

Functional outcome of open reduction internal fixation of distal humerus intra articular fracture using recon plates

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Abstract

Background: Distal humerus fractures are challenging to manage successfully, even for the most experienced surgeon because of the complex anatomy. These fractures are often associated with comminution, displacement, and osteopenia.

Objective: To assess the functional outcome of open reduction internal fixation of distal humerus, intra-articular fracture using recon plates.

Material and Methods: This was a retrospective study conducted in the Department of Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore over 4-years (April 2015–April 2019). The functional outcome was assessed using the Mayo Elbow Performance Score.

50 patients were included in this study. Data were entered and analyzed using SPSS version 22.

Results: In this study, the majority were males as 33 (66%), and 17 (34%) were females with an average age of 32.92 ± 9.79 years ranged from 17-65 years. The minimum follow up time was 3-months, the mechanism of injury was RTA in the majority of cases. Mean union time was 10-weeks. The mean MEPS score was 89.70 ranged from (45-100) poor to excellent. The results indicated that more than half of the patients reported excellent outcome (56%) as compared to those group of patients with good outcome identified as 22%, 7-patients assessed with fair outcome 2-male and 2-female patients reported the poor outcome. The insignificant association was obtained between gender and functional outcome as $p\text{-value} > 0.05$.

Conclusion: The study concluded that the use of elbow reconstruction using recon plates for the fixation of complex intra or extra-articular fracture is a safe and effective surgical procedure for early recovery and early immobilization.

Keywords: Distal humerus, intra articular fracture, surgical treatment, Elbow Reconstruction, Contoured Recon Plates, Intra-articular, Mayo Elbow performance Score (MEPS).

Introduction:

Distal humerus fracture constitute 2% of all fracture in adult population. Distal humerus fractures are challenging to manage successfully, even for the most experienced surgeon because of the complex anatomy.¹⁻³ These fractures are often associated with comminution, displacement, and osteopenia. Mechanism of injury include high energy trauma in young and low energy trauma in old osteoprotic patients.⁴⁻⁶ Standard treatment and protocols for these fractures have not been well established. Various treatment options are available to treat these fractures. These

are conservative and operative. Conservative treatment usually results in loss of elbow movement and permanent disability.^{1,7,8} The recent trends to treat these intra-articular fractures of the distal humerus is open reduction and internal fixation with early mobilization. Adequate exposure is the mainstay for the visualization of the fracture fragments.⁹⁻¹¹ Most authors agreed that the posterior approach is best for the good exposure of distal intra articular fracture using olecranon osteotomy.¹²⁻¹⁵ The purpose of our research is to know the functional outcome of distal humerus intra-articular fracture using the

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Table 1: Distribution of patients according to Demographic profile

	Frequency (%)	Mean±S.D(Range)
Gender		
Male	33(66)	
Female	17(34)	
Side		32.92±9.79 years (Ranged = 17-65) years
Left	29(58)	Minimum follow uptime ~3 months
Right	21(42)	
Mean Union time		
10 weeks	35(70)	
15 weeks (delay)	15(30)	

Table 2: Classification of Functional outcome of patients using Mayo Elbow Performance score

Excellent = 90-100, Good = 75-89, Fair = 60-74, Poor = 0-59

Characteristics	Scoring	Definitions	Frequen- cy (%)	Mean±S.D
Pain	45	None	35(70)	40.5±6.9
		Mild	15(30)	
		Moderate	-	
		Severe	-	
Motion	20	Arc of motion >100°	33(66)	17.7±3.9
		Arc of motion B/W 50°-100°	14(28)	
		Arc of motion <50°	3(6)	
Stability	10	Stable	41(82)	8.9±2.5
		Moderate instability	7(14)	
		Grossly unstable	2(4)	
Function	25	Perform all function	38(76)	22.2±5.8
		Perform only 4 function	3(6)	
		Perform only three function	5(10)	
		Perform only two function	2(4)	
		Perform only one function	1(2)	
		None	1(2)	

Table 3: Excellent, good, fair and poor rating results of MEPS based on gender

Outcome of Mayo Elbow score n(%)

Gender	Excellent	Good	Fair	Poor	p-value
Male	19(38)	7(14)	5(10)	2(4)	0.892
Female	9(18)	4(8)	2(4)	2(4)	(Insignificant)

mayo elbow score.

Materials and Methods:

This was a retrospective study conducted in the Department of Orthopaedics & Spine Surgery, Ghurki Trust Teaching Hospital for the patients treated for intra-articular and peri-articular fractures involving the distal humerus over 4-years (April 2015– April 2019) to measure the prospective outcome. Approval from the hospital

ethical committee was taken before conducting the study. Data were collected from 50-patients through informed consent. A total of 70-patients included in the study, from which 20-patients were lost to follow up during the study. Minimum follow up time was 3-months. The exclusion criteria of this study were patients operated with K-Wires, conventional plating, locking plate, treated not primarily in our setup and those who were managed conservatively. The study included the demographic and study variables as age, gender, side, pain, stability, motion and functional scores based on which outcome was assessed using Mayo Elbow Score classified as Excellent= >90 scores, Good = 75-90 score, Fair = 60-74 score and Poor = <60 scores. After the collection of data from respondents, data were entered and analyzed using SPSS version 22. Descriptive and Inferential statistics were applied to describe the summary of data and draw an inference based on the data. For categorical variables like gender, side, pain, stability, motion and function frequency and percentages were constructed and mean as well as standard deviation was also evaluated for continuous variables (age, functional score). A chi-square test was also applied to find the association between variables. A p-value was considered to be significant at 5% level of significance.

Before surgery, informed consent was taken from all the patients. Patients were placed in the supine position with the affected arm placed across the chest. The pneumatic tourniquet was used. Antibiotic was given 30 min before incision. A straight posterior incision with radial deviation across the tip of olecranon was used. The ulnar nerve then identified and protected. Intra-articular chevron olecranon shaped osteotomy was performed 2 cm from the tip of the olecranon in all patients. The proximal part of olecranon along with triceps was elevated upto 7 cm. The first step in fracture reduction was a reduction of the condyles and reconstruction of joint surface the next was re-attachment of condyles with humeral shaft anatomically stable fixation was achieved using recon plates. At the end of the procedure, olecranon was reduced and fixed with two 2 mm K-wires and 18 gauge tension

band wire. Tourniquet was deflated and hemostasis was secured. Hemovac drain was placed and meticulous wound closure was done. The distal humeral articular reductions and post-fixation olecranon osteotomy articular reductions were assessed for accuracy via immediate post-operative AP and lateral radiographs. An articular reduction of functional activity of elbow with a minimum follow up of 3-months was assessed.

Results:

In this study, 50-patients were confirmed diagnosed with distal humerus intra-articular fracture among these majority were males as 33(66%), and minority 17(34%) were females with an average age of 32.92 ± 9.79 years ranged from 17-65 years. The minimum follow up time was 3-months in which the mechanism of injury was RTA in the majority of cases. Mean union time among 35-patients was achieved within ten weeks while the delayed union time of 15-weeks was achieved in 15-patients. In the majority of cases, the left side (58%) was affected as compared to the right side (42%).

Table 2 reveals the distribution of patients according to function of pain intensity, motion, stability and performing usual daily living activities and working, the mean score in terms of pain intensity was 40.5 out of 45 it means (35 out of 50) patients did not feel any pain after surgical intervention, 15 reported mild pain. The mean results of motion after follow up was 17.70 out of 20; it means patients were actively doing supination and pronation function because majority 33(66%) had the arc of motion greater than 100 degree and only two patients evaluated with the arc of motion less than 50 degrees which led to immobilization. All the elbows were stable except nine because of moderate and grossly instability with a mean score of 8.9 out of 10. The mean functional result of Mayo Elbow Performance Score was 22.2 points out of 25, majority of the patients 38(76%) were able to perform all functions like (comb hair, wear, perform hygiene, button shirt, lace shoes by their own) while 12-patients were not able to perform all functions and did not do the usual daily living activities.

When the study analyzed functional outcome during prospective follow up of the patients using the Mayo Elbow Performance Score, then the mean MEPS score was 89.70 ranged from (45-100) poor to excellent. The results indicated that more half of the patients reported excellent outcome (56%) among these male patients were more satisfied after surgical intervention as 19(38%) than females 9(18%) because of high stability and mobility as compared to those group of patients with good outcome identified as 22%; 7-from males and 4-from females, 7-patients assessed with fair outcome 2-male and 2-female patients reported the poor outcome because of instability and stiffness of elbow as well could not perform daily living activities. The results also explored that the majority of the patients were satisfied after surgical intervention because of their excellent and good outcome as compared to a dis-satisfied group of patients with fair and poor results. The insignificant association was obtained between gender and functional outcome as $p\text{-value} > 0.05$. During the prospective follow-up, no patients evaluated in case of loosening of the implant and pulling out screws. There was a superficial infection in three cases which was treated with dressing and oral antibiotics. Transient neuropraxia of the ulnar nerve was observed in two cases which recovered completely with only observation. (table-3) using the Mayo Elbow Score. Data about complications were also recorded.

Discussion:

A distal humerus fracture is one of the most difficult fractures to deal with even, the most experienced surgeon face challenge to deal with these fractures in terms of fixation and reduction.^{1,5,16} Both conservative and operative treatment options are valid options but open reduction and internal fixation with anatomical articular congruity is the gold standard. Any articular fracture demands anatomical reduction, stable fixation, and early mobilization.⁵

Various surgical exposures are available to treat these difficult fractures but posterior approach through olecranon osteotomy is the most commonly used.^{3,4,9,16}



Figure 1: Pre-op



Figure 2: Pre-Op



Figure 2: Pre-Op



Figure 4 Post-Op after three months



Figure 5(a): Representing the Functional outcome of the patient



Figure 5(b): Representing the Functional outcome of the patient



Figure 5(c): Representing the functional outcome of the patient

Elbow joint poorly tolerates immobilization, therefore it is highly recommended to mobilize the elbow as early as possible subjective to bone quality, comminution and stable fixation.^{17,18}

Yılmaz & Bulut conducted a study in 2009 to assess the functional outcome and management of intra-articular distal humerus fracture treated by olecranon osteotomy. In this study, excellent and good results of functional outcome were found in 76% of their cases, and 24% of cases reported the fair and poor outcome.¹⁹

Mang et al., (2014) aimed to analyze the functional outcome of elbow reconstruction after using pre-contoured locking compression plate and reported the results using Mayo Elbow

Score that majority 80% patients reported the excellent(48%) and good (32%) outcome while 20% were found with functional outcome of fair(12%) and poor(8%).²⁰

In our study, Excellent outcome was found in 26(56%), good in 11(22%), fair in 7(14%) and poor in 4(8%). Among these, 35(70%) patients had no pain, 33(66%) had an arc of motion greater than 100 degrees. 82% of patients had stable elbow, while 76% performed all activities of daily living using the Mayo Elbow Performance Score.

Conclusion:

We conclude that the use of elbow reconstruction for the fixation of complex intra or extra-articular fracture is a safe and effective surgical procedure for early recovery and stabilization because of good functional outcome. The complication was found less with adequate healing. In conclusion, treatment of distal intra-articular fracture demands anatomic reduction, stable fixation and early mobilization.

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Role and contribution of authors:

Dr Rafi Ullah, conceptualization, Methodology, Investigation.

Dr Javed Iqbal, did the initial writeup draft.

Dr Anwar Imran, did data collection.

Dr Ashfaq Ahmed, did data and reference collection.

Dr Muhammad Imran Javed, critically review the article.

Sadaf Saddiq, did collection of data and data analysis.

Dr Naeem Ahmed, critically review the article, and made final changes.

References:

1. Gupta R. Intercondylar fractures of the distal humerus in adults. *Injury*. 1996 Oct 1;27(8):569-72.
2. Henley MB. Intra-articular distal humeral fractures in adults. *The Orthopedic clinics of North America*. 1987 Jan;18(1):11-23.
3. Ring D, Jupiter JB. Fractures of the distal humerus. *Orthopedic Clinics*. 2000 Jan 1;31(1):103-13.
4. Kinik H, Atalar H, Mergen E. Management of distal humerus fractures in adults. *Archives of orthopaedic and trauma surgery*. 1999 Nov 1;119(7-8):467-9.
5. Södergård J, Sandelin J, Böstman O. Postoperative complications of distal humeral fractures: 27/96 adults followed up for 6 (2-10) years. *Acta orthopaedica Scandinavica*. 1992 Jan 1;63(1):85-9.
6. Ziran BH, Smith WR, Balk ML, Manning CM, Agudelo JF. A true triceps-splitting approach for the treatment of distal humerus fractures: a preliminary report. *Journal of Trauma and Acute Care Surgery*. 2005 Jan 1;58(1):70-5.
7. Kundel K, Braun W, Wieberneit J, Rüter A. Intraarticular distal humerus fractures: factors affecting the functional outcome.

8. Zhao J, Wang X, Zhang Q. Surgical treatment of comminuted intra-articular fractures of the distal humerus with double tension band osteosynthesis. *Orthopedics*. 2000 May 1;23(5):449-52.
9. Pollock JW, Faber KJ, Athwal GS. Distal humerus fractures. *Orthopedic Clinics of North America*. 2008 Apr 1;39(2):187-200.
10. Helfet DL, Schmeling GJ. Bicondylar intraarticular fractures of the distal humerus in adults. *Clinical orthopaedics and related research*. 1993 Jul(292):26-36.
11. O'Driscoll SW. The triceps-reflecting anconeus pedicle (TRAP) approach for distal humeral fractures and non-unions. *Orthopedic Clinics*. 2000 Jan 1;31(1):91-101.
12. Theivendran K, Duggan PJ, Deshmukh SC. Surgical treatment of complex distal humeral fractures: functional outcome after internal fixation using pre-contoured anatomic plates. *Journal of shoulder and elbow surgery*. 2010 Jun 1;19(4):524-32.
13. Zalavras CG, McAllister ET, Singh A, Itamura JM. Operative treatment of intra-articular distal humerus fractures. *AMERICAN JOURNAL OF ORTHOPEDICS-BELLE MEAD*. 2007 Dec;36(12):8.
14. Self J, Viegas SF, Buford Jr WL, Patterson RM. A comparison of double-plate fixation methods for complex distal humerus fractures. *Journal of shoulder and elbow surgery*. 1995 Jan 1;4(1):10-6.
15. Letsch R, Schmit-Neuerburg KP, Stürmer KM, Walz M. Intraarticular fractures of the distal humerus. Surgical treatment and results. *Clinical orthopaedics and related research*. 1989 Apr(241):238-44.
16. Aitken GK, Rorabeck CH. Distal humeral fractures in the adult. *Clinical orthopaedics and related research*. 1986 Jun(207):191-7.
17. Archdeacon MT. Combined olecranon osteotomy and posterior triceps splitting approach for complex fractures of the distal humerus. *Journal of orthopaedic trauma*. 2003 May 1;17(5):368-73.
18. Wilkinson JM, Stanley D. Posterior surgical approaches to the elbow: a comparative anatomic study. *Journal of shoulder and elbow surgery*. 2001 Jul 1;10(4):380-2.
19. Outcomes of the distal intraarticular humeral fractures treated by olecranon osteotomy Distal humerus eklemler kırıklarının olecranon osteotomilerinin sonuçları Erhan Yılmaz, Mehmet Bulut
20. Mang I, Taufiq I, Najjad MK, Iqbal MN. Functional outcome of elbow reconstruction after using pre-contoured Locking Compression Plate. *Journal of Pakistan Orthopaedic Association*. 2014 Mar 3;26(1).