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ASSESSMENT OF THE OUTCOMES RELATED TO THE FUNCTION FOLLOWING OSTEOSYNTHESIS IN THE ADULT DISTAL HUMERUS INTERCONDYLAR FRACTURE TREATED WITH PRE-CONTOURED COMPRESSION PLATES: A CLINICAL STUDY

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ABSTRACT

Background: To restore the acceptable and painless function of the elbow following distal humerus fracture, stable internal fixation of fracture segment and restoring the actual geometric pattern of the distal humerus is vital. This helps in complete and early rehabilitation.

Aims: The present study was conducted to assess the associated complications and the functional outcomes in distal humerus fracture managed with an anatomically pre-contoured locking plate system.

Materials and Methods: The study included a total of 20 subjects from both the gender, within the age range of 18-68 years and the mean age of 50.4±3.68 years. 20 subjects with AO type C distal humerus fracture treated with anatomically pre-contoured locking plate system. Following surgery, the subjects were assessed at 1 day, 3 weeks for 3 months followed by 6 weeks for the next 6 months, and then at 3 months interval. The final results were evaluated at 1 year. The results were assessed following Mayo elbow performance scoreand the results were formulated.

Results: Excellent result was seen in 35% (n=7) study subjects with the range of motion as 118.15±10.65, good in 50% (n=10) study subjects with a range of motion as 108.35±4.90, the fair result was evaluated in 10% (n=2) study subjects where the range of the motion was 100.02±8.14, and poor in one subject with a mean range of motion as 70.02±0. No complication was seen in 65% (n=13) of subjects following surgery. Superficial infection was seen in the highest proportion in 15% (n=3) of study subjects followed by ulnar neuropathy in 10% (n=2) subjects. Both Stiffness and implant loosening were seen in 5% (n=1) of study subjects.

Conclusion: The present study concludes that treating distal humerus fractures using anatomically pre-contoured locking plates in open reduction and internal fixation approach is an efficacious method resulting in clinically acceptable functional outcomes.

Keywords: Humerus fracture, intercondylarhumerus fracture, pre-contoured compression plates, fracture treatments

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INTRODUCTION

Among all the elbow fractures reported and treated. Fracture of the distal humerus is shown to have an incidence ranging from 0.5% to 7% approximately. These fractures of the distal humerus when treated conservatively, are associated with deformities and functional impairments, whereas, owing to the associated osteoporosis and fracture complexity, achieving stable internal fixation is quite difficult in distal humerus fracture. Satisfactory results in the distal humerus fracture can be obtained with early mobilization, adequate stabilization, and acceptable anatomic alignment.[1]

Difficulty in treating the distal humerus fractures are contributed by less soft tissue envelope, the proximity of neurovascular architecture, and anatomical complexity of elbow joint. Earlier, before the 1970s, the focus was more on the conservative treatment of humerus fracture using olecranon traction or using the plaster. Conservative treatment resulted in poor functional outcomes and stiffness. To restore the acceptable and painless function of the elbow following distal humerus fracture, stable internal fixation of fracture segment and restoring the actual geometric pattern of the distal humerus is vital. This helps in complete and early rehabilitation.[2]

Previous literature data suggests acceptable results in the majority of distal humerus cases treated with open reduction and internal fixation. The complex anatomy and stability lack in distal humerus fracture helped in developing pre-shaped implants following the anatomy that showed clinically acceptable results.[3]However, the complication rates are significantly higher with anatomically pre-shaped implants. Recently, a locking compression plate system is introduced for distal humerus fracture, which is angular stable and anatomically pre-contoured allowing double plate osteosynthesis with distal screw option. These plates have added advantages of application ease and increased stability. These plates have also proved to be advantageous in cases with reduced bone density, as shown in the previous studies.[4]

Lately, previous literature work has shown that open reduction and internal fixation in distal humerus fracture using anatomically pre-contoured plates is an efficacious method with clinically acceptable results. However, the data showing its efficacy is scarce in the literature. Hence, the present study was conducted to assess the associated complications and the functional outcomes in distal humerus fracture managed with an anatomically pre-contoured locking plate system.

MATERIALS AND METHODS

The present observational clinical trial was conducted to assess the associated complications and the functional outcomes in distal humerus fracture managed with an anatomically pre-contoured locking plate system. The study was conducted at Department Of Orthopedics, ShaheedHasan Khan Mewati, Government Medical College, Nalhar, Nuh, Haryana from January 2020 to August 2021, after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects visiting the Department of Orthopaedics with the AO type fracture of the distal humerus. The study included a total of 20 subjects from both the gender, within the age range of 18-68 years and the mean age of 50.4±3.68 years.

The inclusion criteria for the study were subjects with AO type C distal humerus fracture treated with anatomically pre-contoured locking plate system, subjects who were matured skeletally, subjects with no contraindication to anesthesia or surgery, and the subjects who were willing to participate in the study. The exclusion criteria were the subjects with undisplaced fractures, open fractures, subjects who did not attain skeletal maturity, pathologic fractures, fractures with incorporated neurovascular deficits, fractures comminuted grossly, and the subjects who were not willing to participate in the study.

After explaining the detailed study design to the subjects, they were finally included in the study. Following inclusion, detailed history and severity of the trauma were assessed by patients/caretakers (whichever was applicable). This was followed by a detailed clinical assessment by an examiner expert in the field. Lateral and AP view of the elbow was assessed radiographically for AO classification of fracture. The limb was then immobilized in an arm-pouch and elbow slab. The pre-anesthetic evaluation was done before the surgery followed by obtaining consent. Open reduction and internal fixation were done under general anesthesia with anatomically pre-contoured locking plates. After surgery, physiotherapy was done following the protocol for assessing functional outcomes. Following surgery, the subjects were assessed at 1 day, 3 weeks for 3 months followed by 6 weeks for the next 6 months, and then at 3 months interval. The final results were evaluated at 1 year.

Using the brachial block technique, the trans olecranon approach was used for reduction and fixation of the condyles using 3.5mm anatomically pre-contoured locking plates using a 4mm screw (Figure 1). Through the elbow range of the motion, the stability of the internal fixation was assessed. The results were assessed following Mayo elbow performance score[5]bases on 100 units, where 45 units alone are assigned to the pain. The collected data were subjected to evaluation and the results were formulated. The data were expressed as percentages and numbers.

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RESULTS

The present observational clinical trial was conducted to assess the associated complications and the functional outcomes in distal humerus fracture managed with an anatomically pre-contoured locking plate system. The study included a total of 20 subjects from both the gender, within the age range of 18-68 years and the mean age of 50.4±3.68 years. The demographic characteristics of the study subjects are depicted in Table 1. There were 10% (n=2) subjects in age group of <30 years, 15% (n=3) in 31-40 years, 5% (n=1) in 41-50 years, 55% (n=11) in 51-60 years, and 15% (n=3) in >60 years. The majority of subjects were in the age range of 51-60 years. There were 45% (n=9) males and 55% (n=11) females in the present study. Left side distal humerus fracture was seen in 60% (n=12) subjects and right side in 40% (n=8) subjects. Non-dominant extremity fracture was seen in 5% (n=1) subject. The fracture cause was direct fall in 55% (n=11) and Road traffic accident in 45% (n=9) subjects. Fracture AO type C1, AO type C2, and AO type C3 fracture was seen in 30% (n=6), 45% (n=9), and 25% (n=5) subjects respectively. Associated injuries were seen in 20% (n=4) subjects. Mean fracture union time was 12.54±2.12 weeks.

The study results based on Mayo Elbow performance scores (MEPS) were also evaluated following fracture treatment with anatomically pre-contoured locking plates. It was seen that excellent result was seen in 35% (n=7) study subjects with the range of motion as 118.15±10.65. The result was good as MEPS in 50% (n=10) of study subjects with a range of motion as 108.35±4.90. The fair result was evaluated in 10% (n=2) of study subjects where the range of the motion was 100.02±8.14. Following MEPS, the result was poor in one subject with a mean range of motion of 70.02±0. It was seen that the range of motion decreased with poor results from excellent to good to fair and was least in poor (Table 2). The mean MEP score in the study subjects was found to be 82.4±11.97.

The present study also assessed the complications encountered in the study subjects following the surgery. It was seen that no complication was seen in 65% (n=13) subjects following surgery. Superficial infection was seen in the highest proportion in 15% (n=3) of study subjects followed by ulnar neuropathy in 10% (n=2) subjects. Both Stiffness and implant loosening were seen in 5% (n=1) of study subjects each as shown in Table 3.

Characteristic	**Percentage (%)**	**Number (n)**
Mean age (years)	50.4±3.68	
Age range (years)	18-68	
<30	10	2
31-40	15	3
41-50	5	1
51-60	55	11
>60	15	3
Gender		
Males	45	9
Females	55	11
Distal humerus fracture side		
Left	60	12
Right	40	8
Non-dominant extremity fracture	5	1
Fracture cause		
Direct fall	55	11
Road Traffic accident	45	9
Fracture type		
AO type C1	30	6
AO type C2	45	9
AO type C3	25	5
Associated Injuries	20	4
Mean fracture union time (weeks)	12.54±2.12	

Table 1: Demographic and disease characteristics of the study subjects

Results based of MEPS	**Percentage (%)**	**Number (n)**	**Range of Motion**
Excellent	35	7	118.15±10.65
Good	50	10	108.35±4.90
Fair	10	2	100.02±8.14
Poor	5	1	70.02±0

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Table 2: Comparison of the results based on MEPS to the range of motion in the study subjects

Complication Encountered	Percentage (%)	Number (n)
None	65	13
Ulnar Neuropathy	10	2
Stiffness	5	1
Superficial infection	15	3
Implant Loosening	5	1

Table 3: Complications following surgery in the study subjects

Figure 1: Preoperative and postoperative radiographs showing distal humerus fracture management using anatomically pre-contoured mechanical plates

DISCUSSION

The present study included a total of 20 subjects from both the gender, within the age range of 18-68 years and the mean age of 50.4±3.68 years. There were 10% (n=2) subjects in age group of <30 years, 15% (n=3) in 31-40 years, 5% (n=1) in 41-50 years, 55% (n=11) in 51-60 years, and 15% (n=3) in >60 years. The majority of subjects were in the age range of 51-60 years. There were 45% (n=9) males and 55% (n=11) females in the present study. Left side distal humerus fracture was seen in 60% (n=12) subjects and right side in 40% (n=8) subjects. Non-dominant extremity fracture was seen in 5% (n=1) subject. The fracture cause was direct fall in 55% (n=11) and Road traffic accident in 45% (n=9) subjects. Fracture AO type C1, AO type C2, and AO type C3 fracture was seen in 30% (n=6), 45% (n=9), and 25% (n=5) subjects respectively. Associated injuries were seen in 20% (n=4) subjects. Mean fracture union time was 12.54±2.12 weeks. These demographics were comparable to the studies by Ring D et al[6] in 2000 and Nauth A et al[7] in 2011 where authors used the comparable study population in demographics as the present study.

The study results based on Mayo Elbow performance scores (MEPS) were also evaluated following fracture treatment with anatomically pre-contoured locking plates. It was seen that excellent result was seen in 35% (n=7) study subjects with the range of motion as 118.15±10.65. The result was good as MEPS in 50% (n=10) of study subjects with a range of motion as 108.35±4.90. The fair result was evaluated in 10% (n=2) of study subjects where the range of the motion was 100.02±8.14. Following MEPS, the result was poor in one subject

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with a mean range of motion of 70.02±0. It was seen that the range of motion decreased with poor results from excellent to good to fair and was least in poor. The mean MEP score in the study subjects was found to be 82.4±11.97. These results were in agreement with the studies by Erpelding JM et al[8] in 2012 and Tian D et al[9] in 2013 where authors reported comparable range of motion and functional outcome in their study.

The present study also assessed the complications encountered in the study subjects following the surgery. It was seen that no complication was seen in 65% (n=13) subjects following surgery. Superficial infection was seen in the highest proportion in 15% (n=3) of study subjects followed by ulnar neuropathy in 10% (n=2) subjects. Both Stiffness and implant loosening were seen in 5% (n=1) study subject each. These findings were consistent with the findings of Liu JJ et al[10] in 2009 and BabhulkarS et al[11] in 2011 wheresimilar postoperative complications were reported by the authors as in the present study.

CONCLUSION

Within its limitations, the present study concludes that treating distal humerus fractures using anatomically pre-contoured locking plates in open reduction and internal fixation approach is an efficacious method resulting in clinically acceptable functional outcomes. This method allows active and early mobilization with the majority of good and excellent results with minimal complications. Hence, this method should be employed with early active movement and counseling to motivate subjects. However, the present study had few limitations including smaller sample size, descriptive design, geographical area biases, recall bias, and single-institution nature. Hence, more longitudinal and prospective studies with larger sample sizes, and longer monitoring periods are needed to reach a definitive conclusion.

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