

Original article:

Analysis of Outcome of Precontoured Locking Plate Fixation in Distal Humerus Fractures: A Prospective Study

Dipesh Kumar¹, Rahul Bhardwaj¹

¹Senior Resident, Department of Orthopaedics, Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi, India.

Corresponding Author: Dr. Rahul Bhardwaj, Senior Resident, Department of Orthopaedics, VMMC & Safdarjung Hospital, New Delhi, India.



Abstract

Background: In the literature, several methods of open reduction and internal fixation through different approaches have been described for treating patients with distal humerus fractures. The precontoured locking plates are designed as per the anatomy of the distal humerus and their use will be helpful to achieve the perfect anatomical reduction. Hence; the present study was conducted for assessing the outcome of precontoured locking plate fixation in distal humerus fractures.

Materials & Methods: A total of 20 patients with fracture of distal end humerus were enrolled in the present study. In the emergency department, first aid treatment was provided in the form of back splintage, analgesics, antibiotics and antiseptic dressing. Under general anaesthesia/ brachial block /regional anaesthesia, under all aseptic conditions proper painting and draping was done. In all the patients, Precontoured locking plate fixation was done under the hands of skilled and experienced orthopaedic surgeons. Follow-up was done and both clinical examinations of all the patients were done. Results were assessed according to Mayo elbow performance index. All the results were summarized in Microsoft excel sheet and were analysed by SPSS software.

Results: Excellent results were found to be present in 65 percent of the patients while good results were obtained in 25 percent of the patients. Mean time for complete radiologic union was 12.88 weeks. Superficial infection and skin necrosis were found to be present in 1 patient each.

Conclusion: In treating patients with distal humerus fractures, Precontoured plate fixation provides excellent results.

Key words: Humerus, Precontoured Plating.

INTRODUCTION

Recent advances in industrialization, increase in number of automobiles and fast track life style have led to many fold increase in road traffic and industrial accidents, involving bony injury in form of fracture of bones which may range from closed to open or segmental to highly comminuted fractures. Fracture of distal humerus is no exception. The fracture distal end of humerus is probably caused by the impact of the ulna in the trochlear groove, acting as a wedge, forcing the condyles of distal humerus apart.¹⁻³

One of the most disastrous consequences following internal fixation for such fractures is iatrogenic neurological injury. As such the operative surgeon must have intimate knowledge of the course and relations of the adjacent nervous structures; namely the radial and ulnar nerves.⁴

In the literature, several methods of open reduction and internal fixation through different approaches have been described. All the surgical methods have some limitations to achieve perfect anatomical reduction due to the complex anatomy of the lower end of humerus. The precontoured locking plates are designed as per the anatomy of the distal humerus and their use will be helpful to achieve the perfect anatomical reduction.⁵⁻⁷ Hence; the present study was conducted for assessing the outcome of precontoured locking plate fixation in distal humerus fractures.

MATERIALS & METHODS

The present study was commenced in the Department of Orthopaedics, Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi (India) and it included assessment of outcome of precontoured locking plate fixation in distal humerus fractures. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol. A total of 20 patients with fracture of distal end humerus were enrolled in the present study. In the emergency department, first aid treatment was provided in the form of back splintage, analgesics, antibiotics and antiseptic dressing. This was followed by stitching of wound was done. Complete history of patients including the mode of injury was taken. General physical examination and local examination was done. Under general anaesthesia/ brachial block /regional anaesthesia, under all aseptic conditions proper painting and draping was done. In all the patients, Precontoured locking plate fixation was done under the hands of skilled and experienced orthopaedic surgeons. Follow-up was done and both clinical examinations of all the patients were done. Results were assessed according to Mayo elbow performance index. According to this index, score of 90 or more was classified as excellent, score between 75 to 89 was classified as Good, Score between 60 and 74 was classified as Fair and score of less than 60 was classified as poor. All the results were summarized in microsfot excel sheet and were analysed by SPSS software. Chi- square test and student t test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

In the present study, mean age of the patients was found to be 54.8 years. 60 percent of the patients were found to be within the age group of 51 to 60 years. 80 percent of the patients were males while the remaining were females. Mean duration of surgery was found to be 118.5 minutes. In the present study, excellent results were found to be present in 65 percent of the patients while good results were obtained in 25 percent of the patients. Mean time for complete radiologic union was 12.88 weeks. Superficial infection and skin necrosis were found to be present in 1 patient each.

Table 1: Age-wise distribution of patients

Age group	n	%
18 to 30	2	10
31 to 40	1	5
41 to 50	5	25
51 to 60	12	60
Total	20	100
Mean age (years)	54.8	

Table 2: Gender-wise distribution

Gender	n	%
Males	16	80
Females	4	20
Total	20	100

Table 3: Duration of surgery

Duration of surgery (Minutes)	Precontoured plating
Mean	118.5
SD	5.69

Table 4: Mayo elbow performance score grading

Mayo elbow performance score grading	Precontoured plating	
	n	%
Excellent	13	65
Good	5	25
Fair	2	10
Poor	0	0
Total	20	100

Table 5: Time for complete radiographic union (weeks)

Time for complete union	Number
Mean (weeks)	12.88
SD	5.13

Table 6: Incidence of postoperative complications

Postoperative complications	n	%
Superficial infection	1	5
Skin necrosis	1	5
Absent	18	90

DISCUSSION

The distal humerus is involved in two joints: the ulno-humeral, which allows for flexion and extension of the elbow, and the radio-capitellar, which allows forearm rotation that is pronation and supination. The ulno humeral joint is essentially a hinge variety of synovial joint, whose axis of rotation lies in 3° to 9° of external rotation and 4° to 8° of valgus in relation to the humeral shaft, which contributes to the carrying angle of the elbow. The trochlea forms the center of the hinge and is supported by the medial and lateral columns; it has a 300° arch of cartilage, which leads to the highly constrained association with the olecranon, thus providing the bony stability of the elbow. Distal humerus fractures typically present in a bimodal distribution as either

younger males or elderly females. These fractures can be very challenging to manage, as they often can involve an articular as well as a diaphyseal component.⁸⁻¹⁰ Hence; the present study was conducted for assessing the outcome of precontoured locking plate fixation in distal humerus fractures.

In the present study, mean age of the patients was found to be 54.8 years. 60 percent of the patients were found to be within the age group of 51 to 60 years. 80 percent of the patients were males while the remaining were females. Mean duration of surgery was found to be 118.5 minutes. Hungerer S et al investigated hypothesis that in current anatomical precontoured plates, angular stability plays only a minor role for the efficacy of the osteosynthesis at the distal humerus. An AO C2.3 fracture model was simulated and osteosynthesis performed with plates positioned in parallel. System rigidity and median fatigue limit were analyzed in artificial bones and the cycles to failure in cadaver specimens. Loads were applied in anterior-posterior direction (75° flexion) and axial direction (5° flexion). Four composite bone groups were investigated as follows: (1) 2.7 mm polyaxial locking screws, (2) 3.5 mm polyaxial locking screws, (3) 3.5 mm polyaxial locking screws and a gap bridging screw, and (4) 2.7 mm nonlocking screws. Two cadaver groups were investigated with 3.5 mm diameter polyaxial locking (5) versus nonlocking screws (6). There were no differences in stiffness found between the locking versus nonlocking constructs in artificial (1) versus (4) and in cadaver bones (5) versus (6). The larger screw diameter of 3.5 mm in combination with a gap bridging screw significantly increased construct stiffness by 25% (3). The median fatigue limit was significantly increased using larger screw diameters (2) and a gap bridging screw (3). In cadaver bones, the polyaxial locking screws constructs (5) resisted higher peak loads and more cycles until failure compared with nonlocking constructs (6). They concluded that system stiffness increases with larger screw diameters and becomes significant with additional gap bridging screws in artificial bones. The use of polyaxial locking screws in anatomical adapted plates becomes more important in poor bone quality.¹¹

In the present study, excellent results were found to be present in 65 percent of the patients while good results were obtained in 25 percent of the patients. Mean time for complete radiologic union was 12.88 weeks. Superficial infection and skin necrosis were found to be present in 1 patient each. Sarkhel S et al determined the outcome of treating these fractures with technique of condylar orientation precontoured plating. The principle of the technique is to primarily restore the anatomical orientation of the reconstructed distal humeral condyle with the diaphysis of the humerus apart from anatomical reduction of fracture. Seventy one consecutive patients with comminuted intraarticular adult distal humerus fractures were treated with the condylar orientation plates, which were specifically designed between 1999 and 2009. 43 fractures were Association for osteosynthesis (AO) type C3, 24 were C2 and 4 were C1. Six were open cases and two were of nonunion distal end humerus. On medial and posterolateral side of the distal humerus, precontoured Sherman plates were applied. Patients were followed up for a mean of 3 years. They were assessed clinically (using mayo elbow performance score [MEPS]) and radio-graphically. Sixty (84.5%) patients regained MEPS of 90 or more that is an excellent result (range of movement and functional status). One patient had nonunion with implant failure, and two patients developed heterotopic ossification. The mean MEPS was 95. Average extension and flexion was 15° and 133°. The result was graded as excellent in 60, good in 7, fair in 3 and poor in 1. At the time of most recent followup, 63 elbows were painless, and eight had mild pain. They concluded that excellent pain free range of motion with a high rate of union can be achieved in comminuted intraarticular distal humerus fractures in adults with the use of condylar

orientation precontoured plating technique. Condylar orientation is very important with perfect articular congruity in elbow motion.¹²

CONCLUSION

From the above results, the authors concluded that in treating patients with distal humerus fractures, Precontoured plate fixation provide excellent results. However; further studies are recommended.

REFERENCES

1. Galano GJ, Ahmad CS, Levine WN. Current treatment strategies of bicolunar distal humerus fractures J AM Acad Orthop Surg.2010;18:20-30
2. Jupiter JB, Mehne DK: Fractures of the distal humerus. Orthopedics 1992;15:825-833.
3. Niemann KM. Condylar fractures of the distal humerus in adults. Berlin: Springer-Verlag 1991:411-452.
4. Jupiter JB, Neff U, Holzach P, Allgöwer M. Intercondylar fractures of the humerus. An operative approach. J Bone Joint Surg Am. 1985 Feb;67(2):226-39.
5. Robinson C, Hill R, Jacobs N, Dall G, Court-Brown C. Adult Distal Humeral Metaphyseal Fractures: Epidemiology and Results of Treatment. J Orthop Trauma. 2003; 17(1):38-47.
6. Mark F, Herscovici A, DiPasquale D, Thomas G, Matthew VB. A Comparison of Open Reduction and Internal Fixation and Primary Total Elbow Arthroplasty in the Treatment of Intraarticular Distal Humerus Fractures in Women Older Than Age 65. J Orthop Trauma: August 2003; 17(7): 473-80.
7. Korner J, Lill H, Müller LP, Hessmann M, Kopf K, Goldhahn J et al. Distal humerus fractures in elderly patients: results after open reduction and internal fixation. Osteoporos Int. 2005 Mar;16 Suppl 2:S73-9.
8. Arnander, Reeves M, MacLeod A, Pinto I, Khaleel T, Arshad. A Biomechanical Comparison of Plate Configuration in Distal Humerus Fractures. J Orthop Trauma. 2018; 22: 332-6.
9. Shin SJ, Sohn HS, Do NH. A clinical comparison of two different double plating methods for intraarticular distal humerus fractures. J Shoulder Elbow Surg. 2010 ;19(1):2-9.
10. Babhulkar S, Babhulkar S. Controversies in the management of intra-articular fractures of distal humerus in adults. Indian J Orthop 2011;45:216-25.
11. Hungerer S, Wipf F, von Oldenburg G, Augat P, Penzkofer R. Complex distal humerus fractures-comparison of polyaxial locking and nonlocking screw configurations-a preliminary biomechanical study. J Orthop Trauma. 2014 Mar;28(3):130-6.
12. Sarkhel S, Bhattacharyya S, Mukherjee S. Condylar orientation plating in comminuted intraarticular fractures of adult distal humerus. Indian J Orthop 2015;49:523-8.

Date of Submission: 14 June 2020

Date of Peer Review: 10 July 2020

Date of Acceptance: 28 Aug 2020

Date of Publishing: 15 September 2020

Author Declaration: Source of support: Nil, Conflict of interest: Nil

Ethics Committee Approval obtained for this study? YES

Was informed consent obtained from the subjects involved in the study? YES

For any images presented appropriate consent has been obtained from the subjects: YES

Plagiarism Checked: YES

Author work published under a Creative Commons Attribution 4.0 International License



Creative Commons Attribution

CC BY 4.0

DOI: 10.36848/IJBAMR/2020/18215.55598