

Functional Outcomes of Distal Humerus Fractures Fixed by Orthogonal Double Plating

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Abstract

Background: Distal humerus fractures constitute 2% of all fractures in the adult population. Surgical intervention is indicated in most cases, and these fractures are often complicated by difficulty in fracture-site exposure, comminution in the metaphyseal or articular region, and the presence of osteoporotic bone. The objective of the study was to assess functional outcome of operative fixation of distal humerus with locking plate and screws.

Materials and Methods: This is a retrospective study of 30 patients with distal humerus fractures fixed with orthogonal plating from 2018-2019 in KIMS Hospitals, Kondapur, Hyderabad. Functional outcome was assessed using Mayo Elbow Performance score along with other major and minor complications were noted.

Results: There were 18 male patients, and 12 female patients. Average age of the patients was 39.68 years with age ranging from 18 years to 80 years. 16 cases were right humerus and 14 were left humerus involved. All cases were operated through trans olecranon approach and chevron osteotomy technique, fracture stabilised by orthogonal locking compression plate. 6 fractures were C1, 15 were C2 and 9 were C3 types according to AO classification. Complications were noted in 5 patients. 13.3 % patients were rated as excellent, 63.3% were rated good, 16.6% were rated as fair, 6.8% were rated as poor according to Mayo Elbow Performance Scoring.

Conclusion: Orthogonal dual plate configurations can provide anatomical reconstruction and stable fixation of Type C intra articular distal humeral fractures and allow early mobilization of the elbow after surgery which result in good functional outcome.

Keywords: Distal humerus fractures, Trans Olecranon, Chevron Osteotomy, MEP score.

Introduction

Distal humerus fractures constitute 2% of all fractures in the adult population [1]. These injuries are distributed in a bi-modal fashion with the first peak being seen in the young resulting from high-energy trauma Table 4 and the second peak being seen in the elderly osteoporotic population [2].

These fractures are challenging to the treating surgeon due to fracture comminution, poor bone quality and difficulty in restoring the complex anatomy of the distal humerus. Classification of these fractures not only differentiates, but also guides them towards standardized treatment protocols. Our aim is to restore a functional elbow, which Morrey described as requiring 30 to 130 degree range of motion [3]. Loss of this movement can severely affect activities of daily living and lead to a loss of independence in the elderly population [4]. The goals of surgical treatment are to restore articular

congruity and bone alignment whilst providing rigid, stable fixation that enables early active motion [7, 8]. Previous biomechanical studies on internal fixation methods for distal humerus fractures have indicated that double-plate fixation provides adequate stability [10, 11]. The standard method used by most surgeons is the application of 2 plates perpendicular to each other, with 1 on the medial supracondylar ridge and the other placed posterolaterally [13, 14]. Operative fixation has been shown to give satisfactory results with long term follow up demonstrating good or excellent outcome in 86% [5, 6]. Despite the evolution of surgical techniques, fixation has been associated with dissatisfaction in some patients with minor complications such as elbow stiffness and ulnar neuropathy & infection.

Present study aims over functional recovery of patient after distal humerus fracture fixation with orthogonal plating.

Materials and Methods

Study design

This retrospective study was performed from data from all patients treated during the study period 2018-2019 at KIMS Hospital, Kondapur, Hyderabad were available for review and analysis. All patients who had a type C intraarticular distal humerus fracture (according to the AO classification 15) were considered for inclusion in this study.

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Table 1: Age distribution

Age in years	Number of cases	Percentage
18-38	18	60.00%
39-58	6	20.00%
59-78	4	13.33%
< 80	2	6.67%

Table 2: Sex distribution

Gender	Number of cases	Percentage
Male	18	60.00%
female	12	40.00%
	30	100.00%

Table 3: Side involvement

Side	Number of cases	Percentage
Left	14	46.60%
Right	16	53.30%
	30	100%

Table 4 : Mode of injury

Mode of Injury	Number of cases	Percentage
RTA	8	28.60%
Domestic fall	22	73.30%
Total	30	100.00%

We excluded patients who had an extraarticular or pathological fracture, patients who were not skeletally mature, and patients with psychological problems that would prevent them from following the rehabilitation protocol.

Thus, 30 patients with a distal humerus fracture were included in this study, and these patients underwent double-plating surgery with precontoured distal humerus plates.

Surgical Approach

All the surgeries were performed under general anesthesia or brachial plexus block in lateral decubitus position after application of tourniquet. A longitudinal midline incision was given over posterior aspect of elbow around 10 cm proximal and 5 cm distal to the joint with slight curvature over olecranon prominence. The ulnar nerve lying in the bony groove on the back of the medial epicondyle was fully dissected out.

AV-shaped olecranon osteotomy was done approximately 2 cm distal to its tip with the help of drill bit and osteotome. The triceps muscle along with osteotomized bony fragment was wrapped with wet gauze and retracted proximally to expose the fractured fragments. The intra articular fragments were first of all reduced and provisionally fixed

**Figure: Immediate Post Op****Figure: 4 Weeks Follow Up**

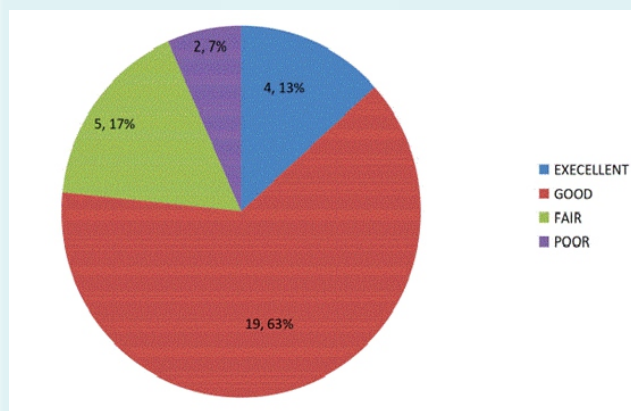
with K wires followed by fixation with partially threaded cannulated screws to convert the complicated intercondylar fractures to supracondylar varieties. The reduced articular fragment was then fixed to the shaft of humerus. If articular bones were severely comminuted, either condyle was first reduced and fixed to the shaft as it provided a good key for reduction. Now, articular fragments were reconstructed and opposite condyle was also fixed to the main bone. When satisfactory reduction was achieved, definitive fixation was performed by the orthogonal plating system where one plate was put on medial column and another plate on the posterolateral column of distal humerus. The olecranon osteotomy was fixed with tension



10 Weeks follow-up

Mayo Elbow Performance Score

6 Months



Mayo Elbow Performance Score

MEPS	6 Weeks	3 Months	6 Months
Excellent	0	2	4
Good	11	17	19
Fair	16	9	5
Poor	3	2	2

* Scoring : Excellent 90-100, Good 75-89, fair 60-74, Poor <60.

while 63.3% (19) patients 120-130 degrees, 5 (16.6%) of patients had range of motion less than 100 degrees, remaining 2 (6.8) had range of motion less than 70 degrees.

bind wiring using two 2 mm K-wires. At our centre typical post-operative management protocol includes a ROM brace locked in extension for 2 weeks, passive mobilization from two weeks then active after six weeks. Records of the patients followed up in OPD at 4 weeks, 10 weeks, 3 months, 6 months were reviewed.

Results

30 patients were included into the study with complete data available. 6 fractures were C1, 15 were C2 and 9 were C3 types according to AO classification. Of the total 30 patients recruited in the study, a total of 12 women and 18 men Table 2, with a mean age of 39.68 years (range 18–80 years) Table 1 were included in this study. All the patients were followed up at the end of 1 year. Complications were noted in 5 patients. As previously stated, olecranon osteotomy was used in all patients, At the end of the operation, all patients had olecranon fixation performed using tension-band wire, 1 patient treated with a tension-band wire at the olecranon osteotomy site had metal failure 1 week postoperatively. Therefore, the tension-band wire was replaced with a plate, and the osteotomy site was healed at 4 months postoperatively, 1 patient had non union olecranon osteotomy site which was replaced with olecranon plating with bone grafting, 3 patients had superficial infection.

Overall 25 patients had no complications reported during the period of the study

13.3% (4) patients had range of motions greater than 130 degrees ,

Discussion

The aim of treatment for distal humerus fracture is to achieve the painless and stable elbow with satisfactory functions. This requires stable fixation of fracture fragments, anatomical reconstruction of intra-articular surface, re-establishment of geometry of elbow joint to allow early mobilization, and full rehabilitation [27].

The correct use of the plates, in terms of placement, size and number of screws, can obtain a stable and painless elbow and prevent complications such as stiffness or nonunion. The distal humerus can be represented as a triangular structure, consisting of three columns 16: medial, lateral and transverse intercondylar; its stability depends on the integrity of this triangle. Recently Kumar et al. [21] showed that it is possible to obtain excellent outcomes in distal third fractures using only a single 4.5-mm LCP with two-screw (4-cortices) purchase in the distal fragment. Nonetheless, according to our observations, it is advisable to use two reconstruction plates (normally 3.5 mm) positioned in a perpendicular or parallel manner, in order to restore the triangle. Currently, there are different opinions about the parallel or orthogonal positioning of the plates. Shin et al. in 2010 and Lan et al. in 2013 reported similar results: they concluded that there are no significant differences in two groups of patients treated with plates in parallel or orthogonal configuration. Schwartz et al. [27] found no difference in the stiffness of the 2 plane constructs when loading was performed in the coronal and sagittal planes, as well as in torsion, within the limits of construct failure. Stoffel et al [26]

concluded that the parallel plating method was superior to orthogonal plating in terms of resisting axial loading and torsion and providing more stable fixation. Additionally, Got et al. [28] found that the orthogonal plating method had a significantly greater load to failure in torsion than the parallel plating method.

From our study for better management of these fracture we infer: careful pre-operative evaluation and planning, early operative intervention with pre contoured distal humerus plates for anatomical reduction and stable fixation, followed by early mobilization. Early

mobilization in turn provides good functional outcome and decreases elbow stiffness.

Conclusion:

Orthogonal dual plate configurations can provide anatomical reconstruction and stable fixation of Type C intra articular distal humeral fractures and allow early mobilization of the elbow after surgery which result in good functional outcome.

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