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Outcome of Distal Humeral Fractures: An Experience to Evolve

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ABSTRACT

Objective: To evaluate the functional outcomes of distal humerus fracture fixation using locking plates and screws, focusing on fracture reduction, fixation stability, and post-operative recovery as measured by the Mayo Elbow Performance Score (MEPS).

Study Design: Cross sectional study.

Place and Duration of Study: Pakistan Navy Station Shifa Hospital, Karachi Pakistan, from Jan 2019 to 30 Jun 2021.

Methodology: A total of 19 patients aged 18-65 with closed distal humerus fractures were included in the study. All patients underwent open reduction and internal fixation (ORIF) using locking plates. The primary outcome was functional recovery assessed using the Mayo Elbow Performance Score (MEPS) at 3 and 6 months post-operatively. Secondary outcomes included complication rates, time to union, and patient adherence to post-operative rehabilitation.

Results: At 6 months, the mean MEPS score was 72.37±8.39, with significant improvement from the 3-month follow-up. Males showed better recovery than females (p=0.032). Two patients (10.5%) experienced mild surgical site infections, and one patient (5.3%) had delayed union. Notably, 89.5% of patients missed regular rehabilitation sessions, which negatively impacted their functional outcomes. Fracture union occurred in an average of 20 weeks.

Conclusion: Locking plate fixation provides stable fracture fixation and satisfactory functional outcomes for distal humerus fractures. Gender and compliance with rehabilitation were significant factors influencing the outcomes in this study.

Keywords: Elbow Joint, Fracture Fixation, Humeral Fractures, Outcome Assessment.

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INTRODUCTION

Distal humerus fractures, though relatively rare, represent a significant portion of elbow fractures, particularly in adults. These fractures, accounting for approximately 2-6% of all fractures and 30% of elbow fractures, often result from falls, sports injuries, or road traffic accidents.[1-3] The objective of treating distal humerus fractures is to achieve a pain-free and stable elbow with satisfactory functional capacity,[4] Traditional non-operative treatments have generally yielded unsatisfactory functional results, primarily due to limited elbow mobility post-treatment.[5] Conversely, surgical fixation, particularly with the advent of improved implant technologies, offers better prospects for achieving stable fixation under physiological loads.[6] The Locking Compression Plate (LCP) system, exemplified by the Synthes® model, presents a novel method for addressing distal humerus fractures. This system provides angular stable fixation through the use of anatomically pre-shaped plates that are specifically tailored for this type of injury.[7] By enhancing angular stability, these implants offer improved biomechanical properties and better anchorage in complex injury scenarios.[8]

Management of such fractures in Pakistan and abroad show mixed results. One study on distal humerus intercondylar fractures treated with dual plating reported a mean MEPS of 73.5±16.5. Within this study, 32% of patients had excellent, 42% good, 18% fair, and 9% poor outcomes.[9] Internationally, ORIF, studies commonly report a goal of restoring elbow range of motion to 30-130° of flexion and that the majority of patients regain 75% of elbow motion and strength. Unsatisfactory outcomes can be up to 25% due to complexity.[10]

This study aims to evaluate the functional outcomes of distal humerus fracture fixation using locking plates and screws, focusing on factors such as fracture reduction, fixation stability, and post-operative range of motion assessed through Mayo elbow performance score.

METHODOLOGY

This cross-sectional study was conducted in the Department of Orthopedics at Pakistan Navy Station Shifa Hospital, Karachi Pakistan, from Jan 2019 to Jun

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2021. Ethical approval was obtained from the institutional ethics committee (ERC/2024/ortho/128) dated 16-12-2024.

Inclusion Criteria: Patients aged 18 to 65 years of either gender with closed distal humerus fractures or open fractures classified as Gustilo-Anderson type I and II were included.[11]

Exclusion Criteria: Patients with other types of fractures, and those with cardiovascular diseases or open fractures classified as Gustilo-Anderson type III were excluded. In addition, patients having polytrauma or refusing open reduction were also excluded.[12]

Sample size was calculated using WHO calculator, using proportion of patients presenting with poor outcome in terms of Mayo elbow performance score as 2.8%.[13] Sample size was 18. Non-probability convinent sampling was done.

Routine hematological and radiological investigations were performed to assess the patients' fitness for surgery. Pre-operative planning included evaluating X-rays to strategize the surgical approach and choice of implants. The surgical procedure was performed under brachial block anesthesia, with the patient positioned laterally and the affected side up. A tourniquet was applied. The approach is posterior, elbow joint opened via chevron osteotomy, olecranon is osteotomized and reflected up, triceps is split on the sides. After reduction fracture fixation is done with anatomical LCPs.

Patients were followed up for six months post-operatively. Functional outcomes were evaluated using the Mayo Elbow Performance Score (MEPS). Post-operative care included early mobilization to enhance functional recovery and reduce complications like elbow stiffness.

All data were entered using software Statistical Package for the Social Sciences (SPSS) version 25. Continuous variables as age, BMI, time of union were represented in mean and standard deviation. Gender, complications and co-morbid conditions were presented as frequency and percentage. Independent t-test was applied to compare the means between two groups for continuous variables that were parametric. Chi-square test was applied to see effects discrete variables between groups. A *p*-value was considered significant of ≤0.05.

RESULTS

A total of 19 patients were included in the study. There were 10(52.6%) males and 9(47.4%) females. The mean age of the individuals was 43.31±15.51 years. The minimum age of patient was 22 years and the oldest case was 65 years old. In terms of co-morbid conditions 12(63.2%) patients had no prior illness, Diabetes Mellitus was present in 4(21.1%), hypertension in 2(10.5%) and one (5.3%) patient had multiple co morbidities.

The mean follow up was 6 months. There was no peri-operative complication. However, post operatively 2(10.5%) patients suffered from mild surgical site infection which was managed with oral antibiotics. One (5.3%) patient had delayed union. In our study 2(10.5%) patients had history of fall rest 17(89.5%) were due to road traffic accidents. The mean MEPS at three month was 60±10.54 with maximum and minimum value of 75 and 40 respectively. At 6 months follow up, the mean MEPS score was 72.37±8.39 with maximum and minimum value of 85 and 55 respectively. The score was divided into excellent (range from 90 to 100), good (range from 75 to 89), fair (range from 60 to 74) and poor (<60). Around 17(89.5%) patients missed their regular rehabilitation program. The outcomes at three months is shown in Figure which revealed that 63% patients had fair to good recovery whereas MEPS at 6 months showed around 95% patients having fair to good recovery. The one patient with poor score at 6 months was the one who had delayed union. Data was further stratified based on gender and age being divided into groups. Post stratification outcome at three months is shown in Table-I which showed no significnat effect with respect to age and gender. Similarly, stratification at six months showed males showing significant MEPS score as compared to females (*p*-value=0.032) shown in Table-II. The males had a significantly better response than females in terms of MEPS at six months.

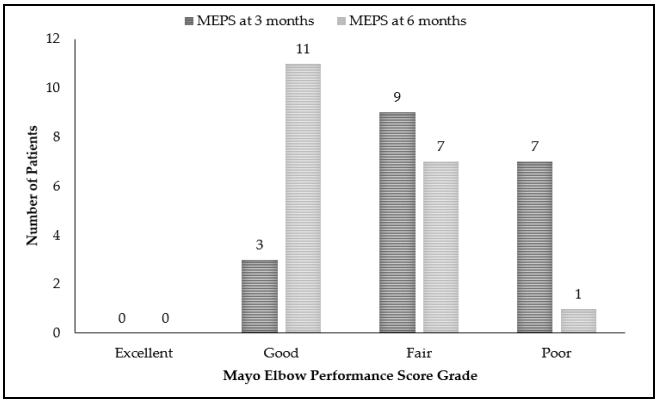

Figure: Outcome in terms of Mayo Elbow Performance Score (MEPS) at Three and Six Months (n=19)

Table-I: Association of Age and Gender with MEPS at 3-Month Follow Up (n=19)

Gender	Excellent	Good	Fair	Poor	*p*-value
Male	0(0%)	3(30%)	5(50%)	2(20%)	0.163
Female	0(0%)	0(0%)	4(44.4%)	5(55.6%)	
Age					
≤50 years	0(0%)	3(27.3%)	6(54.5%)	2(18.2%)	0.150
>50 years	0(0%)	0(0%)	3(37.5%)	5(62.5%)	

Chi square test was used to check the significance

Table-II: Association of Age and Gender with MEPS at 6-Month Follow Up (n=19)

Gender	Excellent	Good	Fair	Poor	*p*-value
Male	0(0%)	8(80%)	1(10%)	1(10%)	0.032
Female	0(0%)	3(33.3%)	6(66.7%)	0(0%)	
Age					
≤50 years	0(0%)	8(72.7%)	3(27.3%)	0(0%)	0.224
>50 years	0(0%)	3(37.5%)	4(50%)	1(12.5%)	

Chi square test was used to check the significance

DISCUSSION

Distal humerus fracture management is very complex and requires an in-depth knowledge of anatomy and biomechanics. Various surgical procedures and novel implants have been developed to improve outcomes. However, various patient related factors such as osteoporosis and mechanism of injury make reduction and better end-term functionality more challenging. Our study not only demonstrated that posterior approach is safe but also has satisfactory outcomes.

The mean age in our study cohorts was 43 years which is comparable to previous published series by Islam *et al.,* and Gupta *et al.,* with mean ages ranging from 35 to 45 years.[14,15] Although our patients had almost equal gender distribution literature shows more male preponderance.[13] This can be explained by exposure of males to more outdoor activities and hence are more prone to injuries.

When comparing the mean MEPS at three months, it was 60 in our study whereas literature showed mean MEPS to be 87.1.[13] This discrepancy can be due to lack of patients' induction into rehabilitation program, as 89.5% of patients did not follow the regular sessions. Moreover, mechanism of injury can also be one factor, as RTAs result in more severe comminution. The patient with poor MEPS at six months was due to delayed presentation of patient and intraarticular complex fracture.[16] Time of union in our study was 20 weeks. This was comparable to a study published by Sunil *et al.,* where time of union was 24 weeks. However, other studies have shown union time to be between 10-16 weeks. This, again, can be attributed to complex and high speed injuries in our study. Sunil *et al.,* also indicated that delayed union could be due to urban trauma.[17,18]

Surgical site infection was present in two of our patients and delayed union in one case, which was managed with oral antibiotics. This rate was comparable to various studies in literature. Post stratification, it was evident that female patients had significantly higher chances of lower MEPS at six months (*p*-value=0.032). This can be due to osteoporotic bones of middle-aged females in our country and poor compliance to rehabilitation. One study also showed RTA, female gender and advancing age to be predictors of poor MEPS score.[13]

LIMITTATION OF STUDY

The present study has several limitations that must be acknowledged. First, the small sample size of 19 patients limits the generalizability of the findings, and a larger sample size would provide more robust statistical power. Additionally, the follow-up period of six months may be insufficient to capture long-term outcomes such as late-onset complications, including implant failure or elbow stiffness. Moreover, the study was affected by poor adherence to rehabilitation programs, with 89.5% of patients missing their regular sessions. This non-compliance likely impacted functional recovery, limiting the ability to assess the full efficacy of surgical treatment. The single-centre design also restricts the external validity of the findings, as a multi-centre study could offer broader applicability across different populations and healthcare environments.

CONCLUSION

Surgical fixation of distal humerus fractures using locking plates provided satisfactory outcomes in terms of fracture reduction, fixation stability, and functional recovery, as measured by the Mayo Elbow Performance Score (MEPS). However, the outcomes were significantly influenced by factors such as gender, and adherence to post-operative rehabilitation.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SFA & SSA: Data acquisition, data analysis, critical review, approval of the final version to be published.

SI & SLO: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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