

Functional Outcome of Bicolumnar Plating in Distal Humerus Fracture

Bhattachan S*, Gupta AK*, Hamal B**, Adhikari BR***

*Orthopaedics surgeon, Department of Orthopedics and Trauma Surgery, National Academy of Medical Sciences, National Trauma Center, Kathmandu, Nepal, **Assistant Professor, Department of Orthopedics and Trauma Surgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal, ***Associate Professor, Department of Orthopedics and Trauma surgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal

ABSTRACT

INTRODUCTION: Surgical reconstruction of intraarticular distal humerus fracture imposes a challenge to orthopedics surgeon. Stable fixation and anatomical joint restoration are crucial factors for optimal outcome of elbow joint. The purpose of this study was to evaluate the functional outcome of bicolumnar plating in distal humerus intraarticular fracture.

METHOD: This was a prospective analytical study of 30 patients with Type C distal humerus fractures fixed with orthogonal plating at National Academy of Medical Sciences, National Trauma Center. Functional outcome using Mayo Elbow Performance Index (MEPI) Score and the complications were noted.

RESULT: Eight (26.6%) fractures were C1, 12 (40%) were C2 and 10 (33.3%) were C3 according to AO/OTA classification. Mean duration of follow up was 6 months. Mean flexion extension arc was 90.66 ± 21.32 degrees with mean block to extension of 21.33 ± 10.41 degrees. Overall, C1/C2 and C3 MEPI scores were 80.33 ± 11.29 , 85 ± 8.58 and 71 ± 10.48 respectively ($P=0.002$). Functional outcome was graded as excellent in 6 (20%) patients and good in 18 (60%) patients. Minor complications were seen in 10 patients.

CONCLUSION: Bicolumnar plating in orthogonal configuration can provide anatomical reconstruction and stable fixation of type C distal humerus fractures and allow early mobilization of elbow after surgery. Most patients have a high level of satisfaction.

KEY WORDS: Bicolumnar Plating, Mayo Elbow Performance Index Score, Orthogonal.

INTRODUCTION

Distal humerus fractures represent 2% of all fractures in adult population.¹ The primary goal in management of intraarticular fractures of distal humerus is to achieve stable and mobile elbow. Prolonged immobilization of the elbow predisposes to joint stiffness, muscle atrophy and permanent functional impairment. Therefore, consensus has shifted towards treating these fractures with open reduction and stable fixation so as to restore

painless and satisfactory elbow function by early mobilization.²

Surgical reconstruction of intraarticular distal humerus fracture imposes a challenge to even an experienced surgeon as it is complicated by complex anatomy of elbow, its small area of fixation, associated comminution and osteopenia of articular surfaces.³ Single column plating does not provide stable construct for comminuted distal humerus fractures as compared to the double column plating methods.⁴ Double column plating is currently the established technique for the intraarticular fractures of distal humerus based on the various clinical and biomechanical studies.⁵ Dual plating technique is either orthogonal where one plate is placed in medial column and the other plate is placed in posterolateral column or parallel configuration with placement of plates on both medial

Correspondence :

Dr. Sijan Bhattachan
Orthopaedics Surgeon
Department of Orthopedics and Trauma Surgery
National Academy of Medical Sciences
National Trauma Center, Kathmandu, Nepal
Email: sijanbt@gmail.com

and lateral column. Even though controversies exist regarding the position of dual plating, there is no significant difference in functional outcome between these two techniques.⁶

Functional outcome of surgery depends on comminution of fracture, quality of bone, associated swelling around elbow joint, stability of fracture fixation, attitude of patients, regular physiotherapy, associated myositis ossificans and even age of the patients. The aim of this study was to evaluate functional results, complications and associated risk factors for optimal results after osteosynthesis of distal humerus Arbeitsgemeinschaft für Osteosynthesefragen/ Orthopedic Trauma Association (AO/OTA) Type C fractures with dual plating system. To appreciate functional outcome, Mayo Elbow Performance Index (MEPI) score was used in this study.

METHOD

It was a prospective observational study conducted at National Trauma Center and Bir Hospital, Kathmandu from August 2017 to July 2018, after approval from Institutional Review Board of National Academy of Medical Sciences (NAMS).

All men and women of age more than 18 years with AO Type C distal humerus fracture were included in the study after taking informed consent. Pathological, open, fracture with neurovascular compromise and those with comorbidities and contraindications to anaesthesia were excluded from the study.

Patients who met the criteria were enrolled in the study. Fractures were subclassified as Types C1 (complete articular with no comminution), C2 (articular with metaphyseal comminution) and C3 (articular comminution). Surgeries were performed by trained orthopaedics surgeons under regional anaesthesia in lateral decubitus position. Under tourniquet control, midline posterior skin incision was made. Subcutaneous tissues were dissected. Ulnar nerve was identified on medial aspect and was protected. Then the distal humerus was approached through either triceps splitting approach or olecranon osteotomy

approach. The intra articular fragments were first of all reduced and provisionally fixed with K wires followed by fixation with partially threaded cannulated screws to convert the complicated intercondylar fractures to supracondylar variety. The reduced articular fragment was then fixed to the shaft of humerus. When satisfactory reduction was achieved, definitive fixation was performed by orthogonal plating system using locking plates where one plate was put on medial column and another plate on the posterolateral column of distal humerus. Skin was closed after applying the closed suction drain.

A posterior slab was applied at the time of surgery which was removed 3 days after surgery. Passive mobilization exercise was started while a full range of active and passive exercises were started after removal of suture.

Patients were followed up in OPD at 2 weeks, 6 weeks, 3 months and 6 months. The functional results of elbow were assessed by MEPI score and total range of motion of elbow at 6 months.

The variables included in MEPI were Pain, Range of motion, Stability and Function. Total points were 100. Outcome was graded as excellent if total score was between 90-100, good if 75-89, fair if 60-74 and poor if <60.

Statistical analysis was performed using statistical package for the social sciences (SPSS) version 11.5 software package.

RESULT

Out of 30 patients, 12 (40%) were male and 18 (60%) were female. Patients were from 20 to 70 years of age with a mean age of 47.6 years. Majority of cases were due to Road Traffic Accident comprising 18 (60%) cases. Nine cases (30%) were due to fall injury and remaining 3 (10%) were due to physical assault. Twelve (40%) cases were of Type C2, 10 (33.3%) cases were Type C3 and 8 (26.6%) cases were Type C1. Mean time from injury to surgery was 3.83±1.23 days with ranging from 2 to 7 days.

Table 1: Variables according to fracture type

	Type C1/C2	Type C3	Overall	P value
MEPI score	85 ± 8.58	71 ± 10.48	80.33 ± 11.20	0.002
Flexion to extension	97 ± 21.29	78 ± 15.49	90.66 ± 21.32	0.01
Block to extension	20 ± 11.23	24 ± 8.43	21.33 ± 10.41	0.28

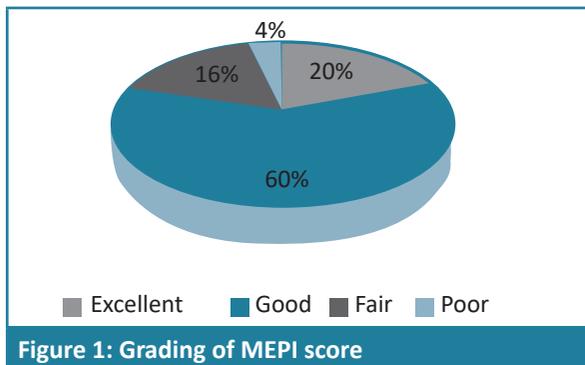


Figure 1: Grading of MEPI score

The mean MEPI score in age group <60 years was 82.29 ± 10.2 and that in >60 years was 72.5 ± 12.94 . Six (20%) patients were graded as excellent, 18 (60%) patients were graded as good, 5 (16.7%) were graded as fair and 1 (3.3%) was graded as poor.

Table 2: Comparison of functional outcome with similar studies

Study	N	Flexion to extension	Block to extension	Supination to pronation	MEPI score
Sanchez-Sotelo	34	99			85
Huang JI	23	92	20	152	83
Virani	41	105	15	156	85
Lakhey	20	115	9		
Our study	30	90.66±21.32	21.33±10.41	132±33.12	80.33±11.29

In our study, out of 30 patients, 6 (20%) were graded excellent, 18 (60%) were graded good, 5 (16.7%) were graded fair and 1 (3.3%) was graded poor. In the study by Sanchez-Sotelo, out of 34 patients, 11 were graded excellent, 16 were graded good, 2 were graded fair and 3 were graded poor.⁷ Similar study by Kelkar had 47% excellent, 33% good, 7% fair and 13% poor grades.¹²

Minor complications were seen in 10 patients in our study. Complications with transient ulnar nerve palsy (2 patients), deep infection (2 patients) and hardware pain (5 patients) occurred in the study of Krishna.¹³ whereas Sanchez-sotelo had deep infection in 1 patient.⁷

Despite recent advances in surgical techniques and technologies, controversies still exist over several issues of operative management including the optimal surgical approach, plate orientation and the role of elbow arthroplasty.¹⁴

Sharma did a systematic meta analysis on surgical approaches for open reduction and internal fixation (ORIF) of intra articular distal humerus fractures in adults and found no differences in the functional outcome or complication rates between olecranon osteotomy and triceps splitting approach but had indicated for further research.¹⁵

Six cases (20%) developed hardware pain, 3 cases (10%) developed superficial infection and were managed conservatively. One case (3.3%) had transient ulnar nerve palsy.

DISCUSSION

The aim of treatment for distal humerus fracture is to achieve the painless and stable elbow with satisfactory functions. Bicolumnar plating has remained the gold standard technique even for the complex intraarticular fractures.⁷ A number of studies have shown that there is no significant difference of clinical outcome in between the parallel and orthogonal plating systems in terms of function, range of motion, MEPI score and other clinical results.⁸

Clinical studies that have compared perpendicular to parallel plating reported no differences between the groups in terms of functional outcome or complication rate.¹⁶ In our study, combination of locking and conventional reconstruction plates were used in orthogonal construct. None of the cases had implant failure or screw loosening.

In our study, mean MEPI score in patients of age >60 years was less than that of age <60, (72 vs 82, $P=0.003$). This suboptimal outcome in elderly subgroup was due to severe comminution of distal articular surface and poor quality of bone due to osteopenia that was very difficult to achieve stable fixation. Total elbow arthroplasty (TEA) is becoming recognized as a safe and effective alternative to operative fixation in the treatment of comminuted intra articular distal humerus fractures in the elderly patients. This is reflected in the number of TEAs performed annually for distal humerus fractures, which has increased 2.6 fold between 2002 to 2012.¹⁷ TEA has limited longevity due to aseptic loosening due to which it is only recommended in patients with sedentary lifestyle who can comply with the post operative rehabilitation regime.

McKee compared operative fixation with TEA in a prospective, randomized, multicenter study of 40

patients above 65 years presenting with comminuted, displaced, intra articular fractures of the distal humerus AO/OTA Type C. The authors concluded that the TEA was a preferred alternative to fixation in elderly patients with complex distal humeral fractures that were not amenable to stable fixation.¹⁸ In a recent systematic review comparing TEA to ORIF for the treatment of distal humerus fractures in the elderly. Githens pooled the results of 27 papers including 563 patients and found no significant difference between groups with respect to functional outcome or complication rates.¹⁹ Currently the treatment of choice for these patients remains unclear.

CONCLUSION

ORIF with bicolumnar plating in orthogonal configuration can provide good functional outcome in most of the patients with distal humerus fracture in adult population. Achievement of good range of motion in both flexion-extension and supination-pronation, good MEPI score with only minor complications in some patients signify the good functional outcome. Early, vigorous, active physiotherapy is a must for the good results. Functional outcome is better in Types C1/C2 than Type C3 fracture due to the challenges in achieving anatomic reduction in Type C3. Despite controversial issues regarding optimal surgical approach and plate configuration, bicolumnar plating remains the gold standard for the treatment of distal humerus fracture. Total elbow arthroplasty has been advocated as a treatment option especially for elderly patients or those with unreconstructable distal humerus fractures.

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