

Title: Endoprosthetic Replacement for Malignant Tumors of the Proximal Femur: A Consecutive Series of 211 Patients

Authors: Matthew Houdek, Benjamin Wilke, Cody Wyles, Peter Rose, Michael Taunton, Franklin Sim

Institution: Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN

Background: Endoprosthetic replacement is an option for reconstruction of the proximal femur to restore a functional extremity and achieve limb salvage. Although these prostheses are commonly used, they can be fraught with complications and are commonly revised.

Purpose: Currently there is a paucity of data concerning the long-term survival of endoprostheses with studies frequently combining benign and malignant conditions, or grouping endoprostheses from multiple areas of the body into one cohort. The purpose of this study was to examine a consecutive series of endoprosthetic replacements of the proximal femur performed for a malignant process to evaluate 1) overall patient and implant survival, 2) need for reoperation, and 3) postoperative complications including infection.

Methods: Using our institutions total joint registry we identified 1,361 patients who underwent a total hip arthroplasty for an oncological process of the hip from 1969-2013. We excluded all patients that did not have an endoprosthesis placed for a malignant process, leaving a cohort of 211 patients. Kaplan-Meier survival outcomes and Hazard ratios were assessed for overall survival, reoperation, infection, and revision. Mean age was 59 years (range 11-88) at the time of the surgery with 55% being male. 33% of patients were classified as obese. The most common pathology was metastatic disease (n=123, 58%). All surviving patients had 1-year follow-up with a mean follow-up of 5 yrs (1-20 yrs). The mean time to death was 2 yrs (range 2 weeks-18 yrs). A bipolar component was used in 91% of patients.

Results: The mean 5-, 10-, 15-, and 20-year overall survival was 26%, 14%, 12% and 4%, respectively (Fig. 1). In regards to survival of the implant, the 5-, 10-, 15-, and 20-year overall survival was 86%, 66%, 58% and 31% (Fig. 1). The mean time to revision THA, reoperation for any cause, and postoperative infection was 4, 3 and 0.5 yrs. Hazard ratios showed an increased risk for revision, reoperation and infection in patients ≤ 50 years of age and those with postoperative complications including hematoma and delayed wound healing (Table 1). Likewise osteosarcoma statistically increased the risk of infection (Table 1). Postoperative complications included hematoma (n=8, 4%), delayed healing (n=11, 5.2%), periprosthetic fracture (n=9, 4.2%), DVT/PE (n=9, 4.2%), dislocation (n=16, 8%) and component loosening (n=3, 1%). There was no significantly increased risk of dislocation based on type component (THA v. bipolar, OR 2.98, $P=0.12$).

Discussion: Although patients typically succumb to their disease prior to implant failure, we believe endoprosthetic replacement of the proximal femur provides a durable reconstructive option in the setting of a malignant process. Younger patients and those with a postoperative wound complication are at increased risk of revision, reoperation and infection. In contrast to other studies, we did not find an increase of dislocation in patients where a THA was used.

Table 1: Hazard Ratios for Rerevision, Reoperation and Postoperative Infection for Endoprosthetic Reconstruction for Malignant Processes of the Proximal Femur

Preoperative Factors	Revision THA (95% CI)	p Value	Reoperation (95% CI)	p Value	Infection (95% CI)	p Value
Obesity	1.83 (0.69-4.65)	0.21	1.24 (0.52-2.78)	0.60	0.99 (0.26-3.15)	0.99
Male Gender	1.22 (0.54-2.81)	0.61	0.94 (0.46-1.93)	0.88	1.05 (0.34-3.28)	0.92
Age ≤50	3.17 (1.38-7.51)	0.006	3.39 (1.65-7.08)	0.001	5.21 (1.73-17.26)	0.003
Osteosarcoma	2.52 (0.82-6.47)	0.09	1.75 (0.58-4.22)	0.28	5.67 (1.71-17.04)	0.006
Chondrosarcoma	1.14 (0.41-2.80)	0.78	1.28 (0.53-3.59)	0.59	1.04 (0.16-3.91)	0.95
Metastatic Disease	0.51 (0.18-1.31)	0.16	0.68 (0.30-1.50)	0.34	0.36 (0.09-1.11)	0.07
Myeloma	0.80 (0.12-2.75)	0.75	1.21 (0.35-3.13)	0.71	1.54 (0.23-5.73)	0.59
Pathologic Fracture	0.62 (0.25-1.45)	0.27	0.64 (0.31-1.31)	0.23	0.40 (0.12-1.22)	0.10
Bipolar Endoprosthesis	0.72 (0.24-3.09)	0.61	0.41 (0.16-1.21)	0.09	0.44 (0.12-2.89)	0.34
Post-Operative Complications						
Dislocation	2.81 (0.98-7.00)	0.05	7.14 (3.15-15.30)	<0.0001	2.63 (0.40-9.83)	0.26
Hematoma	11.70 (3.70-31.84)	0.0002	17.56 (6.16-44.23)	<0.0001	19.92 (5.28-63.86)	0.0001
Delayed Healing	26.01 (9.90-69.57)	<0.0001	38.63 (15.18-100.06)	<0.0001	385.77 (68.44-7287.2)	<0.0001
Periprosthetic Fracture	1.43 (0.22-4.94)	0.64	1.62 (0.38-4.66)	0.45	-	-
Component Loosening	2.42 (0.52-8.00)	0.22	1.72 (0.37-5.65)	0.44	-	-
Infection	39.40 (14.55-124.2)	<0.0001	37.91 (15.72-97.36)	0.0001	-	-

Figure 1:

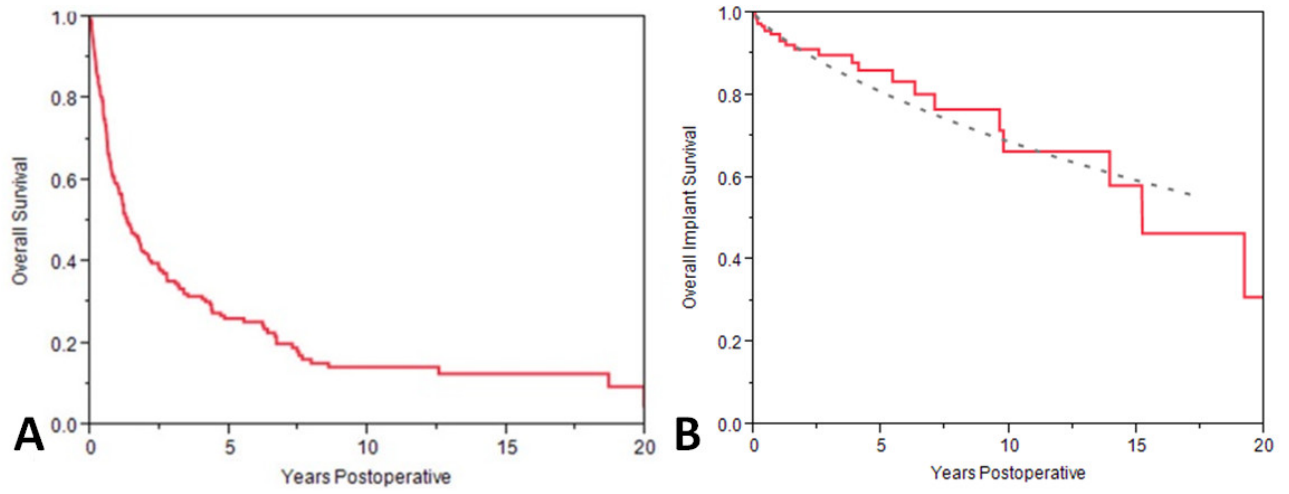


Figure 1: Overall- (A) and revision-free (B) survival with competing risk for death (dashed line) following endoprosthetic reconstruction for a malignant process of the proximal femur. Patients frequently succumb to their disease prior to needing a revision procedure.