



Evaluation of the Results of Internal Fixation of Olecranon Fracture: Comparative Study between Olecranon Plate and Screws Versus Tension Band and K Wires

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Olecranon fractures constitute a large proportion of injuries about the elbow. Several fracture patterns are recognized, with each pattern lending itself to a different treatment modality ranging from conservative treatment to fixation by different methods like tension band wiring, olecranon plate, intramedullary screw with or without tension band, and single Rush pin fixation. This study aimed to evaluate and compare the result of fixation of olecranon fracture tension band with K-wire and posterior olecranon special non locked plate fixation.

Materials and Methods: This study included 30 patients, prospectively of simple olecranon fracture. Patients were randomly classified into two equal groups; group I was managed by tension band and K wires, while group I was managed by special non locked olecranon plate and screws.

Results: No significant differences were found between both groups in DASH score, range of motion, improvement rate, radiological outcomes and return to previous activities.

Conclusion: There were no significant differences between the two-fixation method regarding to DASH, ROM, radiological outcomes, and return to previous activity but rate of hardware removal was higher in tension band and K wires than posterior olecranon special non locked plate fixation.

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1. INTRODUCTION

The subcutaneous location of the olecranon makes it more vulnerable to trauma [1]. It represents approximately 10% of all fractures around the elbow [2]. Olecranon fractures are susceptible to direct injury, although indirect injuries can occur by sudden triceps contraction.

Fracture pattern may be simple or complex. More complex fracture patterns have varying degrees of articular comminution, ulno-humeral instability and associated osseo-ligamentous injuries [3].

Many methods have been used for the management of olecranon fractures including non-operative methods for non-displaced incomplete fractures or for displaced fractures in low demand patients and operative methods for displaced fracture in an active patient like tension band wiring, inter-fragmentary screws with or without wires, wires alone, plates, rush pin, intramedullary screws with or without tension bands or bone fragment excision with reattachment of the triceps muscle.

Treatment aims to restore early and active elbow motion in order to prevent joint stiffness and to avoid late arthritis [4]. Nowadays several numbers of operative methods are used. Two of the most frequent operations are tension band wiring and osteosynthesis with a plate and screws.

The most common complications of internal fixation of olecranon fracture are hardware prominence, hardware failure, infection, nonunion, elbow joint stiffness and ulnar nerve injury [5].

This study aimed to evaluate and compare the result of fixation of olecranon fracture tension band with K-wire and posterior olecranon special non locked plate fixation.

2. PATIENT AND METHOD

This study included 30 patients, prospectively of a simple olecranon fracture. Patients were randomly classified using closed sealed envelopes into two equal groups; Group I included 15 patients managed by Tension band and Kirschner wires, while Group II included 15 patients managed by special non locked olecranon plate and screws. All cases were done

at Orthopedic Department of Tanta University Hospitals. Patients were followed up for at least six months. Written informed consent was obtained from every patient. Privacy of participants and confidentiality of the data was given the most care and attention. Each patient data file including investigation will be code-assigned and only the code was used in data management without disclosure of patient's name and personal information. The study was carried out by The Declaration of Helsinki and the principles of good clinical practice.

Inclusion criteria:

- Skeletally mature patients.
- Patient fit for surgery.
- Isolated fresh fracture of olecranon.
- Simple olecranon fractures (Mayo type I and type IIA) [6]
- Closed fractures.

Exclusion criteria:

- Previous elbow fractures.
- Concomitant ipsilateral upper limb injury.
- Open fractures.
- Comminuted fracture.
- Peripheral neuropathy.

Through posterior approach, in group I two k-wires and a stainless steel wire were applied in a figure of eight configurations, while in group II plate was placed dorsally and fixed with screws. A program of physiotherapy was applied to prevent stiffness and muscle wasting, patients were followed up and the result was evaluated according to DASH score and radiologically.

Follow up period ranged from 6 to 12 months.

2.1 Statistical Analysis

The obtained data were tabulated and analyzed statistically, by the using of SPSS 24 (IBM Corp-Chicago- IL- USA). The means and the standard deviations ($M \pm SD$), and student t-test was measured. Categorical variables were presented as numbers and percentage and compared with Chi-square. P-value < 0.05 was considered a significant difference.

3. RESULTS

The age ranged between 19 and 65 years, the mean age of group I was 36.4 ± 17.041 years,

while in group II was 40.2±15.608 years. The study included 23 males and 7 females. 16 patients were fractured in the right side and 9 were in left side. Mode of trauma was direct in 7 patients and indirect in 23 patients.

According to DASH Among the group treated by tension band the final results were found to be excellent in 7 patients (23.3%), good in 5 patients (16.7%) and fair in 3 patients (10%), while in the group treated by olecranon plate the final results were found to be excellent in 6 patients (20%), good in 7 patients (23.3%) and fair in 2 patients (6.7%) as shown in Table 1.

The dash score range was (10-58) with mean 28.667±15.967 In Group I, while in Group II the range was (6-59) with mean 29.0±15.339. There was no statistically significant difference between the two studied groups regarding to DASH scoring system (P = 0.9539) (p>0.05 statically insignificant) as shown in Table 2.

4. DISCUSSION

We compared the final clinical results between the two groups using DASH score. Group I in

clinical seven cases with excellent results, five cases with good results, and three cases with fair results comparing to results in group II that were excellent in six cases, good in seven cases and fair in only two cases.

Sui and Fang [7] concluded that both methods of fixation are effective treatments for olecranon fractures with better results among young age.

A significant difference between age and the total score was seen in Badawy et al. [8] study between the two groups as the mean age for satisfactory patients in group I was 41.1 years and for unsatisfactory patients was 49.0 years, while in group II satisfactory patients mean age was 38.1 years and was 48.0 years for unsatisfactory patients.

In this study agreeing with Sui and Fang [7] and Badawy et al. [8] studies there was a positive correlation between age and final score in the two groups that young patients show better results than older, Duckworth et al., study [9] documented that there was no correlation between gender and final results in both groups.

Table 1. Comparison between the two studied groups regarding to final result

Final result		Group I		Group II		Total	
		N	%	N	%	N	%
Satisfactory	Excellent	7	23.3%	6	20%	13	43.3%
	Good	5	16.7%	7	23.3%	12	40%
Unsatisfactory	Fair	3	10%	2	6.7%	5	16.7%
	Poor	0	0%	0	0%	0	0%
Total		15	50%	15	50%	30	100%

Table 2. Comparison between the two studied groups regarding to DASH score

DASH	Group I (n = 15)	Group II (n = 15)	t-test	P
Range	10-58	6-59	0.05831	0.9539
Mean±	28.667	29.000		
S.D.	15.967	15.339		

Anthony et al. [10] reported that the gender of the patient didn't affect the final result.

In the other side, Powell et al. [11] documented that there was a positive correlation between result and gender.

In this study, there was no statistically significant difference between male and female as regards final score in both groups. In group I the mean final score for males was 27.9 ± 15.5 and for females was 30.7 ± 19.3 (P value = 0.7729) while group II the mean final score for males was 30.7 ± 15.72 and for females was 22.0 ± 14.0 (P value = 0.3967). So we reported that the gender of patient not affects the final result in agreement with Duckworth [9] and Anthony [10] studies but in contrast to Powell et al., study [11].

In Duckworth et al. [9] during their study, in tension band group were 13 smokers (38.2%) and in plate group there were 12 smokers (36.4%) they noticed increasing in time of union among smoker patients in the two groups.

In this study, in the tension band group there were 5 smokers (33.3%) and in plate group there were 7 smokers (46.7%), agreeing with Duckworth et al. [9] study, There was a positive correlation between smoking and final score as non-smokers showed better results than smokers in both groups.

Rommens et al. [12] reported that diabetes affected the final result. In this study, we documented positive correlations between diabetes mellitus and final score, that medically free patients show better results than diabetic in both groups.

Duckworth et al. [9] in their study comparing plate versus tension band wire fixation for olecranon fractures using DASH scoring system which same as our evaluation score reported that there is no statistically significant difference between the two methods of fixation regarding the final results.

In this study, according to DASH scoring, In Group I the dash score range was (10-58) with mean 28.667 ± 15.967 , while in Group II the range was (6-59) with mean 29.0 ± 15.339 so there was no statistically significant difference between two studied groups regarding to DASH scoring system (P = 0. 9539).

Delsole et al. [13] compared 23 cases operated with tension band versus 25 cases operated with hook plate, all fractures showed that good outcomes were achieved in both methods; however, there was a statistically significant delay in the union of the hook plate group.

In contrary with Delsole et al., study [13] we documented that there were no significant differences between the two groups regarding time for radiological bone union (P value = 0.8074). Mean union time in group I was 13.3 ± 3.735 , delay in union occurred in 3 patients (20%) due to diabetes and smoking, group II union time mean was 13.0 ± 3.684 , delay in union occurred in 4 patients (26.7%) due to infection, diabetes and smoking.

Macko et al. [14] in a retrospective study of twenty patients encountered a high incidence of complications related to the technique of tension band wire fixation of displaced fractures of the olecranon. The most frequent complication was symptomatic prominence of the wires at the elbow in sixteen patients.

Michael Del Core et al., [15] in a study about the comparison of complications, reoperations, and outcomes between tension band wiring and plate fixation in olecranon fractures reported that among 59 patients of olecranon fracture, complications were seen in 33 (55.9%) patients. The most common complications were symptomatic implants in 26 (44.1%), infection in 6 (10.2%), wound complications in 4 (6.8%), ulnar neuritis in 2 (3.4%), and implant failure in 2 (3.4%) patients.

In this study, we noticed some complications as two patients in plate group had stiffness due to delay of a post-operative rehabilitation program. They couldn't perform less than 40° of elbow extension. After 8 weeks of physiotherapy, the first patient became able to extend his elbow less than 40°, while the other patient which was younger showed better result as he became able to extend his elbow less than 20°.

Three patients among the tension band group were suffering from k-wire prominence that need to be removed, there were signs of infection in one patient that managed conservatively by antibiotic, removal was done after 3 month in one patient and after 6 months in two patients. All of them regained less than 20° of elbow extension and pain disappeared after removal of hardware.

In tension band group, the fracture healed after 16 weeks in a smoker patient, while two patients in the same group needed 20 weeks to get their fracture completely healed. Those patients were diabetic and smokers.

On the other hand, two patients in plate group needed 16 weeks to get completely healed they were old age diabetic patients. Another fracture in two old aged, diabetic and smoker patients needed 20 weeks to be united, there were signs of infection in one of them that managed by antibiotic.

One patient in tension band group and another in plate group had superficial infections that were subsided by oral antibiotics; both of them were diabetic and smoker.

Romero et al. [16] reported removal of hardware in 67.4% of 55 patients treated using tension band the period of study follow-up was till 48 months.

DelSole et al. [13] reported that hardware removal was more common among those managed by tension band, in our study we reported that removal was done for three patients with tension band wiring due to metal prominence.

The study limitations of patients included and the follow up period didn't cover all possible complications.

Our Future recommendations are increasing number of patients in future studies, comparing other methods for olecranon fixation, study for patients done by different surgeons in different trauma centers and assessment of the elbow function by the different scoring system.

5. CONCLUSION

There are no significant differences in DASH score, range of motion, improvement rate, radiological outcomes and return to previous activities between tension band wiring versus non-locked olecranon plate fixation for olecranon fractures (Mayo type IA and type IIA). However, the incidence of metalwork-associated complications was higher in the TBW group due to metal prominence that needs removal. On the other hand, the plate fixation method can overcome this main complication.

CONSENT

A written informed consent was obtained from every patient.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the Tanta University Hospitals.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ali M, Hatzantonis C, Aspros D, Joshi N, Clark DI, Tambe A. Management of type IIB and IIIB olecranon fractures. *International Journal of Surgery Case Reports*. 2017;41:296-300.
2. Veillette CJ, Steinmann SP. Olecranon fractures. *Orthopaedic Clinics of North America Journal*. 2008;39(12):229-236.
3. Wiegand L, Bernstein J, Ahn J. Olecranon fractures. *Clinical Orthopaedics and Related Research*. 2012;470(12):3637-3641.
4. Siebenlist S, Buchholz A, Braun K. Fractures of the proximal ulna: Current concepts in surgical management. *EFORT Open Reviews Journal*. 2019;4(1):1-9.
5. Trivedi N, Cohn M, Trehan S, Daluiski A. Risk factors for 30-Day postoperative complications following open reduction internal fixation of proximal ulna fractures. *The Journal of Hand Surgery*. 2016;41(12):1122-1127.
6. Hardy BT, Glowczewskie F, Wright TW. Vascular anatomy of the proximal ulna. 2011;36:808-810.
7. Matar HE, Ali AA, Buckley S, Garlick NI, Atkinson HD. Surgical interventions for treating fractures of the olecranon in adults. *Cochrane Database of Systematic Reviews*. 2014;11.
8. Badawy MA. Comparison between the usage of tension band wiring versus hook plate in type ii mayo olecranon fractures in adults, unpublished MSc thesis, department of orthopedic surgery, faculty of medicine, Menofia University, Egypt; 2018.
9. Duckworth AD, Clement ND, White TO, Court-Brown CM, McQueen MM. Plate versus tension-band wire fixation for olecranon fractures: A prospective

- randomized trial. *Journal of Bone and Joint Surgery*. 2017;99:1261-1273.
10. Anthony F. De Giacomo, Tornetta P, Sinicrope A, Cronin A, Althausen B, Bray B, Kain C, Marcantonio C, Sagi D. Outcomes after plating of olecranon fractures: A multicenter evaluation. *Injury Int. J. Care Injured*. 2016;47(7):1466-1471.
 11. Powell A, Farhan-Alanie O, Bryceland J, Nunn T. The treatment of olecranon fractures in adults. *Musculoskelet Surg*. 2017:1-9.
 12. Rommens PM, Kuchle R, Schneider RU, Reuter M. Olecranon fractures in adults: Factors influencing outcome. *Injury*. 2004;35(11):1149-1157.
 13. DelSole EM, Pean CA, Tejwani NC, Egol KA. Outcome after olecranon fracture repair: Does construct type matter. *Eur J Orthop Surg Traumatol*. 2016;26(2):153-159.
 14. Macko D, Szabo R. Complications of tension-band wiring of olecranon fractures. *JBJS*. 1985;67(9):1396-1401.
 15. Del Core M, Ahn J, Gates S, Jo Ch, Maroto M, Sanders D. Comparison of complications, reoperations, and outcomes between tension band wiring and plate fixation in olecranon fractures. *Journal of Orthopedics Trauma Surgery and Related Research*. 2019;27;14(1).
 16. Romero JM, Miran A, Jensen CH. Complications and re-operation rate after tension-band wiring of olecranon fractures. *J Orthop Sci*. 2000;5(4):318-320.

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