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# Functional Outcome of Supracondylar and Intercondylar Fractures of Distal Humerus Fixed With Precontoured Plates in Adults

Medical Science

**KEYWORDS :** Adults, Distal humerus, Type C Fractures, olecranon, posterior approach.

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## ABSTRACT

***Aim**: Accurate reconstruction of articular surface of distal humerus by closed manipulation is not possible. The recent trend for displaced intra-articular fractures of the distal humerus is open reduction and stable osteosynthesis with early rehabilitation*

***Purposes**: To evaluate the management and outcome of supracondylar and inter condylar fracture of distal humors fixed with Precontoured in adults through posterior approach via olecranon osteotomy and to restore early elbow joint function.*

***MATERIAL AND METHODS** :30 cases of supracondylar and intercondylar fractures of distal humerus were treated by open reduction and internal fixation. All the patients were of adult age group. Chevron type olecranon osteotomy was performed and fixed with tension band wiring in majority and follow-up period was upto 24 Months. Regular clinical examination and periodical radiological evaluation were done.*

***Results** : All fractures united within average duration of 3 Months. Results were evaluated as per Mayo Elbow Performance Score. According to this criteria, excellent results was achieved in 9 patients (30%), good in 16 (53.33%), fair in 4 (13.33%) and poor in 1 (3.33%) patients. Thus satisfactory result was obtained in 96% cases.*

***Conclusions** :The critical factors for a successful outcome of Supracondylar and Intercondylar fracture of the distal humerus depends upon severity of fracture, meticulous surgical technique, stable internal fixation, and early controlled postoperative mobilization.*

## INTRODUCTION

In this modern era of industrialization, increased vehicular traffic and more use of mechanized agricultural methods, trauma of different kinds including fractures, are increasing in frequency and severity. At the same time, because of busy and competitive life and advent of modern technique in orthopaedics, one wants to be treated by a method which will allow the patient to back to duties as early as possible.[1-6]

Fractures of the distal humerus in adults have traditionally presented a treatment challenge for the orthopaedic surgeon. The combination of anatomic complexity, multifragmentarycomminution, and a short distal segment, often in the setting of osteoporotic bone, renders these fractures difficult to treat successfully, and often make full restoration of function uncertain. Although fractures of the distal humerus account for only 2% of adult fractures, traditional methods of treatment are associated with a significant number of poor results.[7]

In the last quarter of century, improved outcomes have been reported with surgery for distal humerus fractures. The principles set out by the Arbeitsgemeinschaft furOsteosynthesfragen ("Association for the Study of Internal Fixation", or AO) group, including anatomic articular reduction and rigid internal fixation, which allow for rapid healing and early postoperative range of motion. The last decade has seen advances in the understanding of elbow anatomy, improvements in the surgical approaches, new innovative fixation devices and an evolution of postoperative rehabilitation protocols.[8-10]

Many newer techniques advised the use of a precontoured plate centrally placed on the posterior humerus with a flare extending distal and lateral for added fixation. The use of locked plates has also been described.[11]

Plates applied on distal humerus at right angle to each other create "Girder like effect' which strength then fixation construct. Plates should end at different levels on humeral shaft to minimize the 'stressriser' effect. Each plate should have at least 3 bicortical screws proximal to metaphyseal comminution.[12]

Plates should be applied such that compression is achieved at the supracondylar level for both columns. Plates used must be strong enough to resist breaking or bending before union occurs at the supracondylar level.[13]

Every screw should pass through a plate. Each screw should engage a fragment on the opposite side that is also fixed to plate. As many screws as possible should be placed in the distal fragments. Each screw should be as long as possible. Each screw should engage as many articular fragments as possible. Plates should be applied such that compression is achieved at the supracondylar level for both columns. Plates used must be strong enough to resist breaking or bending before union occurs at the supracondylar level.

Distal humerus fractures comprise 2-6% of all fractures. There is a bimodal distribution with respect to age and gender with peak incidence in young male and in older female patients.

## MATERIAL AND METHODS

The present study was carried out in Department of Orthopaedics, Govt. Medical College, Patiala. 30 Cases of distal humerus fracture coming to Orthopaedics department was taken up for the study. Fractures was classified according to AO fracture classification. This was a prospective interventional study.

InclusionCriteria includesPatients who give consent for the surgery and patient aged more than 18 years. While exclusion Criteria includes ,open fractures, badly contaminated and with associated neurovascular injury, fracture in paediatric patients less than 18 years of age, fractures with compartment syndrome needing fasciotomy, distal humerus fractures with vascular injury needing vascular repair and refusal to provide informed consent. After taking the history, detailed clinical and radiological examination was conducted and all observations was recorded.

Primary treatment in the form of splintage of limb, analgesics, anti-inflammatory drugs and intravenous fluids in multiple injuries was given. Routine investigations including Haemoglobin, Bleeding Time, Clotting Time, Urine complete examination, Blood Sugar, Blood Urea, Serum Creatinine,

Analgesics and anti-inflammatory drugs was given as required shoulder and elbow exercises within the limit of tolerance, was started as soon as pain subsides.

All patients were taken for elective surgery as soon possible General anaesthesia or regional anaesthesia was used after proper pre-medication as per the anaesthetist recommendation. Transolecranon posterior approach was used as it gives visualization of the articular surface for reduction and fixation. Disadvantages are non-union and hardware prominence related to osteotomy and linked visualization for anterior articular surfaces. In our study we used 3.5 mm reconstruction plates of appropriate size mostly which will be contoured according to the need and appropriate size cortical screws along with Kirschner wires and stainless steel wires for tension band wiring of osteotomised olecranon.[14]

Patient was placed in lateral decubitus or supine position. A midline posterior incision was made over the distal humerus, with or without curving around the tip of olecranon. The ulnar nerve was identified and protected. And olecranon chevron osteotomy was used for adequate exposure of the joint surface with the osteotomy being placed at the lowest point of trochlear notch. The anconeus muscle was elevated as a flap to preserve its innervation and olecranon osteotomy was done in most cases. Osteotomy was started by oscillating saw. But completed using a fine osteotome through the subchondral bone. Later on osteotomy was fixed with tension band wiring in all cases. The articular fragments were reduced and held with partially threaded cancellous screw or cortical screw.[15-17]

Analgesics and anti-inflammatory drugs were given as required. All patients were followed up at monthly intervals for 6 months. During this period patient was motivated for physiotherapy and gradual normal use of the affected limb. Fracture union was assessed clinically and radiologically. Elbow function on the operated side was evaluated and compared with the normal side as per Mayo elbow score.

Post-op x-ray

showing functional movement after union

**OBSERVATIONS AND RESULTS**

In the present study 30 cases of supracondylar and intercondylar fracture of distal humerus fixed with precontoured plates via olecranon osteotomy. Intra-articular fractures of the distal humerus occurred in all age group but were more common in younger age from 18 to 36 years. There were more number of males than females with a male female ratio of 3:1. Most of the fractures are the result of Road side accidents. Left humerus was found to be more commonly involved. 86% of patients had closed fractures and among those with open fractures, Grade III (10%) fractures were the more common. There were associated injuries in 30% of cases like fracture ulna, fracture both bone leg or nerve injuries.

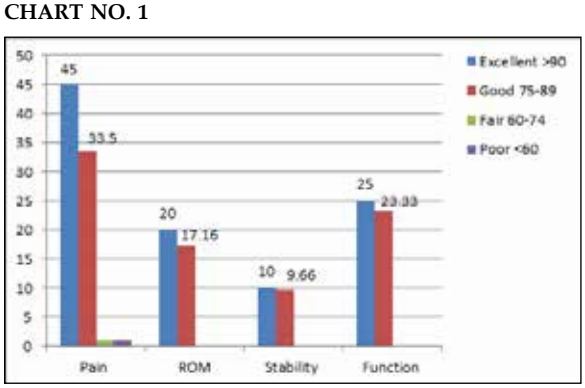
**FINAL FUNCTIONAL OUTCOME**

Among 30 patients, according to Mayo Elbow Performance Score Good results was achieved in 53% patients and 9% have excellent outcome and the Mean Mayo Elbow Performance Score is 83.65.

**TABLE NO. 1**

| FUNCTION | | NO. of Patients | Percentage (%) | Mean Score (Points) |
|---|---|---|---|---|
| Pain (Maximum 45 points) | None (45) | 8 | 26.67 | 33.5 |
| | Mild (30) | 21 | 70 | |
| | Moderate (15) | 1 | 4 | |
| | Severe (0) | | | |
| **ROM** (Maximum 20 points) | >100 (20) | 17 | 56.67 | 17.16 |
| | 50 to 100 (15) | 11 | 36.67 | |
| | >50 (5) | 2 | 6.67 | |
| **Stability** (Maximum 10 points) | Stable(10) | 28 | 93.33 | 9.66 |
| | Moderately (5) | 2 | 6.67 | |
| | Unstable (0) | | | |
| ***Function (Maximum 25 points)*** | Comb (5)<br>Feed (5)<br>Personal (5)<br>Shirt (5)<br>Shoes (5) | 25<br>30<br>30<br>30<br>25 | 83.33<br>100<br>100<br>100<br>83.33 | *23.33* |
| **Mean Total** (Max. 100 Points) | | | | 83.65 |

**CHART NO. 1**




**FINAL FUNCTIONAL OUTCOME:**

84 % of the cases had attained good functional arc of motion.

**Table no. 2.**

| Grading | No. of Patients | Percentage |
|---|---|---|
| Excellent | 9 | 30 |
| Good | 16 | 53.33 |
| Fair | 4 | 13.33 |
| Poor | 1 | 3.33 |

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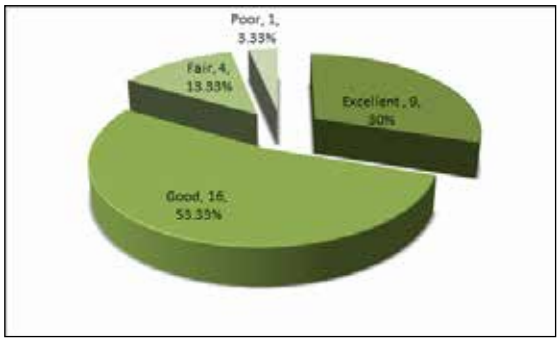
**Pie chart;**




Out of 30 cases had associated medical illness. 2 had diabetes mellitus type-2,3 had hypertension and 2 had both DM-2 and HTN. Most of the patients were operated within 24 hours of injury. Most of the fractures are of C1 type as per AO system of classification. At the average follow up of 18 months, the flexion at the elbow joint ranged from 70 degrees to 140 degrees with an average of 120.2 degrees. 25 patients had a flexion beyond 110 degrees (83%).and average loss of extension ranged from 0 degrees to 30 degrees with an average of 14.2 degrees. All the patients have extension loss less than 30 degrees. More than 100 degree of range of movement is obtained in 56% cases. In most the cases functional arc of motion ($30^0$ to $110^0$) is preserved. Scoring of range of motion is done as per Mayo Elbow performance Score. Most of the fixations are stable. (20%) patients, suffered transient Ulnar N Neuropraxia in the early postoperative period. No patient suffered from iatrogenic vascular injury. Hardware failure in 4 painful hardware in 5 superficial infection in 4 non-union of olecranon osteotomy in 2 elbow stiffness in 8 and 4 had cubitus varus deformity.

**DISCUSSION**

In the present study most of the fractures (65 %) occurred in the younger age group i.e. 18 to 36 years. Males constituted the largest group in the study with a male-female ration of 3:1. The low incidence of females in our study was probably because of less incidence of road traffic accidents in females due to less outdoor activities in females. (65%) of the patients had injury of left side and (35 %) had injury of right humerus. 84% of patients had closed fractures and among those with open fractures, grade III (10%) fractures were the more common. Road side accident was the most common mode of injury in 70% patients followed by those sustaining the fracture due to falls (20%). Since most of the fractures were the result of high velocity trauma, There was high incidence of associated injuries (28%). In the present study, 16 patients had C1 (53%) 9 had C2 (32%) 4 had C3 (13%) and 1 had type B1 (4%) fracture configurations according to AO classification. There were more number of C type fracture (96%) and out of them C1 type is more common (53%). Time elapsed between injury and surgery ranged from 12-24 hours with most patients (72%) being operated between 12-24 hours of injury. 21 out of 30 patients (70%) were managed within 24 hours of presentation. 4 patients (18%) wee given definitive treatment within a few days but a few (8%) had to wait for more than a week for definitive management either because they were managed initially at other centres or because of associated problems which were either an associated injuries or systemic problems. All patients were treated by open reduction and internal fixation with precontoured plates with orthogonal plates followed by early physiotherapy. In this study, results were evaluated according to Mayo Elbow Performance Score. According to this criteria, excellent result was achieved in 9 patients (30%), good in 16 (53.33%), fair in 4 (13.33%) and poor in 1 (3.33%) patients. Thus satisfactory result was obtained in 96% cases.

Rigid fixation and early rehabilitation are the most important goals in treatment of type c elbow fracture. In our study, posterior approach with olecranon osteotomy was used in distal humerus fracture. The advantages of this approach are exposure of the intra-articular fragments which aids in good reduction and the implementation of early functional exercises is possible. Articular restoration is the most essential step followed by stabilization. The aim is to facilitate biomechanical reconstruction of two column structure which was carried out in all 30 cases in our study. In each case fracture reduction was satisfactory, fixation was strong and durable, fracture site stable and early post-surgical functional exercise was possible. In our series, at the time of injury 2 patients had ulnar nerve palsy and 2 patients had radial nerve which completely recovered over a period 10 months. Post-operatively, 6 patients had transient ulnar nerve Neuropraxia (which was completely recovered after 3 months), 5 patients had superficial infection which got better with antibiotics and dressings. Some degree of loss of extension is seen in most of the cases, more than 20 degree of stiffness is seen in 8 patients. Other complications encountered in our series were varus deformity in 4 patients, hardware failure in 4 patients had mild pain and 8 patients had no pain at all. Pain at final follow up was not related to the type of fracture. Henley (1987)[18] in their series of 33 patients observed fixation failure in 5 patients, infection in 2 patients, one superficial and one deep and heterotrophic ossification in 2 patients. Sodegard et al (1992)[19] in his series of 96 patients encountered 6 post failures. Thus the complications in our study was comparable to other studies.

It is important to realize that final outcome of painless, functional range of motion at elbow causing no disability is more important than a sound radiographic and anatomic union. At the average follow up of 18 months, the average flexion achieved was 120.2 degrees ranged from 70 degrees to 140 degrees 25 patients had a had a flexion beyond 110 degrees (83%). The average loss f extension was 14.2 degrees ranged from 0 degrees to 30 degrees. In most of cases functional arc of motion ($30^o$ to $110^o$) is preserved. 17 patients had a mild pain not limiting their activities of daily living. 1 patients had a moderate disability so that he could not work in the same job which they used to do before sustaining the fracture. The results were graded according to Mayo Elbow Performance Score (1993) and good results was achieved in 16 (53.33%) patients and 9 (30%) have Excellent outcome 4 (13.33%) had fair results and 1 (3.33%) had poor outcome. The Mean Mayo Elbow Performance Score is 83.65 dashengtian et al in (2013)[20] compared the clinical outcome of the perpendicular and Y-shaped double-plating with olecranon osteotomy methods when applied to type C distal humerus fractures in young adults and found Mayo Elbow Performance Scores, 84.6% of patients in group I and 83.3% in group II had excellent or good scores. Kilicarslan K et al (2011)[21] conducted study on 27 patients and observed the Mayo Elbow Performance Scores to be excellent results in 20 patients (74%), good in 4 (14.8%), fair in 2 (7.4%) and poor in 1 patient (3.7%). Thus the results of our study were comparable to other studies. General limitations observed in our study were small sample size for comparative study, Limited facilities in govt. setup, inadequate follow-up in some cases and there is limited literature regarding objective extensor mechanism strength assessment in our study.

## CONCLUSION

From the study we concluded that, the AO classification is most comprehensive classification for clinico-radiological assessment of fractures of distal humerus as it is very thorough and allows better documentation and specific comparison of fracture types. Supracondylar and intercondylar fractures of distal humerus are more common in males than females due to more outdoor activity in males. The mode of injury for supracondylar and intercondylar fractures of distal humerus is road side accidents mostly, which is results of increased vehicular traffic. The most important factor in determining outcome of these fractures is the displacement of the intra articular components. The quality of elbow function after fractures of distal humerus is related is related to degree to which anatomic relationship are maintained. The reliable method to restore the normal alignment and contours of distal humerus is operative exposure by Trans-olecranon approach (with Chevron osteotomy) which gives best view to intra articular distal humeral fractures and direct manipulation of fracture fragments. It is imperative to maintain the width of distal humerus and the two columns with orthogonal plates, so that the fixation is stable enough for early post-operative rehabilitation. The method is safe, effective, and economical and the period of hospital stay is short. By this method, we have achieved early mobilization of the elbow with good range of elbow movement with fewer complications.

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