

Clinical Evaluation of Surgical Management of Simple and Comminuted Olecranon Fractures

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Abstract

Background: Olecranon fractures are among the common orthopaedic injuries. It is very essential to obtain accurate anatomical realignment and also rigid stable fixation so as to start early mobilization and prevent stiffness. Tension band wiring for transverse displaced fractures and olecranon hook plate for oblique and comminuted fractures are gold standard fixation methods to obtain the desired outcomes.

Materials & methods: The study was conducted in a tertiary care centre, between January 2019 to December 2020. Patients with displaced transverse, oblique and comminuted olecranon fractures involving the coronoid process were included in the study. A total of 50 patients who met with the inclusion criteria were included in the study and the study was conducted in a prospective manner.

Results: Functional outcome in our series was evaluated using Mayo Elbow Performance Score. Based on the scoring system, we had excellent results in thirty six cases(72%), good outcome in eight cases(16%) and fair results in six cases(12%). There were no cases with poor outcomes in our series. However, we had our share of complications with two of our cases having superficial infection(4%) and seven cases had hardware prominence(14%).

Conclusion: The technique of open reduction and internal fixation with tension band wiring for transverse olecranon fractures and olecranon locking hook plate for oblique and comminuted olecranon fractures is an effective and gold standard technique and is also bio mechanically very sound.

Keywords: Olecranon fractures, Tension band wiring, Olecranon hook plate.

Introduction

Olecranon fractures are one of the commonly encountered fractures in the emergency room. Olecranon fractures are most commonly results from road traffic accidents or fall from height, when patient lands over the elbow. In displaced fractures of olecranon it is very essential to obtain articular alignment so as to prevent stiffness and also to prevent the development of arthritis. The fixation should be stable enough to start the early mobilization of the joint so as to obtain complete range of movement and to prevent the stiffness^{1,2}. Early mobilization of the joint also helps in the union process there by enhancing the rate of union. For displaced transverse fractures, tension band wiring can be performed which helps in converting the shear forces into compressive forces on mobilization of the elbow and allows for the union of the fracture². However, for comminuted fractures, fractures involving the coronoid process and unstable oblique fractures, routine tension band wiring can not be done, since it does not give a stable fixation. It is ideal to fix such fractures with dorsal olecranon hook plates, which helps in achieving the stability and restoration of the articular surface and also the reduction of coronoid process can be done an also early mobilization can be initiated^{2,3,4}. Hence the study to evaluate the clinical outcomes and merits and demerits of surgical management of simple and comminuted displaced olecranon fracture treated by tension band wiring and olecranon hook plate respectively.

Materials and Methods

The study was conducted in a tertiary care centre, between January 2019 to December 2020. Institutional ethical committee clearance was obtained to conduct the study among the patients who have sustained olecranon fractures and presented to our hospital

emergency department. Patients with displaced transverse, oblique and comminuted olecranon fractures involving the coronoid process were included in the study. Undisplaced fractures, open fractures and fractures with radial head were excluded from the study. All pre operative investigations done including the x rays and the affected limb was immobilized till the day of surgery.

A total of 50 patients who met with the inclusion criteria were included in the study and the study was conducted in a prospective manner. Patients who had displaced and transverse fracture of the olecranon were treated by tension band wiring and those with comminuted displaced, oblique and involving the coronoid were treated by open reduction and internal fixation with olecranon hook plate.

Surgical Technique

Exposure of the olecranon was done using the Campbell's posterolateral approach. A posterior midline incision was made 2.5cm proximal to the olecranon tip and extended distally along the lateral subcutaneous border of the olecranon 5 to 7 cm distal to the fracture, depending upon the requirement incision was extended further distally in case of fixation with plate.

For transverse fracture, reduction was done, two 2mm K wires were passed from tip of olecranon distally entering the opposite cortex. Then a transverse drill hole was made in the ulna distal to the fracture site and 18mm stainless steel wire was passed and crossed over the fracture in a figure of 8 fashions and tightened around the tip of k wires and then the k wires were bent. Wound closed in layers.

For comminuted fractures, accurate anatomical hairline reduction was achieved and held with either reduction clamp olecranon hook plate of size 3.5mm was applied

on the posterior surface with cortical screws after drilling and tapping, thorough wash was given, wound closed in layers and sterile dressing was applied.

For severely comminuted fractures with an unstable fixation, a posterior slab was applied for a period of two weeks before the mobilization was started. For all other patients, mobilization was started from 3rd post-operative day following check dressing. A post-operative check x ray was obtained to check the reduction and articular alignment. Suture removal was done on 12th post-operative day. All the patients were followed up at 2 weeks, 6 weeks, 12 weeks and at 6 months regularly. At each follow up patients were evaluated for clinical functional outcome and also the radiological outcome.

Evaluation of the results

Functional outcome was assessed using the Mayo Elbow Performance Score (MEPS)⁵. A total of 100 points were given. Those with score greater than 90 were considered excellent results. Those between 75-89 as good, 60-74 as fair and less than 60 as poor outcome (Table 1). Radiological outcome was assessed using the standard anteroposterior and lateral views.

Results

Our study included 50 patients who met with the inclusion criteria. None of our patients lost to follow up. All the patients were treated either by tension band wiring or by open reduction and internal fixation with olecranon hook plate. The age distribution of the patients is as mentioned in the Table 2. Majority of our patients were in the age group of 31-50 years (30 patients). Thirty four patients were males (68%) and sixteen were female(32%). Right side was the most commonly injured extremity with thirty two patients (64%) having right side involvement. Most of the cases were result of road traffic accidents, thirty patients

(60%). Remaining twenty patients (40%) sustained fracture as a result of fall from height.

When the fractures were classified based on the Colten's classification system⁶, majority of the fracture patterns belonged to the transverse and oblique type (Table 3). All the patients were operated within one week of admitting to the hospital. Among 50 patients, 25 patients were of avulsion and transverse type of fractures and were treated by tension band wiring method. 15 were of oblique type and 10 were of comminuted type and were fixed using olecranon hook plate. Four cases of comminuted fracture with an unstable fixation were immobilized post operatively for a period of two weeks following which mobilization of elbow joint was initiated. All the patients were followed up for a minimum period of six months. The mean average follow up period was 8.2 months.

The fracture was considered united when clinically there was no tenderness and radiologically fracture line was not visible. All of our patients went for union without need for any intervention. In our series, thirty four cases (68%) went to union in less than four months. Remaining sixteen cases (34%) went for union in four to six months. Most of the cases which went for union in four to six months' time frame were of comminuted type (Nine cases). The mean time duration for fracture union was 3.9 months.

Functional outcome in our series was evaluated using Mayo Elbow Performance Score. Based on the scoring system, we had excellent results in thirty six cases (72%), good outcome in eight cases(16%) and fair results in six cases(12%). There were no cases with poor outcomes in our series. However, we had our share of complications with two of our cases having superficial infection (4%) and seven cases had hardware prominence(14%). The two cases of

superficial infections were treated by antibiotics and infection subsided in both cases. Out of the seven cases with hardware prominence, two were tension band wirings and five cases were those fixed by olecranon hook plate. Patients with tension band wiring implant removal was done 8 months after surgery and in patients with hook plate, implant removal was done in all cases one year after the index surgery.

Discussion

Being intraarticular fractures, the main aim in the treatment of olecranon fractures is not only achieving the anatomical reduction, but also to obtain the optimum amount of movement at the elbow joint. To achieve this, a perfect anatomical reduction of the articular fragments to obtain the articular alignment and rigid fixation is of utmost importance. This prevents the development of stiffness and also the development of arthritis⁷.

In simple transverse fractures and avulsion fractures, fixation by k wires and stainless wires using the tension band wiring principle gives adequate stable reduction and shearing forces are converted to compressive forces once the joint mobilization is started, thereby helping the fracture union. However, the scenario is not the same in oblique and comminuted fractures. Oblique fractures are primarily unstable hence tension band wiring may not give rigid fixation. Similarly in comminuted fractures with coronoid process fractures, tension band wiring cannot be done. In such cases olecranon hook plates give good amount of rigid fixation and also early mobilization can be initiated because of the stability given by the locking plate.

In our series, 50 cases of olecranon fractures were treated with tension band wiring and olecranon hook plate. Twenty five cases of transverse and avulsion fractures were treated by tension band wiring and

remaining twenty five cases of oblique and comminuted variety were treated by olecranon hook plate. Our experience with this method of fixation has given us favorable outcomes (Figure 1 and 2).

The mean age in our series was 40.1 years. This was comparable with the studies by Jiang Xieyuan et al⁸ and Macko Donald and Szabo et al⁹ in which mean age were 38 years and 35.5 years respectively. The present study of fracture olecranon revealed greater incidence in males (68%). Similarly male predominance was found in the study of Jiang Xieyuan, Hume and Wiss and Garry Wolfgang et al¹⁰ series. In this study the involvement of right side [32 patients (64%)] was seen more frequent than left side. But according to author Wolfgang G. et al¹¹, study right side is more and according to author Hume and Wiss left is more commoner.

In the present series 25 (50%) transverse fractures, 15 (30%) oblique fractures and 10 (20%) comminuted fractures. In Jiang Xieyuan study 1 (6.67%) oblique fractures and 14 (93.34%) comminuted fractures. In Murphy et al¹² series 26 (57.5%) transverse fracture 12 (26.7%) oblique fractures 7 (15.6%) comminuted fractures.

The results were evaluated according to the Mayo elbow performance score. The results obtained in our series were excellent in 36 (72%) patients, good in 8(16%) patients, fair in 6(12%) patients and no poor results. The results in our series is almost accordance with the studies of Murphy et al and Jiang Xieyuan (Table 4).

Conclusion

The technique of open reduction and internal fixation with tension band wiring for transverse olecranon fractures and olecranon locking hook plate for oblique and comminuted olecranon fractures is an effective and

gold standard technique and is also bio mechanically very sound. The advantages with this techniques are- it gives rigid fixation, early mobilization can be started , thereby minimizing the chances of joint stiffness. Early mobilization results in compression of the fracture, hence results in early fracture union. Considering the advantages of the tension band wiring and olecranon hook plate, they are the ideal choice of fixation for transverse, oblique and comminuted olecranon fractures respectively.

Limitations

The sample size of the study is small. A larger study involving multiple centres is needed to conclude the outcome of the proposed technique. Also comparative study with other operative techniques helps to validate the advantages of the technique described in our study.

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Legend Tables and Figures

Table 1: Mayo Elbow Performance Score ⁵

Section- 1:Pain Intensity		Max Score-45	
None		45	
Mild		30	
Moderate		15	
Severe		-	
Section-2: Motion		Max Score-20	
Arc of Motion greater than 100 Degrees		20	
Arc of Motion between 50 and 100 Degrees		15	
Arc of Motion less than 50 Degrees		5	
Section – 3 Stability		Max Score-10	
Stable		10	
Moderate Instability		5	
Grossly Unstable		-	
Section – 4 Function (Tick as many as able)		Max Score-25	
Can Comb hair		5	
Can eat		5	
Can perform hygiene		5	
Can don Shirt		5	
Can don Shoe		5	
Total Maximum score		100	
Interpretation of the Scores			
>90	75-89	60-75	<60
Excellent	Good	Fair	Poor

Table 2: Showing the Age Incidence

Age in years	21 – 30	31 – 40	41 – 50	51 – 60
No.of Cases	8	16	14	12
Percentage	16%	32%	28%	24%

Table 3: Patient distribution as per fracture pattern(Colten’s classification)

Fracture type	No of patients	Percentage
Type I- Undisplaced	--	--
Type II- Displaced		
1. Avulsion	02	04%
2. Transverse	23	46%
3. Oblique	15	30%
4. Comminuted	10	20%
5. Fracture dislocations	–	--

Table 4: Functional results compared with other studies.

Study	Results in Percentage			
	Excellent	Good	Fair	Poor
Murphy et al	60	10	30	--
Jiang Xieyuan	53.33	40	6.66	–
Our study	72	16	12	--

Figure 1: X rays and Clinical outcome of a patient with Tension band wiring.

- A) Pre operative X ray of a transverse fracture
- B) X ray showing union
- C) Flexion
- D) Extension
- E) Supination
- F) Pronation



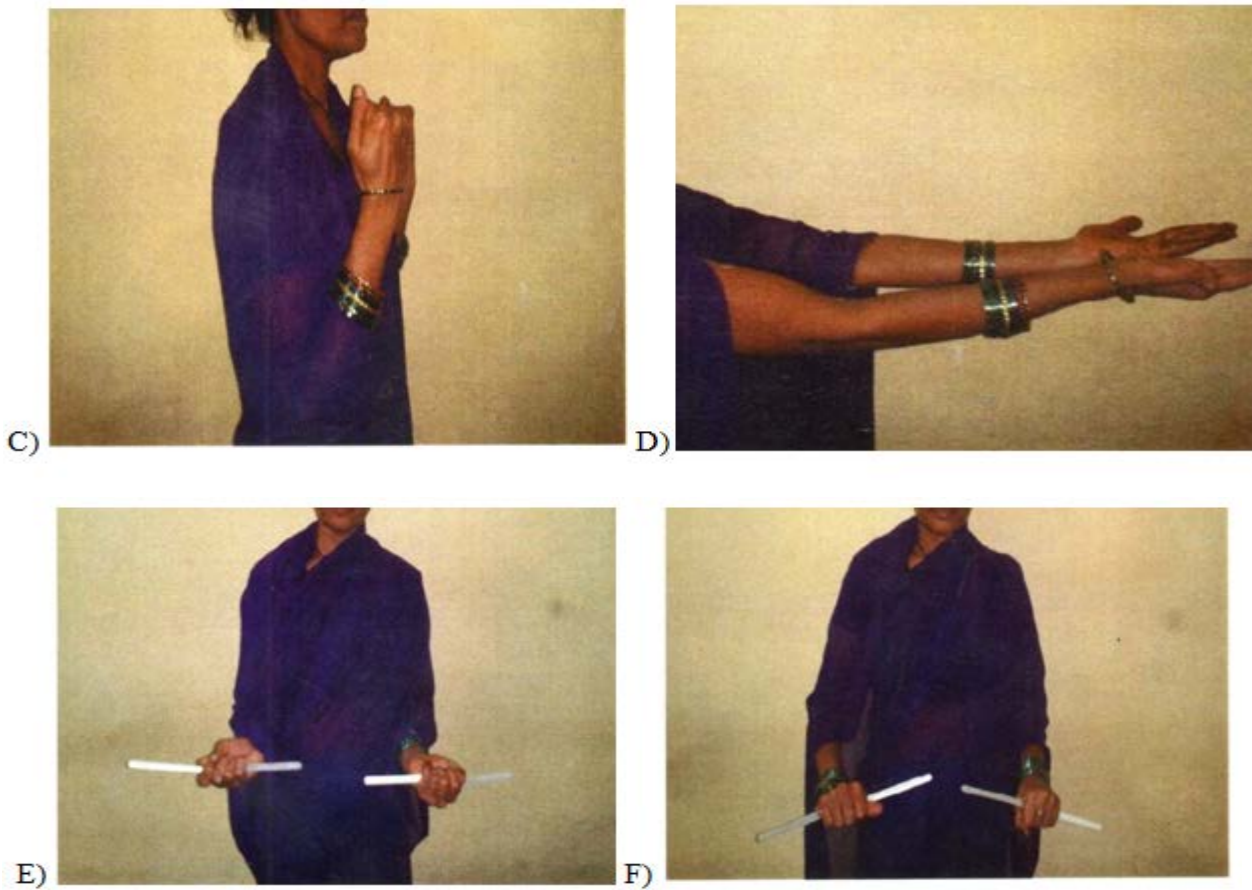


Figure 2: X rays and Clinical outcome of a patient with Olecranon hook plate.

- A) Pre operative X ray of a comminuted fracture
- B) X ray showing union
- C) Flexion
- D) Extension
- E) Supination
- F) Pronation



