

## Comparative study of different methods of olecranon fracture fixation

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### Abstract

Olecranon process is the proximal expansion of ulna bone which takes part in formation of elbow joint and is essential for elbow joint movements. Therefore, fractures of olecranon are to be treated by stable fixation and early mobilization. We have, in our study, tried to identify the best treatment option for the olecranon fracture. This is a prospective cohort study of 35 patients treated at Civil Hospital Ahmedabad for olecranon fracture between 1<sup>st</sup> January, 2015 to 31<sup>st</sup> December, 2015. Adult patients with traumatic closed isolated olecranon fractures were enrolled in our study. Post-operatively, all the patients were followed up to 6 months and their functional outcomes compared. Olecranon fractures are more common in elderly with male predilection. Post-operatively, range of movements ranged from full extension to full flexion in majority of patients but not in all. Complication like implant impingement, infection and restricted range of motion were noticed in our study. There was 100% union rate achieved at the end of 6 months. Treatment of choice for olecranon fracture depends on fracture type. Simple two-part transverse fracture is best treated with K-wiring and tension band wiring whereas oblique or comminuted fractures are best treated with olecranon plating.

**Keywords:** Olecranon, TBW, K-wire, CCS, Plating, ROM

### Introduction

Word olecranon literally means elbow (olene) + head (kranion) derived from Greek. Olecranon process is the proximal most expanded part of ulna bone which takes part in the formation of elbow joint. Olecranon process articulates with trochlea of distal end of humerus. Movement between these two structures forms the mainstay of elbow flexion and extension. Also, olecranon process is the major contributor to the stability of the elbow joint. Any fracture of the olecranon may end up in restriction of movements at the elbow joint if not treated properly due to its intra-articular nature.<sup>(1-3)</sup> As it goes by the principle, any fracture involving articular surface must be reduced anatomically and should be stably fixed so as to allow full range of movements and early mobilization. In this study, we have compared the different methods of olecranon fixation and its outcome to identify the best treatment for olecranon fractures in adult population with isolated olecranon fracture.

### Materials and Method

This is a prospective study of 35 patients, who were operated at a tertiary care centre for olecranon fracture between 1<sup>st</sup> January 2015 and 31<sup>st</sup> December 2015.

#### Inclusion criteria:

- Isolated olecranon fracture
- Adult patients (Age >18 years)
- Traumatic in nature (history of trauma within 10 days from the date of admission)

#### Exclusion criteria:

- Paediatric population
- Polytrauma patients

- Olecranon fracture associated with complications (like elbow dislocation, terrible triad injury, multiple fractures)

Patients with polytrauma were purposefully not involved in the study to avoid any external factor affecting bone healing, recovery, rehabilitation, and to remove all possible confounding factors. The different methods used were TBW (Tension Band Wiring) along with K-wire fixation, olecranon plating, and intramedullary cannulated cancellous screw fixation. Operative method of fixation was decided based upon fracture morphology and surgeon's acquaintance with the operative technique.

All the patients were followed upto 6 months post-operatively on OPD basis and their clinical outcomes compared. Protocol was established to obtain antero-posterior and lateral view radiographs of elbow joint and assess elbow movements at each visit planned at 1 month, 3 months and 6 months postoperatively.

### Results

Out of 35 patients enrolled in our study, 25 were males and 10 were females (Male: Female ratio being 2.5:1). Age of the patient ranged from 32 years to 67 years. Patient distribution in our study, according to fracture type is shown in the Table 1.

**Table 1: Patient distribution according to fracture type**

Mayo classification	Non-comminuted	Comminuted
Type 1 Undisplaced	5	1
Type 2 Displaced,	22	6

stable		
Type 3 Displaced, unstable	0	1

Out of 35 patients, 24 patients were treated with TBW (Tension Band Wiring) along with K-wire fixation, 8 patients were treated by olecranon plating, and 3 patients were treated by intramedullary cannulated cancellous screw (CCS) fixation (Fig. 1).

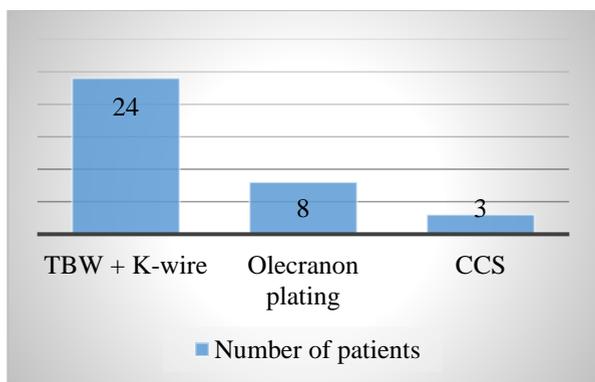


Fig. 1: Methods of fixation

Average range of motion (ROM) at the end of 6 months was compared (Table 2). There was no significant difference observed with regards to ROM between all three methods. But maximum ROM was achieved with olecranon plating.

Table 2: Average ROM at 6 months follow-up

Methods of fixation	Average extension	Average flexion
TBW + K-wire	10	110.8
Olecranon plating	7	109.5
CCS	13	107

Average union time as determined by post-operative X rays was 8 weeks for TBW and K wiring, 12 weeks for CCS fixation and 10 weeks for olecranon plating. Average day of mobilization post-operatively was 2<sup>nd</sup> day for TBW and K wire, 5<sup>th</sup> day for CCS fixation and 15<sup>th</sup> day for olecranon plating.

The complications observed in our study were implant impingement (8 patients), infection (1 patient), movement restriction (7 patients), and implant backout (1 patient) (Fig. 2).

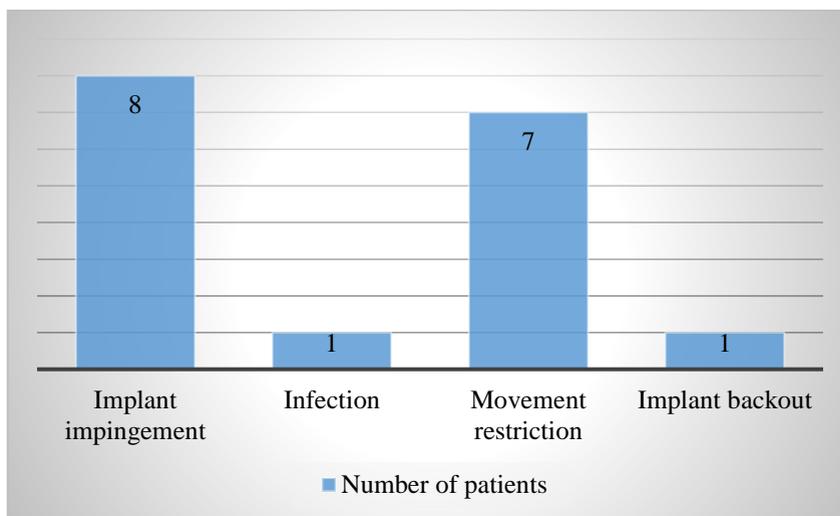
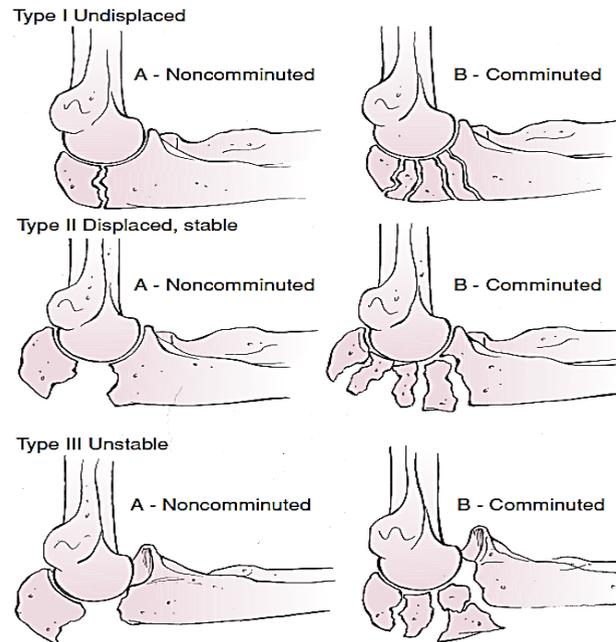


Fig. 2: Postoperative complications in patients

**Discussion**

In our study, we found that out of 35 patients, 25 were males and 10 were females (Male: Female ratio being 2.5:1). Most of the patients ranged from 45-60 years of age with the age range being 32 to 67 years. Mayo classification of olecranon fracture is described below.<sup>(2)</sup>



**Fig. 3: Mayo classification of fracture**

Most common type of fracture in our study was type 2 non-comminuted fracture and most common mechanism of injury was direct trauma to the elbow. All the comminuted fractures were treated by olecranon plating. Only 3 patients having type 1 non-comminuted fractures were treated with CCS screw fixation and rest all the fractures were treated by TBW + K-wire technique (Bicortical K-wire) (Fig. 4-6).



**Fig. 4: Method of fixation (TBW + K-wire technique)**



**Fig. 5: Method of fixation (CCS screw fixation)**



**Fig. 6: Method of fixation (olecranon plating)**

Average union time as determined by post-operative radiograph was 8 weeks for TBW + K wiring,

12 weeks for CCS fixation, and 10 weeks for olecranon plating. Average day of mobilization post-operatively was 2<sup>nd</sup> day for TBW + K wire, 5<sup>th</sup> day for CCS fixation and 15<sup>th</sup> day for olecranon plating. End result was measured by degree of flexion and extension at the elbow at 6 months post-operatively which showed similar results for all 3 methods. Almost all patients were able to extend the elbow upto full extent with terminal restriction, elbow flexion ranged from 90 degrees to 150 degrees with no restriction complained by any patients for activities of daily living.

Regarding ROM, maximum ROM of approximately 102 degrees was achieved with olecranon plating, whereas TBW + K wire achieved 100 degrees of ROM and CCS achieving 94 degrees of ROM at 6 months of follow-up, with statistical analysis showing no superiority of one method over another and neither of methods interfering with activities of daily living or vocational rehabilitation.

Complication is a major concern for any olecranon surgery owing to its subcutaneous nature. In our study TBW + K wire technique was associated with maximum complication rate of implant impingement (33%). Macko et al, Yi Ming Ren et al, Matar HE et al reported similar complications as reported in our study.<sup>(3-6)</sup> Implant impingement was the most common complication observed in our study which was associated with TBW + K wire technique (all 8 cases). All the implant impingement eventually needed implant removal. Out of 8 patients of implant impingement, 5 patients had restricted movement. Rest 2 cases of movement restriction (totalling 7) were associated with olecranon plating. Implant backout was associated with the CCS screw fixation. As consistent with the findings of our study, Schneider MM et al; Romero JM et al; Bhattacharya et al reported complexity of fixation methods along with complication rates and solution for the various complications which further support findings of our study.<sup>(5,7,8)</sup> (Movement restriction was defined as movements of less than 90 degrees).

Olecranon plating was associated with least complication but was associated with more union time as compared to other techniques due to static nature of fixation unlike TBW or CCS fixation. One patient of TBW + K wiring technique presented with infection which subsided with 15 days of intravenous antibiotics. Furthermore, TBW and K wiring technique allowed early mobilization as compared to other methods as early as 1<sup>st</sup> post-operative day leading to early rehabilitation and better functional outcomes with better patient satisfaction.

### Limitations

Shortcomings of our study includes lack of comparison between various modalities in single type of fractures, arbitrary definition of movement restriction, lack of long term follow-up >2 years,

author's acquaintance with particular methods which might have effect on overall outcomes.

### Conclusion

Olecranon fractures are more common in males (Male to female ratio being 2.5:1 in our study) and in older individuals. Most common mechanism of injury is direct trauma to the elbow due to fall. Most common type of fracture is Mayo type 2 non-comminuted. Best modality of treatment for fracture depends upon the type of fracture. Comminuted fractures are best treated with olecranon plating whereas non-comminuted fractures are best treated with TBW + K wire. Mayo type 1 non-comminuted fracture may be treated with intramedullary CCS fixation but implant backout complication has to be kept in mind. Though TBW + K wiring is the most common method used for olecranon fracture fixation, it is associated with complication like implant impingement in approximately 1/3<sup>rd</sup> of the patients. Olecranon plating may prove important alternative to TBW +K wiring technique as it is associated with less complication rates along with similar functional outcomes at the end of 6 months. TBW + K wire technique provides earliest post-op rehabilitation whereas olecranon plating is associated with least rate of complications. Mid-term results in terms of union and elbow movements are similar for all 3 methods. Long term studies with larger database are required to further analyse olecranon plating as preferred method in majority of olecranon fractures.

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