

Functional and radiological outcome of extra articular distal humerus fractures treated with distal humerus locking compression plate: A prospective study

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Abstract

Background: Management of extra-articular distal humerus fractures presents a challenge to the treating surgeon due to the complex anatomy of the distal part of the humerus and complicated fracture morphology. The use of distal humerus locking compression plates is promoted for the management of these fractures.

Objectives: To evaluate the Functional and radiological outcome of extra-articular distal humerus fractures treated with distal humerus locking compression plate.

Materials and Methods: Our study consists of 29 cases of extra-articular distal humerus fracture operated at Mysore medical college and research institute from January 2021 to January 2023. Functional outcome was assessed through The Mayo Elbow Performance Score. All the cases in the study were post traumatic. Patients were following up regularly for a period of 1 year post operatively. And radiological parameters like Metaphyseal-Diaphyseal angle, humeral-ulnar angle, shaft-condylar angle, anterior line are calculated and were compared with normal values.

Results: There were 21 male (70.0%) patients and 8 (30%) female patients. Average age of the patients was 41.38 years with age ranging from 24 years to 65years. 16 cases were right humerus and 13 were left sided humerus involved. All cases were of AO type 13A fractures were operated using paratricipital approach, fracture stabilized with distal humerus locking compression plate. Most of the patients had excellent postoperative elbow flexion with average arc of elbow flexion of 117.33 degrees, average extension deficit of 8.67 degrees, average pronation of 70.83 degrees, average supination of 70.83 degrees. 2 patients in our study had superficial skin infection, 6 cases had Radial nerve neuropraxia.

Conclusion: Distal humerus locking compression plates offer a good fixation for the extra-articular distal humerus fractures with particular advantage in extra-articular type A3. The device helps in early mobilisation even in fractures with comminution due to its enhanced stability where as other fixation methods tend to delay mobilisation due to lack of stability of construct.

Keywords: Extraarticular distal humerus fracture, paratricipital approach, distal humerus locking compression plate, MEP score

Introduction

Extra-articular distal humerus fracture comprises of about 16% of humerus fracture and 3% of all the fractures in adults ^[1]. There are two schools of thoughts. One group of surgeons favors non-operative treatment with plaster cast immobilization and functional bracing, while the other favors operative fixation ^[2]. Concern of radial nerve injury, mal-aligned fracture ends and stiffness of the shoulder and elbow following non-operative treatment are the major reasons to opt for an operative fixation. It is found that operative treatment achieves more predictable alignment and potentially early return of function than functional bracing ^[3]. Majority of the studies are in favor of using a 4.5 mm low-contoured dynamic compression plate. But for the fractures of the distal humerus this technique of plate fixation does not yield good results. Firstly, the small size of the distal fragment in humerus di-a-metaphyseal fractures does not provide adequate area to hold eight cortices and secondly, the distal end of the plate may impinge on the olecranon fossa ^[4, 5]. Double plating techniques using two 3.5 mm plates in orthogonal or parallel patterns can be used to deal with the problem of distal fixation ^[3, 6]. To deal with all these problems use of an oblique posterior plate with an orientation of 5 to 8 degree angle of centre from the long axis of the humerus was proposed ^[7]. The extra-articular distal humeral locking compression plate is pre contoured to be placed in the centre of humeral diaphysis proximally and distally over the lateral supracondylar ridge. This plate has the benefit that a purchase of eight cortices can be easily obtained distally and also due to the oblique design, there is no impingement on the olecranon fossa ^[8]. Most studies are case series. There are less studies regarding the outcome analysis of extra articular distal humerus fractures fixed with lateral plate.

Materials and Methods

This Observational longitudinal Study was conducted in Department of orthopaedics, Mysore medical college and research Institute in association with Krishna Rajendra Hospital, Mysore from January 2021 to January 2023 with sample size of 29. Detailed history was taken from patient and clinical examination was done according to pre prepared Performa. Patients were subjected for further radiological investigations like x-ray. Finally, after the diagnosis based on X ray and classified according to AO classification the patients were selected for the study depending on the fulfilment of inclusion and exclusion criteria.

Inclusion criteria include

1. Patients aged more than 18 years of age.
2. Diagnosed with extra-articular fracture of distal humerus and willing for surgery.

The exclusion criteria for the study were

1. Patients with open fractures.
2. Patients who are medically unfit for surgery.
3. Patients aged less than 18 years of age.
4. Patients with intraarticular distal humerus fracture.

Informed written consent was taken from the study subjects after explaining to them the plan, surgical procedure going to be performed and complications associated with it and intention of the study in language best known to them. All of the patients underwent open reduction and internal fixation with a 4.5mm distal humerus locking compression plate. All of the surgeries were performed under tourniquet control. The fracture was approached through triceps sparing approach described by Gerwin *et al.* ^[9]. The patients were advised for active wrist and finger movements in the immediate post-operative period. The elbow was immobilized in a arm pouch for two weeks. The arm pouch was removed at two weeks and

the patients were instructed by a physiotherapist regarding the standard range of motion exercises for the elbow. The range of motion at the elbow joint was measured with the help of a goniometer. All of the functional parameters were recorded at six weeks and at the final follow-up. The functional outcome was evaluated using mayo elbow performance score at every follow up and also radiological assessment was done by including three parameters namely Metaphyseal-Diaphyseal angle, Humeral-ulnar angle, Shaft-condylar angle, Anterior line. Follow up was done at 1 month, 3 months, 6 months, 1 year.

Results

There were 21 male (72.0%) patients, and 8 (28%) female patients. Average age of the patients was 41.38 years with age ranging from 24 years to 65years. 16 cases were right humerus and 13 were left sided humerus involved. All cases were of AO type 13A fractures were operated using paratricipital approach, fracture stabilized with distal humerus locking compression plate. Most of the patients had excellent postoperative elbow flexion with average arc of elbow flexion of 117.33 degrees, average extension deficit of 8.67 degrees, average pronation of 70.83 degrees, average supination of 70.83 degrees. Average follow up was 24 weeks (6 months) ranging from 18 to 32 weeks in our study. There was no loss of follow up and all have completed minimum of 18 weeks follow up. Average duration of surgery was 50 mins (45-60 min). Radiological evaluation confirmed fracture healing in all patients by 16 to 20 weeks. Final evaluation in our series was done at 6 months follow up on the basis of Mayo elbow performance score [Table 2]. In our series 14 patients had excellent results accounting for 49%, 9 patients had good results accounting for 31%, 4 patients had fair result accounting for 13% and 2 patients had poor result accounting for 7%. Radiological indicators showed that average parameters at post op day 1 were more than the normal and were gradually normalized at 6 months post op correlating with the functional outcome [Figure 8]. The mean metaphyseal-diaphyseal angle [Figure 3] was 84.20° (SD 3.31°, normal 82-84°), the mean humeral-ulnar angle [Figure 4] was 15.55° (SD 2.55°, normal 17.8° valgus), and the mean shaft-condylar angle [Figure 6] was 41.4° (SD 2.50°, normal 40°) [Table 3]. The anterior humeral line [Figure 5] passed through 52.23% (SD 12.5%) of the capitellar width (normal, middle third). Two of the patients had superficial skin infection at post-operative day 6 which was managed with extra dose of iv antibiotics and six patients had wrist drop post op and was treated symptomatically and had recovered in next follow up.

AO types with follow up results [Table 1]

Table 1

AO type-description	Number of patients	Mayo elbow score excellent	good	fair	poor
A1-Apophyseal avulsion	0	0	0	0	0
A2-Metaphyseal simple	19	10	5	2	2
A3-Metaphyseal multi-fragmentary	10	4	4	2	0

Table 2 showing the mean values of mayo elbow score and results at 6 months follow up

Table 2

Parameters	Mean Value
AGE	41
Mayo Elbow score at 6 months	86
Final rating	Good to excellent
Follow Up	6 Months

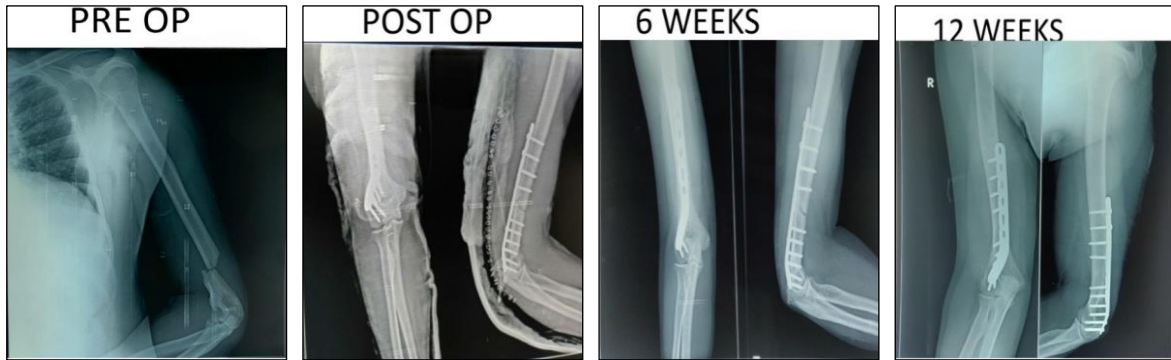


Fig 1: Showing Pre and Post-operative X-rays

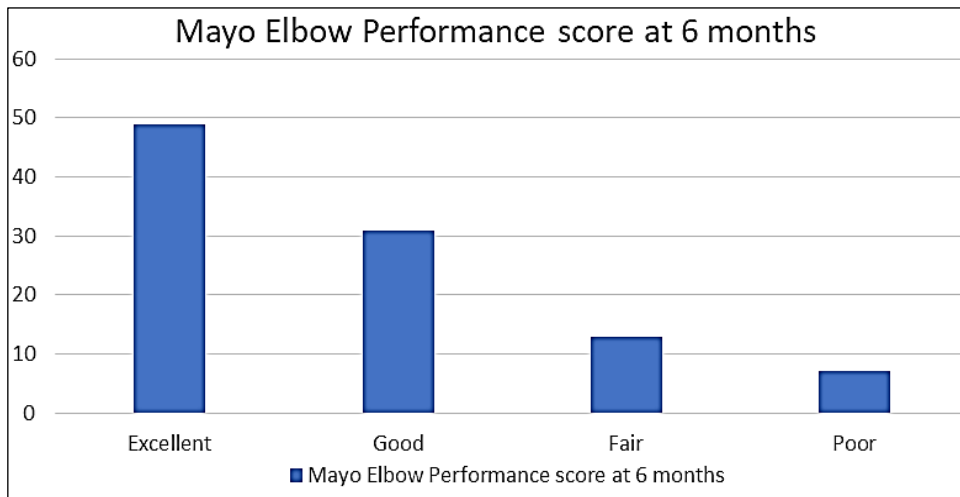


Fig 2: Showing Mayo Elbow Performance score at 6 months

Table 3

Parameter	Normal Range	Standard Deviation	Mean Value at 24 Weeks Post-Op
Metaphyseal-diaphyseal angle	82-84 degrees	3.31	84.2 degrees
Humero-ulnar angle	17.8 degrees	2.55	15.55 degrees
Shaft- condylar angle	40 degrees	2.50	41.4degrees
Anterior line	40 percent	12.5	52.23 percent

Table 3 showing Statistical analysis of Radiological Parameters.

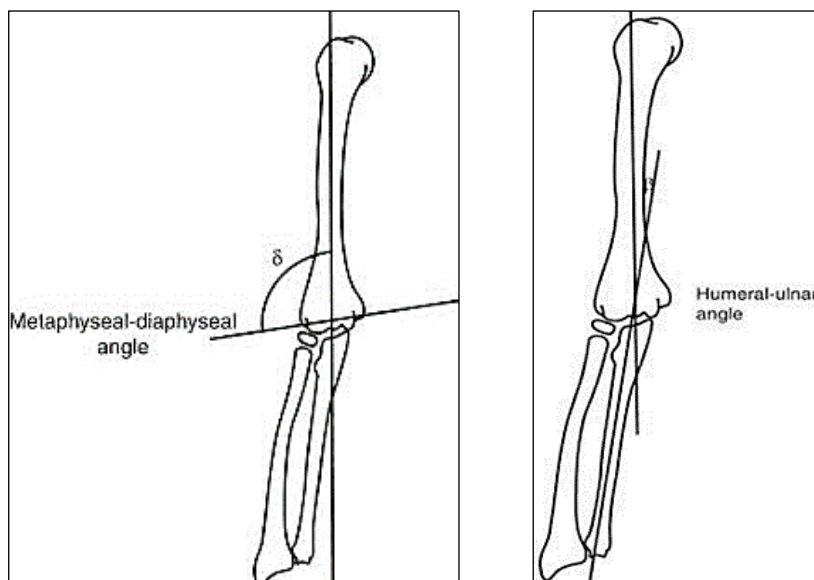


Fig 3: [Metaphyseal-diaphyseal angle]

Fig 4: [Humeral-Ulnar angle]

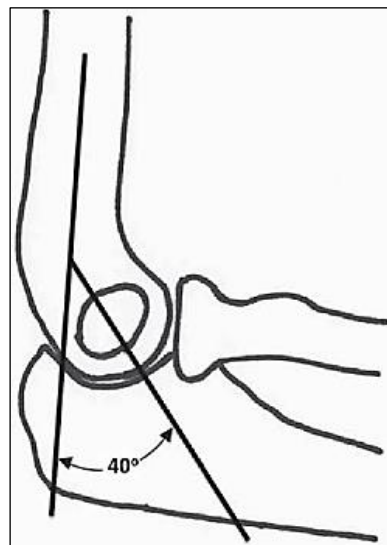
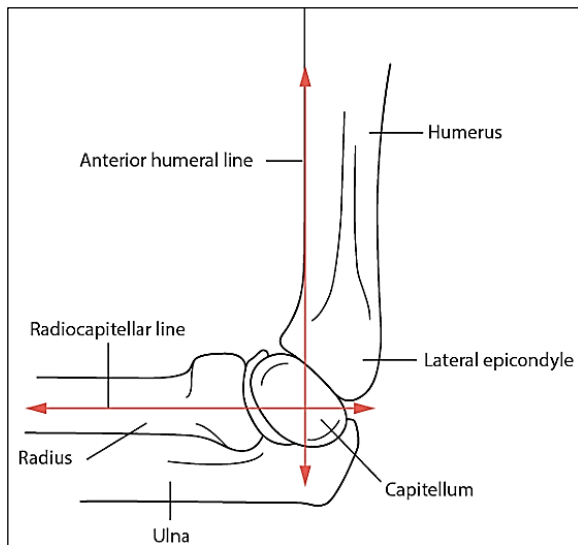


Fig 5: [Anterior Humeral line]

Fig 6: [Shaft-Condylar angle]



Fig 7: Showing Follow up clinical pictures of a patient at 6 months with near full range of flexion, extension, pronation, supination

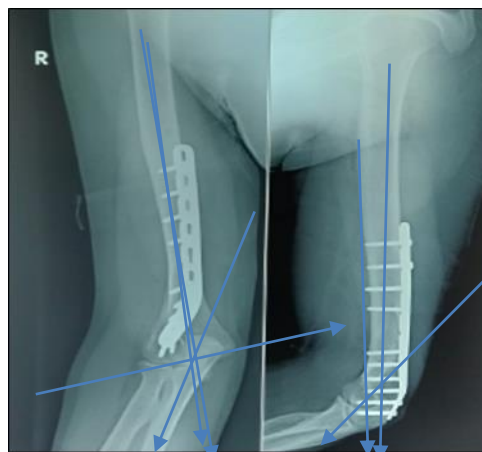


Fig 8: Showing radiological assessment on a Post Op x-ray.

Discussion

We studied 29 patients (21 men, 8 women) with distal humerus fractures AO type 13-A over a period of 1 year, all were extra articular fractures and we evaluated their functional outcome. Palvanen and Robinson ^[11, 10] observed in their respective studies, a bimodal age distribution, 13 patients aged 18-38 years and rest of the 16 patients more than 40 years. In our study 17 patients had Road traffic accident and 12 had self-fall 6 had a trivial fall from

standing height, indicating that osteoporosis may be a pre-disposing factor. Osteoporosis is the major risk factor leading to these type of fractures in the elderly. Single Paratricipital approach and single technique was applied for all the fractures and then the fracture was fixed with 4.5mm locking compression plate. Gerwin *et al.* [9] proposed triceps sparing approach which has several advantages over the traditional triceps splitting approach. Sparing the triceps muscle limits the formation of intramuscular adhesions and scar formation and theoretically reduces the chances of elbow contracture and improves post-operative triceps function. We used Paratricipital approach which gave very good visualization of the fracture site and it gave sufficient working space to attain anatomic reduction and stable fixation. Open reduction and internal fixation with locking compression plate is the gold standard treatment for distal humerus AO type 3 A fractures. However, nailing and fixation with 2 plates have also been tried. In case of nailing the distal fragment is short and the medullary canal is narrow, rendering it difficult to perform nail osteosynthesis in distal third fractures [12]. Yang *et al.* [13] also suggested that the excessive soft tissue dissection required for dual plating may be responsible for the increased incidence of iatrogenic radial nerve palsy reported in some series. Placement of implant over the distal medial aspect of humerus which has a scant soft tissue cover also leads to a high incidence of implant-related complications such as ulnar neuropathy [14]. To circumvent these problems, single column plating has been suggested by many to be the answer. According to our radiographic outcomes, the mean metaphyseal-diaphyseal angle, the mean humeral-ulnar angle and the mean shaft-condylar angle were all within the normal range [Table 3]. Additionally, more than half of the anterior capitellum was anterior to the anterior line, which is within the normal range. These radiographic outcomes demonstrate that the extra-articular distal humerus LCP system is successful in maintaining elbow joint alignment and bone reduction over the long term.

Conclusion

In conclusion, this study shows extra-articular distal humerus fractures operated with distal humerus locking compression plates using paratricipital approach has good functional outcome with particular advantage in AO type A3 which allows early mobilisation of the patients even in fractures with comminution due to the enhanced stability of the construct.

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