



FUNCTIONAL OUTCOME ANALYSIS OF BIPLANAR BICOLUMNAR PLATE TECHNIQUE FOR DISTAL HUMERAL INTRAARTICULAR FRACTURE IN ADULTS

Orthopaedics

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ABSTRACT

Background: Distal end of the humerus, with its unique orientation of articular surfaces supported by a meagre amount of cancellous bone, makes its fracture a constant challenge to orthopaedic surgeons. **Aims & Objectives:** To evaluate the functional outcome of bicolumnar distal humeral intraarticular fractures treated with double plate technique. **Materials & Method:** A prospective study was conducted at our hospital between August 2020 to July 2022 for 30 consecutive patients (21 Male & 9 Female) with bicolumnar distal humeral intraarticular fracture in adults included in study as per inclusion criteria. All patients were treated surgically using transolecranon approach with ulnar nerve exploration then fixation using biplanar bicolumnar plating and tension band wiring for olecranon osteotomy was followed clinically. **Results:** Using MEPS (Mayo Elbow Performance Scoring) system excellent outcome are noticed in 21 patients (70%), good results in 5 patients (16.67%), fair results in 3 patients (10%) and poor results in 1 patient (3.33%). **Conclusion:** Open reduction and internal fixation of bicolumnar distal humeral intraarticular fractures is challenge to surgeon. Precise preoperative planning, adequate surgical approach, anatomical interfragmentary stabilization, biplanar bicolumnar plating and adequate physiotherapy over a period of time provides excellent reduction & successful results in view of elbow range of motion & stability.

KEYWORDS

Distal humerus, intraarticular fractures, biplanar bicolumnar plating.

INTRODUCTION-

Distal humerus fractures in adults are difficult and challenging to treat due to intra articular and inter condylar involvement, high comminution, difficulty in reconstruction of articular surfaces and maintaining stability, if not reconstructed anatomically. Rabinson reported that the incidence of distal humerus fractures in adults was 5.7/100000 per year.⁽¹⁾ Non surgical treatment can be justified in cases of hemiplegia sequelae involving the ipsilateral upper limb, advanced osteoporosis and fractures with extensive bone loss. The chances of functional impairment and deformity are high following conservative treatment.⁽²⁾ The main goal of surgical treatment is to obtain fixation that is stable enough to allow immediate post operative elbow mobilization to prevent it from stiffening malunion and nonunion, hence open reduction and internal fixation allows early mobilization and good functional outcomes. Trans olecranon approach and Chevron osteotomy technique exposes the articular surface of the distal humerus more than other approaches.⁽³⁾ Patients who underwent Open reduction and internal fixation through an olecranon osteotomy showed good range of movement and good to excellent results than those who underwent open reduction and internal fixation through other approaches.⁽⁴⁾ Locking compression plates are more beneficial in distal humerus fractures than dynamic compression plates and k - wires. Single columnar plating, recon plating and conventional plates have more fixation failures. Complete fixation with two precontoured anatomical locking compression plates in 90 degree to each other is the most suitable technique for distal humerus fractures.⁽⁵⁾ Patients treated with biplanar bicolumnar plates show a greater functional range of motion, better restoration of articular congruity, secure bony fixation, better bone healing, and early rehabilitation.⁽⁶⁾ The aim of this prospective study is to analyze the functional outcome of bicolumnar distal humeral intraarticular fractures treated with double plate technique.

MATERIALS AND METHOD-

This study is a prospective hospital-based study conducted in Jawaharlal Nehru Institute of Medical Sciences, Imphal for a period of 2 years (August 2020 to July 2022) among 30 cases of distal humeral

intraarticular fracture in adults who fulfilled inclusion and exclusion criteria. Informed consent was obtained from all patients and research ethics committee approval was taken.

Preoperative planning:

Detailed history was taken including particulars of patient, date, time of injury, involved side, associated injuries, type of fracture, comorbidities, activity level of patient.

Surgical approach:

Under general anaesthesia or regional anaesthesia tourniquet applied. Position the patient in the lateral decubitus position with shoulder at 90° of abduction and flexion and elbow at 90° of flexion, with arm hanging on a side bar. Prepare and draping was done in sterile manner, cautery & suction tube was placed, ioban was applied. A midline incision a curve over the tip of the olecranon and develop full-thickness flaps. Dissect the ulnar nerve. Laterally, dissect the triceps. Incise the interval between the triceps and anconeus muscles to expose the joint. Predrill the holes for olecranon fixation before making the osteotomy. Make a distally oriented chevron osteotomy with an oscillating saw directed toward the sulcus of the articular surface. Raise the triceps with the proximal olecranon, and direct the triceps musculature off the humerus. Debride the fracture edges to clean surfaces. Insert Kirschner wires or mini fragment lag screw can be used for provisional fixation. Plate the column with the better key to reduction first, then the opposite column. Alternatively, a plate can be placed along the column with provisional unicortical screws distally. Reconstruct the articular surface around the clock, provisionally fix the reconstructed fragments, and reduce the remaining condyle to the shaft and apply plate fixation. 2 precontoured anatomical locking compression plates in 90 degree to each other are applied. Evaluate every screw to ensure that it does not cross the articular surface. Repair the olecranon osteotomy, transpose the ulnar nerve, and close the incision in layers over closed suction drainage.

Post operative protocol-

The patient is placed into a bulky cotton padding and POP splint, and is

elevated for 24-48 hours and then, suction drain removed and dressing changed. Depending on the fracture stability, active and active assisted range of motion is started, as tolerated by the patient. This consists of range of motion for flexion / extension and supination/ pronation. Aggressive passive range of motion is definitely contra-indicated. The postoperative rehabilitation protocol to be followed can only be determined by the stability of fixation achieved. Patients were evaluated at 6 weeks, 3months, 6months and 1 year. In the follow up the following parameters were assessed- Wound related complications, range of movements at elbow joint, return to professional / routine activities, ulnar neuropathy, Mayo elbow performance score.

RESULTS-

This was a prospective study of 30 distal humerus intraarticular fracture treated by open reduction and internal fixation by trans olecranon approach with chevron osteotomy and internal fixation by biplanar bicolumnar locking compression plate. Results were analysed in terms of functional outcome of postoperative elbow range of movement and complications. The mean age was 39.68, with the youngest being 21 years and oldest is 80 years. This study included 21 males and 9 female patients, 19 patients left side and in 11 patients right side was involved, 15 cases were due to Road traffic accidents and 15 cases due to fall, only 1 patient did not return to his prior activities. The mean arc of movement in the flexion – extension plane was 117.33° with a mean fixed extension of 8.67°. 3 patients had superficial skin infection & 2 patients had post operative ulnar neuritis in their early follow up but they had no motor deficits and treated symptomatically however at the final follow up none of them had ulnar neuritis. MEPS was excellent in 21 patients, good in 5 patients, fair in 3 patients and poor in 1 patient. Patient with poor score had severe stiffness and experienced difficulty in performing daily routine activities. “Paired t test” was used to analyse the comparison of MEPS between different time intervals. A “p value” of < 0.001 was obtained signifying that the comparison was statistically highly significant in every follow up.



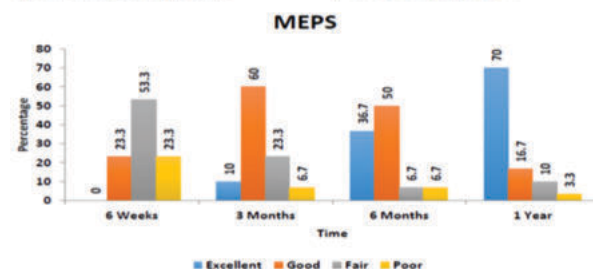
Fig-1 Preop elbow x-ray Fig-2 Intraop picture Fig-3 Postop elbow x-ray

Table - 1 Comparison of MEPS between different time intervals

MEPS	N	Mean	Std. Deviation	Repeated Measures ANOVA	
				F	p-value
6 Weeks	30	63.00	10.22	176.18	<0.001*
3 Months	30	76.83	11.02		
6 Months	30	84.33	11.28		
1 Year	30	92.00	13.37		

*p<0.05 Statistically Significant.

p>0.05 Non Significant, NS



DISCUSSION-

We studied 30 patients (21 men, 9 women) with distal humerus intraarticular fractures AO type 13C over a period of 2 years and we evaluated their functional outcome. Osteoporosis is the major risk

factor leading to these types of fractures in the elderly. Wilkinson and Stanley recommended in their studies that olecranon osteotomy exposes the articular surface fully than other approaches.⁽³⁾ We used trans olecranon approach with Chevron osteotomy which gave very good visualization and ability to reconstruct the articular surface. Open reduction and internal fixation with bi columnar locking compression plating is the gold standard treatment for distal humerus AO type 3C fractures. However, the position of the two plates with respect to each other has been a matter of discussion. There are three studies in the literature which have compared the two techniques. While Jacobson and his colleague concluded that orthogonal plating provided better stability to the construct, Schemitsch⁽⁷⁾ and Self⁽⁸⁾ concluded the contrary, stating parallel plating technique was better. Gofton⁽⁹⁾, Kundel & Aslam⁽¹⁰⁾ all obtained excellent to good functional outcome with orthogonal plating technique. We followed orthogonal plating using 3.5mm fixed angled AO anatomic locking compression plates and obtained excellent to good outcome. In our study, a mean arc of flexion of 117.33 with a mean extension deficit of 8.67 was observed. This is comparable to that obtained by Gofton⁽⁹⁾, Kundel & Aslam⁽¹⁰⁾ in their study on AO type 3C fractures of the distal humerus. Radiologically, all the fractures showed union at final follow-up. The common complications seen following surgical management of distal humerus AO type 3C fractures as noted by Rabinson⁽¹⁾ in a review article include elbow stiffness, infection, non-union, ulnar neuropathy, and heterotopic ossification (HO).

Table 2. Comparisons of our study with those in the literature

Reference	No. of Patients Followed up	No. of Excellent to good results	Mean arc Of Flexion in degree	No. of Complications / type
Gofton	23	21	122	7HO, 2infection, 3 non union
Aslam	20	14	122	2 HO, 2 infection, 1 ulnar neuritis
Kundel	77	40	104	2 HO, 8 infection, 2 Ulnar neuritis
This study	30	26	117	3 Infection, 2 ulnar neuritis

CONCLUSION-

Intra articular distal humerus fractures are commoner in 3rd-4th decade of life with male predominance. Mode of injury both RTA & direct fall on elbow was equal number cases. These fractures demand careful evaluation & preoperative planning. As early as possible surgery in trans-olecranon approach with rigid anatomical internal fixation should be the line of treatment. Active physiotherapy is a must for good results.

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