Long-term Results Of 165 Cemented Endoprosthetic Reconstructions For Tumors Of The Humerus: A 30-year Experience

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INTRODUCTION: Limb salvage surgery of the upper extremity requires additional focus on soft tissue repair and reconstruction to preserve functionality given the different stability needs of upper extremity reconstructions in terms of weightbearing requirements. Long-term implant survival data following limb salvage surgery of the upper extremity is heterogenous and largely limited to small series. This study assesses the long-term outcomes and causes of failure of endoprosthetic reconstruction for tumors involving the humerus.

METHODS:

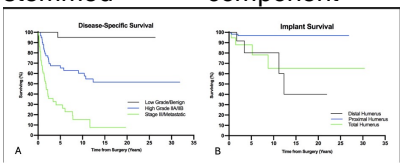
165 consecutive patients who underwent limb salvage surgery via proximal, total, or distal humerus replacement for musculoskeletal tumors at a single institution between 1980 and 2021 were reviewed. Demographic, oncologic, procedural, and functional outcome data were analyzed with average follow-up of 5.6 years. Implant failure was defined as revision of stemmed implant and classified by the Henderson classification. All-cause failure was also noted. Descriptive statistics and 2-sample *t-tests* were performed on the cohort (Stata, College Station, TX). Patient, implant, and limb salvage survival rates were calculated using implant revision as the endpoint. Kaplan-Meier survivorship analysis was performed on patients based on grade of disease.

RESULTS:

133 proximal humerus, 16 total humerus, and 16 distal humerus endoprostheses were included. The mean age of the cohort at surgery was 44.2±23.8 years. 55% of patients were treated for primary sarcomas. Average follow-up time was 5.6±6.9 years (range: 3 months – 31.9 years); 77.6% of the cohort followed up for at least 10 years. There was a 15% rate (25 cases) of implant failure, defined as requiring revision of the stemmed implant. Failure occurred on average 3.2±3.8 years after surgery. The most common reason for implant failure was tumor progression in 13 cases (7.8%); 6 (3.6%) for structural failure; 4 for aseptic loosening (2.4%); and 2 for infection (1.2%). All-cause failure was 27.2% (45 cases). 4.8% (8) patients were revised to forequarter amputation, predominantly due to tumor progression. Proximal humeral replacements had an implant-specific survival of 96.7% at 10 years, which exceeded that of DHR and THR.

DISCUSSION AND CONCLUSION:

The present study confirms the long-term durability of cemented endoprosthetic reconstructions in setting of massive bone and soft tissue loss in the humerus. In this series, the most common cause of implant failure requiring revision of the stemmed component in humerus reconstructions is tumor progression.



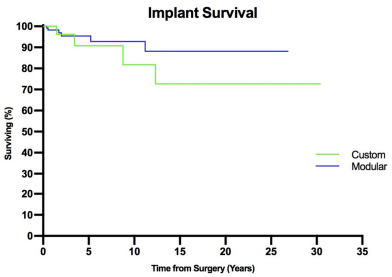


Table I: Survival Data following Upper Extremity Endoprosthetic Reconstruction

	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
Implant Survival						
Custom (N=34)	90.8%	81.7%	72.7%	72.7%	72.7%	72.7%
Modular (N=131)	95.4%	92.8%	88.1%	88.1%	88.1%	-
Total Humerus (N=16)	88.0%	65.2%	65.2%	65.2%	65.2%	65.2%
Distal Humerus (N=16)	80.2%	80.2%	40.1%	40.1%	-	-
Proximal Humerus (N=133)	96.7%	96.7%	96.7%	96.7%	96.7%	-
Overall (N=165)	93.4%	89.0%	82.1%	82.1%	82.1%	82.1%
Patient Survival						
Low Grade or Benign (N=31)	95.0%	95.0%	95.0%	95.0%	95.0%	-
High Grade IIA/IIB (N=63)	67.5%	60.3%	51.6%	51.6%	51.6%	51.6%
Stage III/Metastatic (N=71)	29.5%	15.3%	7.7%	7.7%	-	-
Limb Salvage	92.5%	88.9%	88.9%	88.9%	88.9%	88.9%