

ORIGINAL RESEARCH

Comparative evaluation of efficacy of two different double plating methods for intraarticular distal humerus fractures

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Received: 11 March, 2022

Accepted: 14 April, 2022

ABSTRACT

Background: The present study was conducted for comparing the efficacy of two different double plating methods for intraarticular distal humerus fractures. **Materials & methods:** 40 patients were randomly assigned to 2 groups based on plate positions. 20 patients were treated using 2 orthogonal plates: 1 placed along the medial supracondylar ridge and another placed posterolaterally, with the plates approximately perpendicular to each other (group 1). Remaining 20 patients received pre-contoured anatomical plates along each supracondylar ridge approximately parallel to each other (group 2). Results were subjected to radiological and clinical evaluations, and internal fixation status for the 2 groups was compared. Clinical evaluations consisted of recording the incidences of complications and determining Mayo elbow performance scores (MEPS). The outcome was evaluated and compared. **Results:** Mean postoperative range of extension among patients of group 1 and group 2 was 12.6° and 10.7° respectively. Mean postoperative MEPS among patients of group 1 and group 2 was 92.7 and 95.3. Although non-significant, slightly better results were obtained among patients of group 2. Mean union time among patients of group 1 and group 2 was 6.8 months and 6.1 months respectively. Non-union was seen among 1 patient of group 1. **Conclusion:** A parallel plating method appears to better provide rigid fixation that is adequate for obtaining bone union. However, no significant differences were observed in terms of clinical outcomes and complication rates.

Key words: Double plating, Distal Humerus, Intraarticular

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INTRODUCTION

Fractures of the distal humerus in the adult comprise 2 % of all fractures and approximately 30 % of all humeral fractures, with an incidence of 5.7/100000 per year, the fracture patterns being mainly distributed bimodally, differentiating between young male (high energy trauma) and elderly female patients (osteoporotic fractures). Thus, due to an increasingly older population and the continuing motorisation of the developing world, it is estimated that the incidence of fractures of the distal humerus will grow similar to the ones of the distal radius, hip, and spine.^{1,2}

Formerly, they were seen in young males following high energy trauma, but the last few decades have seen an increase in elderly females resulting from relatively low energy trauma. Palvenen et al noted a steady increase in these injuries in this patient population between 1970 and 1998. The same group then noted a subsequent decline from 1998 to 2014, the reasons for which were unclear but likely were

related to better functional ability of older women, as well as false prevention measures. Distal humeral fractures in osteoporotic bone are particularly problematic due to the propensity for intraarticular comminution, poor bone stock for solid fixation as well as limited space for fixation devices. Results of internal fixation, although improved, are not without complications. Indeed total elbow arthroplasty as primary treatment is gaining popularity in selected patients.^{3,4}

Open reduction internal fixation still being considered the gold standard for treatment of distal humerus fractures, parallel and perpendicular plating have been showing similar clinical results. The introduction of locking compression plates improved the outcome of internal fixation in distal humerus fractures significantly, especially in patients with minor bone quality. In the early 1980s, total elbow arthroplasty (TEA) has been established successfully as a therapy option for patients suffering primarily from non-union

after open reduction internal fixation (ORIF) and post-traumatic osteoarthritis. In the following decades, the indication for TEA has widened.^{5, 6} Hence; the present study was conducted for comparing the efficacy of two different double plating methods for intraarticular distal humerus fractures.

MATERIALS & METHODS

The present study was conducted for comparing the efficacy of two different double plating methods for intraarticular distal humerus fractures. 40 consecutive patients with a fracture of the intraarticular distal humerus underwent dual plating fixation. All the patients were followed for a minimum of two years. All the patients were randomly assigned to 2 groups based on plate positions. 20 patients were treated using 2 orthogonal plates: 1 placed along the medial supracondylar ridge and another placed posterolaterally, with the plates approximately perpendicular to each other (group 1). Remaining 20 patients received pre-contoured anatomical plates along each supracondylar ridge approximately parallel to each other (group 2). All plates used in this study were made of titanium. All surgeries were performed within 5 days of injury. All 40 patients included in this study followed the same postoperative rehabilitation protocol. Passive and active assisted range of elbow motion exercises commenced at 3 days

postoperatively. Results were subjected to radiological and clinical evaluations, and internal fixation status for the 2 groups was compared. Clinical evaluations consisted of recording the incidences of complications and determining Mayo elbow performance scores (MEPS). The outcome was evaluated and compared. All the results were analyzed by SPSS software. Chi-square test and Mann Whitney U test were used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

Mean age of the patients of group 1 and group 2 was 49.2 and 51.7 years respectively. Majority of patients of both the study groups were males. Mean postoperative range of motion among patients of group 1 and group 2 was 108.3° and 111.7° respectively. Mean postoperative range of flexion among patients of group 1 and group 2 was 118.2° and 120.6° respectively. Mean postoperative range of extension among patients of group 1 and group 2 was 12.6° and 10.7° respectively. Mean postoperative MEPS among patients of group 1 and group 2 was 92.7 and 95.3. although non-significant, slightly better results were obtained among patients of group 2. Mean union time among patients of group 1 and group 2 was 6.8 months and 6.1 months respectively. Non-union was seen among 1 patient of group 1.

Table 1: Comparison of two different plating methods

Plating methods	Group 1	Group 2	p- value
Mean range of motion	108.3	111.7	0.326
Mean range of flexion	118.2	120.6	0.771
Mean range of extension	12.6	10.7	0.622
Mean MEPS	92.7	95.3	0.829

Table 2: Comparison of union time

Union time	Group 1	Group 2	p- value
Mean (months)	6.8	6.1	0.541
SD	1.3	1.8	

Table 3: Incidence of non-union

Non-union	Group 1	Group 2	p- value
Number	1	0	-
Percentage	5	0	

DISCUSSION

Distal humerus intercondylar fractures are intra-articular comminuted fractures of the elbow that involve soft tissue injury. These types of fractures are relatively rare (<2%) and are difficult to treat due to their epiphyseal location. Complete fractures result from impaction of the proximal ulna onto the articular part (trochlea, capitellum) of the distal humerus, and can occur with the elbow flexed or extended. Due to the fact these fractures are fairly rare, a specific management scheme is challenging to devise.^{7, 8} Treatment consists of assessing the mechanism of the injury, defining the diagnostic modalities, and developing a clinical

approach which will allow for recovery of full mobility of the elbow. Any approach should aim at mobilizing the elbow joint to avoid stiffening and heterotopic ossification. Immobilization is only feasible in situations in which the fractures are non-displaced or as temporary treatment under specific circumstances. Normal function can be difficult to restore if the joint is deformed due to malunion and/or stiffened by capsular and ligament contractures or heterotopic ossifications.^{9- 11} Hence; the present study was conducted for comparing the efficacy of two different double plating methods for intraarticular distal humerus fractures.

Mean age of the patients of group 1 and group 2 was 49.2 and 51.7 years respectively. Majority of patients of both the study groups were males. Mean postoperative range of motion among patients of group 1 and group 2 was 108.3° and 111.7° respectively. Mean postoperative range of flexion among patients of group 1 and group 2 was 118.2° and 120.6° respectively. Mean postoperative range of extension among patients of group 1 and group 2 was 12.6° and 10.7° respectively. Jacobson SR et al assessed the bending and torsional stiffness of five commonly used multiple plate constructs. Plates were applied in three positions: medially, along the medial supracondylar column; laterally, along the lateral supracondylar column; or posterolaterally, extending distally to the capitellum. Each specimen was randomly assigned to one of five construct groups. All plated specimens were stiffer in the frontal plane as compared with the sagittal plane and, when compared with intact specimens, showed a disproportionate decrease in sagittal plane stiffness. Constructs 1 and 5 had significantly greater relative bending stiffness in the sagittal plane than constructs 3 and 4. Construct 4 had the lowest relative bending stiffness in the frontal plane. This reached statistical significance when compared with constructs 2 and 5. There was no significant difference in the torsional stiffness of the five constructs. They concluded that the multiple plate constructs offered significantly less bending stiffness than the intact specimens, with a particular deficiency in the sagittal plane.¹²

Mean postoperative MEPS among patients of group 1 and group 2 was 92.7 and 95.3. although non-significant, slightly better results were obtained among patients of group 2. In another study conducted by Shin et al, authors compared clinical outcomes in patients with intraarticular distal humerus fractures treated using 2 different double plating methods. Seventeen patients were treated by perpendicular plating (group I) and 18 by parallel plating (group II) methods. Eleven patients in group I recovered full arc of flexion and 13 patients in group II achieved full arc of flexion. All patients obtained bone union, except 2 patients in group I. Nonunion in these patients developed in the supracondylar area. Complications developed in 6 patients in group I and in 8 in group II. No significant differences were found between the clinical outcomes of the 2o plating methods. Although more patients failed to achieve bony union in the perpendicular plating group, both parallel and orthogonal plates positioning can provide adequate stability and anatomic reconstruction of the distal humerus fractures.¹³

Mean union time among patients of group 1 and group 2 was 6.8 months and 6.1 months respectively. Non-union was seen among 1 patient of group 1. In another previous study conducted by Lee et al, authors compared the clinical and radiographic outcomes in patients with distal humerus fractures who were treated with orthogonal and parallel plating methods

using precontoured distal humerus plates. Sixty-seven patients with a mean age of 55.4 years (range 22–90 years) were included in this prospective study. The subjects were randomly assigned to receive 1 of 2 treatments: orthogonal or parallel plating. The following results were assessed: operating time, time to fracture union, presence of a step or gap at the articular margin, varus–valgus angulation, functional recovery, and complications. No intergroup differences were observed based on radiological and clinical results between the groups. No significant differences were found between the orthogonal and parallel plating methods in terms of clinical outcomes or complication rates.¹⁴

CONCLUSION

A parallel plating method appears to better provide rigid fixation that is adequate for obtaining bone union. However, no significant differences were observed in terms of clinical outcomes and complication rates.

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