Outcomes of Open Reduction Internal Fixation and Reverse Shoulder Arthroplasty for 3- and 4-Part Proximal Humerus Fractures in Patients Ages 60 and Younger

Megan Lanelle Anderson[1], Samuel S Rudisill, Michael Baird[2], Brandon J Yuan, Michael E Torchia[3], Jonathan D Barlow, Mark E Morrey[3], Joaquin Sanchez-Sotelo, Jennifer Tangtiphaiboontana
[1]Department of Orthopedic Surgery, Mayo Clinic, [2]Walter Reed National Military Medical Center, [3]Mayo Clinic

INTRODUCTION: Surgical treatment of complex 3- and 4-part proximal humerus fractures (PHFs) presents a substantial clinical and technical challenge. While utilization of reverse shoulder arthroplasty (RSA) has dramatically increased for elderly patients with complex PHF, the relative benefit of open reduction and internal fixation (ORIF) versus arthroplasty in younger, active patients remains poorly understood. This study assessed the outcomes and complications of open reduction and internal fixation (ORIF) and reverse shoulder arthroplasty (RSA) for the acute management of 3- and 4-part PHFs of patients aged ≤ 60 years.

METHODS: All patients aged 60 years and younger who underwent ORIF or RSA for acute PHFs between 2008- 2023 at a single institution were identified. After excluding those with ipsilateral upper extremity fracture, pathologic fracture, or less than 1 year of follow-up, 76 PHFs in 73 patients were included. Thirty-three (43%) PHFs were classified as AO/OTA type 11B1, 6 (8%) as 11C1, and 38 (50%) as 11C3. Displacement was categorized as severe in 57 (75%) of cases. Sixty-two patients (63 shoulders) underwent ORIF (35 female [56%], mean age 49.5 ± 8.4 years), and 11 patients (13 shoulders) underwent RSA (8 female [73%], mean age 56 ± 4.5 years), with mean follow-up of 8.2 and 5.3 years, respectively. Postoperative complications and reoperations were retrospectively reviewed. American Shoulder Elbow Surgeons score (ASES), Subjective Shoulder Value (SSV), Numeric Pain Rating Scale (NPRS), and satisfaction were assessed at final follow-up. Postoperative radiographs were analyzed for reduction quality and overall radiographic outcomes.

RESULTS: Fracture or tuberosity reduction was considered poor in 29% of ORIF cases and 38% of RSA cases (p=0.503). RSA yielded inferior ASES (70.5 ± 18 vs. 75.6 ± 22.2; p=0.338), SSV (65.6 ± 27.3 vs. 76.0 ± 22.7; p=0.147), and satisfaction scores (7.1 ± 3 vs. 8.3 ± 2.1; p=0.172), though these differences did not achieve statistical significance. NPRS was similar between groups (RSA: 2.2 ± 2.6, ORIF: 1.8 ± 2.5; p=0.759). Among patients who underwent ORIF, SSV was significantly lower in patients who developed avascular necrosis compared to those who did not (63.5 vs. 82.8, p=0.036). The reoperation rate was higher with ORIF (39% vs. 9%; p=0.085). One patient in the RSA group required reoperation for infection. Fifteen shoulders (24%) in the ORIF group were subsequently converted to arthroplasty (14 RSA, 1 hemiarthroplasty), and fracture malreduction was associated with a 4.6-fold increased risk of conversion (p=0.007). Patients who failed ORIF had significantly lower ASES (62.1 ± 22.2 vs. 80.2 ± 20.6; p=0.032), SSV (57.8 ± 31.4 vs. 81.7 ± 19.5; p=0.007), and satisfaction scores (6.5 ± 2.3 vs. 8.9 ± 1.7; p=0.006) compared with patients successfully managed with ORIF. Reoperation risk was 12 times higher among those with severe displacement at time of injury (HR, 12.0; 95% CI, 1.6 - 88.8; p=0.015).

DISCUSSION AND CONCLUSION: RSA was associated with a lower reoperation rate than ORIF in patients 60 or younger presenting with complex PHF. Satisfactory reduction was difficult to obtain. For patients with successful ORIF, patient-reported outcomes tended to be better. Avascular necrosis after internal fixation was associated with worse patient-reported outcomes. Severe initial displacement was associated with increased risk of conversion to arthroplasty and reoperation.