European Radiology

NEURO Open Access

Smaller WEB devices show lower retreatment rates than larger devices: results from the WorldWideWEB study

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Abstract

Objectives Small Woven EndoBridge (WEB) devices (≤ 4.5 mm) for the intracranial aneurysm treatment are technically challenging to deploy, with limited efficacy and safety data. This study compared functional, angiographic, and safety outcomes of small WEBs with large (> 4.5 mm) and very large (> 7.5 mm) WEBs.

Materials and methods The WorldWideWEB consortium is a retrospective, multicenter collaboration across 30 international institutions including adults with intracranial aneurysms treated with WEB. Patients were stratified into small (≤ 4.5 mm) and large (> 4.5 mm) groups; a subanalysis compared small with very large (> 7.5 mm) devices. Primary outcome was retreatment rate. Secondary outcomes included modified Rankin Scale (mRS), angiographic outcomes periprocedurally and last follow-up (FU), and safety events (intracranial hemorrhage (ICH) and thromboembolic complications (TECs)).

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Results Among 1473 patients, 229 (15.5%) received small WEBs. Baseline characteristics were similar. Small WEBs showed lower retreatment (4.3% vs 8.8%, $p = 0.04$) and higher complete occlusion (periprocedurally: 57.1% vs 36.6%, $p < 0.01$; FU: 76.2% vs 58.5%, $p < 0.01$). Median mRS was comparable (1 [1–2] vs 1 [1–2], $p = 0.88$), as was safety (ICH 2.6% vs 0.9%, $p = 0.10$; TECs 3.1% vs 3.9%, $p = 0.69$). Very large WEBs had higher retreatment (16.1%, $p < 0.001$) and lower complete occlusion (periprocedurally: 32.2%, $p < 0.001$; FU: 50.5%, $p < 0.001$), with comparable safety (ICH 0.9%, $p = 0.27$; TECs 4.5%, $p = 0.51$).

Conclusion Small WEBs demonstrated lower retreatment, superior anatomic and comparable clinical outcomes compared with large devices, with similar safety profiles.

Key Points

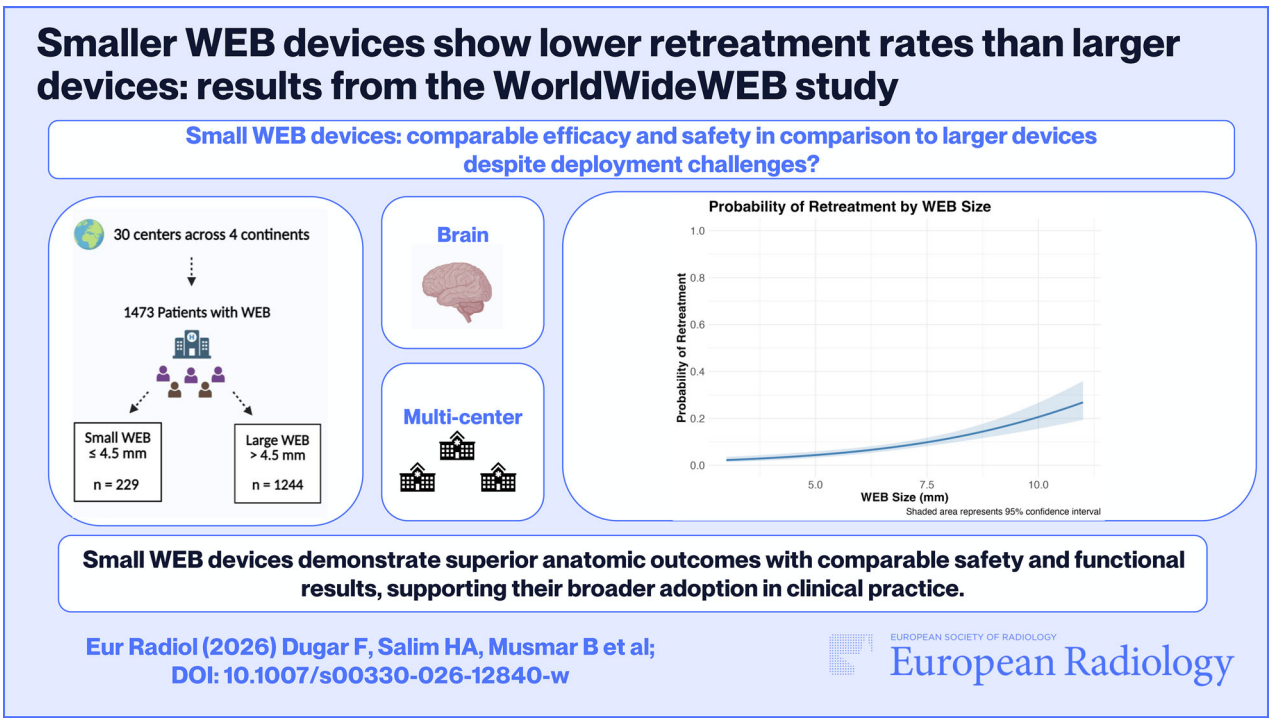
Question *Do small Woven EndoBridge devices have comparable efficacy and safety to larger devices for intracranial aneurysm treatment despite technical deployment challenges?*

Findings *Small Woven EndoBridge devices (≤ 4.5 mm) achieved lower retreatment rates and superior angiographic occlusion compared with larger devices, with similar safety and functional outcomes.*

Clinical relevance *These findings support the use of small Woven EndoBridge devices for appropriately sized aneurysms, providing reassurance that deployment challenges do not translate into worse clinical outcomes, while superior anatomic outcomes may encourage their broader adoption in clinical practice.*

Keywords Device size, Endovascular treatment, Intracranial aneurysm, Woven EndoBridge (WEB)

Graphical Abstract



Introduction

The Woven EndoBridge (WEB) device is a well-established treatment option for intracranial aneurysms, offering an alternative to conventional coiling or stent-assisted techniques. Several large prospective studies—including WEBCAST, WEBCAST-2, the French Observatory, WEB-IT, and CLARYS—have consistently demonstrated a favorable safety and efficacy profile of the WEB device [1–4].

Despite these advances, most available data are derived from earlier generations of the WEB system, particularly before the introduction of the smaller devices, such as WEB-17. While newer device generations expand the treatment spectrum to include small and technically challenging aneurysms, concerns remain that they may be more difficult to deploy, less stable, and potentially associated with higher complication or retreatment rates.

Longer procedure times may contribute to an elevated risk of ischemic and hemorrhagic complications [5]. Previous studies on coil embolization have already highlighted that treatment of smaller aneurysms is technically demanding, with higher risks of protrusion, rupture, and technical failure [6, 7]. Importantly, limited data are available on the comparative safety and efficacy of the WEB device in small versus large intracranial aneurysms. Most prior reports either focused on the device in general or included only a small subset of patients treated with the small WEB device [5, 8–12].

Therefore, we conducted a retrospective multicenter cohort study to compare the efficacy and safety profiles of small (≤ 4.5 mm) and large (> 4.5 mm) WEB devices. We hypothesized that smaller WEBs may present greater technical challenges during deployment and could be associated with different occlusion and complication profiles compared to larger devices.

Methods

Study design and participants

The WorldWideWEB consortium is a retrospective study based on data collected from 30 academic institutions across Europe, North and South America, and Australia [13]. All consecutive adult patients (age ≥ 18 years) with ruptured and unruptured intracranial aneurysms treated with the WEB device were eligible for inclusion. Patients were excluded if WEB device measurements were missing. Treatment algorithms, follow-up schedules, and clinical management were performed according to local practice. Institutional review board approval (IRB number 00000178, LSU Health in Shreveport) was obtained from the lead institution and each participating site. Given the study's retrospective nature and use of anonymized data, informed consent was not required. Reporting is in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology guidelines for observational studies) statement.

Angiographic outcomes were evaluated using DSA, MRA, or CTA. The choice of follow-up imaging modality was determined according to local practice at each participating center. Periprocedural thromboembolic complications were identified on DSA by the presence of thrombus formation, delayed filling of previously normal vessels, or vessel dropout. Hemorrhagic complications during the procedure were detected on DSA as contrast extravasation. Data on deployment attempts, recaptures, device resizing, or intraprocedural device instability were not systematically recorded. Angiographic outcome assessment was performed in routine clinical practice at each participating center by the treating neurointerventionalists. Fluoroscopy systems (single- or biplane, depending on clinical requirements) were subject to standardized quality-control procedures in accordance with current legal and regulatory standards. The decision to perform endovascular treatment with the WEB device was made independently at each participating center by interventional neuroradiologists, based on aneurysm-specific characteristics, including rupture status, location, overall dimensions, and neck morphology. Antiplatelet and anticoagulation regimens were determined according to local practice. Retreatment decisions were similarly made at the discretion of the treating neurointerventionalist at each center and were not based on a predefined angiographic threshold but generally considered to involve clinically relevant residual or recurrent aneurysm filling on follow-up imaging.

Based on WEB device size, patients were divided into two groups: (1) devices ≤ 4.5 mm and (2) devices > 4.5 mm. A subgroup analysis was conducted comparing small WEB devices (≤ 4.5 mm) with large devices (> 7.5 mm) (Fig. 1). To assess the potential influence of rupture status on primary outcomes, a sensitivity analysis was performed restricting the analysis to unruptured aneurysms only. A location-stratified subgroup analysis was performed examining complete occlusion (Raymond-Roy score I) and retreatment outcomes across all four anatomical locations (ACoM, Basilar, ICA/PCoM, MCA). To address the potential influence of the shorter median follow-up duration in the smaller WEB device group on outcome comparisons, a further sensitivity analysis was performed, restricting the analysis to patients with a minimum follow-up duration of 6 months, corresponding to the median follow-up of the smaller device group. To evaluate whether the observed treatment effect of WEB device size was confounded by operator/center experience, a volume-stratified subgroup analysis was performed. Centers were classified into three categories based on their cumulative number of small WEB (≤ 4.5 mm) procedures: low-volume (< 5 procedures), medium-volume (5–15 procedures), and high-volume (> 15 procedures). Baseline, procedural, and outcome

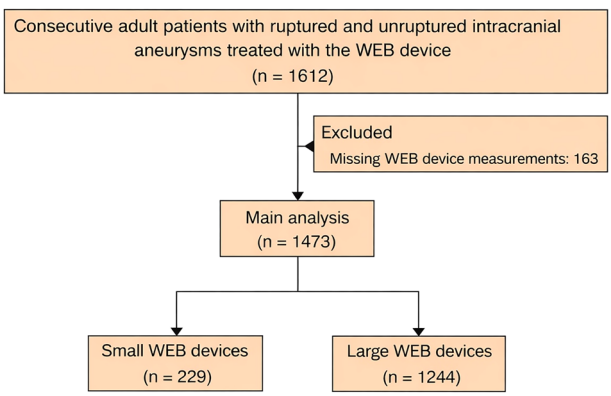


Fig. 1 Patient flowchart

Table 1 Baseline characteristics of the participants

Variable	Overall ($n = 1473$)	WEB ≤ 4.5 mm ($n = 229$)	WEB > 4.5 mm ($n = 1244$)	*p*-value
Male	437 (29.7)	64 (27.9)	373 (30.0)	0.58
Age	59.0 [51.0, 68.0]	57.0 [50.0, 66.0]	60.0 [52.0, 68.0]	0.03
Median pre-treatment mRS score		0 [0, 1]	0 [0, 0]	< 0.01
Current smoking	739 (61.3)	104 (58.4)	635 (61.8)	0.499
Ruptured aneurysms	443 (30.1)	98 (42.6)	345 (27.8)	< 0.001
Aneurysm neck (mm)	3.8 [3.0, 4.9]	3.0 [2.3, 3.1]	4.0 [3.1, 5.0]	< 0.001
Maximum diameter of aneurysm (mm)	6.3 [5.0, 8.0]	4.0 [3.7, 4.9]	6.9 [5.7, 8.3]	< 0.001
Aneurysm width (mm)	5.3 [4.2, 7.0]	3.5 [3.0, 4.0]	5.8 [4.7, 7.0]	< 0.001
Aneurysm height (mm)	5.7 [4.4, 7.3]	4.0 [3.5, 4.6]	6.0 [5.0, 7.8]	< 0.001
Aneurysm depth (mm)	5.5 [4.1, 7.0]	3.3 [3.0, 4.0]	5.8 [4.7, 7.1]	< 0.001
Aneurysm location				0.040
ACom	546 (37.1)	104 (45.2)	442 (35.6)	
Basilar	284 (19.3)	35 (15.2)	249 (20.0)	
ICA-PCom	254 (17.2)	35 (15.2)	219 (17.6)	
MCA	389 (26.4)	56 (24.3)	333 (26.8)	

WEB Woven EndoBridge device

comparisons between small and large WEB devices were repeated within each volume stratum.

Outcomes

Safety outcomes included the rate of periprocedural intracranial hemorrhage and the rate of periprocedural thromboembolic complications. Angiographic outcomes included immediate and follow-up aneurysm occlusion (measured with Raymond-Roy score: complete, remnant neck and remnant aneurysm, immediate and follow-up occlusion status, and immediate blood flow stagnation) [14].

Efficacy outcomes included mRS score at last follow-up, median difference in mRS score at last follow-up, and retreatment rate.

Statistical analysis

Continuous variables are reported as median (25th–75th [Q1–Q3]) and compared using *t*-test or Mann–Whitney U-test, as appropriate. Categorical variables are reported as counts (percentages) and compared using chi-squared or Fisher's exact tests. The 95% confidence intervals (95% CI) were calculated using Wilson's method if not otherwise specified [15]. Ordinal data were analyzed using ordinal mixed-effects logistic regression. The location-stratified subgroup analysis for complete occlusion (Raymond-Roy score I) and retreatment outcomes across all four anatomical locations was presented as forest plots with odds ratios and 95% confidence intervals. In cases where a statistically significant difference was observed across location categories, post hoc pairwise chi-squared tests were performed for each location against all remaining categories combined. Bonferroni correction was applied to adjust for multiple comparisons, with adjusted *p*-values reported accordingly. A *p*-value less than 0.05 was considered statistically significant. All statistical analyses were performed using R, version 4.2.2 (R Foundation for Statistical Computing) [16].

Results

From January 2011 to December 2022, a total of 1473 patients were included in the study. Median age was 59 [51.0, 68.0] years, and 437 (29.7%) patients were male. Small WEBs (≤ 4.5 mm in maximum diameter) were deployed in 229 (15.5%) patients. There was a significant difference in aneurysm location between groups (Table 1). The median maximum aneurysm diameter was 4.0 [3.7, 4.9] mm in the small WEB group and 6.9 [5.7, 8.3] mm in the rest of the cohort ($p < 0.01$). Baseline characteristics of the participants are summarized in Table 1.

The length of procedure was longer for smaller WEBs (92.0 [65.0, 126.0] min versus 79.0 [57.0, 112.0] min, $p < 0.01$). There was no difference in procedural technique, including the type of access and ancillary treatment. Immediate angiographic outcomes were significantly

Table 2 Procedural characteristics, including angiographic and safety outcomes

Variable	Overall ($n = 1473$)	WEB ≤ 4.5 mm ($n = 229$)	WEB > 4.5 mm ($n = 1244$)	*p*-value
Length of procedure (min)	80.0 [58.0, 114.0]	92.0 [65.0, 126.0]	79.0 [57.0, 112.0]	< 0.01
Type of access				0.78
Radial	182 (12.4)	30 (13.1)	152 (12.2)	
Femoral	1286 (87.5)	199 (86.9)	1087 (87.6)	
Transcarotid	2 (0.1)	0 (0.0)	2 (0.2)	
Adjunctive treatment				0.46
None	1046 (90.8)	189 (92.2)	857 (90.5)	
Balloon	18 (1.6)	5 (2.4)	13 (1.4)	
Coiling	39 (3.4)	6 (2.9)	33 (3.5)	
Flow diverter	3 (0.3)	0 (0.0)	3 (0.3)	
Stenting	46 (4.0)	5 (2.4)	41 (4.3)	
Immediate Raymond-Roy score				< 0.01
Complete	559 (39.8)	125 (57.1)	434 (36.6)	
Remnant neck	284 (20.2)	39 (17.8)	245 (20.6)	
Remnant aneurysm	563 (40.0)	55 (25.1)	508 (42.8)	
Immediate occlusion status				< 0.01
100–90%	778 (54.7)	140 (62.3)	638 (53.2)	
< 90%	645 (45.3)	85 (37.8)	560 (46.7)	
Periprocedural intracranial hemorrhage	15 (1.2)	5 (2.6)	10 (0.9)	0.10
Periprocedural thromboembolic complications	55 (3.7)	7 (3.1)	48 (3.9)	0.69

WEB Woven EndoBridge device

better in the smaller aneurysm group, with 125 (57.1%) patients having complete aneurysm occlusion and 140 (62.3%) patients showing immediate occlusion status of more than 90%. There was no significant difference observed between the two groups in terms of periprocedural thromboembolic complications and hemorrhagic complications (Table 2).

Table 3 depicts the retreatment rates and angiographic outcomes at last follow-up. The median length of follow-up was shorter in the smaller WEB group (6.6 [3.1, 15.0] versus 10.0 [5.0, 21.0] months, $p < 0.01$). There was no difference in median mRS as well as median difference in mRS at follow-up (Table 3). Angiographic outcomes, including occlusion status and Raymond-Roy score, were significantly better in small WEBs (Table 3). The rate of retreatment was lower in the case of smaller WEBs (4.3%) compared to others (8.8%) ($p = 0.04$). Logistic regression analysis revealed that larger WEB device dimensions were associated with increased probability of retreatment (OR = 1.41, 95% CI: 1.2–1.57, $p < 0.01$) (Fig. 2).

Subgroup analysis comparing small and very large devices demonstrated similar observations, with comparable baseline characteristics between groups (Supplementary Table 1). When compared to very large WEBs (> 7.5 mm), smaller WEBs demonstrated significantly better complete occlusion rate (Raymond-Roy score I) intraoperatively (57.1% versus 32.2%, $p < 0.001$) as well as at follow-up (76.2% vs 50.5%, $p < 0.001$) (Supplementary Tables 2 and 3). The rate of ancillary treatment was similar in both groups ($p = 0.093$). At follow-up, patients in both groups achieved the same median mRS (1 [1, 2], $p = 0.65$) and median difference in mRS (0 [0, 0], $p = 0.05$) (Supplementary Table 3). Both groups showed no difference in rate of periprocedural intracranial hemorrhage (2.6% versus 0.9%, $p = 0.27$) and periprocedural thromboembolic complications (3.1% versus 4.5%, $p = 0.51$) (Supplementary Table 2). The large WEB group had a higher retreatment rate compared to smaller WEBs (16.1% vs 4.3%, $p < 0.001$).

In the sensitivity analysis restricted to unruptured aneurysms, 132 of 1030 cases (12.8%) were treated with WEB devices ≤ 4.5 mm, and 898 (87.2%) with devices > 4.5 mm (Supplementary Table 4). Smaller devices were associated with longer procedure times but higher rates of immediate and follow-up complete occlusion (Raymond-Roy score I) (Supplementary Tables 4 and 5). Periprocedural complications, retreatment, and clinical outcomes were similar between groups (Supplementary Tables 4 and 5).

Location-stratified subgroup analysis demonstrated that the advantage of smaller WEB devices (≤ 4.5 mm) for complete occlusion (Raymond-Roy score I) was consistent across all anatomical locations, reaching statistical significance at ACoM (75.4% vs 58.4%, $p = 0.01$) and MCA (78.6% vs 49.8%, $p < 0.001$), with a concordant but non-significant trend observed at basilar and ICA/PCoM locations. A similar directional consistency was observed for retreatment rates, although individual location subgroups were underpowered to detect statistically significant differences. Location-stratified analysis of periprocedural thromboembolic complications and intracranial hemorrhage was not feasible due to the low

Table 3 Retreatment rates and angiographic outcomes at last follow-up

Variable	Overall ($n = 1473$)	WEB ≤ 4.5 mm ($n = 229$)	WEB > 4.5 mm ($n = 1244$)	*p*-value
Time since last follow-up (months)	9.0 [5.0, 20.0]	6.6 [3.1, 15.0]	10.0 [5.0, 21.0]	< 0.01
Median mRs		1 [1, 2]	1 [1, 2]	0.88
Median difference in mRs		0 [0, 0]	0 [0, 0]	0.05
Occlusion status				< 0.01
100–90%	1024 (87.5)	150 (94.3)	874 (86.4)	
< 90%	146 (12.5)	9 (5.7)	137 (13.6)	
Raymond-Roy score				< 0.01
Complete	696 (60.8)	115 (76.2)	581 (58.5)	
Remnant neck	308 (26.9)	28 (18.5)	280 (28.2)	
Remnant aneurysm	140 (12.2)	8 (5.3)	132 (13.3)	
Retreatment	108 (8.1)	9 (4.3)	99 (8.8)	0.04

WEB Woven EndoBridge device

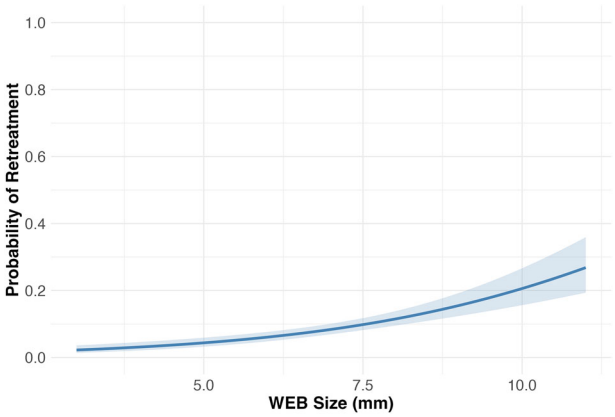


Fig. 2 Probability of retreatment depending on the WEB device size. The solid blue line represents predicted probabilities from logistic regression analysis, with the shaded area indicating 95% confidence intervals. WEB size represents the larger dimension (mm) of the device

event rates within individual anatomical subgroups (Supplementary Fig. 1).

The sensitivity analysis restricting the analysis to patients with a minimum follow-up of 6 months was performed to account for the significantly shorter median follow-up in the smaller device group. Angiographic outcomes remained significantly superior in the smaller WEB device group, with complete occlusion status (Raymond-Roy score I) of 70.7% versus 54.5% ($p = 0.009$). Retreatment rates were 8.3% versus 11.3% in the smaller and larger device groups, respectively, with no statistically significant difference observed ($p = 0.433$) (Supplementary Table 6).

A volume-stratified subgroup analysis was performed based on each center's number of small WEB procedures. Low-volume centers had not performed any small WEB procedures in this cohort, precluding comparison. In high-volume centers, small WEBs remained associated with higher complete occlusion (58.5% vs 37.7% periprocedurally, 78.2% vs 59.0% at follow-up, both $p < 0.001$) and lower retreatment (4.0% vs 8.6%, $p = 0.039$). Medium-volume centers showed the same directional trend without reaching significance (Supplementary Tables 7–9).

Discussion

This retrospective multicenter cohort study is, to the best of our knowledge, the largest analysis comparing small WEB devices with large WEB devices in patients with intracranial aneurysms, focusing on safety and efficacy. We report 4 major findings.

First, the retreatment rate for smaller WEBs in our cohort was 4.3% at a median follow-up of 6.6 months. This result is broadly consistent with prior reports. Girot et al observed a higher retreatment rate of 10% in patients treated with WEBs ≤ 3.5 mm at a median follow-up of 11.2 months, though their small sample size (2/29 cases) and longer follow-up likely contributed to this difference [17]. In another series, Pagano et al reported a 12-month retreatment rate of 2.0% for small WEBs, while the CLEVER study found a comparable 1-year rate of 2.6% [10, 18]. Taken together, our findings suggest that retreatment rates with small WEBs are low and within the range of published data, though longer follow-up will be necessary to confirm durability.

Second, both immediate and follow-up complete occlusion rates (Raymond-Roy score I) were significantly higher with small WEBs than with large devices, a finding that persisted in the subanalysis comparing large and very large (> 7.5 mm) WEBs. Complete occlusion was achieved in 76.2% of small WEB cases, similar to the rates reported by Girot et al (71%) and van Rooij (72% with WEB-17) [8, 17]. In contrast, large WEBs more often resulted in incomplete occlusion, consistent with prior observations [19]. In our cohort, large WEBs had a higher incidence of remnant necks or aneurysms. These findings align with Cagnazzo et al, who showed that aneurysms classified as residual at long-term follow-up were, on average, larger than those that achieved complete occlusion [20]. Similarly, Fortunel et al identified large aneurysm diameter as an independent predictor of incomplete occlusion [19]. In addition to absolute aneurysm size, the relationship between device size and aneurysm dimensions may further influence occlusion durability. Slight oversizing is required for stable WEB deployment; however, in larger aneurysms, this may result in a recessed device configuration with incomplete neck coverage, which has been associated with higher rates of neck remnants and recess filling in previous studies [19, 20]. While these mechanisms are plausible, their precise contribution cannot be determined in the present study, as detailed device-to-aneurysm sizing metrics were not systematically available. Together, these results underscore the impact of aneurysm and device size on occlusion durability, with larger aneurysms being inherently less likely to achieve complete and stable occlusion.

Third, functional outcomes measured by the mRS were comparable between patients treated with small and large WEBs. This likely reflects the fact that most patients presented with good baseline clinical status and that complication rates were similar between groups. Thus, while angiographic outcomes varied by device size, these differences did not translate into functional impairment at short- to mid-term follow-up but may do so in the long term.

Fourth, periprocedural complication rates were low overall. Thromboembolic events occurred in approximately 3% of both small and large WEBs, with no significant difference between groups. This contrasts somewhat with prior reports, in which overall thromboembolic rates were higher and appeared lower with smaller WEBs [12, 21]. The discrepancy may be explained by our very limited use of adjunctive stenting: > 90% of cases were treated without adjunctive devices, thereby minimizing one of the main risk factors for thromboembolic events [12]. Periprocedural intracranial hemorrhage was rare and did not differ between device sizes, consistent with evidence that hemorrhagic complications are influenced more by aneurysm morphology and technical factors than by device size [22]. Although smaller WEB devices are often perceived as technically more demanding, procedural complexity in this study was assessed using surrogate markers only, including procedure duration and the need for adjunctive devices. More granular deployment-specific metrics were not available; therefore, increased technical difficulty is supported only indirectly by the present data. In summary, by directly comparing small and large WEBs, our study emphasizes that smaller devices are not associated with inferior safety or functional outcomes and may, in fact, provide superior angiographic results. These findings support the technical feasibility and clinical reliability of WEB treatment even in very small or technically demanding aneurysms.

Finally, to address the possibility that center experience confounds the observed advantage of small WEBs, we performed a volume-stratified subgroup analysis. The therapeutic advantage of small WEBs was consistent across capacity levels, reaching statistical significance in high-volume centers and following the same directional trend in medium-volume centers. This indicates that the observed benefit of small WEB devices is not driven by center-level procedural volume and supports the broad external validity of our findings.

Several limitations should be acknowledged. The retrospective design introduces the possibility of unmeasured confounders, selection bias, and incomplete data. While the multicenter setting enhances generalizability, it may also have introduced variability in treatment techniques, device selection, patient management, aneurysm measurement, antithrombotic regimens, follow-up imaging modality and timing, and retreatment decision-making. Additionally, detailed information on operator experience and the temporal distribution of device sizes was not available, and unmeasured differences in operator experience, institutional learning curves, and temporal trends may represent a source of residual confounding. Moreover, functional outcome was assessed using the modified Rankin Scale at the last follow-up. In a population with predominantly unruptured aneurysms and a favorable baseline status, mRS may be insufficiently sensitive to detect subtle neurological sequelae, such as minor stroke, cognitive changes, or cranial nerve deficits. As additional clinical endpoints were not systematically collected, such events may be underrepresented. Furthermore, the shorter median follow-up in the smaller WEB device group may have influenced the assessment of retreatment rates, as suggested by sensitivity analyses restricted to patients with ≥ 6 months follow-up. In addition, the absence of core laboratory adjudication could have influenced the accuracy of angiographic outcome assessment and introduced the possibility of inter-observer variability in occlusion grading, including the possibility of misclassification bias, particularly as limited data exist regarding the inter-observer reliability of the

standard 3-grade Raymond-Roy Occlusion Classification [14, 23]. Fluoroscopy systems were subject to standardized quality-control procedures, reducing the likelihood that technical imaging variability substantially influenced occlusion assessment. In general, prospective studies with longer and more balanced follow-up and greater event accrual would be required to draw definitive conclusions regarding retreatment rates.

Conclusion

This comparative analysis suggests that small WEB devices achieve better angiographic outcomes and lower retreatment rates than larger devices, without increasing procedural risk or compromising functional results. Future prospective studies with long-term follow-up, standardized imaging protocols, and independent core laboratory evaluation are warranted to confirm durability and to refine treatment strategies across different aneurysm and device sizes.

Abbreviations

FU	Follow-up
ICH	Intracranial hemorrhage
TECs	Thromboembolic complications
WEB	Woven EndoBridge device

Supplementary information

The online version contains supplementary material available at https://doi.org/10.1007/s00330-026-12840-w.

Funding

Open access funding provided by University of Basel.

Compliance with ethical standards

Guarantor

The scientific guarantor of this publication is Peter B. Sporns.

Conflict of interest

The authors of this manuscript declare no relationships with any companies whose products or services may be related to the subject matter of the article.

Statistics and biometry

No complex statistical methods were necessary for this paper.

Informed consent

Written informed consent was waived by the Institutional Review Board.

Ethical approval

Institutional Review Board approval was obtained.

Study subjects or cohorts overlap

Not applicable.

Methodology

- Retrospective
- Retrospective analysis of a prognostic study
- Multicenter study

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Received: 23 March 2026 Revised: 22 June 2026 Accepted: 28 July 2026
Published online: 08 September 2026

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