

Original Research Article

A comparative study of outcome of tension band wiring and hook plating in fracture olecranon

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ABSTRACT

Background: Olecranon fractures are common upper limb fracture accounting for 40% of the fractures around elbow. Anatomic reduction and restoration of the joint surface is required for good outcome and to prevent post-traumatic arthritis. This study was directed towards the functional results and complications of surgical management of olecranon fracture treated with hook plate fixation and tension band wiring.

Methods: This prospective comparative study was done at a tertiary care centre from 2019 to 2022. This study consisted of 30 patients of fracture olecranon of which 15 were treated with tension band wiring and 15 with hook plate. All patients were followed up with minimum follow up of six months and evaluated for their functional outcome using Mayo elbow performance score.

Results: In this study, the average age was 34 years in TBW group and 37 years in hook plate group. The mean Mayo elbow performance score after 6 months in TBW group was 88.33 (excellent) and in plate group was 90 (excellent). Superficial infection was present in 2 patients of the TBW group. Elbow stiffness was present in 2 patients of TBW group. Hardware impingement was present in one patient in each of TBW group and plate group.

Conclusions: To achieve early movements and to prevent complications like traumatic arthritis and joint stiffness we need a perfect anatomical reduction in intra-articular fractures of the olecranon. This study showed no significant difference in functional outcome with both the techniques, but the complications are more with TBW.

Keywords: Olecranon fractures, Tension band wiring, Hook plating, Elbow injury

INTRODUCTION

The subcutaneous nature of the olecranon makes it prone to direct trauma. Trauma to the adult elbow can be challenging to treat by virtue of the complex articular structure, complex capsular ligament and musculotendinous arrangements, and the proximity of neurovascular structures. Word olecranon literally means elbow (olene) and head (kranion) derived from Greek.¹ The common causes of Olecranon fractures are mostly due to self-fall, motor vehicle crash, fall from a height, or a

direct blow to the elbow and are commonly observed orthopaedic injuries in the emergency room.

Olecranon fractures usually involve the articular surface of the elbow. Posttraumatic arthritis occurs in approximately 20% of cases and persistent malreduction >2mm is associated with this outcome. In fractures with significant comminution, inadvertent malreduction by narrowing the greater sigmoid notch may further predispose the patient to arthritis.² Displaced fractures of olecranon interrupt the extensor mechanism which results in loss of active elbow

extension. Unstable olecranon fractures require reduction and stable fixation of the olecranon to restore elbow stability. Diagnosis of any upper limb injury begins with a thorough physical examination of the entire extremity, including observation of the attitude, palpation, and complete neurovascular examination. The aims of olecranon fracture treatment are anatomic restoration of articular surface, elbow extensor mechanism repair, restoration of joint stability and motion, and joint stiffness prevention and other complications. Treatment options include immobilization, surgical fixation and fixation with tension-band wiring or plate fixation and excision of the proximal fragment with triceps advancement.

Tension-band wiring usually provides stable fixation with a high union rate for simple non-comminuted transverse olecranon fractures.³ This method involves insertion of two parallel K wires or intramedullary cancellous screw from the tip of the olecranon spanning the fracture site towards the opposite cortex, with placement of a metal wire in a figure-of-eight pattern.

The K wires are typically inserted in either of the two configurations: Directed anteriorly to engage the anterior cortex of the distal fragment, also known as 'transcortical' or parallel along the ulna, also known as 'intramedullary'.

Present study aims to evaluate and compare the outcome of surgical management of Olecranon fracture treated with Hook plate fixation and tension band wiring.

The objectives of this study were to evaluate the outcome of surgical management of olecranon fracture treated with Hook plate fixation, to evaluate the outcome of surgical management of olecranon fracture treated with tension band wiring and to assess the complications associated with both the techniques and their management.

METHODS

The study was randomized, prospective, cross sectional study. The study included 30 patients of olecranon fracture who presented to the OPD/casualty of department of orthopaedics and traumatology, M. G. M. Medical College and M.Y. Hospital, Indore between September 2019 and August 2022. Patients were chosen for the study with the help of elbow radiograph in accordance with Mayo's classification of olecranon fracture.

Pre-operatively, patients were assessed according to a Mayo's elbow performance score and VAS score. Pre-operatively, details were recorded till the period of six months at regular follow-ups. The study was approved by the institutional ethics committee and informed written consent was taken from all patients. Participant included for study were 18-60 years of age, presenting within 7 days of injury, having closed fractures and Gustillo classification grade I and Mayo Ia, IIa, IIIa classification. Exclusion criteria for study participants was age <18 or >60 years, having other ipsilateral fractures, pathological

fractures, compound fractures grade 2 and 3, Mayo Ib, IIb, IIIb classification.

The selected patients who satisfied the above inclusion criteria were then registered, all history and clinical details were recorded in the history sheet as per the proforma.

Immediate management- immediately on arrival of the patient, if he/she was in shock, the level of shock was noted and managed accordingly. X-ray of the part was taken and the elbow was immobilized in whatever the position patients presence in a A/E POP posterior slab.

The affected limb was kept elevated. Analgesics and antibiotics were given if necessary. Patient was then prepared for surgery and anaesthesia after the pre-anaesthetic checkup.

Pre-operative diagnosis and assessment: by history, clinical examination, radiological evaluation. For selection of cases for Kirschner wires with tension band wiring and olecranon hook plate following points were considered- age of the patient, extent of damage to the articular surface, degree of comminution.

The operation was performed under general anaesthesia or brachial block. Mid arm tourniquet was applied with patient in supine or lateral position. Site of the surgery was thoroughly painted with iodine and spirit and draped. Exposure of the olecranon was done by Campbell's posterolateral approach (Figure 1). A vertical incision was taken over the posterior aspect of the elbow about 2.5 cm proximal to olecranon, curving distally along the lateral aspect of olecranon reaching the subcutaneous border of the ulna and extending distally for about 7.5 cm distal to olecranon. Fascia was incised along the line of skin incision and fracture site was exposed. Fracture haematoma was cleared off and the fracture site was gently curettage. Accurate anatomical hairline reduction was achieved and held with either reduction clamp or long towel clip. K-wires is introduced parallel from the tip of the olecranon. Periosteum was stripped from the shaft of ulna distal to fracture site and a transverse hole was drilled approximately 3 to 5 cm distal to fracture site. A no. 18 stainless steel malleable wire was passed through this transverse hole and crossed over the posterior surface of olecranon in a figure-of-eight manner and then passed around the protruding Kirschner wires and tightened using AO tensioner and then secured with a twist. Bend the proximal ends of the Kirschner wires 180° and tap the cut ends back into the proximal fragment. Wound closed in layers and sterile dressing and compression bandage given.

All the patients were treated with injection ceftriaxone 1.5 g twice daily for 5 days followed by tablet cefuroxime 500 mg twice daily for 5 days. Some cases were treated with injection amikacin 500 mg daily for 3 days. With anti-inflammatory and analgesic medicines. In our study the patients on discharge were

advised to report for follow up after 6 weeks and 12 weeks and thereafter every 3 months. The result is assessed 3 months after the procedure. Check X-ray were taken and when final X-ray showed union, implant was removed. All the patients were assessed using SPSS 21.0 Software.

RESULTS

The study was done in a total of 30 patients of olecranon fractures divided in two groups- 15 patients in Hook plate fixation group and 15 patients in tension band wiring group.

In Hook plate fixation, there were 5 patients in the age group 20-30 years, 4 in the age group 31-40 years, 5 in the age group 41-50 and one patient belonged to age group 51-60 years. In tension band wiring group, there were 8 patients in the age group 20-30 years, 2 in the age group 31-40 years, 3 in the age group 41-50 and 2 belong to age group 51-60 years. The mean age in Hook plate fixation was 37.00±11.071 years and Tension band wiring was 34.06±12.00 years.

Although there are many methods of evaluation of results given by many authors, the treated olecranon fractures by tension band wiring and olecranon hook plate were evaluated in our study with Mayo elbow performance score (MEPS) for functional outcome and standard radiographs for radiological outcome. The mean age in Hook plate fixation was 37.00±11.071 years and tension band wiring was 34.06±12.00. In Hook plate fixation, there were 12 (80%) males and 3 (20%) females. In tension band wiring, there were 7 (46.7%) males and 8 (53.3%) females. In Hook plate fixation, there were 6 (40.0%) were left and 9 (60.0%) were right side of injury.

In tension band wiring, there were 6 (40.0%) left and 9 (60.0%) were right side injury.

In Hook plate fixation, there were 3 (20.0%) patients who injured because of assault, 9 (60.0%) were injured because of fall and 3 (20.0%) were injured because of RTA.

In tension band wiring, there were 3 (20.0%) patients who injured because of assault, 8 (53.3%) were injured because of fall and 4 (26.7%) were injured because of RTA.

The most common mode of injury was fall.

Out of the total patients, three patients had history of hypertension while one patient had hypothyroidism. One patient in each group developed hardware impingement post-operatively. Two patients in TBW group developed stiffness post operatively due to lack of physiotherapy. One patient in Hook Plate group and two patients in TBW group developed superficial infection. All the three patients were managed conservatively by antibiotic coverage for 21 days.

In Hook plate fixation, there were 12 (80%) patients in whom functional outcome was excellent and in 3 (20.0%) patients functional outcome was good after 6 months follow-up. In tension band wiring, there were 12 (80%) patients functional outcome was excellent, 1 (6.7%) patients functional outcome was good and 2 (13.3%) patients functional outcome was fair after 6 months follow-up. Excellent results 80% were seen in Hook plate fixation and Tension band wiring both the group respectively. The above association found to be statistically not significant (p>0.05) which shows the functional outcome of patient of both groups are comparable.

Table 1: Distribution of patients according to complications in both the groups (n=30).

Complications	Hook plate fixation (n=15)		Tension band wiring (n=15)		Total	
	No.	%	N	%	N	%
Hardware impingement	1	6.7	1	6.7	2	6.7
Stiffness	0	0.0	2	13.3	2	6.7
Superficial infection	1	6.7	2	13.3	3	10.0
Nil	13	86.7	10	66.7	23	76.7
Total	15	100.0	15	100.0	30	100.0

Note: Pearson Chi square=2.725, DF=2, p value=0.436, not significant.

Table 2: Distribution of patients according to time interval between injury and surgery in both the groups (n=30).

Time interval between injury and surgery (days)	Hook plate fixation (n=15)		Tension band wiring (n=15)		Total	
	N	%	N	%	N	%
0-1	1	6.7	1	6.7	2	6.7
2-3	5	33.3	4	26.7	9	30.0
4-5	7	46.7	7	46.7	14	46.7
6-7	2	13.3	3	20.0	5	16.7
Total	15	100.0	15	100.0	30	100.0
Mean±SD	3.80±1.56		3.93±1.79		3.86±1.65	

Note: Pearson Chi-square=0.311, DF=3, p value=0.958, not significant.

Table 3: Distribution of patients according to time of union (weeks) in both the groups (n=30).

Time of unions (weeks)	Hook plate fixation (n=15)		Tension band wiring (n=15)		Total	
	N	%	N	%	N	%
11.0	1	6.7	0	0.0	1	3.3
12.0	4	26.7	2	13.3	6	20.0
13.0	4	26.7	4	26.7	8	26.7
14.0	4	26.7	5	33.3	9	30.0
15.0	1	6.7	3	20.0	4	13.3
16.0	1	6.7	1	6.7	2	6.7
Total	15	100.0	15	100.0	30	100.0
Mean±SD	13.20±1.32		13.80±1.14		13.50±1.25	

Note: Pearson Chi-square=2.778, DF=5, p value=0.734, not significant.

Table 4. Comparison of Mayo elbow performance score (MEPS) score at 3 and 6 months (functional outcome) (n=30).

Functional outcome	MEPS score at 3 months (n=15)				MEPS score at 6 months (n=15)			
	Hook plate fixation		Tension band wiring		Hook plate fixation		Tension band wiring	
	N	%	N	%	N	%	N	%
Excellent	2	13.30	2	13.30	12	80.00	12	80.00
Good	12	80.00	10	66.70	3	20.00	1	6.70
Fair	1	6.70	2	13.30	0	0.00	2	13.30
Poor	0	0.00	1	6.70	0	0.00	0	0.00
Total	15	100.00	15	100.00	15	100.00	15	100.00
	P value		0.679- not significant		P value		0.223- not significant	

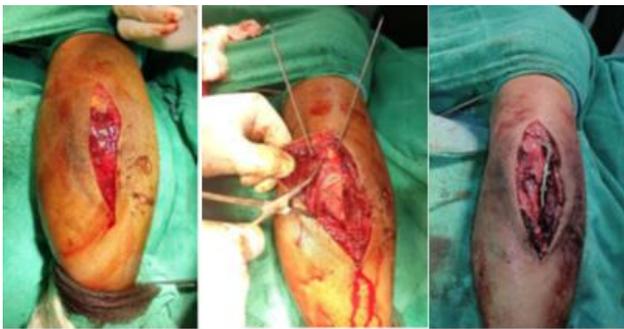


Figure 1: Surgical approach.



Figure 3: Radiological and functional outcome after hook plating.



Figure 2: Radiological and functional outcome after tension band wiring.

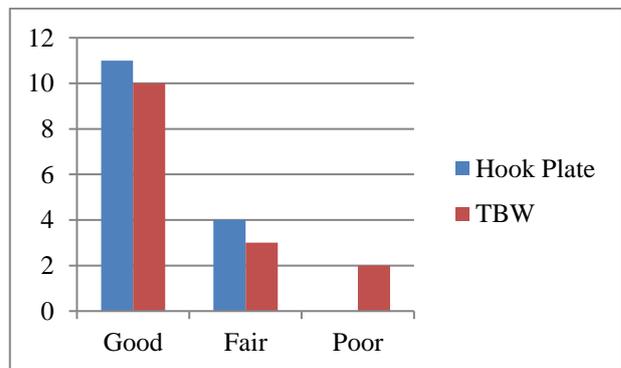


Figure 4: Final functional outcome at 6 months.

DISCUSSION

Olecranon fractures account for approximately 10% of all proximal forearm fractures. Those displaced, intra-articular fractures require an anatomic reduction to get satisfactory clinical outcomes. Operative treatment is advised in fractures with an articular incongruity of more than 2 mm, hence only a few of patients are treated conservatively.

The surgical techniques available for the treatment of acute olecranon fractures and non-unions are tension band wiring, different plating, different intramedullary nailing procedures and screw insertion and rarely resection of the avulsed fragment. In the present study, a total of 30 patients with olecranon fractures were included and broadly divided into two study groups with 15 patients in each group.

In the present study, majority of the patients of both the study group belonged to the age group of 20-30 years. It was similar to another study done by Ahmed et al mean age of the patients of tension band wiring group and Hook plate fixation group was 34.0 years and 37.0 years respectively.

Among the patients of the tension band wiring group, right side involvement occurred in 60 percent of the cases while among the patients of the Hook plate group, right side involvement occurred in 60 percent of the cases. Similar results have been reported the past literature where authors have observed higher incidence of involvement of right side like Chan et al with right side 52.3% and left side 47.7%

Mean time for complete union among the patients of the tension band wiring group and the patients of the Hook plate group was found 13.20 weeks and 13.80 weeks respectively, results of which were found to be statistically non-significant. Our results were in concordance with the results obtained by Bhattacharyya et al with 10.15 weeks in TBW group and 10.60 in Hook plate group which was non-significant difference in relation to time for complete union.⁶

In the tension band wiring group, 13.3 percent of the patients showed Elbow stiffness, 6.7 percent patients showed hardware impingement. In the Hook plate fixation group, one patient (6.7 percent) showed hardware impingement.

According to Wolfgang et al, tension-band wiring usually provides stable fixation with a high union rate for simple non-comminuted transverse olecranon especially in fractures.⁸ Papagelopoulos et al reported nonunion of olecranon fractures up to 1% of patients, with typical symptoms of pain, instability, or loss of motion.⁹

Gathen et al in their study showed no difference in final outcome of tension band wiring and plating group for

olecranon fractures based on Mayo and DASH score.¹⁰

Ren et al did a meta-analysis and showed no difference in final outcome of tension band wiring and plate fixation in olecranon fractures.¹¹

Gordon et al did a study on cadavers and found good functional outcome of plate fixation in olecranon fractures.¹²

Midtgaard et al in another cadaveric study found 80% implant failure after tension band wiring in comparison to only 10 % after plating in olecranon fractures.¹³

The K-wire with tension band technique achieves and maintains the reduction satisfactorily but unfortunately is plagued with hardware prominence issues. The findings in the present study show that the transcortical screw technique is at least equivalent in strength and stability compared with the standard K-wire with tension band wiring technique.

The final results of this work showed better clinical results for tension band wiring especially in comminuted fractures in terms of shorter duration of surgery and no non-union case in comparison to transcortical screw fixation.

There were certain limitations to our study. The sample size is too small to give a generalized decision regarding which implant works better in olecranon fractures. A further research with more number of cases is important and worth doing. There was loss of follow up in some of our patients due to the hard times during the pandemic.

CONCLUSION

Both the above techniques for management of fractures of the olecranon has the following distinct advantages, provided the surgery is performed as early as possible, giving due care to all the technical details. The post-operative immobilization in POP is greatly minimized, thereby avoiding fracture disease. Because of rigid fixation between the fracture fragments, early active and functional movements can be achieved at the involved joints during the phase of fracture healing. This reduces the chances of joint stiffness. Early active movement at the involved joint induces compression between the fragments and thus hastens fracture healing and early return to work. Both tension band wiring and Hook plate give excellent results in patients with olecranon fractures, but Hook plate is better considering more complications associated with tension band wiring like superficial infection, elbow stiffness, etc.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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