

Do Endoprostheses Performed for Tumor, Arthroplasty, or Post-Trauma Indication Have the Same Fate?

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INTRODUCTION:

Endoprosthetic reconstruction has become the mainstay of treatment to replace large segmental defects of bone. While these constructs are commonly used following musculoskeletal tumor resection, they can also be used in revision arthroplasty or following traumatic injuries. As a limb salvage procedure, endoprostheses have a high risk of potential adverse outcomes, including infection, aseptic loosening, and dislocation which frequently require reoperation, implant removal, or amputation. To date, no large study has examined whether the incidence of these adverse outcomes is different for patients undergoing endoprosthetic reconstruction based on their indication for surgery. In this study, we sought to determine if the indication for index endoprosthesis surgery (e.g., sarcoma, metastatic disease, revision arthroplasty, or trauma) was associated with long-term patient outcomes.

METHODS:

Institutional records were queried to identify all patients who underwent endoprosthetic reconstruction at a single tertiary academic hospital between 1999-2021. Patients were included if they had one of the following indications for surgery: 1) Sarcoma, 2) Metastatic disease, 3) Revision arthroplasty, or 4) Trauma. Patients with less than 2 years of follow up were excluded from the study. A retrospective chart review was performed to collect patient demographic and outcome information. Outcomes included indications for reoperation, time to first reoperation, number of reoperations, implant survival rate, time to implant removal, rate of amputation, and time to amputation. Sarcoma, metastatic disease, revision arthroplasty, and trauma groups were all compared against each other. Further analysis was performed by comparing oncological indications (sarcoma and metastatic disease) versus non-oncological indications (revision arthroplasty and trauma). Chi-square tests were performed to assess for significant differences in the incidence of categorical events between groups. Log-rank (Mantel-Cox) tests were performed to assess for significant differences in time-to-event analyses.

RESULTS:

Of the 892 endoprostheses performed since 1999, there were 288 that met the inclusion criteria for this study, including patients undergoing endoprosthetic reconstruction for sarcoma (n=148; 51%), metastatic disease (n=70; 24%), revision arthroplasty (n=42; 15%), or trauma (n=28; 10%). Demographic variables were similar between groups (Table 1).

There was a significantly higher rate of all-cause revision surgery for non-oncological indications (36/70; 51%) compared to oncological indications (70/218; 32%) (p=0.02) (Table 2). The rate of all-cause reoperation was highest for the revision arthroplasty (23/42; 55%) and trauma subgroups (13/28; 46%), followed by metastatic disease (23/70; 33%) and sarcoma (47/148; 32%). Log-rank testing revealed a significant difference in reoperation-free survival between the four subgroups (p=0.004) (Figure 1A), as well as between oncological and non-oncological groups (p=0.0008) (Figure 1B).

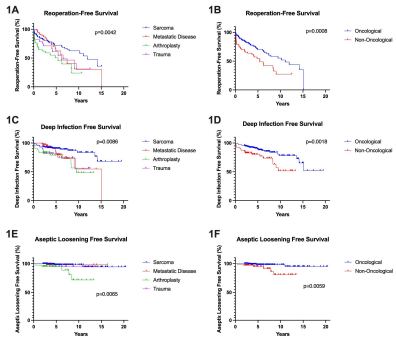
The rate of deep infection was highest for trauma (6/28; 21%), followed by revision arthroplasty (6/42; 14%), metastatic disease (9/70; 13%), and sarcoma (10/148; 7%). Log-rank testing revealed a significant difference in deep infection-free survival between the four subgroups (p=0.009) (Figure 1C), as well as between oncological and non-oncological groups (p=0.002) (Figure 1D).

There was a significantly higher rate of aseptic implant loosening in the non-oncological indications group (6/70; 9%) as compared to the oncological indications group (3/218; 1%) (p=0.009). Rates of aseptic loosening were highest for revision arthroplasty (5/42; 12%) and trauma (1/28; 4%), followed by sarcoma (3/148; 2%). There were no cases of aseptic loosening in the metastatic disease group (0/70; 0%). Log-rank testing revealed a significant difference in aseptic implant loosening-free survival between the four subgroups (p=0.007) (Figure 1E), as well as between oncological and non-oncological groups (p=0.006) (Figure 1F).

There were no statistically significant differences in the rates of superficial wound problems, fractures, dislocations, amputations, or index endoprosthesis removal between the groups (all p>0.05).

DISCUSSION AND CONCLUSION:

Patients undergoing endoprosthetic reconstruction for non-oncological indications such as revision arthroplasty and post-trauma have higher rates of deep infection, aseptic loosening, and all-cause reoperation. These results will be invaluable in counseling patients on the risk and benefits of endoprosthetic reconstruction based on their personal surgical indication.



	Type of Operation Indicated by Surgical Indication					
	All Indications	Trauma	Metastatic Disease	Arthroplasty	Sarcoma	Unknown
Overall No. (%)	299	100%	248	31%	24	23%
Age (mean±SD), yr	69.4	65.7	69.3	73.7	62.7	51.9
Gender, %	144	50%	75	48%	42	40%
Race, %	252	88%	120	67%	67	63%
Black	33	11%	12	6%	3	3%
White	19	6%	7	4%	1	1%
Unknown or Other	4	1%	4	2%	0	0%
ETHNICITY, %	4	1%	4	2%	0	0%
Hispanic or Latino	4	1%	4	2%	0	0%
LOCATION						
Total, n (%)	74	25%	3	1%	0	0%
Eastern Area	100	34%	30	12%	11	10%
Great Lakes	110	37%	31	13%	8	8%
Midwest	91	31%	29	12%	5	5%
Combined Areas/Other	7	2%	0	0%	1	1%
Posterior	88	30%	31	13%	5	5%
ASA (mean±SD)	2.2	0.70	2.2	0.68	2.4	0.71
ASA (mean±SD) (n=16)	29.0	11.71	27.0	11.52	29.4	10.61
SMOKING STATUS						
Current	43	15%	22	9%	1	1%
Former	240	81%	126	51%	23	22%
Never	103	35%	106	43%	40	38%
MEDICAL COMORBIDITIES						
Diabetes	40	14%	32	13%	14	13%
COPD	10	3%	7	3%	3	3%
PREOP TREATMENTS						
Post-op (at 30 days or more)	133	45%	100	40%	27	25%
Pre-op (at 30 days or more)	88	30%	88	35%	20	19%
Pre-op (at 30 days or more)	88	30%	88	35%	20	19%
ADJUVANT THERAPY (n)	103	35%	88	35%	31	29%
Adjuvant chemotherapy (within 3 months)	30	10%	31	12%	11	10%

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Figure 1. Kaplan-Meier curves demonstrating differences in reoperation-free survival (A-B), deep infection-free survival (C-D), and aseptic loosening-free survival (E-F) based on surgical indication.