

Surgical management of the olecranon fractures with emphasis on merits and demerits of various surgical management techniques with the assessment of joint stability and motion: A clinical study

Lalit Pathak¹, Ashish Upadhyay², Dushyant Jadon³, Siddharth Goel⁴, Surendra Kumar^{5*}

¹Senior Resident, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India

²Senior Resident, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India

³Senior Resident, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India

⁴Professor and head, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India

⁵Senior Resident, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India

Received: 05-06-2021 / Revised: 12-08-2021 / Accepted: 13-09-2021

Abstract

Background: Surgical intervention has gained popularity and became a vital management strategy. The early active mobilization following surgery helps early restoration of the normal function. This active and early mobilization helps in early fracture union rapidly with the prevention of tissues from the fracture. **Objectives:** The present study was conducted to clinically evaluate the outcomes following the surgical treatment of the Olecranon fractures using plate fixation in comminuted fractures and using tension band wiring for simple transverse fracture. The study also evaluated the demerits and merits of the procedure with stability and elbow joint motion after surgical management of the olecranon fracture. **Materials and Methods:** In 23 subjects from both genders, comminuted fractures were treated with an olecranon hook plate and simple transverse fractures with tension band wiring with K-wire. The study results were assessed at 3 months postoperatively. At the recall visits, clinical examination was conducted for all the subjects for assessing muscle power related to the treated joint, cancellous screw head prominence, elbow joint movement, tenderness, and joint swelling. Joint movement and its restrictions, swelling, and pain were also assessed at recall visits. The collected data were subjected to evaluation and the results were formulated. **Results:** Based on Mayo Elbow Performance scores. It was seen that excellent results with scores of more than 90 were seen in 69.56% (n=16) of study subjects. The Good result was seen in 13.04% (n=3) study subjects. The results were fair in 17.39% (n=4) of study subjects. The poor results were not seen in any subject. No complications were seen in 73.91% (n=17) study subjects. Symptomatic metal prominence was seen in 13.04% (n=3) of study subjects. Superficial infection was seen in 8.69% (n=2) of study subjects. Implant loosening was the least common complication seen only in 4.34% (n=1) study subject. **Conclusion:** The present study concludes that managing the Olecranon fracture using comminuted fracture with Olecranon hook plate and tension band with K-wire for simple transverse fracture with open reduction and internal fixation are efficacious treatment modalities with very few demerits.

Keywords: Olecranon fracture, olecranon hook plate, Tension band wiring, simple transverse olecranon fracture, comminuted fracture.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

One of the most common orthopaedic injuries reported for emergency management is the Olecranon fracture. The common causes for the Olecranon process fracture of the ulna are assault, fall, and/or motor vehicle accidents. Displaced fractures are managed with open reduction and internal fixation to allow normal elbow function and articular surface realignment anatomically, whereas, non-displaced fractures are managed with immobilization for a short span followed by increasing the range of motion gradually.

The fixation achieved for fracture management should allow good fracture union, elbow extension, and flexion with desirable stability[1].

Earlier, application of the plaster cast and closed reduction was preferred for managing the Olecranon fracture. However, there was increased mortality and morbidity owing to the complications of prolonged immobilization in treated subjects. Owing to these factors, surgical intervention has gained popularity and became a vital management strategy. The early active mobilization following surgery helps early restoration of the normal function. This active and early mobilization helps in early fracture union rapidly with the prevention of tissues from the fracture[2].

The early motion of the simple transverse fracture with minimum stiffness is achieved via stable internal fixation with a tension band. However, concerning the tension band, better results are seen with K-wire in the AO tension band technique due to better resistance for shearing force, resulting in better clinical outcomes by converting the tensile force to the compressive force[3].

*Correspondence

Dr. Surendra Kumar

Senior Resident, Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana, India.

E-mail: surenkrgupta@gmail.com

Concerning the comminuted fracture, oblique fractures, the coronoid process involving distal fractures, fixation using the plates is the most adequate treatment mode for fracture management. Olecranon hook plate applied dorsally, is the most appropriate management method for non-united comminuted fractures. Both methods are acceptable based on the fracture type and clinical situation[4]. However, the data concerning the comparison of the two techniques are scarce in the literature. Hence, the present study was conducted to clinically evaluate the outcomes following the surgical treatment of the Olecranon fractures using plate fixation in comminuted fractures and using tension band wiring for simple transverse fracture. The study also evaluated the demerits and merits of the procedure with stability and elbow joint motion after surgical management of the olecranon fracture.

Materials and methods

The present clinical study was conducted to clinically evaluate the outcomes following the surgical treatment of the Olecranon fractures using plate fixation in comminuted fractures and using tension band wiring for simple transverse fracture. The study was conducted at Department Of Orthopedics, Shaheed Hasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana from February 2020 to August 2021, after obtaining clearance from the concerned Ethical committee. The study population was comprised of the

subjects visiting the Department of Orthopaedics for the simple transverse or comminuted fractures of the Olecranon in the defined study period. The study included a total of 23 subjects from both genders, where comminuted fractures were treated with an olecranon hook plate and simple transverse fractures with tension band wiring with K-wire.

After inclusion in the study, the subjects were initially managed with appropriate pain management techniques, and the fracture was immobilized. Following the pre-anaesthetic evaluation, the subjects were taken for surgery. Detailed trauma and injury history was taken from all the subjects with equal emphasis on the associated injuries. Further swelling, pain severity, external wound, and active joint movements (extension and flexion) were noted. This was followed by a detailed local and general examination of all the included subjects.

Routine urine and blood investigations were done including Haemoglobin, bleeding and clotting time, ESR, WBC counts, fasting blood sugar, viral markers, ECG, Blood grouping, and sugar and albumin in the urine. The subjects were treated with K-wire (Krishner wire) after considering their age, comminution degree, and articular surface damage extent. Old-aged and associated surgical risk subjects were not treated surgically. The fractures were surgically exposed with Campbell’s posterolateral approach. The simple transverse fractures were approximated and managed with two K-wires and comminuted fractures with an Olecranon hook plate (Figure 1).



Figure 1: Olecranon fracture management following two techniques.

Postoperatively, the subjects were managed with appropriate antibiotics and analgesics for 5 days. The treated arm was kept elevated with finger movements done on day 1 and elbow movement on day 3 postoperatively. Limbs were mobilized on the 3rd postoperative day, except for comminuted fractures which remained immobilized for 2 weeks in 90-degree flexion. The subjects were recalled on 6 weeks and 12 weeks for every 3 months. Subjects were advised physiotherapy without loading. Physiotherapy was done for pronation-supination and flexion-extension.

The study results were assessed at 3 months postoperatively using the Mayo Elbow Performance Score[5]. At the recall visits, clinical examination was conducted for all the subjects for assessing muscle power related to the treated joint, cancellous screw head prominence, elbow joint movement, tenderness, and joint swelling. Joint movement and its restrictions, swelling, and pain were also assessed at recall visits. Implants were removed when radiographic joint fusion

was seen. The time from surgery to resuming normal work was also noted.

The collected data were subjected to evaluation and the results were formulated. The data were expressed in terms of percentages and numbers.

Results

The present clinical study was conducted to clinically evaluate the outcomes following the surgical treatment of the Olecranon fractures using plate fixation in comminuted fractures and using tension band wiring for simple transverse fracture. The study included a total of 23 subjects from both genders, where comminuted fractures were treated with an olecranon hook plate and simple transverse fractures with tension band wiring with K-wire. The demographic characteristics of the study subjects are depicted in Table 1.

Table 1: Demographic and disease characteristics of the study subjects

Characteristic	Percentage (%)	Number (n)
Mean age (years)	33.4±2.68	
Age range (years)	18-60	
<30	26.08	6
31-40	30.43	7
41-50	17.39	4
51-60	26.08	6
Gender		
Males	65.21	15
Females	34.78	8
Fracture side		
Left	30.43	7
Right	65.21	15
Fracture cause		
Direct fall	39.13	9
Road Traffic accident	56.52	13
Assault	4.34	1
Fracture type		
Comminuted	21.73	5
Oblique and transverse	73.91	17
Avulsion	4.34	1
Associated Injuries	8.69	2
Injury to surgery time within 10 days	100	23
Union duration (months)		
Non-union	0	0
<4	65.21	15
4-6	34.78	8
6-12	0	0

The mean age of the study subjects was 33.4±2.68 years and the age range of 18-60 years. The highest number of the subjects were within the age range of 31-40 years with 30.43% (n=7) study subjects. There were 65.21% (n=15) males and 34.78% (n=8) females in the present study. There were 30.43% (n=7) fractures on the left side and 65.21% (n=15) on the right side. The fracture causes were fall, road traffic accident, and assault in 39.13% (n=9), 56.52% (n=13), and 4.34% (n=1) subjects. Comminuted, Oblique and transverse, and avulsion type fracture was seen in 21.73% (n=5), 73.91% (n=17), and 4.34% (n=1) subjects. Associated injuries were seen in 8.69% (n=2) subjects. Time from injury to surgery was within 2-10 days in all the subjects. Union duration was <4 and 4-6 months in 65.21% (n=15) and 34.78% (n=8) study subjects. No non-union was seen in the study.

The present study assessed the pain, range of motion, stability, and functional evaluation results based on Mayo Elbow Performance scores. It was seen that excellent results with scores of more than 90 were seen in 69.56% (n=16) of study subjects. The Good result was seen in 13.04% (n=3) study subjects. The results were fair in 17.39% (n=4) of study subjects. The poor results were not seen in any subject (Table 2).

Table 2: Mayo Elbow Performance Score in the study subjects

MEPS Grading (scores)	Percentage (%)	Number (n)
Excellent (>90)	69.56	16
Good (75-89)	13.04	3
Fair (60-74)	17.39	4
Poor (<60)	0	0

The study also assessed the complications/ demerits of the two evaluated procedures. It was seen that no complications were seen in 73.91% (n=17) of study subjects. Symptomatic metal prominence was seen in 13.04% (n=3) of study subjects. Superficial infection was seen in 8.69% (n=2) of study subjects. Implant loosening was the least common complication seen only in 4.34% (n=1) of study subjects (Table 3).

Table 3: Demerits/ Complications following surgery in the study subjects

Complication Encountered	Percentage (%)	Number (n)
None	73.91	17
Symptomatic metal prominence	13.04	3
Superficial infection	8.69	2
Implant Loosening	4.34	1

The results showed that the two procedures were efficacious and few complications were associated with the procedure.

Discussion

The present study included a total of 23 subjects from both genders, where comminuted fractures were treated with an olecranon hook plate and simple transverse fractures with tension band wiring with K-wire. The mean age of the study subjects was 33.4±2.68 years and the age range of 18-60 years. The highest number of the subjects were within the age range of 31-40 years with 30.43% (n=7) study subjects. There were 65.21% (n=15) males and 34.78% (n=8) females in the present study. There were 30.43% (n=7) fractures on the left side and 65.21% (n=15) on the right side. The fracture causes were fall, road traffic accident, and assault in 39.13% (n=9), 56.52% (n=13), and 4.34% (n=1) subjects. Comminuted, Oblique and transverse, and avulsion type fracture was seen in 21.73% (n=5), 73.91% (n=17), and 4.34% (n=1) subjects. Associated injuries were seen in 8.69% (n=2) subjects. Time from injury to surgery was within 2-10 days in all the subjects. Union duration was <4 and 4-6 months in 65.21% (n=15) and 34.78% (n=8) study subjects. No non-union was seen in the study. These demographics were comparable to the populations of Boyer MI et al[6] in 2003 and Gordon MJ et al[7] in 2006 where authors assessed comparable demographics.

The present study assessed the pain, range of motion, stability, and functional evaluation results based on Mayo Elbow Performance scores. It was seen that excellent results with scores of more than 90 were seen in 69.56% (n=16) of study subjects. The Good result was seen in 13.04% (n=3) study subjects. The results were fair in 17.39% (n=4) of study subjects. The poor results were not seen in any subject. These results were consistent with the findings of Chaldis BE et al[8] in 2008 and Inam M et al[9] in 2012 where authors reported acceptable excellent and good outcomes using tension band wiring with K-wire and Olecranon hook plate.

The study also assessed the complications/ demerits of the two evaluated procedures. It was seen that no complications were seen in 73.91% (n=17) of study subjects. Symptomatic metal prominence was seen in 13.04% (n=3) of study subjects. Superficial infection was seen in 8.69% (n=2) of study subjects. Implant loosening was the least common complication seen only in 4.34% (n=1) of study subjects. The results showed that the two procedures were efficacious and few complications were associated with the procedure. These findings were in agreement with the studies of Rommens PM et al[10] in 2004 and Tejwani Nc et al[11] in 2002 where similar demerits and complications were seen following olecranon fracture treatment using olecranon hook plate and tension band wiring with K-wire.

Conflict of Interest: Nil Source of support: Nil

Conclusion

Within its limitations, the present study concludes that managing the Olecranon fracture using comminuted fracture with Olecranon hook plate and tension band with K-wire for simple transverse fracture with open reduction and internal fixation are efficacious treatment modalities with very few demerits. The present study had few limitations including a shorter follow-up period, a small sample population, and geographical area biases. Hence, the studies with a large sample and long follow-up will help in concluding.

References

1. Veillette CJ, Steinmann SP: Olecranon fractures. Orthop Clin North Am. 2008;39:229-36.
2. Bailey C.S., MacDermid J., Patterson S.D., King G.J. Outcome of plate fixation of olecranon fractures. J Orthop Trauma. 2001;15:542-548.
3. John R Willams 'Coronoid, Radial head, Olecranon fractures and Elbow Dislocations' Chapter 3-35 Vol -3 in Oxford Textbook of Orthopaedics and Trauma.2002 1969-1972.
4. Cabanela Morrey. 3rd ed. Saunders; Philadelphia: 2000. The Elbow and Its Disorders; pp. 365-379.
5. David Ring "Elbow fractures and dislocations in 'Rockwood and Green Fractures in Adults' Chapter 32 Vol I 7th, Bucholz RW, Heckman JD, Lippincott Williams and Wilkins.2010, 936-942.
6. Boyer MI, Galatz LM, Borrelli J, Axelrod TS, Ricci WM: Intra-articular fractures of the upper extremity: new concepts in surgical treatment. Instr Course Lect. 2003; 52: 591-605.
7. Gordon MJ, Budoff JE, Yeh ML, Luo ZP, Noble PC: Comminuted olecranon fractures: a comparison of plating methods. J Shoulder Elbow Surg. 2006;15:94-9.
8. Byron E Chaldis , Nick C Sachinis, Efthimios P Samoladas 'Is tension band wiring technique the "gold standard" for the treatment of olecranon fractures. Journal of orthopedic surgery and research.2008,3:9.
9. Muhammad Inam, et al 'Study to assess clinical and radiological outcome of Tension band wiring of olecranon fractures. Professional Med J. 2012;19:537-41.
10. Rommens P.M., Kuchle R., Schneider R.U., Reuter M. Olecranon fractures in adults: factors influencing outcome. Injury. 2004;35:1149-1157.
11. Tejwani N.C., Garnham I.R., Wolinsky P.R., Kummer F.J., Koval K.J. Posterior olecranon plating: biomechanical and clinical evaluation of a new operative technique. Bull Hosp Jt Dis. 2002;61:27-31.