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Original Research Article

Functional results of AO 13C fractures managed with bicolumnar plating in a tertiary care centre of North India

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ABSTRACT

Background: Distal humerus fractures are associated with many problems like fracture comminution and complex fracture anatomy. Achieving a good functional range of motion at the elbow with stability are the primary objectives in managing a comminuted distal humerus fracture.
Methods: 25 consecutive patients were operated with bicolumnar plating for fracture distal humerus AO type 13C. The patients were kept in follow up for at least six months. Mayo elbow performance (MEP) score and flexion extension arc was calculated to study the outcome.
Results: All patients achieved fracture union with mean MEP score of 73.2 and mean flexion extension arc of 93º. This was within the functional range of elbow. Stiffness was observed to be most common complication.
Conclusions: Our study concluded that internal fixation with bicolumnar plating offers good functional results in comminuted intra-articular fractures even in osteoporotic bone with negligible complications.

Keywords: Distal humerus, Comminuted fracture, Bicolumnar plating

INTRODUCTION

The overall incidence of distal humerus fracture is 5.7 in 100,000. Distal humeral fractures have a bimodal distribution. In younger patients, fracture is often result of high-energy trauma, while simple fall may cause distal humerus fracture in elderly osteoporotic patients.[1] Distal humerus fractures are associated with many problems like fracture comminution, osteoporotic bone and complex fracture anatomy. Elderly patients are even more difficult to manage because poor quality bone makes osteosynthesis challenging.[2] Achieving a good functional range of motion at the elbow with stability are the primary objectives in managing a comminuted distal humerus fracture. Hence, it is necessary to achieve anatomical articular reduction and a stable fixation, so that early motion can be started at the elbow joint. By starting early motion at the elbow, development of painful arthritis and stiffness are drastically reduced. Not many studies have assessed the internal fixation of comminuted intra-articular fractures of distal humerus in elderly in terms of functional outcome.[3,4] Better appreciation of the functional anatomy of the elbow, injury patterns and technological advances in internal fixation and arthroplasty have substantially improved the potential for more functional outcomes.[5] The main purpose of surgical treatment is anatomical reduction with early mobilization. Bicolumnar plating is a frequently used modality of treatment, even in comminuted fractures.[6]

There are many classification systems for distal humerus fractures. The classifications propounded by Jupiter and Mehne, along with the AO classification are used more commonly. Distal humerus fractures can be classified under AO classification system into three groups. Extra articular fractures are grouped as 13-A while as the partial intra-articular fractures are labelled as 13-B and the complete intra-articular ones as 13-C. This study aimed to evaluate the functional outcome of AO type 13C fractures managed surgically with bicolumnar plating.

METHODS

All patients managed with bicolumnar plating for comminuted intra-articular distal humerus fractures (AO 13-C) at the Department of Orthopaedics, Government Medical College, Jammu from January, 2019 to November, 2020 were included in the present study. The study was a prospective observational type of study.

Inclusion criteria

The following categories of patients were included in the study: age 20 to 70 years, isolated and unilateral distal humerus fracture, AO type 13-C, closed fracture, injury <1 week old and both males and females.

Exclusion criteria

The following categories of patients were excluded from the study: age <20 years or >70 years, associated ipsilateral clavicle of humerus shaft fracture, AO type 13-A and 13-B, open fracture, old fractures (>1 week old) and patients with pre-existing arthritis or inflammatory joint disease.

A total of 28 patients were included in the study based on the inclusion and exclusion criteria. Three patients were lost to follow-up and hence excluded from the study. Hence, finally only 25 patients were enrolled for the present study (n=25). An informed written consent was obtained from all the study participants after explaining the nature of the study in their local language.

After initial stabilization of the patient, proper splintage of the limb was done in the emergency wing. All the involved patients were subjected to radiographic evaluation. Strict anteroposterior and lateral view radiographs of the involved elbow were taken (Figures 1A and 1B). Computer tomography (CT) scans were done in all cases. All patients were operated within one week of trauma.

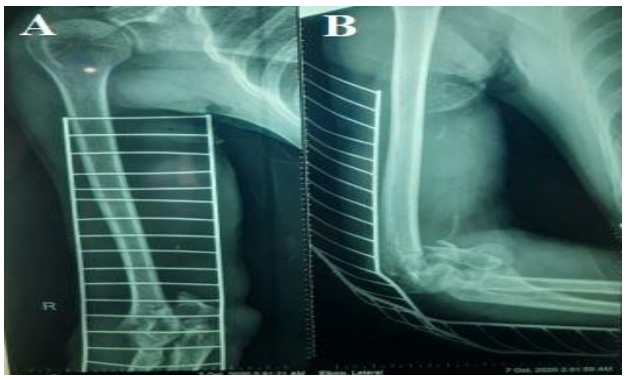

Figure 1: Radiographs showing distal humerus fracture (A) anteroposterior view and (B) lateral view.

Surgical procedure

All the patients underwent open reduction internal fixation with bicolumnar plating, with a lateral locking plate and a medial locking or reconstruction plate. The operation was performed under general anaesthesia in all cases. Surgery was done in lateral position using the standard posterior midline approach by the senior consulting surgeons. A V-type olecranon osteotomy was performed in all cases for proper visualization of the fracture and anatomical joint reduction (Figure 2A). Ulnar nerve was localized, mobilized and protected. Intra-articular fragments were reduced and temporarily stabilized with Kirschner wires (K-wires). The reduction was securely fixed using 4 mm cannulated screws and bicolumnar plating (Figure 2B). The lateral plate was an anatomically contoured locking plate and was applied at the posterior surface of the distal humerus. A reconstruction plate or a medial locking plate was used medially, which was placed at 90º to the lateral plate. The ulnar nerve was not transferred anteriorly in any case and was left in the cubital groove. The olecranon osteotomy was fixed with tension band wiring (TBW). Submuscular suction drain was used for all patients. Injectable antibiotic doses were given half an hour prior to the surgical incision and immediately after the skin closure.

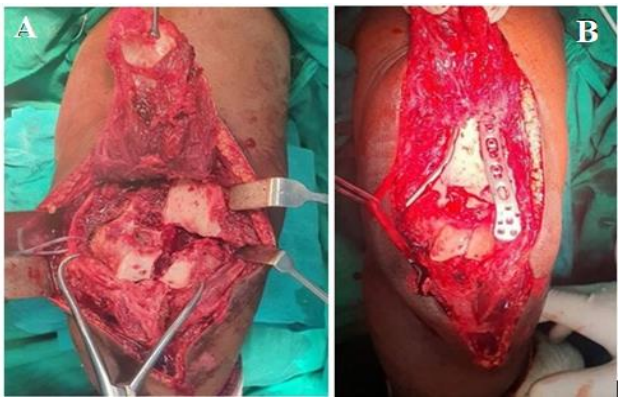

Figure 2: (A) Posterior approach with olecranon osteotomy showing complete exposure of the distal humerus (B) internal fixation done using bicolumnar plating in 90-90 fashion.

Post-operative protocol and follow-up

An above elbow slab was given for one week post-surgery, after which an arm sling pouch was given. Post-operative radiograph was taken on the 2nd day (Figures 3A and 3B). The antibiotics were continued for three days post-operatively, according the hospital antibiotic protocol. Physiotherapy was started with passive elbow exercises from 3rd post-operative day onwards, with removal of back slab temporarily. Patients were evaluated on weekly follow-ups for first month and later monthly follow-up was done for six months. Skin sutures were removed at two weeks post-operatively. At every follow-up, the assessment of the patient was done with regards to range of motion at elbow and complications if any were dealt with accordingly. Mayo elbow performance (MEP) score of operated side was calculated at the final follow-up to study functional outcome.[7]

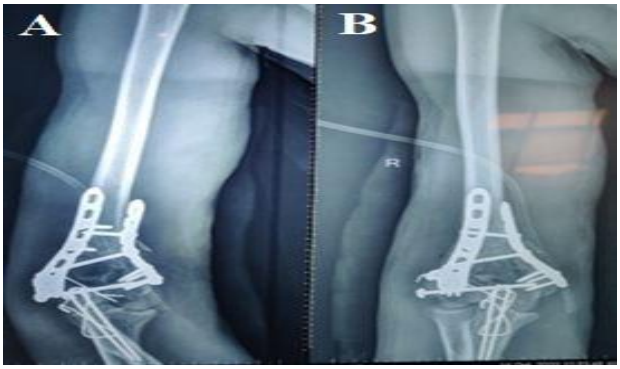

Figure 3: (A and (B) Post-operative radiograph showing fixation of distal humerus fracture with bicolumnar plating.

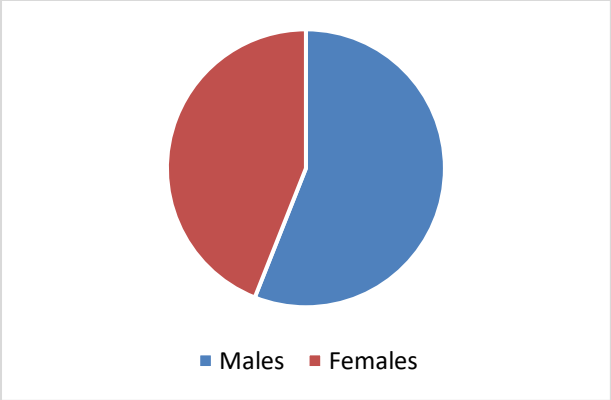

Figure 4: Sex distribution.

The statistical tools used in our study include percentage, range and mean.

RESULTS

This study included 25 participants, out of which 14 (56%) were males and 11 (44%) were females. The most common age group involved was between 50-60 years (40%) followed by the age group 40-50 years (28%). The age and sex distribution are depicted in Table 1 and Figure 4, respectively.

Table 1: Age distribution.

Age	Patients	Percent (%)
20-30	2	8
30-40	4	16
40-50	7	28
50-60	10	40
60-70	2	8

In the present study, 14 patients (56%) sustained an injury due to fall on outstretched hand, followed road traffic accidents in 10 patients (40%) and assault in one patient (4%). 19 of the patients were seen in the emergency on the day of the injury and for patients were seen on the second-day of injury and two patients were seen after second day of the injury.

All of the cases were operated within a period of 1 week from the time of injury. The mean follow-up period was 6 months. Fractures were assessed clinically and radiologically for union. All the fractures united in the present study. The patients were functionally evaluated based on the MEP scoring system. The mean MEP score achieved in the present study was 73.2 and the flexion range at elbow at final follow-up was 55º to 100º. The mean flexion-extension arc was 93º (range 80º-120º). All elbows were stable. Of the 25 elbows, two showed excellent result, thirteen showed good result, nine were fair and one showed poor result (Table 2).

Table 2: Final outcome according to MEP score.

MEP score	No. of patients	Percentage (%)
91-100 (excellent)	02	8
75-90 (good)	13	52
60-74 (fair)	09	36
<60 (poor)	01	4

Post-operative infection was found in two patients (8%) patients and was managed successfully by wound debridement and antibiotics. Most common complication seen was post-operative stiffness which was seen in 13 patients (52%). Other complications seen during study include ulnar neuropathy in two patients (8%), delayed union in one patient (4%) and non-union of olecranon osteotomy in two patients (8%).

DISCUSSION

Treatment of the intra-articular distal humerus fractures is a challenging task. These fractures may be compounded by many problems such as significant comminution and multiple intra-articular fracture lines. This problem is further compounded by increased incidence of osteoporosis in the older population. Several studies have demonstrated a good outcome of fixation in these fractures. However, many studies have quoted a significant failure rates, especially in elderly patients. The aim of treatment in these fractures is accurate articular reduction, rigid fixation and early physiotherapy and rehabilitation.[8] In the present study, most common age group involved was between 50-60 years (40%). Most of the other related studies have a higher mean age. This can be attributed to large number of road traffic accident cases in our study which tend to occur in younger people. Similarly, most common mode of injury in present study was fall (56%) which is consistent with the previous studies and is closely followed by road traffic accidents (40%).

In the present study, all the patients achieved fracture union and the mean MEP score achieved was 73.2 and the

flexion range at elbow at final follow-up was 55º to 100º. These scores were poor when compared to the opposite side. Also, the mean flexion-extension arc was 93º (range 80º-120º) which is almost within the functional range of elbow. Huang et al had almost similar results with mean MEP score of 83 and mean flexion extension arc of 92º.[4] Similarly a study by Atalar et al also had better mean MEP of 86.1 with flexion extension arc of 90.2º.[8] All patients had radiologic evidence of fracture union.

Most common complication was elbow stiffness and most common cause of this was lack of early and adequate physiotherapy. Other complications include ulnar neuropathy which was seen in 2 patients. Ulnar nerve neuropathy is a common complication after surgical treatment for distal humerus fracture. Flinkkila et al did not transpose ulnar nerve anteriorly, and they reported neuropraxia in 4 of 47 patients and sensory disturbance of all patients healed without sequelae.[9] In our study, we did not transpose ulnar nerve anteriorly. We also had 2 cases of non-union of olecranon osteotomy which is not in line with studies of Coles et al and Kural et al who have stated 100% union rates of olecranon osteotomy.[10,11] Khalid et al concluded that olecranon osteotomy approach is more effective and preferable to triceps sparing approach.[12]

Many studies have evaluated the functional outcome of total elbow arthroplasty and claimed it to be a better option mainly in the elderly age group. A study by Cobb et al included 15 elbows that underwent total elbow arthroplasty and they found the mean range of flexion from 25 to 130 degrees.[13] Gambirasio et al reported a mean MEP Score and DASH score of 93 and 23 with total elbow arthroplasty at three years follow up.[14] Hence, the results achieved in the present study are comparable to the existing literature (Table 3).

Table 3: Comparison with previous studies.

Study	Mean MEP score	Mean flexion extension arc
Huang et al[4]	83	92º
Atalar et al[8]	86.1	90.2º
Present study	73.2	93º

The limitation of our study is a relatively small patient group with C-type fractures. Also, the duration of follow up was also less.

CONCLUSION

Intraarticular fractures of the distal humerus in adults present a challenging situation to the treating surgeon. Accurate reduction along with stable internal fixation is the foundation stone of success in intra-articular distal humerus fractures. We establish that internal fixation with bicolumnar plating offers good functional results in comminuted intra-articular fractures even in osteoporotic bone with negligible complications.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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