Risk factors for all-cause early re-operations in patients undergoing tumor resection and endoprosthetic reconstruction: a secondary analysis from the PARITY trial

Kendal JK[1], Slawaska-Eng D[2], Gazendam A[2], Schneider T[2], Wessel L[1], Ghert M[2], Bernthal NM[1]

1. Department of Orthopaedic Surgery, University of California, Los Angeles, Santa Monica, CA, USA
2. Division of Orthopaedic Surgery, Department of Surgery, McMaster University, Hamilton, ON, Canada

Background

Extremity tumor resection and reconstruction using large endoprosthetic devices are complex procedures that typically require aggressive soft tissue resection and long operative times in patients with potential systemic compromise. Tumor endoprosthetic reconstructions are therefore fraught with multiple modes of failure. A robust assessment of specific factors contributing to early re-operations in this population has not been performed in a large prospective cohort.

Questions/Purposes

The purpose of this study was to assess baseline demographic and surgery-specific risk factors for early re-operation in patients undergoing tumor resection and endoprosthetic reconstruction based on the Prophylactic Antibiotic Regimens in Tumor Surgery (PARITY) multi-center prospective trial data.

Patients and Methods

The PARITY trial was a multi-center blinded randomized controlled trial that assessed the effect of post-operative prophylactic antibiotic duration on the rate of surgical site infection in patients undergoing lower extremity tumor resection and endoprosthetic reconstruction. We performed a secondary analysis of the PARITY data assessing for risk factors associated with all-cause early re-operation. Baseline characteristics and surgery-specific factors were selected *a priori* as potential risk factors. Baseline characteristics assessed included age, sex, tumor type, tumor location, soft tissue mass, diabetes, smoking status, use of neo-adjuvant chemotherapy, and neutropenia. Operative factors included operative time, use of topical vancomycin, use of silver-coated prosthetics, endoprosthetic fixation type, extra-articular resection, use of tranexamic acid, use of negative pressure wound therapy (NPWT) at the time of surgery and length of stay (LOS). Demographic data was presented with descriptive statistics. Univariate analysis was performed to explore differences in patients undergoing a re-operation within the first year vs. those who did not. A multivariate Cox proportional hazards regression model explored predictors of re-operations within 1 year of surgery. Results of the model are presented with hazards ratios (HR) and 95% confidence intervals (CI).

Results

155 of 604 (25.7%) patients experienced a re-operation. In univariate analysis, the following variables were associated with re-operation: tumor type ($p < 0.001$), operative time ($p < 0.001$), use of topical vancomycin ($p = 0.026$), associated soft-tissue mass ($p = 0.045$), use of NPWT at the time of surgery ($p = 0.010$), and hospital LOS ($p < 0.001$). Upon multivariate assessment with Cox proportional hazards (Table 1), tumor type (benign aggressive bone tumor vs. primary bone malignancy, HR 0.15, 95% CI = [0.05-0.60], $p = 0.008$), operative time (HR 1.14, 95% CI = [1.07-1.20], $p < 0.001$), and use of NPWT at the time of surgery (HR 1.60, 95% CI = [1.05-2.40], $p = 0.029$) remained significant predictors of re-operation at 1 year.

Conclusions

Using the PARITY dataset, independent predictors of re-operation at 1 year in patients undergoing tumor resection and endoprosthetic reconstruction included: tumor type (primary bone malignancy vs. benign aggressive bone tumor), operative time and use of NPWT. These results will help inform patients and surgeons about risk of re-operation by diagnosis and reinforce operative time as a factor influencing complications requiring re-

operation. These results also support further investigation into the use of NPWT at the time of surgery in this patient population.

Table 1. Cox regression analysis

Variable	HR	95% CI for HR		P Value
		Lower	Upper	
Age (per year)	1.00	0.99	1.01	0.565
Location				
Femur (ref)				
Tibia	1.03	0.68	1.60	0.888
Tumor type				
Primary bone malignancy (ref)				
Soft tissue sarcoma	0.96	0.58	1.60	0.880
Metastatic bone disease	0.57	0.26	1.30	0.166
Benign aggressive bone tumor	0.15	0.04	0.60	**0.008**
Total operative time	1.14	1.07	1.20	**<0.001**
Soft tissue mass	0.82	0.55	1.22	0.334
NPWT at the time of operation	1.60	1.05	2.4	**0.029**
Resection type				
Intra-articular (ref)				
Extra-articular	0.89	0.58	1.36	0.586
Intrawound vancomycin powder	0.747	0.45	1.23	0.257
Silver Coated Prosthesis				
No (ref)				
Yes	1.60	0.85	3.0	0.146

HR = Hazards Ratio, CI = Confidence Interval, NPWT = Negative Pressure Wound Therapy