



## Precontoured Plate Fixation in Fracture Olecranon in Adults

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### Abstract

**Introduction:** *Olecranon process is a large, curved eminence comprising of the proximal and posterior part of the ulna. It lies subcutaneously which makes it more vulnerable to injury. Due to intra-articular extension of fractures, anatomical reduction and early mobilization should be achieved in every case.*

**Aims and Objectives:** *To evaluate the results of precontoured LCP in fracture olecranon and to achieve union in fracture olecranon.*

**Materials and Methods:** *This was a prospective study consisted of 25 cases of olecranon fractures which were managed by open reduction and internal fixation using Precontoured locking compression plate (LCP). Patients were followed up every month till 6 months. Final assessment was done at 6 months using the Mayo Elbow Performance Score.*

**Results:** *According to the Mayo classification, 20 fractures were type II and 5 type I. An adequate reduction was maintained in all elbows until union. The MEPS-rated outcome was 19(76%) excellent, 4(16%) good and 2(8%) fair with best result in 20-29 yr age group. 2(8%) patient develop superficial infection which was treated with broad spectrum antibiotic and wound dressings and 6(24%) patient develop symptomatic metal prominence which is managed with implant removal.*

**Conclusion:** *open reduction and internal fixation with precontoured LCP is based on sound biomechanical principle with a good functional outcome and a low incidence of complications.*

### Introduction

Anatomically the olecranon process is a large, curved eminence comprising of the proximal and posterior part of the ulna. It lies subcutaneously which makes it more vulnerable to injury. Together with coronoid process it forms greater sigmoid notch which articulates with trochlea. This provides motion only in the sagittal plane along

with stability to the elbow joint. Triceps tendon is inserted into olecranon after covering the capsule of elbow joint. Approximately 10% of fractures of the adult elbow consist of fractures of the olecranon process of the ulna and range from simple non displaced fractures to complex fracture-dislocations of the elbow.<sup>1</sup> Most of the olecranon fractures are intra-articular and isolated. Most

common mech of injury is direct trauma as falling on the back of the elbow or direct impact at the posterior surface of the elbow or upper part of forearm causing comminution of the olecranon. Degree of comminution depends on severity of trauma.<sup>2</sup>

Patient are classified on the basis of MAYO classification which is based on the fracture's degree of stability, displacement and comminution.<sup>3</sup>

Due to intra-articular extension of fractures, anatomical reduction and early mobilization should be achieved in every case. Fracture fail to heal because of improper immobilization, complete devascularisation of the segment of fracture bone, persistent infection and interposition of soft tissue between the fracture end of bone etc. Problems associated with wire protrusion and pain after TBW have been reported without even proximal migration of the pins. In comminuted or oblique longitudinal fractures tension band wiring result in shortening of the olecranon which effects the articulation with loss of motion or impingement. The AO-ASIF foundation<sup>4</sup> recommends a careful reconstruction of the articular surface and use of precontoured LCP in which the proximal end of the plate is wrapped around the tip of olecranon, leads to good results when used for oblique fractures and biomechanical testing found that they provide significantly greater compression than tension bands in the treatment of transverse olecranon fracture. Fixation by a plate, in combination with bone grafting, is an alternative method used to maintain reduction of comminuted fractures after reconstruction of the joint surface.<sup>9,10</sup>

### Material and Methods

This was a hospital based prospective study conducted on patients admitted in Orthopaedics Department of Government Medical College Amritsar.

### Criteria for Selection of Patients

#### Inclusion Criteria

- 1) Age(above 18 years)

- 2) Either sex
- 3) All closed or Type I open fractures.

### Exclusion Criteria

- 1) Open fractures, other than type I.
- 2) Pathological fractures.
- 3) Poor soft tissue condition.

Immediately on arrival of the patient, all patients managed as per Advanced Trauma Life Support (ATLS) protocols. Elbow immobilized in an above elbow crammer wire. A detailed history taken from the pt. about the duration and mechanism of injury. Detailed clinical examination both local and systemic was done and findings were recorded preoperatively. Standard X-ray in anteroposterior and lateral views were taken for the confirmation of diagnosis and also to know the type of fracture as per the Mayo classification of olecranon fractures.

- Type I or non displaced fractures. Subdivided into
  - Type IA- Non comminuted.
  - Type IB- Comminuted.
- Type II fractures, which includes fractures with 3mm displacement, intact collateral ligaments, and preserved forearm humerus relationship. Subdivided into
  - Type IIA- Non comminuted
  - Type IIB- Comminuted.
- Type III- fractures include fractures with a disruption in the relationship between the forearm and the humerus, constituting a fracture dislocation. Subdivided into
  - Type IIIA- Non comminuted.
  - Type IIIB- Comminuted.

### Surgical Technique

In supine position under anaesthesia, tourniquet control with proper painting and draping the limb was holded in flexed position over the chest of the patient.

A dorsal midline longitudinal incision was given. The flexor carpi ulnaris was reflected on the medial side and anconeus on the lateral side. The joint capsule was released medially and lateral.

Under direct visualization, articular fragments were manipulated and reduced and confirmed under image intensifier. In appropriate length plate proximal screws were inserted after first drilling via centering sleeve under the image intensifier. The screw hole was predrilled with the 2.8mm drill bit. After determined length with a depth gauge screw was inserted using a locking screw driver. This step was repeated until stable plate-bone fixation was achieved. Reduction and plate position was confirmed with image intensifier.

Wound was washed with normal saline and closed in layer under negative suction drain. Aseptic dressing was done.

Range of motion exercises were started on the next post-operative day, within the limits of pain tolerance.

Patients were followed every month till 6 months. At each follow up visit, clinical parameters ( pain, surgical wound, swelling, range of mov, any complication) and radiological parameter (Maintenance of reduction, union ) were assessed:

Final assessment was done at 6 month using the Mayo Elbow Performance Score.

Section 1 Pain intensity	45
None	45
Mild	30
Moderate	15
Severe	0
Section 2 Motion	20
Arc of motion greater than 100 degree	20
Arc of motion between 50 and 100 degree	15
Arc of motion less than 50 degree	5
Section 3 Stability	10
Stable	10
Moderately unstable	5
Grossly unstable	0
Section 4 Function	25
Can comb hair	5
Can eat	5
Can perform hygiene	5
Can do shirt	5
Can do shoe	5
Total	100

## Interpretation of Mayo Elbow Performance Score

Score greater than 90	Score 75-89	Score 60-74	Score below 60
Excellent	Good	Fair	Poor

**Statistical Analysis**

The data was collected and evaluated using the relevant statistical methods and techniques and results are discussed at the end of the study.

**Results**

The patients in our study ranged in age from 20-65 years with mean age of 37 years. In this series, 9(36%) patients were between 20-29 years, 7 (28%) patients between 30-39 years, 4 (16%) patients between 40-49 years, 3 (12%) patients between 50-59 and 2 (8%) patients between 60-69 years.

In present study there were 16 (64%) males and 9 (36%) females with a male to female ratio of 1.77:1. Left side was involved in 13 (52%) of cases where as right side was involved in 12 (48%) of cases.

In present study fall from standing height was most common cause of injury comprising of 14 (56%) of all cases and road traffic accident in 10(40%) case.

Most of the fractures in our series were type 2 fracture 20 (80%) followed by type 1 fractures 5(20%).

The fracture was considered united when clinically there was no tenderness and no subjective complaints and radiologically when fracture line was not visible. Average union in our series was 14.5 weeks and ranged from 10-26 weeks.

**MAYO ELBOW PERFORMANCE SCORE (MEPS)**

Section -1 PAIN INTENSITY: In our series 19(76%) patients had no pain and 6(24%) patients had mild pain. Section-2 RANGE OF MOTION: In our series 22(88%) patients had an arc of motion greater than 100 degrees, 3(22%) patients had arc of motion between 50-100 degrees. Section-3 STABILITY: all fracture were stable after fixation. Section-4 FUNCTIONAL EVALUATION: 2 patient were unable to comb their hair and 3 patient were unable to close the button of shirt.

## Interpreting the Mayo Elbow Performance Score

Grading	No. of cases	Percentage
Excellent(score greater than 90)	19	76
Good (score 75-89)	4	16
Fair (score 60-74)	2	8
Poor (score below 60)	-	
Total	25	100

## Results As Per Age Groups

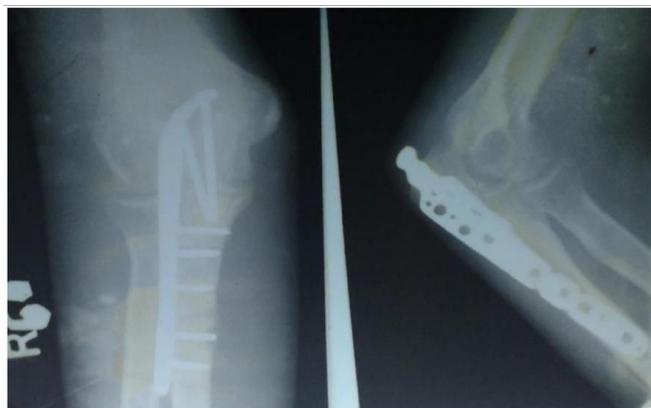
Age group	Total no. patient as per age group	RESULTS			
		Excellent	Good	Fair	Poor
20-29 years	9	9(36%)	-	-	-

30-39 years	7	4 (16%)	3 (12%)	-	-
40-49 years	4	4 (16%)	-	-	-
50-59 years	3	1 (4%)	1 (4%)	1(4%)	-
60-69 years	2	1 (4%)	-	1 (4%)	-

The main complication was symptomatic metal prominence which required removal of the implant in 4(16%) patients, 2(8%) patients developed superficial wound infection which was treated by appropriate antibiotics and dressings.



**Pre-Operative**



**Immediate Post-Operative**



**Final Follow Up**



**Flexion**



**Extension**

**Discussion**

Locking compression plating provides several advantages, first, it provides both angular and axial stability, which eliminates the need for exact plate contouring and thereby minimising the risk of primary loss of reduction. It acts as an “internal external fixator”, which has shown to provide better rigidity because of its close proximity to the bone and fracture site.<sup>11</sup> Second, LCP fixations are not subject to the toggling of unlocked screws seen

in conventional plates, which improves fixation in decreased bone mineral quality and comminution. Furthermore, LCP preserves the periosteal blood supply, as no compression of the plate onto the bone is required. Necrosis-induced bone loss as a consequence of decreased periosteal perfusion has been described as potential factor for implant loosening.<sup>12</sup>

In the management of intra articular fractures like fractures of the olecranon, a perfect anatomical reduction of the fragments to obtain articular congruity and rigid fixation of the fragments is of utmost importance, if early movements are to be instituted to prevent complications like traumatic arthritis and joint stiffness.<sup>13,14</sup>

Due to subcutaneous nature of the proximal ulna, hardware prominence is common which causes discomfort to the patient, and is a reason to necessitate its removal. up to 20% of plates have required removal to manage patient reported symptoms of discomfort.<sup>15</sup>

In our study 25 cases of fractures of the olecranon were treated with pre contoured LCP. Our experience with this method of fixation has given favourable results. The findings, the end results and various other data are analysed and compared in the following discussion.

Age of patients in the present study ranged from 20 to 65 years with a mean age of 36.8 years. Which is consistent to studies done Gagan K et al.<sup>16</sup> In the present study the most susceptible sex was males, which is comparable to the studies done by Ernest Munoz et al.<sup>17</sup>

In the present study the predominant mode of trauma was fall from standing height 14(56%) which is comparable to the studies done by Greet Buijze et al.<sup>18</sup> Mean union time in our series was 14.5 wk which is comparable to the study by Greet Buijze et al.<sup>18</sup> & Cervera-Irimia J et al.<sup>19</sup>

The results obtained in our series were excellent in 19 (76%) patients, good in 4(16%) patients, fair in 2(8%) patients and no poor results. The results in our series are almost in accordance with the studies of Greet Buijze et al.<sup>18</sup>

In the present series symptomatic metal prominence was seen in 6(24%) patients (managed by removal of implant) which is consistent with Greet Buijze et al.<sup>18</sup>, superficial infection was seen in 2(8%) patients, which was treated with broad spectrum antibiotic and wound dressings consistent with Bailey CS et al.<sup>20</sup>

### Conclusion

25 cases of fractures of olecranon treated by Precontoured olecranon LCP at the Post-Graduate Department of Orthopaedics, Government Medical College, Amritsar has been presented. Patients were diagnosed as having olecranon fractures on the basis of detailed history and thorough examination. Specific investigations like x-ray, (antero-posterior and lateral view) of elbow was done in all 25 cases, which helped to confirm the diagnosis. Routine investigations were carried out. After analyzing various parameters e.g. age, sex, side of involvement, mechanism of injury, type of fracture surgical procedure (ORIF with precontoured LCP) was carried out in all 25 patients.

In the present study maximum number of patients was found to be in the age group between 20-29 years, (9 patient's i.e.36%) with a mean of 36.8 years.

Males formed 64% of the patients while 36% were females with a male to female ratio of 1.8:1. Males sustained their fracture at a significantly younger age than females.<sup>2</sup>

Left sided 13(52%) olecranon fracture were more common than Right side 12 (48%) in the present study. In the present study fall from height 14(56%) was more common than road traffic accident 10(40%).

All fractures were closed.

There were 80% type 2 & 20% type 1 fractures according to mayo classification.

ROM exercise was started on 2nd post op day in all patients.

The time taken for complete radiological union ranged from 10 weeks to 26 weeks. The average time to union was 14.5 weeks.

All the cases were followed up and findings have been recorded regularly. Results were analysed according to Mayo elbow performance score. Excellent results were achieved in 76%, good results in 16% and fair results in 8%. There were no poor results. The complications like superficial infection and symptomatic metal prominence were noticed in 2 (8%) and 6 (24%) cases respectively, which were treated accordingly.

From the present study it is concluded that the technique of open reduction and internal fixation with precontoured LCP is an effective means for treating fractures of olecranon and is based on sound biomechanical principle.

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