

## COMPARISON OF FUNCTIONAL OUTCOME IN MAYO ELBOW PERFORMANCE SCORE IN OLECRANON FRACTURES AFTER TREATMENT WITH TENSION BAND WIRING AND LOCKING COMPRESSION PLATE

Raja Adnan Ashraf, Junaid Khan, Muhammad Sheraz Mustafa, Riaz Ahmed

Rawalpindi Medical College Rawalpindi Pakistan

### ABSTRACT

**Objective:** To compare mean change in the Mayo Elbow Performance Score in olecranon fracture after treatment with tension band wiring and locking compression plate.

**Study Design:** Randomized controlled trial.

**Place and Duration of Study:** Department of Orthopaedics, Benazir Bhutto Hospital Rawalpindi, from Aug 2015 to Aug 2016.

**Material and Methods:** Sixty patients were included in the study. Patients were divided into two groups, A and B. For group A, Locking compression plate while in group B tension band wiring was used. Follow-up was carried out at the end of 1st week and then at the end of 6th week post-operatively. Functional outcome was assessed by mean change in Mayo Elbow Performance Score.

**Results:** Mean age in the study was  $43.62 \pm 12.187$  years. There were 32 (53%) male patients and 28 (47%) female patients, while 34 (57%) patients had Mayo IIB fractures and 26 (43%) had Mayo IIA fractures. Twenty five patients (42%) belonged to ASA class II while 35 (58%) belonged to ASA class I. Twenty Six patients (43%) presented within 24 hours of the injury while 34 (57%) presented within 48 hours. Mean change in the Mayo Elbow Performance Score in TBW group was  $8.77 \pm 3.54$  versus  $10.63 \pm 3.479$  for the LCP group ( $p=0.044$ ).

**Conclusion:** Locking Compression plate is superior to Tension Band Wiring in patients with olecranon fracture in terms of Mayo Elbow Performance Score.

**Keywords:** Locking Compression Plate, Mayo Elbow Performance Score, Mayo type II, Olecranon fracture, Tension Band Wiring.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### INTRODUCTION

One of the common injuries of the proximal ulna are the fractures of the olecranon and are around 10% of the upper extremity fractures. Various types of olecranon fracture patterns occur from non-displaced fractures to complex fracture dislocations of the elbow. Olecranon fractures are intraarticular injuries and thus joint surface restoration is required to prevent post-traumatic arthritis<sup>1,2</sup>. Aim of surgery of olecranon is functional and painless elbow. Various methods of fixation are used for olecranon fractures. Two of the most popular are the plate with screw fixation and tension band wiring of the olecranon<sup>3,4</sup>. Locking plate is a recent advancement in this fracture fixation. One of the advantages of

using locking plates was that in osteoporotic fractures they have superior fixation strength, although locking plates have shown good results but there is little evidence in comparison to other techniques of olecranon fracture fixation.

The gold standard for transverse olecranon fractures for many years has been tension band wiring but numerous problems have also been reported<sup>5</sup>. Due to complications associated with the removal of hardware, a different technique in addition to tension band wiring was required<sup>6,7</sup>. 93% of the fractures of the olecranon require fixation as they are displaced where as 5% to 7% are stable and can be managed conservatively<sup>8</sup>.

In one study by Luigi functional outcome by mean Mayo Elbow Performance Score for tension band wiring was  $88.3 \pm 10.9$ , whereas mean Mayo Elbow Performance Score for plate fixation is  $9.1 \pm 11.1$ , another study concluded that tension

**Correspondence:** Dr Raja Adnan Ashraf, House No F-833/14-B, Satellite Town Rawalpindi Pakistan

Email: [dr.addi79@yahoo.com](mailto:dr.addi79@yahoo.com)

Received: 06 Sep 2017; revised received: 13 Nov 2017; accepted: 05 Mar 2018

band wiring fixation provides satisfactory result in most olecranon fractures, however author suggested future researcher to compare it with other new modalities due to complications associated with tension band wiring<sup>1,2,9</sup>.

The rationale of this study was to compare the use of locking plate and tension band wiring in management of olecranon fractures in terms of functional outcome by Mayo Elbow Performance Score. Moreover, locking plate is a newer modality of treatment and as no research data is available in our population so this study was conducted.

### **MATERIAL AND METHODS**

This randomized controlled study was conducted in the department of Orthopaedics, Benazir Bhutto Hospital, Rawalpindi for a duration of 01 year from 18<sup>th</sup> August 2015 to 17<sup>th</sup> August 2016. Sample size calculated using WHO sample size calculator using the following parameters; Level of significance = 5%, power of test 80% which came out to be 30 patients in each group. Non-probability consecutive sampling technique used. Patients were divided into two groups, A and B, by lottery method. For group A, Locking compression plate while in group B tension band wiring done. Inclusion criteria were patients of both genders between 20-65 years age, patients with Mayo type-IIA and II-B fractures, patients operated within 48 to 72 hours of injury and those belonging to ASA class I and II. Exclusion criteria were previous surgery for olecranon fracture, open olecranon fracture, pre-existing neurologic damage or illness of the arm (e.g. tumors or after any previous surgery) involved, congenital deformities or diseases of the musculoskeletal system (e.g. cerebral palsy, arthrogryposis, polio, etc). Information recorded on preformed questionnaires after taking an informed consent. All patients were operated by a consultant Orthopaedic surgeon. Follow-up was done at the end of 1<sup>st</sup> week and at 6<sup>th</sup> week post-operatively and functional outcome was assessed by mean change in Mayo Elbow Performance Score. Data entered and analyzed

using SPSS version 23. Mean and Standard deviation calculated for quantitative data i.e. age, duration and Mayo Elbow Performance Score at the end of 1st and 6th week. Qualitative variables measured as frequency and percentages. Students t-test applied to compare the mean change in Mayo Elbow Performance Score between the two groups and for post stratification. A *p*-value<0.05 considered as significant.

### **RESULTS**

Sixty patients were included in the study. There were 30 patients in group A which underwent internal fixation by Locking Compression plate, 30 patients were in group B which underwent internal fixation via Tension Band Wiring. Mean age in the study was  $43.62 \pm 12.187$  years. Out of the total, 32 (53%) were male and 28 (47%) female patients. 26 (43%) patients had IIA fractures while 34 (57%) had II-B type fracture. Eleven patients presented within 1 day of the trauma (37%) while 19 patients presented within 2 days (63%). The mean Mayo Elbow Performance score after 1 week was  $80.62 \pm 2.929$ , while at 6 weeks it was  $90.32 \pm 2.397$ .

In group A, there were 13 male patients (43%) and 17 female patients (57%). Eleven patients presented within 1 day of the trauma (37%) while 19 patients presented within 2 days (63%). Eleven patients (37%) had IIA type fracture while 19 patients (63%) had IIB type fracture. Eighteen patients (60%) belonged to ASA I while 12 patients (40%) belonged to ASA class II. Mean age in group A was  $43.37 \pm 12.861$  years. Mean change in the Mayo Elbow Performance Score in group A was  $10.63 \pm 3.479$ .

In group B there were 19 male patients (63%) and 11 female patients (37%). Fifteen patients presented within 1 day of the trauma (50%) while 15 patients presented within 2 days (50%). Fifteen patients (50%) had IIA type fracture while 15 patients (50%) had IIB type fracture. Seventeen patients (57%) belonged to ASA class I while 13 patients (43%) belonged to ASA class II. Mean Age in group B was  $43.87 \pm 11.688$  years. Mean

change in the Mayo Elbow Performance Score in group B was  $8.77 \pm 3.54$ .

Mean Mayo Elbow Performance Score after 1 week was  $79.8 \pm 2.759$  in group A while it was  $81.43 \pm 2.909$  in group B ( $p=0.028$ ). At 6

Score from 1 week after surgery to 6 weeks after surgery was significantly more in the patients who had their treatment of the olecranon fracture by locking compression plate. Mean age in this study was  $43.62 \pm 12.187$  years. The mean age in

**Table-I: Change in mayo elbow performance according to age.**

Age Group	Group	Change in Mayo Elbow Performance Score		p-value
		Mean	SD	
20-35 years (n=17)	A (n=8)	10.22	4.41	0.712
	B (n=9)	11	4.071	
35-50 years (n=25)	A (n=13)	11.17	3.407	0.037
	B (n=12)	8.08	3.57	
50-65 years (n=18)	A (n=9)	10.33	2.784	0.047
	B (n=9)	7.78	2.224	

**Table-II: Change in mayo elbow performance gender-wise.**

Gender	Group	Change in Mayo Elbow Performance Score		p-value
		Mean	SD	
Male (n=32)	A (n=13)	10.38	3.525	0.405
	B (n=19)	9.26	3.798	
Female (n=28)	A (n=17)	10.82	3.54	0.033
	B (n=11)	7.91	3.015	

**Table-III: Change in mayo elbow performance according to fracture type.**

Mayo Type	Group	Change in Mayo Elbow Performance Score		p-value
		Mean	SD	
Type-IIA	A	9.73	3.636	0.348
	B	8.27	3.99	
Type-IIB	A	11.16	3.371	0.101
	B	9.27	3.081	

**Table-IV: Change in mayo elbow performance according to days to fracture management.**

No. of days to fracture management	Group	Change in Mayo Elbow Performance Score		p-value
		Mean	SD	
1	A	9.67	3.229	0.609
	B	8.85	4.506	
2	A	10.21	3.473	0.216
	B	8.67	3.619	

weeks, mean Mayo Elbow Performance Score was  $90.43 \pm 2.622$  and  $90.2 \pm 2.188$  ( $p=0.351$ ) in group A and B, respectively. Post Stratification of mayo elbow score performance according to age groups, gender, fracture type and days to fracture are presented in table-I, II, III and IV respectively.

## DISCUSSION

The results of this study showed that the mean change in the Mayo Elbow Performance

the study done by Tarallo *et al* was  $51.8 \pm 10.0$  and  $49.4 \pm 12.7$  years in the TBW and LCP groups respectively<sup>1</sup>.

There were 32 (53%) male patients and 28 (47%) female patients. Tarallo *et al* had 30 (38%) male patients and 48 (62%) female patients. Thirty Four (57%) patients had IIB fractures while 26 (43%) had type IIA fractures. In the study done by Tarallo *et al* 31 (39%) patients with Mayo IIA

fractures and 47 (61%) patients with Mayo IIB fractures<sup>1</sup>.

Mean change in the Mayo Elbow Performance Score was  $8.77 \pm 3.54$  in the TBW group while it was  $10.63 \pm 3.479$  in the LCP group ( $p=0.044$ ). No significant differences were observed between the two groups by Tarallo *et al* in terms of functional and clinical outcome but the rate of complications was significantly greater in the TBW group<sup>1</sup>. Although the sample size of this study is roughly the same, the difference in results which may be attributed to the inclusion of younger patients in this study as compared to somewhat older patients in the study by Tarallo *et al*. Their study also had more female patients as compared to this which may be a confounding factor. Even though they did not find any statistical difference between TBW and LCP in terms of Functional and Clinical Outcome but due to the significantly more complications in the TBW group. In their study they had a follow-up of 33 months which is an optimum time for determining the long term effects and complications of the procedures. In the study done by Schliemann *et al* the plate fixation was found to be better than TBW in terms of Mayo Elbow Performance Score with 92% patients of the LCP group achieving good to excellent results compared to 77% patients in the TBW group. This may be due to the smaller sample size which had only 26 patients with 13 patients in each group, other contrasting factors include inclusion of only Mayo IIA fracture patients and differences in the surgical technique<sup>2</sup>.

Post-stratification t-test showed that the difference between the mean change in the Mayo Elbow Performance Score in the two treatment groups was not statistically significant in Mayo type IIA ( $p=0.348$ ) and IIB ( $p=0.101$ ) fractures as well as in patients presenting within 24 ( $p=0.609$ ) and 48 ( $p=0.216$ ) hours. This leads us to speculate that there is no statistical difference between TBW and LCP when type of fracture is the

same<sup>10</sup>.

My results provide insight into the short term benefits of using LCP (as there is improved Mayo Elbow Performance score at one week) but further multicentric randomized controlled trials are needed before it can be definitively determined which fixation method is superior<sup>11</sup>.

## CONCLUSION

Locking Compression Plate was found to be superior to Tension Band Wiring in terms of mean change in the Mayo Elbow Performance Score from 1 week after surgery to 6 weeks after surgery in our study.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

## REFERENCES

1. Tarallo L, Mugnai R, Adani R, Capra F, Zambianchi F, Catani F, et al. Simple and comminuted displaced olecranon fractures: A clinical comparison between tension band wiring and plate fixation techniques. *Arch Orthop Trauma Surg* 2014; 134(8): 1107-14.
2. Schliemann B, Raschke MJ, Groene P, Weimann A, Wahnert D, Lenschow S, et al. Comparison of tension band wiring and precontoured locking compression plate fixation in Mayo type IIA olecranon fractures. *Acta Orthop Belg* 2014; 80(1): 106-11.
3. Erturer RE, Sever C, Sonmez MM, Ozcelik IB, Akman S, Ozturk I. Results of open reduction and plate osteosynthesis in comminuted fracture of the olecranon. *J Shoulder Elbow Surg* 2011; 20(3): 449-54.
4. Durrani A, Inam M, Siraj M. Olecranon fracture treated with tension band wire by passing two parallel Kirschner wires distally into the anterior cortex of ulna. *Pak J Surg* 2013; 29(2): 115-18.
5. Liu QH, Fu ZG, Zhou JL, Lu T, Liu T, Shan L, et al. Randomized prospective study of olecranon fracture fixation: Cable pin system versus tension band wiring. *J Int Med Res* 2012; 40(3): 1055-66.
6. Catalano LW, Crivello K, Lafer MP, Chia B, Barron OA, Glickel SZ. Potential dangers of tension band wiring of olecranon fractures: An anatomic study. *J Hand Surg Am* 2011; 36(10): 1659-62.
7. Brink P, Windolf M, De Boer P, Brianza S, Braunstein V, Schwieger K. Tension band wiring of the olecranon: Is it really a dynamic principle of osteosynthesis? *Injury* 2013; 44(4): 518-22.
8. Nowinski RJ, Nork SE, Segina DN, Benirschke SK. Comminuted fracture-dislocations of the elbow treated with an AO wrist fusion plate. *Clin Orthop Relat Res* 2000; 378(2): 238-44.
9. Luksic B, Juric I, Boschi V, Pogorelic Z, Bekavac J. Tension plate for treatment of olecranon fractures: new surgical technique and case series study. *Can J Surg* 2015; 58(1): 24-30.
10. 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): 153-59.
11. Von Ruden C, Woltmann A, Hierholzer C, Trentz O, Buhren V. The pivotal role of the intermediate fragment in initial operative treatment of olecranon fractures. *J Orthop Surg Res* 2011; 6: 9-12.