

## Proximal Humerus Replacement With The Mutars™ System Following Resection Of Primary Or Secondary Bone Tumors – A Systematic Analysis Of The Reasons For Prosthetic Failure

Orthopaedics / Musculoskeletal Tumors / Miscellaneous

**Dimosthenis Andreou**, Jan Niklas Bröking, Georg Gosheger, Julia Wilhelmy, Marcel-Philipp Henrichs, Markus Nottrott, Jendrik Harges, Arne Streitbürger

Münster University Hospital, Münster, Germany

Keywords: Bone Tumors, Proximal Humerus, Endoprosthetic Replacement, Prosthetic Failure, Risk Factors

### Introduction

The proximal humerus is one of the most common localizations of primary malignant bone tumors and metastases in the long bones. The reconstruction of massive bone defects following a tumor resection is most usually performed with a proximal humerus prosthesis.

### Objectives

We sought to evaluate the reasons for the first endoprosthetic failure and the functional outcome following resection of bone tumors in the proximal humerus and reconstruction with MUTARS™ megaprotheses.

### Methods

We retrospectively analyzed the files of 118 patients, who underwent resection of the proximal humerus due to locally aggressive (n=7), primary malignant bone tumors (n=79) or bone metastases (n=32) and reconstruction with the MUTARS™ system between 1998 and 2013. Failure modes were classified according to Henderson et al. as mechanical (soft tissue failure – type I, aseptic loosening – type II, structural failure – type III) and nonmechanical (infection – type IV, tumor progression – type V). The functional outcome of surviving patients was evaluated with the American Shoulder and Elbow Surgeons (ASES) score. Non-parametric analyses were performed with the Mann-Whitney U test. Survival curves were calculated with the Kaplan-Meier method and compared with the log-rank test.

### Results

The mean duration of surgery was 186 minutes (range, 71-355 minutes). The mean excision length amounted to 14 cm (range, 6-25 cm). The mean follow-up was 48 months (range, 1-172 months) for all patients and 61 months (range, 6-172 months) for surviving patients. 21 patients suffered from an endoprosthetic failure after a mean interval of 13 months (range, 1-104 months). The prosthesis survival probability amounted to 86% after 1 year and 80% after 5 years.

The most common failure mode was infection developing in 10 patients, followed by soft tissue failure in 5, structural failure in 4 patients and tumor progression in 2 patients. None of the patients in our series developed aseptic loosening. Duration of surgery, humerus excision length, coating of the prosthesis or method of stem fixation had no impact on prosthesis survival probability (P=0.792/0.139/0.224/0.624, respectively). On the other hand, extraarticular resection, preoperative radiation

treatment and the presence or development of metastasis in patients with primary sarcomas were significantly associated with a higher risk for prosthesis failure ( $P=0.008/0.026/0.009$ , respectively). Regarding functional outcome, the mean ASES score of 28 patients who were able to complete the self-evaluation form amounted to 67 points (range, 40 – 93 points).

### **Conclusions**

The implant failure probability following tumor resection and prosthetic reconstruction with the MUTARS™ system in the proximal humerus is comparable to that of other systems. The most common failure mode was infection. Patients undergoing preoperative radiotherapy, extraarticular resections and patients with primary sarcomas and metastatic disease appear to be at a higher risk for prosthesis failure. The functional outcome following proximal humerus replacement appears to be comparable to the outcome patients undergoing shoulder replacement due to arthritis or proximal humerus fracture.