

International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(4): 211-215
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www.orthopaper.com
Received: 17-08-2018
Accepted: 21-09-2018

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Study of surgical management of distal third shaft humerus fractures by extraarticular distal humerus locking compression plate in adult patients

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DOI: <https://doi.org/10.22271/ortho.2018.v4.i4d.40>

Abstract

This study has been done to evaluate the functional results and complications following surgical fixation by extra articular distal humerus locking compression plate for closed distal third shaft of humerus fractures in adults, In this study 20 patients of fresh fractures of distal third shaft of humerus treated surgically by internal fixation with extra articular distal locking compression plate studied between January 2015 to march 2016 in Mamta general and super specialty hospital, Khammam. Surgeries were performed within 2-3 days average. All cases treated by open reduction and internal fixation with extraarticular distal locking compression plate. All the fractures united with a union rate of 90%. Radiological union was possible in 13.9 weeks, there were two case of radial nerve neuropraxia and one patient develops superficial infection. Functional outcome as per mayo elbow performance score was excellent in 18 cases and good in 2 cases.

Keywords: Closed fracture, distal third, humerus, extraarticular locking compression plate, adults

Introduction

Diaphyseal fractures of the humerus account for 1–3% of all fractures among adults and 20% of all fractures of the humerus^[1, 2, 3]. The patients with compound humeral shaft fractures have often sustained high-energy trauma and have an increased incidence of radial nerve palsy, fracture comminution, ipsilateral upper extremity fractures and systemic injuries. Appropriate treatment should be based on a classification that describes the fracture pattern, easily reproducible and allows development of treatment guidelines. Over the past two decades, the AO/OTA Classification has been the most accepted classification in the literature. It is reproducible and allows not only descriptive, but also treatment guidelines for each defined fracture type.

Extra articular fractures of distal humerus occur at an anatomical watershed between the humerus shaft and the intercondylar region. These are relatively rare injuries and have been in the limelight owing to a higher incidence of radial nerve injuries, as well as the dilemmas surrounding their management. These injuries are often displaced and have complex fracture pattern with associated comminution.

However, it is also known that this goal is often difficult to obtain because of complex joint anatomy, substantial forces across the elbow region, diminished bone mineral quality and lack of primary stability results in increased complication rates and poor results. Treatment of these fractures has evolved from conservative modalities like cast immobilization and functional brace to operative interventions like External fixator application, Intramedullary Nailing and Plate Osteosynthesis. The goal of operative treatment of humeral shaft fractures is to reestablish length, alignment and rotation with stable fixation that allows early motion and ideally early weight bearing on the fractured extremity^[5]. It depends on a thorough knowledge of anatomy, surgical indications, reduction techniques, proper implants, patient functions and expectations.

Initially popularized by Sarmiento in 1977 Functional bracing as conservative treatment has been an acceptable option for humeral shaft fractures; however, in the distal third of the humerus in adults it can cause problems owing to difficulty in controlling angulation and varus

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deformity [6]. External fixator generally is reserved for high-energy gunshot wounds, fractures with extensive soft tissue injuries and fractures with massive contamination. Intra medullary nailing is often difficult to be executed at the distal humerus fractures due to the anatomical zone of transition, where the medullary canal becomes almost flat.

Plate Osteosynthesis remains the “gold standard” for fixation of distal humeral shaft fractures. Plating can be used for distal third shaft fractures with proximal and distal extension and for open fractures. Double columnar plating using two 3.5-mm plates in orthogonal (90–90) or parallel (180°) patterns were also generally used, but nonunion and infections due to extensive soft tissue dissection and periosteal stripping is seen with double-plating techniques [8, 9].

Objectives

To study the surgical management of fractures of lower one third of humerus by extra articular distal humerus locking compression plate in adults, problems and difficulties encountered in surgical procedure and postoperative complications.

Material and methodology

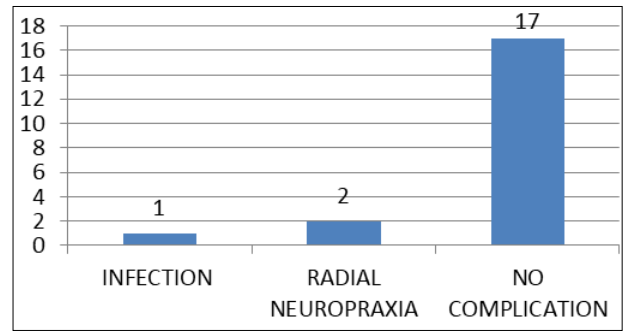
This is the prospective study of results and complications of distal third shaft of humerus fractures following surgical fixation by extraarticular distal humerus locking compression plate in adults, 20 patients with fracture of distal third shaft of humerus admitted from January 2015 to march 2016 in Mamta general and super Speciality hospital, Khammam were selected for the study, all patients were aged above 18 years, all the fractures in the series were post traumatic, and no pathological fractures included in the study. The method used for fracture fixation was open reduction and internal fixation by extraarticular distal humerus locking compression plating after anatomical reduction. Distal humerus fractures in patients aged less than 18 years, those fractures treated conservatively, compound fractures with Gustilo Anderson classification type 1 and 2, those fractures occurred more than 3 weeks and those with neurovascular disruption, and fractures with intra articular extension are excluded in this study. The following protocol was observed for patients with fractures of distal third shaft of humerus on arrival.

1. General and systemic examination as well as local examination of the patients
2. Thorough assessment of patient to rule out head/chest/abdominal/spinal or pelvic injuries
3. Preoperatively all patients were immobilized in U slab.

Observation and Results: A total of 20 patients with fresh distal third shaft of humerus fractures were studied from January 2015 to march 2016. All these patients were available for follow up at the time of study. Pre operatively following factors were observed and tabulated as follows:

Table 1: Post-operative complications wise distribution of study participants

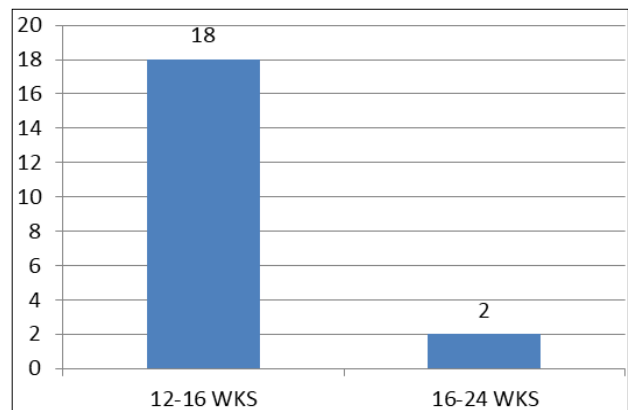
Complications	Number of cases	Percentage
Infection	1	5%
Radial neuropraxia	2	10%
No complications	17	85%
Total	20	100%



Graph 1: In present study only 15% patients had complications; remaining 85% cases had no complications.

Table 2: Time of fracture union wise distribution of study participants

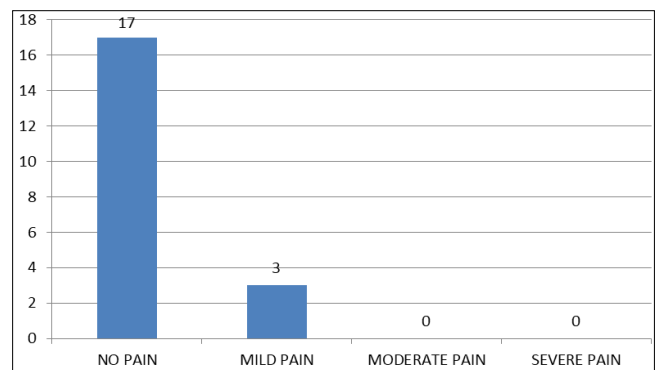
Time of union (weeks)	Number of cases	Percentage
12-16WKS	18	90%
16-24WKS	2	10%
Total	20	100%



Graphs 2: In the present study 90% patients had union in 12-16 weeks, 10% patients had union in 16-24 weeks

Table 3: Postoperative pain 15 days after the surgery wise distribution of study Participants

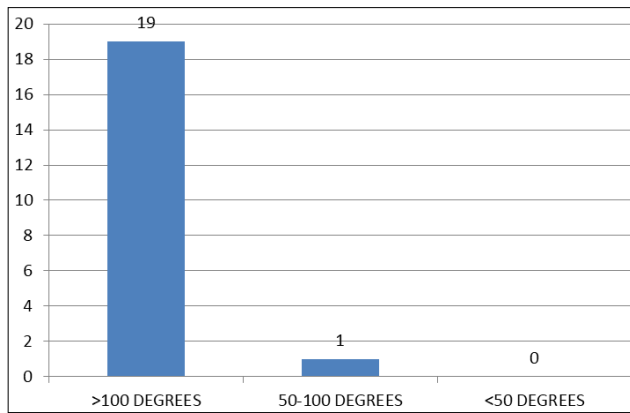
Type of Pain	Number of Patients	Percentage
No Pain	17	85%
Mild Pain	3	15%
Moderate Pain	NIL	NIL
Severe Pain	NIL	NIL
Total	20	100%



Graphs 3: In the present study 85% patients were pain free and 15% patients had mild pain postoperatively 15 days after surgery

Table 4: Rom of elbow as per mayo elbow performance score wise distribution of study participants

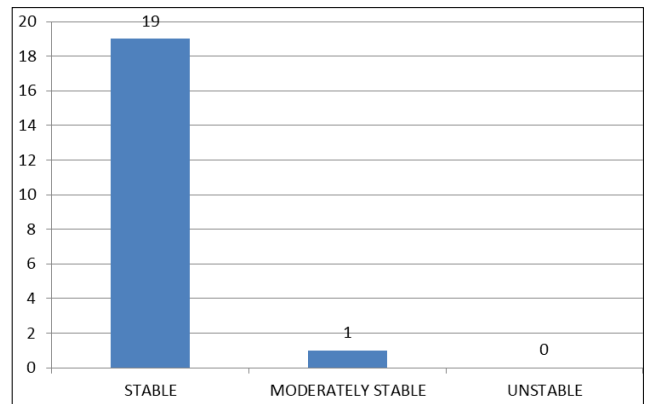
Range of Motion	Number of Patients	Percentage
>100 ⁰	19	95%
50-100 ⁰	1	5%
<50 ⁰	NIL	NIL
Total	20	100%



Graphs 4: In the present study 95% of patients had more than 100⁰ range of motion

Table 5: Stability of elbow as per mayo elbow score wise distribution of study participants

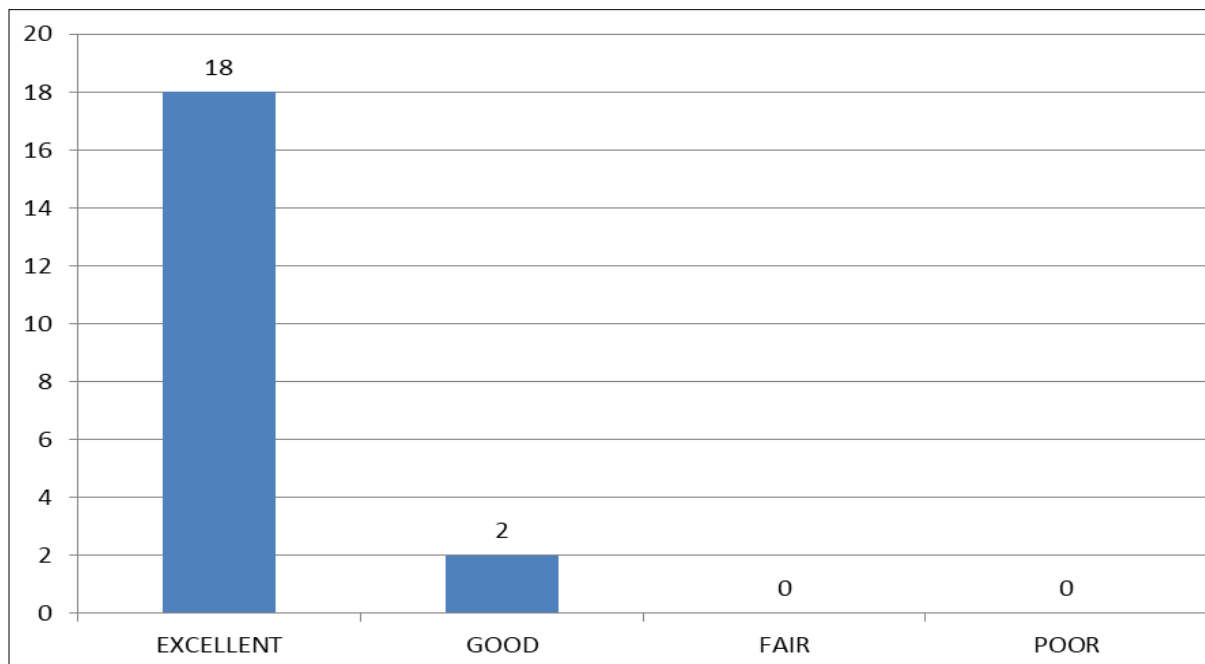
Stability	Number of cases	Percentage
Stable	19	95%
Moderately stable	1	5%
Unstable	NIL	NIL
Total	20	100%



Graphs 5: In the present study 95% of patients had stable elbow joint.

Table 6: Results by mayo elbow performance score wise distribution of study participant

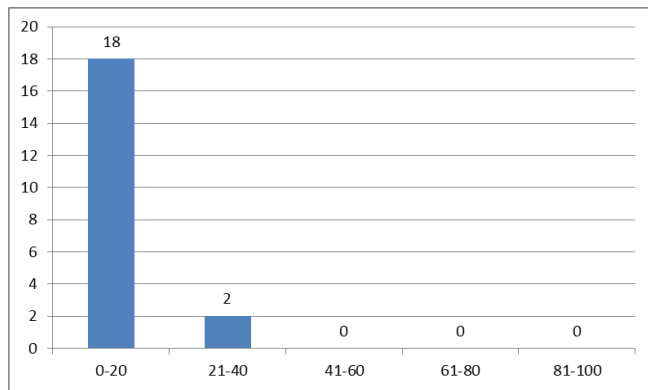
Mayo elbow grading (total score 100)	Number of cases	Percentage
Excellent(>90)	18	90%
Good(75-89)	2	10%
Fair(60-74)	nil	nil
Poor(<59)	nil	nil
Total	20	100%



Graphs 6: In the present study 90% patients had excellent and 10% patients had good results

Table 7: Results by dash score wise distribution of study participants.

Dash score At 1year	Number of cases	Percentage
0-20	18	90%
21-40	2	10%
41-60	Nil	nil
61-80	Nil	nil
81-100	Nil	nil
Total	20	100%



Graphs 7: Results by dash scoring in the present study group shows no disabilities in 90% patients.

Discussion

Distal third humerus shaft fractures remain one of the most challenging orthopaedic surgeries. They are commonly multi-fragmented; occur in osteopenic bone with peri articular and complex joint anatomy. Even after anatomical and stable reduction of fractures, end results are often associated with elbow stiffness, nonunion, mal union and pain. A painless, stable and mobile elbow joint is desirable as it allows the hand to conduct the activities of daily living. Twenty cases of fresh distal third shaft fractures of humerus were studied from January 2015 to march 2016 forms the basis of the present study.

In our study all fractures were acute fractures and all were managed by open reduction and internal fixation by extra articular plating system. Majority of cases were operated on the third day after injury with mean time interval between injury and surgery was 2.3 days. Fawi *et al.* [11] 2014 series reported the mean time as 4.2 days. Their study excluded two patients with non-union and two patients with failed conservative management, as they were taken for surgery after at a later stage. Yashwant Singh Tanwar *et al.* [13] 2016 series reported the mean interval as 1.8 days and excluded two non-union cases following conservative management and which were operated at 3 and 4 month interval, respectively. All the fracture united in the present study with a union rate of 96%. Our results were comparable with Fawi *et al.* [11] 2014 series and Yashwanth Singh Tanwar *et al.* [13] 2016. But Jain *et al.* [14] 2017 series reported that there was delayed union rate as four patients had failure of cortical screws in the proximal fracture fragment, of which two required revision fixation with bone grafting. Another nonunion was seen following a surgical site infection, which healed after wound lavage and bone grafting.

Regarding the complications, in our study 1(5%) patient had superficial infection which subsided by higher antibiotics for 8 weeks. 2(10%) patients had post operative Radial nerve Neuropraxia. Of these two patients one patient was recovered in 6 weeks and another patient recovered in 3 months. There was no single patient needing reoperation. comparing with other series John T. Capo *et al.* [12] 2013 (n=21) series reported that there was 1(4.7%) patient who showed postoperative sensory ulnar neuropathy that recovered completely, and 1(4.7%) patient developed elbow stiffness as well as heterotopic ossification as a result of concomitant proximal ulnar and radial fractures due to a gunshot wound. 1(4.7%) patient with an open fracture developed Osteomyelitis, which was treated with debridement, antibiotics and retention of the hardware. (14.1%) and Fawi *et al.* [11] 2014 (n=23) series reported that there was 1 patient

who had radial nerve neuropraxia pre-operatively, and 1(4.3%) postoperatively, and both recovered uneventfully 3 months postoperatively. Neither superficial, nor deep infections were observed in this cohort. (4.3%), Sushant Uday Chavan *et al.* [15] 2017 (n=47) series reported to have 1 case (2.1%) with postoperative radial nerve neuropraxia which recovered completely at the end of 3 months. There were no cases of superficial or deep infection encountered. No cases of nonunion or malunion were observed. In our study the mean mayo elbow performance score was 94.75 (ranges from 80-100) with excellent results 90% cases and 10% cases had good results.

Conclusions

Distal humerus shaft fractures are complex fractures and represent 1-3% of all fractures. These fractures require careful evaluation and preoperative planning for good functional outcome.

Early operative intervention with extra articular distal humerus Locking Compression Plates (EADHP) provides good anatomical reduction and stable internal fixation in these fractures and facilitates early mobilization preventing elbow stiffness.

In our series we treated 20 patients of lower one third humerus shaft fracture with open reduction and internal fixation with Extraarticular Distal humerus Locking Compression Plates (EADHP) and functional outcome was Excellent in 90 % patients. There were only minor complications noted.

We conclude as per AO principles that early operative intervention with extra articular Distal Humerus Locking Compression Plating (EADHP) on poster lateral column of humerus for these fractures will result in excellent functional outcome.

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