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Treatment of Intercondylar Fracture of Distal Humerus in Adults by Double Plate

Graham Bell Marbaniang[1], A Mahendra Singh[2], S Waikhom[3], Snehasish Datta[4], Christopher L Hmarj[5], Sagnik Mukherjee[6]
[1,2,3,4,5,6][Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India]

Abstract: *Aim- To know the outcome of treatment of intercondylar fracture (C1 and C2) of distal humerus in adults with double plates in Regional Institute of Medical Science, Imphal, Manipur India. Introduction: Fractures of distal humerus in adults represent approximately 2 % of all fractures and a third of all humeral fractures. These injuries often present with articular comminution and require anatomical restoration of the joint surface with stable and rigid internal fixation that allows early motion. Material and Methods: In Regional Institute of Medical Sciences, Imphal, Manipur, twenty consecutive patients with intercondylar fracture (C1 and C2) of distal humerus were treated using standard dorsal approach, olecranon osteotomy and double plates with follow up period of 24 months. Results: Based on the Mayo Elbow Performance score (MEPS) for the present study, the final outcome for all cases was Excellent in12 (60%), Good in 7 (35%) and fair in 1 (5%) patients (Table 5). Average MEPS was 89.65. Conclusion: The plates act as an extra-medullary load bearing device, stabilising fracture fragments and ensuring early bony union. Early return of joint functions is easily achieved concurrent with fracture healing.*

Keywords: *Distal humerus, double plating, Intercondylar fracture (C1,C2), internal fixation, olecranon osteotomy.*

I. Introduction

Fractures of distal humerus in adults represent approximately 2 % of all fractures and a third of all humeral fractures[1]. Most low-energy distal humeral fractures are produced from simple falls in middle-aged and elderly females in which the elbow is either struck directly or axially loaded in a fall onto the outstretched hand. Road-traffic accidents and sport are a more common cause of injury in younger males[1]. The treatment of these fractures continues to present challenges despite advances in internal fixation. These injuries often involve articular comminution, and many occur in older patients with osteoporotic bone. Joint function often is compromised because of stiffness, pain, and weakness. But outcomes have been improved with advances in implant technology, surgical approaches, and rehabilitation protocols. Most distal humeral fractures in adults must be treated operatively. These injuries require anatomical restoration of the joint surface with stable and rigid internal fixation that allows early motion[2].

1.1Functional anatomy[3]

The distal humeral shaft is triangular shaped in cross section, with its apex directed anterior. It consists of two divergent cortical columns- the medial and lateral columns. The medial column diverges approximately 45 degrees from the humeral shaft in the coronal plane and terminates as the medial epicondyle. The lateral column, in the coronal plane, diverges at approximately 20 degrees from the shaft and as it extends distally it curves anteriorly creating approximately a 35- to 40-degree angle with the shaft in the sagittal plane. The lateral column terminates in the capitellum anteriorly. The trochlea is the intervening segment of bone between the terminal ends of the medial and lateral columns that articulates with the greater sigmoid notch of the ulna. In the coronal plane, the trochlea is more distal than the capitellum resulting in a valgus alignment of 4 to 8 degrees. Overall, when including the ulna, the elbow has a valgus angle in extension of 10 to 17 degrees, termed the carrying angle. Axially, the distal humerus articular surface is internally rotated 3 to 8 degrees; therefore, as the elbow flexes it also internally rotates resulting in slight varus alignment. Superior to the trochlea and between the medial and lateral columns lies the olecranon fossa posteriorly and the coronoid fossa anteriorly. The olecranon fossa is matched to the olecranon and accepts it during extension; similarly, the coronoid fossa is matched to the coronoid and accepts it during flexion.

The elbow joint is a hinge variety of synovial joint. This includes two articulations
1) Humero-ulnar, between humeral trochlea and ulnar trochlear notch and
2) Humero-radial, between humeral capitulum and radial head.

Its complexity is increased by continuity with the superior radio-ulnar joint within a continuous synovial cavity, this complex being the cubital articulation.

1.2 Ligaments

The articular capsule:

It is anteriorly broad and thin, attached proximally to the humerus above the coronoid and radial fossae and to the front of medial epicondyle, and distally to the edge of the ulnar coronoid process and annular ligament. On either side it is continuous with the ulnar and radial collateral ligament. Posteriorly the capsule is thin and attached proximally to the humerus behind its capitulum and lateral trochlear margin and lower part of the olecranon and distally it reaches the superior and lateral margins and is laterally continuous with the superior radio-ulnar capsule.

The lateral collateral ligament:

The lateral collateral ligament (LCL) complex consists of the radial collateral ligament, the lateral ulnar collateral ligament and the annular ligament. The annular ligament attaches to the anterior and posterior margins of the lesser sigmoid notch, whereas the radial collateral ligament originates from an isometric point on the lateral epicondyle and fans out to attach to the annular ligament. The lateral ulnar collateral ligament also arises from the isometric point on the lateral epicondyle and attaches to the crista supinatoris of the proximal ulna.

The medial collateral ligament:

The medial collateral ligament (MCL) consists of an anterior bundle, posterior bundle and transverse ligament. The anterior bundle is of prime importance in elbow stability. It originates from the anteroinferior aspect of the medial epicondyle, inferior to the axis of rotation, and inserts on the sublime tubercle of the coronoid.

1.3 Neuro –vascular structure

The ulnar nerve pierces the medial intermuscular septum in the middle third of the arm to travel along side the medial head of triceps. As the nerve approaches the elbow it travels behind the medial epicondyle to enter the cubital tunnel.

The radial nerve: The nerve lies between brachialis and brachioradialis, where it bifurcates to the posterior interosseous nerve and the radial sensory nerve.

The median nerve travels with the brachial artery between the biceps and brachialis muscles in the anteromedial aspect of the arm. The nerve passes under the bicipital aponeurosis to enter the medial antecubital fossa, medial to the biceps tendon and brachial artery. The nerve then passes between the heads of pronator teres.

Blood supply: blood supply to the adult elbow consists of three vascular arcades: medial, lateral, and posterior. The lateral arcade is formed by the interosseous recurrent, radial recurrent, and radial collateral arteries and supplies the capitellum, radial head, lateral epicondyle, and lateral aspect of the trochlea. The medial arcade is formed by the superior and inferior ulnar collaterals and the anterior and posterior ulnar recurrent arteries and supplies the medial epicondyle and the medial aspect of the trochlea. The posterior arcade is formed by the medial collateral artery and contributions from the medial and lateral arcades and supplies the olecranon fossa and supracondylar area.

II. Materials And Methods

The study was conducted in the department of Orthopaedics, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, for a period of two years from September 2012 to August 2014. This was a prospective study in which at least twenty (20) consecutives cases of supracondylar fracture of humerus with inter-condylar extension, aged 18-60 years, irrespective of sex, were operated using two locking compression plate fixation after obtaining written informed consent.

III. Operative/Surgical Technique[2]

Patients were positioned in the lateral decubitus position with arm rest for the operated site. The arm and forearm were washed with soap and water. Tourniquet was applied on the proximal arm. Skin was prepared by povidone iodine (10% v/v) solution and the operating field from mid arm to mid forearm was draped.

A posterior midline incision 5 cm proximal and distal to the olecranon was made and full-thickness flaps retracted medially and laterally. Ulnar nerve identified and retracted medially with a long gauze. Laterally, the triceps was dissected off the lateral intermuscular septum. The interval between the triceps and anconeus muscles was developed to expose the joint.

A chevron osteotomy over the olecranon was made with an oscillating saw and completed with an osteotome. The triceps were retracted with the olecranon proximally. The fracture edges were cleaned with normal saline. The fracture fragments were reduced and stabilised with bone clamp and were provisionally fixed with Kirschner wires. Then rigid fixation was achieved by insertion of lag screws and variable numbers of locking screws which were inserted after drilling the bone through the plate and bone surface by motorized power drill or hand-drill. The plates were placed in 90-90 position.

The olecranon osteotomy was repaired with stainless steel wires (20 mm) using tension band principle. The skin wounds were closed over a negative suction drain after thorough washing with copious amount of sterile saline solution and sterile dressings applied over the limb. A posterior above elbow pop slab applied in extension for three days.

The operated limb was kept elevated. During this time passive and active movements of the fingers were encouraged. Patients received parenteral third generation cephalosporin for five days which was then changed to appropriate oral formulation from the sixth day and continued for another seven days. Anti-inflammatory analgesics and other supportive measures were also given as per individual requirements. The suction drain was removed after 48 hrs and check X-ray (AP/Lat) of the limb was taken. Active movements of the limb was started and continued from immediate post operative day. Skin sutures were removed on the tenth post-operative day and patients were discharged and some patients were discharged after few post-operative days and were called in the OPD for suture removal.

IV. Results And Discussion

Twenty (20) adult patients of supracondylar fractures with intercondylar extention of humerus were subjected to open reduction and internal fixation (ORIF) using two locking compression plates between September 2012 and August 2014, in the department of Orthopaedics, RIMS, Imphal. Patients were followed 3 weeks for the first three months after surgery, then once a month the next six months and then every three (3) months for period of one year in the out-patient department of Orthopaedics, RIMS. There were 14 males and 6 females with an average age of 30.9 years (19-56 years). Majority of cases were due to road traffic accident in younger age group and direct fall onto elbow was a common mode of injury in the older age group. The supracondylar fractures of humerus show male preponderance (Table 1). According to AO/ASIF classification, there were 16 cases of type C1, 4 cases of type C2 and NO cases of type C3 (Table 2) .The mean time to operation 3.75 days (2-6) days from the date of injury. The mean duration time of operation was 87.25 minutes (range 60-120 mins). The mean duration of hospitalisation for all patients was 13.85 days (range, 8-20 days). Clinical union was seen at a mean time of 12.7 weeks (range, 8 – 16 weeks) and the mean time to complete radiological union was 19 weeks (range, 14-24 weeks) (Table 3). There were no intra-operative and immediate post operative complications. Two cases of superficial infection were managed by antibiotics and local wound dressing. With respect to motion average arc of flexion-extension was 112.5° (range 70°-130°), with all patients exhibiting full supination and pronation (Table 4). Based on the Mayo Elbow Performance score (MEPS) for the present study, the final outcome for all cases was Excellent in12 (60%), Good in 7 (35%) and fair in 1 (5%) patients (Table 5). Average MEPS is 89.65.

V. Conclusion

The plates act as an extra-medullary load bearing device, stabilising fracture fragments and ensuring early bony union. The plate-screw system produces a rigid screw-bone fixation which prevents malrotation or shortening. Early return of joint functions is easily achieved concurrent with fracture healing.

Table 1: Showing age and sex distribution of the patients

Age range	**Male**	**Female**	**Percentage** (n=20)
18-20 yrs	2	1	15
21-30yrs	6	2	40
31-40 yrs	4	1	25
41-50 yrs	2	1	15
51-60 yrs	1	0	5
Total	15	5	100

Table 2:Radiological classification according to AO/ASIF group

AO	**No. of patients**	**Percentage %(n= 20)**
C1	16	80
C2	4	20
C3	0	0
Total	20	100

Table 3: Showing time of clinical and radiological bony union (in weeks)

Type of Union	**Duration to union (weeks)**	**Mean duration to union (weeks)**
Clinical union	**8-16**	**12.7**
Radiological union	**14-24**	**19**

Table 4: ROM at Elbow joint

ROM in degrees	**No. of patients**	**Percentage %(n= 20)**
>120	8	40
100-120	9	45
50-100	3	15
< 50	0	0
Total	20	100

Table 5: Showing final result of this study according to Mayo Elbow Performance score [3] (MEPS)

Outcome		**No. of patients**	**Percentage %(n= 20)**
Excellent	(90-100)	12	60
Good	(75-89)	7	35
Fair	(60-74)	1	5
Poor	(<60)	0	0
Total		20	100

Fig. 1: Preoperative x-rays

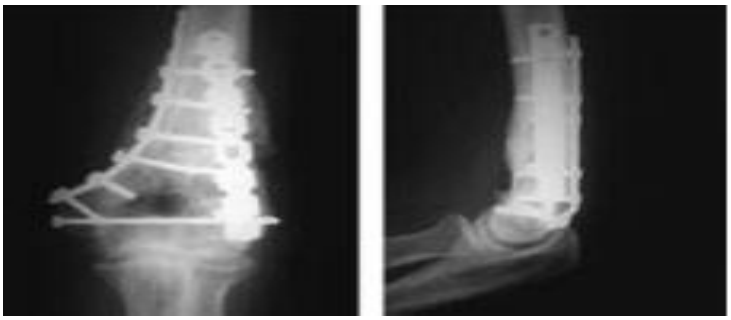

Fig.2: Postoperative x-rays

Fig.3: Range of motion at 6 months (Right side is the operated site)

Fig. 4: Range of motion at 15 months (Right side is the operated site)

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Author Profile:

Dr. Graham Bell Marbaniang has passed MBBS in 2006 from Gauhati Medical College & Hospital, Guwahati, Assam. He is Post-graduate trainee, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India.

Dr. A Mahendra Singh is Professor, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India.

Dr. S Waikhom is Associate Professor, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India.

Dr. Snehasish Datta is Post-graduate trainee, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India.

Dr. Christopher L Hmarj is Post-graduate trainee, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India

Dr. Sagnik Mukherjee is Post-graduate trainee, Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, Manipur, India.