

## ANALYSIS OF PROXIMAL HUMERAL FRACTURE-DISLOCATIONS MANAGED WITH LOCKED PLATES: AN INSTITUTIONAL BASED STUDY

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### Abstract

**Background:** Despite the vast majority of proximal humerus fractures being treated nonoperatively, for displaced proximal humeral fractures, open reduction and internal fixation with locking plates has been the most frequent surgical treatment. The present study was conducted to assess proximal humeral fracture-dislocations managed with locked plates. **Materials and Methods:** In the present retrospective study 56 patients with proximal humeral fracture-dislocations between the ages of 18 and 60 years were included. Before surgery, routine radiographs and computed tomography scans were obtained. All shoulders were operated using a deltopectoral approach or deltoid-splitting approach. Patients were assessed regularly. The final outcome was determined by the functional outcome on the last follow-up visit. **Results:** In the present study 56 shoulders with proximal humeral fracture dislocations in 56 patients were managed with locked plates. There were 43 men (76.78%) and 13 women (23.21%), with a mean age of 39.8 years. The fracture-dislocations in 48 shoulders (85.71%) were caused by high-energy trauma. The fracture-dislocations were on the left side in 27(48.21%). The dislocation was anterior in 46 shoulders (82.14%) and posterior in 10 (17.85%), with 50% patients had 3-part fracture dislocations and 50% had 4-part fracture dislocations. All of the fractures united at an average of 15 weeks after surgery. At the final follow-up visit, the mean forward flexion was 130°, mean abduction was 129°, mean external rotation was 43°, and mean internal rotation was 68°. The mean Constant score at the latest follow-up was 79 points. **Conclusion:** The present study concluded that in patients with 3- and 4-part fracture dislocations, all the fractures united at an average of 15 weeks after surgery. At the final follow-up visit, the mean forward flexion was 130°, mean abduction was 129°, mean external rotation was 43°, and mean internal rotation was 68°. The mean Constant score at the latest follow-up was 79 points.

## INTRODUCTION

Fractures of the proximal humerus are common injuries and generally follow a bimodal age distribution pattern.<sup>[1,2]</sup> Management of three- and four-part proximal humeral fracture-dislocation is challenging especially in the younger patients where an arthroplasty may not be the best option. Devascularisation of the humeral head leads to a high risk of non-union or avascular necrosis.<sup>[3-5]</sup> As the humeral head fragment is dislocated and locked anterior to the glenoid, reduction forces are not transmitted via the surgical neck, and therefore an attempt for closed reduction typically fails.<sup>[6]</sup> Instead, open reduction is required in order to facilitate

reduction of the humeral head; however, care must be taken not to cause further harm to neurovascular structures by any means.<sup>[7]</sup> Inclination toward arthroplasty over the conventional open reduction and internal fixation (ORIF) is because of the concern of potential risk of osteonecrosis or nonunion reported with the latter procedure.<sup>[2,8]</sup> In older patients, primary arthroplasty is usually the treatment of choice, but functional outcome may still be less than satisfactory.<sup>[9]</sup> Significant complications such as infection, loosening and instability may cause long-term problems even after an initially promising result. Arthroplasty is not an ideal treatment in younger patients. Functional outcome can be poor, and the limited survival time of the prosthesis means

revision procedures will often be required.<sup>[9]</sup> Locking plates have shown promising outcome after fixation of complex proximal humeral fractures.<sup>[10]</sup> By virtue of the fixed-angle plate-screw construct, the locking plate confers superior anchorage and stability in the fracture fragments compared with conventional plates.<sup>[11]</sup> The present study was conducted to assess proximal humeral fracture-dislocations managed with locked plates.

## MATERIALS AND METHODS

In the present retrospective study conducted in Department of Orthopaedics, GMERS Medical College and Civil Hospital, Himmatnagar, Gujarat (India) on patients with proximal humeral fracture-dislocations between the ages of 18 and 60 years were included. 56 patients were included in the study. The study excluded patients with associated ipsilateral upper limb fractures, open injuries, age older than 60 years, or those with associated vascular injuries. Most of these injuries were the result of high-velocity trauma resulting in 3- or 4-part fracture-dislocations. Before surgery, routine radiographs and computed tomography scans with 3-dimensional reconstruction were obtained to determine the accurate fracture configuration. All shoulders were operated on by a single surgeon using a deltopectoral approach or deltoid-splitting approach. An anterior deltopectoral approach was used when the dislocation was anterior. The deltoid-splitting approach was used when the dislocation itself was in the posterior direction. Dissection to mobilize the head fragment was performed meticulously to preserve the soft tissue attachments to the fractured fragments. The head fragment was then reduced by gentle manipulations. In patients with good bone stock, a threaded Kirschner wire or a thin Schanz pin was used to pull the humeral head back into place. For surgical neck fractures, the medial calcar was followed to ascertain reduction, whereas for anatomic neck fractures, the biceps groove was evaluated for assessment of reduction. The fracture fragments were reduced and provisionally stabilized with Kirschner wires. The plate was positioned to avoid subacromial impingement. Care was also taken to ensure that the plate was placed lateral to the tendon of the long head of the biceps. Every effort was made to put the lower calcar screws to prevent varus collapse of the head fragment. Bone substitute material was used in 11 cases where there was void caused by severe comminution. In 3 shoulders with a 4-part fracture-dislocation with absent medial cortical support, a tricortical graft from the iliac crest was also used. This helped to maintain medial continuity and provide biological support. The surgery in a few patients was delayed for more than 7 days because of associated injuries, comorbidities, or referral from other hospitals. Relocating the head fragment in these neglected patients was difficult. In these cases, gentle mobilization of the head fragment was done to

remove the adhesions, followed by identification of head fragment with the help of pointed retractors. Postoperatively, patients were placed in a sling except for the period of exercises. An aggressive physiotherapy regimen was initiated without stressing the bony fixation or the soft tissue repair. The course of physiotherapy was based on the injury pattern, fixation strength, bone quality, and patient compliance. Early passive range of motion (ROM) exercises were started on postoperative day 1 with pendulum exercises. Passive or active, or both, assisted forward elevation and external rotation were commenced up to 90° and 30°, respectively; restrictions were placed on passive adduction and internal rotation. Patients were discharged with a home-based physiotherapy regimen along with intermittent follow-up because most of the patients had limited access to regular formal physiotherapy. After 3 to 4 weeks, submaximal isometric internal rotation, external rotation, flexion, extension, and abduction were initiated as tolerated with the aim of achieving full passive ROM by 4 to 6 weeks; at that time active ROM was gradually initiated. As early as 8 weeks postoperatively, resisted ROM was commenced, which generally progressed to an aggressive stretching and strengthening phase after 10 to 12 weeks. Patients were assessed regularly, and anteroposterior and lateral radiographs were taken at each follow-up visit to evaluate fracture healing. Follow-up radiographs were carefully scrutinized to detect any secondary loss of reduction, displacement of fragments, varus or valgus deformity, and osteonecrosis of the humeral head (ONHH). An assessment was also done of various implant-related problems such as screw perforation of the humeral head, loosening, backout, and plate pullout or breakage. The Constant score.<sup>[12]</sup> was also determined for the injured side during follow-up. The final outcome was determined by the functional outcome on the last follow-up visit (minimum, 24 months).

## RESULTS

In the present study 56 shoulders with proximal humeral fracture dislocations in 56 patients were managed with locked plates. There were 43 men (76.78%) and 13 women (23.21%), with a mean age of 39.8 years.

The fracture-dislocations in 48 shoulders (85.71%) were caused by high-energy trauma and 8(14.28%) were caused by low energy trauma to the involved extremity. The fracture-dislocations were on the left side in 27(48.21%) and on the right side in 29(51.78%) patients. The dislocation was anterior in 46 shoulders (82.14%) and posterior in 10 (17.85%), with 50% patients had 3-part fracture dislocations and 50% had 4-part fracture dislocations.

All of the fractures united at an average of 15 weeks after surgery. At the final follow-up visit, the mean forward flexion was 130°, mean abduction was 129°,

mean external rotation was 43°, and mean internal rotation was 68°. The mean Constant score at the latest follow-up was 79 points.

**Table 1: Demographic data**

Gender	N(%)
Male	43(76.78%)
Female	13(23.21%)
Mean Age	39.8 years

**Table 2: Data regarding fracture dislocations**

Variables	N(%)
Cause of fracture dislocations	
High-energy trauma	48(85.71%)
Low-energy trauma	8(14.28%)
Side of fracture dislocations	
Left side	27(48.21%)
Right side	29(51.78%)
Position	
Anterior	46(82.14%)
Posterior	10(17.85%)
Fracture type	
3- part fracture dislocations	28(50%)
4-part fracture dislocations	28(50%)

**Table 3: Final outcome**

Variable	
Average Union time of fracture after surgery	15 weeks
Mean forward flexion	130°
Mean abduction	129°
Mean external rotation	43°
Mean internal rotation	68°
Mean Constant score	79

## DISCUSSION

The locking plate osteosynthesis of displaced proximal humerus fractures remains a challenge for the upper extremity surgeon. Despite development of new implants and awareness of new biomechanical fracture characteristics, the complication rate stagnates on a high level. Especially varus impaction with penetration of proximal screws is a frequent complication.<sup>[13]</sup>

In the present study 56 shoulders with proximal humeral fracture dislocations in 56 patients were managed with locked plates. There were 43 men (76.78%) and 13 women (23.21%), with a mean age of 39.8 years. The fracture-dislocations in 48 shoulders (85.71%) were caused by high-energy trauma. The fracture-dislocations were on the left side in 27(48.21%). The dislocation was anterior in 46 shoulders (82.14%) and posterior in 10 (17.85%), with 50% patients had 3-part fracture dislocations and 50% had 4-part fracture dislocations. All of the fractures united at an average of 15 weeks after surgery. At the final follow-up visit, the mean forward flexion was 130°, mean abduction was 129°, mean external rotation was 43°, and mean internal rotation was 68°. The mean Constant score at the latest follow-up was 79 points.

Siebenbürger et al, in a retrospective study of 94 patients, reported no statistically significant differences in rates of loss of fixation between the 39 patients with cemented screws compared with the 55

patients treated with standard surgical technique (11% vs. 5%, P=74). However, it is important to note a possible study bias because only the higher-risk patients with low bone stock in the humeral head were assigned for augmentation while the lower-risk patients were treated without augmentation. Their findings may suggest that augmentation of the higher-risk subjects was successful in achieving similar outcomes to lower risk subjects.<sup>[14]</sup>

Trikha V et al concluded that the average delay from injury to surgery was 7 days (range, 1-35 days), with a mean follow-up of 40 months (range, 24-66 months). All of the fractures united at an average of 15 weeks after surgery. At the final follow-up, the mean forward flexion was 129° (range, 100°-160°), and mean abduction was 128° (range, 100°-150°). The mean Constant score at the final follow-up was 78 points (range, 68-88 points). One case of complete osteonecrosis of the humeral head and 1 case of partial osteonecrosis of the humeral head were noted. Two cases of screw perforation of the humeral head were seen, with subsequent restricted range of motion improving after removal of the offending screws.<sup>[15]</sup>

Johnson NA et al, found that the mean age was 51 years (range 32–65). Mean follow-up was 36 months (range 24–72 months). At last follow-up mean Constant score was 75 (range 64–86) compared to 88 (range 85–92) for the uninjured shoulder. Mean Oxford shoulder score was 41 (range 34–46). One patient developed avascular necrosis. Screw back out was seen in three patients. These were removed under

local anaesthesia. There were no screw penetrations of articular surface. One patient suffered a radial nerve neuropraxia which resolved.<sup>[9]</sup>

## CONCLUSION

The present study concluded that in patients with 3- and 4-part fracture dislocations, all the fractures united at an average of 15 weeks after surgery. At the final follow-up visit, the mean forward flexion was 130°, mean abduction was 129°, mean external rotation was 43°, and mean internal rotation was 68°. The mean Constant score at the latest follow-up was 79 points.

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