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Original Research Article

FUNCTIONAL OUTCOMES OF LOCKING PLATE FIXATION IN THE MANAGEMENT OF DISPLACED OLECRANON FRACTURES AMONG ADULT PATIENTS PRESENTING TO TERTIARY CARE HOSPITAL

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ABSTRACT

Background: *Displaced olecranon fractures are common upper limb injuries in adults and often require surgical intervention to restore elbow function. Locking plate fixation has gained increasing popularity due to its biomechanical stability and ability to allow early mobilization.* ***Objective:*** *To evaluate the functional outcomes of locking plate fixation in the management of displaced olecranon fractures among adult patients.* ***Study Design:*** *Descriptive study.* ***Setting:*** *Department of Orthopedic Surgery, MTI-Khyber Teaching Hospital, Peshawar, Pakistan.* ***Duration of Study:*** *18-October-2024 to 18-May-2025.* ***Methods:*** *A total of 114 adult patients aged 18–65 years with displaced olecranon fractures were included in this study. All patients underwent open reduction and internal fixation with an olecranon locking plate through a posterior midline approach under general anesthesia, with intraoperative imaging utilized when required. Functional outcomes were assessed at two months postoperatively using the Broberg and Morrey rating system. Data were analyzed using SPSS version 25.* ***Results:*** *The mean age of patients was 45.44 ± 14.42 years, with 59 (51.8%) males and 55 (48.2%) females. Functional outcomes were excellent in 79.8% of cases, good in 14.0%, and fair in 6.1%, with no poor outcomes reported.* ***Conclusion:*** *Locking plate fixation of displaced olecranon fractures demonstrated excellent to good functional outcomes in the majority of patients, highlighting its effectiveness in restoring elbow function with minimal complications.*

Keywords: Olecranon Fracture, Locking Plate Fixation, Functional Outcome, Broberg And Morrey Scale, Complications

INTRODUCTION

Olecranon fractures account for a significant proportion of upper extremity fractures in adults, comprising approximately 10% of these injuries (1). Fractures can occur due to a direct impact on the proximal ulna or indirectly via forceful contraction of the triceps towards resistance. The olecranon refers to the proximal ulna segment that spans from the ulna's tip to the coronoid process. Three primary anatomical characteristics should be considered when handling olecranon fractures. The olecranon serves as the insertion point for the triceps muscle, and its movement may contribute to the displacement of a fracture (2).

Olecranon fractures primarily affect individuals aged 50 or older, usually occurring from falls. Younger individuals tend to suffer injuries associated with mechanisms that include higher energy levels. Olecranon fractures can arise from forced hyperextension of the elbow as well as a direct impact to the elbow when it is flexed at a 90-degree angle. Avulsion injuries may originate from a disproportionate contraction of the triceps tendon (3-5). These usually demonstrate a transverse as well as oblique fracture line, and are more frequently observed in patients with osteoporosis.

Managing complex, comminuted fractures of the olecranon can be pretty challenging, especially if accompanied by fractures of the radial head and coronoid process of the ulna, or injuries to the collateral ligament of the elbow joint (5, 6). The purposes of treatment are to achieve a stable anatomic reduction over time, encourage bone healing, and help with functional recovery. To facilitate early functional mobilization and prevent stiffness of the elbow joint, fracture fixation must ensure safe stability (7, 8). Tension band wiring is often advised for non-comminuted fractures (9, 10). Plate fixation is a popular option for comminuted fractures, as subchondral bony comminution opposing the tension band may contribute to failure under compression (11, 12). Plate fixation has been indicated for the treatment of simple olecranon fractures. According to the study, the recoded functional outcome of locking plate fixation in the management of displaced olecranon fractures among adults is as follows: Excellent (76%), Good (16%), Fair (8%), and Poor (0%) (13). Locking plate fixation offers biomechanical advantages in displaced olecranon fractures, such as stable fixation and early mobilization, which may lead to improved functional recovery compared to traditional fixation methods. However, there is a paucity of literature on this subject locally; therefore, the goal of this study is to determine the functional outcome of locking plate fixation in the management of displaced olecranon fractures among adult patients at our hospital setup. The findings of this study will help our medical professionals provide valuable insights into the sustainability of locking plate fixation in restoring elbow function.

METHODOLOGY

In this study, we employed a descriptive design, conducted at the Department of Orthopedic Surgery, MTI-Khyber Teaching Hospital, Peshawar, from 18/October/ 2024, to 18/May/2025, after obtaining ethical approval from the hospital. The sample was evaluated to include 114 patients based on the assumptions of a 5% margin of error and a 95% confidence level, with a fair functional outcome of 8% (13). Consecutive non-probability sampling was used to select cases that met the inclusion criteria, which included males and females (aged 18-65 years) with displaced olecranon fractures. Patients with additional ipsilateral upper extremity injuries, neurovascular injuries, and pregnant women were dropped from the study.

After obtaining consent from the patients, we collected demographic information, including age, gender, BMI, socioeconomic status, residence, employment status, and educational level. Patients diagnosed with displaced olecranon fractures underwent surgery under general anesthesia with the arm placed in a lateral decubitus position. The surgery involved the use of an olecranon locking plate for fracture fixation, and an image intensifier was available for

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intraoperative imaging if necessary. A posterior midline approach was used, and a tourniquet was inflated to achieve limb exsanguination. After fixation, a posterior removable POP slab was applied, maintaining the elbow in 90-degree flexion for two weeks. We assessed the functional outcome using the Broberg and Morrey rating system, a 100-point scale that evaluates elbow function based on motion, strength, stability, and pain. This assessment was performed two months post-surgery under the guidance of a consultant with over five years of experience following a fellowship.

SPSS 25 software was used to analyze the data collected on the proformas. For numerical variables, we used mean and SD, and for categorical variables, we evaluated frequency and percentage. We stratified the outcomes by demographics and complications using the Chi-Square test, with a notable P-value of ≤ 0.05.

RESULTS

The mean age of 114 patients was 45.44±14.42 years, with a mean BMI of 25.45±1.34 kg/m². The cohort comprised 59 (51.8%) male and 55 (48.2%) female patients (Table 1).

Complications' analysis showed that 1 (0.9%) case was reported, and delayed union was observed in 3 (2.6%) cases (Table 2).

Functional outcomes were assessed, revealing excellent results in 91 (79.8%) patients, good outcomes in 16 (14.0%), and fair outcomes in 7 (6.1%). None of our patients had poor functional outcomes (Table 3). Stratification of functional outcomes, complications, and demographics can be seen in Table 4.

Table 1: Demographic attributes of the patients

Demographic attributes		N	%
Gender	Male	59	51.8%
	Female	55	48.2%
Socioeconomic status	Low (< 20K Rs/Month)	24	21.1%
	Middle (20 to 50K Rs/Month)	73	64.0%
	High (> 50K Rs/Month)	17	14.9%
Education status	Educated	51	44.7%
	Uneducated	63	55.3%
Employment status	Employed	50	43.9%
	Unemployed	64	56.1%
Area of residence	Urban	66	57.9%
	Rural	48	42.1%

Table 2: Complications of the procedure

Complications		N	%
Infection	Yes	1	0.9%
	No	113	99.1%
Delayed union	Yes	3	2.6%
	No	111	97.4%

Table 3: Functional outcome

Functional outcome	N	%
Excellent	91	79.8%
Good	16	14.0%
Fair	7	6.1%
Poor	0	0.0%

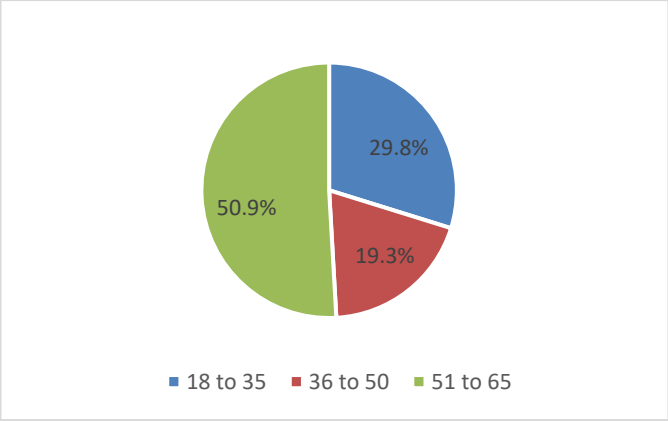

Figure 1: Age distribution (Years)

Table 4: Stratification of functional outcome with demographics and complications

		Functional outcome						P value
		Excellent		Good		Fair		
		N	%	N	%	N	%	
Gender	Male	47	51.6%	10	62.5%	2	28.6%	0.32
	Female	44	48.4%	6	37.5%	5	71.4%	
Socioeconomic status	Low (< 20K Rs/Month)	19	20.9%	3	18.8%	2	28.6%	0.78
	Middle (20 to 50K Rs/Month)	60	65.9%	9	56.2%	4	57.1%	
	High (> 50K Rs/Month)	12	13.2%	4	25.0%	1	14.3%	
Education status	Educated	38	41.8%	8	50.0%	5	71.4%	0.28
	Uneducated	53	58.2%	8	50.0%	2	28.6%	
Employment status	Employed	38	41.8%	8	50.0%	4	57.1%	0.63
	Unemployed	53	58.2%	8	50.0%	3	42.9%	
Area of residence	Urban	49	53.8%	12	75.0%	5	71.4%	0.21
	Rural	42	46.2%	4	25.0%	2	28.6%	
Infection	Yes	0	0.0%	0	0.0%	1	14.3%	0.0001
	No	91	100.0%	16	100.0%	6	85.7%	
Delayed union	Yes	0	0.0%	1	6.2%	2	28.6%	0.0001
	No	91	100.0%	15	93.8%	5	71.4%	
Age distribution (Years)	18 to 35	27	29.7%	3	18.8%	4	57.1%	0.31
	36 to 50	19	20.9%	2	12.5%	1	14.3%	
	51 to 65	45	49.5%	11	68.8%	2	28.6%	
BMI (Kg/m2)	18 to 25	58	63.7%	8	50.0%	5	71.4%	0.50
	> 25	33	36.3%	8	50.0%	2	28.6%	

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DISCUSSION

We observed that the functional outcomes were excellent in 79.8% of patients, good in 14.0%, and fair in 6.1%, with no poor outcomes reported in our patients. Complications were minimal, with only 0.9% of the cohort experiencing an infection and a 2.6% rate of delayed union.

The study by Bhowmik et al. evaluated 25 patients who were treated with locking plate fixation and reported excellent outcomes in 76% of cases, with a mean flexion-extension arc of 116.2° and low complication rates, including only 12% delayed union (14). These results are consistent with our findings, which show that excellent outcomes were achieved in 79.8% of patients, further supporting the efficacy of locking plates.

Bethell et al. analyzed 20 studies involving 2164 patients, reporting similar functional outcomes between TBW and plate fixation, with no notable differences in Disabilities of the Arm, Shoulder, and Hand (DASH) scores (12.3±4.7 vs. 12.1±4.9) or Mayo Elbow Performance Scores (MEPS) (92.0±5.4 vs. 92.3±3.7). In their study, plate fixation demonstrated superior results in terms of lower rates of loss of reduction (6.6% vs. 2.6%), implant removal (31.4% vs. 14.3%), and overall complications (45.1% vs. 27.6%).[14] These findings affirm the findings of our study, where plate fixation showed minimal complications and no need for implant removal, reinforcing its reliability.

Bailey et al assessed 25 patients treated with plate fixation, reporting good functional outcomes and lower rates of complications in their study (15). Amini et al. conducted a matched-cohort study to compare TBW and locking plate fixation in transverse olecranon fractures. They found no notable differences in the functional outcomes or complications but reported a trend toward higher implant removal rates with TBW (40% vs. 10%). Their cost analysis revealed that TBW was initially cheaper; however, when reoperation costs were included, plate fixation became more cost-effective due to lower complication rates (16). This aligns with our findings, which show that plate fixation demonstrated fewer complications, suggesting long-term cost benefits despite higher initial expenses.

Powell et al. compared TBW and locking plates in Mayo 2A fractures, reporting no difference in Quick DASH scores but potentially higher complication rates (39.6% vs. 0%) and reoperation rates (33.3% vs. 0%) in the TBW group. Their cost analysis showed that locking plates were cheaper overall due to their fewer reoperations, which reinforces the economic advantage of plate fixation. These results corroborate our study, which found that locking plates yielded excellent outcomes with minimal complications, supporting their preference over TBW.

Our findings, combined with the literature, suggest that locking plate fixation has superior outcomes for displaced olecranon fractures, particularly in terms of lower complication and reoperation rates. While TBW remains a viable option for simple fractures, its higher rates of hardware irritation and removal make plate fixation a more reliable choice, especially with modern low-profile designs. The economic argument also favors the plate fixation when considering long-term costs associated with reoperations.

We recommend locking plate fixation as the preferred treatment for displaced olecranon fractures, particularly in cases with comminution or osteoporotic bone. Future studies should focus on long-term outcomes and cost-effectiveness in larger randomized cohorts to further validate these findings.

CONCLUSION

Locking plate fixation for the treatment of displaced olecranon fractures yielded excellent to good outcomes in the majority of cases, with fewer incidences of infection and delayed union.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRB-699/DME/KMC)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTION

MUHAMMAD AFAQ KHAN (Trainee Medical Officer***)***
Data Collection, Study Design,Manuscript writeup, Review of manuscript, and final approval of manuscript.
M AYAZ KHAN (Professor***)***
Manuscript revisions,Supervision and critical input.
RIZWAN SAMI (Trainee Medical Officer***)***
Review of literature
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