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Functional Outcome of Olecranon Fractures Treated by Tension Band Wiring

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A B S T R A C T

Introduction: The olecranon is the proximal articular portion of the ulna. Olecranon fractures account for approximately 8–10% of all elbow fractures. These injuries can result from high-energy trauma, simple falls, forced hyperextension, or triceps avulsion. Surgical intervention is often necessary, but there remains ongoing debate regarding the optimal treatment method—tension band wiring (TBW) versus plating.

Objectives: To evaluate the functional outcomes of olecranon fractures treated with tension band wiring and to analyse the factors influencing these outcomes.

Materials and Methods: This prospective study was conducted at Government Medical College, Thrissur, from February 2, 2021, to February 2, 2022. A total of 22 patients with displaced, non-comminuted olecranon fractures—specifically Mayo Type 2A and 3A—were selected based on defined inclusion criteria. All patients underwent open reduction and internal fixation using tension band wiring with Kirschner wires and stainless steel wire. Patients were followed for a minimum of six months, and functional outcomes were assessed using the Mayo Elbow Performance Index (MEPI) score.

Results: Of the 22 patients included in the study, 14 were male and 8 were female. The majority of cases (64%) occurred in individuals over the age of 50. Simple falls were the most common cause of injury overall, while road traffic accidents were more frequent in younger patients. Two patients developed postoperative infections, and nine experienced joint stiffness. At final follow-up, 14 patients (63.64%) had excellent outcomes, and 6 patients (27.27%) achieved good results according to the MEPI score. The average time to fracture union was 12.4 weeks.

Conclusion: This prospective study demonstrates that open reduction and internal fixation of displaced, non-comminuted olecranon fractures using tension band wiring provides good to excellent functional outcomes in most cases. Tension band wiring remains a reliable and effective technique for managing this type of fracture, with satisfactory radiological and clinical results.

Key words: Olecranon fracture, open reduction and internal fixation, MAYO score

INTRODUCTION

The word *olecranon* originates from the Greek terms *olene*, meaning "elbow," and *kranon*, meaning "head." It represents the proximal articular end of the ulna and forms a joint with the trochlea of the humerus. Anatomically, it is a thick, curved bony prominence that, together with the coronoid process, creates the semilunar or greater sigmoid notch. This structure articulates with the humeral trochlea and enables movement of the elbow in the anteroposterior direction.[1,2]

Olecranon fractures can vary significantly in severity, ranging from simple, non-displaced injuries to complex fracture-dislocations involving the elbow joint. The functional outcome after such fractures is closely related to the precision of joint surface reduction, restoration of mechanical stability for early mobilization, and preservation of the extensor mechanism.

Due to its subcutaneous location, the olecranon is particularly vulnerable to direct trauma. The most common injury mechanism is a fall onto an outstretched hand with the elbow in a semi-flexed position and the forearm supinated, often accompanied by a sudden, forceful contraction of the triceps muscle.[3]
This mechanism typically results in transverse or oblique fractures. In contrast, direct blows or falls onto the elbow more commonly lead to comminuted fractures. In some cases, a combination of forces can cause displaced, comminuted fracture patterns. Patients usually present with pain and swelling over the elbow, and in high-energy or complex fractures, ulnar nerve involvement may also occur.[4]The objective of this study was to assess the functional outcomes of olecranon fractures treated with tension band wiring and to analyze the various factors that influence recovery.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Orthopaedics, Government Medical College, Thrissur, Kerala, India, over a period of one year. The study population included patients presenting to the department with olecranon fractures who provided informed consent to participate.

Inclusion criteria were:

- Age 18 years and above
- Fracture duration between 1 to 10 days
- Isolated olecranon fractures

Exclusion criteria included:

- Olecranon fractures associated with other fractures
- Terrible triad injuries
- Elbow dislocations
- Polytrauma involving the head, chest, or abdomen

The study commenced after obtaining clearance from the Institutional Ethics Committee. The sample size was determined based on a previous study by Dr. Abhishek Pathak et al.[5] and was calculated to be 22 patients.

Informed written consent was obtained from all participants prior to surgery. After a detailed history and clinical examination of the injured limb, anteroposterior and lateral radiographs of the elbow were taken. All patients underwent surgical management using tension band wiring. Postoperatively, standard care and rehabilitation protocols were followed, and patients were discharged with specific instructions on elbow mobilization. Passive mobilization was initiated on the third postoperative day.

Follow-up radiographs were taken at three-week intervals for the first three months and then every two months until six months postoperatively.

Data collection included demographic and clinical variables such as age, gender, education level, socio-economic status, mode of injury, open vs. closed fracture, associated bony injuries, dislocation, and any head, chest, or abdominal trauma. These were recorded using a structured, pre-designed questionnaire.

Radiological outcomes were assessed using anteroposterior and lateral view X-rays at the time of admission and during follow-up at 3 weeks, 6 weeks, 3 months, and 6 months post-surgery. Functional outcomes were evaluated using the Mayo Elbow Performance Score (MEPS) and measurement of range of motion at 6 weeks, 3 months, and 6 months following surgery.

Statistical analysis was conducted using Microsoft Excel. Qualitative variables were expressed as proportions, while quantitative variables were presented as mean ± standard deviation (SD). The Mayo scores were analyzed using appropriate statistical tools to determine the distribution of functional outcomes and to assess factors influencing recovery.

RESULTS

The age of the 22 patients in our study ranged from 22 to 64 years, with a mean age of 46.59 years and a standard deviation of 13.4. The majority of the cases were male (63.63%), resulting in a sex ratio of approximately 2:1. The most common mode of injury was slip and fall, accounting for 54.54% of cases.

Grading revealed that 7 patients (31%) experienced mild pain during follow-up. No clinical instability was reported in any of the cases. Elbow stiffness was observed in 9 patients (40.9%), primarily attributed to inadequate mobilization exercises. All 22 cases achieved anatomical union, with the average time to union being 12.4 weeks.

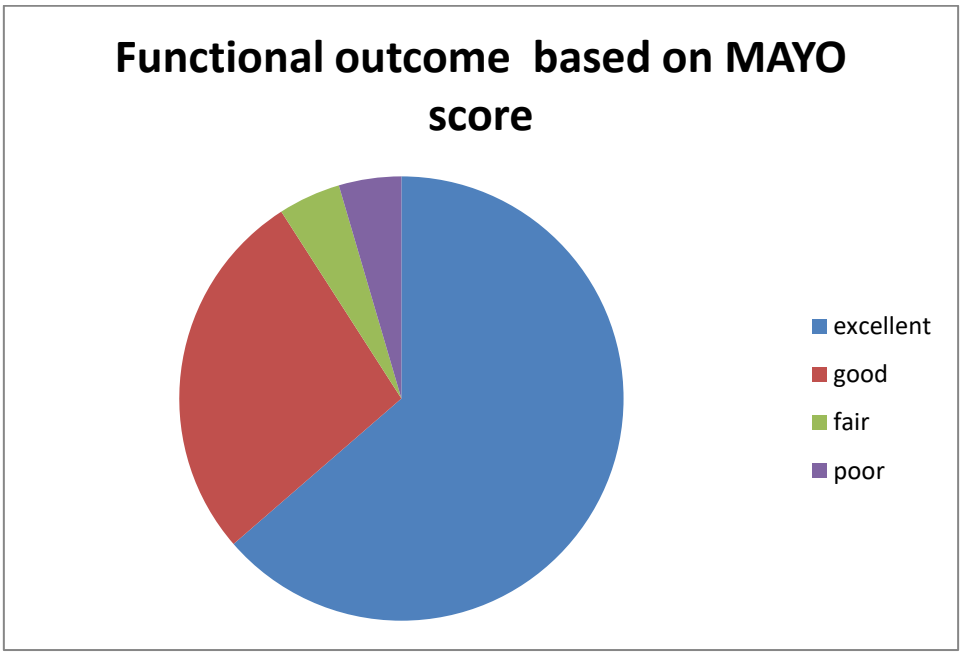

Figure 1: Functional outcome based on mayo score

The most common complication observed was elbow stiffness. The primary complaint among affected patients was pain caused by proximal migration of the implant. No implant removal was required during the follow-up period. Postoperative infection was noted in two patients, both of whom had uncontrolled diabetes, which likely contributed to the infection.

Table 1: Complications

Complications	Frequency	Percentage
Infection	2	9 %
Hardware symptoms	7	31,8%
Stiffness	9	40.9%

DISCUSSION

Olecranon fractures typically result from direct trauma to the posterior aspect of the elbow or from the pull of the triceps muscle during a fall on a partially flexed elbow. Accurate reduction of the articular surface is a critical component of successful management, as it directly influences functional recovery.[5,6]

The exceptional mobility of the upper extremity is due to a series of highly mobile joints. Among these, loss of function at the elbow joint is the least well tolerated. Even moderate deficits in flexion, extension, or pronation/supination can significantly impair activities of daily living.

Olecranon fractures account for approximately 10% of all upper extremity injuries. These fractures can result from both direct and indirect trauma, particularly forced hyperextension of the elbow. Various classification systems have been proposed, though none has achieved universal acceptance. Most are descriptive, categorizing fractures based on the location of the primary fracture line, morphological characteristics, and degree of instability.[7,8]

Early surgical intervention for displaced olecranon fractures is essential to reduce morbidity and to achieve favorable radiological and functional outcomes. Open reduction and internal fixation using tension band wiring has shown consistently good results, particularly in Mayo Type 2A fractures. Several studies support the use of tension band wiring even in certain comminuted fractures, such as Mayo Type 2B, citing its cost-effectiveness, shorter operative time, and reliable outcomes.[9,10]

In this prospective observational study we tried to assess the functional outcome and factors associated following operative treatment of olecranon fractures. In our study, the age of patients ranged from 22 to 64 years, with a mean age of 46.59 years. Males were more commonly affected than females. Our results were consistent with previous studies.

Table 2: Age distribution of various studies

Study	No. of patients	Mean age in years
Byron E Chalidis et al[11]	62	48.6
Deepak k Aher et al[12]	30	30
Saurabh kumar et al[13]	20	43.2
Pankaj Spolia et al[14]	24	42.5
Our study	22	46.59

Table 3: Sex distribution of various studies

Study	No. of patients	Male: Female	Percentage of males
Byron E Chalidis[11]	62	33:29	53%
Deepak K Aher et al[12]	30	26:4	86.67%
Saurabh Kumar et al[13]	20	13:7	65%
Pankaj spolia et al[14]	24	15:9	62.5%
Our study	22	14:8	63.64%

In our study, the commonest mode of injury was fall on ground, 12 patients (54.54%).

Table 4: **Mode of Injury Seen in Various Studies**

Study	No. of patients	Commonest mode
Byron E Chalidis et al[11]	62	Simple Fall (61.3%)
Deepak K Aher et al[12]	30	Fall on ground (90%)
Pankaj spoila et al[13]	24	Fall from standing height (75%)
Saurabh kumar et al[14]	20	Simple fall (60%)
Our study	21	Simple Fall on ground (54.54%)

In our study, 63.63% of patients achieved excellent outcomes, 27.27% had good results, 4.54% had fair outcomes, and 4.54% had poor results. These findings are consistent with previous studies and further support the effectiveness of tension band wiring in the treatment of olecranon fractures. Our results indicate that this technique yields a high rate of excellent functional recovery when applied appropriately. The average time to radiological union was 12.4 weeks, which aligns with the healing timelines reported in similar studies.

CONCLUSION

This study demonstrated that open reduction and internal fixation of olecranon fractures using tension band wiring resulted in good to excellent functional outcomes in the majority of patients. A higher percentage of favourable results was observed in patients who underwent timely and anatomically accurate surgical intervention. These findings support the continued use of tension band wiring as an effective and reliable technique for the management of displaced, non-comminuted olecranon fractures.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this study.

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