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Title: Allograft Reconstruction For The Proximal Humerus - Does It Work?

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BACKGROUND

Large bone defects of the proximal humerus after tumor resections or complicated revision surgeries are challenging situations. For restoring the proximal humerus an osteoarticular allograft (OA) or an allograft-prosthetic composite (APC) can be used as an alternative to megaprosthesis. The reattachment of capsule and tendons are crucial for the function and stability of the shoulder joint. Allograft reconstructions enable a direct suture of the soft tissues to the implant and provide theoretically a stable and well-functioning joint. But the achievement of better functional results may be at the expense of a higher complication and revision rate.

QUESTIONS/PURPOSES

What are the reasons for failures after allograft reconstruction of the proximal humerus? Which reconstruction technique shows the best implant survival?

PATIENTS AND METHODS

A consecutive case series of 53 patients who received an allograft reconstruction for the proximal humerus from June 1996 to December 2013 was retrospectively reviewed. The indication of the surgery was in all cases a primary bone tumor located in the proximal humerus without joint invasion. The average resection length was 12.1cm (Range: 5-23cm). In all patients the glenoid, the deltoid muscle and the axillary nerve were preserved during the resection (Type I resection according Malawer classification). The mean age of the patients at the time of surgery was 31.7 years (range 8-76). An APC with an anatomic prosthesis was used in 12 patients (23%), with a resurfacing device in 10 patients (19%) and with a reverse prosthesis in 13 patients (24%). The remaining 18 patients (34%) received an OA. Two different surgical techniques were used for the fixation of the reverse prosthesis in the allograft. In the first 10 cases (19%) a reverse prosthesis with a long stem was cemented into allograft and host bone. In the following 3 patients (6%) a conventional reverse prosthesis with a short stem was implanted into the allograft. Afterwards the allograft was fixed with a plate to the residual host humeral shaft.

RESULTS

After a mean follow-up of 60.6 months (Range 24-163) 10 allografts (18.9%) had to be revised surgically, 6 in the OA group and 4 in APC with a reverse shoulder prosthesis. The reasons for revision were fracture of the allograft (n=4), pseudarthrosis between host bone and allograft (n=2), as well as aseptic loosening of the stem (n=2), deep infection (n=1) and joint instability (n=1). In 8 out of these 10 cases the allograft had to be removed. The allograft / implant survival for OA was 77.8% (95%CI: 51.1-91.0%) after 5 years and 68.1% (95%CI: 37.5-86.0%) after 10 years, respectively (see figure 1). A radiographic degeneration of the joint surface was observed in 3 cases (16.7%). All 3 patients were asymptomatic at the last follow up and no further treatment was necessary. The APC in combination with anatomical prosthesis or resurfacing showed no failures, resulting in a 100% 10-year survival of the implant. But all patients in this group with a long follow up showed a continuous loss of function over the years. The APC including a reverse prosthesis had the lowest implant survival rate of 50.9% (95%CI: 7.9-83.5%) after 10 years (p=0.25). All failures occurred in reverse prosthesis group with a long stem. Reverse prosthesis with short stem on the other hand showed no complications at all.

CONCLUSION

Despite various possible complications, OA and APC are valid methods for the reconstruction of extensive bone loss in the proximal humerus. The most frequent problem in the OA group was the compromise of long-term stability through fracture or non-union of the allograft. The use of APC further improves this aspect and avoids cartilage degeneration as seen in OA. APC in combination with anatomic prosthesis or resurfacing provide a long lasting reliable implant. But the shoulder function is decreasing over time, probably associated with a degeneration of the rotator cuff. Reverse prosthesis with a long stem cemented in the host and allograft bone lead to a high complication and failure rate. Especially aseptic loosening of the stem seems to be a real problem. We assume rotational forces at the junction between host and allograft bone lead to early loosening. In this series APC with a short stem reverse prosthesis was the implant of choice. All the disadvantages of the other techniques, such as structural failure, loss of function and stem loosening are theoretically solved. More patients and a longer follow up are needed to analyze the long term reliability.

FIGURES

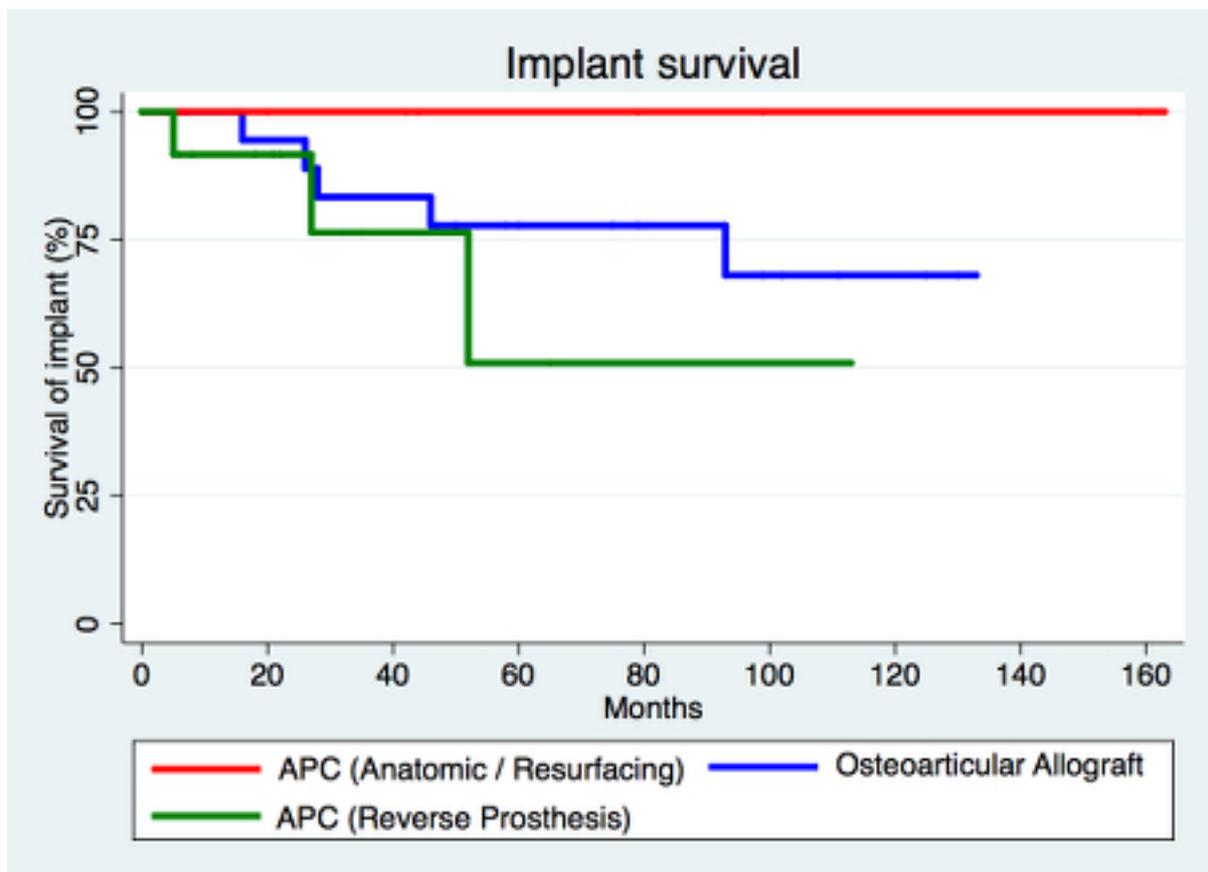


Figure 1: Implant survival of the different reconstruction techniques