# Assessment of the functional outcome in patients with olecranon fracture treated by tension band wiring technique

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**ABSTRACT**

**Introduction:** Tension Band Wiring (TBW) is a common fixation method for olecranon fractures. This study aims to evaluate the functional outcomes of patients treated with TBW, using the Mayo Elbow Performance Score (MEPS). Methods: Thirty patients with olecranon fractures were randomly selected for operative treatment, meeting the inclusion criteria. They were followed up for six months, with outcomes assessed using the Visual Analogue Scale (VAS) and MEPS at the final follow-up. Results: Among the 30 patients evaluated, males comprised 70%, and 30% were females. The olecranon of the right side was more commonly injured (56.67%). The mean age of participants was 34.10 years (range 18-64 years). Most fractures resulted from fall injuries (46.67%), followed by Road Traffic Accidents (43.33%). The most frequent fracture type was Mayo Type 2 (56.67%), followed by Type 3 (43.33%). The mean time from injury to surgery was 3.93 days, and the average union time was 7.57 weeks. At three months, the mean VAS score was 1.20, improving to 0.63 at six months. The mean MEPS at three months was 84.83, increasing to 92.33 at six months. At the final follow-up, 20 patients had excellent outcomes, 8 had good outcomes, and two had fair outcomes. Conclusions: Open reduction and internal fixation with TBW leads to excellent functional outcomes, supporting its continued use as the gold-standard technique based on solid biomechanical principles.

**Keywords:** MEPS score, olecranon fracture, open reduction and internal fixation, tension band wiring, VAS score.

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## INTRODUCTION

Olecranon fractures account for approximately 10% of all upper extremity fractures and are among the most frequent injuries to the proximal ulna, making them a common orthopedic injury encountered in emergency rooms. These fractures range from simple nondisplaced to complex fracture-dislocations of the elbow joint.[1] Olecranon fractures have a higher incidence in the elderly and can result from both direct and indirect trauma.[2] Common causes include motor vehicle accidents, falls, and assaults. Although these fractures typically occur in isolation, they can also present as part of complex polytrauma cases.[3] The degree of comminution depends on the severity of the trauma.[4]

Due to their intra-articular nature, olecranon fractures require anatomic reduction and early mobilization to avoid complications such as restricted range of motion.[5,6] Nondisplaced fractures can be managed with a brief period of immobilization followed by a gradual increase in range of motion. However, displaced fractures generally necessitate open reduction and internal fixation to anatomically realign the articular surface and restore normal elbow function. The fixation must provide stability, allow for active flexion and extension

of the elbow, and promote fracture union.[7]

The Mayo classification system, as presented in Figure 1, guides treatment based on displacement and ulnohumeral joint stability.[8] The classification is: Type I: Nondisplaced fractures, treated nonoperatively, Type II: Displaced, stable fractures requiring surgical treatment, and Type III: Displaced, unstable fractures needing surgical treatment.

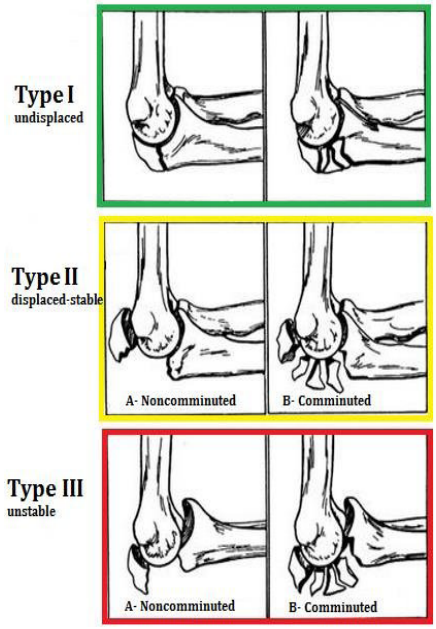


**Figure 1:** Mayo classification of olecranon fracture

The purpose of this study was to evaluate the functional outcomes of tension band wiring for olecranon fractures and to identify factors that may influence the final results.

## METHODS

This was a hospital-based prospective longitudinal study conducted at Gandaki Medical College, Pokhara, over nine months (April 15, 2024 to January 15, 2025) involving a total of 30 patients. Patients with isolated olecranon fractures meeting the inclusion criteria were purposively selected. Each patient underwent operative treatment and was followed up for six months. The outcomes were evaluated using the Visual Analogue Scale (VAS) and the Mayo Elbow Performance Score (MEPS)[12] at three months and the final follow-up at six months.

The study included patients with isolated olecranon fractures, aged between 16 and 65 years. Only closed oblique and transverse fractures with a duration of trauma of less than two weeks were considered. Patients were excluded if they had comminuted fractures, compound fractures, or pathological fractures. Polytrauma patients and those with olecranon fractures associated with elbow dislocation, terrible triad injuries, or multiple fractures were also excluded from the study.

Ethical approval was taken from the Institutional ethical review committee of GMC (Ref. No. 92/080/081-f). Data were collected from patients attending the orthopedic outpatient and emergency departments of GMCTH. Informed consent was obtained using a prescribed format after explaining the study details and the procedures involved. Relevant history, clinical examinations, and other information were documented in a printed case report form.

All patients underwent preoperative and postoperative X-ray imaging. Postoperative observations were conducted at 2 weeks, 6 weeks, 3 months, and 6 months. The functional outcomes were evaluated using the Mayo Elbow Performance Score (MEPS).[12] Statistical analysis was carried out using a computer-based statistical analysis program, Microsoft Excel, and Statistical Packages for the Social Sciences (SPSS) version 18.0.

The Mayo Elbow Performance Index (MEPI)[12] is a comprehensive tool used to evaluate the outcomes of elbow treatments, assessing four key domains. The Pain domain, with a maximum score of 45 points, measures the level of discomfort the patient experiences, with lower pain scores indicating better outcomes. The Range of Motion domain, which is scored up to 20 points, evaluates the extent of movement in the elbow joint, including flexion, extension, and rotational movements, where a higher score reflects a greater range of motion. The Stability domain, with a maximum score of 10 points, assesses the stability of the elbow joint, and a higher score indicates a more stable joint. Finally, the Function domain, scored on five items (each worth five points), examines the patient's ability to perform daily activities such as lifting, carrying, pushing, pulling, and personal hygiene tasks, with better functionality leading to higher scores. The total MEPI score, which is out of 100, provides a valuable metric for evaluating the overall functional recovery of the elbow joint.

Higher scores across these domains indicate better outcomes, reflecting improved pain levels, greater range of motion, enhanced joint stability, and better functional abilities. Based on the total score, the results are classified into four categories: Excellent (scores greater than 90 points) represents near-perfect or fully restored elbow function, signifying a highly successful treatment outcome. Good (scores between 75 and 89 points) indicates significant improvement, with the patient experiencing functional recovery and minimal residual issues. A fair result (scores

ranging from 60 to 74 points) suggests moderate recovery, where the patient may still have some limitations but can perform most activities. Poor (scores below 60 points) denotes suboptimal outcomes, with persistent pain, limited motion, or significant functional impairments, often indicating the need for further intervention or treatment. This grading system helps clinicians evaluate recovery progress and decide on the next steps for patient care.

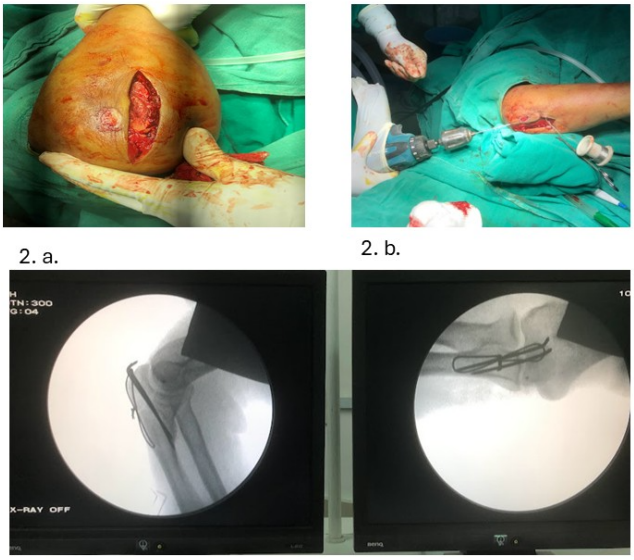


**Figure 2**: a, b: Operative images and c: Intra-operative X-ray

## RESULTS

In this study, the majority of fractures were observed in the age group of 15 to 30 years, accounting for 46.67% of patients. The mean age was 34.10 years with a standard deviation of 14.18. Among the patients, 70% were male and 30% were female. Injuries predominantly affected the right side (56.67%), compared to the left side (43.33%), indicating a right-sided predominance.

The mode of injury was comparable between road traffic accidents (RTA), which accounted for 13 cases (43.33%), and fall injuries, which accounted for 14 cases (46.67%). The majority of fractures were classified as type 2A. The mean time to fracture union was 7.57 weeks (range: 6 to 10 weeks). Union was achieved in nine cases (30%) at 6 weeks, six cases (20%) at 7 weeks, seven cases (23.33%) at 8 weeks, five cases (16.67%) at 9 weeks, and three cases (10%) at 10 weeks. All cases achieved good union with no evidence of nonunion. The intraoperative photographs and radiographs are demonstrated in Figure 2.

Complications were observed in four cases (13.33%). Two cases (6.66%) had wound infections, which were successfully managed with oral antibiotics, and two cases (6.66%) developed hardware prominence. Regarding pain, 20 cases (66.7%) reported no pain, while 10 cases (33.3%) reported mild pain. The mean Visual Analogue Scale (VAS) score was 0.63 (range: 0–3). (Figure 3)

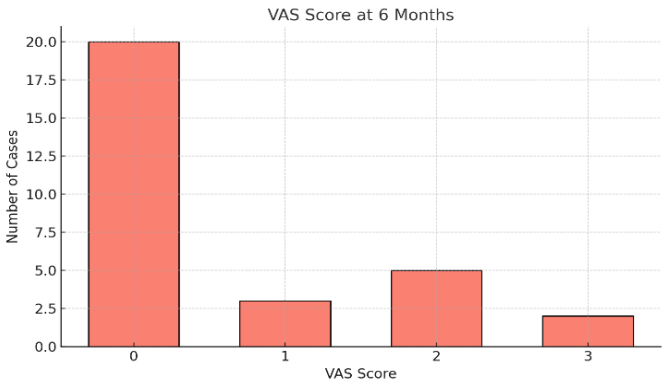


**Figure 3:** VAS score at six months

The mean MEPS at three months was 84.83, increasing to 92.33 at six months. At the final follow-up, 20 cases (66.67%) had excellent outcomes, 8 cases (26.67%) had good outcomes, and two cases (6.67%) had fair outcomes. (Table 1)

The pre-operative, intra-operative, and post-operative X-ray images are demonstrated in Figure 4.

**Table 1:** Frequency of results according to MEPS score

| Results | Frequency | Percentage |
|---|---|---|
| **Excellent (score >90)** | 20 | 66.67% |
| **Good (score 75–89)** | 8 | 26.67% |
| **Fair (score 60–74 )** | 2 | 6.67% |
| **Poor** | 0 | 0 |
| **Total** | 30 | 100% |


**Figure 4:** Pre-operative, intra-operative, and post-operative X-ray images

## DISCUSSION

The primary goal in treating olecranon fractures is not only to achieve bone union but also to preserve the optimal

function of the surrounding soft tissues and joints. To prevent complications such as traumatic arthritis and joint stiffness, early mobilization is essential. For this, achieving perfect anatomical reduction of fracture fragments to restore articular congruity and securing rigid fixation is crucial in managing intra-articular fractures. The most common technique for fixing olecranon fractures is tension band wiring with K-wires. This method converts tensile forces into compressive forces at the fracture site, typically resulting in excellent functional outcomes. This study aims to assess the functional outcomes in patients with fractures of the olecranon process of the ulna managed with tension band wiring.

In our study, 30 cases of olecranon fractures were treated using Open Reduction Internal Fixation with Tension Band Wiring. The highest incidence of fractures was in the 15 to 30 years age group, accounting for 46.67% of patients. The mean age of patients was 34.10 years, with a range of 18 to 64 years. Spolia et al.[12] evaluated the functional outcomes of tension band wiring in patients aged 18 to 65 years and reported a mean age of 42.5 years, which was not statistically significant. Similarly, Kumar et al.[13] reported a mean age of 43.2 years, with a range of 19 to 75 years, which was also not statistically significant.

Regarding gender distribution, our study included 21 male patients (70%) and 9 female patients (30%). Sharma et al.[14] observed 62.5% male and 37.5% female patients in their study. Spolia et al.[12] reported 66.67% male and 33.33% female patients, while Kumar et al.[13] found 65% male and 35% female patients. Similarly, Singh et al.[15] reported 62.85% male and 37.15% female patients. All studies, including ours, demonstrate a male predominance, likely attributable to greater male participation in outdoor and sports activities.

In terms of injury laterality, 17 cases (56.67%) involved right-sided injuries, while 13 cases (43.33%) involved left-sided injuries. Echalidis et al.[16] reported 56.4% left-sided injuries and 43.6% right-sided injuries, contrasting with our findings. However, Aher et al.[17] observed 80% right-sided injuries and 20% left-sided injuries, which aligns with our results. Similarly, Spolia et al.[12] found 75% right-sided and 25% left-sided injuries.

In the majority of participants, the mode of injury was fall injury in 14(46.7%) patients, followed by road traffic accidents in 13(43.3%) patients, and 3(10%) patients following physical assault.

The most common mechanism of injury in our study was falls, accounting for 46.7% of cases, followed by road traffic accidents (43.3%) and physical assaults (10%). Our findings are comparable to Spolia et al.[12], who reported falls in 75% of cases, road traffic accidents in 16.7%, and physical assaults in 8.3%. Aher et al.[17] similarly reported falls in 90% of cases and road traffic accidents in 10%. All of the above study shows fall injury to be the most common mechanism of injury to cause fracture of the olecranon process.

The fractures in our study were classified using the Mayo classification system. The most common type was Mayo Type 2A (56.67%), followed by Mayo Type 3A (43.33%). Spolia et al.[12] and Chalidis et al.[16] also reported Mayo Type 2A as the most common fracture type, supporting our findings.

In our study, the mean time to union was 7.57 weeks, with a range of 6 to 10 weeks. This is comparable to Spolia et al.[12] who reported a mean of 8.5 weeks, and Alawa et al.[13] who recorded a mean of seven weeks. In our study, five patients (16.67%) developed complications, out of which two patients (6.67%) developed wound infection, elbow stiffness was seen in two patients (6.67%), and hardware prominence was seen in one patient (3.33%). Both cases of wound infection were treated with intravenous antibiotics. Spolia et al.[12] and Aher et al.[17] reported similar rates of complications.

At the six-month follow-up, 20 cases (66.67%) achieved excellent results, 8(26.67%) good results, and 2(6.67%) fair results based on the Mayo Elbow Performance Score. These results are consistent with previous studies by Spolia et al.,[12,] Chalidis et al.,[16,] and Aher et al.[17]

## CONCLUSIONS

From this study, it is advised that tension band wiring with Kirschner wire is a well-recommended treatment procedure for isolated simple transverse and oblique fractures of the olecranon process of the ulna and leads to good elbow function and minimal loss of physical capacity, and is based on sound biomechanical principles.

**CONFLICTS OF INTEREST**: None declared

**SOURCE OF FUNDING:** None

## AUTHORS' CONTRIBUTIONS

RMD and SKC collected the data, performed statistical analysis and data interpretation. KBB and AP contributed in literature review and data analysis. All authors read and

approved the manuscript.

**REFERENCES**


1. Van der Horst CM, Keeman JN. Treatment of olecranon fractures. The Netherlands journal of surgery. 1983;35(1):27-9.
2. Rouleau DM, Sandman E, van Riet R, Galatz LM. Management of fractures of the proximal ulna. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2013;21(3):149-60. DOI: 10.5435/JAAOS-21-03-149 PMID: 23457065.
3. Duckworth AD, McQueen MM. Isolated displaced olecranon fracture. Journal of Hand Surgery. 2012;37(2):341-5. DOI: 10.1016/j.jhsa.2011.06.005 PMID: 21741776.
4. Paremain GP, Novak VP, Jinnah RH, Belkoff SM. Biomechanical evaluation of tension band placement for the repair of olecranon fractures. Clinical Orthopaedics and Related Research (1976-2007). 1997; 335:325-30. DOI: 10.1097/00003086-199702000-00034
5. Bailey CS, MacDermid J, Patterson SD, King GJ. Outcome of plate fixation of olecranon fractures. Journal of Orthopaedic Trauma. 2001;15(8):542-8. DOI: 10.1097/00005131-200111000-00002 PMID: 11733669.
6. King GJ, Lammens PN, Milne AD, Roth JH, Johnson JA. Plate fixation of comminuted olecranon fractures: an in vitro biomechanical study. Journal of shoulder and elbow surgery. 1996;5(6):437-41. DOI: 10.1016/S1058-2746(96)80015-2 PMID: 8981268.
7. Ring D, Jupiter JB. Current concepts review-fracture-dislocation of the elbow. JBJS. 1998;80(4):566-80 DOI: 10.2106/00004623-199804000-00014
8. Macko DO, Szabo RM. Complications of tension-band wiring of olecranon fractures. JBJS. 1985;67(9):1396-401. DOI: 10.2106/00004623-198567090-00015
9. Duckworth AD, Bugler KE, Clement ND, McQueen MM. Nonoperative management of displaced olecranon fractures in low-demand elderly patients. JBJS. 2014;96(1):67-72. DOI: 10.2106/JBJS.L.01137 PMID: 24382727.
10. Gallucci GL, Piuzzi NS, Slullitel PA, Boretto JG, Alfie VA, Donndorff A, et al. Non-surgical functional treatment for displaced olecranon fractures in the elderly. The bone & joint journal. 2014;96(4):530-4. DOI: 10.1302/0301-620X.96B4.33339 PMID: 24692623.
11. David Ring "Elbow fractures and dislocations in 'Rockwood and Green Fractures in Adults' Chapter 32 Vol I 7th, Bucholz RW, Heckman JD,, Lippincott Williams& Wilkins.2010, 936-942.
12. Spolia P, Ghani A, Arfee S. Clinico-Radiological and functional outcome of Mayo Type IIA olecranon fractures managed with tension band wiring in a tertiary care Center in North India. International Journal of Research in Orthopaedics. 2021;7(6):1099.
13. Kumar S, Singh PK, Kant S, Kumar M, Roshan R. Study of functional outcome in a patient of olecranon process fracture, treated with tension band wiring technique. Journal of Indira Gandhi Institute of Medical Science. 2020;6(2):138-41.
14. Sharma A, Bajoria R. Assessment of functional outcome in olecranon fracture managed by tension band Wiring. International Journal of Orthopaedics Sciences. 2022;8(1):475–7. DOI: 10.22271/ortho.2022.v8.i1g.3058
15. Singh DrH, Zuber DrMohd. Olecranon fractures: Tension band wiring and complications. International Journal of Orthopaedics Sciences. 2020;6(3):346–9. DOI: 10.22271/ortho.2020.v6.i3f.2221
16. Chalidis BE, Sachinis NC, Samoladas EP, Dimitriou CG, Pournaras JD. Is tension band wiring technique the "gold standard" for the treatment of olecranon fractures? A long-term functional outcome study. Journal of orthopaedic surgery and research. 2008; 3:1-6. DOI: 10.1186/1749-799X-3-9 PMID: 18294381.
17. Aher DrD, Pandey DrS, Alawa DrS, Pathak DrA. Evaluation of functional outcome of tension band wiring in olecranon fractures and factors affecting the overall functional outcome. International Journal of Orthopaedics Sciences. 2018;4(2e):334–6. DOI: 10.22271/ortho.2018.v4.i2e.50