



FUNCTIONAL OUTCOME BETWEEN TBW AND PLATE FIXATION IN OLECRANON FRACTURES

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ABSTRACT

Objectives: To compare the efficacy, clinical outcome and complications of Tension band wiring and Plate fixation in Olecranon fractures, using;

- 1.Mayo Elbow Performance Score
- 2.DASH score

Methods: 30 patients, who are clinically and radiologically diagnosed with olecranon fracture between the age group of 18 to 75 years are selected and put into 2 groups (15 in each group):

Group A: undergoing plate fixation

Group B: undergoing tension band wiring

Results: In our study, majority of the patients were males, middle aged, fall on elbow was the most common mode of injury. Most of the cases were Mayo type II fractures i.e., transverse or oblique fractures according to Colton's classification. Surgery was performed within 3-4 average days. Union noted clinically and radiologically and functional evaluation was done by Mayo elbow performance score. In TBW group 11(73%) patients had excellent results, 3(20%) patients had good results and 1(07%) patient had fair results. In Plating group 10(67%) patients had excellent results, 4(26%) patients had good results and 1(07%) patients had fair results. There were no patients with poor results in both the groups. **Conclusion:** From the present study it is concluded that using tension band wiring and plating for oblique or transverse olecranon fractures gives excellent results in majority of patients and both procedures are associated with superficial hardware prominence and superficial infections in some patients with no significant difference between the final outcome of two procedures.

KEYWORDS : Olecranon fracture, TBW, Plate fixation.

INTRODUCTION

Olecranon is an important part of elbow joint and associated with elbow instability and fractures. Olecranon fractures are the one of most common elbow fractures in adults and also constitutes approximately 8to10% of all upper limb fractures^[1]. Incidence in the adult population is 11.5per 100,000 population per year^[1]. The olecranon fractures have bimodal distribution, in young patient fracture is seen after high energy trauma and in old aged patients after trivial fall due to osteoporotic bone quality^[1].

The common pattern of olecranon fracture is simple transverse pattern. Most of the olecranon fractures are displaced due to tension of the triceps brachii muscle and its tendon attachment to olecranon and therefore conservative management is not done preferably. Depending on the fracture displacement, comminution and ulno-humeral stability Mayo classified the olecranon fractures into three groups with increase in fracture pattern severity. Hence in Surgical management of olecranon fractures many different procedures have been defined, and the most commonly done surgeries are Tension band wiring (TBW) and Plate fixation (PF)^[1].

Tension band wiring is most commonly done procedure for simple transverse pattern olecranon fracture and it's a simple, low cost procedure with easy learning curve. The principle of Tension band wiring is that it acts by converting tensile forces [of triceps brachii muscle] into compressive forces. And it's done using K (Kirschner) wires and SS (Stainless steel) wires.

Plate fixation for olecranon fractures can be used for all olecranon fractures, particularly oblique and complex fractures using hook plates, LCP plates^[3]. Plating of olecranon requires skilled experience and is high cost compared to tension band wiring.

No single method of fixation has proven to be ideal for different types of Olecranon fractures, So the present study is being done to compare the efficacy, clinical outcome and complications between Tension band wiring versus Plate fixation for olecranon fractures.

MATERIALS AND METHODS

This randomized comparative study was carried out between February 2023 and August 2024 following approval from the Institutional Ethics Committee. The study included 30 patients with Mayo type 2 olecranon fractures. The participants were between 18 and 75 years old and provided informed consent to participate. Exclusion criteria were

patients with trans- olecranon fracture dislocation, fracture extending beyond the coronoid of ulna or having ligamentous injury and open fracture and patients with pathological fractures due to tumor.

After obtaining informed consent, all patients will be subjected to thorough clinical examination, baseline investigations, radiographic analysis and the details will be recorded in the study proforma. Patients will divided into 2 groups based on fracture pattern (15 in each group) Group A: undergoing plate fixation and Group B: undergoing tension band wiring. Prior to the surgery, the patient informed about the risks including post-operative pain, infection, swelling of the joint, and damage to surrounding tissues including bone, ligament, and nerve and also discussed about benefits. All patients operated in the lateral position, and tourniquet for bleeding control. A standard posterior approach was used for reduction and fixation. The efficacy, clinical outcome and complications is assessed using Mayo Elbow Performance Score. These assessments will be performed after the treatment, and after 12, 14, and 16 weeks of follow-up. The data will be recorded in the appropriate proforma.

RESULT

The study included 30 patients, with 15 in Group A: undergoing plate fixation and Group

B: undergoing tension band wiring. There were no significant differences between the two groups in terms of demographic characteristics such as age and sex. Additionally, there were no statistically significant differences between the groups regarding side, nature of trauma, type of fracture and complications. (Table 1)

Table 1: Demographic data were comparable in both the groups

Parameter	Group A(n-15) Mean ±SD	Group B(n-15) Mean ±SD	P- Value
Age (years)	35.56±11.099	32.06±10.26	0.352
Sex: Female	Count – 6, % - 37.5%	Count – 3, % - 18.8%	0.238
Male	Count –10, % - 62.5%	Count –13, % - 81.3%	
Side – Right	Count – 8, % - 50%	Count – 7, % - 43.8%	0.723
Light	Count – 8, % - 50%	Count – 9, % - 56.3%	
Nature of trauma:			0.311
Assault	Count – 1, % - 6.3%	Count – 3, % - 18.8%	
Fall	Count – 10, % - 62.5%	Count – 11, % - 68.8%	
RTA	Count – 5, % -31.3%	Count – 2, % - 12.5%	

Type of fracture: Comminuted Transverse	Count - 3, % - 18.8% Count -13, % - 81.3%	Count - 5, % - 31.3% Count - 11, % - 68.8%	0.414
Complications: 1. NIL 2. SI 3. SMP	Count - 10, % - 62.5% Count - 2, % - 12.5% Count - 4, % - 25%	Count-11, % -68.8% Count - 1, % -6.3% Count - 4, % - 25%	0.827

Table 2: Results

RESULTS		TYPE OF FIXATION		Total
		PLATING	TBW	
EXCELLENT	Count	11	11	0.788
	%	68.8%	68.8%	
FAIR	Count	2	1	
	%	12.5%	6.3%	
GOOD	Count	3	4	
	%	18.8%	25%	
Total	Count	16	16	
	%	100%	100%	

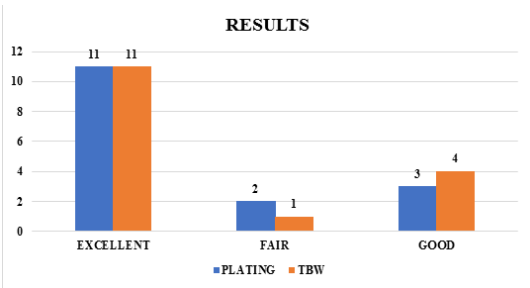


Figure 1: Results

Both groups had 68.8% of patients with excellent outcomes. The Plating group had 12.5% with fair results and 18.8% with good results, while the TBW group had 6.3% with fair and 25% with good results. The p-value was 0.788, showing no significant difference.

Table 3: MAYO ELBOW PERFORMANCE SCORE

MAYO ELBOW PERFORMANCE SCORE		TYPE OF FIXATION		P VALUE
		PLATING	TBW	
PAIN	MEAN	40.31	40.31	1.00
	SD	7.181	7.181	
MOTION	MEAN	19.38	18.44	0.287
	SD	2.5	2.394	
STABILITY	MEAN	9.38	9.69	0.559
	SD	1.708	1.25	
FUNCTION	MEAN	23.13	23.44	0.721
	SD	2.5	2.394	
TOTAL SCORE	MEAN	91.88	91.88	1.00
	SD	12.093	12.5	

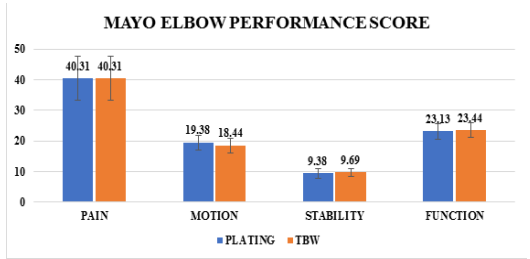


Figure 2: MAYO ELBOW PERFORMANCE SCORE

Pain The mean pain score for both the plating and TBW groups was 40.31 ± 7.18 , indicating no difference between the groups, as evidenced by a p-value of 1.00. This score suggests that on average, patients in both groups experienced similar levels of pain. Motion The motion score, which reflects the range of movement of the elbow, has a mean of 19.38 ± 2.50 for the Plating group and 18.44 ± 2.39 for the TBW group. The difference between these means was not statistically significant, with a p-value of 0.287, suggesting that both groups had comparable motion ranges post-fixation. Stability Stability, indicating how stable the elbow joint is post-operation, showed mean scores of

9.38 ± 1.71 for the Plating group and 9.69 ± 1.25 for the TBW group. The p-value of 0.559 indicates no significant difference in joint stability between the two groups.

Function Function, reflecting the overall functional use of the elbow in daily activities, had mean scores of 23.13 ± 2.50 for the Plating group and 23.44 ± 2.39 for the TBW group. With a p-value of 0.721, there is no significant difference between the groups, suggesting similar functional outcomes.

Total Score The total Mayo Elbow Performance Score, which is a composite of the pain, motion, stability, and function scores, was identical for both groups at 91.88. The standard deviation was 12.09 for the Plating group and 12.50 for the TBW group, with a p-value of 1.00, indicating no overall difference in performance between the two types of fixation.

Table 4: Others

		TYPE OF FIXATION		P VALUE
		PLATING	TBW	
Return to work (weeks)	MEAN	8.275	7.4	0.026
	SD	1.0536	1.0671	
Revision rate (%)	MEAN	13.369	2.056	0.001
	SD	1.449	1.0844	
DASH score	MEAN	9.956	7.15	0.001
	SD	0.7061	0.8446	

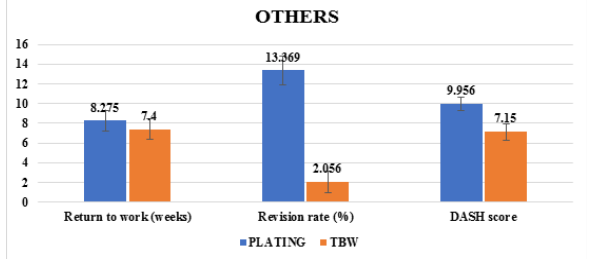


Figure 3: Others

Return to Work : The average time to return to work differed significantly between the two groups. Patients in the Plating group needed an average of 8.28 ± 1.05 weeks to resume work, while those in the TBW group returned in 7.40 ± 1.07 weeks. The p-value for this difference was 0.026, suggesting that the TBW group experienced a statistically significant shorter duration before returning to work compared to the Plating group.

Revision Rate:. The revision rate, which indicates the percentage of patients needing additional surgery, was notably higher in the Plating group at $13.37 \pm 1.45\%$, compared to only $2.06 \pm 1.08\%$ in the TBW group. This difference was statistically significant, with a p-value of 0.001, suggesting that patients treated with TBW fixation had fewer complications that required revision surgery.

DASH Score: The DASH (Disabilities of the Arm, Shoulder, and Hand) score, which assesses physical function and symptoms in individuals with upper limb musculoskeletal disorders, also differed significantly between the groups. The Plating group had an average DASH score of 9.96 ± 0.71 , reflecting greater disability, whereas the TBW group had an average score of 7.15 ± 0.84 . The p-value for this difference was 0.001, indicating a statistically significant improvement in upper limb function for the TBW group.

DISCUSSION

It's a randomized comparative investigation. The dates of operation are February 2023–August 2024. Patients having olecranon fracture and operation performed in hospitals affiliated with Bangalore Medical College and Research Institute. Once the patients' informed permission and institutional consent have been obtained, this prospective, randomized comparison study will proceed. Patients will be randomly assigned to one of two groups in this. Each group had 15 patients. Olecranon fractures are common injuries encountered in orthopedic practice, often resulting from falls onto an outstretched hand or direct trauma. These fractures can significantly impair upper limb function due to the disruption of the extensor mechanism of the elbow. Historically, tension band wiring (TBW) and plate fixation have been the mainstay surgical treatments for olecranon fractures, each offering distinct advantages and considerations. This study aims to

compare these two methods concerning outcomes such as fracture healing, functional recovery, complications, and patient satisfaction, providing insights into their application in clinical practice.

In our study, demographic data like, age of patients and sex of the patients were comparable in both the groups. Like wise clinical features like , side of the fracture , nature of trauma , type of fracture and complications between both the groups were of no statistical significance and comparable with each other.

SURGICAL PROCEDURE OUTCOME

In our study, among the Plating group, 62.5% experienced no complications, 12.5% had surgical infections (SI), and 25% had superficial metal prominence (SMP). In the TBW group, 68.8% had no complications, 6.3% had SI, and 25% had SMP. Both groups reported 68.8% of patients achieving excellent outcomes. The average number of days to discharge was 4.94 ± 0.93 days for the Plating group and 5.19 ± 0.98 days for the TBW group. The average follow-up period was 4.94 ± 0.68 months for the Plating group and 5.19 ± 0.83 months for the TBW group. The mean time to union was 13.13 ± 1.46 weeks for the Plating group and 12.75 ± 1.24 weeks for the TBW group, with a p-value of 0.439, indicating no significant difference.

Overall, the two groups was comparable in terms of post-operative complications, surgical outcomes, and days to discharge, as the differences observed were not statistically significant.

In the Powell, A J et al. study, the mean post-injury QuickDASH for the TBW group was 12.9, while the locking plate group's was 15.0 . The results for the two groups did not differ in a way that was statistically significant. Of the 48 TBW patients, 19 (or 39.6%) experienced problems. Of the 48 TBW patients, sixteen underwent reoperations (33.3%). Specifically, they draw attention to the fact that 13 (27.1%) of the patients treated with TBW had metalwork removed later on due to hardware discomfort. The 16 patients who underwent locking plate fixation did not experience any issues or require additional surgeries. The rates of complications and reoperations varied statistically. Locking plates was discovered to be less expensive per patient than TBW even though they were initially more expensive when the reoperation costs for the TBW group were taken into account.

MAYO ELBOW PERFORMANCE SCORE

In our study, the mean pain score was 40.31 ± 7.18 for both the Plating and TBW groups. The motion score, indicating the range of elbow movement, averaged 19.38 ± 2.50 for the Plating group and 18.44 ± 2.39 for the TBW group, suggesting that both groups had similar ranges of motion after fixation.

The stability of the elbow joint after surgery, which measures how stable the joint is, had mean scores of 9.38 ± 1.71 for the Plating group and 9.69 ± 1.25 for the TBW group. The function score, reflecting the elbow's overall use in daily activities, averaged 23.13 ± 2.50 for the Plating group and 23.44 ± 2.39 for the TBW group. With a p-value of 0.721, there was no significant difference between the groups, indicating comparable functional outcomes.

The total Mayo Elbow Performance Score, which combines pain, motion, stability, and function scores, was the same for both groups, at 91.88. The standard deviation was 12.09 for the Plating group and 12.50 for the TBW group. With a p-value of 1.00, there was no significant difference in overall performance between the two fixation methods.

DASH SCORE

The DASH (Disabilities of the Arm, Shoulder, and Hand) score, which assesses physical function and symptoms in individuals with upper limb musculoskeletal disorders, varied significantly between the groups. The Plating group had a mean DASH score of 9.96 ± 0.71 , reflecting greater disability, while the TBW group had a mean score of 7.15 ± 0.84 . With a p-value of 0.001, this indicates a statistically significant improvement in upper limb function for the TBW group.

FOLLOW UP FINDINGS

In our study, there was a significant difference in the mean time to return to work between the two groups. Patients in the Plating group returned to work after an average of 8.28 ± 1.05 weeks, while those in the TBW group did so in 7.40 ± 1.07 weeks. The p-value for this difference was 0.026, indicating that the TBW group experienced a statistically significant shorter time to return to work compared to the Plating group.

In the et al. study, the revision rate was 2% in the Plating group while it was 14% in the TBW group . The patients in the Plating group took an average of 7.8 ± 2.6 weeks to return to work, whereas those in the TBW group returned to work in 9.2 ± 3.1 weeks. The Plating group had a mean DASH score of 7.7 ± 1.2 compared to the TBW group, which had a mean score of 10 ± 1.8 . They came to the conclusion that both approaches produced functional outcomes that were satisfactory. The PF group returned to work earlier, had less revisions, and had more range of motion in the flexion-extension joint. Despite its low cost, orthopedic surgeons have a significant obstacle when it comes to implant irritation with the TBW. Which treatment is better depends on a number of criteria, such as the patient's bone quality, the fracture pattern, and the surgeon's preference.

The rate of revision surgery, indicating the percentage of patients needing additional procedures, was notably higher in the Plating group at $13.37 \pm 1.45\%$, compared to only $2.06 \pm 1.08\%$ in the TBW group. This difference was statistically significant, with a p-value of 0.001, suggesting that patients in the TBW group had fewer complications that required revision surgery.

Both TBW and plate fixation are acceptable methods of treatment for Mayo type 2 olecranon fractures with no significant difference in terms of Mayo elbow performance score, after a follow up period of six months. However TBW group showed less revision surgery rate, earlier return to work and better over all DASH score. Long term studies with bigger cohort are needed to validate these results.

CONCLUSION

In conclusion, both tension band wiring and plate fixation are effective methods for treating olecranon fractures, each offering distinct benefits and considerations. The selection of the appropriate technique should be based on the specific characteristics of the patient's fracture, their overall health, and their functional objectives.

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