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EVALUATION OF EXTRA ARTICULAR DISTAL HUMERUS FRACTURE FIXATION OUTCOMES WITH SINGLE COLUMN EXTRA ARTICULAR DISTAL HUMERUS PLATE

Orthopaedics

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ABSTRACT

Aim: To determine the Radiological and Functional outcomes of extraarticular distal humerus fracture with extra articular distal humerus plate fixation. **Methods:** This prospective study was conducted from 2020 to 2022, including Extra articular distal humerus fractures which were managed by open Para tricipital approach and fixation were done with extra articular distal humerus locking plate with or without lag screw. Radiological union were assessed on regular follow up and Final Functional outcomes were assessed according to MAYO elbow performance index. **Result :**Total 25 cases were selected for the study in which mean age were 44.68±12.39 and average follow up was 6 months. The Mean time to radiological union was 13.72 weeks and 1 case show union at 18 weeks. The average Mayo performance elbow score with excellent result in 68% Cases. **Conclusion:**Using Extra articular distal humerus plate for extra articular distal humerus fracture fixation provide better union and Functional rates with less soft tissue disruption, stable fixation and early functional recovery.

KEYWORDS

Distal Humerus, Extra Articular Plate, Mayo, Extra Articular Fracture

INTRODUCTION:

Fractures of the distal humerus account for 0.5% to 7% of all fractures, and 30% of elbow fractures. Extra-articular distal humerus fracture accounts for approximately 16% of humerus fracture and 3% of all fractures in adults.[1] Extra articular distal humerus fractures are common injuries which are usually associated with complex fracture pattern, metaphyseal comminution and radial nerve palsy due to entrapment of radial nerve between the fracture fragments and the lateral intermuscular septum. Due to all these problems and complications, anatomical reduction and adequate stabilization of fracture is essential to ensure timely union of fracture without any untoward complications. Traditionally, these fractures have been treated conservatively like use of cast or Sarmiento's functional brace.[2] Conventional plate and dual plate system were devised for extraarticular distal humerus fracture but got difficulty in proper fixation in 8 cortex purchases with less soft tissue disruption[3]. Thus, in this study we are using extra articular distal humerus locking plate for extra articular distal humerus fracture.

Aim & Objectives

To evaluate the of radiological and functional outcomes of the use of the Extra Articular locking plate in the extra articular fractures of distal humerus.

MATERIAL AND METHODS

This prospective observational consisted of 25 cases of either gender with fracture of distal humerus with age group between 21 and 60 admitted in the Orthopaedic department of Guru Nanak Dev Hospital/ Government Medical College, Amritsar. The study was conducted after approval from Institutional Ethics Committee, Government Medical College, Amritsar. A written informed consent from the patient was taken before recruitment.

Inclusion Criteria:

A Total of 25 patients who met the following criteria were included in the study, All the displaced diaphyseal non comminuted humerus fractures – AO Classification (Type A).

Fractures with shortening less than 2 cm.
Fresh fracture and old fractures

Exclusion Criteria:

- Fractures with marked comminution (AO).
- Paediatric fractures.
- Pathological fractures.
- Congenital anomaly or bone disease.
- Any medical contraindication for surgery.
- Fractures with shortening of more than 2cm.

After following inclusion and exclusion criteria, patients were selected for study then detailed history of patients including the mode of injury was taken. Patients were investigated fully for operative and anaesthetic purposes. Radiological examination of arm including elbow in antero-posterior and lateral planes were done, to assess the type of fracture and fracture geometry. X-ray pictures of other associated injuries were taken. AO classification was followed for further treatment purpose. CT scan was be done whenever required.

Surgical Management:

Figure 1. Position of upper limb in lateral position & Incision Mark for approach

Patients were put on Ot table in lateral position, a midline posterior incision centred over the fracture site was given (Fig 1). Fascia was incised in line with the skin incision. By palpation with a finger, the interval between the lateral and long heads of the triceps was identified. The proximal interval between the two heads by dissection, retracting the lateral head laterally and the long head medially was developed. Within the spiral groove, the radial nerve and the accompanying profunda brachii artery was identified. Distally, the common triceps tendon, along the line of the skin incision by sharp dissection were stripped. The lateral head of the triceps from the humerus proximally was released, and incised distally, in line with the humeral shaft. The muscle from the bone only as much as needed and protect the ulnar nerve medially. The ulnar nerve is constrained at the point where it passes distally through the medial intermuscular septum, from the anterior to the posterior compartment of the arm. The medial head of the triceps from the humerus proximally was released and incised distally, in line with the humeral shaft. If fractures were long /oblique in which longer plate was required. The nerve was adequately mobilized to prevent iatrogenic injury. Distally, the triceps was lifted off the bone only on the lateral side to expose the lateral condylar ridge. Oblique fractures or Wedge comminuted fragments were stabilized. After ensuring adequate reduction by k-wires, the fracture was fixed

with extra articular lateral locking plate while protecting the radial nerve. The plate was applied such that proximal straight portion of plate lies on the proximal shaft fragment and the lower curved end over the distal humeral fragment. The plate is then fixed with appropriate sizes of cortical and locking screws combination in the proximal fragment and locking screws in distal fragment. Plate was usually fixed with 4 screws in proximal fragment and 4 screws in distal fragment. Meticulous wound closure was done and splinting was done post-operatively. Suction drains were used in all the cases. Fixation was confirmed under the image intensifier:

Figure 2. Plate Fixation With Help Of Reduction Forcep
Figure 3. Wound Closure

Proper Antibiotics with adequate dose and sequential dressing done. All patients were examined clinically and radiologically at three weeks interval till the union occurred. Each patient completed a comprehensive written questionnaire regarding functional capabilities, residual symptoms and existing disabilities. The range of motion and strength of the elbow were noted. Radiographs were obtained in antero-posterior and lateral projection on each follow up visit till bony union. The duration of follow up lasted for a minimum period of 6 months.

Clinically the Fracture union was assessed clinically by absence of tenderness on palpation, absence of pain on performing day to day activities and functional assessment done according to below index.

Table 1: Assessment System (According to Mayo Elbow Performance Index)[4].

Functional Points:	
Pain	
None	45
Mild	30
Moderate	15
Severe	0
Movement ARC (Degrees)	
>100	20
50-100	15
<50	5
Stability	
Stable	10
Moderate instability	5
Gross instability	0
Function	
Combing hair	5
Feeding oneself	5
Hygiene	5
Putting on shirt	5
Putting on shoe	5
Total	100

Evaluation Of Results	
Excellent	90 or more
Good	75 – 89
Fair	60-74
Poor	<60

Follow up: All patients were followed up at an interval of 3 weeks for 6 months post operatively. At each visit, patients were assessed clinically regarding elbow and shoulder function, fracture union, X-ray of the arm was taken to asses fracture union and implant bone interaction,

Statistical Analysis:
The data was systematically collected, tabulated and subjected to quantitative statistical analysis and relevant conclusions was drawn.

Case 1: 36year male closed fracture following tom RTA.

Fig 4. Pre operative X ray

Fig 5. Immediate Post operative

Fig 6. Follow up at 3 weeks

Fig 7. Follow up at 6 weeks

Fig 8. Follow up at 6 Months

Case 2- 43 years male closed distal 1/3rd humerus fracture following to RTA

Fig 9. Pre operative x ray
Fig 10. Immediate Post Operative X ray

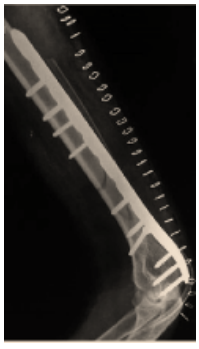

Fig 11. Follow up at 3 weeks

Fig 12. Follow up at 6 Months

Case 3- 29 years male following to RTA

Figure 13. Preoperative Xray
Figure 14. Post Operative X ray

RESULTS

To better outcome of any surgery is always needed the pattern of fracture , thus 25 cases were included in this study , out of which 19 cases were A2 types and 6 cases were A3 types.

In this study, there were mostly closed cases, 92 % (23 Cases) were closed, grade 1 and grade 2 cases was 1 respectively according to Gustilo Anderson Classification.

In this study, 20 % cases show associated injuries, in which 1 case with ipsilateral proximal shaft humerus fracture, 1 case with ipsilateral carpal bone fractures, 1 case with shaft of femur fracture, 2 case with head injury.

As we are approaching the fractures near to course of the nerve, so chances of radial nerve palsy but it can be avoided with meticulous surgery, thus most of the cases were treated without any complication but 1 case presented post op fever, 1 case with skin necrosis, 1 case with superficial infection and 1 case with radial neuropraxia which was

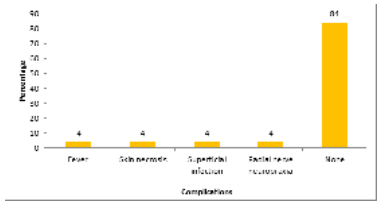

Figure 15- Graphically representation of immediate and early post operative complications

We found some delayed complications in this study as 12 cases show persistent pain and 8 cases show delayed union which were regained to normal after a period of time.

In this study, most of the cases show union in 7 to 22 weeks, out of which 13 cases achieved union in 7 to 13 weeks and 11 cases achieved union in 15 to 22 weeks and 1 case show union in more than 22 weeks.

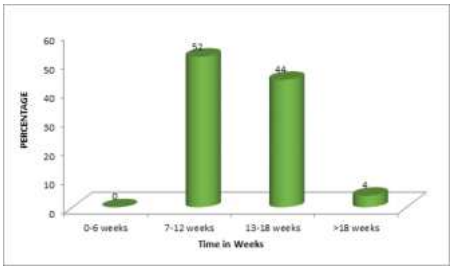

Figure 16- Graphically representation of union of the study cases

We found in our study that extraarticular plate for extra articular distal humerus fracture fixation is excellent results in 68% cases, good in 20% cases and Fair in 12 % cases.

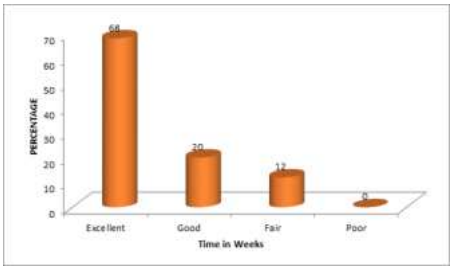

Figure 17: Graphically representation of results of the study

DISCUSSION

Treatment of extra articular fractures of the distal humerus is still debatable for treatment modalities, with conservative management in form of brace and surgical fixation with plate. Radiological misalignment, especially varus deformities and apex posterior angulation was most common deformity. Thus, surgical fixation provides anatomical restoration and maintainace of alignment of the fracture fragment and early return to work.

Various surgical techniques like, Conventional 4.5 mm plates do not allow appropriate number of screws in distal fragment and impingement in olecranon fossa. In same way dual plating for distal humerus provide rigid construct at cost of excessive soft tissue damage with risk of non-union and infection.

Table 2: Brief overview and comparison with other published studies extra articular distal humerus fracture fixation.

Author/study	Implant used- Results	Comments
V Tirkha et al[5]	EADHP-34 patients and 94.4% cases achieved union within 3 months, 2 patients developed Non-Union, mean flexion achieved 123, 1 elbow stifness,1 iatrogenic radial nerve palsy, no infection, 1 implant removal due to hard ware prominence.	Support pre contoured anatomical plate with well pre operative planning

Capo et al[6]	EADHP-Mean union time 7.3 months, mean arc of elbow motion 120, 1 osteomyelitis 1 post op ulnar neuropathy, 1 elbow stiffness, 1 hard ware removal due to irritation.	Supports EADHP for stable fixation
Prasarn et al[7]	EADHP+ 3.3/2.7 mm pelvic recon plate on lateral column- mean arc 131, union time 11.5 weeks, No case of iatrogenic radial nerve palsy,1 case of implant removal due to prominence.	Addition of second lateral plate postulated to help in obtaining, maintaining reduction and increase stability.
Our study	EADHP- Mean age 45 years, Union within 3.5 months, 1 case show delayed union, excellent result with MAYO score of elbows, No Non-Union, 1 radial neuropraxia which recovered completely.	

Thus, in our study, mean age was 44.68±12.39 years, with Mostly patients was seen in >50 years age group having 10 (40%) cases followed by 31-40 years age group having 6 (24%) cases. 13 (52%) patients were males and 12 (48%) patients, were females. Kommera s el, [8] Kumarasamy M et al,[9] Chavan SU et al,[10] Jindal S et al[11] all supports our above finding and concluded maximum number of patients were in age group of 44 to 60 years.

Small size of distal fragment and strong torsional forces at this junction does not allow optimal stable fixation with the standard plate s were available. Thus, in way to achieve stable fixation and maximum purchase at distal fragment and to overcome this difficulty, modifications in plate designs have been suggested and recommended for different locations- Levy et al[12] recommended proximal tibia head buttress locking plate of same side with different modifications.

Spitzer et al[13] encouraged 'hybrid' Metaphyseal LCP for proximal and distal metaphyseal humerus fractures. It used 4.5 mm screw at one end and 3.5 mm screw at other end to encourage the purchase in distal fragment with taking the benefits of small Caliber of screw.

Saragaglia et al[14] 'lambda' plate which is an inverted Y-shaped plate with a stem and two sectile arms that can be easily remodeled according to stem and type of fracture in distal humerus. But these above designs did not achieve satisfactory goal and reported with complications.

In our study, The early complications occurred within first seven days postoperatively. These were in form of fever in 1 (4%) case, superficial infections in 2 (8%) cases, skin necrosis in 1 (4%) case and Radial nerve neuropraxia in 1 (4%) case.

Radial nerve neuropraxia iatrogenic and incidences which were recovered completely suggested as per previous studies Kumar S M et al[9], Fawi H et al,[15] Gupta AK et al,[16] Chavan SU et al[10] and Yang Q et al.[18] The late complications were those which were observed after first postoperative week till union. 3 (12%) patients had persistent pain; 2 (8%) case had delayed union. These complications may vary due to type of injury, pattern and soft tissue damage during the injury. No case had Instability, malunion, non-union, deep infection and implant failure.

The average time for the fractures to unite radiologically was 13.72 weeks postoperatively, with maximum cases showed radiological union in 18 weeks. In 1 case, the fracture union was observed to be in more than 18 weeks. The gross variability of union may be explained on the basis of different type of complex fracture pattern and inter observer variability in assessing the fracture union. In similar study by Fawi H et al[15], Capo JT et al[7], Kumarasamy Met al[9] and Trikha V et al[5] concluded similar time of radiological union another study by results of approximately of 3 Months.

68% cases show excellent result with these surgical fixations, in same way by Trikha V et al,[6] Kumar MN et al,[17] and Yang Q et al[18] concluded mayo elbow score of 90 and excellent result. Triceps splitting or lateral para patellar approach did not have any bearing on final motion arc so all above studies support the approach and better motion arc.

CONCLUSION

Our study supports extra articular fixation for distal humerus fracture with pre contoured anatomical locking plate as it yields excellent outcomes according to MAYO index as compared to other methods of fixation of distal humerus as Conventional plating with less screw purchase in distal fragment and relatively weak fixation compared to extraarticular plate fixation, Dual plating provides rigid fixation but at cost of extensive soft tissue damage.

This technique provides better outcomes as less soft tissue disruption, better contouring of plate for anatomy of distal humerus, more stable fixation in distal fragment, less implant material, less surgical time, fast recovery time, less complication rate and less skin implant exposition.

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