

Endoprosthetic failure after resection of primary or secondary bone tumors in the proximal humerus and reconstruction with the MUTARS™ system – a systematic analysis

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Background: 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.

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

Patients and Methods: We retrospectively analyzed the files of 102 patients, who underwent resection of the proximal humerus due to locally aggressive (n=8), primary malignant bone tumors (n=66) or bone metastases (n=28) and reconstruction with the MUTARS™ system between 1998 and 2011. 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). 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. The functional outcome was evaluated with the American Shoulder and Elbow Surgeons (ASES) score.

Results: The mean duration of surgery was 193 minutes (range, 85-355 minutes). The mean reconstruction length amounted to 14 cm (range, 9-22 cm). The mean follow-up was 52 months (range, 1-172 months). 17 patients (17%) suffered from an endoprosthetic failure after a mean interval of 26 months (range, 1-155 months). The prosthesis survival probability amounted to 89% after 1 year and 81% after 5 years. The most common failure mode was infection developing in 8 patients (47% of all failures), followed by soft tissue failure and structural failure in 4 patients (24%) each and an aseptic loosening in 1 patient (5%). A tumor progression developed in 7 patients, one of whom underwent an amputation, having previously developed a type IV failure. Neither reconstruction length nor duration of surgery correlated with the probability of endoprosthetic failure in general ($p=0.512/p=0.807$), or a type IV failure in particular ($p=0.416/p=0.772$). Local radiotherapy was also not associated with a significantly higher failure probability (26% vs. 19% after 5 years, $p=0.358$). The mean ASES score was 65 (range, 13-93).

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. Local radiotherapy, reconstruction length and duration of surgery appear to have no influence on failure probability.