning and registry based research (Research Parallel Session), October 14, 2024, 5:20 PM -

6:50 PM

Background: Traumatic brain injury (TBI) is, among others, associated with reduced cerebral blood flow and increased blood-brain-barrier (BBB) permeability, yet the underlying mechanisms remain elusive. This study explores the involvement of microthrombi (MT) in the traumatic penumbra and their contribution to BBB dysfunction.

Methods: MTs were visualized in C57BL/6 mice by systemic administration of super-bright 30 nm lipid nanodroplets (SBLDs) one hour following controlled cortical impact (CCI). Brains were investigated by fluorescent confocal imaging. Additionally, caveolin (Cav1) knockout mice (Cav1tm1Mls/J) and wildtype controls (WT) were used to investigate the mechanisms of BBB dysfunction in the proximity of MT.

Results: Our findings demonstrate that 50% of MT colocalized with the extravasation of albumin, fibrinogen, IgG, and SBLDs within the traumatic penumbra. Immunohistochemistry revealed that MT contain erythrocytes, platelets, fibrin, and leukocytes. The extravasation of blood-borne molecules positively correlated with the presence of cells within MTs (n=426 clots; R=0.31, p=0.02) and inversely with fibrin content (R=-0.64, p<0.001). Genetic deletion of Cav1 notably reduced SBLDs extravasation across the BBB compared to WT controls (n=5 animals per group, p=0.002).

Conclusions: Our study shows that vessels within the traumatic penumbra are occluded by MT, MT colocalize with an increase in BBB permeability, and that the increased permeability of the BBB is mediated by caveolin. These findings propose a novel mechanism of BBB dysfunction after traumatic brain injury related to microthrombi formation in the traumatic penumbra, offering potential diagnostic and therapeutic interventions for traumatic brain injury using nanoscale carriers.

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472

Brain and Spine 4 (2024) 103403

Number and laminar distribution of excitatory and inhibitory neurons in different areas of human cerebral cortex: a feasibility study

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Neurosurgical research from Translational neuroscience to Machine learning and registry based research (Research Parallel Session), October 14, 2024, 5:20 PM - 6:50 PM

Background: The data on neuronal composition of human cortex was mainly collected many decades ago and derived from postmortem brain tissue. Most of the experiments were performed using Nissl-stains, not allowing for differentiation between inhibitory and excitatory neurons. The total numbers of neurons in human cortex were mainly estimated by extrapolations from sparse sampling of thin slices, not considering the three-dimensional and layer-specific distributions of neuronal somata. In order to better understand structure-function relationships in both healthy and disease-affected cortex, more quantitative approaches comprising larger volumes are required. Here, we present a pilot study with the aim of adapting modern large-scale histology techniques to human brain tissue.

Methods: Cortical access tissue from five individuals undergoing resection of deep-seated cerebral lesions (primary brain tumors or metastases) was collected, comprising samples from the frontal, parietal and temporal lobes. Informed consent has been obtained in all cases. After immersion fixation for 7 to 9 hours, 50 µm-thick slices were cut with a vibratome and immunostained with anti-NeuN for neuronal somata and anti-GAD67 for inhibitory neurons. After that, the slices were imaged with a Laser-Scanning Confocal Microscope. Cells were then detected both manually and automatically using existing algorithms which were adapted to human tissue.

Results: Existing protocols for large-volume neuroanatomy could be adapted and successfully applied to human cortical access tissue obtained during surgery. However, automated image segmentation algorithms performed worse than manual segmentation and worse than in previous animal studies due to lower staining quality and higher neuron soma volume variability in humans. In this pilot study, we found that the ratio between excitatory and inhibitory neurons was remarkably constant across different cortical areas, comprising ca. 26.2% ± 2.2% of all cortical neurons, based on an analyzed volume of 0.33 mm3 ± 0.03 mm3 containing 7962 ± 1982 neurons. Six layers could be defined based on the distribution of NeuN positive cells. There was no significant difference in the overall proportion of interneurons between different cortical areas (frontal, parietal or temporal).

Conclusions: Modern large-scale histology Methods are applicable to human brain tissue and 3D imaging can potentially be evaluated semi-automatically. Improvement of image segmentation algorithms for neuron detection are required. High-throughput analyses of the neuronal composition of large cortical volumes will enable the investigation of structural organizational principles at the cellular level underlying both physiological cortical function as well as disease-related cortical dysfunction.

Optional Image

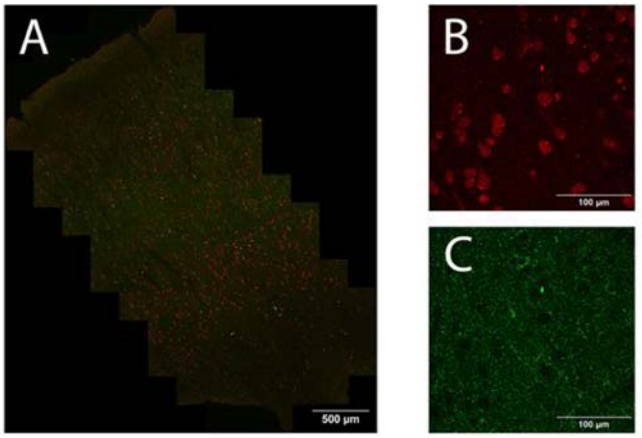


Figure 1: Confocal imaging. (A) Large-scale high-resolution confocal image stacks from 50 µm-thick tangential brain slices, immunostained against NeuN and GAD67. (B) Optical section of NeuN image stack from A. (C) Optical section of GAD67 image stack from A.

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299

Brain and Spine 4 (2024) 103404

Language function of prosody perception is vulnerable to be injured but evokes sensitive network plasticity in patients with intrinsic brain tumors

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Diffuse gliomas - clinical (Neuro-Oncology Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: As an important component of human language, prosody affects multiple aspects like hearing, comprehension, memory and expression in linguistic communication. Prosodic speeches are easy to be understood, memorized and acquired, showing prominent speech rehabilitative effect in brain lesioning patients. In clinical practice, we often observe good plasticity of language function in brain tumor patients, while the underlying mechanisms stays unknown. In this study we used prosody features as an engage point to investigate the language functional network plasticity mechanisms under the status of intrinsic brain tumor invasion.

Methods: Focusing on advanced language tasks——auditory perception of natural speeches, we designed two comparative experimental groups with contrasting level of prosodic harmony. Using 256 channel high-density EEG system to collect resting-state and event-related EEG, we investigate and analyze the EEG activities in 47 brain tumor patients and 28 healthy controls (HCs).

Results: 1. Event-related potential (ERP) analysis of negative slow wave (NSW) and closure positive shift (CPS) showed deficits in patients' advanced language functions.

2. In HCs, processing of strong prosodic speeches evoked broad neural networks, with the center being left frontal lobe which was inhibited prominently in patients.

3. In patients, with the stimulation of strong prosodic speeches, active network re-construction was observed, with frontal lobe being the core correspondence hub.

4. Patients with frontal lobe tumors showed stronger frontal network re-construction, indicating that network plasticity tends to invoke neighboring hubs close to the frontal lesions.

Conclusions: Due to the network attribute of language function, the efficiency of

network re-construction is higher than focal compensation in functional preservation. Strong prosodic speeches activate broad functional network re-construction and frontal lobe seems to be a coordinating center, so staged resective surgeries is worthwhile considered in frontal lobe to earn time and space for functional compensation. Moreover, for one-stage surgeries in frontal lobe, it might not be best choice to perform maximal resection of standard frontal lobectomy for every case. Further, for language rehabilitation, corpus of strong prosodic speeches shows good potential in evoking functional plasticity.

Optional Image

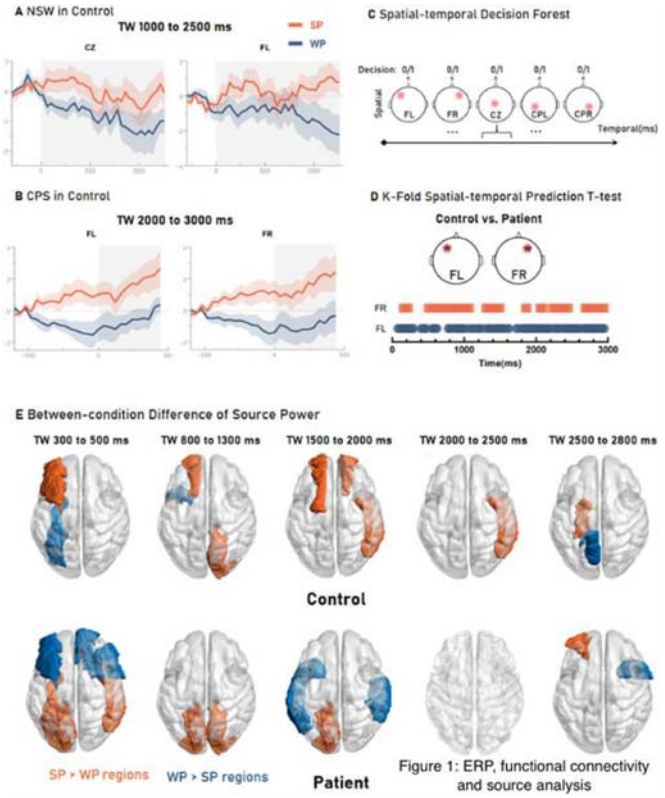


Figure 1: ERP, functional connectivity and source analysis

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1259

Brain and Spine 4 (2024) 103405

Personalized Surgery Of Brain Tumors In Language Areas: The Role Of Preoperative Brain Mapping In Patients Not Eligible For Awake Surgery

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Diffuse gliomas - clinical (Neuro-Oncology Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

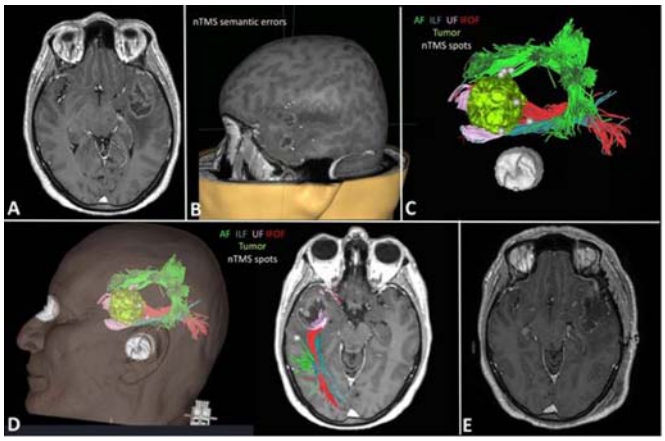
Background: Awake surgery represents the gold standard for resection of brain tumors close to the language network. However, in some cases, patients may be considered not eligible for awake craniotomy. In these cases, a personalized brain mapping of the language network may be achieved by navigated transcranial magnetic stimulation (nTMS) and could guide surgical resection under general anesthesia.

Methods: We reviewed data from all patients harboring a brain tumor in or close to the language network who were considered not eligible for awake surgery, and were operated on asleep surgery between 2017 and 2022, under the intraoperative guidance of the nTMS data. We analyzed 1) the ability of the nTMS-based mapping to stratify patients according to surgical risks, 2) the occurrence of postoperative language deficits, and 3) the EOR.

Results: A total of 176 patients underwent preoperative nTMS cortical language mapping and nTMS-based tractography of language fascicles. According to the nTMS-based mapping, 115 (65.3%) tumors were defined as true-eloquent because of a close spatial relationship with the language network. Conversely, 61 cases (34.7%) in which the nTMS mapping disclosed a safer distance from the network were defined as false-eloquent. After three months from surgery, a permanent language deficit was present in 13 patients (7.3%). In particular, a permanent deficit was observed in 12 out of 115 (10.4%) true-eloquent tumors, and in 1 out of 60 (1.6%) false-eloquent lesions. The gross total resection was achieved in 80.1% of overall cases, in 69.5% of true-eloquent lesions, and in 100% of false-eloquent tumors.

Conclusions: The nTMS-based mapping allows for a reliable preoperative mapping of the language network that may be used to stratify patients according to surgical risks, and to guide a safe and effective resection of brain tumors in the dominant hemisphere whenever awake mapping is not feasible.

Optional Image



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1305

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Efficacy and Safety of Long-term Adjuvant Treatment with Temozolomide (Extended STUPP) in Patients with Glioblastoma. Prospective Analysis of 81 Patients Receiving Up to 101 Cycles.

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Diffuse gliomas - clinical (Neuro-Oncology Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: The duration of adjuvant chemotherapy with temozolomide (TMZ) in glioblastomas (GBMs) was originally established arbitrarily without any comparative studies. Although several studies investigated the efficacy of long-term adjuvant TMZ therapy, no univocal data are currently available. The present study on our ongoing experience aims to assess whether the extended STUPP protocol confers prognostic benefits with acceptable safety.

Methods: From 2004 to 2018, 81 patients with a new diagnosis of GBM according to WHO 2021 classification, treated with gross total (GTR) or subtotal resection (STR), were enrolled. Patients were divided into Group A (long-term TMZ; N=40) and Group B (standard STUPP protocol; N=41).

Results: In the extended STUPP protocol, outcomes were notably better compared to the standard STUPP regimen, with both Progression-Free Survival (PFS) and Overall Survival (OS) showing significant improvement (PFS: 27.8 months vs. 7.5 months, $p=0.00001$; OS: 35.9 months vs. 11.3 months, $p=0.0001$). To address potential survival bias, our analysis concentrated on individuals in Group B who completed the advised 6 cycles of treatment. These patients experienced longer OS than those in Group A (27 months vs. 10 months, $p<0.001$). This trend persisted in subsets of patients surviving at least 12 months (27 vs. 15 months, $p<0.001$) and 18 months (34 vs. 24 months, $p=0.044$). A regression tree analysis using R was conducted to determine the impact of specific factors on the outcomes of patients receiving long-termTMZ therapy. Importantly, the incidence of side effects was comparable between the two groups, with treatment cessation due to adverse effects occurring in just one instance within Group B.

Conclusions: Our analysis demonstrates a PFS and OS advantage with extended STUPP and suggests that young patients, without corpus callosum invasion, with MGMT promoter methylation and GTR are the best candidates. In addition, we observed the safety profile of such treatment compared with the standard protocol.

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490
Brain and Spine 4 (2024) 103407
Prognostic factors for survival and malignant progression outcomes in WHO Grade 2 gliomas: a survival analysis in a long-term follow-up group

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Diffuse gliomas - clinical (Neuro-Oncology Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Adult Diffuse Grade 2 Gliomas are slow-growing infiltrative tumors. These tumors have the capacity to progress as tumors of the same grade or higher grade and can be the cause of death for most patients. They are more likely to occur in individuals aged 35-45 years, and the overall survival is, on average, 5-15 years. The objective of this work was to analyze a cohort of patients diagnosed with Grade 2 Oligodendroglioma and Grade 2 Astrocytoma, with the possibility of having a follow-up time exceeding 15 years, to assess Malignant-Free Survival (MFS) and Overall Survival (OS) at 5, 10, and 15 years after diagnosis and identify prognostic factors for malignant progression and death.
Methods: A retrospective analysis of 52 consecutive surgically treated patients diagnosed with Grade 2 Oligodendroglioma (n=26, 50%) and Astrocytoma (n=26, 50%) between 2000 and 2009 was performed. Survival analysis was conducted using the Kaplan-Meier method, and Cox Regression was used for univariate and multivariate analysis.
Results: The average age of the 52 patients was 43.9 years old, and 65.4% were male. Median OS was 13.3 years, and median MFS was 11.6 years. MFS at 5, 10, and 15 years was 75.2%, 54.1%, and 28.2%, respectively. OS at 5, 10, and 15 years was 83.1%, 64.2%, and 39.1%, respectively. In multivariate analysis, residual tumor after surgery (HR=3.36, p=0.021), eloquent area tumor (HR=2.56, p=0.011), age older than 40 years (HR=2.21, p=0.047), and Watchful Waiting approach before surgery (HR=4.66, p=0.002) increased the risk of malignant progression. Residual tumor after surgery (HR=6.98, p=0.002), eloquent area tumor (HR=3.11, p=0.025), and Watchful Waiting approach before surgery (HR=4.46, p=0.004) increased the risk of death.
Conclusions: This study supports that surgical resection as an initial approach as soon and as extensively as possible increases overall survival and decreases malignant progression.

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443
Brain and Spine 4 (2024) 103408
Status quo of clinical use and scientific value of quality of life and neurocognitive assessment practice in neuro-oncological patients

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Diffuse gliomas - clinical (Neuro-Oncology Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Patient-centred, neuro-oncological treatment strategies require a detailed picture of the patients' health-related quality of life (HRQoL) and their functional and neurocognitive status. However, extensive assessment is time-consuming, and only few standardised tools have been tailored to the special needs of brain tumour patients. The aim of this survey study was to shed light on the clinical use and scientific value of the current assessment practice in German interdisciplinary neuro-oncology tumour centres, to establish a broad basis for further discussion.
Methods: We surveyed the use of HRQoL, functional and neurocognitive status assessments using patient-reported outcome measures (PROMs) and external assessments by medical professionals in clinical routine (Clinics) and registered clinical studies (Study). 97 interdisciplinary neuro-oncology centres participated with at least one discipline (79% response rate). 28 study teams (60%) responded.
Results: HRQoL assessments were conducted in clinical routine on a regular basis by 34% of respondents, and are part of most clinical study protocols (14% primary, 72% secondary outcome). Mostly, the EORTC QLQ-C30 questionnaire (Clinics 61% / Study 86%) was used. The complementary BN-20 was relatively rarely included in clinical routine (Clinics 27% / Study 71%). The KPS was the most frequently used overall functional status assessment (Clinics 87% / Study 88%). In Clinics, external neurocognitive assessments were applied by 29% of sites, and rarely included specific tools beyond relatively quick screening instruments like the MMSE. Neurocognition was rather often considered as study outcome parameter (64%), mostly based on short screening tools.
Conclusions: In conclusion, there seems to be a broad consensus and general acceptance for the use of HRQoL and functional status PROMs, but much less for more elaborate neurocognitive assessments. This emphasises the need for an interdisciplinary discussion to better integrate well-suited instruments, adapted to brain tumour patients' profile, not only into scientific but also routine clinical practice.

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37
Brain and Spine 4 (2024) 103409
Characteristics and outcome of surgically treated patients with intradural spinal metastasis - a single-center retrospective case series

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Intradural spinal metastases are considered to be exceptionally rare. At present, limited information is available on incidence, surgical management and outcomes.
Methods: We conducted a retrospective patient chart review (2003-2023) at our tertiary academic reference center identifying all patients surgically treated for intradural spinal metastases. Data on patient demographics, primary cancer histopathology, spinal location, relation to the spinal cord, clinical course, pre- and postoperative neurological status, the extent of tumor resection, and survival were collected and compared to literature data for patients surgically treated for extradural spinal metastases.
Results: A total of 172 intraspinal tumors were identified, of which 12 patients met inclusion criteria (7%). The mean age at diagnosis of metastases was 49years, with diverse primary tumors including lung (n=3), breast (n=2), and seven other entities. Metastasis was diagnosed on an average of 2.7 years after the primary diagnosis. In total, we observed five (42%) intradural-extramedullary, and seven (58%) intramedullary metastases. The majority of intradural metastasis occurred in the cervical (50%), followed by thoracic (33%) and lumbar spine (17%). The most common preoperative symptoms were pain (75%), motor (67%), sensory (83%) and vegetative deficits (25%). Gross-total resection was achieved in 58%, while in 42% a subtotal resection was performed. Postoperatively, 90% of patients exhibited clinical improvement, while neurologic function was severely affected in one patient. The most frequent postoperative adjuvant treatment was radiotherapy (42%) and/or chemotherapy (17%), while best-supportive-care was chosen by 41%. The mean overall-survival from the diagnosis of primary cancer to death was 5.2years (range 0.5–16.7years). The average survival-after-operation for spinal metastases was 1.7years, with six patients surviving <1 year (averaging 3.5months).
Conclusions: Intradural location of spinal metastases is exceptionally rare and accounts for only 7% of all spinal metastases. Despite initial neurological improvements, survival appears lower compared to reported survival of extradural spinal metastases.

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342
Brain and Spine 4 (2024) 103410
Spinal schwannoma classification based on the presumed origin with preoperative MR images

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Classification is used in deciding surgical approach with prognosis expected. However, existing spinal schwannoma classification systems are limited with a significant rate of 'unclassified' in every system. Here, we aim to develop a new comprehensive classification system for spinal schwannomas based on their presumed origin. Then, we compare the new system with the existing systems regarding the rate of 'unclassified'. Finally, we assess the surgical strategies, outcomes, and complications according to each type of the new classification.
Methods: The location of origin was assigned by the anatomy of the spinal nerves, with the origin inferred from the most significant tumor portion and the cystic component in the preoperative MRI. The new classification system comprises 9 types according to the presumed tumor origin.
The patient surgery database collected prospectively from 482 patients with spinal schwannomas was analyzed to compare our new classification with the existing classifications of Eden, Sun and Pamir, and modified Siridhar, regarding 'unclassified' in each classification system. We defined 'unclassified' as the inability to classify a patient with spinal schwannoma using the classification criteria. Also, the surgical approach and its outcome were reckoned by the new classification system.
Results: In the classification systems compared, only our new classification system had no 'unclassified' rate. Also, the system has demonstrated usefulness in predicting the surgical outcome with the approach planned. With a gross total removal (GTR) rate of 88.0% across all types, high GTR rates were observed in Type 1 (95.3%) and Type 2 (96.0%) tumors. The approach varied with tumor type, with laminectomy predominantly used for Types 1, 2, and 9, and facetectomy with pedicle screw insertion employed in 36.6% of Type 3 tumors. This new classification not only guides surgical strategies but also aids in anticipating patient outcomes post-surgery.
Conclusions: The new classification system for spinal schwannomas based on their presumed origin is applicable to all spinal schwannomas. It could help plan a surgical approach and predict its outcome, compared with existing classification systems.
Optional Image

Table. Patients classified by our new classification based on the presumed origin

N = 482	Patient number	Classifying by level	Percentage (%)
Type 1 (Dorsal root)	296	C: 36, C-T:3, T: 84, T-L: 29, L: 130, L-S: 8, S: 6	61.4%
Type 2 (Ventral root)	25	C: 3, C-T: 2, T: 12, T-L: 2, L: 6	5.2%
Type 3 (Dorsal root ganglion)	41	C: 21, C-T: 1, T: 3, T-L: 3, L: 8, L-S: 1, S: 4	8.5%
Type 4 (Ventral ramus)	31	C: 8, T: 12, L: 10, S: 1	6.4%
Type 5 (Dorsal ramus)	5	C: 3, L: 1, S: 1	1.0%
Type 6 (Sympathetic ganglion)	5	C-T: 1, T-L: 1, L-S: 1, S: 2	1.0%
Type 7 (Communicantes)	6	C: 1, T: 1, L: 4	1.2%
Type 8 (Sinuvertebral nerve)	2	L-S: 1, S: 1	0.4%
Type 9 (Intramedullary)	4	C: 3, T: 1	0.8%
Hybrid form (Multiple origins)	67	Refer to Table 7	13.9%
Unclassified	0		

C, Cervical; C-T, Cervicothoracic; T, Thoracic; T-L, Thoracolumbar; L, Lumbar; L-S, Lumbosacral; S, Sacral

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344
Brain and Spine 4 (2024) 103411
Intramedullary Spinal Cord Tumors: The Do's and the Don'ts

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Intramedullary spinal cord tumours (IMSCTs) are rare, predominantly benign tumours accounting for 20-30% of all spinal cord tumours. Intramedullary tumours can lead to severe neurological deficit in the form of motor and sensory disorders, decrease and loss of conductive function, which leads to a significant decrease in quality of life or even death. Although these tumours are quite thoroughly studied, surgical treatment of these patients remains a difficult, even arduous task. We describe our experience and what tips and tricks we found for ourselves after more than 1000 cases of intramedullary spinal cord tumours treated over the course of 25 years
Methods: Authors report the current recommended treatment options available from literature and their experience and know-how on surgical treatment of every tumour type based on experience of more than 1000 cases. Various uncommon tumour presentations and surgical nuances are extensively described.
Results: Presentation contains our data on surgical treatment of more than 1000 cases of intramedullary spinal cord tumours, our tips and tricks for treating patients with various tumour types and a short analysis of our patients series
Conclusions: Surgery for IMSCT continues to be challenging due to the rarity of this disease, the high functional relevance of the spinal cord, and the consequent risk of inducing severe neurological deficits.
Taking into account modern surgical Methods, wide knowledge and treatment experience in most cases complete or maximally safe tumour resection can be achieved. Despite advancements in neurosurgical techniques and assistive devices, IMSCT resection still carries a considerable risk for neurological deterioration, reaching as high as 90% in the immediate postoperative period. We report our tips and tricks for treating patients with various tumour types and a short analysis of our patients series

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855
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Predictors For Spinal Deformity Following Resection Of Intradural Tumor Via Posterior Approach: Systematic Review And Meta-analysis

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Intradural tumors of the spinal cord make up 30% of all primary spinal cord tumors. The treatment of choice is tumor resection via laminectomy, laminoplasty or laminotomy. The incidence rates of postoperative spinal deformity (SD) reach 10% in adults, with an occurrence of up to 100% in pediatric patients.
Methods: A review of the literature has been performed according to PRISMA guidelines. Databases PubMed, Web of Science and Scopus has been searched with the use of keywords "laminoplasty", "laminotomy", "laminectomy", "tumor", "resection", "spinal deformity", "kyphosis", "intradural", "intramedullary", "extramedullary". Odds ratios (OR) have been estimated for dichotomous values, and mean differences (MD) have been calculated for continuous values. The quality of each study has been assessed using the Newcastle-Ottawa Scale (NOS).
Results: Eleven retrospective studies have been identified, yielding a total of 715 patients with a mean age of 17.1 years (range 0.5-76). 183 patients developed postoperative SD. Younger patients (cut-off 25 years; OR=4.03;p<0.0001 and cut-off 13 years; OR=3.72;p=0.003, age group between 5 and 21 years in non-fusion only subgroup; OR=9.36;p=0.02) were at increased risk of developing SD. Preoperative SD strongly predicted postoperative SD (OR=12.19;p=0.0007), with risk greatly increased in the non-fusion subgroup (OR=22.14;p<0.0001). Thoracolumbar junction involvement in surgery increased risk of SD (OR=3.11;p=0.04). In the fusion subgroup only, surgery involving at least 3 spinal levels increased risk of SD (OR=9.18,p=0.02). Another risk factor for postoperative SD, significant only in the non-fusion subgroup, included

intramedullary location of the tumor (OR=3.67;p=0.04).
Conclusions: Younger age, preoperative SD, thoracolumbar junction involvement in surgery, decompression comprising at least 3 spinal levels, and intramedullary location of the lesion are significant risk factors for postoperative spinal deformity after resection of intradural spinal cord tumors. Results of our meta-analysis can give the practitioners valuable information in the decision-making and surgical strategies in the treatment of high-risk patients.

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1260
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Cavernous Malformations of the Spinal Cord - Surgical Treatment and Nuances

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Vascular tumors of spinal cord are a rare pathology, which is most often comprised of hemangioblastomas and cavernomas of different localization. These vascular tumors arise sporadically, however hemangioblastomas may be associated with the von Hippel-Lindau disease. The spectrum of clinical manifestations of these pathologies is quiet wide – from asymptomatic carriage to severe neurological deficit that lead to permanent disability or death of the patient.
Methods: From 2002 to 2020 at Burdenko Neurosurgery Institute 70 patients with cavernous malformations at different spinal levels were operated. Preoperative assessment consisted of MRI data and thorough neurological examination. Patient status was assessed on before and after surgical treatment and analyzed.
Results: Complete microsurgical removal of cavernous malformations of the spinal cord is the only treatment method that prevents recurrent hemorrhages. Indications for surgery are based on the clinical course of the disease and the patient's condition at the time of examination. In the presence of persistent neurological symptoms, surgery was performed even if their severity was insignificant (2 or more on the McCormick scale). In case of obvious hemorrhage and international macrohematoma, surgery is performed 2–3 weeks after the hemorrhage. With complete regression of symptoms (1 on the McCormick scale), surgery was not indicated and observation is recommended.
Conclusions: Surgery of vascular tumors of the spinal cord is a sophisticated and multicomponent task that requires a search for the correct approach to treat the patient, a decision made on the need for embolization of vascular tumor, as well as microsurgical treatment when needed.

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1405
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The effect of hemilaminectomy versus laminectomy on the extent of resection of intradural juxtamedullary spinal tumors: A European retrospective multicenter study.

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Spinal Oncology (Spine Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Spinal cord tumors account for up to 15% of all central nervous system neoplasms. The extent of resection and postoperative neurological status are among the major prognostic factors for good (functional) outcome. Minimally invasive approaches have been introduced intending to improve the clinical outcome. The aim of the current multicenter study is to determine whether hemilaminectomy is a reliable alternative to conventional laminectomy.
Methods: Data was analyzed out of multicenter patients' registry; operative approaches, imaging, extent of resection, length of stay (LOS), estimated blood loss and adverse events were assessed retrospectively. Fisher's exact test was performed to determine whether the surgical approach effected the extent of resection. T-test was used to compare the length of hospital stay between the cohorts.
Results: Laminectomy was performed in 198/452 (43.80%) cases and hemilaminectomy in 254/452 cases (56.20%). There was no statistically significant difference between the two surgical approaches (p = .716) with GTR being achieved in 93.43% in the laminectomy group and 92.13% in the hemilaminectomy group, respectively. LOS in the hemilaminectomy cohort was significantly shorter accounting 8 5 days in comparison with 9 7 days in the laminectomy cohort (p =.0413).
Conclusions: Minimally invasive hemilaminectomy is not inferior to the conventional laminectomy regarding the EOR and is also associated with shorter LOS.

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1029
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Spheno-orbital meningiomas: a treatment flow-chart for improving outcome

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Spheno-orbital skull base lesions (Skull Base Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Spheno-orbital meningiomas (SOM) may be predominantly osseous, with variable intradural development and involve periorbita, lateral cavernous sinus wall, superior orbital fissure, middle cranial fossa floor and infratemporal fossa. Goals of surgery are to reduce proptosis and restore visual function, rather than achieve radical resection. However, incomplete resection is associated with recurrence. We report our recent series of SOM, focusing on surgical management strategy, visual function, and esthetic outcomes.
Methods: Materials and Methods: From a prospective skull base tumors database, we extracted all patients operated on for SOM from 2019 to 2023. All patients underwent pre- and post-operative brain MRI and CT scan. Proptosis index (PI) was measured. Ophthalmological pre- and post-surgical evaluation comprised visual acuity (VA, Snellen chart) and visual field (VF, Humphrey/Goldman automated perimetry).
Results: Twenty patients were included (9 males, 11 females, mean age 53 years). Predominantly intradural or osseus development was found in 60% and 40% of patients respectively. Decreased visual acuity was present in 20% and visual field deficit in 2% of patients. All patients presented PI>1. Postoperatively proptosis was improved in 85%, VA and VF improved in 95% and 79% respectively. All patients had Simpson 1 dural component resection and complete removal of osseous infiltration, while periorbita infiltration was removed in 80%. At 38 months mean follow-up, no recurrence was observed. A surgical strategy flow-chart is proposed, that consider the indication of clinoidectomy, decompression of cranial nerves at their exit from the skull base, resection of lateral cavernous sinus wall and one-step cranial reconstruction.
Conclusions: SOM are infiltrative tumors with an indolent nature and surgery is the primary treatment. The appropriate surgical resection with or without clinoidectomy and reconstruction strategy is evaluated on a case-by-case basis. The treatment flow-chart proposed was applied with satisfactory results in terms of visual function and aesthetic outcome.

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1429
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Minimally invasive lateral orbitotomy approach for middle fossa and orbital lesions

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Spheno-orbital skull base lesions (Skull Base Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Lesions of the anteromedial middle fossa such as spheno-orbital meningiomas and trigeminal schwannomas are often resected using pterional or orbito-zygomatic craniotomy approaches, which utilize a large skin incision with mobilization of the temporalis muscle and larger areas of cerebral cortex exposure. These approaches are associated with cosmetic and functional morbidities, particularly temporalis muscle atrophy and/or dysfunction. There is minimal long-term experience published with minimally invasive lateral orbitotomy approaches through a small lateral epicanthal incision.
Methods: A retrospective review of all patients treated with lateral orbitotomy approach at a single institution was performed. After mapping of the frontalis branch of the facial nerve, a 2-3cm lateral epicanthal incision and canthotomy was made. Utilizing this incision and the natural opening of the eye, the lateral orbital rim and zygoma were exposed and a craniotomy performed to reveal the lateral periorbita, and frontal and temporal dura. After tumor resection, fat graft was performed as needed, the lateral orbital rim reconstructed, and the incision closed. Primary outcome measures included length of stay (LOS) and perioperative complications such as cranial nerve palsy or visual deficit.
Results: Forty-eight patients treated via lateral orbitotomy were identified. The average patient age was 47 years old (range 14-85) and average length of follow up was 27 months. Twenty-nine patients (60%) underwent preoperative lumbar drain placement for brain relaxation and abdominal fat graft was used for reconstruction in 42 patients (87.5%). Twenty-seven patients (56%) were treated for meningioma, seven (14.6%) for schwannoma and 14 (29%) for other pathologies such as metastatis and juvenile angiofibroma. Lesions targeted for treatment were intraorbital in four cases (8.3%), intracranial in 13 cases (27%), and both intraorbital and intracranial in 31 cases (64.5%). Of the 34 cases in which complete tumor resection was intended, gross total resection was achieved in 24 (71%), near total resection in 9 (27%) and subtotal resection in 1 (3%), and only one case of tumor recurrence occurred. Five patients (10%) experienced postoperative complications: one wound infection, one temporal lobe venous infarct, one permanent oculomotor nerve palsy, one transient encephalopathy and one partial retinal artery occlusion with decreased visual acuity. No patient developed pulsatile enophthalmos, exophthalmos, or globe injury. The median post-operative length of stay was three days (interquartile range 2 to 4 days).
Conclusions: The lateral orbitotomy approach is a minimally invasive means of addressing a wide variety of intracranial and intra-orbital pathologies. Review of a decade long, single institution experience with long-term patient follow-up suggests that it is a safe procedure in appropriately selected patients. Notably, the adverse events identified in our series are also risks of more traditional open approaches, suggesting that the lateral orbitotomy approach may have comparable safety with favorable cosmetic results compared to these approaches.

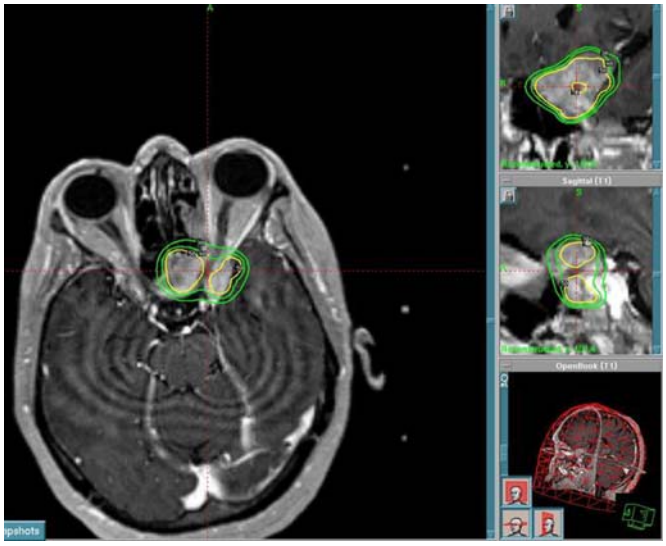
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110
1340
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Spheno-orbital meningiomas: predictors of recurrence and novel strategies for surgical management

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Spheno-orbital skull base lesions (Skull Base Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Spheno-orbital meningiomas (SOM) are characterized by the pathognomonic hyperostosis of the sphenoid bone. Gross-total resection (GTR) is possible only in limited cases. Notably, the relation between the extent of resection and risk of recurrence is still undefined, especially for the bony tumor portion (BTP).
This study aims to identify any potential correlation between the recurrence rate of SOM and the extent of resection of the (I) bony (BTP) and (II) soft tumor portions (STP) and to analyze the progression-free survival (PFS) of patients harboring SOM.
Methods: This retrospective study included patients who underwent surgical resection of a SOM between 2011-2021 at our Institution. Demographic and clinical data was retrieved from the institutional medical record. Pre- and post-operative brain CT and MRI scans were analyzed. STP and BTP volumes were segmented. The Kaplan-Meier method estimated PFS by considering the possible treatments at recurrence [stereotactic radiosurgery (SRS) versus surgery] and the Youden index for the best STP residual cut-off.
Results: The study cohort included 89 patients diagnosed with SOM (8.9/1 – F/M). The mean follow-up time was 78 months. Sixty percent of patients had a history of contraceptive assumption for more than 10 years. There was no significant correlation between the postoperative BTP volume and the recurrence rate ($p>0.05$) whereas a significant correlation was identified for the STP ($p<0.001$). Patients who had a STP volume above 3.7 mm3 postoperatively presented an adjusted odds ratio of 1.342 for risk of recurrence ($p<0.001$).
Conclusions: Safe maximal resection of STP may reduce the recurrence rate of SOM, while this may not be the case for the BTP. In general, the surgical strategy for SOM should be patient-based with the aim of achieving maximal resection of the STP. Conversely, the BTP removal should be tailored based on the need to decompress anatomical structures with the aim of preserving neurological functions.
Optional Image



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Correlation between improvement of visual acuity and degree of decompression of the optic canal in patients with parasellar meningioma: a single centre retrospective analysis

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Spheno-orbital skull base lesions (Skull Base Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Visual deficits frequently occur in case of parasellar meningiomas because of thier tendency to invade optic canal (OC), and it is not uncommon to observe in clinical practice absence of improvement of visual function after surgery. The aim of this study is to evaluate correlation between degree of circumferential decompression and length of decompression of OC and improvement of visual acuity.

Methods: In this retrospective study, adult patients with parasellar meningiomas underwent extradural clinoidectomy (EC) with unroofing of the optic canal (UOC) between 2013 and 2023 were identified. Visual acuity improvement 3-months after surgery was considered in case of variation of one line or more in the recorded level of Snellen acuity. Decompression of the optic canal was studied using postoperative 0.5 mm CT-scan multiplanar reconstructions. Degrees of decompression were calculated through coronal plane reconstruction at intracranial opening (ICO), middle part (MP) and intraorbital opening (IOO). Subsequently, considering these points as a reference, the optic canal was divided in a posterior segment (from ICO to MP) and an anterior segment (from MP to IOO).
Results: 29 patients were identified. 3-months visual acuity improvement was documented in 18 patients (62%), while 8 patients showed stability in visual acuity (27%) and 3 patients developed a worsening (11%). Decompression >90° of the anterior segment of OC or decompression >180° of the posterior segment were associated with improvement of visual acuity (p=0.023). Full-length decompression > 90° was associated with improvement of visual acuity (p=0.035).
Conclusions: Anterior segment decompression >90°, posterior segment decompression >180° full-length decompression of OC >90 and were associated with improvement of visual acuity at 3 months after surgery, providing useful information regarding how far surgeons should pursue bony removal of the optic canal to achieve a decompression that can lead to clinical benefits for patients, optimizing surgical times and reducing surgical complications.

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516
Brain and Spine 4 (2024) 103419
Global Standards for Neurosurgical Training and Certification: EANS and Beyond

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Training programs and modern technology in low income countries- challenges and possibilities (Global Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: The number of neurosurgeons trained globally has increased significantly but standards for training and certification vary greatly country-by-country. A recent European study found consensus from nearly 40 countries that variability in training and certification across countries should be addressed. Standardized digital/electronic documentation and global curriculum could improve the quality of neurosurgical care worldwide.
Methods: Standards for neurosurgical training and certification have been sought from the WFNS (World Federation of Neurosurgical Societies) continental societies and the individual societies, where possible, for countries globally. These data have been combined with information from websites such as the American Board of Neurological Surgery (ABNS) and the European Union of Medical Specialists (UEMS) and from articles retrieved from PubMed.
Results: The five continental neurosurgical societies vary greatly in the number of countries within their continent, from two countries in North America to roughly 15 countries in Africa and Latin America to 30 to 40 countries in Asia and Europe. In North America, the USA and Canada reversed their common certification criteria in the 1990s – neurosurgeons trained in Canada are no longer recognized in the USA. The Royal College of Physicians and Surgeons of Canada introduced competency-based (rather than time-based) neurosurgical training in 2019.
In Europe, the UEMS and EANS have published an optional standardized competency-based curriculum for training and certification alongside the FEBNS (European Board Examination in Neurological Surgery) examination within EANS member countries.
A worldwide competency-based curriculum would need some modifications based on the types of cases encountered locally (e.g. some regions have a much higher incidence of trauma, infections, or congenital disorders) as well as resource-based limitations (e.g. radiosurgery, interventional neuroradiology, deep brain stimulation). An Emergency Neurosurgery curriculum would be suitable for global application with defined capabilities in practice. All trainees should utilize digitized case logs to support their clinical experience. While videos of surgical procedures could enable assessment of competency, such a step may raise difficulties related to authenticity and patient confidentiality.
Conclusions: Global standards for neurosurgical training and certification incorporating a WFNS curriculum and adoption of digital/electronic techniques has the potential to augment the competency of the neurosurgical workforce worldwide.

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1008
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External Ventricular Drainage in Acute Hydrocephalus Following Hemorrhagic Strokes in Tanzania: The Savior or Killer?

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Training programs and modern technology in low income countries- challenges and possibilities (Global Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Acute hydrocephalus represents a common emergency condition following hemorrhagic strokes, necessitating urgent intervention through external ventricular drainage (EVD) to alleviate increased intracranial pressure (ICP). However, the implementation of EVD carries the various risks of complications that can significantly affect patient outcomes. These play a deciding role especially in specific conditions which a low-income country as Tanzania truly constitutes. The study assesses the current management of patients suffering from acute hydrocephalus due to hemorrhagic events with a special focus on EVD procedure and its further management, seeking to identify all factors contributing to unfavorable neurological outcome.
Methods: In this retrospective cohort study, 277 patients diagnosed with hemorrhagic strokes who suffered from acute hydrocephalus from January 2018 to November 2023 were included in the study.
Data on demographics, clinical and radiological characteristics, relevant vascular risk factors, surgery, EVD insertion and management, and neurological outcomes were collected and further analyzed. The primary outcome was overall mortality, with secondary outcomes including EVD-related complications.
Results: The study revealed that patients with EVD insertion for more than 15 days had a significantly higher mortality rate, with an adjusted hazard ratio for mortality of 9.7 (95% CI, 5.8-16.2; P<0.001) compared to those with shorter durations of EVD placement. Complications related to EVD except for infections were observed in 18.1% of patients, leading to additional neurosurgical procedures in 11.9% of the cohort.
Conclusions: Presently, the duration of EVD in situ is the one critical determinant of overall mortality in patients with hemorrhagic strokes undergoing treatment for acute hydrocephalus. Specifically, an EVD placement exceeding 15 days is associated with a markedly increased mortality risk.
The study highlights the challenges faced in the Tanzanian healthcare setting, and the need for stringent infection control practices. These findings underscore the importance of vigilant monitoring and timely EVD weaning strategies. Furthermore, it calls for the development of localized treatment guidelines. The results emphasize the necessity for a balanced approach in managing acute hydrocephalus, weighing the benefits of EVD against the potential risk of infections. This study contributes to the ongoing efforts to optimize clinical management in resource-limited settings, aiming to improve patient outcomes through evidence-based practices.

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270
Brain and Spine 4 (2024) 103421
The Impact of Folic Acid-Fortified Iodized Salt on Serum Folate Concentration in Women of Reproductive Age- A Longitudinal Interventional Study Based in South India

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Training programs and modern technology in low income countries- challenges and possibilities (Global Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Despite thirty years of literature showing that folic acid (FA) can prevent Spina Bifida and Anencephaly (SBA), only 25% of such births are prevented globally. India contributes around one-third of this burden, leading to high numbers of pregnancy termination, stillbirths, and under-five child mortality. Dietary variations across India makes staple food fortification particularly difficult. FA fortified salt serves as a viable food vehicle to deliver FA across the heterogenous Indian population. The aim of our study was to determine the effectiveness of FA-fortified iodized salt in increasing serum folate concentrations among women of reproductive age.
Methods: A pre- and post-intervention study was conducted in four rural villages in Southern India from July 2022 to November 2022. Participants were provided with approximately 300 micrograms of FA daily using double fortified salt (FA + Iodine). Change in median serum folate levels among non-pregnant non-lactating women ages 18-45 years, between study start and endpoint was the primary outcome of the study.
Results: 83 women were eligible for the study and provided serum samples for analysis before and after the intervention. The median serum folate concentration increased from 14.6 nmol/L at baseline to 54.4 nmol/L at end of study, showing a serum folate level increase by a median of 39.8 nmol/L (i.e., 3.4-fold or 272.6% increase from baseline to study endpoint). Two-tailed Wilcoxon Signed Rank Test showed this difference to be highly significant ($p < 0.001$). The villagers found the salt acceptable in color, taste and cooking properties.
Conclusions: FA-fortified iodized salt significantly increases serum folate concentrations in women of reproductive age. This novel evidence demonstrates that salt holds potential be an effective vehicle in reducing the burden of SBA equitably across a large population and can inform public health policy to accelerate SBA prevention in large and heterogenous countries.
Optional Image

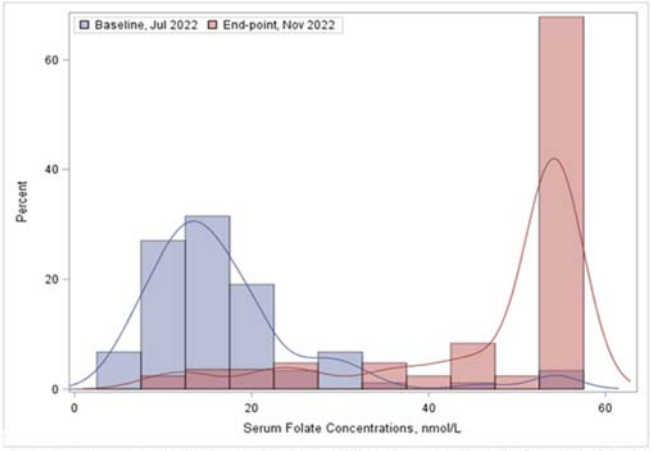


Figure 1: Comparison between median serum folate concentrations before and after the intervention.

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361
Brain and Spine 4 (2024) 103422
Taking an Out of Program (OOP) Experience in Global Neurosurgery- a Cross-Sectional Study Exploring the Perspectives of UK Neurosurgeons

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Training programs and modern technology in low income countries- challenges and possibilities (Global Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: With a rising interest in global neurosurgery, there has been an expansion in training initiatives and opportunities to enable neurosurgeons to work abroad and experience different healthcare systems. While there are several formalized programs around the world, there is a lack of neurosurgical OOPEs within the UK. There is a paucity of data on the need for such OOPEs and the barriers to developing them in the UK. The aim of our study was to explore the perspectives of UK based neurosurgeons on undertaking OOPEs abroad.
Methods: A cross-sectional survey-based study was undertaken between 1.3.2023 and 31.4.2023 with the help the SBNS Global Neurosurgery initiative and disseminated amongst UK-based Neurosurgical consultants and trainees. Quantitative data analysis was performed on Stata MP 17.0 software. Thematic analysis was undertaken of free text responses.
Results: 63 responses were recorded, 37 were consultants and 26 were trainees. 94.59% (n=37) of consultants stated they would be supportive of their trainees taking OOPs abroad, but 83.78% (n=37) stated they required support to enable their trainees to undertake such an OOPE. Amongst trainees, 23.08% (n=26) had already taken OOPE, and majority were research based OOPE. 69.32% (n=26) of trainees responded that they would be interested in an OOPE in an LMIC if such an opportunity was available. The main barriers trainees reported to undertaking such as OOPE was funding, maintaining clinical skills, and finding an appropriate supervisor.
Conclusions: Our study found a significant interest amongst both neurosurgical consultants and trainees to have OOPE opportunities abroad, but both consultants and trainees require support to support and undertake such OOPEs respectively. Our study highlights a need to develop formalized OOPE opportunities abroad that are ethical and sustainable, ensuring that trainees are well supported and able to address the service needs within the location of their OOPE.

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679
Brain and Spine 4 (2024) 103423
The Global Epidemiology and Outcomes after Traumatic Brain Injury (GEO-TBI) registry: A Collaborative TBI Audit and Research Platform – Status Update and Ongoing Research

Tommi Korhonen [1,2,3], Midhun Mohan [1,2], David Clark [1,2], Carole Turner [1,2], Michael Martin [4], Angelos Kolias [1,2], Peter Hutchinson [1,2], Alexis Joannides [1,2]. [1] *Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom;* [2] *NIHR Global Health Research Group on Acquired Brain and Spine Injury, University of Cambridge, Cambridge, United Kingdom;* [3] *University of Oulu & Oulu University Hospital, Oulu, Finland;* [4] *Orion MedTech Ltd. CIC, Cambridge, United Kingdom*

Training programs and modern technology in low income countries- challenges and possibilities (Global Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: Traumatic brain injury (TBI) epidemiology is unclear, treatments are variable and outcomes differ significantly between healthcare settings. The factors underlying these differences remain unclear. The Global Epidemiology and Outcomes after Traumatic Brain Injury (GEO-TBI) registry was established to produce a more accurate global picture of the burden of TBI and intervention outcomes to facilitate service benchmarking against a global standard, highlight best practices and facilitate evidence-based prioritization of TBI in decision-making.
Methods: The GEO-TBI provides a readily accessible, standardised platform for TBI data collection, audit and collaborative research, which was constructed via a consensus-based process. The first study to run on the platform, GEO-TBI: Incidence, is currently ongoing.
Results: The registry has been active for one year, and currently includes 753 patients from eight centres situated in Africa, Asia, Americas and Europe. Patients from low-to-middle income countries were younger than those from higher income countries, and differences in TBI mechanisms were evident.
Conclusions: We will present the one-year report of the international GEO-TBI dataset, which will provide epidemiological and outcome data from different healthcare settings. We will also highlight future studies to be run on the collaborative registry. Further information is available on https://geotbi.org.

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477

Brain and Spine 4 (2024) 103424

Establishing a Virtual Reality Database for teaching in children with craniosynostosis.

Attill Saemann [1], Sina Schmid [1,2], Maria Licci [1,2], Marek Zelechowski [3], Balazs Faludi [3], Philippe Cattin [3], Jehuda Soleman [1,2,4], Raphael Guzman [1,2,4]. [1] *Department of Neurosurgery, University Hospital of Basel, Basel, Switzerland;* [2] *Department of Neurosurgery, University Children's Hospital Basel, Basel, Switzerland;* [3] *Department of Biomedical Engineering, University of Basel, Allschwil, Switzerland;* [4] *Faculty of Medicine, University of Basel, Basel, Switzerland*

Pediatric neurosurgery (Pediatric Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

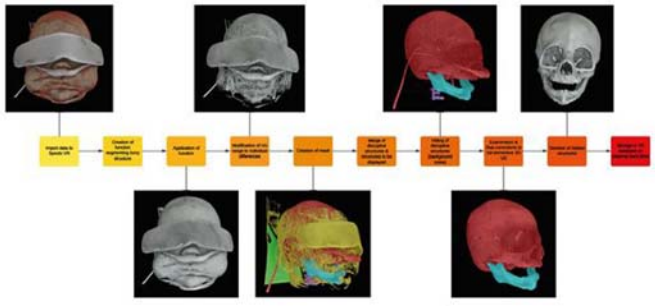
Background: Craniosynostosis entails skull deformities in children due to premature ossification of cranial sutures, necessitating three-dimensional (3D) visualization for effective teaching and pathology comprehension. We aimed to evaluate the efficacy, motivation, and memorability of a Virtual Reality (VR) Database featuring 3D models of craniosynostosis deformities compared to traditional non-VR Methods like 2D illustrations.

Methods: All craniosynostosis cases with preoperative CT scans from 2012 to 2022 were included. These scans were converted to DICOM data and imported into SpectoVR, enabling bony structure segmentation. Using a headset system, an immersive VR experience facilitated measurements, sub-segmentation, and anatomical planning. Teaching sessions were conducted in group settings with multiplayer VR views, allowing simultaneous exploration and discussion of 3D models. Participant experiences were evaluated via a questionnaire gauging understanding, memorization, and motivation on a scale from poor (1) to outstanding (5).

Results: Among 37 cases in our 3D VR Library, highly satisfactory scores (mean 4.5 ± 0.2) were observed across evaluated parameters. Participants reported increased understanding (mean 4.3 ± 0.77) and memorization (mean 4.2 ± 0.8) compared to non-VR Methods. The 3D VR models facilitated easier comprehension (mean 4.6 ± 0.6), faster learning (mean 4.4 ± 0.7), and heightened motivation (mean 4.3 ± 0.9), leading to perceived teaching efficiency (mean 4.8 ± 0.6).

Conclusions: Our 3D VR database for craniosynostosis teaching demonstrated advantages in enhancing understanding, memorization, and motivation, ultimately promoting more efficient learning. This approach proved cost-effective without significant additional resource requirements. Future exploration should consider applications in patient consent and teaching across other medical domains.

Optional Image



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609

Brain and Spine 4 (2024) 103425

Increased Incidence of Neurosurgically Managed Intracranial Infections in Children Between 2021 and 2023: A Monocentric Analysis

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Pediatric neurosurgery (Pediatric Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Pediatric intracranial infections, though rare, can cause significant morbidity and mortality. A substantial increase of pediatric intracranial infections requiring neurosurgical interventions at our centre post the onset of the COVID-19 pandemic prompted a comprehensive analysis.

Methods: In a retrospective monocentric analysis all pediatric patients with intracranial infections necessitating neurosurgical intervention from 2010 to 2023 were identified via electronic medical records. Demographic, radiological, clinical and surgical data were systematically analyzed. Cases with postoperative infections or trauma were excluded.

Results: 15 patients were operated (9 male) with a median age of 11.3 years. Regarding the seasonal distribution, 33% of patients underwent surgery in winter, 20% in spring, 33% in summer and 13% in autumn. 73.3% (n=11/15) were hospitalized between 2021 and 2023, contrasting sharply with 26.7% (n=4/15) from 2010 to 2020. The diagnostic categorization unveiled brain abscess (33.3%), subdural empyema (40%), coexistence of abscess and subdural empyema (13.3%) and cerebellitis (13.3%). Clinically, 93.3% demonstrated intracranial pressure symptoms, 53.3% focal neurological symptoms, 27.3% fever and 46.7% seizures. Preoperatively, 80% showed respiratory infections or sinusitis. Leucocyte count and C-reactive protein levels were significantly higher in subdural empyema compared to brain abscess. Pathogens were detected in 73.3%, S. intermedius was isolated in 63.6%. Polymicrobial infection occurred in 18.8%. Craniotomy and/or craniectomy were performed in 86.7%. Treatment for brain abscess required one surgery in 57.1%. 75% of subdural empyema patients needed multiple surgeries. All subdural empyema patients underwent otolaryngologic surgery due to sinusitis. Postoperatively, 53.3% were symptom-free, 20% suffered cognitive deficits and 20% had mild symptoms. The mortality rate was 6.6% (n=1/15).

Conclusions: The notable increase in pediatric intracranial infections requiring neurosurgical intervention from 2021 to 2023 could be multicausal. A potential role of immune dysregulation following SARS-CoV-2 infections may be considered. Due to small patient numbers, observation on multicenter or national-level are imperativ.

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1166

Brain and Spine 4 (2024) 103426

Management of Pediatric Sylvian Arachnoid Cysts. A Single Center Experience

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Pediatric neurosurgery (Pediatric Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Arachnoid cysts are cerebrospinal fluid-filled benign lesions whose intracranial forms mainly localize in the sylvian fissure. Severe symptoms and large cysts require surgical treatments, including microsurgical, endoscopic, and shunting approaches. Yet, the efficacies and safeties of different approaches are still debated. This retrospective study evaluated 36 pediatric patients with sylvian arachnoid cysts receiving different surgeries to contribute to global data.

Methods: The study included 24, 8, and 4 patients receiving endoscopic, microsurgical, and shunt surgeries, respectively. Preoperative and postoperative assessments included the patient's demographics and symptoms, cyst size and type, psychomotor status, length of hospital stay, and complications with a mean follow-up of 37.3 months.

Results: All surgeries significantly alleviated headaches and seizures in most patients. Shunt operations led to the highest reductions in cyst size in the early postoperative period and relieved cranial palsy in all patients. Microsurgery achieved greater healing regarding hemiparesis and seizures and reduced cyst size more efficiently in the early postoperative period than endoscopy. Complication rates were similar between the endoscopy and microsurgery groups.

Conclusions: All surgeries significantly alleviated headaches and seizures in most patients. Shunt operations led to the highest reductions in cyst size in the early postoperative period and relieved cranial palsy in all patients. Microsurgery achieved greater healing regarding hemiparesis and seizures and reduced cyst size more efficiently in the early postoperative period than endoscopy.

Complication rates were similar between the endoscopy and microsurgery groups.

Optional Image



A and B) Intraoperative endoscopic view of a right-sided type III sylvian cyst. Optic nerve (OP), internal carotid artery (ICA), oculomotor nerve (OC), anterior cerebral artery (ACA), middle cerebral artery (MCA), and the tentorium (T) free edge. The cyst membrane at the carotico-oculomotor triangle (2) and at the oculomotor-tentorial triangle (3). C) The membrane at the carotico-oculomotor triangle (3) was perforated using the monopolar probe.

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187
Brain and Spine 4 (2024) 103427
Ethics of Medical Education and Responsibilities of Medical Schools

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Multidimensional Perspectives of Ethics: Training, Research and Clinical Practice (Ethics Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Socioeconomic dynamics and technological advances can lead to ethically flawed changes in academic missions and educational results. The objective of this study is to reveal these ethical concerns in the field of neurosurgery medical education (ME).

Methods: This scoping review analyzed relevant articles on ME and ethics from the PubMed and Web of Science databases from the past five years (January 2019–December 2023). A narrative synthesis approach was applied.

Results: This study identified seven domains of ethical concern in recent neurosurgery-relevant ME activities: (1) the use of artificial intelligence (AI), (2) social injustice and oppression, (3) predatory publishing, (4) inappropriate use of virtual reality in anatomy (VRA), (5) generative language models (GLMs), (6) surgical palliative care (SPC), and (7) burnout in the work environment. First, AI has ethical implications, such as the production of biased predictions leading to discrimination against patients, misdiagnoses, overtreatments, and undertreatments. Second, the use of force and/or authority over individuals of certain racial and ethnic origins, religions, gender, sexual orientations, and cultural differences, as well as differences in appearance and ability, emerge as significant concerns. Third, the threat of predatory publishers to medical students needs to be better understood. Fourth, there are concerns about the realism and accuracy of VRA. Fifth, GLMs can lead students to violate academic ethics by bypassing learning processes. Sixth, in SPC, it is ethically imperative to support patients' treatment goals while helping alleviate their physical pain and psychosocial suffering by respecting their ethnic, racial, religious, and cultural values. Seventh, a well-cultivated ethical climate focusing on a healthy lifestyle is mandatory in ME institutions.

Conclusions: Both advanced technologies and socioeconomic factors have led to the emergence of new ethical concerns in ME in recent years that affect neurosurgical education and development.

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1261
Brain and Spine 4 (2024) 103428
Perception of Neurosurgery among Medical Students: A Single-Center Survey Study

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Multidimensional Perspectives of Ethics: Training, Research and Clinical Practice (Ethics Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: There is a decreasing interest in neurosurgery among medical students, particularly in low- and middle-income countries. This study aimed to explore potential factors that influence medical students' interest in a neurosurgery career and to provide novel insights into this important, understudied area.

Methods: A cross-sectional survey study was conducted using a new self-administered Likert-type questionnaire. The target sample comprised fourth-, fifth-, and sixth-year medical students (n = 476). This study was approved by the ethics committee of our institution.

Results: The response rate was 56%. Although 61.5% of the respondents thought that the future of neurosurgery was bright, neurosurgery ranked 16th among the respondents' first choices for specialization. Slightly more than half of the respondents thought that a neurosurgeon's income was insufficient to compensate for the difficulties of the profession. The number of those who thought they received sufficient theoretical knowledge in neurosurgery from their rotation at medical school was 1.6 times higher than the number who thought they did not, excluding undecided participants. The number of those who thought they received sufficient practical information in neurosurgery was almost equal to the number of those who thought they did not. However, 68% of the participants stated that neurosurgery is a physically demanding branch, 72% stated that it is psychologically difficult, 61% stated that being a neurosurgeon would leave them less time for hobbies, and 71% stated that neurosurgical interventions cause serious morbidity and mortality. More women than men did not believe that the need to continue neurosurgery education after specialization would negatively affect their professional careers ($P < 0.05$).

Conclusions: Factors affecting students' choice to pursue a career in neurosurgery may include socioeconomic elements and the level of theoretical and practical neurosurgery knowledge offered to students in medical school.

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1178
Brain and Spine 4 (2024) 103429
Caffeine, Alcohol, and Drug Use as Job Adjuncts Among Neurosurgeons. Ethical Considerations and Proposed Strategies.

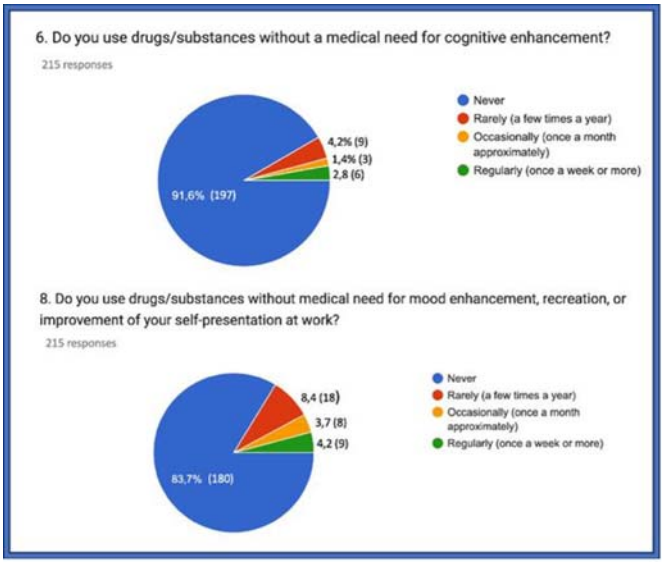
Maria Karampouga [1,2], Maria Karagianni [3], Stiliana Mihaylova [4], Aysegul Esen Aydin [5], Niina Salokorpi [6], Xanthoula Lambrianou [3], Eleni Tsianaka [7], Insa K. Janssen [8], Sylvia Hernandez-Duran [9], Daniela L. Ivan [10], Anna Rodríguez-Hernandez [11], Marike L.D. Broekman [12], Nurperi Gazioglu [13], Anastasia Tasiou [3], Mary Murphy [14]. [1] *Department of Neurological Surgery, Center for Cranial Base Surgery, University Of Pittsburgh Medical Center, Pittsburgh, USA;* [2] *Department of Neurosurgery, Nicosia General Hospital , Nicosia , Cyprus;* [3] *Department of Neurosurgery, University Hospital of Larissa, Larissa, Greece;* [4] *Clinic of Neurosurgery, St. Ivan Rilski University Hospital, Medical University of Sofia, Sofia, Bulgaria;* [5] *Department of Neurosurgery, Arnavutkoy State Hospital, Istanbul, Turkey;* [6] *Department of Neurosurgery, Oulu University Hospital, Oulu, Finland, and Research Unit of Clinical Neuroscience, Medical Research Center, Oulu University, Oulu, Finland;* [7] *Department of Neurosurgery, Kuwait Hospital, Sabah Al Salem, Kuwait;* [8] *Department of Neurosurgery, Hôpitaux Universitaires de Genève, Geneva, Switzerland;* [9] *Klinik für Neurochirurgie, Universitätsmedizin Göttingen, Göttingen, Germany;* [10] *Department of Neurosurgery, Bucharest Emergency University Hospital, Carol Davila University of Medicine, Bucharest, Romania;* [11] *Department of Neurological Surgery, Germans Trias i Pujol University Hospital, Universidad Autónoma, Barcelona, Spain;* [12] *Department of Neurosurgery, Haaglanden Medical Center and Leiden University Medical Center, Leiden, The Netherlands;* [13] *Istinye University, Faculty of Medicine, Department of Neurosurgery, Istanbul, Turkey;* [14] *Department of Neurosurgery, National Hospital for Neurology and Neurosurgery, Queen Square, London, UK*

Multidimensional Perspectives of Ethics: Training, Research and Clinical Practice (Ethics Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM

Background: Neurosurgeons strive for excellent performance, yet they face challenges of hefty workloads, heightened stress and personal concerns. Caffeine, alcohol, and various drugs have been reported to be effective aids, but their use remains controversial. The extent to which neurosurgeons resort to these aids is also largely unexplored.

Methods: Utilizing an anonymous questionnaire, our research group (GROWING) aimed to assess the prevalence of caffeine, alcohol, and drug use among neurosurgeons, together with potential underlying job-related factors. The questionnaire was distributed to personal contacts of the group and via neurosurgical societies. Data were analyzed using regression and descriptive

statistics in python.
Results: In total, 215 neurosurgeons (43 residents and 172 specialists) participated. The survey comprised 23 optional questions. 213 disclosed their gender, 94 females and 119 males. Out of 215, 9.3% were <30, 38.1% were 30-39, 44.6% were 40-59 and 7.9% were above 60 years old. 70.7% practiced in Europe, 18.6% in Asia, 6.5% in North and South America with the rest in Africa and Australia. 132 participants stated that they consume caffeine to manage their demanding timetable, while 18 and 35 participants mentioned they take drugs, for cognitive and mood enhancement respectively (fig. 1). 28 used alcohol to alleviate stress and 4 reported they were heavy drinkers. 82 admitted drug use to deal with sleep disorder and 8 to improve hand dexterity. Notably, 12 out of 29 who claimed drug use initiated it in medical school. Exercise, self-care activities and counseling were the top alternatives sought. Finally, the majority suggested extending help for mental health and raising awareness on drug use in the neurosurgical workplace.
Conclusions: The phenomenon of job-associated pharmacological support among neurosurgeons is generally overlooked. We recommend that caution should be exercised when considering drug use. Employer-led focus on the surgeons' wellness is strongly recommended by the authors.
Optional Image



https://doi.org/10.1016/j.bas.2024.103429

1289
Brain and Spine 4 (2024) 103430
Perspectives on Professionalism in the new millennium; A tale of two continents

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Multidimensional Perspectives of Ethics: Training, Research and Clinical Practice (Ethics Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: The evolving landscape of our society has brought forth significant demographic shifts, challenging conventional notions of professionalism. In light of these transformations, it becomes evident that fresh perspectives on professionalism are imperative.
Methods: This mixed-Methods study employs both qualitative and quantitative analyses to examine codes of professionalism from European and North American perspectives.
Results: Results: Our analysis compares codes of conduct and professionalism from esteemed organizations such as the European Association of Neurosurgical Societies, the Royal College of Physicians and Surgeons of Canada, the North American Spine Society, and the Canadian Medical Association. Key principles identified include respect for colleagues, honesty, integrity, and a commitment to altruism. Notably, ongoing efforts are underway to review recommended guidelines and codes of conduct in response to current social and demographic shifts.
Conclusions: Discussion: The field of neurosurgery has a longstanding tradition of upholding high levels of professionalism and demonstrating altruism in patient care. While each society may prioritize different aspects, they all converge on fundamental principles of integrity, transparency, accountability, professionalism, and social responsibility. Understanding and adhering to these principles are paramount for fostering ethical behaviour and sustaining trust within the medical and professional communities.

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348
Brain and Spine 4 (2024) 103431
The Ethics of Shared Decision-Making Process in Skull Base Surgery and its Impact on Patients' Satisfaction.

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Multidimensional Perspectives of Ethics: Training, Research and Clinical Practice (Ethics Parallel Session), October 15, 2024, 8:00 AM - 9:30 AM
Background: The concept of patient-centered care has evolved over time and is a key element of modern medicine. Utilising the Shared Decision-making process has been set out as one of the duties of a modern-day doctor, as it allows patients to exercise their autonomy to make informed decisions regarding their management and strengthens trust between doctors and their patients.
Methods: The method and idea of respecting the needs and wishes of patients usually meets its best when practitioners involve patients, families and all health support system in care discussions and decisions making. Skull base surgeries are complex procedures which require patients to spend time weighing up their options. In such cases, a Shared decision-making process provides an opportunity for the treating Neurosurgeon to clearly discuss the benefits and risks of the procedure and acknowledge the patient's (and family's) ideas, concerns, and expectations. However, typical options, including "wait and see policy", radiation - GK, and surgery, may often have equipoise for some patients and their disease. Prior to their Skull-base procedure, the patient should have scheduled clinic appointments with their operating neurosurgeon. This allows them to be informed about any actions they should take prior to surgery like: the timeline of stopping and re-starting the antiplatelet/anticoagulation prior and post surgery, fasting rules, rules on anti-diabetic medications etc. Ideally, they should also converse with their anaesthetist and nursing team who will be looking after them pre-, peri- and post-operatively if time and resources allow.
Results: The British General Medical Council (GMC) makes it a doctor's duty to practice Shared Decision-making process to their practice of medicine upon qualification. Their published guide- Good Medical Practice (GMP), highlights that a doctor "must work in partnership with patients, sharing with them the information they will need to make decisions about their care..." (General Medical Council 2013). Neurosurgeons cannot exercise this practice without actively engaging in conversations with patients and their families about what expectations they have regarding approaching complex procedures like in skull base surgery. Such discussions also allow the neurosurgeon to identify and debunk any misconceptions the patients may hold about their upcoming procedure. Lastly, often patients express apprehension about their approaching skull-base procedure and talking to their operating Neurosurgeon can make the patient more at ease, strengthening their doctor-patient relation and reducing risks of complications due to patient apprehension, medical errors due to misunderstanding and even potential lawsuits against the Neurosurgeon or the healthcare organization. However, it must be acknowledged that the ethics behind the Shared Decision-making process is a qualitative subject and user dependent. Some Neurosurgeons may opt to spend a significant amount of time with their patient and/or their family discussing their upcoming skull-base procedure and some may provide a small yet sufficient brief to their patients. The Neurosurgeon must gauge how much information their patient would like and understand to prepare for such crucial discussions.
Conclusions: A Shared decision-making process is a hallmark of excellent Neurosurgical practice as it strengthens communication and trust between them and their patients. This is paramount when leading up to complex procedures like in Skull-base surgery requiring the patient to weight their options – which can be tough for patients if have not received proper information from their operating Neurosurgeon.

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568
Brain and Spine 4 (2024) 103432
Latest advances in neurosurgical management of trigeminal neuralgia.

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Neurosurgical innovation in pain treatment (Functional Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Trigeminal neuralgia (TN) is a debilitating condition characterized by recurrent, excruciating facial pain. Despite advances in medical therapy, a subset of patients remains refractory to conservative treatment, prompting the exploration of neurosurgical interventions. The aim of this study is to disseminate our clinical experience and to conduct a comparative analysis of the surgical outcomes in the treatment of trigeminal neuralgia (TN).
Methods: A longitudinal study assessing the modern neurosurgical interventions for trigeminal neuralgia (TN) is conducted. The study population consists of over 452 patients treated for TN between the years 1990 and 2023 at our neurosurgery clinic. All patient records, encompassing historical data, examination results, imaging findings, operative observations, and patient documentation, were meticulously reviewed and analyzed. Surgical techniques such as microvascular decompression (MVD), percutaneous procedures including glycerol rhizotomy, and stereotactic radiosurgery (SRS), are compered. Furthermore, the study examines the diagnostic imaging modalities utilized, including a preoperative magnetic resonance imaging (MRI) protocol incorporating CISS/FIESTA sequences and 3D MRI/Virtual Simulation (VS).
Results: Patients underwent MVD numbered 250 (55.31%), while 202 individuals received percutaneous glycerol rhizolysis (PRGR) (44.69%). Evidence of neurovascular conflict, indicating the cause for trigeminal neuralgia (TN), detected in nearly 85% of cases, and no signs of compression observed in 15.9%. In patients underwent MVD, late-term outcomes were reported as excellent in 85%, good in 5.91%, and recurrences in 9.09%. Conversely, among PRGR patients, excellent outcomes were noted in 55.75%, good in 14.16%, and recurrences in 30.09%. Early recurrences following MVD were exceedingly rare and associated with younger age at operation, prolonged preoperative history, presence of venous compression at the root entry zone (REZ), female gender, and left-side involvement in male patients. Analysis using the McGill Pain Questionnaire (Mc Gill PQ) revealed a reduction from 11-12/12 preoperatively to 0-5/12 postoperatively. Preoperatively, the Present Pain Index-Visual Analysing Score (PPI-VAS) scores ranged from 9.5-9.7/10, decreasing to 0-1.5/10 postoperatively. The pain relief effect after PRGR typically becomes evident later, usually within 1-5 days, while with SRS, pain relief may occur after a month or longer. In contrast, patients undergoing MVD often experience immediate pain alleviation following the operation.
Conclusions: In conclusion, we advocate for a patient-centered approach to determine the most appropriate treatment modality for TN. MVD emerges as a feasible and safe surgical treatment method, particularly for medically refractory TN in patients younger than 75 years who are suitable candidates for general anesthesia. PRGR is recommended as the treatment of choice for elderly individuals or those for whom general anesthesia is contraindicated. SRS represents a valuable elective treatment option for TN.

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851
Brain and Spine 4 (2024) 103433
Microsurgical DREZ lesioning is effective for different deafferentation pain syndromes

Borut Prestor [1], Doctor Jure Pešak [1]. [1] *University Hospital Center, Ljubljana, Slovenia*

Neurosurgical innovation in pain treatment (Functional Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: In the treatment of intractable deafferentation pain (DP), different procedures in the dorsal root entry zone (DREZ) have proved most effective. The aim is to describe anatomy of the DREZ, analyze different neurosurgical techniques, determine long-term clinical results of our junctional microcoagulation lesions of the DREZ in patients with different deafferentation pain syndromes, and defining possible new anatomical target in the dorsal horn.
Methods: 27 patients with intractable deafferentation pain after brachial plexus avulsion (BPA) lesion and 25 patients with other DP were selected for the junctional coagulation DREZ microsurgery at our Department between 1995 and 2021. The group of pain other than BPA consisted of 6 cases of post herpetic pain, 4 cases of phantom pain, 3 cases of peripheral nerve injury pain, 3 cases of reflex sympathetic dystrophy pain, 1 case of spinal cord injury and 8 cases of syringomyelia pain. Junctional coagulation lesion was made extending along the entire DREZ region. The patients assessed the postoperative effect of pain relief on a visual analog scale (VAS) from 0 to 10 (0%-100%) at 1 week, 1 year, 3 years, and 5 years after the surgery.
Results: Over 5-year follow-up period, the BPA pain relief effect gradually decreased ($P<0.001$). The longer BPA pain lasted before the operation, the greater the pain relief 5 years after the operation ($r=0.623$, $P=0.007$). 21 cases of BPA pain (80.76%) reported overall more than 50% pain relief in 5 year interval, and only 12 cases (48%) do so in deafferentation pain other than BPA. The case of DREZ lesion with extension to the whole depth of dorsal horn is also presented, and the result is analyzed.
Conclusions: This study showed that analgesic effect of DREZ microcoagulation surgery gradually decreased over the longer period of time. However, this technique is higly effective treatment of BPA pain and syringomyelya pain, and recommended also in other deafferentation pain syndromes. As a new possible target deeper Rexed zones are proposed as deep as to include 6th Rexed zone.

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815
Brain and Spine 4 (2024) 103434
Optimizing Stereotactic Radiosurgery for Pain: Thalamic Nuclei Segmentation in Treatment Planning

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Neurosurgical innovation in pain treatment (Functional Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: The thalamus plays a key role as a brain relay, significantly influencing motor and sensory signals through cortical-subcortical pathways. Targeting and lesioning the posterior part of the central lateral nucleus (CLp) in the thalamus is thought to affect pain in multiple ways; however, thalamic subregions are not clearly visible using standard MRI techniques. As a result, CLp targeting Methods depend on indirect techniques, which often fail to consider individual differences in anatomy. Therefore, standardizing this targeting process is critical for improving treatment planning. This technical study evaluated the integration of thalamic nuclei segmentation in Gamma Knife treatment planning for chronic pain.
Methods: Ten healthy participants without structural abnormalities underwent T1-weighted high-resolution structural MRI, and subcortical segmentation was performed using FreeSurfer software (version 7.4.1). Detailed segmentation was performed with a probabilistic atlas of the thalamic nuclei built with histological data. Label images were then converted into a DICOM form as 3D label objects, and these objects, along with the associated T1-weighted image, were imported into GammaPlan. A single 4-mm isocenter was placed on the CLp using an indirect targeting method based on stereotactic brain atlases.
Results: The data from 10 participants (5 males, 5 females, aged between 25 and 60 years) were analyzed. All segmentations were confirmed to accurately delineate the subregions of the thalamus. In cases with atypical thalamic structures and where the indirect coordinates alone would have been less reliable, the pre-segmented thalamic maps provided a critical visual reference.
Conclusions: Our observations suggest that incorporating thalamic segmentation into the radiosurgical planning process could be a valuable tool in enhancing the accuracy of indirect targeting Methods. This is particularly relevant in patients with anatomical variations, where deviations from standard thalamic morphology could otherwise lead to inaccuracies in targeting.

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479
Brain and Spine 4 (2024) 103435
Microvascular Decompression for Trigeminal Neuralgia: Predicting Long-Term Outcome

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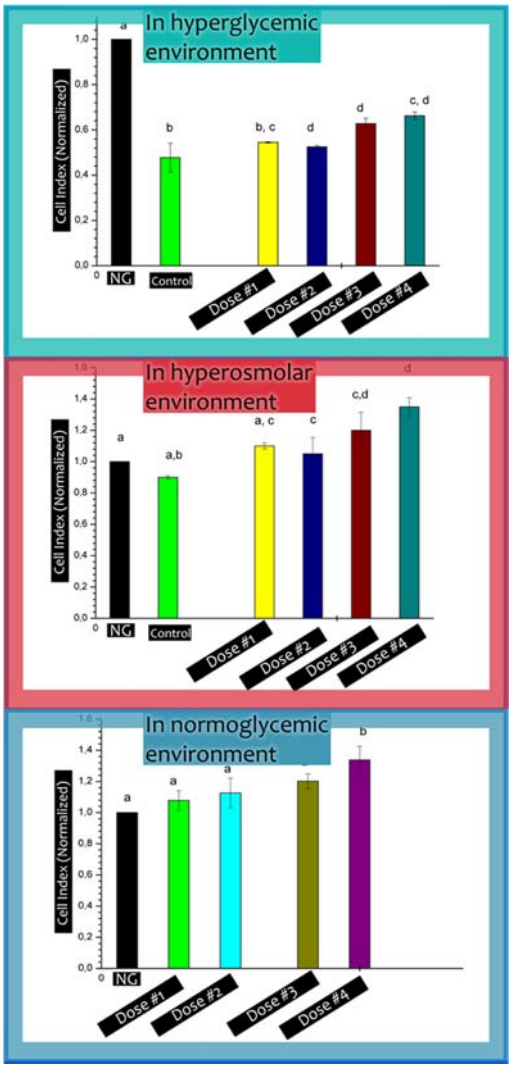
Neurosurgical innovation in pain treatment (Functional Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: The most common cause of trigeminal neuralgia (TN) is neurovascular conflict when the trigeminal nerve is compressed by a vessel. The most effective treatment method is microvascular decompression (MVD) of the trigeminal nerve by isolating the nerve from the vessel.
Methods: The long-term treatment results in 70 patients with trigeminal neuralgia that have undergone microvascular decompression were retrospectively analyzed. Arterial compression was diagnosed in 42 patients, venous in 12, and combined in 16. We have analyzed neuralgia type, pain duration, trigeminal nerve branches involved, age and sex, compression factor, and compression severity (according to operation protocol and intraoperatively recorded videos) and correlated the data with long-term outcomes. Compression severity was evaluated via intraoperative video retrospectively according to the classification proposed by M.Sindou et al. The new classification based on compression severity and arachnoid adhesions is introduced by the authors of this paper. Long-term patient outcome was evaluated by the Barrow Neurological Institute (BNI) scale.
Results: Patients were grouped into 3 similar groups in terms of pain duration: <3 years, 3-9 years, and >10 years. The most favorable outcome is witnessed in the <3 years of pain group (15 out of 19 patients are BNI I). BNI I status has been achieved in 33 patients with arterial compression, 5 patients with venous compression, and 12 patients in a combined group. Intraoperative videos of 59 patients were evaluated to define the severity of compression. Grade I compression was found in 33 cases (27 patients BNI I), Grade II in 11 cases (8 are BNI I), and Grade III in 13 cases (12 are BNI I).
Conclusions: The proposed grading scale enables more accurate prediction of long-term outcomes in patients undergoing microvascular decompression and better selection of patients for MVD.

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294
Brain and Spine 4 (2024) 103436
Investigation of Therapeutic Effect of Bevacizumab on Rat Trigeminal Nerve Cells as an In vitro Model of Trigeminal Neuralgia

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Neurosurgical innovation in pain treatment (Functional Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Trigeminal neuralgia is a neuropathic disorder characterized by severe pain that reduces the quality of life. VEGF (Vascular Endothelial Growth Factor) have some effects on reducing secondary damage by increasing vascularization. However, it has recently been thought that anti-VEGF drugs may also have a positive effect by preventing excessive vascularization. Furthermore it may have neuroprotective effects by providing limited angiogenesis, and increasing the efficiency in the nutrition of nerve cells.
Methods: Cell cultures obtained from 10 rats were performed after trigeminal ganglia (TG) were removed after decapitation. After the cells were separated, sterile normoglycemic (NG), hyperosmolar (HPO) and hyperglycemic (HPG) environments were created and placed on the plates in the xcelligence system with 100-200 cells. For the adhesion, growth and proliferation of cells, impedance measurements were carried out using biosensor electrodes for up to 24 hours according to RTCA (Real Time Cell Analysis) software.
Results: It was shown that all bevacizumab treatment doses did not have negative efficacy in NG medium, however, there was a positive significant difference in cell index at high dose. Although there was a statistically significant difference between only high dose and other groups, it was observed that there has been a dose-dependent positive effect on cell index. It has been shown that bevacizumab treatment in HPO and HPG medium did not a harmful effect in all treatment modalities, but a significant difference was found in cell indices in a dose-dependent manner and positive efficacy was demonstrated. Although there was no statistically significant difference among all doses in both mediums, it was observed that there were a dose-dependent positive effect on cell index.
Conclusions: It has been thought that anti-VEGF treatment may contribute to neuronal regeneration in trigeminal neuralgia, and may have a reducing or limiting effect on secondary damage by protecting functional neurons.
Optional Image



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795
Brain and Spine 4 (2024) 103437
Hyperspectral Imaging Detects Tissue Damage In A Spinal Cord Injury Rat Model.

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Intraoperative in situ evaluation of the extent of damage in spinal cord injury (SCI) could provide a further modality for perioperative decision-making. Hyperspectral Imaging (HSI) is a novel, non-invasive diagnostic tool that could help differentiate between injured and healthy spinal cord tissue by identifying variations in tissue perfusion and oxygenation, which could be indicative of underlying neural damage. The aim of this proof-of-concept study was to demonstrate the efficacy of HSI in informing onn the extent of injury after SCI in an animal rat model.

Methods: After a laminectomy at T9, the TIVITA® Tissue system, a medically certified HSI camera, was used to acquire spectral data before and after experimentally induced clip-compression/contusion SCI in n=6 Wistar rats. The imaging process involved acquiring data across a broad wavelength range, focusing on the visible to near-infrared spectrum. Animals were sacrificed after 14 days and HSI findings were correlated with conventional immunohistochemistry analyses, serum cytokine data and functional outcomes (using an open-field locomotor scale and the CatWalk XT® computer-based gait analysis).

Results: Global principal component analyses (PCA) revealed a differential clustering between injured and non-injured spinal cord tissue based on mere spectral signatures. Moreover, quantitative analysis of HSI data showed a correlation with the injury extent after 14 days, as informed by cyst size in isolated spinal cord tissue, pro-inflammatory serum cytokine levels, and endpoint neurobehavioral parameters pertaining to locomotion and coordination of hind limbs.

Conclusions: HSI-derived data successfully identified SCI in a rat model. Its ability to provide detailed, in situ post-injury insights into the perfusion state of spinal cord tissue holds significant potential for both animal studies and future clinical applications in traumatic and degenerative spinal cord diseases.

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901

Brain and Spine 4 (2024) 103438

The Effect of Implant Type and Material on Cranioplasty Outcomes

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Cranioplasty is associated with a high failure rate of 10%-20%. The optimal cranioplasty material and implant type remain unknown. We assessed the effect of cranioplasty material and implant type on surgical cranioplasty outcomes.

Methods: We analysed 433 cranioplasty procedures performed to 379 patients. The data was retrospectively identified from the Cambridge University Hospital and Oulu University Hospital patient databases. Titanium and fiber-reinforced composite-bioactive glass (FRC-BG) were categorized as onlay-type implants, and the others as inlay-type. The primary and secondary outcome were implant removal and complications, respectively.

Results: The mean age was 42,8 years (SD 17,6) and 274/379 (63%) patients were male. The mean ASA grade was 2,5 (SD 0,67), and the median follow-up time 9 months (IQR 21,7). Eighty (19%) of the implants were autografts, 212 (49%) titanium, 79 fiber-reinforced composite-bioactive glass (FRC-BG) (16%), and 56 plastic (13%). Although overall complication rates were different between inlay and onlay implant types (29% vs. 27%, respectively, p=0,005, 95% CI), there was no difference in implant survival (15% vs. 13%, respectively, p=0.589). There were no significant differences in removal rates (21%, 19%, 14%, and 16%, p=0.759) or complication rates (64%, 59%, 47%, and 57%, p=0.602) among autografts, FRC-BG, titanium, and other implant materials.

Conclusions: Outcomes were similar between inlay- and onlay-type implants, but complication profiles were different. There were no significant differences in removals or complications between materials. Individualised implant choice may improve outcomes.

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1069

Brain and Spine 4 (2024) 103439

Efficacy and Safety of Exosomes from Wharton's Jelly-Derived Mesenchymal Stem Cells in Patients with Spinal Cord Injury

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Traumatic spinal cord injury (SCI) is a disease characterized by neurological deficits that vary d on the severity and level of the injury. In addition to neurological deficits, it has autonomic dysfunctions and effects on the cardiovascular and gastrointestinal systems. It has consequences such as urinary and intestinal incontinence and spasticity that affect the quality of life of patients. In this study, we investigated the effectiveness and safety of mesenchymal stem cell-derived exosomes (MSCdE) in the treatment of SCI.

Methods: A total of 16 patients with a mean age of 26.25 (±4.89) who developed spinal cord damage due to combat injury were included. Of these patients, 2 (12.5%) had injuries at the lumbar level, 11 (68.75%) at the thoracic level, and 3 (18.75%) at the cervical level. Exosome application was applied to the patients in 6 rounds over a period of 4.5 months. In each application, 3 ml (30 billion/ml) was given intrathecally and 3 ml (30 billion/ml) exosome was given intramuscularly. The patients were followed for 1 year after the application. Side effects were classified using Common Terminology Criteria for Adverse Events version 5.0 (CTCAE v5.0). Neurological examinations of the patients were evaluated with the American Spinal Injury Association Impairment Score (ASIA), their spasticity with the Modified Ashworth Scale (MAS), their functional motor and cognitive capacity with the Functional Independence Measure (FIM) score, and their urinary and intestinal incontinence with the Wexner Incontinence score and Qualiveen Short Form (SFQ) evaluated and followed up. All examinations and scoring of the patients were performed by a team consisting of a neurosurgeon and a physical therapy and rehabilitation specialist

Results: During the treatment and follow-up period, no serious side effects were observed, except for side effects such as subfebrile fever and pain, which were evaluated as CTCAE v5.0 Grade 1, which were generally did not require medical treatment and resolved within 24 hours. A statistically significant improvement was observed in all follow-up parameters of the patients. FIM motor scores increased from 26.75 ± 9.81 before the application to 43.88 ± 17.01 after the application ($p<0.01$). ASIA motor scores showed a statistically significant improvement when compared before (47.00 ±21.15) and after treatment (56 ± 18.738) ($p<0.001$). ASIA sensory scores (light touch/pin-prick) increased statistically before (66.063/66.250) and after treatment (77.563/79.750) ($p<0.001$). MAS values (right/left) improved when compared before treatment (7.00/6.94) and after treatment (4.56/4.50) ($p<0.001$). A significant improvement was observed in incontinence scores (SFQ/Wexner) when compared before (31.38/19.75) and after the procedure (27.56/16.44) ($p<0.001$).

Conclusions: This study demonstrated the safety and efficacy of MSCdE therapy in patients with SCI. High-evidence data about the effectiveness of this treatment protocol can be obtained through randomized case-control studies with more participants in the future.

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383

Brain and Spine 4 (2024) 103440

Cranioplasty after Craniectomy: Or, There and back again. Impact of surgical ICP treatment on biomechanical properties and function of underlying brain

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: One of the drawbacks of decompressive craniectomy (DC) is the abolition of mechanical support provided to the brain tissue by the rigid skull. In consequence, cortical and subcortical structures are subjected to external forces, including mechanical deformation, which is alleged to be the background for syndrome of the trephined. The goal of this proof-of-concept analysis is a pilot attempt to assess in vivo the white matter distortion and potential correction of its deformation before and after cranial repair (= cranioplasty, CP) and to evaluate the impact of these changes on the brain function.

Methods: A prospective, single-center pilot study was conducted in a group of 8 patients, previously subjected to DC for the TBI or ischemic / hemorrhagic stroke. According to study protocol, radiological assessment (magnetic resonance imaging (MRI) with diffusion tensor imaging (DTI) = tractography) as well as detailed psychological and cognitive workup (according to California Verbal Learning Test (CVLT), Tower of London (TOL) test and Color Trail Test (CTT)) were performed directly before the CP and 5-6 weeks thereafter. The statistical analysis was made using paired t-test comparing the parameters before and after CP

Results: The MRI DTI delineated a partial course correction of white matter fibers (in particular ascending / descending tracts and long-range association fibers) due to cranioplasty, with subjective increase of the visualized fiber density (Fig 1ab). Psychological workup demonstrated improvement of executive brain function apparent in TOL test and characterized by reduction of total test time ($p = 0,03$) biomolecular analysis and functional imaging. and rate of protracted attempts ($p = 0,04$) as well as by lower numbers of TOL rule breach ($p = 0,02$).

Conclusions: The distortion of white matter tracts and its correction after cranioplasty may underlie the syndrome of the trephined. These changes are apparently reversible, as visualized by the MRI tractography performed before and after CP. Such correction of structural changes is related with the improved functional performance. The clinical importance of this pilot prospective observation implies the further analysis in long-term follow-up including both biomolecular analysis and functional imaging.

Optional Image

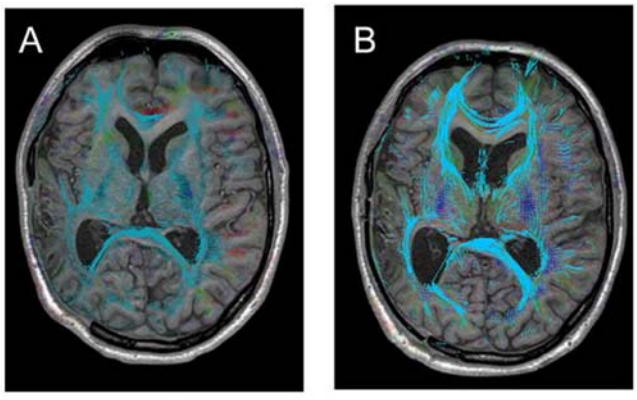


Fig 1. Demonstration of course and density of association fibers a) before the cranioplasty and b) 6 weeks thereafter.
Scans obtained in the sample study subject using the same MRI DTI protocol.

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914

Brain and Spine 4 (2024) 103441

Risk Factors And Mortality Prevention: An Analysis Of Hospital Mortality In Thoracolumbar Spinal Cord Injuries In 525 Cases In Germany.

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: This study aims to analyze the relationships between comorbidities, injury location, and demographic characteristics and their influence on hospital mortality in adult patients with thoracolumbar spinal cord injuries. Given the severe consequences of these injuries, it is essential to identify possible risk factors for hospital mortality.

Methods: This study utilized data from the InEK GmbH database for the year 2022, which contains comprehensive information on Diagnosis-Related Groups (DRGs) and hospital billing in Germany. We included patients aged 18 years and older with thoracolumbar spinal cord injuries. The hospital mortality rate was determined, and differences in comorbidities and accompanying diseases were analyzed using the Chi-square test. Odds ratios (OR) with 95% confidence intervals (95% CI) were calculated to identify potential risk factors for hospital mortality.

Results: The study included 525 patients with a hospital mortality rate of 5.7%. Thoracic spinal cord injuries were more common at 73.9% (n = 388) than lumbar (26.1%, n = 137), but did not show a significantly increased risk of death (OR=1.44, CI:0.57-3.6, p=0.44). In the older patient group (>80 years), both incidence (10.97 per million per year) and mortality risk (OR=4.65, CI: 2.09-10.24, p=0.0002) were higher compared to younger patients (7.2 per million per year for 18-80-year-olds). Significantly associated with increased hospital mortality were acute hemorrhagic anemia (OR=4.33, 95% CI: 2.04-9.18, p<0.001) and paroxysmal atrial fibrillation (OR=12.45, 95% CI: 5.28-19.23, p<0.001). Non-uncontrolled Type II diabetes mellitus (OR=2.34, 95% CI: 0.88-6.45, p=0.10), essential hypertension without hypertensive crisis (OR=1.36, 95% CI: 0.61-3.07, p=0.44), and the pre-existing use of anticoagulants (OR=1.67, 95% CI: 0.61-4.54, p=0.31) were identified as potential, but statistically non-significant, risk factors.

Conclusions: Especially older patients and patients with certain pre-existing conditions show an increased risk of hospital mortality after a thoracolumbar spinal cord injury. Therefore, the prevention of complications and adequate treatment of existing diseases are critical to mitigate the severe impacts of spinal cord injuries.

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745

Brain and Spine 4 (2024) 103442

"Team work" in the management of anterior cranial base traumas: a retrospective study on a series of 111 surgically treated patients

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Everything all at once on cranioplasty (Trauma Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Management of traumatic anterior cranial base fractures and related complications represent peculiar reconstructive challenges and require a multidisciplinary approach. We report our experience on a consecutive series of patients who were surgically treated in collaboration with maxillofacial and ENT surgeons.

Methods: We retrospectively analysed a series of 111 patients with traumatic anterior cranial base fractures who underwent surgical treatment between January 1996 and October 2023. Pertinent clinicoradiological features and surgical outcomes were retained.

Results: Ninety-six patients (mean age 36.4 years) underwent microsurgical treatment for frontobasal fractures (Sakas I in 10, II in 7, III in 45, IV in 34 patients). Eighty-four patients were males (87.5%). Twenty-five patients (26.04%) underwent urgent surgery for life-threatening intracranial injuries, while a "delayed" elective reconstruction was performed in 71 cases (73.96%). Ethmoidal encephalocele was noted in 19 cases (mainly in Sakas II and IV), while orbital encephalocele in 31 (mostly in Sakas I and IV). Fifty-five patients (57.29%) had frontal sinus fractures (53 required a treatment). One-Step Customized PMMA Cranioplasty was carried out in 3 patients. Post-operative complications included CSF leaks in 5 cases (5.21%), and bandeau resorption in 2 patients.

Fifteen patients (mean age 52.4 years) underwent endoscopic endonasal approaches for reconstruction of traumatic anterior skull base fractures (ethmoidal in 5, sphenoidal in 6, combined in 4 cases). Ten patients were males (66.67%). CSF fistula was registered in 14 cases. A multilayer reconstruction using a combination of fascia lata autograft and/or a pedicled flap was performed. No post-operative complication was noted. No reoperation was required.

Conclusions: A careful multidisciplinary evaluation of patients with anterior cranial base fractures may allow to select the best treatment option, thus permitting an effective defect reconstruction and good aesthetic and functional long-term outcomes, while minimizing post-operative complications.

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582
Brain and Spine 4 (2024) 103443
Audit of medulloblastoma cases with molecular subgrouping in a tertiary care centre

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Posterior fossa tumours - insights from adult and pediatric perspective (Joint Pediatric&Neuro-Oncology Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: The aim of the study was to see the demographic factors, treatment related and survival in various medulloblastoma subgroups
Methods: This was a retrospective audit of cases of medulloblastoma presenting at our institute over 15 year period . The cases which had molecular subgrouping data available was used in the audit (some done in retrospect). We looked at the demographic characteristic, treatment modalities and survival in these select group of patients.
Results: 296 patients with molecular subgrouping reports and clinical data were selected for the audit. The group wise distribution was Wnt-49, SHH-105, Group 3-54, and group 4- 88. Only 18 patients were less than 3 years old and they were predominantly SHH(12) , with no patients in the Wnt subgroup. Though male patients were more common, this ratio was maximum in group 4 (85.2%) and SHH(75.2%). Majority of group 3 patients (44.4%) followed by group 4(25%) had metastases at presentation. Overall metastasis were common in group 3 and group 4.Treatment related factors were equally distributed between the groups. Subtotal resection rates were between 19% to 25% between the subgroups. The best survival was seen in Wnt subgroup followed by SHH. Group 3 and group 4 has worse survival compared to other subgroups
Conclusions: Medulloblastoma subgroups have a distinct demographic, clinical and survival characteristic . Further studies may offer differential treatments based on the subgroup characteristic.

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126
Brain and Spine 4 (2024) 103444
Pediatric Posterior Fossa Tumor Identification Using Artificial Intelligence Algorithms and Deep Learning Techniques on Intraoperative Microscopic Images

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Posterior fossa tumours - insights from adult and pediatric perspective (Joint Pediatric&Neuro-Oncology Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: CNS tumors represent the second most common tumor group in childhood, with approximately 45-60% of cases located in the Posterior Fossa area. Performing pediatric posterior fossa tumor surgery, which involves numerous vital neural structures within a confined space, poses significant challenges. While personal experience and skill are essential, integrating artificial intelligence (AI) technologies into this surgery could mitigate surgical risks and enhance prognosis. This study aims to utilize microscope images from pediatric posterior fossa tumor surgeries to facilitate intraoperative tumor recognition and delineation through deep learning methods.
Methods: This retrospective study obtained videos recorded during surgeries of pediatric patients diagnosed with posterior fossa tumors, converting them to 'jpg' format, resulting in one image per second. From 22 patients, 2800 images were selected where tumors were clearly visible without blood or surgical tool artifacts. Using the "Toronto Annotation Suite" application, tumor boundaries were polygonally marked to create three datasets: training, validation, and testing. Artificial neural networks were trained using the Mask R-CNN function on 2623 training data in open-source libraries such as "Python-3.7," "Keras," and "TensorFlow." The model was developed with 95 validation data and tested with 82 data.
Results: Analysis of the Mask R-CNN model on 82 test images revealed an average precision of 0.90 and a recall of 0.94, indicating the model's ability to detect 94% of tumors and classify 90% of them accurately. Metrics for delineating the area, including Dice and JAC metrics, showed substantial alignment between the model's predictions and actual tumor areas.
Conclusions: Pediatric posterior fossa surgery demands high skill and experience. Developing proficiency in this field requires courage and time. However, leveraging AI applications can expedite this process and bolster confidence. By adapting the developed model to current microscopes, this study facilitates easier and more successful operations.
Optional Image

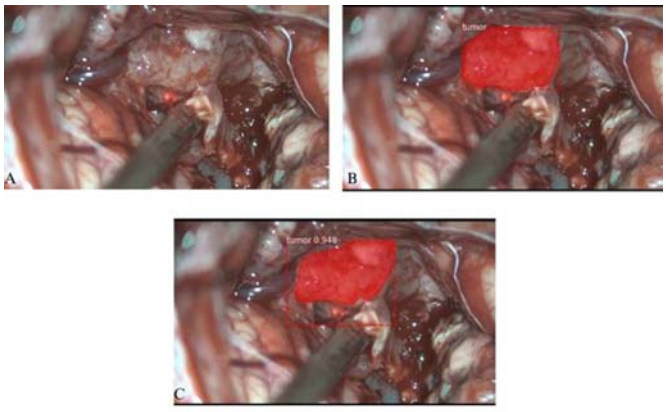


Figure 1.An illustration demonstrating tumor recognition and delineation of boundaries by the Mask R-CNN model. A; Original image B; Annotated image C; Tumor image detected by Mask R-CNN

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209
Brain and Spine 4 (2024) 103445
Optimal management of hydrocephalus in children with posterior fossa tumors

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Posterior fossa tumours - insights from adult and pediatric perspective (Joint Pediatric&Neuro-Oncology Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Children with posterior fossa tumors (PFTs) frequently present with obstructive hydrocephalus. Still, there is no international consensus regarding optimal preoperative management of hydrocephalus in these children. The aim of this study was to investigate the association between preoperative management of hydrocephalus (i.e., external ventricular drainage [EVD], endoscopic third ventriculostomy [ETV] or tumor resection alone) and persisting hydrocephalus necessitating early postoperative cerebrospinal fluid (CSF) diversion. The rate of permanent CSF shunting was also investigated for each subgroup.
Methods: An international multicenter retrospective study of children (<18y) undergoing primary PFT resection at three tertiary pediatric neurosurgical centers in Denmark and the United Kingdom. Primary outcomes included early postoperative CSF diversion defined as any CSF diverting procedure performed within 30 days following PFT resection, and permanent CSF shunting defined as placement of a ventriculoperitoneal shunt within the same postoperative period. Uni-, and multivariate analyses were performed for children with preoperative hydrocephalus using the following explanatory variables; age, tumor histology and preoperative hydrocephalus management.
Results: In total, 234 children (46.6% female, mean age 7.4, SD 4.5) were included. Preoperative hydrocephalus was observed in 169 (72.2%) children, of whom 76 (45.0%) underwent preoperative CSF diversion (ETV n=38, EVD n=38). Persistent hydrocephalus requiring early postoperative CSF diversion was

observed in 53 (22.6%) children, and was found to be significantly associated with histology, most commonly occurring in children with ependymoma and medulloblastoma (OREPN: 1.36, 95% CI: 1.09-1.72, ORMB: 1.18, 95% CI:1.01-1.38). No significant association was observed between preoperative hydrocephalus management and need for early postoperative CSF diversion in either univariate (ETV vs EVD vs Tumor resection, Chi-squared test, p=0.091) or multivariate analyses (ORResection: 1.0 [reference group], ORETV: 1.04, 95% CI:0.88-1.23, OREVD: 1.02, 95% CI: 0.86-1.21). Similarly, no significant association was found between permanent CSF shunting and preoperative hydrocephalus management.

Conclusions: In this large retrospective multicenter study of children undergoing primary PFT resection, no significant associations were observed between management of preoperative hydrocephalus and early postoperative CSF diversion or permanent CSF shunting. Children with ependymoma and medulloblastoma were significantly more likely to undergo early postoperative CSF diversion. While tumor resection alone appears appropriate - if time allows - for managing hydrocephalus in children with pilocytic astrocytomas, optimal treatment of hydrocephalus in children with other PFTs remains undetermined warranting further investigation

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867

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Outcome Comparison of Ventriculoperitoneal Shunting and Endoscopic Third Ventriculostomy for the Treatment of Hydrocephalus After Pediatric Brain Tumor Resection

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Posterior fossa tumours - insights from adult and pediatric perspective (Joint Pediatric&Neuro-Oncology Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Ventriculoperitoneal shunting (VPS) and endoscopic third ventriculostomy (ETV) are both utilized to manage hydrocephalus after brain tumor surgery. The optimal treatment approach remains largely unclear and practice pattern dependent. We examined the outcomes of CSF diversion in children with hydrocephalus after brain tumor surgery by evaluating overall failure rate, time to failure, and impact on subsequent neuro-oncology treatments.

Methods: A retrospective chart review was conducted on all patients who received either VPS or ETV for hydrocephalus following brain tumor surgery over a 15-year period. Data extraction included demographics, tumor characteristics, and surgical/clinical outcomes. Primary outcomes included CSF diversion failure rate and time to failure. Secondary outcomes included assessment of delay in adjuvant therapy, complications, and readmission within 30 days.

Results: Eighty-three patients were included; 38 underwent VPS and 45 underwent ETV. Mean age was 7.4 years (SD=5.4, median=6.0, range=0.5-18), with mean follow-up time 4.4 years (SD=4.0, median=3.2, range=0.04-15.1). There was no difference between tumor grade, location, or extent of resection between those subsequently treated with ETV or VPS. Overall, those undergoing VPS, with STR ($p<0.001$), intraparenchymal location ($p<0.001$), and irrespective of tumor-grade ($p=0.044$ and 0.019), had more tumor surgeries after the initial surgery. Overall failure rates for ETV and VPS were 40.0% and 55.3%, respectively ($p=0.19$). Mean time to failure was 7.4 months (SD=14.0, median=1.9, range=0.13-59.0) for ETVs and 17.3 months (SD=21.8, median=5.8, range=0.23-79.4,) for VPSs ($p=0.03$). Kaplan-Meier curves demonstrated a trend in improved failure rates at longer lengths of time in those treated with ETVs, but this was not statistically significant (log-rank: 0.8). There was no statistical significance between mean time to next treatment, 30-day readmission, or complications.

Conclusions: With no difference in overall failure rates, complications, or time to adjuvant treatment, our study suggests that ETV and VPS have similar outcomes in the management of hydrocephalus after brain tumor surgery. Given these findings, ETV may offer a better long-term solution and should be an early treatment consideration in this population.

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1432

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CTH Secondary to Paediatric Posterior Fossa Tumour and Post-operative Paediatric Cerebellar Mutism Syndrome: A Retrospective Study in a Tertiary Care Centre

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Posterior fossa tumours - insights from adult and pediatric perspective (Joint Pediatric&Neuro-Oncology Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Post-operative paediatric cerebellar mutism syndrome (CMS) is a recognised complication following paediatric posterior fossa tumour (PFT) surgery. In this study, we investigated the incidence of CMS at our institution and explored its correlation with pre-operative and post-operative cerebellar tonsillar herniation (CTH) and other potential risk factors.

Methods: This retrospective, single-centre clinical audit encompassed paediatric patients aged 2 to <18 years, spanning from November 2013-2023. An array of variables, including demographic, clinical, radiological, and histological data, were collected and subjected to statistical analysis to discern any association with CMS.

Results: Among the 26 PFT surgeries included, the median age was 6.3 years, with an approximate male-to-female ratio of 2:1. The overall incidence of post-operative CMS was 15.4%. The most common tumour types of tumours were pilocytic astrocytoma 42.3% (25% CMS vs 45.5% non-CMS), medulloblastoma 30.8% (75% CMS vs. 22.7% non-CMS) and ependymoma and other tumours at 26.9% (0% CMS vs 17.4% non-CMS). All CMS patients exhibited pre-operative CTH (mean 8.7 mm, median 10 mm) radiologically, in contrast to 45.5% of non-CMS patients. Among CMS cases, the mean time to symptom onset was 4.6 days (median 5 days), with symptom duration ranging from several days to a mean of 186 days (median 147). Symptoms encompassed mutism, ataxia, ocular disturbances, and neuropsychological manifestations, amongst others. Nonparametric analysis of the dataset revealed no significant association between pre-operative CTH ($p=0.100$), pre-operative hydrocephalus, tumour volume, location, brainstem and vermis invasion ($p=0.072$), and gross total or subtotal resection in the CMS and non-CMS groups.

Conclusions: Although our study did not identify statistical significance in the examined variables, the presence of pre-operative CTH in all CMS patients ($p = 0.100$) may warrant closer scrutiny in larger retrospective and prospective studies.

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1059

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V-REX: A randomized trial comparing observation and Gamma Knife radiosurgery for Vestibular Schwannoma

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Less than total resections for skull base tumors (Joint Radiosurgery & Skull Base Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Treatment of small- and medium-sized vestibular schwannoma remains controversial. The two most utilized options for these patients is either to undergo up-front radiosurgery, or to follow a wait-and scan protocol and receiving treatment if the tumor grows. There is a lack of high-level evidence to guide us in advising patients about the best treatment.Therefore, we conducted a trial comparing two groups of patients randomized to either of the two options. The study is the first RCT to investigate these treatment outcomes in vestibular schwannoma.

Methods: One hundred out of 142 consecutive eligible newly diagnosed VS patients with tumor CPA diameter <20mm were randomized to a wait-and scan protocol or up-front gamma knife radiosurgery (12 Gy given to the tumor periphery). They underwent five study contacts; baseline plus annually for 4 years. Study visits included clinical assessment, contrast MRI, audiovestibular tests and questionnaires. Study personnel was blinded to any treatment given. The primary study outcome was the ratio between tumor volume at 4 years and baseline (V4/

V0). Tumor volume measurements were done on randomly sorted scans by a blinded observer. The 26 secondary outcomes included audiometric data, clinical findings, vestibular tests and QOL outcomes. Safety outcomes included risk of salvage microsurgery and radiation-associated complications.
Results: Two patients withdrew from study. Tthe remaining 98 (mean age 54 years, 42% female) completed the 4-year trial period and were included in the primary analysis . The study showed a significant difference for the primary endpoint; V4/V0 was 0.87 in the SRS group, and 1, 51 in the expectation group ($p<0.002$). In the upfront SRS group, 3 patients needed additional treatment; SRS in one, and surgery in two cases. The remaining 45 patients in the SRS group did not receive additional treatment. In the wait-and- scan group, 23 patients needed treatment due to tumor growth; 21 had SRS, 1 received surgery. The remaining 28 observed patients remained untreated during the 4 years. The 25 secondary outcomes including hearing loss, distributed similarly between the two groups.
Conclusions: Conclusion: The study provides evidence at RCT level for the effect of GKRS on vestibular schwannoma growth, but at the same time suggests that GKRS does not lead to any other beneficial effects over a 4-year period compared with an initial wait-and-scan aproach. Notably, 28 out of 50 patients in the observational group did not need any treatment during the study period due to stationary tumor volume.
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1447
Brain and Spine 4 (2024) 103449
Radiomics in prediction of histology of skull base chordomas and chondrosarcomas

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Less than total resections for skull base tumors (Joint Radiosurgery & Skull Base Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Skull base chordoma and chondrosarcoma are rare, typically slow growing malignancies. Their locally invasive growth and affinity to the clival region makes them challenging to treat. Literature identifies gross total resection (GTR) as one of the most important factors correlating with progression-free survival (PFS). Due to surgical complexity, the recommended management of chordoma integrates biopsy, which occasionnaly increases the risk of local dissemination of the disease.
The aim of our study was to predict the histologic features of chordomas and chondrosarcomas using radiomics of preoperative MRI imaging, and thus increase the quality of the patient's management.
Methods: We analyzed the clinical, radiological, and histopathology data of patients operated in our center for skull base chordoma, chondrosarcoma from 1998 to 2024.
The dataset included 39 patients. Dataset was randomly split (4 training : 1 validation sets).
The radiomics was based on preprocessed preoperative Gd-T1- weighted magnetic resonance imaging (Gd-T1wMRI), T2wMRI and FLAIR imaging. The MRI were segmented using semi-automated segmentation (ITK-SNAP) by 2 independent specialists. Overall, 1400 combined features were extracted for each of sequence using our algorithm in Python. These features were designed as combination of several layers of preprocessing of original image (e.g. various wavelet transforms combined with histogram-based, shape-based features…). Features were classified using various techniques (XGBoost with tunning, LASSO, CNN). The best results were achieved with XGBoost technique/presented here. Shapley method extracted the most significant features for the final model. The accuracy of the binomial model was evaluated as accuracy with CI for whole model. The visualization of AUC from ROC curve analysis was performed.
Results: The study includes 39 patients who underwent surgery:30(77%) with chordomas, and 9(23%) with chondrosarcoma.
Our model achieved the accuracy of 79% (95%CI 0.71-0.84) of prediction distinction between chordoma and chondrosarcoma. AUC was 0.78. Among the most important features were voxel volume, shape features and predominantly T2-based wavelet-derivated features.
Conclusions: Our model distinguishes the chordoma versus chondrosarcoma with the accuracy of 79%. We intent to test our model in prospective study, allowing us to better plan the resection of these rare skull base tumors.

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1383
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CyberKnife radio-neurosurgery for secreting pituitary adenomas treated with single fraction radio-neurosurgery: a systematic review and meta-analysis

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Less than total resections for skull base tumors (Joint Radiosurgery & Skull Base Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Stereotactic radiosurgery (SRS) is one of the treatment options in the management of residual or recurrent secreting pituitary adenomas (PAs), with effects on both biological and tumor control.
Methods: To perform a systematic review of the literature and meta-analysis, with the aim of focusing on the effect of CyberKnife (CK) robotic radiosurgery on secreting PAs. We reviewed articles published between January 1994 and January 2004 referenced in PubMed or Embase. Inclusion criteria were peer-reviewed clinical studies or case series of PAs treated with CK, if they differentiated the patients treated with single fraction SRS, reporting biochemical cure, tumor control, and hypopituitarism.
Results: Eight studies were incorporated, including 152 secreting PAs. Of these 152, the vast majority were treated with single fraction SRS (115, 75.6%), with an overall rate of 59.9% (range 38.8-81.1%, I2= 92.07, p heterogeneity =0.001, $p<0.001$). Total remission was achieved in 44 out of 108 patients, for an overall rate of 50.2% (range 26.3-74.2%, I2=80.93, p heterogeneity =0.001, $p<0.001$). Partial remission was inconsistently reported, and data were available for 25 out of 55 patients, resulting in an overall rate of 38.8% (range 13.1-64.6%, I2=52.82, p heterogeneity = 0.145, p = 0.003). Uncontrolled disease was encountered in 36 out of 108 patients, with an overall rate of 32.7% (range 24-41.4%, I2=0, p heterogeneity =0.758, $p<0.001$). Tumor control was not reported separately for secreting and non-secreting PAs but achieved overall high rates.
Conclusions: Single fraction CK radiosurgery was a common practice for secreting PAs. Our meta-analysis suggests high rates of total and partial remission (as high as 89% when combined), with a complete remission rate of 50.2%. These results encourage the use of single fraction CK robotic radiosurgery for secreting PAs. To achieve high rates of biochemical control, high doses of irradiation should be used (30-35 Gy).

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1401
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Skull base chordomas and chondrosarcomas – long terms outcomes using 360O approach and multimodal treatment

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Less than total resections for skull base tumors (Joint Radiosurgery & Skull Base Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Skull base chordomas and chondrosarcomas remain pathologies challenging to treat despite maximal surgical resection and radiotherapy (RT).
The aim of our study was to assess the role of radiologic risk factors of recurrence, and the role of gross total resection (GTR) on survival outcomes of these skull

base tumors.
Methods: We analyzed the clinical, radiological,and histopathology data of patients operated in our center for skull base chordoma, chondrosarcoma or parachordoma from 1998 to 2024.Sekhar's chordoma score was assessed.
The chi-square test, ANOVA, ROC curve analysis,and logistic regression were used to identify predictors of GTR and progression-free survival (PFS). Kaplan-Meier and Cox proportional hazards modeling were performed.
The study includes 40 patients who underwent surgery:30(75%) with chordomas,9(22.5%) with chondrosarcoma,and 1(2.5%) with parachordoma.
Results: The study included 40 patients. GTR was achieved in 10 patients(25%), the adjuvant radiotherapy was used in 32 patients.GTR increased with endoscope.
Significant predictors of radicality of surgery:tumor volume and Sekhar'score (p=0.026; 0.009,respectively).
Prediction of the PFS: initial tumor volume, chordoma score,residual volume, extent of surgery were significantly associated with better PFS (p=0.12; 0.012; 0.02; 0.033,respectively). Cut-off value of chordoma score was ">8".
Kaplan-Maier analysis revealed significantly better PFS-probabilities for chondrosarcoma and GTR,but no difference for the modality of RT.
Conclusions: Our rate of GTR increased to 27%since introduction of endoscope.Factors significantly impacting PFS are radical resection, volume of the tumor,and its extent, but not modality of RT. We are persuaded that Sekhar's chordoma score reflects the extent and technical difficulty of chordomas, thus having prognostic value.

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1243
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Safety, Efficacy And Feasibility Of Hypofractionated Gamma Knife Radiosurgery For Perioptic Meningiomas: Results From A Large Series

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Less than total resections for skull base tumors (Joint Radiosurgery & Skull Base Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Perioptic meningiomas are benign tumors arising in the proximity of the optic pathways. Despite showing non-aggressive features histologically in the majority of cases, they can grow to be a significant burden for patients' quality of life, causing visual deterioration or other neurological deficits or symptoms. Surgical resection has historically been considered the mainstay for the treatment of these tumors but is often associated with non-negligible morbidity and mortality. Radiosurgery with Gamma Knife (GKRS) has progressively emerged as an effective alternative to surgery in some cases and nowadays is preferred when a patient may present contraindications to surgery.
Methods: Our population comprised 185 patients harboring 190 meningiomas. Female patients were 139 (75.1%) and mean age of the population at the time of treatment was 56.7 years. One hundred-thirty-two tumors (69.5%) received fractionated GKRS (fGKRS) as primary treatment. At the time of treatment, mean target tumor volume was 7.2 cm3. For 89 lesions (46.8%), varying degrees of visual symptoms were present before the treatment. Mean clinical follow-up was 55.8 months and mean radiological follow-up was 46.7 months.
Results: At last clinical follow-up, 6 patients had died (none of those died due to the meningioma). Mean overall survival (OS) was 123.6 months. Three-, 5- and 8-years OS was 98.8%, 96.5% and 94.1%, respectively. At last MRI, 95.8% of tumors appeared stable or reduced in size. At volumetric analysis (possible for 119 lesions which represented 62.6% of total tumors), a mean reduction of 18% of total volume was observed after treatment. Six lesions out of a total of 190 (3.2%) needed further treatments after radiosurgical treatment, so at last follow-up overall clinical tumor control (CTC) was 96.8%.
Conclusions: Fractionated GKRS represents in our experience an effective treatment for perioptic meningiomas with limited morbidity.

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963
Brain and Spine 4 (2024) 103453
Anticipating the Clip: Analyzing VR-Guided Clip Placement in Preoperative Planning for Intracranial Aneurysms - A Pilot Study

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Innovative strategies for neurosurgical education and training (Young Neurosurgeons Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: With increasing complexity and decreasing exposure to aneurysm surgery, innovative technologies facilitating planning, teaching, and preparation of the surgery are emerging. Virtual Reality (VR) enables immersive exploration of patient-specific anatomical structures, facilitating visualization of intricate vascular networks and potential clipping scenarios. We aimed to analyze the degree of predictability of the clip when fully planned in VR, comparing it with the actual postoperative images as a control.
Methods: A total of 5 UIA clipping cases from 2022-2023 were randomly selected for analysis. Utilizing SpectoVR, we generated fully immersive 3D VR models. Mesh models of the original Yasargil-Clips were integrated, allowing their incorporation at true-to-life proportions. Three raters placed the clips in VR, assessing the aneurysm intra- and extraluminally and performing precise point-to-point measurements of the 3D anatomy. Different parameters, such as size, type, configuration, and the position of the clip in three-dimensional space, were assessed. Subsequently, these parameters were retrospectively compared to corresponding modalities in actual postoperative imaging data. The comparison of a composite score (number of clips, length, type, expected dog ear) of the clipping was chosen as the primary endpoint.
Results: In retrospective comparison, the average composite scoring was 2.8 (±1.23) out of 4, with a full score (4 out of 4) in 40% (n=6) and 3 out of 4 in 20% (n=3) when comparing the planning to the actual clipping.
The clip length was within 1mm in 53% (n=8), and the clip type matched in 40% (n=6) of the planned case. Image fusion could accurately display the orientation of the planned and real clip in all three dimensions. The average time for clip planning in VR was 3.4 (±1.67 min) per case.
Conclusions: Our results show that clip choice and placement in VR correlate well with the actual intraoperative clip placed and chosen. Further prospective studies to underline these findings are warranted.
Optional Image



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298
Brain and Spine 4 (2024) 103454
3D-Printed Intraventricular Neuroendoscopy Simulator: Development, Validation, and future Training Applications

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Innovative strategies for neurosurgical education and training (Young Neurosurgeons Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Surgical education and training necessitate continuous refinement of technical skills. Creating safe and effective training opportunities is paramount in neurosurgery, where procedures are technically demanding, and caseloads are limited. Our study focuses on a point-of-care 3D-printed simulator designed to train neurosurgical residents' endoscope handling skills. The aim is to develop, describe, and validate this model, addressing the demand for accessible and practical training resources in neuroendoscopic education.

Methods: Medical image processing software was used to segment the healthy ventricle and skull from a patient's MRI and CT scans. The pathologic ventricle was artificially modeled using computer-aided design software. Hard and soft tissue models were 3D-printed mimicking the hardness levels of the original tissues. Neurosurgery residents participated in a trial, performing standardized endoscopic procedures using the model. A questionnaire assessed qualitatively participants' perceptions of the simulator's teaching efficacy in neuroendoscopic ventricular tumor surgery.

Results: The neurosurgeons' training on the model had a mean age of 30 ± 3.27 years and a neurosurgical training time of 4 ± 2 years. The average caseload of the corresponding operations in real-life patients was 7.5 ± 3.74. Feedback from the questionnaire indicated a unanimous agreement on the effectiveness of the simulator in developing systematic approaches to intraventricular visualization and replicating real surgical settings. Out of 12 participants, 75% (n=9) felt more confident in the use of neuroendoscopic instruments and 91,7% (n=11) expressed increased confidence in future neuroendoscopic procedures after using the model. The analysis of variance showed that mean values do not differ significantly (p=0.28) from each other. Thus, the model was rated equally well with an overall mean Likert score of 4.27 ± 0.21.

Conclusions: The 3D-printed simulator presented is an effective tool in neuroendoscopic training. Providing an accessible and practical training opportunity ultimately benefits the technical skills of future neurosurgeons.

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225

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Enhancing surgical training: hybrid dissection courses in neurosurgery

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Innovative strategies for neurosurgical education and training (Young Neurosurgeons Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: In recent years, the field of surgical training has witnessed a paradigm shift with the widespread adoption of surgical simulators. This study aims to assess its impact on improving surgical skills when combined with traditional cadaveric dissection investigating the validity of a training model that incorporates simulation as a preliminary step before engaging in cadaveric dissection.

Methods: We developed a model of "hybrid" course- focused on transphenoidal or on transcranial approaches - that involved an initial phase of simulator-based dissection followed by a subsequent session of cadaveric dissection. A total of 66 participants were enrolled in this study, and their performances were evaluated and compared with participants from courses exclusively focused on simulation or cadaveric dissection. Participants' performances were evaluated using both objective and subjective criteria during both phases of the courses. Questionnaires, surgical skill assessments, and quantitative metrics were employed to analyze skill improvement.

Results: The results revealed that participants in hybrid training courses consistently demonstrated higher levels of satisfaction and outperformed their counterparts in exclusively simulator-based or cadaveric dissection courses. Objective skill assessments and participant feedback consistently favored the hybrid training model.

Conclusions: The introduction of this novel training course model demonstrates its potential to enhance the neurosurgical education landscape. Findings from this study contribute to refining and optimizing training methodologies, ultimately benefiting neurosurgeons and advancing the field of neurosurgical education.

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1233

Brain and Spine 4 (2024) 103456

Holographic surgical planning of cerebrovascular cases: the benefits of 3D Mixed Reality over standard 2D imaging

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Innovative strategies for neurosurgical education and training (Young Neurosurgeons Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Cerebrovascular surgery represents a challenging field demanding thorough anatomical knowledge, excellent dexterity and extensive training. An interactive three-dimensional (3D) visualization of the patient-specific anatomy may benefit greatly the preoperative planning of such complex procedures providing a better anatomical understanding and an optimization of the intraoperative trajectory. This study investigates the added value of MxR-guided surgical planning of cerebrovascular procedures over standard two-dimensional planning.

Methods: All cases of middle cerebral artery intracranial aneurysm (MCA-IA) clipping, flow augmentation bypass and carotid endarterectomy (CEA) planned with MxR-guidance between January 2022 and February 2024 were included. Data relative to the surgery and the perioperative use of holograms have been collected. Enhanced anatomical understanding and optimized surgical planning were achieved by segmenting key anatomical structures in different colors, i.e. aneurysm and parent vessels in clipping cases, superior temporal artery (STA) and distal MCA in bypass cases and calcified plaques in CEAs.

Any step of surgical planning influenced by MxR, as well as mean time of intraoperative MxR use were documented.

Results: Seventy-one procedures were included. Intracranial procedures amounted to thirty-six cases (51%). The remaining 35 cases (49%) were CEAs. Cases of MCA-IA clipping prepared with MxR showed a lower mean surgical time from skin incision to skin closure than a historical cohort of matched cases prepared without MxR (p value = 0.04046). STA delineation with MxR proved significantly faster than Doppler-guided STA delineation (p value <0.001). Skin incision was tailored in 13 CEAs (37%) after holographic planning.

Conclusions: Perioperative 3D holographic study of intracranial and extracranial surgical cases has the great potential to increase case-specific anatomical understanding and improve the personalized surgical management without negatively influencing intraoperative efficiency. Multi-centric data will be needed to validate the experienced gathered in this study.

Optional Image

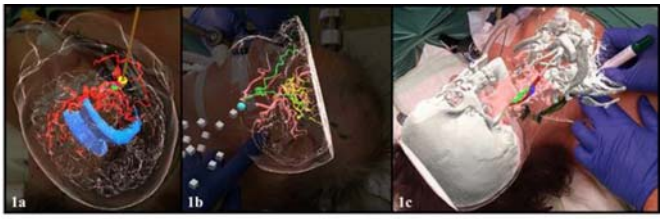


Figure 1: Exemplifying intraoperative cases, respectively MCA-IA clipping (1a), flow augmentation bypass (1b) and CEA (1c). The apparent drift between the patient's head and the hologram is due to the height of the HoloLens 2 camera, which is above that of the user's eyes. Nonetheless, the user visualizes an adequate head-to-hologram match.

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651

Brain and Spine 4 (2024) 103457

Medical Education in Surgical Aneurysm Clipping (MEDUSA)-a mixed reality solution

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Innovative strategies for neurosurgical education and training (Young Neurosurgeons Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: Realistic opportunities to enhance the quality and efficiency of surgical education and procedure planning in a safe environment are highly warranted. A caseload reduction due to endovascular treatment has occurred and the remaining cerebral aneurysms tend to be more complex. The aim of this study was to develop a patient-specific aneurysm-clipping simulator.

Methods: Since 2019 the MEDUSA consortium is developing an advanced surgical simulator based on a mixed-reality (hybrid) approach using advanced technologies

Results: We have successfully created a simulator that is based on a patient specific model of the skull and brain using 3D print technologies. Further, meninges are artificially created. These models get supplemented with virtually created holograms (aneurysm and parent artery) in real time. This way the real (skull, brain) and virtual (aneurysm and parent arteries) world gets merged digitally to create a realistic environment for neurosurgeons. All surgical steps are integrated: planning, craniotomy, subarachnoid dissection as well as aneurysm exposure and clipping. Aneurysm clipping is simulated with original instruments requiring spatial depth perception. An appropriate scoring instrument evaluates aneurysm clipping. Decisive for this is the simulation of the blood flow to determine the residual aneurysm and a potential occlusion.

Conclusions: We have successfully developed a hybrid cerebral aneurysm-clipping simulator and will now validate this prototype.

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552

Brain and Spine 4 (2024) 103458

Knowledge, interest and perspectives on Artificial Intelligence in Neurosurgery. An EANS survey supported by the ETIN Task Force.

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Trends & Innovation (Trends & Innovation Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

Background: The development of artificial intelligence (AI) technologies in healthcare is growing exponentially. The field of neurosurgery is particularly suited to implement AI applications given its technology-driven nature. It is therefore of paramount importance for the neurosurgical community to understand the basics of these technologies in order to take informed decision on how to shape current and future applications. With the support of the EANS Emerging Technologies and Innovation in Neurosurgery Task Force, we conducted an online survey to explore basic knowledge, interest and perspectives of the neurosurgical community with regards to AI technologies.

Methods: A survey of 24 items was designed including a total of three sections respectively exploring participant demographics and work-related environment features, knowledge of basic AI terms, perspectives and attitude towards the application of AI technologies to neurosurgery.

Results: We considered a total of 250 responses for analysis. The majority of the partecipants were younger than 40 years (62%) and worked in teaching hospitals (68%). The definition of basic AI terms were guessed correctly on average by 55% of the partecipants, 70% read at least one paper regarding AI application to neurosurgery over the previous year, with only 28% of the partecipants being actively involved in AI research projects. 80% of the participants considered useful to create in their neurosurgical association of reference a dedicated team force for the evaluation of the clinical readiness of AI applications. Lack of funding and multidisciplinary collaborations were considered the main barriers to the development of these technologies, while privacy and sustainability were considered the main concerns regarding the implementaiton of AI in neurosurgery.

Conclusions: The results of this survey show a low-to-moderate general understanding of the basic concepts underlying AI technologies. There is, on the other hand, a strong sense on the need for these applications to be responsibly developed and evaluated by dedicated, properly formed personnel.

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301

Brain and Spine 4 (2024) 103459

Synthesis of Cranial CT Imaging from Biplanar Radiographs using Deep Learning

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Trends & Innovation (Trends & Innovation Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM

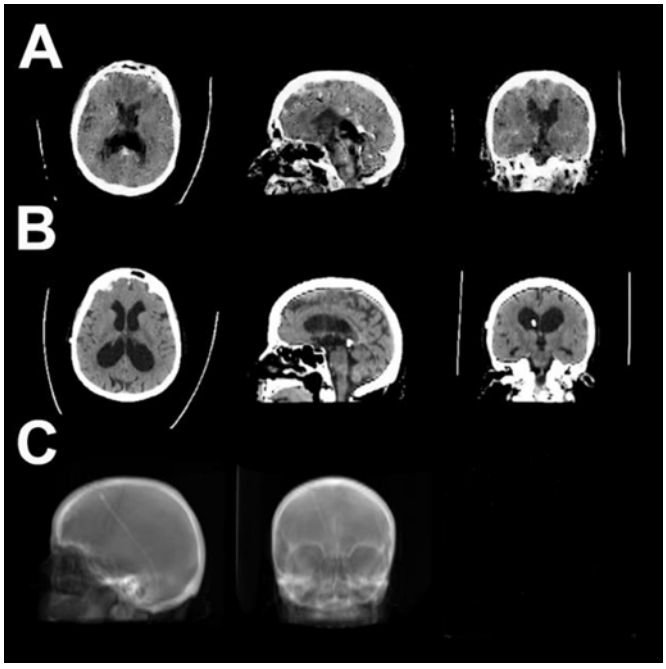
Background: Besides clinical examination, cranial computed tomography (CT) plays a critical role in diagnostics in neurosurgery. In trauma cases or intraoperatively during routine procedures like placement of external ventricular drainage or ventriculoperitoneal shunting, having low-barrier access to CT-like imaging would be highly beneficial. Therefore, this proof-of-concept study aimed to explore the feasibility of generating synthetic CT imaging from radiographs taken in two planes using deep learning.

Methods: 150 native cranial CT volumes were used to train the algorithm. The imaging used during training originated from Zurich, Switzerland, and the CQ-500 dataset. From these CT scans, digitally reconstructed radiographs (DRR) to train a 2D-to-3D generative adversarial model (GAN) for DRR conversion into synthetic CTs were derived. The results were internally validated on a holdout set of 35 images from the same sources. External validation was performed using 50 scans from Bologna, Italy.

Results: The model performance reached 16.68 dB for peak-signal-to-noise ratio (PSNR) and 0.799 for structural similarity index (SSIM) at internal validation. During external validation, a PSNR of 15.61 dB and SSIM of 0.782 were achieved.

Conclusions: Synthesis of CT-like imaging from a two-dimensional input presents a difficult task. Even though the synthetic tomography scans computed in this study do not correspond perfectly to ground truth CT, our pilot study is the first to derive such artificial cranial images using deep learning, and our results indicate that this innovative approach holds potential for further investigation.

Optional Image



https://doi.org/10.1016/j.bas.2024.103459

1460
Brain and Spine 4 (2024) 103460
Accurate Extraction of Procedural Information from Lumbar Spine Surgery Operative Notes using Artificial Intelligence

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Trends & Innovation (Trends & Innovation Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: The accurate extraction of procedural information from operative notes is critical for clinical research and quality control in surgical practice. This study explores the development of a Natural Language Processing (NLP) algorithm that leverages a rule-based approach, incorporating regex syntax and sequential spinal order functions, to extract detailed procedural information from operative notes, while also allowing for further enhancement with transformer correction.
Methods: We utilized a comprehensive dataset, including operative notes, extracted from our institutional Data Analytics Center (DAC), specifically targeting lumbar decompression surgeries between January, 2019 and September, 2023. The NLP algorithm, rooted in a rule-based framework, employed regular expressions and predefined spinal order functions to parse and classify surgical procedures within operative notes. The pre-processing stage involved cleaning and standardizing text segments, followed by the application of regex patterns to identify procedure-specific phrases. Fuzzy regex matching was used to handle slight variations in procedure nomenclature. To address the inherent limitations of a rule-based system in recognizing complex sentence structures and contextual nuances, a transformer-based model, specifically OpenAI's GPT-4 Turbo gpt-4-1106-preview Application Programming Interface (API), was integrated.
Results: Internal validation of the NLP algorithm was conducted on 162 records, with a focus on the extraction of lumbar diskectomy procedures. The algorithm correctly identified diskectomies in 162 records, achieving a precision rate of 100% (162/162). Initially level strings were accurately extracted in 159 records, translating to a 98.14% (159/162) success rate, which was limited by the rule-based model's lack of contextual depth. These issues were resolved with integration of GPT-4 Turbo. Overall, the pipeline correctly identified all diskectomies, level strings, and numbers of disks procedure performed on.
Conclusions: The GPT-4 Turbo augmented NLP algorithm showcased exceptional performance in parsing complex surgical records and accurately extracting procedural details with high precision, suggesting a path toward automating clinical data extraction that may render manual review obsolete.

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1462
Brain and Spine 4 (2024) 103461
Accurate Extraction of Intraoperative Complications from Spine Surgery Operative Notes using Artificial Intelligence

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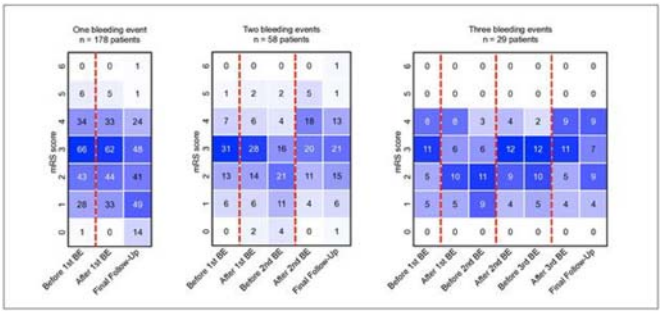
Trends & Innovation (Trends & Innovation Parallel Session), October 15, 2024, 5:20 PM - 6:50 PM
Background: Precise procedural data extraction is crucial for both advancing clinical research and improving quality control. Automation could streamline the extraction of procedural data, potentially reducing time and errors inherent in manual management, which would alleviate the workload for healthcare professionals.
Methods: We employed a comprehensive dataset from our institutional spine deformity database, focusing on patients undergoing long-segment thoracolumbosacral posterior spinal fusion (PSF) for adult spinal deformity (ASD). Our natural language processing (NLP) algorithm, based on a rule-based framework, utilized regular expressions and predefined spinal order functions to identify and classify intraoperative complications within operative notes. Text segments were cleaned and standardized during preprocessing, with regex patterns used to detect complication-specific phrases. Fuzzy regex matching handled variations in nomenclature. To address limitations in recognizing complex structures and contextual nuances, we integrated OpenAI's GPT-4 Turbo gpt-4-1106-preview API.
Results: Validation of the NLP algorithm was conducted on 487 records. The rule-based NLP framework identified 73 candidate cases, which included all 47 actual incidences of durotomy, and extracted the reference sentences. Thereafter, the gpt-4-1106-preview API was used to verify candidate cases and correctly identified, extracted, and encoded 46 cases. The performance of the NLP algorithm was exemplary, demonstrated by its accuracy of 0.998 (CI 0.994-1), sensitivity of 0.979 (CI 0.93-1), PPV (Precision) of 1.000 (CI 1-1.000), AUC-ROC of 0.989 (CI 0.965-1), and F1-Score of 0.989 (CI 0.964-1.000). In comparison, the performance of the medical student demonstrated solid results with an accuracy of 0.973 (CI 0.957-0.986), sensitivity of 0.745 (CI 0.622-0.861), PPV (Precision) of 0.972 (CI 0.909-1.000), AUC-ROC of 0.871 (CI 0.806-0.930), and F1-Score of 0.843 (CI 0.746-0.921).
Conclusions: Our study demonstrated exceptional performance of a GPT-4 Turbo augmented NLP algorithm for identification of incidental durotomies within operative notes, suggesting a path toward automating clinical data extraction that may render manual review obsolete.

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642
Brain and Spine 4 (2024) 103462
Functional Outcome after Initial and Multiple Intracerebral Hemorrhage in Patients with a Brainstem Cavernous Malformation: a Multicenter Study

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Cavernomas (Vascular Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Brainstem cavernous malformations (BSCM) can be related to spontaneous intracerebral hemorrhage (ICH). This study aimed to assess the natural course of the disease and to identify predictors of functional neurological outcomes after single and multiple bleeding events.
Methods: We included BSCM patients with complete baseline characteristics, MRI dataset, ≥1 ICH, and ≥1 follow-up examination treated between 2003 and 2022. Functional neurological outcome was obtained using the modified Rankin Scale (mRS) at diagnosis, before and after each ICH, and at last follow-up.
Results: A total of 265 patients were included. Functional neurological outcome deteriorated in 40.2% (P=0.003) after the second bleeding event and in 44.8% (P =0.038) after the third bleeding event. Moreover, the functional neurological status was reduced in 15.8% (P<0.001) of patients at last available follow-up compared to the time of BSCM diagnosis
Conclusions: ICH due to a BSCM generally implies neurological deterioration. Our study shows that functional outcome tends to improve after each bleeding event, but with each ICH the chance of full recovery decreases. Bleeding was significantly associated with neurological deterioration compared to initial ICH. This deterioration is further accentuated after subsequent hemorrhagic events.
Optional Image



https://doi.org/10.1016/j.bas.2024.103462

824
Brain and Spine 4 (2024) 103463
Surgical Impact of a Capsulated-like Structure Surrounding Brainstem Cavernomas

Davide Colistra [1], Giulia Meccariello [2], Davide Boeris [1], Maria Fragale [1], Laura Lippa [1], Enrico Gambatesa [1], Manuela Bramerio [1], Mariangela Piano [1], Enrica Fava [1], Marco Cenzato [1]. [1] *Great Metropolitan Hospital Niguarda, Milan, Italy;* [2] *Santobono-Pausilipon Children's Hospital, Naples, Italy*

Cavernomas (Vascular Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Despite the potential benefits, surgery of BSCs (brainstem cavernomas) remains highly risky due to the delicate nature of the brainstem and requires a nuanced approach based on comprehensive preoperative evaluation. Our study investigates the surgical outcomes of BSCs with a focus on the presence of a consistent "capsule" around the lesion. It also seeks to identify preoperative markers for recognizing this capsule, potentially influencing surgical planning and minimizing distress for the surgeon
Methods: We retrospectively analyze a case series of 60 patients with BSCs operated in the last 10 years by a single surgeon at our Neurosurgery Department. A subgroup analysis compared patients with capsulated and non-capsulated lesions. Imaging data were assessed by a senior neuroradiologist, while intraoperative specimens were reviewed by a senior neuropathologist – both specialized in cerebral vascular malformations.
Results: Out of 60 patients, the first surgeon described capsulated-like lesions in 13 cases, consisting in a cavernoma surrounded by capsule that allowed an easier dissection and a total removal of the lesion. The pathologist correctly associated 12 glass slides to the capsulated group and 1 case incorrectly. The neuroradiologist correctly identified a capsule around the cavernoma in 11 cases out of 13. All patients with capsulated BSCs presented no remnant at 6 months MRI, while all patients with non-capsulated BSCs had a residue (p=0,018). Indeed, mean surgical length was significantly shorter in capsulated group compared to the non-capsulated, and capsulated group showed a trend of better outcome compared to the non-capsulated one.
Conclusions: Our results support the existence of a "benign" variant of BSC, histologically recognizable, that identifies a lesion with a "capsule" that is easier to empty, dissect and resect for the surgeon. Preliminary neuroradiological assessment provides evidence that this capsule can be safely presumed on initial MRI, allowing a pre-operative identification of these capsulated lesions.

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1735
Brain and Spine 4 (2024) 103464
The radiosurgical versus conservative management in cerebral cavernous malformations

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Cavernomas (Vascular Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Cavernous malformations are benign vascular malformations and can occur ubiquitously throughout the central nervous system. Due to their diversity in size and location, a wide range of clinical symptoms can occur. Management options for cerebral cavernous malformations (CCMs) include conservative management, microsurgical resection and radiosurgery. Still, CCM management is still controversially discussed. As a tertiary referral center, the Department of Neurosurgery, Medical University Vienna offers all treatment options to CCM patients.
Methods: We present our preliminary long-term follow-up data of an international retrospective collaboration study that pooled radiosurgically treated CCM patients of both centers. We compare the clinical and radiological outcome and the hemorrhage risks in patients with cerebral cavernous malformations, treated with Gamma Knife radiosurgery (GKRS) to the natural course / conservative management.
Conclusions: From our data, we may conclude that radiosurgical treatment for CCM represents a safe and effective treatment option for selected CCM.

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744
Brain and Spine 4 (2024) 103465
Awake mapping for resection of cavernous angioma and arteriovenous malformations in the left dominant hemisphere

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Cavernomas (Vascular Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: The complete resection of arteriovenous malformations (AVMs) and cavernous angiomas (CAs) (with the associated gliosis area, when possible) is paramount to reduce the risk of seizure and/or (re)bleeding. However, this may be very challenging and risky for lesions close to language areas. We report a consecutive series of patients who underwent awake mapping for resection of vascular malformations in the left dominant hemisphere.
Methods: Between December 2018 and December 2023, we performed 64 surgical operations for brain lesions using awake mapping. Six of these patients were admitted for bleeding cerebrovascular malformations (five CAs and one AVM) in the left dominant hemisphere. Initial symptoms were transient aphasia in two cases, transient aphasia and seizures in one, only seizures in another one, and acute headache in the remaining two. The AVM (Spetzler-Martin grade II) was located in the left fronto-temporal region close to the arcuate and inferior fronto-occipital fasciculi. Four CAs were located in the left frontal region (3 in the middle frontal gyrus, one in the inferior frontal gyrus), while the remaining one in the left superior temporal gyrus.
Preoperatively, functional MRI and diffusion tensor imaging were carried out and uploaded into the neuronavigation system. Intraoperatively, neuroradiological data were effectively combined with awake mapping, which was performed using cortical and subcortical stimulation during neuropsychological testing, to precisely locate eloquent regions.
Results: Total resection of the vascular malformation was achieved in all patients. Awake mapping was paramount to carefully identify the eloquent regions, thus guiding the choice of the safer cortical entry for CAs removal, as well as delimiting the surgical approach for the AVM. In addition, subcortical stimulation with language assessment permitted to further define safe margins avoiding eloquent white matter tracts. There was no intraoperative seizure during cortical-subcortical stimulation. The postoperative course was uneventful in 4 cases. Two patients experienced mild expressive dysphasia that completely resolved within 3 months.
Conclusions: In selected patients, awake mapping using intraoperative cortical and subcortical stimulation may play a key role for the resection of left dominant hemisphere vascular malformations. Indeed, together with intraoperative neuronavigation, awake mapping may guide the surgery allowing to select the best "cortical approach" as well as to define safer subcortical margins, thus optimizing the removal while minimizing the risk of postoperative language deficits.

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448
Brain and Spine 4 (2024) 103466
Comparison Between Dedicated Magnetic Resonance Angiography and T1 with Double Contrast for Avascular Stereoelectroencephalography Planning

Velislav Pavlov [1], Petar Karazapryanov [1], Kaloyan Gabrovski [1,2], Petya Dimova [1], Yoana Milenova [1], Krasimir Minkin [1,2]. [1] *University Hospital "St.Ivan Rilski" - Sofia, Bulgaria, Sofia, Bulgaria;* [2] *Medical University, Sofia, Bulgaria*

Epilepsy Surgery and Low Grade Glial Tumors (Functional Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: The risk of hemorrhage during stereoelectroencephalography (SEEG) is about 1% and the planning of avascular trajectories plays an important role for its reduction. The aim of our study was to compare the vessel visualization using dedicated magnetic resonance angiography (MRA) with the most frequently used double contrast-enhanced T1-weighted imaging (T1 + 2C) for the planning of avascular SEEG trajectories.
Methods: Four hundred seventy-eight trajectories for 30 SEEG were planned. Every SEEG has an individual schema which try to test a hypothesis for the

epileptogenic zone localization. Every patient has a magnetic resonance imaging including the following three-dimensional sequences: T1, Flair, T2, dedicated MRA and T1 + 2C. The avascular planning based on the individual schema with 12 to 18 electrodes (mean: 16 electrodes) was performed on Surgiplan software using first the T1 + 2C and checked on the MRA and using first the MRA and checked on the T1 + 2C. We consider a margin of 2.5 mm to the closest vessel on the pial surface as an obligatory safety margin. We investigate the rate of detection of a vessel in the safety zone by the by T1 + 2C and by the MRA.
Results: We found 66 trajectories (14% of 478 trajectories) where the MRA visualized a vessel in the safety zone after SEEG planning using T1 + 2C. We have no vessel visualized by T1 + 2C in the safety zone when the SEEG was planned on MRA.
Conclusions: Our data shows that MRA allows better vessel visualization than T1 + 2C and may reduce the hemorrhagic risks during SEEG.

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481
Brain and Spine 4 (2024) 103467
Predictive factors for Engel I patients in Epilepsy Surgery

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Epilepsy Surgery and Low Grade Glial Tumors (Functional Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Epilepsy surgery is the gold standard to treat in the most effective way patients affected by drug-resistant epilepsy (DRE). Once the foci are identified, the surgical procedure aims to improve patients' quality of life diminishing seizure events. Seizure freedom is the main goal of these procedures: different studies were conducted to analyze predictive factors influencing postoperative seizure outcome, known as Engel Surgical Outcome Score. The aim of this study is to identify possible clinical factors influencing outcome in a tertiary epilepsy surgery center.
Methods: We retrospectively included all patients undergoing phase I and phase II studies at Geneva University Hospitals from 2007 to 2020 with available clinicoradiological data with at least 1 year follow-up. Patients undergoing biopsies and palliative surgery with no reported follow-up were excluded. The population was divided between Engel I and non-I.
Results: 254 patients underwent phase I and phase II surgeries from 2007 to 2020. There were 118 females and 136 males, with a mean age at surgery of 28 years old (range 14-58).
88 patients were pediatric (<18 years old) whilst 166 adults (range 1-61). 42.2% of all patients presented epileptic events daily, 32.7% weekly, 20.6% monthly and 4.5% sporadically. Patients used on average 4 antiepileptic drugs (range 0-12). 14.7% of all patients presented a postoperative complication and 86.3% of those needed a surgical procedure.
Age at surgery ($p=0.04$), location (Extratemporal lobe epilepsy [ETLE] vs Temporal lobe epilepsy [TLE], $p=0.032$), side (Right vs Left, $p=0.003$) and type of epilepsy (lesional vs non-lesional, $p<0.001$) were statistically significant for Engel I surgical outcome.
Conclusions: Epilepsy surgery is pivotal for seizure control in selected cases. Age at surgery, location, side and type of epilepsy partecipate in Engel I postoperative outcome. Multicentric databases should be implemented to identify other predictive factors for epileptic control.

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1013
Brain and Spine 4 (2024) 103468
Combining depth electrodes and intraoperative ultrasound to overcome limits of intraoperative electrocorticography in epilepsy surgery

Luca Zanuttini [1], Elena Pasini [1], Lorenzo Ferri [1], Lidia Di Vito [1], Ambra Caruso [1], Fernando Blasioli [1], Ms Lara Alvisi [1], Ms Irene Minardi [1], Ms Maria Concetta Sapienza [1], Gianfranco Vornetti [1], Caterina Tonon [1], Mino Zucchelli [1], Sofia Asioli [1], Francesca Bisulli [1], Roberto Michelucci [1], Matteo Martinoni [1]. [1] *Ircss Istituto Delle Scienze Neurologiche Di Bologna, Bologna, Italy*

Epilepsy Surgery and Low Grade Glial Tumors (Functional Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: The use of intraoperative electrocorticography (iECoG) in epilepsy surgery has been widely re-ported in the literature, although its impact on improving seizure outcomes is still debated. The limiting factors of iECoG include the fact that inadequate anatomical coverage may not allow sufficient electrophysiological recording and sampling. To overcome the spatial limitations of standard strip iEcoG, we use a multimodal approach, combining the use of depth electrodes with intraoperative ultrasound (IOUS) and neuronavigation.
Methods: In the past year, at IRCCS ISNB, four patients with lesional drug-resistant epilepsy underwent iECoG-guided resective surgery. In all cases, the position of the electrodes was previous-ly planned in a multimodal scene and then exported to the neuronavigation system. All elec-trodes were detected intraoperatively via IOUS. iECoG was recorded before and after the planned resection.
Results: In all cases the electrodes were clearly recognisable. iECoG was recorded effectively in all pa-tients and in two patients (patient 2 and 4) led to a larger resection. Patient 1 had mesial tem-poral lobe epilepsy due to temporal encephaloceles. Patient 2 had anterior cingulate cortex epi-lepsy due to frontal focal cortical dysplasia (FCD) type IIb. Patient 3 had frontal lobe epilepsy due to frontal FCD IIb. Patient 4 had lateral temporal lobe epilepsy due to FCD IIb of the angular gyrus. Postoperative MRI showed a radical resection in all cases. Three out of four patients are seizure-free (median FU of 7m), and one patient has significantly reduced the number of seizures (Engel 2).
No post-operative neurological deficits were reported.
Conclusions: Whereas the time constraints of iECoG are fixed, spatial limits like bottom of sulcus exploration and placement accuracy could be overcome by coupled use of depth electrodes and IOUS. This method helps the surgeon to improve the accuracy of electrode positioning.

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1251
Brain and Spine 4 (2024) 103469
Surgical implications of anatomical relationships among the Meckel's cave, foramen ovale, foramen spinosum and VI cranial nerve in the anterior transpetrosal approach.

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Tentorial and petrous meningiomas (Skull Base Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Anterior transpetrosal approach (ATA) allows to reach the petroclival area. In this approach some practical difficulties are routinely encountered, such as: identification of middle meningeal artery (MMA); peeling of the dura over the greater superficial petrosal nerve (GSPN) and V cn; VI cn palsy after excessive drilling. This anatomical study provides further details to perform those steps.
Methods: ATA was performed on 21 cadaveric heads (35 sides). The drilling area was divided into standard petrosectomy and extended petrosectomy (including the bone below V3). Measurements were taken with navigation system. The relationship between foramen spinosum (FS), GSPN, foramen ovale (FO), arcuate eminence was calculated. The location of VI cn regarding drilling area was calculated.
Results: The FS was situated lateral to the intersection between GSPN and V3 (GSPN/V3), in most cases among FO and GSPN/V3. The VI cn exited from the pontomedullary junction, reached the dural porus where it became interdural. The length of interdural segment (IS) of VI cn was 3-16mm. In 73,5% of sides the IS was 3-7mm and the nerve ran far from the extending drilling area; in the 8,8%

of sides the IS was 8mm and the nerve ran near the extending drilling area, in the 17,6% of sides the IS was >8mm and it passes very close to the standard drilling area.
Conclusions: An understanding of the relationship between MMA, V3, GSPN and VI cn is useful to reduce the length of surgery and neurological deficits. The risk of injury the VI cn depends on the extension of the drilling area and on individual anatomical variability, in particular the longer IS is potentially related to a high risk of injury the nerve.

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561
Brain and Spine 4 (2024) 103470
Mucosal Suturing in Targeted Endoscopic Endonasal Approaches to the Clivus

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Tentorial and petrous meningiomas (Skull Base Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: The extended endoscopic endonasal approach (EEA) has progressively evolved and widened the armamentarium of skull-base surgeons. Although EEA revolutionized the resection of complex skull base tumor, reconstruction remains difficult. Numerous closure techniques have already been described, primarily based on the use of the nasoseptal flap (NSF), but also carrying their own morbidity related to the flap integrity and complications associated to the recipient or donor site. Recently, our group presented an alternative minimally invasive approach and reconstruction to clival lesions in which the rostral mucosa is preserved and sutured at the end of the procedure. Here, we present an improvement of this endonasal suturing technique in a series of 37 patients.
Methods: A total of 37 patients who underwent clival and paraclival surgeries using a monostril chopstick targeted clival approach were included. The mucosa suture technique with variations was described in details. All surgical videos of the tumoral resection and endoscopic controls were reviewed. We assessed the indications, the rate of extent of resection, limitations and the morbidity associated with this procedure.
Results: From May 2020 to October 2023, 37 patients underwent surgical approaches to the clival and paraclival regions using the targeted clival approach technique. Among the pathologies treated, chordomas (n=28, 75.7%) and chondrosarcomas (n=4, 10.8%) represent the majority of cases. There was a predominance of surgeries performed on the upper or middle clivus (72.9%). Six patients (16.2%) underwent a previous open and/or endoscopic surgery for the same tumor, and one a previous endoscopic endonasal biopsy (2.7%). The rate of GTR was 65.9%. The rare of postoperative CSF leakage was 13.5% (5 cases). All postoperative CSF leakage occurred within the first postoperative month and patients were approached again via the endonasal route for leak correction. In three of the cases, an external lumbar drain was placed. Meningitis occurred in 4 cases of postoperative CSF leak.
Conclusions: This new targeted approach and reconstruction strategy represents an alternative to classic reconstruction techniques defining the natural mucosa as a physiological barrier to cover neurovascular structures and to prevent CSF leakage in endoscopic skull-base cases. This technique applies the classic concept of skin incision and closure for transcranial to EEA, and is also associated with a low rate of nasal morbidity. Further comparative studies are mandatory to show the superiority of this technique compared to classic reconstruction techniques using the NSF.

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102
Brain and Spine 4 (2024) 103471
Surgical Strategy for Tentorial Meningiomas Removal

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Tentorial and petrous meningiomas (Skull Base Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Tentorial meningiomas (TMs) pose significant challenges due to their intricate anatomical location and proximity to critical neurovascular structures. Our presentation aims to provide a comprehensive overview of contemporary surgical strategies for TM surgeries based on our own experience.
Methods: Between 2009 and 2023, we operated on 64 patients with TMs (58 (90.6%) female, 6 (9.4%) male; mean age 50.4 years). Tumor locations included medial "incisural" (37.5%), lateral tentorial (25.0%), falcotentorial (17.2%), peritorcular "torcular" (10.9%), and paramedian "intermediate" (9.3%), with extensions into infratentorial (37.5%), supratentorial (14.0%), and supra-infratentorial (48.5%) regions. Surgical approaches included combined supra/infratentorial (37.5%), infratentorial supracerebellar (43.6%), suboccipital supratentorial transtentorial (9.4%), interhemispheric (1.7%), and subtemporal extra- and intradural with and without anterior petrosal bone drilling (9.4%). Intraoperative neuromonitoring and neuronavigation were used routinely. Follow-up from 3 to 174 months.
Results: During surgeries, we aimed to achieve wide exposure of involved venous sinuses, minimal brain retraction, resection of affected tentorium, precise invaded bone drilling, resection of venous sinuses only when completely occluded, preservation of non-occluded venous sinuses, and preservation of veins. Total tumor resection was achieved in 47 cases (73%), subtotal in 16 (25%), and partial in 1 (2%). Histologically, tumors were Grade I in 52 cases (81%), Grade II in 11 (17%), and Grade III in 1 (1,7%). There were no fatalities. Complications included cerebrospinal fluid leakage (1), venous discirculation (3), and blood clot in the tumor bed (1).
Conclusions: Tentorial meningiomas represent a heterogeneous group of tumors requiring a wide spectrum of surgical approaches tailored to their location. Early devascularization of TMs, exposure of the sub- and supratentorial surfaces of the tumor, and surgical flexibility on an individual basis are crucial. Intraoperative adjuncts such as neuro-navigation and neurophysiological monitoring enhance surgical precision and safety.

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1176
Brain and Spine 4 (2024) 103472
Far-lateral approach to lower clivus: when is it still mandatory? An anatomical cadaver study

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Tentorial and petrous meningiomas (Skull Base Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Surgical exposure of lower clivus is challenging owing to the deep location and complex regional anatomy. Far-lateral approach (FL) is the most used approach for lesions in this region although it is burdened by a greater risk of damaging neurovascular structures and increased operative time. Midline suboccipital subtonsillar approach (ST) has been proposed as a reasonable and safe route for this area through a direct angle of view. The aim of this study is to quantify the differences of surgical exposure and surgical freedom in this region by these approaches.
Methods: FL and ST were performed in 8 adults cadaveric head specimens (16 sides) at the Neuroanatomy Laboratory G. Cantore at IRCCS Neuromed, Pozzilli, Italy. Surgical area was divided in a medial and a lateral part by the line from the petroclival fissure to the hypoglosseal canal (HC), and in a superior and inferior part by a horizontal line passing by HC, defining 4 sectors. Encountered neurovascular structures were described. Length of exposure of cranial nerve, areas of exposure, angle of attack and corridor depth were measured for every defined sector. Necessary tonsillar retraction and condilectomy to expose every sector was also measured.
Results: FL showed larger areas of exposure in every sector, however ST provided good exposure of the lateral sectors. The exposure of the upper quadrants required greater retraction of the cerebellar tonsils. The angle of attack at the HC was better with ST than FL. Condylectomy allowed to increase the area of exposure, in particular of the lower-medial quadrant.
Conclusions: FL offers a greater surgical exposure, expecially in medial part, however ST shows a good surgical exposure of lateral part of LC providing a straightforward corridor in particular to HC, being a safe and reasonable option in selected cases.

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1301
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Variation in Cerebrospinal Fluid Production Rate During Asleep and Awake States

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Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

Background: Sleep serves several essential and diverse functions for the maintenance of healthy brain activity. Our study aimed to evaluate whether sleep influenced cerebrospinal fluid flow rate and if there was a variation in net cerebrospinal fluid production rate (PRcsf) during asleep and awake states.
Methods: A prospective observational study was performed in all compos mentis patients in our hospital who required CSF drainage as part of their ongoing management. The drain was connected to a LiquoGuard7 (Möller-Medical, Germany) with the intracranial pressure sensor at the level of the external auditory meatus. The internal software and flow-rate data of the LiquoGuard7 pump was used to calculate net PRcsf during asleep and awake states for each individual patient. The methodology requires the patients to be completely flat for 30 minutes during the measurement. Statistical analysis used SPSS (version 25.0, IBM) by paired t-test, comparing the measured flow rates during asleep and awake states in individual patients.
Results: After exclusion PRcsf was calculated in 9 patients in both awake and asleep states (4M:5F, average age 64 years, n=7 NPH, n=2 IIH). Net CSF flow rate was found to be between 20-40ml/hour higher during asleep state than awake state in individual patients. Quality of sleep and the use of pharmacological sleeping aides appeared to influence PRcsf during sleep.
Conclusions: There is variation in PRcsf during asleep and awake states in individual patients. This preliminary study will require validation with larger patient numbers.

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730
Brain and Spine 4 (2024) 103474
Choosing wisely: adjustable or fixed pressure valves for patients with idiopathic normal hydrocephalus? A systematic review and meta-analysis on ventriculoperitoneal shunt outcomes

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Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

Background: This study explores the efficacy of adjustable differential pressure valves (ADPV) versus fixed differential pressure valves (FDPV) in ventriculoperitoneal shunt (VPS) procedures for idiopathic normal pressure hydrocephalus (iNPH) patients, addressing the ongoing debate surrounding optimal valve types.
Methods: A systematic review and meta-analysis of proportions were conducted following PRISMA guidelines. The PICO framework guided our research question, focusing on PubMed/Medline and Embase literature searches. Outcomes included improvement in gait, cognition, urinary incontinence, and general improvement.
Results: Our meta-analysis of 26 studies revealed a mean age ± standard deviation, of 71.7 ± 2.6 years among patients. Gender distribution was nearly equal, with 672 out of 1036 patients (65%) showing general improvement, exhibiting substantial heterogeneity (I2 = 96%). When stratified per treatment, proportions were 0.62 (95% confidence interval, 0.54-0.74). Gait improvement was moderate in the ADPV group 0.50 (0.25-0.75), and substantial in the FDPV group 0.89 (0.75-1), while cognition improvement was limited in both groups. Urinary incontinence improvement was moderate in the ADPV group 0.38 (0.04-0.72) and high in the FDPV group 0.84 (0.60-0.97). Funnel plots suggested potential publication bias in gait and cognition outcomes.
Conclusions: Despite the comprehensive nature of this study, the observed heterogeneity raises uncertainties about the definitive impact of valve type on iNPH symptom improvement. Ethical constraints limit direct comparative studies, suggesting a need for alternative approaches such as a multicenter retrospective study to gain further insights into these patients' outcomes with ADPV versus FDPV.

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1024
Brain and Spine 4 (2024) 103475
Comparison of Decline In Different Cognitive Domain In Patients With Normal Pressure Hydrocephalus

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Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

Background: We sought to describe the cognitive profile of patients with Idiopathic Normal Pressure Hydrocephalus (iNPH) using a comprehensive neuropsychological battery. Based on age and education correlated norms, we aimed to compare performance in each measured cognitive domain: executive functions (EFs), verbal memory (VM), non-verbal memory (nVM), visuoconstructional abilities (VA) and attention/psychomotor speed (A/PS).
Methods: Patients diagnosed with iNPH according to nowadays gold standard (Tap test, Lumbar Infusion Test) underwent comprehensive neuropsychological evaluation before shunting. Their performance was compared to the age and education correlated norms. Correlation of different cognitive domains in iNPH profile was performed.
Results: A total of 53 iNPH patients (73.21 ± 5.48 years) were included in the study. All of the measured cognitive domains were significantly damaged. The most affected domains were EFs and VM ($p<0.001$ and $p<0.001$, respectively). A/PS domain was affected milder than EFs and VM ($p<0.001$). The least affected domains were nVM ($p<0.001$) and VA ($p<0.001$).
Conclusions: Patients with iNPH are affected in all cognitive domains and the cognitive decline is uneven across these domains. The impairment of memory was shown to depend on the presented material. VM was shown to be much more severely affected than nVM and along with VM, EFs were shown to be the most affected. A/PS speed was shown to be less affected than VM and EFs and the least affected domains were nVM and VA.

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733
Brain and Spine 4 (2024) 103476
Cerebrospinal Fluid Tap Test Did Not Predict Shunt Response in The Kuopio Idiopathic Normal Pressure Hydrocephalus Protocol

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Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

Background: Idiopathic normal pressure hydrocephalus (iNPH) is a clinical condition characterized by Hakim's syndrome: gait disturbance, cognitive impairment and urinary incontinence, and ventriculomegaly. Symptom alleviation by cerebrospinal fluid (CSF) diversion, mainly ventriculoperitoneal shunt (VPS), has been reported in 29-82 % of treated patients, with variable criteria for shunt response. Hellström scale was introduced in 2012 to provide comprehensive scale to address shunt response. CSF tap test, a single-time lumbar puncture CSF reduction, has been used as a prognostic test for shunt response, although its predictive value varies greatly in reported series. We present the results of the Kuopio iNPH protocol, with comprehensive shunt response evaluation and CSF tap test analysis.
Methods: 235 (44 % women) consecutive patients were treated with VPS for iNPH between 5/2017 and 12/2022. Symptom domains of Hellström scale were assessed preoperatively, at 3 months, and at 12 months. Tap test with 40 ml CSF removal and repeated 10-meter walking tests were performed preoperatively. Data of 200 patients was available for the analysis at the end of the follow-up.
Results: Positive shunt response (Hellström ≥ 5 points) was observed in 73 % patients at 3 months and 71 % patients at 12 months. Repeated-measures ANOVA adjusted for sex and age showed increased Hellström score between preoperative and 3-month follow-up (49.5 vs 62.0, $p < 0.001$), and preoperative and 12-month follow-up (49.5 vs 62.1, $p < 0.001$). No significant difference in mean

Hellström score was observed between 3-month follow-up and 12-month follow-up. CSF tap test did not predict shunt response at 3 months (AUC = 0.60) nor at 12 months (AUC = 0.61).
Conclusions: No predictive effect of CSF tap test was observed in the Kuopio iNPH protocol. Majority of patients treated for iNPH benefitted of VPS. Hellström scale is feasible for comprehensive evaluation for shunt response.

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661
Brain and Spine 4 (2024) 103477
Cerebrospinal Fluid Biomarkers of Neurodegeneration in Idiopathic Normal Pressure Hydrocephalus

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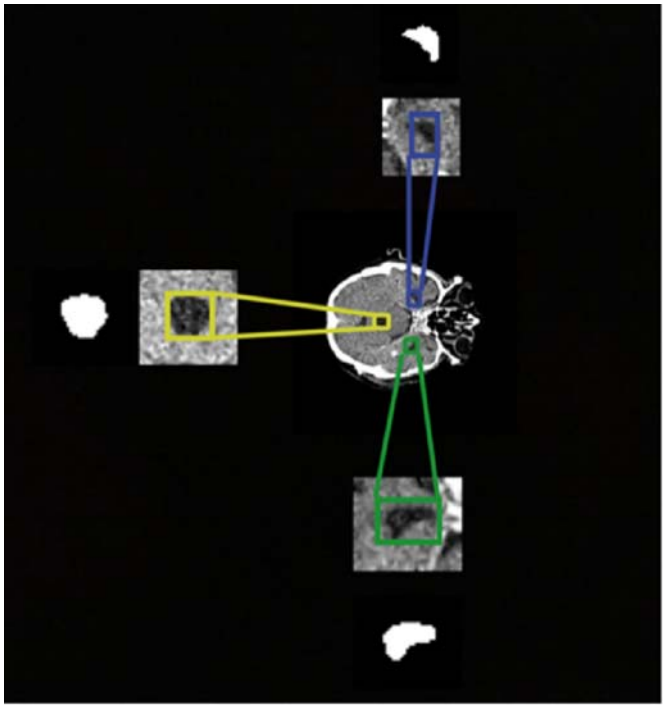
Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Idiopathic normal pressure hydrocephalus (iNPH) is a condition affecting gait, cognition, and urinary continence. The cerebrospinal fluid (CSF) shunt surgery alleviates symptoms for the most patients. The CSF-based biomarkers may be useful in diagnostics and prognostics of iNPH. Here we aimed to elucidate the longitudinal and rostro-caudal dynamics of selected CSF biomarkers. Additionally, we evaluated the prognostic value of a CSF biomarker panel in relation to symptom alleviation.
Methods: Altogether, 285 possible iNPH patients participated and received ventriculoperitoneal shunts between 2009-2021. The participants had their lumbar-CSF collected before and after and the ventricular-CSF during and after shunt surgery. The CSF biomarkers representing the amyloid-β cascade (Aβ38, -40, -42, sAPPα, -β), tau pathology (P-tau181), inflammation (MCP1), neurodegeneration (T-tau), axonal damage (NfL) and synaptic function (Ng) were analyzed from the samples. Participants were APOE-genotyped, and a subset of the participants had a brain biopsy analyzed for tissue Aβ- and τ-pathology.
Results: The CSF P-tau181, T-tau, NfL, and Ng increased 140-810% after the shunt surgery and stabilized thereafter. The CSF Aβ42 levels increased in patients who were initially Aβ-pathology negative, while those with a Aβ-positive biopsy exhibited a slight decrease. The preoperative lumbar-CSF Aβ42, T-tau, and P-tau181 correlated to corresponding intraoperative ventricular-CSF levels. Postoperative concentrations of lumbar- and ventricular-CSF Aβ42, T-tau, P-tau181, NfL, and Ng showed strong correlations between them and expressed 14-32% lower levels in ventricular-CSF. Low preoperative lumbar-CSF T-tau and the absence of APOE ε4 predicted gait improvement and low P-tau181, T-tau and NfL predicted normal cognition by the MMSE after shunt surgery.
Conclusions: The measured CSF biomarkers are influenced by shunt surgery, tend to stabilize postoperatively, and present a rostro-caudal gradient. The preoperative lumbar-CSF P-tau181, T-tau, and NfL have prognostic value for gait and cognitive improvement after the shunt surgery in iNPH.

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333
Brain and Spine 4 (2024) 103478
Fully Automated Estimation of Ventricular Volume and Width of Twelve Anatomic Subregions Using Object Detection and Semantic Segmentation

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Hydrocephalus and CSF disturbance (CSF Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: Our goal was to develop and validate machine learning models that are capable to recognize frontal, temporal, occipital horns, the body of the lateral ventricle, third and fourth ventricle as well as the atrium on either side. We then automatically extracted features such as maximum width and total volume, allowing for monitoring of disease progression over time.
Methods: We included patients with a shunt due to hydrocephalus at our center. A second center was used for external validation. Labels of the ventricular structures were generated by hand. First, an object detection algorithm (YOLOv5) was trained. This allowed for precise cropping of the subregions that could then be used as input for a 2D-UNet. For comparison, a nnU-Net was also trained. Precision, recall, mean average precision 50 and 50-95 (mAP50, mAP50-95) were used as performance metric for the YOLO-algorithm. Dice score, Jaccard score and 95th percentile Hausdorff distance assessed performance for the U-Net respectively.
Results: 80 scans from patients with a shunt due to hydrocephalus at our center were included as well as 50 from a second center. Mean age was 68.59 ± 15.89 and 75.94 ± 4.17 for the first and second center and 43 (52.5%) and 30 (60%) were male. MAP 50, mAP50-95 was 0.728, 0.453 for internal and 0.274, 0.124 for external validation across all classes. Best mean dice scores were 0.89 ± 0.09 and 0.85 ± 0.13 for the body of the right lateral ventricle. Maximum width of these ventricles per slice correlated well with a Pearson correlation coefficient of 0.92, 0.84 and interrater correlation coefficients [95% confidence intervals] of 0.83 [0.23, 0.94], 0.82 [0.68, 0.90].
Conclusions: We were able to segment twelve subregions of the ventricular system with high precision, enabling the extraction of a wide range of features, both established and potentially novel.
Optional Image



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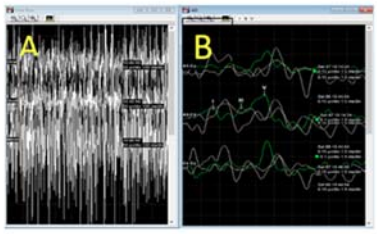
1418
Brain and Spine 4 (2024) 103479
A Cross-over study comparing the effects of Lactated Ringers vs. Normal Saline irrigation on Multi-Modality Intraoperative Neuromonitoring during skull base Surgery involving the facial nerve

Hussam Abou-Al-Shaar [1], Allyson Eismont [1], Joshua Sunderlin [1], Jeffrey Balzer [1], Paul Gardner [1], Georgios Zenonos [1]. [1] *University Of Pittsburgh Medical Center, United States*

Updates on Intraoperative Neurophysiological Monitoring (IONM Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

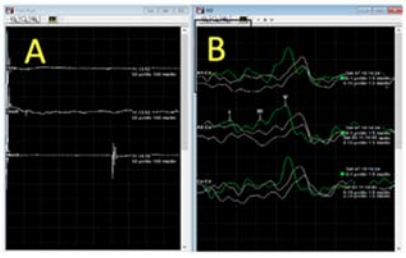
Background: LR has proven advantages over NS in decreasing neuronal hypexcitability in intra-axial brain surgery and is the irrigation of choice for abolishing seizures. We postulated that these same effects may be beneficial in decreasing detrimental facial nerve hyperexcitability during skull-base surgery involving significant manipulation of the nerve.
Methods: We performed a cross-over study in 26 skull base procedures involving the facial nerve (15 vestibular schwannoma resections and 9 microvascular decompressions for hemifacial spasm) where warm NS and subsequently LR irrigation was used sequentially in each surgery to study the effects on multimodality neuromonitoring. Specifically, we evaluated facial nerve free-run electromyography (f-EMG) a) during irrigation, and b) during dissection around the nerve, the facial nerve electromyography (EMG) threshold at the brainstem, as well relative interference of protracted f-EMG with reliably following brainstem auditory evoked potentials (BSAERs).
Results: In all cases, NS irrigation resulted in protracted facial nerve f-EMG. Significant f-EMG was also seen during dissection close to the facial nerve while using NS. Protracted f-EMG interfered with the ability to reliably follow ipsilateral BSAERs (performed in all MVDs and one VS resection). Switching to LR during NS irrigation nearly instantaneously abolished or significantly decreased facial nerve f-EMG activity which facilitated concomitant BSAER monitoring. The calming effects of LR extended beyond the time of active irrigation to subsequent dissection close to the nerve. The facial nerve EMG threshold at the brainstem was not affected.
Conclusions: Our findings suggest that warm LR is superior to NS as irrigation in skull base surgery involving the facial nerve as it decreases the nerve's detrimental hyperexcitability and facilitates the reliability of multi-modality neuromonitoring without decreasing its sensitivity.
Optional Image

Figure 1:



A) f-EMG recorded from orbicularis oculi, orbicularis oris, and mentalis muscle groups after normal saline irrigation. Amplitude measured from the mentalis muscle is 555.1uV with a frequency of approximately 140Hz. The duration of firing from the irrigation was 9 minutes 38 seconds. B) BAER baseline trace (set after dura was opened at 10:14 A.M, green) and the BAER trace that was averaged during the time of normal saline irrigation and EMG discharge (white trace). Latency and amplitude of the BSER cannot be accurately recorded due to artifact caused, most probably, by facial contractions.

Figure 2:



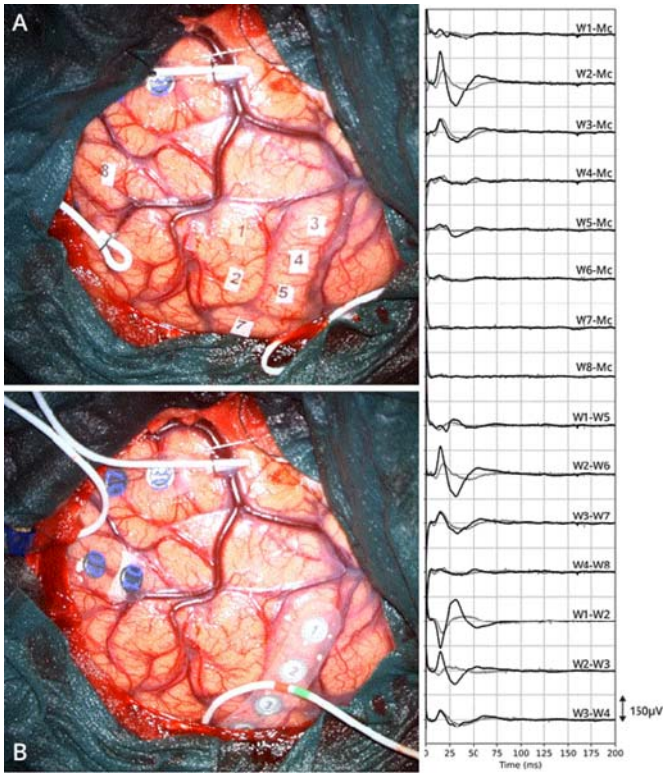
A) f-EMG recorded from orbicularis oculi, orbicularis oris, and mentalis muscle groups after lactate ringers' irrigation. Largest amplitude measured from the mentalis muscle was an isolated 122.9uV discharge. B) BAER baseline trace (set after dura was open at 10:14 A.M.) and the BAER trace that was averaged during the time of lactate ringers' irrigation. The BAER has no artifact due to facial muscle contraction and can be accurately recorded.

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134
Brain and Spine 4 (2024) 103480
Cortico-cortical evoked potentials of the arcuate fascicle in minimally invasive glioma surgery guided by Penfield stimulation

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Updates on Intraoperative Neurophysiological Monitoring (IONM Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM
Background: We investigated the feasibility of recording cortico-cortical evoked potentials (CCEPs) in patients with low- and high-grade glioma. We compared CCEPs during awake and asleep surgery, as well as those stimulated from the functional Broca area and recorded from the functional Wernicke area (BtW), and vice versa (WtB). We also analyzed CCEP properties according to tumor location, histopathology, and aphasia.
Methods: We included 20 patients who underwent minimally invasive surgery in an asleep-awake-asleep setting. Strip electrode placement was guided by classical Penfield stimulation of positive language sites and fiber tracking of the arcuate fascicle. CCEPs were elicited with alternating monophasic single pulses of 1.1 Hz frequency and recorded as averaged signals. Intraoperatively, there was no post-processing of the signal.
Results: Ninety-seven CCEPs from 19 patients were analyzed. There was no significant difference in CCEP properties when comparing awake versus asleep, nor BtW versus WtB. CCEP amplitude and latency were affected by tumor location and histopathology. CCEP features after tumor resection correlated with short- and long-term postoperative aphasia.
Conclusions: CCEP recordings are feasible during minimally invasive surgery. CCEPs might be surrogate markers for altered connectivity of the arcuate fascicle. This study may guide the incorporation of CCEPs into intraoperative neurophysiological monitoring.
Optional Image



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352
Brain and Spine 4 (2024) 103481
The influence of eloquent brain tumors on excitability of the primary motor cortex

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Updates on Intraoperative Neurophysiological Monitoring (IONM Parallel Session), October 16, 2024, 8:00 AM - 9:30 AM

Background: The effects of motor eloquent brain tumors on cortical excitability and the motor network are still not completely understood. In this study, we compare the motor evoked potential (MEP) resting motor threshold (RMT) during preoperative transcranial magnetic stimulation (TMS) examination with the baseline MEP motor threshold (MT) of intraoperative neurophysiological monitoring (IOM) in relation to various clinical and tumor characteristics.
Methods: We included 65 patients with motor eloquent tumors who underwent surgery with IOM and had a preoperative TMS examination. The TMS-RMT and the IOM-MT of the abductor pollicis brevis muscle (APB) were collected. A previously defined threshold ratio was used for TMS (TMS-RMTratio=TMS-RMTtumor/TMS-RMThealthy) and similarly for IOM (IOM-MTratio=IOM-MTtumor/IOM-MThealthy). These ratios were used as surrogate markers for cortical excitability analysis. Additionally, a random forest (RF) classifier was used to see whether a machine learning (ML) algorithm was able to tell healthy from tumor side IOM MEPs apart.
Results: Tumor side TMS-RMT was significantly higher than healthy side TMS-RMT (TMS-RMTratio = 112%), and tumor side IOM-MT was significantly higher than healthy side IOM-MT (IOM-MTratio = 152%). There was a significant positive linear correlation between the TMS-RMTratio and the IOM-MTratio. For tumors in the precentral gyrus, the average TMS-RMTratio and IOM-MTratio were significantly higher than 100% (TMS-RMTratio = 123% and IOM-MTratio = 158%). Furthermore, the RF model achieved 87% accuracy on the IOM MEP data classification task.
Conclusions: We observed a lower excitability in the tumor hemisphere compared to the healthy hemisphere, both pre- and intraoperatively. Low excitability in preoperative TMS generally correlated with lower intraoperative excitability. In particular, tumors in the precentral gyrus seem to affect the excitability of the motor system more than tumors in other cortical regions, with the healthy side being more excitable than the tumor side. Finally, a standard ML algorithm was able to classify healthy and tumor side MEPs accurately with our data, indicating that there might be additional neurophysiological markers of excitability in MEPs.

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1053
Brain and Spine 4 (2024) 103482
Cerebral Revascularization Surgery: Surgical Indications and Strategies

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Revascularization (Vascular Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: In the treatment of chronic cerebral ischemia, surgical revascularization still remains controversial due to the difficulty in predicting its results. The aim of the study was to determine the criteria for the effectiveness of surgical revascularization in patients with consequences of stroke caused by stenoocclusive pathology of the brachiocephalic arteries.
Methods: During the period from 2000 to 2024, brain revascularization was performed in Burdenko Center for Neurosurgery in 747 patients with cerebral ischemia, who underwent 837 different surgical interventions. Among them, there were 575 patients with ICA occlusions, 160 with Moyamoya disease, and 102 with MCA occlusions. 282 surgeries were performed in order to prevent cerebrovascular accidents, 529 surgeries were performed to treat the consequences of a stroke and improve the rehabilitation prognosis, and in addition, 26 surgeries were performed in the acute period. Surgical options included single- and double-barrel, proximal anastomoses and combined revascularization. Clinical, perfusion and angiographic data were analyzed.
Results: Surgical revascularization showed the greatest efficiency in restoring cerebral perfusion in patients with smaller foci of ischemia, with a shorter period from the moment of ischemic stroke, as well as in cases of decompensation or subcompensation of cerebral blood flow according to perfusion data. In addition, local hemodynamic studies and the state of the collateral blood flow system turned out to be important components of effective revascularization. In addition, the principles of targeted revascularization and ultrasound navigation were used to select the acceptor branch, taking into account the restructuring of the collateral system.
Conclusions: Understanding the mechanisms of pathophysiology and criteria for the effectiveness of revascularization in the treatment of chronic cerebral ischemia opens the way for their rational use. Modern algorithms for penumbra visualization for stroke patients offer opportunities for use of cerebral revascularization in stroke treatment and rehabilitation.

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676
Brain and Spine 4 (2024) 103483
Direct Oral Anticoagulation (DOAC) and Platelet Inhibition (PAI) in Neurosurgical Intracranial Emergencies - A retrospective Analysis

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Revascularization (Vascular Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Intracerebral hemorrhages (ICH) are among the most severe forms of stroke. The role of direct oral anticoagulants (DOAC), acetylsalicylic acid (ASA), clopidogrel, and vitamin K antagonists (VKA) in relation to ICH is inadequately defined. Although DOACs are known for their ease of use, their impact on the risk and outcome of ICH following surgical hematoma evacuation remains unclear.
Methods: In this retrospective, single-center study at the Medical University of Innsbruck, 359 patients over 18 years old with surgically treated ICH were included. Patient data were collected, including demographic information, medication (DOAC, VKA, ASA, Clopidogrel), laboratory values, administration of blood products and antidotes, as well as clinical outcomes after 3 and 6 months.
Results: Among the 359 predominantly male patients (56%), 17 took DOAC, 72 ASA, 24 VKA, and 9 Clopidogrel. Univariate analysis showed a significant impact of these medications on clinical outcomes ($p < 0.001$). After adjusting for age, sex, laboratory values, and blood products in the multivariate analysis, DOAC and VKA lost their statistical significance. Age, red blood cell count, and INR at the time of surgery were significantly associated with outcomes ($p < 0.001$ and $p = 0.01$, respectively). In univariate analysis, administered blood products and anticoagulation-correcting medications were associated with a worse outcome.
Conclusions: The study demonstrates that the initial influence of DOAC, platelet aggregation inhibitors (PAI), and VKA on clinical outcomes decreases after adjusting for cofactors. Interestingly, INR emerged as a risk indicator, suggesting an indirect role of anticoagulation in ICH and not entirely dismissing its risk increase. These results moderate the importance of these drugs in risk assessment for neurological deficits after ICH.
The study suggests that DOAC, VKA, and PAI are not the primary predictors of outcomes after ICH and hematoma evacuation. Rather, age, red blood cell count, and INR play an important role, indirectly associated with the administered anticoagulation medication.

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821
An MRI-based scoring system for the severity of Moyamoya Angiopathy
Brain and Spine 4 (2024) 103484
MRI based Assessment of Risk for Stroke in Moyamoya Angiopathy (MARS-MA):

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Revascularization (Vascular Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Before potential revascularization, Moyamoya patients require hemodynamic evaluation. In this study we validated the scoring system Prior

Infarcts, Reactivity and Angiography in Moyamoya Disease (PRIAMID), respective the capability to predict neurological symptomatology. We further outlined a new scoring system MRI based Assessment of Risk for Stroke in Moyamoya Angiopathy (MARS-MA) and compared the scoring systems with respect to the capability to predict impaired [15O]water PET cerebral perfusion reserve capacity (CPR).
Methods: We evaluated 69 structural and 69 breath-hold functional MRI (bh-fMRI) data sets, 69 DSA data sets and 38 [15O]water PET data sets of Moyamoya patients. The PIRAMID system was validated in the territories of the internal carotid arteries and the anterior and middle cerebral arteries by receiver operating characteristic (ROC) curve analysis with neurological symptomatology as dependent variable. The components of the MARS-MA system and their weightings were determined by binary logistic regression analysis. Comparison of PIRAMID and MARS-MA and MARS-MA grade stratification were performed by ROC curve analysis with CPR as dependent variable.
Results: The PIRAMID score correlated well with symptomatology (area under the curve (AUC) = 0.749/0.784). The MARS-MA system consisting of impaired bh-fMRI, the presence of an Ivy sign and of arterial wall contrast enhancement correlated slightly better with CPR impairment than the PIRAMID system (AUC = 0.861 vs. 0.826, Akaike information criterion 140 vs. 146). We determined three grades with low, intermediate and high risk of impaired hemodynamics and therefore stroke (AUC = 0.860).
Conclusions: The entirely MRI-based MARS-MA scoring system might be a promising tool to predict impaired hemodynamics and therefore possible stroke.

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820
Brain and Spine 4 (2024) 103485
Concentric vessel wall contrast enhancement in Moyamoya disease as risk factor for perioperative strokes in revascularization procedures

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Revascularization (Vascular Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: Concentric vessel-wall contrast enhancement (VW-CE) of the terminal carotid artery and its proximal branches is linked to disease activity and progression in Moyamoya angiopathy (MMA). We have analyzed the incidence of perioperative stroke in revascularization procedures in correlation with the occurrence of concomitant VW-CE.
Methods: All previously untreated MMA patients with indicated bypass surgery who had preoperative MR imaging with contrast-enhanced T1 vessel-wall sequences to visualize a possible VW-CE were included. A perioperative stroke was detected by CT angiography and/or diffusion-weighted MRI sequences <48h postoperatively.
Results: 110 patients with 157 direct EC-IC bypasses were included.A priori VW-CE was present in 67.3% of the cases. The mean time-interval between MRI and surgery was 86 days. A perioperative stroke occured in 5 patients while the primary revascularization procedure (stroke rate per bypass 2.1%). All affected territroies had VW-CE in their supplying arteries (chi2= 4.1, p= 0.04; OR= 5.8). 2 (40%) strokes occurred in the revascularized territory, 3 (60%) in a vascular territoy other than the revascularized one, each also showing VW-CE of the supplying artery as sign of disease activity. No other perioperative strokes occurred during subsequent revascularizations of multistage proedures (n=38).
Conclusions: Patients with preoperative VW-CE may have a higher risk of perioperative stroke at the time of first revascularization. This specifically applies to the vascular territory that is supplied by the vascular segment affected by VW-CE. To achieve an optimal outcome, vessel wall imaging should be performed when planning surgical revascularizations in Moyamoya patients. If VW-CE is found, strict perioperative monitoring of these high-risk patients must be performed to achieve the best results possible.

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1473
Brain and Spine 4 (2024) 103486
Complications in cerebral bypass surgery

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Revascularization (Vascular Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: The surgery of cerebral revascularization consists of creating a direct or indirect anastomosis with one or more cerebral vessels. The indications for bypass surgery are divided into "flow-augmentation" techniques (in case of cerebral vascular insufficiency) and "flow-preservation" techniques (in case of need to interrupt cerebral flow for the treatment of a cerebral pathology). There are multiple surgical techniques for bypass. The main ones are represented by EC-IC bypass, EC-IC bypass with graft interposition, and IC-IC bypass.
The aim of our study is to analyze the clinical outcome at the last available follow-up of patients undergoing cerebral bypass surgery at the Niguarda Metropolitan Grande Hospital in the last 10 years. Our secondary objectives are the analysis of bypass patency and the analysis of postoperative complications, distinguished into early and late, with particular attention to ischemic complications.
Methods: We analyzed a cohort of 95 patients undergoing bypass between 2012 and 2022. Surgical indications are divided into giant aneurysms (48 patients), fusiform or multiple aneurysms (10 patients), moyamoya disease (16 patients), chronic cerebral vascular insufficiency (17 patients), and skull base tumors (4 patients). 107 direct bypasses were created.
Results: The clinical outcome showed a "good outcome" in 92% of cases. The mortality rate was 2%. The bypass patency rate was 97%. Early postoperative complications showed a rate of 30%; late complications of 12.6%. Ischemic complications had an incidence of 24%, of which 15.8% were symptomatic. There were four cases of hemorrhages requiring evacuation. No preoperative analytical element was statistically significantly correlated with a worse outcome or a higher complication rate.
From a descriptive point of view, it is necessary to note that the group of patients with giant aneurysms showed a relatively higher rate of worse outcomes and postoperative complications.
Conclusions: Our study demonstrates that in a selected population of patients, the indication for bypass surgery can ensure a good outcome. However, it is necessary to consider the high incidence of complications requiring multidisciplinary treatment.

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381
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Functional anatomy of arithmetic processing identified by function-based connectome and tumor-based disconnectome analysis in brain tumor patients

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Intra- and extraoperative imaging in surgical neuro-oncology (Neuro-Oncology Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: As an advanced function, arithmetic performances require the collaboration of various cortical and subcortical structures within the brain. While arithmetic-related cortical and subcortical functional anatomy is sparsely investigated in patients with tumors in the right hemisphere.
Methods: We enrolled 19 patients with right parietal malignant tumors and performed navigated transcranial magnetic stimulation (nTMS) mapping with arithmetic tasks. Fibers were traced under fractional anisotropy (FA) thresholding at 0.10 and 0.15 for connectomes based on nTMS results and disconnectomes based on tumor locations. Tract volumes and average FA values from both connectomics were generated for the correlation analysis with arithmetic performance.
Results: Arithmetic performance did not correlate with FA (P(FAT=0.15) = 0.710; P(FAT=0.10) = 0.897). However, it was related to tract volumes from nTMS-based connectome as a sign of impaired functional anatomy (P<0.01) but not with disconnectome-related parameters. The presence of the frontal aslant, frontal insular, and frontal superior longitudinal tracts in the connectome was

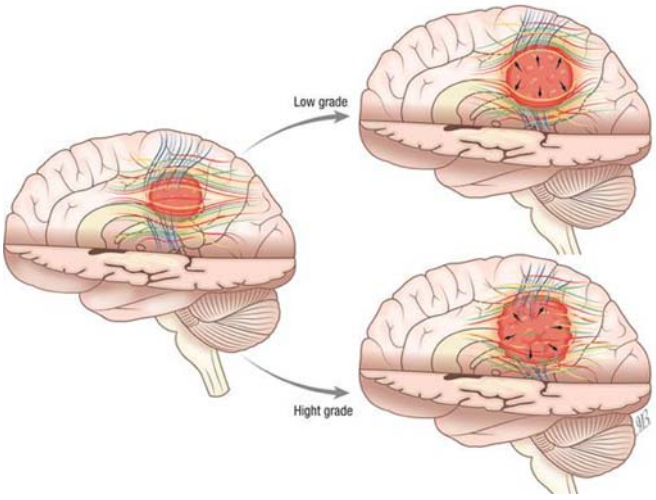
related to worse arithmetic performance.
Conclusions: These findings revealed different involvement of tracts in tumor-induced structural reorganization for functional compensation.

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121
Brain and Spine 4 (2024) 103488
DTI fiber-tracking parameters adjacent to gliomas: the role of tract irregularity value in operative planning, resection, and outcome

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Intra- and extraoperative imaging in surgical neuro-oncology (Neuro-Oncology Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: Diffusion tensor imaging-fiber tracking (DTI-FT) is a widely used MRI method for visualizing specific fiber bundles in the surroundings of gliomas and for achieving optimal surgical planning. However, it has limitations in providing quantitative data. Recent studies have focused on DTI-FT analysis in the periphery of gliomas, where it has been found that the brain adjacent tumor (BAT) area contains a significant amount of altered fiber tracts with less infiltration and disruption. The main DTI metrics, such as fractional anisotropy (FA) and mean diffusivity (MD), are influenced by factors that increase the degree of directionality of water diffusion in the BAT. Additionally, new quantitative measurements, including tract irregularity (TI), have been applied to investigate the shape characteristics of human association pathways.
Methods: This is an observational prospective study on a series of 118 glioma patients who performed MRI with pre-operative DTI-FT analyzed on the BAT by two different software. We examined DTI parameters of FA, MD, and TI grade, comparing it with clinical, radiological, and outcome data.
Results: The relationship between mean FA value and grading is inversely proportional to the MD and TI values. Tumor and edema volume influence the FA mean and MD values. The FA mean value decreases in HGGs surrounding the tumor, while the MD value increases. TI demonstrates an independent relationship with the tumor's aggressiveness, radiological features, and dimensions, and is associated with grading, resection and survival. At higher TI values, more patients achieve a GTR, suggesting that high fibers-irregularity around the tumor leads to macroscopic alteration noticed by the surgeon.
Conclusions: DTI-FT quantitative parameters, particularly TI, can predict patient outcomes and guide surgical planning in the BAT. This independent parameter may also allow for better supramarginal surgical resection of glioma. The research won the Italian award of the association for surgical Neuro-oncology in 2023.
Optional Image



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1456
Brain and Spine 4 (2024) 103489
Glioblastoma Stem-like Cell Detection using Advanced MR Imaging: results from the STEMRI trial

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Intra- and extraoperative imaging in surgical neuro-oncology (Neuro-Oncology Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: With current gold standard treatment, which associates maximum safe surgery and chemo-radiation, the large majority of glioblastoma patients relapse within a year in the peritumoral non contrast-enhanced region (NCE). A subpopulation of glioblastoma stem-like cells (GSC) are suspected to be the cause of these relapses. Previous studies have shown that their distribution is heterogeneous in the tumour.
Methods: In the context of the STEMRI clinical trial on 16 glioblastoma patients, their tumours were mapped using advanced MRI examination: Choline/N-acetyl-aspartate index (CNI), relative Cerebral Blood Volume (rCBV) and Apparent Diffusion Coefficient (ADC) were measured. During resective surgery, biopsies were extracted using image-guidance in the CE and nCE (FLAIR) regions. GSC subpopulation was quantified within the biopsies and then cultivated in selective conditions to determine their density and aggressiveness.
Results: Biopsy and derived-GSC characterization revealed a FLAIR/CNI+ sample enrichment in GSC and in gene signatures related to stemness. FLAIR/CNI+ samples generate GSC-enriched neuro-spheres faster than FLAIR/CNI−. In addition, low ADC was found to be a good predictor of the time to GSC neurospheres formation in vitro; and, GSCs were found in higher concentrations in areas with high rCBV. Parameters assessing biopsy GSC content and time-to-neurosphere formation in FLAIR/CNI+ were associated with worse patient outcome.
Conclusions: Taking into account MRI signatures of aggressiveness would certainly allow better surgical planning in the context of expected supramarginal resections.

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446
Brain and Spine 4 (2024) 103490
Right- versus left-sided lesions of the arcuate fasciculus – time to rethink the indications for awake monitoring of cognitive functions?

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Intra- and extraoperative imaging in surgical neuro-oncology (Neuro-Oncology Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: The increasing evidence that not only the different segments of the dominant arcuate fasciculus (AF), but also its right-hemispheric counterparts are crucial for distinct communication functions like the recognition of facial expressions, receive little clinical attention. In this study, we investigate the correlation between cognitive functions and tumour infiltration of bihemispheric AF

segments.
Methods: 121 glioblastoma patients (male/female=79/43, median age 62yrs) underwent a preoperative cognitive assessment consisting of 11 subtests, expressed in percentile ranks (PR), normalised regarding age, gender and education. Cluster analysis was used to build seven neurocognitive domain scores. FLAIR/T2-weighted cMRI were acquired on a Phillips 3T scanner. Tumour/oedema volumes were segmented semi-automatically using BrainLab Elements. A NatBrainLab atlas template was used to calculate the overlap of the lesion and the 3 segments of the AF in both hemispheres. Kendall-tau rank correlation coefficients between the cluster scores and the overlap were calculated in R and corrected for multiple comparisons.
Results: Associations were found for right-hemispheric lesions of the long AF segment with visuospatial judgment (τ= -0.17; p= 0.046), and of the posterior segment with visuospatial memory (τ= -0.18; p= 0.038) and construction abilities (τ= -0.21, p= 0.013). All segmental left AF lesions, but most strongly the long one, correlated with (verbal) working memory and lexical fluency (τ= -0.26/-0.29; p<0.01).
Conclusions: Our data confirm the strong involvement of the left AF and, particularly, its long segment, in cognitive language functions such as verbal fluency and working memory, but also emphasise the importance of the right AF for visuospatial functions, which are for instance involved in emotional communication aspects. These findings could stimulate the discussion whether appropriate mapping and monitoring tasks should be integrated in the awake surgery setting and calls for further analysis of the patients' follow-up outcomes.

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468
Brain and Spine 4 (2024) 103491
Managing The Painful Shoulder In The Spine Clinic: Radiculopathy or Frozen Shoulder? An Imaging Based Case-Control Study

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: Cervical radiculopathies, frequently present with symptoms radiating to the shoulder. These symptoms include motor deficits resulting in reduced shoulder range of motion, mimicking adhesive capsulitis, commonly known as frozen shoulder (FS). This presents significant clinical diagnostic uncertainty, in particular when the pathologies may coexist. We therefore propose a pathway to best differentiate these pathologies.
Methods: To examine the relationship between cervical foraminal stenosis and FS we reviewed 438 cases of patients undergoing glenohumeral hydrodistension at a tertiary referral centre between 2012 and 2019. Of these, 48 met study criteria and were included in the final analysis. FS was corroborated by shoulder ultrasound scans and axial cervical spine, T2-weighted MRI scans were assessed for foraminal stenosis. The presence or absence of foraminal stenosis ipsilateral to the FS (cases) was compared with the contralateral side (controls). McNemar's exact test was employed to determine correlation strength.
Results: Following imaging assessment, a significant correlation was found between C4/5 foraminal stenosis ipsilateral to the shoulder presenting with FS (p = 0.00000008636). Most patients (84%) had consulted a spine surgeon regarding concomitant neck pain and 23 (48%) patients underwent either CT-guided steroid injections (29%) or single level ACDF (19%). Patients in whom interventions were carried out experienced significant resolution of both neck and shoulder symptoms at follow-up. Deltoid wasting was noted in 12 patients (24%) of whom 6 (12%) had nerve conduction studies confirming denervation.
Conclusions: A strong relationship exists between C4/5 foraminal stenosis and ipsilateral FS, with C5 radiculopathy being a potential risk factor for a "neurogenic frozen shoulder". This, therefore, highlights the importance of multidisciplinary clinics for those presenting with cervicobrachialgia, with both neurosurgical and orthopaedic involvement. Finally, we suggest MRI scanning of the cervical spine be employed in those presenting with FS and nerve conduction studies in those presenting with motor dysfunction.

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226
Brain and Spine 4 (2024) 103492
Relevance of Cortical Thickness of Brain Regions Associated with the Somato-Cognitive Action Network in Patients with Degenerative Cervical Myelopathy

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: A new organization for the human motor cortex (M1) has been recently proposed. Proper motor effector areas were found to be interrupted by inter-effector regions which showed strong functional connectivity to the cingulo-opercular network (CON). These regions were suggested to be critical for action planning, coordination, and axial body movements whose disruption is constantly reported by patients with degenerative cervical myelopathy (DCM). We hypothesized that patients with DCM might show signs of cortical reorganization in these areas, with clinical relevance for their functional recovery.
Methods: Three-dimensional T1-weighted MRI was performed in 31 DCM patients and 43 healthy controls (HC). Clinical evaluation of DCM patients was conducted using the modified Japanese Orthopedic Association scale (mJOA). Cortical thickness estimation and between-groups (HC vs. DCM t-test) analysis were performed using FreeSurfer. Further, cortical thickness of the identified significant regions was compared between DCM patients who did and did not show functional improvement one year after surgery.
Results: For DCM patients, cortical thinning was observed in the right and left anterior prefrontal cortex (aPFC), insula, pre-supplementary motor area (pre-SMA), dorsal anterior cingulate cortex (dACC), and left SMA. Patients with DCM and improved neurological function at follow-up had significantly greater mean preoperative cortical thickness in the right and left aPFC, right superior frontal gyrus (SFG) and insula, with a statistical trend being also shown in both the left insula and SFG.
Conclusions: Patients with DCM present signs of cortical atrophy in regions of the CON which has been recently described to have critical implications for the human motor network. The preoperative cortical thickness of these regions may be of clinical prognostic value as patients who showed neurological improvement one year after surgery exhibited less atrophy in these cortical areas.

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1464
Brain and Spine 4 (2024) 103493
Predicting Postoperative Complications, Intensive Care Unit Length of Stay, and Transfusion Requirements in Posterior Spinal Fusion for Adult Spinal Deformity using Artificial Intelligence

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM
Background: Surgical correction with posterior spinal fusion (PSF) in adult spinal deformity (ASD) is highly complex and carries a high risk for post-operative complications. Utilizing machine learning (ML) algorithms can support clinical decision-making and optimize outcomes prediction. This study aimed to evaluate the effectiveness of various machine learning models in predicting post-operative complications, intensive care unit (ICU) length of stay (LOS), and total red blood cell (RBC) transfusion requirements in thoracolumbosacral posterior spinal fusion (PSF) procedures for ASD.
Methods: This retrospective study examined 646 adult spinal deformity patients undergoing thoracolumbosacral PSF of 6 or more vertebral levels for ASD. After data extraction, a panel of clinicians, research fellows, and statisticians identified candidate predictors. Feature engineering of candidate predictors was performed to identify key demographic, pre-operative, and intra-operative variables for inclusion, which differed between predicted outcomes and cutoffs. The dataset was divided into training (70%), validation (15%), and test (15%) sets.

Multivariable logistic regression, feedforward ANN, ensemble boosted ANN, extreme gradient boosting (XGBoost), random forest, explainable boosting machine (EBM), and support vector machine (SVM) models were utilized and evaluated on accuracy, sensitivity, AUC-ROC, F1-score, and precision. Bootstrapping was performed to calculate 95% CI and feature analysis was performed in explainable models. The design and reporting of this study was supported by TRIPOD + AI.

Results: For postoperative complications, the ensemble boosted ANN demonstrated the best performance with an accuracy of 0.78 (95% CI 0.69-0.86), sensitivity of 0.94 (CI 95% 0.88-0.99), AUC-ROC of 0.77 (CI 95% 0.66-0.86), F1-Score of 0.85 (CI 95% 0.8-0.91), and precision of 0.78 (CI 95% 0.69-0.87). Discrimination for transfusion requirements was AUC-ROC of 0.86 (CI 95% 0.76-0.94). For ICU LOS ≤7 days, XGBoost demonstrated exceptional accuracy of 0.94, sensitivity of 1.00, AUC-ROC of 0.94, F1-score of 0.97, and precision of 0.94.

Conclusions: Our research highlights the potential of cutting-edge machine learning techniques, particularly ensemble artificial neural network methods, to act as beneficial aids for spinal surgeons by optimizing risk stratification, surgical planning, and outcome prediction in this complex patient population.

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1335

Brain and Spine 4 (2024) 103494

Re-analysis of the CSM-PROTECT Multicentre Randomized Controlled Trial Reveals a Global Treatment Benefit of Riluzole in Patients Undergoing Surgery for Degenerative Cervical Myelopathy

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

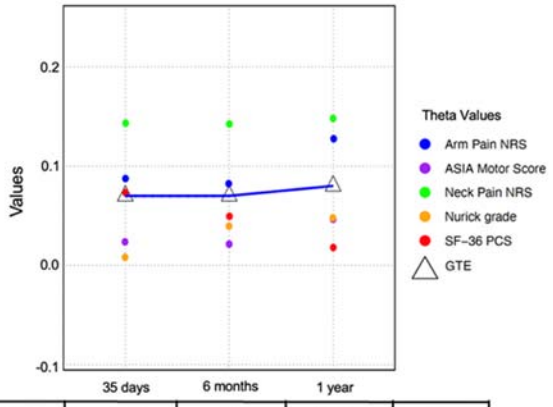
Background: While the primary analysis of the CSM-PROTECT Trial did not demonstrate improved recovery with the adjunctive use of Riluzole in patients with degenerative cervical myelopathy (DCM), secondary analyses suggested potential therapeutic benefits not captured by the modified Japanese Orthopedic Association (mJOA) scale. This study aims to re-evaluate Riluzole's efficacy using a global statistical analysis encompassing multiple outcomes.

Methods: We re-analyzed data from the phase III CSM-PROTECT study involving 290 DCM patients who underwent decompressive surgery. We assessed clinical improvement at 1 year using five distinct assessment scales: SF-36 Physical Component Summary (PCS), Numeric Rating Scale for Neck and Arm pain, ASIA motor score and Nurick grade. A nonparametric global statical approach was used to evaluate treatment efficacy. The resulting global treatment effect (GTE, ranging from -1 to 1) measured the net gain in probability that one arm outperforms the other across multiple endpoints. A GTE >0 indicated a more favorable global treatment response to Riluzole than placebo.

Results: Our analysis included 290 patients [mean (SD) age of 59(10.1) years, 129 (44%) females]. Of these, 141 received Riluzole, and 149 received placebo. Riluzole demonstrated significantly higher GTE than placebo at 1 year [GTE = 0.08 (SD 0.04), p=0.02]. A similar favorable global response was identified at 35 days and 6 months (GTE = 0.07; p=0.04). Riluzole-treated patients had a 54% higher likelihood of improved outcomes at six months. The combination of ASIA Motor score, Neck and Arm pain NRS ratings yielded the best-fit parsimonious model for detecting Riluzole's greatest benefit [GTE = 0.11 (SD 0.05), p=0.007].

Conclusions: This trial reanalysis demonstrates that perioperative Riluzole administration leads to overall clinical improvement compared to placebo, as measured by the GTE. Based on these data, clinicians may wish to consider Riluzole as an adjunctive treatment for DCM patients undergoing surgery.

Optional Image



	35 days	6 months	1 year	
Arm Pain NRS	0.09	0.08	0.13	-
ASIA Motor Score	0.02	0.02	0.05	+
Neck Pain NRS	0.14	0.14	0.15	-
Nurick grade	0.01	0.04	0.05	-
SF-36 PCS	0.07	0.05	0.02	+
GTE (SD)	0.07 (0.04)	0.07 (0.04)	0.08 (0.04)	
Mean Rank sum (placebo)	704.10	703.20	698.80	
Mean Rank sum (riluzole)	752.30	753.20	757.80	
p value	0.04	0.04	0.02	

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1347

Brain and Spine 4 (2024) 103495

Machine learning-based cluster analysis identifies four unique phenotypes of degenerative cervical myelopathy patients with distinct clinical profiles and long-term functional outcomes

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

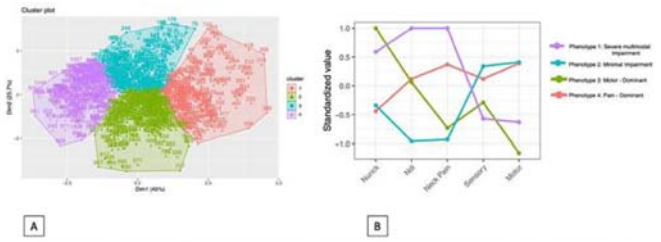
Background: Degenerative cervical myelopathy (DCM), the predominant cause of spinal cord dysfunction among adults, exhibits a diverse range of symptoms. Traditional classification using mJOA has not been able to address its complex heterogeneity. This study employs machine learning-based clustering algorithms to identify distinct patient clinical profiles and functional trajectories following surgery.

Methods: We implemented both latent profile analysis and k-means clustering on aggregated data from three large DCM trials. Key covariates, including the Nurick score, NDI (neck disability index), neck pain, and motor and sensory scores, were employed for clustering. Outcome differences among identified phenotypes were assessed using ANOVA, followed by posthoc Tukey test.

Results: A total of 1,047 DCM patients (mean [SD] age: 56.80 [11.39] years) had complete one year outcome assessment. Both LPA and k-means clustering identified four DCM patient phenotypes: "severe multimodal impairment" (n=286), "minimal impairment" (n=116), motor-dominant" (n=88) and "pain-dominant" (n=557) groups. The "severe multimodal impairment group", comprising of frail elderly patients, demonstrated the worst overall 1-year outcomes (SF-36 PCS mean [SD]: 40.01 [9.75]; SF-36 MCS mean [SD]: 46.08 [11.50]), but exhibited the most substantial neurological recovery after surgery (mJOA mean [SD]: 3.83 [2.98]). A higher frailty score and a positive smoking status predicted membership in phenotype 1 ("severe multimodal impairment" group).

Conclusions: Unsupervised learning algorithms applied to baseline DCM symptoms enabled the prediction of distinct patient phenotypes. The concept of symptom clustering, provides a valuable framework for uncovering novel DCM subpopulations, enhancing patient identification beyond the use of a single patient reported outcome measure such as the mJOA.

Optional Image



A. Cluster analysis showing 4 classes using k-means algorithm. B. Four patient phenotypes identified using LPA analysis with x-axis showing the symptom scales and the y-axis showing the standardized mean values

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1320
Brain and Spine 4 (2024) 103496
Long-term clinical outcome and reoperation rates following lumbar facet fixation in patients with lumbar spinal stenosis

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Spinal Degenerative Disease (Spine Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Symptomatic lumbar spinal stenosis (LSS) unresponsive to conservative therapy is commonly treated by surgical decompression. In this study, we compared clinical outcomes after decompressive surgery for LSS in patients implanted with interarticular spacers along with microdecompression (MD) with those receiving only MD.
Methods: A retrospective study was analyzed 40 patients (Group A) affected by LSS treated by MD and implant of interarticular spacers comparing the outcome with a homogeneous group of 40 patients with LSS treated with MD alone (Group B). Clinical outcome was evaluated using the Oswestry Disability Index (ODI) and visual analog scale (VAS) scores, as well as Macnab's criteria.
Results: At 1-year follow-up, ODI improved in both groups with statistically significant differences as compared to baseline and both Groups ($P < 0.05$). Statistically significant differences were observed at 3-year follow-up ($P < 0.05$), without further variation at 5-year follow-up. At 1-year follow-up, VAS for back and leg pain scores was significantly better than that of Group B ($P < 0.05$). At 3-year follow-up, back and leg pain scores were no longer significantly improved ($P > 0.01$), resulting almost the same at 5-year follow-up. A comparison of functional outcomes between the groups showed significant improvements in Group A as compared to Group B ($P < 0.05$). The reoperation rate was 10% in Group A and 30% in Group B. In implanted patients, successful fusion was obtained in 90% of the cases.
Conclusions: Interarticular spacers showed significant and clinically meaningful improvements in pain and disability, even in a long follow-up.

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769
Brain and Spine 4 (2024) 103497
Hypofractionated Gamma Knife Icon radiosurgery for perioptic tumors

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Bening Tumours (Radiosurgery Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Perioptic tumors, defined as those that are less than 3 mm from the optic apparatus, present a treatment challenge when using stereotactic radiosurgery. Achieving tumor control must be carefully weighed against the potential for radiation-induced optic neuropathy.
Single-fraction radiosurgery has been considered the gold standard therapy for small brain lesions, but hypofractionation offers a good option to treat tumors close to critical structures.
Methods: Between September 2017 and December 2020, 80 patients (61 female and 19 male) with a mean age of 61 years (38-85) underwent hypofractionated Gamma Knife radiosurgery for perioptic tumors. Skull base meningiomas were the most frequent lesions treated (70 patients), followed by pituitary adenomas (12 patients), craniopharyngiomas (2 patients), and solitary fibrous tumor (1 patient). In three patients, we treated multiple meningiomas for a total of 85 tumors. The average tumor volume was 5.27 ml (0.608-16.441), and the median was 3.240 ml. Thirty-seven of 85 lesions were symptomatic; the most common symptom was visual deficit (24 patients), reported both as visual acuity reduction and as visual field defects.
All the patients were treated with the thermoplastic mask and the Cone Beam CT stereotactic system. In most cases, we performed a 5-fraction treatment, with a marginal dose of 25 Gy (5 Gy/fraction); in only 7 patients, we performed a 3-day treatment with a marginal dose of 21 Gy (7 Gy/fraction).
The median radiological follow-up was 38.29 months, while the median clinical follow-up was 40.4 months.
Results: Tumor control was achieved in 99% of cases. Most patients had stable clinical symptoms, while we observed an improvement in initial symptoms in 3 patients (8.1%). Five of the 37 symptomatic patients at onset reported a worsening of the symptoms (13.5%). None of the asymptomatic patients became symptomatic.
Conclusions: Our preliminary experience with hypofractionated Gamma Knife Icon proved to be effective and safe in the treatment of patients with perioptic tumors.

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1378
Brain and Spine 4 (2024) 103498
Stereotactic radio-neurosurgery for jugular foramen schwannomas

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Bening Tumours (Radiosurgery Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Stereotactic radiosurgery (SRS) represents a minimally invasive and valuable alternative for jugular foramen schwannomas, both as upfront and/or adjuvant treatment (in hybrid approaches).
Methods: We conducted a retrospective review of our experience at Lausanne University Hospital (CHUV) from June 2010 to January 2024. Eleven patients underwent SRS, among whom three (27.3%) had prior surgery. Two (18.2%) patients received "staged-volume" SRS. The mean age at SRS was 60 years (median 68; range 29-83). Cranial nerve (CN) symptoms were present in eight (72.7%) patients, while three (27.3%) were asymptomatic. The mean tumor volume at SRS was 2.1 mL (median 1.2; range 0.068-7.3 mL), with a marginal physical dose of 12 Gy in all cases.
Results: The mean follow-up period was 46.9 months (range 12-84). Cranial nerve function improved after SRS in seven (63.6%) patients, with no instances of clinical deterioration and four (36.4%) patients remaining stable. At the last follow-up, all tumors showed a decrease in volume. The mean tumor volume at 1 year post-SRS was 1.6 mL (median 0.55; range 0.028-7.77 mL), at 2 years was 1.31 mL (median 0.76; range 0.19-5), and at 3 years was 1.32 mL (median 0.59; range 0.23-4.8). No adverse radiation events were observed, and no patients required further intervention due to the absence of tumor progression.
Conclusions: Stereotactic radiosurgery emerges as a safe and effective treatment for jugular foramen schwannomas, ensuring tumor control in all patients over the long term. The improvement in cranial nerve function after SRS was approximately 60%.

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770
Brain and Spine 4 (2024) 103499
Adaptive Staged Gamma Knife for large brain metastasis

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Bening Tumours (Radiosurgery Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Stereotactic radiosurgery is the preferred treatment for small and a limited number of brain metastases. However, due to the risk of toxicity, it is not recommended for large-sized metastases. The introduction of new dose fractionation protocols has offered new perspectives. It is not yet clear whether hypofractionation (3-5 consecutive days) or adaptive staged radiosurgery (two treatments repeated at intervals of 2-4 weeks) is more effective, and the optimal prescription dose is also unknown.

Methods: In this study, we report our experience in treating large brain metastases with two-staged fractionations. The inclusion criterion for the study was the presence of metastases with a volume exceeding 7 ml, which are not suitable for surgical intervention due to the metastasis location (deep or eloquent area), the patient's general conditions, or the presence of multiple brain metastases.

Between January 2019 and November 2023, we treated 25 patients with brain metastases using fractionated modalities. Of these, 14 were men and 11 were women. Two patients had three metastases with a volume greater than 7 ml; therefore, a total of 29 tumors were treated.

The average volume of the lesions was 12.1 ml (7.0 - 21.7 ml), the median prescription dose was 12 Gy, and the median interval between stages was 30 days. 25 tumors showed a volume reduction before the second fraction. Three tumors exhibited a volume variation of less than 5% and were considered stable, while one tumor increased by 30% (treated with only 10 Gy due to proximity to the brainstem) and was consequently treated surgically.

Results: The average volume of the tumors at the time of the second fraction was 7.4 ml (0.5-18.4 ml). The mean percentage reduction of the lesion was 39%, with the maximum reduction being 93%.

Eight patients exhibited neurological symptoms before the first fraction, and seven showed improvement by the second fraction. Nineteen patients were taking dexamethasone before the first fraction. Eight patients halved the dose or completely discontinued the steroid before the second treatment due to clinical improvement.

Conclusions: Two-staged Gamma Knife radiosurgery is a safe, non-invasive, and effective treatment for brain metastases. The reduction in volume between the first and second fractions allows the treatment of even large metastases with stereotactic radiosurgery, rapidly alleviating symptoms and the need for steroids.

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809
Brain and Spine 4 (2024) 103500
Optimizing outcome in radiosurgery for sphenoorbital meningioma: A case report on the critical role of planning quality.

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Bening Tumours (Radiosurgery Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: Sphenoorbital meningioma (SOM) is a unique and uncommon subset of skull-base meningiomas. Optic nerve involvement and visual impairment are not uncommon. For tumors in close contact with the optic nerves, it is very difficult both to preserve vision and inhibit tumor progression by remaining within safe dose ranges, especially for single fraction stereotactic radiosurgery (SRS). To achieve this, it is essential to perform radiosurgical planning with the utmost caution. We report radiosurgical planning, implementation, and the long-term results of SRS to manage a SOM surrounding the optic nerve.

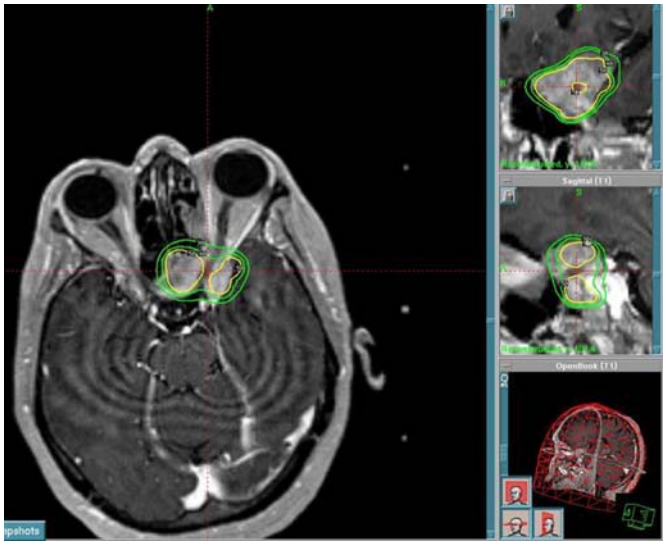
Methods: In January 2011, a 54-year-old woman was examined in another center for headache and referred to our outpatient clinic for SRS after being diagnosed with SOM. Her neurologic examination, including normal visual acuity and visual field, was unremarkable. Magnetic resonance imaging (MRI) revealed a left SOM surrounding the left optic nerve. Stereotactic radiosurgery was performed using a Leksell G frame (Elekta, Sweden), MRI-guided dose planning, and the 4C model Gamma Knife unit. Radiosurgical planning was carefully tailored to spare the left optic nerve. The tumor was treated with a 10 Gy prescription dose to 50% isodose line.

Results: The patient's postoperative course was uncomplicated, and her headaches gradually improved over the course of the next 6 months. MRI showed tumor volume regression at 12 months. Twelve years after radiosurgery, the patient is asymptomatic, including no visual field defect, and there has been no further progression of the tumor.

Conclusions: The main goal in both surgical and radiosurgical treatment of perioptic tumors is to manage the tumor without causing or increasing vision loss. A crucial step in SRS is the evaluation of treatment plans, which affects the features of the plan chosen for treatment and, subsequently, how radiotherapy patients are treated. The process involves creating a detailed map of the target area, determining the optimal radiation dose and delivery technique, and considering patient-specific factors such as anatomy and any previous treatments. Accurate planning helps maximize the therapeutic benefit and minimize the risk of adverse effects.

SRS provides a minimally invasive treatment option as an alternative to surgical resection, particularly for tumors that are challenging to access, close to vital structures, and patients with contraindications to surgery. This case demonstrates the unique technical importance of radiosurgical planning in managing a challenging neurosurgical task with long-term effectiveness and safety.

Optional Image



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268
Brain and Spine 4 (2024) 103501
The Middle Cranial Fossa: Effectiveness of Digital Tools in Modern Teaching of Neuroanatomy

Elia Lorrain [1], Joe Ryan Kremer [1], Yawen Wang [1]. [1] *MSB Medical School Berlin, Berlin, Germany*

New trends in neurosurgical education (Education & Training Parallel Session), October 16, 2024, 5:20 PM - 6:50 PM

Background: The middle cranial fossa is one of the most complex regions in neurosurgery. Understanding the skull base requires the highest level of knowledge in applied neuroanatomy. One of the greatest challenges in training medical students and neurosurgeons is the teaching of 3D-dimensional competence concerning topographical relationships in the CNS. The foundation for understanding functions and topography is based on effective teaching strategies. In this study, we address the value of digital tools in the teaching of the central skull base.

Methods: 49 medical students (30 female, 19 male) of the preclinical segment were offered virtual teaching over a period of one semester in addition to classical teaching on models and cadaver plastinates: Using digitally prepared presets

on a virtual dissection table, M1 (= "Physikum", equivalent to USMLE Step 1) relevant structures such as the pterygopalatine fossa were visualized in a targeted manner. Implementation of the supplementary teaching was exclusively digital: Onboarding was via QR code and teaching was given at a virtual dissection table. A performance evaluation survey was used to investigate the level of knowledge and expectations prior and after tutorial.

Results: Our questionnaire evaluated the performance as followed: 1= high performance/very likely, 5=low performance/very unlikely. Evaluations have revealed the following: The usage of virtual dissection table for self-study prior to our tutorial was estimated poorly (4,8 points). The level of knowledge in neuroanatomy was rated with 4,0 points. Post tutorial both ratings increased: Using virtual tools for self-study was now rated with 2,1 points and the level of knowledge improved (1,9 points). In general, teaching with digital features was universally accepted among students with an 2,3 rating.

Conclusions: Using a digital scalpel on a virtual cadaver, dissection steps can be performed repeatedly at will and anatomical relationships can be individually designed. The brains of body donors can be virtually displayed together with vascular, nervous, osseous and other surrounding structures. Our virtual teaching shows that medical students have improved with regard to topographical competence. The use of customizable, digital tools will continue to grow in modern teaching and will pave the way for innovation in educational institutions. In conclusion, we propose this method should also find its way into the anatomical training of young neurosurgeons.

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453

Brain and Spine 4 (2024) 103502

Evolution of the Treatment of Brain AVMs with High Surgical Risk: From Surgical Removal to Combined Treatments Involving Radiosurgery

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Vascular Malformations (Vascular Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Spetzler-Ponce C (SPC-C) arteriovenous malformations of the brain (bAVM) are lesions that carry a high risk when surgically treated. Our aim was to formulate a care of practice model to guide the management of SPC-C bAVMs.

Methods: We retrospectively reviewed the imaging studies and medical records of all SPC-C bAVM patients treated at our own institution, the Kuopio University Hospital (KUH). We them performed a systematic review and meta-analysis of studies that have reported treatment outcomes of SPC-C bAVM patients. Based on these results, we formulated a proposition for a care practice model.

Results: Altogether 30 patients with a SPC-C bAVM were treated with 109 interventions in KUH. Rate of complete occlusion per intervention was 68% for surgery, 0% for embolization and 44% for radiotherapy. The risk of a new, permanent deficit per procedure was 56% for surgery, 9% for embolization and 11% for radiotherapy. A multimodality treatment strategy was applied to 55%. The best outcome as measured by GOS was achieved with a combination of embolization and radiotherapy. Results from other centers are in line with ours, with a rate of treatment induced permanent deficits of 34% (range 0-62%) for surgery, 16% (range 11-21%) for embolization and 9% (range 0-25%) for radiotherapy.

Conclusions: Comparison of the procedure associated risk with the untreated clinical course suggests that embolization combined with surgery or radiotherapy should be considered as the first line treatment for ruptured SPC-C bAVMs, while radiotherapy to shrink the nidus should be the first choice for treatment of unruptured SPC-C bAVMs.

Optional Image

Treatment	Rate of total occlusion	Treatment induced immediate deficit		Treatment induced permanent deficit		Mortality	Procedures per patient
		Any	*Severe*	*Any*	*Severe*		
Surgery	68% (17/25)	64% (16/25)	56% (14/25)	56% (14/25)	44% (11/25)	4% (1/25)	1.19
Embolization	0% (0/66)	9% (6/66)	8% (5/66)	9% (6/66)	3% (2/66)	2% (1/66)	3.67
Radiotherapy	44% (8/18)	0% (0/18)	0% (0/18)	11% (2/18)	6% (1/18)	0% (0/18)	1.5

Table S2. Results of treatment procedures performed for Spetzler-Ponce grade C bAVMs in KUH. The results are presented per treatment attempt, with multiple patients having received several treatments. Rate of total occlusion is defined as the percentage of treatment times that led to radiographically confirmed total occlusion of the bAVM. New neurological deficits caused by the treatment procedures were stratified according to whether they impacted the patient's ability to work (severe). An immediate deficit was defined as a deficit present at seven days of follow-up while a permanent deficit was present at two years of follow-up.

https://doi.org/10.1016/j.bas.2024.103502

640

Brain and Spine 4 (2024) 103503

Single-Cell RNA-Sequencing Analysis of Brain Arteriovenous Malformations Reveals Novel Insights into Disease Pathogenesis and Clinical Correlations

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Vascular Malformations (Vascular Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Brain arteriovenous malformations (bAVMs) are abnormal connections between arteries and veins that bypass the capillary network and are often a cause of hemorrhagic stroke in young adults. Despite their clinical relevance, molecular mechanisms underlying the pathophysiology of bAVM, particularly in relation to neurological symptoms and risk of hemorrhage, remain incompletely understood.

Methods: This study employed bioinformatics to analyze previously published single-cell RNA sequencing (scRNA-seq) data to elucidate the transcription factor (TF) landscape in bAVM endothelial cells. Additionally, functional pathway analyses (FPA) were performed, and TFs were correlated to human genome wide association studies. Lastly, we performed bulk RNA-sequencing on 17 bAVM samples that were microsurgically dissected at the University Hospital Zurich, Switzerland, to explore the association of novel TF with clinical phenotypes.

Results: Differential gene expression analysis revealed 57 TFs showing significant differential expression within the endothelium of human bAVM lesions, compared to healthy control tissue. FPA identified key biological processes associated with these TFs, including WNT-signaling, transforming growth factor-beta signaling, and endothelial cell migration. Additionally, selected TFs correlated with genome-wide association studies, linking these newly discovered TFs to clinical phenotypes such as stroke, vascular tortuosity, and perivascular inflammation. Among all identified TF, HIF1A emerged as a key upregulated factor in venous endothelial cells of bAVMs as shown through subcluster analysis. Bulk RNA-sequencing of 17 bAVM samples showed a positive correlation between HIF1A expression levels and neurological symptoms ($p=0.006$) in patients, accompanied by downregulation of neuronal and synaptic markers.

Conclusions: Our research presents a comprehensive atlas of transcription factors in bAVMs at single-cell resolution, revealing intricate molecular dynamics and the critical influence of venous endothelial cells as shown by specific enrichment of HIF1A. These findings provide new insights into the molecular mechanisms of bAVM pathogenesis and lay the groundwork for future research and therapeutic approaches.

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840
Brain and Spine 4 (2024) 103504
The role of microsurgery in the management of cranial dural arteriovenous fistulas– a 30-year experience including 72 cases

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Vascular Malformations (Vascular Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Cranial dural arteriovenous fistulas (dAVFs) are rare vascular lesions and an increasing number are treated with endovascular embolization. However, due to the rarity and heterogeneity of dAVFs the generation of high-level evidence is challenging, and the best treatment option is still unclear. Over the past decades, only a few retrospective series have evaluated microsurgery as a primary treatment option, and it might be underrepresented in the literature. To further evaluate the role of microsurgery without prior embolization in the treatment of dAVFs we present our 30-year experience.
Methods: Medical records, imaging studies, and surgical reports of 72 patients diagnosed with a dAVF and treated with microsurgery between 1990 and 2022 were reviewed. 42 patients were treated before 2010 (prior to the use of liquid embolic agents i.e. premodern era) and 30 between 2010 and 2022 (after the introduction of liquid embolic agents i.e. modern era). We evaluated presenting symptoms, location, surgical strategy, surgical complications, occlusion status of the dAVF, and neurological outcome.
Results: No difference in patient characteristics was demonstrated between patients treated in the premodern and modern area. Overall, 46% (33/72) of patients developed neurological symptoms due to cerebral hemorrhage. 24% (17/30) of fistulas were classified as Borden type II and 76% (55/76) as Borden type III. In the combined patient cohort, a permanent surgery-associated morbidity of 6% (4/72) and an overall occlusion rate of 97% (70/72) was demonstrated. None of the patients died due to the surgery or as a consequence of the initial bleeding.
Conclusions: The presented surgical series shows that the operative morbidity is low and the dAVF occlusion rate is high in both non-sinus and sinustype fistulas. We therefore propose that microsurgery should be considered early in the treatment of both types of aggressive dAVFs.

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1328
Brain and Spine 4 (2024) 103505
Optimization of a Liquid Biopsy Technique for Detection of Somatic Mutations in Vascular Malformations

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Vascular Malformations (Vascular Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Vascular malformations (VMs) harbour activating somatic mutations in major cellular pathways, which may be targeted with various small molecule inhibitors. We aimed to optimize a liquid biopsy protocol for detecting somatic mutations from VMs using cell-free DNA (cfDNA) in lesional blood at time of endovascular therapy.
Methods: A group of 21 patients with either venous malformations (VeMs) or arteriovenous malformations (AVMs) were selected. Blood samples from the peripheral vein and efferent vein of the VM were collected. Serum was centrifuged and plasma was extracted. cfDNA was isolated from the plasma with either silica-membrane or magnetic bead technologies before being sequenced with digital droplet polymerase chain reaction (ddPCR) for targeted mutations. Variant allele frequencies (VAF) were calculated by determining the frequency of mutant alleles compared to wild-type droplets, with a threshold of VAF >0.05. External validation of cfDNA isolation methods was conducted at the Ontario Insitute of Cancer Research.
Results: cfDNA was isolated from all patients, including 4 patients with VeMs, 5 patients with extracranial AVMs, and 12 patients with AVMs of the central nervous system (CNS). We demonstrated that in 11 patients (52%), an activating mutation in either KRAS, MAP2K1 or PIK3CA were present in the efferent vein, with VAF ranging from 0.06-0.78%. These results were externally validated, showing that the same genetic mutational variant was detected with similar VAF in patients across both institutions using both isolation techniques. The magnetic bead isolation method was superior in isolating cfDNA for sequencing.
Conclusions: We demonstrate that cfDNA can be isolated from lesional blood of patients with VMs and mutations detected even from low plasma volumes and from VMs of the CNS. Magnetic bead technology can improve upon yield and purity. Validation in larger cohort of patients is required for clinical translation.

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335
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In-Situ Microsurgical Disconnection of Highly Eloquent CNS Arteriovenous Malformations

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Vascular Malformations (Vascular Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Extirpation of a nidus is the criterion-standard microsurgical method to obliterate an arteriovenous malformation completely and permanently in the central nervous system. The angioarchitecture of a nidus may preclude its safe removal when adjacent to- or within eloquent nervous tissue. Isolation of a nidus by surgically disconnecting both the arterial irrigation as well the venous drainage has been demonstrated as an effective means to treat some eloquent and/or diffuse malformations that otherwise defy treatment. We present our experience with this technique in a highly selected group.
Methods: Retrospective case review of cases treated with a planned in-situ disconnection. This strategy was selected only when it was anticipated from imaging that all arterial inflow to the malformation as well as venous outflow could be interrupted at the pial surface or in the subarachnoid space without embarrassment to the perfusion of viable neurological tissue in the region. Dural, pial and perimedullary fistulae were excluded from the analysis. So too were malformations where extirpation had been the intention and while not accomplished, the arteriovenous shunt had subsequently thrombosed.
Results: 6 cases were identified as treated in this way between 2007 and 2014. All had originally presented with central nervous system haemorrhage. In one case surgery was undertaken after a second haemorrhage. Endovascular treatment had been attempted in 2 cases but was unsuccessful. In 5 out of 6 cases in-situ disconnection was feasible based on pre-operative imaging. In one case an intramedullary aneurysm did not present to the pial surface necessitating a dorsal root entry zone myelotomy to complete treatment. 2 patients experienced post-operative neurological worsening- 1 had diplopia which normalised within 3 months. The other non-disabling dermatomal sensory loss. All arteriovenous shunts were abolished on control catheter angiography. At last follow-up no further haemorrhages had occurred (median follow-up duration 30.5months, range 9-120 months).
Conclusions: In-situ disconnection proved to be an effective means of preventing rebleeding in this series of patients who presented following haemorrhage from AVMs in highly eloquent locations. The procedure was well tolerated with minimal morbidity and merits serious consideration for similar selected lesions where definitive treatment is challenging.
Optional Image

Case ID	Age (yrs)	Gender	Presentation	Previous Treatment	Location	Angio-architecture	Post-op Neurological Exam	Residual AV Shunt?	Duration of Follow-up (months)	Comment
1	30	F	IM haemorrhage x 2	No	Cervical- C1	Diffuse AVM	Unchanged	No	120	
2	56	M	SAH	No	Cervical- C1	Diffuse AVM, aneurysm	Unchanged	No	60	
3	28	F	IVH	No	Thalamus (pulvinar)	Compact AVM	Diplopia- resolved at 3 months	No	36	
4	60	F	ICH	Embolisation	Dorsal-midbrain	Compact AVM	Unchanged	No	25	
5	35	F	IM haemorrhage	Embolisation	Cervical- C5	Compact AVM	Unchanged	No	13	
6	38	M	IM haemorrhage	No	Cervical- C6	Diffuse AVM, aneurysm	Slight increase in left LE sensory loss, otherwise unchanged	No	9	Myelotomy required to access aneurysm

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386
Brain and Spine 4 (2024) 103507
The Impact Of Sarcopenia On Overall Survival After Resection Of Cerebral Metastasis In Patients With Non-small Cell Lung Cancer

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Frailty is an established predictor of response to therapy and survival in patients with brain metastasis and can be measured using temporal muscle volumetry (TMV) as a surrogate parameter. However, the role of frailty in patients undergoing surgical resection is still largely unknown.
The aim of this study is to determine the impact of sarcopenia on survival after resection of brain metastasis in non-small cell lung cancer (NSCLC).
Methods: We performed a single-center retrospective study including patients undergoing resection of supratentorial NSCLC metastasis. Patients were included between February 2011 and December 2020. Demographic data, Karnofsky Performance Score (KPS), Charlson Comorbidity Index (CCI) and Clinical Frailty Score (CFS) were compiled before surgery. Temporal muscle volumetry as surrogate for sarcopenia was performed using T1 weighted MRI images using brainlab elements v4.0.0.108 (Brainlab AG. Munich).
Results: 179 consecutive patients with a median age of 63 (56-69) years were included in this study (64/ 35.8% were female); while 64 (35.8%) patients had a single lesion. Median follow-up after surgery was 11 (0-120) months. PFS was 8 (3-23) and OS 11 (8-34) months. The median KPS before surgery was 80 (70-90), CCI 9 (8-10) and CFS 3 (3-4), classifying 37 (20.6%) as frail. Median temporal muscle volume (TMV) was 20.8 (14.2-26.7) cm3. (All median, IQR)
Frailty as assessed by CFS correlated with age (r=0.361 p>0.001), CCI (r=0.229 p=0.014), pre- and postoperative KPS (r=-0.809 p>0.001; r=-0.715 p>0.001). TMV correlated with frailty (r=-0.222 p=0.018) and postoperative KPS (r=0.195 p=0.038). However, frailty according to CFS (PFS: 24 vs 20 months, p=0.455; OS: 34 vs 29 months, p=0.278) and median TMV (PFS: 32 vs. 21 months, p=0.9; OS: 29 vs. 25 months, p=0.94) alone did not predict differences in survival. A ROC analysis to define a cut-off for TMV and frailty showed an optimal discrimination for 1-year survival at 15.5(±9,5) cm3. The comparison of patients above and below this cut-off revealed a significant difference in OS of 34.5 vs 10.3 months (Chi2=16.953 p>0.001) but not in PFS (27.7 vs 16.3 months; Chi2=0.858 p=0.354). In the multivariate analysis sex, sarcopenia, radiation- and immunotherapy predicted a longer PFS and OS.
Conclusions: In the presented cohort, sarcopenia is an independent predictor of OS after surgery of cerebral metastasis in NSCLC in addition to radiotherapy. Consideration of sarcopenia in surgical decision-making can improve patient selection for different treatment modalities

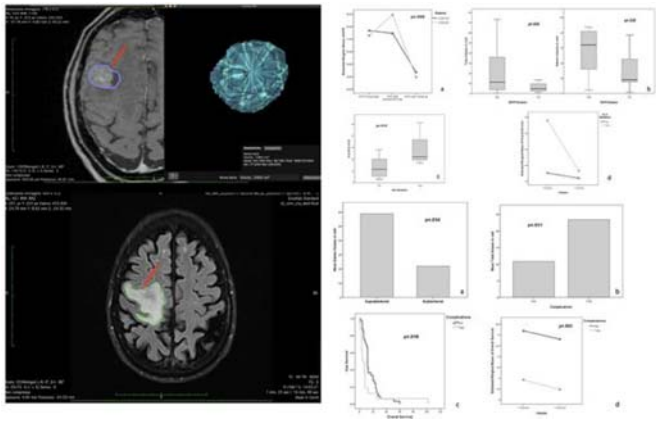
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174
Brain Metastases
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EGFR-Driven Mutation in Non-Small-Cell Lung Cancer (NSCLC) Influences the Features and Outcome of

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Brain metastases (BMs) is one of the most frequent metastatic sites for non- small-cell lung cancer (NSCLC). It is a matter of debate whether EGFR mutation in the primary tumor may be a marker for the disease course, prognosis, and diagnostic imaging even for BMs. To understand the significance of EGFR positivity for the natural course of NSLC-derived BMs, we carried out the present study.
Methods: We performed a retrospective analysis to identify the relevance of EGFR mutations and prognostic factors for diagnostic imaging, survival, and disease course within a cohort of 81 patients affected by NSCLC-BMs. Imaging was carried out using MRI at various time intervals. The disease course was assessed using a neurological exam carried out at three-month intervals. The survival was expressed from surgical intervention.
Results: BM size and and peri-lesional edema were significantly associated with the EGFR mutations (for BM's volume 22.38±21.35 cm3 in EGFR expressing BMs versus 7.68±8.44 cm3 in non-EGFR expressing BMs while for peri-lesion edema was 72.44±60.71cm3 versus 31.92 cm3 p=0.046 and p=0.028, respectively). was not associated with any specific neurological symptom but the incidence of pre-operative seizures (p=0.004). EGFR was not associated with survival, while the expression of ALK as previously reported was strongly associated with survival.
Conclusions: The presence of EGFR mutations significantly correlates with greater edema and mostly a higher seizure incidence of BMs from NSCLC. In contrast, EGFR mutations do not affect the pa- tient's survival, the disease course, and focal neurological symptoms but seizures. This contrasts with the significance of EGFR in the course and prognosis of the primary tumor (NSCLC).
Optional Image



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167
Brain and Spine 4 (2024) 103509
Asymptomatic vs. Symptomatic Brain Metastases: Surgical Treatment Results

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Asymptomatic brain metastases (BM) patients are prime candidates for novel systemic therapy options. Treatment results need to be compared to the current standards of local therapy for BM, including surgery. This study details surgical treatment results in asymptomatic vs. symptomatic patients.
Methods: We retrospectively analyzed survival and functional outcomes in 328 consecutive patients (365 surgeries) operated for one or more BM 2015-2022. Symptom burden was assessed using the presurgical NANO score for neurological deficits, the KPI for functional health status and by occurrence of seizures. Patients with a NANO score 0-1, KPI 90-100% and without seizures were classified as asymptomatic (asymp.), whilst patients with a NANO score ≥ 4 or a KPI $< 70\%$ were classified as severely symptomatic (symp.), and all others as moderately symp..
Results: Median OS was 11.5 (95%CI 8.9-14.0) months. 67.6% of the patients had already died at the time of analysis. Asymp. patients lived significantly longer (medOS: 17.4 (10.7-24.1) months; cf. symp.: 8.3 (6.2-10.4) months; $p < 0.001$). Complication rates (CTCAE III-V) were much lower for asymp. vs. symp. cases: 4.3 vs. 7.3% surgical (p = NS), 3.4 vs. 10.7% medical ($p = 0.022$), and 0.9 vs. 5.8% persistent new neurological deficits ($p = 0.04$). Asymp. patients underwent significantly more often postoperative treatment (radiotherapy: 89.8 vs. 72.3%, $p < 0.001$; systemic treatment: 74.4 vs. 58.9%, $p = 0.012$). When compared to moderately symp. patients, severely symp. cases lived significantly shorter (medOS: 4.1 (2.0-6.2) vs. 11.5 (7.9-15.1) months; $p < 0.001$), had higher

complication rates (surgical: 11.2 vs. 5.2%, medical: 14.6 vs. 8.1%, new persistent neurological deficits: 7.9 vs. 4.4%, p = NS) and less intensive postoperative therapy (radiotherapy: 59.8 vs. 80.6%, p = 0.001; systemic treatment: 43.8 vs. 68.9%, p < 0.001).
Conclusions: Our results can serve as a benchmark for surgical treatment of patients with asymptomatic BM who may expect to have systemic therapy options. We show that survival and functional outcomes worsen significantly with increasing symptom burden. Treatment paradigms deferring surgical BM therapy will have consider poorer outcomes that come with "late" surgery for symp. patients after failure of primary systemic treatment.

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996
Brain and Spine 4 (2024) 103510
Treatment of solitary brain metastases: comparison of surgical resection followed by radiotherapy with preoperative stereotactic radiosurgery

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Brain metastases are a frequent complications of primary cancer. The historical standard in the management of brain metastases has been surgical resection followed by radiotherapy. Preoperative stereotactic radiosurgery is an emerging treatment strategy for metastatic brain disease.
Methods: This retrospective study included 66 patients with a confirmed diagnosis of solitary brain metastasis. The cohort comprised two treatment groups: the first group received conventional treatment (surgical resection followed by radiotherapy), while the second group received preoperative stereotactic radiosurgery. The patient age ranged from 36 to 75 years old, with a mean age of 52.9±10.4 years. Local control, leptomeningeal progression, overall survival and complications were analyzed.
Results: In postoperative radiotherapy group local control rates were 88.2%, 79.4% and 42.9% at 3, 6 and 12 months; while in preoperative radiotherapy group local control rates were 100%, 93.3% and 66.7%, respectively. Leptomeningeal spread was observed in 11 patients, 8 patients from the first group and 3 patients from the second group. 1-year overall survival was 73.5% (25) patients in the first group and 84.4% (27) in the second group. Complications were observed in 12 patients (18.2%).
Conclusions: Preoperative radiosurgery followed by surgical resection has emerged as the best treatment regimen for patients with solitary brain metastases. This strategy provides effective and potentially better local control rate and lower incidence of leptomeningeal progression.

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539
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Large supratentorial intraventricular meningiomas: post-operative analysis and results of structural and functional visual field deficits following a lateral anatomically-based trajectory

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The atrium of the lateral ventricle is the most common location for intraventricular meningiomas (IVM). There is no area on the lateral surface of the atrium that is totally devoid of a relationship with the optic radiation (OpR). Surgical approach to the atrium via the transtemporal or transparietal approach from the lateral surface may be necessary for large meningiomas. With the alternative medial posterior interhemispheric approach, the presence of a large mass lesion may preclude easy access and the potentially required degree of retraction may be damaging. Although objective assessment of visual field (VF) defects and tractography (DTI) accurately estimates the extent of structural damage by the surgical approach, it is the functional outcome by establishing daily life limitation by the defect is what determines the quality of life.
Methods: Out of 20 cases of supratentorial IVM who had complete total resection, 17 cases (all > 4cm & 9 > 5cm) were operated upon through a lateral trajectory using a tract-sparing approach with dissection in parallel to the white matter fibres. A transcortical trans-sulcal approach was employed through either the posterior part of the superior temporal sulcus (n = 10) or the intraparietal sulcus (n = 7). Two additional cases were located in the IIIrd ventricle and one in the body of the lateral ventricle and were resected via the transcallosal approach. DTI studies were performed for 8 out of 17 patients who had undergone the tract-sparing approach. Tensor map (one tensor per voxel) was extracted and fractional anisotropy (FA) colour maps were generated. VF outcomes were assessed using Humphrey Perimeter and the visual field index (VFI) was recorded. The impact of VF defect on daily activities, employment and permission to drive was recorded.
Results: Total resection was achieved in all 20 cases, but one case located in the third ventricle had a doubtful tiny area suspicious of residual meningioma which was the only recurrence 9 years later. Overall There was no mortality and complications included 2 CSF leaks, 2 DVT and 3 required CSF diversion procedures. No new speech deficits but transient dysphasia in 3.
In the 17 cases operated upon through a lateral trajectory using a parallel tract-sparing approach a clinically detectable VF defect occurred in 4 (the defect was pre-existing in 3 due to preoperative spontaneous peri-lesional haemorrhage in one and oedema in the other 2 at presentation). Two patients exhibited no clinical or functional deficit. In 9 cases the extent of the VF defect had no impact on functional performance (7 minor defect and 2 adapted to the deficit). Cognitive dysfunction precluded reliable assessment in 2. Varying degrees of VF defects were detected on formal testing and correlated with the disruption of the OpR demonstrated on DTI. Reconstructing the optic radiations was of sufficient quality DTI and quantification of optic radiation disruption was correlated with permanent VF defects. The OpR Volume ratio did not always correlate with the VFI. The OpR Volume ratio showed some correlation with the size of the resected meningioma however in 3 the VF defect was pre-existing.
Conclusions: Appreciation of the white matter tract orientation in relation to the atrium of the lateral ventricle and application of a tract-sparing parallel approach minimises rather than totally avoids disruption of the optic radiation via lateral approaches to the ventricles.

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811
Brain and Spine 4 (2024) 103512
Upfront Frameless Hypofractionated Gamma Knife Radiosurgery for Large Posterior Fossa Metastases

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The management of large posterior fossa metastases presents a unique challenge in neuro-oncology, demanding an approach that balances efficacy, safety, and preservation of neurological function. Traditionally, the treatment paradigm for large brain metastases, particularly those in the posterior fossa, has heavily relied on surgical resection. In recent years, hypofractionated Gamma Knife radiosurgery (hf-GKRS) has emerged as a promising modality, offering a targeted, minimally invasive approach with a favorable side-effect profile. This retrospective, single-center study evaluated patient outcomes of upfront frameless hf-GKRS for large posterior fossa metastases.
Methods: Thirty-one patients with 37 large (>4 cm3) posterior fossa metastases were included for analysis. There were 20 male patients, and the median age of the patients was 64 years (range, 26-83 years). The most common primary diagnosis was non-small cell lung cancer (n=12). The median target volume was 8.1 cm3 (range, 4.10 cm3-34.80 cm3). hf-GKRS was administered in 3 daily fractions for 11 lesions (median volume=6.7 cm3) and 5 daily fractions for 26 lesions (median volume=8.25 cm3). The median total dose to the margin was 30 Gy (range, 24-30 Gy), with a dose per fraction of 6 Gy (range, 5-9 Gy). Key outcomes assessed included local control, distant progression-free survival, overall survival, and associated toxicities.
Results: The mean follow-up was 12.6 months (range, 2-44 months). LC was achieved in 89.2% of metastases. LC estimates at 6, 12, and 24 months were

100%, 92.9%, and 69.6%, respectively. Distant progression-free survival rates were 73.3% at six months, decreasing to 55.9% at one year. At the end of the follow-up, 83.9% of patients were alive. Radiation necrosis occurred in 2 patients (8.1%), while no cases of leptomeningeal disease were observed.
Conclusions: A high tumor control rate was achieved over sufficient follow-up, which demonstrates the efficacy and safety of upfront hypofractionation in unresected, large posterior fossa metastases in selected patients.

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163
A prospective study on 100 consecutive patients
Brain and Spine 4 (2024) 103513
Predicting Critcial Surgical Characteristics of Intracranial Meningiomas on Preoperative MRI

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Extraaxial tumors (Neuro-Oncology Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Our aim was to identify magnetic resonance imaging (MRI) markers that are able to predict critical surgical characteristics of meningiomas such as consistency, surgical plane of cleavage, and vascularity. Those are directly related to surgical decision making and operative morbidity.
Methods: 100 consecutive patients were included in this prospective study trial. All patients underwent a dedicated preoperative MRI protocol on the same MRI scanner. Regions of interests (ROIs) were set within the meningioma to measure signal intensities (SI). In addition, an intraoperative surgical questionnaire was obtained for each patient and histological analysis was performed for each meningioma.
Results: 93 patients were included in the final analysis. The median meningioma volume was 17.8cm3 (range 0.4 – 185.6). The average duration of surgery was 176 minutes (range 35 – 610). Meningioma consistency (a) and vascularity (b) significantly correlated with higher SI on T1-weighted imaging before (a) $p=0.002$, b) $p=0.009$) and after (a) $p=0.020$, b) $p=0.002$) contrast medium application, time of flight (TOF) sequences (a) $p=0.001$, b) $p=0.019$), and T2-weighted imaging (b) $p=0.019$). The surgical plane of cleavage did not show any correlations with preoperative MRI, but the type of dissection plane was significantly correlated with the duration of surgery ($p=0.048$) and the length of hospitalization ($p<0.001$). Meningioma volume was significantly correlated with length of stay ($p<0.001$) and duration of surgery ($p<0.001$). Lower SI on T2-weighted imaging were significantly correlated with histological analysis ($p=0.044$).
Conclusions: Surgical key aspects of meningioma including consistency and vascularity can be predicted on conventional preoperative MRI sequences. This may improve patient counseling and surgical planning.

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456
Brain and Spine 4 (2024) 103514
Survival and Neurological Recovery Following Atlantooccipital Dislocation (AOD): Insights from a Multicenter Analysis

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Spinal Trauma (Spine Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Traumatic atlantooccipital dislocation (AOD) is a serious consequence of high-energy trauma, now seen as potentially survivable due to advancements in prehospital care and increased recognition of craniocervical junction injuries. Immediate surgical stabilization is crucial, emphasizing the importance of prehospital immobilization without traction. This study aims to examine contemporary management strategies and outcomes associated with AOD.
Methods: A multicenter retrospective analysis was conducted at six level III trauma centers in Germany. Cases of AOD from 2007 to 2023 were analyzed, along with data from road traffic accident (RTA) fatalities undergoing autopsy between 2004 and 2018.
Results: Twenty-two AOD cases were documented, with patients averaging 42 years old (range: 9-86). Trauma mechanisms included car accidents (7), motorcycle accidents (6), falls (3), bicycle accidents (3), and others (3).
Upon admission, the mean Glasgow Coma Scale (GCS) score was 7. Eighteen patients received prehospital immobilization, while one patient died before surgical intervention. The remaining 21 patients underwent stabilization from the occiput to C2/3, with 32% mortality and 80% of survivors experiencing improved neurological outcomes post-surgery. Thirty-two RTA fatalities with AOD were autopsied, revealing predominance among males, mainly powered-two-wheeler riders and vulnerable road users. Multiple trauma was the primary cause of death in the majority of cases.
Conclusions: AOD remains an infrequent yet significant consequence of high-energy trauma. Effective prehospital care, including cervical spine immobilization, alongside prompt diagnosis and surgical stabilization, can enhance neurological recovery and patient outcomes. Heightened awareness of craniocervical junction injuries and comprehensive imaging modalities are vital in clinical practice.

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1534
Brain and Spine 4 (2024) 103515
Complex Thoracolumbar Fractures with and without Spinal Cord Injury: Changing Surgical Management and clinical outcome over Ten years

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Spinal Trauma (Spine Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Thoracolumbar fractures caused by high axial load trauma may lead to spinal cord injury due to dislodged bone fragments and are often associated with neurologic deficits. Optimal treatment, timing of intervention, and whether a posterior or a combined 360 approach should be performed remain debated.
Methods: We conducted a retrospective analysis of all patients treated for complex traumatic thoracolumbar fractures at our department from January 2012 to December 2023 with spinal cord compression on MRI. We included patients with spinal cord injury, mild neurological deficits, and those who were symptom-free. Patients with osteoporotic fractures or ankylosing spondylitis were excluded.
Results: Of 770 patients treated for spine fractures, 121 experienced traumatic thoracolumbar burst fractures. At admission, 69 patients (57%) exhibited no neurological deficit, whereas 18 of the 51 patients with neurological deficits were classified as AIS A or B, indicating severe spinal cord injury (SCI). All patients received dorsal fixation; 67 patients (55%) underwent a staged procedure with vertebral body replacement after a median of five days, during which microsurgical ventral decompression was performed in 32 patients (47%). Improvement by discharge was noted in half of these patients. A comparison of surgical strategies between 2012-2017 and 2018-2023 revealed a doubling in the number of surgeries performed. The proportion of patients undergoing dorsal and combined ventral decompression decreased from 13% to 8%, while those showing improvement increased from 11% to 42%. The median hospital stay was 21 days.
Conclusions: Patients with severe thoracolumbar junction fractures following high-energy trauma benefit from early surgical intervention, regardless of the presence of neurological deficits. Our findings suggest that a strategy of percutaneous dorsal fixation combined with early ventral decompression minimizes complications associated with dorsal decompression alone (e.g., blood loss, dural tear) and shows promising results concerning neurological recovery after SCI.

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71
Brain and Spine 4 (2024) 103516
C2 odontoid fracture: Assessing the impact of concurrent C1-C2 rotatory subluxation on conservative management

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Spinal Trauma (Spine Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The association between a type 2 odontoid fracture and dislocation

of the C1-C2 joint is rarely found in the literature, that is why its importance in the treatment decision seems to be underestimated. We report 115 cases of odontoid fracture type 2 with/without C1-C2 subluxation. We evaluated the need for operation and the conservative management failure rate.
Methods: This was a single-center, retrospective, cohort study of patients with odontoid C2 fractures with/without C1-C2 rotatory luxation who were treated at our institution. Patients were classified according to the type of odontoid fracture according to the Alonzo classification and whether or not there was a C1-C2 dislocation according to the Feldings classification. We classified patients according to whether they were treated with collar or surgery. We looked for the number of patients that were treated with collard and underwent surgery due to failure of conservative treatment. We performed a logistic regression between the degree of dislocation and failure of conservative treatment to determine the odds ratio and the ROC curve.
Results: We analyzed 131 patients that were diagnosed with C2 fractures with/without C1-C2 rotatory luxation and were suitable for the analysis. We obtained 115 patients with a type 2 Alonzo Fracture and 16 with type 3, no Type 1 were found in our cohort. Patients were grouped if they had or not a C1-C2 luxation and graded accordingly to Feldings classification. We found that patients with odontoid fractures type 2 have in 30% of cases at least a grade 2 luxation or more, eighty-nine percents of patients needed an intervention . Among patients initially treated conservatively, 29 (30%) experienced treatment failure, leading to surgery. In these patients a statistically significant correlation was found when the subluxation grade 2 and more was present, compared to patients where C1-C2 rotatory subluxation was not existing or mild (grade 1) with an odd ratio of 34, with an AUC of 0.66
Conclusions: C2 Alonzo type II fractures associated with C1-C2 rotatory dislocation grade 2 and more is a prognostic factor that can predict failure of a conservative treatment. It may be of special importance to have additional studies reporting this association as it could improve the management of this pathology and avoid delay of surgical intervention.

https://doi.org/10.1016/j.bas.2024.103516

591
Brain and Spine 4 (2024) 103517
Surgical Approach Of Thoracolumbar Somatic Fractures: The Limit Of Percutaneous Stabilization. A Multicentric Retrospective Clinical Study

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Spinal Trauma (Spine Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The correction of thoracolumbar kyphosis, generated by thoracolumbar fractures (TLFs) is essential to guarantee better clinical and functional results for patients. There are no studies about the relationship between global spinal parameters in thoracolumbar fractures and post-surgical outcomes, due to usual association of these parameters only to degenerative pathology. In this study we aimed to understand how the post-surgical recovery of sagittal alignment can represent a clinical impact and how the treated fracture level and the surgical approach (open versus percutaneous) can influence the reduction of kyphosis.
Methods: A multicentric retrospective clinical study analyzed a cohort of patients with traumatic vertebral fractures, evaluating relations, in different surgical approaches, between radiological features (including global spinal parameters) and patient's status in the immediate postoperative and long-term outcomes.
Results: 188 patients with post-traumatic vertebral fractures treated surgically by percutaneous or open technique were analyzed. The percutaneous technique showed significant advantages in terms of blood loss, immediate post-surgical pain and surgical times. Among pelvic parameters, segmental lordosis (SL) variation showed greater variability. The recovery of SL correlates with long-term pain recovery. In TLF, open surgery favors more significant average SL recovery (4.34° versus 1.08°, p=0.003), showing a tendency to have more patients with complete long-term pain relapse.
Conclusions: In TLFs, percutaneous technique provides shorter surgical times, less blood loss, and more significant reduction in immediate postoperative pain. Open surgery allows greater recovery of SL than percutaneous procedures in TLFs. SL correction is closely related with long-term pain recovery, especially in TLFs. Nowadays, global spinal parameters are cornerstones for surgical planning in degenerative spinal pathology. This study suggests the importance of extending the application of these spinal parameters in traumatic pathology, as a planning guide for surgical treatment.

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404
Brain and Spine 4 (2024) 103518
Surgical fixation of thoracolumbar fractures in the super-elderly population

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Spinal Trauma (Spine Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The global average life expectancy has been increasing steadily as the quality of healthcare continues to improve. There is a paucity of data looking at surgical fixation of thoracolumbar spine fracture in patient ≥80 years old (super elderly). Hence, the aim of this study is to look at whether there is higher rate of complications from surgical fixation in the super elderly.
Methods: We performed a single centre retrospective study of patients who underwent surgical fixation of thoracolumbar spine fractures from 2019 to 2023. Patients were dichotomized into those who were 80 years old and above (super elderly) and those below the age of 80 (normal). Variables include sex, age, Charleston comorbidity index, presence of osteoporosis, length of hospital stay, complications, 6 and 12 months' implant status and mortality. Incidence of revision surgery, rate of implant loosening and mortality between the 2 groups were analyzed.
Results: Total of 132 patients were included, 45 patients in the super elderly group and 87 patients in the normal group. Although the super elderly had a higher rate of osteoporosis (p<0.0001), there was no significant difference between the 2 groups with regards to revision surgery (p= 0.884) needed. However, the super elderly patients were noted to have the revision within 6 months of the index surgery while the patients in normal group required it after 6 months. Despite the super elderly having a higher rate of osteoporosis and higher proportion of patients with severe comorbidities (p=0.0002), there was no significant difference in rate of implant loosening at 12 months' follow up (p=0.665) or all-cause mortality (p=0.556).
Conclusions: Despite having a higher incidence rate of osteoporosis, there is no significant difference between the 2 groups in terms of implant complications, revision surgery required or all-cause mortality. Hence, surgical fixation of thoracolumbar spine fractures in people above 80 years old should be considered despite their advanced age.

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323
Brain and Spine 4 (2024) 103519
Outcomes and complications of the surgical treatment of pituitary adenomas with cavernous sinus invasion

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Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Surgical treatment of pituitary adenomas (PA) with cavernous sinus (CS) invasion with Knosp 3 and 4 grades is a challenging problem. The aim of the current study is to present the results and complications rate of surgical treatment of patients with PA with CS invasion with Knosp 3 and 4 grades via transnasal endoscopic rout.
Methods: The results of surgical treatment of 69 patients were retrospectively analyzed. Primary PAs were observed in 47 patients, recurrent PAs - in 22 cases, 1 patient had prior radiosurgical treatment.
Results: Gross total tumor resection was achieved in 23 (33.4%) patients, subtotal resection - in 28 (40.6%) patients, and partial resection of the PA in 18

(26%) patients. The most frequent complications were diabetes insipidus in 10% (n=7) patients and nasal cerebrospinal fluid leak in 5.7% (n=4) patients; 2.8% (n=2) patients developed meningitis; 1.4% (n=1) had cranial nerve III palsy; 1.4% (n=1) developed adrenal insufficiency; 1.4% (n=1) had intracranial hemorrhages. There were no injuries of the internal carotid artery and no mortality in the study group.

Conclusions: Transnasal endoscopic resection of PA with CS invasion with Knosp 3 and 4 grades can be radical with good parameters of efficacy and safety for surgeons with sufficient experience.

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314
Brain and Spine 4 (2024) 103520
Endoscopic Transsphenoidal Approach to Pediatric Pituitary Adenomas

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Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Pediatric pituitary adenomas are rare lesions and account for approximately 3% of all supratentorial tumors in children. There is a paucity of reports on endoscopic transsphenoidal surgery in children. The aim of this study was to assess outcomes of endoscopic pediatric pituitary adenoma surgery at a high volume tertiary center.

Methods: Between August 1997 and November 2023, a total of 4809 cases underwent endoscopic transsphenoidal surgery for pituitary adenoma at the Department of Neurosurgery and Pituitary Research Center of the Kocaeli University School of Medicine. Of these, 73 (1.5%) pediatric patients (26 males, 47 females) (age <18 years) with a pathological diagnosis of pituitary adenoma were retrospectively reviewed.

Results: The mean age of patients was 15.5 ± 2.3 years. Among the hormone-secreting adenomas, 19 (33.4%) were adrenocorticotrophic hormone secreting, 14 (24.5%) were growth hormone secreting, 19 (33.4%) were prolactin secreting, and 5 (8.7%) were both growth hormone-prolactin secreting. Gross total resection was achieved in 93.75% of nonfunctional tumors. Five sparsely granulated corticotroph tumors, 5 sparsely granulated somatotroph tumors, and 11 densely granulated lactotroph tumors were classified as aggressive histopathological subtypes.

Conclusions: The characteristics of the pediatric population and the aggressiveness of the disease in this population pose considerable therapeutic challenges. To increase treatment success, current adjuvant therapies that are appropriate for the morphological and biological characteristics of the tumor are required.

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360
Using Dynamic Contrast-Enhanced MRI for Predictive Analysis of Pituitary Adenoma Consistency
Brain and Spine 4 (2024) 103521
Unveiling the Intricacies

Pooja Choudhary [1], Prakash Nair [1], Hariharan Venkat Easwer [1], Kesavapisharady Krishnakumar [1], P. Rajalakshmi [1], C. Kesavadas [1]. [1] *Sree Chitra Tirunal Institute for Medical Sciences And Technology, Trivandrum, India*

Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: The most common sellar region lesion is a pituitary adenoma which is surgically managed either endoscopic or transcranially. Optimal outcomes require preoperative assessment of tumor consistency. This study aims to assess Dynamic contrast-enhanced MRI (DCE-MRI) ability(based on pharmacokinetics) to predict pituitary adenoma consistency by correlating pharmacokinetic parameters with histological results.

Methods: We prospectively studied 50 patients with pituitary adenoma admitted to our hospital from March 2022 to March 2023. DCE-MRI was done in all cases. Used the Extended Tofts model to calculate tumor pharmacokinetics (ve, Ktrans, Kep). [ve = volume of extravascular extracellular space (EES) per unit volume of tissue, Ktrans = volume transfer constant between blood plasma and EES, Kep = rate constant between EES and blood plasma]. Tumor consistency is evaluated by a blinded neurosurgeon, categorized as soft or hard/firm. Areas of collagen were compared to the total tumor volume, to calculate the percentage of collagen content.

Pearson's correlation coefficients will be used to analyze correlations between the MRI parameters, PCC, and hormone levels.

Results: In our study, 50 participants (mean age: 48 years) were included. Soft and hard adenomas were found in 66% and 34% of participants, respectively. Firm adenomas had significantly higher collagen content ($p < 0.01$) and extravascular extracellular space (ve) ($p = 0.03$), and significantly lower blood plasma volume (vp) ($p = 0.04$) than soft adenomas. No other MRI parameters showed significant differences. Correlation between collagen content and ve was significant (n=50, $r = 0.591$, $p < 0.01$). For diagnostic accuracy, receiver operating characteristic curves were plotted. The area under the curve for ve was 0.294, showing higher accuracy (83.6) than other MRI parameters.

Conclusions: Pituitary adenomas are complex sellar-suprasellar tumors. Preoperative understanding of consistency impacts morbidity and mortality. We assessed DCE-MRI's quantitative parameters and their correlation with intraoperative consistency and collagen content.

Optional Image

Table - MRI parameters and its co-relation with firm adenomas

PARAMETERS	AUC	SENSITIVITY (%)	SPECIFICITY (%)	ACCURACY (%)
rT1	0.239	60	65	63
V_e	0.294	67	99	84
Ktrans	0.191	81	72	71
Kep	1.69	60	69	63

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137
Brain and Spine 4 (2024) 103522
Predicting Pituitary Gland Location During Endoscopic Endonasal Surgery Using Machine Learning Model

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Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Identification of the pituitary gland during surgery for removal of pituitary neuroendocrine tumor (PitNET) can be challenging but is associated with better preservation of the pituitary gland tissue and lower postoperative hormonal dysfunction. This study focused on developing and validating a machine learning (ML) tool designed to accurately identify the pituitary gland during endoscopic endonasal surgery for sellar lesions.

Methods: A total of 52 anonymized surgical videos of patients who underwent endoscopic endonasal transsphenoidal surgery for resection of PitNET were obtained. Videos were recorded in high definition 4K resolution using Karl Storz Endoscopy equipment. The editing process involved trimming the videos to focus on the critical phases of the surgery, starting from the moment the dura is opened and ending before the closure and reconstruction of the skull base. Using the web-based annotation platform Encord, frames were manually annotated using a polygon shape to delineate the pituitary gland's position when present. AI predictions were evaluated using a single hold-out set method.

Results: A total of 2316 frames underwent annotation, with a distribution of 60%, 20% and 20% allocated for training, validating, and testing the ML model, respectively. Performance metrics were as followed: accuracy of 97.8%, specificity of 98.7%, recall of 27%, precision of 18.6% and a F1-score of 0.22.

Conclusions: This study demonstrates the feasibility of using deep learning technology for anatomical recognition, specifically identifying the pituitary gland in PitNET surgeries. The model has a high accuracy level in correctly classifying pixels belonging to either the pituitary gland or the surrounding non-gland areas The model's low precision reflects a propensity misclassifying adjacent background tissue as pituitary gland. With further refinement and enhancements in precision, this tool could be an invaluable adjunct in helping

neurosurgeons and trainees to identify the pituitary gland during surgery and optimally improve postoperative pituitary hormonal function.

Optional Image

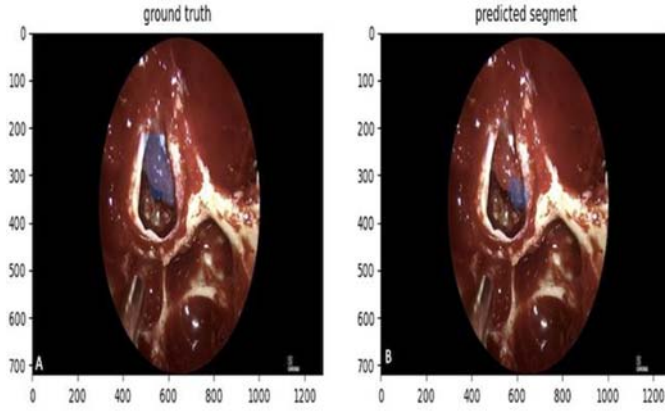


Figure 1. Example of the manual annotation (ground truth) of the pituitary gland (A) and the model prediction (B). The model is predicting accurately a segment of the pituitary gland while not defining its entire boundary.

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334

Brain and Spine 4 (2024) 103523

Automatic Grading of the Zurich Pituitary Score: Using Semantic Segmentation and a Seed-Growing Algorithm

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Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

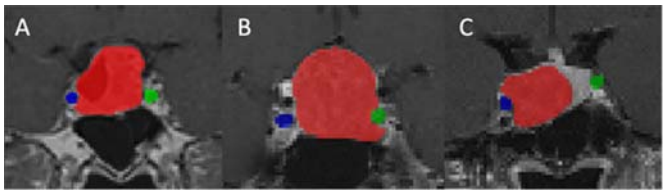
Background: Precise determination of pituitary adenoma can pose a challenge for inexperienced raters. It is conceivable that a fully automated pipeline, determining the Zurich Pituitary Score, offers a more objective alternative.

Methods: We retrospectively collected scans from our center (University Hospital Zurich) and manually labeled tumor tissue and the cavernous segment of the internal carotid artery. First, a nnU-Net was trained to segment the labeled tissues. Subsequently, maximum horizontal tumor diameter and minimum intercarotid distance were extracted. Last, a seed-growing algorithm checked for total enclosing of the carotid by tumor tissue to determine the Zurich Pituitary score.

Results: 213 patients were included, of which 128 (60%) had a non-functioning PA, 49 (23%) a growth-hormone secreting and 19 (9%) a prolactin producing tumor. According ZPS values were I=61 (29%), II=91 (43%), III=39 (18%) and IV=12 (6%). Dice scores (mean ± standard deviation) for the tumor, left and right carotid in training validation of 0.78 ± 24, 0.62 ± 0.31 and 0.62 ± 0.30 as well as 0.79 ± 0.24, 0.59 ± 0.32 and 0.58 ± 0.33 for holdout performance were reached. Intraclass correlation coefficients for the intercarotid distance [95% CI], maximum horizontal tumor diameter [95% CI], and the quotient [95% CI] from the two was 0.89 [0.80, 0.94], 0.91 [0.82, 0.96], 0.80 [0.66, 0.89]. Cohen's unweighted kappa [95%] for the ZPS was 0.57 [0.36, 0.78].

Conclusions: We developed and internally validated both a segmentation algorithm for pituitary adenoma and the cavernous segment of the internal carotid artery segment as well as a subsequent automatic determination or the Zurich Pituitary Score. Generally, robust segmentation performance was achieved. ZPS evaluation generally worked well. For raters with low experience, our approach offers a solid and objective alternative.

Optional Image



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1458

Brain and Spine 4 (2024) 103524

Endoscopic Endonasal Approach to the lateral compartment of cavernous sinus: step-by-step surgical technique, anatomical considerations and clinical experience

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Recent advances in pituitary neuroendocrine tumors management (Skull Base Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

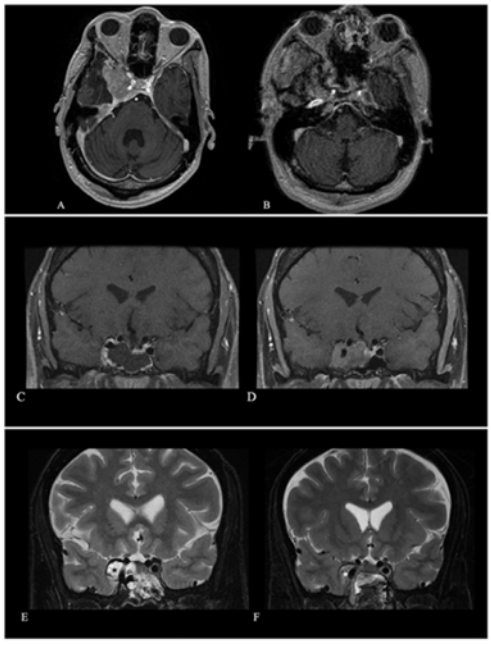
Background: Endoscopic endonasal approaches have reinvigorated the move towards surgical treatment of pathology within the cavernous sinus. However, the lateral compartment, defined as the space between the carotid and the lateral wall, remains a challenging area to operate in. Herein we describe a step-by-step anatomical and surgical considerations of the technique, as well as our experience with EEA in this compartment.

Methods: The surgical technique involves a wide sphenoidotomy and a transpterygoid approach towards the side of interest. The bone overlying the parasellar and paraclival carotid is removed as well as the bone overlying the superior orbital fissure, Mecke's cave, and the pituitary gland. The dural opening starts in the anterior wall of the cavernous and is extended to the foramen lacerum inferiorly and the proximal dural ring superiorly. After mild packing of the cavernous with hemostatic agents, the dissection continues aiming to identify the abducens nerve, and separate from the horizontal cavernous carotid. The inferolateral trunk is coagulated and divided to untether the carotid and allow medial mobilization. Six cadaveric dissections were performed. Our institutional experience over the past-decade was reviewed.

Results: An approach to the lateral compartment was undertaken in 18 patients, including 11 pituitary adenomas, 3 chondrosarcomas, 2 chordomas, and 2 meningiomas. Postoperative abducens nerve and trigeminal nerve paresis occur in 4 and 1 patients, respectively. Vascular injury involving the carotid occurred in 2 patients without permanent sequelae early in the series, but evolution of the technique has minimized complications in later years without any vascular injury.

Conclusions: Although accessing the lateral compartment endonasally is still challenging, refinement of the surgical technique has made it safer and more effective. Appropriate case selection and intra-operative decision making remains crucial.

Optional Image



(Preop. and Postop. MRI of meningioma -top panel, adenoma- middle panel, chordoma-lower panel)

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868
Brain and Spine 4 (2024) 103525
Outcome Prediction in Traumatic Brain Injury Using Traditional and Machine Learning Algorithms.

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Long term outcome following TBI (Trauma Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Predicting the evolution of patients after traumatic brain injury (TBI) is crucial for decision-making in clinical practice. The main objective of this study is to develop and validate a prognostic model of patient outcome after TBI based on Machine Learning (ML) algorithms and compare the advantages with respect to traditional prognostic models.
Methods: Patients admitted to our I-level hospital between 2012 and 2023 for complicated mild TBI (GCS 13-15 requiring hospital admission with traumatic findings in the head CT-scan or loss of consciousness or amnesia) or moderate and severe TBI (GCS 3-12) were used for model development and validation. The case split for model development and validation was 80:20. Up to 72 demographic and clinical characteristics recorded in the first 48 hours after TBI were evaluated. The outcome measure was the GOS at 12 months collapsed in three categories: GOS 1, GOS 2-4, GOS 5. Model performance metrics were accuracy or positive predictive value, sensitivity or true positive rate (recall), F1-score, and area under the precision-recall curve.
Results: 1152 patients were analyzed and 22 characteristics were included in the models because they were considered most relevant (having greater association with the outcome measure and lower collinearity with other variables). Principal component analysis methodology did not improve the performance of the models. Pupillary abnormalities, AIS head, clinical frailty score, and compressed cistern were stronges predictors. Among the ML models (HistGradientBoost, XGBoostClassifier, ExtraTreesClassifier, SVC, MLP, MLP-regressor, GradientBoostinRegressor) developed, the Extra Tree Classifier was the model demonstrating the best metrics with an F1-score of 0.76, outperforming logistic regression (0.74) and ordinal regression models (0.71).
Conclusions: ML models can identify hidden complementary information in demographic and clinical characteristics, offering improvements in outcome prediction of patients with TBI.

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925
Brain and Spine 4 (2024) 103526
Sleep Disorder And Mild Traumatic Brain Injury

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Long term outcome following TBI (Trauma Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Mild traumatic brain injury (TBI) is strongly associated with several clinically recognized sleep-wake disorders, but its detection is challenging. The identification of biomarkers related to the sleep-wake regulation cycle could help in its diagnosis
Methods: Methods Patients treated in the emergency room with a mild TBI (GCS 14-15) and pathological head CT and/or symptoms of concussion were recruited; unless they had a previous sleep disorder or neurological pathologies. Patients been studied with cranial MRI (fraction anisotropy (FA)), home actigraphy for sleep monitoring, biomarkers in peripheral blood and saliva, and sleep quality (Pittsburgh) and daytime sleepiness (Epworth) questionnaires; and they have been compared with healthy controls.
Results: 42 patients (mean age 45 years, 69% men) and 39 controls have been recruited. The mean results of the Pittsburgh and Epworth questionnaires were not statistically different from the controls, however 14 and 10 patients presented scores greater than 5 and 10, respectively, considered pathological (sleep disorder present). The MRI of the cases showed significantly lower FA values than the controls in multiple tracts (corpus callosum, internal capsule, external capsule, superior longitudinal fasciculus, etc.), however, when comparing exclusively those with sleep disorder we saw differences in the FA of external capsule ($P<0.01$). Actigraphic recording showed that TBI patients spent significantly more time in bed than controls, with more hours of sleep, lower efficiency, more awakenings, and longer awakenings ($p < 0.01$), but with similar sleep latencies. However, there were no actigraphic differences between patients with pathological and normal questionnaires
Conclusions: mild TBI is associated with the appearance of sleep disorders with high frequency, both objectively and subjectively, and with alterations in FA on MRI.

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742
Brain and Spine 4 (2024) 103527
The Impact of Contusion Expansion, Bifrontal Contusions and Coagulopathy on Patient Outcome Following Traumatic Brain Injury - A retrospective Swedish single-center study

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Long term outcome following TBI (Trauma Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM

Background: Cortical contusions are common in moderate-severe traumatic brain injury (TBI). Cortical contusions often expand, potentially causing neuroworsening several hours to days post-trauma. While contusion expansion (CE) may affect outcome, potential clinical and radiological markers that can predict CE have been insufficiently explored. In the present single-center retrospective observational cohort study, we evaluated clinical outcome by the Glasgow Outcome Scale extended (GOSE) scale and evaluated risk factor for CE.
Methods: Adult TBI patients >18 years of age, and of all injury severities, were included. Main variables of interest were platelet count, defined as <150x109/L or >150x109/L, presence of bifrontal contusions and CE, defined as absolute contusion volume increase in cm^3. Primary outcome was CE and secondary

outcome was morbidity according to GOSE.
Results: Between the years 2012-2022, 271 patients were included. Contusion size on admission correlated positively with CE, as did the Marshall and Rotterdam radiological classification scores. Bifrontal contusions were significantly larger at admission, experienced CE more than contusions in other locations, and had a worse outcome. Patients with a platelet count <150x109/L experienced CE more often and had a worse outcome when compared to patients with a higher platelet count. In a multivariate analysis, CE remained significantly associated with a poor outcome six months post- injury.
Conclusions: Contusion volume at admission, and Marshall- and Rotterdam scores positively correlated to CE. Bifrontal contusions and a platelet count <150x109/L were associated with CE, and a poor clinical outcome. Large CE volumes were associated with a worse clinical outcome, and CE was per se associated with outcome in a multivariate analysis. Management of these risk factors for CE in the acute post-injury setting may be needed to attenuate contusion expansion and to improve clinical outcome in TBI patients suffering from cortical contusion injuries.

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1413
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ANGIOMYELOMA in an atypical location, a diagnostic challenge

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PNS tumors - what's new? (Peripheral Nerve Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Peripheral nerve tumors make a differential diagnosis with a rare tumor group, but their diagnosis should not be ruled out. Angiomyelomas are rare benign smooth muscle tumors originating from the tunica media of the vessel walls. Imaging they have common features easily confused with peripheral nerve tumor lesions,
Methods: We report the case of a 60-year-old female patient, who, due to pain and swelling of the 5th finger, underwent a soft tissue ultrasound, which demonstrated vascularized nodular formation, which was better characterized by MRI, which suggested peripheral nerve swannoma
Results: The patient underwent surgery, complete excision of the lesion. It was confirmed as angiomyeloma of the lower limb. However, these tumors make a differential diagnosis because they do not show a main vessel but show a connection to a nerve.
Conclusions: Although both lesions are benign, excision for histological clarification and resolution of pain is the best option

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408
Brain and Spine 4 (2024) 103529
Radial nerve injury. Features of surgical treatment.experience of city clinical hospital 7 almaty (Kazakhstan)

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PNS tumors - what's new? (Peripheral Nerve Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: The radial nerve has its own distinctive features, including significant functional load, good regenerative abilities, and frequent susceptibility to traumatic effects, also iatrogenic.
Methods: 151 patients was operated with radial nerve injury in Neurosurgery Centre of City clinical hospital 7 (Almaty, Kazakhstan) from 2010 to 2023 years. There were 105 men (69.5%) and 46 women (30.5%). The patients were predominantly young – 109 (72.2%) and middle–aged - 30 (19.9%). The average age was 37.2 years. There were 139 patients of working age (92.1%). 103 patients (68.2%) were admitted at the optimal time for nerve regeneration. In the late period of traumatic nerve disease, 25 patients (16.8%) were operated on, in the long–term period - 23 patients (15.4%). According to the mechanism of injury, closed nerve injuries prevailed – 69 patients (45.7%). Penetrating nerve injuries were observed in 55 patients (36.4%). Nerve damage in road accidents was observed in 27 patients (17.9%). In 58 (38.4%) patients, nerve damage was combined with a fracture of the humerus. Iatrogenic lesions of the radial nerve were observed in 31 patients (20.8%). In most cases, they are associated with interventions for fractures of the humerus (17.2%).
Results: Scarring of the nerve was observed in 90 (59.6%) patients. Nerve rupture was observed in 61 (40.4%) patients. Neurolysis was used in 87 (57.6%) patients, nerve suture in 28 (18.5%) patients, and nerve autoplasty in 15 (9.9%) patients. Tendon-muscle plastic surgery was performed in 21 (13.9%) patients, while nerve repair was performed in 19 patients. Excellent and good results in the analysis of the catamnesis of 118 observations were observed in 108 patients (91.5%), satisfactory in 6 (5.1%), unsatisfactory in 4 (3.4%). The best results were observed after the operation of neurolysis and nerve suture. All results corresponded to an excellent and good degree of muscle strength.
Conclusions: Based on clinical experience we developed recommendations for surgical treatment of nerve damage to restore useful movements in the hand, depending of the time after injury and the degree of nerve damage.

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999
Brain and Spine 4 (2024) 103530
The role of pre-operative biopsy in Malignant Peripheral Nerve Sheath Tumors: a management algorithm based on a single-centre experience

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PNS tumors - what's new? (Peripheral Nerve Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Peripheral Nerve Tumors are very common neoplasms encountered in the daily practice. In a very small percentage, they might result in aggressive and invasive tumors, also known as Malignant Peripheral Nerve Sheath Tumors. Because of their rarity, they are often mistakenly confused during the diagnosing phase with their benign counterpart. A preoperative biopsy could be useful in order to out the hypothesis of a malign lesion. This single-centre study aimed to elaborate an evidence-based algorithm tested through a case series to establish the role of a preoperative biopsy.
Methods: A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A case series of patients with peripheral nerve lesion was collected at authors' Department.
Results: A total of 36 patients with peripheral nerve tumors were involved and went through the algorithm. Only 4 patients were found eligible for a preoperative biopsy. In 3 case, a early diagnosis of MPNST was performed. The algorithm proposed and the case series are described.
Conclusions: Pre-operative biopsy could be a safe and cost-effective measure to formulate an early diagnosis in MPNSTs. The preoperative diagnosis allows the physician to use a neoadjuvant therapy, like radiotherapy or chemotherapy, in order to perform a radical surgery with improvement on the survival rate of the patient.

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1170
Brain and Spine 4 (2024) 103531
Another method of surgical treatment of spastic paralysis

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PNS tumors - what's new? (Peripheral Nerve Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: Surgical procedures for the spastic upper extremity aim to correct the common deformities of elbow flexion, forearm pronation, wrist and finger flexion, ulnar deviation, and thumb-in-palm deformity. Surgery is crucial in terms of care of the spastic upper limb. Different surgical techniques have been described to address each of the common deformities and underlying causes, including muscle spasticity, joint contracture, and paralysis. Partial neurectomy of motor nerves has been shown to decrease spasticity in the target muscles. After appropriate evaluation, as well as determining the goals of surgery, deformity

correction can be achieved through single-event, multi-level surgery. Surgery includes a combination of soft tissue lengthening, tendon transfer, joint stabilization procedures and selective denervation of spastic muscles.
Methods: The inclusion criteria of the patients in our series were spastic upper limb secondary to stroke, traumatic brain injury, and cerebral palsy. Recorded measurements were patient's age at surgery, gender,etiology of the spasticity, associated procedures during the selective neurotomy such as tendon transfer. The results were studied by passive and active range of movement in the affected joint; the first follow-up occurred between 1 and 6 months, and at the last follow up at around 12 months to study the durability of the results based on several criteria: spontaneous position, range of motion, muscle tone, spasticity according to functional evaluation (House scale).
Results: The results were collected as we recorded passive and active range of motion straight after surgery, two weeks post op and 1-6 months postoperatively as the early follow up. Passive range of motion restored first just in the days after surgery, active range of motion restored at least two weeks post op. At 12 months post op passive and active range of motion remains restored.
Conclusions: The management of spasticity is multidisciplinary and involves physical therapists, occupational therapists, physiatrists and surgeons. Selective neurectomy is performed to decrease muscle tone.
In all of our cases, spasticity is reduced with improvements in the functional Housescore and these results are stable at the last follow up. But still further studies need to be done to evaluate late follow up at long terms post op.

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899
Brain and Spine 4 (2024) 103532
Methological Approach in Brachial Plexus Surgery Research: A Systematic Review.

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PNS tumors - what's new? (Peripheral Nerve Parallel Session), October 17, 2024, 8:00 AM - 9:30 AM
Background: In the aim to publish a meta-analysis related with brachial plexus injuries surgeries our team realized that there is a lack of high evidence articles. Around the world these injuries are treated by a very heterogenous procedures according with the knowledge and specialization of the physicians. The aim of this study it is to show the diversity of the treatments with the intention to emphasize the need for a multidisciplinary treatment of these patients by the collaborative work of the physicians
Methods: A systematic review was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines to identify all articles that reported clinical outcomes in BPI surgery; to identify the surgical techniques that demonstrate clinical recovery and to evaluate the frequency of the reports. A total of 2,382 articles that were published between 1962 and 2023. According with our inclusion criteria we analyzed 152 articles in which 12,826 patients were evaluated.
Results: We extracted the information of the articles and organized it by continent and specialization of the physicians. Most of the information reported focused on motor improvements, some other clinical scales who reported pain components (Intensity, location frequency, drug management and functional repercussion), positive sensory symptoms and quality life evaluations were mainly displaced in the article's reports.
Conclusions: Multidisciplinary collaboration in brachial plexus injuries it is necessary to the treatment of this patients with the aim to find the best results for the patients. It is important to report also clinical findings like pain, sensory symptoms and functional outcomes.
Optional Image

Table 1.

Continent	Speciality	# articles	Multidisciplinary	BMRC	Other motor evaluation*	DASH	Pain	Sensory Symptoms	Autonomic	QOL	# patient
Asia	Neurosurgery	5	2	4	1	0	2	2	0	2	2269
	Orthopaedic surgery	31	7	23	16	3	8	8	1	5	1289
	Plastic surgery	13	3	10	9	3	0	2	1	0	1966
	Hand surgery	16	3	13	4	2	3	5	1	1	1295
	Other	1	1	2	0	0	0	0	0	0	12
	Total	66	16	52	30	8	13	17	3	8	6831
America	Neurosurgery	19	7	15	6	3	6	4	3	3	2649
	Orthopaedic surgery	19	9	16	6	3	6	3	0	4	731
	Plastic surgery	8	5	8	5	1	2	2	1	1	596
	Hand surgery	0	0	0	0	0	0	0	0	0	0
	Other	1	2	2	0	0	0	0	1	0	34
	Total	47	23	41	17	7	14	9	5	8	4010
Europe	Neurosurgery	15	3	9	2	1	2	3	0	2	1105
	Orthopaedic surgery	14	2	11	8	0	2	3	0	2	483
	Plastic surgery	6	1	5	3	0	2	4	1	1	123
	Hand surgery	0	0	0	0	0	0	0	0	0	0
	Other	2	0	1	0	0	1	1	0	0	224
	Total	37	6	26	13	1	7	11	1	5	1935
Africa	Neurosurgery	0	0	0	0	0	0	0	0	0	0
	Orthopaedic surgery	1	0	1	1	0	1	1	0	0	32
	Plastic surgery	1	1	1	1	1	1	0	0	0	18
	Hand surgery	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0
	Total	2	1	2	2	1	2	1	0	0	50
	Total	152	46	121	62	17	36	38	9	21	12826

BMRC: Medical Research Council. DASH: Disabilities of the Arm, Shoulder and Hand. QOL: Quality of life.
*Louisiana State University Individual Muscle Grading Scale, NRS, Gasping, Pinch Strength, Highet Scale, Ploncard Scale, Protraction Test, Motor Function.

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837
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Psychological factors and treatment compliance in mask-based gamma knife radiosurgery

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM
Background: Gamma Knife Icon provides stereotactic radiosurgery treatment in two different ways: frame- and mask-based treatment. This offers a wide selection of treatment options for patients; however, some psychological factors may affect patients' compliance. The aim of this study was to investigate the relationship between anxiety and depression levels and treatment compliance of patients undergoing frameless Gamma Knife Radiosurgery.
Methods: 117 patients with various diagnoses were included in the study. Before treatment, Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) were used for evaluating depression and anxiety, respectively. Patients were allocated into two groups: patients with depression and without depression. Patients were tracked during treatment and instances such as exceeded motion gating threshold on high-definition motion management (HDMM) system, interruption of treatment, and need for a repeat CBCT were considered as non-compliance.
Results: Most patients (57%) were female, and the median age was 55 (range, 23-72) years. There was no significant difference between the ages of the groups in terms of depression score ($F=0.407$, $p=0.841$) and anxiety score ($F=0.642$, $p=0.669$). Of 110 patients, 53 (48%) had meningioma and the remaining patients were diagnosed with AVM (21%), metastasis (18%), vestibular schwannoma (13%). There was no significant difference between the mean scores of BDI ($F=0.691$, $p=0.679$) and BAI ($F=0.258$, $p=0.966$) in the treatment groups. Besides, the groups were also analyzed in terms of treatment duration: In the group of patients with depression, the mean treatment duration was 38.9 minutes (SD 12.8) and in the group of patients without depression, the mean treatment duration was 34.6 minutes (SD 9.9) ($p=0.568$). The correlation coefficients between BDI scores with total number of warnings ($r=0.380$, $p<.05$) and reCBCT ($r=0.540$, $p<.01$) were significant. Likewise, the correlation coefficients between BAI scores with total number of warnings ($r=0.412$, $p<.01$) and reCBCT ($r=0.320$, $p<.05$) were significant. When the two groups with and without anxiety were compared in terms of treatment compliance, there was a significant difference between the reCBCT numbers ($F=5.543$, $p=0.024$). When the two groups with and without depression were compared in terms of treatment compliance, there was a significant difference between the reCBCT numbers ($F=5,080$, $p=0.030$).
Conclusions: According to the outcomes, patients' compliance to GKRS treatment can be influenced by psychological factors. Patients with higher BDI and BAI scores had decreased compliance to treatment. The clinician can predict the patient's treatment compliance with scales that can be administered quickly and

organize treatment plan.

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884
Brain and Spine 4 (2024) 103534
Immune cells subpopulations in peripheral blood in patients with high-grade gliomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 3 (GBM & malignant gliomas), October 14, 2024, 9:30 AM - 10:10 AM

Background: High-grade gliomas (HGG) are the deadliest type of primary brain tumors. Tumor microenvironment characterization may provide new insights in understanding disease and the balance between inflammatory and suppressor cells and represent a key factor in tumor-microenvironment interaction. This study aims at characterizing peripheral immune cells subpopulations in HGG patients.
Methods: We analyzed peripheral blood mononuclear cells (PBMC) from 57 patients with newly diagnosed HGG who underwent surgery in Neurosurgery department from 2019 to 2023. Blood sample was taken before surgery and PBMC were stored in Institutional Biobank. Clinical and radiological features and steroid dosage at sample time were recorded. For flow cytometry analysis, two panels of antibodies were designed, one for myeloid and one for lymphoid cells. Acquisition was performed with BC CytoFLEX LX and CytExpert software and data were processed with FCS Express 7. Statistical analysis was performed with SPSS 28.
Results: Survival data were available for 52 patients: the mean overall survival (OS) was 15.98 months. A Cox regression analysis was performed to identify any prognostic impact of subpopulations, on which steroids' influence was checked. A small effect was noted for monocytes (HR 1.055, p 0.018) and CD11b+/CD33+ cells including peripheral myeloid-derived suppressor cells (MDSC, HR 1.044 , p 0.055), both influenced by steroids. A stronger effect was noted for immature NK cells (HR 0.198, p 0.029), uninfluenced by steroids. A significant correlation was found between immature NK cells and ECOG performance status (PS), with higher levels in patients with lower ECOG (p 0.029). MDSC and CD8+ T cells were more represented in patients with necrosis on MRI while patients with midline shift showed higher MDSC and lower immature NK cells. FLAIR volume was positively correlated with mature NK while MDSC and mature NK showed a correlation near to significance with the difference between FLAIR and contrast-enhancing volume.
Conclusions: These results are promising in identifying subpopulations in peripheral blood with a putative role in patients' OS. Higher immature NK cells correlate with higher PS at surgery and are associated with increased OS. On the other hand, monocytes and MDSC correlate with radiological parameters such as midline shift, necrosis, and FLAIR volume. Further analysis on larger sample and longer follow-up is required to confirm these promising results.

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953
Brain and Spine 4 (2024) 103535
History of Cranioplasty: a Long Travel Along Times

Selene Marika Cavallo [1], Fabio Serpico [1], Nicole Amanda Capialbi [1], Federico Saturno Spurio [1], Giorgio Casoli [2,3], Corrado Iaccarino [1,2,3], Giacomo Pavesi [1,2,3]. [1] *School of Neurosurgery, University of Modena and Reggio Emilia, Modena, Italy;* [2] *Neurosurgery Unit, University Hospital of Modena, Modena, Italy;* [3] *Neurosurgery Unit, AUSL RE IRCCS, Reggio Emilia , Italy*

Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM

Background: Cranioplasty is a common neurosurgical procedure performed to reconstruct cranial defects. It has its ancient roots in Incans period (3000 BC), then Fallopius used gold plates (1532 AD), van Meekeren used the bone graft from a dead dog (1666 AD), and the first use of autologus bone graft is documented by Walther in 1821. World Wars I and II spurred an evolution in cranioplasty materials and surgical techniques with a growing interest in synthetic materials to counter the common complications associated with bone grafts. After that different materials and tools were studied. To the authors knowledge, a recent historical and technical overview of cranioplasty is missing. Aim of the authors is to provide an historical outline, selectively review the current state of knowledge, consider advantages and pitfalls associated with each material and identify new research directions.
Methods: The authors performed a comprehensive search through PubMed and Google Scholar using the following keywords: cranioplasty, history, trauma, xenograft, allograft, alloplast, methylmethacrylate, hydroxyapatite, titanium, custom-made, PEEK implants, ceramics, induced pluripotent stem cells, bone morphogenetic protein, neurosurgical history, surgical technique, reconstruction, neurotechnology.
Results: This study analized how history of cranioplasty intermingles with the historical, cultural and scientific contexts. Since wartime, the exponential increase in the number of craniolacunia together with advancement in technology, tissue engineering and laboratory research led to a paradigm shift from metals to synthetic materials to new cranioplasty tools and techniques within the realm of regenerative medicine and implantable neurotechnology.
Conclusions: Over millennia, indications for decompressive craniectomy have more and more etiologies and the management of craniolacunia has become a very common problem for neurosurgeons. If technical procedure is now established, nowadays research is looking for a lifelong biocompatible material, perfect for restoring normal cosmetics, and ensuring adequate protection for intracranial structures. Efforts must be made in this regard.
Optional Image

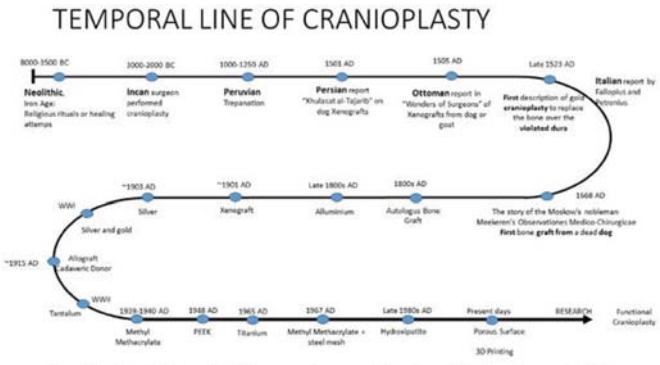


Figure 1. Timeline of the history of cranioplasty: a step-by-step travel from the very beginning to the new technologies

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1308
Brain and Spine 4 (2024) 103536
Idiopathic Delayed Peri-lead Edema after Deep Brain Stimulation – A Systematic Single Center Analysis

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Among surgical complications after Deep Brain Stimulation (DBS), idiopathic delayed postoperative peri-lead edema (IDPPE) remains poorly understood. The goal of this study is to investigate its frequency, clinical relevance and identify risk factors based on a monocenter systematic retrospective study.
Methods: We included 47 patients after DBS surgery from February 2020 to August 2022. All patients received an intraoperative high-resolution CT or MRI on the day of surgery and a delayed CT scan one to eight days after electrode implantation to assess peri-lead edema and associated signs of hemorrhage. Clinical follow-up data 12 months after surgery were analyzed.
Results: IDPPE was radiologically diagnosed in 38 patients (80.9%). In 23 cases (48.9%), the edema was accompanied by peri-lead hemorrhage, typically located in subcortical regions. 13 out of 38 patients (34.2%) with peri-lead edema were initially symptomatic (delirium, neurological and neuropsychological deficits). There was no clinical predictor of IDPPE occurrence, however symptomatic

patients tended to be older and exhibited higher levels of cortical brain atrophyand were significantly more often on blood thinners (p = 0.010) before surgery. At 12 months follow-up, all patients showed complete clinical recovery with no neuropsychological deterioration.
Conclusions: IDPPE is a radiologically frequent finding after DBS and shows in general a clinically benign course. Neurological symptoms usually subside entirely within three months of follow-up. Intake of blood thinners prior to surgery was more frequently associated with IDPPE associated haemorrhage.

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266
Brain and Spine 4 (2024) 103537
Development of Skills in Biportal Endoscopic Surgery: An Effective Approach through simulators and anatomical Models

Andrea Sandoval Otero [1], Natalia Frade Porto [1], Celia Ortega Angulo [1], María Dueñas Carretero [1], Juana Fernández González [1], Sofía Santiño Gómez [1], Patricia Muñoz Cabrerizo [1], Aurora Molina Foncea [1]. [1] *Hospita Central De La Defensa Gómez Ulla, Spain*

Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM
Background: Endoscopic techniques enable less invasive surgeries with comparable or superior outcomes to traditional techniques. However, their application requires a learning curve that includes becoming familiar with specific materials and procedures, as well as the careful selection of patients. We intend to describe the training model for physicians conducted at our center for the use of the biportal endoscopy system, starting with simulators and anatomical models, and progressing to application on a porcine cadaver anatomical model.
Methods: The training method with the box model is cost-effective and does not require special facilities. It consists of a rigid cardboard box with two holes spaced 3 cm apart, used for inserting instruments such as the endoscope and dissector. Its purpose is to improve manual dexterity and visuospatial coordination. Subsequently, the acquired skills are applied to an anatomical model on a porcine cadaver to practice biportal endoscopic spinal surgery.
Results: The simulation sessions conducted at our center are detailed, progressively implementing the biportal endoscopy technique. These sessions cover everything from the selection and basic handling of instruments to the complete execution of the surgical procedure. Practice includes dissecting through layers and milling of laminae and articulations, aiming to prepare participants for clinical application.
Conclusions: Training on simulators and animal models is essential for improving skills in biportal endoscopy, leading to greater efficiency and safety. This approach benefits surgeons, residents, and patients by ensuring a high level of competence and medical care. Despite endoscopic techniques offering comparable or superior results to traditional methods, their implementation requires long learning curves, including familiarization with specific materials and procedures, as well as careful patient selection.

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751
Brain and Spine 4 (2024) 103538
Hydrocephalus in surgically treated glioblastoma patients – To treat or not to treat?

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 3 (GBM & malignant gliomas), October 14, 2024, 9:30 AM - 10:10 AM
Background: Due to overall poor prognosis in glioblastoma patients, the decision whether and how to treat hydrocephalus is challenging. The aim of this study is to analyze the indication and decision-making as well as functional outcome, and overall survival of hydrocephalus treatment in glioblastoma patients.
Methods: We retrospectively analyzed consecutive patients who underwent surgery for GBM between October 2009 and October 2023 at our department. The indication for treatment and treatment method were recorded. Further, patient and tumor characteristics, radiological features, overall survival, as well as functional outcome based on mRS und Karnofsky index were assessed. Outcome measurements in the treated group before and after treatment, as well as clinical outcome and overall survival between the treated group and the group not receiving treatment were compared.
Results: Out of 781 consecutive glioblastoma patients, we identified 28 patients (3.6%), who developed hydrocephalus during the course of treatment. Overall, 15 (54%) patients received treatment for hydrocephalus, of which nine (60%) patients were treated with ventriculoperitoneal shunt (VPS), three (20%) with endoscopic third ventriculostomy, two (13.3%) with external ventricular drainage, and one (6.6%) with hematoma evacuation. The indication for treatment in most patients was somnolence or CSF-leakage, while reasons for non-treatment were mostly poor prognosis due to tumor progress, surgeon-decision, or patients' wish. Mean mRS significantly improved after treatment of hydrocephalus (from 4 ± SD to 3 ± SD, p = 0.005) at a median of 25 months [4;50] follow up. In 88% of the cases, hydrocephalus treatment led to an improvement of the symptoms. In four patients (14%) complications occurred, all within the group receiving VPS implantation. Hydrocephalus treatment prolonged survival by 154 days (480 [60;676] vs 326 [232;634] days), without a significant difference.
Conclusions: The decision when to treat hydrocephalus in GBM patients depends on various factors and remains challenging. Treatment seems to non-significantly prolong overall survival, lead to a relief in symptoms, and improve functional outcome.

https://doi.org/10.1016/j.bas.2024.103538

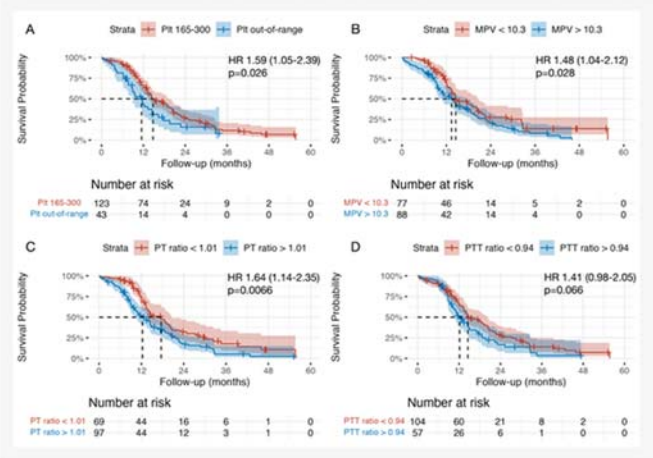
1031
Brain and Spine 4 (2024) 103539
Pre-operative Mean Platelet Volume (MPV) is associated with Glioblastoma IDH-wt overall survival, preliminary data from 167 patients

Pierfrancesco De Domenico [1], Silvia Snider [1], Francesca Roncelli [1], Andrea Bisoglio [1], Matteo Braga [1], Anna Ghelfi [2], Raffaella Barzaghi [1], Cinzia Mura [1], Pietro Mortini [1], Filippo Gagliardi [1]. [1] *IRCCS S. Raffaele Scientific Institute, Department of Neurosurgery and Gamma Knife Radiosurgery, Milan, Italy;* [2] *Duke University, Durham, USA*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 3 (GBM & malignant gliomas), October 14, 2024, 9:30 AM - 10:10 AM
Background: Glioblastoma (GBM) is the most common, fast-growing, and aggressive malignant primary CNS tumor, with a survival time of about 15 months despite surgery and adjuvant treatments. In recent years, there has been a growing interest in exploring the potential contribution of hemostasis and platelet activation in GBM biology. This study aims to address the association between pre-operative coagulation profile (PT ratio, aPTT ratio), overall platelets' count (PC), and the mean platelet volume (MPV) with tumoral characteristics and overall survival in GBM IDH-wt patients.
Methods: A total of 167 adult patients undergoing maximal safe resection of newly diagnosed glioblastoma WHO grade 4 IDH-wt were included. The variables of interest (MPV, PT ratio, and aPTT ratio) were dichotomized at the median, while the overall PC was split up using the central distribution (10th to 90th percentile). Correlation analyses of markers with tumoral and demographic characteristics, Kaplan Meier survival analysis, and Cox multivariate regression analysis were conducted to explore the single contributions of these parameters in building a predictive model of overall survival (OS) in these patients.
Results: The mean baseline MPV correlated to increasing age (r=0.18, p=0.01), the overall FLAIR tumoral volume (r=0.17, p=0.02), and lesional contrast-enhanced (T1-CE) volume (r=0.19, p=0.01). The median OS in the whole cohort of GBM patients was 14.4 months (95% CI: 12.9-17.6). Patients with MPV > 10.3 10-15L had a median OS of 13.4 months (95% CI: 10.6-17.6) compared to 14.5 months (95% CI: 13.4-20.6) in patients with MPV <= 10.3 10-15L, p = 0.028. Similarly, shorter OS was recorded in patients with PT ratio > 1.01 (p=0.006), and PC out-of-range 165-300 109/L (p=0.026). A subgroup analysis of patients > 65 years confirmed baseline MPV > 10.3 10-15L was associated with shorter OS (9.4 months, 95% CI: 8.1-13.4) compared to 13.3 months (95% CI: 11.3-32.3, p = 0.026). Baseline increased MPV showed an independent predictive role for poor survival (HR: 1.29, 95% CI 1.01-1.66, p=0.04) in multivariate analysis accounting for age, gender, pre-operative performance status, and tumoral molecular and radiological characteristics, whereas PC within central range had a protective role (HR: 0.47, 95% CI 0.26-0.88, p=0.01).
Conclusions: This study highlights an intriguing association between tumoral burden and systemic hemostasis activation in GBM IDH-wt patients. Increased MPV and deranged PC outside the central range were independent in predicting shorter OS, which was even more prominent among older patients. These preliminary data require additional studies to further characterize glioblastoma

pathological features of aggressiveness related to neo-angiogenesis, tumor immune microenvironment, hemostasis activation, and their effect on response to treatments and OS.

Optional Image



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249

Brain and Spine 4 (2024) 103540

Can ChatGPT pass the Canadian Royal College written examination in Neurosurgery? A performance comparison of GPT-4 and PGY-6 residents

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Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM

Background: Recently, many groups have studied the performance of general large language models (LLMs) such as ChatGPT (OpenAI) on various professional examinations and certifications. However, performance on the Royal College of Physicians and Surgeons of Canada written examination in Neurosurgery has never been reported.

Methods: The Canadian exam is comprised of 36 question stems, each comprised of multiple short-answer questions (6 hours). A passing grade is 70%. Most questions are purely text-based, while some require interpretation of radiological or histological images. Although the official question bank has never been released, a set of 18 practice questions was prepared by the national Ottawa Review Course committee and administered to 41 final year (PGY-6) residents and fellows less than 2 months prior to their scheduled examination. The same questions were then administered to GPT-3.5 and GPT-4. Text-based questions were inputted without modification. However, because public versions of GPT are not capable of image interpretation, image-based questions were entered one of two ways: unmodified (without prompting) and modified with a written description of the image (with prompting). Responses from both human- and AI-participants were graded by a faculty member using a pre-established rubric.

Results: The mean grade of the PGY-6 residents and fellows was 59% (162/264), with a range of 28–74%. Without prompting, GPT-3.5 scored 48% (132/274) while GPT-4 scored 68% (/274) ($p < 0.00001$). Without prompting, GPT-4 outperformed the average resident (68% vs 59%, $p < 0.0001$). With written prompting for image-based questions, GPT-3.5 scored 63% (160/254) and GPT-4 scored 76% (194/254) ($p < 0.01$). With prompting, GPT-3.5 scored similarly to the residents (63% vs 59%, $p = 0.36$) and did not pass, while GPT-4 outperformed the average resident (76% vs 59%, $p < 0.0001$) and achieved a passing grade.

Conclusions: On a practice exam designed to approximate the Canadian Royal College written examination in Neurosurgery, GPT-4 achieved a passing grade and performed significantly better than both GPT-3.5 and a cohort of PGY-6 residents and fellows.

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289

Brain and Spine 4 (2024) 103541

Late Hypoglossal-facial latero-terminal anastomosis: Effective reanimation for total facial paralysis post-vestibular schwannoma resection - A compelling case report of remarkable recovery.

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Oral e-Poster Presentations - Booth 2: Global Neurosurgery & Peripheral Nerve Surgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Facial paralysis results in notable aesthetic, functional, and psychological changes. The absence of spontaneous facial expression, especially among young individuals, can lead to significant psychological distress. Here, we present a case that underscores the effectiveness of hypoglossal-facial nerve anastomosis in treating facial paralysis, even when performed years after onset.

Methods: We present the case of a 25-year-old female who underwent complete macroscopic resection of a vestibular schwannoma seven years prior, resulting in total left-sided facial paralysis. The patient underwent hypoglossal-facial latero-terminal anastomosis. This intervention involves redirecting the intratemporal facial nerve to connect with the hypoglossal nerve (XII) just before its descending branch, above the digastric muscle.

Results: One-year follow-up demonstrated satisfactory neurological recovery with minimal lingual morbidity.

The importance of timing in facial reanimation surgery post-paralysis onset is widely acknowledged. Even with a longer duration since the onset of facial paralysis, significant functional recovery remains possible. There is currently no established timeframe after which hypoglossal-facial anastomosis loses effectiveness.

Conclusions: This case underscores the effectiveness of hypoglossal-facial nerve anastomosis in treating facial paralysis, even when performed years after onset, as in our patient's case, occurring seven years post-onset. It highlights improvements in both aesthetic and functional outcomes, offering hope for affected individuals.

Optional Image



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666

Brain and Spine 4 (2024) 103542

Using graph theory to analyze human brain neuronal networks – a novel approach to investigate neuronal crosstalk.

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Dysfunction of brain neuronal networks plays a pivotal role in the pathogenesis of epilepsy and brain cancer. Epilepsy represents an effect of synchronized and unsynchronized neuronal activity, while recent publications integration of brain cancer into neuronal networks. Here, we present a novel

approach to evaluate activity of neuronal networks and show how neuromodulators change this activity in human brain slices.
Methods: We cultured human brain slices from tissue of using human CSF. MEA recordings (n=24) were performed in three conditions (baseline n=10, baseline + 30μM norepinephrine [NE] n=8, baseline + 30μM acetylcholine [AC] n=6). Action potentials ('spikes') were identified using a threshold-based approach and neuronal networks were defined as timely-shared spiking activity. We used graph theory to compare baseline network properties and their change upon neuromodulation by investigating the mean degree of centrality (DC) – a metric for connectivity of network nodes.
Results: The mean firing rate was 7.94 Hz for baseline, 7.47 Hz for AC and 19.9 Hz for NE treated slices. Visual inspection and graph theoretical analysis revealed differences in the activity patterns between baseline and after neuromodulation. NE increased synchronized network activity, while AC disrupted existing spiking network-patterns and resulted in disseminated unsynchronized activity. Network changes were quantified using the mean degree of centrality (DC). Mean DC was increased by NE from 0.278 to 0.389, while AC decreased DC from 0.058 to 0.026.
Conclusions: Here, we were able to show that graph theory can be used to quantify and compare changes in human brain neuronal networks in both baseline state and after neuromodulation. Both, NE, and AC show distinct forms of neuronal activity patterns. Considering the significance of neuronal network activation in the pathogenesis of disease, we provide an experimental and analytical framework to explore background mechanisms and novel therapeutic approaches in epilepsy and brain cancer.

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782
Brain and Spine 4 (2024) 103543
A real-life study on second surgery for recurrence glioblastoma

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 3 (GBM & malignant gliomas), October 14, 2024, 9:30 AM - 10:10 AM
Background: Glioblastoma accounts for 30% of CNS tumors. The standard of care for newly diagnosed glioblastoma has been maximally safe resection, radiotherapy (RT), and concurrent and adjuvant temozolomide for over 15 years. However, treated patients have a poor prognosis, with a median overall survival (OS) of 15 months and recurrence within a median time of 7 months.
Upon recurrence, there is little consensus on salvage management. Although current international guidelines state that repeated resection may be suitable for selected candidates, limited evidence exists on the appropriate criteria for such selection. Overall, researchers still agree that surgery for recurrent glioblastoma can be beneficial in selected patients and is associated with an acceptable morbidity rate. Nevertheless, the heterogeneity of the patients and the persistence of variable surgical expertise and instrumentation hamper definite conclusions, and further studies are needed to identify patient eligibility criteria. With the aim to shed light on this topic, we retrospectively analyzed data on patients with recurrent glioblastoma who underwent either a second surgery or other therapies in two centers in Italy.
Methods: This retrospective study enrolled consecutive patients with histological diagnosis of glioblastoma (according to WHO criteria) who had recurrent disease. All patients included were treated in IRCCS Regina Elena National Cancer Institute, Rome, Italy and Neuro-Oncology Unit, Fondazione IRCSS Istituto Neurologico Carlo Besta, Milan, Italy, between January 2004 and December 2022. The patients were stratified into a group that received a second surgery and a group that received other therapies or no therapy after recurrence.
The endpoints were OS (defined as the time from the first surgery to death or loss to follow-up, whichever occurred first), progression-free survival (PFS) after the first surgery (defined as the time from the first surgery to documented radiological progression, death or loss to follow-up, whichever occurred first) and PFS2 (defined as the time from the second surgery to documented radiological progression, death or loss to follow-up, whichever occurred first).
Results: A total of 560 patients were included, of whom 219 were females, ranging in age at diagnosis from 16 to 85 years. The second surgery was performed in 138 (25%) patients, while in 422 (75%), radiotherapy and chemotherapy (RT + CT), CT alone or supportive care were performed. Among the 422 patients who did not receive second surgery, 242 (57%) underwent supportive therapies, 180 (43%) underwent active treatments (RT + CT or CT alone). The two groups were not significantly different in female-to-male ratio and MGMT methylation status frequency, while patients who received a second surgery were significantly younger than patients in the other group (median age at diagnosis 56 vs 61 years; $p<0.001$) and had received a higher median number of CT cycles (8 vs 6; $p<0.001$). After the second surgery, 26 (19%) patients received supportive care, 22 (16%) received RT + CT (RT followed by CT), and 90 (65%) received only CT.
The median OS was 18±0.58 months (95% CI: 16.8–19.1) in the entire study population, 25±2.07 months (95% CI: 20.9–29.0) in patients treated with a second surgery and 15 ± 0.56 months (95% CI: 13.9–16.0) in those who did not undergo a second surgery, with a significant difference between the two subgroups ($p<0.0001$). The patients who underwent a second surgery more than 12 months after the first intervention had a better OS than those who had a second surgery ≤12 months after the first one (median OS: 38 ± 4.97 months, 95% CI: 28.2–47.7 vs OS: 18 ± 0.77 months, 95% CI: 16.4–19.5; $p<0.001$). A difference in OS was also found between those who had a second surgery more than 9 months after the first intervention and those who had a second surgery ≤9 months after the first one (median OS: 30 ± 2.21 months, 95% CI: 25.6–34.3 vs median OS: 18 ± 0.92 months, 95% CI: 16.1–19.8; $p<0.001$); no significant difference was found for a cut-off of 6 months ($p=0.09$)-
The OS of patients who underwent a second surgery was not related to the subsequent systemic treatment. The median OS of patients who had no systemic therapy was 26 ± 2.90 months (95% CI: 20.3–31.6), of those who had RT + CT was 24 ± 1.69 months (95% CI: 20.6–27.3), and of those who had only CT was 27 ± 3.01 months (95% CI: 21.0–32.9), with a not significant difference ($p=0.95$). No significant difference in OS was also observed when the treatment groups were compared.
The multivariate analysis of the whole population showed that the second surgery, a higher Karnofsky index, MGMT methylation status, younger age at diagnosis, and a higher number of previous CT1 cycles were factors associated with a longer survival. Among patients undergoing a second surgery, multivariate analysis showed that MGMT methylation status, a higher Karnofsky index, a higher number of previous CT1 cycles and time to second surgery were factors associated with longer survival-
The median PFS2 in the whole group with a second surgery was 5 ± 0.54 months (95% CI: 3.9–6.0). The patients not receiving systemic therapy had worse PFS2 than those receiving RT + CT ($p=0.04$) and those receiving only CT ($p<0.0001$).
Conclusions: In our study, the second surgery represents the first-line intervention choice at recurrence in a selected subset of the sample. Factors to be considered in patient selection are: younger age, a higher number of CT cycles, MGMT methylation and, overall, a time to second surgery longer than 9 months.

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1314
Brain and Spine 4 (2024) 103544
Infectious and Non-infectious Complications Of Neuromodulatory Procedures. Four-Year Experience in Spinal Cord and Deep Brain Stimulation

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM
Background: Procedures of functional neurosurgery utilizing either deep brain stimulation (DBS), or spinal cord stimulation (SCS) cover a wide range of treatment options for various neurological conditions, predominantly neurodegenerative diseases and chronic pain. Permanent stimulation requires implantation of pace generator and leads targeting proper neural structures and is therefore associated with risk of adverse events including system failure, infections and may necessitate to dismantle the system. While medical management and surgical technique is maintained to reduce risk, a significant number of patients experiences inadequate therapy, warranting attempts at further refinement.
Methods: The aim of this study is to extract complications associated with either DBS, or SCS therapy observed at the Department of Neurosurgery of Maria Sklodowska-Curie National Research Institute of Oncology between January 2020 and December 2023. Data used in this study has been retrospectively

collected from filed patients' records and then systematically analysed.
Results: Collected material consisted of 116 patients with SCS and 320 patients with DBS system. The most common indication for SCS implantation was persistent spinal pain syndrome, while for DBS therapy was Parkinson's disease. Among SCS patients, 12 (10,3%) did not respond adequately during trial period and another 12 presented local complications with concomitant infections and all eventually required removal of the whole system. In the DBS subset, 44 (13,8%) patients experienced suboptimal outcome and local complications and 25 (56,8%) out of them required consequent system removal. Further analysis, including age, sex, primary indication and comorbidities did not allow to distinguish a single factor aggravating the risk of complications.
Conclusions: Our study demonstrates a complex analysis of unfavourable outcomes in DBS and SCS patients. These conclusions may serve as basis for measures to ameliorate outcomes, and are already being introduced as such in our Department to improve standard of care.

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1244
617
Brain and Spine 4 (2024) 103545
Understanding and addressing insomnia among neurosurgical professionals in Europe: a survey-based analysis

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Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM
Background: Sleep disturbances are prevalent issues that can significantly impact an individual's quality of life and performance, particularly in demanding professions such as neurosurgery. Lack of adequate sleep can compromise decision-making abilities, patient safety, and the surgeon's overall health, underlining the urgency for addressing sleep health in this population.
Methods: A survey was conducted among neurosurgeons and neurosurgical trainees from all over Europe to assess presence and severity of sleep disturbances, their possible causes and impact on daily functioning. A total of 212 neurosurgical professionals from 19 European countries answered the questionnaire, providing insights into frequency of sleep difficulties and concerns about the impact of sleep problems on personal and professional life.
Results: The majority of respondents were under the age of 60, with a notable representation across all age groups. There was a slight female predominance. A significant portion (75%) of the participants reported having some difficulties with sleep, with over 20% experiencing them at least once a week. The most common factors contributing to sleep disturbances included work, personal relationships/family, and social media/TV. Concerningly, one third of respondents indicated that insomnia interfered with their daily functioning and clinical judgment. Stress was identified as the most prevalent issue related to sleep problems, and a significant correlation was found between work-related issues and sleep disturbances. Employer support for managing work-life balance and insomnia was reported to be less than adequate by a majority of respondents.
Conclusions: The findings highlight the critical need for better support systems and interventions to manage insomnia and support achieving work-life balance among neurosurgical professionals. There is an evident gap in employer support, indicating a requirement for institutional changes to address these challenges. Future studies should focus on developing targeted strategies to improve sleep hygiene and mitigate the impact of work-related stressors, thereby enhancing the overall wellbeing and professional efficacy of neurosurgeons.

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Brain and Spine 4 (2024) 103546
Collaborative Initiatives in Neurosurgery Research and Publications between High-Income and Low/Middle-Income Countries: A Bibliometric Analysis

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Oral e-Poster Presentations - Booth 2: Global Neurosurgery & Peripheral Nerve Surgery, October 14, 2024, 9:30 AM - 10:10 AM
Background: Despite the globalization of healthcare information, robust collaborations between high-income countries (HICs) and low-/middle-income countries (LMICs) are lacking. This study builds on previous research highlighting LMICs underrepresentation in neurosurgery literature.
Methods: We conducted a comprehensive bibliometric analysis using the Scopus database to investigate collaborative neurosurgical research between High Income and Low/Low Middle Income countries between 2018 and 2020. Exclusion criteria included commentaries, letters to the editor, responses, and news items. Articles were categorized into three groups: guidelines, conferences, and consensus statements; articles related to training and collaborations; and other articles, including case reports, case series, and systematic reviews. We categorized articles and authors by country, role, and specific topic.
Results: Of the 260 articles identified, 22 were excluded, leaving 238 reports from 34 neurosurgical journals for analysis. The top LIC/LMICs contributors were India, Egypt, Pakistan, and Kenya. Among the HICs, the USA and the UK had the highest contribution. Certain LMICs significantly increased their contributions in collaborative papers compared to general neurosurgery publications. Kenya matched India's contributions in training and collaborations. In collaborative studies, Uganda, Cameroon, Tanzania, Indonesia, and Nigeria made significant contributions. The analysis revealed that LIC/LMICs accounted for 446 authors, while HICs contributed with 592. India has presented the highest number of authors in significant positions, followed by Egypt, Pakistan, and Nigeria. In HICs, significant positions are recognized in USA articles, Canada, Japan, UK, and Italy. The highest number of collaborations between HICs and LICs/LMICs has been observed in articles related to training and collaborations, followed by papers on conference guidelines and consensus, and finally case reports, case series, and systematic reviews.
Conclusions: Global guidelines and consensus papers can enhance patient care, but LMICs' involvement remains limited. This study emphasizes the importance of promoting collaboration and training between countries with varying resources to advance neurosurgical care globally.

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430
Brain and Spine 4 (2024) 103547
Bilateral Pallidotomy Through Existing DBS Lead, A Case Report

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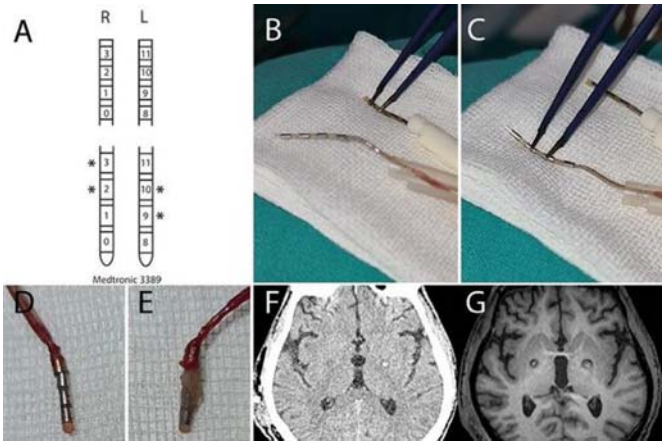
Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM
Background: Neuromodulation via implantable pulse generators, highly effective for certain conditions, faces setbacks due to foreign body complications. We report a case where bilateral GPi lesions were induced via existing DBS electrodes before their removal.
Methods: A 37-year-old male with ataxia telangiectasia presented with status dystonicus and underwent bilateral GPi DBS using Medtronic 3389 leads (Figure 1A). The treatment significantly alleviated his symptoms, yet dependency on stimulation with high power settings (140Hz, 90μs, Right: 4.5V, Left: 5.2V) led to dystonic episodes when stimulation was off due to battery depletion. Frequent pulse generator changes caused skin erosion and infection, prompting the removal of the DBS system. Prior to removal, bilateral GPi lesions were induced using a Leksell Neuro Generator through the electrodes. The procedure involved

bipolar coagulation, applying P16 for 10 seconds and P8 for 10 seconds, with a planned 1-minute interval (Figure 1B-C). The right lead was removed smoothly (Figure 1D), whereas the left encountered resistance due to adherent coagulum (Figure 1E). The interval between lesions differed between sides, extending beyond the intended 1 minute on the right.

Results: Postoperative imaging showed minor bleeding at the left lesion site (Figure 1F) and a larger left lesion volume (585.55 mm^3) compared to the right (204.08 mm^3) (Figure 1G). Wound healing progressed well, with suture removal after 15 days. Post-lesion Burke-Fahn-Marsden scores improved compared to scores under stimulation, and the patient has not suffered any status dystonicus episodes since the removal 14 months ago, highlighting the procedure's efficacy.

Conclusions: Lesioning through a DBS electrode, albeit off-label, is feasible. Experience is needed since the procedure differs from the usual practices. However, with the right indication and for select patients, lesioning is an invaluable and effective tool at the humanity's arsenal against movement disorders.

Optional Image



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437

Brain and Spine 4 (2024) 103548

Outcome Reporting in Deep Brain Stimulation For Obsessive-Compulsive Disorder: A Systematic Review

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Obsessive-compulsive disorder (OCD) is a debilitating psychiatric disease with varying degrees of severity. Generally managed medically, treatment resistant cases may undergo invasive procedures to improve disease control. Previously, lesioning procedures were used, but deep-brain stimulation (DBS) is emerging as an effective non-destructive treatment modality. This review aimed to evaluate the consistency of reporting in the DBS for OCD literature, acting as a platform to inform future standardised reporting which improves research efficiency.

Methods: A systematic search of MEDLINE, Embase and Web of Science was conducted on clinical studies investigating the use of DBS in OCD. Full text original clinical studies in English were included, but case reports were excluded. Outcomes of interest included parameters used for pre- and post-operative clinical and radiological patient assessment.

Results: In total, this search yielded 626 studies of which 53 were included in the final synthesis. This comprised a total of 715 patients with a mean age of 40 years. This included 14 randomised trials and 11 case-series. Most studies published were from the Netherlands (17%) or the US (17%). The most commonly used definition of treatment response was a ≥35% reduction in the Yale-Brown Obsessive-Compulsive Disorder scale (YBOCS), used in 66% of studies. Participant predominant symptoms were not included in 47% of studies with significant variation in symptom dimension reporting seen in the remaining studies. Most studies reported stimulation parameters (92.5%). The most commonly used imaging modality was MRI (73.6%) and a rising trend in the use of tractography was noted.

Conclusions: There is heterogeneity in the reporting of outcomes in DBS for OCD. Greater transparency is required when reporting symptom dimensions and imaging techniques used by researchers. This review highlights the need for the development of a common data element which would allow for standardised reporting and effective comparison between studies.

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581

Brain and Spine 4 (2024) 103549

How Continuing Medical Education Changed after COVID-19 – Results of an Online Survey among Users af a Non-profit Multi-specialty Live Online Education Platform

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Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM

Background: The impact of COVID-19 on medical education, specifically continuing medical education (CME) was previously published by this group. Here, we present the results of an online survey on the adaptation and changes of online CME after the pandemic.

Methods: The online survey of 45 questions taken by users of a German online CME platform after being invited via newsletter, inquired CME habits, requirements, personal perception and changes due to and after the pandemic. Standard statistical methods were applied.

Results: 2,488 Respondents took the survey; 2,477 properly completed surveys were included in final analysis. Most contributions originated from Germany, Austria and Switzerland. Physicians accounted for 78% of responses followed by midwives (7.9%) and paramedics (4.6%). Participating physicians were mainly board-certified specialists (88%; 58% hospital doctors, 33% private practice). A combination of regularly recurring and occasional online lectures (64.1%) and combined face-to-face and online CME (65.3%) were favored. A duration of 1-2 hrs. was found ideal (56.8%). Technical issues remained less relevant as a major concern after the pandemic.

Conclusions: Online CME was accelerated by the pandemic and remained a vital CME modality afterwards. Despite missing personal human interaction, the demand for online CME endured in the post pandemic era. Today, only a few would rather continue with mere face-to-face CME (5.6%) and less see the future in such format (1.2%).

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1249

Brain and Spine 4 (2024) 103550

Factors Contributing to Survival of IDH Negative Glioblastomas according to WHO 2021 Classification: Is Resection Extent Relevant?

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 3 (GBM & malignant gliomas), October 14, 2024, 9:30 AM - 10:10 AM

Background: In 2021, the World Health Organization reclassified IDH-negative gliomas as glioblastomas. Although the positive effect of extensive surgery on survival in high-grade glial tumors is known, the relationship between residual tumor volume and prognosis in this subgroup (IDH-negative) has not been well addressed yet. This study aims to determine whether the extent of resection

significantly impacts survival in IDH-negative gliomas.
Methods: The adult patients with IDH-negative glioblastoma operated in our tertiary care center between July 2018 - August 2022 were analyzed retrospectively. Patients who didn't receive adjuvant therapy or lacked postoperative imaging were excluded. Demographic data, survival, American Society of Anaesthesiologists (ASA) score, and modified Rankin score (mRS) were collected. Tumor and residual tumor volumes were measured using Eclipse (v18.0) radiotherapy planning software, and the residual tumor percentage was calculated accordingly.
Results: 52 patients were enrolled in this study, with 26 males and a median age of 64.5 (interquartile range(IQR)=15.75) (Table 1). The median survival time was 8 (IQR= 14.65) months. The preoperative mRS score had a median of 2.5 (IQR=2); postoperatively, it was 3 (IQR=3). The preoperative and postoperative mean tumor volumes were 45.9±29.7 and 6.6±10.3 cm3, respectively. The mean residual tumor percentage was 12.9± 14.5%. Statistical analysis showed that survival was inversely correlated with age(-.386, p=0.005) and residual tumor percentage (-.354, p=0.01). A 95% and above tumor excision rate was associated with improved outcomes compared to excision rates <95%, resulting in 60% to 30% survival at 12 months, respectively. ASA score, mRS, and preoperative tumor volume didn't affect survival.
Conclusions: In this study, the extent of resection significantly affected the survival rate of IDH-negative glioblastomas. Gross total tumor removal is crucial for more prolonged survival.
Optional Image

Table 1. Descriptive statistics (n=52)			
Male: Female	26:26		
Age	64.5	IQR=15.75	30-84
Survival (months)	8	IQR=14.65	1-43
Preoperative mRS			
0-3	40	76.9%	
4-5	12	23.1%	
Postoperative mRS			
0-3	34	65.4%	
4-6	18	34.6%	
ASA Score			
1	13	25%	
2	24	46.2%	
3	15	28.8%	
Preoperative Tumor Volume (cm3)	45.89	+-29.69	3 - 136.6
Residual Tumor Volume (cm3)	6.61	+-10.27	0 - 49.05

Table 1. Descriptive statistics of the patients

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330
Brain and Spine 4 (2024) 103551
Novel Five Target Microsurgical Approach in Psychosurgery for Refractory Complex Multipsychiatric Disorders

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM
Background: Psychosurgery remains treatment modality for severe psychiatric disorders that don't respond to standard therapies and electroconvulsive therapy(ECT). Mostly known targets are cingulate gyrus, anterior capsule, and subcaudal tracts. Performing cingulotomy and subcaudal tractotomy bilaterally is known as limbic leucotomy. Limbic leucotomy can be used alone or with capsulotomy. Conventional techniques involve one or two bilateral regions, which may be inadequate for complex multipsychiatric pathologies. However, there are two more targets, genu of the corpus callosum and stria terminalis, which may not be suitable for stereotactic interventions. All targets are aligned in same plane. We decided to reach them. Multipsychiatric disorders have more than two disorders, intervention of all targets might increase the success rate. This study evaluates the clinical efficacy of novel psychosurgical technique for complex multipsychiatric disorders.
Methods: A retrospective analysis was conducted on eleven patients who underwent psychosurgical procedure from 2016 to 2023. These patients had no response to pharmacotherapy, psychotherapy, and ECT with suicide risk. Diagnoses included various combinations of Major Depressive Disorder, Generalized Anxiety Disorder, Obsessive-Compulsive Disorder, Panic Attack, and Impulse Control Disorder. All patients exhibited impulsive aggressive disorder. Procedure encompassed minicraniotomy for anterior interhemispheric approach, bilateral cingulotomy, anterior callosotomy, bilateral subcaudate tractotomy, bilateral anterior capsulotomy and cutting stria terminalis bilaterally.
Results: Remarkable clinical improvements were evident postoperatively. Average Beck Depression Inventory (BDI) scores decreased from preoperative 28–45(mean = 37.9) to postoperative scores of 4–12(mean = 7.7). First month post-surgery, 73% of patients were able to reduce and in third month to discontinue psychiatric medications. Three patients (%27) were maintained single medication until six-month follow-up when psychiatrist ceased. Postoperative controls were done double-blindly by chief neurosurgeon and psychiatrists.
Conclusions: This micropsychosurgical technique offers promising advancement in treating multipsychiatric disorders. The high rate of remission observed in this study suggests it may be alternative to conventional methods.
Optional Image

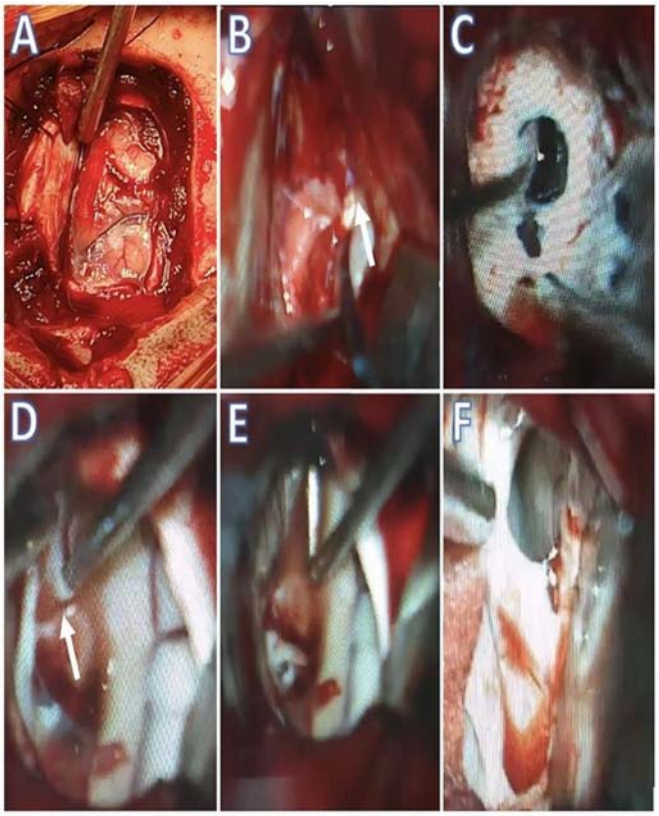


Figure 1: A: Minicraniotomy and dural opening, followed by an anterior interhemispheric approach preparation. **B:** Cingulotomy procedure to access deeper brain structures. **C:** Callosotomy involves the sectioning of the corpus callosum. **D:** Sectioning of the stria terminalis(white arrow), a critical limbic pathway efferent of the amygdala. **E:** Subcaudate tractotomy targeting fibers below the head of the caudate nucleus. **F:** Anterior capsulotomy is a precise procedure focusing on the anterior limb of the internal capsule.

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1449
Brain and Spine 4 (2024) 103552
Advances in Deep Brain Stimulation for Bipolar Disorder: A Comprehensive Review

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Oral e-Poster Presentations - Booth 1: Functional & Radiosurgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Bipolar disorder (BD), characterized by recurrent episodes of mania and depression, presents a significant challenge to the currently used psychiatric treatments. The conventional therapeutic approaches only provide minimal symptomatic relief, leaving a substantial proportion of patients with functional limitations. Deep Brain Stimulation (DBS) has grown into a promising new modality for treatment-resistant BD. DBS offers the potential to regulate the mood circuits involved in BD and thus enhances long-term effects.
Methods: A narrative review was carried out using the PubMed database to identify pertinent articles published in the last 10 years. Keywords used included "Bipolar Disorder", "Deep Brain Stimulation," "Clinical Trials", and "Neurostimulation". The relevant review articles, clinical trials, and consensus guidelines were assessed based on their applicability to DBS in BD. These articles were examined for study design, patient population, responses to treatment, adverse effects, and the implicated neural pathway mechanisms.
Results: This study describes the existing literature, critically analyzes clinical trials, and determines major obstacles and opportunities in DBS for BD management. DBS is shown to be a revolutionary neurosurgical approach that improves mood stability and symptomatic control in treatment-resistant BD. Although recent trials have shown promising results, multiple challenges persist in the anatomical target selection, neurosurgical technique refinement, patient selection criteria, and long-term result assessment.
Conclusions: This review seeks to guide clinicians and researchers into driving therapeutic innovation in the management of BD by highlighting the present state of understanding and developing trends in this field. Additional well-designed trials are necessary to conclusively determine the efficacy and safety profile of DBS in BD. Responsible application of DBS in BD necessitates careful attention to specific ethical and social considerations. Future research endeavors should prioritize interdisciplinary collaboration, standardized protocols, and personalized approaches to enhance the quality of life for individuals with BD.

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98
Brain and Spine 4 (2024) 103553
Objective Assessment Of Facial Paralysis With Artificial İntelligence-Based Software

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Oral e-Poster Presentations - Booth 2: Global Neurosurgery & Peripheral Nerve Surgery, October 14, 2024, 9:30 AM - 10:10 AM

Background: Facial paralysis (FP) is the partial loss of facial movements due to a pathological condition of the facial nerve. FP is a very common condition. The scales used to assess facial nerve paralysis do not give qualitative results. The results of the scale may vary according to physician. In this study, we objectively assessed FP from a short video of patients using artificial intelligence-based software.
Methods: Seven patients with FP were included in the study. The patients were asked to laugh three times and blink three times during the video. The recorded videos were uploaded to a software developed by the authors. This software has identified 68 specific points on the face. Some of these were recorded during facial movements and others were used as reference lines. The time dependent coordinate changes of these points were recorded. The vertical and horizontal range of motion of the oral comissure and the range of motion of the palpebral aperture were used for the study(Figure 1). The range of motion was obtained by subtracting the minimum value from the maximum value. The results of the right side were divided by the results of the left side.
Results: A total of seven patients were included in the study. Four of the patients had FP on the right side and three on left side. All of the ratios were less than one in the right fascial paralysis and greater than one in the left fascial paralysis. In patients with a low House Brackmann grade, the ratios were close to one (Table 1).
Conclusions: This study shows that it is possible to objectively assess FP with developing technology and artificial intelligence. The qualitative results obtained with this software make it possible to clearly assess the improvement or deterioration of FP during patient follow-up.

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757
Brain and Spine 4 (2024) 103554
Broadcasting Neurosurgical Grand Rounds: the New Norm of Knowledge Dissemination in Global Surgery.

Nargiza Saatova [1], Gidugu Venkata Ramdas [1], Iype Cherian [1], Andrey Dubovoy [2], John Bennett [3], Mario Ganau [4]. [1] *Institute of Neurosciences Krishna Vishwa Vidyapeeth, Karad, India;* [2] *King Faisal Specialist Hospital & Research Center, Riyadh, Kingdom of Saudi Arabia;* [3] *Neurosurgical.TV, Miami, United States of America;* [4] *Nuffiedl Department of Surgical Neurosciences, University of Oxford, Oxford, United Kingdom*

Oral e-Poster Presentations - Booth 3: History, Ethics and Education, October 14, 2024, 9:30 AM - 10:10 AM

Background: Knowledge acquisition is a precious and a tedious process. Access to classes taught by exceptionally talented and fortunate leaders in neurosurgery could unlock learning opportunities for a worldwide audience, hence meeting the needs of education for the next generation of neurosurgeons worldwide. For this, the broadcasting of neurosurgical grand round holds the potential to close the gap between Low and Middle Income Countries (LMIC) and High Income Countries (HIC) by overcoming geopolitical, cultural, language and financial barriers.
Methods: METHODS: Since 2023, the Russia Neurosurgery Grand Rounds (RNGR) had been delivered in a webinar-like format via the Zoom platform. Registered attendees did interact with experts invited in each live webinar; recordings were made available on Youtube afterwards. The key metrics of this educational project were assessed with regards to the impact in bringing forward the themes of research ethics and global neurosurgery.
Results: RESULTS: A total of 9 webinars covering different subspecialty topics, were broadcasted by Neurosurgical.TV between 2023 and 2024. The RNGR webinars consisted of 907 minutes of teaching delivered by 41 speakers from 10 countries. The demographics of the speakers indicate that 7 of them were from LMIC whereas 3 speakers were HIC. Overall, RNGR attracted 2887 views.
Conclusions: CONCLUSION: In today's world, keeping abreast with technological advances in many neurosurgical fields is a big challenge for both educators and trainees. Broadcasting Neurosurgical Grand Rounds appears to be the need of the hour and the success of the RNGR project indicates that this format is most suited for neurosurgical training. Webinars fit for purpose of global neurosurgery needs should no longer be run in the form of one-sided didactic lectures, but be designed as interactive conferences, with audiovisual demonstrations followed by panel discussions.

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1459
Brain and Spine 4 (2024) 103555
Psychological And Functional Impact Of An Arteriovenous Malformation (AVM) Diagnosis

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: The psychosocial profile of patients diagnosed with an unruptured cranial arteriovenous malformation (AVM) remains undetermined. We aim to

provide a qualitative and quantitative evaluation of the psychosocial effects following an AVM diagnosis to allow a guide neurosurgical practice tailored for the needs of these patients to be devised in future practice.
Methods: Data were collected prospectively on patients diagnosed with an unruptured AVM at our centre over a 24-months period from November 2021 to November 2023 using the electronic health record. This included age, sex, and previous psychiatric history. Included patients underwent a semi-structured telephone interview about their diagnosis process, clinical experiences and completed the SF-36 and HADS questionnaires to assess QoL. Statistical analysis was performed on SF-36 and HADS.
Results: 52 patients met our inclusion criteria (mean age = 41.6 ± 14.9) with a female predominance (61%).
Of the included cohort, 38 patients completed interviews. Of the 8 domains in SF-36, 4 were significantly lower than the baseline provided by RAND health care. These includes emotional well-being (mean 56.9 ± 24.3, p=0.0002); social functioning (mean 57.2 ± 30.8, p=0.0001); bodily pain (mean 56.4 ± 28.1, p=0.0006) and general health (mean 45.5 ± 21.9, p=0.0009). The mean HADS anxiety score was 8.9 ± 5.3, significantly greater than UK normative data (p=0.0001). The mean HADS depression score was 5.2 ± 4.0, significantly greater than UK normative data (p=0.0473).
Conclusions: There appears to be a significant psychological burden associated with an AVM diagnosis. This could be explained by the fact that there were insufficient mental wellbeing assessment and support offered both at the initial AVM consultation and throughout the patient care journey. This shows a potential area in neurosurgical clinical practice that could be improved to provide better services for AVM patients.

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1217
271
Brain and Spine 4 (2024) 103556
Informing Patients About 3D-Printed Patient Specific Pedicle and Iliac Screw Guiding Models

Rahan Deniz Aydeniz [1], Mert Arslan [1], Can Şensöğüt [1], Sina Yiğitsoy [1], Koray Ur [1], Orhan Kalemci [1], Ceren Kizmazoglu [1]. [1] *Dokuz Eylül Univesity Faculty Of Medıcıne Surgery Medıcıne Department Of Neurosurgery, Turkey*

Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Spinal deformities are very challenging to treat and have a great risk of neurologic complications because of hardware placement during corrective surgery. Various techniques have been introduced to ensure safe and accurate placement of pedicle screws. Patient-specific screw guides with predrawn and prevalidated trajectory seem to be an attractive option for patients.
Methods: MashMixer software used to create models with 3D Printer in our clinic. Spinal CT performed with 1 mm thick sliced images. PLA filament material used while creating the models. Models created discussed with patient also to inform him/ her about the procedure and planning. During procedure surgical drills used for guide asissted free hand screw placement.
Results: Guide asissted surgery helped us perform screw placement correctly. Instrumentation for scoliosis and reductive procedures done without flaws and misplacements with guide models. With these models it was much easier to explain procedure to patient and relatives.
Conclusions: Spinal deformities are difficult to treat and without access to certain technologies it gets even more complicated. 3D printed guides enhanced safety of screw placement particulary at iliac levels. In case of negliance of these deformities and patient's inability to reach treatment surgical procedures to fix these deformities becomes harder to perform. Developing these patient specific drill guides with 3D printers is cheap and easy to access world wide for any spine surgeon, enabling them treat these patients with much ease and safety. With these models we were able to explain these procedures to patients pre-operatively and explaining them all steps. It was relief for the patient and patient would undergo the operation more confident and stress free.
Optional Image



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Brain and Spine 4 (2024) 103557
Self-reported psychological distress among patients with sellar processes

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Diagnosis of pituitary tumor may induce psychological distress and have a significant impact on the quality of life. Among other factors, treatment strategy, tumor entity and hormonal dysregulation may have a significant factors on patient emotional well-being. The aim of this study was to evaluate the level of distress and quality of life in operated vs. non-surgically managed patients with pituitary tumors.
Methods: We performed a prospective study in a tertiary neurosurgical center and two endocrinological medical offices in Mainz, Germany. Patients after surgical treatment with good functional neurological outcome and patients under conservative treatment (e.g. prolactinomas under medical therapy) as well as patients undergoing radiological follow-up without treatment were asked to participate in the study. Sociodemographic, clinical, and health-related quality of life and clinical data were assessed. Psychosocial factors were measured by the

Distress Thermometer (DT), Hospital Anxiety and Depression Scale (HADS), Short Form (SF-36) and Sino-nasal outcome test (SNOT).
Results: In total, 62 patients were recruited into the study (n=32 operative, n=30 conservative), mean age 52.4 (SD 18.1) years, 55.6% female. Prolactinomas were identified in 31.9%, Non-functioning pituitary adenomas in 18.8%, ACTH-producing adenomas were present in 6.3% of cases. In 14.5% of cases the entity was unknown, and the patients were followed up. 15.9% of patients reported increased anxiety and 14.5% elevated depression, although mean HADS scores were similar to the general population. The patients did not score low on SF-36 component scores (43% and 44%). The Mean DT score was 4.8 (SD 2.7), 38% of patients reported significant distress. There was no significant difference between the treatment groups except for increased Role limitations due to emotional problems in conservative group.
Conclusions: In our cohort of patients with pituitary tumors, the level of self-reported distress seems to be comparable to the general population. Further assessment is necessary to identify the patients who need psychooncological support.

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1339
Brain and Spine 4 (2024) 103558
Minimally İnvasive Supraorbital Keyhole Approach İn Childhood, Clinical Experience And Outcomes

Umit EROGLU [1], Murat Zaimoglu [1], Ozan Tekneci [1], Siavash Hasimoglu [1], Baran Can Alpergin [1], Gokmen Kahiogullari [1], Agahan Unlu [1]. [1] *Ankara University Faculty of Medicine Department of Neurosurgery, Ankara, Turkey*

Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: The minimally invasive supraorbital keyhole approach has recently become increasingly popular. In contrast to traditional approaches, it has gained acceptance in recent years due to less soft tissue damage, shorter incision hidden in the eyebrow, smaller craniotomy and no retraction required. The advantages include shorter operating time, reduced brain edema due to less retraction, low morbidity and satisfactory cosmetic results. In this article, we describe the clinical results and share our experience with this approach applied to pediatric patients.
Methods: The authors conducted a retrospective review of 18 cases of patients in whom the first author had performed a minimal invasive supraorbital keyhole approach between January 2017 and January 2024. Only cases of patients younger than 18 years with a follow-up of at least 6 months were included in this study. All inpatient and outpatient records were retrospectively reviewed and clinical/operative outcomes, cosmetic results and complications were recorded.
Results: Eighteen pediatric patients who had undergone minimal invasive supraorbital keyhole approach met the inclusion criteria. The pathological conditions were mostly tumors or other resectable lesions. With a total of 14 resectable lesions, 10 operations resulted in a gross total resection (100%) and 4 cases resulted in a subtotal resection (50%–99%). The epidural hematoma was removed in 2 patients, the frontal bone and frontal sinus were repaired in 1 patient and a cerebrospinal fluid fistula was repaired in 1 patient. Considering the small size of the frontal sinus in children, opening of the frontal sinus was not observed. In all cases the healing of the incision was extremely good and the scar was almost completely gone after 6 months. Furthermore, no cerebrospinal fluid leak or wound infection was detected.
Conclusions: The supraorbital keyhole approach is a minimally invasive tecnique that is more advantageous than conventional approaches (surgery time, cosmetic scores, hospital stay etc.). The incision in the eyebrow provides cosmetic results that are welcomed by patients and their families.
Optional Image



Figurel 1: Pre-operative patient position

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492
Brain and Spine 4 (2024) 103559
A Novel Tissue-selective High-speed Drill – First Experiences in Neurosurgery

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: High-speed drills are widely used in neurosurgery to expose the intracranial and spinal neural structures. Drilling may occasionally cause iatrogenic injury to the dura, to neural tissue, and vascular structures. Such injuries and their perioperative handling may lead to prolonged operation times, longer hospital stays, and postoperative complications. Surgify Safety Burr (SSB™) is a recently developed burr tip with an integrated safety mechanism for soft tissue protection. The aim of this clinical pilot study was to demonstrate the usability, safety, and efficacy of the SSB™.
Methods: 20 adult patients (6 male, 14 female, age 38–77 years) who underwent intracranial or spinal neurosurgical operations at the Department of Neurosurgery, Helsinki University Hospital, participated in this study. High-speed drilling was performed with SSB™ instead of standard diamond or fluted burr tips. Video recordings of the surgical microscope view and the perioperative verbal feedback from the surgeon were collected. Postoperatively we collected feedback from the surgeon.
Results: SSB™ worked normally in all 20 patients. We observed no soft-tissue injuries or device-related adverse events in any of the 20 patients. According to surgeons' feedback, the SSB™ was safe and effective. Subjective evaluation suggested less heating and chattering with SSB™ than with standard burrs.
Conclusions: SSB™ appears safe and efficient tool for bone removal in various cranial and spinal neurosurgical procedures. Further studies with higher number of patients are warranted to evaluate the various aspects of the SSB™. The SSB™ could have a wide clinical usage in all fields of surgery which include bone drilling.

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707
Brain and Spine 4 (2024) 103560
Indocyanine green fluorescence (ICG) in endoscopic transsphenoidal resection of pituitary adenomas: A systematic review and data analysis

Ida Olesrud [1], Ingeborg Halvorsen [2], Marit Storaker [1], Ansgar Heck [1], Daniel Dahlberg [1], Markus Wiedmann [1]. [1] *Oslo University Hospital, Oslo, Norway;* [2] *University of Olso, Oslo, Norway*

Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Endoscope integrated ICG (E-ICG) has been gradually introduced in skull base surgery over the last decade. Intraoperative use of E-ICG may aid in differentiating tumour from normal pituitary gland. Recent technical developments have enabled real-time intraoperative E-ICG with simultaneous near-

infrared/white-light overlay imaging. This may result in more precise surgery and ultimately better patient outcome. This review evaluates the use of E-ICG for pituitary adenomas, especially in regards to recent technological developments.
Methods: Systematic review following PRISMA guidelines. PubMed, EMBASE and Scopus databases were searched using different terms for "pituitary adenoma" combined with "ICG". Searches were independently performed by I.O, I.H. and M.S. and last updated on February 6th, 2024. Data from relevant original papers were extracted and analyzed.
Results: Search results are displayed in Figure 1. In total, 14 studies were included for qualitative assessment. The studies had heterogenous endpoints and methodology. Case-series size ranged from one to 25 cases undergoing transsphenoidal endoscopic surgery with E-ICG for pituitary adenoma. Ten studies utilized a first-generation endoscope, not allowing for overlay/dual mode visualization. Dual mode endoscopes were used in four studies. Ten studies assessed tumour fluorescence (124 cases). Eight studies evaluated differences in fluorescence between tumour and pituitary gland. Six studies performed objective quantitative assessment of ICG fluorescence in tumour and/or pituitary. Twelve studies administered ICG intraoperatively, two reported on the "second-window" technique. ICG dosage varied from 5mg to 25mg (bolus), administered one to three times during the procedure, alternatively 5mg/kg (infusion) 16-30 hours preoperatively. No safety issues regarding ICG were reported.
Conclusions: The current literature is mainly limited to case-series and E-ICG performed with first-generation endoscopes. Next generation E-ICG equipment enables real-time overlay images during tumour dissection. There is lack of consensus for ICG utility in pituitary tumour surgery, but it seems a promising tool for improving tumor/gland differentiation.
Optional Image

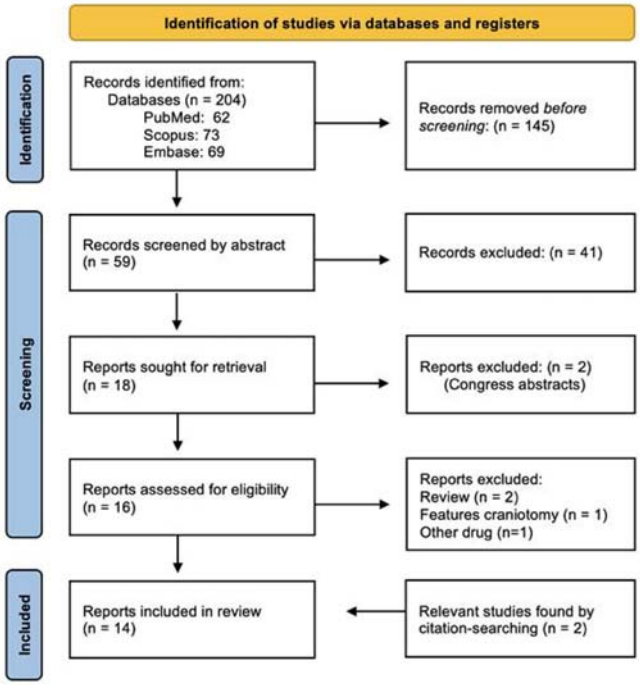


Figure 1: PRISMA flow diagram for systematic review on ICG and endoscopic surgery for PitNET

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30
Brain and Spine 4 (2024) 103561
Suggestion of follow-up period in nonfunctioning pituitary incidentaloma based on MRI characteristics

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: For patients diagnosed with asymptomatic, non-functional pituitary incidentaloma (PI), periodic follow-up is generally proposed. However, the recommended follow-up period differs among existing guidelines. In addition, a consensus is lacking. Thus, this study aimed to suggest follow-up periods for PI based on magnetic resonance imaging (MRI) characteristics.
Methods: Between 2007 and 2023, 245 patients who were diagnosed with PI were retrospectively assessed. Their mean clinical and neuroradiological follow-up periods were 74.2 and 27.3 months, respectively. Their baseline clinical and neuroradiological characteristics were analyzed. These 245 patients were divided into two groups: those with PI size progression and those without PI size progression. Additionally, neuroradiological features of each group were analyzed according to presumptive diagnoses of PI.
Results: PI size increased in 33 of 245 patients. For the remaining 212 patients, PI size decreased or stayed unchanged. Of the 33 patients with PI size progression, ten underwent surgery. Stalk deviation ($P < 0.001$) and lesion enhancement ($P = 0.001$) were significantly more observed in those with PI size progression than in those without PI size progression. MRI morphological factors were not related to changes in PI size in the presumptive Rathke's cleft cyst (RCC) group. In the presumptive pituitary adenoma group, absence of tumor enhancement ($P < 0.001$) and stalk deviation ($P < 0.001$) were significantly associated with tumor reduction and progression, respectively.
Conclusions: Our findings support an additional guideline for patients with asymptomatic non-functional PI without stalk deviation or enhancement. For these patients, clinical and neuroradiological follow-up periods could be reduced.

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499
Brain and Spine 4 (2024) 103562
Exploring Cerebral Hemodynamic Status via Non-invasive BOLD Cerebrovascular Reactivity Mapping: A Journey Through Past, Present, and Future

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Various hemodynamic parameters can be utilized to categorize the severity of hemodynamic impairment in cerebrovascular diseases, reflecting typical alterations as cerebral perfusion pressure declines progressively. Unlike certain other techniques, CVR consistently decreases with increasing severity of hemodynamic failure (HF). This distinct characteristic positions CVR as a potentially optimal marker for staging hemodynamic failure.
Methods: The MRI-based BOLD technique coupled with a CO2 challenge is an emerging method enabling the evaluation of CVR. BOLD-CVR serves as a genuine brain stress test, facilitating the quantification of hemodynamic status at the brain parenchymal level. Previous studies have shown good agreement between BOLD-CVR and PET perfusion reserve. Our recent efforts have focused on establishing specific quantitative BOLD-CVR cutoff points to classify vascular territories into distinct stages of HF and validating the clinical utility of the BOLD-CVR technique.
Results: With reference to HF staging using 15O-water PET, we established BOLD-CVR cutoff points for different vascular territories. Notably, BOLD-CVR applied to the middle cerebral artery territory demonstrated the highest consistency, with a sensitivity of 0.85, specificity of 0.81, and accuracy of 0.83 when classifying HF stage 2 versus HF stages 0 to 1. Furthermore, we have found that BOLD-CVR is able to predict the risk of ischemic stroke recurrence. The adjusted hazard ratio for ischemic stroke recurrence was 10.7 in patients with versus without significantly impaired CVR. Additionally, BOLD-CVR aids in better characterizing candidates for surgical revascularization via STA-MCA bypass.
Conclusions: By establishing BOLD-CVR cutoff points an important contribution toward demonstrating the clinical utility of quantifying hemodynamic impairment using novel BOLD-CVR was made. This clinically applicable technique allows to evaluate hemodynamic impairment and the risk of stroke recurrence and may replace techniques currently used in clinical routine as well as guide surgical decision-making regarding revascularization.

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313
Brain and Spine 4 (2024) 103563
Endoscopic Approach to Pediatric Craniopharyngioma: Retrospective Evaluation of 56 Patients

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: We aimed to evaluate the clinical and endocrinological results of the endoscopic transnasal approach applied to the 56 pediatric craniopharyngioma patients which diagnosed with radiological and pathologically and to present the surgical approaches applied to these cases.
Methods: Between September 1997 and November 2023, 5521 cases who were operated on endoscopic transnasal route in Kocaeli University Medical Faculty Neurosurgery Clinic were retrospectively screened. 56 pediatric craniopharyngioma patients, as well as their 67 operations, were included in the study. These 67 cases were divided into 4 groups according to infundibulum and third ventricle. Standard endoscopic surgery was performed in the cases, and in some cases an extended infrachiasmatic approach was performed.
Results: Standard techniques were performed in our cases with intrasellar spread craniopharyngioma, but our remaining cases were treated extended technique. GTR was achieved in 38/67 (56,7%) cases. Postoperatively cerebrospinal fluid (CSF) leakage developed in six cases included in the study. In 21 cases were transient, 32 had permanent diabetes insipidus, and 24 patients had postoperative hypophyseal insufficiency (one or multi hormonal) evolved.
Conclusions: The extended approach that can be applied after obtaining a certain experience is the ideal method if the lateral expansions are not excessive in the lesions of preinfundibular, transinfundibular and retroinfundibular craniopharyngioma. Combined approaches should be preferred in patients with lateral expansion. The extended approach in the middle midline lesions is easier and safer.

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1149
Brain and Spine 4 (2024) 103564
Transsylvian Approach for Resection of a Hypothalamic Teratoma in a Pediatric Patient

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: Hypothalamic tumors are rare entities with challenging surgical management. Patients present with symptoms related to endocrinological function and visual disturbances. Proper evaluation contains examination of blood and CSF for markers and a biopsy, if the diagnosis is not established. Different approaches have been described, such as endoscopic, transcallosal, and skull base approaches: pterional, orbitozygomatic, supraorbital eyebrow and subtemporal approaches
Methods: A 12-year-old female presented to outpatient clinic complaining about visual disturbances. Ophthalmologic evaluation revealed optic fields' deficit and further evaluation with MRI showed a lesion in the region of hypothalamus. AFP and b-hCG levels were high in both blood and cerebrospinal fluid (CSF), and the patient underwent chemotherapy according to the protocol for a non-germinomatous germ cell tumor. The follow-up MRI showed that the tumor had not responded to treatment, so a surgical resection was scheduled and a pterional transsylvian approach was performed
Results: During the resection of the tumor, special attention was given to internal carotid artery (ICA), middle cerebral artery (MCA) and optic chiasma. Gross total resection was achieved and the histologic evaluation showed a teratoma. Postoperatively the patient had no new neurological deficits and transient diabetes insipidus was resolved after a week
Conclusions: Tumors of the central nervous system that have positive markers (AFP, b-hCG) in CSF and blood are categorized as non-germinomatous germ cell tumors. For those tumors, a biopsy is not necessary and the treatment of choice is chemotherapy. However, in case that the tumor does not respond to first line treatment, surgery is the treatment of choice. The most proper approach is indicated by the position of the lesion, regarding patient's safety and best surgical outcome

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1227
Brain and Spine 4 (2024) 103565
Pituitary Germinoma after Resection of a mature 3rd ventricular Teratoma: A Case Report and Review of the Literature

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: Metachronous intracranial Germ Cell Tumors (iGCTs, unrelated, histologically different iGCTs occurring at different timepoints) occurring within the same patient, remain a rarity. We herein report such a case, discuss the literature and potential pathophysiological mechanisms leading to this phenomenon.
Methods: Work-up of the clinical case information and literature search on Embase, PubMed and Medline using a search string containing germ cell tumors, second hit, germinoma.
Results: A 9-year-old boy presented with new onset impaired balance, headaches, nausea, visual disturbances and left facial paresis. MRI scans revealed a third ventricular mass originating from the pineal gland with consecutive obstructive hydrocephalus. A mature teratoma was diagnosed and resected. Postoperative recovery was good, and the patient could return to normal daily activities. However, a new, slowly progressive lesion in the sellar region with an enlarged infundibular stalk was detected on follow-up MRI 3.5 years after initial tumor resection. Biopsy revealed a de-novo developed pure germinoma. The patient was treated with radio-chemotherapy and remained relapse free at last follow up. Sixteen other cases report a surgically resected primary mature teratoma, where patients developed metachronous germinomas during follow-up. Different theories try to elaborate this phenomenon, yet none can completely account for it.
Conclusions: Although rare, neurosurgeons should be aware of the phenomenon of metachronous iGCTs. In patients treated for iGCT, close long-term clinical, image, and laboratory follow-up should be recommended.

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558
Brain and Spine 4 (2024) 103566
Volumetric 3D analysis of cosmetic defects after clipping via mini-pterional and conventional pterional craniotomies

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM
Background: Less invasive approaches suggest a better cosmetic outcome after surgery, which is decisive for patients choosing between aneurysm treatment options. Nonetheless, esthetic outcomes remain poorly evaluated. We analysed the cosmetic results of the mini-pterional (MPT) in comparison to the conventional pterional (PT) craniotomy for elective clipping of aneurysms.
Methods: Radiological files of patients who had undergone elective anterior circulation aneurysm clipping were searched for availability of data sets allowing an elaborated 3D analysis with dedicated volumetric and visualisation software. Patients were included if these required data sets prior to and after wound healing (minimum 3 months post-op) were available. The cosmetic outcome was judged independently by two procedure-blinded observers.
Results: 41 radiological patient files were screened to find appropriate 3D data sets (CT or MRI, maximum 1mm slice thickness, voxel and distorsion corrected, complete aquisition of the pterional area) for 5 MPT and 5 PT craniotomies. Datasets prior to and after the respective craniotomy were surface-fused and subtracted to quantify the relevant defect volume and localization, as illustrated

in the attached image. The defect volume of MPT craniotomies was 2.7 +/- 2 cm^3, opposed to 6.6 +/- 5.8 cm^3 in the PT group. The cosmetic results of MPT were juged good (MPT 3; PT 1), acceptable (MPT 2; PT 2) or poor (MPT 0; PT 2) by the observers.

Conclusions: The MPT craniotomy showed a reduction of the volumetric defect to a third of the PT defect in this volumetric 3D workup, with cosmetic relevance for the patient.

Optional Image

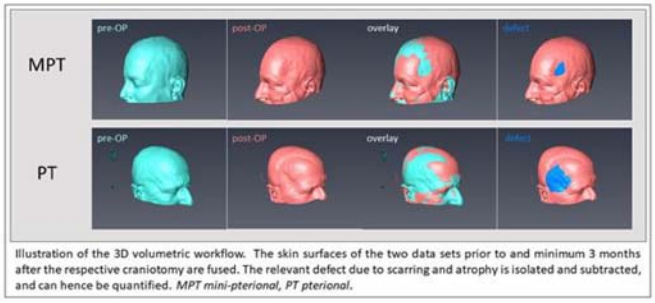


Illustration of the 3D volumetric workflow. The skin surfaces of the two data sets prior to and minimum 3 months after the respective craniotomy are fused. The relevant defect due to scarring and atrophy is isolated and subtracted, and can hence be quantified. *MPT mini-pterional, PT pterional.*

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185

Brain and Spine 4 (2024) 103567

European Survey on Follow-up Strategies for Unruptured Intracranial Aneurysms

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: The increasing detection rates of unruptured intracranial aneurysms (UIA) pose a challenge for both neurovascular centers, tasked with managing a growing pool of patients requiring regular monitoring with imaging, and the healthcare system that must bear the costs of such surveillance. While there is consensus on the need for follow-up of UIA, uncertainties persist regarding the optimal cessation of surveillance, especially when considering diverse patient risk factors and, notably, in cases of treated aneurysms with stable rest perfusion. Detailed guidelines on UIA follow-up are currently lacking, exacerbating these challenges.

We sought to investigate European strategies for follow-up of untreated, microsurgically and endovascularly treated UIA.

Methods: An online survey consisting of 15 questions about follow-up management of UIA was sent out to the cerebrovascular section of the European Association of Neurosurgical Societies (EANS).

Results: The survey response rate was 27.3% (68/249). There was consenus upon the necessity for longterm follow-up of UIA (100% [n=68]). The recommendation to perform follow-up was inversely correlated with patient age and more prevalent among endovascularly compared to microsurgically treated patients (92.6% [n=63] vs. 70.6% [n=48]). A majority recommended continued follow-up of treated aneurysms with stable rest perfusion, with lifelong surveillance in patients under 60 years and continuation for 5-10 years in patients aged 61-80, irrespective of whether they underwent microsurgical (38.3% [n=23]; (33.3% [n=20]) or endovascular (41.9% [n=26]; (30.6% [n=19]) treatment.

Conclusions: This survey confirmed a European consensus on the necessity of longterm follow-up for untreated UIA. However, significant variations in follow-up strategies, especially for treated UIA and post-treatment rest perfusion, were noted. Despite limited evidence suggesting low risk from aneurysm remnants, respondents favored long-term follow-up, highlighting uncertainty in management. This underscores the need for collaborative research on aneurysm remnants and standardized follow-up protocols for UIA in Europe.

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1210

Brain and Spine 4 (2024) 103568

3d Prınted Guıde Assısted Iliac Screwıng

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Iliac screw fixation is a commonly used surgical approach worldwide, particularly in cases where lumbosacral stabilization is inadequate. However, the surgeon's competence in performing iliac screws, the challenges in accessing the bony structure to be screwed, and the presence of vital anatomical structures around the iliac crest pose significant challenges for surgeons. To guarantee comfort during surgery and reduce the risk of complications, it is crucial to make thorough preoperative preparations. One such preparation is the creation of a guide using 3D modeling in the Bioengineering laboratory, based on Computed Tomography imaging, and printed using a 3D printer.

Methods: This study presents five patients who underwent iliac screw fixation using a 3D printed guide based on preoperative computed tomography imaging at our clinic in the last year. Of the patients, two were male and three were female. All had previously undergone lumbar or thoracolumbar fusion, but lumbosacral stabilisation had not been achieved. The iliac screw was planned, and bioengineers prepared a 3D guide. The patients underwent iliac screw placement using this guide.

Results: Five patients underwent iliac screw fixation using a 3D guide at our clinic in the last year. Postoperative computed tomography scans were analysed to determine the orientation and location of the iliac screws and their relationship with surrounding tissues. All patients had successful iliac screw fixation without complications, and no malposition or need for early revision was detected. Patients were discharged after wound healing was complete.

Conclusions: The use of emerging technologies in the surgical field is on the rise. This trend offers several benefits, including increased surgeon comfort, improved operation success rates, shorter operation times, and reduced need for postoperative revision surgery. It is predicted that the introduction of technology into the surgical field will bring even more conveniences in the near future.

Optional Image



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119

Brain and Spine 4 (2024) 103569

Surgical management of Chiari 1.5 in children: a truly different disease?

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: In patients with Chiari 1.5 malformation, characterized by the caudal descent of the brainstem through the foramen magnum along with tonsils ptosis, a more aggressive disease course, and an increased association with craniovertebral junctions (CVJ) anomalies have been suggested. The best management of this subgroup of patients is not clearly defined, also due to the lack of specific series elucidating this anomaly's peculiar characteristics. We present a broad, homogenous series of Chiari 1.5 children submitted to posterior fossa decompression and duraplasty (PFDD) in a tertiary national referral center better to understand the Chiari 1.5 behavior in the pediatric population.
Methods: We retrospectively evaluated all patients under 18 years admitted to our Institution for PFDD between 2006 and 2021, fulfilling the criteria for Chiari 1.5 diagnosis. Clinical data about headaches, brainstem involvement, sensorimotor impairment, and radiological findings comprising syringomyelia extension and evolution, CVJ alterations, and scoliosis were analyzed
Results: Thirty-three patients (25 females, 8 males) with a median age at surgery of 13 years were included. Headache was present in all children, five presented central apnea, five had dysphagia, and three rhinolalia. Syringomyelia was present in 19 (58%) children. Twenty patients (61%) showed various CVJ anomalies, but only one child presented signs of instability requiring arthrodesis. The mean tonsils displacement below the foramen magnum was 19,9 mm (range 12-30), but without statistically significant correlation with the severity of symptoms. In all children, the hindbrain was downward displaced for more than 1/3 of its length, with the obex under the foramen magnum. Arachnoid tonsils coagulation or resection was necessary for 19 children (58%), more frequently than in “simple” Chiari 1 patients. Syringomyelia recurred or was unchanged in three patients, and one needed C1-C2 fixation. The headache disappeared in 28 children (84%).
Conclusions: There are no peculiar symptoms and signs of Chiari 1.5. Such patients do not show an increased CVJ instability. In our series, the need for tonsils resection or coagulation could raise the risk of arachnoiditis and syringomyelia recurrence or persistence.

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940
Brain and Spine 4 (2024) 103570
Defining the Learning Curve of the Exoscope in Spine Surgery

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: In recent years, introduction of the exoscope system has been responsible for a new era of optics in surgery. Such a system has started to be widely used in neurosurgery. More recently, the exoscope has also been increasingly used for spinal procedures. Thus, we aimed to explore the potential for exoscope-assisted spinal procedures and define the advantages and drawbacks of implementing the system into our daily routine.
Methods: To achieve the aim of the study, we retrospectively reviewed the case series of patients treated by a senior surgeon and analyzed the results, complications, and operative time. The operating times were compared between the exoscope-assisted procedures and microscope-assisted procedures.
Results: A total of 24 spinal procedure were performed with the exoscope in a 2-month period. In this first patient series performed by a single surgeon without experience with the exoscope, the learning curve seemed to be relatively low, with mastery of the instrument achieved after the performance of only a few cases. Comparing the cases after the plateau of the learning curve had been reached with those performed during the still active phase of the learning curve, a significant difference was found in the operative times. No statistically significant difference was detected in terms of blood loss or intraoperative complications.
Conclusions: Based on our first experience, use of the exoscope shows promising potential for opening up new frontiers in spinal microsurgery. In addition, it has a low learning curve for experienced surgeons.

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1230
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Endoscopic endonasal approach in the diagnosis and treatment of non-chordomatous clival tumors

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Clival tumors are rare. Chordomas are considered the most common primary tumors arising in the clivus. The rest of clival lesions comprise a histopathologically heterogenous group of various tumors. The location of these tumors is challenging for neurosurgeons. The aim of the study was to review the surgical results in a series of patients with non-chordomatous clival tumors operated with endoscopic endonasal approach.
Methods: The study is a retrospective analysis of a series of 79 patients (38 women and 41 men) treated from the 2010 to 2023 by the endoscopic transsphenoidal surgeries for non-chordomatous clival tumors. The mean age of the patients was 49.0 years (17-90 years), and the mean follow up period was 6.1 years (0-14 years).
Results: The most common histopathological diagnoses were: metastatic carcinoma (30.4%), fibrous dysplasia (15.2%) and chondrosarcoma (10%). Ten patients had gross total resection (12.7%), 19 – subtotal resection (24.1%), and 50 – partial resection (63.3%), including 38 cases of tumor biopsy (38/50, 76.0%). Seven patients had fat tissue graft as a reconstruction of the meningeal defect (8.9%). The most common complication was transient diabetes insipidus observed in 2 patients (3.4%). There were also single cases of epistaxis, and infection at the resection cavity. There were no deaths during the postoperative period.
Conclusions: Endoscopic endonasal approach for non-chordomatous clival tumors allows for a good extent of resection or diagnostic biopsy. The complication rate is low.

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710
Brain and Spine 4 (2024) 103572
Life-style, allergy and metabolic factors and risk for pituitary adenoma: A large prospective cohort study (CONOR)

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Pituitary adenomas (PA) account for about 13.5% of all primary intracranial tumours. PA are associated with significant morbidity due to their vicinity to neurovascular structures and hormone disturbances. The knowledge about risk factors for PA is scarce and modifiable factors have been hardly assessed. Aim of study: To investigate life-style, allergy and metabolic factors in relation to PA risk.
Methods: The Cohort of Norway (CONOR) is a prospective population-based health survey including anthropometric measures, blood tests and health questionnaires. CONOR was linked to the National Cancer Registry to identify PA during follow-up. Follow-up time was calculated as person-years from time of baseline examination until date of PA diagnosis, other cancer diagnosis, death, or end of follow-up. Cox proportional hazard regression, using attained age at study baseline as time axis, was performed to calculate hazard ratios (HR) with 95% confidence intervals (CI), stratified for sex.
Results: The study cohort consisted of 160,938 adult women and men. During a total of 2,877,646 years of follow-up, 97 histologically confirmed PA were identified.
Obesity (HR 2.02; 95% CI 1.17-3.48) was associated with increased PA risk. Increasing levels of blood triglycerides (HR 2.13; 95% CI 1.13-4.02) were positively, while increasing levels of HDL (HR 0.36; 95% CI 0.19-0.69) were negatively associated with PA risk (HRs shown for highest quartile).
Systolic or diastolic blood pressure levels or hypertension did not significantly

increase PA risk. Allergic condition, hay fever or asthma were not associated with PA risk. The life-style factors physical activity, smoking or alcohol consumption did not show an association with PA risk.
Conclusions: This is the first study to present comprehensive data on modifiable risk factors for PA in a prospective cohort study. Obesity and unfavourable blood lipid profiles may increase PA risk.

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1009
Brain and Spine 4 (2024) 103573
Machine learning identifies electrophysiological criteria for postoperative motor deficit in supratentorial tumor surgery.

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Electrophysiological neuromonitoring is crucial during tumor resection near the primary motor cortex and corticospinal tract, but clear criteria for resection cessation are lacking.
Methods: Clinical and electrophysiological data (including transcranial MEP (tcMEP) amplitude, direct cortical stimulation MEP (dcMEP) amplitude, and corticospinal-tract (CST) stimulation intensity) from 88 patients undergoing neurosurgical procedures for supratentorial intracranial tumors were used in training a machine learning algorithm, XGBoost, based models for classification of cases established on postoperative motor function ($\leq$4/5 muscle manual test (MMT) score points, group 1, and $\leq$3/5 points, group 2). The models were assessed with cross-validated metrics for imbalanced datasets. SHAP values were used for evaluation of feature importance and model optimization by feature elimination. The optimized models were tested against 64 independent prospective cases.
Results: Five-factorial optimized prediction models for groups 1 and 2 were generated with Matthews correlation coefficients of 0.64 and 0.54, respectively. Notably, end values of direct cortical MEP amplitude <50% of baseline strongly correlated with permanent postoperative deficits, with preoperative MMT score and extent of resection being significant predictive factors. Preoperative status significantly correlated with permanent postoperative motor status $\leq$3/5p. MMT, indicating the importance of baseline function. The end values of dcMEPs <50% of baseline as well as minimal positive CST stimulation intensity <3mA were associated with significant risk of moderate to severe deficits, emphasizing their predictive value. When subjected to the prospective cases models for group-1 classification performed excellently, however those for group-2 classification were inconsistent in accounting for borderline cases.
Conclusions: Machine learning facilitates multifactorial analysis of clinical and electrophysiological predictors. These models offer timely, individualized analyses for intraoperative neuromonitoring in tumor surgery, aiding in decision-making regarding resection cessation. By eliminating information noise and selecting important predictive factors, the interpretation of electrophysiological data is enhanced and functional outcomes in neurosurgical procedures could be optimized.

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814
Brain and Spine 4 (2024) 103574
An Endoscopic Endonasal Approach to Craniopharyngiomas: Surgical outcomes and follow-up results of 150 patients

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Craniopharyngiomas are locally invasive neoplasms and usually firmly adhere to the surrounding neurovascular structures. Despite advancements in endoscopic techniques, gross-total resection (GTR) of tumors with invasion or adhesion to important surrounding anatomical structures is extremely difficult. We present a single-center study that evaluated the impact of the endoscopic endonasal approach (EEA) on the surgical outcomes of craniopharyngiomas, the factors affecting the resection rate, and recurrence.
Methods: 170 operations on 150 patients with pathologically identified craniopharyngioma who were treated via the EEA from August 1997 to January 2024 were included in the study with the added cases after the articles that were published in 2021 and 2023 (1,2).
Results: In total, 45 patients (20 pediatric and 25 adult patients) (30%) had history of operation before. The most common symptom at presentation was endocrine disturbances (94.6%). Patients were classified as infrasellar (6%), sellar (33.3%), sellar-suprasellar 64 (42.6%), and suprasellar (18%) localization. GTR was achieved in 103/150 patients (68.6%). The ratio of GTR was higher in infrasellar (100%) and sellar (90%) tumors compared with sellar-suprasellar (62.5%) and suprasellar (33.3%) tumors. Postoperative complications, other than endocrine impairment, occurred in 24/150 patients (16%). At follow-up, 45/150 (30%) patients presented with tumor recurrence (27 pediatric and 18 adult patients).
Conclusions: This retrospective cohort study provides surgical indications for EEA, as well as the factors affecting the resection rate and recurrence of craniopharyngioma. The most important factors affecting a successful resection are recurrent tumor, the location of the tumor and increasing experience.

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398
Brain and Spine 4 (2024) 103575
Usefulness of cranial scanning and 3d printing of cranial helmet using software in the treatment of positional plagiocephaly

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: Positional plagiocephaly (PP) is an asymmetrical skull deformity, increased significantly from approximately 5% to over 46% by the age of 7 months. Classically, the diagnosis is clinical, and the treatment is generally conservative by wearing a helmet. The new techniques of light scanning and computer processing allow to obtain the cranial diameters, making a diagnosis and the manufacture of a helmet by 3d printing in a more accurate.
Methods: 5 Patients, one girl and four boys, with diagnosis of PP, with age between 5 and 6 months, with a follow-up between 5 and 7 months and with intermediate determinations between 6 and 10 times, were studied.
A 3D Shining ® scanner was performed using light and determining cranial index (CI), Cranial Asymmetry Index (CAI), Anterior Cranial Asymmetry Index (ACAI) and Posterior Cranial Asymmetry Index (PCAI). The helmet was 3D printed using the ORTHOGALEA® cranial orthosis. Sensors were used to quantify the pressure exerted on the contact points, without producing decubitus lesions. A monthly digital control, or less if needed, allowed a readaptation in the necessary cases.A control was performed one month after removal of the helmet.
Results: The mean age at treatment initiation and end of treatment was 5.6 and 9.2 months, respectively. The values of the indices obtained are shown in table 1. The pressure exerted on the contact points was 60 mm Hg, and no pressure ulcers were observed. All patients presented a reduction of the indices with disappearance of the cranial asymmetry.
Conclusions: The treatment of PP using customised 3D scanning and printing techniques achieves optimal results, with the asymmetry disappearing and displacing classical treatment. Intermediate controls allow a high precision correction of the helmet, improving the evolution. The control of the pressure on the contact points allows a better expansion of the free zones.
Optional Image

TREATMENT		INDEX			
		CI	CAI	ACAI	PCAI
MAXIMUM	STAR	20.6	94.1	18.54	22.22
	END	7.5	86.4	6.09	11.76
MINIMUM	STAR	7.5	83.1	6.94	10.11
	END	4.5	82.1	4.22	8.9
MEAN	STAR	11.6	88.13	8.56	16.07
	END	6.4	84.44	6.18	8.97

Table 1: cranial index values

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500

Brain and Spine 4 (2024) 103576

Hemodynamic alterations in seizure-prone brain AVM patients: Angiographic and BOLD cerebrovascular reactivity features pre- and post-microsurgical resection

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Patients with seizure-prone brain arteriovenous malformations (bAVMs) exhibit more pronounced hemodynamic changes, manifesting as impaired whole brain and peri-nidal cerebrovascular reactivity (CVR) on blood oxygenation-level dependent (BOLD) MRI, along with angiographical venous congestion characteristics compared to bAVM patients without epileptic symptoms. Our aim is to investigate these hemodynamic changes and assess whether the disappearance of venous congestion post-microneurosurgical bAVM resection leads to CVR normalization, ultimately resulting in a seizure-free status.

Methods: Patients with untreated bAVMs, categorized into seizure and non-seizure groups, were recruited from the Department of Neurosurgery at University Hospital Zurich for this prospective case-control study. Quantitative CVR measurements were obtained from BOLD MRI scans using a standardized hypercapnic vasoactive stimulus method. Whole-brain CVR was evaluated, alongside detailed brain tissue and bAVM analyses, to compare the two groups. Venous congestion assessment was conducted via 6-vessel digital subtraction angiography (DSA) for all patients. BOLD-CVR studies were conducted three months post-microneurosurgical bAVM resection, with DSA performed before hospital discharge.

Results: The analysis comprised 30 patients, with 12 in the seizure group and 18 in the non-seizure group. Patients with seizure-prone bAVMs exhibited compromised whole-brain CVR and more venous congestion compared to those without seizures. Following complete bAVM resection and antiepileptic medication, all seizure-prone patients remained seizure-free, with post-surgery BOLD-CVR revealing an improvement of peri-nidal and whole-brain CVR towards normal levels in these patients when venous congestion was resolved.

Conclusions: In patients with seizure-prone bAVMs, our findings indicate that resolving venous congestion after microneurosurgical resection leads to the normalization of BOLD cerebrovascular reactivity. BOLD-CVR could potentially serve as an imaging indicator to evaluate seizure outcomes in bAVM patients.

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874

Brain and Spine 4 (2024) 103577

To what extent can inexpensive ArUco marker based webcam navigation technology be used in neurosurgery?

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: The use of intraoperative image guidance technologies has become routine in many neurosurgical practices and has become a fundamental part of modern medicine. Computer-assisted neurosurgery is used to improve surgeon performance and achieve better patient outcomes in both spine and cranial surgical procedures.

Historically In 1890, Russian anatomist Zernov described the encephalometer which is is an arc-shaped device fixed to the skull for intracranial localization based on superficial marker points as the first attempt in stereotaxic field. In 1891, Zernov's student Altuchow examined the basal ganglia with an encephalometer. The concept of stereotaxis was introduced by Sir Victor Horsley (who is considered the father of stereotaxy) in 1908. Sir Victor Horsley with Robert Henry Clarke described stereotactic calculation based on a coordinate system and succesfully, and accurately detected position of any intracranial point by using frame fixed to the skull. By using this frame-based stereotactic system an electrode was placed in the dentate nucleus of monkeys. (1)

Neuronavigation or in another name frameless stereotaxy is considered the next evolutionary step in stereotactic surgery. Stereotactic and neuronavigation systems have become an almost ubiquitous technique in the field of neurosurgery. Commercially available neuronavigation systems are both large (a problem for small operating rooms) and expensive which are major problem that prevents their widespread use.

Hence Webcam-based neuronavigation is inexpensive, and if acceptably accurate, may be a suitable neuronavigation method candidate, especially in hospitals where neuronavigation systems can't be provided. In this article, we will try to evaluate the accuracy of ArUco marker based webcam neuronavigation system as inexpensive technology. Will try to answer the question to can we use this too cheap technology in operation room as a neurosurgeons ?

Methods: To create the one 3D model (virtual and phantom model), MRIs of 75 patients who were operated on for intracranial lesions at Akdeniz University Neurosurgery Clinic between February and May 2023 were examined. The desired lesion size is around 2x2x2 cm which is not very deep, nor superficial. The selected patient has left frontal lesions measuring 26x28X24 mm and 2.5 cm deep.figure (1)

The patient's MRI was segmented using SegmentEditorExtraEffects extension in 3d slicer. the produced 3d model exported in STL file format and printed using 3d printer. Segmented lesion was divided into 2 overlapping region of interest (roi1 and roi2) where roi1 had a diameter of 8 mm and roi2 had a diameter of 2 cm. We used webcam with ar0234 cmos global shutter sensor and 2.8 mm non-distortion lens. The webcam was calibrated and the resolution was reduced to 800X600 to avoid lag in the system. (Frame Per Second) FPS was set to be on 60 FPS. The web camera was connected to the 3D slicer application via the plus tool kits (6) and the previously segmented 3D model has been loaded into the system. For tracking process 5x5 cm ArUco marker attached to 150X7mm marker model figure (2),actually to show that anything can be used in navigation process we intentionally used pen as a marker. registration was carried out using 5 superficial landmark points on the 3D model; (real and virtual model alignment) and we make sure that RMS error was <1 in all trials. Bilateral burrhole was opened on the phantom 3D model. An endoscopic camera was attached through the burr hole on the side contralateral to the lesion to verify the location of the marker tip as shown in Figure (3)

Workflow:

Segmentation:to generate 3D object both virtual and real phantom model.

Registration: allignment of models and make sure RMS error to be less than 1

Creating the tracking system which consists of ArUco marker attatched to stylus marker (we used pen) and webcam as tracker.

Testing of the monitor system (in qualitative manners).

The primary outcome of trial is to successfully detection of ROI1 (8mm diameter)

Segmentation:

It refers to the process of extracting the desired object ROI (organ, tumor, etc.) from a medical image which can be done manually, semi-automatically or fully automatically (Fick et al.) (2,3)

There are some kind of programs used for segmentation, for example: ITK-SNAP, SİMPLE ITK , VTK (Visualization Toolkit) and 3D SLICER

3D Slicer, also known as "Slicer", is a free, open-source software platform widely used by Medical professionals, researchers, developers and developers for medical image visualization, analysis and segmentation. It was first developed in the Surgical Planning Laboratory (SPL) at Brigham and Women's Hospital, an educational institution of Harvard Medical School. (late 1990s) (4)

Because 3D slicer is open source, researchers and developers have contributed code, modules, extensions, and documentation, and over time, 3D Slicer has grown beyond Brigham and Women's Hospital with the contribution and collective effort of professionals from a variety of institutions, including hospitals, research centers, and universities.

In our study, 3D slicer was used as a segmentation platform.The medical imaging was transferred from Sectra İDS7(Sectra AB, Sweden) to 3D slicer as DICOM data and segmented using Local threshold segmentation method which is a semi-automatic segmentation method which was added to the 3d slicer application in 2019 via the SegmentEditorExtraEffects extension.

Registration (alignment):

The registeration process was done by using fiducial registration wizard extention in 3d slicer to align the position and orientation of 3D object produced by segmentation (virtual) with the 3d model printed with 3d printer representing patient's head.

Tracking:

Tracking Methods**:** Image-guided surgery (IGS) is a surgical procedure that involves the use of surgical instruments monitored in conjunction with preoperative or intraoperative images. IGS systems use different tracking techniques, including mechanical, optical, ultrasonic and electromagnetic. Optical monitoring systems are widely used in IGS surgeries. For example, medtronic stealth

station surgical navigation system provides both optical and electromagnetic (EM) tracking capabilities.
ArUco marker tracking
ArUco marker tracking method developed by Rafael Muñoz-Salinas and Sergio Garrido-Jurado (5). The ArUco marker is a square with a wide black border and a white matrix interior (identifier) which can be detected by webcams and the pose (position and direction) of the marker can be estimated.figure (4)
Results: The trial was repeated in 10 different sessions, using different registration points.RMS error was <1 in all trials. Roi1 (8mm diameter) was successfully detected in 8 attempts. In two trials, roi 2 (2 cm) was detected instead of roi 1. the installation of system took 1.5 hour for the first trial and just 30 minutes on the 10.th. trial.this tinme was spent for stylus calibration and registration process.This time is important because it represents the time will be needed after the head is fixed to myfield fixation device. We found that the installation time decreased with repetition. Although our study is qualitative, we found that the general error of ArUco marker-based neuronavigation could be between 0.8 mm and 20 mm. This range of error might not be acceptable for some cranial procedures, but can certainly be used in spinal and cranial procedures that tolerate this margin of error, such as sampling lesions > 2 cm in size especially where a traditional neuronavigation device is not possible.
Discussion: The use of open source programs (such as 3D slicer) instead of commercially available neuronavigation systems is preferred especially in research, education and surgical planning rather than intraoperative guidance. Since these programs are open source (use, modify and distribute without license fees), they are flexible to use. For example, rather than navigational contrast-enhanced T1 MRI, different imaging data (venography, DWI, tomography, etc.) can be loaded into systems and used in a variety of operations.the figure (4) shows patient with brainstem lesions. UFK tractography extension (7) was used to segment DTI MRI in this patients.other applications that can be use in this type of programs are for example construction a 3d model of lost cranial bone to create mold for cranioplasty by registering the head tomography of the patint and its mirror. Figure (5) or by registering of both pre and post craniectomy operation head tomography. Figure (6)
The conducted study is a qualitative study. The potential effectiveness, feasibility and applicability of webcam-assisted tracking technologies (as a possible alternative candidate to existing expensive neuronavigational systems) were tested. By repeating the trial, the installation time of the system (the time needed after the skull clamp is installed) was reduced. Roi 1 (8 mm) was determined 80% correctly. Although positive results were obtained, Further studies are required these studies should be quantitative, and different variables such as marker distance and size, light and the depth of tracked ROI should be examined.before.for now we think that webcam based navigation techniques using open source programs can be used in procedures that can tolerate the range of error that we found.
Conclusions: Although web-cam based neuronavigation systems are not as accurate as commercial neuronavigation system , given that the overall error of commercial neuronavigation after registration and mechanical application was 3.93 ± 1.70 mm and 3.65° ± 1.29 (position and orientation) pedro D. Batista et al.(8) We found that error of web-cam based neuronavigation systems can be roughly somewhere between 0.8-2 cm. our study found that this type of 'cheap' technology can be used in neurosurgery prosedures that can tolerate range of error as locating borders of subdural , epidural or intraparanchymal hematomes or in spinal prosedures to determine the level of spinal tumor without using c-arm.

Optional Image

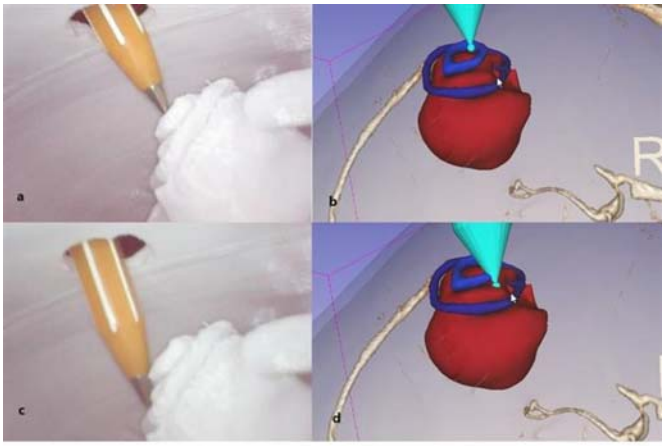


Figure 3: showing a patient with left frontal lesion tracked using ArUco marker based navigation system. 3a:real marker tip on ROI1 of the lesion as shown through endoscopic camera 3b:virtual marker tip on ROI1 3c: real marker tip on ROI2 of the lesion shown through endoscopic camera 3d: virtual marker tip on ROI2 of the lesion.

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522
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Predictors of neurological worsening and recurrence after resection of pituitary adenoma in elderly patients

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Considering the aging of the general population, brain tumors are recognized with increasing frequency in older patients. Earlier research has indicated the safety of surgery for elderly patients although the findings regarding pituitary tumors have been based on small sample sizes and have yielded mixed results in terms of risk and complication rates.
Methods: Data acquisition was conducted as a retrospective analysis. Demographic and clinical data, as well as surgical outcome of elderly patients (> 75 years) were compared to patients aged 75 or younger. Knosp grad, extent of resection, complications and outcome were analyzed and compared. Univariate and multivariate logistic regressions were used to evaluate the prognostic impact of age on extent of resection and surgical outcome.
Results: In the study, 204 patients with pituitary adenoma were involved, with 41.2% (n=88) being over 75 years old. The mean age was 79.1 years (range 76-88). Visual impairment was the predominant symptom at admission (61%, n=51), followed by dizziness (10%, n=8), and headache (8%, n=7). Younger patients (<75 years) exhibited higher rates of acromegaly (18% vs. 4%, p=0.002) and other preoperative hormonal activity (22% vs. 4%, p=0.001) compared to those over 75 years. In the elderly patients, cavernous sinus invasion was present in 78% (n=54), and extension into the sphenoid sinus was found in 23% (n=16, p=0.001). Total resection was achieved in 75% (n=63), followed by subtotal resection (24%, n=20), and partial resection (1%, n=1).
Postoperatively, the clinical condition improved in nearly 80% of cases, remained unchanged in 12% (0), and worsened in 6% (4 patients) at the three-month follow-up.
Multivariate logistic regression identified preoperative hormonal insufficiency (OR 2.11, 95% CI 1.03-4.31, p=0.04) and tumor extension into the sphenoid sinus (OR 3.38, 95% CI 1.20-9.51, p=0.02) as significant predictors for worsening neurological function at the 3-month follow-up. Additionally, subtotal resection (OR 15.3, 95% CI 3.36-68.2, p<0.001) was significantly associated with tumor regrowth, and cavernous sinus infiltration (OR 5.8, 95% CI 1.41-23.9) was linked to clinical worsening at the last follow-up.
Conclusions: Our study indicates that pituitary adenoma surgery in this age group is both safe and effective, with a high resection rate and low complication

rate. However, patients undergoing subtotal resection require long-term follow-up due to the risk of tumor recurrence. Meticulous patient selection and thorough preoperative evaluations are essential for optimal outcomes in the elderly population. These findings offer valuable insights into the characteristics, surgical outcomes, and prognostic factors of pituitary adenoma, with a particular focus on age-related considerations.

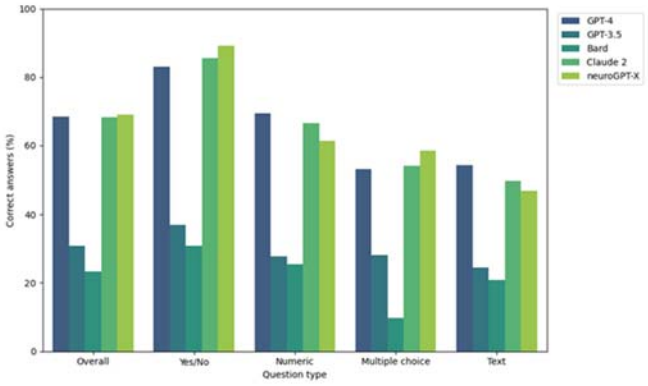
https://doi.org/10.1016/j.bas.2024.103578

634
Brain and Spine 4 (2024) 103579
Large Language Models Can Extract Tabular Data from Unstructured Patient Records To Be Used in Large-Scale Retrospective Studies

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: The recent progress of Large Language Models (LLM) has received significant attention across broader society. Their ability to analyze vast quantities of unstructured patient data suggests a potentially transformative role in conducting retrospective studies, particularly in extracting structured tabular data from patient records, at an unprecedented scale.
Methods: All patients hospitalized at our institution within a one month period were asked to participate in the study. Their patient records were reviewed and 35 data points were manually extracted. Various types of patient records (clinical summaries, physical examination reports, progress notes, prescription orders, nursing assessment, in- and outpatient consult notes, radiology reports) were merged into one document per patient and anonymized. The document was further joined with a prompt to extract the 35 data points in a machine-readable JSON format and entered into 5 LLMs (GPT-4, GPT-3.5, Google Bard, Claude 2, neuroGPT-X). We assessed the accuracy and machine-readability of their responses.
Results: A total of 172 patients were enrolled in the study. There were 81 (47.1%) male patients, the mean age at the time of admission was 59.1 ± 15.3 years. The mean length of the concatenated patient documentation was 906.0 ± 158.7 characters. The consensus rate in data extraction was 92.6%. The highest number of machine-readable replies was returned by Claude 2 (99.4%). The highest percentage of correct answers was achieved by neuroGPT-X (68.9%), followed by GPT-4 (68.5%) and Claude 2 (68.3%), all significantly outperforming GPT-3.5 (30.8%) and Bard (23.4%) ($p < 0.001$).
Conclusions: This research underscores the significant role of LLMs in extracting structured data from medical records, opening new avenues for advanced AI-driven medical data mining. In the context of working with sensitive patient data, its reliance on prospectively collected patient data, acquired through explicit patient consent, ensures both ethical integrity and robustness in research methodology.

Optional Image



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1457
Brain and Spine 4 (2024) 103580
Application of Artificial Intelligence for Addressing Surgical Patient Questions: An Observational Cross-Sectional Study

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: The intersection of artificial intelligence (AI) and healthcare has opened avenues for improved patient care and engagement, particularly in the surgical domain. As AI models become increasingly sophisticated, their role in preoperative and postoperative settings is a subject of considerable interest.
Methods: A comprehensive set of 38 surgery-related questions was formulated, encompassing a broad spectrum of patient concerns from understanding surgical indications and procedures to managing expectations for post-operative recovery. On August 16, 2023 these questions were used as single-shot inputs for three state-of-the-art LLMs: OpenAI's ChatGPT GPT-4, Antropic's Claude 2, and Google's Bard. Two board-certified physicians independently evaluated the responses using a 5-point Likert scale to grade accuracy, relevance, and clarity, while emotional sensitivity was rated on a more granular 7-point scale. Statistical methods, including the Shapiro-Wilk test, Levene test, Kruskal-Wallis, ANOVA, and post-hoc comparisons with Bonferroni corrections via Dunn and Tukey tests, were employed to analyze the data. The inter-rater reliability was quantified through Weighted Percentage Agreement (WPA).
Results: Claude 2's responses scored highest in all categories, with significant differences noted in accuracy ($H=27.464$, $p<.001$), relevance ($H=29.074$, $p<.001$), clarity ($H=32.745$, $p<.001$), and emotional sensitivity ($F=10.799$, $p<.001$). Non-normal distribution was detected for the scores of accuracy, relevance, and clarity (Shapiro-Wilk $p<.05$). Non-homoscedasticity was found in relevance ($F2=5.009$, $p=.008$). While no significant difference was found between ChatGPT and Bard in most categories, except in clarity ($Z=1.972$, $p=.038$), Claude 2 notably outperformed both in pairwise comparisons ($p<.05$). Claude 2 demonstrated the highest WPA across the board, reflecting a strong agreement between raters.
Conclusions: The study indicates that AI holds significant promise in accurately and efficiently responding to a diverse range of surgical patient inquiries. AI models can effectively supplement the role of surgeons in patient education and communication, offering substantial support by easing patient concerns, especially during times when direct professional assistance is not readily accessible.

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1193
Brain and Spine 4 (2024) 103581
Registration of Frame-Based Stereotactic Biopsies Using Cone-Beam CT

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Computed tomography (CT) is the standard of care for registration in frame-based stereotactic procedures. Meanwhile, cone beam CT-capable devices find their way into multidisciplinary hybrid operating rooms. We hereby report our experience with cone-beam CT in registration for stereotactic biopsies.
Methods: 16 candidates for stereotactic biopsy underwent registration using cone beam CTs by the Siemens Pheno Artis and a Fischer Revison-U open ceramic stereotactic ring. The registration and trajectory planning was done through Brainlab iPlan Software. As a historical group, 11 patients with conventional CT-based registration were analyzed.
Results: In all 16 patients, the registration could be completed using the cone-beam CT. Here, the latter 10 patients received a 360-degree large-volume protocol to enlarge the field of view (FOV). The median procedural time in the cone beam registration group compared to the conventional CT registration was 1.85h vs. 2.28h, respectively (p=0.009). Three patients also received a cone beam CT scan to rule out biopsy-associated complications.
Conclusions: Cone-beam CT by Pheno Artis is capable of frame-based stereotactic registration. Procedure time can be saved through on-site registration in a hybrid operating room.
Optional Image

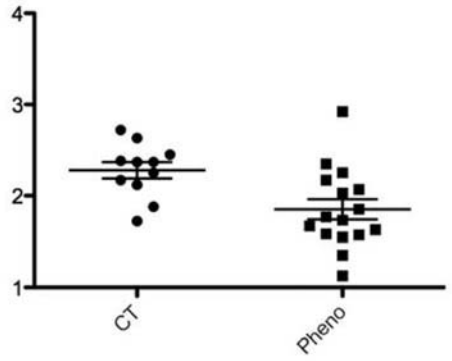


Figure 1: Quantitative measurement of the intraoperative time in hours undergoing registration through conventional CT (CT) versus intraoperative cone-beam CT (Pheno)

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695
Brain and Spine 4 (2024) 103582
Methodological approach for treatment planning in neurovascular surgery patients utilizing patient-specific 3D printed models and mixed reality technology

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM
Background: In recent years, mixed reality (MR) head mounted devices (MR-HMD) and three-dimensional printed models (3DMs) have emerged as options to enhance the three-dimensional stereovision and depth perception of neuroanatomy. However, limited data exist on whether these technologies can effectively aid surgical planning.
The aim of this study is to outline the methodological approach of utilizing patient-specific MR-HMD and 3DMs in the planning of neurosurgical treatments.
Methods: Between February 2020 and June 2021, patient-specific MR-HMD and 3DMs were created for 29 patients undergoing elective surgical clip ligation of an intracranial aneurysm (IA). Routine clinical evaluation for aneurysm surgery included CT scans and 3D rotational angiography (3D-RA). A 3D hologram of the patient's anatomy was generated from these imaging data and integrated into the MR-HMD. Similarly, 3DMs were produced using commercially available software and hardware. Preparation and manufacturing times, as well as potential pitfalls and advantages of both methods, were evaluated.
Results: The mean printing time for the 3DMs was 894.9 minutes (SD +/- 41.6 min), with additional refinements requiring 67.7 minutes (SD +/- 12.4 min). Setup time for the MR-HMD was 7.0 minutes (SD +/- 2.8 min). Despite significant differences in production time between the two methods, drawbacks of the hologram included: i) Manual registration of the correct hologram before patient draping, necessitating repositioning with any movement. ii) Inability to track surgical instruments or allows interaction and manipulation within the MR-HMD mode, unlike the 3DM object. iii) Difficulty in displaying small perforators with the MR-HMD.
Conclusions: Both MR-HMD techniques and 3DMs serve as valuable supplements to conventional methods by providing spatial awareness. While the production time for 3DMs is significantly longer than the setup time for MR-HMD, the latter currently has limitations in representing small perforators. Further development is required to enhance the clinical applicability of both methods.

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1443
Brain and Spine 4 (2024) 103583
Rub Not Scrub: "Greener Neurosurgery" – a day-to-day Sustainable Approach in Neurosurgical Theatres

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: The NICE guidelines advocate a shift in hand hygiene practices, suggesting the use of alcohol-based hand rub (ABHR) for subsequent antisepsis after the initial water-based hand wash of the day. The ecological impact of operating theatres as a carbon footprint hotspot is acknowledged, primarily due to the resource-intensive nature of surgical procedures utilising substantial single-use consumables, including water. This quality improvement project seeks to assess the effectiveness of a one-time preoperative hand wash followed by ABHR, in contrast to conventional scrubbing.
Methods: A quality improvement audit conducted in neurosurgical theatres of a tertiary care centre over a 12-month period. A cohort of 60 neurosurgical patients undergoing various elective neurosurgical procedures at the tertiary care centre were included in this prospective audit. Introducing a sustainable hand hygiene protocol, the study implemented a one-time preoperative hand wash followed by ABHR.
Results: Among the 60 patients, one infection was documented three weeks postoperatively, with the noteworthy observation that the affected patient was immunocompromised.
Conclusions: Adopting ABHR for subsequent scrubs could substantially reduce water consumption in neurosurgical theatres. This initiative not only addresses environmental concerns but also underscores the broader concept of sustainable practices in neurosurgical settings. The project emphasises the significance of embracing environmentally responsible approaches without compromising patient safety or surgical outcomes to improve the path to greener theatres in neurosurgery.

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1264
Brain and Spine 4 (2024) 103584
The Use of Open-Source Software and Mixed Reality for Preoperative Planning in Cranial Neurosurgery: A Proof of Concept

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

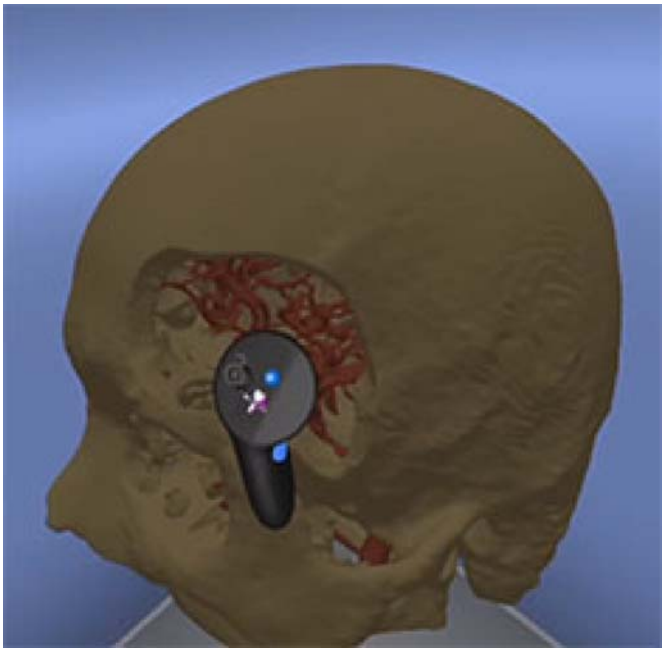
Background: The conventional methods of visualizing the anatomy and pathology of a patient, more specifically CT and MRI scans, are limited to the 2D nature of the study. There is a possibility for 3D reconstruction of a patient-specific 3D model, but until recently this was limited to a monoscopic display. Novel methods of 3D visualization in the form of Virtual (VR) and Mixed (MR) reality provide much more possibilities to manipulate the 3D models in an immersive environment. However, most of these techniques require expensive software solutions. In our study, we have used open-source software algorithms only to upload the patient-specific 3D segmented models into VR and MR environments and test the possibilities of the technology applied to cranial neurosurgery preoperative planning.

Methods: We used the Slicer and Horos 3D open-source software for the segmentation of patient-specific MRI data. The Blender software was used for post-processing of the data. The Gravity Sketch platform and Meta Quest Pro headset VR/MR headset were used for immersive visualization of the data.

Results: The segmented 3D model can be used for simulation of the steps of the operation (positioning, skin incision, craniotomy, intraoperative orientation). Additionally, the 3D model in the MR environment allows for the direct comparison between the models of preoperative planning and the actual operative field which is used for educational purposes and orientation. The multiplayer function in VR allows for preoperative planning with several participants in one environment, which can be used as a teaching platform.

Conclusions: Case discussion and education on a specific patient's pathology and treatment plan inside an immersive VR/MR environment is possible through the use of open-source software only. The validation and accuracy of the method should be assessed in future studies.

Optional Image



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251

Brain and Spine 4 (2024) 103585

The Impact of Arteriovenous Malformations Dissected Transsulcal Microsurgical Approach on Brain Structure Volumes

Abdulkerim Gökoğlu, Hüseyin YİĞİT, Tolga Turan DÜNDAR, Erdoğan UNUR, Ahmet SELÇUKLU.

Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Arteriovenous malformations are known as arterial-venous shunts that connect nidus, the nourishing arteries, to draining veins. Although they are not very common in the brain, they are responsible for approximately 2% of all strokes. The volumetric changes in the surrounding brain tissues caused by cerebral arteriovenous malformations have not yet been reported.

Methods: To detect these volumetric changes, MR data were acquired from 8 controls and 8 unoperated patients with arteriovenous malformations in the precentral and postcentral gyrus. MR data were analyzed with vol2Brain, Ceres and HIPS pipelines. The niduses of these patients were resected by transsulcal microsurgical dissection.

Results: Among the 135 brain structures analyzed, primary motor cortex, supplementary motor cortex, medial segment of postcentral gyrus, which are close to the precentral and postcentral gyrus, showed significant volumetric excess in the patient group compared to the control group ($p<0.05$). In the declive and pyramis of the cerebellum structures, there was a volumetric excess in the patient group compared to the control group ($p<0.05$). However, there was a volume deficit in the central lobule of cerebellum in the patient group ($p<0.05$). There were no significant differences in the hippocampus and its substructures dentate gyrus, subiculum, CA1-2-3-4 ($p>0.05$).

Conclusions: Although the incidence is quite rare, cerebral arteriovenous malformations cause volumetric differences both in the adjacent cerebral structures and in the cerebellar structures to which these cerebral structures are related. However, further studies are needed to clarify whether these volumetric differences are due to the mass effect of the nidus or for other reasons. The combined use of both neuronavigation and ultrasound before and after craniotomy contributes to minimally invasive surgery by identifying the nidus location and planning according to the size of the nidus.

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968

Brain and Spine 4 (2024) 103586

Role of IL6 induced inflammation in cerebral aneurysm pathogenesis

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Cerebral aneurysms (CA) carry significant morbidity and mortality specially when they rupture. Although endovascular approaches have decreased procedural morbidity, recurrence remains a concern with these techniques. Therefore, better understanding underlying pathogenesis of CA development can help develop new medical therapies which can complement endovascular techniques. Inflammation has been shown to play a pivotal role in pathogenesis of CA. Interleukin 6 (IL6) has been identified in blood collected from human aneurysm dome. Further, elevated IL6 has been linked with poor outcomes in patients with SAH. It is not known if IL6 plays a direct role in CA development.

Methods: We used an established murine CA model using elastase. This model develops CAs as early as +d6. First, we wanted to establish if there is increased expression of IL6 in the CA. CAs were induced on d0 and cerebral vessels at the base of the brain were collected on +d6 and +d14. mRNA expression was measured using Nanostring. Further, to study a direct role of IL6 in CA development, IL6-/- knockout mice were used. CAs were induced on 0d. Surviving animals were euthanized on +d21 and assessed for incidence and size of CAs.

Results: There is elevated expression of IL6 on +d6 compared to control. On +d14, IL6 levels were still elevated but not as high as on +d6. This shows a critical role of IL6 at least in the early phase of CA development. To confirm if IL6 plays a direct role in CA development and progression, we used IL6 -/- knockout mice. First, IL6-/- knockout group demonstrated increased survival compared to control mice, 90% vs 50% at the end of 21-day period (+d21). Control group developed multiple large CAs. Incidence of CA formation in IL6-/- knockout group was only 20% compared to 85% in control. When the CAs were analyzed in the 20% of IL6 KO mice which developed aneurysms, the aneurysms were singular and much smaller, 28mm in control vs 14mm in IL6 KO.

Conclusions: We have demonstrated for the first time, a direct role of IL6 in pathogenesis of CA, confirming observations in humans. This has significant translational implications. IL6 receptor (IL6R) blockers such as Tocilizumab can be used to block the activity of IL6 in the form of coated coils in humans which can suppress local activity of IL6 in CAs in human, potentially suppressing recurrence.

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621
Brain and Spine 4 (2024) 103587
World-first In-vivo Validation of a Self Propelled Microinvasive Robot

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Robots have shown great potential for neurosurgery given their precision among brain structures. Robeaute is developing a neurosurgical microrobot to access the brain with a microinvasive approach. The goal is to develop a versatile tool for brain surgery capable of performing various procedures such as biopsies through dedicated trajectories. After validating the implantation feasibility, navigation, and extraction of the microrobot through cadaveric studies in animals and humans, the device underwent its first "in vivo" procedure.
Methods: The surgeries were conducted at Veranex, Paris. Two sheeps were placed under general anesthesia and monitored according to standard of care. The skull was accessed via a linear incision, and the CAP (microrobot launching module) was fixed to the skull. A burr hole was made in the selected position based on preoperative imaging. A 2.4mm-large prototype of the microrobot was used . Navigation, tracking, speed, and extraction were analyzed. 3D scans were performed to validate our ultrasound tracking system. After the procedure, animals were sacrificed, and brains were extracted to evaluate tissue damage
Results: Two surgeries were successfully performed on living sheeps. The microrobot was introduced through a 14mm burr hole. The microrobots propelled in a linear trajectory at a speed of 2.97 mm/s, with a tracking system accuracy better than the one given by the CT. The endpoint of the trajectory was successfully reached 2.5 cm from the insertion point. The microrobot was extracted through a backward motion following the same trajectory. The procedures were safe, and the sheeps tolerated it well, without signs of hemodynamic instability or cranial hypertension. No major brain damage was observed.
Conclusions: These results demonstrate the feasibility of in-vivo brain navigation using a neurosurgical microrobot, potentially opening doors to microinvasive brain biopsies, focalized treatments, and continuous monitoring along more complex trajectories such as 3D curves.

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812
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Endoscopic Transnasal Approach for Microprolactinomas with Experience of 125 Cases in a Single Center

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: In microprolactinoma patients, the classically recommended primary treatment method is medical therapy. Surgical treatment is considered as secondary treatment in the presence of drug resistance and intolerance following the use of dopamine agonists, or when patients prefer surgery over medical treatment. The high rates of hormonal remission and low complication rates after surgery for microprolactinomas suggest that the surgical outcomes of endoscopic surgeries may be similar to or better than medical therapy in well-selected patients.
Methods: This study is a retrospective cohort analysis of microprolactinoma patients operated with the endoscopic transnasal approach by a single experienced pituitary surgeon at a tertiary center between August 1997 and January 2024, with the 20 added cases after the article(1) of 105 cases that was published in 2023. The inclusion criteria of the study were increased prolactin levels, presence of a microadenoma (<10 mm in diameter) on pituitary magnetic resonance imaging (MRI), and histopathologically confirmed diagnosis of lactotroph adenoma.
Results: This study includes 125 cases (107 females, 18 males). The postoperative day 1 remission rate is 86.4%, while the long-term remission rate is 76.8%. The long-term remission rates of patients in the preference group were 90%, drug-resistant group were 63.7% and intolerant group were 82.3%. The remission rates in patients using dopamine agonists for more than 3 years was 28.1% and those using for a shorter duration was 50%. The surgical complication rate is 4%.
Conclusions: According to our findings, endoscopic transnasal surgery performed by an experienced neurosurgeon in well-selected microprolactinoma patients has similar cure rates to medical treatment and may be an alternative primary treatment option to dopamine agonists.

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1299
Brain and Spine 4 (2024) 103589
Enhancing Transsphenoidal Pituitary Surgery with Endoscopic Micro-Inspection and 3T Intraoperative MRI 'Final Look

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: In recent years, transsphenoidal surgery for the removal of intrasellar lesions has made significant progress, especially in the areas of endoscopic and microsurgical techniques. Both methods have their specific advantages: The endoscopic method is characterized by improved visualization of the surgical field, while the microsurgical technique is known for its high effectiveness and safety.
Methods: In our study, 36 patients with various types of pituitary adenomas were treated: 14 with non-functioning, 9 with growth hormone-secreting, 4 with ACTH-secreting, 7 with recurrences of non-functioning adenomas, and 2 with other intrasellar lesions. Each patient initially underwent a microsurgical treatment, followed by an endoscopically-assisted inspection and evaluation using intraoperative 3-Tesla MRI. This multi-stage approach aimed to maximize the effectiveness of tumor resection while minimizing the risk to the patient.
For the final assessment of the surgical outcome, all patients were examined neuro-endocrinologically, ophthalmologically, and via MRI 3 to 6 months after neurosurgical treatment. These comprehensive follow-up checks were crucial in evaluating the long-term results and quality of life of the patients' post-surgery.
Results: The use of intraoperative MRI was particularly advantageous in cases of recurrences of non-functioning pituitary adenomas. The endoscopically-assisted resection control showed benefits in detecting remaining tumor residues in growth hormone-secreting and non-functioning adenomas. In cases of ACTH-secreting adenomas or other intrasellar lesions (i.e. Rathke's cleft cyst), a purely microsurgical technique proved to be sufficient. These findings underline the importance of an individualized treatment approach for each patient.
Conclusions: The results of this study mark a significant advance in the precise and effective treatment of sellar lesions. The combination of these technologies could increase the likelihood of complete resection and reduce the need for further surgeries. To validate the results and further substantiate the applicability of these combined approaches, it is necessary to increase the number of patients in future studies with a similar treatment setting.

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858
1269
Brain and Spine 4 (2024) 103590
If you let it fall, you can save it all: Preventing permanent Diabetes mellitus in pituitary tumor surgery

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024,

12:40 PM - 2:10 PM

Background: Risk of permanent DI (lasting more than 2 weeks after surgery) is a return gift mostly given by neurosurgeon to their patients after pituitary surgery in 0.9% - 10.1%. Moreover, complications of surgery have lower incidence at high-volume centres, reportedly. Risk factors associated with permanent DI are older patient, large intrasellar masses, hydrocephalus, intraoperative CSF leak, type of Surgical approach and S Sodium >145 mmol/L within 5 days, and Early DI within 24 to 48 hours after surgery.

Methods: It was observed that no pituitary tumor patient needed long acting Desmopressin, not even during early experience over more than a decade of independent private practice. So a retrospective study (2001-2023) was conducted to find key factors which prevented this complication in our low volume (1-4 cases/year) center. Age, Gender, Knosp Grading, tumour size, hormone secretory status, presence of hydrocephalus and tumor handling technique were assessed, later by reviewing of operative video records of patients. We used a simplified criteria to diagnose DI: unquenchable thirst, daily urine output >3.5 L, and plasma sodium >143 mmol/L.

Results: There were 52 cases. Age ranged from 12-68 years, thirteen were older than 50 years. Fortysix percent were females, 2 of them were pregnant (later had successful uncomplicated delivery in both). Knosp Grade was more than 1 in 29 (56%), and maximum height was more than 20 mm in 32 (61.5%). Majority (34 cases, 65%) were Nonfunctional adenoma. No one had hydrocephalus. Out of total 55 surgeries done, 4 were reoperations (2 were operated first at another Centre). Trans-sphenoidal microsurgery was done in 9, Endoscope assisted Microsurgery in 5, Endoscope guided trans-sphenoidal in 39, and Transcranial in 02. Complete tumor removal was achieved in 41 (75%) cases, mostly parasellar part left. All patients were followed up for 1 to 6 months and maximum follow up was 20 years. 8 had CSF leak (many detected by endoscopic exploration of sella). The surgical technique used was of intratumoral decompression only, never tried extracapsular dissection, avoiding suction in outer part of dissection. Scraping of sellar wall was done with only light pressure of ring curettes (holding curette lightly). When curette tend to entangle in some structure, it was not pulled out, till gently disengagement. We never used arachnoid injection of air or saline for descent of mass, but waited till it fallen down spontaneously in all cases. In the background of this technique was the mind set of fear (to damage the already compromised structures) with dare (to remove the tumor completely), which was the most important guiding force. None of our patients (0%) had permanent DI, so none of evaluated demographic, radiological or change in operative tool (endoscope / microscope) or technique, experience could be correlated as negative risk factor. We believe that Surgical technique was the only positive factor which determined the desired outcome in all cases.

Conclusions: The very low risk of permanent DI is achievable even in a low volume centre. The only key factor seems to be the surgical technique with mindset of "dare with fear". None of the other risk factors mentioned in other series affected our results. Though the size of series is relatively small, however, it represents the one of lowest complication rate reported in literature for permanent diabetes mellitus.

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Reassessing the Related Factors of Hydrocephalus in Pediatric Patients with Posterior Fossa Tumours: 5-year Single-Center Data

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: Although 70-90% of the children with posterior fossa tumours present with concurrent hydrocephalus, it persists only 10-40% post-resection. We examined our own clinical data regarding previously proposed risk factors and considered novel parameters to predict which patient is likely to exhibit a need for permanent CSF diversion.

Methods: Patients under 18-years-old that underwent posterior fossa tumour resection in our institution in between the years of 2018-2023 were retrospectively assessed. Patients lacking preoperative imaging and had CSF shunting prior to resection surgery, were excluded. Digital patient charts were examined for demographics, clinical presentation,pathology reports and whether the patient had CSF leakage. Imaging records were evaluated for related radiological aspects: tumour location (midline/hemispheric), pre resection presence of 'moderate-severe hydrocephalus' with fronto-occipital horn ratio (FOHR) >0.42 and 'ventriculomegaly' with Evan's index(EI) >0.3 , spinal metastasis status, resection amount (total/subtotal). In addition, the modified Canadian Preoperative Prediction Rule for Hydrocephalus (mCPPRH) score was calculated.

Results: Out of 44 eligible patients, 17 underwent CSF shunt placement within a median of 26 days (Range:0-374 days) postresection. Parameters that supposedly affect the requirement for CSF shunting were assessed with Kaplan-meier and Cox analysis in the univariate analyses and the ones with $p<0.15$ were then taken into account for the multivariable Cox regression model. Sex and age showed no association ($p=0.34$ and $p=0.23$, respectively). mCPPRH score, tumour location (midline/hemispheric), spinal metastasis presence, ventriculomegaly and moderate-severe hydrocephalus were analysed with backward elimination and only mCPPRH was statistically significant. (HR= 1.38, 95%CI: 1.15-1.67, $p<0.001$)

Conclusions: We considered previously overlooked factors that might indicate permanent CSF shunting requirement and revisited known variables. Although failing to present new parameters, we once more validated the mCPPRH as a successful predictor in this matter.

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1027

Brain and Spine 4 (2024) 103592

AVM treatment trifecta. The multidisciplinary approach to achieve obliteration. A single center, 10 years, experience.

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: AVM's is still considered a complex and difficult disease in terms of complete obliteration. Many studies have proposed the superiority of each of the 3 available interventional therapies [Embolisation, Stereotactic Radiosurgery (SRS), Surgery] alone or in a combination between them.

Methods: We collected data of patients from our institution from 2011-2021. We found 214 patients in total that received interventional treatment. We excluded patients without angiographic follow-up. Especially for the patients that received SRS treatment the angiographic follow-up was at least 24 months. Out of 151 included patients, 40 received treatment with embolisation only (group I), 76 were treated with SRS with or without prior embolisation (group II) and 35 underwent surgical treatment with or without other prior treatment (group III). We further subgrouped the patients of groups I, II and III according to their Spetzler-Martin grade to Group A for patients with grade I-II AVM's, Group B for those with grade III AVM's and Group C for grade IV-V AVM's.

Results: The obliteration rate for group I has been found to be 66% for group A, 28.5% for group B and 0% for group C. For group II, it was 75.5% for group A, 69,5% for group B and 50% for group C. Finally, for group III it was 91% for group A and 100% for group B.

Conclusions: Obliteration rate is, probably, the most important factor when it comes to choosing the ideal treatment for AVM's. A multidisciplinary approach and a patient specific treatment can provide the best results for this challenging disease.

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983

Brain and Spine 4 (2024) 103593

Application And Efficacy Of Large Language Models In Patient Education On Spinal Cord Injuries

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: The complexity of spinal cord injuries (SCI) and the diversity of potential therapeutic approaches require a deep understanding of pathophysiology, as well as precise diagnosis and individually tailored treatment strategies. Patients often face the challenge of comprehending complex information and the potential impacts of various treatment options. In today's digital era, new opportunities arise to support patients and their families with accurate and easily

accessible online information. Incorporating Artificial Intelligence (AI), especially Large Language Models (LLMs) like ChatGPT, into patient education could enhance the understandability and personalization of the information provided and facilitate communication between doctors and patients. However, the reliability and appropriate use of these technologies in SCI education warrant careful examination. The effectiveness of LLMs in patient education appears promising, prompting this study to explore and evaluate their role and efficacy in medical practice.

Methods: A Google search for "frequently asked questions and spinal cord injury" was conducted to examine the first 20 hits according to specific inclusion and exclusion criteria to identify relevant questions. This was complemented by a targeted search in PubMed and a direct inquiry to ChatGPT-4 to determine the most common patient questions about SCI. This three-step method resulted in a pool of 120 questions, from which the 10 most frequently asked questions were selected and focused on the most critical topics. These questions were then presented to ChatGPT 3.5, ChatGPT 4 and Google Gemini, with their responses recorded and assessed for clarity, accuracy, and completeness using an established rating system. Ratings were made on a 4-point scale from "unsatisfactory" to "excellent," supplemented by a 5-point Likert scale to assess the clarity and professionalism of the responses.

Results: The preliminary evaluation of the combined question set indicates that all responses were adequately clear, with none requiring substantial clarification. A minor proportion, 10%, necessitated moderate clarification, while 33.3% warranted minimal clarification. A majority, 56.6%, were categorized as excellent, reflecting a high standard of response quality. Upon examining the overall rating distribution, there was negligible variance between Google Gemini and ChatGPT 3.5, indicating a comparable level of performance between the two. In contrast, ChatGPT 4 exhibited a statistically significant enhancement in its overall rating distribution, suggesting a refined performance over its predecessors. Furthermore, Gemini received slightly higher ratings for its empathy and professionalism, while ChatGPT 4 offered more comprehensive and professional responses.

Conclusions: This observation underscores the importance of further improvements in integrating nuanced, human-like qualities into response mechanisms for professional engagement. Additionally, Large Language Models (LLMs) have proven their ability to provide precise, user-friendly information on spinal cord injuries, highlighting their significance in patient education. These insights stress the ongoing need for research to improve LLMs for medical communication, striving to combine their technical accuracy with the crucial qualities of empathy and professionalism in healthcare discussions.

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564

Brain and Spine 4 (2024) 103594

Real-time Intra-operative Hyperspectral Imaging Derived Tissue Properties in Neurosurgery: A First in Human Case Series (IDEAL 1 and 2a)

Oscar MacCormac [1,2], Conor Horgan [3], Phil Noonan [3], Mirek Janatka [3], Théo Trotouin [3], Jaco Jacobs [3], Zhonghao Wang [1], Anisha Bahl [1], Matt Elliot [1,2], Silvere Segaud [1], Dale Waterhouse [3], Sabina Patel [2], Ahilan Kailaya-Vasan [2], Jose Lavrador [2], Keyoumars Ashkan [1,2], Michael Ebner [3], Sebastien Ourselin [1,3], Tom Vercauteren [1,3], Jonathan Shapey [1,2,3]. [1] *King's College London, School of Biomedical Engineering and Imaging Sciences, London, United Kingdom;* [2] *Dept. of Neurosurgery King's College Hospital, London, United Kingdom;* [3] *Hypervision Surgical Ltd., London, United Kingdom*

Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

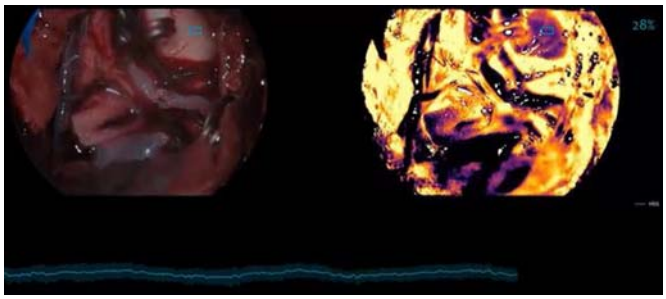
Background: Hyperspectral imaging (HSI) is a wide-field advanced optical imaging technique. HSI exploits the ability to split light into multiple narrow bands beyond the three conventional red, green and blue (RGB) visible spectral bands, enabling analysis of images not seen with the naked eye. This additional spectral information has shown promise for differentiating between biological tissues and in providing information relating to tissue oxygenation (StO2). In neurosurgery, such information could improve tumour resection and potentially reduce intra-operative complication rates. In this IDEAL 1/2a study we demonstrate the first in human use of a novel real-time HSI system integrated with the standard neurosurgical operating microscope, capable of providing video-rate hyperspectral information to the operating surgeon.

Methods: A snapshot mosaic HSI camera was coupled to a Zeiss Kinevo-900 and connected to a dedicated camera control unit. Using specialized software developed by Hypervision Surgical Ltd, real-time HSI video recordings were acquired during neuro-oncology and neurovascular surgeries. From these recordings, spectral tissue information was extracted from surgeon annotated frames, including cerebral StO2.

Results: 11 patients (neuro-oncology n=6, neurovascular n=5) were included in the study. Using our system, real-time HSI was successfully and safely acquired in each case. Real-time visual interpretation of HSI-derived cerebral StO2 during unexpected ischemic events in two of the neuro-vascular cases, that correlate with intra-operative neuro-monitoring (IONM) changes. Early tissue differentiation capabilities have also been demonstrated using our system.

Conclusions: Our intra-operative HSI system seamlessly integrated into the neurosurgical workflow and demonstrated the capability to provide enhanced tissue information, that correlates with electrophysiological changes, to the surgeon in real-time. Such a system has the potential to improve surgical outcomes in neurosurgery

Optional Image



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263

Brain and Spine 4 (2024) 103595

Management and Outcomes of Post-Embolization Perianeurysmal Vasogenic Oedema (PAVO) – A 10 Year Retrospective Review

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Perianeurysmal Vasogenic Oedema (PAVO) is a rare but important complication of endovascular treatment of intracranial aneurysms (IAs). It can cause persistent post-procedural symptoms such as headaches, visual disturbance, seizures, and focal neurological deficits, subsequently increasing post-embolization morbidity. Literature is scarce regarding management strategies and outcomes for patients who develop this complication. We aimed to review patients with post-embolization PAVO who were diagnosed and managed at our institution and report outcomes.

Methods: A 10-year retrospective review was conducted between 2011 and 2021 at Royal Preston Hospital, Preston, UK. Inclusion criteria included:

- Endovascularly treated intracranial aneurysms
- Pre-treatment or post-treatment radiological evidence of PAVO

Results: 8 patients were identified. This included 6 (75%) females and 2 (25%) males. The mean age was 64. All patients had anterior circulation aneurysms with the middle cerebral artery (MCA) being the most common site. Mean aneurysm size was 12 mm. All patients underwent endovascular treatment of the aneurysm. 5 patients had symptomatic PAVO, whereas 3 patients were asymptomatic with only radiological evidence of PAVO. PAVO onset time ranged from 0 – 1855 days. The average onset time was 397 days. 5 patients were managed with varying courses of Dexamethasone whilst the others were managed conservatively. The average follow up time was 45 months. All patients with symptomatic PAVO saw symptom resolution. PAVO resolution was achieved in 4 cases and significant improvement achieved in 3 cases. PAVO progression was seen in 1 case.

Conclusions: PAVO is an important complication of endovascularly treated IAs. It should be suspected in patients with persistent headaches, seizures and/or neurological deficits despite appropriate aneurysm management. We have shown these patients can be effectively managed with steroids with resultant oedema

regression and resolution of symptoms. Further research is required to discover alternative treatment options which would avoid steroid associated side effects.

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1021
Brain and Spine 4 (2024) 103596
Deep Learning Methods for Brain Tumor Recognition in Gliomas Using Convolutional Neural Network

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: Despite the advances of modern diagnostic instruments, human supervision for imaging interpretation seems still to be crucial to reaching a correct diagnosis. In the last decades, Machine Learning (ML) methods have been largely approached for helping automatic and semi-manual image classification. In such a contest, Convolutional Neural Networks (CNN) have gained a growing interest and have been successfully proposed in Brain tumor segmentation. Among them, the U-NET model has been found to perform efficiently the task of recognizing brain infiltrating gliomas.
Methods: The dataset chosen comes from the BRaTS (BRain Tumor Segmentation) 2018 which represents one of the largest challenge worldwide competitions for Brain Tumor Segmentation. The BRaTS ground truth comprises 4 labels: Background, Necrotic and Non-Enhancing tumor, Peritumoral Edema, Gadolinium-Enhancing Tumor. The system was trained according to the sample size (small, medium, and large groups), different labels, and different tumor subtypes (high grade vs low grade).
Results: The system trained with 62 samples (32 HGGs and 30 LGGs) resulted in the best performance values. By evaluating the degree of matching of the hard-dice coefficient, the system trained with mixed HGG/LGG dataset seems to have the best prediction performance and to be less likely to overfit. Interestingly, the necrosis labels for mixed subtypes and LGGs resulted in low performance, while the HGG group showed high HD values (0.79) which better match with a higher number of iterations. The prediction of LGG segmentation resulted then less performance, as previously described.
Conclusions: The difficulty of this task comes from the heterogeneity of brain tumors, but as a starting point of classification can be defined as noninfiltrating and infiltrating tumors and high-aggressive and low-aggressive behavior. These data were only preliminary shown in this project, but it represents an interesting starting point to integrate clinical information.

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438
Brain and Spine 4 (2024) 103597
Artificial intelligence and neurovascular decision-making: A comparative analysis of ChatGPT treatment advice and multidisciplinary neurovascular expert decisions

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM
Background: In the multidisciplinary treatment of cerebrovascular diseases, specialists from different disciplines strive to develop patient-specific treatment recommendations. ChatGPT is a natural language processing chatbot with increasing applicability in medical practice. This study evaluates ChatGPT's ability to provide treatment recommendations along with its quality in clinical scenarios involving patients with unruptured intracranial aneurysms (UIA).
Methods: Anonymized patient data and radiological reports of 20 patients with UIAs were provided to GPT-4 in a standardized format and used to generate a treatment recommendation in different clinical scenarios. GPT-4 responses were evaluated by a multidisciplinary panel of specialists by means of the Likert scale and subsequently benchmarked against the Unruptured Intracranial Aneurysm Treatment Score (UIATS) as well as the actual treatment decision made by the multidisciplinary institutional neurovascular board (INVB). Agreement between INVB and GPT-4 recommendations was measured using Cohen's kappa (kw) coefficient.
Results: GPT-4 responses analyzed individual pathological features of the radiological reports and formulated a corresponding assessment for each aspect. None of the recommendations generated reflected evidence of factual hallucination, although in 25% of the case studies no specific recommendation could be derived from the GPT-4 responses. The expert panel rated the overall quality of the GPT-4 recommendations with a median of 3.4 out of 5 points. The GPT-4 recommendations were congruent with those of the INBI in 65% of cases with moderate agreement (kw=0.444).
Conclusions: GPT-4 appears to be capable of processing clinical information on complex neurovascular diseases such as UIAs in order to suggest treatment algorithms. However, the level of ambiguity and the utilization of scientific evidence in the recommendations are not yet patient/case specific enough to substitute the decision-making of a multidisciplinary neurovascular board. A prospective evaluation of GPT-4 competence as a companion in decision-making panels is deemed necessary.

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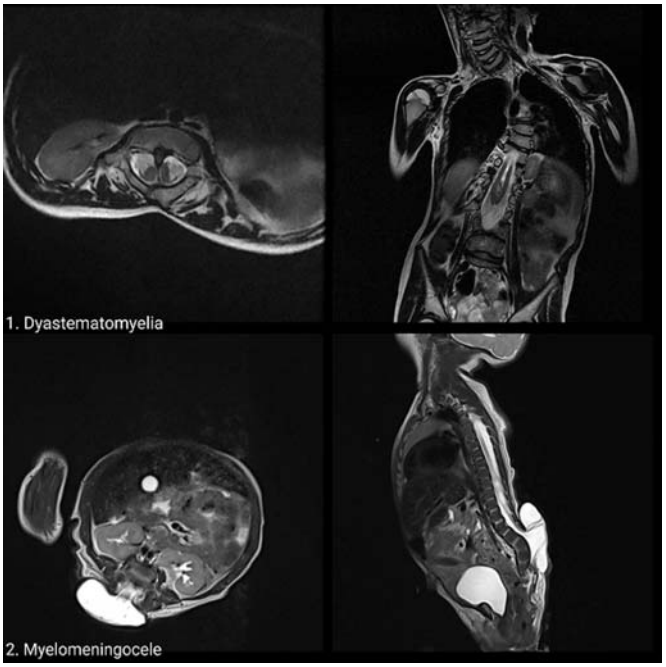
427
Brain and Spine 4 (2024) 103598
Tethered Cord Syndrome – case series

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: Tethered Cord Syndrome (TCS) is a pathological condition characterized by the fixation of the conus medullaris to the caudal sections of the spinal column due to various pathological processes, which often leads to impaired ascension of the conus towards the cranial direction as the body grows. The aim of this paper is to analyze our experience in the treatment of TCS.
Methods: Our research focused on 48 children, aged between 2 weeks and 14 years, presenting with different forms of spinal deformities resulting in the fixation of the spinal cord. These deformities included Spinal cord lipoma (8 cases), Teratoma (2 cases), Cholesteatoma (1 case), Myelomeningocele (16 cases), Filum terminale abnormalities (8 cases), Diastematotomyelia (7 cases) and Dermal sinus tract (6 cases). The gender distribution was equal (female/male ratio of 1:1). Clinical symptoms varied and included neurological deficits in all cases, retention/incontinence in 22 cases, leg weakness in 31 cases, foot deformities in 19 cases and visible spinal manifestations in 36 of the cases. All patients underwent surgical intervention involving total release of the conus and nerve roots.
Results: During the follow up's of the patients, 20 showed significant improvement following surgery, 15 showed no significant improvement, and 13 showed no improvement.
Conclusions: Disorders such as Spina bifida occulta/aperta predominantly manifest as various dysfunctions of the distal section of the spinal cord, meninges and other structures of the spine. The combination of progressive neurological dysfunction - inferior paraparesis/paraplegia, incontinence/retention, deformities, atrophy, spinal pain syndromes, and the typical MRI and CT scan

findings is crucial for accurate diagnosis. Surgical treatment is tailored individually to each patient.

Optional Image



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1298

Brain and Spine 4 (2024) 103599

A Rare Complication of Subdural-Peritoneal Shunt in an Infant with Chronic Subdural Hematomas: A Case Report

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: Shaken baby syndrome is a common form of abusive head trauma in infants, often resulting in severe neurological consequences like chronic subdural hematomas (cSDH). Surgical interventions such as subdural-peritoneal shunting are commonly used to alleviate intracranial pressure and minimise adverse effects on cranial development. Although they are uncommon, complications from this treatment can present significant challenges.

Methods: We present a case of a 3-month-old infant admitted to the hospital following a reported seizure, characterised by gaze fixation and tonic contractions of upper and lower limbs. Computed tomography scan findings revealed temporal and occipital contusions on the left side along with bilateral chronic subdural hematomas, attributed to shaken baby syndrome, treated with a subdural-peritoneal shunting through a 40 cm single catheter. Two weeks post-shunting, the infant developed bulging of the anterior fontanel and CSF leakage from the surgical wound, prompting emergency imaging which revealed total translocation of the shunt catheter into the intracranial space. Surgical intervention was promptly initiated, and the catheter was successfully removed through a small incision adjacent to the right side of the anterior fontanel.

Results: Following catheter removal, the infant's condition improved significantly, and they were discharged in good health after a two-week hospitalisation period. Subsequent monitoring showed no recurrence of intracranial complications, and the child exhibited normal neurological development during follow-up visits.

Conclusions: This case emphasises the need for vigilant monitoring and consideration of rare complications, such as catheter translocation, in infants undergoing subdural-peritoneal shunting for chronic subdural hematomas secondary to abusive head trauma. Prompt recognition and surgical intervention are crucial for favourable outcomes. Healthcare providers should be aware of this potential complication to optimise patient care and outcomes.

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691

Brain and Spine 4 (2024) 103600

The role of three-dimensional models in preoperative clip selection for aneurysm surgeries: a prospective single-center study

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Three-dimensional printed models (3DMs) offer haptic feedback and may serve as planning aids for optimal clip selection in unruptured intracranial aneurysms (IAs). This prospective study aimed to 1) assess the accuracy of 3DMs for presurgical clip selection and 2) determine their potential to reduce temporary clipping time and clip repositioning compared to a matched cohort with conventional preoperative planning.

Methods: Hollow, semi-elastic 3DMs of 20 patients' neurovascular anatomy and surrounding skull base were generated from CTA and 3D-DSA imaging data. A standardized questionnaire evaluated the accuracy of 3DMs compared to conventional imaging regarding intraoperative findings, including correct clip selection, depiction of parent vessels, and adjacent perforators. We matched patients with 3DMs in a 1:2 ratio to patients with unruptured IAs, accounting for covariates such as age, maximal IA size, neck size, and IA location. We then compared both cohorts for temporary clipping time and clip repositioning.

Results: Twenty-four IAs in 20 consecutive patients were clipped, with a mean patient age of 61 years (range, 39-78 years). 3DMs accurately depicted IAs, parent vessels, and adjacent perforators <1mm in all patients. Intraoperative clip application was correct as selected with 3DMs in 77% IAs. Compared to the matched cohort, the use of 3DMs significantly reduced temporary clipping time from 9.2 ± 5.4 min to 4.2 ± 4.1 min (p=<0.001). There were no significant changes in the number of clip repositionings; 21% IAs without preoperative 3DM planning versus 29% IAs with preoperative 3DM planning (p=0.56).

Conclusions: The novel 3D model provides sufficient haptic feedback, enabling optimal surgical approach selection and clip configuration in the majority of patients, resulting in a significant reduction in temporary clipping time. These findings highlight the potential of 3DMs as a valuable tool for enhancing surgical precision and efficiency in the treatment of unruptured IAs.

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883

Brain and Spine 4 (2024) 103601

Use of the lumbar infusion test in paediatric populations with variable pathologies: a systematic review of the literature and case series

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: The lumbar infusion test (LIT) is a routine part of the diagnostic process of various CSF dynamics disorders in adults. However, it is rarely used in the paediatric population due to a lack of evidence substantiating its efficacy. This study aims to evaluate the LIT regarding the indication criteria with the efficacy of its usage.

Methods: PubMed, Science Direct, Scopus and additional sources were searched to identify articles utilizing the LIT in a paediatric cohort (≤18 years). The PRISMA guidelines were followed; the Newcastle-Ottawa Scale was used to assess the risk of bias and to evaluate limitations based on selection/outcome

biases. Moreover, case reports from a monocentric experience in children who underwent LIT between 2022 and 2024 were discussed.
Results: A total of 426 patients along with seven cases (8.86 ± 4.75 years) from a single institution who underwent LIT as a part of a diagnostic process were included. The most common indications to perform LIT were shunt responsiveness prediction for hydrocephalus, and idiopathic intracranial hypertension (IIH). All analyzed studies demonstrated a high positive predictive value of LIT to select patients for shunt surgery. Patients with posterior fossa arachnoid cysts harbored pathological LIT results were present. In the institutional experience, all patients underwent LIT due to suspicion of IIH. One patient underwent dural venous stenting, four patients underwent shunt implantation and the remaining two were conservatively treated. All invasively treated patients improved in terms of vision impairment, headaches and/or papilledema.
Conclusions: LIT represents a useful part of the diagnostic battery for hydrocephalus, IIH or arachnoid cysts. Most of the published series are outdated, and the potential of LIT as a part of the diagnostic process of CSF disorders in children has not been extensively studied. This gives a future perspective on the research of LIT usage in clinical practice.

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1723
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Microscopic vs. exoscopic transsphenoidal surgery for craniopharyngiomas – a retrospective single center study of 102 patients

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: 4K 3D orbital camera is a novel exoscopic system, which was described for skull base transsphenoidal operations, however structured analyses regarding application for craniopharyngioma resection are lacking. The aim of this study was to assess the utility of exoscopic transsphenoidal surgery (ExTS) and compare it to well established microscopic transsphenoidal surgery (MTS).
Methods: Patients with confirmed histological diagnosis of craniopharyngioma and operated between 2013-2022 were enrolled into our retrospective monocentric study. Data regarding duration of surgery, length of hospital stay, recurrence rate, extent of resection and postoperative complications (diabetes insipidus, SIADH, anterior pituitary insufficiency, CSF-leak, meningitis, nonobstructive hydrocephalus) were assessed.
Results: A total number of 102 patients, who underwent 122 operations were included. Mean(±SD) duration of surgery in minutes was significantly shorter for repeated ExTS (144(±50.5) minutes vs. 121.3(±50.2) minutes, p=0.028). Mean length of hospital stay was significantly shorter after ExTS comparing to MTS for repeated surgeries (6.9 days vs. 5.6 days, p=0.048).
The incidence of postoperative complications like CSF-leak (11.3% vs. 9.5%, p>0.99), diabetes insipidus (25% vs. 23.8%, p=0.83), SIADH (2.5% vs. 2.4%, p>0.99), new pituitary insufficiency (38.8% vs. 35.7%, p=0.84), meningitis (2.5% vs. 0%, p=0.55), nonobstructive hydrocephalus (2.5% vs. 2.4%, p>0.99) was not significantly different between both groups. Recurrence rate was 36% and 25% (p=0.28) for MTS and ExTS respectively. Gross total resection rate was higher for MTS, however without statistical significance (47.5% vs. 40.5%, p=0.25).
Conclusions: Our study confirmed the utility of ExTS for craniopharyngioma resection, as it revealed no statistically significant differences regarding complication rates, recurrence rate along with mean duration of surgery and mean length of postoperative stay for both all and first surgeries comparing to MTS. Moreover the mean duration of surgery and mean length of postoperative stay after repeated ExTS were significantly shorter than by MTS reoperations.

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1003
Brain and Spine 4 (2024) 103603
Anatomical differences in sphenoid sinus during trans-sphenoidal surgery: comparison between non-functional pituitary adenomas and gh-omas

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: The various anatomy of sphenoid sinus structures is one of the most relevant surgical factors during endoscopic endonasal approach. Acromegaly is a chronic condition that cause an overgrowth of bony and soft tissues. Regarding the sphenoidal bone anatomy of acromegalics, it is reported that these patients had morphologic differences in the nasal cavities and sinuses that can cause a deeper and narrower surgical field. The aim of this study is to evaluate the anatomical differences of the sphenoid sinus between patients with GH-omas and patients with non-functional pituitary adenomas (NFPA) that underwent EEA.
Methods: This is a monocentric retrospective study that was conducted at author's institution. This series included adult patients that underwent EEA for histopathological certified diagnosis of pituitary adenoma (PA) from January 2018 to November 2023.
The parameters evaluated were: ICD: the minimum intercarotid distance measured from the medial rim of the carotid sulcus to the contralateral medial rim; DSS: largest diameter of the sphenoid sinus (given in mm); VCD: distance between vomer and clivus (given in mm); presence, localization and course of intersphenoid sinus septum (ISS): (a) median, (b) para-median, (c) running into the inner wall of the carotid sulcus, or (d) an absent septum.
Results: A total of 100 consecutive patients were identified: 60 patients had NFPA (60%) and 40 had GH-oma (40%). Measuring sphenoid sinus landmarks, ICD was 19.5± 4.42 mm (range 10-30.5 mm), DSS was 36.6± 11.8 mm (range 11-59 mm) and VCD was 28.6± 8.69 mm (range 10-51.7 mm). GH-omas group presented inferior values of ICD (16.8± 3.94 mm vs. 20.4± 3.94 mm, p<0.001), DSS (32.5± 9.81 mm vs. 38.6± 11.03 mm, p=0.006) and VCD (25.5± 6.96 mm vs. 29.6±8.47 mm, p=0.012) compared to NFPA group.
Conclusions: All three parameters considered, ICD, DSS and VCD, resulted dimensionally smaller in acromegalic patients; in all cases, this was statistically significant. As a consequence, GH-omas present a narrower and deeper surgical field, as empirically evaluated in our surgical experience in EEA. For this reason, neuronavigation and a meticulous anatomical preoperative planning are fundamental to recognize the sphenoid anatomical landmarks, especially in acromegalic patients.

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654
Brain and Spine 4 (2024) 103604
A Novel T-Holding Chopsticks Technique For Endoscopic Endonasal Surgery Of Regular And Invasive Pituitary Adenomas Via Mono-Nostril Approach

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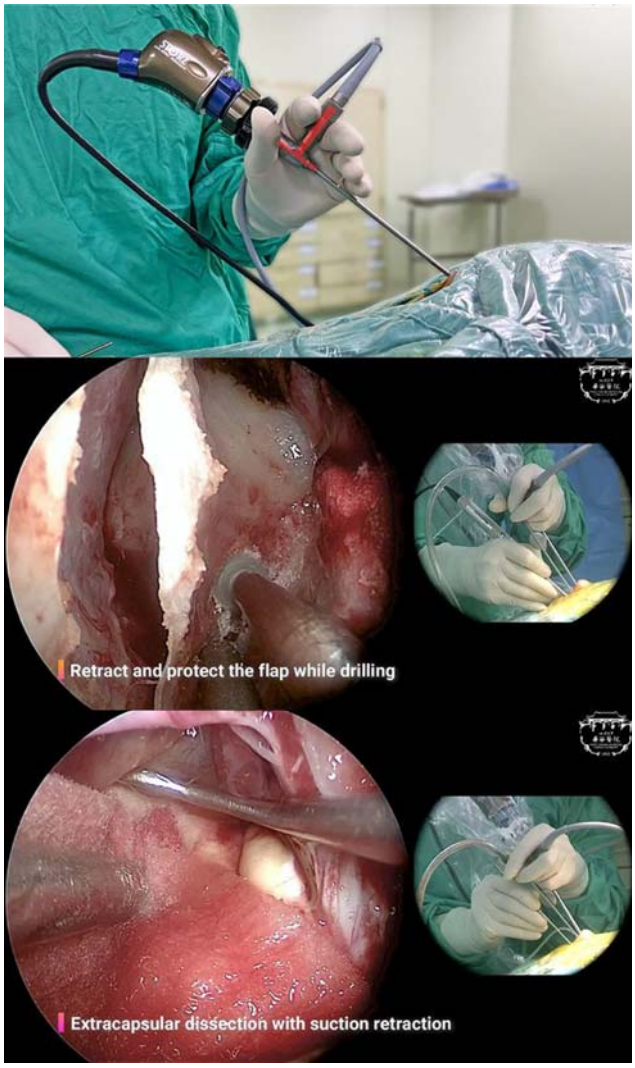
Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Endoscopic endonasal surgery (EES) is now the mainstream surgical procedure for pituitary adenomas (PAs). However, in the initial stage of EES, the surgeons still have to endure the dilemma of not being able to operat bimanually. In the stage of tumor resection, especially for functional or invasive PAs, bi-nostril approach is often required for fine extra-pseudocapsular resection and intra-cavernous sinus dissection, which is relatively more disruptive to the nasal cavity.
Methods: A novel endoscope holding method of chopsticks technique named as "T-holding" was used since 2020. The T-holding was based on the structure of the endoscope, which provides more stable, effortless and flexible aspirator manipulation. It achieves stability by distributing the weight of the endoscope over the perlicue and middle finger, while the index and middle fingers fix the light post to prevent the endoscope from rotating. The center of gravity of the endoscope-

camera is placed behind the thumb, then the tip of the endoscope naturally moves upward and retract the nostril to reduce the effort of uplift the endoscope; The body of the endoscope is placed at the root of the fingers, which allows three or four fingers to participate in the aspirator manipulation with adequate flexibility.

Results: Since 2020, 316 cases of PAs of Knosp Grade 0-3 and 38 cases of PAs of Knosp Grade 4 were operated in our hospital. The gross total resection rate is 82.3% and 57.9% respectively. Most of them were performed with the T-holding chopsticks technique, which can improve the efficiency of the operations such as hemostasis, retraction, dissection, protection, and suturing. The majority of operations require only mono-nostril approach without interfering the contralateral nasal cavity.

Conclusions: The T-holding chopsticks technique achieve the fulltime bimanual EES, which improves the operation efficiency and the surgeons' operating experience, and in most cases, only mono-nostril approach is needed.

Optional Image



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1361

Brain and Spine 4 (2024) 103605

Case-Specific Unruptured Intracranial Aneurysm Simulation for New Medical Device Development: Validation of the First Fully Functional Additively Manufactured Aneurysm Clip

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: The microsurgical treatment of Unruptured Intracranial Aneurysms (UIAs) is based on the reconstruction of the physiological anatomy by surgical or endovascular treatment. Surgical training and planning simulators hold the unexplored potential of aiding the development of new medical devices, like aneurysm clips.

Methods: Anonymized images of an internal carotid artery UIA case with (dome diameter: 6.5 mm) were acquired and segmented. The aneurysm and its parent artery were isolated from the rest of the digital vasculature, a constant wall thickness of 0.4 mm applied and silicone 3D printed. A surrounding portion of the brain was isolated and subsequently produced with silicone casting. By assembling them in a rigid housing on a 3D printed fixed skull, the case-specific simulator was obtained. To test development and testing support of the simulator, an aneurysm clip was newly produced based on the design geometry of a standard L-Aneurysm Clip (Peter Lazic GmbH, Germany). The clip was analysed in laboratory to evaluate its superficial finishing, closing force, and dimensional accuracy through microCT scanning. After clip application and neck reconstruction, intraoperative ICG-Videoangiography (ICG-VA) simulation and CT scan of the simulator were obtained to evaluate aneurysm reconstruction.

Results: The patient simulation showed excellent anatomical and physical realism, confirming clip compatibility with the replicated clinical setting and the utility of simulator for device development. The produced clip showed a mean and root mean deviation from the digital model respectively of 0.05 mm and 0.24 mm, and self-closing force of 1.77 $\pm$ 0.13 N. Intraoperative ICG-VA simulation revealed complete aneurysm occlusion, and the CT confirmed Raymond 1 reconstruction of the vascular anatomy.

Conclusions: A case specific UIA simulator was proven successful in developing and testing a new medical device. This represents one of the first examples of a versatile simulation tool, opening unprecedented possibilities.

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543

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Impact of selection criteria on the outcome of surgery following microsurgical resection of Intracranial Arterio-Venous Malformations (AVM)

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Surgical results and outcome after intracranial AVM surgery are dependent on careful case selection and are not just related to microsurgery technique. Existing scales that assess the angio-architectural characteristics of AVMs are predictive of post-operative outcome, however there are multiple additional selection factors such as treatment indications, existence of an intracerebral haematoma (ICH), use of adjuvant endovascular embolization and timing of surgery that are potentially important.

Methods: Details of 200 consequent surgically treated AVMs from a prospectively collected data base were analysed. All (100%) had pre-operative angiographic assessment. 142 were Spetzler-Ponce (S-P) [A], 42 S-P [B] and 16 S-P [C]. Of the 163 presenting with haemorrhage, microsurgical resection of the AVM was performed concomitantly with evacuation of a mass-producing ICH acutely (within 48 hours) in 27 and “sub-acutely” (>2 days – 28 days) in 76, where a liquifying ICH facilitated the AVM resection in selected cases. 37 (19%) were paediatrics and 47 (24%) were infratentorial. Of the S-P [B] & [C], 12 had partial pre-operative embolization of the nidus at some stage. Outcome, complications, neurological deficits and obliteration rate were correlated with S-P grade, category of surgery (AVM + acute ICH evacuation - AVM + subacute ICH evacuation – AVM after haemorrhagic presentation + no or resolved ICH - AVM with non-haemorrhagic presentation), location, age, other procedures and timing of surgery. In addition, new and persistent neurological deficits were correlated with eloquent location of the AVM and the ICH. Modified Rankin score mRS was used to assess outcome.

Results: Six died (2 as a result of the acute ICH and 1 from unrelated

undiagnosed malignancy 3 months later) and 2 were severely disabled - mRS 5 (1 as a result of the acute ICH and 1 as complication from acute post-embolisation ICH). The complications included 6 wound or EVD infections, 6 post-operative haematomas or brain selling (3 fatal) and 5 recorded epilepsy. 13 had a new or exaggerated neurological deficit as a result of surgery being 8 in S-T [A], 3 in S-T [B], 2 in S-T [C], 2 of those operated upon for AVM + subacute ICH evacuation – 5 AVM after haemorrhagic presentation + no ICH - 6 AVM with non-haemorrhagic presentation. Good outcome was achieved in 170, while 1.4% & 9% of S-T [A], 7% & 19% of S-T [B], 18% & 0% of S-T [C], 15% & 22% of those operated upon for AVM + acute ICH evacuation - 1% & 12% AVM + subacute ICH evacuation – 5% & 7% AVM after haemorrhagic presentation + no ICH - 3% & 6% AVM with non-haemorrhagic presentation, had an mRS 5-6 & 3-4 respectively. 11 required the insertion of a VP shunt. In 4 a postoperative angiogram was not performed for either persistent poor neurological state or early mortality. Of those where an angiogram was performed 4 the AVM nidus was not totally obliterated with the first surgery (98% obliteration rate). The timing of surgery did not have a negative impact on the obliteration rate or outcome.
Conclusions: Multiple factors need to be considered for surgical treatment of AVMs beyond the well-established scales. Postoperative neurological deficits are related to eloquent cortical and white matter tracts location. The timing of intervention in the presence of an ICH with surgery performed in the subacute stage and prior to resolution of the ICH facilitated the AVM resection - provided careful selection and attention to the details of the nuances of surgery (will be presented) in these situations – without compromising the obliteration rate or neurological outcome.

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1224
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Endoscopic endonasal surgeries for giant pituitary adenomas in elderly people

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Nowadays increasingly more elderly people are diagnosed with pituitary adenomas (PAs) as the life expectancy has become longer. PAs in elderly are associated with milder symptoms mainly due to an overlap with age-related medical conditions. However, the elderly may have increased anesthetic and surgical risks, which limit treatment options. The aim of the study was to review the surgical results in a series of elderly patients with giant PAs (GPAs) operated with endoscopic endonasal approach.
Methods: The study is a retrospective analysis of a series of 58 elderly patients aged 65 years or more at the day of the surgery (29 women and 29 men). The control group consisted of 118 patients younger than 65 years (37 women and 81 men). The patients were treated from the 2007 to 2023 by the endoscopic transsphenoidal surgeries for GPAs (>40mm). The mean age of the elderly patients was 70.3 years (65-81 years), and in control group – 50.5 years (20-64 years). The mean follow up period was 7.5 years (0-16 years).
Results: In elderly group gross total resection was achieved in slightly fewer patients (41.4% vs. 44.1% in control group, p=0.5). Fewer elderly patients experienced complications (31.0% vs. 34.7%, p=0.7). The most common complications were transient diabetes insipidus (19.0% vs. 21.2%) and hematoma (5.2% vs. 7.6%). Early reoperations were required in non-significantly fewer elderly patients (8.6% vs. 10.2%, p=1.0). However, the hospitalizations of elderly patients were slightly longer (7.3 vs. 7.0 days, p=0.8).
Conclusions: The endoscopic surgeries for GPAs in elderly people seem to be as safe and efficacious as in younger population with no statistically significant differences.

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678
Brain and Spine 4 (2024) 103608
Risk Assessment of Clinical Outcome in the Treatment of Unruptured Intracranial Aneurysms: A Retrospective Analysis of PHASES, ELAPSS, and UIATS Scores in clinical practice

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM
Background: The treatment of unruptured intracranial aneurysms (UIA) requires a balance between the risks of surgery and the consequences of rupture. Risk assessment scores such as PHASES, ELAPSS, and UIATS provide quantitative evaluations of rupture and growth risks, thus supporting decision-making. However, their predictive value for postoperative outcomes remains uncertain.
Methods: In this single-center, retrospective study, aneurysm characteristics and common risk assessment scores were collected for patients with UIAs. The focus was on the predictive value for the risk of poor postoperative outcomes. Between January 2010 and 2021, 378 patients were included. Clinical outcomes were assessed using the modified Rankin scale (mRS).
Results: The cohort of 378 patients was predominantly female, with an average age of 54.8 years. The average aneurysm diameter was 8.03 mm, with most being saccular. PHASES and UIATS achieved statistical significance in predicting poor clinical outcomes ($p < 0.05$), and all 3 scores were able to predict the increased risk for new neurological deficits postoperatively ($p < 0.05$). Age was a significant factor for postoperative neurological deficits and poorer clinical outcomes ($p < 0.03$), while aneurysm size was significant for new neurological deficits ($p = 0.01$).
Conclusions: Scoring systems that allow for surgical risk estimation are still lacking. While the ELAPSS score was effective in predicting immediate postoperative complications, it was less predictive for long-term clinical outcome. The PHASES and UIATS scores showed significant predictive value for new neurological deficits and overall clinical outcomes. Aneurysm size is a significant predictor of postoperative morbidity, while the presence of intraluminal thrombi or multiple aneurysms did not increase postoperative morbidity.
Our study highlights the potential role of PHASES, ELAPSS, and UIATS scores in the preoperative assessment of aneurysms and provides valuable insights for surgical risk assessment, aiming to improve clinical decision-making and patient outcomes.

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90
Brain and Spine 4 (2024) 103609
Molding Helmet Therapy In Positional Plagiocephaly, Brachycephaly And Plagiobrachycephaly: A Monocentric Study

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM
Background: The rising incidences of positional skull deformities confront different medical specialties with molding helmet therapy of infants. The cephalometric parameters cranial vault asymmetry (CVA) and cranial index (CI) are used to determine between positional plagiocephalus (PP), brachycephalus (PB) and plagiobrachycephalus (PPB) and to indicate helmet therapy.
Methods: In a retrospective study, 25 patients treated with helmet therapy for positional skull deformity between 2016 and 2023 were included. CVA and CI were measured using a 3-dimensional camera. The groups were defined as follows: PP ($CI \leq 90$ %, $CVA \geq 3.5$ mm), PB ($CI > 90$ %, $CVA \leq 3.5$ mm), PPB ($CI > 90$ %, $CVA \geq 3.5$ mm). The mean differences of CVA and CI before and after helmet therapy were tested in each group for statistically significant difference using Student's t-test.
Results: The 15 male and 10 female patients were 6.6 months old (SD 1.88) and were treated with helmet therapy for 5.8 months (SD 1.62) on mean. 13 patients were assigned to PP, 4 to PB and 8 to PPB. In the entire study population, mean

CVA decreased from 13.85 mm (SD 4.88) at baseline to 5.95 mm (SD 3.14) at follow-up and CI from 90.17 % (SD 5.1) to 87.81 % (SD 4.49). Figure 1 shows the decrease of CVA and CI in the groups. Among PP patients, mean CVA and CI values changed significantly ($p (CVA) < 0.001$, $p (CI) < 0.05$). In the PB group, only the decrease of CI was significant ($p (CVA) > 0.05$, $p (CI) < 0.05$). PPB patients showed greatest significance ($p (CVA, CI) < 0.001$).

Conclusions: Helmet therapy is a useful and effective treatment option for positional skull deformities. The distinction between the various types can ameliorate treatment decisions and follow-up care.

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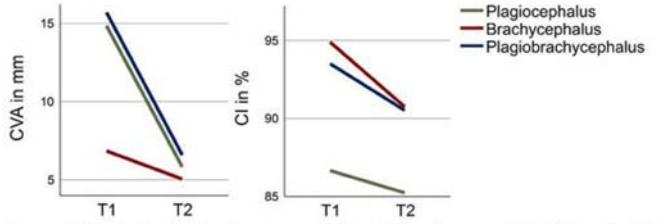


Figure 1: Line charts showing the decrease of cranial vault asymmetry (CVA) on the left and cranial index (CI) on the right side in the groups positional plagiocephalus, brachycephalus and plagiobrachycephalus before (T1) and after (T2) molding helmet therapy (note different scaling)

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1455

Brain and Spine 4 (2024) 103610

Intraoperative Detection of Pads Using Machine Learning Method, A Preliminary Study and Future Perspective

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Artificial intelligence is expected to push the boundaries of diagnosis, clinical decision making and prognostic evaluation. However, its intraoperative use is very limited in the current literature. In our study, with the object detection method using artificial intelligence, neurosurgical pads was detected intraoperatively in cranial surgeries in terms of its relative ease of detection and its utility as a useful model, the workflow for intraoperative object detection in neurosurgical interventions was presented.

Methods: Screenshots from microsurgery videos of 40 patients were annonated with Roboflow and processed using the YoloV8 library and Colab. A total of 1565 augmented surgical images were used in the study, 1440 images used for the train set and 41 images annonated for the test set. The cycle was set to 25 epochs. After the training was completed on both Colab and Roboflow, the test phase was started and the system's operability was verified on previously unused microscope images. In addition, the operability of the system was tested in real time with the help of a software adapted to a mobile phone during a cranial surgery.

Results: Confidence Threshold in the range of 0.2%, Precision was 76.0% and Recall was 51.0%. mAP was 73.4%. This indicates that our model trained with Roboflow and Colab provides high precision in object recognition at intraoperative level.

Conclusions: Although the boundaries of artificial intelligence concepts are gradually expanding, their use in the operating room is quite limited compared to prediction and treatment planning stages. In the light of the data obtained as a preliminary study, it has been seen that these concepts can be adapted for use in operating theatres, and a suitable workflow has been put forward. Artificial intelligence concepts may provide solutions in the future for some problems in current neurosurgery that cannot be overcome with human power and ability.

Optional Image



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501

Brain and Spine 4 (2024) 103611

A Rigid Endoscopic Approach To Choroid Plexectomy As An Adjunct To Endoscopic Third Ventriculostomy And Choroid Plexus Coagulation

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Oral e-Poster Presentations - Booth 4: Pedıatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: The current standard for endoscopic treatment of hydrocephalus includes endoscopic third ventriculostomy (ETV) with or without choroid plexus coagulation (CPC). Choroid plexectomy (CPL) has been previously avoided due to many problems associated with the procedure. We present a safe CPL technique during a standard ETV/CPC with a rigid endoscope through a single-access point eliminating previous concerns for such morbidity and mortality.

Methods: A rigid endoscope was used as per usual for an ETV. After identification of the choroid plexus, a long glomus if present is coagulated by monopolar cautery at its blood supply. This was then cut with endoscopic scissors alternating with cautery to minimize blood loss until the glomus was fully disconnected and retrieved with forceps. The remaining choroid plexus was then coagulated. Continuous irrigation during the procedure prevented ventricular collapse.

Results: This technique minimizes operative time and anesthetic exposure by decreasing the area of choroid plexus that requires coagulation as well as improving visualization than if the glomus was left in place. This technique has been practiced at our institution over the past 4 years with no mortality as a result of the procedure or significant intraoperative bleeding.

Conclusions: The addition of CPL to standard ETV/CPC is shown here to be safe,

although long-term follow-up studies are recommended to assess its full benefit and possible complications.

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165

Brain and Spine 4 (2024) 103612

Predicting rupture risk in cerebral arteriovenous malformations – how universal are current scores?

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Brain arteriovenous malformations (AVM) are an important cause of morbidity and mortality, especially in young subjects. Natural history is still largely debated, and the fundamental question of hemorrhagic risk remains unanswered. Various scores for predicting hemorrhagic risk of AVMs were proposed in recent years. Our purpose was to externally validate R2eD score, VALE score and ARI score in our patient population.

Methods: We reviewed all surgically treated AVMs between 2009 and April 2023. A total of 43 AVMs were operated during this period. R2eD score, VALE score and ARI score were applied, and model performance was assessed using receiver operating curves (ROC).

Results: Mean population age was 42 years old and hemorrhage occurred in 67.4% of patients. Area under the curve (AUC) from ROC analysis was 0.666 for the R2eD score (CI 0.497 – 0.835; $p = 0.08$). Original article description found a nearly identical AUC of 0.685. ROC analysis of the VALE score yielded an AUC of 0.633 (CI 0.466 – 0.801; $p = 0.162$), as compared to the 0.77 originally reported. Patients in the high-risk group of the VALE score had a statistically significant higher risk of hemorrhage ($p = 0.022$). ROC analysis of the ARI score yielded an AUC of 0.669 (CI 0.493 – 0.846; $p = 0.078$), as compared to the AUC of 0.759 in the first paper. Interestingly, 80% of patients with an ARI ≥ 2 vs 58% of patients with an ARI < 2 had hemorrhage which, although non-significant, might be used as an additional predictor. Of note, 84% of patients had a good outcome in our series (mRS ≤ 2 at 6 months).

Conclusions: Management algorithm for AVMs is both crucial and challenging. All 3 evaluated scores had a good performance in our population and might be used to predict hemorrhage risk and guide decision-making in this devastating disease.

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692

Brain and Spine 4 (2024) 103613

Preclinical Rat Model of Cerebral Arteriovenous Malformation's Surgery: Quantifying Blood Brain Barrier Improvement With DCE-MRI

Ana Rodríguez-Hernández [1], Alejandra Mosteiro [2], Leire Pedrosa [2], Carlos Laredo [3], Roser García-Armengol [1], Sergi Amaro [4], Carlos J. Dominguez [1], Ramon Torné [2]. [1] *Department of Neurosurgery, Germans Trias i Pujol University Hospital, Spain;* [2] *Department of Neurosurgery, Hospital Clinic of Barcelona, Spain;* [3] *Neuroscience Area, August Pi i Sunyer Biomedical Research Institute (IDIBAPS), Spain;* [4] *Department of Neurology, Hospital Clinic of Barcelona, Spain*

Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: A growing body of evidence suggests that inflammation and blood-brain barrier (BBB) dysfunction are involved in the clinical course of cerebral arteriovenous malformations (AVMs) and their risk of bleeding. Moreover, AVMs behave as low-resistance circuits, wich may cause chronic hypoperfusion of the perimalformative tissue and subsequent dynamic vascular overload after surgical removal. Having a reliable animal model to evaluate how different management srategies impact this phenomenae may be key to improve current AVM treatments and to unlock new ones. We aimed to develop a rat model that mimics the hypoperfusion-reperfusion damage of peri-AVM tissue before and after surgical intervention, and to evaluate its BBB alteration using dynamic contrast-enhanced MRI (DCE-MRI).

Methods: First stage: animal subjects undergo ligation of both external carotids (ECA) and end-to-side anastomosis between internal jugular vein and common carotid artery. (Y-C). Next, evaluation of BBB in the hypoperfusion phase with DCE-MRI (7-Teslas) on days +1, +7 and +21. Second stage: closure of Y-C anastomosis by ligation ("treatment") and evaluation in the reperfusion phase with DCE-MRI at 24 hours.

Results: Out of 17 animals operated on, 12 survived with a patent Y-C fistula until day +21. The BBB permeability constant (Ktrans) measured by DCE-MRI increased from day+1 (0.159±0.127) to day+21 (0.303±0.231), and decreased 24h after fistula closure, but without reaching basal levels again (0.227±0.132)

Conclusions: The described model seems to reproduce the dynamic BBB damage induced by the low resistance arteriovenous circuit, loco-regional hypoperfusion and venous overload. The BBB alteration is more evident on day +21 of evolution. Twenty-four hours after "curative surgical treatment", a decrease in BBB permeability is observed, but its full normalization is not achieved. DCE-MRI seems a reliable tool to evaluate BBB permeability in this model, and could be used in the study of disease-modulating drugs.

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421

Brain and Spine 4 (2024) 103614

Innovations in neurosurgery - a novel machine learning predictive model for lumbar disc reherniation following microsurgical discectomy

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Lumbar disc herniation (LDH) is the most common spinal pathology treated surgically. Reoperation rates due to same level reherniation vary from 5% to 15% in different studies. Reherniation surgery is associated with poorer outcomes and greater complications rate. The objective of this study was the creation of a predictive score for lumbar disc reherniation following microdiscectomy without fusion.

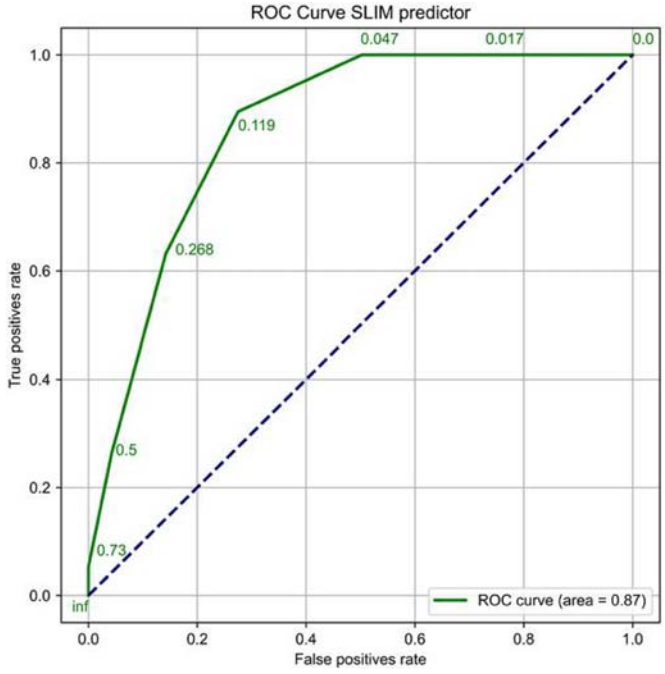
Methods: A retrospective chart review was completed of all adult patients that underwent microdiscectomy without fusion for symptomatic single level LDH, in a single center, over the last 3 years. Only adult patients with single level herniation were included in the study. Radiological and common medical information was obtained. Machine learning models excel in creating accurate predictions based on pools of non-liner data, when compared to traditional statistical methods. Utilizing the novel machine learning algorithm (the RISK-SLIM model), the Lumbar Reherniation Score (LRS) was created. Following the creation of the model, standard five-fold cross-validation was performed. The model's accuracy was tested against a Random Forest classifier and a deep learning model implemented in TensorFlow's Keras.

Results: In total 230 patients were included in the study. 19 of them developed same level symptomatic reherniation during a follow-up period of 1 to 3 years and required a second surgical intervention. The Lumbar reherniation score was then created. The reherniation risk ranged from 0% for a score value of 0 to 88.1% for a score of 13. The LRS has area under the curve of 0.87, confusion matrix accuracy of 0.74, Matthews correlation coefficient of 0.36 and informedness of 0.62.

Conclusions: The LRS is an easy-to-use, patient-specific tool for preoperative

prediction of the individual patient-specific risk of same level symptomatic reherniation following microdiscectomy. It illustrates that machine learning algorithms can be successfully incorporated into the field of neurosurgery. Further validation of the model is needed in order to improve its accuracy.

Optional Image



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1177

Brain and Spine 4 (2024) 103615

Virtual Reality Guided Neuroanatomy Education: Elevating Knowledge and Understanding

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Virtual Reality (VR) technology offers a novel approach to medical education, especially in teaching complex subjects like neuroanatomy. Traditional methods struggle to fully represent the intricate three-dimensional nature of neuroanatomy, leading to a demand for more immersive and interactive educational tools.

Methods: To assess the efficacy of VR in neuroanatomy education, we conducted a study involving sixty-three medical students with varying levels of neuroanatomy knowledge. Participants engaged in a VR educational experience designed to teach neuroanatomy. The study employed a pre-test and post-test model where participants answered five neuroanatomy questions before and after the VR sessions. The aim was to measure the impact of VR on their understanding of neuroanatomy. Additionally, participants were surveyed on their perceptions of the VR experience's educational value.

Results: The study demonstrated a significant improvement in neuroanatomy knowledge among participants. The median number of correct answers increased from 3 (pre-VR experience) to 4 (post-VR experience), with a statistically significant difference (Wilcoxon test, $p < 0.0001$). This indicates a notable enhancement in the participants' ability to grasp complex neuroanatomical concepts through the VR experience. Moreover, an overwhelming 97.1% of respondents strongly affirmed the utility of the VR experience for educational purposes, highlighting the potential of VR as a powerful tool in medical education

Conclusions: The marked improvement in knowledge acquisition, coupled with the high level of student engagement and positive perception, suggests that VR can be an effective and innovative method in the teaching of complex subjects like neuroanatomy.

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645

Brain and Spine 4 (2024) 103616

The Development and Validation of an Intra-Operative Hyperspectral Imaging System for Neurosurgery: Embedding Human Factors in the Design Phase of Novel Surgical Technology.

Matthew Elliot [1,2], Qusai Al Banna [2], Ms Ashley Payne [2], Oscar MacCormac [1,2], Ms Sabina Patel [2], Zhonghao Wang [1], Mirek Janatka [3], Philip Noonan [3], Jose Pedro Lavrador [2], Ahilan Kailaya-Vasan [2], Michael Ebner [3], Mads Bergholt [4], Keyoumars Ashkan, Professor [1,2], Sebastien Ourselin, Professor [1,3], Gabriel Reedy, Professor [5], Janet E. Anderson, Professor [6], Tom Vercauteren, Professor [1,2,3], Jonathan Shapey [1,2,3]. [1] *Department of Surgical Interval Engineering, King's College London, London, United Kingdom;* [2] *Department of Neurosurgery, King's College London Hospital NHS Foundation Trust, London, United Kingdom;* [3] *Hypervision Surgical Ltd, London, United Kingdom;* [4] *Centre for Craniofacial and Regenerative Biology, King's College London, London, United Kingdom;* [5] *Centre for Education, Faculty of Life Sciences and Medicine, King's College London, London, United Kingdom;* [6] *Department of Anaesthesiology and Perioperative Medicine, Monash University, Melbourne, Australia*

Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Human factors is the scientific discipline that uses a systems approach to optimise safety, effectiveness and efficiency through improved design. The introduction of robotic surgery highlighted the importance of rigorous human factors analysis at the design phase of innovation. A recent innovation is intra-operative hyperspectral imaging (HSI), which has shown promising results for intra-operative tissue differentiation and oxygen saturation analysis in neurosurgery. This has led to the development of microscope-integrated HSI systems undergoing validation in our group. The aim of the study was to evaluate the effect of the HSI system on surgical workflow.

Methods: A ten-item questionnaire was developed based on the SEIPS framework and observations of high-fidelity surgical simulations (see Figure 1 for items). In 12 surgeries using the HSI system surgeons, anaesthetists, and nurses completed questionnaires and semi-structured interviews, which underwent thematic analysis to elicit potential benefits, risks, and challenges of the technology.

Results: Questionnaire responses showed 84% disagreed, or strongly disagreed that the HSI system led to surgical interruptions, 83% agreed, strongly agreed, or answered not applicable that it integrated with surgical workflows (Fig1). Semi-structured interviews revealed distinct use cases based on subspecialty, with a focus on tissue differentiation in neuro-oncology, and perfusion in vascular cases. Novel uses not anticipated by the design team were identified, including an alternating hyperspectral/white light view to assess flow in AVM surgery. Heuristic analysis revealed potential conflicts with standard surgical tasks during HSI system white referencing and balancing, allowing refinement of system design in subsequent iterations.

Conclusions: Human factors analysis of surgical technologies at the design and validation stage allows for optimisation of integration and ergonomics whilst identifying and reducing unanticipated risks to patient safety. Our novel HSI system was shown to integrate well with current workflows, with areas for

refinement identified in system footprint and calibration – along with unanticipated use cases.

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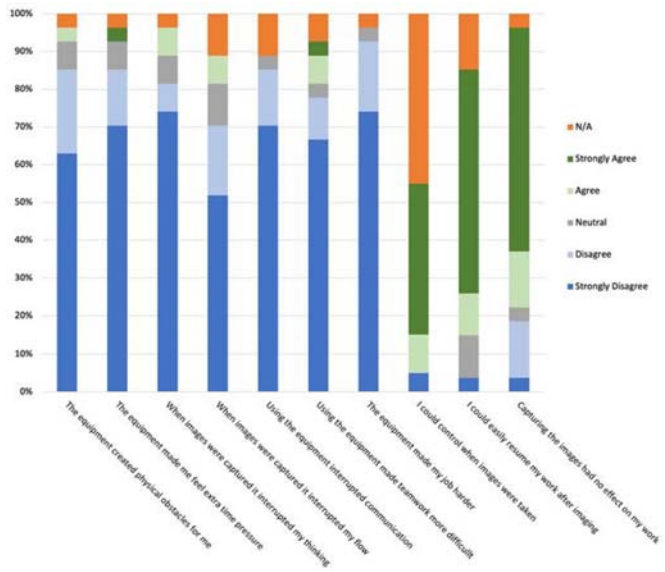


Fig1. Summary of matrix questionnaire responses following Neuro-HSI study cases. Neuro-HSI is an observational study with the aim of validating a microscope integrated HSI system. Respondents include consultant neurosurgeons (n=8), senior clinical fellow in neurosurgery (n=4), consultant anaesthetists (n=11), anaesthetic registrars (n=1), scrub nurses (n=12).

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1315
Brain and Spine 4 (2024) 103617
Treatment and Outcome of Vertebrobasilar Dolichoectatic Aneurysms: A Multinational study of 183 patients

Behnam Rezai Jahromi, Reza Dashti, Amin Ohadi, Visish Srinivasan, Nakao Ota, Hanna Kaukovalta, Christoph Schwartz, Antti Lindgren, Timo Koivisto, Olli Tähtinen, Joao Silva, Oriela Rustemi, Babak Jahromi, Monika Killer-Oberpfalzer, Matthew Potts, Milla Kelahaara, Kusumo Noda, Constantin Hecker, Christoph J. Griessenauer, Jussi Numminen, Felix Göhre, Hugo Andrade-Barazante, Ferzat Hijazy, Lars Wessels, Yashar Kalani, Peter Vajkoczy, Robert Spetzler, Juha E. Jääskeläinen, Akitsugu Kawashima, Ethan Winkler, Rokuya Tanikawa, Juha Hernesniemi, Michael Lawton, Mika Niemelä. [1] *Helsinki University Hospital, Finland*

Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Vertebrobasilar (VBA) dolichoectatic aneurysms (VBADA) are challenging to treat. Many times these form diffuse enlargement of whole posterior circulation making invasive treatment options limited. Those cases who have possibility to be treated via microneurosurgical and endovascular means are often exposed to high risk of morbidity and mortality. There have not been international large cohort on VBADA treatment and outcome. To analyze outcomes of different invasive treatment modality of VBADA in multinational patient cohort.

Methods: 380 patients were collected with VBADA, from 11 multinational high volume neurovascular centers, 183 patients underwent microsurgical or/and endovascular treatments. Basic patients and aneurysms characteristics were collected as the different treatment methods. Patients were divided to flow alteration (FA) and artery reconstruction (AC) cohort based on how the treatment affected VBADA despite the method of treatment (endo- or exovascular). Modified Rankin Score (mRS) for unruptured cases were compared to post-op mRS, for subarachnoidal haemorrhage (SAH) cases severity of SAH were compared to outcome. Technical success were identified for each cases and complications were analyzed

Results: Out of 183 patients 85 of them were admitted due to SAH and 98 patients with other symptoms. 55 patients in non-SAH cohort were treated with FA and 42 with AC, and 1 patient treatment failed. In SAH cohort 65 were treated with AC and 19 with FA and 1 patient treatment failed. There were a drop of mRS in non-SAH cohort after treatment, as in SAH cohort relative to severity of SAH. Aneurysm characteristics had an impact in choosing different flow alteration methods as it impacted the outcome when measured by mRS. Overall mortality was dependent on severity of disease in SAH.

Conclusions: VBADA is challenging to treat but due to tailored treatment option might give relatively good outcome in selected cases compared to natural history. Specially of in VBADA with saccular symptomatic component.

https://doi.org/10.1016/j.bas.2024.103617

688
Brain and Spine 4 (2024) 103618
Microsurgical Treatment of Paraclinoid Aneurysms

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: Aneurysms arising from the clinoid (C5) and ophthalmic (C6) segments of the internal carotid artery (ICA) are referred to as paraclinoid aneurysms (PAs). Microsurgical treatment of PAs contains challenges such as securing proximal control, drilling the anterior clinoid process (ACP) to expose ICA and PA, and dissecting dural rings.

Methods: Twenty-two cases of PA treated microsurgically between November 2017 and January 2024 were included in this retrospective analyzed study.

Results: Twenty-two cases presented with 24 PAs (2 cases bilateral). There were 21 and 1 cases of unruptured and ruptured PAs, respectively. The mean age was 47 years (34-66). Proximal control was achieved at the cervical ICA (C1) and at the C5 in 4 and 14 cases, respectively; C1 was prepared but not incised in 6 cases. The ACP was drilled with intradural technique in 11 cases and with extradural in 6 cases. In 6 cases, drilling started extradurally but completed intradurally, which was necessary due to anatomical variations such as carotico-clinoid foramen and interclinoid ligament calcification. In 1 case no clinoidectomy was performed. One patient developed postoperative rhinorrhea, which resolved spontaneously; one patient developed a new-onset epileptic seizure; and one patient died due to ischemic complications.

Conclusions: Microsurgical treatment of PAs is becoming less common due to advances in endovascular techniques; however, with the proper techniques, it is a viable treatment modality with an acceptable safety rate. Microsurgical treatment of PAs has advantages of providing permanent treatment in a single session, not requiring use of antiaggregants, and resolving optic nerve compression.

Optional Image

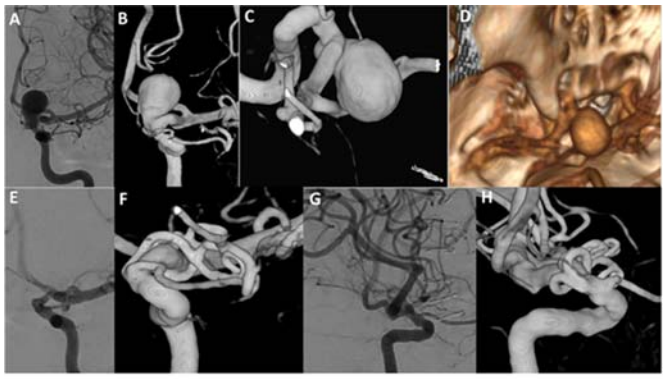


Figure 1: *Preoperative (A-D) and postoperative (E-H) radiologic images of a 46-year-old woman with PA. A-B: AP image of the left ICA injection shows an upwardly directed aneurysm arising from the medial surface of the ICA. C-D: 3D angiography and CT angiography showing skull base structures adapted to the surgical position. E-H: Postoperative AP and lateral views show complete aneurysm closure with a fenestrated "L" shaped clip.*

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1185
Brain and Spine 4 (2024) 103619
Pineal Region and Higher Functions, Do we Know Anything? Results From a Single-Institution Experience With Pineal Region Tumors

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Oral e-Poster Presentations - Booth 4: Pediatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: Pineal region tumors represent challenging surgical lesions due to their deep location and different histological types. They are more common in children. They often necessitate a multifaceted therapeutic approach, including surgery and adjuvant therapies. In this article we review our institutional experience to find possible factors that may influence children's development and their long-term outcome with particular attention to educational background, occupational engagement and employment status.
Methods: A retrospective analysis was conducted on data collected from a single-center database regarding medical history, surgical approaches, histological findings, administered chemo- and radiotherapy. Outcome was assested using Glasgow Outcome Scale questionnaire and patients' level of education, and employment status. Statistical analysis was performed to assess for variables related to functional outcomes.
Results: 38 patients were included in the study, comprising 32 men and 6 women, with a mean age at diagnosis of 12.1 ± 5.53 years and a mean follow-up 8.79 ± 5.71 years (ranging from 6 months to 19 years). The most common tumor histology was Germinoma (47.4%) according to the pediatric population of our series. The quoad vitam prognosis was obviously related to the degree of aggressiveness of the lesion(p-value=0.03), 100% of deceased patients (3/3 GOSE 1) had dissemination at diagnosis. Another interesting finding statistically significant (p-value= 0.05) was linked to school dropout. Among 15 patients showing school dropout no patients in GOSE class 1-3, only 5 patients within a GOSE class 5-6. Instead, the other 10 patients were settling in a high GOSE class (GOSE 7-8). 4 out of 30 patients have difficulty finding a job, and all of these 4 patients were among the school dropout patients. 2 of these patients also have a high GOSE. Other independent factors (such as number and kind of surgery and adjuvant therapies) did not show a statistically significance.
Conclusions: We think in light of these data that it can be hypothesized that pineal involvement results in impairment of higher functions regardless of the extent of disease and consequent therapies. All these data lead us to suppose that there is something to be investigated in terms of pineal involvement and higher functions.

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1200
Brain and Spine 4 (2024) 103620
Life Expectancy In Patients With Unruptured Intracranial Aneurysms – A Systematic Review And Meta-Analysis.

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Oral e-Poster Presentations - Booth 1: Vascular 1, October 14, 2024, 12:40 PM - 2:10 PM

Background: We assessed mortality and risk of vascular diseases and cancer in patients with unruptured intracranial aneurysms.
Methods: We included studies with a longitudinal study design and at least three months of follow-up, reporting on the occurrence of overall and non-aneurysm-related death, cancer, or vascular disease
Results: We included 58 studies with data on 61,949 patients and mean follow-up of 4.9 years. 12.9% of patients died from non-aneurysm related causes, 4.5% were diagnosed with vascular disease, and 7.3% with cancer.
Conclusions: Five years after diagnosis, more than 20% of patients with an unruptured intracranial aneurysm will have died or been diagnosed with cancer or vascular disease. This proportion should be considered when balancing pros and cons of preventive treatment.

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610
Brain and Spine 4 (2024) 103621
Endoscopic treatment methods of Suprasellar Arachnoid Cysts in Children: A Systematic Review and Meta-Analysis

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Oral e-Poster Presentations - Booth 4: Pediatric, October 14, 2024, 12:40 PM - 2:10 PM

Background: A systematic review and meta-analysis of the literature comparing the efficacy and safety of the two prevailing endoscopic techniques in the treatment of suprasellar arachnoid cysts (SAC), ventriculocystostomy (VC) and ventriculocystocisternostomy (VCC).
Methods: We conducted a literature search following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to identify surgical articles evaluating endoscopic treatment modalities for SAC using PubMed/Medline and Embase. Two investigators reviewed the articles for eligibility, extracted data, and assessed the risk of bias using the Newcastle-Ottawa scoring system (NOS).
Results: Nineteen observational studies were eligible for inclusion, comprising 94 patients who underwent VCC and 427 patients who underwent VC. A meta-analysis was performed for recurrence rates comparing the surgical approaches. Comparing the VC and VCC procedures, VCC had a significantly lower risk ratio of reoperation of 0.33 (95% confidence interval, 0.17–0.65; $P < 0.002$). However, the overall morbidity rate was higher in the VCC group (16.2%) compared to the VC group (12.7%), however not significant (P=0.915). Within the subgroup of infants, the recurrence rate and secondary risk of reoperation were significantly higher (29.4%) compared to older children (5.7%) (95% confidence interval, 1.96–42.07; $P < 0.002$).
Conclusions: VCC is as an effective and long-lasting treatment option for symptomatic SACs with lower reoperation rates. However, the morbidity rate is higher in the VCC group compared to the VC group. In the absence of symptoms and isolated endocrine dysfunction or gaze disturbance, surgery needs to be carefully considered, with possible watchful waiting as the preferred approach.
Optional Image

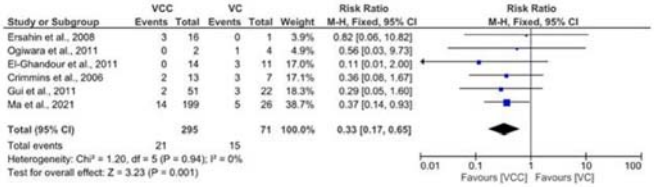


Figure 2: Forest plot for pooled recurrence using a fixed effects model. The figure illustrates the comparison of reoperation rates in children treated with ventriculocystostomy (VC) and ventriculocystocisternostomy (VCC) based on six included studies. Each square represents an individual study's odds ratio, with horizontal lines indicating the 95% confidence interval. The diamond represents the pooled summary estimate, and the vertical line signifies the null hypothesis.

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639
Brain and Spine 4 (2024) 103622
Laser in Neurosurgery: extensive use on a large cohort of patients and technical nuances.

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Oral e-Poster Presentations - Booth 3: Emerging Technologies & Innovation 2, Emerging Technologies & Innovation 3, October 14, 2024, 12:40 PM - 2:10 PM

Background: Thulium laser has recently been used not only in endoscopic intraventricular surgery, but also in intracranial and spinal tumor resection due to the reduced risk of thermal damage, the absence of interference with intraoperative neuromonitoring and the possibility to obtain an unparalleled precision cut, combining the action of mechanical and electric tools. Herein, we report our experience in laser-assisted (LA)-surgery, focusing on the role of this innovative tool.
Methods: From January 2010 to January 2024, 553 LA-procedures were performed in our neurosurgical department. We retrospectively collected clinical data and intraoperative videos from 120 intracranial, 264 endoscopic and 169 spinal procedures. Moreover, we compared the duration of the LA-procedure with similar surgical cases in which the laser was not used.
Results: Thulium laser has been used or many different procedures either endoscopic or microsurgical. Laser assisted surgery helps to reduce all the effects of monopolar or bipolar cauterization such as vascular lesions and we reported no surgery-related complications. It has also been used for hemostasis or cutting tumor sections. Moreover, it can enter in narrow working channels and can be used in pediatric operations too. The operative times were almost superimposable.
Conclusions: Our experience tells us that, compared to the use of bipolar or monopolar coagulation, laser can be a valid alternative to substitute them in hemostasis when performing open surgical and endoscopic operations. Thulium laser consents the surgeon to debulk, shrink, and coagulate with only one device without alternating different instruments.

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557
Brain and Spine 4 (2024) 103623
Empirical Gasket reconstruction of the sellar floor following endoscopic endonasal trans-sphenoidal surgery for pituitary adenomas: a single centre experience

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Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: The endoscopic endonasal transsphenoidal approach has largely replaced the microsurgical approach for the management of pituitary adenomas. Whilst it affords many advantages, it does carry a greater risk of a cerebrospinal fluid (CSF) leak following surgery. Post-operative CSF leaks, which can occur even in the absence of an intra-operative leak, carry risks of significant morbidity including meningitis, pneumocephalus and a need for further surgery. Additionally, post-operative CSF leaks incur significant healthcare costs, with studies estimating an additional €14000 cost per cases complicated with a CSF leak.
There is no consensus for what constitutes an ideal reconstruction to minimise CSF leak risk following endoscopic endonasal transsphenoidal surgery.
Methods: Case series of 101 endoscopic endonasal transsphenoidal surgeries for pituitary adenomas between 2015 and 2023, performed by two consultants in our centre.
Results: Of the 101 operations, 15 were emergencies and 86 were elective, with 93 representing primary surgeries and 8 revision surgeries. Macro-adenomas made up 92% of cases, of which the majority were non-functioning.
Our unit previously used the gasket reconstruction in cases with an intra-operative CSF leak and, in cases with no intra-operative leak, a gelatin sponge with a layer of fibrin sealant. In 30 cases, with the gelatin/fibrin repair, we had a single case of a post-operative CSF leak and this was in a patient with no intra-operative CSF leak. This led to a review of our practice and change in management to empirical gasket reconstruction for all patients. A gasket reconstruction in our unit consists of a porous polyethylene implant buttressing a layer of a collagen implant with a dural sealant applied over this, to achieve a water-tight seal. In patients with high flow intra-operative leaks, we augment this by placing abdominal fat graft in the sella before the reconstruction. In 71 patients undergoing gasket reconstruction, one patient had a post-operative CSF leak representing a leak rate of 1.4%.
Conclusions: We demonstrate that empirical reconstruction of the sellar floor following endoscopic endonasal transsphenoidal surgery can achieve a CSF leak rate, which is lower than that in the literature with recent meta-analyses suggesting rates of 3.4% – 7.11% for endoscopic endonasal transsphenoidal approaches to pituitary adenomas. Given the morbidity and costs to the healthcare system associated with post-operative CSF leaks, we endorse empirical gasket reconstruction of the sellar floor to minimise the risk of post-operative CSF leak.

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1280
Brain and Spine 4 (2024) 103624
Exploring factors behind Arginine-Vasopressine Deficiency after endoscopic endonasal surgery: a single-center analysis of 349 patients

Raffaele De Marco [1,2], Alice Antico [1,2], Giuseppe Di Perna [1,2], Federica Penner [1,2], Alessandro Pesaresi [1,2], Irene Portonero [1,2], Enrico Lo Bue [1,2], Diego Garbossa [1], Michele Lanotte [1], Francesco Zenga [2]. [1] *University Of Turin, Turin, Italy;* [2] *Skull Base and Pituitary Surgery Unit, "Città della Salute e della Scienza", Turin, Italy*

Oral e-Poster Presentations - Booth 2: Skull base 2 (Pituitary), October 14, 2024, 12:40 PM - 2:10 PM
Background: Arginine-Vasopressine Deficiency (AVP-D) (formerly known as central diabetes insipidus) is a well-known complication of surgery for sellar and parasellar lesions. Aim of the study is to investigate risk factors behind this complication in patients underwent endoscopic endonasal resection (EEA) of pituitary neuroendocrine tumors (PitNET).
Methods: All the patients underwent endoscopic endonasal resection of pathologically confirmed PitNET in the period 2016-2022 at Author's Institution were included in the analysis. All procedures were performed by the same surgeon with experience in endoscopic pituitary surgery. A minimum follow-up of 12 months was considered for inclusion in the study. Simple correlation analysis and binomial logistic regression was performed to investigate any causative effect.
Results: 349 (0.8:1 F:M) patients were included in the study. Mean age at surgery was 57.5 (range 19.0-84.0) for PitNET measured on average 21.8 mm (0.6-65). 14.6% had at least a previous pituitary surgery (either endoscopic or microscopic). An intraoperative CSF-leak was reported in 16.9%. 44 patients experienced an AVP-D requiring a vasopressin analogue and for almost half of them this condition was irreversible. Younger age ($p= 0.03$), intraoperative CSF leak regardless the grade (low or high flow or following Esposito's Classification) ($p< 0.01$), functioning PitNET ($p= 0.01$), larger diameter ($p= 0.02$) and longer operating time ($p< 0.01$) were statistically related to the appearance of AVP-D. No relationship was found with the transitory nature of the water imbalance. Age at surgery and intraoperative CSF leak was confirmed relevant in binomial logistic regression.
Conclusions: The possibility to identify causative factors of AVP-D after EEA could help in the management of the patient in the postoperative period. Furthermore, expanding the sample of patients suffering from AVP-D after EEA could be used to analyse factors capable of anticipating its irreversibility.

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217
Brain and Spine 4 (2024) 103625
Long-Term Outcome of Endoscopic Endonasal Approach for Rathke's Cleft Cysts

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Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM
Background: Rathke's Cleft Cysts (RCCs) are benign, sellar region cystic lesions that present a unique challenge in neurosurgery due to their location and potential for symptomatic compression of surrounding pituitary tissue and optic pathways. This study aims to demonstrate the effectiveness of the endoscopic endonasal approach (EEA) in managing RCCs, with a focus on long-term outcomes and recurrence rates.
Methods: We conducted a retrospective analysis of 22 patients who underwent EEA for RCC at our clinic from November 2004 to November 2022. We assessed preoperative conditions, surgical methods, and postoperative results, emphasizing symptom resolution and complications.
Results: Clinical symptoms presented by the patients included headache (52.4%), visual impairment (28.6%), and endocrine dysfunction (61.9%). The RCCs were located intrasellar in 31.1% of the cases, and 52.4% had suprasellar extension. The mean cyst volume was 2.61 ± 1.81 cm^3. Full endoscopic endonasal surgery was performed, achieving complete removal of the cyst content

under endoscopic control in all cases. Additional partial cyst wall resection was performed in 13 cases (61.9%). Intraoperative CSF flow was observed in six patients (28.6%). The remaining patients showed no CSF flow after the Valsalva maneuver, yet four developed a CSF leak post-surgery. Postoperatively, headache resolved in all patients, and visual impairment improved in 83.3% of cases. Preoperative pituitary dysfunction improved in 41.7% of patients but deteriorated in 16.7%, with six instances of postoperative new-onset (transient) pituitary dysfunctions. The median follow-up period was 10.1 years, the longest recorded for such studies. A recurrence rate of 33.3% for RCCs was observed, with an average recurrence time of 4.3 years and the latest occurrence at 9.5 years post-surgery.
Conclusions: EEA remains a viable and effective method for RCC management, offering significant symptom relief. However, the higher rate of cyst recurrence even on the long-term requires follow up examination.

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1317
Brain and Spine 4 (2024) 103626
Overall Survival and Progression Free Survival prediction in patients with Glioblastoma: Machine learning approach

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 4 (Gliomas), October 14, 2024, 4:40 PM - 5:20 PM
Background: Glioblastoma is considered as the most aggressive malignant primary brain tumor, characterized by systemic recurrence and poor overall survival (OS). Although progression-free survival (PFS) is considered a routine parameter for clinical decision-making, it is currently unclear whether OS can serve as an appropriate surrogate endpoint. The aim of this study was to identify relevant predictive variables for prognosis in patients with glioblastoma (GBM) and to use machine learning to assess individual survival probability.
Methods: Data were sourced from a multicentric database of 150 patients with histologically confirmed GBM diagnosis from three neurological surgery departments. Ten pertinent demographic, molecular, radiological, and surgical variables were considered for each patient. The UMAP dimension reduction algorithm was utilized to reduce each patient to a 2D point on a scatter plot. A Built-in Inverse Map Function of UMAP (BIMPFU) was employed to examine each cluster and identify possible common characteristics of patients with similar OS and PFS.
Results: Outcomes revealed that the analysis of ten variables using Uniform Manifold Approximation and Projection (UMAP) successfully distinguished two primary groups: those patients exhibiting a higher mean overall survival (OS) and progression-free survival (PFS), and those with lower averages in these metrics. The Bi-Modal Precision Filtering Utility (BIMPFU) provided an in-depth review of each identified cluster, enabling the discovery of potential shared traits associated with increased or decreased longevity among specific cohorts of patients. These approaches highlight the growing importance of advanced analytical tools in understanding the heterogeneity of disease progression and treatment responses among patient populations.
Conclusions: ML-based prediction models demonstrated a strong capability to predict patient outcomes, identifying patient-based variables at higher risk for early recurrence and reduced OS.

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318
Brain and Spine 4 (2024) 103627
Recurrency And Morbidity In Cerebellopontine Angle Epidermoid Cysts

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Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM
Background: Intracranial epidermoid cysts (EC) have a high recurrency and reoperation rate. In the cerebellopontine angle (CPA) they form adhesions to surrounding neural and vascular structures, which makes complete removal difficult. To evaluate the rate of recurrency and the effect of extend of resection, we analysed patients operated for CPA EC in a long-term follow-up.
Methods: We report a consecutive series of 31 patients operated between 1975-2022 for CPA EC in a single centre responsible for all neurosurgical patients of a catchment area of 2,2 million inhabitants. The patients were identified from patient records, surgical logbooks and pathological databases. CPA EC extending into the temporal bone were excluded as these may represent a different origin. Clinical data and reoperations were collected from patient records. Extend of resection was determined based on surgeon evaluation and imaging data separately.
Results: A reoperation due to recurrence was required in 42 % of patients. A total of 25 reoperations were performed. Median follow-up was 12,4 years (0,2-48). The incidence of reoperations is represented in figure 1. Recurrency was observed in all grades of resection. Although functional status seems to return to preoperative levels by 3 months follow-up visit, 48 % of patients develop new postoperative symptoms, and only 16 % are asymptomatic at end of follow-up.
Conclusions: Operation of CPA EC is often associated with functional and cranial nerve sequelae. Recurrencies can appear a long time after both primary operation and reoperations of CPA EC. As recurrency occurs in all grades of resection, routine postoperative magnet resonance imaging follow-up including diffusion weighted series is recommended beyond ten years after primary operation.
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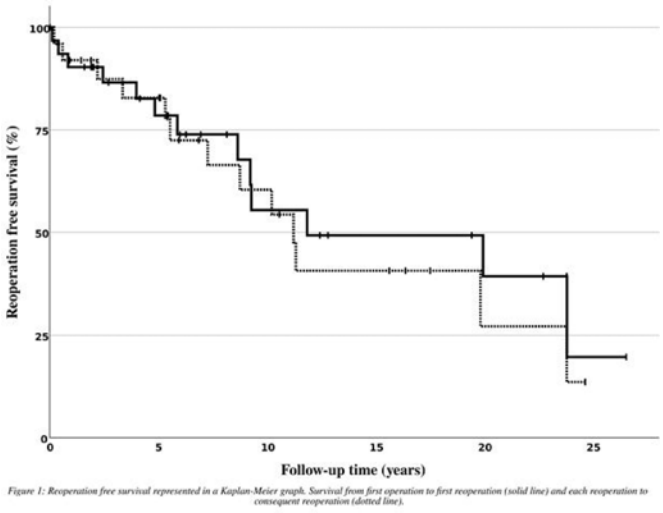


Figure 1: Reoperation free survival represented in a Kaplan-Meier graph. Survival from first operation to first reoperation (solid line) and each reoperation to consequent reoperation (dotted line).

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1246
Brain and Spine 4 (2024) 103628
Analysis of errors and complications when performing microdiscectomy on the lumbar spine in the conditions of the neurosurgical department of the city of Minsk, Belarus.

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Oral e-Poster Presentations - Booth 2: Spine 3 (Degenerative), October 14, 2024, 4:40 PM - 5:20 PM
Background: In the age of new technologies and the use of automation in production and human activity, the number of people with back pain is growing. Pain syndrome worsens the quality of a person's life and requires immediate solutions to problems that are the causes of pain. The most common cause is a herniated disc. If conservative therapy is not effective, neurosurgical microdiscectomy helps solve this problem. However, the increase in the number of operations leads to an increase in complications that arise in patients.
Methods: To analyze errors and complications that arose in the early postoperative period in patients after microdiscectomy in the lumbar spine, operated from 2020 to 2022. on the basis of the neurosurgical department of the Ultrasound Hospital of the Emergency Hospital of the city of Minsk.
Results: During the period from 2020 to 2023, 320 operations for microdiscectomy on the lumbar spine were performed in the neurosurgical department. The operations were performed by neurosurgeons with more than 7 years of experience, carried out under a microscope and a standard set of medical

instruments. Distribution of operations by segments: on the L5-S1 segment (160 operations), on the L4-L5 segment (84 operations), on the L3-L4 segment (46 operations), on the L2-L3 segment (18 operations), on the L1-L2 segment (12 operations). In the early postoperative period, the following complications were noted: 1) hematoma in the area of the postoperative field (20 cases), all patients were taken for revision due to pain. 2) development of spondylodiscitis after surgery (12 cases), conservative therapy was carried out for a long time in an inpatient setting. 3) an incompletely removed fragment of a disc herniation (18 cases), all patients were taken again for surgical treatment. 4) formation of a cerebrospinal fluid cyst and a cerebrospinal fluid fistula (4 cases), patients required surgical treatment, elimination and closure of the defect in the dural sac.
Conclusions: When performing microdiscectomy at the lumbar level, the use of a microscope, careful hemostasis, careful attention to the surrounding tissues, as well as assessment of clinical and instrumental data before surgery allows to minimize the number of complications and improve the quality of surgical treatments performed

https://doi.org/10.1016/j.bas.2024.103628

1420
Brain and Spine 4 (2024) 103629
The Utility Of Intraoperative MRI In The Resection Of Recurrent GBM: A Monocentric Retrospective Analysis.

Obada Alhalabi [1], Philip Dao Trong [1], Kirill Mironov [1], Khurshed Nabiev [1], Nour Gareib [1], Sandro M. Krieg [1], Andreas W. Unterberg [1], Christine Jungk [1]. [1] *Heidelberg University Hospital, Germany*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 4 (Gliomas), October 14, 2024, 4:40 PM - 5:20 PM
Background: The effectiveness of intraoperative magnetic resonance imaging (iMRI) guidance and fluorescence guidance for resecting newly diagnosed glioblastoma (GBM) has been well established. However, the role of iMRI in resecting recurrent GBM remains uninvestigated. This study hence aimed to evaluate the utility of iMRI in the resection of recurrent GBM.
Methods: This retrospective analysis was conducted on patients undergoing re-resection for the first recurrence of WHO grade 4 IDH-wildtype GBM. It assessed the impact of iMRI (1.5T) guidance on intraoperative decision-making for further tumor resection and the presence of residual nodular contrast-enhancing (CE) tumor on early postoperative MRI (poMRI, within 48 hours, 3T).
Results: The study included 103 consecutive patients (mean age: 59 years; 64 males and 39 females) undergoing re-resection for first GBM recurrence between 2018 and 2022. iMRI-guided resection was performed in 84 (81%) cases, with 5-ALA used in 8 (8%) cases and neither applied in 11 (11%) cases. In 77/84 (92%) of iMRI cases, gross total resection (GTR) was intended. After iMRI, further resection performed in 53/84 cases (63%). On poMRI, GTR was achieved in 63/84 (75%) cases, while residual CE was detected in 17 (20%) cases. Of the cases assumed to have achieved GTR intraoperatively, 25/28 (89%) were confirmed on poMRI. Achieved GTR was observed in 63 out of intended 77 patients (81%). Postoperative neurological deficits were noted in 11/53 patients with additional resection (20%) compared to 3/28 patients without additional resection (10%, $p=0.126$). The median survival after repeat surgery was 220 days.
Conclusions: iMRI facilitates intraoperative decision-making regarding additional tumor resection in recurrent GBM cases by providing valuable information on residual CE tumor. Discrepancies between GTR assessments on iMRI and poMRI may be attributed to different magnetic field strengths.

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804
Brain and Spine 4 (2024) 103630
Towards liquid biopsy for glioblastoma: relying on plasma extracellular vesicles for tumor diagnosis and monitoring

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Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM
Background: Glioblastoma (GBM) is the most lethal brain tumour in adults. Its diagnosis and profiling rely on neuroimaging and brain biopsy, with limited specificity and sensitivity. Monitoring GBM molecular evolution is hampered by the the surgical risks associated to tumour sampling. The identification of circulating GBM biomarkers is essential to track GBM non-invasively, from diagnosis until relapse. EVs secreted by GBM cells cross the blood brain barrier and harbor tumour-derived molecules. This makes them an interesting target for the longitudinal assessment of GBM presence and status.
Methods: We isolate EVs by Size Exclusion Chromatography (SEC) from 2mL of plasma, and characterized them by immunoblot, flow cytometry and transmission electron microscopy.
We measure EVs concentration and size by Tunable Resistive Pulse Sensing (TRPS).
We compared EV levels in 50 GBM patients before surgery with non-GBM controls, including 100 healthy subjects and 50 patients with brain malignancies that mimic GBM at neuroimaging.
We assessed plasma EVs longitudinally in 44 GBM 72h post-operative plasma matched with pre-operative samples.
We analyzed GBM and non-GBM plasma EVs surface markers by MACSPlex, and the EV proteome by mass spectrometry in 27 GBM patients and 38 healthy individuals.
Results: Plasma EVs concentration and mean size are higher in baseline GBM plasma with respect to controls, and drop in post-operative GBM plasma.
Multiplex flow cytometry reveals the expression of CD9, CD63 and CD81 in all samples, with a significant enrichment of CD63 and CD81 in GBM plasma EVs. The other 34 markers have similar expression profiles in all subjects, suggesting that tumor-derived EVs in GBM plasma are diluted in non-tumor EVs. Still, the T-cell markers CD8 and HLA-DRDPDQ are more present on GBM-EVs.
Proteomic analysis identified >2000 proteins in all samples. Of these, 117 are upregulated in GBM samples and enriched in pathways of the complement cascade.
Conclusions: Our findings indicate that monitoring the levels of circulating EVs is a reliable, non-invasive approach for GBM differential diagnosis and patients follow-up. Altogether, the combined analysis of EVs concentration, size and proteome may provide promising biomarkers for GBM longitudinal monitoring, supporting the implementation of liquid biopsy for GBM care.

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461
Brain and Spine 4 (2024) 103631
Survival Analysis of Intracranial Chondrosarcoma: Insights from a Systematic Review

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Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM
Background: Chondrosarcoma is a rare intracranial neoplasm. Due to their rarity, standard management protocols are challenging to develop. The study is anticipated to enhance understanding of intracranial chondrosarcoma and offer evidence-based treatment recommendations, laying the foundation for future investigations and more uniform treatment guidelines.
Methods: We conducted a retrospective analysis of the medical records of 51 patients who were referred and treated at our institution since 2000. In all patients, the diagnosis was confirmed histologically.
Demographics, clinical and radiological data were taken into account. The state of neurological function was assessed using the Karnofsky Performance Scale (KPS). Survival analysis was done with Kaplan Meier survival analysis.
Results: The overall median survival time was 9.3 years. Survival rates at the end of one, three, and 10 years were 100%, 98%, and 96% respectively. Mean progression-free survival (PFS) was 38.16 months. The 5-year mortality rate was 2%. Endoscopic surgery was performed in 22% of cases, and 42% underwent total resection. No significant difference in prognosis or complication rate was found between transcranial surgery and endoscopic approach. After complete excision, a 20% local recurrence rate was noted, with a mean time to recurrence of 24.5 months. Subtotal resection led to substantial size growth in an average of 36 months. Patients treated with surgery alone had a 5-year survival of 97.8% without adjuvant radiation or chemotherapy. Complete tumor removal was associated with low recurrence rates, and upfront radiation did not improve

tumor control.
Conclusions: Skull base chondrosarcoma management is challenging. Maximal safe resection is crucial, but neurological function should not be compromised. Gross Total Resection (GTR) shows benefits, and initial resection extent is a key prognostic factor. Radiotherapy can be delayed until recurrence or significant tumor growth after safe maximal resection.
Optional Image

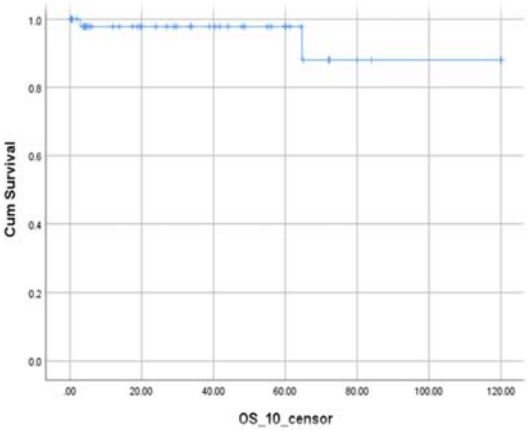


Figure 1
Kaplan -Meier survival estimates of overall survival in Intracranial chondrosarcoma. The overall median survival time was 9.3 years. Survival rates at the end of one, three, and 10 years were 100%, 98%, and 96% respectively. Mean progression-free survival (PFS) was 38.16 months.

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924
Brain and Spine 4 (2024) 103632
Trainee to faculty transition – Operative cases, techniques, complications, and perspectives in first 12 weeks of faculty position.

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Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM
Background: Transition between training to a new faculty position can be challenging. One is never truly prepared for this leap into the unknown that so many have taken before. There are no guidelines out there which prepare one for this daunting experience. This transition depends a lot on the extent of prior training. Here, I share my operative experience in the first 12 weeks of faculty position.
Methods: All cases performed by the primary author in the first 12 weeks of faculty appointment, as primary surgeon. Case selection, operative techniques, and complications were reviewed.
Results: 39 cases were performed during the first 12 weeks. 8 gliomas, 6 meningiomas, 4 pituitary adenomas, 3 decompressive hemicraniectomies (DHC) for acute subdural hematomas, 3 cerebrospinal fluid leaks, 2 chordomas, 2 metastatic tumors, 2 esthesioneuroblastomas, 2 trigeminal schwannomas, 1 vagal nerve schwannoma, 1 cervical schwannoma, 1 cerebellar hemangioblastoma, 1 squamous cell carcinoma of head, 1 ponto-medullary epidermoid cyst, 1 ventriculoperitoneal shunt for hydrocephalus and 1 thoracolumbar instrumentation for T12 3-column fracture. 24 cases were performed using open techniques and 15 were performed using endoscopic endonasal approaches. Anatomical locations included, left operculum, insula, left parietal lobe, cerebellum, cervical and thoracolumbar spine, sella, cavernous sinus, anterior skull base, spheno-orbital, optic canal, clivus, Meckel's cave, petroclival, ponto-medullar junction, and jugular foramen. Complications included wound dehiscence after 1 DHC, CSF leak, head of caudate infarction, partial 6 nerve palsy in clival chordoma, full 6th palsy in petroclival meningioma, residual tumor, carotid injury without sequelae in cavernous meningioma, cranial nerve 9 and 11 dysfunction in vagal nerve schwannoma.
Conclusions: As a new skull base faculty, complex procedures can be performed with acceptable complications. Guidance from mentors from prior training is very helpful in ensuring appropriate patient selection and choice of approach.

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1040
Brain and Spine 4 (2024) 103633
Advances in the Treatment of Autism Spectrum Disorder: A Comprehensive Case Report on Wharton Jelly Mesenchymal Stem Cell Transplantation

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Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM
Background: According to the data of the World Health Organization, Autism Spectrum Disorder (ASD) is observed in approximately one in every hundred children. ASD is a complex neurodevelopmental disorder with multifaceted origins. In recent studies, neuroinflammation and immune dysregulation come to the fore in its pathogenesis. There are studies suggesting that stem cell therapy may be effective in the treatment of ASD. This article delves into the evolving landscape of ASD treatment, focusing on potential benefits and safety of stem cell transplantation.
Methods: The treatment protocol included six sessions of i.t. and i.v. Wharton Jelly Mesenchymal Stem Cells (WJ-MSCs) administration under sedo-anesthesia. In every instance, the cellular dose was modified to 1 x 106 WJ-MSCs/kg of the patient for each of the two application routes.
Results: The study demonstrates a significant improvement in the child's functional outcomes (Childhood Autism Rating Scale, Denver 2 Developmental Screening Test), especially in language and gross motor skills. No serious side effects were encountered during the two-year follow-up.
Conclusions: The findings support the safety and effectiveness of WJ-MSCs transplantation in managing ASD.

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1393
Brain and Spine 4 (2024) 103634
Fluorescence-Guided Surgery in Glioblastoma: 5-ALA, SF or Both? Lessons Learned From 640 Consecutive Cases.

Flavio Panico [1], Andrea Bianconi [1], Pietro Zeppa [1], Antonio Melcarne [1], Fabio Cofano [1], Diego Garbossa [1]. [1] *University Of Turin, Turin, Italy*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 4 (Gliomas), October 14, 2024, 4:40 PM - 5:20 PM
Background: As is now widely accepted, extent of resection (EOR) is considered one of the most important prognostic factors, being closely correlated with progression-free survival (PFS) and overall survival (OS). Over the past two decades, fluorescence-guided surgery (FGS) has been increasingly used to support glioma surgery with the purpose of obtaining a maximal EOR, with 5-aminolevulinic acid (5-ALA) and sodium fluorescein (SF) being the most explored fluorescent dyes. There is no clear superiority of one fluorophore over the other concerning the volumes of EOR. The debate continues on which one to use in specific circumstances, taking into account the associated costs.
Methods: We retrospectively analyzed cases from a single center, considering patients undergoing high-grade glioma resection at the Neurosurgery Unit of AOU Città della Salute e della Scienza di Torino, dividing patients based on the use of 5-ALA, sodium fluorescein, or both. Primary outcome measures included EOR, OS, and PFS, while secondary measures included average surgery duration

and postoperative neurological deficits.
Results: 640 patients were included in our analysis. 160 patients received only 5-ALA, 207 patients received both 5-ALA and fluorescein, and 273 patients received only fluorescein. Mean PFS and OS were 8.59 and 16.9 months, respectively.There were no differences observed in EOR of the enhancing volume when using 5-ALA versus fluorescein alone, but superiority of dual fluorescence was noted in FLAIR volume resection, without impacting postoperative neurological deficits. Additionally, average surgery duration was shorter with combined fluorescein and 5-ALA (208 minutes) compared to 5-ALA alone (242 minutes). In order to maximize the advantages of the two methods and, at the same time, curb their limitations, we propose to use them simultaneously but in sequential fashion. Therefore, the first debulking phase is achieved by using fluorescein alone, followed by a second look using 5-ALA
Conclusions: Fluorophores in glioblastomas are highly reliable, with dual fluorescence particularly increasing EOR of the tumor volume without assuming MDC, with the advantage of using fluorescein for the enhancing part and refining the resection with 5-ALA for the infiltrating part, thereby reducing surgical times. Preoperative selection of cases that can benefit from dual fluorescence allows for resource optimization.

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1356
Brain and Spine 4 (2024) 103635
Is stand-alone alif effective and safe for the treatment of low grade l5-s1 isthmic spondylolisthesis? A comparative study with posterior and transforaminal lumbar interbody fusion

Stefano Colonna [1], Enrico Lo Bue [1], Ayoub Saaid [1], Flavio Panico [1], Ludovico Comite [1], Marco Ajello [1], Nicola Marengo [1], Diego Garbossa [1], Fabio Cofano [1]. [1] *University Of Turin, Turin, Italy*

Oral e-Poster Presentations - Booth 2: Spine 3 (Degenerative), October 14, 2024, 4:40 PM - 5:20 PM
Background: Optimal surgical treatment for low-grade L5-S1 isthmic spondylolisthesis (IS) is still object of debate. While various surgical approaches exist for its treatment, anterior minimally invasive stand-alone lumbar interbody fusion (AS-ALIF) has emerged as a promising technique, offering distinct advantages in terms of biomechanical stability and potential for neural decompression. The purposes of this paper were to compare the efficacy, clinical and radiological outcomes of AS-ALIF and posterior lumbar interbody fusion in the management of low-grade L5-S1 IS.
Methods: A total of 55 patients met the inclusion criteria. Intraoperative blood loss, intervention duration, radiation exposure and postoperative length of hospitalization were retrospectively evaluated. ODI and VAS scales were considered for postoperative clinical outcome assessment. Upright lumbosacral Xray and CT scan were used for spinopelvic parameter evaluation and intersomatic fusion according to Brantigan scale, respectively.
Results: Mean postoperative follow-up was 39 months. Intraoperative blood loss, radiation exposure, intervention duration, and postoperative length of hospitalization (LOH) were significantly lower in AS-ALIF group. Effective ODI and VAS improvement was achieved in both anterior and posterior groups. No significant differences between anterior and posterior groups were observed in postoperative spinopelvic parameters assessment. Solid spinal fusion was achieved in 23 patients from AS-ALIF group (92%), and in 26 patients from posterior group (87%).
Conclusions: While both techniques offer effective means of achieving spinal fusion and symptom relief, minimally invasive AS-ALIF demonstrates significant advantages in terms of intraoperative blood loss, radiation exposure, and intervention duration compared to posterior lumbar interbody fusion.

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585
Brain and Spine 4 (2024) 103636
Investigating Limits, Advantages, and Potential Applications of 5-ALA and Sodium Fluorescein in Grade II and III Gliomas: A Monocentric Retrospective Analysis

Marta Bonada [1], Andrea Bianconi [2], Pietro Zeppa [1], Pietro La Cava [1], Francesco Bruno [1], Antonio Melcarne [1], Fabio Cofano [1], Roberta Rudà [1], Diego Garbossa [1]. [1] *University of Turin, Turin, Italy;* [2] *University of Milan, Milan, Italy*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 4 (Gliomas), October 14, 2024, 4:40 PM - 5:20 PM
Background: Fluorescence-guided surgery (FGS) has been increasingly used to support glioma surgery to obtain a maximal extent of resection (EOR). Current evidence in lower-grade gliomas does not support the routine use of FGS because of low fluorescence rates obtained with the most common fluorescence agents (e.g. 5-ALA and sodium fluoresceine). However, the combination of these two dyes has not been extensively explored yet.
Methods: 121 patients affected by a histologically confirmed glioma grade II-III (WHO 2021 classification) have been operated on in "Città della Salute e della Scienza" Molinette hospital (Turin, Italy). Surgery has been performed under general anesthesia with the previous administration of both 5-ALA (20 mg/kg) and sodium fluoresceine (3 mg/kg). We retrospectively investigated clinical, radiological, histological and molecular data. Fluorescence positive rate and pattern have been reported both for 5-ALA and for fluoresceine.
Results: The histological analysis revealed 62 cases of astrocytoma, 40 cases of oligodendroglioma and 19 cases that presented mixed characteristics. Concerning intraoperative fluorescence rates, 16 cases classified as positive for both 5-ALA and SF (13.3%), 28 only for 5-ALA (23.1%), 2 only for FS (1.6%), 75 negative cases (62.0%). Both SF and 5-ALA expression prevailed in grade III gliomas, especially for 5-ALA ($p=0.028$). The relationship between intraoperative fluorescence and the presence of foci with contrast enhancement uptake in preoperative MRI (pMRI) resulted as statistically significant ($p<.001$) for both the dyes. Concerning prognosis, 5-ALA intraoperative detection had a statistically significant impact on OS (log-rank $X2=9.11$, $p=0.003$).
Conclusions: The results achieved in this study do not support the role of 5-ALA and SF to intraoperatively define the extent of resection, because of low fluorescence rates. Nevertheless, 5-ALA expression could add useful prognostic information to the diagnosis before the histological analysis. Indeed, SF is mostly related to blood-brain barrier damage and, thus, with contrast enhancement in MRI.

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1239
Brain and Spine 4 (2024) 103637
Clinical outcomes in patients with multiple surgeries for clival chordomas

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Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM
Background: Chordomas are rare malignant tumors arising from the embryonic notochord cells mainly in the clivus. The gold standard in treatment of these tumors is surgery. However, complete resection is often not achievable and local recurrences are common. The aim of this study was to assess the surgical results in a series of patients treated for recurrent clival chordomas.
Methods: The study is a retrospective analysis of a series of 34 patients (18 women and 16 men) treated from the 2010 to 2024 by at least 2 surgeries for clival chordomas. The first surgery was endoscopic transnasal transsphenoidal resection in all the patients. The patients were selected from 82 patients treated endoscopically for clival chordomas (41.5%). The mean age of the patients was 52.6 years (22-80 years), and the mean follow up period was 6.5 years (0-14 years).
Results: As a result of the first surgery in most of the patients subtotal resections (65.7%) were achieved. Partial resections were achieved in 22.9% of the patients, and gross total resections in 11.4%. The patients had on average 2.6 surgeries (1-9 surgeries) after the first resection. Endoscopic transnasal surgeries were most common among subsequent surgeries (69.6%). The mean time to the second surgery was 17.2 months (1-133 months). Thirteen patients died during the follow-up period (38.2%). The mean time from the second surgery to death was 39.5 months.
Conclusions: Multiple surgeries can be used in patients with clival chordomas to control the disease which is often recurrent. This treatment method is safe and may prolong the patients' lives.

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469
Brain and Spine 4 (2024) 103638
Osteosarcoma of the Cranio-Cervical Junction: A Case Report and Review of Literature

Aleksandar Marković [1], Hristina Jocić [1], Jovan Ilić [1], Vesna Nikolov, Professor [1,2], Nikola Stojanović [1], Slavko Živković [1], Aleksandar Kostić, Professor [1,2]. [1] *Clinic for Neurosurgery, University Clinical Center Of Nis, Serbia;* [2] *University of Nis, Nis, Serbia*

Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM

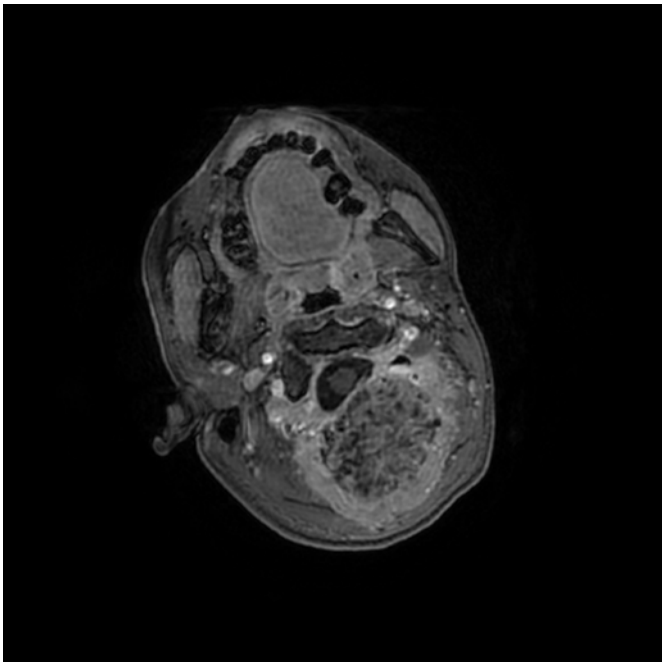
Background: Osteosarcoma is the most common primary malignant bone tumor. In the head and neck region it occurs in 6 to 10% of cases, most often in the third and fourth decades of life. Tumor involvement of the adjacent structures, including bones, nerves and vertebral arteries, often leads to technical difficulty during the surgical approach. Therefore, a multidisciplinary approach is imperative in establishing an accurate diagnosis and adequate treatment. The treatment options and prognosis are discussed.

Methods: In this paper, we presented a case of a twenty three-year-old woman who was admitted to the Clinic of Neurosurgery, Clinical Center Niš, Serbia, after she underwent a CT brain scan that showed an intra/extracranial, partial calcified, invasive tumor of the occipital and suboccipital region. MR brain and Digital subtraction angiography presented a highly vascularized tumor lesion that initially resembled hemangiopericitoma. The patient underwent endovascular procedure, and partial embolization of the tumor vessels was established. In the next 24 hours, we performed an radical extirpation surgery.

Results: Postoperatively, the patient's GCS was 15, with no new neurological deficits. Postoperative brain CT scan showed minimal rest of the tumor, without blood clot inside the tumor bed. Pathohistological finding revealed osteosarcoma.

Conclusions: Despite the technical difficulties, functional impairment or cosmetic defects, wide surgical excision of a tumor is the main goal of treatment. Further research is needed to determine the most optimal adjuvant treatment in cases such as this in which the primary tumor cannot be completely surgically removed.

Optional Image



https://doi.org/10.1016/j.bas.2024.103638

1190
Brain and Spine 4 (2024) 103639
OPTOGENETIC CLOSED-LOOP THERAPY FOR INTERICTAL DISCHARGES IN A MOUSE MODEL

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Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM

Background: The neurocognitive impairment in temporal lobe epilepsy and early Alzheimer's is linked to interictal epileptiform discharges (IEDs) in the hippocampus1–4 . The hippocampus comprises different anatomical subfields that are connected predominantly in a feed-forward loop in which excitation from the entorhinal cortex reaches the dentate gyrus and then progresses through the CA2/3 and 1 areas. In addition to the specialized principal cells in the respective hippocampal subfields, different types of GABAergic interneurons help to regulate and coordinate hippocampal networks7. Specifically, dendritic inhibition from somatostatin-expressing interneurons and soma-inhibiting, parvalbumin-expressing interneurons may have differential impact on neuronal network functions. The DG is thought to be a 'gate' for both pathological, hypersynchronized activity as well as physiological activity. The most important of the latter is the 'dentate spike' which plays an important role in memory consolidation and maintenance 8–10. This project has two objectives: First describing the effect of optogenetic activation of different classes of inhibitory interneurons in the dentate gyrus. Second explore the feasibility of selectively inhibiting pathological but not physiological activity patterns.

Methods: a) In healthy mice the two different classes of inhibitory interneurons were selectively transfected with a light-excitatory opsin. Subsequently these mice were implanted with high density silicon probes and optic fibers. Interneurons were stimulated optogenetically while the entire network was recorded with the silicon probes.

b) We used this recording setup to establish closed-loop coupling between recorded electrophysiological events and optogenetic stimulation.

Results: a) While parvalbumin-interneuron stimulation has a modest and biphasic effect, optogenetic somatostatin-interneuron activation causes a drastic reduction in dentate spike rate.

b) Preliminary results indicate that closed loop optogenetic interneuron stimulation with microsecond precision is feasible and can be used to powerfully suppress hippocampal population activity. It may therefore be a promising tool to disrupt pathological network activation during IEDs.

Conclusions: We proved that physiological patterns of hippocampal activity can reliably be altered and that closed-loop stimulation of hippocampal interneurons contingent on physiological activity patterns is feasible. We aim to apply this knowledge in disease mouse models displaying IEDs with the ultimate goal of developing a closed-loop optogenetic treatment approach to disrupt IEDs and improve memory.

While taking optogenetics to the human hippocampus is still far it might open up an avenue of new treatment options for cognitive impairment in Alzheimer's and temporal lobe epilepsy.

1. Soula, M. et al. Interictal epileptiform discharges affect memory in an Alzheimer's Disease mouse model. 2023.02.15.528683 Preprint at https://doi.org/10.1101/2023.02.15.528683 (2023).

2. Warsi, N. M. et al. Which is more deleterious to cognitive performance? Interictal epileptiform discharges vs anti-seizure medication. Epilepsia 64, (2023).

3. Henin, S. et al. Spatiotemporal dynamics between interictal epileptiform discharges and ripples during associative memory processing. Brain 144, 1590–1602 (2021).

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611
Brain and Spine 4 (2024) 103640
UNet-Enhanced Deep Learning-based Prediction of Intraoperative 5-ALA-Fluorescence Via Preoperative Multimodal MRI in Lower-Grade Gliomas

Eric Suero Molina [1], Zeynep Özdemir [1], Ghasem Azemi [1], Alex Valls Chavarria [1], Christian Thomas [1], Carlo Russo [1], Sidong Liu [1], Walter Stummer [1], Antonio Di Ieva [1]. [1] *University Hospital Münster, Germany*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 4 (Gliomas), October 14, 2024, 4:40 PM - 5:20 PM

Background: Only 20-30% of lower-grade gliomas typically have fluorescence after 5-aminolevulinic acid (5-ALA) administration. This can be increased by doubling the administered dose of 5-ALA. We aimed to analyze if a deep learning model can predict intraoperative fluorescence based on preoperative multimodal magnetic resonance imaging (MRI). Accurately identifying tumor regions during surgery is crucial for identifying regions of anaplastic foci, as they tend to fluoresce, allowing surgeons to precisely deliver malignant tissue for histopathological evaluation and avoid undergrading.

Methods: The MRI images consisted of T1, T1-post gadolinium, and FLAIR. The images were standardized through a preprocessing pipeline involving isotropic transformation, bias field correction, registration to T1-post gadolinium space, alignment to a brain atlas, and skull stripping using ANTs and FSL software packages. The preprocessed MRIs were fed into the UNet, which was initially developed for tumor segmentation for each subject. We used the outputs of the bottom layer of the UNet in the Variational Autoencoder as features for classification. Using the partial least square discriminant analysis algorithm, we identified and utilized the most effective features in a Random Forest classifier. We allocated ~80% of the data for training purposes.

Results: We included a cohort of 170 patients categorized as positive (n=89) or negative (n=81). The performance of our proposed approach is evaluated using key metrics. The optimal results were obtained by employing 18 top-performing features, resulting in an accuracy of 79% with the following associated confusion matrix:
[14 3
4 13]

Conclusions: Our findings highlight the potential of a UNet model, coupled with a random forest classifier, for intraoperative fluorescence prediction. We achieved a good accuracy by using advanced techniques such as DL-based tumor segmentation and Variational Autoencoder for radiomics feature extraction. While the model can still be improved, it has the potential for evaluating when to administer 5-ALA to tumors lacking typical imaging features of high-grade gliomas.

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706
Brain and Spine 4 (2024) 103641
A case-based literature review on post-traumatic pseudoaneurysm of the superficial temporal artery

Jovan Ilić [1], Marija Ilić [2], Aleksandar Kostić, Professor [2], Vesna Nikolov, Professor [2], Nikola Stojanović [1], Aleksandar Marković [1], Hristina Jocić [1]. [1] *Department of neurosurgery, University Clinical Center Nis, Niš, Serbia;* [2] *Faculty of Medicine University of Niš, Niš, Serbia*

Oral e-Poster Presentations - Booth 1: Young Neurosurgeons & Research, October 14, 2024, 4:40 PM - 5:20 PM

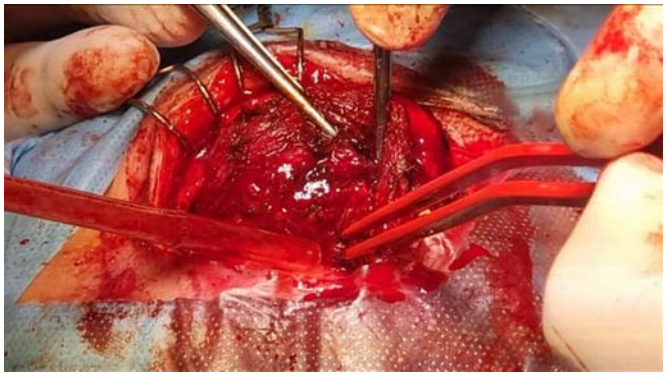
Background: Blunt head trauma often leads to the formation of a frontotemporal subcutaneous hematoma, which usually completely resolves with conservative treatment methods. If the mass persists for a long time after the injury and enlarges, it is necessary to consider the possible development of a pseudoaneurysm of the superficial temporal artery. In this case-based literature review we explore this rare phenomenon together with the appropriate diagnostic and treatment modalities.

Methods: We conducted a comprehensive review including relevant scientific literature from internet databases (MEDLINE, PubMed, Embase, ClinicalTrials.gov) where 113 papers published in the period from 1963 to 2024 were analyzed together with references and relevant conference abstracts. Moreover, the inclusion criteria for traumatic pseudoaneurysm of the superficial temporal artery were satisfied by 36 case reports and case series.

Results: The etiologies of aneurysms and pseudoaneurysms differ, with true aneurysms usually caused by degenerative factors, while pseudoaneurysms are caused by trauma. Furthermore, clinical suspicion is crucial for the diagnosis of pseudoaneurysm, since hematoma and pseudoaneurysm of the superficial temporal artery do not show visual differences, but the characteristic feature of pseudoaneurysm of the superficial temporal artery is the presence of a pulsating mass. Moreover, when a pseudoaneurysm is suspected, diagnostic tests such as Doppler ultrasonography, CT angiography, or conventional angiography should be performed.

Conclusions: This research underscores the significance of the anatomical considerations relevant to pseudoaneurysm formation after blunt head trauma and reviews the necessary diagnostic and therapeutic considerations, highlighting surgical ligation and excision as the main treatment modality.

Optional Image



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1240
Brain and Spine 4 (2024) 103642
The Significance of Redundant Nerve Roots in Lumbar Stenosis Surgery

Ilhan Aydin [1], Ahmed Bayramoglu [1], Fatih Eksi [1], Abdullah Safa Kursun [1], Fuat Pirincci [1], Talat Cem Ovalıoglu [1], Ozden Erhan Sofuoglu [1], Erhan Emel [1]. [1] *Bakirkoy Mazhar Osman Training And Research Hospital For Psychiatry, Neurology And Neurosurgery, Istanbul, Turkey*

Oral e-Poster Presentations - Booth 2: Spine 3 (Degenerative), October 14, 2024, 4:40 PM - 5:20 PM

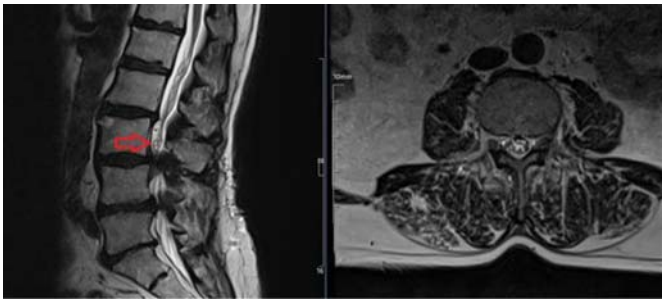
Background: This study investigates the demographic characteristics, lumbar MR spinal canal anteroposterior diameters, stenosis level, and clinical manifestations in lumbar stenosis surgery patients with and without elongated nerve roots within the cauda equina, defined by Verbiest in 1954 and termed by Cressman and Pawl in 1968 (referred to as redundant nerve roots or RNR). The study compares patients with and without RNR in terms of demographic characteristics, lumbar MR spinal canal anteroposterior diameters, stenosis level, and clinical manifestations. The study found that RNR is a significant factor in lumbar stenosis surgery and should be considered in surgical planning.

Methods: A sample of 181 patients who underwent lumbar stenosis surgery between January 1, 2023, and January 1, 2024, was randomly selected. The frequency of RNR in preoperative MRI scans was compared between patients with and without RNR, taking into account age, stenosis level, spinal canal anteroposterior diameter, and neurological classification distances.

Results: Out of the 181 patients, 72 exhibited RNR, with an average age of 67, while those without RNR had an average age of 58. The mean anteroposterior diameter of the spinal canal was 5.68 mm in the RNR group and 7.53 mm in the non-RNR group. The study found a significant association between the presence of RNR and spinal canal narrowing ($p < 0.05$). The RNR-identified group had a shorter mean neurological classification distance. Stenosis was predominantly observed at the L4-5 level in 48% of patients.

Conclusions: This study highlights the correlation between RNR and lumbar stenosis, emphasising the importance of considering RNR in surgical decision-making for lumbar stenosis. Further comprehensive studies are needed to validate these findings.

Optional Image



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1366
Brain and Spine 4 (2024) 103643
Minimally invasive techniques in the surgical treatment of lumbar degenerative disease: a comparative study between percutaneous mis-tlif and open-tlif with cortical bone trajectory (cbt) screws

Stefano Colonna [1], Marco Ajello [1], Enrico Lo Bue [1], Flavio Panico [1], Ayoub Saaid [1], Giada Mai [1], Alessandro Fiumefreddo [1], Nicola Marengo [1], Emanuele Bavaresco [2], Nicola Zullo [2], Diego Garbossa [1], Fabio Cofano [1]. [1] *University Of Turin, Italy;* [2] *Casa di Cura "Clinica Città di Bra", Bra, Italy*

Oral e-Poster Presentations - Booth 2: Spine 3 (Degenerative), October 14, 2024, 4:40 PM - 5:20 PM

Background: The surgical treatment for lumbar degenerative diseases has evolved significantly over the past few decades, with a progressive shift towards minimally invasive surgical techniques aimed at minimizing surgical trauma and postoperative morbidity. The development of Minimally Invasive Transforaminal Lumbar Interbody Fusion (MIS-TLIF) and Cortical Bone Trajectory (CBT) screws represent a convergence of advances in technology, surgical instrumentation, and understanding of spinal biomechanics. The primary endpoint of this comparative study is to evaluate the efficacy, safety, and clinical outcomes of MIS-TLIF versus open TLIF with CBT technique in the management of lumbar degenerative disease.
Methods: A total of 96 patients met the inclusion criteria. Intraoperative blood loss, intervention duration, radiation exposure, and postoperative length of hospitalization were retrospectively evaluated. ODI and VAS scales were considered for postoperative clinical outcome assessment. Upright lumbosacral Xray was used for radiological outcome evaluation. Postoperative complication in terms of adjacent segment syndrome and pseudoarthrosis was evaluated in all cases.
Results: Overall, both techniques demonstrated efficacy in achieving interbody fusion and improving clinical outcome. Open CBT-TLIF showed significative advantages in terms of minor radiation exposure, intervention duration, and better immediate postoperative pain control. Intraoperative blood loss, length of postoperative hospitalization, and complication rates were comparable between the two techniques.
Conclusions: Both MIS-TLIF and open TLIF with CBT technique are effective surgical options for the treatment of lumbar degenerative disease. The choice between the two techniques should be based on patient-specific anatomical consideration and surgeon experience.

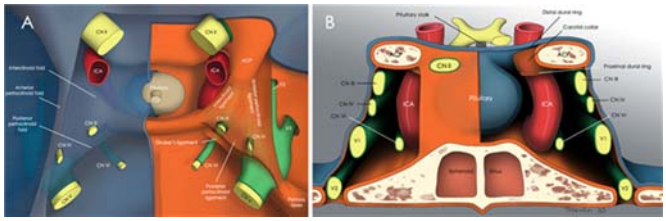
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317
Brain and Spine 4 (2024) 103644
Connective Tissue Architecture of the Cavernous Sinus: An Anatomical Study and Unifying Conceptualization

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Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM

Background: This study aimed to clarify the connective tissue architecture of the cavernous sinus (CS) by integrating previous knowledge, reviewing anatomical hypotheses, and conducting anatomical dissections.
Methods: We performed stepwise dissections on fifteen fresh adult cadavers. Five specimens were dissected from lateral approaches, five specimens were cut in the axial plane, and five were dissected via endoscopic endonasal approaches.
Results: Based on histologic and embryologic data, we developed several anatomic concepts and investigated them through dissections:
1) Uninterrupted periosteum covers all skull surfaces and forms a periosteal dural layer endocranially.
2) All neuraxis structures are covered by a meningeal layer of dura.
3) Cranial nerves (CN) are ensheathed by one layer of meningeal layer as they pierce it. This meningeal layer invaginates along the course of the nerves to various lengths forming the corresponding CN cisterns before fusing with the nerve's perineurium.
4) Fibers of the periosteal layer that are strained between the nearby bony structures form a thin periosteal "ligamentous" layer. This layer is mostly attenuated but becomes more robust in named "ligaments". These ligaments covered by meningeal layer of dura form "dural folds" such as anterior and posterior petroclinoid folds.
As a result, the lateral wall of the CS consists of 1) meningeal layer of the mesial temporal lobe, 2) a thin periosteal "ligamentous" layer, 3) a meningeal layer of the CNs III, IV, and V1 from the posterior cranial fossa (PCF).
The medial wall of the CS is formed by one layer of periosteal layer inferiorly and by meningeal layer superiorly.
The superior wall of the CS is formed only by the periosteal layer of the anterior clinoid anteriorly in the clinoidal triangle (carotidooculomotor membrane), while posteriorly, in the oculomotor triangle, is comprised by both a meningeal layer, as well as thin "periosteal ligamentous layer" extending between three more robust periosteal condensations (anterior and posterior petroclinoidal, and interclinoidal ligaments).
The posterior wall of the CS is formed by a meningeal layer of the PCF dura and periosteal layer that covers the clivus and petrous apex and forms the posterior petroclinoidal and Gruber's (petrosphenoid) ligaments.
A single layer of periosteal dura forms the anterior and inferior walls of CS.
Conclusions: The dural anatomy of the CS involves an intricate interplay between the meningeal and periosteal dural layers, which is better understood when following some basic principles guided by embryology.
Optional Image



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331
Brain and Spine 4 (2024) 103645
Exploring Cytokeratin Profile Of Cerebellopontine Angle Epidermoid Cysts

Anselmi Kovalainen [1], Olli Tynninen [1], Justiina Huhtakangas [1], Martin Lehecka [1]. [1] *Helsinki University Hospital and University Of Helsinki, Helsinki, Finland*

Oral e-Poster Presentations - Booth 3: Skull Base 5, October 14, 2024, 4:40 PM - 5:20 PM

Background: It is a widely accepted theory, that intracranial epidermoid cysts (EC) originate from displaced epithelial cells of the first branchial groove during the closing of the neural tube within the 3rd and 5th weeks of gestation, which explains their affinity for the cerebellopontine angle (CPA). Histologically, the lining of EC consists of stratified squamous epithelium resembling normal

epidermis. Malignant transformations are exceedingly rare. Cytokeratins (CK) are structural proteins of epithelial cells. Different types of epithelia express unique cytokeratin profiles, which can be utilized to characterize their developmental lineages.
Methods: Twenty-six histological samples from 24 patients operated for CPA EC were analysed, including 2 malignant cases. Only CPA EC with no bony extensions were included. Immunohistochemical staining of cytokeratins characteristic for simple epithelia (CK7, CK8, CK18, CK19, CK20), stratified epithelia (CK14) and cell proliferation marker MIB-1 was performed.
Results: The cytokeratin expression profile of CPA EC is shown in figure 1. CK14 was strongly and consistently expressed in the CPA EC epithelium. At least focal expression of CK19, CK7 and CK8 was detected in over 50 % of CPA EC. No differences in cytokeratin profile were found in recurrent or malignant cases. MIB-1 index was not increased in recurrent cases or before malignant transformation.
Conclusions: Cytokeratin profile of CPA EC showing strong expression of CK14 corresponds with stratified epithelium of ectodermal origin which is consistent with previous theories of CPA EC origin. The cytokeratin profile of CPA EC differs from the surgical samples of middle ear cholesteatoma reported in literature suggesting their different epithelial origin. Therefore, CPA EC and middle ear cholesteatoma can be considered distinct entities. Cytokeratin profile or MIB-1 index was not predictive for consequent recurrences or malignant transformation of CPA EC.
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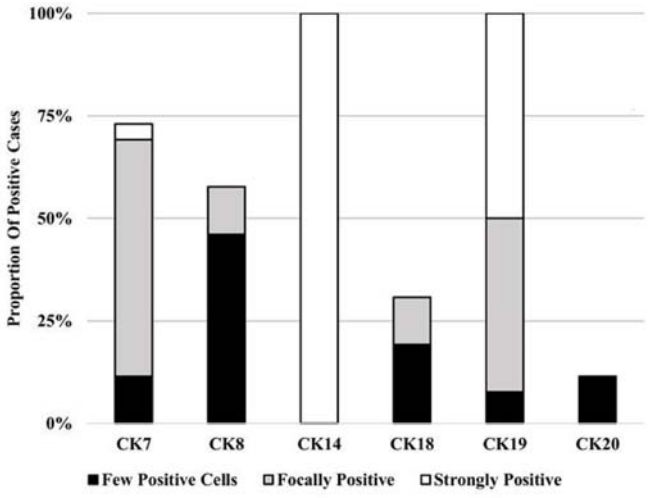


Figure 1: Cytokeratin (CK) profile of cerebellopontine angle epidermoid cysts (n=26) graded semiquantitatively into three categories.

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828
Brain and Spine 4 (2024) 103646
Atypical Teratoid/Rhabdoid Tumor Mistaken for Medulloblastoma: Review of a Case

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM
Background: Atypical Teratoid/Rhabdoid (AT/RT) tumor is a rare, highly malignant tumor of the central nervous system (CNS) that is most commonly found in children under 3 years of age. The main differential diagnosis for posterior fossa AT/RT is medulloblastoma (MB). Since its histologic appearance can be confused with other tumors, especially medulloblastoma, a reliable diagnosis is not possible without demonstrating the lack of nuclear INI1 protein expression through immunohistochemical methods.
Methods: We present the case of a seven-month-old infant who presented with symptoms of intracranial hypertension (ICH) syndrome and rapidly progressive posterior fossa syndrome. Radiographically, tumors were localized in the posterior fossa with significant mass effect on the fourth ventricle and brain stem, causing obstructive hydrocephalus. Heterogeneous enhancements were observed on MRI, resembling medulloblastoma. A cerebrospinal fluid (CSF) drainage to the peritonea was performed, followed by a biopsy resection of the tumor.
Results: In this case, the diagnosis during intraoperative consultation and the preliminary diagnosis differed from the final diagnosis after immunohistochemical analysis. Immunohistochemistry staining revealed a lack of nuclear expression of INI1, prompting a diagnosis revision to atypical teratoid rhabdoid tumor.
Conclusions: The diagnosis of AT/RT requires a high index of suspicion, with early tissue diagnosis and INI1 immunohistochemistry to differentiate it from other morphologically similar tumors. This case report highlights a case of AT/RT mistaken for medulloblastoma, emphasizing the importance of distinguishing between these two entities.
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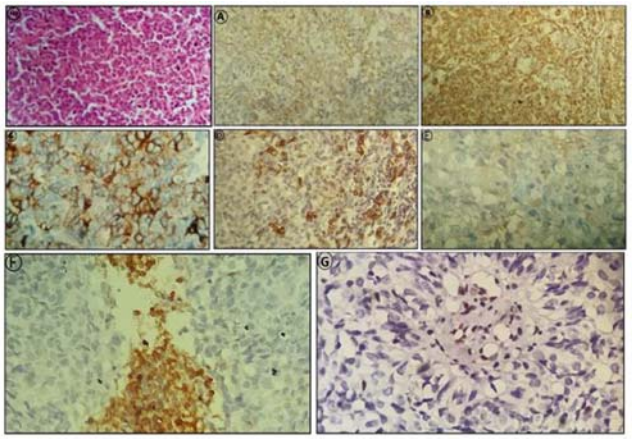


Figure 1. Histopathological Examination of the Resected Specimen
The histopathological examination of the resected specimen reveals the presence of tumor tissues characterized by the proliferation of small round blue cells with rhabdoid features, brisk mitotic activity, and necrosis (HP). Immunohistochemical (IHC) examination demonstrates positive reactions for EMA, vimentin, synaptophysin, and focal positivity for GFAP and smooth muscle actin (A, B, C, D). However, the tumor cells typically exhibit negative staining for INI-1 (G), CD45, and chromogranin (F, E).

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262
Brain and Spine 4 (2024) 103647
Seizure outcome after epilepsy surgery for gangliolioma – a multicenter analysis

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Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM
Background: Gangliogliomas are the most frequent glioneuronal tumors causing drug-resistant epilepsy. We investigated a large series of gangliogliomas with a focus on predictors for epilepsy outcomes.
Methods: We identified 201 patients with a history of pharmacoresistant epilepsy and a confirmed ganglioglioma after epilepsy surgery. Data were obtained at three large epilepsy centers in Germany. Relevant clinical data and follow-up information were retrospectively extracted from patients' records.
Results: A total of 201 tumors presented with an accumulation of temporal location (n=159, 87%) and a balanced gender distribution (female n=99 49%). Epilepsy onset showed a median age of 13 years (6-19), and epilepsy surgery was performed at a median age of 22 years (15.0-34.8). At the time of the last available follow-up, 147 (76 %) patients were seizure-free (ILAE 1). In 21 patients, ganglioglioma was associated with hippocampus sclerosis as well, which was addressed during the surgical resection but did not influence the final seizure outcome. Complete resection of the tumor could be achieved in 71.4% of the patients and showed a positive trend to influence the final seizure outcome (p=0.08). Molecular analysis revealed that only gangliogliomas harboring BRAFV600E mutations recurred during follow-up (p=0.04). Of note, tumor recurrence was the only clinical feature associated with a higher chance of seizure recurrence as well (p=0.007).
Conclusions: Gangliogliomas are highly epileptogenic glioneuronal tumors.

Surgery is an effective option to treat tumor-associated epilepsy, showing excellent seizure outcomes in 76% of the patients. Tumor recurrence was the only predictor associated with poor seizure outcome, and molecular analysis for BRAFV600E might help better stratify the patients at risk for recurrence.

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709

Brain and Spine 4 (2024) 103648

Experience of endovascular treatment of penetrating blast trauma of the head and neck arteries

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Penetrating blust trauma of the head and neck with arteries damage has an extremely high risk of life-threatening complications in the form of profuse bleeding and secondary strokes. Endovascular methods have great potential in the early period of treatment of such an injury, which can prevent the development of severe and irreversible complications.

Development of methods of approach to endovascular treatment of penetrating blast injuries of the arteries of the head and neck, which prevents the development of bleeding and secondary strokes.

Methods: In the endovascular center of the Dnipropetrovsk Regional Clinical Hospital named after I.I. Mechnikov from February 22, 2022 to January 2024, 1,117 cerebral angiographies and 173 (15.5%) endovascular operations were performed on casualties with arteries damage of the head and neck. To select patients with lesions of extracranial segments for endovascular treatment, the classification of dissection lesions of arteries by Biffl W.L. and co-authors was used. Patients with a low risk of antiplatelet therapy were selected for reconstructive operations using stents and stent-grafts. In patients with a significant risk of antiplatelet therapy, the possibility of performing reconstructive operations without the involvement of stents and graft-stents (embolization of pseudoaneurysms and AV fistulas with spirals, hardening compositions) was evaluated; in the absence of this possibility, the possibility of deconstructive sacrificing of the artery together with the affected segment was evaluated, taking into account the possibilities collateral blood flow in this arterial basin. In the presence of intraluminal thrombi, endovascular thrombectomy was considered. Pseudoaneurysms of intracranial arterial segments were embolized, as a rule, as the first stage before extensive surgical treatment of wounds to prevent the risks of intraoperative bleeding.

Results: Mortality was 4.6% (n=8): in 4 (2.3%) cases due to the severity of combined trauma, 2 (1.15%) cases - the severity of craniocerebral injury, 2 (1.15%) cases - secondary ischemic hemispheric stroke that developed at the prehospital stage. There were no cases of secondary development of ischemic/hemorrhagic stroke after endovascular intervention, or cases of bleeding. Observation of patients in the delayed period is unfortunately difficult, so long-term follow up is generally almost non-existent.

Conclusions: The developed comprehensive approach to the endovascular treatment of patients with injuries of the arteries of the head and neck allows to prevent the development of secondary strokes and life-threatening bleeding in the early period after a penetrative blast trauma.

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1188

Brain and Spine 4 (2024) 103649

The "Double Wing" titanium mesh anterior skull base reconstruction protocol for challenging contexts within the transbasal approach: technical description and efficacy

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Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: The anterior skull base reconstruction is a challenging but crucial step in surgeries of this anatomical region, often benefiting from a multidisciplinary approach. Its main goal is to achieve a tight reconstruction, re-establishing the barrier between the intracranial and facial compartments, and avoiding CSF leaks that can hinder prognosis. We hereby describe a technical protocol employed iteratively over the past five years in a single center, and an outcome review of a series of patients.

Methods: The detailed anatomical principles and surgical technique are portrayed. A case series encompasses patients submitted to combined or isolated anterior skull base surgery at our hospital between the years 2019 and 2024, where this specific reconstruction protocol was employed. Social, demographic, and clinical data were collected. Evidence of failure and/or complication was assessed through medical records. Examples of three-dimensional CT scan post-operative reconstruction are provided.

Results: A total of 17 patients (12 males and 5 females) were admitted. The median age was 60 years (SD ± 15,75). 13 patients (76,4%) had cranionasal neoplasms (of wich 9 were patients with sinonasal carcinoma, 2 meningiomas, 1 basal cell carcinoma and 1 sinonasal undifferentiated carcinoma), 2 harbored invasive fungal infections, and 2 had complex defects, either iatrogenic or secondary to trauma. With a median follow-up of 312 days (SD±389), only one patient (5,6%) had evidence of a CSF leak, and none required treatment for infection or reoperation

Conclusions: The "double wing" titanium mesh anterior skull base reconstruction protocol for the transbasal approach is a versatile technique that provides a multilayered barrier to the intracranial compartment, allowing for reduced complication occurrences and an early patient discharge with access to adequate adjuvant treatment.

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937

Brain and Spine 4 (2024) 103650

Identification of an Isolated Epidural Hematoma Using Blood-Based Biomarkers in Traumatic Brain Injury

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Blood-based biomarkers have shown promise in identifying head injury patients with acute traumatic intracranial findings, however their capacity in detecting patients with isolated extra-axial hematomas remains unknown. The objective of this study was to assess the potential S100 calcium-binding protein B (S100B), glial fibrillary acid protein (GFAP), total tau (t-tau), neurofilament light (NF-L), ubiquitin C-terminal hydrolase L1 (UCH-L1), and neuron specific enolase (NSE) to identify mild TBI (mTBI) patients with epidural hematoma (EDH).

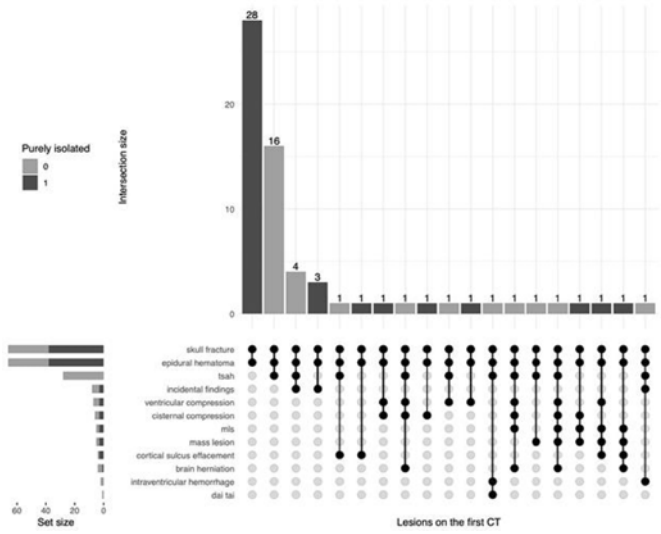
Methods: This prospective study included 1043 patients (median age 46 years, interquartile range 29-63) with mild traumatic brain injury [mTBI (GCS ≥13)]

with 1) all six serum blood biomarker levels measured and 2) acute head computed tomography (CT) scan within 24 hours of injury. The main outcome measure was the area under the curve of the receiver operating characteristic (AUC) for each biomarker in distinguishing between patients with CT-negative findings and those with EDH without coexisting surgical findings, i.e. subdural or intraparenchymal haemorrhage. An AUC≥0.7 was considered clinically adequate. A distinction was made between i) isolated EDH and ii) EDH occuring concomitantly with non-surgical findings (e.g. subarachnoid haemorrhage, intraventricular haemorrhage, and/or signs of axonal injury).

Results: Of the patients, 37 (3,5%) patients had an isolated EDH, 30 (2,5%) patients had EDH with non-surgical lesions and 976 patients had CT-negative findings (94%). In discriminating between any EDH versus CT-negative, the AUCs were 0.83 for GFAP, 0.65 for NSE, 0.66 for t-tau, 0.60 for NF-L, 0.57 for S100B, and 0.67 for UCH-L1. For discriminating between isolated EDH and CT-negative, the AUCs were 0.77 for GFAP, 0.63 for NSE, 0.58 for t-tau, 0.52 for NF-L, 0.51 for S100B, and 0.60 for UCH-L1.

Conclusions: Blood levels of GFAP adequately discriminated mTBI patients with EDH.

Optional Image



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1081

Brain and Spine 4 (2024) 103651

Effects on Functional Recovery of Exosomes from Wharton's Jelly-Derived Mesenchymal Stem Cells Patients with Traumatic Brain Injury

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Traumatic Brain Injury (TBI) is described as a brain function change or other signs of brain pathology that is induced by external forces. Rate of hospitilization cause of TBI approximately 1 per 1000 population. Traumatic brain injury can cause neurological sequelae at different levels. TBI is a prominent public health and socioeconomic issue. In this study, we aimed to evaluate the effectiveness and safety of mesenchymal stem cell-derived exosomes (MSCdE) therapy

Methods: 6 patients with a mean age of 27.00 (±4.06) who had TBI due to combat injury were included. MSCdE treatment was applied to the patients in 6 rounds over a period of 4.5 months. In each application, 3 ml (30 billion/ml) was given intrathecally and 3 ml (30 billion/ml) exosome was given intramuscularly. The patients were followed for 1 year after the application. Side effects were classified using Common Terminology Criteria for Adverse Events version 5.0 (CTCAE v5.0). The functional status of the patients was evaluated and monitored with the Functional Independence Scale (FIM), their spasticity with the Modified Ashworth Scale (MAS), and their general condition with the Karnofsky performance scale (KPS). All examinations and scoring of the patients were performed by a team consisting of a neurosurgeon and a physical therapy and rehabilitation specialist.

Results: During the treatment and follow-up period, only CTCAE v5.0 Grade 1 side effects such as subfebrile fever and pain were observed. FIM motor scores increased from 46.20 ± 16.39 before the application to 64.20 ± 18.20 after the application ($p<0.01$). FIM cognitif scores showed a statistically significant improvement when compared before (30.60 ±4.56) and after treatment (34.00 ± 1.41) ($p<0.001$). MAS values (right/left) were better when compared before treatment (4.60/3.60) and after treatment (2.20/1.60), but this improvement was not statistically significant. ($p>0.05$). A significant improvement was observed in KPS when compared before (46.00±11.402) and after the procedure (72.00/8.37) ($p<0.001$).

Conclusions: This studies demonstrated that MSCdE therapy might be greatly beneficial and safety in the treatment of TBI. We believe that the reason for not achieving a statistically significant improvement in spasticity in our study is due to the lack of serious spasticity in our patient group. Randomized, placebo-controlled trials of exosome or combined cell based therapies should be carried out to reach more definite results.

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373

Brain and Spine 4 (2024) 103652

Surgical Outcomes of Cerebrospinal Fluid (CSF) Leakage Cases Treated With Transnasal Endoscopic Approach of A Single Tertiary Center

Pinar Yildirim [1], Asst Melih Caklili [1], Assoc Burak Cabuk [1], Ihsan Anik [1], Savas Ceylan [2]. [1] *Kocaeli University, Kocaeli, Turkey;* [2] *Bahcesehir University, Istanbul, Turkey*

Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: Cerebrospinal fluid (CSF) rhinorrhea is the leakage of active CSF due to a defect in the skull base, causing clear fluid flow from the nose, resulting in disruption of the arachnoid, dura mater, and sinonasal mucosa. One of the treatment methods is surgical treatment, where the surgical approach is determined based on the localization of the leakage. The aim of our study is to investigate the results of cases of CSF rhinorrhea, repaired using a transnasal endoscopic approach and factors that may affect surgical success.

Methods: Between January 2004 and January 2024, patients with CSF rhinorrhea treated at a single tertiary center, were retrospectively screened.

Results: The study includes 62 cases, 52 patients. Recurrence occurred in 9 patients, with 8 patients undergoing surgery twice and 1 patient three times. The mean age was 40.8 and the number of female cases was 38, number of male patients was 24, respectively equals to 61,2% female and 38,7% male of all patients. A combined approach was applied in 1 case. Trauma history was present in 19 cases. The location of bone defects was as following by the decreasing order: ethmoid, frontal, sphenoid sinus, and clival region. Ethmoid and frontal defects were present together in 4 cases, and ethmoid and clival defects were present together in 1 case. A multi-layer closure technique was applied in all patients for defect repair, and lumbar drainage was applied in 37 cases. An encephalocele sac was observed intraoperatively in 25 cases. The mean follow-up duration was 68.07 (±70.078) months.

Conclusions: It has been shown that, repairing a CSF rhinorrhea, successful surgical outcomes can be achieved with accurate localization of the defect area and multi-layer closure of the dural defect. Studies involving more cases and specific comparisons could yield more precise results.

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905
Brain and Spine 4 (2024) 103653
Blood Biomarkers, Diffusion Tensor Imaging, and Outcome after Mild Traumatic Brain Injury

Malla Mononen [1,2], Mehrbod Mohammadian [1,2], Iftakher Hossain [1,2,3], Timo Roine [1,4], Olli Tenovuo [2], Kaj Blennow [6], Peter Hutchinson [3], Henna-Riikka Maanpää [1,2], David K. Menon [3], Virginia F. Newcombe [3], Jean-Charles Sanchez [10], Riikka Takala [1,2], Jussi Tallus [1,2], Mark van Gils [5], Henrik Zetterberg [6,7,8,9,11], Jussi P. Posti [1,2]. [1] *University Of Turku, Turku, Finland;* [2] *Turku University Hospital, Turku, Finland;* [3] *University of Cambridge, United Kingdom;* [4] *Aalto University School of Science, Finland;* [5] *University of Tampere, Finland;* [6] *University of Gothenburg, Sweden;* [7] *Sahlgrenska University Hospital, Sweden;* [8] *University College London, London, United Kingdom;* [9] *Hongkong Center for Neurodenegerative Diseases, China;* [10] *University of Geneva, Switzerland;* [11] *University of Wisconsin, USA*

Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Association of blood levels of the axonal biomarker neurofilament light and brain white matter (WM) injury in mild traumatic injury (mTBI) has been reported. The purposes of this study were to assess the association between the levels of several non-axonal blood-based biomarkers at admission and WM integrity, measured using post-acute diffusion tensor metrics, and to investigate their associations with outcome in patients with mTBI.
Methods: A total of 92 patients with mTBI (Glasgow Coma Scale $\geq$ 13) having plasma samples for glial fibrillary acidic protein (GFAP), interleukin 10 (IL-10), heart fatty-acid binding protein (H-FABP), S100 calcium-binding protein B (S100B), total tau (T-Tau), amyloid beta 40 and 42 (amyloid B40 and B42) within 24 h of admission and diffusion-weighted magnetic resonance imaging (DW-MRI) $\geq$ 90 days post-injury (median = 231) were included. Patients were divided into computed tomography (CT)-positive and CT-negative subgroups. Outcome was assessed using Glasgow Outcome Scale-Extended (GOSE) at the time of imaging during the follow-up visit. Outcomes were dichotomized as complete (GOSE 8) and incomplete recovery (GOSE <8). Mean fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD) were calculated from the skeletonized WM tracts of the whole brain.
Results: Admission plasma levels of GFAP, IL-10, and T-Tau had negative correlations with FA and positive correlations with MD, RD, and AD in whole mTBI cohort, in CT-positive group (excluding IL-10), and in incomplete recovery group. In contrast, Ab-42 had a positive correlation with FA in whole mTBI cohort. The levels of S100B had a positive correlation with AD in CT-positive group.
CT-positive patients had significantly lower FA levels and higher levels of MD and RD than the CT-negative patients.
Conclusions: Admission plasma levels of GFAP, IL-10, and T-Tau correlate with WM integrity measured $\geq$ 90 days post injury. Higher levels of these biomarkers may be associated with diffuse axonal injury.
Optional Image

Correlation between fractional anisotropy (FA) and biomarkers

	All patients		CT-positive		CT-negative		Incomplete recovery		Complete recovery	
Biomarker	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value
GFAP	**-0.231**	**0.028**	**-0.325**	**0.049**	0.073	0.608	**-0.315**	**0.019**	0.063	0.728
IL-10	**-0.223**	**0.038**	-0.310	0.065	-0.064	0.663	**-0.455**	**<0.001**	0.096	0.608
H-FABP	-0.128	0.241	-0.216	0.205	0.031	0.834	-0.247	0.074	-0.004	0.981
T-Tau	**-0.21**	**0.045**	**-0.331**	**0.045**	0.032	0.824	**-0.336**	**0.012**	0.081	0.652
S100B	0.035	0.746	-0.164	0.340	0.069	0.639	-0.029	0.836	0.013	0.942
Amyloid B42	**0.240**	**0.024**	0.309	0.066	0.233	0.104	0.200	0.146	0.312	0.081
Amyloid B40	0.059	0.580	0.197	0.243	0.169	0.242	0.065	0.636	0.146	0.423

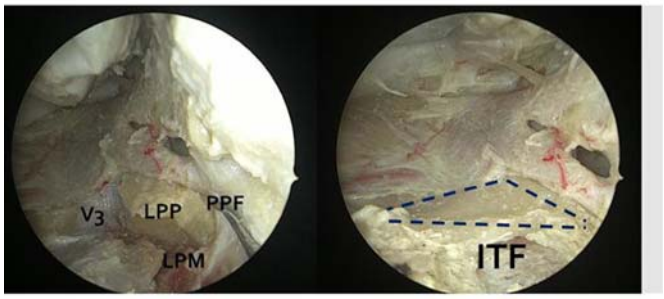
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183
Brain and Spine 4 (2024) 103654
Endoscopic transorbital approach to the infratemporal fossa. Anatomical feasibility study

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Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: The infratemporal fossa (ITF) is a complex anatomical region. Deep location and high density of critical neurovascular structures contributes to the challenge of accessing the ITF. The historical open surgical approaches (pre and post auricular, transfacial), carried high morbidity rates and unsatisfactory cosmetic results. Therefore, several minimally invasive, endoscopic surgical approaches have been described to provide access to the ITF (endonasal transmaxillary transpterygoid, sublabial transmaxillary, transoral). Superior eyelid endoscopic transorbital approach (SETOA) has been recently described as a possible route to gain a supero-anterior access to the ITF. Moreover, combined endoscopic skull base approaches have gained lot of popularity over the last years, thanks to the refinements of endoscopic technique and anatomical knowledge, providing advantages, particularly in terms of visualization and surgical freedom, and reduction of post-operative morbidities. This study examines the feasibility of combination between endoscopic transorbital and transmaxillary approach as a minimal access technique for ITF. This combination of approaches offers a favorable exposure to the ITF providing multiple angles of attack.
Methods: Surgical dissections were realized on both sides of three cadaver specimens embalmed and injected with colored latex solutions at the Laboratory of Neuroscience EBRIS (Salerno, Italy) and the Trecchi Human Laboratory (Cremona, Italy). The combined superior eyelid endoscopic transorbital approach (SETOA) and sublabial transmaxillary approach (SLTMA) was performed. Morphometric measurements, angles of attack and surgical field depth were measured on high resolution CT scans by means of neuronavigation system (Medtronic, Luisville, CO). Standard endoscopic instruments (Karl Storz Endoscopy, Tuttlingen, Germany) and high-speed drill were used. Rod-lens endoscopes with 0 and 30 degrees lenses (4-mm diameter, 18-cm length) coupled to a high-definition camera and monitor (Karl Storz Endoscopy, Tuttlingen, Germany) provided visualization during the dissections.
Results: The SETOA allowed to accede the ITF through the inferior orbital fissure (IOF), it provides direct access to the ITF from a supero anterior perspective. On the other hand, SLTMA provide a straight access, after remotion of the posterior wall of the maxillary sinus, to the entire ITF. Combining the approaches enhance the field of exposure, angle of attack, and the instrumentation of the anterior ITF.
Conclusions: This cadaveric study suggests that a combination of minimal access infratemporal approaches can provide adequate exposure of the ITF. This multiport approach can be customized according to the extension of the lesions, as well as the surgical strategy.
Optional Image



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600
Brain and Spine 4 (2024) 103655
Brain-Heart interaction during ecstatic seizures

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Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Ecstatic epilepsy is a rare form of focal epilepsy with seizures including a blissful feeling of increased self-awareness. Heartbeat evoked potential (HEP), the brain response synchronized with the R-peak of heart rhythm, plays an important role in brain-body integration, influencing perception and self-related processes. Heart rate variability (HRV), a marker of autonomic activity, usually shows a shift in autonomic balance toward sympathetic dominance interictally in epilepsy, whereas increased HRV has been shown to correlate with states of higher emotional well-being. We hypothesize that during/after the ecstatic auras there is i) a specific change in HEP, with ii) an increased HRV.

Methods: We investigated brain-heart interaction in patients with epilepsy experiencing ecstatic auras, in terms of heart and brain signals (HRV and HEP). Three patients with drug-resistant ecstatic epilepsy implanted with intracerebral electrodes for epilepsy presurgical evaluation manifested reproducible ecstatic auras when electrical stimulation was applied to the right dorsal anterior insula. HEP and HRV were computed after each induced ecstatic aura (1-3 min sequences, mean total duration: 300 s) and compared to sequences of "control" stimulations of same duration. In the three patients, for both conditions, HRV was computed and HEP inspected for all intracerebral electrodes' contact (Patient_1 = 124, Patient_2 = 175, Patient_3 = 156).

Results: HRV was statistically increased for the three patients in the "ecstatic" condition ($p < 0.05$). HEP evaluated in the left insula in two patients and left inferior frontal gyrus in one patient had a reduced amplitude between 200-350 ms ($p<0.05$).

Conclusions: Ecstatic aura represents a peculiar case of alteration in self-related processes. In our patients, we could associate this state to a modulation of heart-brain connection, measured in terms of HEP, with significant consistent variations in amplitude ~200 ms after R peak, and an increase in HRV, testifying increased vagal tone.

Optional Image

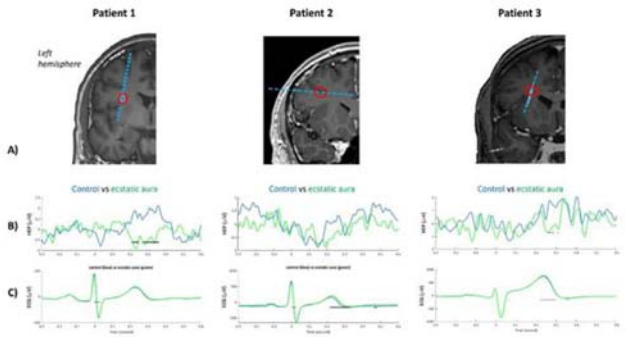


Figure 1. Heart-Brain interaction in ecstatic patients. A) The site in or in the proximity of the left insula where significant modulations of the HEP were observed during ecstatic sensation is indicated on individual patients' MRI (red circle. Brain (i.e. HEP, **B**)) and heart (ECG, **C**)) rhythms are shown for each patient, in ecstatic (green line) and control (blue line) conditions. Periods of significant ($p<0.05$) difference between conditions are represented by a black line.

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93

Brain and Spine 4 (2024) 103656

The migratory and invasive behaviour of malignant meningioma cells depends on glucose concentration and glycation

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM

Background: Meningioma is the most common non-malignant intracranial tumour and the risk of developing the disease increases with age. It is known that glucose tolerance decreases with age, leading to higher glucose levels. Like almost all tumours, meningiomas use altered aerobic glycolysis to generate energy, also known as the Warburg effect. This leads to an accumulation of highly reactive by-products such as methylglyoxal (MGO). MGO has been discussed by as a possible link between diabetes, serum glucose levels and cancer. MGO is 20,000 times more reactive than glucose and reacts mainly with proteins, DNA or lipids to form advanced glycation end products (AGEs), a non-enzymatic reaction between the carbonyl groups of dicarbonyls or sugars (such as glucose or fructose) and the amino groups of proteins. However, whether the behaviour of meningiomas depends on glucose levels and glycation has not been investigated. The aim of this study was to investigate the influence of glucose levels and glycation on the migration and invasion behaviour of meningioma cells.

Methods: We used a benign meningioma cell line (WHO grade 1, BEN-MEN1) and a malignant meningioma cell line (WHO grade 3, IOMM-Lee). Cells were cultured for 24h with different glucose levels: normal (5.5mM), low (3mM) and high (15mM) and additionally treated with 0.3mM MGO. Cell cycle analysis was performed with propidium iodide staining using a BD Accuri C6 flow cytometer. Migration was analysed by Electric Cell-substrate Impedance Sensing (ECIS) and invasive behaviour by Real-Time Cell Analysis (RTCA).

Results: We have observed that the cell cycle in the malignant meningioma cell line is influenced by different glucose levels and glycation. At low glucose levels, the cell cycle was slowed down. In addition, the malignant tumour cells showed reduced migration and invasion behaviour at low glucose levels. With the addition of the glycating agent MGO, we saw no more migration and a reduction in invasive behaviour. In contrast, these effects were not observed in the benign meningioma cell line.

Conclusions: This study shows that low glucose levels can reduce the migration and invasion behaviour of malignant meningioma cells. This could be an indication that the western lifestyle may influence the behaviour of meningioma cells. An appropriate diet with a reduction in carbohydrates could lead to a better oncological outcome for patients. This should be further investigated in future studies.

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497

Brain and Spine 4 (2024) 103657

Keyhole concept applied to Endoscopic Transorbital Approach with and without Lateral Rim Osteotomy: Clinical Experience and Anatomical Reappraisal

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Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: Over the last decade, endoscopic transorbital approaches (ETOA) have gained increased recognition, and their application has expanded. To date, there is still a paucity of data about the clinical impact of ETOA, and its effectiveness and advantages compared to ETOA with lateral rim orbitotomy (LOR) require to be fully elucidated. The keyhole concept in neurosurgery relies on minimizing the craniotomy extension to address deeply located lesions. Investigating this concept in transorbital surgery, this study aims to compare indications, outcomes, and anatomical exposures between ETOA with and without LOR to provide evidence-based indications to choose the most suited transorbital variation.

Methods: Five formalin-fixed, latex-injected cadaveric specimens were used to perform bilateral ETOA with consequent LOR. Dissections were conducted in a stepwise fashion to depict the ETOA and its variation. Measurements were taken to assess and compare the surgical windows and anatomical landmarks. A retrospective analysis of outcomes, complications, and extent of resection of patients who underwent ETOA and ETOA with LOR has been conducted.

Results: Our study characterized the operative corridors of ETOA and ETOA with LOR through high-resolution photographic and endoscopic image acquisition techniques. ETOA with LOR afforded a significantly wider surgical window compared to ETOA alone. However, for posterior orbital lesions and middle cranial fossa (MCF) ones, the ETOA provided optimal anatomical visualization and access. From 2020 to 2023, 29 and 9 patients underwent ETOA and ETOA with LOR, respectively. Of these procedures, 63.6% ETOA and 67.7% ETOA with LOR were for extra-axial tumors. Gross-total or near-total resection was achieved in 93% of ETOAs and 50% of ETOAs with LOR ($p<0.05$). Minor complications occurred in 16.6% of ETOA and 33.3% of ETOA with LOR ($p<0.05$).

Conclusions: ETOA with LOR may be used in a wider range of MCF pathologies due to the wider exposure and instrument maneuverability. However, ETOA showed similar outcome results with fewer perioperative complications and

better cosmetic results compared to ETOA with LOR. The ETOA approach may be efficiently employed for MCF and posterior orbital lesions, minimizing the approach's invasiveness.

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677
Brain and Spine 4 (2024) 103658
Segmentation of 7 Tesla Magnetic Resonance Images of Epileptic Patients using SynthSeg

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Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM

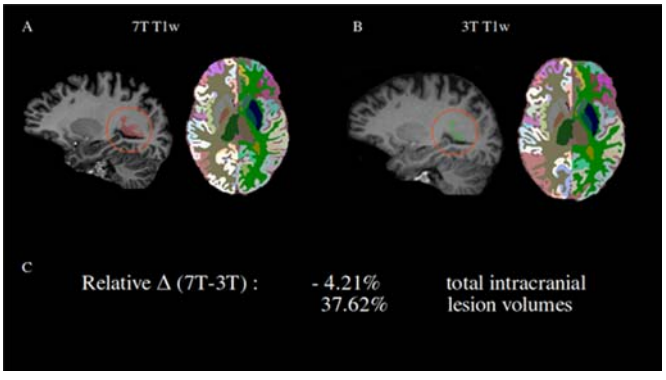
Background: Epilepsy is a neurological disorder that affects more than 65 million people worldwide, making it the fourth most common neurological disorder [1]. About 20-30% of individuals with epilepsy require resective surgery [2]. To improve the surgical results, it is important to precisely locate the Epileptic Zone (EZ) in the brain [3]. One way to achieve this is by using 7 Tesla (7T) Magnetic Resonance Imaging (MRI) scanners, which offer higher contrast and resolution compared to conventional imaging techniques [3, 4].

Methods: The dataset consists of MRI scans of 30 epilepsy patients, including 7T and 3T images. Among these patients, eight have visible lesions. We segmented T1w images using SynthSeg [5], which utilizes a convolutional neural network technique. By using the parcellation package within this software, we were able to identify 115 specific brain regions. To compare the 3T and 7T scans, we calculated the median of the volumes across all patients in various areas. In addition, the lesions in MR-positive patients were manually segmented and compared.

Results: The study results indicate a volume variation between 7T and 3T. This relative difference ([7T-3T]/7T) is -14.01% and 6.85% for total gray and white matter, respectively. Figure 1 illustrates an example of parcelation and lesion segmentation of 7T and 3T images in A and B, respectively. Their quantitative difference, reported in C, is -4.21% for the total intracranial and 37.62% for lesion volumes. As expected, due to B1-inhomogeneity at the skull base, the median values of the regions' volumes are a few percent higher in 3T scans compared to 7T.

Conclusions: In this study, we investigated the segmentation of the 7 T MRI images of patients, both with and without lesions, and showed that the initial results compare positively to 3T MRI.

Optional Image



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1297
Brain and Spine 4 (2024) 103659
A case series of retrosigmoid craniectomies and an emergent grading system for the transverse, sigmoid and superior petrosal sinus configuration.

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Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: The transverse/ sigmoid/ superior petrosal sinus (TSSPS) morphology is widely acknowledged as the primary constraint in retrosigmoid procedures. This study seeks to present a simple and practical grading system for the TSSPS configuration, based on a clinical series' metrics.

Methods: A retrospective review was conducted on the clinical records of patients who underwent retrosigmoid craniectomy for tumor resection between June 2016 and June 2023. The analysis focused on two fundamental parameters measured on MRI angiographies, namely the transverse sinus width protruding below the tentorium or Tp (0-4mm = 0 points, >4mm = 1 point), and the sigmoid sinus width protruding medially to the petrous ridge/superior petrosal sinus or Sp (0-8mm = 0 points, >8mm = 1 point), measured the closest to the transverse-sigmoid junction on the coronal and axial planes respectively. Cutoffs were decided based on the Tp and Sp mean values. Consequently, three separate grades (0, 1, 2) were designated, directly determined by the total points' summation.

Results: After excluding 10 cases with either combined procedures or unreliable data, 82 patients (38 males and 44 females) were enrolled. Mean age was 55.6y and 84.1% harbored either schwannomas or meningiomas. Grade 0 (= 0 total points) TSSPS morphology was found in 18 patients, Grade 1 (=1 total point) in 32 and Grade 2 (=2 total points) in 32. Average transverse and sigmoid sinus total widths were 9.52mm and 11.83 respectively. Five sinus-related complications were observed in one Grade 1and four Grade 2 patients, including 4 sinus thrombosis and one intraoperative injury. (Spearman's rho 0.21, p=0.053).

Conclusions: Reflecting on the applicability of this classification system, the correlation between the grade and postoperative sinus-related complications almost reached statistical significance. Notably, the surgical view is dependent on the TSSPS configuration and could possibly affect sinus manipulation, thus compromising the outcomes.

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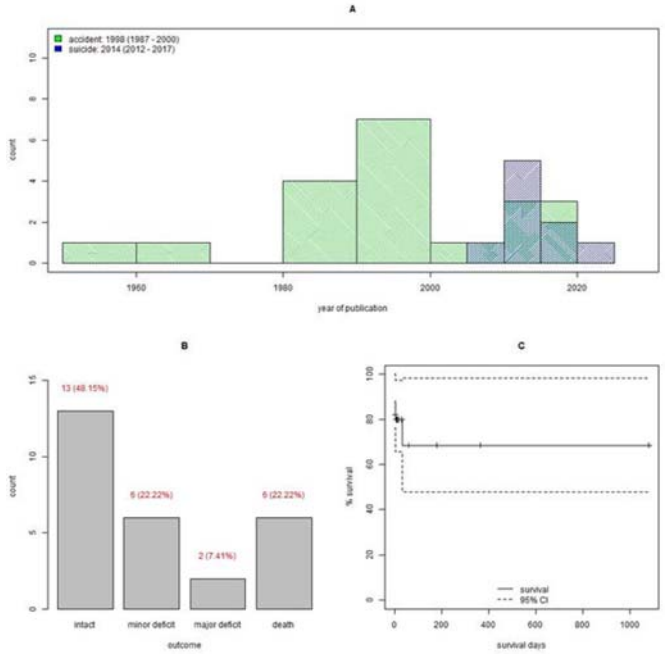
276
Brain and Spine 4 (2024) 103660
Traumatic Brain Injury Caused By Fishing Speargun: A Suicide Case And Systematic Review Of Case Reports

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Traumatic brain injury (TBI) is a severe neurosurgical emergency and a significant public health concern. Only a few cases of TBIs caused by fishing spearguns have been published during the past 68 years. As a result, despite the knowledge surrounding the general role and impact of penetrating brain injuries, neurosurgical communities lack experience and standardized protocols in dealing with such paradoxical cases due to the rarity and inherent variability in reported cases. On the occasion of dealing with an incident of suicidal-etiology TBI by fishing speargun in our department, we decided to introduce it, and we performed a systematic review of related case reports –the first of its kind, aiming to offer valuable insights into the clinical aspects of speargun-related TBIs, trends in management strategies, prognosis, and outcomes.

Methods: This systematic review, in accordance with PRISMA guidelines, included incidents of TBI by speargun published in Pubmed, Scopus, and Web of Science until January 2024. PROSPERO: CRD42024510718.
Results: A total of 22 publications, reporting 26 cases of speargun-related TBIs formulated the 27 investigated cases including the current patient which were used in this descriptive and inferential statistical analysis. Predominantly affecting males (88.89%) with a median age of 29 years, these injuries were primarily due to accidents (65.38%), with a noticeable trend towards suicide. Outcome variability ranged from intact recovery (48.15%) in majority of cases to a range of unfavorable outcomes. Significant factors impacting outcomes included initial GCS score <8, major initial CT head findings, and major complications. Survival analysis indicated early manifestation of unfavorable outcomes.
Conclusions: In summary, the diverse presentation, management, outcomes and identified influencing factors highlight the complexity of managing speargun-related injuries, and the need for personalized approaches and further research to enhance care protocols.
Optional Image

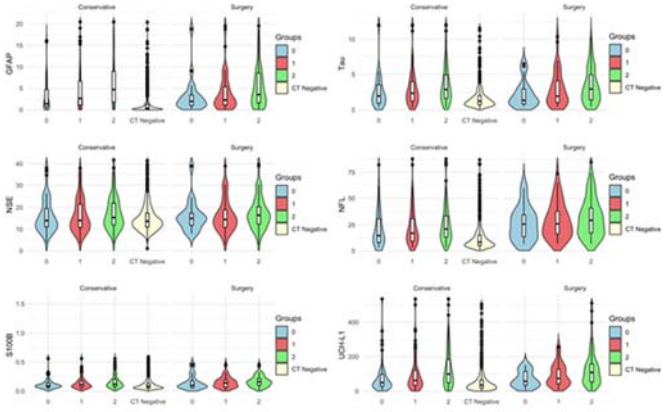


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1121
Brain and Spine 4 (2024) 103661
Biomarker Levels in Patients with Acute Subdural Hematoma

Otto Korhonen [1], Rick Vreeburg [2], Mehrbod Mohammadian [1,12], Iftakher Hossain [1,10], Teemu Luoto [5], Wilco Peul [2,3], Olli Tenovuo [6], Andrew Maas [7], David Menon [8], András Büki [9], John Yue [11], Thomas van Essen [2,3,4], Jussi Posti [1]. [1] *Neurocenter, Department of Neurosurgery and Turku Brain Injury Center, Turku University Hospital and University of Turku, Turku, Finland;* [2] *University Neurosurgical Centre Holland, Leiden University Medical Centre, Haaglanden Medical Centre, and Haga Teaching Hospital, Leiden-The Hague, The Netherlands;* [3] *Department of Neurosurgery, Leiden University Medical Centre, The Netherlands;* [4] *Department of Surgery, Division of Neurosurgey, QEII Health Sciences Center and Dalhousie University, Halifax, Canada;* [5] *Department of Neurosurgery, Tampere University Hospital and Tampere University, Tampere, Finland;* [6] *Division of Clinical Neurosciences, University of Turku, Turku, Finland;* [7] *Department of Neurosurgery, Antwerp University Hospital and University of Antwerp, Edegem, Belgium;* [8] *Division of Anaesthesia, University of Cambridge, Addenbrooke's Hospital, Cambridge, United Kingdom;* [9] *School of Medical Sciences, Örebro University, Örebro, Sweden;* [10] *Department of Clinical Neurosciences, Neurosurgery Unit, University of Cambridge, Addenbrooke's Hospital, Cambridge, United Kingdom;* [11] *Department of Neurological Surgery, University of California – San Francisco, San Francisco, United States;* [12] *Department of Radiology, Massachusetts General Hospital, Boston, United States*

Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM
Background: Acute subdural hematoma (aSDH) is the most common space-occupying mass lesion in patients with traumatic brain injury (TBI). The decision to treat these patients either surgically or conservatively is typically made on neurological and CT findings. However, the selection of patients for acute surgery may benefit from objective decision support with blood-based biomarkers. Our aim was to examine and describe the biomarker levels of six protein biomarkers in surgically and conservatively treated patients with aSDH.
Methods: Our study cohort (CENTER-TBI) included 638 patients with traumatic aSDH and blood biomarker levels of Glial Fibrillary Acidic Protein (GFAP), Tau, Neuron-Specific Enolase (NSE), Neurofilament-Light (NF-L), S100 Calcium-Binding Protein B (S100B), Ubiquitin C-terminal Hydrolase L1 (UCH-L1) available within 24 h of injury. We compared the biomarker levels between patients receiving acute surgery vs those conservatively treated (initially). Patients were also divided into subgroups based on imaging variables: 0 (isolated aSDH), 1 (aSDH + intraventricular hemorrhage (IVH) / subarachnoid hemorrhage (SAH)), 2 (aSDH + IVH/SAH/contusion). Comparison analyzes of the biomarker levels between the groups were done using Mann-Whitney U -test.
Results: 214 (34%) were treated surgically and 425 (66%) conservatively. Levels of S100B were significantly higher in the surgically treated patients ($p=0.03$). No differences in other biomarker levels were observed between the surgically vs conservatively treated patients in the whole study cohort or any of the subgroups. The levels of all studied protein biomarkers differed significantly between those with isolated aSDH and the patients with aSDH + other findings on head CT imaging ($p<0.05$) (Figure 1).
Conclusions: The biomarker levels did not differ between treatment groups, except for S100B. The biomarker levels were different between patients with isolated aSDH vs. those with aSDH + other lesions. Further research should address the potential of these biomarkers in identifying patients benefiting from surgical treatment.
Optional Image



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928
Brain and Spine 4 (2024) 103662
Epilepsy in Primary Central Nervous System Lymphoma: Prevalence, Risk Factors, and Prognostic Significance

Oumaima Aboubakr [1,2], Caroline Houillier [1], Agusti Alentorn [1,3], Sylvain Choquet [1], Pr Sophie Dupont [1,3], Pr Khê Hoang-Xuan [1,3], Pr Alexandre Carpentier [1,3], Bertrand Mathon [1,3]. [1] *Pitié Salpêtrière, AP-HP, Paris, France;* [2] *Université de Paris, Paris, France;* [3] *Sorbonne University, Paris, France*

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM
Background: Brain tumor-related epilepsy is a common comorbidity of brain tumors; however, little is known about the prevalence, time of onset, semiology,

and risk factors of seizures in primary central nervous system lymphoma (PCNSL).

Methods: We performed a monocentric retrospective study from January 2011 to July 2023 and included 330 immunocompetent patients with PCNSL. The primary aim of this study was to determine the prevalence of epilepsy in these patients. The secondary objectives were to identify clinical, radiological, and therapeutic factors that could predict the occurrence of seizures and determine the survival rates of patients with PCNSL and epilepsy.

Results: 83 (25.2%) patients with PCNSL had at least one epileptic seizure from the initial diagnosis to the last follow-up, 40 (12.1%) as the onset symptom, 16 (4.8%) during first line of treatment, 27 (8.2%) at tumor progression or recurrence and 6 (1.8%) while in remission. Seizure rate varied from 1 to 6 with a median of 2 seizures. Focal aware and generalized tonic–clonic seizures were the most frequent seizure types, and seizure freedom under antiseizure medication was observed in 97.6% patients. Cortical contact on the initial MRI and a higher proliferation index (Ki-67) were identified as independent risk factors for epilepsy in patients with PCNSL. Epileptic PCNSL patients tended to have a worse prognosis, with a trend toward shorter progression-free and overall survival rates.

Conclusions: Epilepsy affects a quarter of the patients with PCNSL, half of them at initial presentation and later as a manifestation of tumor progression or relapse. Consequently, it should not be overlooked by neurosurgeons at diagnosis or by neurooncologists and hematologists over the course of the disease.

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277

Brain and Spine 4 (2024) 103663

Resting-state non-invasive EEG microstates are potential biomarkers of refractory temporal lobe epilepsy

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Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Although surgical treatment for refractory temporal lobe epilepsy (TLE) is readily available, the disease remains largely unknown and the surgical outcomes remain suboptimal. A contemporary view defines epilepsy as a network disorder derived from diseased dynamical networks rather than a single or several epileptogenic foci. Resting-state EEG microstates have notable spatiotemporal features that demonstrate the dynamics of whole-brain networks and may provide information on surgical outcomes and clinical features in TLE. In this study, we extensively explored the spatial and temporal dynamics of microstates panorama in TLE during the resting-state interictal periods. This work hypothesizes that the brain network dynamics based on resting-state EEG microstates can offer an accurate depiction of the disease and provide potential screening and outcome predicting tool for TLE even without detectable epileptic spikes on EEG.

Methods: Microstate analyses were based on 256-channel scalp EEG in 67 refractory TLE patients and 30 healthy controls (HCs). We propose a novel framework for EEG microstate spatial-temporal dynamics (EEG-MiSTD) analysis based on machine learning method. Among the patient group, 11 pairwise clinical features were identified. Four dominant microstate classes A-D with their spatial and temporal measures were computed for between-group comparisons. We applied topographic analysis of variance (TANOVA) and global field power (GFP) contrast analysis to explore spatial features, multiple independent t-tests, Pearson's correlation and decision forest-based machine learning methods to explore temporal features.

Results: With only 100 seconds of resting-state EEG even without epileptic discharges, spatial measures of all microstate classes significantly differentiated TLE from HCs (TANOVA and GFP contrast analysis), and favorable prognosis from poor prognosis (TANOVA). Temporal measures of all microstate classes showed a consistent trend of increasing Duration and decreasing Occurrence in TLE, compared with HCs. Specifically we found that the Coverage decreased in class A whereas increased in class D prominently, and the Syntax altered significantly in these two classes, suggesting major alterations in corresponding networks. Moreover, we observed wide association of microstate spatiotemporal measures and various clinical features in TLE.

Conclusions: From a new perspective, microstate temporal and spatial features are found to be widely related to clinical parameters of TLE, which help support that TLE is a network disease. The analysis found overall neural protractions reflected by microstate temporal measures and spatial alterations across all four classes in TLE compared to HCs. Specifically, microstate class A and D corresponded to auditory and attention networks respectively are prominently altered in TLE. Spatial rather than temporal microstate features showed promise in predicting surgical outcomes in TLE patients before surgery with non-invasive short-term EEG. Microstate features hold potential as biomarkers of refractory TLE, even in the absence of epileptic discharges in EEG, and may be useful to improve diagnosis and guide surgical treatment of TLE.

Optional Image

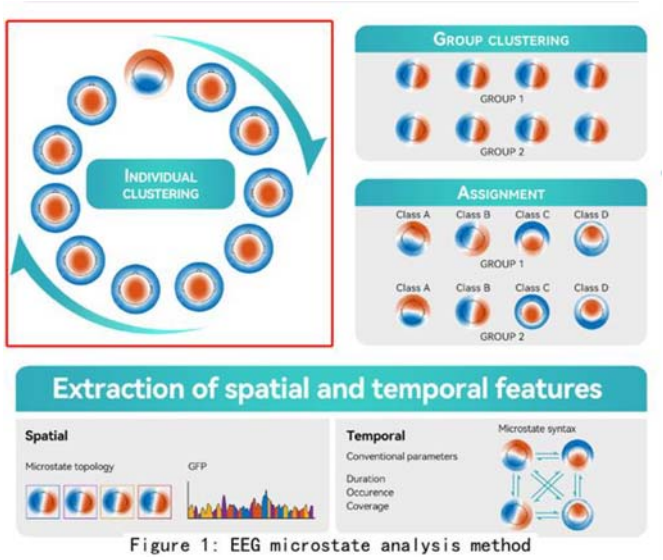


Figure 1: EEG microstate analysis method

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1398

Brain and Spine 4 (2024) 103664

MRI-guided Laser Interstitial Thermal Therapy for Hypothalamus Hamartoma

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Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Hypothalamic hamartoma (HH) is a rare, congenital, tumour-like growth in hypothalamus. It may be associated with precocious puberty, epilepsy with gelastic or dacrystic seizures and neurobehavioral symptoms. Depending on the anatomical location and morphology on the magnet resonance imaging (MRI), it may be classified in four different types. The treatment options for HH-associated epilepsy may include open surgery, endoscopic disconnection, radiofrequency ablation or radiosurgery, with varying degrees of treatment-associated morbidity. A novel treatment option, MRI-guided laser interstitial thermal therapy (MRgLITT), is aimed to minimize postsurgical complications and optimize the destruction of the pathological tissue. It was recently added to the surgical armamentarium in the treatment of pharmacoresistant epilepsy in our centre.

Methods: Clinical and radiological data of 5 patients with HH who underwent MRgLITT for pharmacoresistant epilepsy were prospectively collected. The placement of laser catheter was performed using frameless system (Varioguide) with intraoperative CT autoregistration and postoperative verification of catheter at the target.

Results: The median age at the time of treatment was 11 years (range, 4-35 years). Two patients had previous surgery, one underwent a partial endoscopic HH disconnection and the other an MRgLITT at another center. No surgical complications occurred during MRgLITT, however, all patients experienced transient electrolyte disturbances. Three patients were completely seizure free (two at 2-year and one at 6-month follow-up), and two patients had Engel class IIIA outcome.

Conclusions: In patients with pharmacoresistant epilepsy and HH, MRI-guided LITT showed promising postsurgical results with low risk of complications.

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204
Brain and Spine 4 (2024) 103665
Challenges of establishing a neurosurgery unit and working as a neurosurgeon in Karnali, a remote province of Nepal

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Karnali is one of the most remote regions in Nepal with a population of one and a half million. Most of the districts in the region are sparsely connected with other developed parts of Nepal. The province is among the poorest in Nepal with an estimated 28.9% of people living under absolute poverty (second highest in the country) and 51.7% of the people are multidimensional poor (highest in the country). Due to the geography, it is one of the regions with the highest concentration of neurotrauma cases in Nepal. Neurosurgical services were started only recently in the region with efforts by two neurosurgeons. Currently two neurosurgeons are serving the entire region.
Methods: This is a descriptive study describing the establishment of neurosurgery unit in Karnali, the current scenario, the cases being performed and the challenges. The data have been collected from the hospital records. The human, logistic and financial resources have been described. After the service was established various recommendations have been made on a continuous basis. The plans for further expansion of the service have been described. Plans for sustainability of the services have been discussed.
Results: The neurosurgical service was started in Karnali in May 2021 with out patient clinic, operation theatre and emergency services. Neuro ICU was started in March 2023. The human resources include two neurosurgeons, two anesthesiologists, radiologists, radio technician, medical officers, intensive care unit nurses, ward nurses, operation theatre nurses, attendants and physiotherapists. There is 24 hour computed tomography, x ray, ultrasound back up with three tesla magnetic resonance imaging. Modular operation theatre set up has been started with table, Mayfield head holder and three pin, fluoroscopy, c arm, microscope, autoclave service, microsurgical set, craniotomy and burr hole set, neurosurgery, drill. Twenty four hour lab with blood bank service has been started. The financial resources include government grants, insurance and out of pocket payment by patients.
Most common cases presenting to emergency are traumatic brain injury, traumatic spine injury followed by intracerebral hematoma, brachial plexus injury, tumors, and hydrocephalus. Most common surgical procedures performed are burr hole and evacuation of chronic subdural hematoma, craniotomy for traumatic epidural hematoma, subdural hematoma, intracerebral hematoma, external ventricular drain, ventriculoperitoneal shunt, instrumentation and decompression for spine injuries. After starting the services it has become a huge boost for the population. The referral of neurosurgical cases to other centres has been significantly reduced. The mortality rate especially from traumatic brain injury has been significantly reduced. But significant challenges still remain in providing neurosurgical care. Proper manpower trained in neurocritical care and trained operation theatre staffs, intensive care unit staffs aren't available. Though diagnostic and curative services have been started very little has been done for rehabilitation services of severe head injury patients, traumatic paraparesis and quadriparesis patients, hemorrhagic stroke and intracranial hematoma survivors, patients with post traumatic and post stroke speech disorders, tracheostomy patients. Financial resources aren't enough to sustain neurosurgical services. Proper referral services for neurosurgical critical care patients who can't be managed here isn't available.
Conclusions: Thought significant progress has been made in neurosurgery in other parts of world; Nepal is still struggling to provide these services. But the services that have been started in Karnali has shown that it is quite feasible and sustainable. The services that have been started in karnali can serve as a model for providing neurosurgical services in other regions of Nepal and in other underdeveloped regions of world.

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614
Brain and Spine 4 (2024) 103666
Electric Scooter Related CT Positive Brain Injuries: Overview of 5 Years Single Centre Experience

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Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: The popularity during the last five years of electric scooters (e-scooters) due to climate neutrality and wide availability led also to accidents with significant injuries. Traumatic brain injuries require additional attention because of long-term consequences and disability with potential urge for prevention regulation decisions. This study was conducted to overview e-scooter related CT positive traumatic brain injuries, exploring circumstances, clinical course and outcomes.
Methods: We retrospectively reviewed medical data of all patients treated in our center with e-scooter related brain injuries that had any traumatic feature in the CT scan during the period 2019, when e-scooters started being available via rental mobile applications, to 2023.
Results: 45 patients were included in the review, 75.6% were males with median age of 40 years old. Numbers of injured patients consistently increase annually (4 in 2019, 14 in 2023), it did not differ between weekdays, working days versus weekends and time of the day. 80% of patients were injured because of fall off the scooter, the rest were hit by another vehicle while riding. Helmet usage was not reported in more than half of the cases, significant intoxication (>0,4‰) was found in 68,8% of cases. The most common intracranial changes were subarachnoid hemorrhage (55,6%), followed by brain contusions (48,9%), epidural (26,7%), subdural (26,7%) hemorrhages. Cranial fractures had a significant correlation with moderate intoxication (p=0,027), other bone fractures were more common in women (p=0,028). Men over 40 years old were more likely to undergo surgery (p=0,024), operated patients suffered more infections and more often ended with poor outcomes - mRS 4-6 (p<0,005).
Conclusions: E-scooter related brain injuries increase annually, >40 years old males are prone to more severe injuries and worse outcomes.

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935
Brain and Spine 4 (2024) 103667
High-throughput Combinatorial Drug Screening of FDA-approved Drugs Identifies Potential Synergistic Drug Partners for the Treatment of Aggressive Meningiomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM

Background: Synergistic drug combinations may improve the treatment effectiveness by targeting multiple aspects of cancer cells or by overcoming resistance to single drugs for aggressive meningiomas. We performed an automated and multiplexed combinatorial drug screening of 166 FDA-approved (Food and Drug Administration) anticancer drugs in three grade 3 meningioma cell lines.
Methods: Three grade 3 meningioma cell lines (NCH93, IOMM-Lee, and KT21-MG1) were transduced with green, red, and blue fluorescence proteins. Cells were multiplexed into 384-well plates. Drugs were added in 5x5 dose-response matrices (0-1000 nmol/l) by the automated liquid handler Hamilton MicroLAB STAR®. The drug library AODX (Approved Oncology Drugs) from the NCI (National Cancer Institute) consisted of 166 FDA-approved anticancer drugs. The viability of the cell lines was demultiplexed by measuring the fluorescence signal, followed by an ATP-based end-point viability assay CellTiterGlo 2.0 (Promega) as an independent combined result of all cell lines. Drug-drug synergisms were calculated by the ZIP (Zero-inflated Poisson Regression) synergy model and were defined as a ZIP score over 10.
Results: This drug screening effort generated 13,695 unique drug-drug

combinations per cell line. Most synergistic combinations were observed in the combined group (n=188,1.37%), followed by IOMM-Lee (n=157,1.14%), KT21-MG1 (n=122,0.88%), and NCH93 (n=75,0.54%). 86 combinations were uniquely found in IOMM-Lee, 54 in KT21-MG1, and 20 in NCH93, indicating specific tumor vulnerabilities. 18 drug combinations were observed in all measurement groups. Especially Romidepsin, Gemcitabine, and Temsirolimus were highly enriched. As an interesting example, mTOR inhibitor Temsirolimus showed strong synergism with the androgen receptor antagonist drug Darolutamide in all cell lines (average ZIP-Score: 27.75, P<.0001).
Conclusions: This combinatorial drug screening identified synergistic drug-drug partners for the treatment of aggressive meningiomas. Further validation studies in patient-derived meningioma organoids are ongoing.

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628
Brain and Spine 4 (2024) 103668
Retrosigmoid Transhorizontal Approach: Presentation of 2 Cases

Kyriakos Papakonstantinou[1], Antonia Malli[1], Spyridon Theodoropoulos[1], Nikolaos Georgakoulias[1]. [1] *General Hospital Of Athens "G. Gennimatas", Athens, Greece*

Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM
Background: The retrosigmoid trans-horizontal approach is a recognized approach to lateral brainstem lesions such as cavernous malformations. In this study, we present 2 patients with lesions located in the middle cerebellar peduncle, who underwent this approach.
Methods: The first patient, 67 years old female presented in our department due to gait disturbance and vertigo. The MRI revealed a cavernous malformation located in the right middle cerebellar peduncle. The second patient, 59 years old male, presented with mild cerebellar ataxia and gait disturbance. The MRI revealed a left middle cerebellar peduncle medulloblastoma.
Results: Both patients underwent a typical retrosigmoid craniotomy under park bench position. After careful exposure of the sigmoid sinus and gentle cerebellar retraction, the horizontal fissure was recognized and carefully dissected. Opening of the fissure led to identification of the middle cerebellar peduncle and the lesions. Both lesions were totally removed. The postoperative period of the patients was uneventful, only with mild cerebellar symptoms and transient nystagmus that gradually resolved. The female patient developed a transient facial nerve palsy immediately after surgery, that resolved over a month.
Conclusions: The retrosigmoid trans-horizontal approach is a safe approach that needs to be considered for brainstem lesions or lesions located in cerebellar peduncles, that offers a direct route to the target as well as minimal retraction.

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1172
Brain and Spine 4 (2024) 103669
Clinical Characteristics and Prognosis of Polymorphous Low-Grade Neuroepithelial Tumor of the Young (PLNTY)

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM
Background: Polymorphous Low-Grade Neuroepithelial Tumor of the Young (PLNTY) is a rare low-grade neuroepithelial tumor with limited understanding to date. This study aims to investigate the imaging and histopathological features, treatment, and prognosis of patients with PLNTY.
Methods: Ten cases diagnosed with PLNTY from January 2016 to April 2020 at the Department of Neurosurgery, Changhai and Changzheng Hospitals were collected. Clinical characteristics, imaging manifestations, histological morphology, molecular genetic features, treatment plans, and overall or progression-free survival times were observed, recorded, and reviewed alongside the literature.
Results: Among ten patients (six males and four females, aged 13-58 years), the main symptoms were epileptic seizures and dizziness, with a disease course of less than one year. Imaging showed brain parenchymal occupying lesions located in the parietal, temporal, and frontal lobes. Under the microscope, the tumors showed characteristic oligodendroglioma-like components, often with calcification. Immunohistochemistry showed diffuse strong positivity for CD34 and positive expression of GFAP, Olig2, and ATRX, with a Ki-67 index <3%. Molecular tests indicated IDH1 wild type, no 1p/19q co-deletion, unmethylated MGMT promoter, with BRAF V600E mutation or FGFR gene fusion in most cases, and one case had TERT promoter mutation. All patients underwent complete surgical resection, with one receiving concurrent chemoradiotherapy and adjuvant TMZ chemotherapy. During 14-65 months of follow-up, three patients experienced tumor progression or recurrence, while seven remained in good condition.
Conclusions: PLNTY shows variable imaging characteristics, with diagnosis dependent on histopathological examination and differentiation from oligodendroglioma. Although some studies categorize PLNTY as equivalent to WHO Grade I tumors, indicating a good prognosis post-complete resection, some PLNTY cases may still rapidly progress to higher-grade gliomas, making precise molecular typing under molecular testing guidance crucial.

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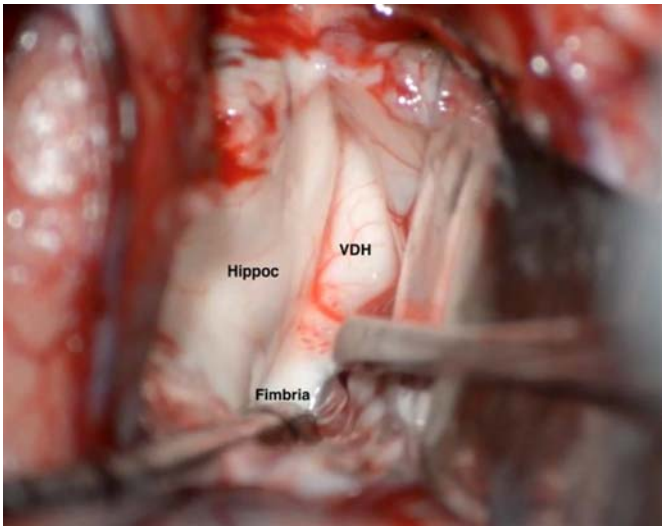
624
Brain and Spine 4 (2024) 103670
Vertical digitation of hippocampus: An intraventricular landmark to perform safe and enough amygdalohippocampectomies

Eduardo Seoane[1,2], Eduardo Seoane[1,2], Exequiel Verdier[2]. [1] *Hospital Ramos Mejia, Argentina;* [2] *Hospital El Cruce, Argentina*

Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM
Background: To perform amygdalohippocampectomies is necessary to enter the temporal horn. Different approaches have been described at this point to resect hippocampus and amygdala. We use the vertical digitation of hippocampus described by Duvernoy as a landmark to disconnect the amygdala from its deeper nucleus near to globus pallidus and resect the piriform area. This landmark, located at the uncal recess, forms the medial wall of the temporal horn anterior to the inferior choroidal point. Extraventricularly, it is related to the uncus at the semilunar gyrus, housing the cortical nucleus of the amygdala and the so called "area tempesta" in its surface. The area tempesta is the temporal part of the piriform lobe, lately implicated in the origin of the mesial temporal epilepsy. Resecting this vertical digitation of the hippocampus establishes the superior limit, avoiding damage to the globus pallidus and optic tract while ensuring effective amygdalar resection.
Methods: Three hundred consecutive patients were operated between 2002 to 2022 using this anatomical landmark. Outcomes were analyzed in terms of Engel's class and complications. After performing an anterior temporal lobectomy, temporal horn is entered, and the vertical digitation of hippocampus identified. After its resection the crural cistern is accessed through the semilunar gyrus which harbors the cortical nucleus of the amygdala and the cortex of the piriform area ("area tempesta"). From this point below the rest of the amygdala and the hippocampus is taken. Five cadaveric specimens were used to demonstrate the surgical anatomy and feasibility of this approach.
Results: The vertical digitation of hippocampus is the medial extension of hippocampal head's internal digitation. In its extraventricular aspect, this landmark is related to medial aspect of uncus at the semilunar gyrus with the piriform area cortex on its surface ("area tempesta"). The cortical nucleus of the amygdala is found inside the semilunar gyrus. In resecting this small structure, the superior resection limit is done. In all patients this intraventricular landmark was found, and it was sufficient to perform enough and safe amygdala's resection. Engel I was achieved in 79% (237 patients). One patient had postoperative hemiparesis who improved with rehabilitation , 8 patients had "aseptic" meningitis with no consequences and 5 patients had wound superficial infections.

Conclusions: A step by step useful intraventricular landmark is described to perform safe and enough amygdalohippocampectomies. Three hundred temporal lobectomies were analyzed in order to show that this could be a reproducible technique.

Optional Image



https://doi.org/10.1016/j.bas.2024.103670

100
Brain and Spine 4 (2024) 103671
Functional characterisation of the growth factor Midkine in glioma cells

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Gliomas are the most common primary brain tumours. Subtypes can be divided into 4 different grades, classified by the World Health Organisation according to their progressiveness. Glioblastoma represents the most aggressive subtype, classified as WHO grade 4, with an average life expectancy of approximately 15 months after diagnosis. Due to its high invasiveness and heterogeneity, this tumour remains difficult to treat and new therapeutic approaches are increasingly being sought. Midkine (Mdk) is a heparin-binding growth factor known to be positively correlated with progression and invasion of several tumour types, including glioblastoma, and negatively correlated with survival. In this study, we aim to investigate the potential use of Mdk not only as a biomarker to facilitate diagnosis and monitoring during therapy, but also as a promising target to improve therapy itself.

Methods: So far, we have used Western blotting to determine Mdk levels in 16 different primary glioma cultures and the following glioblastoma cell lines: U87, LN229, U251, F98, A172, U343 and GL261. We also performed XTT cell viability assays with LN229 and U251 treated with 0 nM, 500 nM or 1 µM iMDK (Mdk inhibitor) for 24, 48, 72 and 96 hours. To assess the effect of Mdk expression, we developed transfectants of U87, U251 and LN229. Since LN229 and U251 showed high levels of Mdk expression, we chose these cell lines for knockout, while we chose U87 (very low levels of Mdk expression) for overexpression. The cell lines were transfected with an Mdk-pIRES Venus overexpression vector and sgRNA against Mdk cloned in a pL-CRISPR.EFS.PAC vector. Subsequently, the transfected cells were selected with Puromycin or Neomycin.

Results: We were able to show that the different cell lines and primary cultures differ greatly in terms of Mdk protein level. Using the viability assay, we were also able to show that iMDK reduces cell growth in cell lines with initially high Mdk expression. With iMdk treatment, we observed a reduction in cell viability of glioblastoma cells up to 62.41% compared to the untreated cells after 96 hours of growth. In addition, an altered growth behaviour of the Mdk overexpression and knockout cells was detected.

Conclusions: The results presented suggest that Mdk promotes cell growth in glioblastoma cells and that its inhibition could reduce further progression of the disease. Its use as an additional therapeutic approach is promising and should be further investigated.

https://doi.org/10.1016/j.bas.2024.103671

327
Brain and Spine 4 (2024) 103672
Exploring differences in intracranial blood clearance after aneurysmal subarachnoid hemorrhage depending on the way of cerebrospinal fluid drainage

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: The intracranial blood burden is a known risk factor for secondary complications following aneurysmal subarachnoid hemorrhage (aSAH). Hence, enhancing blood clearance via a cerebrospinal fluid (CSF) drainage represents an approach to reduce the intracranial blood burden and ameliorate the morbidity after aSAH. This study was conducted to assess differences in blood clearance within the subarachnoid space and the ventricular system using different ways of CSF drainage.

Methods: A consecutive study cohort with aSAH treated at our center between 2010 and 2020 was retrospectively reviewed. Patients with available imaging within the first three days after ictus for the assessment of intracranial blood burden were included in the study. The blood amount within the subarachnoid space and the ventricular system were semiquantitatively evaluated applying the Hijdra score and the Le Roux score respectively. The way of CSF drainage (external ventricular drainage EVD or lumbar drainage LD) and the amount of drained CSF were documented within the first three days after ictus.

Results: A total of 290 patients met the inclusion criteria and were analyzed in the study. The mean age was 55.98 13.56. A CSF drainage via EVD only was performed in 32% (93/290), via LD only in 31% (91/290), and EVD + LD in 37% (106/290) of all patients. The mean total CSF drainage within 72 hours was significantly higher in the EVD + LD group (549.1 204.3 ml) compared to the groups with EVD only (434.3 216.2 ml) and LD only (440.3 216.6 ml), $p=0.0002$. The absolute reduction of the Hijdra score between day 1 and day 3 correlated positively with a CSF drainage via EVD + LD ($r=0.34$, $p<0.0001$), but there was a negative correlation with LD only ($r=-0.46$, $p<0.0001$). The absolute reduction of the Le Roux score between day 1 and day 3 also correlated positively with a CSF drainage via EVD + LD ($r=0.67$, $p<0.0001$), but there was a negative correlation with a CSF drainage via EDV only ($r=-0.43$, $p<0.0001$) and via LD only ($r=-0.27$, $p=0.0007$). CSF drainage with EVD + LD correlated significantly with ventricular peritoneal shunt ($r=0.14$, $p=0.04$).

Conclusions: A CSF drainage via EVD + LD within the first three days following aSAH led to the most enhanced blood clearance within the subarachnoid space as well as the ventricular system compared to EVD only or LD only. However, a CSF drainage via EVD + LD was also associated with the need for permanent CSF diversion via ventriculoperitoneal shunt.

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616
Brain and Spine 4 (2024) 103673
Hydrocortisone vs. dexamethasone in the prophylaxis of post-subarachnoid hemorrhage cerebral salt wasting syndrome

Leander Steger [1], Benoit Liquet [1], Kevin Agyemang [1], Moritz Freistühler [1], Antonio Di Ieva [1], Christian Ertmer [1], Walter Stummer [1], Eric Suero Molina [1]. [1] *University Hospital Münster, Germany*

Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: Cerebral salt wasting syndrome (CSW) leads to hyponatremia and is frequently observed in aneurysmal subarachnoid hemorrhage (SAH) patients. Although standards for the diagnosis "CSW" are controversial, it is known that CSW leads to excessive natriuresis and decreased extracellular fluids that result in hyponatremia and hypovolemia. Our findings demonstrate that hydrocortisone is an effective drug for the prevention of CSW-associated hyponatremia following

non-traumatic SAH and demonstrate its superiority to dexamethasone. In this retrospective study, we compare Hydrocortisone and Dexamethasone for the prophylaxis of CSW-associated hyponatremia after non-traumatic SAH.
Methods: In this retrospective cohort study, we analyzed data from 510 non-traumatic SAH patients admitted from October 2009 to December 2019. Hyponatremia was defined as blood sodium levels <130mmol/L. Patients treated with dexamethasone (N=188) and hydrocortisone (N=322) were included. We compared the incidence of hyponatremia (<130mmol/l) and CSW, as well as the influence of corticosteroid dose on both groups. Criteria for CSW diagnosis were defined as blood sodium levels <135 mmol/L and a simultaneous negative fluid balance on the same day.
Results: 87 patients (N=47, 25% dexamethasone patients and N=40, 12·4% hydrocortisone patients) developed hyponatremia (Na(s) <130 mmol/L). Patients received dexamethasone for a median of 9 days (IQR:5-15) and hydrocortisone for a median of 10 days (IQR: 8-12.75) with an average dose of 9·21 mg (± 4.32) dexamethasone per day and 114·27 mg (± 81.88) hydrocortisone per day. Of 510 patients, 203 (39.80%) (89 dexamethasone (47.34%) vs. 114 hydrocortisone patients (35.40%)) showed simultaneous negative fluid balance as well as hyponatremia (Na(s) <135 mmol/L) (p<0·05,OR:1·64,95%CI: 1.14, 2.37).
Conclusions: Our findings demonstrate that hydrocortisone is an effective drug for the prevention of CSW-associated hyponatremia following non-traumatic SAH and demonstrate its superiority to dexamethasone.

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788
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Role of coccygectomy in the treatment of chronic refractory coccygodynia. When and how.

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Coccygodynia refers to pain in the coccygeal region of the spine. Management strategies range from conservative measures to coccygectomy. Generally, coccygectomy yields good results, especially in patients who are refractory to conservative treatment. Its most common complication is wound infection.
A review of the literature on coccygectomy and our series of patients was performed to determine the role and effectiveness of coccygectomy in chronic refractory coccygodynia, we present a protocol for evaluation and treatment
Methods: A retrospective review of 21 patients (13 females and 8 males) that consulted for coccygodynia between January 2015 and June 2023 at the Spinal Unit of our center was carried out, and the outcomes were studied (measurements of pain relief and degree of patient satisfaction with the results). Patients had conservative therapeutic treatment for at least 6 months before undergoing coccygectomy, surgery was performed on eight patients (3 males and 5 females) . Five were identified with instability.
Results: Eight patients underwent coccygectomy following failed conservative management, the average age of patient was 42 years (range: 23–58 years), and the male to female ratio was 1:1.6, the median duration of symptoms prior to surgery was 16 months. Trauma, was identify in five patients (62.5%). The favorable result (excellent or good) were reported by seven patients (87.58%), one patient reported a fair outcome (12,5%). The mean VAS significantly improved from 7.5 preoperatively, to 1.5 ($P < 0.001$) three months postoperatively. There were one infection (12.5%).
Conclusions: Coccygectomy is an simple and effective treatment with a low complication rate for chronic refractory coccygodynia. Precaution must be taken to avoid wound infection. The study and treatment of patients should be institutionally protocolized.

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1440
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Intraoperative AI-based Analysis and Diagnosis of Intradural Extramedullary Spinal Tumors by Stimulated Raman Histology

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Intraoperative Stimulated Raman Histology (SRH) has been reported to be fast and accurate in the assessment of neurooncological lesions. However, the utility of SRH in spinal tumors, especially intradural extramedullary tumors (IDEM), is currently unknown. Surgical resection is the primary step in the treatment of most IDEM, but the surgical approach and aggressiveness may depend on the expected histopathological diagnosis. This study presents our findings on the use of AI for intraoperative analysis of SRH to distinguish among various spinal IDEM pathologies.
Methods: Between 2021 and 2023, intraoperative Stimulated Raman Histology (SRH) images from 46 patients were acquired using the NIO Laser Imaging System (Invenio Imaging Inc). Patients were assigned to separate training, validation and test datasets. We trained and tested different models based on the ResNet and Vision Transformer architectures for histopathological classification using definitive histopathological diagnoses as labels. Three diagnostic classes were created: “Meningioma”, “Schwannoma”, and “Other”.
Results: Our best model based on the ResNet-50 architecture was able to differentiate between schwannomas, meningiomas, and other spinal tumors with an accuracy of 100% in our test set.
Conclusions: This study shows the potential of the AI-based analysis of intraoperative SRH-images and the clinical application in neurosurgery. Our approach can discriminate between the most common intradural extramedullary lesions and demonstrates that AI- and SRH-based diagnosis can contribute to clinically meaningful surgical decision-making.

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595
Brain and Spine 4 (2024) 103676
Age-specific Clinical Results In Spinal Meningioma Surgery: Should We Still Consider Age Detrimental To Satisfactory Outcomes?

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Spinal meningiomas (SM) are relatively rare primary spinal neoplasms. The increasingly growing average age and number of elderly patients presenting with spinal neoplasms raises questions concerning the cost and the benefit of proposing surgical intervention. In this study, outcomes and complications of a large cohort of elderly patients affected by spinal meningiomas were analyzed to define the real benefit of surgery in this subgroup of patient.
Methods: A multicentric retrospective clinical study analyzed a cohort of patients with SM underwent surgical treatment, dividing this cohort into three groups according to their age: group A: patients under 50 years of age; group B: patients whose age was between 51 and 74; group C: patients over 75 years of age. Neurological and clinical outcomes (McCormick and Frankel scores), grade of resection, complications, histology, and possible recurrences were evaluated.
Results: The final cohort was composed of 156 patients (average age was 55.93±14.80). The average follow-up, was 41.5±11.4 months. Group A was

found to have a significantly higher Frankel score at follow-up though the remaining groups (B and C), presented no significant difference between their average scores. The number of patients who improved their preoperative neurological condition showed no significant difference between the subgroups; indeed, all subgroups benefited from surgical treatment with significant improvements in functional status and quality of life. Three recurrences were recorded, all in group A. Axial topography, level of the lesions and preoperative symptoms, including impairment of the sphincter functions proved no statistical interaction.

Conclusions: Elderly might not be a contraindication for surgery treatment in SMs, due to important improvements in functional status and quality of life in this subgroup of the population. Older patients can benefit from prompt assessment and early surgery in case of acute onset, with a complication rate not higher than in younger patients.

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1108
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Current state of spinal robotics – an AO Spine Survey

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Robotics in spine surgery has gained popularity in recent years since the indications and implementation tremendously expanded from pedicle screw instrumentation to surgical resection of the spinal column, augmentative procedures, and complex deformity and revision cases. We designed a survey to provide a landscape assessment regarding the adoption of robotics in spine surgery and to create educational awareness for this topic through the AO Spine regions.

Methods: AO spine members were invited to fill out a 27-question online questionnaire regarding the utilization of navigation and spinal robotics in practice between October 25th and November 13th, 2023. The survey was created using the SurveyMonkey platform (https://www.surveymonkey.com; SurveyMonkey Inc., San Mateo, CA, USA) and distributed by the AO Spine email platform and further promoted via social networks. All statistical analyses (descriptive statistics, Pearson Chi-Square tests) and generation of all graphs were performed using SPSS Version 29.0.1.0 (IBM SPSS Statistic).

Results: We received 424 responses from AO Spine members (response rate = 9.9 %). The participants were on average 43 10 years old and the majority stated to be board-certified orthopedic surgeons (46 %, n=195) or board-certified neurosurgeons (32%, n=136). Respondents from all continents and primarily university hospitals (49.5 %, n=210) or private hospitals/practices (28.5%, n=121) with most frequently an average rate of annual instrumentation procedures (48%, n=31-120 instrumentations/year) took part. While 42% of all participants (n=177) stated to place pedicle screws with navigation assistance, only 16 % (n=68) indicated the use of robotic assistance. Only 21 % (n=89) of all participants stated they had used a robot during a real patient procedure for spinal instrumentation in their departments with a significant difference based on the geographic origin of the respondents as most of the robotic users came from Europe, Asia & Arab countries, or North America (p=0.006). Further assessment revealed that only 11 % (n=47) of all surgeons use a spinal robot frequently (1-2x/week) while 5% (n=23) possess one but don't use it at all. Although 35 % (n=150) plan to acquire a robotic system in the future, a similar number of participants (36 %, n=153) stated they don't want/need one from a current perspective. On the question of why they have not implemented a spinal robot in their department yet, most participants (77%, n=301) stated that high acquisition costs are a major issue while further most common reasons were insufficient benefit of spinal robots (28%, n=109) and high enough precision of spinal navigation systems (20%, n=79). Although most robotic users believe that robots increase precision during instrumentation procedures (69%, n=55) and that they are useful tools (72%, n=57), they could not indicate a clear benefit regarding the reduction of intraoperative complications (54%, n=43) and increase in surgical efficiency (43%, n=34). Most respondents believe robotics might make an impact on the outcome in minimally invasive surgery (67%, n=264), adult (62%, n=244), or pediatric (50 %, n=196) deformities. Future innovations, which most respondents (70%, n=271) wished for were primarily more integrated surgical options and the integration of artificial intelligence (55%, n=211). Most surgeons (43 %, n=166) stated they would consider a shared company investment with guaranteed use of implants or other products by the hospital as an investment option to acquire a robotic system.

Conclusions: Although the hype for robotics recently increased, it still appears that robotic systems are not standard equipment for spine surgeons due to high acquisition costs and limited usability. Further developments appear to be mandatory to justify a broader utilization.

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109
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Exploring the Gut Microbiome and Mycobiome in Glioblastoma Patients

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Glioblastoma (GBM), the predominant malignant brain tumor in adults, continues to pose significant clinical challenges, with a persistently poor prognosis despite aggressive therapeutic approaches. This study aims to unravel potential distinctions in the gut microbiome and mycobiome compositions between primary GBM patients and healthy control subjects.

Methods: In a prospective case-control study, we enrolled 23 GBM patients and 23 control participants. Rectal swabs were collected from GBM patients prior to surgery, and DNA extracted from these samples underwent 16S and ITS sequencing. Additionally, fluorescence in situ hybridization (FISH) analysis, employing universal eukaryotic and fungal probes, was performed on GBM sections.

Results: Preliminary results illuminate intriguing variations in the microbiome and mycobiome profiles between GBM patients and their healthy counterparts. Notably, GBM patients exhibited lower abundance of Bacteroidaceae and Lachnospiraceae, while higher levels of Candida and Cryptococcus were observed compared to the control group. FISH analysis did not reveal the presence of bacteria or fungi in GBM sections.

Conclusions: These preliminary findings offer valuable insights into the distinctive microbiome landscape in GBM patients, shedding light on microbial and fungal imbalances that may play a role in the pathogenesis of this aggressive brain tumor. The observed alterations in microbial composition could potentially influence therapeutic strategies, as identifying key microbial players may open avenues for novel treatment modalities aimed at improving clinical outcomes for GBM patients.

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952
Brain and Spine 4 (2024) 103679
Embolization of Middle Meningeal Artery in Patients with Chronic Subdural Hematoma: a Monocentric Experience

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: The endovascular treatment of middle meningeal artery (MMAe) for Chronic Subdural Hematoma (cSDH) is undergoing analysis of efficacy and effectiveness with several trials. Many series reported satisfactory results in terms of recurrence. Debated issue is the definition of effectiveness in terms of

radiological or clinical results. An overall rate of failure as recurrence is reported about 5%. The primary endpoint of this study is to estimate the effectiveness in terms of decreasing of the hematoma thickness, while secondary endpoints are reduction of the midline shift, recurrences and complications rate such as acute bleeding, acute thrombosis. The percentage of patients with clinical improvement at 3-days and 1-month follow-up after embolization was also estimated.
Methods: The retrospective study included 50 patients who underwent MMAe for cSDH from July 2020 to October 2023. The embolizations included were either primary or secondary to surgery or previous embolization. Clinical and radiological follow-up data were included, either pre and post procedural. In the CT scans performed, hematoma thickness and midline shift were observed, as well as the presence of bilaterality and collection density.
Results: 2 patients were excluded because they had too short follow-up time. Among the remaining patients, 38 were male, 12 were female. The mean age was 75y. There were 24 primary and 26 secondary embolizations. Primary statistical analysis showed correlation between thickness reduction on CT 3 months after embolization. Secondary analysis showed correlation between midline reduction 3 months after embolization with lower incidence of postoperative complications and greater clinical improvement. The percentage of patients undergoing retreatment is 8%, while a percentage of 90.9% showed clinical improvement.
Conclusions: MMAe in selected patients with cSDH could be proposed as safe procedure. Improvements of radiological features can relate to clinical improvement. The future results of ongoing trials can better explore further indications for this procedure.

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1333
Brain and Spine 4 (2024) 103680
Comparison of Outcomes and Recurrence Rates in Patients Undergoing Single or Double Burr Hole Surgery for the Treatment of Chronic Subdural Hematoma

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Chronic subdural hematoma (CSDH) is a very common disease of elderly patients in treated by neurosurgeons, with incidence is in general population between 8.2 to 17.6/100 000/ year, with the triple incidence among patients older than 80 years. One of the most common complications of the surgery of CSDH is the recurrence which is reported from 0 to 30% in different studies.
Methods: A retrospective study was conducted on patients treated for CSDH between January 2018 and December 2022. The diagnosis of CSDH was confirmed through preoperative CT or MRI of the brain. Patients underwent either single or double burr hole surgery based on the neurosurgeon's decision. Preoperative and postoperative brain CT scans, along with clinical outcomes, were analyzed.
Results: A total of 88 patients were included in the study, with 102 burr hole surgeries performed. Among these, 49 patients received single burr hole surgery, while 53 patients underwent double burr hole surgery. Recurrence of CSDH occurred in 8.8% of cases, with no significant difference observed between the groups. Of note, single burr hole surgery demonstrated comparable efficacy to double burr hole surgery in terms of subdural reduction and occurrence of pneumocephalus, while exhibiting fewer complications and shorter hospitalization.
Conclusions: Single burr hole surgery for CSDH is an effective intervention, showing comparable outcomes in terms of subdural reduction and pneumocephalus occurrence compared to double burr hole surgery. Additionally, it is associated with fewer complications and shorter hospital stays.

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1428
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Re-Resection For Recurrent Glioblastoma – Does Timing Matter?

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM
Background: Surgery for recurrent glioblastoma (GBM) offers potential for prolonged patient survival, but the optimal timing of re-resection after tumor suspicion and its effects on post-surgical outcomes remain unclear.
Methods: A retrospective analysis was conducted on patients undergoing first re-resection for recurrent WHO grade 4 IDH-wildtype GBM. Post-surgical neurological deterioration and survival outcomes were compared between patients undergoing early surgery (within 3 weeks) after suspected recurrence and those receiving surgery later than three weeks. Volumetric analyses were utilized to assess tumor burden and location.
Results: The study comprised 103 consecutive patients (mean age: 59 years; 64 males and 39 females) undergoing first re-resection for recurrent GBM from 2018 to 2022. Gross total resection (GTR) was achieved in 93 patients (91%) at initial diagnosis and in 96 patients (93%) at repeat surgery. Intraoperative MRI-guided resection was performed in 84 (82%) cases, with 5-ALA applied in 8 (8%) cases and neuromonitoring used in 14 (14%) cases. The median time interval between first and second resection was 341 days (IQR 343 days), while the median time interval between suspected tumor recurrence and re-resection was 20 days (IQR 23 days). Surgery was delayed beyond 3 weeks after suspected recurrence in 49 cases, primarily due to salvage chemotherapy/targeted therapy, suspicion of pseudo-progression, or patient preference. Delayed surgery did not correlate with increased rates of immediate or permanent post-operative neurological deterioration. Median survival after repeat surgery was 220 days, with no significant difference between early and late surgery groups. Volumetric analyses showed no significant differences in tumor volume or eloquence between patients receiving early or late surgery.
Conclusions: Timing of surgery for suspected first recurrence of GBM did not affect functional outcomes or post-surgical survival. Satisfactory rates of post-operative neurological deficits and survival were achieved in this contemporary cohort of patients undergoing repeat surgery for recurrent GBM.

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589
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The Influence of Frailty score on the treatment of Glioblastoma patients: Insights from a Retrospective Multicenter Analysis

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM
Background: Frailty is defined as a condition marked by diminished physiological capacity and a decreased ability to withstand stressors, resulting from the cumulative decline associated with aging. It is linked to a higher likelihood of illness and serves as a significant indicator of the risk of death. Few data show the relationship of frailty with adverse outcomes and survival after elective craniotomy. Limited evidence exists on how frailty impacts negative outcomes and survival rates following elective craniotomy in case of Glioblastoma. It is crucial to pinpoint risk factors that identify patients at a higher risk for complications or death during and after surgery to guide surgical choices and subsequent

radiotherapy and chemotherapy treatments effectively.
Methods: This multicenter study conducts a retrospective analysis on a cohort of 675 patients who underwent elective craniotomy for glioblastoma from July 2013 to May 2022. The degree of frailty was measured using a frailty index established by conventional methods, encompassing factors such as diabetes, chronic obstructive pulmonary disease, congestive heart failure, hypertension, stroke with neurological deficit, renal insufficiency, use of antiplatelet medications, liver condition and other tumors. Patients were categorized into non-frail (with a score of $\leq$2) and moderately to severely frail (with a score of $\geq$3). Kaplan-Meier estimates and multivariable Cox proportional hazard models were used to evaluate the prognostic value adjusted for clinically relevant variables, including age, the average duration of hospital stay, volume of tumor and Karnofsky Performance Status (KPS) scores before and after surgery, Ki-67 levels, and American Society of Anesthesiologists (ASA) scores.
Results: The median follow-up period after the surgery spanned about 50 months. The median participant age was 64 years, (SD: 11.23). Among the patients, 575 (85%) were classified as non-frail, while 100 (15%) fell into the moderately to severely frail category. Statistical analyses revealed significant differences between the two groups in pre and post KPS. However, the change in KPS (ΔKPS) did not display a statistically significant difference. Subsequent Cox regression analysis underscored a significant association between survival and age (HR, 0.94; p-value, 0.004), pre and post-operative tumor volume (HR, 1.02, p-value 0.01; and HR, 0.97, p-value 0.02, respectively) and ASA scores (HR, 2.73, p-value 0.01). In contrast, no significant correlation was identified between frailty, pre and post-KPS, and hospital stay duration.
Conclusions: Results suggest that, although patients identified as frail may begin with a lower functional status, their capacity for functional improvement or decline following surgery mirrors that of non-frail patients. Indeed, our multivariate analysis revealed that the frailty score does not impact survival or KPS outcomes directly. Instead, other factors such as age at diagnosis, ASA and pre- and post-operative tumor volume have a discernible impact on survival. This underscores the critical need for a comprehensive evaluation of the patient, considering multiple variables beyond frailty alone. We should improve “fragile” patient planning in pre-operative management and post-operative care protocols and determine «long-term consequences» of surgery. Updating this data could define a more effective clinical practice. Finally, we will be able to develop a novel frailty score capable of predicting mortality and severe morbidity outcomes after neurosurgical treatment.

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638
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Collagen autofluorescence in surgery for spinal extradural suspected malignancies

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Intraoperative light microscopy at a peak wavelength of 400nm (blue) induces autofluorescence of collagen in connective tissue. Here, we retrospectively analyze properties of intraoperative white and blue light microphotographs and histological findings in a single-center cohort of patients who received surgery for spinal extradural suspected malignancies.
Methods: 8 patients (2 male, age: 56-85 (mean: 73) years) were included. Tumors comprised adenocarcinoma of unknown primary (n=1), breast cancer (n=2), esophageal cancer (n=1), lymphoma (n=1), prostate cancer (n=2), and renal cell carcinoma (RCC, n=1). Approaches to the lesions included hemilaminectomy (n=3), laminectomy (n=4), and resection of a spinous process (n=1). No fluorescent agent was administered. Extent of resection was based on intraoperative white light microscopy, using a ZEISS Pentero 800 S surgical microscope. White and blue (peak wavelength 400nm) light microphotographs were taken intraoperatively with the same microscope. Image registration, segmentation and histogram analyses were performed with MATLAB R2023b. Image contrast was calculated according to Michelson’s formula. Paired sample t served as statistical test, with p values less than 0.05 considered significant.
Results: In 7 patients, extradural lesions of the spine showed collagen autofluorescence void and were histologically confirmed neoplastic. In the remaining patient, who had received irradiation of the spine and immunotherapy for RCC prior to spinal surgery, an extradural mass lesion that had caused intractable pain showed collagen autofluorescence void while histologically deemed non-neoplastic. Intraoperative blue light microscopy detected connective tissue at significantly higher contrast ($p = 0.020$) but significantly lower image intensity ($p = 0.033$, and less) as compared to white light microscopy.
Conclusions: Intraoperative blue light microscopy detects connective tissue at higher contrast but lower image intensity as compared to white light microscopy. Collagen autofluorescence void may occur in histologically confirmed neoplastic lesions as well as in lesions which, following irradiation or immunotherapy, do not contain vital tumor cells at the time of surgery.

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1165
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The Role Of Amantadine In Traumatic Brain Injury. A Systematic Review

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Traumatic Brain Injury (TBI) is a leading cause of death and disability worldwide with major socioeconomic impact. Management of this condition requires continuous awareness to minimize its consequences and improve patients’ quality of life. Amantadine (AMA) is a pharmaceutical agent with multiple but poorly understood mechanisms of action especially in TBI. It is considered to act mainly as an NMDA receptor antagonist and it is involved in several presynaptic and postsynaptic dopaminergic procedures. The aim of this study is to systematically analyze the current literature on the effects of AMA in TBI-patients.
Methods: A search was conducted in accordance with the PRISMA guidelines in PUBMED-MEDLINE and SCOPUS databases. The keywords were searched Amantadine, Trauma, Nervous System, Traumatic Brain Injury. Only studies in humans from the last decade written in English were included. Final assessment resulted in 57 articles entering the analysis.
Results: Posttraumatic administration of AMA in patients with TBI offers multiple benefits, resulting in improvement of the level of consciousness. Additionally, its use may reduce the severity and the possibility of the occurrence and extent of cognitive and behavioral disorders. Specifically, patients who received amantadine showed an improvement in functional recovery and reduced degree of disability based on various clinical severity and outcome scales (MMSE, DRS, GOS, FIM-cog, etc.). Nevertheless, a reasonable part of the current literature failed to demonstrate any efficacy of the medication and a minority of studies showed a negative impact of AMA administration. Adverse effects were rare, mostly dose-dependent, and were well-tolerated by the patients.
Conclusions: Current data supports the posttraumatic usage of AMA in TBI-patients with decreased level of consciousness, irritability, agitation and aggression. However, the information is insufficient to draw safe conclusions. Carefully designed prospective trials are needed to better understand the role and efficacy of AMA in TBI.

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1257
Brain and Spine 4 (2024) 103685
Short Segment Posterior Transpedicular Stabilization with Kyphoplasty at the Affected Level as an Alternative to Traditional Surgical Treatment of Spinal Metastases

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Surgical treatment of spinal metastasis is needed when spinal instability, neurologic deficit or severe pain are present. The goals of surgical treatment have shifted from total tumor resection to fast postoperative recovery followed by adjuvant therapy. Therefore, many new, less aggressive strategies

have been developed recently.
Methods: During the period 2018 – 2023, 30 patient (19 males and 11 females), diagnosed with potentially unstable (SINS 9-12) and unstable (SINS 12-18) spinal metastasis in the thoraco-lumbar spine, all with significant epidural compression (ESCC 1c-3), were operated on in our clinic by one surgical team.
Circumferential decompression of thecal sac and nerve roots was achieved in all of them. Traditional long segment posterior transpedicular stabilization was done in 13 cases (group A). For the rest 17 cases a short stabilization with 4 pedicle screws and kyphoplasty at the affected level was performed (Group B). Retrospective analysis conducted.
Results: The two groups were compared in terms of neurological improvement, median survival, postoperative drop in hemoglobin levels and need of hemotransfusion. Neurological status was evaluated pre- and postoperatively with Frankel score. All patients in both groups experienced pain relief and no decline in their Frankel score after surgery. The median survival time was 12 months for group A and 18 months for group B. The drop of hemoglobin levels on second postoperative day was 3,08g/dL in group A and 2,17g/dL in group B. Hemotransfusion was needed in 6 cases in group A and in only 1 case in group B.
Conclusions: Preserving neurological function and spinal stability, ambulation, pain control and quality of life are the goals of neurosurgical treatment of patients with spinal metastases. Short segment posterior transpedicular stabilization with kyphoplasty is a worthy alternative to traditional treatment. It provides fast recovery, less blood loss and a cost effective method of treatment of these patients.

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864
Brain and Spine 4 (2024) 103686
The Establishment and Initial Results of Whole Genome Sequencing Service for Meningiomas in a Single UK Centre

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Whole Genome Sequencing (WGS) is a pivotal investigation in the advent of molecular diagnostics for brain tumours, both for stratification of disease outcome but also for future recruitment to clinical trials of targeted treatments for meningioma.
Methods: We established a WGS service with the multidisciplinary team and recruited 39 participants undergoing neurosurgical treatment for meningioma in a tertiary neurosurgical centre of the United Kingdom.
Results: Of all cases, one sample failed analysis. Five were WHO grade II and three WHO grade III. Sixteen meningiomas (39%) were convexity in origin, twenty-two skull base (61%). The most common location was right frontal (7/38, 18%) followed by olfactory groove (6/38, 16%). Three meningiomas were recurrences. The most common identified pathogenic variant was in NF2 (15/38, 39%), and in all cases there was a classic loss of heterozygosity in chromosome 22q. In keeping with major molecular studies, there were two distinct groups of NF2-mutated meningioma where loss of chromosome 1p was present in all higher grades of these tumours (n=3/38, 8%). Other pathogenic variants detected include TRAF7 (n=6/38, 16%), AKT1 (4/38, 11%), and SMO (4/38, 11%). No pathogenic variant was detected in six tumours (16%). Of these hyperdiploidy was characteristic which warrants further investigation.
Conclusions: Whole genome sequencing provides an ideal platform to establish molecular stratification of patients clinically while providing a rich resource to explore mechanisms of tumourigenesis in cases without an identified recognised mutation in meningioma, which remains a significant proportion of reported cases. Our cohort serves as a validation of existing molecular classifications and demonstrate how WGS can be incorporated as part of routine clinical care in patients undergoing neurosurgical treatment of meningiom

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524
Brain and Spine 4 (2024) 103687
Minimally invasive posterior approach for surgical treatment of craniovertebral junction meningiomas: a single center experience

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Surgical treatment of extramedullary tumors affecting the region of the craniovertebral junction is one of the most difficult problems in modern neurosurgery. Despite the extensive and comprehensive development of this problem, a single universal approach to the surgical treatment of this nosology of neoplasms has not been formed.
Methods: At the Burdenko Neurosurgical Center in the period from 2016 to 2021, 61 patients (13 men, 48 women) underwent surgical removal of meningiomas of the craniovertebral junction. The mean age of the patients was 58 years (40-66 years). The patients were divided into 2 groups: group I consisted of 32 patients operated on with the classical open surgical approach; Group II consisted of 29 patients operated on with a minimally invasive surgical approach. The Frenkel, Karnofsky, VAS, neurological status and control MRI scales were used to assess patient outcomes.
Results: Patients in group II postoperatively had lower VAS scores (average difference between groups was 4 points), lower need for postoperative analgesia, shorter hospital stay (average hospital stay for group I - 6 days, for group II - 3 days) with a similar percentage of radical removal and Frenkel scale indicators.
Conclusions: Minimally invasive surgical approach in the treatment of craniovertebral junction meningiomas allows for complete tumor resection with lower intraoperative soft tissue and muscle trauma based on postoperative MRI findings, lower postoperative pain, lower analgesic consumption, and shorter hospital stay compared to classical open surgery.

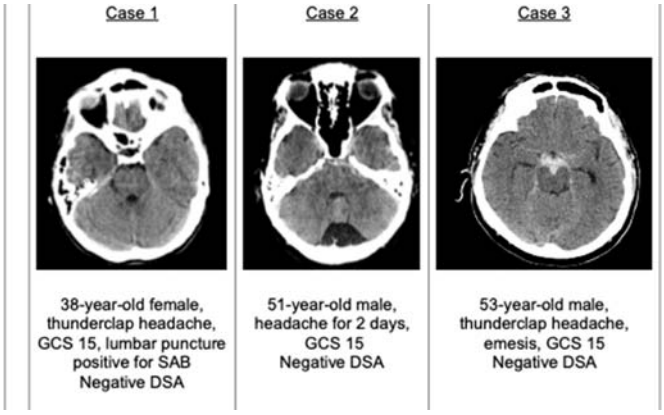
https://doi.org/10.1016/j.bas.2024.103687

376
Brain and Spine 4 (2024) 103688
Management of perimesencephalic non-aneurysmal subarachnoid hemorrhage: results of an EANS survey

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Based on the current guidelines, there is no clear consensus on best clinical management modalities concerning cerebral vasospasm prophylaxis (CVP) and follow-up imaging for perimesencephalic non-aneurysmal subarachnoid hemorrhage (NASAH). This survey aims to evaluate the incidence of NASAH patients treated annually as well as the estimated complication rate.
Methods: The survey was conducted on an online platform and distributed through the Vascular Section of the European Association of Neurosurgical Societies (EANS). General information about the hospital, the employees' status and the NASAH patients' treatment were gathered. Encompassing three clinical vignettes of NASAH with the initial CT-scans, questioning the in-hospital treatment including initial observation, blood pressure management, CVP and the need for digital subtraction angiography (DSA). The case vignettes are depicted in picture 1.
Results: Thirty-two questionnaires were answered from eighteen different countries. Most questionnaires were filled out by departments located in Italy (n=6; 18.8%) and Greece (n=4; 12.5%), followed by the United Kingdom (n=3; 9.4%). The answers were most often provided from employees of University Hospitals (n=27; 84.4%). Nearly half of the departments reported an annual caseload of more than 2000 patients (n=14; 43.7%), whereof the remaining n=18 reported annual caseloads less than 2000 patients (56.3%). Up to five NASAH cases annually were reported by n=10 (31.3%), another 12 (37.4%) treat more than 20 cases in the same time period. In case of a negative DSA, a second one is performed in most of the centers (n=25; 78.1%). With regard to the three different case studies, most centers admit their patients (case 1) to the regular ward (n=17, 51.5%), while only n=9 (27.3%) in the third case. Non-invasive

blood pressure management is performed in n=24 (72.7%) in the first case, compared to n=18 (54.5%) in the third. In the third case, most centers perform a CVP (n=15; 45.5%), in comparison to n=8 (24.2%) in the first case.
Conclusions: This study confirms the inconclusive treatment of NASAH throughout the EANS members. Furthermore, it depicts that the amount of hyperdensity in the first native CT scan influences the treatment decision. However, clear intercontinental differences cannot be worked out based on the low numbers.
Optional Image



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166
Brain and Spine 4 (2024) 103689
Clip-first policy in aneurysmal subarachnoid hemorrhage – an European center experience

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Aneurysmal subarachnoid hemorrhage (aSAH) is a devastating disease. Mortality still reaches 35% in some contemporary series. Since the publication of ISAT, there has been a shift in treatment paradigm, with most centers preferring a "coil-first" policy. Although ISAT evaluated a select cohort of aSAH patients, the generalization of its results spread well beyond its supporting evidence. BRAT was the largest single-center study to compare endovascular treatment to surgical clipping and found no differences in functional outcome. Centro Hospitalar Universitário Santo António has a "clip-first" policy in aSAH treatment. Our purpose was to evaluate our functional outcomes and compare both treatments with the reported literature.
Methods: We reviewed all surgically treated aSAH patients between 2015 and April 2023. Patients treated by endovascular coiling were also reviewed between 2019 and April 2023. Primary outcome was functional status at 6 months. Good outcome was considered for patients with a modified Rankin scale ≤ 2.
Results: 194 patients were submitted to aneurysm clipping. Good outcome was observed in 71.9% of patients at 6 months. This result is similar to ISAT and BRAT reported outcomes. Between 2019 and the present time, surgical clipping was favored in 70% of aSAH patients. Patients in the endovascular treatment group were older (63.7 years vs 55.9 years) ($p = 0.007$), but pre-morbid functional status was comparable between the 2 groups, as well as WFNS score at admission. Posterior circulation aneurysms were preferentially assigned to endovascular treatment ($p = 0.002$). Functional outcome at 6 months showed no differences between endovascular and surgical treatments ($p = 0.571$).
Conclusions: Clip-vs-coil is an unsettled question, despite the ever-increasing tendency to favor endovascular treatment. As durability of treatment is becoming increasingly important in decision-making, a multidisciplinary team including elements with microsurgical capabilities should discuss all aSAH patients to provide patients with the best possible treatment.

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341
Brain and Spine 4 (2024) 103690
Clinical outcomes of cervical spine chordoma: a multicenter retrospective study in the Republic of Korea

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Chordoma in the cervical spine is a rare malignant tumor. Compared to the sacral or clival chordoma, cervical spine chordoma poses several major surgical challenges in dealing with verterbral artery and spinal cord. The purpose of this study is to review the outcomes of patients with cervical spine chordoma.
Methods: This study is a multicenter retrospective study involving five largest tertiary referral hospitals in the Republic of Korea. We analyzed the oncologic outcomes of 45 patients who underwent surgery, radiation, or proton therapy for cervical spine chordoma from January 1998 to March 2023.
Results: The mean age of the patients was 46.4 $\pm$ 22.0 years, with 30 males (66.7%). The mean No. of vertebrae involved was 2 (range, 2 to 3). Maximal tumor diameter was 3.9 1.7 cm. (mean SD). GTR was achieved in 14 (2 en-bloc and 12 intralesional). There were 6 operative complications (13.3%). The mean follow-up period was 52.0 months (range, 31.6 to 88.2). At the last follow-up, 36 (80%) were in a stable condition and 9 (20%) were in a progressive status. Local recurrence occurred in 21 patients (46.7%) after initial treatment, and the median progression-free survival (PFS) was 28.6 months. The factor influencing local recurrence was surgery and adjuvant therapy (HR 0.31, $P = .018$). Overall survival was a median of 58.7 months, and the factors influencing OS were higher age (HR 1.05, $P = .009$) and presence of distant metastasis (HR4.30, P=.041).
Conclusions: For the local control of cervical spine chordoma, receiving adjuvant therapy after surgery is important, while increasing age and presence of distant metastasis are significant unfavorable factors affecting overall survival.

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746
Brain and Spine 4 (2024) 103691
The Cellular Composition of Chronic Subdural Hematoma

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: The pathophysiology of chronic subdural hematoma (CSDH) remains to be fully understood. Basic knowledge of the composition and features of cells in the CSDH fluid may contribute to the understanding of the seemingly complex processes involved in CSDH formation and recurrence.
With this study, we identified the composition of cells and of cellular features in both systemic blood and subdural fluid from CSDH patients. We hypothesized that the cellular composition and features in the hematoma fluid may be; 1) different from that in the systemic blood; 2) different between patients with and without recurrence; 3) and different between the first and second operation in patients with recurrent CSDH.
Methods: Systemic blood and subdural hematoma fluid were collected from CSDH patients with and without recurrent CSDH at the time of primary and secondary surgery. Analyses of cells and cellular features included total number of white blood cells, erythroblasts, reticulocytes, platelets, neutrophilocytes, lymphocytes, monocytes, eosinophils, basophils, reticulocytes, immature granulocytes, mean corpuscular cell volume (MCV), mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, hemoglobin and hematocrit.
Results: Of the 85 included patients, 20 patients were operated for a recurrent

CSDH within 90 days follow-up. All cells found in the systemic blood were present in the CSDH fluid, but the composition was different ($p<0.0001$). MCV was higher in the hematoma fluid from the primary operation of patients later developing a recurrent CSDH compared to patients not developing recurrence ($p=0.009$). Also, the percentage distribution of inflammatory cells in hematoma fluid from patients with recurrent CSDH was different between the first and second operation ($p=0.0017$).
Conclusions: This study is the first to investigate the cellular composition of CSDH fluid. Compared to systemic blood and to a reference distribution, an increased number of immune cells were present in the hematoma fluid, supporting an inflammatory component of the CSDH pathophysiology. MCV was higher in the subdural fluid at time of the first operation of CSDH patients later developing recurrence. CSDH fluid may therefore provide useful clinical information, but our results should be confirmed in a larger cohort before routine use.

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148
Brain and Spine 4 (2024) 103692
Vitamin D deficiency in German hospital patients with aneurysmal subarachnoid hemorrhage and traumatic brain injury

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Inflammatory processes lead to the development and rupture of intracranial aneurysms. Vitamin D has shown to attenuate neuroinflammation. The aim of this study was to assess the prevalence of vitamin D deficiency in hospitalized German patients with aneurysmal subarachnoid hemorrhage (aSAH) vs. a control group consisting of patients with traumatic brain injury (TBI).
Methods: We included patients diagnosed with aSAH (ICD-10 I60) and TBI (ICD-10 S06). Data about vitamin D deficiency (ICD-10 E55) in both disease groups were collected. In a subgroup analysis, we distinguished between children and adolescents (<20 years), adults and elderly (>65 years). Data were obtained from the German Federal Statistical Office (DeStatis) and covered all hospitalized and discharged patients with the respective diagnoses in Germany during the time period between January 1st and December 31st, 2022.
Results: 16,835 aSAH patients and 309,598 TBI patients were admitted in the one-year study period. The prevalence of Vitamin D deficiency was 2.07 % in aSAH patients vs. 1.23 % in TBI patients (OR=1.70, confidence intervals(CI)= 1.52-1.90). The prevalence of Vitamin D deficiency in children was 0% in aSAH vs. 0.04 % in TBI (OR infinite with zero cases/Haldane-corrected OR≈11.97, CI≈0.73-197.03), in adults 1.3 % in aSAH vs. 0.29% in TBI (OR=4.47, CI=3.43-5.81) and in elderly 2.4% in aSAH vs. 2.19% in TBI (OR=1.10, CI=0.97-1.25).
Conclusions: The prevalence of Vitamin D deficiency was distinctly higher in aSAH than TBI patients, especially in adult and elderly subgroups.

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560
Brain and Spine 4 (2024) 103693
Quantification of Microvascular Perfusion in Patients with Aneurysmal Subarachnoid Hemorrhage Using Standard Angiography Datasets

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Aneurysmal subarachnoid hemorrhage (aSAH) causes micro- and macrovascular spasms, resulting in impaired cerebral perfusion and, ultimately, delayed cerebral ischemia. However, microcirculatory changes cannot be easily detected in SAH patients. Our aim was to develop an algorithm for quantifying microvascular perfusion using standard angiography datasets.
Methods: Patients treated for aneurysmal subarachnoid hemorrhage between 05/2019 and 02/2023 and matched healthy controls were included. DSA datasets were post-processed using a custom-made MATLAB-algorithm. After generation of time-density curves, parameters reflecting different aspects of microvascular perfusion were analyzed in 21 regions of interest (ROIs), with focus on peripheral cortex areas reflecting microcirculatory blood flow. Time-to-peak (TTP), relative TTP (rTTP), area under the curve (AUC), full width at half maximum (FWHM), and maximal slope of wash-in and wash-out (MS) were calculated and correlated with clinical parameters.
Results: FWHM, MS, rTTP, TTP were significantly different between aSAH and control-patients. FWHM was significantly larger in the aSAH-group in both hemispheres in all peripheral ROIs (e. g. M4_2 ROI: 3.8 0.7 vs. 5.5 1.9 ms in aSAH patients; $p<0.0001$), indicating reduced blood flow due to microvascular dysfunction. The changes observed were more pronounced with increasing hemorrhage severity (by WFNS ($r=0.1814$, $p=0.002$)).
Conclusions: Quantification of microcirculatory blood flow in SAH patients is feasible using standard DSA datasets. Several parameters reflecting different nuances of parenchymal/microvascular blood flow were significantly different between SAH and non-SAH patients. FWHM seems to be the most sensitive angiographic marker. Larger cohorts are currently investigated to further assess clinical and therapeutical implications of these findings.

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662
Brain and Spine 4 (2024) 103694
Acute Subdural Hematoma in adults over 75 years: craniotomy in the acute phase versus trephination after hematoma chronification

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Acute subdural hematomas (HSDA) are an increasing pathology in the elderly, and it remains controversial whether it will be more beneficial to a conservative approach until the hematoma becomes chronic performing trepanation or immediately for a craniotomy in the acute phase. Therefore, it becomes essential to compare these surgical techniques to predict which one translates into a better outcome in elderly patients.
Methods: Eighty-two patients who underwent evacuation of HSDA at Hospital de Braga, between 2016 and 2018, were retrospectively studied and categorized into two subgroups according to whether they underwent craniotomy in the acute phase (Group C) or trephination after chronification (Group T). These subgroups were compared regarding demographic, clinical, and imaging data, as well as using the assessment of complications resulting from surgery, medical complications during hospitalization, and application of the Glasgow Outcome Scale (GOS) after discharge.
Results: The occurrence of surgical complications differed significantly between the groups ($p<0.001$), as well as in-hospital mortality ($p=0.002$), with Group C having a higher frequency of both complications and deaths. On the other hand, the prevalence of medical complications during hospitalization and the assessment of GOS in the follow-up after discharge at 3, 6, and 12 months post-operatively did not show significant differences between the groups.
Conclusions: Trepanation after hematoma chronification proved to be the surgery with the best short-term outcome in terms of complications resulting from the surgery and in-hospital mortality. However, it was concluded that the long-term assessment using the GOS did not differ significantly between the groups.

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140
Brain and Spine 4 (2024) 103695
Plasma nitric oxide synthase 3 (NOS3), nicotinamide adenine dinucleotide phosphate (NADPH) and 8-iso-prostaglandin F2α improve accuracy in delayed cerebral ischemia (DCI) diagnosis.

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: The pathophysiology of delayed cerebral ischemia (DCI) remains unknown. Lack of an appropriate diagnostic tool increases the probability of delayed diagnosis, and postpones treatment. We assessed the relationship between 8-iso-prostaglandin F2α (F2-IsoPs), nitric oxide synthase 3 (NOS3) and nicotinamide adenine dinucleotide phosphate (NADPH), with DCI after aneurysmal subarachnoid haemorrhage (aSAH).

Methods: We assessed 65 patients for F2-IsoP, NOS3 and NADPH concentrations using commercial ELISA on days 2, 4, and 6 after aSAH. We examined the correlation between plasma F2-IsoP, NOS3 and NADPH concentrations and clinical variables with the DCI onset.

Results: High plasma concentrations of F2-IsoP on day 2 and NOS3 on day 6. as well as low concentrations of plasma NADPH on day 6 were strong laboratory predictors of DCI ($p<0.01$) Modified Fisher grade, Hunt-and-Hess grade and tobacco smoking were the important clinical predictors. In DCI patients, plasma F2-IsoP and NOS3 concentrations were higher, and NADPH concentrations were lower than in those without ($p < 0.01$). Plasma F2-IsoPs concentrations on day 2 and NADPH and NOS3 concentrations on day 6 correlated with DCI ($p < 0.01$).

Conclusions: DCI patients display decreased antioxidant capacity, as evident by the increased F2-IsoPs, and decreases NADPH concentrations. Testing F2-IsoPs, NOS3 and NADPH levels may be helpful in predicting DCI. More research should be done to determine the role of F2-IsoPs, NOS3 and NADPH in clinical practice and DCI pathophysiology.

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1392

Brain and Spine 4 (2024) 103696

The optimal timing for resection of intramedullary hemangioblastoma: Single Center Study of the impact on neurological outcome and quality of life

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Hemangioblastomas are among the third most common intramedullary benign neoplasms. Complete and safe resection is considered first-line therapy. Due to the benign nature and rarity of malignant transformation, the question arises as to which patients require surgical resection and how this affects neurological outcomes and quality of life.

Methods: We retrospectively analyzed the surgical outcomes for 27 patients treated at our neurosurgical department (between 2014-2022), to investigate potential risk factors influencing surgical outcome. Pre- and postoperative neurological status were classified according to the McCormick scale. Furthermore, we analyzed surgical quality indicators, such as length of hospital stay (LOS), 90-day readmissions, tumor size and surgical approach. Additionally, patients were asked to fill out the EQ-5D-3L questionnaire to assess their quality of life after surgery. For comparison of surgical timing patients were divided in two groups with McCormick Scale I and II (group 1) and McCormick Scale III and IV (group 2).

Results: Resection of hemangioblastoma in patients with no or minor neurological deficits (group 1) is associated with a favorable postoperative outcome and overall higher quality of life compared to patients who already suffer from severe neurological deficits (group 2; $p<0.001$). Von-Hippel-Lindau-Mutation (vHL) and subtotal-resection ($p<0.017$) had a significant negative influence on the neurological outcome. Moreover, group 1 had a significant shorter LOS (5.85 days) compared to group 2 (8.29 days, $p<0.022$).

Conclusions: Early surgical intervention prior to the development of severe neurological deficits may offer a better neurological outcome and quality of life.

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442

Brain and Spine 4 (2024) 103697

Elevated BDNF Levels in Glioblastoma Patients: Exploring the Impact on T Cell Function

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Glioblastoma (GBM) has a detrimental prognosis and no treatment to date has demonstrated long-term effectiveness. The success of immune checkpoint therapy in treating other immunogenic cancers brings hope for immune-based strategies, particularly for the long-term management of GBM. Therefore, a deep understanding of GBM's immunobiology is crucial for shifting towards an immunotherapy-focused treatment approach. Our objective was to uncover changes in the circulating immune profile of GBM patients relative to those with other brain tumors, aiming to pinpoint soluble immune markers that could serve as potential biomarkers and targets for therapy.

Methods: We conducted an analysis of 30 different immune markers in plasma of 208 participants, including primary and recurrent GBM, cerebral metastases, meningioma and healthy donors (HD), using bead-based multiplex immune assays. In a smaller subset, we employed a high-sensitivity discovery biomarker platform to assess an expanded set of 368 immunological markers. Furthermore, we conducted flow cytometry analysis out of peripheral blood mononuclear cells (PBMC).

Results: We detected a distinct immune signature of patients with GBM, which markedly differed from other brain tumors and defined by an increased prevalence of soluble immune checkpoint markers along with elevated levels of proinflammatory markers. Notably, we identified a specific subset of GBM patients that exhibited elevated levels of BDNF, alongside increased proinflammatory markers, immune checkpoints and vascular factors. Furthermore, GBM patients with higher levels of BDNF demonstrated a significantly shorter survival ($p=0.008$). Our proximity extension assay also revealed an upregulation of an additional 130 cytokines in the high BDNF cohort, which were associated with proinflammatory processes, as well as neuronal networking and cell metabolism. Additionally, flow cytometry of PBMCs from this subgroup showed significant alterations on surface markers regulating T activation.

Conclusions: In summary, we were able to delineate a specific immune profile of soluble markers in GBM patients, distinguishing them from those with other brain tumors and HDs. Furthermore, we identified a particular subset of GBM patients who exhibit higher levels of BDNF along proinflammatory markers and immune checkpoints. This distinct immunological profile not only affects survival rates in GBM patients but also demonstrates variations in immune response.

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173

Brain and Spine 4 (2024) 103698

Complication rate comparing two different EVDs: bolt-connected antimicrobial-impregnated catheter vs subcutaneous tunneled antibiotic-impregnated catheter.

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Strategies to minimize complications associated with external ventricular drainage (EVD) placement involve different protocols and catheter types (including those impregnated with antimicrobials and with different anchoring systems to the patient). This study aims to assess if catheters combining bolt-connected and antimicrobial impregnation (Silverline®) are associated with fewer complications than tunneled antibiotic-impregnated EVDs (Bactiseal®), since no study has compared them to date.

Methods: prospective single-center study including all Silverline® and

Bactiseal® EVD implantation procedures performed between January 2022 and January 2024. Infection, malposition, obstruction, hemorrhage, involuntary withdrawal and need for reinsertion of a new catheter will be analyzed, as well as possible risk factors for each complication. EVDs inserted due to an infectious pathology will be excluded for infection analysis to avoid bias.
Results: Seventy-six procedures were included (33 in the Silverline® cohort and 43 in the Bactiseal® cohort). No significant differences were observed between the two types of EVD, except for the obstruction rate, which was lower in the Silverline® cohort (p=0.009). When the overall complication rate was considered, the Silverline® catheters also showed superiority (p=0.029), although this was not associated with a greater need to reinsert a EVD after any of the complications. Hemorrhagic etiology (vascular or spontaneous) and the presence of cerebrospinal fluid fistula were identified as risk factors for infection.
Conclusions: The overall complication and obstruction rates were lower in the antimicrobial-impregnated and bolt-connected catheter cohort, in absence of a different need for drain reinsertion. Hemorrhagic etiology and concurrent cerebrospinal fluid fistula were identified as risk factors for infection.
Optional Image

VARIABLES	Bactiseal® Cohort (n = 43)	Silverline® Cohort (n = 33)	*p*	Odds Ratio (95% CI)
Infection [n (%)]	3 (7.50)	2 (6.67)	0.893	0.88 (0.14-5.63)
Hemorrhage [n (%)]	6 (13.95)	1 (3.03)	0.103	0.19 (0.02-1.69)
Obstruction [n (%)]	15 (34.88)	3 (9.09)	**0.009**	**0.19** (0.05-0.72)
Malposition [n (%)]	4 (9.30)	4 (12.12)	0.691	1.34 (0.31-5.83)
EVD pull-out [n (%)]	7 (16.28)	6 (18.18)	0.827	1.14 (0.35-3.79)
Overall complication [n (%)]	29 (67.44)	14 (42.42)	**0.029**	**0.36** (0.14-0.91)
EVD replacement [n (%)]	13 (30.23)	7 (21.21)	0.344	0.60 (0.21-1.73)

EVD: external ventricular drain; CI: confidence interval; **bold:** p<0.05

Table 1: Comparison of complication rates. Univariable analysis.

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66
Brain and Spine 4 (2024) 103699
Preoperative epilepsy is an independent predictive factor for overall survival in Glioblastoma patients - a Bi-Center Analysis of 597 patients

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM
Background: More than one-third of all glioblastoma patients develop epilepsy, which significantly increases the burden of an already devasting oncological disease. Since the introduction of the field of cancer neuroscience, increasing scientific evidence suggests that underlying altered neuronal activity may regulate the growth of glial malignancies through direct electrochemical synaptic communication, meaning that seizures can play a role in tumor growth. Here, we aim to determine if the occurrence of preoperative epilepsy influences patient survival, thereby offering a novel perspective in the understanding of glioblastoma patient management.
Methods: We conducted a retrospective analysis of a cohort comprising 597 patients diagnosed with primary IDH1-Wildtype Glioblastoma, who underwent surgical treatment in two neurosurgical centers. Relevant clinical data were extracted from the electronic medical records. The influence of epilepsy on overall survival was investigated in both univariate and multivariate analyses, incorporating prognostic factors such as MGMT status, extent of surgical resection (total resection, partial resection, and biopsy) and patient age.
Results: Preoperative epilepsy was observed in 190 of the patients (31.8%). The presence of MGMT promoter methylation was noted in 310 patients (53.9%). 438 patients (72.8%) received postoperative adjuvant treatment with a median overall survival of 15.6 months. The presence of preoperative epilepsy was associated with longer overall survival (p=0.012). A multivariate analysis including treatment modality, MGMT status, and neurosurgical center as covariate confirmed preoperative epilepsy as an independent predictor for longer overall survival (p=0.042). In the subgroup of patients, who underwent adjuvant treatment, preoperative epilepsy was again independent predictor for longer overall survival in both univariate (p=0.013) and multivariate (p=0.009) analyses, together with age, MGMT status, and extent of resection. No significant differences in outcomes were observed between the two treatment centers.
Conclusions: Our data confirm preoperative epilepsy as an independent predictor of overall survival in primary IDH1-Wildtype Glioblastoma patients. In the spotlight of cancer neuroscience, where neuronal activity and tumor behavior seem to interact, preoperative epilepsy may resemble in important clinical biomarker, potentially pointing at more personalized treatment strategies.

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843
Brain and Spine 4 (2024) 103700
Serum Procalcitonin in the diagnosis of pneumonia in the neurosurgical intensive care unit

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Procalcitonin (PCT) is an inflammatory blood marker associated with respiratory tract infections. An optimal cutoff value and its validity in the diagnosis of Hospital-Acquired Pneumonia (HAP) is controversial. This study investigates the utility of PCT in supporting the diagnosis of HAP in a neurosurgical intensive care unit (NICU).
Methods: In this single-center retrospective study, we evaluated patients with suspicion of HAP in our NICU from 01.01.2020 until 31.12.2022. A confirmed HAP diagnosis was based on a combination of clinical, biochemical, microbiological and radiological data. Inclusion criteria were serum PCT measurements taken for suspected HAP cases. Exclusions were patients whose PCT levels were measured >48 hours after HAP onset or for reasons unrelated to HAP. The optimal PCT cutoff value for confirmed HAP was calculated using a ROCC curve and Youden Index. The relationship between PCT levels above this cutoff value, chest imaging results and sputum culture findings with confirmed HAP was analyzed using chi-square tests.
Results: Among 2363 patients, 193 met inclusion and exclusion criteria, 45 (23.3%) of whom met our criteria for confirmed HAP. The optimal cutoff procalcitonin value was 0.095ng/ml, and is significantly associated with confirmed HAP (p<0.001), with a sensitivity of 89.2% and specificity of 93.3% yielding a positive likelihood ratio of 13.3 and a negative likelihood ratio of 0.116. No significant association was found between confirmed HAP and signs of pneumonia on imaging or positive microbiological cultures.
Conclusions: Contrary to previous studies, this research highlights the beneficial role of PCT in confirming HAP among patients with clinical suspicion in the NICU, establishing a cutoff value of 0.095ng/ml. Prompt and accurate identification of HAP could expedite antibiotic treatment, enhancing patient care in the NICU.
Optional Image

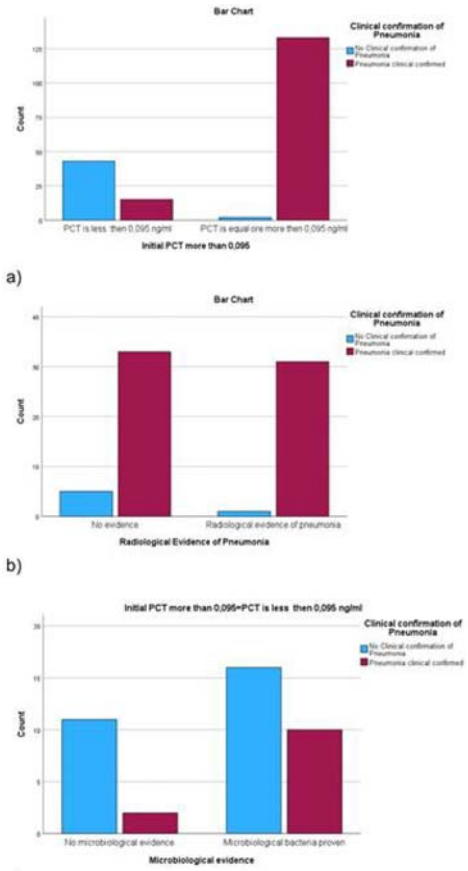


Figure 2: a) Cutoff PCT value of 0.095ng/ml has the optimal sensitivity and specificity (p<0.001) for hospital acquired pneumonia (HAP) diagnosis. *b)* Chest imaging has a relatively high specificity but low sensitivity in HAP diagnosis (p>0.05). *c)* Microbiological evidence of bacteria in sputum has a relatively high sensitivity but low specificity in HAP diagnosis (p>0.05)

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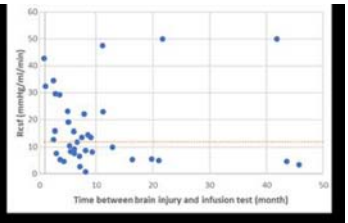
719
367
Brain and Spine 4 (2024) 103701
CSF hydrodynamics in prolonged disorders of consciousness

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Prolonged disorders of consciousness (PDOC) following brain injury is a major public health problem. Advances in intensive care allow patients to survive after brain injury. However, one third of the patients will not recover consciousness. To date, no specific treatment has shown its effectiveness in the recovery of consciousness. Brain imaging in PDOC patients often shows cerebral atrophy and ventriculomegaly suggesting hydrocephalus secondary to deranged intracranial fluid circulation. Hydrocephalus may participate to PDOC, either quickly or with delay, reducing the potential for natural recovery of consciousness. Controversies remain about how to diagnose hydrocephalus and whether to propose CSF diversion. We hypothesize that CSF hydrodynamics is relevant to better identify hydrocephalus in PDOC patients.
Methods: We retrospectively analyzed 41 patients (26M/15W) with i) acute brain injury, ii) persistent (i.e.>1 month) disorder of consciousness and iii) ventriculomegaly (i.e. Evan's ratio >0.3). PDOC patients suspected of hydrocephalus we explored (from 12/2010 to 04/2023) with a lumbar infusion test to gauge CSF hydrodynamics using ICM+.
Results: Acute brain injury was related to: head trauma (17), subarachnoid hemorrhage (16), intracerebral hematoma (6), cardiopulmonary arrest (1), metabolic (1). Mean resistance to CSF outflow (Rcsf) was increased (i.e. ≥12 mmHg/ml/min, cf. table 1). 21 patients (51%) exhibit normal Rcsf (i.e. <12) and 20 patients (49%) exhibit increased Rcsf (i.e. ≥12). Raised Rcsf (i.e. ≥12 above dashed line) was identified several months, up to 40 months, after the brain injury (cf. Figure 1).
Conclusions: Half of the patients with PDOC and ventriculomegaly exhibit altered CSF hydrodynamics. Lumbar infusion test seems to be relevant to better identify hydrocephalus in PDOC patients. Rcsf is an important metric that should be implemented in the management algorithm of PDOC patient to better advocate for CSF diversion when hydrocephalus is suspected, even months or years after brain injury.
Optional Image

	Age (year)	Time between brain injury and insuflion test (month)	ICP baseline (mmHg)	Pulsatility baseline (mmHg)	ICP plateau (mmHg)	Pulsatility plateau (mmHg)	Rcsf (mmHg/ml/min)
Mean	53,7	12,8	9,59	0,65	25,26	2,34	16,26
SD	17,5	18,7	3,34	0,54	11,21	1,80	13,34
Min	17,2	0,8	2,66	0,04	1,65	0,11	0,80
Max	79,4	104,9	19,26	2,25	55,05	7,58	50,00



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Brain and Spine 4 (2024) 103702
Atlantoaxial Instability in the Era of Non-Inflammatory Degenerative Arthrosis: Surgical Strategy and Clinical Outcome in 36 Patients

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: While rheumatoid arthritis is a well-recognized cause of C1-2 instability, more recent research shows that instability can arise from severe degenerative arthrosis, independent of any autoimmune or inflammatory influences. Therefore, this study aims to analyze the surgical approach and clinical outcome in patients with atlantoaxial instability attributed to non-inflammatory degenerative arthrosis.
Methods: A retrospective review was conducted on patients who underwent C1-2 stabilization for symptoms and radiographical signs of C1-2 instability with retrodental pannus strictly of degenerative origin in our neurosurgical department from January 2012 to December 2021. Radiological parameters, surgical details, and clinical follow-up data were analyzed.
Results: Among 36 included patients (mean age: 72 years), C1-2 fixation was performed. In 61% of cases, C1 laminectomy for myelopathy symptoms were performed. The median mJOA score improved from 14/18 preoperatively to 15/18 post-surgery and 16/18 at a median 3-month follow-up. Clinically, 71% showed improvement, 29% remained stable, and 9.7% deteriorated. The mean preoperative atlantodental distance was 2mm. The overall complication rate was 8.6%, with minor incidents like asymptomatic vertebral artery injuries and one case of CSF leakage.
Conclusions: Surgical intervention for C1-C2 fixation yielded favorable outcomes in non-inflammatory atlantoaxial instability cases, showcasing notable improvements in neck pain and myelopathy symptoms.

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178
Brain and Spine 4 (2024) 103703
Causes Of Unfavorable Outcome In Patients With Good Grade SAH Prior To Aneurysm Treatment

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: Clinical prognosis following aneurysmal subarachnoid hemorrhage is largely dependent on patients' initial clinical status, age and extent of the bleeding. Other factors also have effect on outcome. The aim of this study was to see which factors have strong impact on the clinical outcome of patients that are of good clinical grade (WFNS 1-3) before aneurysm treatment.
Methods: Prospectively gathered data of patients treated for aneurysmal SAH in Sweden under the years 2014-2018 was analysed. Subanalysis was made on patients that were of good clinical grade before aneurysm occlusion; microsurgery or endovascular treatment. Factors such as comorbidites, radiological findings, and treatment-related complications were analysed. Uni- and multivariate logistical regression was used for statistical analysis. Outcome was assessed with Glasgow outcome scale extended (GOSE) one year after the bleeding.
Results: 1037 patients were treated for aneurysmal SAH. 607 patients were in good clinical grade just prior to aneurysm treatment. Of these, we had clinical follow-up of 525 patients. 106 of these patients had unfavorable outcome at one-year follow-up. Factors significantly and independently affecting risk of unfavorable outcome in this group of patients were increased age (OR 1.05; 95% CI 1.02 - 1.07), hydrocephalus (OR 1.9; 95% CI 1.1 - 3.2), meningitis (OR 2.3; 95% CI 1.2 - 4.6), delayed ischemic neurological deficits (OR 3.6; 95% CI 2.1 - 6.2), and complications with microsurgical or endovascular occlusion of the ruptured aneurysm (OR 2.5; 95% CI 1.4 – 4.4).
Conclusions: Among patients with good clinical status prior to occlusion of a ruptured cerebral aneurysm, 20% have unfavorable outcome after one year. Complications directly related to aneurysm occlusion have significant effect on functional outcome.

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1002
Brain and Spine 4 (2024) 103704
Giant Lumbosacral Neural Tumours with Extraspinal Extension: An Illustrative Case Series and Review of Surgical Approaches

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Giant lumbosacral neural tumours with extra-spinal extension (GLSNTE) are rare tumours with extra-foraminal growth >2.5cm. They pose significant operative challenges due to the complex regional anatomy and varied presentations. Pelvic extension and large tumour growth create additional difficulties and require more complex surgical strategies. We present a case series of GLSNTE's and a review of the surgical approaches used to achieve maximal safe resection.
Methods: We conducted a retrospective review of patients operated at a national spinal referral centre between January 2015 and February 2024. Clinical demographics, radiology, histopathology and post-operative outcomes were assessed.
Results: Thirteen patients (4 males, 9 females) with an average age of 40 (range 19-52) were included. Ten patients (79%) presented with back pain and 57% presented with leg pain. Three patients presented with leg weakness and bladder/bowel dysfunction (21%). Histological diagnoses were as follows: Schwannoma WHO grade 1 (8/13 patients, 62%), Ganglioneuroma WHO grade 1 (2/13), Myxopapillary Ependymoma WHO grade 2 (2/13) and Malignant Peripheral Nerve Sheath Tumour (MPNST) WHO grade 3, (1/13). Pelvic extension was present in seven patients (54%) and tumour volume averaged 1,204cm3. Surgical approaches included: Standard posterior approach (7/13), Posterior-lateral approach (2/13) and Combined anterior and posterior approach (4/13). Total resection was achieved in 85% of cases (10 en-bloc, 1 piecemeal). Sub-total resection was achieved in two cases. Patients were followed-up for an average of 29 months with tumour recurrence in one patient. New post-operative urinary incontinence occurred in one patient. Two patients needed revision surgery for post-operative wound dehiscence and graft subsidence. Symptomatic improvement or complete resolution of presenting symptoms occurred in 93% of patients.
Conclusions: We demonstrate various surgical approaches to achieve maximal safe resection for GLSNTE's. Large lumbosacral tumours with pelvic extension may require cross-speciality collaboration to achieve optimal outcomes and maintain low surgical morbidity.

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565
Brain and Spine 4 (2024) 103705
Graph Theory Approach for Assessment of Long-term Corpus Callosum Changes After Traumatic Brain Injury.

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: The advance in recent research of the human brain revealed the development of the brain connectome. The connectome is the brains` 'wiring diagram' or a map of all brain connections. This connectivity design presents the possibility to use the mathematical concept of graph theory for exploring the properties of structural brain networks. As a centrally located brain structure, corpus callosum (CC) is highly susceptible to injury. The aim of the current study is to evaluate CC integrity after traumatic brain injury (TBI) according to graph theory.
Methods: A prospective analysis was performed with diffusion tensor imaging (DTI) of patients following TBI. We post-processed DTI data with tractography and connectometry analysis according to graph theory. Between-group analysis of DTI parameters and global measures of CC graph was performed. The results were compared to compatibile by age and sex healthy control subjects. We used a two-tailed t-test to analyze the patients and the control group.
Results: The mean period between the TBI and the follow-up was 21 months (12-60). 9 patients had severe TBI and 16 had mild or moderate. 17 patients had focal cerebral contusions, 2 had subarachnoid hemorrage, 3 had intraventricular hemmorage, 3 had diffuse axonal injury. The mean age of patients was 37,4 years (19 - 63), with a male predominance (M:F=4:1). A significant between-group difference was established in fractional anisotropy ($p<0,01$), mean diffusivity ($p<0,01$), axial diffusivity ($p=0,01$) and radial diffusivity ($p<0,01$), as well as in global graph measurements, such as graph density ($p=0.05$), average clustering coefficient ($p=0,02$), transitivity ($p=0,01$), path length ($p<0,01$), small-worldness ($p<0,01$), global efficiency ($p=0,01$), diameter of graph ($p=0,01$) and the rich club coefficients.
Conclusions: The current study presents findings for a long-term damage of CC following TBI. The results suggest that both diffuse axonal injury and cortical cerebral cotusions patients show injury of CC.

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445
Brain and Spine 4 (2024) 103706
Sex-biased immune response in glioblastoma patients

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Glioblastoma (GBM) is the most common malignant brain tumor with short survival rates despite standard therapy. Male GBM patients present a 1.6-fold higher incidence and show a less favorable prognosis compared to their

female counterparts. Sex differences in cancer are widely recognized and aside from influences including sex chromosomes, hormones, diet and behavioral factors, variations in the immune system might also contribute to progression and therapy response. Recent studies discovered a higher responsiveness for anti-PD1 therapy and higher frequency of exhausted T-cells in male GBM mice only. Therefore, the current study investigates sex-biased differences regarding human immune response in GBM.

Methods: Patients with primary and recurrent CNS-WHO°4 GBMs, aged >18 years, were included. Flow cytometric analyses were performed on peripheral blood lymphocytes (PBLs) using multicolor antibody staining panels. Soluble immune markers were analyzed using the multiplex immune assays. Immune cell subsets within the tumor were analyzed based on their gene-expression signature.

Results: In the flow cytometry, male patients with pGBM demonstrated significantly lower levels of naïve CD8+ T-cells in PBL (p=0.0121) and higher PD-1 expression on CD8+ T cells (p=0.0377). In contrast, females had notably higher levels of the purinergic marker CD73 (p=0.0099). Furthermore, male pGBM patients displayed elevated levels of CD8+ effector memory T-cells (p=0.0088) and CD8+ early-like T-cells (p=0.0361). Throughout the clinical course, GBMs in female patients were located more frequently in the frontal and parietal lobe and showed a higher incidence of seizures. Additionally, female patients had a significantly higher ratio of lymphocytes to monocytes. A total of n=33 patients, who received anti-PD-1 treatment, did not show significant differences in OS based on gender. Nevertheless, we did discover that during anti-PD-1 therapy, female patients displayed notably elevated levels of soluble immune checkpoint markers in comparison to their male counterparts.

Conclusions: This study reveals significant differences in the immune system between genders in GBM. Males exhibit immune exhaustion with increased expression of checkpoint markers, while females show higher activity in the purinergic pathway. These findings imply that gender-specific immune variations might impact responses to immunotherapy, warranting further research to explore their relevance in personalized treatment for GBM patients.

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942

Brain and Spine 4 (2024) 103707

Our Experience With Scoliosis Patients Who Were Operated With Double VBT And Hybrid VBT Techniques At Ankara Bilkent City Hospital

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Anterior Vertebral Body Tethering (AVBT) is a contemporary technique used as a growth modulation treatment for skeletally immature scoliosis patients. It offers benefits such as continued growth and early return to physical activities. However, it also has drawbacks, including the unpredictable nature of final deformity correction in some patients and the need for reoperation. Patients with double major curvature can be treated with double AVBT or with a hybrid system using posterior spinal fusion in the thoracic spine and AVBT in the lumbar spine. This study analyzes the 1-year follow-up results of 12 patients who underwent double AVBT and hybrid AVBT.

Methods: The study analyzed scoliosis radiographs of 12 patients who underwent double AVBT and hybrid AVBT surgery at Ankara Bilkent City Hospital between 2022 and 2024. Radiographs were taken preoperatively and postoperatively at 1 day, 6 weeks, 3 months, 6 months, and 1 year.

Results: The study included 12 patients, consisting of 2 males and 10 females. Of these, 10 had adolescent idiopathic scoliosis, 1 had neuromuscular scoliosis, and 1 had congenital scoliosis. The double AVBT technique was used in 4 patients, while the hybrid AVBT technique was used in 8 patients. The patients had a mean age of 13.16 years, a mean Sanders score of 4.25, and a mean Risser score of 0.91. The mean main Cobb angle was 53.16° preoperatively and 19° postoperatively. Only one patient experienced overcorrection as a complication. There was no patient experienced with pulmonary, vascular or instrumentation complication.

Conclusions: Both double AVBT and hybrid AVBT techniques are effective in correcting the deformity in scoliosis patients with double major curvature. These techniques have common advantages, including preservation of mobility, continuation of growth, and early return to physical activity.

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464

Brain and Spine 4 (2024) 103708

War-Related Traumatic Spinal Cord Injuries During the Syrian Armed Conflict in Damascus 2014–2017

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Combat-related traumatic spinal cord injuries (CRT-SCIs) constitute a critical facet of battlefield trauma being responsible for a high proportion of war-related disability. Nevertheless, most studies describe injuries among shielded military personnel receiving care in well-resourced medical systems. In contrast, the proportion of unshielded civilians affected by CRT injuries has increased in recent wars, reaching 70% in the Syrian civil war. In this project, we aim to investigate the presentation, management, and outcomes of CRT-SCIs in civilians during the Syrian war.

Methods: This is a retrospective cohort study conducted between 2014 and 2017 at Damascus Hospital, the largest community hospital in the Syrian capital. The medical records and CT imaging of all patients who presented with CRT-SCIs were reviewed to extract the mechanism, type, and site of injury. We also collected information regarding accompanying injuries, invasive interventions, ICU admissions, mortality, and neurological status at discharge.

Results: Our sample comprised 68 civilian victims, 57.3% of whom were males aged 18-44. 48.5% of the injuries were from shrapnel, the rest from gunshots, and all but five were penetrating. The injuries were associated with vertebral fractures in 75% of the cases, and this occurred more commonly in gunshot injuries (P=0.011). Half of the injuries involved the thoracic spine and they were associated with more neurological deficits at discharge (81.8%, P=0.006). Twenty patients underwent surgery, predominantly to extract foreign bodies, and 14 died during hospitalization; 11 of them had cervical spine injuries (P<0.001).

Conclusions: The high rate of penetrating injuries in our civilian sample likely stems from the absence of shielding. Limited personal and physical resources hindered the feasibility of surgical interventions, resulting in alarming mortality and disability rates. These findings shed light on the complexities of managing CRT-SCIs in war zones, highlighting the urgent need for innovative approaches to address these challenges effectively.

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1038

Brain and Spine 4 (2024) 103709

Clinical Effects of Allogeneic Mesenchymal Stem Cells in Patients with Chronic Complete Spinal Cord Injury: Phase I Study

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Traumatic spinal cord injury (SCI) is a devastating condition characterized by long-lasting consequences, including progressive cord atrophy and neurodegeneration. It poses a substantial medical need with significant social and economic consequences. This study aimed to investigate the safety and

initial efficacy of allogeneic MSCs derived from Wharton's jelly (WJ-MSCs) in SCI.

Methods: This open-label, multi-center phase I study aimed to evaluate the safety and preliminary efficacy of both triple route and multiple Wharton's jelly-derived mesenchymal stem cell (WJ-) implantations. The inclusion criteria for participants were as follows: having SCI for at least six months, substantial impairment, and disability. The administration of WJ-MSCs was performed twice a month for two months using three different routes: intrathecal (i.t.), intramuscular (i.m.), and intravenous (i.v.). The target dose for each administration route was 1x106/kg. All patients underwent one year of monitoring following WJ- infusion.

Results: At the beginning of the study, the participants had the following baseline scores: a Functional Independence Measure (FIM) score (motor and cognitive) of 77.5±2.26, a Modified Ashworth (MA) Scale score (right and left) of 15.83±4.83, an American Spinal Injury Association Impairment Score (ASIA) Motor score (right and left) of 1.67±2.66, an ASIA Light Touch score (right and left) of 62±18.42, an ASIA Pin-Prick score (right and left) of 62±18.42, a Wexner Incontinence score of 20, and a Qualiveen Short Form (SFQ) score of 32. Throughout the one-year follow-up period, all neurological functions showed significant improvement. For example, analysis revealed a statistically significant difference in the ASIA Motor scores between the pre-intervention and post-intervention assessments ($\chi 2=23.938$, $p<.001$); also there was statistically significant difference in pre-intervention and post-intervention SFQ measurements ($z=-2.214$, $p<0.05$).

Conclusions: This study demonstrated the safety and efficacy of triple route administration and multiple implantations of WJ-MSCs in patients with SCI.

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250

Brain and Spine 4 (2024) 103710

Prediction Of Small Cerebral Aneurysms Rupture – Do We Have Sufficient Tools?

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: Intracranial aneurysms may cause life-threatening subarachnoid haemorrhage (SAH). They are subject to reparative treatment if found unruptured. Small (≤7mm) intracranial aneurysms (SIAs), in contrast to larger ones, are difficult to weight treatment risk against rupture risk. Our study aim was to compare results of different scoring systems and SIA features between ruptured and unruptured SIAs.

Methods: We have investigated all patients with SAH from SIA and patients with unruptured SIAs admitted to Department of Neurosurgery in 2021 and 2022. Patient data, radiological data and operative notes were studied. SIAs were diagnosed and described based on computed tomography/magnetic resonance angiography or digital subtraction angiography. SIAs rupture risk was estimated by 4 different scoring systems: PHASES, Small intracranial aneurysms of the anterior circulation (SIAAC), Unruptured Cerebral Aneurysm Study (UCAS) and simplified version of Unruptured Intracranial Aneurysm Treatment Score (UIATS) by Juvela.

Results: Study group included 170 patients, including 111 females (64,7%) 74 patients (43.5%) were admitted with SAH. All analyzed scoring systems results were significantly higher in SAH group. The one with over 2-fold greater scores for ruptured SIA was simplified UIATS by Juvela. Patients with SAH were younger and had larger SIA domes, but size difference was relatively small (0,46mm; p=0,059). Strikingly, male patients were admitted with SAH more often than female patients (64,4% vs 32,4%; p<0,001). Internal carotid artery and anterior communicating artery SIAs were ruptured in 25.9% and 74.5% respectively.

Conclusions: SIAs are a complex field that differs from larger aneurysms. Male dominance, lack of size difference between ruptured and unruptured SIA, suggests the necessity to evaluate precisely other rupture influencing factors with the use of modern scoring systems with simplified UIATS giving the biggest difference.

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328

Brain and Spine 4 (2024) 103711

Preliminary insights into the correlations between 5-ALA fluorescence and 7T MRSI in gliomas

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Heterogeneity in gliomas presents a clinical and diagnostic challenge. Fluorescence guided resection using 5-aminolevulinic acid (5-ALA) is one of the methods used for better distinguishing tumor regions. Ultra-high Field Magnetic Resonance Spectroscopic Imaging (MRSI) is a non-invasive imaging method that detects levels of various metabolites in tissues, giving insights into altered metabolism of tumors and their microenvironments at higher resolution than clinical MR methods. The aim of our study was to correlate 5-ALA fluorescence with various 7T metabolic ratios in search of new diagnostic markers for surgery planning, as well as using 7T MRSI in studying 5-ALA-related metabolism in gliomas.

Methods: We retrospectively correlated intraoperative 5-ALA fluorescence from clinical reports to metabolic ratios from 7T MRSI scans in a cohort of 23 patients. The evaluated ratios for this study using python were tCho/tNAA, Glu/tNAA, Gln/tNAA, Ser/tNAA, Tau/tNAA, Gly/tNAA, Ins/tNAA, GSH/tNAA, tCho/tCr, Glu/tCr, Gln/tCr, Ser/tCr, Tau/tCr, Gly/tCr, Ins/tCr, and GSH/tCr.

Results: Of all, Gln/tCr ratios correlated highest with 5-ALA fluorescence (r2=0.597). Furthermore, ratios of Gln/tNAA (r2=0.546), Ins/tNAA (r2=-0.652), Gln/tCr (r2=0.773), Ins/tCr (r2=-0.585), GSH/tCr (r2=0.57) and Gly/tCr (r2=0.52) correlate strongly with tumor grade. Moreover, we found a correlation between 5-ALA fluorescence and tumor grade (r2=0.836).

Conclusions: To our knowledge, this is the first study that correlated 5-ALA fluorescence to 7T MRSI in gliomas. These results indicate that 5-ALA fluorescence could be a promising tool in exploring 7T MRSI tumor markers thus optimizing the extent of tumor resection and improving patient prognosis. Moreover, it supports 7T MRSI as a promising technology for in vivo studies of glioma metabolism.

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866

Brain and Spine 4 (2024) 103712

Surgical therapy of spinal metastases of the thoracolumbar junction: Morbidity and postoperative revision rate according to surgical complexity

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: The thoracolumbar junction (TLJ) defined as the spinal vertebrae Th11- L1 is the most affected region of the spinal column in regard to bone metastases. Its anatomical and physiological properties make it unique as its interlocking facet joints are aligned differently at the meeting point between Th12 and L1. This is subsequently reflected on the SINS Score, since tumors located in this region contribute the most to spinal instability.

Methods: Methods: Our aim was to find a correlation between defined surgical treatments and patient survival as well as rate of reoperation in patients with metastases of the TLJ. A retrospective monocentric study was carried out with a total of 158 patients, from which 100 were treated surgically between the years 2005-2020 whether with (1) decompression only, (2) posterior instrumentation or (3) posterior instrumentation and corpectomy. Surgical procedures were classified according to the grade of complexity, being group 1 less complex and group 3 most complex. Survival curves were obtained and analyzed with the Logrank test for trend.

Results: Results: No negative effect on the rate of postoperative survival or reoperation rate despite increasing complexity of surgical procedure was

observed. This may be due to good preoperative patient selection for group 3. Overall median survival rates were very similar for all 3 groups (approximately 22 months since first diagnosis).
Conclusions: Conclusion: preoperative factors such as mechanical pain and instability proved to be determinant regarding decision-making towards instrumentation surgery. Surgical complication rates and most specifically reoperation rates prove to increase according to worse preoperative prognosis. Due to the limited number of patients, survival and complication rates were not statistically significant between the different groups analyzed. An expansion into a multicentric cohort study is underway. Our goal will be to determine both statistical significance as well as spinal deformity postoperatively in patients who underwent posterior decompression.

https://doi.org/10.1016/j.bas.2024.103712

1163
Brain and Spine 4 (2024) 103713
Timing of surgery and neurological outcomes in non-urgent newly diagnosed chronic subdural hematoma patients: a multicenter study

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Chronic Subdural Hematoma (cSDH) is one of the most common diseases in the neurosurgical practice. The role of timing in cSDH surgery remains uncertain. The aim of this study is to evaluate if timing of surgery could represent a predictive factor of favorable neurological outcome in patients with cSDH
Methods: In this multicentric retrospective cohort study, patients with cSDH treated with surgical evacuation by single burr hole from January 2020 to December 2023 were enrolled. Clinical history and timing from symptoms' onset to surgery were evaluated in all cases. Neurological status was assessed at admission and at discharge using Glasgow Coma Scale (GCS) score and Markwalder Grading System (MGS) score. Considering GCS, a favorable neurological outcome was considered in case of an improvement of at least 1 point in GCS scale, or patients with preoperative GCS 15 remained unchanged postoperatively or in case of an improvement of at least 1 point in MGS or if patients with preoperative MGS score 0 remained unchanged at discharge, considering MGS
Results: 227 patients were enrolled. Considering GCS score, patients with better preoperative GCS (mild: 88.5% vs moderate: 80% vs severe: 63.5%, p=0.043), better preoperative MGS (0-1: 90.5% vs 2: 85.5% vs 3-4: 65%, p=0.012) and patients underwent early surgery (before 7 day from symptoms' onset, 91.5% vs 79%, p=0.007) showed a postoperative favorable neurological outcome at univariate analysis. Patients with better preoperative GCS (88% vs 73% vs 63.5%, p=0.027), better preoperative MGS (91% vs 81% vs 70.5%, p=0.016) and patients underwent early surgery (90% vs 79%, p=0.021) showed a postoperative favorable neurological outcome using MGS score at univariate analysis. Early surgery remained statistically significative at multivariate analysis in both cases (p=0.012 and p=0.018, respectively). No other factor showed any significative difference.
Conclusions: Early surgery could improve neurological outcome in patients with cSDH

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201
Brain and Spine 4 (2024) 103714
Decompressive craniectomy in neurosurgical emergencies: an institutional experience of 11 years

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: A last-tier procedure to lower intracerebral pressure (ICP) in patients with otherwise fatal brain injury, decompressive craniectomy (DC) entails the removal of a large portion of the skull bone to lower ICP to re-establish sufficient cerebral perfusion and facilitate recovery. DC significantly reduces mortality in traumatic brain injury (TBI) and ischemic stroke, but evidence of its benefits in hemorrhagic stroke is less decisive. The aim of this study was to compare the outcomes of patients who had undergone a DC in the Oulu University Hospital with an emphasis on the outcomes in hemorrhagic stroke.
Methods: All DC procedures conducted in the Oulu University Hospital between January 2009 and December 2019 were retrospectively identified. Mortality and functional outcomes were assessed during a median follow-up period of 21 months. Favorable outcome was defined as an extended Glasgow Outcome Scale (GOSE) score ≥ 5.
Results: One hundred and twenty-four DCs had been conducted to patients aged at mean 40 years (SD 16), of whom 88 (71%) were male. Fifty-eight (47%) of the surgeries had been conducted due to TBI and 66 (53%) due to stroke. Of the strokes, 41 (62%) were ischemic, 21 (32%) aneurysmal subarachnoid hemorrhages (SAH) with (n=11) or without (n=10) an intracerebral hemorrhage (ICH), three (5%) spontaneous ICHs, and one (2%) sinus thrombosis. In univariate analysis, patients with TBI had more commonly recovered favorably than those with stroke (52% vs. 19%, respectively), but no statistically significant difference between patients with SAH and arterial ischemic stroke was found (14% vs. 22%, respectively).
Conclusions: More than half of patients with TBI had achieved a favorable recovery following DC. Although recovery trajectories were poorer for patients with strokes with 19% recovering with favorable outcome, no outcome difference was observed between patients with SAH and those with ischemic stroke in a multivariate model. Patients with SAH and concurrent ICH may be poor candidates for DC, but DC can be considered for selected SAH patients especially in the absence of an ICH. Further prospective and comparative research is required to elucidate the role of DC following hemorrhagic stroke.
Optional Image

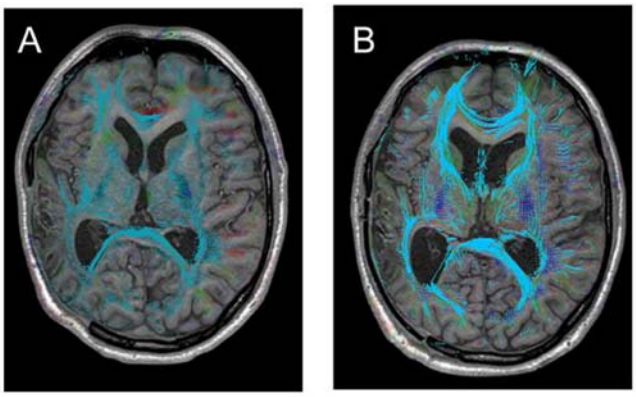


Fig 1. Demonstration of course and density of association fibers a) before the cranioplasty and b) 6 weeks thereafter.
Scans obtained in the sample study subject using the same MRI DTI protocol.

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941
Brain and Spine 4 (2024) 103715
The 1-Year Follow-Up Results Of 47 Scoliosis Patients Operated with MAGEC Rod in Ankara Bilkent City Hospital

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: Distraction-based spinal instrumentation represents the most common and standard surgical technique for the correction of early-onset scoliosis (EOS), that is, scoliosis diagnosed before the age of 10 years. In this

study, we analyzed the effect of MAGnetic Expansion Control (MAGEC) rods, which we used in the treatment of 47 EOS patients operated in our hospital, on the patients during the 1-year follow-up period.
Methods: Forty-seven patients with early-onset scoliosis (19 males and 28 females) who underwent surgery at Ankara Bilkent City Hospital between 2021 and 2024 and were treated with magnetically controllable growth rods were followed up with rod lengthening procedures every 2 months. The patients were evaluated using preoperative, early postoperative, 6-month, and 12-month control scoliosis radiographs.
Results: The MAGEC rod was inserted unilaterally in 9 patients and bilaterally in 38 patients. The patients had a mean age of 8.24 years and included 18 with idiopathic scoliosis, 11 with congenital scoliosis, and 18 with neuromuscular scoliosis. The mean preoperative Cobb angle was 54.95°, while the mean early postoperative Cobb angle was 31.25°. Eight patients experienced complications, including five cases of instrumentation problems and three cases of wound infection. No complications were observed in the remaining patients.
Conclusions: Our study demonstrated that magnetically controllable growth rods, which are distraction-based spinal devices used in patients with early-onset scoliosis, improved Cobb angles by an average of 23.48° in the early postoperative period. Furthermore, the deformity continued to correct with external remote lengthening in the subsequent 1-year period. The correction of the deformity was achieved without the need for repeated surgical procedures, leading to lower rates of wound infection and instrumentation complications, as well as improved mental and emotional status.

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108
Brain and Spine 4 (2024) 103716
Overcoming Antigen Escape Mechanisms in Glioblastoma: A Combined CAR T-Cell Approach for Ex Vivo and In Vivo Models

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM
Background: Chimeric Antigen Receptor (CAR) T-cell therapy holds promise for glioblastoma (GBM) treatment, but the tumor's substantial heterogeneity presents a major challenge. To overcome potential antigen escape mechanisms and immune evasion, we combined CAR T-cells in a dual targeting approach.
Functional evaluations were conducted by co-culture of CAR T-cells with patient-derived organoids (PDOs) and in in vivo experiments using an orthotopic mouse model.
Methods: PDOs were generated from freshly resected GBM tissue and could be cultivated stably for months. CAR T-cells, derived from allogeneic peripheral blood mononuclear cells (PBMCs), were incubated with PDOs at a 1:4 effector-to-target ratio. Apoptosis in tumor-associated antigen (TAA)-expressing cells was assessed after 16 hours using immunofluorescence staining (TAA+/CC3+). In the orthotopic mouse model, U87 cells were stereotactically injected into the nucleus caudatus and CAR T-cells into the lateral ventricle of NSG mice at day 7 after tumor cell engraftment. Tumor reduction was quantified by bioluminescence imaging and overall survival was monitored.
Results: PDOs showed target expression rates of 33% for target 1 and 17% for target 2. Treated PDOs exhibited significantly higher apoptosis after co-incubation with CAR T-cells specific for target 1 ($p=0.002$) and target 2 ($p<0.001$) compared to untransduced T-cell controls. Dual CAR T-cell treatment resulted in significantly higher apoptosis compared to the mono approaches ($p=0.05$ and $p<0.001$, respectively). In vivo, targeted therapy reduced tumor burden, prevented outgrowth, and provided a survival advantage. Dual targeting regimens significantly amplified these effects, allowing for a more durable remission of local GBM.
Conclusions: CAR T-cells targeting relevant TAAs demonstrated significant efficacy in ex vivo and in vivo settings. The dual treatment approach proved to be superior, suggesting a potential strategy for overcoming GBM heterogeneity and antigen escape mechanisms. Altogether, this study introduces a promising therapeutic approach to enhance CAR T-cell efficacy in GBM treatment.

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23
Brain and Spine 4 (2024) 103717
Clinical outcome and complications after endovascular vasospasmolysis in patients with aneurysmal subarachnoid hemorrhage

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: The present study aimed to investigate whether endovascular therapy of large-artery vasospasms in delayed cerebral injury after aneurysmal subarachnoid haemorrhage (aSAH) results in a better outcome than in those who do not receive vasospasmolysis. Secondarily, predicting factors for cerebral vasospasm (CVS) and complications following vasospasmolysis were examined.
Methods: Patients who were treated with aSAH between March 2006 and March 2020 in our department were retrospectively analyzed regarding general health data, aneurysm treatment strategies and development of CVS, symptomatic and/or measured using TCD, respectively. Severe vasospasm was defined by TCD mean velocities of >200 cm/sec or occurrence of new neurological deficits.
Results: Overall, 853 Patients with acute aneurysmal SAH were treated. Of those, 310 (36%) suffered from severe vasospasm. Conservative treatment including induced hypertension was performed in all these patients. 92 patients (30%) underwent endovascular vasospasmolysis (eSL) due to persistent symptoms despite conservative therapy. Among endovascularly treated patients 79 patients (86%) improved in terms of angiographic results, 71% (n=44) improved clinically. Clinical worsening occurred in 11% of cases (n=7). Periprocedural complications were observed in 4% (n=4). In 30 (33%) unconscious or sedated patients of all 92 patients no obvious clinical improvement could be accessed immediately after eSL. Therefore, we evaluated the rates of secondary infarcts on CCT scans at discharge, TCD outcome and mortality among this subgroup.
Conclusions: Endovascular vasospasmolysis appears to be a valuable and favorable therapeutic option for patients with persistent cerebral vasospasm despite conservative measures. The procedure demonstrates promising clinical and radiological outcomes with low rates of periprocedural risks. Careful evaluation and continuous advancements in spasmolysis techniques are crucial in addressing cases of clinical deterioration after vasospasmolysis and further optimizing patient outcomes. Unconscious and sedated patients do not show a clinical or radiological improvement following eSL, evaluated by secondary infarct rates on CCT.

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641
Brain and Spine 4 (2024) 103718
Clinical Profile, Management and Outcomes of Patients with Traumatic Brain Injury at Vicente Sotto Memorial Medical Center from January 2020 to December 2022

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Traumatic Brain Injury (TBI) is a global health concern, with impacts on both socioeconomic and the overall health of the patients affected, causing physical and cognitive disabilities as well as economic burdens. Historically, it was regarded as an injury mostly affecting younger individuals, mostly males, however, recent trends on epidemiology highlighted increasing incidence in older population and as well as on females. TBI increases long-term mortality rate and may reduce life expectancy significantly. Furthermore, it is usually associated with many sequelae. Most of the studies focus on general causes of the

injuries and the mortality of patients. In order to bridge the gap in the information, to help future studies and researches and to generate institution-based guidelines on management of patients with TBIs, this was study was conducted.
Methods: This is a retrospective study, descriptive analysis of data using charts of patients from the period January 2020 to December 2022 designed to determine the clinical profiles (age, gender, nature of injury, types of brain lesion), management (conservative and surgical) and outcomes (mortality rate, GOSE) of patient with Traumatic Brain Injury admitted at Vicente Sotto Memorial Medical Center.
Results: A total of 1,356 patients were seen and examined, admitted, and managed by the Department of Neurosurgery from January 1, 2020 up to December 31, 2022, however, only 1,174 patients satisfied the inclusion criteria and were not affected by the exclusion criteria. Moreover, patients cases were classified further based on their admitting GCS scores into the following, Mild TBI (n=1003), Moderate TBI (n=77) and Severe TBI (n=94). It was noted in the study that the mean and median age in general among patients with TBI was 33 and 30 respectively, with the youngest being at 3 months old and oldest at 90 years old. The data collected in the study also shows a male preponderance with 68% of the total population as opposed to females with only 38%. The mean and median age for male patients were 34 and 31 respectively, while the mean and median age for female patients were 44 and 41 respectively. The top 3 causes of TBI noted were Motor Vehicular Accident with 752 cases (64.05%), followed by Fall with 165 cases (14.05%), then Assault/Mauling with 140 cases (11.93%). For the types of lesion, Epidural Hematoma has the highest number of cases with 271 (23.08%) followed by Contusion Hematoma with 212 cases (18.06%), then Acute Subdural Hematoma with 173 cases (14.72%). Majority of Mild TBI were managed conservatively than surgically (77.30%vs22.70%), as contrast to moderate and severe TBI whom patients were managed more surgically than conservatively. Moreover, all surgical cases had more days of LOS than conservative management across all TBI severities. Furthermore, mortality rate were high in both moderate and severe TBI as compared to Mild TBI. And an overall GOSE score were better in Mild TBI managed both conservatively and surgically as opposed to Moderate and Severe TBI patients.
Conclusions: In conclusion, in a third-world country like the Philippines, Traumatic Brain Injury still posses burden in both the health-care and socio-economic sector. Legislatives that strongly implement discouragement on the avoidable hazards/risk factors should passed, such as Road Safety Advocacies, Alcoholism and Violence. Furthermore, guidelines that are adopted in the local settings of the health facilities should be created to achieve better outcomes with regards to Traumatic Brain Injuries.

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571
Brain and Spine 4 (2024) 103719
Mixed reality-guided glioblastoma resection compared to standard procedures: assessing the surgical and clinical benefits of the virtual world in tumor surgery

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM
Background: Glioblastomas (GBM) are typically managed through surgery and radio-chemotherapy, with patient survival often contingent upon the quality of tumor resection. This retrospective study evaluates the efficacy of mixed reality (MR) technology in GBM surgery compared to conventional approaches, examining surgical, clinical, and survival outcomes.
Methods: The study included GBM patients undergoing primary tumor resection at Geneva University Hospitals between 2015 and mid-2022, excluding those undergoing biopsies or partial debulking. Primary outcomes assessed extent of resection (EOR) and postoperative residual volume (RV), while secondary outcomes included overall survival (OS), progression-free survival (PFS), Karnofsky performance scale scores at 6 weeks and 3 months, and incidence of new postoperative focal neurological defects. Confounding factors such as intraoperative monitoring, 5-ALA and iMRI were analyzed.
Results: A total of 76 patients were included in the standard (STD) group and 40 in the mixed reality (MR) group, with statistically comparable demographics. The MR group exhibited superior median EOR (100%) and lower median RV (0.00 [cm3]) compared to the STD group (98.2% and 0.34 [cm3], respectively) (p=0.001 and p=0.005, respectively). Incidence of new postoperative focal defects and postoperative KPS scores were comparable between groups. Median OS was 375 days for STD and 475 days for MR (p=0.8), while median PFS was 113 and 183 days (p=0.05). Multiple regression analysis revealed a -0.05 hazard ratio for MR compared to STD regarding OS (p=0.8) and a -0.41 hazard ratio for PFS (p=0.04).
Conclusions: Mixed reality facilitates higher-quality resections compared to standard procedures without compromising patient clinical outcomes. While MR did not significantly impact OS, it notably improved PFS.
Optional Image

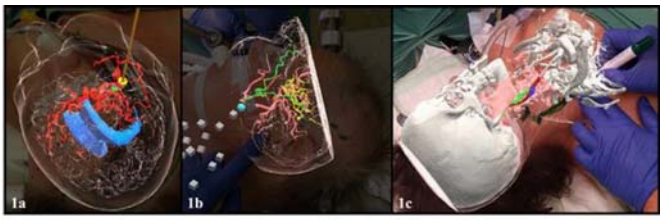


Figure 1: Exemplifying intraoperative cases, respectively MCA-IA clipping (1a), flow augmentation bypass (1b) and CEA (1c). The apparent drift between the patient's head and the hologram is due to the height of the HoloLens 2 camera, which is above that of the user's eyes. Nonetheless, the user visualizes an adequate head-to-hologram match.

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91
Brain and Spine 4 (2024) 103720
Deep Immunophenotyping Unveils Depletion of Anti-inflammatory T-helper Type-2 Cells (Th2) and Links Loss of Alternatively-Activated-Monocytes (M2) to Vasospasm and Delayed Cerebral Ischemia Following Subarachnoid Hemorrhage

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Circulating immune cells, particularly monocytes and T cells, depending on their polarisation form and activation status, play a decisive role in the outcome-relevant sterile inflammatory response after aneurysmal subarachnoid hemorrhage (aSAH). The exact dynamic of subgroup polarisation and their role after aSAH is unclear. Therefore, this prospective and controlled study investigated monocyte and T-cell polarisation after aSAH to explore dynamic changes over the course of aSAH and their association with post-SAH complications and clinical outcomes.
Methods: We conducted a prospective observational cohort study involving 75 patients with aSAH. Twenty healthy controls were enrolled for this study. Deep immunophenotyping of T-cells and Monocytes was performed using multi-colour FACS analysis on days 1, 4, 7, and 11 post-aSAH. Clinical events, including macro vasospasm, cerebral infarction, and the outcome (mRS 6 months 0-2 vs 3-5 vs 6) were recorded prospectively and analysed using ANOVA and following post-hoc t-tests.
Results: Patients with aSAH displayed reduced alternatively activated monocytes (M2) (3.0% vs 6.3% of all monocytes; p=0.04) and Th2 T cells (45.5% vs 75.3% of all T cells; p<0.001) within 24h after bleeding compared to healthy individuals. Prior to macro vasospasm, patients depict relative reduction in alternatively activated monocytes (M2) (2.0% vs 4.0% of all monocytes; p=0.019) and relative increase in proinflammatory Th1 T cells (15.8% vs 9.3% of all t cells; p=0.0022). Likewise, prior to cerebral infarction, patients showed a relative reduction in anti-inflammatory alternatively activated monocytes (M2) (2.7% vs 4.1% of all monocytes; p=0.049). No significant correlation was observed with patient outcomes (for all p>0.61).
Conclusions: Aneurysmal SAH led to an enhanced pro-inflammatory response, inducing an early shift of monocyte and T-cells towards classical inflammatory phenotypes. Patients confronting CVS or DCI revealed a loss of alternatively activated monocytes (M2) and Th2 T cells shortly after the bleeding prior to macro vasospasm and cerebral infarction. Reconstitution of anti-inflammatory monocytes and T-cells can be exploited to combat vasospasm and confer

neuroprotection after aSAH.

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399
Brain and Spine 4 (2024) 103721
Intraoperative Precision Sampling of Tumor Microenvironments based on 7T MRSI: A pipeline development

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

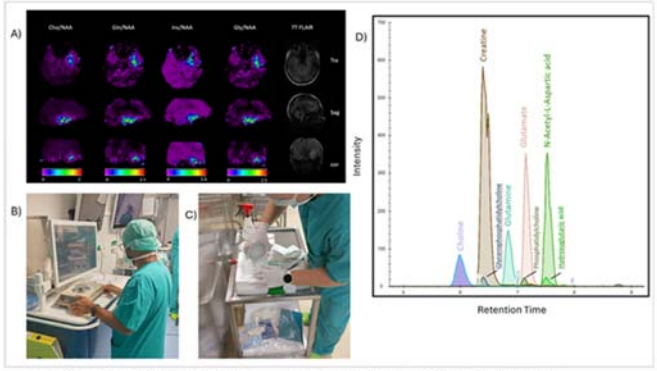
Background: 7 Tesla (7T) magnetic resonance spectroscopic imaging (MRSI) is capable of imaging neurochemical compounds in the human brain at higher resolution than previous methods. Gliomas represent a complex type brain tumours that also can display intratumoral heterogenities. Our 7T MRSI maps can resolve metabolic heterogeneties and could be used to obtain samples from specific intratumoral hotspots. Therefore, the purpose of this study is to develop a pipeline to validate this that includes MRSI, map transfer to neuronavigation, surgical sampling, and sample validation by mass spectrometry (MS).

Methods: We acquired 7T MRSI with 3.4 mm resolution in patients with suspected gliomas. After quantification using LCmodel, metabolic maps (primarily for choline (Cho), N-acetylaspartate (tNAA), glutamine (Gln), glycine (Gly), and myo-inositol (Ins) were created and converted to DICOM using KARAWUN. We transferred these together with morphological reference data to our neuronavigation planning server. Metabolic hotspot regions of interest (ROIs) were then contoured by neurosurgeons for sampling. During surgery, samples were taken from the ROIs and separated for histopathology, Raman spectroscopy (NIO Imaging), and analytical chemistry. Mass spectrometry was used to create quantitative metabolic profiles of the tumors.

Results: We have applied this pipeline to 4 patients so far. This first patient's metabolic ratio maps show the intratumoral increases of Cho, Gln, Ins and Gly ratios to tNAA. NIO identified tumorous tissue in all four patients. Preservation for further chemical analysis was successful and preliminary MS results confirm at least the presence of Cho and Gln.

Conclusions: We successfully tested our proposed pipeline. Preliminary MS and NIO results show that we were able to sample tumor hotspots based on 7T MRSI maps. This indicates that our intended workflow is feasible for future studies to validate 7T MRSI and to explore heterogeneous glioma metabolism.

Optional Image



A) MRSI maps of metabolites of interest **B)** Weighing of tumor **C)** Sampling of tumor
D) Mass spectrum for quantified metabolites

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861
Brain and Spine 4 (2024) 103722
Specific Reversal Agents For DOACs In Neurosurgical Emergencies – A Systematic Review

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Idarucizumab and andexanet alfa (AA) are approved to reverse the anticoagulant effect of direct oral anticoagulants (DOACs). However, there is little knowledge of effectiveness and safety of their use for emergent neurosurgical interventions such as craniotomy, ventriculostomy, or craniectomy. This systematic review aims to evaluate the available literature on the use, effectiveness, and outcome of specific reversal agents for DOACs in patients who need emergency neurosurgical treatment, e.g. for intracranial hemorrhage (ICH).

Methods: We performed a systematic review among various databases from January 2015 to 15th February 2024. Inclusion criteria were case series of minimum 5 patients on DOACs receiving AA or idarucizumab for emergency neurosurgical treatment (<24h after last DOAC intake). Safety was the primary outcome, with thromboembolic events (TE), functional clinical outcome, and mortality as secondary outcomes.

Results: The literature search returned 761 records, of which 9 were assessed for eligibility. For AA, four articles reported on one or more of the outcomes of interest (range: 5 to 15 subjects). No neurosurgery-related post-operative bleedings were described, and adequate hemostasis was reported in 80-100%. One study showed a TE rate of 8.3% and an in-hospital mortality of 50% in 12 patients, while another reported no TE and an in-hospital mortality of 20% in 5 patients. For idarucizumab, five articles met the inclusion criteria, two of which were (interim) analyses of later published data and were excluded. The number of patients in the three remaining articles ranged from 5 to 97. Satisfactory hemostasis was reported in 93.5 to 100%. TE rates ranged from 0 to 4.1% and mortality rates were 0, 3.1 and 12.5%.

Conclusions: Specific reversal agents for DOACs in emergency neurosurgical procedures achieve adequate hemostasis in the majority of patients. The available literature, however, is very limited and heterogeneous. Projects to fill this knowledge gap are urgently needed.

Optional Image

Study	Neurosurgical patients (n)	Type of surgery (n)	Effectiveness of intraoperative hemostasis[c] (%)	Postoperative bleedings (n)	TE (%)	Functional clinical outcome[d]	In-hospital mortality (%)	30-day mortality (%)
Andexanet alpha								
Ammar et al., 2023	12	EVD (12)	NA	1	8.3%	mRS 4-6	50%	NA
Bradshaw et al., 2022	15[a]	craniotomy (6), EVD (9)	80%*	NA	27,3%**	GCS 10-15	22.7%**	34.1%**
Giovino et al., 2020	5	craniotomy (4), EVD (1)	100%	0	NA	NA	0%[e]	NA
Culbreth et al., 2019	5	craniotomy (2), EVD (2), HE (1)	80%	NA	0%	NA	20%	NA
Idarucizumab								
Levy et al., 2021	8	craniotomy (8)	100%	NA	0%	NA	NA	12.5%
Haastrup et al., 2021	5	NA	100%	NA	0%	NA	0%	0%
Yasaka et al., 2023	97[b]	NA	93.5%*	NA	4.1%*	NA	3.1%[f]	NA

Abbreviations: EVD, external ventricular drain; HE, Hematoma evacuation; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale; NA, not available; TE, thromboembolic events

a	the study reports on a total of 20 patients requiring neurological surgery / intervention; 15 patients required cranial neurosurgery
b	a total of 112 patients with neurological surgery / procedure were presented
c	supplementary material delivered data for 97 neurosurgically managed patients definitions varied between studies; values describe excellent/good, normal/mildly abnormal, completion of surgery without report on excessive bleeding
d	of alive patients at discharge
e	mortality only reported for the craniotomy patients, NOT for EVD
f	mortality within 5 days after admission of idarucizumab
*	cohort including neurointerventional and spine procedures
**	overall cohort including ALL surgical procedures

Table 1: Overview of the includes studies

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947

Brain and Spine 4 (2024) 103723

C-reactive Protein Is Increased In Patients With Chronic Subdural Hematoma Recurrence: A Cohort Study

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: The systemic inflammatory biomarker C-reactive protein (CRP) is expressed both in the blood and brain and is widely used to identify inflammation. For the management of chronic subdural hematoma (CSDH), CRP may play a role in identifying patients at risk of recurrence by grading the underlying pathophysiological inflammation.

We aimed to explore the role of CRP in patients with CSDH by establishing the systemic and subdural CRP levels, investigating if CRP could predict recurrent CSDH, and comparing CRP levels between the first and second operations in recurrent CSDH patients.

Methods: CRP levels were measured in systemic blood and subdural fluid from adult CSDH patients. Outcomes were recurrence rate and mortality within 90 days. In total, 111 patients were included, of which 25 had recurrence, requiring surgical intervention.

Results: For all CSDH patients, systemic CRP levels (2.54 mg/L; 95% confidence interval (CI): [1.40-9.75]) were significantly higher than subdural levels (2.09 mg/L; 95% CI [0.99-5.22]), but within the clinically defined normal CRP range of < 3 mg/L ($p<0.0001$). Systemic CRP levels at the time of the primary operation could with low accuracy predict recurrence. In patients with recurrent CSDH, comparing both systemic and subdural CRP levels, the CRP levels were significantly higher at the time of the second surgery ($p_{systemic}=0.004$ and $p_{subdural}<0.0001$).

Conclusions: In conclusion, this study establishes a correlation between systemic and subdural CRP levels in CSDH patients. Furthermore, the increase of CRP at the time of the second surgery in patients with CSDH recurrence, suggests an increasing inflammatory process during the development of a recurrent CSDH. Finally, systemic CRP levels may be a weak predictor for recurrence.

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984

Brain and Spine 4 (2024) 103724

Salt versus sugar: a systematic review assessing 3% hypertonic saline versus 20% mannitol for intracranial pressure control in severe paediatric traumatic brain injury

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Traumatic brain injury (TBI) represents a significant cause of morbidity and mortality among children. Guidelines for pediatric TBI management recommend the use of hyperosmolar therapy to address elevated intracranial pressure (ICP), yet no consensus has been reached regarding the optimal treatment. This systematic review aims to evaluate the comparative effectiveness of two hyperosmolar therapies—3% hypertonic saline (HTS) and 20% mannitol—in terms of reducing ICP and improving outcomes for children with TBI.

Methods: Methods: A comprehensive literature search across four major databases for studies published between 2000 and January 2024 was conducted using PRISMA 2021. Cohort studies and randomised control trials (RCT) which compared the efficacy of 3% HTS versus 20% mannitol in paediatric patients with severe TBI (glasgow coma scale ≤ 8) on ICP were included. The risk of bias (RoB) was assessed using the Newcastle-Ottowa scale.

Results: Results: Of 608 initial articles, only four met our inclusion criteria. RoB assessment found half of the included studies with inadequate comparability and follow-up, yet methodology was adequate across all studies. Outcomes varied across studies, with Roumeliotis et al. (2016) reporting no significant change in ICP following either treatment, while Shein et al. (2016) observed a significant decrease in ICP post-HTS administration. Kumar et al. (2019) found no difference in ICP reduction between the two therapies, whereas Kochanek et al. (2022) highlighted a larger ICP decrease with HTS initially, albeit without significant differences after covariate adjustment.

Conclusions: Conclusion: The collective evidence demonstrates the nuanced management of hyperosmolar therapy for managing ICP among paediatric TBI patients; while highlighting the scarcity of RCT-backed evidence. Variations in study design and patient populations may contributed to the heterogeneity between outcomes. The overarching goal of optimising outcomes for severe paediatric TBI remains paramount. Further RCTs are needed to establish definitive hyperosmolar treatment guidelines for severe paediatric TBI.

Optional Image

Study	Neurosurgical patients (n)	Type of surgery (n)	Effectiveness of intraoperative hemostasis[a] (%)	Postoperative bleedings (n)	TE (%)	Functional clinical outcome[d]	In-hospital mortality (%)	30-day mortality (%)
Andexanet alpha								
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Idarucizumab								
Levy et al., 2021	8	craniotomy (8)	100%	NA	0%	NA	NA	12.5%
Haastrup et al., 2021	5	NA	100%	NA	0%	NA	0%	0%
Yasaka et al., 2023	97[b]	NA	93.5%*	NA	4.1%*	NA	3.1%[f]	NA

Abbreviations: EVD, external ventricular drain; HE, Hematoma evacuation; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale; NA, not available; TE, thromboembolic events

a	the study reports on a total of 20 patients requiring neurological surgery / intervention; 15 patients required cranial neurosurgery
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*	mortality within 5 days after admission of idarucizumab
**	cohort including neurointerventional and spine procedures
	overall cohort including ALL surgical procedures

Table 1: Overview of the includes studies

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685

Brain and Spine 4 (2024) 103725

Prospective, Randomized Study Comparing Minimal Invasive Burr Hole Craniotomy to Drill Hole Craniotomy for the Management of Chronic Subdural Hematomas

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: The chronic subdural hematoma (cSDH) is a frequently treated entity for neurosurgeons worldwide. Since the occurrence of this pathology is particularly common in elderly and multimorbid patients, the demographic shift is increasing the pressure on our healthcare systems, which are already facing major economic challenges. The high number of recurrences leads to an even greater importance of standardization of the medical approach. However, a wide spectrum of various surgical procedures is still employed.

Methods: In our study, we compared bedside evacuation of the cSDH using hollow screws (HS) under local anesthesia with the commonly used evacuation via enlarged burr holes (BH) under general anesthesia in a randomized, prospective, unicentric trial. 140 patients were enrolled in the period from 2015 to 2020, 9 patients had to be excluded during the course of the study. Mean age was 77.

Results: HS trephination is not inferior to BH in terms of recurrence rate (BH 31.2% vs. HS 47.8%; $p>0.05$) or clinical outcome ($p>0.05$). Yet, this less invasive surgical approach is associated with a significantly shorter operation duration ($p<0.05$) and a shorter hospital stay (median BH 4.3 days vs HS 3.0 days; $p<0.005$).

Conclusions: In the treatment of chronic subdural hematoma (cSDH), HS trephination should be considered as a reasonable alternative to BH trepanation, especially considering the demographic changes in modern society.

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133
Brain and Spine 4 (2024) 103726
The value of salvage therapy in recurrent glioblastoma

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Virtually all glioblastoma relapse. Progression free- (PFS) and overall survival (OS) after recurrence is poor. Evidence for efficacy of salvage therapies is scarce. The aim of this study is to investigate the impact of salvage therapy on OS in recurrent glioblastoma.
Methods: From August 1st, 2005, to December 31th, 2022 patients presenting with recurrent IDH-wildtype glioblastoma (CNS WHO grade 4) to our department were included in this retrospective analysis. Inclusion criteria were histologically diagnosis, primary complete resection, prior first-line therapy according to STUPP or CeTeG and Eastern Cooperative Oncology Group (ECOG) performance status score 2 or better at the time of recurrence and no re-radiotherapy. Salvage therapies included lomustine (CCNU), dose intensified temozolomide (TMZ+), temozolomide rechallenge (TMZ) and nimustine (ACNU) / teniposide (VM26) as second-line and regorafenib and CCNU as third-line therapy. Primary outcome parameter was overall survival (OS).
Results: A total of 90 patients from all patients with recurrent glioblastoma met the inclusion criteria. The median age was 62 years (21-81) with 38 being female (42 %). MGMT promotor methylation was found in 27 (30 %) and was not analysed in 23 (25,6 %) patients. 47 patients (52.2 %) underwent re-surgery prior to second-line, 8 (4,4 %) patients prior to third-line therapy. In the second-line group, 47 (53,2 %) patients received CCNU, while 14 (15,56 %) received TMZ+, 13 (14,4 %) TMZ and 10 (16,2 %) ACNU/VM26 as second-line therapy. 19 (21,1 %) patients received regorafenib and 10 (11,1 %) patients CCNU as third-line therapy. However, median OS was not significantly different between different second-line treatment modalities (CCNU 8.3 m, TMZ+ 7 m (95% CI 0.45-4.0), TMZ 11.4 m (95% CI 0.34-2.16), ACNU/VM26 7.2 m (95% CI 0.52-2.5) (p=0.07). Median OS after third-line therapy was 10.4 m in those receiving regorafenib and 5.8 in those receiving CCNU (95% CI 0.78-4.1) (p=0.009). No difference was found in OS between patients undergoing re-surgery prior to salvage chemotherapy and chemotherapy alone. OS after third-line treatment was superior compared to best supportive care (p<0.0001). Using multivariate logistic regression analysis re-resection and salvage chemotherapy were significant and independent predictors of OS after tumor recurrence.
Conclusions: Second- and third-line salvage therapies significantly prolonged OS in patients with relapsed glioblastoma independent from deployed therapy regimens. Using multivariate logistic regression analysis re-resection (95%CI 0.409-0.991, p=0.004) and salvage chemotherapy (95% CI 0.165-0.515, p<0.0001) were significant and independent predictors of OS after tumor recurrence. This data emphasizes the high value of salvage therapies as second- and third-line treatment in recurrent glioblastoma.

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194
Brain and Spine 4 (2024) 103727
Effects of argon in the acute phase of subarachnoid hemorrhage in an endovascular perforation model in rats

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: Subarachnoid hemorrhage (SAH) is a devastating disease with high morbidity and mortality. Neuroprotective effects of the noble gas Argon have been shown in animal models of ischemia. The aim of this study was to investigate the effects of Argon in the immediate early phase of SAH in a rat model.
Methods: 55 male Wistar rats were randomly assigned to 3 treatment groups. SAH was induced using the endovascular filament perforation model. CBF, mean arterial blood pressure (MAP) and body temperature were measured continuously. Group A received 2 hours of ventilation by 50% Argon/50% O2 immediately following SAH. Group B underwent a sham operation, and was also ventilated by Argon/O2. Group C received a SAH but no further treatment. Pre- and postoperatively neurological and behavioral testing was performed. Histology and immunohistochemistry were used to evaluate the extent of brain injury and vasospasm.
Results: The CBF dropped in both treatment groups after SAH induction (SAH: 63.0±11.6% of baseline; SAH + argon: 80.2±8.2 % of baseline) and recovered incompletely in all groups. During SAH MAP increased (135.2±10.5%) compared to baseline (85.8±26.0mmHG) and normalized thereafter. MAP in both groups showed no significant differences (p=0.3123). The vessel diameter of the basilar artery in sham operated animals was 234.1±38.0 µm, in those with SAH 296.5±11.4 µm indicating vasodilation (p=0.0096). In those animals with SAH + argon, vessel diameter was 195.3 µm±11.1 µm (p=0.11). Immunohistochemical staining for NeuN demonstrated a decrease of hippocampal immunoreactivity after SAH in the CA 1-3 region compared to baseline (p=0.0127). Animals in the argon ventilated group showed less neuronal loss compared to untreated SAH animals (p<0.0001). Iba-1 staining showed a decreased accumulation after SAH + argon (CA1: 2.57±2.35%; CA2: 1.89±1.89%; CA3: 2.19±1.99%; DG: 2.6±2.24%) compared to untreated SAH animals (CA1: 5.48±2.39%; CA2: 4.85±4.06%; CA3: 4.22±3.01%; DG: 3.82±3.23%). Less microglia accumulation indicated less activation in the argon ventilated group (p=0.0007). The Neuroscore assessment revealed a deterioration after SAH compared to baseline (p=0.0141), however no treatment effect was detected (p=0.385).
Conclusions: In the present study neuroprotective effects of argon occurred early after SAH. However, in the early phase of SAH, neurological deterioration was similar in the pre- and absence of Argon. It remains uncertain if neuroprotective effects of Argon translate in improved outcome over time.

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417
Brain and Spine 4 (2024) 103728
Prognosis-relevant factors in the surgical management of chronic subdural hematomas

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Subdural hematomas (SDHs) present significant challenges in clinical management due to their association with high morbidity and mortality rates. This study aimed to investigate factors contributing to mortality and morbidity in SDH patients, focusing on demographic characteristics, treatment modalities, and drain placement.
Methods: This retrospective analysis was performed on data collected from 85 patients with chronic subdural hematomas (cSDH) treated through a burrhole evacuation and receiving a drain at the Neurosurgery Department of University Hospital Jena between October 2020 and January 2023. Patient information encompassing medication usage, comorbidities, trauma history, symptomatology, hematoma size and density, treatment modalities, complications, and outcome variables including re-operation, recurrence, and overall survival, were obtained through an SAP-data query. Statistical analyses were conducted using JMP 14.0 software.
Results: The total cohort comprised 61 male (71,8%) and 24 female (28,2%) patients, with a mean age of 78.5 years. All patients underwent burrhole evacuation of the hematoma, with 55 individuals (64.7%) receiving subdural drainage and 30 (35.3%) receiving subgaleal drainage.
Analysis of drainage location did not reveal any statistically significant correlation or difference (Pearson's Chi-squared test: p = 0.2462). Survival analysis indicated no noteworthy extension in survival for patients with subgaleal drainage (Log-Rank Test: p = 0.6936). Moreover, the choice of drainage location did not lead to a statistically significant impact on epileptic seizures (Pearson's Chi-squared test: p = 0.8366). Nevertheless, the occurrence of an epileptic seizure was significantly associated with the need for a repeat operation during the same hospital stay (Pearson's Chi-squared test: p = 0.0004). Further

investigation into postoperative complications identified antithrombotic therapy, SDH volume, male gender and non- traumtic trauma history as potential risk factors. A trend towards increased complications with older age and male gender was noted.

Conclusions: The prevalence of chronic subdural hematomas increases with age, necessitating both conservative and surgical interventions. Burr-hole trepanation followed by drainage insertion is the standard approach, although the debate over conventional subdural drainage placement versus subgaleal placement persists. Our study found no significant differences between the two drainage locations regarding postoperative outcomes, including rates of rebleeding, recurrence, new postoperative symptoms, epileptic seizures, need for reoperations, and mortality. However, we identified male gender and initial use of antithrombotic medication as predictors for acute rebleeding, and the occurrence of epileptic seizures and non-traumatic etiology of cSDH significantly correlated with the need for reoperation. While age was not identified as a risk factor for acute postoperative rebleeding or recurrence, the entity of acute subdural hematoma emerged as a critical predictor of high mortality. Our analyses confirmed the findings of other studies but highlighted the need for further multicenter randomized studies to determine the superiority of subgaleal drains.

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419

Brain and Spine 4 (2024) 103729

Usefulness of direct auricular artery injection as refinement of the rabbit shunt subarachnoid haemorrhage model

Kristina Catalano [1,2], Sivani Sivanrupan [1,2], Gwendoline Canzanella [1,2], Ronaldo Schmied [1,2], Jeannine Rey [1,2], Daniela Casoni [3], Hans-Rudolf Widmer [2], Serge Marbacher [1,2,4], Lukas Andereggen [1,2,4], Basil Grüter [1,2,5], Stefan Wanderer [1,2], Ali - Reza Fathi [6]. [1] *Department of Neurosurgery, Cantonal Hospital Aarau, Aarau, Switzerland;* [2] *Program for Regenerative Neuroscience, Department for BioMedical Research, University of Bern, Bern, Switzerland;* [3] *Department for BiomedicalResearch, Faculty of Medicine, University of Bern, Bern, Switzerland;* [4] *Faculty of Medicine, University of Bern, Bern, Switzerland;* [5] *Division of Neuroradiology, Department of Radiology, Kantonsspital Aarau, Aarau, Switzerland;* [6] *Neurochirurgie Fathi AG, Switzerland*

Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: Given the impact of aneurysmal subarachnoid hemorrhage (aSAH) on patients' health, preclinical research is crucial to understand patients' outcomes, necessitating reliable and comprehensive models. In this context, traditional aSAH models with iliacal or subclavian access often require invasive procedures associated with significant risks. Therefore, our aim was to explore a less invasive technique that similarly replicates the traditional aSAH model.

Methods: Material and **Methods**: In a total of 6 female New Zealand white rabbits (3.2 – 4.1 kg body weight) an experimental SAH was induced by applying a subclavian-cisternal shunt. For this, subclavian access was gained via microsurgical preparation, followed by digital-subtraction-angiography. Afterwards, insertion of an ICP-probe, puncture of the cisterna magna and induction of the shunt followed. On day 3, all procedures without inserting the ICP-probe were repeated. Prior euthanasia, contrast agent was given over an arterial catheter located in the auricular artery to induce retrograde filling of the basilar artery.

Results: None of the rabbits died. In two of the rabbits (n = 2), a postoperative hemisyndrome was observed, which improved significantly by the time of the follow-up. No further relevant morbidities were found. Macroscopically, all animals showed clear subarachnoid bleeding pattern. Retrograde bolus injection over the auricular artery led to a strong contrasting of the basilar artery in all animals.

Conclusions: Auricular access demonstrated imaging quality comparable to that of subclavian access, underscoring its potential for meaningful advantages. This non-surgical access offers a significantly shorter operation time. Moreover, employing the aforementioned injection technique mitigates the risks associated with catheter dislocation from the subclavian artery when turning the rabbit from supine to prone. Neurological recovery in rabbits is facilitated by avoiding the need for dissection through the pectoralis muscle. Nonetheless, it's crucial to note the adherence to the principles of replacement, reduction, and refinement (the 3Rs) in animal research.

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994

Brain and Spine 4 (2024) 103730

LAMINOPLASTY VERSUS LAMINECTOMY FOR INTRADURAL SPINAL TUMORS: A RETROSPECTIVE SERIES ANALYSIS OF CONSECUTIVE CASES SERIES

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Intradural spinal tumors resection requires exposure of the dural sac through a laminoplasty (LPL) or laminectomy (LCT). To date there are no studies demonstrating the advantage of one approach over the other.

Methods: Aim of this bicentric prospective observational study is to compare clinical and radiological outcome of LPL vs. LCT in a consecutive series of patients operated on for intradural spinal tumors. Selection of the procedure was based on personal preference of the treating surgeon. All consecutive patients with intradural lesion from 2018 to 2023 with a minimum 6-month-follow-up were included. Operation time, hospital stay, postoperative pain, complications, and incidence of postoperative spinal deformity were extracted.

Results: 74 patients (25M and 49F, average age 53 years) with intradural tumors were included and divided in two groups, depending on whether they underwent LPL (n. 39, groupA) or LCT (n. 35, groupB). Most frequent level was thoracic (51,3%), followed by lumbar (35,1%), cervical (18,9%) and sacral (1,3%). Patients presented with myelopathy (56,8%), radicular deficits (54,1%), dysesthesia (70,3%) and back pain (55,4%). Extension of resection was gross total in 83,8% and subtotal in the remaining cases. Most frequent histology were schwannoma (31,1%) and meningioma (37,8%). Postoperative complications were CSF leak (1 groupA, 3 grouB), epidural hematoma (1 groupA), dysesthesia (2 groupA, 2 groupB), neurological bladder (1 groupA, 3 groupB), chronic back pain (2 groupA, 3 groupB) and worsening of motor deficits (2 groupA, 6 groupB). Significant statistic differences were observed in terms of operation time (P=0.018), hospital stay including residential rehabilitation (P=0.034), complications (P=0.022) and incidence of postoperative spinal deformity (P=0.032) in favor of LPL.

Conclusions: Even with its limitations of a limited sample size and selection bias, LPL seems to portend a better outcome. Further studies are necessary to evaluate the different impact on the outcome of the two techniques.

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202

Brain and Spine 4 (2024) 103731

Impact of continuous levetiracetam use in glioblastoma: An Individual Patient-Level Meta-Analysis Assessing Overall Survival

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Levetiracetam (Lev), an antiepileptic drug (AED), exerts its influence on glioblastoma (GB) by sensitizing to alkylating chemotherapy through the inhibition of MGMT expression. Augmenting the clinical therapy for GB with Lev may be an avenue for optimizing temozolomide therapy. This meta-analysis analyzes the literature and reconstructs survival probabilities of individual patient data (IPD) stratified by Lev use.

Methods: IPD of overall survival (OS) were extracted from published Kaplan-Meier charts using the R package IPDfromKM in R (Version 4.3.1). Reconstructed Kaplan-Meier Charts of the pooled IPD data were generated. One-stage and two-stage meta-analyses were conducted. Hazard ratios (HR) served as metrics for assessing effectiveness.

Results: Out of 3567 records screened, three articles encompassing 825 patients were eligible for inclusion. The prevalence of continuous Lev use was 0.36. IPD with a median follow-up of 16.1 months from 590 IDH wild-type glioblastomas were created. Reconstructed OS curves for the pooled cohort revealed median

survival times of 19.2 (95% CI: 16.4-22.0) months, and 16.5 (95% CI: 15.2-17.8) months for IDH wild-type GB patients with continuous Lev use, and partial/no Lev use, respectively (p=0.006). One-stage meta-analysis demonstrated an association between continuous Lev use and survival time in IDH wild-type GB (HR: 1.33, 95% CI: 1.08-1.64, p = 0.007). Two-stage meta-analysis validated these findings.

Conclusions: The present meta-analysis from IPD underscores that continuous Lev use may extend the survival time of IDH wild-type GB patients. The critical imperative now lies in the conduction of a randomized trial to validate these results and pinpoint subgroups of GB patients benefiting most from Lev treatment.

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727

Brain and Spine 4 (2024) 103732

Reduced temporal muscle thickness predicts shortened survival in patients undergoing chronic subdural haematoma drainage

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: Chronic subdural haematomas (CSDH) cause excess mortality, which is exacerbated by frailty. Reduced muscle mass is a key component in frailty, sarcopenia and other geriatric syndromes, and it can be measured opportunistically from cross-sectional imaging. In particular, temporal muscle thickness (TMT) is associated with whole-body muscle mass and possibly overall recovery capacity.

We examined the prognostic value of TMT measured from routine CT head scans in patients undergoing CSDH drainage. We tested the reliability of these measurements, and assessed their value in predicting post-operative mortality alongside known predictors of poor outcome. We also evaluated associations between TMT, comorbidities, nutritional laboratory parameters and other descriptors of clinical condition.

Methods: All patients (n=188, 122 men, median age 78 years) who underwent CSDH drainage between 2/2019 and 2/2020 were retrospectively identified, and their mean TMT was measured from preoperative CT head scans.

Results: The two-year mortality rate was 18% (n=34), and 51 (27%) patients died during the median follow-up time of 39 months (IQR 34–42). Measurement reliability was good-to-excellent (ICC 0.85–0.97, p<0.05). TMT decreased with increasing age (Pearson's r –0.38, p<0.001), males had higher TMT than females (p<0.001) and low TMT was associated with higher ASA grade, higher Charlson Comorbidity Index, and lower albumin and haemoglobin levels. BMI or height were not associated with TMT.

TMT was associated with shortened post-operative survival, and this effect became more prominent with increasing age (Figure 1). The optimal TMT cut-off values for predicting two-year survival were 4.475mm for males and 3.125mm for females. TMT below these cut-offs was associated with shorter survival (HR 1.86, 95%CI 1.02–3.36) when adjusted for age, ASA grade and bleed volume.

Conclusions: TMT measurements from routine clinical imaging were reliable and provided prognostic information supplemental to known predictors of poor outcomes.

Optional Image

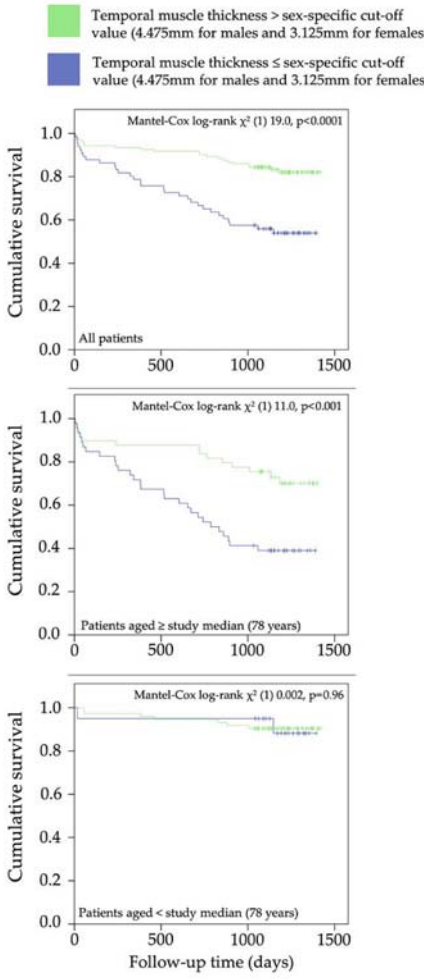


Figure 1. Kaplan-Meier curves of post-operative survival following CSDH drainage including all patients, those aged ≥ study median (78 years) and those aged < study median (top, middle and bottom figures, respectively).

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286

Brain and Spine 4 (2024) 103733

Intracranial-intracranial bypass strategies for the treatment of complex intracranial aneurysms: Anatomical characteristics and surgical intervention

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM

Background: The effectiveness of revascularization for complex aneurysms is well established. The aim of this study was to describe the technical characteristics and clinical efficacy of intracranial-intracranial (IC-IC) bypass for the treatment of complex intracranial aneurysms.

Methods: We retrospectively reviewed all patients with aneurysms who underwent a preplanned combination of surgical clipping or endovascular treatment and IC-IC bypass at our institution between January 2006 to December 2020. IC-IC bypass techniques included four strategies – type A (end-to-end reanastomosis), type B (end-to-side reimplantation), type C (in situ side-to-side anastomosis), and type D (IC-IC bypass with a graft vessel).

Results: During the study period, nine patients with an aneurysm underwent surgical clipping and IC-IC bypass surgery. Aneurysms were located in the middle cerebral artery (n=7, 77.8%), anterior temporal artery (n=1, 11.1%), and anterior cerebral artery (n=1, 11.1%). There were three saccular aneurysms

(33.3%), two fusiform aneurysms (22.2%), and four pseudoaneurysms (44.4%). We performed the type A strategy in five patients (55.6%), type B in one (11.1%), and type D in three (33.3%).
During a mean period of 70 months, a good clinical outcome (mRS score 0-2) was observed in all patients and a follow-up angiogram performed for all patients demonstrated complete aneurysm obliteration in all patients and good bypass patency in eight of nine patients (88.8%).
Conclusions: The treatment of complex aneurysms remains a challenge with conventional surgical or endovascular treatments. IC-IC bypass surgery is a useful technique for complex aneurysms and shows favorable clinical outcomes.

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21
Brain and Spine 4 (2024) 103734
Aneurysmal subarachnoid hemorrhage with fulminant course and fatal outcome: incidence and risk factors

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Aneurysmal subarachnoid hemorrhage (aSAH) is a stroke subtype characterized with high morbidity and mortality. In some severe cases, fulminant onset of SAH predestinates the fatal disease outcome despite maximal treatment. In this retrospective study, we analyzed the incidence and risk factors for aSAH with fulminant and fatal course (FFC).
Methods: The study is based on consecutive aSAH cases treated between 01/2003 and 06/2016 in our clinic. Baseline demographic, clinical and radiographic characteristics were recorded. Patients with initial WFNS Grade V, clinical signs of brainstem herniation and in-hospital mortality were regarded as cases with FFC. Univariate and multivariate analyses were performed.
Results: FFC with median post-aSAH survival of 3 days (IQR: 2-6 days) was observed in 59 of 995 (5.9%) aSAH patients included in the final analysis. There was no change in the prevalence of aSAH with FFC over the observational period. In the multivariate analysis, the location of ruptured aneurysm at the basilar artery (aOR=3.02, 95% CI=1.51-6.04, p=0.002) and sack size >7 mm (aOR=3.53, 95% CI=1.93-6.44, p<0.0001) were independently associated with the risk of FFC. There was a borderline significance for higher probability of FFC in older aSAH individuals (>55 years: aOR=1.74, 95% CI=0.99-3.07, p=0.054). Pre-existing comorbidities and regular medication did not show significant associations with the risk of FFC.
Conclusions: FFC is rare in aSAH patients who survive until hospital admission. Our data underline the importance of preventive treatment of unruptured intracranial aneurysms with large size and location at the basilar artery.

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562
Brain and Spine 4 (2024) 103735
Intracranial aneurysms hemorrhage risk assessment using scales dedicated to unruptured aneurysms – retrospective study

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: The decision to treat unruptured intracranial aneurysms (UIAs) is challenging and based on multiple factors. However, there are many cases where decisions should be taken individually by a consulting physician. Scores and clinical tools, like PHASES, UIATS, or ELAPSS scores, were created, which could be implemented in everyday clinical practice. Despite their external validation, there are controversies around their clinical application.
Methods: A retrospective analysis of the adult patients charts diagnosed and treated for aneurysmal subarachnoid hemorrhage in the Department of Neurosurgery and Neurooncology in Copernicus Memorial Hospital in Łódź from January 2022 to December 2023 was performed. Multiple factors were evaluated according to PHASES, UIATS, and ELAPSS. Ruptured aneurysms were analyzed using aforementioned scores, as there would be unruptured ones.
Results: The mean age of all patients (n=146) was 66.9 ± 11.3 years old. One hundred three patients were in the ruptured group, and 43 had unruptured aneurysms. Based on the UIATS, 55 ruptured cases (53%) were subjected to conservative treatment. According to PHASES, the system indicated lower rupture risk in the bleeding group than in the unruptured (1.5% ± 2.6, 2.1% ± 2.9, p=0.001, respectively). Similar results were observed in the ELAPSS (11.7 points ± 7.1,13.6 points ± 6.4, p=0.065, respectively). Noteworthy, ruptured aneurysms were significantly smaller (5.8 mm ± 3.4) in contrast to unruptured ones (6.5 mm ± 3.5) (p=0.05). A cut point for decision in PHASES was at 1.7% of a 5-year risk of rupture and 28.1% for a 5-year risk of aneurysm growth in ELAPSS. Relatively, a low true predictive potential was revealed (AUC=0.327 and AUC=0.403, respectively), indicating a high proportion of false negative results.
Conclusions: Based on prediction and recommendation, according to UIATS, PHASES, and ELAPSS a large amount of bleeding patients would not be treated in the unruptured scenario. The study revealed that presented scores have low predictive potential. Other systems and factors should be evaluated for more accurate clinical application for treatment recommendations of unruptured aneurysms.

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253
Brain and Spine 4 (2024) 103736
Reducing Soft Tissue Complications in CAD Cranioplasty: The Role of Implant Curvature reduction in a Multidisciplinary Approach

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM
Background: Cranioplasty, particularly with alloplastic materials, is recognized for its inherent risks despite the procedure's superficial simplicity. This study aims to explore the complexities of cranioplasty, focusing on the reduction of curvature in CAD cranioplasties as a strategy to mitigate soft tissue-associated complications, especially in patients with critical soft tissue conditions.
Methods: A cohort of 103 patients who underwent CAD cranioplasty between December 2020 and November 2023 was analyzed. Patients were divided into two groups based on the curvature of their cranioplasty: normal curvature (71 patients) and reduced curvature (32 patients). The primary outcome was soft tissue-associated complications, while secondary outcomes included other preoperative, intraoperative, and postoperative parameters.
Results: The normal curvature group comprised 71 patients (60% male, 40% female) with an average age of 39.74 years, and the reduced curvature group included 32 patients (61% male, 39% female) with an average age of 48.96 years. The reduced curvature group, characterized by a higher complexity score average of 1.46 and an interquartile range (IQR) of 1 compared to the normal curvature group with a complexity score of 1 (IQR = 0), showed a significant improvement in managing soft tissue complications despite the complexity of the cases. Notably, all six explantations due to soft tissue complications occurred in the reduced curvature group, underscoring the critical nature of these cases. However, the strategic reduction of curvature has proven to be an effective measure in these complex scenarios, highlighting its value in enhancing postoperative outcomes.
Conclusions: The study findings affirm that the strategic reduction of curvature in CAD cranioplasties is a viable approach to reducing soft tissue-associated complications in patients with critical soft tissue conditions. This method is particularly beneficial in complex cases, as indicated by the higher complexity scores and the specific challenges faced by the reduced curvature group. The significance of curvature adjustment in CAD cranioplasty underscores the need for careful preoperative planning and a tailored approach to each patient's unique anatomical and clinical circumstances. Our analysis suggests that despite the complexities inherent in cranioplasty procedures, curvature reduction offers a promising avenue for complication mitigation, advocating for its consideration in the surgical planning process.

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1423
Brain and Spine 4 (2024) 103737
Subarachnoid Haemorrhage from Spinal Tumours – A Systematic Review of the Literature

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM

Background: Spinal subarachnoid haemorrhage (SSAH) originating from spinal tumours is a rare entity that may lead to cauda equina syndrome or spinal cord compression with the potential to extend along the entire length of the subarachnoid space.
Methods: A systematic review following PRISMA guidelines was conducted, searching MEDLINE, Embase, Web of Science, and Cochrane databases from January 1997-2024.
Results: A total of 3,794 papers were retrieved, with 42 publications meeting inclusion criteria. We identified 48 cases of SSAH, 81.3% of which were spontaneous SSAH. The median age was 41 years, with a male-to-female ratio of 1.7:1. Ependymomas were the most common tumour type (39.6%), followed by schwannomas (25%) and hemangioblastomas (18.8%). Most cases presented with a combination of cranial/cerebral symptoms (52.3%), while the rest exhibited spinal symptoms alone (47.7%). Notably, 8 cases (34.8%) presented initially with cranial/cerebral symptoms only. Diagnostic modalities included MRI (40.9%), CSF analysis (38.6%), and intraoperative confirmation (11.4%), with surgical treatment (93.8%) being the primary management approach, almost always involving laminectomy. Complete recovery was reported in 60% of cases.
Conclusions: This study represents the first systematic review of SSAH from spinal tumours. The findings underscore the importance of maintaining a high index of suspicion for spinal tumours causing SAH, particularly in cases presenting with a combination of cranial and spinal symptoms. Spinal tumours presenting with SAH may manifest with a spectrum of cranial/cerebral symptoms and SAH on cerebral/cranial neuroradiological investigations. A comprehensive understanding of these presentations is crucial for timely diagnosis and appropriate management.

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474
Brain and Spine 4 (2024) 103738
Molecular differences in long- and short-time survivors of GBM patients

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Glioblastoma (GBM) is a highly aggressive brain tumor. Despite maximal multimodal tumor therapy, the overall survival is still poor (15 months after diagnosis). Regardless of standard molecular diagnostics, there are cases with extremely short (<9 months, short-term survivors, STS) and long-term GBM patients (>36 months, long-term survivors, LTS). An understanding of the underlying molecular mechanisms is still missing.
Methods: This is a single-center retrospective analysis of 206 GBM tumor patients with an overall survival of < 9 months and >36 months. All patients receiving tumor therapy per the Stupp protocol in-house were included. Molecular analyses were performed with TSP 500 next-generation sequencing.
Results: 206 GBM patients were included (57 STS, 125 ITS, 24 LTS). LTS had younger (median 60 years) and more female (54%) patients than ITS and STS do. We found no significant difference between the tumor heterogeneity in all groups (TMB, MSI). TERT promotor mutations are more frequent in LTS 63%, vs. 54% ITS and 53% STS (p=0.7080). Pathogenic TP53 mutations are also slightly more frequent in LTS 13% than in ITS 6% and STS 5% p=0.4746). LTS presented more NF1 likely pathologic mutations (21%) than ITS (18%) and STS (5%) do (p=0.0037).
Conclusions: In summary, the molecular analysis of GBM patients, for those with STS and LTS, reveals the critical role of TERT promotor. Further minor differences were seen, but no distinct biomarker could be identified. Other studies and proteomic analyses are needed.

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106
Brain and Spine 4 (2024) 103739
Enhancing Glioblastoma Immunotherapy: Synergistic Effects of CAR T-Cells and Checkpoint Inhibitors in a patient-derived ex vivo Glioblastoma Organoid Model

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Oral e-Poster Presentations - Booth 2: Neuro-Oncology 1 (GBM & malignant gliomas), Neuro-Oncology 2 (GBM & malignant gliomas), October 15, 2024, 12:40 PM - 2:10 PM

Background: Glioblastoma (GBM) remains a challenge in neurooncology, characterized by high malignancy and limited therapeutic options. Despite advancements in multimodal therapy, prognosis remains poor. Immunotherapies, including checkpoint inhibitors (CPIs), have shown limited efficacy, partly due to complex interactions with the tumor microenvironment (TME). This study explores potential synergistic effects of Chimeric Antigen Receptor (CAR) T-cells and CPIs in an ex vivo patient-derived organoid (PDO) model of GBM.
Methods: PDOs from three different GBM patients were cultured together with allogeneic peripheral blood mononuclear cells (PBMCs) to enhance TME characteristics. These enhanced PDOs (ePDOs) were treated with CPIs (anti-PD1, anti-LAG-3, anti-TIM3, or anti-CTLA4) and CAR T-cells both individually or in combination. Untreated ePDOs served as control. Apoptosis of tumor-associated antigen (TAA)-positive cells and CD4+ T cell proliferation were quantified via immunofluorescence double staining.
Results: Significant synergistic effects were observed with the combination of CPI and CAR T-cells, leading to increased apoptosis rates compared to individual treatments. The most pronounced effects were observed after 36 hours, correlating with the highest apoptosis rate. Notably, CAR T-cells combined with CTLA4-CPI exhibited a significantly higher apoptosis rate than untreated ePDOs (p=0.0152) and CTLA4-CPI treatment alone (p=0.0385). Additionally, combinations of LAG3- or PD1-CPI with CAR T-cells induced significantly higher CD4+ T cell proliferation compared to untreated ePDOs (p=0.0005 and p=0.0042, respectively).
Conclusions: This study unveils the potential of synergistic combinations of CAR T-cells and CPIs in GBM treatment, demonstrating enhanced TAA apoptosis and CD4+ T cell proliferation rates. These findings highlight the potential of this approach to enhance immunotherapeutic outcomes for GBM patients and provide an opportunity to improve the prognosis for patients with this devastating disease.

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986
Brain and Spine 4 (2024) 103740
Intracranial Pressure Prediction Using Machine Learning and Mathematics: what are the pitfalls and is it possible?

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Oral e-Poster Presentations - Booth 4: Trauma and Critical Care 2, Trauma and Critical Care 3, Trauma and Critical Care 4, October 15, 2024, 12:40 PM - 2:10 PM

Background: A great number of patients with intracranial hypertension (IH) are treated annually worldwide. Globally there are more than 25 million TBI cases each year and it remains the most common cause of death in the demographic group of males under 45 years of age. These patients are more often than not, treated with uncertain outcomes and both mortality and morbidity remain high. They are also currently dependent on invasive methods of intracranial pressure (ICP) monitoring. The development of an ICP prediction model using Machine learning would prove extremely valuable and would allow the bedside clinician to adjust the patients treatment before the deterioration of their clinical status.
Methods: A protocol for specific ICP monitoring and data collection for this use was scripted, different machine learning (ML) models and other mathematical models were proposed for this use and a literature analysis was conducted.
Results: In the past, there has been a significant effort to predict ICP values in time. We identified ten studies attempting to predict ICP in a clinical setting. The main problems causing the inaccuracy of data resulting from these studies were (1) the use of a small sample size, either for the effective training of the ML model or for reliable clinical use, (2) the use of purely mathematical models for prediction, and (3) prediction of a relatively short sequence and lastly (4) the use of non-invasive methods of ICP monitoring for the training of the ML models.
Conclusions: Prediction of ICP, more specifically intracranial hypertension episodes in advance is certainly possible, as it has been shown in many studies before, although the study sizes and accuracy of these models would have to be significantly increased for a reliable use in the intensive care setting and the possible modification of therapeutic regimen based on these models.

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24
Brain and Spine 4 (2024) 103741
Weather Conditions Associated With Severity Of Aneurysmal Subarachnoid Hemorrhage: A Single-Center Observational Study

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: Controversy surrounds seasonal variations in spontaneous intracranial aneurysm rupture leading to subarachnoid hemorrhage (SAH). Bio-synop weather classes categorize weather conditions impacting human health positively and negatively, recognized for their potential relevance to acute and chronic conditions by influencing biological processes. This study explores the connection between bio-synop weather classes and SAH occurrence and severity, using data from a large retrospective cohort at our high-volume neurovascular center.
Methods: The analysis involved data from patients with aneurysmal SAH treated between March 2006 and March 2020 at our department. In collaboration with the German Meteorological Service, we compared SAH incidence and severity (graded by the Hunt&Hess score) to bio-synop weather classes. The Kruskal-Wallis test addressed whether SAH occurrence is more frequent and/or severity is increased in specific bio-synop weather classes. Additionally, we assessed if SAH exhibits seasonal dependence, a factor suggested in previous studies.
Results: Overall, data from 982 patients with acute SAH were analyzed. No statistically significant difference in SAH incidence under specific bio-synop weather classes was found ($p=0.168$). Concerning seasonality, a notable reduction in SAH occurrences in June each year was observed, achieving significance in sub-tests for specific months only, although the overall Kruskal-Wallis test did not show statistical significance ($p=0.157$). Regarding severity, our data unveiled a notable increase in H&H grades during class 4 ("rear side of low-pressure system with cold air advection") weather conditions, previously identified as a determinant for adverse health outcomes ($p=0.022$).
Conclusions: Our results suggest that while the incidence of SAH may not be directly influenced by specific weather conditions, there appears to be a notable connection between certain bio-synop weather classes and severity at admission. The observed decrease of SAH incidence in June tentatively implies a possible seasonal pattern. Further research on potential underlying mechanisms is warranted to better understand this phenomenon.

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546
Brain and Spine 4 (2024) 103742
Prognostic Factors in Aneurysmatic Subarachnoid Hemorrhage with Poor Clinical Status on Admission.

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Oral e-Poster Presentations - Booth 1: Vascular 2, October 15, 2024, 12:40 PM - 2:10 PM
Background: In patients with aneurysmatic subarachnoid hemorrhage (SAH), WFNS grade 4 or 5 on admission is a poor prognostic factor, however, some of these patients have a good outcome. Several studies have proposed prognostic factors to select patients who may have a better outcome to optimize therapies and avoid expenses with overtreatment. The goal of this study was to evaluate the impact on the outcome of these prognostic factors.
Methods: We performed a retrospective study including patients with aneurysmatic SAH and WFNS 4 or 5 on admission, treated between 1/1/2015 and 12/31/2021 in two Portuguese centers. We included 96 patients, 71% were female and the median age was 57 years. We evaluated several prognostic factors and applied prognostic scales recently proposed in the literature, namely the HHPA and SAFIRE. We measured outcome using the Glasgow Outcome Scale (GOS) and modified Rankin Scale (mRS) at discharge and at 6 months. Statistical analysis was performed using IBM SPSS software.
Results: At discharge more than 20% of patients had a good outcome, increasing to more than 40% at 6 months. The Glasgow Coma Scale (GCS) on admission, the HHPA and SAFIRE scales had a statistically significant correlation with prognosis. Values of HHPA ≤ 4 and SAFIRE ≤ 10 present a greater likelihood of a good outcome. Earlier treatment also correlated with a better prognosis. The need for decompressive craniectomy upon admission contributed to poor prognosis. Age was not a factor correlating with prognosis.
Conclusions: This study shows that for this subgroup of patients with aneurysmal SAH and WFNS 4 or 5, GCS on admission, HHPA and SAFIRE help predict outcome. In patients with HHPA ≤ 4 and/or SAFIRE ≤ 10, treatment should be undertaken as early as possible to maximize the probability of a good outcome.

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570
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Carbon fiber transpedicular screws in the treatment of spinal metastatic disease and stereotactic radiotherapy - the prospective, randomized trial protocol

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Oral e-Poster Presentations - Booth 3: Spine 7 (Tumors), October 15, 2024, 12:40 PM - 2:10 PM
Background: The standard treatment of metastatic spinal disease is mostly posterior instrumentation of the spine using titanium pedicle screws. These systems cause artifacts in diagnostic imaging, both in CT and MRI. These distortions make it difficult to plan radiotherapy and determine the optimal dose. Moreover, artifacts could make difficult postoperative follow-ups focused on local recurrence. The use of radiolucent implants could be a solution that does not cause typical titanium implant-associated artifacts.
Methods: The present study is a three-arm, prospective randomized trial aiming to enroll 226 adult patients with metastatic spinal disease, with a known or unknown primary tumor, qualified for SBRT and surgical treatment. Patients are qualified for two types of interventions: first, treatment with stereotactic radiotherapy (SBRT) followed by early instrumentation of the spine with titanium implants, or second, surgical treatment with spine stabilization with either carbon-PEEK or titanium instrumentation and postoperative SBRT. Patients stabilized with carbon implants are considered the experimental group compared with those who have titanium implants.
Results: The primary endpoint is the assessment of time to and frequency of local recurrence after complete treatment. Secondary outcome measures include the frequency of radiation complications and the subjective difficulty of planning

radiotherapy according to the NCI CTC, a failure rate of stabilizing systems, pain assessment on the VAS scale between groups, frequency of postoperative infections, differences in dosimetric parameters.
Conclusions: We hypothesize that the treatment proposed in the project may extend progression-free survival by several months or increase the proportion of local control by 5% of patients. Moreover, by improving the quality of imaging, earlier diagnosis of local recurrence and implementation of appropriate locoregional treatment would be possible.
This study has been funded by the Medical Research Agency, Poland, grant no. 2023/ABM/01/00013 (ClinicalTrials no. NCT06293157).

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1445
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Endoscope-Assisted Anterolateral Approach For The Treatment Of A Jugular Foramen Schwannoma

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Jugular foramen (JF) schwannomas are rare skull base tumors that arise from lower cranial nerves. The anterolateral approach (ALA) represents a valid option for JF tumors with predominant extracranial extension considering the direct access to the anterior cervical region, and the lower part of the JF. In case of both intracranial and cervical extension, combination with a transpetrosal to open the JF has been previously described. Here we demonstrate the use of endoscope-assisted technique ALA to avoid additional transpetrosal exposure.
Methods: We present a case of a dumbbell-shaped JF schwannoma with voluminous extracranial extension surgically treated using an endoscope-assisted pure ALA. The surgical steps of the approach and tumor removal are provided along with the surgical video.
Results: A 61-year-old man presented headaches, tinnitus, feeling of fullness of the right ear, vertigo, and swallowing disorders. The MRI showed a right-side dumbbell-shaped JF, lesion with a large cervical extension. The intraoperative monitoring for cranial nerves VII, IX, X, XI, and XII was set up. The ALA was performed by individualizing the accessory nerve, the posterior edge of the digastric muscle, the jugular vein, and the X and XII cranial nerves, exposing the cervical portion of the tumor. We proceeded with debulking of the cervical portion of the tumor until the lower part of the JF. Then, we switched to angled endoscopes to remove the part of the tumor into the JF and extending intracranially. The postoperative MRI showed a gross total resection. The patient showed dysphagia worsening that recovered progressively in early postoperative course.
Conclusions: Endoscope-assisted ALA represents a valid option for JF tumors with large cervical extension and limited intracranial component. Angled endoscopic techniques result in useful tools for skull base surgery, allowing to reduce the extension of the approach and potential complications related to a more aggressive surgery.

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1353
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Pediatric intracranial aneurysms: an institutional experience over 20 years.

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM
Background: Intracranial aneurysms are extremely uncommon in the pediatric population. Their epidemiology is poorly understood, and certain features make them unique. In our study we analyzed pediatric intracranial aneurysm patients to gain an insight into the epidemiology, clinicoradiological and treatment profile as well as outcome.
Methods: A retrospective review of pediatric patients (≤18 years old) obtained between 2000 and 2020 was performed. A non-infundibular arterial luminal outpouching larger than 1mm in size in MRA/DSA was identified as an "Intracranial aneurysm." Patient demographics, clinical presentations, and predisposing risk factors, including family history and underlying medical conditions, were reviewed. MRA images and DSA were analyzed for aneurysm location, number, maximum diameter, and interval changes on follow-up.
Results: 51 patients (31 females, 20 males) with 64 intracranial aneurysms were identified with an average age of 11.51 ± 2.73 years. 13 patients (25%) had multiple aneurysms. An underlying systemic illness was observed in 78% (40/51) cases, with sickle cell disease as the most frequent (9/40, 23%) diagnosis. A first-degree family history of intracranial aneurysms was recognized in 1/51 (2%) patients. While 7/51 (14%) patients presented with acute SAH, headache was the most common (18/51, 35%) symptom at presentation in unruptured cases. The majority (47/64, 74%) of the aneurysms were located in the anterior circulation, with the ICA ophthalmic segment being most frequently (23/47, 48%) involved. Most (55/64, 86%) aneurysms were smaller than 4mm in size at the time of diagnosis. At least one follow-up MRA was obtained in 73% (32/44) of the unruptured aneurysms cohort. There was no change in the aneurysm size and morphology in 93% patients over an average imaging follow-up of 37.6 months. 2 (4%) patients demonstrated an interval increase in the aneurysm size. SAH patients (n=7) and two unruptured aneurysm patients with an interval increase in size were successfully treated with surgical clipping.
Conclusions: Female predominance with a higher frequency of small and unruptured intracranial aneurysms was recognized in our cohort. A higher incidence of an underlying systemic illness, especially sickle cell disease, was also noted. Most intracranial aneurysms in children appear to remain stable. However, there seems to be the risk of an aneurysm size increase which warrants regular clinical and imaging follow-up.

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1237
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Radiation induced meningiomas – a monocentric evaluation of clinical characteristics

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Intracranial meningiomas may be induced after radiation exposure, for example radiotherapy of CNS malignancies. However, little data is available regarding their nature and characteristics of affected patients.
This study aimed to evaluate clinical features and potential differences in surgical treatment of radiation induced meningiomas.
Methods: We identified all cases of radiation-induced (RI) intracranial meningiomas that underwent tumor resection at our hospital between 2007 and 2023. Demographics, tumor-related characteristics were retrospectively evaluated and compared with non-radiation-induced tumors. T-test, Chi-Squared and logistic regression analysis were used for statistic workup, as appropriate, $p<0.05$ was considered statistically significant.
Results: During this period, 40 cases of RI meningioma underwent surgery in our department. For comparison, 817 historic cases were available. Patients exposed to radiotherapy prior to development of meningiomas were significantly younger (43.7±12.4 vs 59.9±13.2 years, $p<0.001$). WHO grade 1 tumors were present in 80.3%, grade 2 in 17% and grade 3 in 0.8% of cases and were significantly higher in RI cases ($p=0.03$). Complete resection was achieved in 70.1% and did not differ from non-RI tumors ($p=0.9$). Tumor diameter ($p=0.8$) and location ($p=0.26$) did not differ significantly.
In multivariate analysis, RI tumors (HR 3.1 95%CI 1.2-7.7 $p=0.01$), WHO grade (HR 2.6 95%CI 1.5-4.3 $p<0.001$) and adjuvant radiotherapy (1.8 1 95%C 1.04-3 $p=0.03$) significantly predicted progression free survival.
Conclusions: The management of radiation-induced meningiomas poses additional challenges due to younger patient population and larger proportion of higher-grade tumors. Tumors induced by radiotherapy show independently decreased progression-free survival.

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772
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Epigenetic Profiling in Meningiomas: Predictive Value and Clinical Implications

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: The epigenetic characteristics of meningiomas may offer greater predictive accuracy than WHO grading potentially impacting treatment decisions.
Methods: We retrospectively analyzed meningioma patients operated in our institution from 1/2021 to 12/2023. Demographics were collected, histological and genome wide DNA-methylation analyses were conducted by an independent neuropathologist, using comprehensive epigenetic analyses with the 850k Illumina chip.
Results: We included 106 patients, median age 65 and predominantly female (ratio 3:1). Median follow up was 6.7 months (range 0.5-36.5).
Histology revealed grade 1 in 81 (76%) patients, grade 2 in 20 (19%) and grade 3 in 5 (5%). In total, 54 tumors (51%) were classified as benign, 18 (17%) as intermediate, and 2(2%) as malignant, while 25 tumors (23%) remained unclassified and 7 (7%) were not epigenetically tested. Discordances between histology and methylation classifier were observed in 18/74 patients, while 25 tumors remained unclassified and 7 were not epigenetically tested.
For WHO grade 1 tumors only, methylation analysis confirmed benign methylation classification in 47 cases, but 8 tumors had an intermediate classifier score, the remainder could not be determined conclusively.
Tumor board decisions were made at a median of 8 days postoperative with WHO grading present, while obtaining the histological epigenetic report took a median of 22 days. All patients with WHO grade 3 or malignant classifier scores were offered adjuvant radiotherapy.
Until 20 January 2024, 16 patients have shown radiological progression with a median of 122 days. Both the meningioma classifier (r 0.3, p 0.0102), as well as tumor volume (r 0.4, p 0.0005) were correlated with progression, but not WHO grading (r 0.17, p 0.084)
Conclusions: The methylation based meningioma classifier seems to be a more robust predictive factor of tumor progression than WHO grading. Clinical decision making can be based on classifier scores. In our series, follow up is still short, and progression data must be interpreted cautiously.

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142
Brain and Spine 4 (2024) 103748
Radiomics-based prediction of intraoperative blood loss during intracranial meningioma surgery

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Meningioma surgery is frequently accompanied by substantial blood loss, which is associated with an increased incidence of medical morbidities. Neuroimaging features, such as radiomic characteristics, could provide additional quantitative information on the tumor. Nonetheless, the usefulness of radiomics in predicting intraoperative blood loss has yet to be validated. Our objective was to examine the potential of radiomics to predict intraoperative blood loss in patients with intracranial meningiomas.
Methods: A total of 109 patients with primary diagnosed intracranial meningiomas were evaluated using high-resolution brain magnetic resonance imaging (MRI), which included T1-weighted pre- and postcontrast, T2-weighted, diffusion-weighted (with apparent diffusion coefficient) images, and arterial spin labelling (ASL). MRI data were processed with subsequent extraction of radiomics features. The most significant predictors were determined using the random forest machine learning-based method, with subsequent negative binomial regression analysis to model the dependency of selected metrics on the rate of intraoperative bleeding.
Results: We found that the best predictors of intraoperative blood loss among the radiomics parameters, including glszm_SizeZoneNonUniformity, ngtdm_Coarseness, and glrlm_LowGrayLevelRunEmphasis metrics, within ASL-based cerebral blood flow (CBF) maps and glrlm_GrayLevelNonUniformity, glrlm_RunEntropy, and glszm_ZoneEntropy metrics within apparent diffusion coefficient (ADC) maps were the most effective ($p < 0.01$ for all factors). The resulting model allowed us to predict intraoperative blood loss with a median precision of approximately -23 (-101; 68) ml (M (Q1; Q3)) in patients with intracranial meningiomas. Tumor volume, tumor location, histological grade, and surgery duration were found to be much less significant predictors than the other parameters and did not improve the model.
Conclusions: Radiomic features could provide valuable information for the presurgical evaluation of patients with intracranial meningiomas. The ADC and ASL were the two modalities for predicting intraoperative blood loss in patients with intracranial meningiomas with good precision.

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985
Brain and Spine 4 (2024) 103749
Effect of shunt-dependency on long-term outcome after aneurysmal subarachnoid hemorrhage: A post-hoc analysis of the EARLYDRAIN prospective patient cohort

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: Shunt-dependent chronic hydrocephalus is common after aneurysmal subarachnoid hemorrhage (aSAH) and has the risk to compromise the functional recovery of affected patients. This study investigated whether the shunt-dependency influences the long-term functional outcome in aSAH patients after reha-bilitation.
Methods: The analysis was performed using the patient collective of a prospective randomized controlled trial (EARLYDRAIN) conducted in the time between 2011 and 2016, where patients were randomized for an early lumbar drainage (144 patients) or standard treatment (143 patients). Shunt insertion within 180 days after ictus was considered as shunt-dependency. Long-term outcome was assessed using the modified Rankin scale (mRS) at 180 days follow-up, mRS 2 was defined as favorable outcome. Univariate and multivariate regression analyses were performed to identify outcome predictors.
Results: The study population involved 287 aSAH patients with a mean age of 55 years. Shunt-dependent hydro-cephalus at 180 days follow-up had 24% (69/287) of all patients. Favorable outcome at 180 days follow-up was found in 61.3% (176/287) of patients. Univariate analyses revealed older age ($p<0.0001$), higher H&H grade ($p<0.0001$), shunt-dependency ($p=0.008$), intraventricular hemorrhage ($p<0.0001$), intracere-bral hematoma ($p<0.0001$), higher modified Fisher grade ($p=0.03$) as predictors of unfavorable outcome. In contrast, an early lumbar drainage was associated with favorable outcome ($p=0.03$). In the multivariate analysis higher H&H grade (OR 0.61, $p<0.0001$), the presence of intracerebral hematoma (OR 0.45, $p=0.008$), and higher age ($p=0.0002$) were negative outcome predictors. The shunt-dependency at 180 days follow-up was not a significant outcome predictor in the multivariate analysis.
Conclusions: This first prospective investigation on the impact of shunt-dependency on functional recovery in aSAH patients after rehabilitation revealed that shunt-dependency did not show an effect on the long-term out-come after correction for age and H&H grade. A clinical improvement after shunt insertion may be the explanation, why chronic hydrocephalus per se does not represent an independent predictor concerning long-term outcome.

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892
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Endonasal surgical management of tuberculum sellae meningiomas. Our experience

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: To assess the outcomes of endonasal interventions in patients with TS meningioma, establish criteria for patient selection for the endonasal approach, determine indications and contraindications, analyze the radicalism of operations, assess technical features, and evaluate complications associated with this approach.

Methods: This study focused on indications and contraindications for endonasal surgery of TS meningioma conducted at Romodanov Neurosurgery Institute from 2014 to 2023. Thirty-two patients with confirmed TS meningioma diagnoses, based on instrumental examinations, underwent endonasal tumor removal. Evaluation of intervention outcomes included postoperative ophthalmological assessments (utilizing optical coherence tomography - OCT), endocrine evaluations, instrumental follow-up (CT and MRI), and rhinoscopic examinations.

Results: The study describes the performance of endonasal surgery for TS meningioma, emphasizing a method of bony defect plastic surgery that significantly reduces the percentage of cerebrospinal fluid (CSF) leaks. The study confirmed a lower CSF leak rate (9.4%) compared to other authors. Radicalism of endonasal removal of TS meningiomas was assessed, with Simpson I achieved in 87.5%. Postoperatively, 81.2% of patients showed improvement in visual acuity and expanded visual fields. Complications included postoperative hypopituitarism (15.6%), syndrome of inadequate antidiuretic hormone secretion (6.25%), and CSF leaks (9.38%). Reoperation was required in cases of CSF leak (3.13%) and decreased visual acuity due to overpacking with a fat graft (3.13%). Anosmia occurred in 18.7% of cases in the postoperative period.

Conclusions: The main complications of endonasal interventions include intraoperative damage to neurovascular structures, CSF leaks, meningitis, nasoseptal flap necrosis, hemorrhages in the tumor bed, and overpacking with a fat graft leading to decreased vision in the early postoperative period and anosmia. The rate of major complications in this study is low and acceptable, with no occurrences of meningitis or hemorrhagic complications.

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415
Brain and Spine 4 (2024) 103751
Microsurgical Treatment Of Spheno-Orbital Meningiomas

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Spheno-orbital meningiomas(SOM) are a distinct type of sphenoid wing meningiomas causing hyperostotic changes in the sphenoid wing and extension into the orbit. The intradural extension often appears en-plaque, with the sphenoid wing protruding due to hyperostotic changes along the lateral orbital wall. Furthermore, the tumor also invades the periorbita through the superior orbital fissure(SOF). Microsurgical treatment of SOMs is challenging due to their complex pathological anatomy. The best oncologic and cosmetic results are achieved through widest possible resection. However, there is no definitive opinion on the tumor character or the best surgical technique for treating SOMs.

Methods: This retrospective series includes 14 SOM cases operated on between September 2017 and January 2024.

Results: Proptosis was presenting symptom in all cases. Vasogenic edema was present in the temporal lobe in 6 cases. Following a frontotemporal craniotomy, hyperostotic sphenoid ridge was drilled until inferiorly the SOF, deeply the anterior clinoid process, and anteriorly the zygomatic process of the frontal bone. The dura anterior to the temporal lobe was invaded by the tumor in all cases and removed to together with the intradural meningioma. In 9 cases, a small remnant was left where Sylvian veins drained into sphenoparietal sinus. In all cases, tumor extended through SOF the periorbita, which was removed until lateral rectus muscle was revealed. After dura closure, the bone opening was repaired using titanium mesh. Extensive removal of the tumor was achieved in all cases. Seven patients experienced significant improvement in proptosis and three patients achieved complete recovery. No neurological worsening occurred. Histopathology revealed intraosseous and meningotheliomatous meningioma in 11 patients, atypical meningioma in 1, secretory type in 2.

Conclusions: In microsurgical treatment of SOMs, it is important to plan the surgery to remove all three parts of the tumor. Two factors limiting tumor removal are invasion to sphenoparietal sinus and orbital roof.

Optional Image



Figure 1: Preoperative and postoperative radiological images of a 51-year-old male patient with a spheno-orbital meningioma (SOM). A-B: T1 contrast-enhanced and T2-weighted MRI images showing a SOM involving right greater wing of the sphenoid bone extending to the temporal lobe, intraorbital space, and the temporal muscle. C-D: Axial and coronal CT images showing hyperostotic changes in the sphenoid wing and lateral wall and roof of the orbita. E-F: T1 contrast-enhanced and T2-weighted MRI images revealed gross total removal of the intradural and intraorbital parts of the SOM. G-H: Axial and coronal CT images show complete removal of the hyperostotic bone. Reconstruction was performed with titanium mesh to support the temporal muscle and skin flap.

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208
Brain and Spine 4 (2024) 103752
Prediction of Meningioma Grade Using Blood Count Test

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Predicting the aggressiveness of meningiomas may influence the surgical strategy timing. Because of the paucity of robust markers, the systemic immune-inflammation (SII) index is a novel biomarker to be an independent predictor of poor prognosis in various cancers including gliomas. We aimed to investigate the value of SII as well as neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR) indices in predicting prognosis.

Methods: Records including demographic, clinical, and laboratory datas of patients operated on due to intracranial meningioma in 2017–2023 were retrospectively reviewed.

Results: A total of 234 patients were included in this study. All of SII index, NLR and PLR values at presentation were significantly higher in grade $\geq$2 meningiomas. A positive correlation was observed between SII index and Ki67 index ($r = 0.313$; $p < 0.001$); between NLR and Ki67 index ($r = 0.330$; $p < 0.001$); and between PLR and Ki67 index ($r = 0.223$; $p < 0.01$). SII index (optimal cutoff level > 618), NLR (optimal cutoff level > 3.53) and PLR (optimal cutoff level > 121.2) showed significant predictive values.

Conclusions: This is the first study to assess the prognostic value of the SII index in patients with intracranial meningiomas. Increased SII index, NLR and PLR were correlated with higher grade and higher Ki-67 index. They also harbor the potential to screen patients that may need more aggressive treatments or more frequent follow-up examinations.

Optional Image

Prognostic performances of SII, NLR, and PLR in predicting grade ≥2 meningiomas. ystemic immune-inflammation; NLR, neutrophil-lymphocyte ratio; PLR, platelet-lymphocyte ratio

AUC 95% CI	p	Cutoff	Sensitivity 95% CI	Specificity 95% CI	PPV	NPV
0.764 0.696-0.831	<0.001	>618	0.83 0.71-0.9	0.56 0.49-0.63	0.38 0.32-0.45	0.90 0.86-0.94
0.74 0.666-0.814	<0.001	>3.53	0.59 0.46-0.7	0.82 0.76-0.87	0.52 0.46-0.59	0.86 0.8-0.89
0.633 0.548-0.717	0.002	>121.2	0.76 0.63-0.85	0.48 0.41-0.55	0.33 0.27-0.39	0.86 0.80-0.89

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880
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The safety and use of perioperative dexamethasone in the perioperative management of primary sporadic supratentorial meningiomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Despite the lack of prospective evidence for the perioperative use of dexamethasone in meningioma surgery, its use is well established in the daily routine of several centers. The present study evaluates the effect of dexamethasone on postoperative complications, peritumoral T2/FLAIR hyperintensity, and progression-free survival in patients with supratentorial meningiomas undergoing resection.
Methods: A total of 148 patients who underwent resection of a primary sporadic supratentorial meningioma at the authors' institution between 2018 and 2020 were included in this retrospective cohort. Safety criteria were side effects of dexamethasone (e.g. hyperglycemia), surgical morbidities, length of stay, and mortality. The individual Karnofsky Performance Scales (KPS) were evaluated regarding the individual development and the delta of KPS at 3- and 12-months compared to baseline KPS was calculated. Longitudinal assessment of the peritumoral T2-/FLAIR hyperintensity changes was performed.
Results: The use of both pre- and postoperative dexamethasone did not influence the incidence rates of wound infections, infarctions, postoperative seizures, pulmonary embolism, postoperative hemorrhage, mortality, length of stay, new-onset hypergylcemia and new neurological deficits. Perioperative Dexamethasone use was associated with an improved Karnofsky performance development at 3- (delta of KPS 3.3 vs. -1.9, p=0.001) and 12-months (delta of KPS 3.8 vs. -1.1, p=0.008) compared to the preoperative Karnofsky performance status. Multivariable analysis revealed that perioperative dexamethasone use enhances the KPS improvement (OR: 3.65, 95% CI: 1.01-13.18, p=0.048). Persistent peritumoral T2/FLAIR hyperintensity changes were observed in 35 cases of 70 patients with available follow-up images and a baseline edema (50.0%). Perioperative dexamethasone use enhanced the reduction of the preoperative peritumoral T2-/FLAIR hyperintensity changes (mean reduction of maximum diameter: 1.8 cm vs. 1.1 cm, p=0.023). Perioperative dexamethasone use was independently associated with a lower risk for persistent peritumoral T2-/FLAIR hyperintensity changes (OR: 3.77, 95% CI: 1.05-13.54, p=0.042) The perioperative use of dexamethasone did not influence the progression-free survival time in Simpson grade I or II resected WHO grade 1 meningiomas (log-rank test: p=0.27).
Conclusions: Perioperative dexamethasone use seems to be safe in surgery for primary supratentorial meningiomas. Dexamethasone use might enhance the functionality by reducing postoperative peritumoral T2-/FLAIR hyperintensities. These findings highlight the need for prospective data.

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920
Brain and Spine 4 (2024) 103754
Surgical therapy of a large ruptured MCA Aneurysm in a 3-year-old infant: Case report and review of the literature.

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: A case of a 3-month-old infant suffering from spontaneous subarachnoid hemorrhage (SAH) from a 15 mm distal M2 aneurysm is reported.
Methods: No history of familiar genetic vascular disease history, infection or trauma was evident. Aneurysm rupture happened in a so far healthy and normal developed 3-month-old female infant. Sudden screaming followed by loss of consciousness lead to urgent hospitalization and performance of head ultrasound, CCT and MRI. SAH and a left insular hematoma was diagnosed and a 15 mm M2 aneurysm in a CTA at the distal insula found as the origin of the hemorrhage.
Results: Interdisciplinary endovascular- microvascular concealing within our vascular working group was performed and pro and cons as well as risks of endovascular versus open microsurgical therapy were weighted. Due to worthening of cerebral perfusion and rise of intracranial pressure, an external ventricular drainage (EVD) had to be planned to insert. Open surgery was chosen for aneurysm therapy and EVD inserted as well as trap ligation and excision of the aneurysm via a fronto-temporal osteoplastic craniotomy performed. The postoperative course was uneventful, no further ICP crises with drainage of about 150 ml CSF daily detected, only a small ischemic brain area at the angular region was diagnosed postoperatively at day 5 in a CT. Weaning and extubation of the infant was possible 10 days after surgery with no apparent neurological deficits detected. Dismission to the hometown hospital was possible 20 days after surgery.
Conclusions: SAH from large M2 aneurysms in infants are very rare (about 20 cases reported in the literature). Neither with endovascular nor with microsurgical therapy parent vessel preservation is regularly possible and bypass surgery normally not feasible. Fortunately, collateral vascularization at this young age seems to be capable to impede large clinically relevant strokes as our case had demonstrated.

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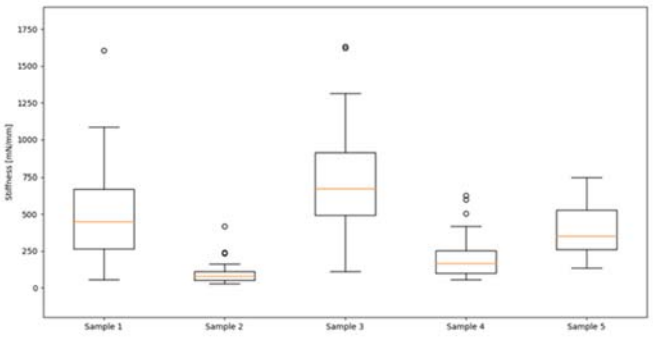
633
Brain and Spine 4 (2024) 103755
Texture Analysis as a Novel Method of Objective Quantitative Consistency Assessment for Meningiomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Preoperative knowledge of meningioma consistency could significantly influence surgical decision making and impact procedure safety. Several studies attempted to predict tumor consistency from MRI, however, they are limited by its subjective nature, typically relying on a basic, observer-dependent classification of tumors as either "soft" or "hard." This binary approach does not reflect the more subtle variations in tumor texture and can negatively affect subsequent statistical analyses. Our work aims to address this gap by introducing texture analysis as an objective quantitative method for assessing meningioma firmness.
Methods: We conducted a total of 169 texturometric measurements on meningioma samples from five patients using the Brookfeld CT3 Texture Analyzer. Analysis of variance (ANOVA) was utilized to examine the variance in stiffness measurements among samples. Linear regression analysis was conducted to investigate the potential influence of time from sample extraction at four time points (immediately after resection and after one, two and seven days). Spearman's rank correlation coefficient was calculated to evaluate the monotonic relationship between the stiffness and the amount of reticulin and type I collagen.
Results: Our results revealed a significantly lower variability in stiffness measurements within the same sample compared to between different samples ($p < 0.05$). There was a notable increase in stiffness corresponding to higher objectively assessed consistency grades ($p < 0.05$). Furthermore, we found a significant negative correlation between stiffness and the time elapsed since sample extraction ($p < 0.01$). There was also a significant monotonic relationship between stiffness and the levels of collagen I and reticulin fibers ($p < 0.05$).
Conclusions: Texture analysis offers a highly accurate representation of the inherent quality related to the consistency of meningioma samples, despite the presence of intra-sample variability. This method opens the possibility for more quantitative research into the role of meningioma consistency in surgical procedures.

Optional Image



https://doi.org/10.1016/j.bas.2024.103755

766

Brain and Spine 4 (2024) 103756

Incidence of hyponatraemia after subarachnoid haemorrhage and association with outcomes: a systematic review and meta-analysis

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: Hyponatraemia after subarachnoid haemorrhage (SAH) is common, however the incidence, and association with vasospasm, morbidity, and mortality, has yet to be defined. We aimed to identify incidence of hyponatraemia after SAH, and quantify its association with measurable outcomes.

Methods: A PRISMA-compliant systematic review and meta-analysis was conducted (PROSPERO ID CRD42022363472). Articles published in MEDLINE, EMBASE, and Cochrane Library between January 2000-September 2022 were included. Hyponatraemia definitions, incidence during admission, and association between vasospasm, length of hospital stay, and poor outcome (Glasgow Outcome Scale 3 or less) were identified. Pooled incidence rates, binary and continuous outcomes were calculated using random effects meta-analysis models.

Results: In total, 52 studies (10512 patients) were included. Most studies included patients admitted to tertiary neuroscience centres (61.5%, N=32), or critical care units (23.1%, N=11). Sodium of less than 135 mmol was the most commonly utilised hyponatraemia definition (84.6%, N=44). The pooled incidence of hyponatraemia was 37.0% (95% CI 31.7-42.4%). Hyponatraemia increased the risk of vasospasm (15 studies, Odds Ratio (OR) 2.93, 95% CI 1.77-4.84), and length of hospital stay (3 studies, 16.4 days vs 8.0 days, Mean Difference (MD) 8.5 (95% CI 4.6-12.4)), but was not associated with poor outcome (10 studies, OR 1.15, 95% CI 0.44-3.02). These findings remained when carrying out sensitivity analysis for different hyponatraemia and outcome definitions, bias, and SAH populations.

Conclusions: Hyponatraemia is common in SAH, increases the likelihood of vasospasm, but in isolation does not appear to affect overall outcomes. Managing hyponatraemia effectively should be a priority for treating clinicians.

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1267

Brain and Spine 4 (2024) 103757

Hybrid treatment (minimally invasive/mini-open) with double anterolateral and posterior approach in degenerative scoliosis: Outcome and clinical/radiological follow-up of 50 cases treated in a single center

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Oral e-Poster Presentations - Booth 2: Spine 4 (Deformities and malformations), October 15, 2024, 4:40 PM - 5:20 PM

Background: Traditional open surgery for treatment of adult degenerative scoliosis has characteristics, such as large surgical incision, long surgical times, considerable blood loss, intense post-operative pain with consequent delay in mobilization, which are poorly suited also in view of increased life expectancy. The use of modern minimally invasive surgical techniques with anterolateral and posterior approach allows to considerably reduce these complications allowing satisfactory correction of the deformity.

Methods: We retrospectively retrieved all 50 patients (mean age 64 years and 10 months, range 51-78) undergoing surgical treatment of degenerative scoliosis with a double minimally invasive antero-lateral (XLIF) and posterior approach (percutaneous osteosynthesis and mini-open TLIF). All patients were studied preoperatively with X-ray, MRI and spine CT, preoperative VAS and ODI were measured. Cobb angles and spinopelvic parameters (PT, PI, SS, LL, L4-S1L) were measured.

Results: For each patient, number and location of vertebral levels, perioperative complications, intraoperative blood losses, average hospital stay, and clinical outcome at 1, 6 and 12 months were analyzed. Radiological outcome was evaluated at 1 and 6 months. Mean postoperative hospital stay was 6.3 days. Difference between pre- and post-operative VAS was 7.545 vs 4.454 ($p < 0.005$), ODI 75.263 vs 44.368 ($p < 0.005$). Average preoperative Cobb angle was 18.68° +/- 8,47, while postoperative was 5,27° +/- 3,27°, with a variation of 71,7% ($p<0,01$). Preoperative mean lumbar lordosis (LL) was 37.9° +/- 14,2, while postoperative was 42,9° +/- 10,5 ($p=0,06$).

Conclusions: The hybrid treatment with double anterolateral and posterior approach has been shown to be noninferior to traditional open treatment in terms of radiological outcome, being burdened by a lower rate of peri and post-operative complications.

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850

Brain and Spine 4 (2024) 103758

Blood load in the 4th ventricle after aneurysmal subarachnoid hemorrhage: prognostic significance and impact of active blood clearance.

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: Blood in the fourth ventricle is associated with particularly poor outcomes after aneurysmal subarachnoid hemorrhage (aSAH). We investigate a) the prognostic significance of 4th-ventricular hemorrhage severity, and, b) the influence of active blood clearance on outcome in patients with 4th ventricular hemorrhage.

Methods: A retrospective review of our aSAH database was performed, and 817 patients with aSAH admitted between 01.01.2009 and 31.12.2022 were included. Blood clearance by cisternal fibrinolysis was introduced in October 2015 and the data set was split in two cohorts with 473 patients BEFORE availability of active blood clearance and 344 patients AFTER introduction of active blood clearance, which was performed in 111 (32.3%) patients. 4th ventricular hemorrhage was classed into 4 categories: grade 1 (no or minimal blood), grade 2 (partly filled), grade 3 (completely filled/cast) and grade 4 (ballooning due to hemorrhage). Neurological outcome was assessed using the modified Rankin Scale after 6 months by an independent rater.

Results: 4th-ventricular hemorrhage was present in 39.7% of patients. Ruptured aneurysms in the posterior circulation were associated with a higher risk for a high-grade (3-4) 4th-ventricular hemorrhage ($p=0.008$). In the BEFORE cohort, patients with grade 3 and 4 hemorrhages had poor outcome in 75.6% and 92.7%, respectively. In the AFTER cohort, blood clearance was performed in 24.7% (grade 3) and 31.7% (grade 4) of patients, and poor outcome was reduced to 57.5% and 75.6% ($p=0.043$, $p=0.017$), respectively. Grade 4 hemorrhage was the most powerful predictor for poor-outcome (OR:19.2, $p<0.001$) without active blood clearance. This association, however, was nullified after implementation of active blood clearance (OR:2.45, $p=0.075$).

Conclusions: Ballooned 4th ventricular hemorrhage (grade 4) represents a very powerful predictor of poor outcome after aSAH. Implementation of active blood clearance significantly improved outcomes in high-grade 4th ventricular hemorrhage patients.

Optional Image

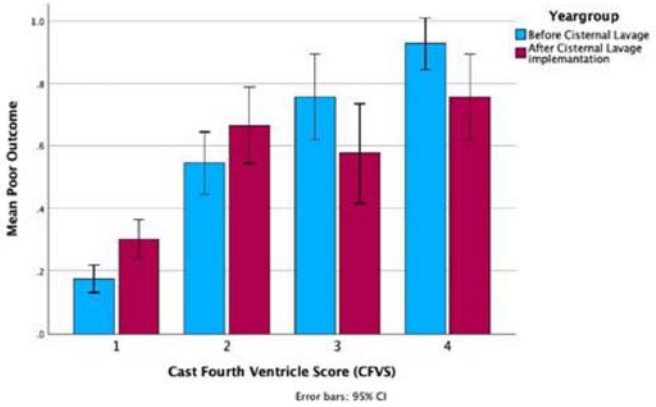


Figure 1: Proportion of poor outcome per degree of 4th ventricular blood. A higher rate of poor outcome occurred in patients with grade 3 or 4 hemorrhages in the cohort BEFORE active blood clearance, compared to AFTER.

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1189
Brain and Spine 4 (2024) 103759
Effectiveness of Gadolinium-yttrium Orthovanadate Nanoparticles for Treatment of Subarachnoid Hemorrhage

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: Despite early aneurysm repair and aggressive management for complications, subarachnoid hemorrhage (SAH) results in at least 25% mortality rate and 50% persistent neurological deficit. We investigated effectiveness gadolinium-yttrium orthovanadate nanoparticles (VNPs) for potential antioxidative activities in treatment subarachnoid hemorrhage and attenuating fatal brain injuries.
Methods: 50 rats were randomly assigned to the following groups: sham operation group (n = 10), SAH + saline group (n = 20), and SAH + VNPs group (n = 20). SAH was induced by endovascular perforation of middle cerebral artery of rats. A single dose VNPs or the control (the same volume of saline) was injected via tail vein at an hour after SAH. SAH grade, neurological outcomes, brain edema, neuronal death, macrophage infiltration, blood eryptosis indexes, ROS formation were evaluated at 72-144 hours after SAH.
Results: In rat SAH models, the severity of hemorrhage was comparable between the VNPs and saline-treated groups. However, VNPs significantly reduced neuronal death, macrophage infiltration, ROS formation after SAH. VNPs successfully improved overall survival rates (P<0.001) and neurological outcomes by modified Garcia score (P<0.001) of the animals with SAH. GdYVO NPs (d= 2 nm) effectively scavenge hydroxyl radicals·and remarkably reduce the lipopolysaccharide-induced ROS generation in rat leukocytes.
Conclusions: VNPs totally synthesized in aqueous phase demonstrated promising results against SAH via potent antioxidative, neuroprotective and anti-inflammatory activities. Given the obvious limitations of current therapies for SAH, gadolinium-yttrium orthovanadate nanoparticles nanoparticles can be a potential therapeutic agent which might result in a better outcome in SAH treatment.

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1453
Brain and Spine 4 (2024) 103760
Diagnosis of osteoporosis using CT based Houndsfield units

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Oral e-Poster Presentations - Booth 2: Spine 4 (Deformities and malformations), October 15, 2024, 4:40 PM - 5:20 PM

Background: Gold standard is the dual-energy X-ray absorptiometry (DEXA) and the resulting T-score. Some studies have already shown that the reliability of DEXA is defeated to other methods of bone densitometry in terms of diagnosis and predictive power for subsequent fractures. The aim of this study is to compare the correlation between measured DEXA values compared to "Houndsfield units" (HU) in patients with severe manifest osteoporosis with osteoporotic vertebral fractures.
Methods: From 2021 to 2023 we examined 230 patients with osteoporotic fractures of the spine (mean age 77 ± 6,5 years). All patients received CT imaging to evaluate the "OF classification." 72 patients were evaluted by Dexa measurement. The HU were evaluated axially in each of three non-fractured vertebral bodies of the lumbar spine. A ROI was measured for each vertebral body below the cover plate, in the central plate and above the base plate in the spongy bone. The HU cut off value was determined for an osteoporotic fracture on the basis of previous postulations of <110 and compared with the T-score of the DEXA.
Results: According to DEXA, only 46% of patients showed an osteoporosis (T-≤-2,5). However, according to the HU, 97% of the examined patients presented an osteoporosis.
While HU demonstrated a high sensitivity of 94% and specificity of 96% (positive predictive value (PPV): 95.6%, negative predictive value (NPV): 94.1%), comparatively DEXA showed a low sensitivity of 51% and specificity of 50% with a PPV of 46,5% and an NPV of 49,5%.
In patients who did not show any osteoporotic fracture (>-1) in the T-score, the mean HU value showed: 73,53; in patients with a low suspicion (-1 to -2.5): 87,16 and with manifest osteoporosis (<-2.5): 78,53. After classification of the osteoporotic fracture via OF classification, a successive decrease in HU according to the severity of the osteoporotic fracture could be evaluated (OF2: 98,28; OF3: 91,83; OF4: 75,48; OF5: 68.297) with a significant correlation (p=0.03).
Conclusions: Although currently still the gold standard for bone densitometry and diagnosis of osteoporosis, DEXA does not seem to be suitable for reliably detecting manifest osteoporosis in the spine in contrast to HU. Based on our data, HU seem to be much more suitable to verify manifest osteoporosis.

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471
Brain and Spine 4 (2024) 103761
The Ratio Of Baseline Ventricle Volume To Total Brain Volume Predicts Postoperative VP-shunt Dependency After Sporadic Vestibular Schwannoma Surgery

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM

Background: Obstructive hydrocephalus (HCP) linked to vestibular schwannoma (VS) typically arises in giant VS. It is anticipated that symptoms associated with HCP will improve following the removal of the tumor. Nonetheless, a subset of patients may necessitate ongoing ventriculo-peritoneal (VP) surgery. This investigation aims to identify the factors linked to the need for CSF diversion after VS surgery in instances of persistent HCP.
Methods: We analyzed 71 sporadic VS patients who underwent surgery in our center from 2012 to 2022. Koos grade 2, 3, and 4 tumors were included in the analysis. Volumetric MRI analyses of the pre- and postoperative tumor volumes, extent of resection (%), cerebellum, cerebrum, ventricle, and brainstem were performed using Brainlab Smartbrush and 3D Slicer. Total brain volume was defined as the sum of cerebrum, cerebellum and brainstem. ROC analyses were performed to identify optimum cut-off values of the volumetric data.
Results: Permanent CSF diversion after surgery was indicated in 12 patients (16.9%). The ratio of baseline volume fraction of brain ventricles to total brain volume volume (VTB-ratio) was found to predict postoperative VP-shunt dependency. The AUC was 0.71 (95% CI: 0.51-0.91) and the optimum threshold value (</≥0.449) yielded a sensitivity and specificity of 67% and 81%, respectively. Multivariable logistic regression analyses of imaging- (pre- and postoperative VS volume, brain ventricle volume to cerebellum volume ratio (VTB-ratio), extent of resection (%) (EoR) and patients-specific (age, sex, preoperative hydrocephalus) factors revealed that an increased VTB-ratio (≥0.049, OR: 6.2, 95%CI: 1.0-38.0, p=0.047) and an EoR (<96.4%, OR: 9.1, 95%CI: 1.2-69.3, p=0.032) are independently associated with postoperative VP-shunt

dependency.
Conclusions: Primary tumor removal remains the optimal treatment to reduce the risk of postoperative hydrocephalus necessitating VP-shunt surgery. However, patients with an increased preoperative ratio of brain ventricle volume – to – total brain volume are prone to need postoperative VP-shunt surgery and may benefit from perioperative EVD placement.

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631
Brain and Spine 4 (2024) 103762
Factors predicting internal carotid narrowing in anterior clinoidal meningiomas: a retrospective single-center study.

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Despite the advances of the anterior and middle skull base approaches, anterior clinoidal (AC) meningiomas remain challenging lesions to resect safely due to their intimate relationship with vital neurovascular structures. In this study, we assess the relationship between the meningiomas' characteristics with the internal carotid artery (ICA) classification by Goel.
Methods: 35 consecutive patients with anterior clinoidal meningiomas who were surgically treated between January, 2019, and December 2023, were reviewed retrospectively.AC meningiomas were classified based on Al Mefty's and Goel's classification by assessing preoperative Magnetic Resonance Imaging (MRI) and Computed Tomography angiography, respectively. 14 out of 35 were classified as group I,12 as group II and the rest were in group III. All three groups were classified based on tumor size, intraoperative consistency, WHO grade and ICA classification.
Results: Preliminary results suggest that both type I of clinoidal meningiomas and hard consistency identified intraoperatively were strongly associated with ICA narrowing. Interestingly, results have not yelled any statistical association regarding meningioma size and WHO grade.
Conclusions: In surgery of AC meningiomas, various clinicoradiological factors are related to resection grade and complication rate. In this study, a positive correlation between tumor consistency and type of AC meningiomas with ICA narrowing was identified, a relationship that has not been studied before based on current literature to this extent.

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283
Brain and Spine 4 (2024) 103763
Drug screening identifies synergistic drug combination carfilzomib & enzalutamide for the treatment of aggressive meningiomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Synergistic combinatorial drug treatment could reduce potential treatment resistance, required drug dosages, and thereby potential side effects, thus providing an effective treatment option for aggressive meningiomas. We previously performed an automated combinatorial screening of 166 FDA-approved anticancer drugs in anaplastic meningioma cell lines and identified several synergistic combinations. In the current study, we aimed to validate the top combinations in vitro, followed by testing the most promising combinations in patient-derived meningioma tumor organoid (TO) models.
Methods: 110 out of 13695 initial drug-drug combinations were validated in 5x5 dose-response matrices (0-1000 nM) in grade 3 meningioma cell lines NCH93, KT21-MG1, and IOMM-Lee. TOs were established from single cell suspensions of freshly resected meningioma tissue (total n=20, grade 1 n=19, grade 2 n=1, n=3 recurrent tumors). Drug screenings were conducted by the automated liquid handler Hamilton MicroLAB STAR®. Viability was measured by CellTiterGlo. Synergism was calculated by the ZIP synergy finder model. Apoptosis was evaluated by Caspase-3/7.
Results: Validating our initial results in vitro, 75 out of 110 drug combinations demonstrated a positive most synergistic area (MSA) score, indicating synergistic effects. Next, we selected the 16 most promising combinations based on synergy scores and literature evidence for screening in TOs. The drug combination of proteasome inhibitor carfilzomib and the androgen receptor inhibitor enzalutamide exhibited the highest MSA scores in TOs. In 40% (n=8/20) of the cases, the combination showed strong synergism (MSA>10) resulting in an overall average MSA of 7.3. This was followed by carfilzomib and neratinib, romidepsin and gemcitabine, and romidepsin and dabrafenib with average MSAs of 5.4, 4.3, and 3.7, respectively. Furthermore, carfilzomib and enzalutamide induced apoptosis in TOs ($p<0.01$).
Conclusions: Carfilzomib and enzalutamide demonstrates strong synergism in the majority of meningioma cases and could present an effective treatment option for selected meningioma patients.

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951
Brain and Spine 4 (2024) 103764
Correlation of activated cytotoxic natural killer cells and regulatory T cells in aneurysmal subarachnoid hemorrhage in peripheral blood and cerebrospinal fluid

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM
Background: The mechanisms underlying delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (aSAH) are incompletely understood. It is believed that the activation of inflammatory immune cells within the intrathecal space is a key factor in triggering DCI. Both cytotoxic natural killer cells (NK) and regulatory T cells (Treg) are crucial components of the immune system. NK can respond rapidly to aSAH without the necessity of antigen priming and produce cytokines that contribute to neuroinflammation and may play a role in DCI development. Tregs can suppress immune responses, including those of NK, possibly protecting against neuroinflammation after brain injury. This study investigates the NK/Treg ratio in the peripheral blood (PB) and cerebrospinal fluid (CSF) of aSAH patients as potential cellular biomarkers for predicting DCI.
Methods: We prospectively collected PB and CSF from 14 patients with aSAH in the first 14 days after hemorrhage. Flow cytometry of PB and CSF to analyze activated CD56-CD16+ NK and CD4+CD25+Foxp3+ Treg at specific timepoints (days 1-2, 3, 7, 11-14) was performed. The ratio of activated NK and Treg in correlation to DCI was calculated.
Results: 86% of the patients were female. Median WFNS grade was 3.5 (range: 1-5) and median modified Fisher grade was 3 (range: 1-4). Aneurysm sealing was done in 64% with coiling and 36% with clipping. 36% of the patients developed DCI and one patient died. Median Glasgow Outcome Score at discharge was 3 (range: 1-5). Patients with DCI had higher median NK/Treg ratios in PB and CSF, peaking at day 3. The median onset of DCI was day 5 (range 3-7).
Conclusions: A high NK/Treg ratio in both PB and CSF may offer a promising method to predict DCI. To solidify the roles of NK and Treg as cellular biomarkers, further evaluation in a larger patient cohort is necessary. Additionally, subsequent studies should aim to exclude any inflammatory para-phenomena.

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440
Brain and Spine 4 (2024) 103765
Methylation Studies in Malignant Meningiomas

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Malignant meningiomas (WHO grade 3) only constitute 1-2% of all meningiomas but are associated with poor overall prognosis with an estimated

median survival of 2.6-4.7 years. Little is known about the underlying biology and the timing of genetic alterations across recurrences in these malignant tumors. Malignant meningiomas are assumed to either arise de novo (primary malignant) or transform from preexisting lower-grade meningiomas (secondary malignant). Methylation analyses have contributed to increased knowledge of tumor biology and have, in meningiomas, allowed the description of clinically relevant subgroups. Further, DNA methylation is highly correlated with tissue age, a phenomenon known as epigenetic clocks. These epigenetic clocks can potentially be used to estimate the age and age acceleration of meningiomas.
We aim to investigate the methylation profiles of meningiomas during malignant transformation of 46 secondary malignant meningiomas and 24 primary malignant meningiomas and their subsequent recurrences. Further, Horvath's and Hannum's epigenetic clocks will be used to estimate the age and age acceleration of meningiomas. Findings will be correlated to the clinical course.
Methods: Tissue was collected from 33 patients with malignant meningioma. The cohort consisted of 70 meningiomas six being WHO 1, 11 being WHO 2 and 53 being WHO 3. Tumor tissue was either preserved as Formalin-Fixed Paraffin-Embedded (FFPE) or as Freshly-Frozen (FF). Methylation analysis was conducted using the Infinium Illumina MethylationEPIC BeadChip.
Results: Preliminary results show that frozen tissue yields adequate methylation profiles even after 30 years of storage at -80oC while FFPE results are sensitive to tissue deterioration. Frozen tissue is necessary for reliable methylation data on meningiomas. Epigenetic age assessed by Horvath's or Hannum's epigenetic clocks indicates similar ages of primary and secondary malignant meningiomas; both appear to reflect accelerated aging compared to the host. Analysis of serial samples during secondary malignant meningiomas allows analysis of epigenetic modification during malignant degeneration from benign to malignant phenotypes.
Conclusions: In conclusion we investigate 70 meningiomas, the majority being WHO grade 3 meningiomas. We show that frozen meningioma tissue preserves its quality for at least 30 years for methylation analysis and is superior compared to FFPE treated tissue. Further, we show similar age of primary and secondary malignant meningiomas questioning the biological distinction between these two groups of malignant meningiomas. Finally, we will characterize epigenetic modifications during malignant transformation in meningiomas bettering our understanding of the underlying tumorigenesis in these rare but highly malignant tumors.

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760
Brain and Spine 4 (2024) 103766
Continuous Facial Nerve Mapping by Tip of the Ultrasonic Surgical Aspirator (CUSA) in Vestibular Schwannoma Surgery: Single Center Experience

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Surgery for vestibular schwannomas is increasingly 'nerve centered' rather than 'tumor centered' given the significant morbidity associated with post operative facial nerve deficit. Therefore, intraoperative monitoring (IONM) has been considered crucial. Shortcomings of classical corticobulbar MEP's and free running – and triggered EMG are the rather post hoc warning in already compromised (irreversible) nerve function. A proper method of continuous facial nerve mapping can improve post operative outcomes and comfort during surgical resection.
Methods: Fourteen patients underwent surgery with continuous facial nerve mapping between 2016 and 2023 at AZ Sint-Lucas Hospital in Ghent, Belgium. Conventional peroperative IONM with free running – and triggered EMG and corticobulbar MEP's was performed. Continuous mapping with (intra)capsular monopolar stimulation on the tip of the CUSA was used at 0.3- 5 mA, 3 Hz, 200 ms. Nearby the nerve classic monitoring with concentric bipolar stimulation probe was used. The purpose of surgery was nerve function sparing maximal resection. Postoperative facial nerve dysfunction was assessed by House-Brackmann score (HBS) immediately and 3 months postoperatively.
Results: Four patients had immediate postoperative facial nerve deficit (HBS 3 or more), however 1 patient recovered after 3 months to HBS 2. Permanent facial nerve deficit of 21% (3/14) was assessed, which is rather low compared to reported ratios up to 53%. Complete resection was achieved in 4 patients, 2 of these had a VII nerve deficit immediately postoperatively, 1 recovered after 3 months. Nine of the 10 remaining patients had only minimal residual tumor rest in the internal auditory canal.
Conclusions: Intraoperative facial nerve mapping with the tip of the CUSA is a safe technique for nerve function preserving maximal resection for vestibular schwannomas. It provides comfort to the surgeon through continuous feedback on nerve function and avoids alternation between different tools within a narrow approach.

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135
Brain and Spine 4 (2024) 103767
Analysis of meningiomas with rhabdoid component: Relationship with prognosis and tumor recurrence. Clinical, cellular, and genetic perspectives

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Oral e-Poster Presentations - Booth 4: Neuro-Oncology 6 (Meningiomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Rhabdoid meningiomas (RM) are tumors that present with a wide range of histological features and chromosomal copy number alterations, making the disease course unpredictable. To study this further, we analyzed a series of 305 patients from existing literature and examined 33 samples from 23 patients at diagnosis and recurrence. These samples were sent to our laboratory from various hospitals in Spain. Our analysis revealed two distinct subgroups of RM based on their genetic profile. The first subgroup had single chromosomal losses, while the second subgroup had combined losses and gains of multiple chromosomes. The latter subgroup exhibited a higher frequency of grade 3 tumors and worse clinical outcomes.
Methods: A retrospective study was conducted in Spain by collecting recurring and non-recurring RM samples from various hospitals. The study included anatomopathological and molecular genetic analysis using FISH and copy number matrices. Statistical significance was achieved using SPSS software with the Chi-square and Mann-Whitney U test, and the log-rank test was used to draw Kaplan-Meier survival curves.
Results: The two genetic profiles that were discovered had different clinical outcomes, with the ones that recurred showing greater genetic instability. Simply having less than 50% rhabdoid cells and a low grade is not enough to assume a good prognosis. All women who had chromosome 17q gain died. Loss of BAP1 was observed in 2/3 of all relapses. Patients who were diagnosed with MRs for the first time had greater progression-free survival. Immediate treatment after the initial surgery was linked to less recurrence.
Conclusions: The study of chromosomal alterations can improve diagnosis, survival prediction, and recurrence rates for patients with rare meningioma subtypes.

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1468
Brain and Spine 4 (2024) 103768
Comparison of Same-Day versus Staged Circumferential Spinal Fusion for Adult Spinal Deformity: A Systematic Review and Meta-Analysis

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Oral e-Poster Presentations - Booth 2: Spine 4 (Deformities and malformations), October 15, 2024, 4:40 PM - 5:20 PM
Background: When undertaking complex spinal procedures, such as circumferential spinal fusion for adult spinal deformity (ASD), these may be performed same-day or staged. The determination of whether to stage these procedures is typically guided by the operating surgeon's preference, influenced by the procedural complexity and patient-specific considerations.
Methods: In accordance with the PRISMA-P guidelines, our protocol was

recorded on PROSPERO (CRD42022339764) and disseminated (PRR1-10.2196/42331) during the initial trial phase. We developed our inclusion criteria based on the PICO (population, intervention, comparison, outcome) model. The population of interest comprised adults diagnosed with ASD. The intervention in question was the staged circumferential spinal fusion. The comparison was same-day circumferential spinal fusion. Evaluated outcomes included operative duration, estimated blood loss quantified in milliliters, intraoperative and perioperative complications, hospital and intensive care unit lengths of stay, rates of surgical revision, hospital readmissions, and patient-reported outcomes (PROs). Comprehensive literature searches were conducted using databases such as MEDLINE, Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, and Scopus. The results were exported to Covidence. Screening, quality assessment, and data extraction were independently conducted by two reviewers, with a third reviewer resolving any conflicts. Quantitative synthesis was carried out using RevMan Web provided by Cochrane.

Results: From the initial 5200 studies examined, 7 met the criteria for our qualitative synthesis, with 4 qualifying for our quantitative assessment through meta-analysis. The meta-analysis revealed a longer hospital stay for the staged surgery cohort (mean difference 5.1 days, 95% Confidence Interval [CI] 2.17-8.02, p<.001). No statistically significant disparities were observed for the remaining outcomes.

Conclusions: The meta-analysis indicated an increased LOS for patients undergoing staged circumferential spinal fusion to correct ASD. No significant differences were noted in estimated blood loss (EBL), peri-operative complications, wound infection rates, incidence of reoperation, and hospital readmissions.

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849

Brain and Spine 4 (2024) 103769

Severity of aneurysmal Subarachnoid Hemorrhage over time: Systematic review.

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

Background: The incidence of aneurysmal subarachnoid hemorrhage (aSAH) has been extensively studied. Yet, little is known about the evolution of aSAH severity. This systematic review aims to analyze the distribution of aSAH severity over time.

Methods: We performed a systematic review according to the PRISMA-P guidelines and included studies from January 1968 up to December 2022. Studies were included if they reported the severity of aSAH on the Hunt and Hess (HH) or World Federation of Neurosurgical Societies (WFNS) scale, either as single increments of the corresponding 5-point scale or as a binary measure (good grade 1-3, poor grade 4,5). Exclusion criteria were: studies with fewer than 50 patients, (systematic) reviews and studies including non-aSAH patients.

Results: A total of 2465 publications were identified, of which 214 met the inclusion and exclusion criteria. In total, 102.845 patients with an aSAH were included. Over the last 5 decades, the percentage of good-grade HH (0.741 fold, $p = 0.004$) and WFNS (0.749 fold, $p < 0.001$) has decreased. In contrast, an increase in the percentage of poor grade HH (2.427 fold, $p = 0.004$), poor grade WFNS (2.289 fold, $p < 0.001$), HH grade 5 (6.737 fold, $p = 0.010$), WFNS grade 4 (1.235 fold, $p = 0.008$) and WFNS grade 5 (8.322 fold, $p = 0.031$) was observed.

Conclusions: This systematic review shows a worldwide 2-3 fold increase of poor grade aSAH patients and an 6-8 fold increase of grade 5 patients, over the last 50 years. This evolution could be due to more severe hemorrhage, improvements in neuro-intensive care and prehospital management, or to a change in grading behavior. This study emphasizes the necessity for an improved grading system to differentiate grade 4 and grade 5 patients, for meaningful clinical decision making in patients with poor outcome.

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922

Brain and Spine 4 (2024) 103770

Inflammatory Signatures in Cerebrospinal Fluid Following Aneurysmal Subarachnoid Hemorrhage: Insights and Implications

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM

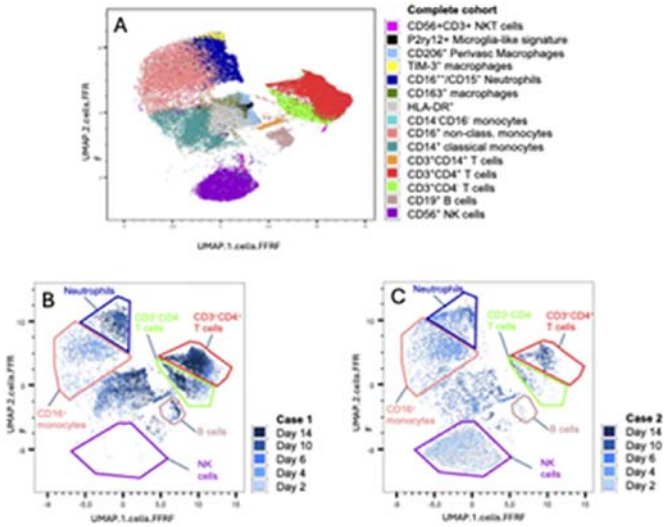
Background: Aneurysmal subarachnoid hemorrhage (aSAH) is a critical condition with high mortality and morbidity. The complex pathophysiology of post-hemorrhagic secondary brain damage is not completely understood but inflammatory processes have been heavily implied in the pathogenesis of acute and chronic post-aSAH brain damage. Therefore, the scope of the current study was to investigate whether such inflammatory processes are reflected by the composition of the cerebrospinal fluid (CSF).

Methods: CSF samples were collected from 10 aSAH patients treated in our neurosurgical ICU up to 23 days post hemorrhage and matching controls undergoing elective aneurysm surgical treatment. Immune cell composition was analyzed with multi-parametric spectral flow cytometry (FACS) (Cytek-Northern-Light, Cytek, USA). Chemokine and cytokine profiles were generated using a Luminex-platform multiplex assay (Luminex200, Luminex Corporation, USA). Clinical, radiological, and outcome data was recorded for all aSAH patients and correlated with CSF findings.

Results: FACS analysis detected brain-resident as well as systemic immune cells after aSAH (Figure A). We observed multiphasic activation patterns, e.g. non-classical monocytes (CD14-/CD16+), activated neutrophils (CD16++/CD15+), and a vast number of CD19+ B- and CD3+ T-cells (Figure B). Analysis of inflammatory CSF mediators revealed an increase of cell-free-DNA and pro-inflammatory cytokines such as IL-1beta and IL-6, particularly in the acute phase between days 5 and 10 after aSAH. None of these findings were observed in the controls. Secondary events such as bacterial meningitis, exhibited characteristic profiles (Figure C: NK-cell influx).

Conclusions: Longitudinal screening of inflammatory status in CSF after aSAH is feasible. Secondary events like meningitis led to characteristic changes in immune cell composition. CSF cell and mediator status might help to advance understanding of the pathomechanisms of post-aSAH brain damage and help to monitor treatment efficacy.

Optional Image



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1245
Brain and Spine 4 (2024) 103771
Idiopathic Thoracic Spinal Cord Herniation: Two Case Reports of a Frequently Misdiagnosed Pathology

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Oral e-Poster Presentations - Booth 2: Spine 4 (Deformities and malformations), October 15, 2024, 4:40 PM - 5:20 PM
Background: Idiopathic spinal cord herniation (ISCH) is an extremely rare cause of thoracic myelopathy characterised by the ventral protrusion of the spinal cord through a defect in the dura. The incidence of ISCH is roughly 0,059%-0.08% of the cases necessitating spinal surgery. The aim of the study is to present our case series of this uncommon entity
Methods: Our case series consists of two female patients with progressive spastic paraparesis and sensory disturbances. The symptomatology of the first patient, a 55 year-old, started approximately one year prior, showed gradual deterioration and was accompanied by incontinence, whereas the second patient, 30 years-old, had a rapid decline of motor function, with no bladder dysfunction. MRI of the thoracic spine demonstrated ventral kink of the spinal cord at T4-5 level and at T5-6 level respectively. Surgical management was selected in both cases. Thoracic laminectomy, intradural adhesiolysis and arachnoid resection under constant intraoperative neuromonitoring, followed by duraplasty using dural allograft was performed in both patients. Postoperatively, the 55-year old patient had worsening of her motor deficit and was re-operated the 1st postoperative day due to a small epidural haematoma. After the second operation, she showed relative improvement, and gradually reached her preoperative neurological status. The second patient had an immediate postoperative improvement.
Results The etiopathogenesis of ISCH remains unknown. Treatment includes conservative and surgical management, depending on the clinical presentation. Based on our cases, a prompt surgical treatment should be considered in order to avoid worsening of the clinical status. In the literature it is reported that 18-20% of the patients remain stable postoperatively while up to 8% showed worsening. In our cases, 50% of the patients showed transient deterioration, a higher percentage, probably due to our smaller sample size.
Conclusions ISCH is a rare pathology and its early recognition and treatment are necessary to prevent permanent neurological deficits.

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168
Brain and Spine 4 (2024) 103772
Microsurgical Excision of Large Cerebellopontine Angle Tumors in Limited Resource Setting: Adapted Techniques and Operative Outcomes

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Cerebellopontine angle (CPA) tumors are complex typical brain lesion that needs a lot of peri-operative care and meticulous techniques. Total excision of large CPA lesions with brainstem compression is considered a big challenge in many institutions and was seldom tried in our set-up due to the initial discouraging results. We present our series of large CPA lesions operated in our limited resource setting, with adapted operative techniques aiming at near-total excision and improved outcomes.
Methods: In the latter half of 2019, we started trying to embark on near-total excision of large CPA lesions by the conventional retro-sigmoid craniectomy. The concept of tumor pulling was abandoned, and careful dissection of the nerves and vessels was done. The narrowest point at the internal meatus was considered the strong base and the main supply line and was removed first. The brainstem compressing part was slowly dissected and brought into the created empty field. Facial nerve preservation was a primary challenge without monitoring. Almost all patients were kept in the Intensive care post-op, and radiological investigations were done within 12 hours.
Results: Results: 37 large CPA tumors were operated on during the study period, and near-total excision was obtained in almost 27 (73%) cases. No patient has any symptoms related to lower cranial nerve palsy. The facial nerve was preserved fully in 7 (19%) patients, and complete palsy was observed in 19 (52%) patients; these were subjected to facial-hypoglossal anastomosis. CSF leak was observed in 4(10.8%) patients, and two expired post-operatively.
Conclusions: Microsurgical excision of CPA lesions is technically challenging with low facial nerve preservation rates, but still an acceptable life-saving option in a limited resource setting.
Optional Image

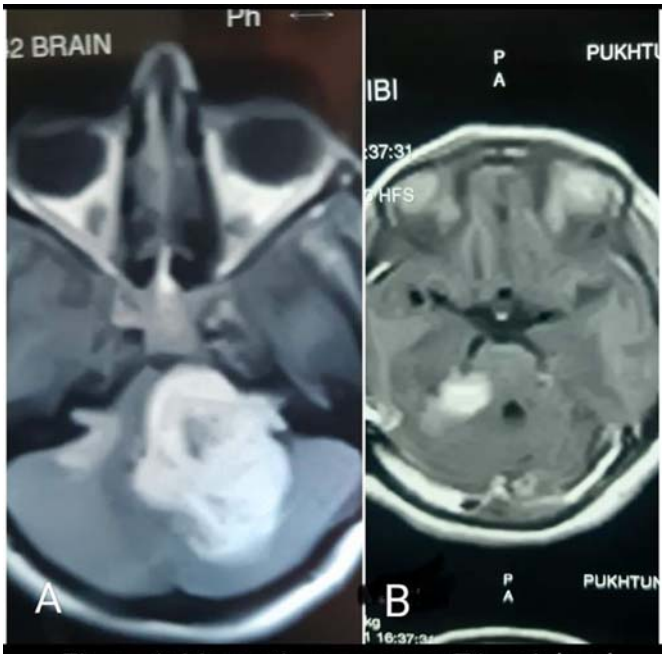


Figure 1: Magnetic resonance T1 weighted axial contrast images of large cerebellopontine angle tumor before(A) and after(B) surgery.

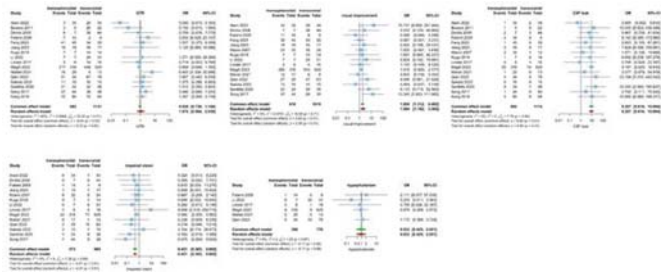
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1124
Brain and Spine 4 (2024) 103773
Transcranial or Endoscopic Endonasal Approach for Tuberculum Sellae Meningioma?

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Oral e-Poster Presentations - Booth 3: Skull Base 1 (Meningiomas & Schwannomas), October 15, 2024, 4:40 PM - 5:20 PM
Background: Tuberculum sellae meningioma (TSM) are meningiomas located in the anterior skull region, posing surgical challenges due to their proximity to critical anatomical structures. Common surgical approaches include endoscopic endonasal (EEA) and transcranial (TCA) methods. This systematic review and meta-analysis conducts a comprehensive comparison of the safety and efficacy of these approaches using available literature.
Methods: A systematic review adhering to PRISMA guidelines was conducted across PubMed, Scopus, and Web of Science databases. The primary objectives included comparing tumor resection extent and visual improvement, alongside major complications such as CSF leakage, hypopituitarism, and visual disturbances. Data underwent statistical analysis utilizing a random weighted effects model.
Results: Seventeen articles were included post-screening, comprising 684 and 1154 patients in EEA and TCA groups, respectively. Gross total resection (GTR) favored EEA, though not significantly (OR: 1.07, 95%CI: 0.59-2.04, I2: 60%, P-value: 0.82). EEA demonstrated significantly higher rates of visual improvement (OR: 1.99, 95%CI: 1.18-3.36, I2: 0.0%, P-value: 0.01). In addition, EEA exhibited significantly higher rates of CSF leakage (OR: 9.21, 95%CI: 5.61-15.9, I2: 0.0%, P-value: <0.0001) and lower visual disturbances (OR: 0.45, 95%CI: 0.30-0.66,

I2: 0.0%, P-value: <0.0001), with no significant difference in hypopituitarism (OR: 0.93, 95%CI: 0.42-2.05, I2: 0.0%, P-value: 0.86). Egger's linear test revealed no significant funnel plot asymmetry.
Conclusions: While no significant difference in GTR was observed, EEA showed superior visual outcomes, with comparable hormonal outcomes to TCA. However, further studies are warranted to guide surgical approach decisions based on tumor size and lateral extension.
Optional Image



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966
Brain and Spine 4 (2024) 103774
Clip reconstruction in complex brain aneurysm surgery. Multicenter study

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Oral e-Poster Presentations - Booth 1: Vascular 3, October 15, 2024, 4:40 PM - 5:20 PM
Background: The complexity of an aneurysm can relate to its form, size, and location, but most of all to the necessity of a more sophisticated technical treatment. In this study we present our series with surgical clip reconstruction of complex aneurysms.
Methods: This is retrospective clinical study on patients, threated with clip reconstruction in two university neurosurgical departments for the period January 2015-February 2024. It comprises of 129 patients (80 women, 49 men; average age 54.2 (31-77y)). Factors such as clinical presentation and image studies, operative time, postoperative hospital stay, number of titanium clips used, clinical result and complications were analyzed
Results: Aneurysms were ruptured in 101 of the cases (78%). The complex aneurysm originates from AcomA (36 cases), ACA (9 cases), PcomA(6 cases), MCA (50 cases), ICA (18 cases), BA (5 cases) VA (3 cases) and PCA (2 ceses). In 21 of the cases patients were with multiple aneurysms, with 2 to 4 aneurysms threated simultaneously in one surgery. In 1 case aneurysm pathology was combined with AVM.. Clip reconstruction was achieved by 2 (76 cases), 3 (33 cases), 4 (14 cases), 5 (5 cases), 6 (1 case,) and 8 (1 case) aneurysmal clips. In two cases there was a revision surgery for clip reposition. Average operative time was 5:45 hours (2-12 hours). Average postoperative stay in ICU was 5 days and average postoperative hospital stay was 14 days. Complications of occurred in 56 cases from which ischemic were in 32 patients (30 of them in cases with ruptured aneurysms; 25 were symptomatic). According to modified Rankin Score (mRS) patient outcome was good (mRS 0,1,2,3) in 101 cases (78 %) and bad (mRS 4, 5, 6) in 28 cases (22%).
Conclusions: Clip reconstruction remains treatment option for complex aneurysm cases with the advantages of dynamical modification the clips in the construction, direct control of bleeding as well as avoidance of postoperative antiplatelet treatment

https://doi.org/10.1016/j.bas.2024.103774

70
Brain and Spine 4 (2024) 103775
3D printing for pedicle screw placement in spine deformities

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Oral e-Poster Presentations - Booth 2: Spine 4 (Deformities and malformations), October 15, 2024, 4:40 PM - 5:20 PM
Background: In surgical treatment of severe spinal deformities, pedicle screw placement is one of the most crucial steps, due to risks associated with screw malposition. Intraoperative navigation is not always available. The use of 3D printing technology can significantly facilitate surgical treatment of this difficult category of patients.
Methods: A prospective study based on surgical treatment of 76 patients with severe spinal deformities was conducted. Patients were divided into 2 groups. Each of them underwent thorough preoperative clinical examination and imaging. Group I (39 patients) underwent standard preoperative planning. In group II (37 patients), preoperative planning included a full-scale 3D model of the patient's spine. For better visualization of pedicle screw trajectory, Kirschner wires were placed at appropriate sites. Also, each instrumented vertebra was labeled with pedicle diameter and screw length. For intraoperative visualization assistance, each model was gas sterilized.
Results: Evaluation of the results was based on time spent on screw placement, and postoperative CT imaging, for assessment of pedicle screw malposition rates. Malposition was assessed according to the following scale: A - no malposition, B - malposition up to 2 mm, C - 2–4 mm, D - more than 4 mm.
In group I, 736 pedicle screws were placed, of which 558 (75.8%) were placed correctly, 178 (24.2%) - with malposition, of which type B was recorded in 76 (10.3%) cases, type C – in 72 (9.8%), and type D – in 30 (4.1%) cases. In group II, 685 pedicle screws were placed, of which 661 (96.5%) implants were placed correctly, and 24 (3.5%) - with malposition, of which type B was recorded in 18 (2.6%) cases, type C – in 6 (0.9%), cases, and type D was not recorded.
The time taken to place one pedicle screw was statistically different in the two groups. In group I, the average time of screw placement was 135.00 ± 10.41 s, in group II - 102.00 ± 8.27 s ($p < 0.05$).
Conclusions: The use of 3D models in preoperative planning and intraoperatively allows for increased speed and accuracy of pedicle screw placement, leading to reduced risks of screw malposition and damage to neural structures.

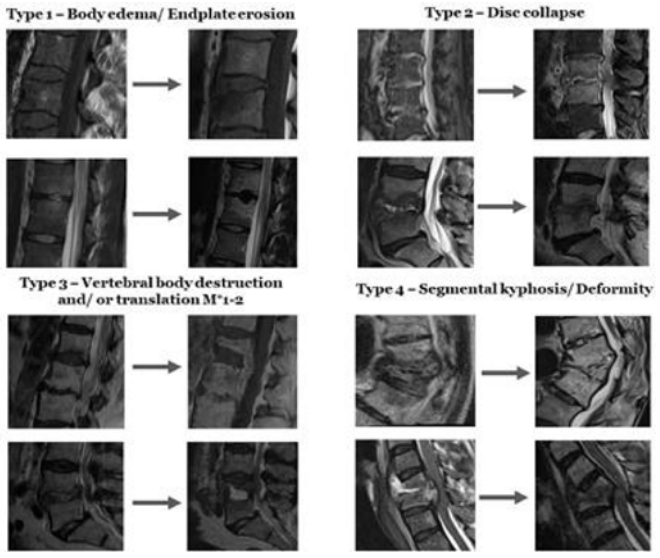
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483
Brain and Spine 4 (2024) 103776
Radiographic Progression and Spinal Deformity in Conservatively Treated Pyogenic Spondylodiscitis: A Monocentric, Retrospective Analysis of MRI Data from 59 Patients

Andreas Kramer [1], Jonathan Neuhoff [2,8], Santhosh G. Thavarajasingam [1,3,8], Benjamin Davies [4,8], Rebecca Sutherland [5], Hugh McCaughan [5], Ehab Shiban [6,8], Prod. Florian Ringel [1,8], Andreas K. Demetriades [7,8]. [1] *University Medical Center Mainz, Germany;* [2] *Berufsgenossenschaftliche Unfallklinik Frankfurt am Main, Germany;* [3] *Imperial Brain & Spine Initiative, Imperial College London, United Kingdom;* [4] *Addenbroke's Hospital, Cambridge University Hospital NHS Healthcare Trust, United Kingdom;* [5] *Western General Hospital Edinburgh, United Kingdom;* [6] *Universitätsklinikum Augsburg, Germany;* [7] *Royal Infirmary Edinburgh, NHS Lothian, Edinburgh, United Kingdom;* [8] *Spondylodiscitis Study Group, EANS Spine Section, Belgium*

Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM
Background: The management of pyogenic spondylodiscitis (SD) often involves conservative treatment without surgical stabilization, yet the risk of developing spinal deformities during such management is not clearly predictable. This study explores the radiographic progression in SD under conservative care, focusing on patterns of spinal deformities and their association with initial clinical and radiological factors.
Methods: A retrospective analysis of MRI data from 59 patients with conservatively treated SD was conducted. The progression of spinal deformities was categorized into four types based on distinct radiological features (Figure 1). Factors assessed

included progressive deformity, translation, fractures, and fusion.
Results: The mean follow-up was 10.75 months. Progressive deformity was seen in 66% of patients. Segmental kyphosis of >20° increased from 12 cases upon admission to 23 at follow-up, representing a 92% increase. Segmental translation cases rose by 167%, from 3 to 8 cases. The distribution of progression types was as follows: No progression in 20 cases (34%), type1 in 2 cases (3%), type2 in 7 cases (12%), type3 in 13 cases (22%), and type4 in 17 cases (29%). Risk of segmental kyphosis >20° at follow-up was significantly increased by >50% involvement of the vertebral body at admission (p=0.0015) and presence of an epidural abscess (p=0.03). Positive predictors for progressive deformity of any kind were found to be >50% involvement of the vertebral body (p=0.03) and vertebral body edema >50% (p=0.008). Lumbar region involvement was significantly associated with reduced likelihood of spinal fusion at follow-up (p=0.01997). The presence of a paravertebral abscess was significantly associated with an increased risk of fractures at follow-up (p=0.0401).
Conclusions: This study underscores the importance of closely monitoring patients with conservatively managed SD for progressive spinal deformities and consideration of early surgical treatment in cases with a high risk of radiological progression.
Optional Image

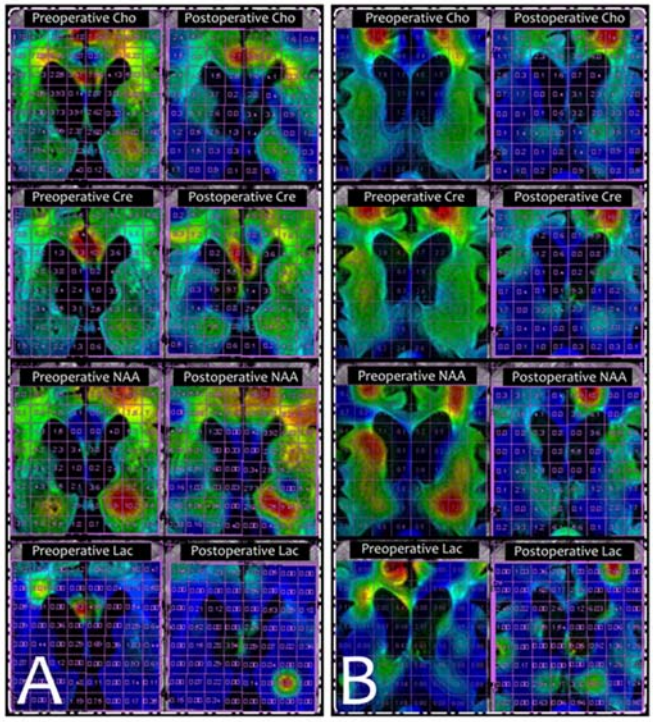


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267
Brain and Spine 4 (2024) 103777
Evaluation of the relationship between proton magnetic resonance spectroscopy parameters and surgical outcomes in shunted patients with Idiopathic Normal Pressure Hydrocephalus

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM
Background: Despite recent advances in diagnosis and treatment of Idiopathic Normal Pressure Hydrocephalus, the biggest challenge is the selection of patients suitable for surgery and predicting of prognosis.
Methods: The clinical responses of 15 patients diagnosed with INBH who underwent shunt surgery and the data on 10 specific cerebral regions obtained using Magnetic Resonance Spectroscopy (MRS) including over 450 parameters were evaluated in our study (Table 1.).
Results: While Cho were significantly higher in the left medial frontal and lower in the left thalamus in neurophysiology responders, the change in the left thalamus with the shunt showed a strong positive correlation with the neurophysiology. While Cre were significantly lower in right thalamus and basal ganglia in continence responders, the change in the right thalamus with shunting was significant. Additionally, there was a strong positive correlation between the changes in neurophysiology and Cre in the right thalamus and; between the changes in gait and the right basal ganglia. NAA were significantly higher in the right medial frontal and lower in the bilateral periventricles in neurophysiology responders; the change in the left medial frontal with shunting was found to be significant in neurophysiological response. Lac were higher in the left basal ganglia in the balance responders, the change in the right medial frontal with the shunt showed a strong negative correlation. Among all the metabolite ratios examined, those that provided significant results in terms of significant components in parentheses are briefly as follows; Cho/Cre (gait, neurophysiology, balance, continence, and total), Cho/NAA (balance), Cre/NAA (neurophysiology and balance), Lac/Cho (balance and continence), Lac/Cre (balance and continence), and Lac/NAA (balance and continence).
Conclusions: The results indicated the existence of a very complex pathological process, as expected for INBH. With future studies, the real potential of MRS use for this disease will be better understood.
Optional Image



https://doi.org/10.1016/j.bas.2024.103777

1226
Brain and Spine 4 (2024) 103778
Proposal of a predictive score for the occurrence of postoperative cerebral vasospasm: analysis of a large single institution retrospective series and literature review.

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Oral e-Poster Presentations - Booth 3: Vascular 4, October 16, 2024, 9:30 AM - 10:10 AM
Background: Despite being uncommon, postoperative vasospasm (PoVS) present notably high morbidity and mortality rates. Our aim was to identify prognostic factors associated with this condition and introduce a scoring system to improve subsequent clinical and radiological surveillance strategies.
Methods: We conducted a retrospective analysis of our institutional database covering patients aged over 18 who underwent craniotomic or transsphenoidal surgery at the Neurosurgical Unit of IRCCS Carlo Besta between January 2016 and August 2023. A comprehensive search was conducted using the Cochrane Database of Systematic Reviews and PubMed database to identify the most correlated risk factors.
Results: Literature review included a final group of 32 studies (52 patients) and identified SAH, vessel encasement or vessel manipulation, hypothalamic disfunction, meningitis, younger age, tumor size >3 cm, and long operative time as

predictive factors for PoVS. Our cohort included 2132 patients, with only 13 individuals (0.61%) presenting PoVS. To predict the occurrence of PoVS, we developed a logistic multivariate regression model that identified thick subarachnoid hemorrhage (coeff. 6.7, $p<0.001$), intraparenchymal hemorrhage (coeff. 3.44, $p<0.001$), lesion located in the parasellar region (coeff. 2.1, $p=0.064$), and lesion size $\geq$ 4 cm (coeff. 2.0, $p=0.069$) as potential independent predictors of PoVS. Based on statistical model for these variables was assigned a score: thick SAH 7 points, intraparenchymal hemorrhage 3 points, parasellar lesion site 2 points, and lesion size $\geq$ 4 cm 2 points. The cumulative scores ranged from 0 to 14.
Conclusions: PoVS is a rare complication but its association with significant morbidity and mortality underscores the importance of early identification and treatment. In our study we proposed a stratified risk score to identify high risk patients. However, due to rarity of this condition, our score proposal should be considered as a training set a to be validated in future studies with a multicenter setting.

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182
Brain and Spine 4 (2024) 103779
Limitations and Outcomes of Minimally Invasive Expanded Endoscopic Endonasal Odontoidectomy: A Retrospective Analysis of the University of Ottawa Experience

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM
Background: Patients with ventral cervical-medullary compression may require anterior decompression of the cervicomedullary junction. Resection of the odontoid process can be accomplished through expanded endoscopic endonasal approach especially in cases of irreducible basilar invagination in which the pathology is situated well above the palatine line.
Methods: A retrospective chart review of patients who underwent an endoscopic endonasal odontoidectomy at The Ottawa Hospital (January 2012-May 2022)
Results: 25 patients were included (median age 67 years, 64% female). Postoperative imaging demonstrated decompression of the anterior cervicomedullary junction pathology in all patients. All patients showed improvement of their myelopathy and neurologic deficit. One patient (4%) had vertebral artery injury which had to be coiled with no neurological deficits; 4 patients (16%) had intraoperative CSF leaks without postoperative leak. Twenty-one (84%) patients were extubated by postoperative Day 1. Three patients (12%) developed postoperative sinus infections. Eight patients (32%) developed transient postoperative dysphagia. Two patients (8%) had postoperative epistaxis and one (4%) had lower cranial nerve symptoms. One patient developed an infection from the posterior cervical fusion. The median hospital stay was 8 days.
Conclusions: Endoscopic endonasal odontoidectomy is a feasible and well-tolerated procedure associated with satisfactory patient outcomes and low morbidity. The expanded endoscopic endonasal approach for odontoidectomy should be considered as a minimally invasive approach for anterior decompression in selected cases.

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1374
Brain and Spine 4 (2024) 103780
A Case Series of Intracranial Aneurysms treated via the Extended Endonasal Corridor in a Single Center. Indications, Outcomes, and Technical Considerations.

Maria Karampouga [1], Kyle Affolter [1], Garret W. Choby [2], Eric Wang [2], Carl H. Snyderman [2], Michael M. Mcdowell [1], Paul A. Gardner [1], Georgios A. Zenonos [1]. [1] *Department of Neurological Surgery, Center for Cranial Base Surgery, University of Pittsburgh Medical Center, Pittsburgh, USA;* [2] *Department of Otolaryngology, University of Pittsburgh Medical Center, Pittsburgh, USA*

Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM
Background: The endoscopic endonasal approach (EEA) provides a ventral surgical corridor, which can be advantageous in the clipping of appropriately selected cerebral aneurysms. Herein we present our clinical experience to better delineate the indications and limitations of these procedures.
Methods: The clinical records of all patients undergoing EEA for clipping of aneurysms were retrospectively reviewed.
Results: Twenty-nine patients (23 females), with a mean age of 52 years, who were treated endoscopically for aneurysm clipping, from October 2005 to June 2023, were analyzed. Six patients had multiple aneurysms clipped during the same procedure, while another six had a sellar tumor excised in the same setting. Out of 35 aneurysms 7 were ruptured, 4 were pseudoaneurysms, 25 were located in the paraclinoid region, 9 in posterior circulation and 1 emanated from the petrous carotid artery. In one a staged endovascular / endoscopic approach was chosen and in another an endoscopic procedure was combined with an open one. Two patients underwent EEA due to post-coiling recanalization, whereas in 12 either endovascular treatment was not thought to be safely feasible or there was a relative contraindication. In 5 aneurysms a small questionable residual was noticed post-operatively that remained stable without requiring retreatment in all cases but one that was treated via pipeline. Finally, 7 patients experienced cerebrospinal fluid leak, 3 meningitis, 2 clip exposure, 3 stroke with only one causing mild disability and 3 cranial nerve palsies that partially improved or resolved. No death due to EEA was observed.
Conclusions: The ventral surgical corridor through an EEA can be advantageous for appropriately selected aneurysms, either because of concomitant sellar pathology or because of their location closer to the midline. Cerebrospinal fluid leaks and reconstructive challenges remain the main limitation.

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488
Brain and Spine 4 (2024) 103781
Artificial Intelligence for Shunt Response Prediction in idiopathic Normal Pressure Hydrocephalus: a Systematic Review

Rafael Tiza Fernandes [1,2], Santhosh G. Thavarajasingam [2,3], Filipe Wolff Fernandes [2,4], Mrinmoy Kundu [2,5], Nathan Chisvo [2,6], Daniele S.C. Ramsay [2,6], Andreas Kramer [3], Florian Ringel [3]. [1] *ULS São José, Lisbon, Portugal;* [2] *Imperial Brain & Spine Initiative, Imperial College London, London, United Kingdom;* [3] *University Medical Center Mainz, Mainz, Germany;* [4] *Hannover Medical School, Hannover, Germany;* [5] *Institute of Medical Sciences and SUM Hospital, Bhubaneswar, India;* [6] *Imperial College London, London, United Kingdom*

Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM
Background: Idiopathic normal pressure hydrocephalus (iNPH) is a chronic neurological disorder and a known reversible cause of dementia. Shunt surgery remains the standard treatment, but its effectiveness is variable. Recent advancements in artificial intelligence (AI) offer the potential to refine shunt response (SR) prediction by analyzing vast amounts of data.
Methods: This systematic review aimed to evaluate the efficacy of AI in predicting SR in iNPH. A systematic search of the literature was conducted in MEDLINE, EMBASE and Web of Science to identify studies that employed AI or machine learning (ML) algorithms for shunt response prediction in iNPH. Original articles published until September 2023 were included. Qualitative synthesis followed the Synthesis Without Meta-Analysis reporting guidelines.
Results: The initial search identified 3541 studies from which 33 were assessed for eligibility. 8 studies were included, featuring 479 patients. Sample size ranged from 28 to 132 patients. Each model incorporated different input data, the most common being imaging/radiomics (62.5%), followed by demographic inputs (37.5%). The most used ML algorithm was the Support Vector Machine (87.5%). 2 articles (25%) implemented multiple ML algorithms with the aim of assessing their relative effectiveness. Only half of the articles reported AUC, which ranged from 0.80 to 0.94. The predefined outcome measures were not consistently reported in every article, highlighting the heterogeneity and the lack of quantitative data to compare each model, in addition to the high risk of bias and unclear applicability of some models.
Conclusions: This review's findings underscore the pressing need for an integrated and more homogenous approach to iNPH management. While AI holds significant promise for improving the diagnosis and management of iNPH, it requires standardized data and more extensive validation studies for each model. Furthermore, to enhance clinical utility, future research should focus on developing more robust and generalizable AI models.

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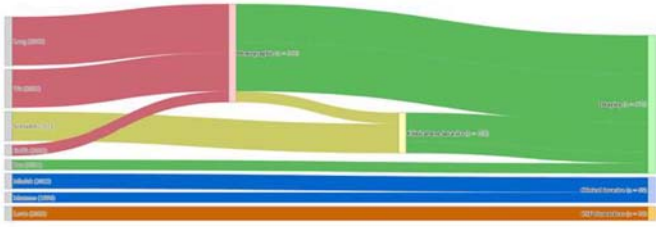


Figure 1: Inputs provided to each article's algorithms

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113

Brain and Spine 4 (2024) 103782

From Weakness to Imaging: Prediagnostic Symptomatic Interval and Characteristics of Patients with Tuberculous Spondylitis (Pott's Disease): a Multi-Center Experience from an LMIC

Christopher Brian Reyes[1,2,3,4], Rhoby Orata[1,2,3], Gene Patrick De Leon[1], Reymond Tapia[1,4]. [1] *Armed Forces Of The Philippines Health Service Command, Quezon City, Philippines;* [2] *Ospital ng Maynila Medical Center, Manila, Philippines;* [3] *Valenzuela Medical Center, Valenzuela, Philippines;* [4] *Tondo Medical Center, Manila, Philippines*

Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

Background: About 1 million Filipinos have tuberculosis. Before medications, the natural history of skeletal TB comprised three stages span 3 to 5 years which makes the disease insidious and slow progressing. Prediagnostic symptomatic interval (PSI) is defined as the interval between the first signs/symptoms to the date of diagnosis. Hence, the goal is to assess the PSI and therapeutic interval of each case and identify risk factors that may increase PSI that may augment decision making.

Methods: This study employed a retrospective cohort design to estimate the PSI and therapeutic interval in patients with Pott's disease. Data was analyzed using descriptive analyses and odds ratio to know if the PSI of the patient population and if the symptoms have any correlation.

Results: Overall, 11 patients were identified from population. The median interval from the initial symptom to initial consult with a physician is 135 days with a wide range (30-365 days) despite patients experiencing weakness. Median interval of spine imaging from the initial symptom is 150 days. Therapeutic intervals are much longer with the mean days to HRZE initiation to initial symptom is 170 days. Mean time from initial symptom to surgery is 227 days among the patients who had surgery. Factors that may increase PSI have also been identified like sensory loss as the only symptom, ongoing anti TB medications and history of tuberculosis infection.

Conclusions: The study showed the PSI and therapeutic intervals for patients with Pott's disease and provide a registry for said patients. This can be useful in determining prognosis and policy making.

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Table 2: Prediagnostic Symptomatic Interval and Therapeutic Intervals

	Number of days from the initial symptom to the initial consult?	Number of days between consult to our institution from the initial symptom?	Number of days between the initial spine imaging procedures from initial symptom presentation	Number of days of initiation of HRZE from initial symptom presentation	Number of days of between surgery from initial symptom presentation
Mean	108	148	159	170	227
Median	135	150	150	105	135
Range	30-365	30-365	21-365	21-380	100-400

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302

Brain and Spine 4 (2024) 103783

Real-time intraoperative depth estimation in transsphenoidal surgery using deep learning

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM

Background: Endoscopic endonasal and transcranial approaches are used for the resection of various pathological lesions in neurosurgery, especially pituitary adenomas, craniopharyngiomas, chordomas, or meningiomas. The video feed provided by endoscopes is generally two-dimensional, which can hinder depth perception. Thus, generating three-dimensional imaging without the need for special endoscopes using deep learning would be beneficial for enhanced intraoperative orientation.

Methods: DINOv2 is a pre-trained deep-learning model published by Meta in 2023. One of its capabilities is to estimate the depth in two-dimensional images. In this study, we explore the real-time application of DINOV2 to the video feed of three transsphenoidal endonasal surgeries. The results were evaluated for quality by both a senior neurosurgeon and a resident neurosurgeon.

Results: DINOV2 was applied to the video feed of transsphenoidal endonasal surgeries, which resulted in the creation of depth information in the form of colormaps. Although these colormaps were not perfect, they were aligned well with the subjective assessment of depth on the video feed by a senior neurosurgeon who has considerable experience in transsphenoidal surgery as well as a resident neurosurgeon.

Conclusions: Through the application of DINOv2, we were able to estimate depth in endoscopic imaging from transsphenoidal endonasal surgeries by generating depth colormaps. This not only has the potential to improve intraoperative orientation but also highlights the potential for further development in the use of artificial intelligence to augment endoscopic video feeds.

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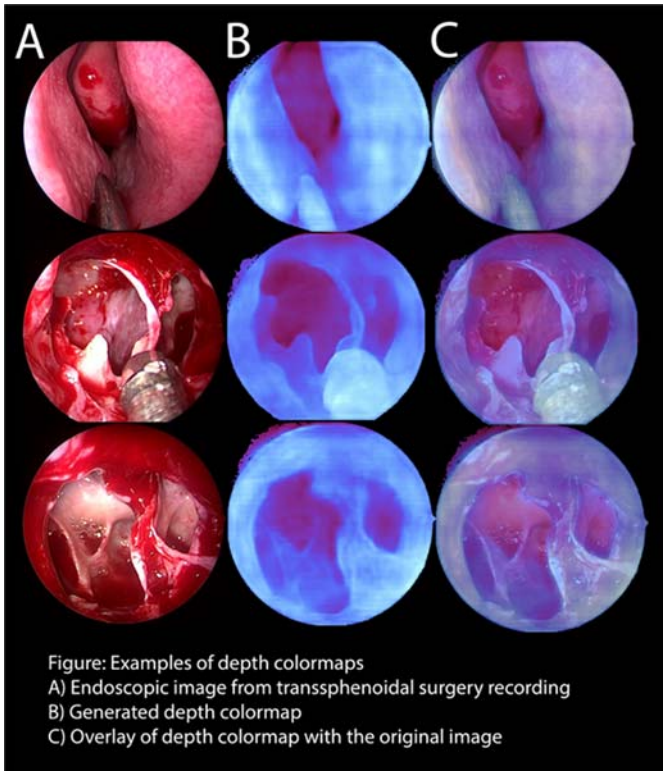


Figure: Examples of depth colormaps
A) Endoscopic image from transsphenoidal surgery recording
B) Generated depth colormap
C) Overlay of depth colormap with the original image

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1313
Brain and Spine 4 (2024) 103784
Effectiveness of endoscopic transoral craniocervical decompression

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM

Background: Anterior craniocervical decompression is a critical surgical procedure for patients with ventral cervicomedullary compression due to rheumatoid pannus, basilar invagination, os odontoideum, tumours or other pathologies. The microscopic transoral approach has historically been the gold standard for this surgery. Recently, advances in endoscopic techniques have provided an alternative minimally invasive approach. This study presents our institutional experience with the endoscopic transoral approach, focusing on clinical outcomes and safety.

Methods: We conducted a retrospective review of patients who underwent endoscopic transoral craniocervical decompression at our institution between 2018-2023. Same stage posterior atlanto-axial or occipito-cervical fixation was performed in all cases. Demographic data, preoperative clinical status, radiographic parameters, surgical details, and postoperative outcomes were collected and analyzed.

Results: A total of 19 patients met the inclusion criteria. Most patients presented with ventral cervicomedullary compression symptoms, including myelopathy and cranial nerve deficits. Endoscopic transoral decompression was performed successfully in all cases, with an average surgical time of 110 minutes. Postoperatively, patients exhibited significant improvements in clinical status, with 55% experiencing complete resolution of symptoms and 85% gaining significant improvement in quality of life (traced via Karnofsky Performance Score). Radiographically, the compression was adequately addressed in all cases. There were no major intraoperative complications, and the postoperative complication rate was 11%, primarily consisting of minor oropharyngeal issues. The viewing angle was significantly greater than in the microscopic approach even without splitting the soft palate.

Conclusions: Endoscopic transoral craniocervical decompression is a safe and effective surgical technique for addressing ventral cervicomedullary compression with extended angle of "attack" in comparison to the microscopic approach because of the additional viewing angles offered by the endoscope. Our institutional experience demonstrates favorable clinical outcomes and a low complication rate. The minimally invasive nature of this approach offers advantages in terms of reduced morbidity and faster recovery. This study supports the use of endoscopic transoral techniques in selected patients with ventral cervicomedullary compression.

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1167
Brain and Spine 4 (2024) 103785
Incidence and Characteristics of Surgical Side Infections in Patients Undergoing Intracranial Neurosurgery for Vascular Pathologies

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM

Background: Surgical site infections (SSIs) constitute a significant source of morbidity in neurosurgical departments. However, there are currently few reports addressing the incidence and risk factors of SSIs in patients undergoing craniotomy for underlying vascular disease. The authors aim to determine incidence, time to diagnosis of SSI, severity, and type of pathogen after intracranial vascular interventions and assess the associated risk factors in a tertiary neurosurgical center.

Methods: Data from consecutive patients undergoing intracranial neurosurgical vascular procedures between January 2013 and 2019 were retrospectively analyzed in our centre. Demographic data related to diagnosis, risk factors, treatment and hospital stay were collected. SSI were classified according to Clavien Dindo Grade (CDG). Parameters studied included the time from index to revision surgery, microorganisms involved, and underlying pathology for the index surgery.

Results: Out of 1065 screened vascular procedures, SSI occurred in 36 (3.38%). Among these, 20 were men (56%) and 16 women (44%), with a mean age of 52 +/- 14 years, respectively. The most common primary cerebrovascular diagnosis and indication for initial treatment were ruptured intracranial aneurysms (16/36, 44%). The mean time from the index procedure to surgical wound revision was 34 +/- 20 days, the mean duration of hospital stay was 14 +/- 19 days. The predominant pathogen was Staphylococcus epidermidis (12/36, 33%), followed by Staphylococcus aureus (10/36, 28%). In 78% of cases, the infection necessitated surgical wound revision and cleansing without bone removal. Regarding CDG, 32 cases (88.9%) required general anesthesia for the revision.

Conclusions: Our study reports an overview of incidence of SSIs in patients undergoing surgery for intracranial vascular pathologies. The overall rate of SSI was about 3.5%, however subpopulations with higher risks and specific pathogens were identified where additional measures could be taken to prevent SSI.

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486
Brain and Spine 4 (2024) 103786
Ventriculoperitoneal Shunt Insertion In Palliative Patients With Hydrocephalus Secondary To Cerebral Metastasis: A Single-Centre Case Series

Jack Sheppard [1], Polen Bareke [2], Shuja Yaqub [3], Lewis Thorne [1], Ciaran Hill [1], Naomi Fersht [4], Ahmed Toma [1], Laurence Watkins [1], Lucia Darie [1]. [1] *National Hospital for Neurology and Neurosurgery, London, United Kingdom;* [2] *University College London, London, United Kingdom;* [3] *Whipps Cross Hospital, London, United Kingdom;* [4] *University College London Hospital, London, United Kingdom*

Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM

Background: Ventriculoperitoneal shunt insertion is an important palliative procedure in the context of cerebral metastatic disease. This work serves the aim of identifying complications, risks and provide insight into the overall outcomes of palliative shunts with the goal of enhancing patient counselling.

Methods: This is a single institution retrospective case-series study of patients with cerebral metastatic and/or leptomeningeal disease undergoing VPS insertion between 2019-2023. Patients with primary brain tumours were excluded. Demographic, clinical, and radiological data was derived from the electronic patient record.

Results: 32 patients with a mean age at intervention of 58.2 years (SD $\pm$ 13.7) were included. The average Karnofsky Index was 67.4 with 50% scoring 0-1 on the ECOG scale. The most common tumour primary was breast, with 8 (25%) cases of invasive ductal carcinoma. 37.5% of cases had >3 intracerebral metastases and 7 (21.9%) cases showed leptomeningeal carcinomatosis. The decision to insert a palliative shunt was made following discussion between neurosurgery and oncology in 56.3% of cases. 53.1% of patients reported subjective symptom improvement and 28.1 % showed objective improvement in mobility. The median survival after intervention was 62 days (IR 28.8-164 days). 5 (15.6%) cases required revision after an average of 19.4 days (SD $\pm$ 17.5), this was due to shunt dysfunction and catheter displacement. Invasive ductal carcinoma was significantly associated with shunt revision ($X2 = 11.8$, $p < 0.05$).

Conclusions: Ventriculoperitoneal shunts effectively manage symptoms in patients with hydrocephalus secondary to cerebral metastasis. The collected data

provides important context to consider during clinical decision making.
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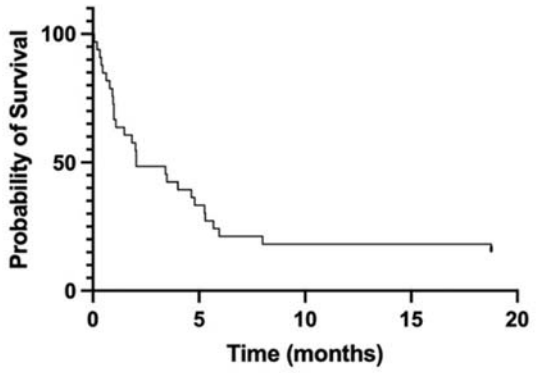


Figure 1: A Kaplan-Meier Curve representing the survival rate of patients after ventriculoperitoneal shunts over time.

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771
Brain and Spine 4 (2024) 103787
Idiopathic normal pressure hydrocephalus (iNPH) after CSF shunt surgery: Is long-term improvement common or exceptional?

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM
Background: Long-term efficacy of cerebrospinal fluid (CSF) shunt surgery in idiopathic normal pressure hydrocephalus (iNPH) patients is differently reported. The aim of this study was to assess responsiveness, symptom improvement and long-term outcome after shunt surgery.
Methods: Altogether, 307 shunted patients with improved Hakim symptoms after preoperative test CSF diversion were retrospectively investigated. Ventriculo-atrial (in 26.1%) or ventriculo-peritoneal (in 73.9%) shunts and anti-siphon devices (in 22.8%) were used. Epidemiological data were retrospectively assessed using hospital records and telephone interviews (59.9 months mean follow up, FU).
Results: Patient age at the time of shunt surgery was 70.3 mean ± 9.0 years. Altogether, 18 patients were lost to FU. Of the remaining 289 cases, 253 (87.5%) showed postoperative symptom improvement, and 36 patients (12.5%) did not respond to shunt surgery. Most frequent symptom prior to surgery was gait disturbance (99.4%) followed by cognitive impairment (80.6%) and urinary incontinence (69.3%). A complete Hakim's Triad was present in 60.2%. Postoperative symptom improvement was observed in 80.6%, 46.9% and 40.8% for gait disturbance, cognitive impairment, and urinary incontinence respectively. Improvement of all three symptoms was seen in 25.6%. Average duration of symptom improvement was 51.5 months (4.3 yrs, from 0 to 21 yrs), 56% had continuing improvement of symptoms after 10 years of FU. Mean number of valve pressure changes was 2.36 ± 2.08. Older patients had significantly shorter duration of symptom improvement ($p < .001$). Neither comorbidity nor longer symptom duration were statistically significant negative shunt outcome predictors. Overall surgical complication rate was 17.3 %, shunt infection rate was 3.3 %, and shunt revision rate 14.9 %, mostly due to shunt dislocation and/or dysfunction.
Conclusions: Surgical CSF diversion by implanting shunt systems is an effective and long-lasting treatment method for iNPH, especially concerning the improvement of gait, with up to 21 years symptom improvement in our study. However, surgical complications are common and shunt revision surgery rate was found higher than commonly expected.

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910
Brain and Spine 4 (2024) 103788
Tentorial dural arteriovenous fistulas: a retrospective study on clinical and therapeutic prognostic factors

Raffaella Messina [1], Marella Morrone [1], Maria Luisa Gorgoglione [1], Luca Speranzon [1], Maria Maggio [1], Concetta Zurlo [1], Nunzio Bruno [1], Aurel Hasanbelliu [1], Carlo Delvecchio [1], Francesco Signorelli [1]. [1] *Neurosurgery Unit, University Hospital Policlinico of Bari, Department of Translational Biomedicine and Neurosciences, Bari, Italy*

Oral e-Poster Presentations - Booth 3: Vascular 4, October 16, 2024, 9:30 AM - 10:10 AM
Background: Tentorial dural arteriovenous fistulas (DAVFs) are generally aggressive in their behavior and, due to their arterial supply from small branches directly off the ICA and PCA, they are difficult to manage endovascularly.
Methods: This retrospective observational study evaluated clinical and radiological outcome of all patients treated in the period 2011-2023. All patients underwent intraoperative indocyanine-green video-angiography (ICG-VA), 3-month postoperative DSA, and yearly clinical and MRI follow-up for the first 5 years and at 5-year interval subsequently.
Results: Twenty consecutive patients (17M and 3F, average age 59.4 ± 9.7 years) were included. According to Lawton classification, n.5 (25%) had type I, Galenic; n.6 (30%) type II, straight sinus; n.2 (10%) type III, torcular; n.3 (15%) type IV, tentorial sinus; n.2 (10%) type V, superior petrosal sinus; n.2 (10%) type VI, incisural.
Seventeen (85%) fistulas were classified as Cognard type IV; n.2 (10%) type IIB; and n.1 (5%) type III.
At admission, n.9 (45%) presented as ruptured, n.6 (30%) with sensorimotor deficits while n.5 (25%) as incidental findings. All patients underwent DSA and attempt at endovascular exclusion, which was feasible in just one patient. Seventeen patients were operated on and n.2 incidentally discovered, Cognard grade III and IV DAVFs, were followed-up. Among surgical patients, n.3 underwent partial endovascular embolization of feeders preoperatively.
Postoperative hydrocephalus and wound infection were detected in one patient each, while one patient died of pulmonary embolism two months postoperatively. At a mean follow-up of 4 years, the survivors have a mRS of 1.
In multivaried analysis, ICG-VA-confirmed DAVF exclusion and surgery was significatively associated with postoperative DSA-confirmed exclusion ($p>0.001$). Senstivity and specificity of intraoperative ICG-VA were both 100% when compared with DSA.
Conclusions: Surgery remains the mainstay of tentorial DAVFs treatment. ICG-VA reliably aids in identifying the point of fistula and confirms intraoperatively its interruption.

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56
Brain and Spine 4 (2024) 103789
The prevention of infectious complications in degenerative spine surgery with sodium aminodihydrophthalazinedione use

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM
Background: A surgical site infection (SSI) is defined as an infection that occurs after surgery in the part of the body where the operation was performed. SSIs lead to increased costs, repeated hospitalizations, longer hospital stays and, in some cases, death of patients. At the same time, according to a number of authors, from 40% to 60% of these infections can be prevented. Modern immunomodulation is also becoming important in spinal surgery
Methods: A prospective, comparative, non-randomized, single-center study. The study included 60 patients, 30 in the experimental group, 30 in the control group. Each patient signed informed consent. When the patient was included in the study, a laboratory examination was performed: T-lymphocytes (CD3+); T-helpers (CD3+CD4+); T-cytotoxic lymphocytes (CD3+CD8+); immunoregulatory index (IRI); B-lymphocytes (CD19+); Natural killers (NK cells, CD3-CD16+/CD56+); T-natural killers (CD3+CD16+CD56+); indicators of

phagocytosis of granulocytes and monocytes; circulating immune complexes (CIC), immunoglobulins A (IgA), M (IgM), G (IgG), E (IgE); leukocyte formula with the determination of the proportion (in%) and concentration (thousand cells / μl) of neutrophils, lymphocytes, monocytes, eosinophils, basophils. The described laboratory examination was repeated in patients on the 10th day PostOp after the course of the 200 mg sodium aminodihydrophthalazinedione 1 time per day.

Results: It was found that the percentage of patients with positive dynamics of immunological indicators was significantly ($p<0.05$) higher after the course of sodium aminodihydrophthalazinedione (T-, B-cell immunity, IgG level, indicators in the CBC - the level of lymphocytes, neutrophils), thus this chemical compound potentiates, enhances the positive effect on the main links of immunity in a much larger number of patients with this pathology. Sodium aminodihydrophthalazinedione demonstrated a pronounced immunomodulatory activity in patients with degenerative diseases of the spine, acting as a true immunomodulator, potentiating anti-infective protection in a significantly larger percentage of individuals compared to the control group ($p<0.05$).

Conclusions: Sodium aminodihydrophthalazinedione significantly effected on cellular immunity, thereby reduced the possible risks of infectious complications in the surgical area in patients with degenerative diseases of the lumbar spine. Further studies, including multicenter ones, will make it possible to more clearly formulate the indications for the use of this chemical compound in the orthopedic patients treatment.

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380

Brain and Spine 4 (2024) 103790

Result of conservative treatment for pyogenic spondylodiscitis in super-aged society

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

Background: Pyogenic spondylodiscitis (PSD) is more frequent among aged people. All developed countries are on the way to aging society. Japan become highest in the world since 2005. By knowing the situation of disease in Japan, it is possible to know the future of European countries. The purpose of this study is to analyze the situation of PSD in one city of Japan and to clarify the factors that influence to the prognosis.

Methods: The consecutive cases of PSD since January 2013 to March 2021 were retrospectively included. The diagnosis was confirmed with symptoms and MRI. Patients' background, co-morbidity, causative organism, length of stay, and outcome were evaluated. The cases who could discharge to home by 6-8 weeks conservative therapy were determined as CS group. The cases hospitalized more than 61days, needed surgery except biopsy, recurred in short period, unable to discharge to home was determined as NC group. The patients were confirmed as cured by 6 months' infection control after the end of treatment.

Results: There were 72 cases, aged 69.5 ± 15.0 (14-91) years. 70 cases had some comorbidities, and common morbidities were DM in 31 cases, malignancy in 21 cases, malnutrition in 56 cases, other site infection in 23 cases. The most common causative organisms were MSSA in 22 cases, followed by streptococcus in 12 cases. Opportunistic bacteria like enteric pathogen were detected in 22 cases, and multidrug-resistant bacteria were in 8 cases. Finally, cure was obtained in 66 cases, and 6 cases were died due to disease other than PSD. 7 cases experienced recurrence, and in these, 2 cases received posterior fixation (PF). 4 cases cured with conservative therapy. 3 cases received PF in first admission, due to poor reaction to conservative therapy. There were 22 cases of CS and 47 cases of NC, and 3 cases were not determined due to death in 6 months. In NC, the age was higher (CS 57.7±18.4 vs NC 74.5±9.6, $p<0.001$), malnutrition (CS 11 vs NC 43, $p<.001$) and multidrug-resistant bacteria (CS 0 vs NC 8, $p<0.005$) were frequent with statistical significance.

Conclusions: The high average age of PSD implies it is frequent in aging society. High age, malnutrition and multidrug-resistant bacteria also make treatment difficult. Future study should clarify whether early nutrition support and surgical intervention will improve clinical course on such patients.

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296

Brain and Spine 4 (2024) 103791

Predictors and outcome of hydrocephalus following aneuysmal subarachoid hemorrhage

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM

Background: Hydrocephalus is frequently encountered complication following aneurysmal subarachnoid hemorrhage (aSAH). Three stages of hyprocephalus have been recognized: acute (48-72h after the hemorrhage), subacute (3-14 days) and chronic (more than 14 days). The aim of our study was to identify predictors and outcome of patients presenting with hydrocephalus after aSAH.

Methods: Hospital - based retrospective study was conducted among patients, who presented with aSAH during 2017 - 2022. The following data were statistically analyzed - age, sex, location of the ruptured aneurysm, Hunt - Hess and Fisher scale, procedure (coiling or clipping), in-hospital medical complications, symptomatic vasospasm occurrence, ventricular and/or lumbar drainage, VP shunt implantation, time to shunt, CSF parameters (protein, erythrocyte count) and CRP before shunt implantation, complications after shunt implantation, premorbid mRS, hospital discharge mRS, mRS after 6 months.

Results: Overall 128 patients were included in our study (43 male), with mean age of 57 years. We did not find correlation between age, location of the aneurysm and the need for drainage. 47% men needed drainage, 21% developed shunt dependeng hydrocephalus (SHDC). Whereas 37% women required drainage and 13% presented with SHDC. 49% patients required drainage after coiling, compared to 37% after clipping, but there was no difference in SHDC occurrence (16% for both methods). We proved correlation between both Hunt-Hess and Fisher grade and the need for drainage as well as SDHC, also there were more complications correlating with higher Fisher grade. Patients with symptomatic vasospasm were more likely to obtain drainage and VP shunt, than patients without vasospasm. There was no correlation between CFS parameters, CRP, time to shunt and complications or worse outcome. There was only one complication after VP shunt implantation. Patients after VP shunt improved in mRS after 6 moths by at least 1 point.

Conclusions: We have been able to identify several predictors of both acute and chronic hydrocephalus following aSAH, complications following VP shunt implantation and outcome of these patients.

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882

Brain and Spine 4 (2024) 103792

Clinical improvement after shunt surgery in idiopathic normal pressure hydrocephalus patients can be quantified by diffusion tensor imaging

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM

Background; White matter changes as measured by diffusion tensor imaging (DTI) typically reflect the functionality of individual tracts. This study aimed to investigate the changes of DTI parameters in the most significant tracts before and after implantation of the shunt system in idiopathic normal pressure hydrocephalus (iNPH) patients along with the evaluation of the relationship between DTI parameters and clinical improvement.

Methods: Between 2017 and 2022, 85 patients with probable iNPH underwent prospective preoperative magnetic resonance imaging (MRI) and comprehensive clinical workup. Patients with clinical symptoms of iNPH, positive result on lumbar infusion test (LIT) and/or gait improvement after 120-hour lumbar drainage (LD) were diagnosed with iNPH and underwent shunt-placement surgery. Fractional anisotropy (FA) and mean diffusivity (MD) values for individual regions of interest were extracted from preoperative and postoperative MRI. These FA and MD values were correlated with the clinical picture of individual patients and preoperative DTI predictors of LIT response were studied.

Results: A total of 32 patients (73.59 ± 4.59 years) with definite iNPH were

analyzed. Preoperative DTI characteristics of internal capsule and corona radiata tracts significantly correlated with the long-term improvement in the Dutch Gait Scale postoperatively ($p<0.036$). All 10 patients with negative LIT improved after LD and benefited from shunt surgery. The most clinically relevant predictor of LIT response was the preoperative FA value of the internal capsule tract with AUC of 0.90.

Conclusions: DTI characteristics of white matter tracts reflect clinical improvement after shunt surgery in iNPH patients in terms of both gait and cognitive impairments. Negotiate LIT should not directly exclude patients from shunting without additional testing. iNPH patients tend to improve towards physiological FA and MD values, thus further underlying the benefit of shunt surgery in both clinical and radiological pictures.

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494

Brain and Spine 4 (2024) 103793

A Comparison of Efficacy And Safety of CSF Diversion Shunting and Procedures In Idiopathic Normal Pressure Hydrocephalus: A Meta-Analysis

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM

Background: Idiopathic normal pressure hydrocephalus (iNPH) is commonly treated using various cerebrospinal fluid (CSF) diversion procedures, including ventriculoperitoneal, ventriculoatrial (VA), lumboperitoneal (LP) shunting, and endoscopic third ventriculostomy (ETV). Despite the prevalence of these interventions, there is limited comparative data on their efficacy, complication and revision rate over time.

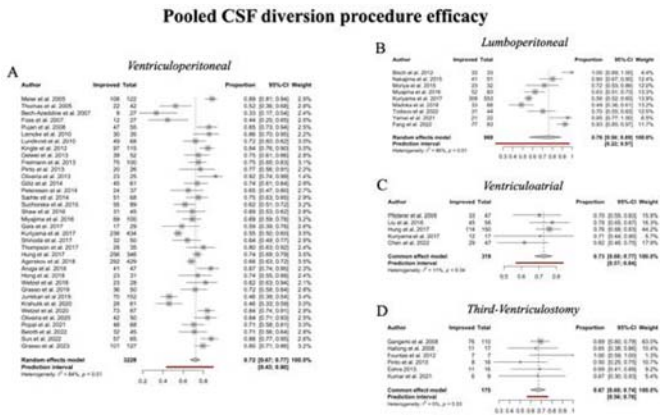
Methods: EMBASE, MEDLINE, and Scopus were screened for studies investigating CSF shunting of iNPH patients. A meta-analysis and regression analyses were conducted, with the primary outcome being shunt response and secondary outcomes being complication rates and rate of surgical revisions between different shunt types.

Results: Out of the 1749 studies screened, 51 were included in this review. 4,691 patients were pooled in this meta-analysis. Overall, more than 70% of patients experienced improvement after surgical treatment ($p<0.05$). LP shunt demonstrated the highest efficacy at 76% ($p<0.05$), followed by VP shunt at 72% ($p<0.05$). ETV exhibited the lowest success rate at 67%.

Complication rates were, however, lowest for ETV (6%) but highest for VP shunt (18%) and LP shunt (20%). Revision rates were lowest for VP shunt (12%) and highest for ETV (23%). The efficacy of CSF shunting was not found to have increased over time between 2005 and 2023 ($p<0.05$).

Conclusions: This comprehensive meta-analysis underscores the overall efficacy of CSF diversion procedures in managing iNPH, with most patients reporting symptomatic improvement. The comparative analysis reveals that while no CSF diversion technique significantly outperforms others in outcomes, ETV is associated with a lower success rate, albeit with fewer complications. Moreover, the unchanged efficacy over the studied period suggests a need for improved patient selection. This study aids in informing clinical decisions in iNPH patients and highlights the benefit of continued refinement of iNPH treatment protocols.

Optional Image



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748

Brain and Spine 4 (2024) 103794

Is preoperative mALS the only reliable predicting factor in SDAVF ?

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Oral e-Poster Presentations - Booth 3: Vascular 4, October 16, 2024, 9:30 AM - 10:10 AM

Background: Spinal dural arteriovenous fistula (SDAVF) is the most common type of spinal cord vascular malformation. The clinical presentations of SDAVF are nonspecific, but typically present with slowly progressive myelopathy. On spinal magnetic resonance imaging (MRI), multisegmental T2 hyperintensities along with associated flow voids are pathognomonic of SDAVF. The neurological state before treatment is certainly relevant in predicting outcome, but the other possible predicting factors should be consider as well.

Methods: We conducted a retrospective study of all SDAVF treated at the department of Neurosurgery in University hospital of “St. Ivan Rilski”, Sofia from 2010 to 2023. We report on the cases of 58 patients (46 men, 12 women) who were treated surgically and endovascularly. Patient age ranged from 24 to 77 years (mean 60 years). The modified Aminoff-Logue scale(mALS) and Denis scale were used to stratify the degree of disability. Age, duration of symptoms, localization of fistula, type of clinical presentation, pre- and postoperative magnetic resonance (MR) imaging findings, and preintervention disability were correlated with outcome.

Results: At follow-up, 61% of the patients reported improvement, without improvement – 35% and deteriorated – 4%. The average interval from onset to diagnosis was 24.8 months. The most frequent localisation of the fistula was in the lower thoracic region – 37%. We found a better outcome when localisation of the fistula was in the mid and lower thoracic region. The extent of intramedullary spinal cord T2 signal abnormality usually correlates with outcomes and should be used as a prognostic factor, whereas dilated perimedullary veins did not significantly correlate with postoperative outcome.

Conclusions: SDAVFs are a rare disease and frequently could be misdiagnosed. Hence patients were often treated incorrectly. Preoperative mALS is the strongest predicting factor of postoperative outcome but other preoperative characteristics however should be taken into consideration.

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1426
Brain and Spine 4 (2024) 103795
Minimally Invasive Contralateral Endoscopic Endonasal Approach for a True Intracavernous Epidermoid Cyst Resection

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM
Background: True intra-cavernous epidermoid cysts are rare pathologies, which develop inside the cavernous sinus deforming the normal anatomy and neurovascular relationships. Thus, it remains a surgical challenge and the approach selection should be tailored to each patient to reduce the risk of cranial nerves and vascular injuries while maximizing tumor resection. A case of a 23-year-old male is presented referred to our Hospital for a progressive worsening of ptosis and diplopia due to a lesion located inside the left cavernous sinus. The surgical goal is to decompress cranial nerve III and improve the patient's symptoms with the surgical goal of emptying the cyst contents while keeping the tumor capsule for potential postoperative treatment by radiosurgery.
Methods: The choice of surgical corridor through a minimally invasive contralateral endoscopic endonasal approach was based on an anatomical window, created by the tumor itself, between the paraclival carotid artery medially and the cranial nerves pushed laterally. Neuronavigation, intraoperative cranial nerves' monitoring and micro-doppler were set up. Angled endoscopes and rotative aspirators were used.
Results: With a one nostril contralateral approach as well as neuronavigation and neuromonitoring, a safe corridor to the cavernous sinus can be opened preserving cranial nerves function and reducing soft tissue trauma. Angled endoscopes and suctions were key allowing to "look around the corners" maximizing tumor resection. The patient showed a postoperative improvement of the ptosis and diplopia with no additional cranial nerve deficits.
Conclusions: Lesions growing into the cavernous sinus remain a surgical challenge. The knowledge of tumor histology and how it could modify the relationships between internal carotid artery and cranial nerves are key to choose the best surgical strategy maximizing tumor resection while reducing surgical risks and morbidities.

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989
Brain and Spine 4 (2024) 103796
Endoscopic Transorbital Treatment of Intracranial Lesions - Case Series

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Oral e-Poster Presentations - Booth 1: Skull Base 4 (Endoscopic Techniques), October 16, 2024, 9:30 AM - 10:10 AM
Background: At first, orbital surgery technique was described by Hermann Knapp in 1874, Rudolf Kroenline described lateral orbitotomy in 1889, since then transorbital approach to intracranial lesions has gone through various updates and modifications, with the development of modern neuro-endoscopic technique and instrumentation gained new actuality. In 2007 Kris Moe introduced the concept of Transorbital Neuro-endoscopic Surgery (TONES), Di Somma et al. in the article "Endoscopic transorbital superior eyelid approach: anatomical study from a neurosurgical perspective", described access to the basis of the anterior cranial fossa, middle cranial fossa, sylvian fissure, opticocarotid region. More than 100 articles were published in the last decade about this topic describing anatomical and clinical experience.
Methods: In our series 7 patients with different intracranial pathologies (5 meningiomas, 1 trigeminal schwannoma, 1 temporal pole cavernoma) were operated using neuroendoscopic equipment (4mm. scope 0 and 30 degrees) with a set of modern endoscopic fine instrumentation. Different skull base approaches through superior eyelid skin incision was performed to the anterior cranial base, temporal pole, combined approach to the Spheno-orbital region, and cavernous sinus through Meningo-orbital band.
Results: In 4 cases complete lesion resection (the lesion resection was completed in 4 cases), in 2 cases subtotal resection, in one case partial removal. Only in one case there was worsening of the neurological symptomatic - III nerve palsy which was present preoperatively, worsened postoperatively, and was not related to the approach but was associated with tumor dissection in the cavernous part. The complications haven't been associated with the surgical approach. All patients have excellent cosmetic outcome.
Conclusions: Modern endoscopic technic and instrumentations give adequate surgical freedom to manipulate and operate various pathologies of this region through transorbital approach, patient selection is crucial for success. Approach gives new vectors and angles of attack, seems to be an additional useful tool in neurosurgeons' armamentarium.

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493
Brain and Spine 4 (2024) 103797
Prognostic factors associated with functional outcomes after ventriculoperitoneal shunt surgery in idiopathic Normal Pressure Hydrocephalus: a retrospective analysis

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM
Background: Idiopathic Normal Pressure Hydrocephalus (iNPH) is typically associated with progressive gait disturbance, cognitive deficits, and urinary incontinence, representing the most common type of hydrocephalus in adults and a potentially reversible cause of dementia. Ventriculoperitoneal shunt (VPS) surgery has shown variable success rates. The objective of this study was to identify prognostic factors associated with functional outcomes after VPS surgery in iNPH patients.
Methods: A retrospective analysis was conducted on 75 consecutive iNPH patients undergoing VPS surgery. Pre- and post-surgery clinical data and MRI characteristics were analyzed. Functional status was compared using the modified Rankin Scale (mRS) before surgery and 6 months after surgery. A comparative analysis was performed between two groups: patients who improved and those who did not improve their mRS score after surgery.
Results: The average age at diagnosis was 70.1 years. The mean duration of symptoms until surgery was 16 months. 65% of patients exhibited complete Hakim-Adams triad. Between pre-surgery and 6 months post-surgery, there was a 49% improvement in gait disturbances ($p<0.001$), a 21% improvement in cognitive changes ($p=0.034$), and a 31% improvement in urinary incontinence ($p=0.003$). 64% showed improved functional outcomes with a significant mRS score decrease 6 months after surgery ($Z=-4.240$, $p<0.001$). Factors associated with functional improvement were as follows: absence of cognitive deficits (80%), no previous cerebrovascular events (84%), and patency of the Sylvian fissure on preoperative MRI (88%). Factors associated with non-functional improvement were as follows: cognitive deficits (86%), complete Hakim-Adams triad (79%), and ependymal transudation on preoperative MRI (71%).
Conclusions: VPS surgery improves the functional outcome of iNPH patients. Cognitive deficit prior to surgery is the most significant factor associated with functional outcome after VPS surgery. Patients with Sylvian fissure patency on preoperative MRI were associated with a better functional outcome, unlike ependymal transudation on preoperative MRI.

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865
Brain and Spine 4 (2024) 103798
Changes in Ventricular Volume after Endoscopic Third Ventriculostomy for Aqueductal Stenosis in Adults

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM
Background: Endoscopic third ventriculostomy (ETV) is an established neurosurgical intervention for treating aqueductal stenosis (AS). Assessment of ventricular size often relies on linear measurements and indexes such as the Evans

Index (EI) and Frontal and Occipital Horn Ratio (FOHR), which can be imprecise and subject to interpretation. Long-term data regarding actual ventricular volume following ETV is scarce. This study aims to analyze the course of the ventricular volume following ETV and evaluate its suitability as a monitoring tool for clinical outcomes.

Methods: We retrospectively analyzed radiological images and clinical records of adult patients (≥18 years) who underwent ETV for AS between 2010 – 2020. The primary endpoint was the lateral and third ventricular (LTV) volume change between the different follow-up periods in patients who did not require revision surgery (successful ETV group). Follow-up periods were grouped as <3 months, 3-6 months, 6-12 months, 1-2 years, and 2-4 years postoperatively. Furthermore, the correlation of ventricular volume with improving clinical symptoms was analyzed using logistic regression analysis. Volumetric analysis was performed by a semi-automated segmentation tool (Sectra Workstation IDS7, Sectra, Linköping, Sweden).

Results: A total of 238 radiological images from 46 patients (median of 5 images per patient) were analyzed. Thirty-nine (84.8%) patients did not require revision surgery (successful ETV group). Overall, there was a direct postoperative decrease in LTV volume by an average of 22.8 ± 22.4 ml (-16.2%), significantly higher than reductions observed in EI (-5%; $p < 0.001$) and FOHR (-3.3%; $p < 0.001$). In the successful ETV group, LTV volume decreased by a mean of 20% within 3 months postoperatively, followed by further 11% and 16% reductions after 3-6 months and 6-12 months, respectively. Overall, the preoperative LTV volume was reduced by 39% after 1-4 years postoperatively, after which it stabilized. Clinical symptoms improved in 69.6% of patients at discharge and 78.8% at last follow-up. There was no association between the amount of LTV volume reduction and clinical improvement during the follow-up period (OR 1.03, [95% CI 0.99 - 1.07]; p=0.186).

Conclusions: The volumetric analysis provides a more accurate representation of ventricular size changes following ETV for AS. It demonstrates a continuous reduction in LTV volume during the first year after surgery, whereafter, the volumes remain stable in most cases. The rate of volume reduction does not seem to correlate with clinical improvement. These novel insights could guide clinical follow-up protocols after ETV for AS.

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1254

Brain and Spine 4 (2024) 103799

Analysis of Postoperative Infections in a Single Tertiary Neurosurgical Center in Western Greece

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

Background: Postoperative infections are a relatively common neurosurgical complication and carry a considerable morbidity. We analyzed prospectively collected data from patients operated in our neurosurgical department during a 2-year time period to ascertain the incidence and type of infection, as well as patient outcomes.

Methods: Data regarding demographics, past medical history, type of surgery, other interventions during hospitalization, length of hospital stay, type of postoperative infections and their respective antimicrobial treatment were prospectively collected from 775 patients operated in our department within 2 years.

Results; Patient age ranged from 14 to 96 years (mean 58.2, SD 16). Mean BMI was 27.6 (range 17.6-49.9, SD 4.6). 17.8% of patients suffered from diabetes mellitus and 4.3% harbored some form of immunosuppression preoperatively. Elective operations comprised 80.9% of the total, while 13.5% of operations were performed on an urgent and 5.6% on an emergency basis. Mean duration of surgery was 109 minutes (range 20-400, SD 69.4). The patients remained non-ambulatory for a mean of 2.5 days (range 0-81, SD 5.4). The incidence of postoperative infections was 11.7%. Pneumonia accounted for 69.4% of the total infections, urinary tract infection (UTI) for 12.2%, superficial thrombophlebitis for 11.2%, bacteremia for 5.1%, COVID infection for 3%, surgical site infection (SSI) for 3%, meningitis for 2%. The most commonly isolated pathogen was Staphylococcus epidermidis, followed by Staphylococcus aureus and Acinetobacter baumannii. The development of infection was independently associated with length of immobilization and duration of mechanical ventilation. The hospitalization was extended due to postoperative infection in 10.6% of operations, while 0.8% of the patients died.

Conclusions; Pneumonia is a common postoperative complication in neurosurgical patients that may be ameliorated by early mobilization. Further elucidation of etiology and precipitating factors of postoperative infections in neurosurgical practice may optimize outcomes.

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537

Brain and Spine 4 (2024) 103800

Long-Term Dynamics of Shunt Non-Response in Idiopathic Normal Pressure Hydrocephalus: Identifying Predictors of Shunt Non-Response Over A 10-Year Period

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Oral e-Poster Presentations - Booth 4: Adult CSF 1, October 16, 2024, 9:30 AM - 10:10 AM

Background: Positive shunt response (S-R) is the gold standard for diagnosing idiopathic normal pressure hydrocephalus (iNPH). However up to 40% of shunted patients do not exhibit clinical improvement within 12 months. With improved monitoring, the phenomenon of late shunt non-responders (S-NR) has become more evident in practice, with patients demonstrating delayed deterioration several years after shunting. The aim of this study is to define the clinical course and predictors of late S-NR.

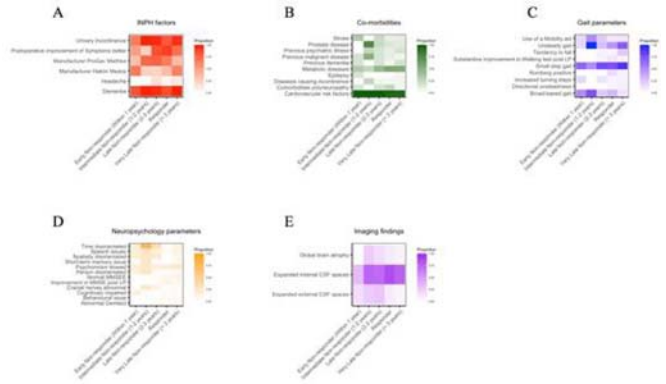
Methods: In this retrospective study, we included patients that underwent ventriculoperitoneal (VP) shunt surgery for iNPH between December 2006 and December 2016. All patients received a lumbar puncture (LP) prior to surgery. Patients were stratified as early (<1 year), intermediate (1-2 years), late (2-3 years) and very late (>3 years) S-NR, and responders. Time series plotting, chi-squared tests, stepwise multivariate regression analyses were used for data analysis.

Results: The study incorporated 65 iNPH patients treated with VP shunting, tracked over an average of 3.75 years, up to over 10 years. Distribution of response to surgery was categorized into early S-NR within one year (7%), intermediate S-NR (8%), late S-NR (28%), responders (32%), and very late S-NR (25%). Stepwise multivariate regression analysis identified urinary incontinence as a significant predictor of non-response in both late and very late cohorts ($p<0.05$), as well as identifying the Hakim Medos shunt valve as inversely associated with the late non-responder group ($p<0.05$), relative to early S-NR. Temporal analysis of symptom trajectories revealed heterogeneity across non-responder groups, with early non-responders showing a uniform decline in symptoms post-surgery, and intermediate non-responders displaying a wider variation in symptom changes. Late non-responders tended to experience a plateau in symptoms, while very late non-responders demonstrated sparse, yet occasionally significant, symptom fluctuations.

Conclusions: This study highlights late S-NR in iNPH, signifying urinary incontinence as a key late S-NR predictor, and associating early S-NR with Hakim Medos valve usage. The varied symptom progression post-shunt surgery suggests a distinct late non-response phenotype in iNPH, warranting personalized

management and nuanced surgical approaches. Future longitudinal studies are essential to better understand and address this complex condition.

Optional Image



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162

Brain and Spine 4 (2024) 103801

Validation of the SITE score for spondylodiscitis patients in clinical practice – a case-based approach

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

Background: De novo spine infections (DNSI) are a concerning and rising healthcare problem. The treatment decision in DNSI regarding conservative or surgical therapy is established on a case-to-case basis in the absence of clear guidelines. The recently proposed Spinal Infection Treatment Evaluation (SITE) score combines clinical and radiological variables to support decision-making, but it has not been validated among non-spine surgeons. We aimed to validate this novel score in a real-life setting among surgeons from different clinical specialties.

Methods: A single-center study was performed at the Kantonsspital St. Gallen from 1/10/2023 until 31/12/2023. We collected clinical and radiological data from DNSI patients, previously treated at our institution. We create fifteen representative case vignettes, which included all spinal locations and SITE scores. A survey was designed, using the SurveyMonkey platform (https://www.surveymonkey.com), to distribute the case vignettes among physicians from the departments that agreed to participate. Participants were asked to score each case and to evaluate the applicability of the SITE score. We calculated intra-class correlation coefficients (ICC3), using R (R Foundation for Statistical Computing, Vienna, Austria) for statistical analysis.

Results: Forty-eight survey forms were analyzed, of which seven and 41 were completed by spine surgeons, or colleagues from other specialties (internal medicine (n=20), orthopedic surgery not involved in spine surgery (n=10), infectiology (n=5), and other surgical disciplines (n=6)), respectively. Spine surgeons showed good interobserver reliability (ICC3 = 0.78). Non-spine surgeons showed poor interobserver reliability with respect to the overall SITE score (ICC3 = 0.48). Subgroup analysis by specialty demonstrated overall low reliability scores (internal medicine ICC3=0.48, non-spinal orthopedic surgeons ICC3=0.43, other surgical specialties ICC3=0.56, infectiology ICC3=0.55). Participants with more frequent exposure to DNSI cases (> 10 per year; n=9) showed higher reliability, scoring more similar like spine surgeons (ICC3=0.7).

Conclusions: We found acceptably high interobserver values for the SITE score only for spine surgeons and non-spine surgeons with frequent exposure to DNSI. The reliability of the score was much lower when applied by physicians from other specialties with lesser experience with DNSI, who would particularly benefit from such a score for decision-making in clinical practice.

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1438

Brain and Spine 4 (2024) 103802

Lymphocyte-mediated Inflammation in the Human Saccular Intracranial Aneurysm Wall

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Oral e-Poster Presentations - Booth 3: Vascular 4, October 16, 2024, 9:30 AM - 10:10 AM

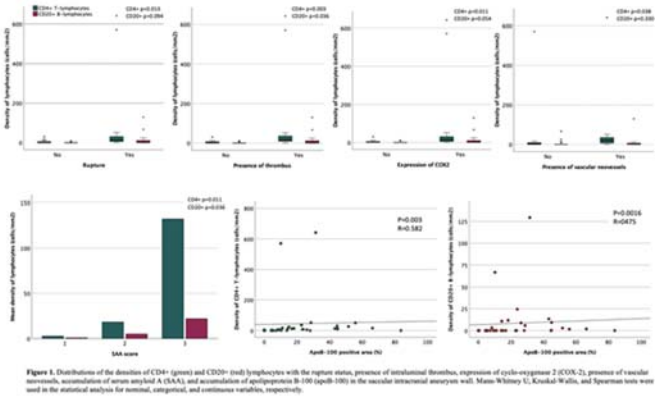
Background: Saccular intracranial aneurysm (sIA) wall is characterized by chronic inflammation before its rupture. While the number of macrophages and CD3+ T-lymphocytes have previously been associated with the sIA wall rupture and wall degeneration, the role of T-lymphocyte subtypes and B-lymphocytes is less studied. This study examines the presence of T-lymphocytes, particularly their helper CD4+ and cytotoxic CD8+ subtypes, and CD20+ B-lymphocytes within the human sIA walls.

Methods: 16 unruptured and 20 ruptured sIA samples were obtained during surgical clip ligation at Helsinki University Hospital. Multiplexed immunofluorescent staining was performed to determine the densities of different immune cell types, including CD3+, CD4+, and CD8+ T-lymphocytes and CD20+ B-lymphocytes, in the sIA walls. The results were compared with variables previously studied in the same sIA series, including clinical characteristics and histological markers for degenerative remodeling, inflammation and lipid accumulation.

Results: The sIA walls contained both CD4+ (n=25/35, 71%) and CD8+ (n=21/35, 60%) T-lymphocyte subtypes, from which the CD4+ T-lymphocytes (median 7 and range 0–642 cells/mm2) were more numerous than the CD8+ T-lymphocytes (median 1 and range 0–30 cells/mm2). The high density of CD4+ T-lymphocytes associated with the sIA rupture and the numbers of vascular and lymphatic neovessels. In addition, the high densities of CD4+ T-lymphocytes and CD20+ B-lymphocytes associated positively with the presence of intraluminal thrombus, lipid accumulation (apolipoprotein B-100 and oxidized LDL), and the expression of inflammation indicators (serum amyloid A [SAA] and cyclo-oxygenase-2), suggesting that they may contribute to the inflammation in the sIA walls, particularly in the presence of atherosclerotic changes. Moreover, the density of CD8+ T-lymphocytes associated positively with the accumulation of SAA in the sIA walls.

Conclusions: CD4+ T-lymphocytes and CD20+ B-lymphocytes may have a role in the pathological changes in the sIA wall that lead to its rupture. Further research is needed to elucidate the functions of lymphocytes subtypes and their contributions to sIA development and rupture.

Optional Image



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104

Brain and Spine 4 (2024) 103803

Minimally Invasive Management Of Cervical Spondylodiscitis. A Multicenter Experience.

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

Background: The etiological diagnosis of cervical spondylodiscitis (CSD) represents the main management goal to start the antibiotic treatment as soon as possible. The present study through a multicenter experience evaluated a minimally invasive surgical approach (MISA) to manage such pathology.

Methods: Retrospective multicenter study on a prospectively built database in 5 European tertiary neurosurgical centers during a 10 years period. Seventy consecutive patients harboring primary CSD undergoing MISA were included. Formal diagnosis was made in all patients on clinical presentation, imaging findings, and laboratory investigation and confirmed by histopathological and bacteriological analysis of perioperative collected specimens.

Results: Forty-one patients were men and 29 were women with a mean age of 47.67 years. Severe neck pain was the most common symptom in 45/70 patients. Fifty-one patients presented a single cervical level of spondylodiscitis, 14/70 a double level, and 5/70 a triple level respectively. The most common identified microorganism was Staphylococcus aureus in 49/70 patients. Each patient received a mean of 3 months antibiotics therapy. With a mean follow-up of 48 months, all patients showed a full recovery without neurological deficits. Neither spine instability nor kyphotic deformation was recorded and bony fusion was confirmed radiologically in all patients. No infection recurrence occurred.

Conclusions: MISA of CSD is an effective management option to identify the infectious agent and/or to decompress the spinal cord ensuring mechanical stability and resulting in an excellent patient outcome.

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1120

Brain and Spine 4 (2024) 103804

Direct Trans-fistulous Occlusion of High-Grade DAVFs – a Forgotten but Effective Technique in Times of Liquid Embolic Agents

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Oral e-Poster Presentations - Booth 3: Vascular 4, October 16, 2024, 9:30 AM - 10:10 AM

Background: Dural arteriovenous fistulas (DAVFs) have been increasingly managed by trans-arterial embolization (TAE), attributed to the introduction of non-adhesive liquid embolic agents (LEAs). While this has resulted in an overall decrease of transvenous occlusions (TVOs) of large sinuses, selective blockage of a fistula's proximal venous outflow continues to appear a logical technique. Particularly, in cases where this most critical target for LAEs can be reached by antegrade transfistulous catheterization, a selective transfistulous occlusion (TFO) can be performed. We present a case series where this technique was successfully applied.

Methods: Six patients presenting with high-grade DAVFs in our institution over the last 4 years were included. Based on their angiographic architecture, it was decided to approach the lesions via transarterial and transfistulous catheter navigation to reach the fistula site for selective occlusion. Utilizing a tri-axial approach, a 1.3F or 1.5F Headway® Duo microcatheter (MicroVention™, Tustin, CA, USA) was supported by a 5F Sofia™ (MicroVention™) and 8F Neuron™MAX (Penumbra, Alameda, CA, USA). After the fistula's venous outflow compartment was reached, selective coil packing was performed.

Results: In all patients, the fistulous connection and primary venous outflow portion could be accessed and completely occluded. In five patients, no additional TAE was deemed necessary, in one patient intravenous LEA was injected. All patients fully recovered and no complications related to the treatment technique were observed. One patient developed transient severe headaches post-procedure, another a mild dizziness 3 weeks later that was unrelated to the treatment.

Conclusions: In cases with suitable angioarchitecture, direct TFO represents a feasible, effective, and safe technique that avoids long arterial injections and eliminates the risks of non-target embolization. TFO, a known but somewhat underreported technique, represents a valuable alternative to traditional TAE, especially in the management of high-grade AV shunting lesions.

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308

Brain and Spine 4 (2024) 103805

3D-C-arm-scan navigated percutaneous transpedicular targeted placement of Gentamycin-PMMA-beads-chain during percutaneous fusion surgery in case of progressive or recurrent spondylodiscitis: a technical note

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Oral e-Poster Presentations - Booth 2: Spine 5 (Infectious diseases), October 16, 2024, 9:30 AM - 10:10 AM

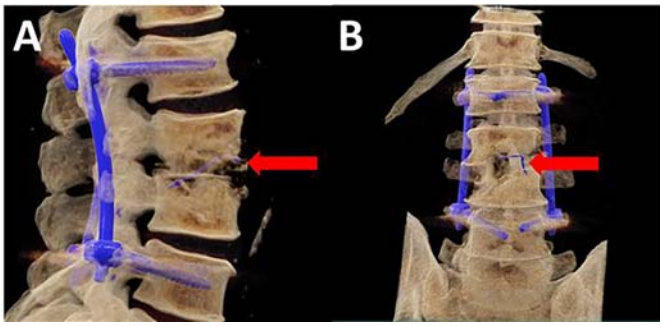
Background: Spondylodiscitis (SD) is a potentially life-threatening bacterial infection with a morbidity rate of more than 7% and a high recurrence rate. This study aims to describe the 3D-C-arm-scan-navigated percutaneous transpedicular targeted placement (3DnavP) of Gentamicin-PMMA-beads-chains (GBC) in case of progressive or recurrent SD.

Methods: For 3DnavP, the patient is positioned under general anesthesia in the prone position. In the first step, a small incision for exposure of one spinal process is performed. The patient's reference array is fixed on the spinal process.
A 3D-C-arm-scan (Ziehm 3D) for spine navigation registration (Brainlab) is performed under apnea after preoxygenation. Percutaneous transpedicular fusion is performed above and below the spondylodiscitis under spine navigation and x-ray. After percutaneous fusion surgery, the percutaneous transpedicular punction with the targed of the infection focus is performed with the vertebra access device using the bevel tip needle (Joline) under spine navigation and x-ray. The trajectory is angled through the caudal part of the posterior pedicle and the upper part of the anterior pedicle. A Kirschner wire (K-wire) is inserted into the trajectory. A vertebra introducer device (Joline) is inserted into the target following the track of the K-wire. A gentamicin-PMMA-beads-chain (Septopal) is inserted into the target through the vertebra introducer device under x-ray guidance.

Results: The postoperative CT scan revealed a proper positioning of the screw (Gertzbein–Robbins grade A) and the antibiotic sphere chain (figure1). At follow-up examination 4 months after surgery, the patient had no neurological symptoms and no pain. The C-reactive protein level was normal.

Conclusions: 3DnavP of GBC might be a good choice for targeted local antibiotic therapy in cases of spondylodiscitis and an alternative to open approaches. It combines the advantages of 3D-C-arm-scan guided navigation regarding the accuracy and targeted placement, percutaneous transpedicular surgery regarding minimal invasiveness, and the advantages of local antibiotic therapy regarding high local antibiotic dose.

Optional Image



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607
Brain and Spine 4 (2024) 103806
Deep Learning-Based Normalization and Unmixing of Hyperspectral Images for Brain Tumor Surgery

David Black [1], Jaidev Gill [1], Andrew Xie [1], Antonio Di Ieva [1], Walter Stummer [1], Eric Suero Molina [1]. [1] *University Hospital Münster, Germany*

Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Identifying glioma margins is difficult. Advances in hyperspectral imaging (HSI) for fluorescence-guided surgery (FGS) have enhanced tumor detection based on their light emission spectra. However, computations are very sensitive to autofluorescence from endogenous fluorophores, and artifacts from the optical and topographic properties of the tissue. To overcome these challenges, measured spectra are normalized to account for artifacts and spectrally unmixed to isolate the protoporphyrin IX (PpIX) signal, which indicates malignant tissue. Existing methods are simplistic and based on phantoms and are unable to account for nonlinear effects such as multiple scattering, the dual photostates of PpIX, or the inhomogeneous optical properties of the tissue. These may include wavelength-dependent variations in absorption and scattering, which are also unmodeled. We propose a deep learning (DL)-based pipeline encompassing normalization and unmixing, which can fully account for the nonlinear effects and produce more accurate distributions of fluorophore abundances.
Methods: The architecture consists of a fully connected multi-layer perceptron to perform the normalization, followed by an encoder network for unmixing. A decoder network or a linear combination of known fluorophore spectra, weighted by the encoder outputs, can be used to compute a reconstruction loss for unsupervised learning on human data with no ground-truth PpIX abundance. A second encoder network with shared weights into which the pure fluorophore spectra are input ensures statistical independence of the computed abundances. This unsupervised approach was compared to the standard classical method and a fully supervised 1D convolutional neural network with two residual blocks and three fully connected layers.
Results: On phantom and pig brain data with known PpIX concentration, the supervised model achieved coefficients of determination (R2) between the known and computed PpIX concentrations of 0.997 and 0.970, respectively. In contrast, the classical approach achieves only 0.93 and 0.82. The unsupervised approach's R2 values were 0.98 and 0.91, respectively. On human data, the unsupervised model gives qualitatively more realistic results than the classical method, better removing bright spots of specular reflectance and greatly reducing the variance of the computed PpIX abundance over biopsies that should be relatively homogeneous.
Conclusions: These results show promise for using deep learning to improve the precision and accuracy of HSI FGS.

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1100
Brain and Spine 4 (2024) 103807
The Role Of Thrombolysis In The Management Of Intraventricular Hemorrhage: A Review Of The Literature

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Intraventricular hemorrhage(IVH) represents a severe hemorrhagic manifestation inside the ventricular system of the brain, either spontaneous or secondary to intracerebral hemorrhage(ICH), that can lead to significant augmentation of morbidity and mortality. As a result, it is obligatory to choose the safest and most efficient therapeutic approach to minimize the hemorrhage and prevent the severe complications from occurring. Although there is no uniform approach for the resolution of IVH, a possible proposed treatment can be the intraventricular injection of thrombolytic therapy via an external ventricular drainage(EVD).
Methods: We searched the following terms in Pubmed, used in specific combination: ("thrombolysis" AND "intraventricular"). We screened 125 studies and we selected 38 studies, matching all selection and exclusion criteria.
Results: Several studies suggest the beneficial role of adding thrombolytic therapy intraventricularly via the external ventricular drainage, contributing to the reduction and resolution of the intraventricular hematoma. The role of thrombolysis in clinical situations of IVH in association with ICH remains a debatable question, with some studies supporting a possible role, while others do not conclude to significant results. Regarding the mortality and the functional outcome, mortality tends to decrease in a significant manner when adding thrombolytics to the EVD while the functional outcome still remains a controversial issue that needs to be solved. As far as the complications go, although it is expected that the risk for bleeding increases, specifically during the treatment phase, several studies support similar complication rates when comparing EVD alone versus EVD plus thrombolytics.
Conclusions: Intraventricular application of thrombolytic therapy is a promising tool for the future approach of a patient suffering from IVH. However, it is a necessity that more future randomized studies are designed in order to establish the efficacy of thrombolytic therapy not only concerning the hemorrhage evacuation but also a better functional outcome.

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406
351
Brain and Spine 4 (2024) 103808
The preliminary result of Robot-assisted ICH aspiration with NaoTrac system

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: The intracranial hemorrhage (ICH) accounts for 15~20% of all strokes and causes neurologic deficits. The goal of the treatment is to coagulate the bleeder and eliminate the mass effect of the hematoma, facilitating the neurologic recovery. The ICH score is a simple scoring system to help rank the risk of 30-d mortality rate and also to set up clinical treatment protocols.
For ICH score 0-2, the 30-day mortality rate is low. However, the functional neurologic outcome is quite important. We try to remove the hematoma with the least damage method to eliminate the mass effect, reduce the peri-hematoma edema, and correlate the functional neurologic outcome.
Methods: Records of the patients with acute basal ganglion ICH presenting to the China Medical University Hospital. We use the Robotic navigation machine, NaoTrac, the machine-vision registration system, to help aspirate the hematoma 3 days later.
Results: Enroll all the10 patients with ICH aspiration in a clinical trial in China Medical University Hospital since 2022/10. The average patient registration time is 77 seconds. The average surgical time is 59 minutes and 33 seconds. The goal of hematoma clearance is at least 75% or less than 15ml of residual hematoma, reaching a better outcome. In our cases, the average rate of hematoma aspiration is around 90%. With NaoTrac, the surgical instruments can be precisely guided to the targeted lesion, making it easier to remove the hematoma.
Conclusions: Using the NaoTrac robotic navigation system, we can register the patient/instrument quickly, aspirate the hematoma easily, quickly, and safely with high accuracy, eliminate the influence on the surrounding neural fibers, and maybe facilitate functional neurologic recovery.
Optional Image

Patient No.	Registration Time (sec)	Registration Accuracy (mm)	Surgical Time (min)	Pre-op Volume (cc)	Pre-op MP (Upper/Lower)	Post-op Volume (cc)	Post-op MP Day 2 (Upper/Lower)	Aspiration Rate (%)
1	61	0.25	53	26.77	0/1	1.19	1/3	95.6%
2	56	0.08	64	16.48	0/0	0.74	0/2	95.5%
3	64	0.10	41	13.24	2/2	0.39	3/3	97.1%
4	70	0.25	51	20.16	2/2	0.52	4/4	97.4%
5	45	0.27	96	25.91	0/0	0.99	0/1	96.2%
6	46	0.34	72	20.60	0/0	10.43	0/2	62.5%
7	122	0.11	56	25.25	2/2	13.17	2/3	92.2%
8	162	0.13	51	14.52	1/1	12.13	1/1	73.3%
9	32	0.25	62	17.53	1/3	1.82	4/4	89.6%
10	28	0.24	31	12.59	2/2	0.77	4/4	93.9%

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Brain and Spine 4 (2024) 103809

Unblackboxing decision making behind artificial intelligence algorithms in intraoperative neurophysiologic monitoring

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: We elucidate the decision making that lies behind artificial intelligence (AI) algorithms in the example of muscle classification in intraoperative neurophysiological monitoring (IONM). The goal is to uncover decisive parameters in motor evoked potentials (MEP) to understand intraoperative changes and optimize AI decision making.

Methods: We classified MEP in supratentorial surgery in a bi-centric setup, training on 160 patients from one center and validating on 50 patients from an independent center. We trained random forests (RF), and 1D and 2D convolutional neural nets (CNN) on a total of 37'000 MEPs and uncovered the decision making by looking into the feature importance and gradient class activation maps (Grad-CAM).

Results: The RF achieved 89% test accuracy and 80% accuracy on the validation dataset from the independent center, whereas the 1D CNN achieved 85% test and 76% validation accuracy. Finally, the 2D CNN achieved 86% test and 81% valication accuracy. Inspecting the RF feature importance reveals that the algorithm focuses on the time interval where the potential has highest amplitude. On the other hand, the grad-CAM reveals that the CNNs might be focusing on the biggest slope of the potential.

Conclusions: Analyzing the decision making of artificial intelligence algorithms is an essential part of ensuring the quality and evidence behind the good performances of these methods. Understanding this rationale will be crucial when improving intraoperative MEP alarm criteria. We showed the key features during identification of MEPs and validated the results in a bicentric setup. To our knowledge, it is the first time an IONM machine learning classification task has been implemented in a multicenter set-up.

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1242

Brain and Spine 4 (2024) 103810

Training for Microvascular Anastomoses on Perfused Human Placenta Model: Participants' Performance Time and Quality at Zurich Microsurgery Course

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Microsurgery requires impressive expertise and precision. Placentas exhibit vascular networks and tissue layers similar to in vivo human settings, allowing surgeons to practice techniques under realistic conditions.
Herein we report on the preliminary results of the intensive two-day microsurgical training on end-to-end and end-to-side microvascular anastomoses (MVA) on perfused human placenta models offered by the Zurich Microsurgery Course (ZMC).

Methods: All participants who attended the ZMC in January 2024 were included. Participants were divided into two groups according to their surgical experience: Group 1, ≤5 years, and Group 2, >5 years. For each participant time and number of MVAs performed (end-to-side or end-to-end), were noted . The quality of MVAs was graded with the ZMC scoring system (Table 1). Besides single participant performance assessment, a comparative analysis of the performances of the two groups was also conducted.

Results: Thirty participants were included and 141 MVAs were analyzed. Group 1 amounted to 18 (60%) participants and Group 2 to 12 (40%). Both groups demonstrated a statistically significant reduction of the time needed to perform an end-to-side MVAs (Group 1, p=0.03236; Group 2, p=0.03). The overall time for performing an end-to-end MVA was shorter for Group 2 (p=0.02642). An improvement of the quality of MVAs was seen in both groups, nonetheless without reaching statistical significance.

Conclusions: The analysis documented a significant reduction of the time needed to perform an end-to-side MVAs during the training: this regardless of previous participants' microsurgical experience. A trend towards improvement of the quality of the performed MVAs was investigated as well . These preliminary data endorse the value of intensive two-day microsurgery training such the one promoted by ZMC as strategy suitable for surgeons at all levels of experience.

Optional Image

Parameter	Score type	Description
Borders' adaptation	Score 1-5	Borders' symmetry between donor and recipient arteries
Number of sutures	Score 1-5	Proper number of sutures (end-to-end: between 8 and 12 sutures; end-to-side: between 10 and 14 sutures)
Symmetry and regularity from outside	Score 1-5	Symmetrical distance from vessel border, use of vessel layers, evaluated from outside
Symmetry and regularity from inside	Score 1-5	Symmetrical distance from vessel border, use of vessel layers, evaluated from inside
Knots' precision	Score 1-5	Symmetry of knots placed on both sides
Threads' length	Score 1-5	Adequate length of cut threads
Patency/Stenosis	Score 1-5	Adequate patency and shape of the anastomosis after perfusion
Microvascular dissection	Score 1-5	Adequate dissection/preparation of vessels and tissue near the anastomosis
Presence of holes	Yes/No	Presence of hole found after perfusion
Endothelial damage	Yes/No	Presence of endothelial tears from inside

Table 1. Scoring system used for microvascular anastomosis (MVA) evaluation.

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790

Brain and Spine 4 (2024) 103811

FALCON Study – A Seamless Transition from Pre-operative Task-based fMRI to Intra-operative Direct Cortical Stimulation

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: The paradigm shift in management of brain tumours in eloquent cortex is maximizing the extent of resection whilst minimizing neurologic morbidity. Intra-operatively, using awake craniotomy for direct cortical stimulation (DCS) and testing of language production and comprehension has become the gold standard for testing to preserve functional outcomes. To circumvent the problems of awake craniotomy, pre-operative imaging using functional magnetic resonance imaging (fMRI) has been employed.
Current fMRI paradigms for presurgical language assessment are focussed on language lateralisation. There are significant differences in the tests that are

conducted pre-operatively to those that are conducted intra-operatively. For example, covert object naming (ON) looks at testing the expressive component of language in task-based fMRI. This is completely different from intra-operative testing where naming errors are used to localise the expressive speech areas during DCS.

The aim of this study was to develop feasible and reproducible language specific task-based fMRI paradigms for assessment providing an alternative to intra-operative DCS in event of failure to perform or complete an awake craniotomy.

Methods: 15 English speaking healthy volunteers with no known intracranial pathology or surgery were recruited for this study. Along with other demographics, their handedness and education level were collected as part of the study. A modified pre-operative task-based fMRI protocol was designed for this study. In addition to T1 weighted structural image, single echo resting state and diffusion weighted imaging, each participant was asked to do the following tasks – covert object naming, overt objecting naming, sentence completion, and semantics association. Task based fMRI images were analysed using SPM12®. Resting state data was analysed using CONN22a toolbox. The regions of interest (ROIs) showing activation obtained from this healthy volunteer cohort were then applied to resting state and diffusion weighted imaging in patients with gliomas to understand functional and anatomical connectivity.

Results: 7 males and 8 females, right-handed English speaking was recruited for this study. All volunteers completed the structural and functional MRI within 50 minutes. This was important to ensure that patients were able to tolerate the entire duration of the scan without resulting in fatigability and errors during tasks. All tasks were completed in 15 volunteers allowing 2nd level analysis generating ROIs of interest. An example of individual level analysis for overt naming has been shown in Figure 1. Both 1st and 2nd level analysis allowed us to understand language representation for various tasks. These ROIs were then applied to resting state analysis in patients with gliomas to understand functional connectivity based on ROIs. This provided further insight into how gliomas can distort functional connectivity in presence of the tumour.

Conclusions: The newly devised protocol to perform the same intra-operative tasks in the pre-operative fMRI is feasible providing robust results which can be replicated across patients. Our data also provides information that can be applied to resting state analysis for those patients who may have severe deficits which prevents them from performing any tasks in the scanner.

Optional Image

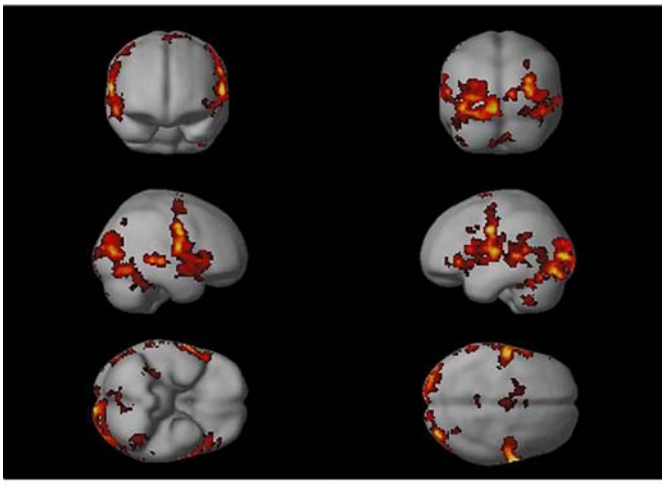


Figure 1 Single Subject Results for Overt Naming Task

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172

Brain and Spine 4 (2024) 103812

Unveiling Self-Related Deficits in Neurosurgical Patients: Insights from the Self-Other Voice Discrimination Task as a Neuropsychological Tool

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Neurosurgeons frequently confront the challenge of managing personality changes and self-related deficits in patients undergoing brain resection. The comprehensive understanding of these issues requires the inclusion of specialized and objective neuropsychological tools. Given the role of self-voice in shaping identity, a paradigm integrating self-voice perception could be promising for detecting self-related abnormalities. Self-Other voice discrimination task has experimentally proven effective in targeting the perceptual and neural mechanisms of self-voice perception. In this work we aim at defining the clinical potential of the Self-Other Voice Discrimination (SOVD) task as complement to the standard neuropsychological assessment to discriminate distinct self-voice deficits in neurosurgical patients.

Methods: We considered 17 patients eligible for neurosurgery (2 eplileptic lesions, 5 astrocytoma, 1 glioma, 6 glioblastoma, 1 oligodendroglioma , 1 meningioma and 1 metastasis). During SOVD task, patients were asked to distinguish whether a presented voice stimulus belonged to them or someone else. The accuracy in discriminating self and other voice was standardized according to statistical analyses commonly used in neuropsychological psychometrics. The links of SOVD performance with other neuropsychological scores and with lesion localization were further investigated.

Results: The SOVD task demonstrated clinical discriminatory capacity, revealing impairments in self-voice perception in three patients, not predictable by other neuropsychological deficits. Impairments in other-voice perception correlated with inhibitory neuropsychological anomaly, indicating a potential association with executive deficits in voice recognition. Preliminary results on the three patients with self-voice deficits suggested the involvement of orbitofrontal and parietal brain regions.

Conclusions; Although a large cohort of patients, with homogeneous lesion-location is needed to understand the brain areas more representative of self-related processes, this exploratory study underscores the clinical value of the SOVD task. It opens new avenues for improved diagnoses and tailored treatments for self-related impairments in neurosurgical patients.

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73

Brain and Spine 4 (2024) 103813

Changes in treatment of intracranial aneurysms during the last decade in a large European neurovascular center

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Treatment modality for ruptured and unruptured intracranial aneurysms has shifted during the last two decades from microsurgical treatment towards endovascular treatment. We present how this transition happened in a large European neurovascular center.

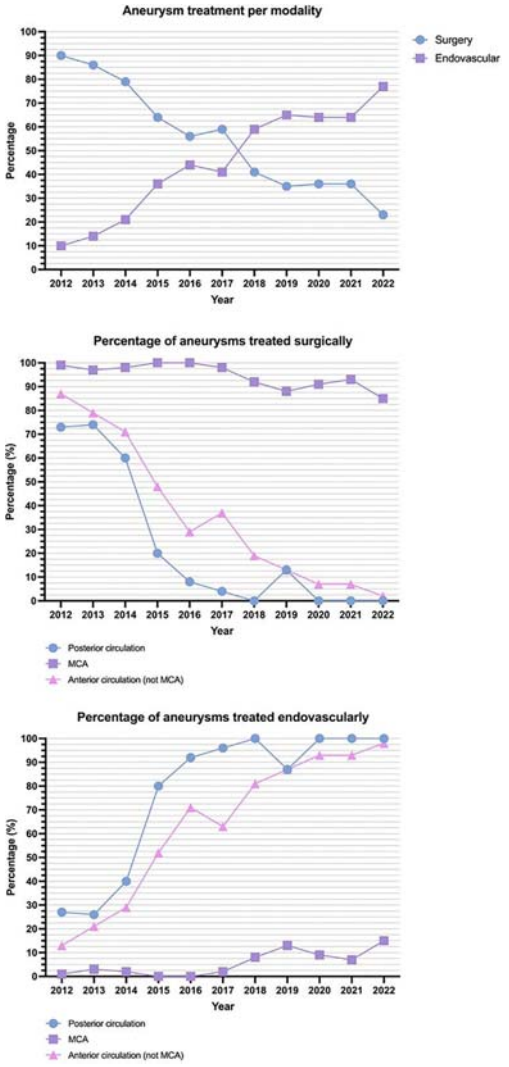
Methods: We conducted a retrospective observational study consecutive patients treated for an unruptured or ruptured intracranial aneurysm at Helsinki University Hospital during 2012-2022. We used Poisson regression analysis to report age adjusted treatment trends by aneurysm location and rupture status.

Results: Totally 2,491 patients with intracranial aneurysms were treated (44% ruptured, 56% unruptured); 1,421 (57%) surgically and 1,070 (43%) endovascularly. A general trend towards fewer treated aneurysms was noted. The proportion of patients treated surgically decreased from 90% in 2012 to 20% in 2022. The age adjusted decrease of surgical versus endovascular treatment was 6.9%/year for all aneurysms, 6.8% for ruptured aneurysms and 6.8% for unruptured aneurysms. The decrease of surgical treatment was most evident in unruptured vertebrobasilar aneurysms (10.8%/year), unruptured communicating artery aneurysms (10.1%/year), ruptured communicating artery

aneurysms (10.0%/year) and ruptured internal carotid aneurysms (9.0%/year). There was no change in treatment modality for middle cerebral artery aneurysms, of which 85% were still surgically treated in 2022. A trend towards an increasing size for treated ruptured aneurysms was found (p=0.033).

Conclusions: A significant shift of the treatment modality from surgical to endovascular treatment occurred for all aneurysm locations except for middle cerebral artery aneurysms. Whether this shift has affected long-term safety and patient outcomes should be assessed in the future.

Optional Image



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375

Brain and Spine 4 (2024) 103814

Digital Subtraction Angiography in Primary Non-Aneurysmal Subarachnoid Hemorrhage: Overdiagnosis or Useful Clarification of Causes?

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Subarachnoid hemorrhage (SAH), most often being caused of intracranial aneurysms harbors a risk of rebleeding, being highest during the first days after the initial SAH. Therefore, it is important to differentiate between aneurysmal and non-aneurysmal SAH. The gold standard to exclude intracranial bleeding sources is the digital subtraction angiography (DSA). However, the role of DSA in perimesencephalic bleeding (PM SAH) pattern is unclear and up to date, it is not recommended in these patients.

Methods: A retrospective analysis of patients suffering from non-aneurysmal SAH patients being admitted and treated from January 2010 to January 2021 was performed. These were distributed into non-perimesencephalic (NPM) SAH (n=29) and PM SAH (n=71). All patients underwent at least one CT or MR angiogram and one DSA.

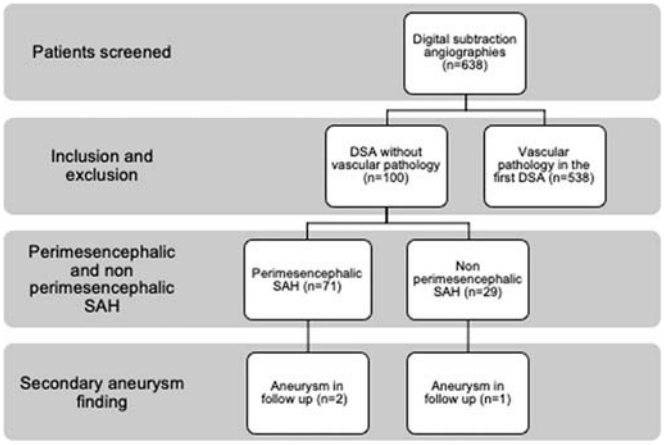
Results: In total, 100 patients with a mean age of 54.9 years (range: 27-84 years) met the inclusion criteria. Female to male ratio was 1.6:1 with 62% females being included. A total number of 96 DSA have been performed in 71 PM SAH patients. These revealed aneurysms of the cerebrovascular system in two patients (one middle cerebral artery bifurcation aneurysm and one basilar tip aneurysm), however only one of these aneurysms could be accounted for the initial bleeding (basilar tip aneurysm). This results in a rate of secondary aneurysm findings in 2/96 (2.1%) in DSA, whereof only 1/96 (1%) lead to diagnostic and therapy of a ruptured aneurysm.

In NPM SAH, 39 DSA in 21 patients revealed one basilar trunk aneurysm being the cause of SAH. This leads to the percentage of 2.6% secondary aneurysm findings in NPM SAH. In total, in 2% of the patients included, aneurysms were identified as a cause of SAH by repetitive DSA.

Conclusions: Even if the percentage of secondary aneurysm finding is low, the risk of rebleeding in case of an unsecured aneurysm could be live threatening and therefore we suggest repetitive DSA in every SAH case with special attention to the basilar artery.

Optional Image

Figure 1: Number of patients screened and included for evaluation



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234

Brain and Spine 4 (2024) 103815

Assistant Robotic Arm In Endoscopic Surgery

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: This study aimed to develop a robotic system with autonomous functionality for holding and manipulating the endoscope in endoscopic transnasal surgery. A cost-effective prototype was created with the goal of using robotic assistance and more efficient learning curve for endoscopic surgery (Figure 1).

Methods: The study utilized a "Stewart Platform" based endoscope holder and positioner robotic system, developed by our Mechatronics Engineering Department, in conjunction with open-source health technology softwares. Following initial configuration on an 3D skull model, the system was applied to a freshly frozen cadaver.

Results: The robotic system and its registration process proved feasible, allowing the robot to autonomously reach predetermined anatomical points during the

nasal step of the surgery. The experiment yielded positive outcomes in both the artificial skull model and the cadaver. various surgical stages applied through both the haptic system and the control computer. The robotic system effectively demonstrated the nasal stage of the surgery.

Conclusions: The integration of a robotic surgical arm in the endoscopic endonasal approach holds the potential to enhance the learning curve through shared experiences. The robot offers an assistance to surgeons during the learning phase of endoscopic endonasal approach, aiding in the identify of anatomical landmarks through preoperative planning. This system may presents advantages such as improved visualization, enhanced maneuverability, and reduced user fatigue compared to conventional methods. The findings showed the potential of robotic assistance in endoscopic surgical techniques.

Optional Image



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19

Brain and Spine 4 (2024) 103816

Multicenter external validation of prediction models for clinical outcomes after spinal fusion for lumbar degenerative disease

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: The effectiveness of lumbar spinal fusion in addressing back and leg pain (BP, LP) in degenerative disease remains hard to predict. Clinical prediction modeling (CPM) is utilized to enhance decision-making by providing quantitative estimates of outcomes, aiding surgeons in assessing the potential benefits and risks of interventions for each individual patient. External validation is crucial in CPM to assess generalizability beyond the initial dataset. This ensures the performance in diverse populations as well as reliability and real-world applicability of the results. Therefore, we externally validated the predictability of improvement in Oswestry Disability Index (ODI), BP and LP following lumbar fusion.

Methods: Partially prospective and retrospective data from multicenter registry was obtained. The SCOAP-CERTAIN tool is a CPM for ODI as well as numeric rating scales (NRS) for BP and LP 12 months after fusion for lumbar degenerative disease. We externally validate this tool by calculating various discrimination and calibration metrics.

Results: We included 1115 patients, average age 60.8 ± 12.5 years. For 12-month ODI, area-under-the-curve (AUC) was 0.70, the calibration intercept and slope were 1.01 and 0.84, respectively. For NRS BP, AUC was 0.72, with calibration intercept of 0.97 and slope of 0.87. For NRS LP, AUC was 0.70, with calibration intercept of 0.04 and slope of 0.72. Sensitivity ranged from 0.63 to 0.96, while specificity ranged from 0.15 to 0.68. Lack of fit was found for all three models based on Hosmer–Lemeshow testing.

Conclusions; Utilizing data from a multinational registry, we externally validate the SCOAP-CERTAIN prediction tool. While the model demonstrated good discrimination, the calibration of predicted probabilities was only fair, necessitating caution in applying it in clinical practice.

We suggest that future CPMs focus on predicting longer-term prognosis for this patient population, emphasizing the significance of robust calibration and thorough reporting.

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980

Brain and Spine 4 (2024) 103817

Resection of malignant radionecrosis results in local control and improvement of symptoms.

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Stereotactic radiotherapy combined with or without surgical resection is a common treatment modality for intracranial malignancies. Radionecrosis (RN) occurs in up to 25% of treated patients. A subset of RN is progressive and requires surgical resection.

The aim of this study is to evaluate the clinical outcome of surgical resection of RN.

Methods: A single-center retrospective study was performed including all patients who underwent surgery for intracerebral RN with or without viable tumor cells between 2018 and 2022.

Results: Fifty-six patients underwent surgery for suspected malignant RN. Median age was 58 (53-64) years and 29 (52%) were female. Primary diagnosis was brain metastasis in 39 patients (70%) and high-grade glioma in 17 (30%) before developing RN. 45% of patients were asymptomatic, 34% had focal deficits, 17% headaches, 2% seizures, 2% confusion or mood changes. Three patients (5%) received high-dose corticosteroids prior to surgery. Using RANO criteria 8.2% underwent biopsy, 36.7% partial resection, 20.4% subtotal resection, 8.2% near-total resection, and 26.5% complete resection. Adjuvant medical treatment was less frequent after RN resection when compared to patients undergoing biopsy (34% vs 55.6% p=0.2).

Among patients with symptomatic RN, deficits improved until discharge in 45.1% and worsened in 3%. At the 6-month follow-up, symptoms had improved in 45% and worsened in 20%. Physical performance increased in 45% and decreased in 30% of patients at the 6-month follow-up.

Mean duration of local control was 15.6 months (95% CI 11.5 - 13.8). Resection of RN improved local control in comparison to biopsy (6 months: OR 3.1 95%CI 2-4.8 | 12 months: OR 2.2 1.6-3). In multivariate analysis, extent of resection, residual tumor volume, adjuvant treatment, presence of viable tumor cells and primary tumor did not significantly affect progression-free survival.

Conclusions: Resection of progressive radionecroses is to achieve local control.

Resection leads to clinical and neurological improvement impacting quality of life and contributes to prolonged PFS.

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482

Brain and Spine 4 (2024) 103818

Treatment of lumbar spinal stenosis with unilateral bioportal endoscopic technique: clinical experience and early results

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: Minimally invasive techniques have evolved in the field of spinal surgery recently. Unilateral biportal endoscopic technique consists of a controlled saline inflow and outflow in order to create an independent working channel with wide magnified visual field for optimal decompression.

Methods: We analyzed our patients data in a longitudunal study. Inclusion criteria were clinical and radiomorphological diagnosis of lumbar spinal stenosis and biportal endoscopic surgery between 2019 and 2021 in our institution.

Results: We included 21 patients to our study sample. Our early postoperative results were excellent. 17 of 21 patients (81%) reported significant improvement of symptoms right after surgery, which could be dedicated to smaller incision and greater preservation of spinal musculature. Three patients (14%) showed mild postoperative pain, but also an improvement of preoperative symptoms. One patient (5%) reported postoperative discomfort. The mean follow-up time was 7 months.

We used PROMIS physical function, pain interfernce short forms and pain intesity numeric rating scale to investigate patient-reported outcome. Mean T-score improvement were 21.1 for physical function, 22.2 for pain interference. Patients reported a mean of 7 points of improvement for pain intensity.

Conclusions: Our early results suggest that unilateral biportal endoscopic technique is an effective therapeutic choice in the treatment of degenerative lumbar spinal stensosis. The method could be the alternative of traditional microscopic surgery. Limitation of our study includes small sample size.

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59

Brain and Spine 4 (2024) 103819

A Randomized Controlled Trial of Social Media Promotion in Neurosurgical Publishing

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: The importance of social media has seen a dramatic increase in recent times, but much about its influence in academia is still unknown. To date, no comparative studies analysing the effect of social media promotion on citation counts have been undertaken in neurosurgical publishing.

Methods: We randomized 177 articles published in Acta Neurochirurgica from May to September 2020. The 89 articles in the intervention group received a standardized social media promotion through one post on our official Twitter/X account, whereas the 88 articles in the control group did not receive any social media promotion. Citation counts, website visits and PDF downloads were tracked at one and two years post-promotion.

Results: We found no significant difference in number of citations at one year post-promotion (Intervention: 1.85 ± 3.94 vs. Control: 2.67 ± 6.65, $p = 0.322$) or at two years (5.35 ± 7.39 vs. 7.09 ± 12.1, $p = 0.249$). Similarly, no difference was detected in website visits at one (587.46 ± 568.04 vs. 590.65 ± 636.25, $p = 0.972$) or two years (865.79 ± 855.80 vs. 896.31 ± 981.97, $p = 0.826$) and PDF downloads at one (183.40 ± 152.02 vs. 187.78 ± 199.01, $p = 0.870$) or two years (255.99 ± 218.97 vs. 260.97 ± 258.44, $p = 0.890$).

Conclusions: In a randomized study, a structured promotion of general neurosurgical articles on Twitter/X did not significantly impact citation count, website visits, or PDF downloads compared to no social media promotion. Combined with published evidence to date, the impact of social media on citation counts in academic publishing ultimately remains unclear. Still, it appears that targeted promotion of high-impact articles may be more impactful – at least regarding article reach – than structured promotion of unselected articles.

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105

Brain and Spine 4 (2024) 103820

Harnessing AI in Neuroradiology: Advantages of Volumetric Assessment and Reproducibility

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Neuroradiology stands poised to experience substantial advancements through the integration of Artificial Intelligence (AI), particularly in volumetric assessment and reproducibility. Our study explores the potential application of AI in quantifying mass effect, employing a deep learning neural network (DLNN) to analyse cerebrospinal fluid (CSF) distribution.

Methods: A retrospective analysis of head CT scans involved manual segmentation of intracranial compartments and CSF. A DLNN model was developed to automate segmentation, utilizing advanced human-in-the-loop (HITL) deep learning techniques. Segmentation performance was evaluated using the Dice Similarity Coefficient (DSC). The CSF ratio was calculated by dividing the volume of CSF on the side with reduced CSF reserve by the volume on the opposite side.

Results: We analysed 274 patients with brain injuries who underwent emergency head CT scans. The average DSC for the training and validation datasets were 0.782 and 0.765, respectively. Lower DSC values were observed for CSF segmentation: 0.589, 0.615, and 0.572 for the right supratentorial, left supratentorial, and infratentorial CSF regions in the training dataset, with slightly lower values in the validation dataset: 0.567, 0.574, and 0.556. 22 patients (8%) exhibited midline shifts >5mm, and 24 (8.8%) had high/mixed density lesions >25ml. Notably, 55 patients (20.1%) displayed mass effect necessitating neurosurgical intervention, associated with lower supratentorial CSF volume and lower CSF ratio (both $p<0.001$). A CSF ratio <60% exhibited 74.5% sensitivity and 87.7% specificity (AUC 0.88, 95%CI 0.82-0.94) in identifying patients requiring neurosurgery for mass effect. Conversely, patients with CSF constituting 10-20% of the intracranial space, with 80-90% in the supratentorial compartments, and a CSF ratio >80% showed minimal risk.

Conclusions: Our study underscores the potential of AI in neuroradiology, particularly in enhancing the precision and consistency of volumetric assessment. The derived CSF distribution ratios may serve as valuable predictive indicators for identifying patients requiring neurosurgical intervention.

Optional Image

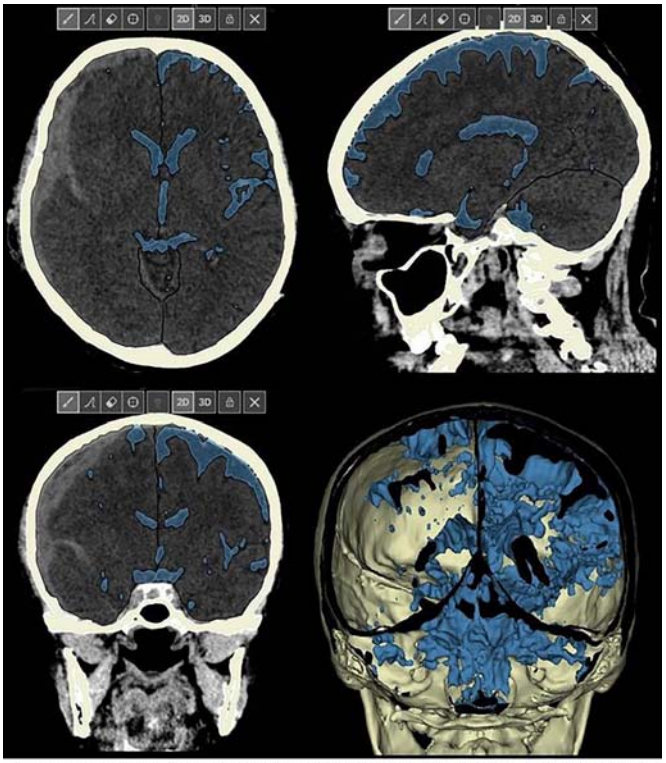


Figure: The illustration depicts the distribution of CSF among three intracranial compartments in the presence of an acute subdural hematoma and no significant midline shift, as segmented by the DLNN model. Abbreviations: CSF, cerebrospinal fluid, DLNN, deep learning neural network.

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362
Brain and Spine 4 (2024) 103821
Contribution of frontal right-hemispheric speech tracts and the superior frontal gyrus to the severity of aphasia and dysarthria in brain tumor patients

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: The frontal aslant tract (FAT) - connecting inferior (IFG) with superior frontal gyrus (SFG) - and the hyper-direct pathway (HP) - connecting IFG with subthalamic nucleus (HP) - link language and speech networks. These pathways have primarily been associated with speech disorders, whilst the cortical endpoints, particularly the IFG, were related to aphasia. This study assessed the relationship between language (aphasia) and speech disorders (dysarthria) with structural HP and FAT representations and the functional contribution of IFG and SFG to language production.
Methods: A language therapist assessed the severity of expressive aphasia and dysarthria in 55 patients with left-hemispheric tumors who underwent left-hemispheric language mapping with navigated transcranial magnetic stimulation. Post-hoc structural bi-hemispheric HP and FAT tractographies were created, and the respective tract ratio and the number of language-relevant cortical sites in left IFG and SFG were determined. Correlational analyses were performed.
Results: Worse aphasia was related to higher functional recruitment of left-hemispheric SFG ($p=0.04$) but not IFG. Additionally, more severe aphasia correlated with lower right-hemispheric HP and higher right-hemispheric FAT tract ratios (both $p\leq0.03$) and more severe dysarthria with lower right-hemispheric HP tract ratios ($p=0.01$).
Conclusions: Left-hemispheric SFG is more crucial for language production in the context of severe aphasia. Simultaneously, right-hemispheric structural FAT representations were more pronounced in patients with worse aphasia, while right-hemispheric HP representations were more pronounced in patients with milder dysarthria. Thus, the present results suggest structural and functional mechanisms that may account for language and speech performance variance across patients with left-hemispheric tumors.

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502
Brain and Spine 4 (2024) 103822
Analyzing the hemodynamic basis of post-stroke epilepsy: impact of BOLD cerebrovascular reactivity changes and the role of STA-MCA bypass

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Post-stroke epilepsy (PSE) is the predominant cause of epilepsy among adults. Previous imaging studies showed marked reduction in cerebral blood flow and compromised cerebral autoregulation in epileptic patients. Hemodynamic compromise in patients with ischemic stroke can be precisely evaluated using quantitative blood oxygenation-level dependent (BOLD) cerebrovascular reactivity (CVR). With this study, we aimed to establish the role of BOLD-CVR impairment and the characteristics of PSE in patients presenting after ischemic stroke. Furthermore, we investigated the impact of flow augmentation STA-MCA bypass on the development of PSE.
Methods: Data from ischemic stroke patients admitted to our institution who underwent BOLD-CVR imaging from January 2014 to December 2023 were prospectively collected. We analyzed treatment modalities, the location of ischemic lesions, the type and frequency of acute and remote symptomatic seizures. BOLD-CVR values were compared between patients who developed epileptic seizures and those who did not. Additionally, a subanalysis was conducted on patients after stroke who underwent STA-MCA bypass for flow augmentation.
Results: The study involved 140 patients who suffered an ischemic stroke and received BOLD-CVR imaging. Of these, 18 patients (12.9%) demonstrated symptomatic PSE. A -18% decrease in mean CVR was observed in the PSE compared to the non-PSE group when considering the whole brain. Additionally, the PSE group exhibited reduced mean CVR in the affected hemisphere and the affected MCA territory. Among the 18 patients with PSE, flow augmentation bypass surgery was performed in 8 cases.
Conclusions: Our findings reveal decreased BOLD-CVR values in patients who develop PSE, indicating that the BOLD-CVR technique might possess the capability to identify hemodynamic alterations underlying post-stroke epilepsy. Timely intervention to address hemodynamic impairment following ischemic stroke could thus be crucial in mitigating the risk of subsequent epileptic episodes. In the future, BOLD-CVR has the potential to function as an imaging marker for PSE

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796
Brain and Spine 4 (2024) 103823
The preoperative evaluation of the ischemia due to interruption in case of CEA by tASL and development of circle of Willis

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: In the ischemic complication of carotid endarterectomy (CEA), occasionally very strong cerebral hypoperfusion induces motor paralysis cases immediately after surgery. It is hard to judge ischemic risk during interruption of carotid artery by preoperative brain images by MRI and CTA that provides only anatomical information. Preoperative evaluation of collateral flow with non-invasive approach is crucial. The purpose of this study is to evaluate if ischemia of the hemisphere can be anticipated by tASL (territorial Arterial Spin Labeling).We investigate the correlation between the tASL based estimation and actual stump pressure during intraoperative actual blocking and the intraoperative MEP/SEP

data.
Methods: For the most recent cases of 100 CEA cases (average74.9, M/F:78/22), preoperative tASL, intraoperative stump pressure, MEP/SEP and postoperative neurological findings were evaluated.
Results: In the case of the perfusion area by tASL on the operation side was wide, the stump pressure at blockade was low, then MEP abnormality appeared at a blockade. The tASL might show collateral circulation. But the degree of development of circle of Willis involved the stump pressure. The dominant perfusion area and stump pressure were correlated according to the degree of development of Acom, ipsilateral Pcom, A1, and ipsilateral P1. The stump pressure decreased in the order of ipsilateral P1 aplasia, Acom aplasia and ipsilateral Pcom aplasia, and contralateral A1 aplasia.
Conclusions: Preoperative tASL in addition to examining the degree of development of collateral circulation before surgery was useful as it helped to predict ischemia during internal carotid artery blockade noninvasively.

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252
Brain and Spine 4 (2024) 103824
Evaluating the Safety and Efficacy of Semi-Synthetic Dural Substitutes in Cranial Surgery: A Combined Retrospective and Prospective Study

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM
Background: Dural closure is a pivotal yet often overlooked step in cranial surgery, with complications such as cerebrospinal fluid (CSF) leakage posing significant risks. This retrospective study focuses on assessing the efficacy and safety of semi-synthetic dural replacements, addressing a gap in literature and practice regarding dural closure techniques, especially in surgeries of the posterior cranial fossa.
Methods: The retrospective component of the study, conducted from December 2022 to March 2023, involved 30 patients who underwent neurosurgical procedures with semi-synthetic dural replacements at the University Hospital Augsburg. The study aimed to evaluate immediate and short-term postoperative outcomes, particularly monitoring for CSF leakage, infection, and inflammation within a 30-day post-surgery follow-up period.
Results: The analysis included 43% female patients with an average age of 63.2 years, undergoing procedures for both benign and malignant conditions. Notably, no adverse events, including CSF leakage, were observed intraoperatively or during the 30-day follow-up. Postoperative MRI scans conducted within 72 hours post-surgery revealed no signs of inflammation, and humoral inflammatory parameters remained within normal ranges throughout the study duration.
Conclusions: The retrospective analysis supports the safety and efficacy of semi-synthetic dural replacements in cranial surgery, with no recorded instances of CSF leakage or adverse inflammatory responses. These findings highlight the potential of semi-synthetic materials in improving dural closure outcomes, warranting further research in this area.

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99
Brain and Spine 4 (2024) 103825
OLIF (Oblique Lumbar Interbody Fusion) For Revision Surgery And Indirect Decompression

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: Clinical outcome of indirect decompression for a revision surgery, at the same level of a previous lumbar decompression, has not been reported. The purpose of this study was to investigate the efficacy of oblique lateral interbody fusion (OLIF) in revision surgery after decompression for degenerative lumbar spinal disease.
Methods: We included 72 patients who were preoperatively diagnosed with a recurrence of canal stenosis, foraminal stenosis, or intervertebral instability at the same level of a prior lumbar decompression. These patients underwent OLIF with supplemental pedicle screw fixation without additional posterior decompression. All patients completed a minimum 1-year follow-up. We compared the cross-sectional area (CSA) of the thecal sac on magnetic resonance imaging as well as clinical outcome scores (ODI and VAS score) preoperatively and at the final follow-up. Fusion status, intervertebral foramen width and disc height/angle were evaluated based on computed tomography scans.
Results: The CSA expanded from 136.4 ± 57.9 mm2 preoperatively to 194.1 ± 58.6 mm2 at the final follow-up (mean: 27.4 months; $P < 0.001$). Clinical symptoms significantly improved (59.0% improvement rate of ODI and VAS score) at the average of a 17.1-month follow-up. The fusion rate was 93.0%. The disc height was restored (preoperative: 5.7 mm; postoperative: 8.3 mm; $P < 0.001$), and foraminal stenosis significantly improved postoperatively. There were no major vascular/ureteral injuries.
Conclusions: OLIF at the same level of a prior lumbar decompression provided a successful indirect decompressive effect, including expansion of the thecal sac, restoration of disc height, and subsequent improvement of foraminal stenosis. Specifically, this procedure can prevent incidental durotomy and nerve root injury, which may occur in conventional revision surgeries for direct posterior fusion.

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787
Brain and Spine 4 (2024) 103826
Afferent and efferent fiber systems of the human amygdaloid body: Anatomical, pathophysiological and clinical significance

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM
Background: The amygdaloid body, also known as the amygdaloid nuclear complex or amygdala, is a collection of multiple interconnected diencephalic grey matter nuclei and is in turn a part of the larger limbic nuclear complex. Important commissural, and projection fibers are interconnected with the amygdaloid body.
Methods: In this study, we investigated the afferent and efferent fiber pathways of the amygdaloid body with white matter fiber dissection and diffusion tensor tractography technique. Functional and clinical syndromes associated with these fiber pathways were also reviewed in this study.
Results: Ansa peduncularis, ansa lenticularis, stria terminalis, and stria medullaris thalami are main amygdalofugal pathways. In this study we showcase these fiber pathways via white matter fiber dissection technique and diffusion tensor tractography. Functional roles and clinical significance of these pathways are also reviewed.
Conclusions: Comprehensive neuroanatomical knowledge of the amygdaloid body and its afferent and efferent pathways will avoid iatrogenic damage to these delicate structures.

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269
Brain and Spine 4 (2024) 103827
New Microsurgical Techniques for Refractory Vertebrobasilar Insufficiency Addressing V1 Segment of Vertebral Artery's External Compressions and Dolichoarteriopathies

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: This retrospective study aimed to investigate the clinical outcomes of new microsurgical approaches for the V1 segment of vertebral artery(VA), addressing the external compressions and dolicoarteriopathies such as kinks

related VA stenosis, which leads to non-atherosclerotic and non-intimal causes of vertebrobasilar insufficiency(VBI). Classical surgical techniques, such as vertebral-carotid transposition and subclavian endarterectomy, often require interruption of blood flow and are geared towards intravascular pathologies. This study explores innovative surgical methods that address extravascular pathologies without necessitating blood flow cessation.

Methods: This study retrospectively reviewed 101 surgeries on the V1 segment, categorizing them by stenosis etiology and location: 23 cases of external compression, 20 instances of kinking at the origin(12 cases of grade 3 and 8 cases of grade 2 kink), 31 cases of grade 2, and 27 cases of grade 3 kinks in the middle segment. Apart from decompression of the VA from external compressive factors, the new techniques included decompression from fibrotic bands around the kink regions named as arteriolysis, perivascular sympathectomy, using SCA traction and grafts for repositioning and straightening the VA.

Results: New techniques effectively treated 23 cases of external compression and 20 kinks at the VA origin, with a 100% resolution rate without using classical interventions. For the 59 cases with grade 2 or 3 kinks, all grade 2 and 74% of 3 kinks were successfully managed. In instances of significant elongation, 7 cases of grade 3 kinks required end-to-end anastomosis, as shown in Table 1. These new approaches show promising results in enhancing vascular patency and morphology while minimizing morbidity.

Conclusions: The innovative surgical techniques developed for V1 segment dolicoarteriopathies and external compressions demonstrate a considerable success rate, preserving blood flow and avoiding morbidity and mortality. Surgeons must be skilled in both classical and new approaches to ensure comprehensive treatment and management of potential complications.

Optional Image

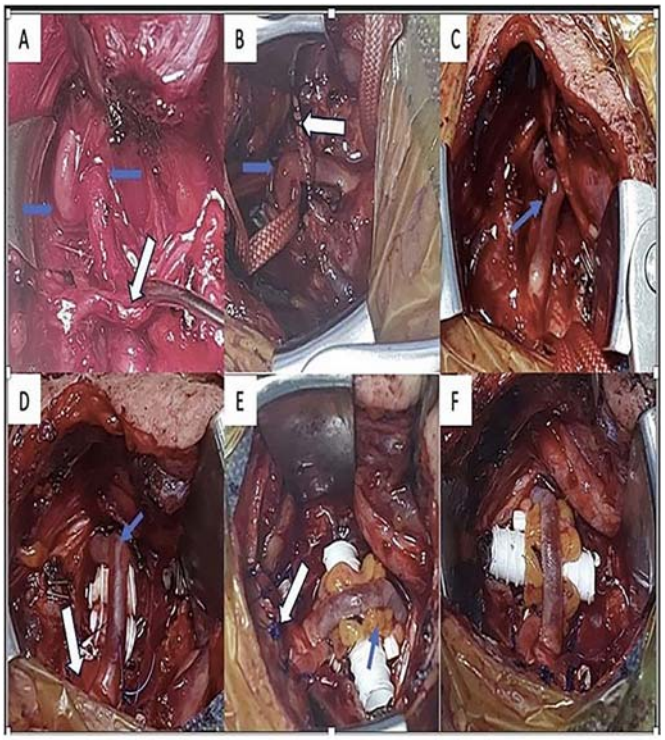


Figure 1: **A:** Blue arrows mark kinked regions of the vertebral artery, and a white arrow highlights an arterial structure from the subclavian artery, postulated as a non-functional kinking cause. **B:** illustrates the kinked region of the vertebral artery (blue arrow) and a clamped arterial structure (white arrow) scheduled for removal. **C:** displays the vertebral artery post-sympathectomy, with a blue arrow marking the former kinked area.**D:** the white arrow shows the transposed vertebral and subclavian arteries to the muscles, with a persistent kinked area (blue arrow) despite vascular grafts. **E:** presents the adjusted vertebral artery (blue arrow) and sutured vascular grafts to the muscles (white arrow). **F:** offers a top view of the surgically corrected vertebral artery, showcasing the operative amendments.

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454

Brain and Spine 4 (2024) 103828

The Dutch Intracerebral Haemorrhage Surgery Trial (DIST); Minimally Invasive Endoscopy-Guided Surgery in Patients with Spontaneous, Supratentorial Intracerebral Haemorrhage

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Intracerebral haemorrhage (ICH) accounts for 16-19% of all strokes in Western Europe and contributes profoundly to mortality and disability. Increasing evidence suggests that surgical treatment may be beneficial, in particular with minimally invasive procedures and when performed early. The aim of the Dutch ICH Surgery Trial (DIST) is to assess whether minimally invasive endoscopy-guided surgery within 8 hours of symptom onset in addition to standard medical management improves functional outcome after spontaneous supratentorial ICH when compared to standard medical management alone.

Methods: The DIST is a multicentre, prospective, randomised, open clinical trial with blinded outcome assessment. We will include 600 adults ($\geq$18 years) with a spontaneous supratentorial ICH with a haematoma volume $\geq$ 10 mL and NIHSS $\geq$ 2. Patients with an aneurysm, arteriovenous malformation or fistula, cerebral venous sinus thrombosis, cavernoma or tumour as the cause of their ICH will be excluded. Patients will be randomised (1:1) to minimally invasive endoscopy-guided surgery performed within 8 hours of symptom onset in addition to standard medical management or to standard medical management alone. The primary outcome is the modified Rankin Scale score at 180 days. The treatment effect estimate will be adjusted for known prognostic variables.

Results: The DIST has started in November 2022 and will be conducted in 11 neurosurgical centres in the Netherlands. Currently 65/600 participants have been randomized, with a mean age of 60 years (SD 12 years); 38% female (February 2024).

Conclusions: Results are expected in December 2026.

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193

Brain and Spine 4 (2024) 103829

AI-based analysis of Intracerebral Hemorrhage using radiomics and clinical features as means for rigor decision making in intracerebral hemorrhage.

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Intracerebral hemorrhage (ICH) is associated with a significant disability-adjusted life years lost. Treatment decision-making largely dependents on clinical judgement of health care professionals lacking rigor and reproducibility. We hypothesized that that AI-based radiomics could guide unbiased prediction of hematoma expansion (HE) and clinical outcomes.

Methods: Patients with spontaneous ICB between 2015 – 2020, were enrolled in this large monocentric retrospective analysis. Modified Rankin Score (mRS) and Glasgow Outcome Scale Extended (GOSE) were used to determine functional outcome. 107 Radiomics features were extracted from non-contrast enhanced Computer Tomography (CT) slice images at the time of admission using 3D-Slicer (Open-Source-Python) together with PyRadiomics. Logistic regression, support vector machine, and random forest classifiers were built using the non-correlated selected radiomic, clinical, and dose features on the training dataset and performance was assessed in the testing dataset. The area under the curve (AUC) was used to assess the prognostic value.

Results: 202 patients with intracerebral hemorrhage (ICH) were analyzed. Median age was 76 years (34 – 93 years), female:male ratio was 94:108. Mean hematoma volume on admission was 37.2±15ml. Early HE within 6h occurred in

52 patients (26%), HE within 48h in 10 patients (5%). 30-day mortality was 26%. At discharge, median GOSE was 3 (1-7) and median mRS was 4 (0-6). Overall, 61 patients (30.4%) reached a favorable outcome (GOSE 5-8) at time of discharge. AI-based analysis using clinical and radiomics features achieved good prediction performance for HE (AUC 0.746±0.159 [95%CI (0.481-0.878)]. Further, the combined model achieved good discrimination of poor outcomes at the time of discharge (AUC 0.975±0.003 [95%CI (0.923-0.999)].
Conclusions: AI-based assisted analysis of ICH based on clinical and radiomic features is capable of predicting impending HE and poor short-term outcome. Unbiased prediction of the clinical course and outcome might help to increase therapeutic efficacy, rigorous decision making and ultimately improve treatment of patients with ICH.

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1042
Brain and Spine 4 (2024) 103830
Pearls and pitfalls in double-barrel STA-MCA bypass surgery for cerebral ischemia

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: STA-MCA revascularization is used in selected patients with chronic cerebral ischemia who suffer from progressive ischemic symptoms despite optimal medical therapy with documented evidence of decreased cerebral perfusion on hemodynamic imaging. However, the indications for and results of double-barrel bypass revascularization are still unclear and require further studies.
Methods: This study included 99 patients (104 hemispheres) operated from 2009 to 2024 - 53 patients with chronic ICA occlusion, 33 with moyamoya disease, 6 with acute stroke and 7 with giant ICA aneurysms. The bypasses were performed between both frontal and temporal branches of the STA and cortical branches of M4 segment of MCA in all patients.
Results: Surgical revascularization was successful in the majority of patients (89%), with the immediate improvement of clinical symptoms in 15% of cases. The ischemic complications were observed in 11 cases (10%). There were 6 cases (6%) of hyperperfusion syndrome. Intraoperative local blood flow evaluation in cortical vessels was used to reveal hemodynamic interference between branches, which was associated with smaller branch thrombosis on follow up and overall decrease in efficacy of bypass.
Conclusions: In cases of hemispheric hypoperfusion, augmenting the flow to both the frontal and temporal lobes via a double-barrel STA-MCA bypass is a viable option. Double-barrel STA-MCA bypasses have high patency rates and patient outcomes comparable to single branch STA-MCA bypass. Local cerebral hemodynamic changes must be taken into consideration during double-barrel bypass planning.

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993
Brain and Spine 4 (2024) 103831
Intraoperative Hypercapnic Arterial Spin Labeling MRI In Surgical Revascularization

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: The effectiveness of surgical revascularization in patients with chronic cerebral ischemia directly depends on the degree of restoration of cerebral blood flow (CBF). The current methods do not take into account dynamic changes in cerebral perfusion after imposition of bypass. The aim of the study was to develop principles for dynamic evaluation of CBF using intraoperative ASL MRI with hypercapnia to assess cerebrovascular reactivity during surgical revascularization in order to determine indications for additional bypasses.
Methods: From April 2022 to January 2024 in Burdenko Neurosurgical Center 47 patients underwent surgical revascularization (STA-MCA extra-intracranial bypass) with intraoperative MRI. Among them were 24 patients with post-thrombotic occlusion of the internal carotid artery or middle cerebral artery and 23 patients with Moyamoya disease. All patients underwent comprehensive preoperative MRI study. During the surgical intervention after applying the first bypass intraoperative MRI (DWI, ASL, 3D TOF sequences) was performed in order to determine the localization of zones of residual hypoperfusion, to identify signs of local hyperperfusion and to determine indications or contraindications for additional brain revascularization with the second donor branch. Mild hypercapnia was used in 15 cases – all of them showed severe perfusion deficit that reflects exhausted CVR. In 13 cases, the single bypass was not enough to restore CBF, and a second bypass was performed.
Results: In all cases, complete restoration of CBF was achieved in the target areas of the brain (zones of perfusion deficit outside the ischemic foci). Postoperative MRI, performed on the 1st day after surgery, confirmed the reliability of the intraoperative MRI data. In the early postoperative period immediate improvement of clinical symptoms was seen in 70% of cases. There were no postoperative complications in any patient.
Conclusions: Intraoperative ASL MRI is effective and useful tool to determine the degree of CBF restoration directly during the surgery that allows adjusting the tactics of surgical treatment and determining indications or contraindications for the additional revascularization and excluding early ischemic complications.

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175
Brain and Spine 4 (2024) 103832
Reduced mortality in patients over 65 years old that undergo surgery for degenerative spine disease

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: The increased life expectancy and prevalence of spondylarthrosis have led to a growing frequency of spine surgery in older people. Two studies have demonstrated lower mortality risk than expected for the general population after spine surgery in the elderly. However, neither of them includes confidence intervals to know whether these results are statistically significant. This study aims to assess whether there is an excess mortality concerning that expected in the general population associated with surgical interventions performed in patients over 65 years old for a lumbar spine degenerative disease.
Methods: Retrospective design to include all patients aged 65 or more who underwent surgery at a single center between 2009 and 2019, for lumbar spine degenerative disease. Only the first one was considered in those subjects who required more than one intervention.
Results: A total of 576 procedures were registered and 411 were finally analyzed after 165 exclusions. The mean age was 72.6 years old and median follow-up was 9.2 years. 1-year mortality was 1.2%. Standardized mortality rate was 0,67 (CI 95% 0,54-0,84). That benefit was observed only in women after sex stratification. When stratified by age at the time of surgery, patients operated on between 65-84 years of age were associated with a lower mortality rate than that expected for the general population, whereas for patients aged 85 years or older, the observed mortality was not different from that expected in the general population (for the same age, sex, and calendar period). Cox multivariate analysis observed an association between higher mortality and the variables age, male, and Charlson comorbidity index score.
Conclusions: Reduced mortality was confirmed in patients between 65 and 84 years old who underwent spine surgery due to degenerative disease when compared with the general population. Increased mortality was associated with age, male sex, and increasing Charlson index score.

Optional Image

Table 1: Standardized mortality ratio in patients undergoing surgery due to spinal degenerative disease.

FACTOR	FAILURES OBSERVED	FAILURES EXPECTED	SMR	95% CI
Overall	77	114.14	0.675	0.539 – 0.844
Sex				
male	51	63.92	0.798	0.606 – 1.050
female	26	50.22	0.518	0.353 – 0.760
Age				
65-74	30	44.41	0.676	0.472 – 0.966
75-84	41	64.81	0.633	0.466 – 0.859
≥85	6	4.92	1.22	0.548 – 2.716

SMR: standardized mortality ratio: failures / expected failures (per 1000)

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549
Brain and Spine 4 (2024) 103833
Reintervention In A Cohort Of Patients Operated For Degenerative Cervical Myelopathy

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: Degenerative cervical myelopathy (DCM) represents the most common cause of spinal cord impairment in adults worldwide. Surgery is the only definitive treatment. According to the most recent guidelines, surgery is recommended for moderate and severe myelopathy, while observation may be an option for mild myelopathy cases. This study aims at investigating reoperation rate and indications to reoperation in a cohort of patients operated for DCM.
Methods: A prospectively collected database of 175 consecutive patients (age ≥ 18 years) who underwent surgery for DCM at Geneva University Hospital between 2008 and 2023 was analyzed regarding reintervention rate and postoperative complications.
Results: The reoperation rate was 19.4% (34/175) with a mean time to reintervention of 552.5 ± 919.6 days. The median age at first surgery was 59.5 years [range: 34-79 years]. The main reason for reintervention was persistence of stenosis in 29.4% (N=10) followed by a postoperative hematoma (N=6, 17.6%). The most performed second procedure was anterior cervical discectomy and fusion (ACDF) (N=6, 17.6%), as well as hematoma evacuation (N=6, 17.6%) and posterior fixation with decompression (N=5, 14.7%). Eight patients (23.5%) underwent a third procedure in a mean time of 361.3 ± 759.9 days. The most performed procedure at third surgery was posterior fixation and decompression (N=3, 37.5%) and the main reason was persistence of stenosis. Overall, these 34 patients underwent 76 surgical procedures with a postoperative hematoma rate of 9.2% (N=7), postoperative infection rate of 3.9% (N=3), and hardware revision rate of 6.6% (N=5).
Conclusions: Reoperations in DCM might be related to postoperative complications in the short term, while in the long term they seem to be due to further treatment of the disease by anterior or posterior approach. This may be related to the persistence of cervical stenosis, as well as the development of a new stenosis elsewhere.

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893
Brain and Spine 4 (2024) 103834
Endovascular Experience For Residents In The United Kingdom Remains Negligible

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: In the post-ISAT and thrombectomy era, endovascular management of cerebrovascular diseases is a key therapeutic option. In the United Kingdom, aneurysm treatment is primarily an endovascular domain. Thrombectomy services, however, are patchy and access is generally limited. There have been calls for neurosurgical residents to undergo endovascular training however this has yet to be realised in most of the country. We aimed to report the endovascular experience of residents logged over a 12-year period.
Methods: Retrospective review of residents' operative electronic logbook data was performed (2011-2022, inclusive). Demographics, year of training, and supervision level of recorded operations were collected. Operations were categorised as either performed or assisted by the resident depending on the supervision level recorded. Angiograms, aneurysm embolisations, and thrombectomies were included. Statistical analyses were performed on Excel.
Results: The number of angiograms recorded since 2011 increased from 3 to 111 in 2022 but the median number of residents recording half of these procedures was 1 throughout the study period. The number of angiograms performed per resident varied widely per year, ranging from 1 in 2012 to 35 in 2019. Similarly, aneurysm embolisations increased from 6 to 26 between 2011-2022 but only 1 resident accounted for half the recorded cases each year. Thrombectomies were recorded from 2016 onwards and increased from 8 to 15 in 2022. On average, 3 thrombectomies were performed by a resident per year.
Conclusions: Endovascular experience in the UK remains limited to a very small subset of residents. Expanding access to endovascular training for neurosurgical residents could improve equity of access for patients with cerebrovascular diseases.

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325
Brain and Spine 4 (2024) 103835
An Experiment in Virtual Reality Simulator-Assisted Lumbar Pedicle Screw Insertion: Moving Beyond Conventional Training Methods - A Randomized Controlled Trial

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: This research compares the effectiveness of Virtual Reality Simulators (VRS) and a saw bone model for training in lumbar pedicle screw insertion (LPSI) in neurosurgery.
Methods: Methods: A single-center, cross-sectional, randomized controlled laboratory study was carried out with residents and fellows from a tertiary care referral hospital. Participants were divided into two groups: Group A and Group B. Group A completed three LPSI tasks: one on a saw bone model, another on VRS, and the last one on a different saw bone model. Group B performed two LPSI tasks, one on a saw bone model and the other on a different saw bone model. The precision of LPSI was evaluated using NCCT scans for the saw bone models, while the in-built application of the simulator was used to assess screw placement accuracy in VRS.
Results: Results: The study included 38 participants, with 19 in each group. Group A participants showed a decrease in mean entry point error of 0.11 mm ($p = 0.024$), an increase in mean purchase length of 4.66 cm ($p = 0.007$), and no cortical breaches ($p = 0.031$) while inserting the second screw in the saw bone model. Group A participants in PGY 1-3 showed comparable improvements when inserting the second saw bone model screws.
Conclusions: Conclusion: Virtual Reality Simulators are essential tools for teaching complex neurosurgical skills, like LPSI, to trainees. This technological investment has the potential to speed up the learning process while maintaining patient safety.

https://doi.org/10.1016/j.bas.2024.103835

717
Brain and Spine 4 (2024) 103836
Cervical Selective Nerve Root Blocks - A Retrospective Descriptive Study on 467 patients.

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: Conservative treatment of degenerative cervical radiculopathy is often the first line strategy. Selective nerve root blocks (SNRBs) have been brought up as an optional treatment. Its role in the treatment of cervical radiculopathy is still controversial. The aim of this study is to evaluate the SNRBs performed in the Neurosurgical department at Lund University hospital.
Methods: Methods: This is a retrospective cohort study collecting data from 467 patients who received a fluoroscopy guided SNRB during 2020-2022. We analyzed the effect on radicular and axial pain. The patients were evaluating their pain with the VAS (visual analogue scale) score before and 30 min after the procedure. A positive block was considered when the patient presented a 50% pain reduction of the VAS score. Thereby evaluating the effect of the local anesthesia in the injection. In addition, data was collected regarding age, gender, cervical level and complications related to the procedure.
Results: Results: Results from the 2021 cohort show that a total of 414 SNRBs were performed on 243 patients. SNRBs were most frequently performed on nerve root C6. The most common complication reported was vasovagal reaction. No serious complications were reported. Pain-score showed a decreasing trend in ratings of severe and moderate pain after the SNRB. Further data from 2020 and 2022 will now be analyzed.
Conclusions: Conclusions: SNRBs seem to have a pain-relieving effect in patients with cervical radiculopathy. This is a safe treatment with minimal risk of complications. The method may be used both as a therapeutic (with steroids) and diagnostic tool. Further prospective studies are necessary to contribute to more evidence in this area.

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82

Brain and Spine 4 (2024) 103837

3D Exoscopic versus Microscopic Superficial Temporal Artery to Middle Cerebral Artery Bypass Surgery for Moyamoya Disease – a Comparative Series

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Superficial temporal artery to middle cerebral artery (STA-MCA) direct bypass surgery is the most common surgical procedure to treat moyamoya disease (MMD). The performance of the 3D exoscope in bypass surgery has not been investigated in direct comparison to the gold standard operative microscope.
Methods: All direct STA-MCA bypass procedures performed at a single university hospital for MMD between 2015 and 2023 were considered for inclusion. Data were retrospectively collected from patient files and surgical video material. From 2020 onwards, bypass procedures were exclusively performed using an digital 3D exoscope as visualization device. Results were compared with a microsurgical bypass control group (2015 – 2019). The primary endpoint was defined as total duration of surgery, performing vascular anastomosis (ischemia time), bypass patency, number of stiches to perform the anastomosis, added stiches after leakage testing of the anastomosis and the Glasgow outcome scale (GOS) at last follow-up as secondary outcome parameter.
Results: A total of 16 consecutive moyamoya patients underwent 21 STA-MCA bypass procedures. Thereof, six patients were operated using a microscope and ten patients using an exoscope (ORBEYE® n = 1; AEOS® n = 9).
Total duration of surgery was comparable between devices (microscope: 313 min. ± 116 vs. exoscope: 279 min. ± 42; p = 0.647). Ischemia time also proved similar between groups (microscope: 43 min. ± 19 vs. exoscope: 41 min. ± 7; p = 0.701). No differences were noted in bypass patency rates. The number of stiches per anastomosis was similar between visualization devices (microscope: 17 ± 4 vs. exoscope: 17 ± 2; p = 0.887). In contrast, more additional stiches were needed in microscopic anastomoses after leakage testing the bypass (p = 0.035).
Conclusions: End-to-side bypass surgery for moyamoya disease using a foot switch-operated 3D exoscope proved to be safe and leads to comparable clinical and radiological results as microscopic bypass surgery.

Optional Image



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794

Brain and Spine 4 (2024) 103838

Surgical Outcomes And Survival Patients With Leptomeningeal Metastasis: A Comparison Of Ventriculo-Peritoneal Shunt Vs. Rickham-Reservoir Placement For Palliative CSF Drainage.

Obada Alhalabi [1], Lukas Klein [1], Carmen Büsken [1], Tareq Juratli [2], Amine Mellal [3], Giulia Cossu [3], Mahmoud Messerer [3], David Wasilewski [4], Clara Buszello [2], Ilker Y. Eyüpoglu [2], Martin Misch [4], Peter Vajcozcy [4], Andreas W. Unterberg [1], Ahmed El Damaty [1], Sandro M. Krieg [1], Alexander Younsi [1]. [1] *Department of Neurosurgery, Heidelberg University Hospital, Heidelberg, Germany;* [2] *Department of Neurosurgery, University Hospital Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany;* [3] *Department of Neurosurgery, Department of Neuroscience, Lausanne University Hospital, Lausanne, Switzerland;* [4] *Department of Neurosurgery, Charité - Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, Berlin Institute of Health, Berlin, Germany*

Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Leptomeningeal metastasis (LM) usually represents a condition of terminal disease. With improved survival rates under systemic therapy, the role of cerebrospinal fluid (CSF) drainage via ventriculo-peritoneal shunt (VPS) or Rickham-Reservoir placement for symptom control and adjuvant therapy is gaining more relevance. This study aimed to describe surgical and survival outcomes of hydrocephalic LM patients after surgical drainage in a contemporary cohort.
Methods: A multi-center retrospective analysis of adult patients with VPS or Rickham-Reservoirplacement for CSF drainage in the presence of hydrocephalic LM between 2017 and 2022 was performed. Patients with occlusive hydrocephalus were excluded.
Results: A total of 119 patients with a median age of 53 (42-77) years (40 males, 79 females) were included. Of those, 64 underwent VPS (54%) and 55 (46%) Rickham-Reservoir placement. The most common underlying oncological condition was breast cancer (n=67, 56%), followed by non-small cell lung cancer (n=25, 21%). The median time between primary tumor and LM diagnosis was 23 months (0 to 180 months). At primary tumor diagnosis, 44 patients (37%) were found to be in end-stage disease. Moreover, in 79 patients (66%), cranial metastases were detected, for which only 20 patients (17%) had received surgical resection. Most patients (n=95, 80%) presented with symptoms of intracranial hypertension. In VPS patients, 79% (n=51/64) showed symptom relief after surgery. Compared to VPS placement, Rickham-Reservoirs were associated with lower complication (11% vs. 30%, p=0.01) and revision (9% vs. 23%, p=0.049) rates. Median overall survival from surgery was 90 (23 -148) days, and longer in VPS patients (107 days) compared to Rickham patients (83 days), without reaching statistical significance (p=0.512).
Conclusions: While surgical CSF drainage in patients with LM disease relieves symptoms of intracranial hypertension in many cases, median survival remains expectedly low. Compared to Rickham-Reservoirs, VPS bear higher rates of complications and revisions without a clear survival benefit in this analysis.

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978
Brain and Spine 4 (2024) 103839
Hematological diseases associated cerebral arteries occlusion (diagnostics and revascularisation).

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: Within population with ICA occlusion there is patient cohort with different ethiology of vascular damage - neither atherosclerosis, no vasculitits, no moya-moya disease. Aim: description of case series of patients with hematological diseases associated with ICA occlusion, which underwent cerebral revascularization (extracranial-intracranial bypass - ECIC) with beneficial clinical results.
Methods: Retrospective assessment of patients following revascularization surgery was performed. Total number of operated patients since 2008 to present was 254 with 263 ECIC applied. Among them 6 patients had hematological abnormalities associated with ICA and/or middle cerebral artery (MCA) occlusion, they underwent 7 interventions. Sex distribution: 4 female, 2 male; age median 38.4 + 13.2 YO.
Results: ICA and/or MCA occlusion was confirmed based on results of extracranial duplex scanning, cerebral angiography, CT-angiography. All patients were symptomatic with ipsilateral ischemic episodes in their history (stroke and/or transitory ischemic attacks). Hematological diagnosis was verified by hematologist before intervention. Most (5/6) patients had concomitant condition: thrombophilia, prothrombotic genetic polymorphisms carriage. Hageman disease – 1 patient. Concomitant diagnosis "moya-moya syndrove" was established in 3 patients due to typical unilateral abnormalities of major and lenticulostriate arteries. Hovewer diagnosis of "moya-moya disease" was confuted by angiography. Early post-surgery period was unremarkable. All patients obtained antiaggregant therapy and were monitored by hematologist. CT-perfusion values improved after surgery in all cases. Treatment efficiency was assessed according to catamnesis data and diagnostic procedures. Clinical condition improvement was observed with local symptoms regression in all patients. One patient had stroke (bilateral occlusion) between two surgeries. She was the only patient with MCA, not ICA, affected.
Conclusions: Surgical revascularization in patients with stenotica and occlusive damage to cerebral vessels in patients with associated hematological conditions is considered to be effective. Collaboration with hematologists is considered to be of great value in treatment of this patients cohort.

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778
Brain and Spine 4 (2024) 103840
Two-Stage Lumbar Dynamic Stabilization Surgery: A Comprehensive Analysis of Screw Loosening Rates and Functional Outcomes Compared to Single-Stage Approach in Osteopenic and Osteoporotic Patients

Mehdi Hekimoglu [2], Mehmet Yigit Akgun [1,3], Ahmet Tulgar Basak [2], Melihcan Savasci [4], Mehmet Ali Tepebasili [1], Caner Gunerbuyuk [3], Raha Maleki [5], Tunc Oktenoglu [1], Ozkan Ates [1,3], Ali Fahir Ozer [1,3]. [1] *Koç University Hospital, Istanbul, Turkey;* [2] *American Hospital, Istanbul, Turkey;* [3] *Koc University Hospital Spine Center, Istanbul, Turkey;* [4] *Bakirkoy Mazhar Osman Hospital, Istanbul, Turkey;* [5] *Tabriz University, Tabriz, Iran*

Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: This study aims to assess and compare the rate of screw loosening and functional outcomes in patients undergoing lumbar dynamic stabilization surgery using the Dynesis system, with a specific focus on evaluating the outcomes between a single-stage surgery approach and a two-stage surgery approach.
Methods: A total of 120 patients with a T score <1.5 who had undergone spinal instrumentation surgery (specifically lumbar dynamic stabilization surgery using the Dynesis system) were included in the study. The patients were categorized into two groups based on the surgical technique used: the single-stage group, comprised of individuals who underwent dynamic stabilization surgery in a single operation, and the two-stage group, consisting of patients who underwent a two-stage surgery with rod placement six months after the initial screw placement operation. Functional outcomes were assessed using the Visual Analog Scale and Oswestry scores.
Results: Among the 539 screws utilized in the study, a higher rate of screw loosening was observed in the single-stage surgery group (14.37%) compared to the two-stage surgery group (2.65%). Notably, instances of screw loosening were most observed in proximity to the initial and terminal points of the instrumentation, particularly in the S1 screws and in the transitional zone of T12-L1. Additionally, iliac screws showed an increased susceptibility to loosening. The pedicular section had the highest incidence of screw loosening with a total of 21 events (41% of all events), followed by the corpus section with a total of 19 events (37%).
Conclusions: Use of two-stage surgical technique for lumbar dynamic stabilization significantly decreases the occurrence of screw loosening. Significantly, this approach yields superior long-term functional outcomes compared to the single-stage technique.
Optional Image

Surgical Stage	Number of Screws Loosened	Total Screws	Screw Loosening Rate	p
Single-Stage	45	313	14.4%	*0,001***
Two-Stage	6	226	2.7 %	*p<0,01*
Total	51	539	9.5%	

Chi-square test ***p<0,01*

Figure 1. Summary of screw loosening in the study

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765
Brain and Spine 4 (2024) 103841
Venous Thromboembolism Prophylaxis in Neurosurgery – The Consultant Neurosurgeons' Opinion – Preliminary Results

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM
Background: Despite representing one of the most common surgical complications, the evidence surrounding the perioperative management of venous thromboembolism (VTE) in neurosurgical patients remains ambiguous. Establishing clear neurosurgical guidelines focused on pharmacological VTE prophylaxis may enhance patient outcomes and improve the understanding of the perioperative pathway.
Methods: A two-stage, international survey addressing the use of pharmacological VTE prophylaxis in neurosurgical patients was designed and distributed via email newsletters and social media channels to consultants and post-CCT fellows. Validation involved internal review by consultant neurosurgeons and haematologists through focus groups. The survey included a total of 29 questions, some of which were sub-specialty specific.
Results: A total of 189 responses were obtained, of which 132 were complete and eligible for analysis. According to subspecialty of interest, neuro-oncology was mostly represented (61%). The average number of consultancy years reported by participants was 10.77. The modal duration for aspirin and clopidogrel omission before elective operations was seven days or more. The use of TEDS was reported by 68% of respondents, with 63% rate of use pre-operatively and 18% rate of use intra-operatively, while flowtrons use has been reported by 57%, with a 45% rate of use intra-operatively. Following neurosurgery, the average time to initiate chemical VTE prophylaxis across all specialties was 30 hours (modal time was 24h). Preoperative access to haematological specialists was reported in 98% and 87% reported a departmental VTE prophylaxis plan in place. The most commonly reported guidelines followed were NICE guidelines (52%). Factors prompting early VTE prophylaxis initiation included thrombophilia (45%), elevated BMI (41%) and cardiac disease history (26%). Clinical assessment for VTE signs was

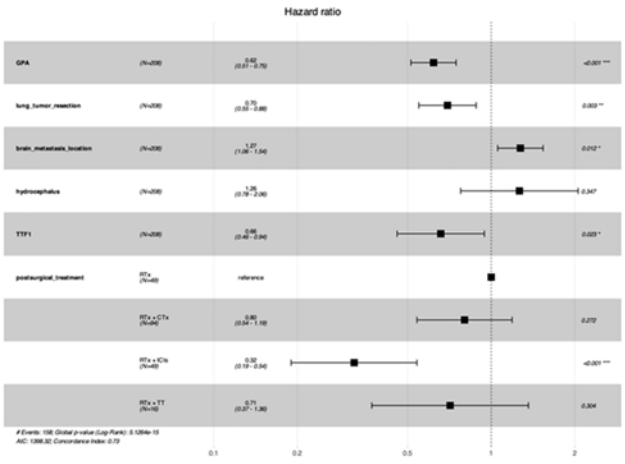
predominantly performed as an inpatient, rather than an outpatient, with ultrasound scan (inpatient - 43%) and CTPA (outpatient - 38%) being preferred.
Conclusions: Consultant reported practice has been analysed and a set of perioperative recommendations targeting neurosurgical patients have been made in relation to chemical VTE prophylaxis provision. These are to be further clarified in an upcoming Delphi study inviting consultant neurosurgeons' opinions.

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1192
Brain and Spine 4 (2024) 103842
Prognostic Value of Thyroid Transcription Factor 1 Expression in Newly Diagnosed, Treatment-Naïve Non-Small-Cell Lung Cancer Adenocarcinoma Brain Metastasis

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM
Background: Thyroid Transcription Factor-1 (TTF-1) expression in non-small-cell lung cancer (NSCLC) adenocarcinoma (ADC) (NSCLC/ADC) has been extensively studied for its prognostic value in patients with early-stage as well as metastatic disease. However, its impact on brain metastasis remains less explored. This study investigates the role of TTF-1 expression specifically in patients with newly diagnosed NSCLC adenocarcinoma brain metastases.
Methods: In this bicentric retrospective observational study 208 patients with newly diagnosed, treatment-naïve NSCLC/ADC brain metastasis were included. All patients were treated with microsurgical brain metastasis resection. Electronic patient records served to extract data on demographics, clinical history, treatment modalities, and TTF-1 expression in brain metastasis tissue. Outcome parameters were overall survival, extracranial progression free survival. Statistical analysis included Kaplan-Meier estimates and Cox proportional hazards regression.
Results: Patients with negative TTF1 status had a survival of 7.55 months (95% CI: 4.83 – 12.90), whereas patients with positive TTF1 showed a survival of 17.43 months (95% CI: 12.70 -22.80) (p=0.0037). Extracranial and intracranial progression-free survival did not differ between patients with negative TTF1 status vs. positive TTF1 status. In a multifactorial model, positive TTF1 status was independently associated with survival with a HR = 0.66 (95% CI: 0.46 -0.94) (p=0.023) beside other independent prognostic factors such as GPA score, resection status of the primary tumor, localization of brain metastasis and postsurgical ICI treatment. Furthermore, TTF1 status was associated with tumor volume, edema volume and Ki67 index, whereas no relationship between anatomical site of brain metastases and TTF1 status could be observed.
Conclusions: This study suggest that TTF-1 positivity is an independent prognostic marker for improved survival in newly diagnosed, treatment-naïve NSNSCLC patients presenting with brain metastasis. This emphasizes the utility for considering TTF-1 expression in prognostic assessments, which potentially can guide therapeutic strategies.
Optional Image



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689
Brain and Spine 4 (2024) 103843
Lumbar Disc Rehydration After Lumbar Discectomy Operation; a Determining Factor to Assess the Recovery

Halıs Cıftcı [1], Naime Dilara Ozkan [1], Burak Bahadir [1], Omer Faruk Turkoglu [1].
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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: Lumbar disc herniations are one of the most common spinal pathologies.
Disc herniation is generally associated with disc degeneration. One of the most identifiable markers of disc degeneration is dehydration of the intervertebral disc which can be determined in MRI scans.
Methods: In this study we analyzed 103 patients who were operated with simple lumbar disc herniation in Ankara Bilkent State Hospital between 2019-2023. We studied the patients' preoperative MRI findings with 3 months to 1 year postoperative control MRI's retrospectively. We used the Modified Pfirrmann scale to measure the lumbar disc degeneration amount.
Results: The recurrent discopathy symptoms were less common in the patients with 1 to 4 preoperative Pfirrmann grades. Therefore we concluded that less preoperative degeneration is associated with better long term results postoperatively both clinically and radiologically.
However the patients with higher preoperative Pfirrmann grades were more likely to have recurrent clinical and radiological symptoms even though the operation was successfull. They also tend to have high Pfirrmann grades postoperatively and the grade rarely decreases. Recurrent discopathy operations were needed in $^{1}/_{3}$ of them.
Conclusions: In this study, we concluded that the preoperative disc degeneration amount is a very important indicator for long term success postoperatively. However the higher degeneration preoperatively is associated with poor postoperative results. The patients with decreased Pfirrmann grades postoperatively were less likely to experience discopathy symptoms.

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682
Brain and Spine 4 (2024) 103844
Pure endoscopic intracerebral hematoma evacuation: using hydrodynamic principles for safe and effective surgery

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: Pure endoscopic intracerebral hematoma evacuation (PEICHE) is a minimally invasive procedure to evacuate clot from deep inside brain. Despite of

its effectiveness in our practice, we find very few centers taking up this procedure due to fear of complications. We address this issue with our protocol explaining the hydrodynamic principles involved in effective delivery of the procedure.
Methods: We conducted a study including patients undergoing PEICHE procedure and compared with the group undergoing standardized microscopic hematoma evacuation (MHE). Using core operative tenets of Minimize Brain Manipulation, Minimize Cavity Distortion, Obtain and Maintain Hemostasis and Intra-op evaluation of completeness of evacuation and hydrodynamic principle of Pascal's law, Bernoulli principle and laminar flow, a standardized PEICHE method was used to remove clot. Variables like patient epidemiological characteristics, volume of hematoma pre and post procedure, morbidity and mortality were studied.
Results: 35 patients underwent PEICHE during the study period. This was compared with 71 patients undergoing MHE. There was no significant variation between the two groups in terms of age, GCS and hematoma volume. Using PEICHE, we could evacuate almost 90% of clot volume with no procedure related morbidity. There were 8.6% 30-day mortality in endoscopic group as compared to 9.9% in craniotomy. None except 1 case, had to undergo decompressive craniectomy, due to cerebral edema. The clot volume evacuated was comparable to MHE. In PEICHE group, hospital stay was shorter than other two groups but not statistically significant.
Conclusions: Our study supports use of pure endoscopic intracerebral hematoma evacuation (PEICHE) as an effective and safe procedure if adopted using hydrodynamic principles and the results are comparable to microscopic hematoma evacuation (MHE) with an advantage of less tissue trauma.

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1346
Brain and Spine 4 (2024) 103845
Stereotactic radiosurgery versus whole-brain radiotherapy in melanoma brain metastasis: A systematic review and meta-analysis

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM
Background: Melanoma is an aggressive malignancy with a propensity towards the brain, with brain metastases (BM) clinically diagnosed in 40–50% of metastatic cases and the main cause of mortality and morbidity among patients with metastatic melanoma. The aim of this study was to discover any significant difference in overall survival and disease recurrence between SRS and WBRT.
Methods: A systematic review and meta-analysis was conducted in accordance with PRISMA guidelines. Three databases were searched, and articles published from 2000 to October 2023 included (last search date 2nd November 2023). Meta-Analysis was performed using R studio.
Results: Of the 128 articles identified, a total of 19 studies were included in the analysis (2617 patients- 1117 WBRT & 1500 SRS). The median overall survival for patients that underwent WBRT was 4.4 months compared to 7.8 months for patients that underwent SRS. A Wilcox rank sum test was conducted and a significant difference in overall survival was found between the two groups ($p<0.05$) with a Wilcox value of, W= 27.5. Random-effect meta-analysis of recurrence failed to reach a statistically significant result, though showing a trend of increased risk for recurrence in patients treated with SRS (RR= 0.63, CI: 0.37-1.06, p=0.61). Number of patients with neurocognitive decline was also recorded; however only 6/19 studies reported it: 39/127 (31%) in WBRT and 21/52 (40%) in SRS patients.
Conclusions: This is the first systematic review and meta-analysis discussing the efficacy and safety of WBRT versus SRS in metastatic brain melanoma. Although SRS may increase the risk of recurrence, it appears to offer significant increase in overall survival compared to WBRT. Furthermore, when considering the safety profile of WBRT, it may prove as a superior treatment modality even when accounting for cofounders. Further randomised controlled trials will need to be conducted to formalise a treatment pathway for these patients with poor prognosis.

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555
Brain and Spine 4 (2024) 103846
Reoperations For Adjacent Segment Disease In A Cohort Of Patients Operated For Degenerative Cervical Myelopathy

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: The incidence of radiographic adjacent segment disease (ASD) following cervical spine surgery ranges from 2-4%/year. Surgery represents the definitive treatment for degenerative cervical myelopathy (DCM). According to the latest guidelines, surgery is recommended for severe and moderate DCM. The frequency of symptomatic ASD and the reoperation rates in patients with DCM are not well documented. This study aims at analyzing reoperation rate for ASD in a cohort of patients operated for DCM.
Methods: A prospectively collected database of 175 consecutive patients who underwent surgery for DCM at Geneva University Hospital between 2008 and 2023 was analyzed regarding reintervention rate for ASD.
Results: The overall reoperation rate was 19.4% (34/175) with 5 patients (2.9%, 5/175) reoperated for a proximal or distal ASD. The median age at first surgery was 41.0 years [range: 34-55 years]. The mean time to develop a symptomatic ASD which required surgery was 5 years (SD: 3.5 years, range: 1-9.5 years). All patients but 1 (N=4, 80%) had an anterior cervical discectomy and fusion (ACDF) as first intervention, the other patient had two-level corpectomy. Among patients who had ACDF in the first place, 3 (60%) had one-level ACDF and only 1 (20%) had a two-level procedure. No patient had postoperative hematoma or infection. Every patient but 1 (N=4, 80%) had a one-level ACDF as second surgery. Only 1 (20%) presented with a proximal and distal ASD associated to pseudoarthrosis. Therefore, he underwent implant revision and two-level ACDF. Only 1 patient (20%) underwent a third surgery for a second ASD. After 5.7 years he developed a second proximal ASD and underwent one-level ACDF.
Conclusions: In our cohort 2.9% of patients were reoperated for ASD. This long-term complication may be more related to anterior procedures, and it was treated with an extension of the anterior approach.

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255
Brain and Spine 4 (2024) 103847
Optoacoustic Recording in Neurosurgery: A Novel Approach for Real-Time Tumor Differentiation Using Operation Suction Device Sounds

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM
Background: Cranial oncological surgery has encountered significant challenges in the real-time differentiation between tumor and healthy brain tissue. Traditional methods, such as fluorescence-based techniques, have their limitations, necessitating the exploration of innovative approaches to enhance surgical precision.
Methods: This study investigated the feasibility of using optoacoustic recording with an operative suction device during tumor resections. The research included 10 patients (6 with glioblastoma, 4 with metastases), employing a method to capture intraoperative sounds. These sounds were processed by an AI system for pattern recognition. Importantly, a 10-point system was established to gauge the viscosity of brain tissue, ranging from 0 (healthy) to 10 (tumor), with 5/6 serving as the borderline zone.
Results: The AI was able to successfully identify reproducible sound patterns that correlated with different tissue types, demonstrating a high level of precision in distinguishing between tumor tissue and healthy brain tissue. Specifically, when the operations were randomly presented to the software, it accurately determined the tissue's score within a range of +/- 1 point on the established 10-point scale. This technique proved effective even in complex scenarios, such as awake

craniotomies, showcasing its robustness and versatility. Moreover, the setup required minimal preparation time, indicating its practicality for integration into standard surgical workflows.
Conclusions: This study confirms the viability of optoacoustic recording in neurosurgery as an innovative method for the real-time differentiation of tumor tissue. The approach presents a promising advancement in surgical precision, potentially transforming the landscape of cranial oncological surgery.

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1348
Brain and Spine 4 (2024) 103848
Enhancing XLIF Safety: Intraoperative Identification and Stimulation of the Iliohypogastric Nerve

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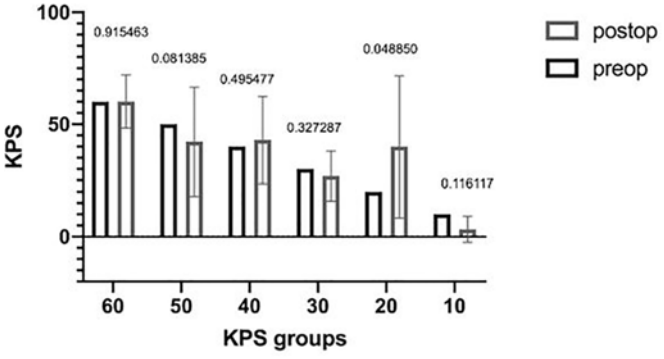
Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: The Extreme Lateral Interbody Fusion (XLIF) is a widely employed technique for degenerative spine conditions, offering a safer alternative to anterior and posterior approaches by reducing vascular, visceral, and muscle manipulation risks from L2 to L5 vertebral levels. However, XLIF poses a significant risk of damaging the lumbar plexus, particularly the iliohypogastric nerve, during the psoas muscle dissection. This nerve is involved in sensory innervation of the gluteal region and motor functions of the lateral abdominal muscles. Its damage may lead to abdominal muscle weakness and sensory loss in its innervation area. To limit the risk of neurological sequelae, electrophysiological monitoring is routinely employed during the XLIF approach. To date, little to no mention of intraoperative identification and stimulation of the iliohypogastric nerve has been made.
Methods: We introduce a new surgical method focused on identifying and stimulating the iliohypogastric nerve during lateral spine surgeries, detailed in a step-by-step video and anatomical images. The technique employs directional EMG neuromonitoring linked to muscle dilators for safe psoas passage and utilizes a monopolar probe for direct nerve stimulation, enhancing procedural safety.
Results: Following skin incision, the superficial muscle fascia is cut parallelly, and dissection through the external oblique muscle exposes the internal oblique muscle underneath. A monopolar probe is employed to locate the iliohypogastric nerve by stimulating muscle fibers, adjusting the stimulation from 0.5 mA to 12 mA to pinpoint the nerve path. The muscle fascia is cut above and below the nerve, allowing for its transposition along the vertebral body lateral wall, thereby enlarging the surgical workspace.
Conclusions: The intraoperative identification and direct stimulation of the iliohypogastric nerve during the transpsoas XLIF approach is a safe and reliable technique. Intraoperative neurophysiological monitoring allows to safeguard this nerve and the lumbar plexus, decreasing the risk of post-operative neurological complications.

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12
Brain and Spine 4 (2024) 103849
Enhancing outcomes: Neurosurgical resection in brain metastasis patients with poor Karnofsky performance score - A comprehensive survival analysis

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM
Background: A reduced Karnofsky performance score (KPS) often leads to the discontinuation of surgical and adjuvant therapy, owing to a lack of evidence of survival and quality of life benefits. This study aimed to examine the clinical and treatment outcomes of patients with KPS < 70 after neurosurgical resection and identify prognostic factors associated with better survival.
Methods: Patients with a preoperative KPS < 70 who underwent surgical resection for newly diagnosed brain metastases (BM) between 2007 and 2020 were retrospectively analyzed. The KPS, age, sex, tumor localization, cumulative tumor volume, number of lesions, extent of resection, prognostic assessment scores, adjuvant radiotherapy and systemic therapy, and presence of disease progression were analyzed. Univariate and multivariate logistic regression analyses were performed to determine the factors associated with better survival. Survival > 3 months was considered favorable and ≤ 3 months as poor.
Results: A total of 140 patients were identified, with a median overall survival of 5.6 months (range 0-58). There was a significant improvement in KPS after surgery in patients with a preoperative KPS of 20% ($p = 0.048$). In the other groups, no significant changes in KPS were observed. Adjuvant radiotherapy was associated with better survival (44 [84.6%] vs. 32 [36.4%]; hazard ratio [HR], 0.0363; confidence interval [CI], 0.197–0.670, $p = 0.00199$). Adjuvant chemotherapy and immunotherapy resulted in prolonged survival (24 [46.2%] vs. 12 [13.6%]; HR, 0.474; CI, 0.263–0.854, $p = 0.013$]. Systemic disease progression was associated with poor survival (36 [50%] vs. 71 [80.7%]; HR, 5.975; CI, 2.610–13.677, $p < 0.001$].
Conclusions: Neurosurgical resection is an appropriate treatment modality for patients with low KPS. Surgery may improve functional status and facilitate further tumor-specific treatment. Combined treatment with adjuvant radiotherapy and systemic therapy was associated with improved survival in this cohort of patients. Systemic tumor progression has been identified as an independent factor for a poor prognosis.
Optional Image



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1015
Brain and Spine 4 (2024) 103850
Stand Alone Porous Titanium Cages in Anterior Cervical Discectomy: A Retrospective Multicenter study

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM
Background: ACDF stands as a widely employed surgical intervention for various cervical conditions. Commonly used interbody devices include allograft, titanium, and PEEK. In recent years, promising results are being obtained from trabecular titanium cages. Few data can be found in the literature regarding implants on the cervical segment. The purpose of this study is to evaluate the rates of subsidence, fusion, cage mobilization, maintenance of sagittal alignment in porous titanium cervical implants.
Methods: A retrospective, multicentre study was conducted collecting data from consecutive patients treated with single- or double-level ACDF. The clinical

outcomes and fusion rates were documented at 1, 6, and 12 months. VAS and SF-12 were used as outcome parameters. Radiographs and dynamic x-rays of the segment were performed to assess rates of subsidence, fusion, cage mobilization, and segmental lordosis.

Results: A total of 70 patients (89 levels) were evaluated. Effective improvement of VAS and SF-12 was achieved in all patients, with 79% of patients reporting complete postoperative symptom relief. Effective fusion rate at 3, 6, and 12 months was 81%, 90%, and 94%, respectively. Subsidence rate was 2.4%, with no cases of cage displacement despite the absence of self-locking screws or anterior plates.

Conclusions: Porous titanium cervical implants for anterior cervical fusion achieved significant clinical improvement after surgery, showing promising results in terms of subsidence and fusion rates, with negligible risk of displacement despite the absence of plates or self-locking screws for cage fixation.

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972

Brain and Spine 4 (2024) 103851

Role of Virtual iMRI in Glioblastoma Surgery: Advantages, Limitations and Correlation with iCT and Brainshift.

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: To evaluate safety and reliability of the Elastic Image Fusion (EIF) algorithm (Virtual iMRI Cranial 4.5, Brainlab, AG) for identification of residual tumour in glioblastoma and for reconstruction after EIF of a "virtual" cortico-spinal tract (CST). Moreover, the impact of brainshift on software reliability is assessed.

Methods: The ambispective study included 80 patients with a diagnosis of glioblastoma. Pre-operative MRI was elastically fused (Virtual iMRI) with intraoperative CT (BodyTom; Samsung-Neurologica). Diagnostic sensibility and sensitivity of each tool was calculated and compared. CST shift and DICE coefficient (a similarity metric commonly used in image segmentation for scientific purposes) after EIF were calculated to assess spatial similarity between the pre-operative and the "virtual" CST. The correlation between brain shift, residual tumour and CST shift was statistically analysed. Analysis of accuracy was performed through Target Registration Error measurement after RIF and EIF.

Results: i-CT showed a sensitivity of 50%, specificity of 100%, while Virtual iMRI demonstrated a sensitivity of 100%, specificity of 41%.

Spearman correlation analysis showed a moderate correlation between pre-operative volume and Virtual iMRI tumor residual. Moreover, variations were observable across various tumor locations (p=0.023), particularly displaying higher median values for those tumour involving insula or infiltrating more than one lobe.

Median CST shift accounted for -2 ± 8.2 mm after EIF with a mean DICE coefficient of 0,7 ± 0,15. CST shift and DICE coefficient had an inverse moderate correlation.

Finally, a statistically significant reduction towards lower TRE values after EIF was observed for lateral shift, cranio-caudal shift, Evan's index and midline shift.

Conclusions: Virtual iMRI has proven to be a feasible option to detect residual tumour. It may provide neurosurgeons with a intraoperative updated tractography, globally enhancing neuronavigation accuracy.

Optional Image

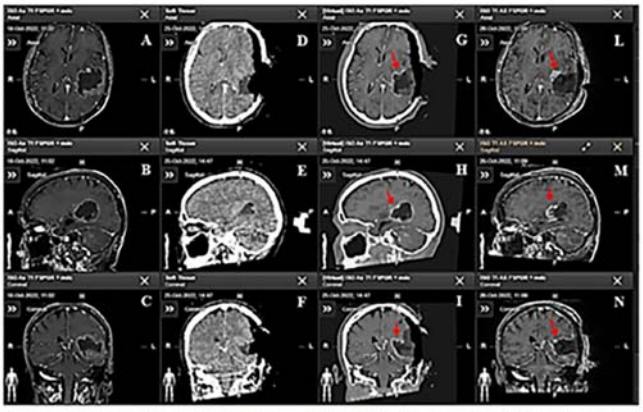


Figure 1. Method adopted for assessing the accuracy of Virtual iMRI. A-C, pre-operative MRI in axial, sagittal and coronal view. D-F, contrasted i-CT scan axial, sagittal and coronal view. G-I, Virtual iMRI image with axial, sagittal and coronal view. L-N, post- operative MRI in axial, sagittal and coronal view. Red arrows indicate corresponding residual tumour on both Virtual and post- operative MRI.

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229

Brain and Spine 4 (2024) 103852

Tumoral Interferon Beta Induces an Immune-Stimulatory Phenotype in Tumor-Associated Macrophages in Melanoma Brain Metastases

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Type I interferons (IFN) such as IFNβ are pro-inflammatory cytokines involved in antiviral immune responses. Increasing evidence indicates that the success of several anticancer therapies, including radiotherapy, relies on the immune-stimulatory effects of type I IFNs on innate and adaptive immune cells in the tumor microenvironment (TME). Tumor-associated macrophages (TAMs) are one of the most abundant innate immune cells in the TME of melanoma brain metastases (MBMs) and can exert potent immune-suppressive functions compromising effective antitumor immune responses. Here, we investigate the potential of tumoral type I IFNs to re-educate TAMs towards an antitumor M1-like phenotype to enhance the efficacy of immunogenic anticancer therapies in MBMs.Type I interferons (IFN) such as IFNβ are pro-inflammatory cytokines involved in antiviral immune responses. Increasing evidence indicates that the success of several anticancer therapies, including radiotherapy, relies on the immune-stimulatory effects of type I IFNs on innate and adaptive immune cells in the tumor microenvironment (TME). Tumor-associated macrophages (TAMs) are one of the most abundant innate immune cells in the TME of melanoma brain metastases (MBMs) and can exert potent immune-suppressive functions compromising effective antitumor immune responses. Here, we investigate the potential of tumoral type I IFNs to re-educate TAMs towards an antitumor M1-like phenotype to enhance the efficacy of immunogenic anticancer therapies in MBMs.

Methods: In order to minimize confounding effects of immunogenic cell death associated with type I IFN-dependent anticancer therapies, we generated an

inducible IFNβ-overexpressing MBM mouse model. Tumor growth was measured by magnetic resonance imaging (MRI) and changes in the TME were analyzed by flow cytometry. We confirmed our in vivo findings by mixed-leukocyte reaction assay and RNA sequencing of IFNβ-treated bone marrow-derived macrophages (BMDMs) and validated our myeloid type I IFN-response signature gene set in a recently published RNA sequencing dataset of treatment-naïve and previously irradiated MBM patient samples.

Results: In this murine MBM model, tumoral IFNβ markedly impaired tumor growth and TAMs from IFNβ-expressing tumors exhibited a decreased expression of CD206, a widely used marker for immune-regulatory M2-like macrophages. Functional and transcriptomic analyses of IFNβ-treated BMDMs revealed an immune-stimulatory M1-like phenotype. Following radiotherapy, the myeloid type I IFN-response signature was upregulated in over 40 percent of MBM patient samples which was associated with a higher M1/M2-like TAM ratio and increased overall survival.

Conclusions: Our findings demonstrate the immune-stimulatory capacity of tumoral IFNβ in the context of type I IFN-inducing anticancer therapies in MBM by re-polarizing TAMs towards a pro-inflammatory M1-like phenotype.

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15

Brain and Spine 4 (2024) 103853

Navigating post-operative outcomes: a comprehensive reframing of an original Graded Prognostic Assessment in patients with brain metastases

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Graded Prognostic Assessment (GPA) has been proposed for various brain metastases (BM) tailored to primary histology and molecular profiles. The residual tumor burden (RTB) is a strong predictor of overall survival. We validated the GPA score and introduced "volumetric GPA" in the largest cohort of operated patients and further explored the role of RTB as an additional prognostic factor.

Methods: A total of 630 patients with BM between 2007 and 2020 were included. The four GPA components were analyzed. The validity of the original score was assessed using Cox regression and a modified index incorporating RTB was developed by comparing the accuracy, sensitivity, specificity, F1-score, and AUC parameters.

Results: GPA categories showed an association with survival: age ($p < 0.001$, hazard ratio (HR) 2.9, 95% confidence interval (CI) 2.5–3.3), Karnofsky performance status (KPS) ($p < 0.001$, HR 1.3, 95% CI 1.2–1.5), number of BM ($p = 0.019$, HR 1.4, 95% CI 1.1–1.8), and presence of extracranial manifestation ($p < 0.001$, HR 3, 95% CI 1.6–2.5). The median survival for GPA 0–1 was 4 months, GPA 1.5–2 12 months, GPA 2.5–3 21 months, and GPA 3.5–4 38 months ($p < 0.001$). RTB was identified as an independent prognostic factor. A cut-off of 2 cm3 was used for further analysis, which showed a median survival of 6 months (95% CI 4–8) vs 13 months (95% CI 11–14, $p < 0.001$) for patients with RTB >2 cm3 and <2 cm3 respectively. RTB was added as an additional component for a modified volumetric GPA score. Survival rates of the modified GPA score were: GPA 0–1 4 months, GPA 1.5–2 7 months, GPA 2.5–3 18 months, and GPA 3.5–4 34 months. Both scores showed good stratification, with the new score showed a trend towards better discrimination in patients with more favorable prognoses.

Conclusions: The prognostic value of the original GPA was confirmed in our cohort of patients who underwent surgery for BM. The RTB was identified as a parameter of high prognostic significance and was incorporated into an updated "volumetric GPA." This score provides a novel tool for prognosis and clinical decision-making in patients undergoing surgery. This method may be useful for stratification and patient selection in future clinical trials.

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128

Brain and Spine 4 (2024) 103854

Virtual Reality for Patient Informed Consent in Skull Base Tumors and Intracranial Vascular Pathologies – A Pilot Study

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Innovations and accessibility for virtual (VR) and augmented reality technologies have contributed to their relevance in daily life and medical research activities over the last few years. So far, the main clinical applications include surgical planning and medical education. With the increasing demand for shared decision-making and patient-centered care, optimal informed consent (IC) gains relevance. VR could improve preoperative informed consent and patient satisfaction, particularly in surgical specialties. The aim of our prospective pilot trial was to investigate the feasibility of VR-IC in Neurosurgery.

Methods: Patients scheduled for skull base meningioma or brain aneurysm surgery between May and December 2023, were screened and included prospectively. Primary exclusion criteria included visual or cognitive impairment. Participants received the standard informed consent followed by a customized VR-enhanced informed consent before surgery, including their patient specific VR model of their pathology. After initial VR demonstration by the treating surgeon, patients were enabled to utilize the VR station by themselves. Subjective impression was assessed with a questionnaire including 18 questions using a 5-point Likert scale.

Results: We included ten patients, of whom six underwent aneurysm clipping and four resections of skull base meningioma. All questions regarding the superiority of VR for patients' understanding of the pathology, indication, and surgical risks, as well as confidence in the surgeon, were answered positively with an overall mean of 4.07 points (range 2-5). The Participants perceived VR-based IC as highly helpful for visualizing their pathology (Mean 4.23) and understanding the planned procedure (Mean 3.90).

Conclusions: Virtual reality-enhanced patient informed consent is a feasible procedure that benefits subjective patient' comprehension, without mentionable side effects. It contributes to a better understanding of complex surgical procedures, improving the perioperative process for patients in Neurosurgery. The pilot study showed good feasibility for a randomized controlled trial, currently planned at our institution.

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1004

Brain and Spine 4 (2024) 103855

Effectiveness criteria and risk factors of surgical revascularization in Moya-Moya angiopathy: experience of 200 cases

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Brain revascularization is recognized as the most appropriate treatment for patients with moyamoya disease worldwide. However, despite the large number of previous studies, the optimal techniques of revascularization are still unclear. Aim of the study was the evaluation of the results of brain revascularization in patients with moyamoya angiopathy with analysis of the clinical picture and perfusion and angiographic features of neoangiogenesis.

Methods: For the period from 2013 to 2024 in the Burdenko Center of Neurosurgery 200 revascularizations were performed in 120 patients with moyamoya disease including direct, indirect and combined surgeries. The average age of the patients was 13.9 ± 10.11 years. All patients were examined according to a single diagnostic protocol, including a comprehensive assessment of the state of brain tissue, cerebral vascular system and cerebral blood flow. The results of surgical treatment were assessed in the early postoperative and long-term periods. The average follow-up period was 14.66 ± 13.17 months. In the postoperative period, the dynamics of neurological status and cerebral blood flow were assessed, and

the features of neoangiogenesis from various components of revascularization were studied.

Results: In the early postoperative period, in 77.2% of cases, a good treatment result was observed with no negative dynamics of the neurological status. Ischemic stroke in the operated hemisphere developed in 5.1% of cases. In the long-term postoperative period, an improvement in focal and cerebral neurological symptoms was observed in 76.6%. Improvement of cerebral blood flow was noted in 92.4% of cases, direct bypasses functioned in 94.3%, and signs of neovascularization in the area of indirect synangiosis were observed in 80.0%. At the same time, a complementary influence of direct and indirect components of revascularization was revealed in ensuring good general angiographic and perfusion results of surgical treatment.

Conclusions: Combined revascularization is the preferred surgical method in patients with Moyamoya disease, however, when planning surgical tactics, a differential approach should be used, taking into account the effectiveness factors of various components of revascularization.

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195

Brain and Spine 4 (2024) 103856

Imaging challenges: Immunotherapy's influence on the diagnostic accuracy of amino acid PET in suspected progressive brain metastases

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Immunotherapy (IT) has gained increased significance as systemic therapy option in the management of metastatic cancer, including cases involving brain metastases (BMs). The differential diagnosis of progressive/relapsed BMs and treatment-related changes (TRC) is often based on imaging with amino acid (AA)-PET, in addition to standard MRI, as this has been established to provide higher diagnostic accuracy. However, diagnostic value of AA-PET in the context of IT has not been studied so far. In this pilot study we quantified diagnostic accuracy of AA-PET in patients with suspected progressive BMs under IT.

Methods: This retrospective study included patients with suspected progressive BMs on MRI after radiotherapy (RT) between 04/2007–01/2023. AA-PET was performed ≤4 weeks prior to surgery/biopsy of BMs. AA-PET results were compared with histopathological findings, distinctive features were highlighted.

Results: Out of 29 patients, 7 were treated with IT (IT + group). Remaining patients (IT-group) were treated with chemotherapy, targeted therapy, or obtained no systemic therapy before PET. Groups did not differ regarding age, gender, number of BMs or time between PET and last RT. In the IT + group, 6 patients had malignant melanoma and 1 urothelial carcinoma as primary tumor. IT + patients obtained ipilimumab, nivolumab, or pembrolizumab. In the IT + and IT-group, 7 and 21 PET scans were read as suspicious for BMs. The rate of false-positive findings was 5/7(71.4%) and 3/21(14.3%), respectively ($p=0.008$). Histopathological analyses revealed an inflammatory reaction with lymphocytic infiltrates in the examined tissue in the IT + group.

Conclusions: There is a significantly higher rate of false-positive AA-PET findings in patients with BMs who have been treated with IT. This observation may be explained by an immunologically mediated inflammatory reaction. Further immunological analyses of lymphocytic infiltrates could provide more information. In conclusion, until more data are available, caution should be exercised when diagnosing tumor recurrence using AA-PET in patients who have previously received IT.

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141

Brain and Spine 4 (2024) 103857

Effect of laminectomy and posterior fixation on the biomechanics of the lumbar spine: an ex-vivo study

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: The decompressive procedures performed due to lumbar spinal stenosis, as laminectomy, require the removal of posterior spinal elements to increase the space in the vertebral canal. Removal of these structure is suspected to aggravate or create spinal instability. Therefore, laminectomy is sometimes completed by a posterior fixation. Both solutions alter the load distribution: this could result in a variation in the mobility of the spine and in a critical increase of the strains on the discs. This study aimed to assess if these decompressive procedures have a detrimental effect on the biomechanics of the lumbar spine, in terms of changes in the range of motion and the strain distribution in the discs.

Methods: Twelve L2-S1 cadaver spine segments were prepared removing the soft tissues around the intervertebral discs and the vertebral body, preserving all the ligaments. A white speckle pattern was sprayed on each specimen to measure surface strains with Digital Image Correlation (DIC). The specimens were tested in flexion, extension, left and right lateral bending (2.5Nm). Each specimen was sequentially tested:

i In the intact condition (intact);
ii After L4-L5 laminectomy (laminectomy);
iii After L4-S1 posterior fixation (fixation).

Laminectomy was performed by a neurosurgeon; posterior fixation was performed by an orthopedic spine surgeon. Surface strains were measured by a 3D-DIC system with two sensors (GOM Aramis 12M). Image correlation and analysis were performed after a optimization of the HW and SW parameters [2]. The range of motion (ROM) and the largest maximum (ε1) and minimum (ε 2) principal strain were computed for each spine condition and loading configuration.

Results: Data were analyzed at the stage where the maximum moment of 2.5 Nm was reached. All data were normalized with respect to the intact condition. ROM significantly increased after laminectomy in flexion and left lateral bending (flexion: $p=0.01$, left bending: $p=0.04$, Anova). Fixation significantly reduced the ROM with respect to laminectomy in all the loading conditions ($p<0.05$) and with respect to the intact condition only in extension ($p=0.01$, Friedman test) and right lateral bending ($p<0.01$, Anova). No significant differences were observed for ε1 and ε2 in the L4-L5 disc after laminectomy in all the loading conditions (except in one case) ($p>0.05$). Conversely, as expected, posterior fixation significantly decreased both ε1 and ε2 in all loading conditions ($p<0.05$). The analyses on the strains on the discs cranial and caudal to the fixation are still ongoing.

Conclusions: Laminectomy did not create a concentration of critical strain in the L4-L5 disc in all the loading configurations, despite that it increased the range of motion of the lumbar spine in flexion and right lateral bending. Posterior fixation decreased the range of motion of the lumbar spine after laminectomy, so in case of prior instability it seems indeed a good compromise to stabilize the spine especially in flexion.

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203

Brain and Spine 4 (2024) 103858

Predictors of malignant swelling in space-occupying cerebellar infarction

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Malignant swelling is a severe complication that can occur abruptly in space-occupying cerebellar infarction, leading to surgical decompression as necessary intervention. However, there is only limited literature on this subject. Therefore, we aimed to identify markers to predict malignant swelling

Methods: We retrospectively analyzed all patients with stroke, treated in our hospital between 2014-2020 to identify space-occupying cerebellar infarctions. Malignant swelling was defined as mass effect in the posterior cranial fossa, accompanied by a decrease in consciousness due to compression of the brainstem and/or development of hydrocephalus. Statistical analyses were performed on several clinical and radiological variables to identify possible predictors of malignant swelling.

Results: Among 7284 patients with cerebral ischemic stroke, we identified 487 patients with an infarct located in the cerebellum. 93 of those had a space-occupying cerebellar infarction. Malignant swelling occurred in 33/93 (35.5%). Large infarct volume, high NIHSS score on admission, and the presence of additional brainstem infarction were significantly associated with development of malignant swelling (multivariate analysis). All 33 cases of malignant swellings occurred between 2-6 days after beginning of the symptoms, with the median day being day 3, meaning 48-72 hours after symptom onset. 13 cases of malignant swelling (39.4%) occurred after day 3.
Conclusions: Infarct volume and additional brainstem infarction are the key predictors of malignant swelling in space-occupying cerebellar infarction. Higher NIHSS score on admission is also significantly associated with malignant swelling. With many cases of malignant swelling occurring after 72 hours after symptom onset, we advocate prolonged neurological monitoring for patients with large space-occupying cerebellar infarction.

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767
Brain and Spine 4 (2024) 103859
Risk factors for perioperative complications after cerebral revascularization surgery

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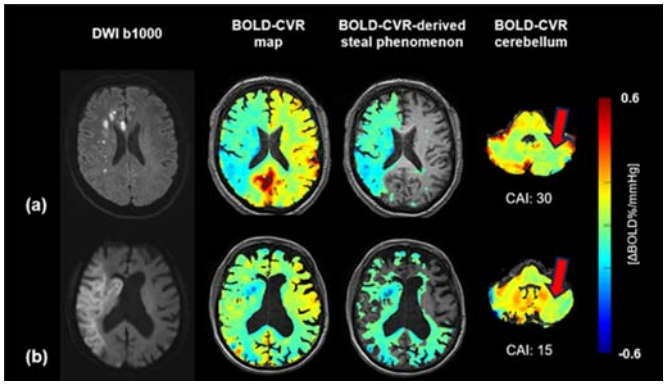
Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: To estimate the frequency and character as well as causes of complications occurred during cerebral revascularization surgical procedures
Methods: Authors operated 2094 patients suffered from stenotic and occlusive diseases of internal carotid artery (ICA) from 01.01.2010 till 31.12.2023 in neurosurgical department. The following 2205 operations were performed: 1541 – carotid endarterectomies (CEA) in patients with hemodynamic ICA stenosis (classic CEA – 587, eversion CEA – 954), 551 low-flow bypasses between superficial temporal artery and middle cerebral artery (STA-MCA bypass) in patients with «symptomatic» ICA occlusion BCA, 45 sympathectomies of occluded ICA and 68 redressments of pathological ICA tortuosity. The surgical treatment outcomes were assessed using Glasgow Outcome Scale (GOS).
Results: Various perioperative (during operation and 30 days after it) complications of surgical treatment were observed at 7,7% of patients (n=169). These complications included the following: acute cerebrovascular event (ACE) - 105 (4,8%) patients, asymptomatic ICA thrombosis - 11 patients (0,5%), hyperperfusion syndrome – 13 (0,6%), damage of cranial nerves – 6 (0,3%), tense hematoma of neck soft tissue requiring urgent evacuation – 20 (0,9%), acute myocardial infarction – 8 (0,4%), acute subdural hematoma after STA-MCA bypass – 4 (0,2%) and necrosis of cutaneous flap after STA-MCA bypass – 2 patients. Lethality was 1,8% (n=40).
ACE was observed at 16 (2,9%) patients after STA-MCA bypass and at 46 (7,8%) – after classic CEA as well as in 41 (4,6%) – after eversion CEA and at 2 (4,4%) patients after sympathectomies of occluded ICA. Among all 28 patients (1,2%) died from ischemic stroke 1 underwent sympathectomy of occluded ICA, 13 – classic CEA, 12 – eversion CEA and 2 patients – STA-MCA bypass.
Intraoperative temporary intraluminal shunt (TIS) and widening patch were performed exclusively with classical CEA. Shunt-associated ischemic stroke was observed in 22 patients (3,7%). In 20 patients (3,4%), the development of postoperative ischemic stroke was noted when using widening patch. It is noteworthy that their stroke developed as a result of acute thrombosis of the operated artery.
Possible risk factors for the development of complications were followed: gender and age of patients, side of the lesion, symptomatic lesion presence, timing of surgery after onset, type of surgical intervention, duration of surgical occlusion of the arteries, use of a shunt and/or patch.
Conclusions: postoperative stroke in patients with and without a shunt was observed 2 times more often (12,2% and 5,4%, respectively). The duration of arterial cross clamping was not identified as a risk factor for ischemic complications. The use of an widening patch is a risk factor for the development of acute ICA thrombosis and severe stroke (p=0,004). The type of CEA did not affect the severity of postoperative ischemic stroke. Hyperperfusion after revascularization was often observed in patients with ICA stenosis operated on in the acute period of stroke, with stenoses greater than 85% (p<0,05).

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529
Brain and Spine 4 (2024) 103860
Exploring hemodynamic-induced crossed cerebellar diaschisis in large-vessel occlusion acute ischemic stroke patients: the role of BOLD cerebrovascular reactivity derived steal phenomenon

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM
Background: Crossed cerebellar diaschisis (CCD) is a recognized neurophysiological phenomenon, yet its clinical significance in acute ischemic stroke management remains unclear. Blood oxygenation-level dependent cerebrovascular reactivity (BOLD-CVR) offers a validated non-invasive imaging technique, not requiring contrast agent, to identify CCD in ischemic stroke patients. We aimed to explore BOLD-CVR-detected CCD in two groups of large-vessel occlusion acute ischemic stroke (LVO-AIS) patients, those successfully treated with endovascular treatment (EVT) and those ineligible for EVT, to further elucidate its pathophysiological mechanisms and clinical implications in acute ischemic stroke imaging assessment.
Methods: We identified unilateral symptomatic LVO-AIS patients from our BOLD-CVR database (June 2015 – June 2022) who received BOLD-CVR and DWI examinations within seven days from ischemic symptom onset. Imaging assessments followed EVT evaluation and intervention, if indicated. For each patient, we calculated DWI infarct lesion size, steal phenomenon volume, and cerebellar asymmetry index (CAI) from BOLD-CVR. CCD was defined by CAI ≥12%. We analyzed CCD occurrence and its association with steal phenomenon volume and infarct lesion size through regression analysis.
Results: Our study included fifty-seven patients, with 23 successfully treated with EVT (reperfusion group) and 34 ineligible for EVT (no-reperfusion group). In the reperfusion group, CCD occurred in 35% of patients, correlating independently with infarct lesion size (OR 12.52, 95%-CI 1.97 to 302.55, P-value 0.038). In the no-reperfusion group, CCD appeared in 30% of patients, correlating with steal phenomenon volume in the affected hemisphere (OR 3.11, 95%-CI 1.14 to 12.01, P-value 0.046).
Conclusions: BOLD-CVR-detected CCD emerged in LVO-AIS patients. Its association with steal phenomenon in the no-reperfusion group suggests a functional, potentially reversible, deafferentation of the cortico-cerebellar system resulting from hypoperfusion-induced tissue hemodynamic impairment. CCD may serve as an additional imaging biomarker guiding the identification of LVO-AIS patients ineligible for EVT who could potentially benefit from microsurgical revascularization through flow augmentation STA-MCA bypass surgery.
Optional Image



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971

Brain and Spine 4 (2024) 103861

Brain Tumour Surgery Guided by Navigated TMS Mapping for Calculation

Camilla Bonaudo [1], Agnese Pedone [1], Federico Capelli [1], Shani Enderage Don [1], Riccardo Carrai [2], Enrico Fainardi [1,2], Antonello Grippo [2], Alessandro Della Puppa, Professor [1,2]. [1] *University Of Florence, Florence, Italy;* [2] *University Hospital of Careggi, Florence, Italy*

Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

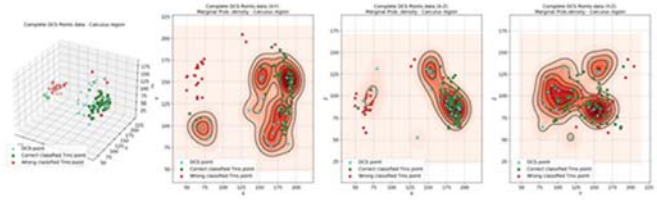
Background: The onco-functional balance represents the first goal in neuro-oncology. The increasing use of navigated Transcranial Magnetic Stimulation (nTMS) allows a non-invasive characterization of cortical functional anatomy, and its reliability for motor and language mapping has been already validated. Calculation and arithmetical processing have not been studied with n TMS yet. In this work, we present our preliminary data concerning n TMS calculation.

Methods: We designed a monocentric prospective study, adopting an internal protocol to use nTMS for preoperative planning, including arithmetical processing. Where awake surgery was possible, according to patients' conditions, n TMS points guided the use of Direct Cortical Stimulation (DCS), i.e. the gold standard for cortical mapping. n TMS based tractography was used for surgical planning. Statystical analyses on n TMS/DCS points was performed

Results: From February 2021 to September 2023, procedures for n TMS calculation mapping were 61(nTMS-C). The clinical evaluation, including pre- and post-operative evaluations (three months after surgery) demonstrated a good clinical outcome with preservation of arithmetical functions and recovery [from 90 to 98,2%]. Between awake or asleep surgery groups, postoperative clinical results were comparable at three-months-follow up: improvement of calculation in >90% of our patients. Surgical strategy adopted was aimed at sparing n TMS positive points in asleep procedures, whereas n TMS and DCS positive points were not removed in awake procedures. Almost 60% of positive points for calculation functions were exposed by craniotomy and 85% spared during surgery. No patients developed nTMS-related-seizures. DTI fiber tracking based on nTMS positive points for calculation was used. The WM fiber tracts involved in calculation functions were the arcuate fasciculus (56%) and fronto aslant tract (22%).

Conclusions: nTMS can be an advantageous tool to study cognitive functions, aimed at minimizing neurological impairment. Postoperative clinical outcome for patients operated on with n TMS was very good. Considering our results, nTMS has proved to be a feasible method to map cognitive areas, including also calculation.

Optional Image



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1019

Brain and Spine 4 (2024) 103862

Innovative Imaging in Neurosurgery: Optical Characterisation and study of ex vivo glioma tissue for hyperspectral imaging

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

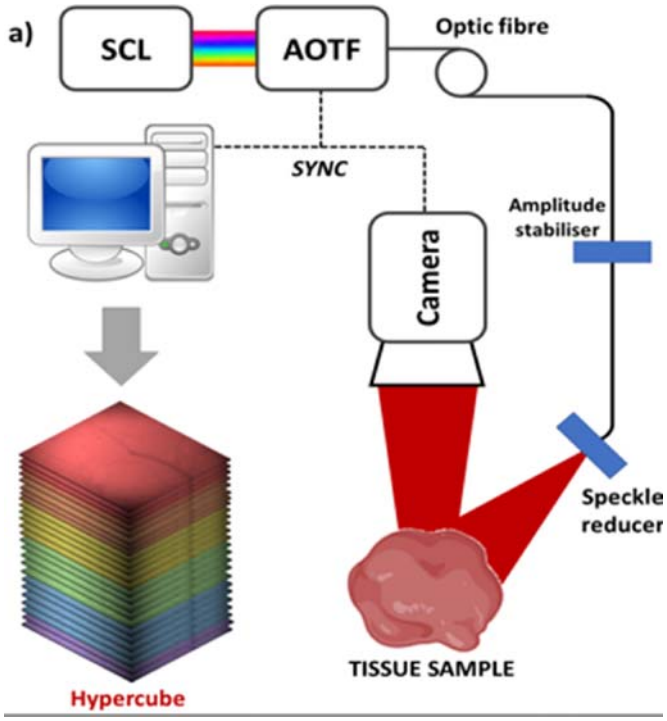
Background: The European Project HyperProbe wants to integrate hyperspectral imaging (HSI) within neurosurgery, for aiding navigation during glioma resection, providing a non-invasive mean to differentiate between healthy and pathological tissue, based on optical absorption and scattering properties. To exploit the capability of HSI, there is a need to optically characterise glioma tissue across the visible and near infrared (NIR) range, to aid the identification of novel cancer biomarkers. Primary candidates are the absorption signatures of oxygenated (HbO2) and deoxygenated (HHb) haemoglobin in the visible range as well as the absorption in the NIR range of the redox states of cytochrome-c-oxidase (CCO), an enzyme involved in cellular metabolism that could be a potential novel biomarker never investigated so far.

Methods: The HyperProbe system is used to analyse biopsies of pathological tissue. HyperProbe system will (1) map, monitor and quantify biomolecules of interest in cerebral physiology; (2) be handheld, cost-effective and user-friendly; (3) apply AI-based methods for the reconstruction of the hyperspectral images, the analysis of the spatio-spectral data and the development and quantification of novel biomarkers for identification of glioma and differentiation from functional brain tissue.

Results: : Analyses on 12 biopsies (8 GBM, 2 grade II, 2 grade III sec WHO 2021) showed significant differences in the shapes and trends of the reflectance spectra on different ROIs for two ranges: (I) 510-660 nm, and (II) 780-880 nm, connected to haemoglobin and CCO, respectively. Glioma samples may present higher concentrations of haemoglobin due to angiogenesis. Hypermetabolism typical of cancerous tissue could result in higher concentrations of CCO in glioma samples, thus potentially providing a new key variable to identify and characterise the tumour area. Such characteristics may be further identifiable in the future comparison between spectra from cancerous vs. non-cancerous tissue.

Conclusions: The results of the optical characterisation of glioma tissue samples provided crucial insight on novel biomarkers for tumour identification, of which CCO has the potential be one of the most important.

Optional Image



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1037

Brain and Spine 4 (2024) 103863

Nanoplastics intruding the Blood-Brain Barrier: Unveiling Extensive Neural Consequences, Emphasizing Microglial Activation, Neuroinflammation, and Beyond.

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Oral e-Poster Presentations - Booth 4: Emerging Technologies & Innovation 1, Research, October 16, 2024, 12:40 PM - 2:10 PM

Background: Nanoplastics (NPs) are extraordinarily small particles obtained from the breakdown of plastic materials. NPs represent a substantial concern for both environmental integrity and human health, given their pervasive presence and persistence in diverse ecosystems. This review critically assesses existing literature investigating the potential adverse effects and toxicity profiles associated with nanoplastic exposure, as elucidated in various experimental models.
Methods: Utilizing a standardized and thoroughly prepared search strategy, databases (Scopus, Medline, Embase, PubMed) were screened.
Results: We found that size is the major determinant of the extent of the toxicity of NPs. We also assessed the impact of NP on the organism C elegans which is a popularly used organism for studying neuronal diseases. We found that indeed, NPs cross the BBB and activate numerous toxic pathways in the brain that eventually lead to the onset or exacerbation of neurodegenerative diseases, learning disabilities, neuroinflammation, and destruction of neurotransmitters in the CNS. We discovered that NP can be transmitted via the placental fetal barrier, breast milk, and food chain. NPs can absorb toxic particles and together are ingested/inhaled by living organisms. When NPs absorb toxic particles, they exacerbate their toxicity in the host. Just like how NPs can exacerbate the toxicity of harmful particles, NP toxicity can also be dampened in the presence of neuroprotective agents. One such agent that was explored was Vitamin D. We established that the NPs use the gut-brain axis as an avenue to get into the brain. We explored general systemic effects and found that NPs can cause inflammation in every organ it invades. It can also dampen the normal physiologic defense against viral pathogens and increase the levels of such pathogens.
Conclusions: It is evident that NPs indeed are intricate particles with proven neurological and general systemic toxic effects. It is paramount that further research should be done to evaluate more of its toxic effects.

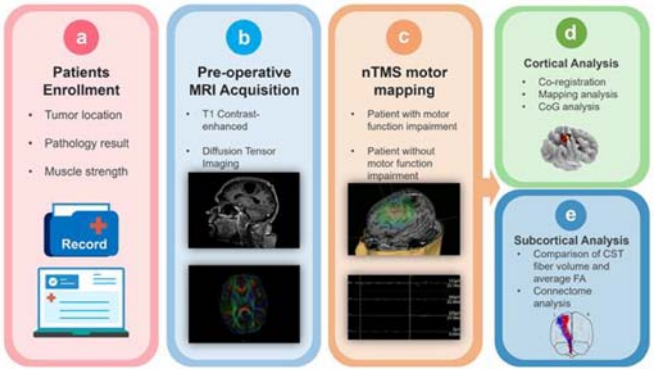
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563
Brain and Spine 4 (2024) 103864
The structural plasticity in motor-eloquent glioma patients with motor deficits

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: The application of navigated transcranial magnetic stimulation (nTMS) for localizing motor functions in humans has notably increased. While prior research has evidenced tumor-induced motor plasticity, the specific patterns of motor function plasticity and reorganization in patients with motor-eloquent tumors remain less understood.
Methods: This study involved sixty glioma patients with tumors in motor-eloquent areas. They were divided into two groups based on the presence or absence of motor impairments in the upper extremities. We employed three-dimensional motor analyses, including Motor Evoked Potentials (MEP), to delineate the motor function control regions' area, localization, and Center of Gravity (CoG). Additionally, these mapped regions served as seeds for tracing the Corticospinal Tract (CST).
Results: The analysis highlighted significant differences in the cortical and subcortical localization of motor functions between the groups. Patients exhibiting motor deficits showed a wider cortical distribution related to motor functions and increased CST volumes, indicative of efforts to maintain functionality (FA 0.15, p=0.02; FA 0.10, p=0.04). Notably, the distribution of CST fibers overlapped with cortical areas associated with the hand-knob region in both patient groups, suggesting these fibers might serve as motor function output pathways despite varying degrees of impairment.
Conclusions: Our study corroborates the "anchor-ship hypothesis" regarding motor function reorganization, demonstrating the brain's capacity to sustain motor function through peripheral reorganization when central motor pathways are intact. This underscores the potential of nTMS in identifying resilient motor pathways in patients with motor-eloquent gliomas, offering insights into adaptive changes in the brain's motor network.
Optional Image



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450
Brain and Spine 4 (2024) 103865
Category naming for intraoperative monitoring of contextual association

Maura Luisa Becker[1], Carla Tampier[1], Phillip Keil[1], Ricardo Loução[1], Julia Pieczweski[1], Marco Timmer[1], Jürgen Hampl[1], Christoph Kabbasch[1], Kristina Jonas[1], Roland Goldbrunner[1], Carolin Weiß Lucas[1]. [1] *University of Cologne, Cologne, Germany*

Oral e-Poster Presentations - Booth 3: Neuro-Oncology 7 (Brain metastases), Neuro-Oncology 8 (Advanced Imaging and Monitoring of Cerebral Functions), October 16, 2024, 12:40 PM - 2:10 PM

Background: Semantic association, which is a critical part of communication, is rather rarely part of the standard monitoring parameters for awake surgery. Promising options like the pyramids and palm trees test (PPTT) deserve more detailed research regarding the suitability of different task instructions to depict dysfunction in distinct parts of the semantic network. We, therefore, examined a PPTT adaption (Cologne Semantic Association Task; COSAT) with different instruction settings regarding functional-anatomical correlates, robustness and intraoperative feasibility.
Methods: 42 stimuli were composed in triplet format, based on the Cologne Naming Test. The task consisted in forced choice/ association of the semantically associated pair of the top drawing. We examined three different instruction types of semantic choice: (I) button press, (II) object naming, and (III) category naming. We evaluated the influence of the instruction type on response robustness, delay and functional cortex activations. First, test robustness was tested in 24 volunteers, stratified by age and gender. Second, fMRIs related to this task (3T, cluster sparse acquisition) were acquired in 20 subjects and analyzed using SPM12. Third, clinical feasibility was tested during task-related fMRI (to inform tractography and surgical planning) and awake glioma surgery monitoring.
Results: First, age was associated with latency ($p<0.005$). Age and gender influenced difficulty and total test time ($p<0.001$). Second, interim fMRI data showed mainly left-hemispheric activations, similar to non-verbal semantic tasks (middle and inferior frontal gyrus, anterior superior temporal gyrus). The most comprehensive activation patterns were in the overt category naming instruction, extending to the frontal association network. Finally, clinical feasibility was proven in five pilot patients.
Conclusions: Our data suggest that semantic association tasks, particularly performed with category naming instructions, hold promise as a functional mapping and intraoperative monitoring tool for communication functions of patients with left frontotemporal lesions.

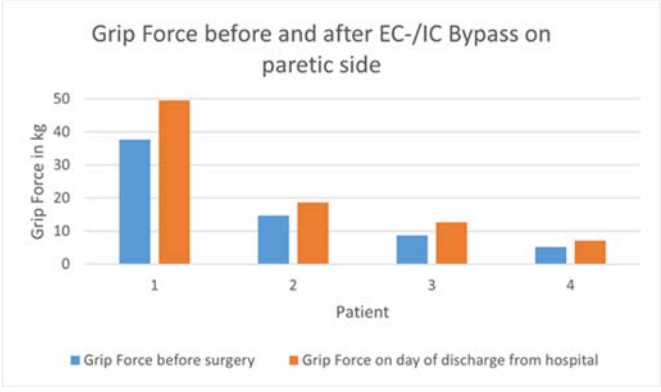
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643
Brain and Spine 4 (2024) 103866
Extra-intracranial (STA-MCA) bypass in crescendo ischemia – a standardized protocol for the daily routine

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Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Extra-intracranial (EC-IC) bypass is a therapeutic option in patients with progressive stroke symptoms and steno-occlusive disease where best medical treatment and interventional options failed. We developed a routine protocol for the diagnostic work-up and follow-up to evaluate the neurological and neuropsychological course pre- and postoperatively.
Methods: Our bypass protocol was conceptually validated in which patients undergo a clinical assessment including Montreal cognitive Assessment- (MoCA) and Beck Depression Inventory- (BDI) -Test and mRS. Cerebrovascular disease is recorded by using the Vascular burden score. The preoperative work-up is completed by 3CT-Perfusion Scan (CTP) with calculated MTT, CBV and CBF as well as grip force (GF) measurement with a standardized dynamometer less than 24hrs before surgery. The neurocognitive/ neuropsychiatric test battery as well as CTP and grip force measurement are repeated on the day of discharge from the hospital as well as 3 and 6 months after surgery.
Results: In all patients post-op CTP showed improved reperfusion (increased MTT and CBV) correlating to their neurological improvement with a grip force increase of 35.4% (mean), the modified-RS with an upgrade of 1.2points (mean) and a 9% (mean) improvement in the patients cognitive assessment.
Conclusions: Our bypass protocol turned out to be highly reliable correlating neuroradiological, clinical and neuropsychological features thereby it is easy to be implemented in the daily routine. While the STA-MCA bypass remains as an important therapeutic option for a small subgroup of stroke patients we offer a standardized protocol to underline the objectives indicating and monitoring EC-IC bypass surgery.
Optional Image



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768
Brain and Spine 4 (2024) 103867
Anterior cervical discectomy and fusion with and without plating: A comparison of clinical outcomes

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: ACDF is an established procedure for treating degenerative cervical spine disease. Debate exists on whether ACDF-C or ADCF-CPA produces better outcomes. The purpose of this study was to compare the outcomes of patients with degenerative cervical spine disease who underwent anterior cervical discectomy and fusion with stand-alone cages (ACDF-C) versus anterior cervical discectomy and fusion with cages and plate augmentation (ACDF-CPA).
Methods: This retrospective cohort study included 55 patients with degenerative cervical spine disease treated with ACDF. 29 patients underwent ACDF-C and 26 ACDF-CPA. Patients' demographics, history, clinical and imaging findings, the number of levels treated, and which levels were documented. The clinical status of the two groups was assessed preoperatively and postoperatively. The modified Japanese Orthopedic Association scale (mJOA), the visual analog pain scale (VAS), the Nurick scale, the Neck Disability Index (NDI), the Odom's criteria and the Charlson comorbidity index were utilized, along with documentation of postoperative dysphagia and hoarseness. Data analysis was performed using IBM SPSS statistics. Descriptive and multivariate analyses were performed on the selected data. The KolmogorovSmirnov test was used for the various scales preoperatively and postoperatively. The Mann-Whitney U test was used to compare the 2 groups. Statistical significance was set at $p < 0.05$.
Results: Statistically significant better mean rank values were observed in patients who underwent ACDF-C compared to those who underwent ACDF-CPA in the assessment of postoperative dysphagia, postoperative hoarseness, and postoperative clinical outcomes.
Conclusions: ACDF-C might exhibit superior clinical outcomes compared to ACDFCPA.

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1336
Brain and Spine 4 (2024) 103868
Active exchange of CSF for rapid removal of blood in hemorrhagic stroke: Multicenter experience in 40 patients

Behnam Rezai Jahromi [1], Silja Soini [1], Jennifer Wilson Peltz [1], Ammad Baig [1], Vikram Bhinder [1], Ryan Hess [1], Felix Göhre [1], Ferzat Hijazy [1], Päivi Tanskanen [1], Jari Siironen [1], Elad Levy [1], Mika Niemelä [1], Adnan Siddique [1], Nicholas Brandmeir [1]. [1] *Helsinki University Hospital, Finland*

Oral e-Poster Presentations - Booth 1: Vascular 5, October 16, 2024, 12:40 PM - 2:10 PM

Background: Spontaneous intracerebral hemorrhage (ICH) and subarachnoidal hemorrhages (SAH) may present with intraventricular hemorrhage (IVH). Previous studies have demonstrated that patients with IVH have higher mortality and morbidity. Neuroinflammation due to organization of blood in cerebrospinal fluid (CSF) is one of the key contributing factors to poor outcomes. We hypothesized that irrigation via active external ventricular drainage (EVD) would accelerate blood removal; thus, adverse events related to organizing blood would be reduced. The study sites utilized double lumen EVD with properties of active irrigation and intracerebral pressure control with passive drainage.
Methods: Data utilizing the new active EVD system were collected from six leading centers in the EU and USA. Forty patients were analyzed: 21 patients had SAH, 13 patients had spontaneous ICH-related IVH, and six patients had vascular anomaly-related hemorrhage. Blood removal from the ventricular system was calculated utilizing computer tomography (CT) imaging. Actual and expected shunt dependency were calculated for SAH patients using CHESS scores.
Results: Removal of blood from the CSF system with an active EVD was safely achieved. The pace of blood removal was highly related to the irrigation volume used during treatment. All 13 spontaneous ICH patients had median IVH clearance of 91.3% (0.7–100%) following an average treatment duration of 7.6 days. Additionally, in the SAH patients, there was lower shunt dependency (2) compared with those observed in the literature and to expected (11) based on calculated CHESS score. The vascular anomaly cohort had a median IVH clearance of 91.3% following an average treatment of 8 days. There were no infection related to CSF exchange.
Conclusions: It is safe and feasible to remove blood from the CSF system in an accelerated fashion via active EVD. The active removal of blood reduced adverse events in this patient population. Removal of blood is highly related to the irrigation rate. Prospective trials are needed to demonstrate the target population that will benefit the most from CSF exchange during hemorrhagic stroke treatment.

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872
Brain and Spine 4 (2024) 103869
Outcomes of stand-alone cervical cage versus cervical cage with plate in single or double level anterior cervical discectomy and fusion: Comparative Study

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: Anterior cervical discectomy and fusion (ACDF) is a well-accepted management option for the treatment of cervical radiculopathy or myelopathy due to cervical disc prolapse. Typically a fusion is performed to stabilize the segment, maintain foraminal height. the aim of the study is to compare between standing alone cervical cage versus cervical cage with plate in single or double level ACDF as regard short term outcome.
Methods: a total of 30 patients who underwent ACDF were grouped into ACDF-with stand-alone cervical cage and ACDF with cervical cage with plate groups. The following parameters were assessed using radiographs: subsidence, fusion and lordotic angle correction , clinical outcomes were assessed using VAS and functional outcomes were assessed using Odom's criteria.
Results: in the comparison of ACDF with stand-alone cervical cage and ACDF with cervical cage with plate groups, at the 3-and 6-months follow-up: Regarding the functional outcome in the cage with plate group 3 (20%) patients had excellent outcome, 7 (46.7%) patients had good outcome and 5 (33.3%) had fair outcome, while in the stand-alone cervical cage group 7 (46.7%) patients had excellent outcome, 2 (13.3%) had good outcome, 6 (40%) had fair outcome.
Conclusions: our results showed that stand alone cervical cage is better in odom's criteria (fair and excellent categories) with less dysphagia duration , less hospital stay and less blood loss with improvement of the lordotic angel .However, cervical cage with plate is better in odom's criteria (good category) , VAS post operative and less duration of neck collar use with no improvement of the lordotic angel and no statistically significant difference in operative time .

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278
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Comparative Analysis of Navigational and Non-Navigational Approaches in Neurosurgical Sacroiliac Joint (SIJ) Arthroplasty

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Oral e-Poster Presentations - Booth 2: Spine 1 (Degenerative), Spine 2 (Degenerative), October 16, 2024, 12:40 PM - 2:10 PM

Background: Sacroiliac joint (SIJ) pain poses a substantial global clinical challenge, impacting a considerable percentage of individuals. Dysfunction in the SIJ can lead to discomfort and contribute to the broader issue of low back pain. Treatment options range from conservative measures to invasive interventions. This study investigates navigational and non-navigational approaches in SIJ arthroplasty, aiming to optimize surgical strategies for improved patient outcomes.
Methods: In a retrospective cohort study, thirty patients underwent SIJ arthroplasty, with thirteen in the navigation group and seventeen in the non-navigation group utilizing intraoperative fluoroscopy. The procedures were conducted utilizing a dorsal approach, and the DIANA implant from Signus was employed. Rigorous comparative analysis included variables such as blood loss (quantified in milliliters), X-ray dose (measured in gray), X-ray duration (measured in seconds), and operation time (measured in minutes). Statistical tests, including effect size estimates and T-tests, were employed.
Results: The study found no statistically significant differences in operative time or blood loss between navigational and non-navigational groups. However, the navigational group demonstrated a significant reduction in X-ray duration. Statistical analysis indicated no significant changes in blood loss, X-ray dosage, or operative time with navigation.
Conclusions: Navigational approaches in SIJ arthroplasty significantly decreased X-ray duration, with no observable impact on operative time or blood loss. The incorporation of navigational systems in specific surgical scenarios should be based on a careful assessment of patient needs, institutional capabilities, and procedural requirements. These findings highlight nuanced benefits and considerations. Further research is recommended to explore the broader implications of navigation technology in optimizing surgical approaches for SIJ arthroplasty.

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1060
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Irrigating Ventricular Drainage System for Treatment of Intracranial Hemorrhages and Infections

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Multiple neurosurgical conditions such as trauma, intracranial hemorrhages, or infections may lead to disruption of cerebrospinal fluid (CSF) pathways and increase of intracranial pressure (ICP). Addressing acute increase in ICP often necessitates medical care or neurosurgical intervention, commonly through the installation of external ventricular drainage (EVD) system. Placement of EVD is performed typically in (neuro)intensive care unit (ICU). The problems associated with EVD include the risk of infection, dysfunction due to clogging of the EVD, and the limitation of passive drainage in effectively removing blood or infected CSF.
Methods: To resolve these problems, we have used active EVD with double lumen catheter with ability to irrigate actively and drain passively. Irrigation is controlled by adjusting safety levels for ICP and intelligent digital pump that also monitors patient's ICP. Irrigation allows removal of components causing high ICP (e.g., intraventricular hemorrhage, IVH), and this process can be enhanced by adding medication to the irrigation fluid. Drainage occurs passively between the cycles of ICP monitoring and irrigation, and drainage is controlled by raising or lowering the drainage bag. Patients' positions are changed every four hours to ensure thorough irrigation throughout the ventricles. ICU nurses play a key role in irrigation treatment: Nurses actively manage the system by monitoring the fluid exchange and ICP levels.
Results: With the active contribution of a multi-professional team, active EVD has been used in several neurosurgical conditions including ventriculitis, IVH, and subarachnoidal hemorrhage. We have achieved a mortality rate of 0% in ventriculitis cases, decreased dependency on shunting, and shortened ICU stays for IVH patients.
Conclusions: Active EVD has opened new avenue for research and has shown promising results. Multiple prospective trials are demonstrating the benefits of active CSF exchange. Successful implementation of active irrigation requires thorough staff education and understanding of CSF pathways to avoid complications.

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1197
Brain and Spine 4 (2024) 103872
A case report: Cerebrospinal Fluid-Venous Fistula

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Spontaneous intracranial hypotension (SIH) consists of non-iatrogenic spinal cerebrospinal fluid (CSF) leak, a debilitating occurrence. While the classic presentation is orthostatic headache, there are numerous other debilitating headaches, including vertigo, tinnitus, blindness, backpacking, and cognitive impairment. It is introduced between the ages of 30 and 50 in most patients. CSF-venous fistula (CSFVF) is an increasingly registered cause of SIH. The exact pathogenesis of these lesions is unclear; These have underpinnings that either represent abnormal connections between the nerve root sheath and paraspinal vessels or are due to increased CSF drainage through spinal arachnoid

granulations that rupture into flexible radicular vessels.
Methods: A 61-year-old male patient came to us with complaints of orthostatic hypotension, headache, headache, feeling of fullness in the ear and tinnitus that had been going on for about 2 years. Brain tomography revealed bilateral frontoparietal enlargement from the subdural distance. With the preliminary diagnosis of intracranial hypotension, the patient underwent a spinal epidural blood patch. Then, in the dynamic CT myelography performed on the patient whose complaints did not regress, Csf-venous fistula was detected at the T11-T12 vertebra level.
Results: The patient underwent spinal angiography and the fistula was embolized. (Picture 1) It was observed that the care complaints decreased in the follow-ups after the angiography.In the 1st month follow-up brain tomography, a significant regression was observed in the widening of the bilateral subdural space that was previously detected.
Conclusions: Although rare, CSF-venous fistula is an important cause of spinal CSF leak contributing to SIH. Dynamic CT myelogram and digital subtraction myelography are the most accurate and effective imaging methods, especially in lateral decubitus positions. These embolization procedures are appropriate treatment methods, and an epidural blood patch provides temporary relief in this process.
Optional Image



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1415
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Double Balloon Kyphoplasty: Innovative vertebral fracture treatment, utilized standalone or in hybrid procedures. A 14-year follow-up on 500 + patients showcases its efficacy.

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM
Background: Augmentative procedures, such as vertebrae- or kyphoplasty have become an important way of treatment for osteoporotic, as well as non-osteoporotic dorsolumbar vertebral fractures within the last 2 decades. Meanwhile, conventional single ballon kyphoplasty (SBK) has certain limits for the remodeling of the original vertebral form, especially in higher levels of compression and more complex fractures, it is being used mostly for lower grade fractures, such as A1.1 according to the AOS classification. A further limit of SBK is the involvement of the posterior wall of the vertebral body. In contrast to that, the Double Balloon Kyphoplasty opens more possibilities for remodeling in more complex fractures, as standalone technique as well as in combination with transpedicular stabilization, in means of hybrid treatments.
Methods: Since 2010, we have been working with a DBK system (Joline®, Hechingen, Germany). Within this system, both catheters bear 2 balloons (in summary 4). Those have a smaller volume as compared to the SBK balloons and each one can be inflated separately. This opens up possibilities to treat also more complex fractures. In this analysis, we retrospectively reviewed the medical records of more 500 patients that have been treated with DBK either in means of a standalone or within a hybrid procedure with a follow-up of up to 14 years.
Results: We will report the detailed clinical, as well as the radiological results of the whole cohort of patients, as over 90% have received preoperative CT- and MRI, as well as postoperative CT- and/or X-ray controls over many years. Within our results, we could show a low rate of complications, long-lasting positive results in means of effectiveness on pain and a very low rate of surgical reinterventions. In summary, DBK could be a less invasive treatment option even for patients with higher grade dorsolumbar fractures in both the settings of the standalone, as well as the hybrid treatment concept. This could be of high interest especially for fragile patients, in which more invasive procedures bear a potentially higher treatment risk.
Conclusions: Double Balloon Kyphoplasty (DBK) demonstrates promising outcomes in treating complex dorsolumbar fractures. With low complication rates and sustained effectiveness, it presents a less invasive option, particularly beneficial for fragile patients with higher treatment risks.

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319
Brain and Spine 4 (2024) 103874
Cervical disc herniation disguised as spontaneous intracranial hypotension: a case report

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM
Background: Spontaneous intracranial hypotension (SIH) is caused by low CSF volume due to CSF leakage usually at the level of the thoracic spine. Patients present with postural headaches relieved by recumbency and a combination of pathognomonic findings on MRI. In rare cases, it may be secondary to surgery or trauma, including traumatic disc herniations.
Methods: A 49-year-old woman presented to the clinic with fronto-occipital headache, nausea, and vomiting that worsen in upright position. She reports a cervical trauma one month ago with subsequent neck pain. Two weeks after the injury, the patient began experiencing her current symptoms, which have since worsened and prevented her from walking at the time of hospitalization. MRI of the brain revealed characteristic for SIH changes and abnormal values of mamillopontine distance, pontomesencephalic and interpeduncular angles. The patient was treated conservatively at another clinic for SIH without success. Additional cervical MRI revealed a large median disc herniation at the C3-C4 level and a CSF collection in the ventral epidural space surrounding it. Surgical strategy included ACDF at the level of the herniation with revision for dural tears. Intraoperatively, a dural defect was found near the right C4 dural nerve root sleeve and profuse CSF leakage was visualized. The defect was closed using autologous fat tissue, synthetic dura, and fibrin glue. Postoperatively, the patient had no clinical signs of SIH and was discharged. At six-month follow-up, there were no residual or recurrent symptoms and the patient made a full recovery.
Results: In the majority of cases, the etiology of SIH remains unclear, with fragility of the dural nerve root sleeve thought to be the cause. In these cases, the usual treatment includes bed rest, painkillers and epidural blood patches (EBP). In secondary cases, whether iatrogenic, traumatic, or caused by osteophytes, EBP is rarely curative and surgery must often be resorted to. In this case, the clear imaging evidence of a dural defect with a large disc herniation compressing the myelon required a combined approach for both pathologies. Removal of spinal pathology, careful examination for dural defects and obliteration of such leads to a successful therapeutic process.
Conclusions: SIH is a rare pathology and its natural course can be ominous. It is essential to investigate any spinal pathology, especially in the case of previous spinal trauma, therefore only treating the mechanical cause may lead to relief of the pathophysiological mechanism and clinical symptoms.

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950
Brain and Spine 4 (2024) 103875
Bridging Veterinary and Human Neurosurgery: Insights from Comparative Neurooncology

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: Comparative neurooncology explores the striking parallels between canine and human brain tumours, offering profound insights into neurosurgical strategies and therapeutic innovations. Dogs, like humans, manifest a diverse array of brain tumours encompassing meningiomas, malignant gliomas, and medulloblastomas, reflecting shared neuro-oncological processes. This convergence underscores the potential of canine models as indispensable tools in unravelling the complexities of neurosurgical interventions and advancing therapeutic modalities. By elucidating shared genetic alterations and tumour characteristics, comparative neurooncology not only enhances our understanding of tumour biology but also informs the development of targeted neurosurgical approaches.
Methods: In the present review, we are reviewing literature data from scholarly databases to document the interrelation between veterinary and human neurosurgery.
Results: Canine gliomas exhibit remarkable similarities to pediatric glioblastomas, presenting a unique opportunity for preclinical trials and therapeutic development. Shared genomic mutations, including those involving the PI3K and MAPK pathways, delineate fundamental insights into the pathophysiology of gliomas across species. Collaborative efforts between veterinary and human medicine have yielded innovative neurosurgical techniques, such as targeted drug delivery via convection-enhanced delivery systems. Preliminary trials in dogs have demonstrated promising outcomes, with significant reductions in tumour size observed. Moreover, environmental risk factors implicated in neurooncogenesis can be assessed using canine models, informing personalized preventive strategies and environmental modifications to mitigate tumour development.
Conclusions: Canine gliomas closely resemble pediatric glioblastomas, offering a promising preclinical model for therapeutic development. Collaborative efforts have led to innovative neurosurgical techniques, including targeted drug delivery systems, demonstrating significant reductions in tumour size in preliminary canine trials.
Canine gliomas closely resemble pediatric glioblastomas, offering a promising preclinical model for therapeutic development. Collaborative efforts have led to innovative neurosurgical techniques, including targeted drug delivery systems, demonstrating significant reductions in tumour size in preliminary canine trials.

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783
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Language Network Plasticity in Multilingual Patient with Frontotemporal Tumor: Insights from Awake Surgery and Transcranial Magnetic Stimulation Intervention

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: The linguistic capabilities of the human brain, particularly in multilingual individuals, have long been a subject of interest in neuroscience. Understanding the organization of language networks and their plasticity in response to pathological conditions such as brain tumors is crucial for both clinical management and fundamental research.
Methods: In this case report, we present the intriguing observations from a multilingual 34-years-old right-handed female patient with an oligodendroglioma, WHO grade III, located in the frontotemporal region. Through a series of surgical interventions in awake state, complemented by direct electrical stimulation (DES) and speech mapping with neuro-navigated transcranial magnetic stimulation (nTMS), as well as nTMS interventions, we explore the complex interplay between language representation, hemisphere dominance, and neuroplasticity.
Results: During two awake surgical procedures, correlations were observed between areas exhibiting speech alteration upon DES and language-responsive cortical regions identified through pre-operative speech mapping with nTMS. Following surgery, the patient experienced difficulties in expressing herself in Spanish, while her proficiency in French and English remained intact. Subsequent TMS treatment according the inhibitory low-frequency protocol targeting the contralateral hemisphere's inferior frontal region resulted in improved Spanish expression but compromised proficiency in French and English. Interestingly, a pause in TMS treatment saw improvements in all languages, albeit with residual difficulties in reading and writing.
Conclusions: The observed language-dependent distribution of regions and connections highlights the complexity of language representation in the multilingual brain. Our findings suggest a differential localization of mother language and secondarily learned languages, with mother language regions predominantly located in the dominant hemisphere and secondarily learned languages potentially distributed across hemispheres. The observed plasticity, evidenced by improvements and fluctuations in language proficiency following TMS intervention, underscores the dynamic nature of language networks and their capacity for reorganization in response to pathological insults and therapeutic interventions.
Insights gained from this case have implications for surgical planning, rehabilitation strategies, and our understanding of language organization in the human brain. Future research endeavors should further elucidate the mechanisms underlying language plasticity and explore individual variability in language representation across diverse linguistic contexts.

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1229
Brain and Spine 4 (2024) 103877
Holographic-supported computer-based navigation: experience on a single-center cohort of 54 neuro-oncological cases

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: The introduction of computer-based navigation systems has brought a fundamental technical advantage to Neurosurgery. Conventional navigation systems bear major disadvantages: line of sight (LOS) interruption and attention shifts from the patient to the remote screen. Perioperative navigation with Mixed Reality head-mounted displays (MxR-HMD) with an integrated tracking camera may eliminate these pitfalls.
Methods: All intracranial neuro-oncological cases planned with MxR-guidance between January 2023 and January 2024 have been included. Data relative to the surgery and the perioperative use of holograms have been collected., Mean total time of intraoperative hologram's use as well as mean time of hologram–to-head manual match and mean total time of conventional navigation have been documented. Any modification of patient positioning, surgical approach or intraoperative trajectory after holographic visualization was noted. Applicability of the system was also assessed.
Results: Fifty-four procedures were included. Mean time of intraoperative MxR use was 7.3 +/- 3.3 minutes, while mean time for hologram-to-head matching was 1.7 +/- 0.8 minutes. Mean time of conventional navigation's set up was 3.1 +/- 2.8 minutes. The comparison between mean time of hologram-to-head match and of conventional navigation's set up proved the former as significantly faster than the latter strategy (p value <0.001). A modification of patient positioning occurred for 4 cases (7.4%) and in 2 cases (3.7%) the intraoperative trajectory was optimized after MxR-visualization. All users with more than 6 months experience with the system rated its applicability positively.
Conclusions: MxR-guided navigation may represent a relevant advancement to the conventional navigation strategy by eliminating the disadvantages connected to computer-based navigation and increasing the efficiency of the intraoperative

workflow. Objective measurement of clinical accuracy and technical precision, as well as the development of a gold-standard automatic hologram to head matching system represent the most urgent future perspectives to help the establishment of this technology.

Optional Image

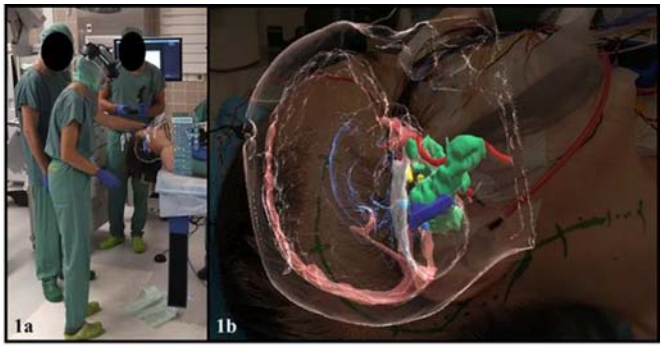


Figure 1: Visual representation of the manual hologram to head matching (1a) and an exemplifying case (1b).

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1409

Brain and Spine 4 (2024) 103878

Middle- and Long term postoperative Outcomes in Patients undergone a dorsal cervical stabilization in the highest 3 segments of cervical spine

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM

Background: The objective of this study was to evaluate the postoperative results in patients who underwent dorsal cervical stabilization in the highest 3 segments of the cervical spine, and to compare the outcomes from two separate neurosurgical departments. The comparison was based on clinical data derived from neurological assessments, Neck Disability Index (NDI) scores, segmental fusion rates, and postoperative complications.

Methods: In this study, we examined the postoperative results in patients who had undergone dorsal cervical stabilization at mid-term (3 to 6 months post-operation) and long-term (more than 1 year post-operation) follow-up in both medical centers. Intraoperative trajectory measurements and screw positioning were primarily guided by navigation assistance using an O-Arm. Clinical outcomes were assessed based on various criteria including age, sex, height, weight, BMI, NDI scores before and after surgery, ASA index, location and number of operated segments, duration of the operation, bleeding volume, types of screws used, screw fixation techniques, complications, and the impact of osteoporosis on the patients' quality of life. Spearman and Cramér's V values were used to evaluate correlations, and exclusion criteria included operations below C4 and absence of patients in follow-up evaluations.

Results: A total of 287 patients were included in the study from both departments, with age stratification under and above 65 years old. Significant correlations were observed between BMI and pre- and postoperative NDI scores. Patients over 65 years old exhibited a correlation between pre- and postoperative pain levels (VAS). Female gender was also correlated with postoperative pain levels. In the initial postoperative follow-up, correlations were identified between age, morbidity (ASA index), and duration of the operation. Additionally, there was a correlation between female gender and postoperative NDI scores, with higher NDI scores in females compared to males. The use of bone replacement materials intraoperatively positively influenced postoperative NDI scores. The number of operated segments was associated with increased postoperative pain levels. There was no significant correlation between types of screws, number of operated segments, and postoperative outcomes.

Conclusions: Conclusions: The results of this study align with existing literature on postoperative outcomes for degenerative cervical spine disease and trauma. Key factors influencing outcomes included age, ASA index, BMI, osteoporosis, and initial NDI scores. Differences in cervical fusion behavior and postoperative outcomes were observed in patients with osteoporotic bone, highlighting the importance of bone quality in surgical success. There was no significant difference between postoperative outcomes in patients of both centers.

The fusion rate could be achieved in 54% in the first 3 months, 70% in 6 months and 94% in long- term follow-up.

Optional Image

	Gender	Age <65	Age>65
Center 1	M= 91, W=87	34	144
Center 2	M= 66, W= 45	98	13
Patient groups	Preoperative, Spearman for NDI and VAS	Postoperative, Spearman for NDI and VAS	Spearman for NDI and VAS First Follow-up
Age <65	NDI 0,251, VAS 0,278	NDI 0,139, VAS -0,231	NDI -0,52 VAS -0,012
Age >65	NDI 0,110, VAS -0,028	NDI 0,137 VAS 0,155	NDI 0,31, VAS -0,020

Table 1: This is a table that indicates the number of patients involved in the study, as well as a correlation between the age, Neck Disability Index and VAS.

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724

Brain and Spine 4 (2024) 103879

Semi-sitting Position vs Standard Supine Position in Reducing Intracerebral Bleedings during Stereotactic Brain Biopsy

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: Stereotactic brain biopsy (SBB) represents a minimally invasive procedure to acquire tissue samples for histological diagnosis. Despite SBB's many benefits, there is a chance of hemorrhagic complications. The incidence of hemorrhagic complications following SBB is not well established, but studies suggest that it may be higher than previously thought. In semi-sitting position (30° elevation of the head), the intracranial pressure is lower than in supine position due to decreased venous congestion. In our hypothesis, intraoperative bleeding may be reduced by exploiting semi-sitting position, potentially leading to decreased surgical morbidity.

Methods: We conducted a retrospective monocentric 2-arms cohort study at our institution (Istituto "C. Besta" in Milan, Italy). We reviewed all patients who underwent stereotactic brain biopsy in 2023. The primary endpoint is to demonstrate the improved safety of the semi-sitting position, as assessed by the absence of intracranial bleeding on postoperative CT scans compared to standard supine position.

Results: Our analysis covered a total of 79 patients, with 39 undergoing biopsy in the semi-sitting position and the remaining 40 in supine positions. Out of those in the semi-sitting position, 5 exhibited a hemorrhagic spot along the catheter's edge or within the lesion as revealed by CT scans. This contrasts with the 14 instances found among patients not in the semi-sitting position, indicating a statistically significant difference (p-value: 0.028). However, no other significant correlations were observed in CT findings, such as bleeding, when compared to age (p-value: 0.352), biopsy site (p-value: 0.355), number of samples (p-value: 0.141), or histology (p-value: 0.251).

Conclusions: This study has the potential to shed light on an innovative approach for patient positioning in stereotactic brain biopsy. The observed decrease in intraoperative bleeding may decrease procedure-related risks and surgical morbidity. As a result, patient safety and outcome can be improved.

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1018
Brain and Spine 4 (2024) 103880
Implementing preventative rehabilitation in neuro-oncology patients - current evidence and our experience of a new pathway

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: Prehabilitation (preventative rehabilitation) aims to optimise patients' function ahead of medical intervention, leading to improved tolerability of treatment, patient experience, and post-treatment outcomes. To date, there is no existing description or analysis of prehabilitation in neurosurgical oncology. In our centre, we implemented a multi-specialist pathway for patients undergoing pituitary, skullbase and awake craniotomy surgeries. We describe our experience in the context of existing literature evidence, and share analysis results of our current pathway.
Methods: Our pathway consists of a multi-stage review process, with selection of patients before surgical intervention. This is followed by inpatient and multiple outpatient reviews during the rehabilitation phase. We established this pathway for patients undergoing awake craniotomies, pituitary and open skull base surgeries. We assessed Hospital Anxiety Depression Scale (HADS) before and after surgical intervention, as well as describe functionality of patients using SBI and FACT-br scores. Patient satisfaction of the service was analysed.
Results: At least 88.9% patients were satisfied with all domains of the service we captured through our questionnaire. Anxiety scores of all patients did not differ significantly when comparing pre-operative against sequential follow ups. Depression scores worsened at follow up for patients undergoing awake craniotomies, improved for those undergoing pituitary surgery, and did not differ for those undergoing open skull base surgery.
Conclusions: Our results demonstrates the need for close evaluation and follow up of a vulnerable group of patients. We implemented our prehabilitation service in hope to improve functional outcomes in neuro-oncology patients. We stress the importance of shifting away from traditional outcome measures, and embracing an emphasis on functional improvement and well-being of our patients. Our prehabilitation service has been met with patient acknowledgement and support; we are using their feedback to fine-tune our pathways as well as broaden its applicability in our department.

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731
Brain and Spine 4 (2024) 103881
Lumbar CSF fluid drainage in patients with severe acute spinal cord injury. Preliminary safety report of a randomized clinical prospective study. (Preliminary data)

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM

Background: Traumatic spinal cord injury (TSCI) is a life changing neurological condition with substantial socioeconomic implications for patients and their caregivers. Following spinal cord injury (SCI), the primary mechanism of injury is followed by a series of pathological events including ischemia, oxidative cell injury, glutamatergic excitotoxicity, apoptosis, inflammation, and edema. Loss of autoregulation is a key component of secondary damage, and thus it is imperative to intervene at this point.
Methods: The primary objective: was to assess the impact and safety o CSF drainage in addition to standard treatment on ASIA score at 12 months (ASIA A-C) in patients with severe traumatic spinal cord. We did a prospective randomized study, where we divided the patients into two groups, one standard treatment, and the other group standard treatment plus placement of lumbar drainage. The patients with standard treatment maintained a mean arterial pressure between 85 and 90 mmHg, the patients with lumbar drainage had the objective of maintaining a spinal cord perfusion pressure between 75 and 80 mmHg. The treatment lasted 72 hours. We collected information on drain-related complications, ability to continuously monitor intrathecal pressure, as well as complete follow-up at 12 months. ASIA complete score was recorded in all patients at 3 , 6 and 12 months
Results: We were able to recruit 10 patients so far, 5 patients were randomized to the standard treatment arm and 5 were randomized to the lumbar drainage treatment . The placement of the lumbar drain was performed without problems in the 5 patients randomized to the corresponding arm. The drain remained in place for 72 hours, and CSF was obtained, measured and drained in all 5 patients. The spinal cord perfusion pressure was successfully maintained above 70mmHg in all 5 patients during the 72 hours. In the short and long term follow up we did not see any complications related to cerebrospinal fluid drainage. Two patients experienced minor adverse events. Mean opening CSF pressure was 19 mmHg, mean CSF pressure after decompression and during the treatment was 8.4 mmHg. Motor function improved in both groups , nevertheless the mean motor scores improved by 11 point in the control group and 27 point in the experimental group at 12 months.
Conclusions: The placement of CSF drainage does not appear to increase the risk of complications in the treatment of patients with severe traumatic spinal cord injury. The use of a CSF drain for the purpose of increasing the accuracy of spinal cord perfusion pressure appears to have a positive impact compared to patients without this drain. At this moment we are still recruiting patients to enlarge our sample in order to have more accurate information.

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791
Brain and Spine 4 (2024) 103882
Evolution of glioblastoma therapy in two decades: Comparison of two prospective, controlled trials on the resection of glioblastoma : The 5-ALA and iMRI vs. 5-ALA-trials

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: Two prospective, controlled multicenter trials on the resection of glioblastomas are published to date spanning almost 2 decades of medical evolution. The 5-ALA (ALA) trial, published 2006, comparing the extent of resection (EOR) and overall survival (OS) of patients after 5-ALA fluorescence-guided and white-light surgery, and the iMRI vs. 5-ALA (iMRI/ALA) published 2023, comparing 5-ALA fluorescence-guided and iMRI-guided surgery. Both studies had comparable inclusion criteria, therefore this analysis aims to compare surgical and survival results of both studies.
Methods: We analyzed the data of both trials in terms of baseline, peri- and postoperative clinical data, as well as EOR and OS.
Results: Data of 243 patients of the ALA and 277 patients of the iMRI/ALA trial were analyzed. Median age and preoperative NIHSS were comparable between cohorts. Tumors were rated “eloquent” in 56% in the ALA and 51% in the iMRI/ALA trial. Total resection of contrast enhancement was achieved in 36.1% (white-light), 64.5% (ALA in ALA trial), 78% (ALA in iMRI/ALA trial) and 81% (iMRI). 19.5% (ALA trial) compared to 8% (iMRI/ALA trial) of patients deteriorated neurologically postoperatively. OS differed significantly between both studies, especially depending on the EOR: Patients with incomplete resections had a median OS of 11.8 (ALA-trial) and 19.4 (iMRI/ALA trial), in contrast to 16.9 and 25.4 months for completely resected tumors, respectively. Incomplete resections led to worse OS in both studies, regardless of residual tumor size. Patients with the prognostically “worst” tumors (MGMT non-methylated, subtotal resection) in the iMRI/ALA trial had a comparable median OS (16.1 months) to patients with the prognostically “best” tumors (total resection) have from the ALA-trial (16.9 months). First-line adjuvant treatment was radiotherapy in 92.6% of patients in the ALA trial and a combined radiochemotherapy with temozolomide in 84% of patients in the iMRI/ALA trial.
Conclusions: Most likely due to increasing experience with5-ALA fluorescence guidance, the numbers of complete resections using this technology increased from 64.5 to 78% within the last two decades. Further, the role of complete resections without any residual contrast enhancing tumor remains a highly significant prognostic factor. OS has significantly improved throughout the last years, most likely caused by the routine use of combined radiochemotherapy in combination with better surgical results.

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831
Brain and Spine 4 (2024) 103883
Model to Simulate Brain Biopsies Using a Navigated Robotic Guiding System and a Bone Cutting Laser

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: Brain biopsies are necessary in cases of unclear lesions on imaging studies to establish a treatment plan based on the histologic diagnosis. This study explores the application of laser technology and robotic guidance in neurosurgery to enhance the precision and safety of brain biopsies. Leveraging previous findings on lasers creating precise burr holes, the research investigates the feasibility of combining laser ablation with a robotic biopsy needle guiding system.

Methods: The brain biopsies with CARLO© (Cold Ablation Robot-guided Laser Osteotome) and its biopsy needle guidance system were performed in an experiment with the following five steps on five fresh frozen heads:

Step 1: Pre¬biopsy, CT scans were made Step 2: Planning of two biopsies per head, one angled 45° and the other 90°. Step 3: Heads fixation with a Mayfield clamp. Registration was performed to match the head to the pre¬biopsy CT. The Er:YAG laser ablated a bone canal approximately 2.5 mm in diameter. Insertion of the biopsy needle through the biopsy needle guiding system. Step 4: Post-biopsy, a follow-up CT scan was conducted Step 5: Biop-sy accuracy is measured in the biopsy planning software using the pre- and post-biopsy CT scans.

Results: In 9 out of 10 biopsies, the laser osteotome demonstrated comparable accuracy to the 1-3 mm deviation achieved with conventional biopsy methods. The experimental results suggest that the combined use of laser ablation and a guidance device enables precise bone ablation and accurate needle guidance for biopsies.

Conclusions: The robotic arm ensures sufficient stability and precision for guiding the biopsy needle. The smaller biopsy angle potentially enabling access to brain areas that would be inaccessible using conventional biopsy techniques. These results demonstrate the potential of integrating laser technology and robotics in neurosurgery, potentially enabling less invasive, faster and safer biopsies, ultimately leading to better patient outcomes.

Optional Image

Distance from bone entry [mm]	Angles								
	45°			90°			45° AND 90°		
	Deviation [mm]			Deviation [mm]			Deviation [mm]		
	min	max	avg	min	max	avg	min	max	avg
0	0.39	3.04	1.74	0.80	5.34	2.24	0.39	5.34	1.99
10	0.39	3.00	1.71	0.80	5.31	2.24	0.39	5.31	1.98
20	0.39	2.95	1.69	0.80	5.29	2.23	0.39	5.29	1.96
30	0.39	2.90	1.67	0.80	5.27	2.22	0.39	5.27	1.94
40	0.39	2.86	1.65	0.80	5.24	2.21	0.39	5.24	1.93
50	0.39	2.84	1.62	0.80	5.22	2.20	0.39	5.22	1.91
60	0.39	2.83	1.60	0.80	5.20	2.20	0.39	5.20	1.90
70	0.39	2.83	1.58	0.80	5.18	2.19	0.39	5.18	1.88
80	0.39	2.83	1.55	0.80	5.15	2.18	0.39	5.15	1.87
90	0.39	2.83	1.53	0.80	5.13	2.17	0.39	5.13	1.85
100	0.39	2.83	1.51	0.80	5.11	2.16	0.39	5.11	1.84

Table 1: Min., max. and average deviations for both planned biopsy angles and combined

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877
Brain and Spine 4 (2024) 103884
Patient Stress Level Caused by Radiological Investigations in Early Postoperative Phase After Craniotomy; the IPAST-CRANIO Prospective Observational Study

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: The postoperative status after intracranial surgery can best be assessed by early MRI, which is ideally performed within 72 hours postoperatively. Advantages of early postoperative imaging are an accurate assessment of resection status, assessment of potential complications, and a potential psychological relief for patients. On the contrary, it may exert psychological and physical stress associated with the transport and execution of the examination. The goal of this study was to compare patient's stress level, and medical and neuroradiological implications of postoperative radiological investigations at different time intervals after elective craniotomy.

Methods: This study was a prospective, observational cohort study, conducted at the Department of Neurosurgery of the University Hospital Zurich, Switzerland, between September 2020 and July 2022. Patients with elective craniotomy were evaluated for stress level before and after the postoperative imaging procedure by filling out questionnaires. Additionally, relevant radiological and medical criteria were registered. Postoperative imaging intervals were divided into two groups by coincidence: imaging <36 hours and imaging 36-72 hours. Patient's change in stress level, radiological and medical criteria were compared between groups.

Results: A total of 149 patients with median age of 57.6 years (IQR 45.9-67.4) were included. The majority (85.2%) underwent craniotomy for resection of a neoplasm. The median change in stress scores who underwent imaging within 36 hours (4.8 [IQR 1.5-7.8]) and 36-72 hours (1.5 [IQR 0.0-3.0]) were significantly different ($p<0.001$). Fifty-four (36.2%) patients preferred their investigation at a later time. Time interval to imaging procedure did not influence radiological or medical criteria.

Conclusions: Postoperative imaging between 36 and 72 hours after elective craniotomy seems to have less impact on patient's stress, without changes in radiological or medical criteria, than imaging earlier. These results strongly suggest that performing imaging between 36 and 72 hours after craniotomy may contribute to better recovery and patient satisfaction.

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927
Brain and Spine 4 (2024) 103885
Segmentation and structural connectivity of the Putamen for targeted Convection Enhanced Drug Delivery in Parkinson's Disease: A tractography-based approach

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Oral e-Poster Presentations - Booth 1: Functional 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Stereotactic convection enhanced drug delivery (CED) for gene or cell therapy in Parkinson's disease (PD) is currently developing as a promising treatment option. Current "untargeted" approaches apply the drug to the whole putamen irrespective to its subsegments and connections to motor and non-motor structures. This study investigates the feasibility of using Diffusion Weighted Imaging (DWI) and tractography for defining more precise drug delivery targets within the putamen, potentially enhancing treatment efficacy and reducing costs.

Methods: Twenty PD patients underwent DWI to visualize the structural connectivity within the brain. A commercial subcortical austosegmentation tool was used to define the putamen as well as the amygdala, the STN and the cerebellum. Utilizing the Jülich Brain Atlas, nine cortical regions (Brodmann areas 44, 45, 3a/b, 4a/p, pre-SMA, SMA, and insula ID10) were semi-automatically segmented. Structural connectomes were analyzed through tractography, allowing for the parcellation of the putamen into four segments in relation to the anterior commissure.

Results: Tractography revealed a significant projection of motor areas to the superior posterior segment of the putamen, followed by connections to the superior anterior segment, suggesting these regions as more specific targets for treating motor symptoms in PD via CED. Non-motor connections were most common in the inferior posterior segment for the amygdala and in the superior anterior segment for the insula.

Conclusions: The application of DWI and tractography for the segmentation of the putamen by its cortical connections offers a pathway towards targeted gene therapy in PD. Identifying the posterior superior segment as the primary recipient of motor area projections underscores the possibility of enhancing therapeutic efficacy while conserving resources. This precise targeting could potentially allow for reduced dosages and more focused treatment, minimizing exposure to

non-motor segments of the putamen and associated risks.

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1300

Brain and Spine 4 (2024) 103886

Neuroimaging criteria and continuous external lumbar drainage recording in adult-onset hydrocephalus patients: evaluating the best radiological diagnostic predictors in a single center patients cohort.

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Adult-onset hydrocephalus is an umbrella condition enclosing several disorders such as normal pressure hydrocephalus (NPH) characterized, among other features, by enlarged brain ventricles on imaging. The aim of this study is to select the best radiological predictors of raised intracranial pressure (ICP) evaluating any significant correlation between radiological pre-operative findings and ICP recorded via continuous external lumbar drainage (ELD) obtained from a cohort of patients operated at our institution.

Methods: This is a retrospective, single-center observational cohort study of patients who underwent continuous ELD through LiquoGuard ® for 72 hours as part of the diagnostic workup for NPH. We included consecutive adult patients from June 2018 to October 2023. All patients underwent head MRI on which radiological features and measures were taken following standard approaches described in the literature. Statistical analysis was conducted using Pearson correlation coefficient (r) comparing radiological measures and pressure recordings.

Results: 19 patients were included. The radiological measures evaluated were: 1. Evans index (EI) 2. Callosal angle (CA) 3. Periventricular hyperintensities 4. Widening of Temporal Horns 5. Transependymal edema 6. Thinning and elevation of Corpus Callosum 7. Tightened sulci in the high convexities 8. Enlargement of sylvian fissure and basal cisterns. The most significant finding was a strong positive correlation between transependymal edema and pressure values ($r = 0.61$, $p = 0.0055$), suggesting that an increase in transependymal resorption is associated with higher ICP. The EI and the CA were found to have weak negative correlations with pressure values, with coefficients of -0.24 ($p = 0.3272$) and 0.14 ($p = 0.5708$).

Conclusions: We demonstrated a statistically significant correlation between transependymal edema and ICP measured via LiquoGuard highlighting this radiological finding as the most valuable radiological predictor of increased intracranial pressure in our cohort. Further research with larger cohorts is recommended to validate these findings.

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554

Brain and Spine 4 (2024) 103887

Degree of kyphotic deformity correction with short segment percutaneous transpedicular fixation in thoracolumbar fractures

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM

Background: One of the most common types of spine fractures is a thoracolumbar fracture. Most of the injuries occur between T11 and L2 and are associated with kyphotic deformity and spinal canal compromise caused by fracture segment retropulsion. If interventions are not carried out properly, kyphotic deformity of the spinal column and the patient's neurologic state may worsen, resulting in major influence on the patient's physical and professional activities. Operative approaches involve placement of short- or long-segment pedicle fixation or internal bracing to restore alignment and preserve neurological function. Surgery using minimally invasive percutaneous fixators lead to the reduction of blood loss and postoperative pain, and a faster return to previous activities but there is lack of data regarding kyphotic angle correction with percutaneous TP fixation approach at national level, so this study has been conducted to scientifically fill the gap and to provide the scientific findings which will help the spine surgeons in various aspects of their clinical practices.

Methods: 205 consecutive patients were enrolled under this study between 2021 and 2023 at the Department of Neurosurgery, Punjab Institute of Neurosciences, Lahore, Pakistan. All patients with kyphotic deformity caused by thoracolumbar fracture with either gender were enrolled under this study after getting informed & written consent. Minimally invasive short segment (1 level above, 1 level below and inclusion of the fractured vertebra) percutaneous transpedicular fixation was used, pre op and immediate post op kyphotic angle was measured by CT scan dorsolumbar spine.

Results: Our study has male predominance with statistically significant mean age difference among males 35.31 ± 29.30 years and females 58.93 ± 9.16 years ($p < 0.05$), respectively. The most common cause of thoracolumbar fracture among males was trauma due to accident in 68.36% cases, while in 70.14% females it was due to fracture caused by osteoporotic changes. Overall success rate is not significantly different among those treated with percutaneous as compared to previously studied open surgery ($p > 0.05$) in terms of kyphotic deformity correction but in-hospital complication rate less significantly seen in patients operated with percutaneous approach as compare to open.

Conclusions: Minimally invasive Percutanous approach is not inferior to open method in terms of kyphotic angle correction for the management of patients with thoracolumbar fractures while complications rate and post-operative hospitalization duration were significantly reduced in patients treated with percutaneous method making it overall a safer technique.

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835

Brain and Spine 4 (2024) 103888

Innovative Probe for Safe Thoraco-lumbar Percutaneous Pedicle Screw Insertion

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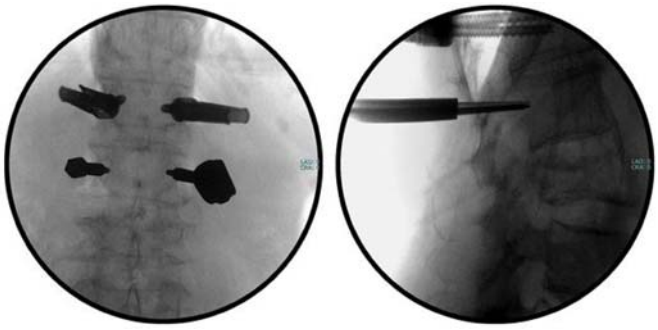
Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM

Background: During insertion of thoraco-lumbar percutaneous pedicle screw (PPS) under C-arm fluoroscopy, insertion probe is proceeded by anteroposterior (AP) view as first step, then it is converted to lateral view and proceeded more deeply. In this first step, there is risk of vascular penetration by too-deep insertion, since it is difficult to know how deeply inserted it is by AP view. To avoid such accident, novel probe is developed.

Methods: The feature of new probe is, the diameter of probe become thicker at the point of 30mm from the tip of probe. By the difference of diameter, the depth can be known. If the probe is inserted 30mm before probe tip reaches medial wall of pedicle, the depth is enough and C-arm is converted to lateral view. And oppositely if the probe tip reached medial wall too shortly, the angle of should be raised. The design and manufacturing were done by TAKAYAMA INSTRUMENT (Tokyo, Japan). Intraoperative C-arm image and postoperative CT scan of the patients received thoraco-lumbar PPS insertion is investigated.

Results: 36 PPSs were inserted with this probe for 6 cases. During surgery, the point of 30mm from probe tip was easily recognized. When probe was proceeded 30mm before reaching inner wall of pedicle, resistance due to sudden change of diameter could be felt. Then C-arm was changed to lateral view. Since the probe couldn't proceed more, guide wire was inserted more deeply. After removal of probe, rest of procedure was same as using traditional probe. There was no probe

insertion beyond anterior wall of vertebral body. Postoperative CT revealed adequate PPS position. Handling was equivalent to traditional probes.
Conclusions: This newly developed probe contributes for safe PPS insertion, without any expensive tools like navigation system. And the cost of probe itself is less expensive. It is recommended for use in C-arm assisted surgery for lower thoracic and lumbar spine, where the distance from the insertion point to the anterior wall of the vertebral body exceeds 30 mm.
Optional Image



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1286
Brain and Spine 4 (2024) 103889
Intraoperative CT in Neurosurgery: Insights and Applications Over a Decade

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: Image-guided surgery is a crucial tool in modern neurosurgery, enhancing the safety and extent of tumor resection (EOTR). Despite the established role of intraoperative magnetic resonance imaging (iMRI), intraoperative computed tomography (iCT) has proven beneficial when used in conjunction with intraoperative neuronavigation, fluorescence-guided surgery (FGS), and intraoperative ultrasound (iUS). This report shares our decade-long experience with routine iCT use to explore indications, advantages, and limitations in the surgery of various cerebral tumor histotypes.
Methods: We analyzed data from 639 patients treated from 2012 to 2022, divided into groups based on age (33 pediatric cases), sex, histotype, tumor location (555 supratentorial and 84 infratentorial), and the devices used (Ceretom and BodyTom, Neurologica). The role of iCT was examined and discussed across different subgroups in terms of identifying intraoperative residual, updating neuronavigation, checking adjacent bone structures in extra-axial tumors, and complications. The main histotypes studied included 164 high-grade gliomas (HGG), 68 low-grade gliomas (LGG), 72 metastases, 187 meningiomas, 23 pituitary adenomas, 41 vascular lesions, and 74 other histologies (lymphomas, neuroepithelial tumors, etc.).
Results: We analyzed the correlation between iCT-detected residual tumor presence and post-operative MRI (MRN) findings, alongside the removal of iCT-identified residuals. Sensitivity and specificity of iCT were calculated, showing 97.9% sensitivity and 93.5% specificity for HGG, 99.2% sensitivity and 95.6% specificity for metastases, and 98.4% sensitivity and 94.2% specificity for extra-axial tumors. For HGG, FLAIR and GadT1 volume resection rates were 78.8% and 98.8%, respectively. In 52% of LGG cases, further resection was performed integrating iUS. Meningioma studies assessed lesion-bone relationships. In pediatric cases, iCT confirmed the extent of resection. iCT did not significantly impact the early detection of hemorrhagic complications ($p > 0.05$).
Conclusions: This study highlights iCT's role in cerebral tumor surgery as an intraoperative imaging tool, impacting HGG EOTR, intraoperative residue evidence, and tumor margin definition.

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1282
Brain and Spine 4 (2024) 103890
Evaluation of Porous Titanium Microspheres in Kyphoplasty for Vertebral Compression Fractures: Outcome and clinical/radiological follow-up

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM
Background: Kyphoplasty, a minimally invasive surgery for vertebral compression fractures (VCFs), can alleviate pain and stabilize the spine. This study evaluates the effectiveness and safety of titanium microspheres in kyphoplasty, which may offer benefits over traditional polymethylmethacrylate (PMMA).
Methods: 31 patients (16 males, 15 females) who underwent kyphoplasty with titanium microspheres from January 2022 to December 2023 at our institution were reviewed. Data on demographics, fracture details, procedural specifics, pain scores (NRS), and quality of life (SF-36) were analyzed. Diagnostic imaging included X-ray, MRI, and CT. Vertebral Height Gain (VHG), Wedge Angle (WA) and Kyphosis Angle were measured. Adverse events and statistical analysis using RStudio version 23.12.0 were noted.
Results: The study included 31 patients with a mean age of 55.5 years with a mean follow-up of 14 months and 14 days. For each patient, the number and location of VCFs level treated were recorded. 26 Patients had an A1 fracture and 4 an A3 fracture according to AO Spine Thoracolumbar Classification System. Significant pain reduction was observed; mean NRS scores dropped from 7.28 to 2.96 ($p < 0.001$). Improvement in post-operative ODI was notable with mean 17.67% +/- 16.1. The SF-36 scores showed marked improvement in physical function and bodily pain domains at 12-month follow-up. Minimal complications were reported, with no microsphere issues, although one case required additional surgery due to post-surgical kyphosis.
Conclusions: Titanium microspheres in kyphoplasty are effective and safe for treating VCFs, providing significant pain relief and quality of life improvements. Titanium may be a superior alternative to PMMA, potentially reducing long-term complications. Further studies are recommended to confirm these results and compare with other materials.

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143
Brain and Spine 4 (2024) 103891
Assessment of Trigeminal Nerve Root Demyelination in Patients with Primary Trigeminal Neuralgia Using Macromolecular Proton Fraction Imaging

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Oral e-Poster Presentations - Booth 1: Functional 2, October 16, 2024, 4:40 PM - 5:20 PM
Background: Primary trigeminal neuralgia (PTN) is a prevalent chronic pain disorder. This condition is believed to be associated with demyelination and axonopathy within the trigeminal nerve. Previous studies in this field focused on using diffusion tensor imaging, which has limited sensitivity and specificity to myelin. In the present study, we assessed demyelination of the trigeminal nerve root via the macromolecular proton fraction (MPF) mapping technique. MPF demonstrated strong correlations with myelin histology in a number of earlier animal studies and is currently viewed as a promising clinical myelin biomarker.
Methods: Fifty-six patients with unilateral PTN and 27 healthy controls of the same sex and age were included in the study. All participants were evaluated using high-resolution brain magnetic resonance imaging, which included the MPF technique. MPF maps were analysed with the Horos Dicom Viewer, with manual ROI placement. MPF values from different parts of the trigeminal nerve root, such as the root entry zone (REZ) and middle and lateral cisternal segments, were extracted. Covariance analyses (ANCOVAs) were performed and included the group (PTN patients, healthy controls) as a factor between subjects, the MPF

values within different parts of the trigeminal nerve root as a dependent variable, and the age and sex of the patient as covariates.
Results: A statistically significant decrease in the average MPF of the affected trigeminal nerve root was observed in the PTN group compared to the healthy control group ($p < 0.01$, FDR corrected). Specifically, reductions in the MPF values of the REZ and middle segments of the affected trigeminal nerve root were found in patients with PTN compared to healthy controls ($p < 0.05$ and $p < 0.01$, respectively, FDR corrected). Additionally, we identified a significant reduction in the MPF in the root entry zone on the affected side compared to the contralateral side in patients with PTN ($p < 0.001$, FDR corrected). A trend toward a decrease in the average MPF was also found for the affected trigeminal nerve root compared to the contralateral nerve root ($p = 0.085$, FDR corrected).
Conclusions: Our preliminary results suggest that MPF could provide a new neuroimaging biomarker of the trigeminal nerve root impairment in patients with PTN and enable non-invasive detection of nerve root demyelination.

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95
Brain and Spine 4 (2024) 103892
Stereotactic Laser Interstitial Thermal Therapy (LITT) and preclinical tumororganoid-based drug-screening in recurrent high-grade glioma. First experiences from the Hi-SMILE study.

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: Laser interstitial thermal therapy (LITT) is a stereotactic approach to target small, difficult to resect tumors under MR-thermometric guidance. Tumororganoids are representative tumor avatars enabling ex-vivo drug-testing even from small tissue samples provided by stereotactic biopsies. The Hi-SMILE study is an ongoing trial to evaluate safety and efficacy of LITT and feasibility of preclinical tumororganoid-based drug screening in n=30 patients with recurrent high-grade glioma.
Methods: Patients are prospectively enrolled. Tumor volume, ablation coverage and accuracy of laser catheter placement are assessed. OR time, length of hospital-stay and complications are documented. Biopsy samples are used for tumororganoid formation. Ex-vivo drug-testing of up to 9 selected drugs is performed. Responses are classified as sensitive, intermediate or resistant.
Results: So far, n=9 patients (mean age 51.8 years) have been enrolled. Final histological diagnoses were glioblastoma (n=6), astrocytoma WHO 4° (n=2) and radiation necrosis (n=1). N=4 patients required 2 catheters to cover the desired mean tumor volume of 4.2 ml. Mean operative time was 194min of which a mean 103min were spent in the intraoperative MRI scanner. Ablation coverage was on average 138% and took 14min 30s per catheter. Laser catheters could be placed with a Euclidian distance of 1.1 mm and a mean radial error of 0.8 mm. Postoperative hospital stay was 2.1 days. One epileptic seizure occurred after surgery. It was always possible to test at least 5 drugs. Most tumors revealed a high level of drug resistance with only 1 case revealing drug sensitivity more than 1 drug.
Conclusions: Surgical accuracy and ablation coverage were high. LITT seems to be a safe and well-tolerated procedure. Progression free and overall survival need to be evaluated at the end of the trial. Tumororganoid-based drug-screening is feasible with tissue from stereotactic biopsies, however its impact on clinical decision-making is yet unclear.

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1380
Brain and Spine 4 (2024) 103893
Dysphagia following Odontoid Screw Fixation in the Geriatric Population-A Case-Control Study

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM
Background: Odontoid fractures commonly occur in the elderly population. Surgical approaches to manage these include anterior odontoid screw fixation (AOSF) and C1-C2 posterior fusion, while non-surgical methods involve use of hard collar cervical orthosis, or halo immobilization. A common complication in high cervical anterior approaches is dysphagia, particularly in the elderly which has not been extensively studied. This prospective study aims to assess the occurrence of long-term dysphagia following odontoid screw fixation in this cohort.
Methods: This study was a single-centre, matched case-control investigation with patients aged ≥65 with an acute odontoid fracture. Participants were divided into two groups: those who underwent AOSF and those treated with hard collar immobilization. The study retrospectively reviewed data on in-hospital adverse events, surgical complications, mortality, rates of revision surgeries, and their causes. The Dysphagia Outcome and Severity Scale (DOSS) was prospectively evaluated as the primary outcome. This involved long-term follow-up to evaluate swallowing in both groups. Furthermore, an analysis of records between 2015-2022 was conducted to determine the immediate impact on swallowing following treatment. Matching criteria were age, frailty scores, Charlson Comorbidity Indexes, and fracture morphology, with the Chi-squared test evaluating significance.
Results: 76 patients participated in this study, divided into 40 in the operative group and 36 in the non-operative group. The AOSF group exhibited a higher occurrence of dysphagia, with rates of 27.5% compared to 5% in the non-operative group ($p = 0.011$), indicating statistical significance. 13 patients in the operative group were given NG tubes post-fixation during their hospital stay, compared to 1 in the non-operative group.
Conclusions: In contrast to managing fractures conservatively in elderly patients, those undergoing ASOF appear to experience a higher rate of dysphagia. This complication is not only evident shortly after the surgical procedure but also persists long term. It is warranted to validate these findings in larger cohorts.

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192
Brain and Spine 4 (2024) 103894
Re-alignment and treatment options for traumatic spondylolisthesis and spondyloptosis in the subaxial cervical spine: A review of literature in cases without neurological deficits

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Oral e-Poster Presentations - Booth 2: Spine 6 (Trauma), October 16, 2024, 4:40 PM - 5:20 PM
Background: Cervical spondylolisthesis is most commonly trauma-induced and usually leads to severe and irreversible neurological deficits. Given that they are very biomechanically unstable, surgical treatment is the most common treatment option, but there are some controversies regarding the treatment modalities of patients without any neurological deficits.
Methods: A comprehensive review was conducted which included available scientific literature from internet databases (MEDLINE, PubMed, Embase, ClinicalTrials.gov) where 31 papers published in the period from 1970 to 2024 were analyzed together with references and relevant conference abstracts. Furthermore, 7 case reports and case series met the inclusion criteria for traumatic cervical spondylolisthesis without neurological deficits.
Results: Cervical spondylolisthesis, characterized by anterior or posterior dislocation of the vertebral body relative to the one below, is extraordinary unusual in the subaxial cervical spine (C3–C7). This condition, often associated with bilateral pedicle fractures or locked facets, is rarely observed, with only 17 cases of anterior complete luxation described in detail in the literature, mostly affecting male patients and presenting with tetraplegia and other serious neurological deficits. Our study contributes to this understanding by presenting a case of cervical subaxial dislocation due to bi-pedicular fractures in neurologically intact patients, with self-repositioning grade III spondylolisthesis, who was just treated conservatively without surgery, highlighting the rarity of post-traumatic spondylolisthesis without neurological deficits. Furthermore, cervical alignment alone may lead to favorable outcomes.
Conclusions: Conclusions: Our research highlights the importance of recognizing subaxial cervical spondylolisthesis and the need for more precise treatment guidelines, bearing in mind the complexity of spine realignment, operative challenges and reduction of neurovascular complications.

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1247

Brain and Spine 4 (2024) 103895

Clinical, radiological, neurocognitive, and patient reported outcomes following surgical treatment of arachnoid cysts in adults

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Arachnoid cysts (AC) are incidental findings often managed conservatively. Limited literature on the effectiveness of surgical management in symptomatic patients exists. We aim to present our case series focusing on clinical, radiological, neurocognitive and patient-reported-outcomes (PROMs).

Methods: Retrospective case series of adult patients undergoing surgical treatment of AC in 2010-2024. Primary outcome was clinical improvement of the main presenting symptoms. Secondary outcomes were AC volumetric changes, neurocognitive outcome, revision rate, PROMs and mortality.

Results: 2349 AC were radiologically diagnosed from 2010-2024. During this time, 18 patients (0.77%) were surgically treated. Out of these patients (median age of 54 (range 20-82) years), 7 (38.8%) had convexity, 4 (22.2%) middle fossa, 5 (27.7%) retrocerebellar, 1 (5.5%) cerebellopontine angle and 1 (5.5%) quadrigeminal cistern AC. The main preoperative symptoms were headache (61.1%), cognitive decline (44.4%) and nausea (16.6%). Thirteen (72.2%) patients underwent endoscopic fenestration, 3 (16.6%) microsurgical fenestration and 1 (5.5%) underwent cystoperitoneal shunt placement. During follow-up duration (median 1.3 (range 0-7.4) years) cyst volume decreased by a mean of 44.5% (SD30.4%).Clinical symptoms improved at the last follow-up in 17 (94.4%) patients. The relative AC volume reduction was not associated with an improvement in clinical symptoms. Four (22.2%) patients underwent neuropsychological examinations before surgery and at follow-up. Preoperatively these patients showed neurocognitive deficits in memory (100%), concentration (75%) and execution (50%). These deficits improved in all patients at last follow-up. Overall, 3 (16.6%) patients required revision surgery due to ventriculitis, hydrocephalus or insufficient fenestration. No mortality occurred. To further evaluate the impact of surgical treatment on the patient's quality of life, PROMs were collected and are currently being analyzed.

Conclusions: Surgical treatment of AC seems to be effective in selected patients, leading to improvement of clinical symptoms and neurocognitive function, with a low morbidity rate.

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144

Brain and Spine 4 (2024) 103896

Does Cerebrospinal Fluid Flow Imaging Aid Decision Making for Surgical Decompression in Chiari Malformation Type 1: Comparison of Symptoms Using Modified Rankin Scores

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Indications for surgical decompression of Chiari malformation type 1 (CM1) includes severity of symptoms and neuroimaging findings. Despite so, up to 45% of patients reported no improvement or worsening of their symptoms following surgery. Previous studies have shown that there were significant changes between pre-operative and postoperative cerebrospinal fluid (CSF) dynamic imagings which correlates with improved headaches post-operatively. This study aims to investigate if the use of phase-contrast MRI brain (pC-MRB) improves their post-operative symptoms objectively measured using the Modified Rankin Score (MRs).

Methods: Adults with CM1 were identified retrospectively from the Skull Base Multidisciplinary Team meeting from 2018 to 2021. Only adult patients who underwent Foramen Magnum Decompression (FMD) were included. Patient records were reviewed to obtain information on their characteristics, symptoms based on MRs (pre-operative and post-operative), and the presence of pC-MRB.

Results: Twelve patients were identified to have undergone FMD, of which 6 patients had pC-MRB prior to surgery whilst 6 patients did not. All pC-MRB demonstrated reduced CSF flow through the foramen magnum either anterior, posterior or both in relation to the spinal cord. The maximal follow-up period for our cohort ranges from 3 months to 3 years (median: 10.5 months). Of the 6 patients who had pre-operative pC-MRB, 4 (66.67%) demonstrated improvements in MRs, whereas 2 (33.33%) patients showed no changes. Of the 6 patients who did not have pC-MRB, 2 (33.33%) patients showed improvements in MRs, 2 (33.33%) patients showed no changes whilst 2 (33.33%) patients showed worsening in MRs.

Conclusions: To our knowledge, this is the first study to objectively quantify symptomatic changes based on MRs in CM1 group undergoing FMD. pC-MRB has been shown to be beneficial in aiding decision making for both clinicians and patients to decide suitability of surgical decompression.

Optional Image

CSF flow imagings done	Initial symptoms	Results of phase-contrast MRI brain	Pre-surgical Modified Rankin score	Post-surgical Modified Rankin score
	Cough headache, exacerbated by sneeze and strains. Pulsatile tinnitus. Brisk reflexes.	Restriction of CSF flow through Foramen Magnum	2	1
	Headache, weak in upper limbs, dizziness, pain across shoulder	Minimal flow posteriorly but preserved anterior flow	2	0
	Intermittent blurred vision, nausea, vomiting and pain in the cape region	Reduced flow posteriorly and anteriorly	2	1
	Headache, nausea, vertigo, vomiting, blurred vision	Anterior flow preserved but posterior flow not seen	2	2
	Headache, left sided deafness, left upper eyelid blepharospasm, dizziness	Reduced flow anteriorly with no flow posteriorly	2	1
	Headache with left hemisensory symptoms	Reduced CSF flow posteriorly	2	2
No CSF flow imagings	Headache, vertigo, double vision, and photophobia	None	2	3
	Upper shoulder and arm weakness with numbness, loss of balance and co-ordination, unable to walk without assistance		4	4
	Headache, left arm paraesthesia and dizziness		2	2
	Neck pain and upper limb pain		3	2
	Urinary incontinence		1	2
	Neck pain on coughing		1	0

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1295

Brain and Spine 4 (2024) 103897

Postoperative monitoring after brain tumor surgery: an evaluation of postoperative care on a PACU

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM

Background: For years brain tumor patients postoperatively went to ICU. In the last years new concepts like PACU (post anesthesia care unit) made it possible to operate patients that need extensive postoperative care without having to hold ICU beds available. In our clinic we use this concept since a few years. Our abstract shows an equal amount of complications in the early postoperative phase in comparison to the known literature.

Methods: We performed a single center cohort study including all patients suffering from brain tumors operated upon from 2014 to June 2023. We only included patients that underwent resection or open biopsy. Data assessment included pre- and postoperative symptoms, early postoperative complications (first 3 days), long-term complications and preoperative risk factors like localization of the tumor and anticoagulants.

Results: We retrospectively collected data on 3570 patients operated upon between 2014 and June 2023. The mean age at operation was 58 years, 51% of the patients were female. 96.5% of patients went to PACU, only 3.5% postoperatively went to the ICU in the first place. Reasons were pulmonary and other systemic infections in 15 cases, intraoperative bleeding or difficult localisation in 90 cases,

reduced preoperative consciousness in 2 cases complex secondary diagnoses in 4 cases and germ colonization in another 5 cases. Secondary another 2% went to the ICU after 1 day at PACU. In our cohort we observed a early postoperative complication rate of 4,8%. Of those 93 cases presented with new and persistent hemi-symptomatic, 17 cases with re-bleeding, 37 cases with facial nerve paralysis and 25 cases with new aphasia.
62.5% occurred at the first, 27% at the second and another 10.5% occurred at the third postoperative day.
Conclusions: In our large cohort, we show complications-rates which are comparable to the current literature. A visit to the ICU was only necessery in severe secondary diagnoses e.g. Covid-infections or heart diseases. Our findings support the safe use of a PACU as an alternative for an ICU with equal complications but easier access and the use of fewer resources.

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962
Brain and Spine 4 (2024) 103898
Molecular Insights Into Human Hydrocephalus

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM
Background: Hydrocephalus research suggests a complex pathogenesis beyond circulatory disturbances, warranting exploration of genetic and molecular aspects in hydrocephalus pathogenesis, especially in congenital disorders such as X-linked hydrocephalus and related conditions like primary ciliary dyskinesia and Dandy-Walker malformation. The emergence of Clustered Regularly Interspaced Short Palindromic Repeats and CRISPR-associated protein 9 (CRISPR/Cas9) genome editing has facilitated the creation of transgenic rat models, such as the L1-cam knockout model of X-linked hydrocephalus (XLH), providing insights into the genetic basis of this condition. Diffusion tensor imaging (DTI) reveals early periventricular white matter tract injury in hydrocephalus, emphasizing the need for advanced imaging techniques.
Methods: In the present paper, we are reviewing literature data from scholarly databases to document molecular landscape underlying hydrocephalus pathogenesis.
Results: Genetic and molecular investigations reveal associations between hydrocephalus and congenital disorders, notably X-linked hydrocephalus linked with L1-CAM mutations, alongside complex pathologies like primary ciliary dyskinesia and Dandy-Walker malformation. Emerging research avenues, including downregulation of Aquaporin 1 (AQP1) implicated in CSF production, offer potential for improved diagnostic and therapeutic strategies.
Conclusions: Hydrocephalus research reveals a complex interplay of genetic, molecular, mechanical, and physiological factors shaping disease pathogenesis. While previous hypotheses such as the cilia hypothesis are reevaluated, novel insights into AQP downregulation, neural development disruption, and the glymphatic flow hypothesis redefine our understanding of hydrocephalus etiology. This multifaceted approach underscores the need for comprehensive investigation integrating advanced technologies and interdisciplinary collaboration to advance diagnostic precision and therapeutic interventions in hydrocephalus management.
Optional Image

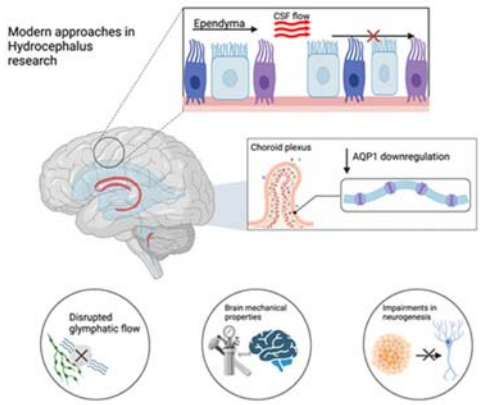


Figure 1: Modern perspectives in hydrocephalus pathogenesis research: Up: Contrasting evidence for the cilia hypothesis, Middle: Alterations in the molecular substrate of ependymal cells, including AQP1 downregulation, Bottom left: The glymphatic flow disruption hypothesis, Bottom middle: Addressing the issue of the mechanical properties of the brain in controlling CSF flow, Bottom right: Impairments in neurodevelopment and stem cell fate determination impacting hydrocephalus pathogenesis. *CSF: Cerebrospinal fluid, AQP1: Aquaporin 1*

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326
Brain and Spine 4 (2024) 103899
Investigation of Angiotensin-Converting Enzyme (ACE) Gene Polymorphism in High-Grade Glial Tumor

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: Glioblastoma, a frequently encountered glial tumor in the central nervous system, is characterized by a short survival period. Despite existing treatments, the high recurrence rates prompt the exploration of additional therapeutic options. The insertion/deletion polymorphism in the angiotensin-converting enzyme (ACE) gene is known to be associated with cancer by regulating the production of vasoactive angiotensin II. This genetic variation may play a role in cancer development by influencing ACE levels. The effects of ACE on tumor cells, regulating cell proliferation, migration, inflammation, and angiogenesis, suggest a potential role in combating cancer. Therefore, the association of ACE I/D polymorphism with various cancer types, including brain tumors, particularly glioblastoma, supports the hypothesis that it may be a risk factor. The aim of this study is to investigate the potential relationship between ACE I/D polymorphism and glioblastoma in the Turkish population and evaluate the role of this genetic variation in identifying therapeutic targets for cancer treatment.
Methods: A total of 49 patients and 45 healthy control subjects were included in the study. DNA samples were isolated, and ACE polymorphism genotyping analysis was performed using the 7500 Fast Real-Time PCR system. Statistical analyses were conducted using SPSS Statistics 23, considering a significance level of $p<0.05$. Nucleotide sequences used in the study were determined, and an amplification mixture was prepared for target gene amplification using the ABI 7500 Real-Time PCR system. Genetic analysis results were evaluated through the device's proprietary software, identifying the insertion/deletion genes. The study

was conducted with the approval of the Yeditepe University Hospital Ethics Committee.

Results: According to the results obtained in the study, no significant difference was observed in ACE genotype distribution between the groups (p=0.171). However, when evaluated based on the ACE deletion allele frequency, it was observed that carrying the deletion increased the risk of tumor formation four-fold. Additionally, it was determined that individuals carrying the D allele were more prevalent in the patient group, and this difference was found to be significant (p=0.027). This indicates that ACE deletion increases the risk of the disease, and not carrying the deletion is a protective factor.

Conclusions: Comparing the study results with the information in the literature, the findings support the potential relationship between glioblastoma and ACE gene polymorphism. It is suggested that ACE deletion increases the risk of tumor formation, and this gene polymorphism may be effective in the pathogenesis of brain tumors. The study investigated the relationship between ACE I/D polymorphism and glioblastoma in the Turkish population, revealing that ACE deletion increases the risk of tumor formation. These findings emphasize the importance of considering ACE gene polymorphism in determining potential therapeutic targets for glioblastoma treatment.

Optional Image

ACE	Glioma (n=35)	%	Control (n=36)	%	p-value	Chi-square
Genotype						
II	3	8,6	8	22,2	0,171	3,527
ID	19	54,3	13	36,1		
DD	13	37,1	15	41,7		

n: number of individuals; Values are reported as number of patients (percentage of the total group). *p values less than 0.05 denoted statistical significance.

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293

Brain and Spine 4 (2024) 103900

Surgical management of syringomyelia associated with spinal arachnoid cyst: clinical and radiological outcomes

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Syringomyelia associated with spinal arachnoid cyst (SAC) is a rare disease entity. This study aimed to analyze the surgical management of SAC in patients with syringomyelia, focusing on clinical and radiological outcomes.

Methods: A total of 135 patients with syringomyelia (not included were patients with neoplastic lesions associated with syringomyelia) underwent surgery at our department between November 2003 and December 2022. All patients underwent magnetic resonance imaging (MRI), with a special syringomyelia protocol (including TrueFISP and CINE), and electrophysiology. Among these patients, we searched for patients with SAC with syringomyelia following careful analysis of patient documents (including neuroradiological and neuropathological data, surgical reports and follow-up data). Patients were evaluated for initial symptoms, surgical strategies, and complications, furthermore clinical and radiological outcomes.

Results: In 17 patients (12,59%) of the 135 patients, the syringomyelia was associated with a SAC. The mean patient age was 51± 12.37 years. 12 patients were male, and 5 were female. The extension of syringomyelia involved in one case only the cervical, in nine cases the cervicothoracic, in four cases only the thoracic, in two cases the thoracolumbar and in one case the cervicothoracolumbar spinal cord. Complete removal of SAC was achieved in 16 cases, fenestration of the SAC was performed in one case. Postoperatively, one patient needed revision surgery due to spinal epidural bleeding in the level of the SAC. In first follow-up (mean duration was 3,7 months) the size of syringomyelia decreased in 16 cases (in two cases the syringomyelia was even not detectable anymore), in one case the size of syringomyelia was unchanged. Clinical symptoms improved in 15 cases and were unchanged in two cases.

Conclusions: In summary SACs can be safely treated by surgery. Clinical symptoms and syringomyelia improves in most cases after surgery.

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1338

Brain and Spine 4 (2024) 103905

Neuromodulation hypothesis in Normal Pressure Hydrocephalus

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Normal Pressure Hydrocephalus (NPH) is a syndrome associating gait impairment, cognitive decline, incontinence and ventriculomegaly caused by CSF mechanics disturbance.

One of the proposed mechanisms to explain NPH symptoms is subcortical chronic ischemia related to cerebrovascular disease, but does not fully explain the reversibility of signs.

NPH often presents with symptoms that are similar to other types of movement or higher-level gait disorders.

Is NPH a simple fluid accumulation problem, or a more complex neurological condition?

We would like to raise an hypothesis of neuromodulation in NPH.

Methods: We reviewed literature to explore whether i) network scale dynamics and ii) intrinsic brain mechano sensitivity might be involved in the development of NPH.

Results: Advanced MRI suggests that NPH may be associated with reversible suppression of frontal periventricular cortico-basal ganglia-thalamo-cortical pathways. Neural circuitry, synaptic plasticity and neural activity should be addressed in NPH.

Reversible intrinsic brain nechanosensing is involved in neuronal cell regulation and should be involved in NPH basal ganglia dysfunction.

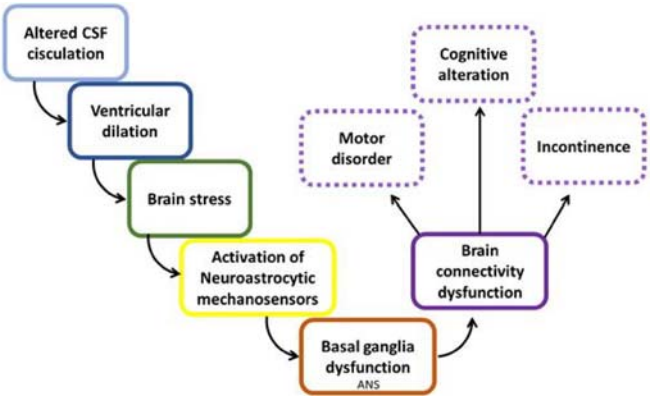
Conclusions: We hypothesize the following neuromodulation to at least partially explain symptoms in NPH

1. Altered CSF circulation with accumulation of fluid
2. Ventricular dilation with normal pressure
3. Fluid pressure stretches periventricular brain tissue
4. Activation of brain stem neuroastrocytic mechanosensors
5. Basal ganglia dysfunction
6. Brain connectivity dysfunction
7. Clinical symptoms

Reducing brain stress with a shunt, might modulate neural activity and brain connectivity that improve symptoms.

Our hypothesis of neuromodulation in NPH requires closer scrutiny and further study.

Optional Image



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1430
Brain and Spine 4 (2024) 103906
Predictors of Cerebrospinal Fluid Shunt Success in Idiopathic Normal Pressure Hydrocephalus: A Systematic Review

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Idiopathic normal pressure hydrocephalus (NPH) is the most common type of adult hydrocephalus. Gait, cognitive and urinary disturbances are the most commonly presenting symptoms however, definitive diagnosis is not possible solely based on the clinical picture and according to guidelines definitive diagnosis can only be established retrospectively after a positive response to ventriculoperitoneal shunt surgery (VPS) is achieved. We aim to summarize current evidence of the predictive value of reported parameters for cerebrospinal fluid (CSF) shunting success in patients with NPH.
Methods: We conducted a systematic review of literature in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. We searched the PubMed database for articles published until February 2024 using the following search algorithm: (((((((shunt, ventriculoperitoneal[MeSH Terms]) OR (ventriculo gall bladder shunt)) OR (ventriculoatrial shunt)) OR (ventriculopleural shunt)) OR (thecoperitoneal shunt)) OR (lumboperitoneal shunt))) AND (hydrocephalus, normal pressure[MeSH Terms]) Filters: English, Humans. We included studies reporting clinical or radiological outcomes of CSF shunting for NPH. We excluded secondary NPH, studies in any language other than English, non-clinical studies, non-primary research, and case reports. Two independent reviewers assessed each abstract and all included abstracts for eligibility. Any disagreement was resolved by consensus of both reviewers. Relevant data was extracted into a pretested master table based on current literature.
Results: 475 abstracts were screened, and 253 were reviewed in full text. 122 studies of 9131 patients were included in our analysis after full text review. VPS was performed more commonly than lumboperitoneal shunting mostly using programmable valves. Gait was the most common symptom assessed pre- and postoperatively, followed by cognition and incontinence, respectively. The callosal angle was the most investigated radiological sign investigated preoperatively other than ventriculomegaly. Postoperative follow-up ranged form 1 week to >5 years. 5542 patients showed improvement after shunting.
Conclusions: VPS is an effective treatment for NPH. Gait disturbances are commonly reported in NPH and might be a reliable clinical indicator for VPS success. However, further investigation is necessary.

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964
Brain and Spine 4 (2024) 103907
Fluorescein Guided Surgical Treatment of D7-D8 CSF-Venous Fistula: Case Report and Literature Review

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: An anomalous outflow of cerebrospinal flow (CSF) from spinal subdural periradicular space to veins of internal or external vertebral plexus, or basivertebral plexus is hypothesized as the pathogenic mechanism of CSF-Venous Fistula (CVF). It is a rare cause of spontaneous intracranial hypotension (SIH) and very difficult to detect.
Methods: The authors reported a case of CVF and a narrative non-systematic review with a specific analysis on the use of intraoperative fluorescein.
Results: since 2011, 111 surgical approaches were reported, but with intrathecal fluorescein in only 4 patients. Following diagnosis of bilateral thin (3mm) hygroma and thrombosis of Superior Sagittal Sinus and left Trolard Vein at Angio-CT scan and angio-MRI, a 58 years-old man was investigated with serial cranial CT scans, due to the persistent 3-months history with olocranic headache, nausea and vomiting. Due to a fluctuating postural aspect of symptoms, in the suspicion of SIH, a spinal MRI was performed, but no CSF leak was identified. Because of persisting symptoms, a spinal myelography disclosed a D7-D8 right CVF.
The patient underwent, a minimal invasive right D7-D8 foraminotomy, through a paramedian skin incision. A 4 ml of solution of fluorescein and ringer lactate (10%) was intrathecally injected through a percutaneous lumbar catheter. A filling of D8 nerve root and of two pararadicular fistulous veins was observed 2 minutes after injection. Thus, the coagulation of the anomalous communication has been optic guided by fluorescein uptake. Patient had immediate post-operative complete regression of symptoms. Radiological findings confirmed the treatment.
Conclusions: CVF should be considered a cause of SIH, when no other causes are detected on basic neuroradiological workout, especially with persistent symptoms. Myelography is the key for the diagnosis. Intrathecal intraoperative fluorescein allows the visualization of the CVF, the proper coagulation of the draining vein and the confirmation of the CVF occlusion.
Optional Image

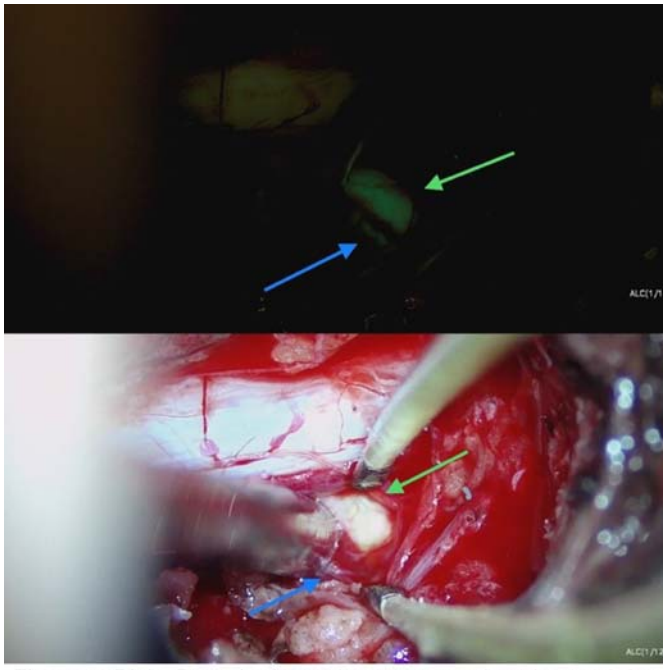


Figure 1: Right D8 spinal root (green arrows) and one of the radicular fistolous vein (blue arrow). Correlation between intra-operative fluorescein filter and normal vision.

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322
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Prospective investigation of the relationship between preoperative melatonin levels and typical symptoms in patients with pineal cysts

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Oral e-Poster Presentations - Booth 4: Adult CSF 2, October 16, 2024, 4:40 PM - 5:20 PM

Background: Melatonin (ML) is synthesized in the pineal gland and is subject to a circadian rhythm. Patients with symptomatic pineal cysts (PC) - who do not have hydrocephalus - suffer from a variety of symptoms in addition to cephalgias and sleep disorders. However, the pathomechanism is still unclear - a disturbed ML secretion is being discussed. However, the data regarding melatonin levels in patients with PC is still insufficient.

Methods: As part of a prospective study in patients with symptomatic PC, we examined the preoperative ML level in the saliva in a half-hour rhythm between 08:30 p.m. and 01:00 a.m.. In addition, symptoms, in particular sleep quality and pain, were recorded over a week with the help of a diary. We analyzed the relationship between symptoms and the ML level using Spearman's correlation and the deviation of the melatonin level from the normal values using a Wilcoxon test.
Results: A total of eight female patients have been included so far. The average age was 36.3 years. The average size of the PC was 12.3 mm. The patients had been suffering from symptoms for an average of 3.2 years. They were able to sleep on 2.7 out of 7 days, problems falling asleep occurred on 3.6 out of 7 days. Headaches occurred on an average of 5.6 out of 7 days. Four of the 8 patients suffered from continuous headaches. The severity of the headaches was on average 3 to 7 on the VAS. 50% of the patients (n=4) reported nausea. Visual disturbances and fatigue were only present in 25% (n=2) of the patients. There was no significant correlation between the size of the PC and the ML level. The ML level at 8:30 p.m. correlated significantly with problems sleeping through the night (p= 0.006). There was no significant correlation between ML level and the other symptoms recorded. However, the ML values deviated significantly from the reference values, particularly due to a lack of increase in ML concentration during the night. While three patients were still within the normal range at 8:30 p.m., from 10:00 p.m. only one was, and from 00:30 a.m. all patients were below the normal range. The deviation from the reference values was statistically significant for the measurements at 8:30 p.m. (p=0.0469), 09:30 p.m. (p= 0.0078), 10:00 p.m. (p=0.0078), 10:30 p.m. (p= 0.0156), 00:30 a.m. (p= 0.047) and 01:00 a.m. (p= 0.047).
Conclusions: The ML level in patients with symptomatic PC deviates significantly from normal ML levels. In particular, a lack of increase at night can be observed, which may provide an explanation for the symptoms. The lack of correlation with symptoms in our group can be attributed to the fact that no symptom-free comparison group was analyzed.

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413
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Cognitive Reserve Index questionnaire – Prognostic relevance in neurosurgery

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Oral e-Poster Presentations - Booth 3: Neuro-Oncology 9 (GBM & malignant gliomas), October 16, 2024, 4:40 PM - 5:20 PM
Background: The Cognitive Reserve Index Questionnaire (CRIq) is a validated tool that measures cognitive reserve, reflecting the brain's resilience to neuropathological damage and its compensatory mechanisms. This study aims to conduct a comprehensive analysis of variations in CRIq scores and the underlying factors among diverse neuro-oncological and neuro-vascular diseases.
Methods: In this pilot series, all patients attending our neuro-oncology outpatient clinic over a 7-month period (October 2022 to April 2023) and patients with subarachnoid hemorrhage (SAH) between April and October 2023 were requested to complete the CRIq questionnaire. Data analysis adhered to the established "Instructions for the administration of the CRIq" (Nucci et al., 2012) and was correlated with epidemiological data. Patients were categorized by age, marital and parental status, tumor malignancy, WHO Grading System, Hunt and Hess Scale, treatment modality, and tumor/SAB/aneurysm localization. Statistical analyses were performed using Prism for Windows 10 (Version 8.4.2, GraphPad Prism).
Results: Neuro-oncology: The study encompassed a cohort of 173 neuro-oncological patients. Among them, 105 individuals (60.7%) fully completed the CRIq questionnaire, allowing for CRI calculation. CRI scores were distributed as follows: 0.95% low, 2.85% medium-low, 67.62% medium, 19.04% medium-high, and 9.52% high (as defined by Nucci et al.). Age and parental status had a statistically significant impact on CRI, while gender did not. Interestingly, a significant increase in CRI scores was observed in highly malignant diseases such as glioblastoma (mean CRI score of 116.63 ± 13.18) compared to less malignant ones like low-grade gliomas (mean CRI score of 99.57 ± 8.18) (two-tailed p-value of 0.0063, Mann-Whitney test).
SAH: Our participant cohort comprises 32 individuals diagnosed with SAH between April and December 2023. Among them, 5 refused to participate, and 10 individuals were omitted, leaving us with our cohort of 17 patients. We found no statistical significance between different treatment modalities (namely incidental SAHs with or without treatment and SAHs with or without aneurysms) or gender. We observed an upward tendency in adult and elderly patients, though without statistical significance. There was a statistically significant increase in cognitive reserve in patients with children in both populations alike (p = 0.0178, two-tailed t-test).
Conclusions: Neuro-oncology: The study encompassed a cohort of 173 neuro-oncological patients. Among them, 105 individuals (60.7%) fully completed the CRIq questionnaire, allowing for CRI calculation. CRI scores were distributed as follows: 0.95% low, 2.85% medium-low, 67.62% medium, 19.04% medium-high, and 9.52% high (as defined by Nucci et al.). Age and parental status had a statistically significant impact on CRI, while gender did not. Interestingly, a significant increase in CRI scores was observed in highly malignant diseases such as glioblastoma (mean CRI score of 116.63 ± 13.18) compared to less malignant ones like low-grade gliomas (mean CRI score of 99.57 ± 8.18) (two-tailed p-value of 0.0063, Mann-Whitney test).
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627
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INDIGO: A global, randomized, double-blinded, phase 3 study of vorasidenib versus placebo in patients with residual or recurrent grade 2 glioma with an IDH1/2 mutation

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Molecular neuro-oncology - from basic research to clinical applications (Neuro-Oncology Parallel Session), Hall 07, October 14, 2024, 8:00 AM - 9:30 AM
Mutations in isocitrate dehydrogenase 1/2 are known oncogenic drivers. In brain tissue, these mutations lead to the development of a slow progressive, malignant brain cancer; mIDH1/2 glioma. Current treatments for mIDH1/2 glioma – surgery followed by radiation/chemotherapy – are not curative and are associated

with serious and debilitating long-term toxicities. Vorasidenib (VOR) is a dual inhibitor of mIDH1/2 with proven brain-penetrance. We evaluated VOR as a treatment for mIDH1/2 glioma in a global phase 3 study (INDIGO study - NCT04164901).

Methods: Patients with residual or recurrent grade 2 mIDH1/2 oligodendroglioma or astrocytoma who met the following key eligibility criteria were enrolled: ≥12 years of age; KPS >80; measurable non-enhancing disease; no prior treatment for glioma (except surgery) with most recent surgery 1-5 years from randomization; and not in immediate need of chemotherapy/radiation. Patients were stratified by 1p19q status and baseline tumor size and randomized 1:1 to receive VOR 40 mg or placebo (PBO) daily in 28-day cycles. Study endpoints included radiographic progression-free survival (PFS) by blinded independent review committee (BIRC), time to next intervention (TTNI), tumor growth rate (TGR), derived by BIRC and defined as percentage change in tumor volume every 6 months, health-related quality of life (HRQoL) by the Functional Assessment of Cancer Therapy – Brain (FACT-Br) questionnaire, as well as neurocognition and seizure activity by means of a validated battery of cognitive performance instruments and a patient diary, respectively.

Results: 331 patients were randomized: 168 to VOR and 163 to PBO. Patient demographics as follows: median age = 40.4 years (range, 16 to 71); KPS-100 = 53.5%; histological subtype = oligodendroglioma (n=172) and astrocytoma (n=159); median time from last surgery until randomization = 2.4 years. PFS by BIRC was statistically significant in favor of the VOR arm (HR, 0.39; 95% CI, (0.27, 0.56); P=0.000000067). Median PFS: VOR: 27.7 mos; PBO: 11.1 mos. TTNI was statistically significant in favor of the VOR arm (HR, 0.26; 95% CI, (0.15, 0.43); P=0.000000019). Median TTNI: PBO: 17.8 mos; VOR: not reached. Post-treatment TGR was −2.5% (−4.7, −0.2) with VOR and 13.9% (95% CI 11.1, 16.8) with placebo. TGR pre- and post-treatment with VOR was 13.2% (10.3, 16.3) and −3.3% (−5.2, −1.2), respectively (difference, −14.6% [−17.9, −11.1]; n=56). TGR pre- and post-treatment with placebo was 18.3% (15.0, 21.7) and 12.2% (9.5, 14.9), respectively (–5.2% [–9.3, –0.9]; n=67). VOR treatment led to a decrease in TGR versus placebo and tumor shrinkage was seen following treatment with VOR. HRQoL and neurocognition was preserved and seizure control maintained.

All-grade adverse events (AEs) occurring in >20% pts receiving VOR vs PBO were alanine aminotransferase increased (38.9% vs 14.7%), COVID-19 (32.9% vs 28.8%), fatigue (32.3% vs 31.9%), aspartate aminotransferase increase (28.7% vs 8.0%), headache (26.9% vs 27.0%), diarrhea (24.6% vs 16.6%), nausea (21.6% vs 22.7%). Common grade ≥3 AEs (>5%): ALT increased (9.6% vs 0%).

Conclusions: VOR is the first effective targeted therapy for the treatment of patients with IDH1/2 mutant diffuse glioma who have predominantly non-enhancing disease and who are not in immediate need of radio- and chemotherapy.