# Management of Periprosthetic Humerus Fractures After Shoulder Arthroplasty

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INTRODUCTION: Periprosthetic humerus fractures following shoulder arthroplasty are a relatively rare complication with a reported incidence ranging from 1 to 3%. The incidence of these injuries is expected to increase due to the increased number of shoulder arthroplasty procedures performed and the increasing life expectancy of patients. Several classification systems have been developed to describe these injuries according to fracture location and implant stability in order to help guide treatment. The purpose of this study was to analyze the time to fracture union and early complications after nonoperative and operative treatment of periprosthetic humerus fractures after primary shoulder arthroplasty.

METHODS: Retrospective review of an institutional shoulder arthroplasty database to identify all patients who sustained a periprosthetic humerus fracture after primary shoulder arthroplasty. Inclusion criteria were patients who sustained a postoperative periprosthetic humerus fracture with radiographic follow-up to fracture union or clinically diagnosed nonunion. Exclusion criteria were patients who sustained a periprosthetic fracture intraoperatively, patients who sustained a periprosthetic fracture after revision shoulder arthroplasty, and patients who lacked adequate radiographic follow-up. Patients were divided into operative and non-operative cohorts based on treatment. Periprosthetic fractures were classified according to the Worland classification. Post-injury x-rays and postoperative x-rays were evaluated to determine time to fracture union. Complications and reoperations of both cohorts were also collected. Patients were contacted via telephone and email survey for American Shoulder and Elbow Surgeons Shoulder Score (ASES), Single Assessment Numeral Evaluation (SANE) of shoulder function, and visual analog scale (VAS) pain score.

RESULTS: There were 46 patients who sustained a periprosthetic humerus fracture after a primary shoulder arthroplasty. Eighteen patients were treated non-operatively and 28 patients were treated operatively. Seven (25.0%) patients in the operative cohort had an initial attempt at non-operative management but underwent surgery due to fracture displacement, delayed fracture healing or difficulty with brace wear. The average length of non-operative treatment for these patients was 3.3 ± 8.1 weeks. There was no significant difference in age (78.3 ± 10.4 vs. 78.0 ± 10.0, p=0.938), sex (p=0.243), or BMI (31.5 ± 4.9 vs. 32.5 ± 7.8, p=0.672) between the non-operative and operative cohorts respectively. There were significant differences in the fracture patterns between the non-operative and operative cohorts (p=0.030). Of the patients who underwent surgical treatment, 22 (78.6%) underwent ORIF alone, 3 (10.7%) underwent revision of the stem without addition fixation, and 3 (10.7%) underwent revision of the stem in combination with ORIF. There was no significant difference in time to fracture union (4.8 ± 3.9 months vs. 4.4 ± 2.5 months, p=0.723) between the non-operative and operative cohorts respectively. There was one patient in the non-operative cohort who had a persistent nonunion 15 months after the injury. The overall complication rate was 28.3% (13 of 46 patients). There was no significant difference in the complication rate (33.3% vs. 25.0%, p=0.723) between the non-operative and operative cohorts respectively. The non-operative cohort complications were four (22.2%) patients sustaining a recurrent fracture after immobilization was discontinued and prior to full union, one (5.6%) malunion, and one (5.6%) nonunion. Of all patients initially treated non-surgically, 12 of 25 (48%) experienced cross-over to the operative cohort, delayed fracture healing due to recurrent fracture, or nonunion. The complications in the operative cohort included: two (7.1%) patients with a nonunion, two (7.1%) patients with hardware failure, one (3.6%) patient with a rotator cuff tear, one (3.6%) patient with wound dehiscence, and one (3.6%) patient with glenosphere baseplate failure. There were no significant differences in ASES (72.7 ± 22.4 vs. 74.0 ± 23.8, p=0.901), SANE (63.8 ± 25.0 vs. 68.3 ± 22.6, p=0.683), and VAS pain scores (2.3 ± 2.4 vs. 2.2 ± 2.6, p=0.942) between the non-operative and operative cohorts respectively.

DISCUSSION AND CONCLUSION: Periprosthetic humerus fractures present treatment challenges due deforming muscle forces, challenging immobilization techniques, and limited bone availability for surgical fixation. This study demonstrates that nonunion is substantially more common in those fractures treated nonsurgically. Ultimately, union was able to be achieved in almost all patients with satisfactory outcomes both surgically and nonsurgically. However, there is a high rate of cross over from non-operative to operative management and complications remain high regardless of treatment.