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Total humerus replacement with the MUTARS™ system following resection of primary or secondary malignant bone tumors – a systematic analysis of the reasons for prosthetic failure

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Background: The humerus is the third most common localization of bone sarcomas and the second most common localization of metastases in the long bones. The resection of the whole bone and the reconstruction with a total humerus replacement can be necessary in patients with large tumors, however little is known about the complications rate of this rare reconstruction method.

Purposes: Our goal was to systematically evaluate the reasons for the first endoprosthetic failure following resection of the total humerus and reconstruction with the MUTARS™ system.

Patients and Methods: We performed a retrospective analysis of the files of 22 consecutive patients, who underwent resection of the total humerus due to bone sarcomas (n=18) or bone metastases (n=4) and reconstruction with the MUTARS™ system between 1999 and 2011 at our department. 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.

Results: The median duration of surgery amounted to 270 minutes (range, 120 – 542 minutes). The median reconstruction length was 28 cm (range, 25 – 31 cm). The median follow-up amounted to 32 months (range, 3 – 159 months) for all patients and 62 months (range, 3 – 159 months) for survivors. Seven patients suffered from an endoprosthetic failure after a median interval of 2 months (range, 1 – 21 months). The prosthesis survival probability amounted to 72% after 1 year and 65% after 5 years.

The most common failure modes were infection and soft tissue failures developing each in 3 patients, followed by a tumor recurrence in one patient. The duration of surgery had no statistically significant influence on the development of endoprosthetic failure (p=0.898). There was a trend for a correlation between the length of reconstruction and implant failure (p=0.063). Patients undergoing local radiation treatment had a significantly higher probability for endoprosthetic failure (71% vs. 14% after one year, p = 0.042).

Conclusions: The resection of the whole humerus and the reconstruction with a total humerus replacement is a feasible alternative to amputation for patients with locally advanced bone sarcomas or bone metastases, however patients need to be informed about the high risk of endoprosthetic failure. More than two thirds of the patients in our cohort had to undergo removal of the prosthesis or secondary amputation following local radiation therapy, so that alternative treatment options should be evaluated when radiation treatment is deemed necessary or has already been performed.