Reverse Humeral Reconstruction Prosthesis vs. Reverse Allograft Prosthetic Composite in the Setting of Massive Proximal Humeral Bone Loss: A Retrospective Comparative Analysis

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INTRODUCTION: Massive proximal humeral bone loss (MPHBL) presents significant challenges in shoulder arthroplasty, often requiring complex reconstructions due to compromised implant fixation and soft tissue support. Treatment options include allograft prosthetic composites (APC), which promote soft tissue integration but carry a higher risk of nonunion and graft resorption, and humeral reconstruction prostheses (HRP), which offer immediate mechanical stability and modularity but uncertain biological integration. The optimal reconstructive strategy remains debated. The PHAROS classification system guides surgical planning based on the severity of bone loss. Reverse configurations have shown better outcomes than hemiarthroplasty in this setting. This study compares Reverse HRP (RHRP) and Reverse APC (RAPC) for MPHBL, hypothesizing that RHRP may offer superior results due to its mechanical advantages and modularity.

METHODS: This retrospective study included 30 consecutive patients (22 females, 8 males) who underwent proximal humeral reconstruction using either a RHRP (n = 20) or a RAPC (n = 10). All patients were evaluated pre- and postoperatively for range of motion (ROM), Constant-Murley Score (CMS), Simple Shoulder Test (SST), and Visual Analog Scale (VAS). Outcomes were compared to the minimal clinically important difference (MCID) and substantial clinical benefit (SCD) for revision reverse total shoulder arthroplasty. Radiographic analysis was performed. Complication rate (CR) and revision rates (RR) were recorded.

RESULTS:

Average follow-up was 37.6 months. RHRP achieved a forward flexion (FF) of 110°, external rotation (ER) of 22°, and internal rotation (IR) to the sacrum. RAPC reached a FF of 92°, ER of 12°, and IR of the buttock. RHRP scored 60.3 for CMS, 7.5 for SST, and 1.3 for VAS, while the RAPC scored 56 for CMS, 6.3 for SST, and 2.0 for VAS. In the RHRP group, 60% of patients (n = 12) surpassed CMS-MCID, and 10% (n = 2) achieved the CMS-SCB. In comparison, 70% of patients (n = 7) in the RAPC group met the CMS-MCID, but none (0%, n = 0) reached the CMS-SCB. All patients in the RHRP group (100%, n = 20) exceeded the SST-MCID, and 35% (n = 7) achieved the SCB. Meanwhile, in the RAPC group, 90% of patients (n = 9) met the SST-MCID, but none (0%, n = 0) attained the SST-SCB threshold. Overall CR was 23.3% (7 out of 30); CR of RHRP was 5% (1 out of 10), while the CR for RAPC group was 60% (6 out of 10) [OR = 0.04, p = 0.002]. Overall, the patient-level RR was 20% (6 out of 30), while the overall procedure-level RR was 26.7% (8 revision surgeries out of 30 patients). RR of RHRP was 5% (1 out of 20) while RAPC was 50% (5 out of 10) [OR = 0.05, p = 0.001].

DISCUSSION AND CONCLUSION: In this retrospective study of 30 patients with PHAROS type 2 or 3 proximal humeral bone loss, both RHRP and RAPC led to improved postoperative outcomes. However, the RHRP group demonstrated superior forward flexion, external rotation, and a significantly lower complication and revision rate. A greater proportion of RHRP patients also achieved clinically meaningful improvements, as measured by MCID and SCB thresholds. Compared to a meta-analysis by Hao et al., our findings aligned on functional equivalence between techniques but highlighted higher complication rates in RAPC and better reliability with RHRP. Overall, RHRP appears to be a more mechanically dependable and clinically beneficial option for managing massive proximal humeral bone loss.