**Table**
Donor source and infection risk (multivariate analysis)

| | Hazard ratio for UCB vs. BM/PBSC (95% CI) | *P*-Value |
|---|---|---|
| Any infection | 3.2 (2.3-4.4) | <0.001 |
| Bacterial | 3.9 (2.8-5.5) | <0.001 |
| Viral | 1.8 (1.1-2.7) | 0.01 |
| Fungal | 2.7 (1.1-6.5) | 0.03 |

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Infection is a major source of morbidity and mortality in patients undergoing allogeneic hematopoietic cell transplantation (HCT). Umbilical cord blood (UCB) recipients appear to be at increased risk, and strategies to better identify and mitigate infection are needed. To investigate patterns and risk factors for infections by graft source (UCB vs. bone marrow (BM) or peripheral blood stem cells [PBSC]), we conducted a single center retrospective study of 308 consecutive adult allogeneic HCT recipients transplanted between 2006 - 2011 (BM 156, PBSC 103, UCB 49 patients). All documented and presumed infections during the first year post-HCT were reviewed by a single reviewer. Among BM/PBSC recipients, 53% received HCT using an unrelated donor. Median age for UCB and BM/PBSC groups was 50 and 51 years. Diagnosis and disease status, HCT-CI scores, performance status, and conditioning regimen intensity were comparable among the two groups. Median time to neutrophil recovery (>500/μL) was 27 days in UCB and 13 days in BM/PBSC recipients. The median length of transplant hospitalization was 46 and 30 days, respectively. Bacterial infections were more common for CB recipients (94% vs. 63%, $P < 0.001$), without significant differences in viral, fungal, or *C. difficile* infections. The day of first infection was notably earlier in the UCB recipients (median 6 vs. 30 days, $P < 0.001$), and >1 infection (bacterial, viral or fungal) occurred in 65% of UCB vs. 34% of BM/PBSC recipients. Incidences of acute and chronic GVHD were similar between groups, however CB recipients were less likely to have GVHD prior to diagnosis of bacterial (11% vs. 35%, $P < 0.001$) or viral infection (36% vs. 59%, $P = 0.03$). On multivariate analysis, UCB donor source remained a significant risk factor prognostic for all infection types (Table). Bacterial infection was associated with increased mortality (HR 2.92, $P < 0.001$), as was fungal infection (HR 2.58, $P < 0.001$), but not viral infection/reactivation. In conclusion, UCB recipients have increased risk of infections compared to BM/PBSC. Infections occurred earlier and before engraftment in UCB recipients, suggesting the role of factors other than prolonged neutropenia in their pathogenesis. The association of donor source and post-HCT infections is likely multifactorial.

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### Management of Hemorrhagic Cystitis after Allogeneic Hematopoietic Stem Cell Transplantation

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Hemorrhagic cystitis is one of the important causes of morbidity, which may occur after allogeneic hematopoietic stem cell transplantation (allo-HSCT). Using high dose cyclophosphamide (Cy) as the conditioning regimen is associated with early-onset hemorrhagic cystitis (HC). It is reported that the administration of mesna protects against early-onset HC, caused by Cy. However, late-onset HC may be seen frequently due to viral infections, mostly cytomegalovirus (CMV) and BK/JC virus.
We have retrospectively analyzed 182 patients, who developed HC after allo-HSCT, from 1988 to 2013. Characteristics of the patients were shown in Table 1.
We also present 44 HC patients having detailed data between 2010 and 2013. In these 44 patients median date of the development of HC was calculated as 46 days (4-144). We defined early-onset HC is HC when developed before the 21st day of HSCT, which consists of 7 patients and late-onset HC is HC when developed afterwards of the 21st day of HSCT, which consists of 37 patients. Graft versus Host Disease and HC developed simultaneously in 28 patients.
Patients were initially treated with intravascular hydration and constant bladder irrigation. This treatment was effective within most of the patients. The treatment failed in 11 cases and 5 of them underwent a cystoscopy for evacuation of blood clots. Two patients infected with CMV and 9 patients

**Table 1**
Characteristics of the Patients

| Variable | | Number of Patients |
|---|---|---|
| Gender | | |
| | Female | 67 |
| | Male | 115 |
| Diagnosis | | |
| | Acute Leukemia | 93 |
| | Chronic leukemia | 48 |
| | Bone Marrow Failure | 31 |
| | Lymphoma | 5 |
| | Multiple Myeloma | 4 |
| | Severe Combined Immune Deficiency | 1 |
| Donor | | |
| | Related | 158 |
| | Unrelated | 24 |
| HSC Source | | |
| | Bone Marrow | 65 |
| | Peripheral Blood | 109 |
| | Bone Marrow+ Peripheral Blood | 3 |
| | Umbilical Cord Blood | 5 |
| Conditioning Regimen | | |
| | With Cy | 174 |
| | Without Cy | 8 |
| | Ablative | 164 |
| | Reduced intensity | 18 |
| Response | | |
| | Complete Remission | 147 |
| | Partial Remission | 4 |
| | Not assessed | 31 |
| HC | | |
| | Grade 1 | 83 |
| | Grade 2 | 43 |
| | Grade 3 | 42 |
| | Grade 4 | 14 |

**Table 2**
Cases with refractory to initial treatment

| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 | Case 7 | Case 8 | Case 9 | Case 10 | Case 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HC Grade** | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 3 | 2 | 3 |
| **Infection Factor** | BK virus | BK+JC virus | BK virus | BK virus | BK+ CMV | CMV | BK virus | BK virus | BK virus | BK virus | BK virus |
| **Onset of HC Treatment** | Late | Late | Late | Late | Late | Early | Late | Early | Late | Late | Late |
| Hydration | + | + | + | + | + | + | + | + | + | + | + |
| Cidofovir | + | + | + | + | - | - | + | - | - | + | + |
| Ribavirin | - | + | + | + | - | - | - | - | - | - | - |
| Ganciclovir | | | | | + | + | - | - | - | - | - |
| Constant Bladder Irrigation | + | + | + | + | - | - | + | - | + | - | + |
| Hematoma | | | | | - | - | - | - | - | - | + |
| Discharge | - | + | + | + | | | | | | | |
| Selective embolization of vesical artery | - | - | - | + | - | - | - | - | - | - | - |
| **Overall Response** | no | no | yes | no | yes | yes | no | yes | no | yes | yes |

infected with BK virus have been treated with ganciclovir or cidofovir (±ribavirin), respectively. The treatment has failed in 3 of 9 patients and all of them have died due to accompanying infections. One patient also underwent selective embolisation of vesical artery (Table 2).
As a result, early-onset HC is related to Cy, but late-onset HC is usually associated with BK or CMV infections. HC is generally well treated with i.v hydration and bladder irrigation. In some cases antiviral drugs could be needed. Also, resistant cases may be observed and mortality may be seen due to HC. It is important that the team, who perform allo-HSCT, should be prepared for morbidity due to HC and multidisciplinary treatment algorithm should be designed which includes cooperation with urology and interventional radiology clinics.

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### Methodological Issues in Exercise Intervention Studies: Attrition and Adherence

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**Purpose:** While the benefits of exercise interventions in people undergoing HCT have been systematically reviewed elsewhere, subject attrition rates and adherence to exercise interventions following HCT have not. This systematic review of the literature examined subject attrition rates and reasons for attrition as well as adherence to exercise interventions following BMT/HCT.
**Methods:** Publications were identified through literature searches of PubMed, CINAHL, and Embase as well as hand searching the references of retrieved studies. Studies published between January 1985 and July 2013 that prospectively tested an exercise intervention in BMT/HCT patients were included. All retrieved abstracts were initially classified as (1) exercise intervention studies; (2) studies related to exercise and/or BMT or HCT that did not prospectively test an exercise intervention; (3) integrative or systematic reviews of exercise intervention studies in BMT or HCT patients; or, (4) other types of reviews articles (i.e., clinical reviews, case reports, etc.). Studies that prospectively tested an exercise intervention were further evaluated to determine (1) the type of exercise modality employed; (2) subject attrition rates and reasons for attrition; (3) the amount of supervision required to implement the intervention; (4) timing of the intervention; and, (5) exercise adherence rates.
**Results:** Twenty studies met the inclusion criteria. The majority of studies tested an aerobic exercise intervention (n=7; 35%) or a combination of aerobic and strength training (n=7; 35%). The aerobic exercise interventions varied and included activities such as stationary bicycling, walking, or treadmill walking. Other exercise modalities tested included: (1) strength training (n=4; 20%) or (2) combination of stretching, aerobic and strength training (n=2; 10%). Supervised exercise sessions (55%; n = 11) were more commonly used than unsupervised sessions (20%; n= 4). Five studies (25%) used a combination approach by supervising some sessions with study participants completing other sessions unsupervised. The overall attrition rate was 18% (180/998 subjects). Major reasons for attrition included death, change in health status, protocol issues, personal issues, and lost to follow-up/no reason provided. Supervised exercise programs rarely published exercise adherence information. Unsupervised exercise program relied mainly on self-report to document adherence. Adherence rates in these studies ranged from 50-100%.
**Conclusion:** Questions regarding subject attrition and adherence to exercise interventions must be addressed to identify those interventions that are likely to be successful when translated into clinical practice. Subject attrition from exercise studies following BMT/HCT is relatively low. Adherence information for exercise interventions needs to be regularly addressed.

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### Differential Effect of Supersaturated Calcium Phosphate Rinse and Palifermin on Oral Mucositis Induced By Conditioning with Fludarabine, Busulfan and TBI or Melphalan

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**Introduction:** Oral mucositis (OM) is a common, debilitating complication of conditioning regimens for hematopoietic stem cell transplantation (HSCT). Supersaturated calcium phosphate rinse (SCPR) and palifermin have shown efficacy in preventing OM. However, whether their efficacy differs is unknown. We compared the efficacy of SCPR and palifermin in HSCT patients receiving myeloablative conditioning.
**Methods:** A comprehensive review of our institutional database was performed to identify patients who received myeloablative-conditioning between 2008 and 2012. Two cohorts were identified and analyzed separately. All patients in the first cohort received 400 cGy of total body irradiation and the majority received Fludarabine 250 mg/m2 and