

## Original Research Article

# The role of open reduction and internal fixation in the treatment of the intercondylar fractures of humerus

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### ABSTRACT

**Background:** Inter-condylar fractures represent one of the most complicated and challenging fractures in the upper extremity. The results of managing these fractures non-operatively are limited by failure to get anatomical reduction and early mobilization, which often results in painful stiff elbow and/or pseudo-arthrosis. The objective of this study was to evaluate and analyse the role of open reduction and internal fixation in inter-condylar fractures of distal humerus.

**Methods:** The present study was done in Malla Reddy Institute of Medical Sciences between June 2014 and June 2017. Out of 34 cases of intercondylar fractures of humerus admitted during the period, 25 patients were selected for the study that satisfied our inclusion criteria. Three patients out of those selected could not be included in the study as one had cardiac issues pre-operatively, one refused surgery and one was lost to follow up.

**Results:** Our study included 22 patients, 14 male and 8 female patients. Their average age was 41.4 years. The fractures were classified as per the AO classification. There were B1-3, B2-1, C1-6, C2-5, C3-7 fractures. Both compound and closed fractures were included. All the patients were operated by posterior olecranon Chevron osteotomy approach by a senior faculty member. Twenty two patients who satisfied our inclusion criteria were treated, followed up and the results analyzed using Cassabaum's scale of elbow function we had 86% of excellent to good results. Our results are comparable with other similar studies.

**Conclusions:** Posterior olecranon approach was found to be of most satisfactory approach by us. It allows good exposure of the joint and the ulnar nerve.

**Keywords:** ORIF, Intercondylar fractures, Humerus

### INTRODUCTION

Inter-condylar fractures represent one of the most complicated and challenging fractures in the upper extremity. They account for about 2% of all fractures in adult patients. Due to relative rarity of these fractures they continue to challenge the skills of most the orthopedic surgeons.<sup>1</sup>

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. The results of managing these fractures

non-operatively are limited by failure to get anatomical reduction and early mobilization, which often results in painful stiff Elbow and/or pseudo-arthrosis. Watson and Jones wrote "few fractures are more difficult to treat" while describing them, thus describing their complexity.<sup>2</sup>

Operative management with anatomical reduction of the fragments became the treatment of choice for these fractures in the recent times.<sup>3</sup>

Satisfactory results can be obtained when anatomical reduction and stable osteosynthesis is possible and when physiotherapy can be initiated early after treatment.<sup>4,5</sup>

The latest reviews in treatment of distal humerus fractures emphasize the fact that dual plate fixation, with placement of a separate strong plate on each column, is indicated for all adult fractures involving both columns of the distal part of the humerus.<sup>6</sup>

Consequently, open reduction and internal fixation (ORIF) is accepted as the gold standard in the treatment of intra-articular distal humerus fractures.<sup>7</sup>

However the complex three-dimensional geometry of the distal humerus poses a considerable challenge to reconstruction.<sup>8</sup>

Advances in implant technology, surgical approaches, and rehabilitation protocols, have given well to excellent results in approximately 87% of patients.<sup>9</sup>

An attempt has been made in this study to evaluate the role of open reduction and internal fixation in the treatment of the intercondylar fractures of Humerus. The aim of this study is to evaluate and analyze the role of open reduction and internal fixation in inter-condylar fractures of distal humerus and note functional outcome and complications.

## METHODS

The present study was done in Malla Reddy Institute of Medical Sciences between June 2014 and June 2017. Out of 34 cases of intercondylar fractures of humerus admitted during the period, 25 patients were selected for the study that satisfied our inclusion criteria. Three patients out of those selected could not be included in the study as one had cardiac issues pre-operatively, one refused surgery and one was lost to follow up.

### *Inclusion criteria*

Patients within the age group of 20 to 70 years, with inter-condylar fractures of humerus and patients with both, compound and closed fractures were included.

### *Exclusion criteria*

Patients above the age of 70 years, intercondylar fractures with ipsilateral fractures of humeral shaft, Ipsilateral fractures of olecranon or radial head fractures, patients unfit for surgery for medical reasons and patients with vascular injuries and pathological fractures.

The fractures were classified as per the AO classification. There were B1-3, B2-1, C1-6, C2-5, C3-7 fractures.

Stainless steel K-wires, 4 mm cannulated cancellous screws with or without washers, stainless steel wires and 3.5 mm recon plates and contoured locking plates were used for fixation in our cases.

All the patients were operated by Posterior Olecranon chevron osteotomy approach by a senior faculty member. The ulnar nerve was explored routinely; we do not routinely transpose the ulnar nerve.

The patients were post operatively given above elbow POP slab and bandage at 90degrees of elbow flexion. The limb was elevated to eliminate post-operative edema. Active assisted movements of the elbow are encouraged as soon as the patient co-operates. All the patients were given intravenous broad spectrum antibiotics during immediate post-operative period. Sutures were removed on the 12th post-operative day and active physiotherapy started. The patients were followed-up every 3 weeks for first 3 months, then every 3 months subsequently.

At each visit the patients were examined clinically and radiologically. Range of movements is accurately measured using a goniometer and data is recorded.

Emphasis is laid on the examination of skin for wound dehiscence, hardware impingement, range of movements and radiological union. The patients were individually given instruction as to the range movement exercises during each visit. The functional evaluation is recorded and graded by Cassabaum's scale.

### *Cassebaum's scale*

Excellent if the extension deficit of 15 degrees or less and flexion to 130 degrees or more; Good if the extension deficit of 15 to 30 degrees and flexion of 120-130 degrees; Fair if the extension deficit of 30-40 degrees and flexion to 90-120 degree and Poor if the extension deficit of 40 degrees or more, flexion to less than 90 degrees.

### *Statistical analysis*

The data was entered into Microsoft excel sheet and analyzed using proportions.

## RESULTS

Table 1 shows distribution of study subjects as per clinical and demographic parameters. In all there were 22 patients, 14 males (63.6%) and 8 (36.4%) females patients. Their average age was 41.4 years. Fifteen (68.1%) were right sided and seven (31.8%) were left sided. Seventeen fractures (77.2%) out of 22 were due to RTA and the rest were due to simple fall. Five of our patients sustained the fracture due to simple fall whereas 17 of them had a road traffic accident.

Table 2 shows distribution of study subjects as per type of fracture and AO classification. There were 8 (36%) compound fractures the rest (64%) being simple fractures. According to AO classification there were three (13.6%) B1, one (4.5%) B2, six (27.2%) C1, Five (22.7%) C2, seven (31.8%) C3 type of fractures. All

patients were operated by a posterior olecranon chevron osteotomy by a senior faculty member.

**Table 1: Distribution of study subjects as per clinical and demographic parameters.**

Parameters		Number	%
Sex	Male	14	63.6
	Female	8	36.4
Side affected	Right	15	68.1
	Left	7	31.8
Reason of fracture	Road traffic accidents	17	77.2
	Simple fall	5	17.8

**Table 2: Distribution of study subjects as per type of fracture and AO classification.**

Parameters		Number	%
Type of fracture	Compound	8	36
	Simple	14	64
AO classification	B1	3	13.6
	B2	1	4.5
	C1	6	27.2
	C2	5	22.7
	C3	7	31.8

**Table 3: Distribution of study subjects as per the complications.**

Complications	Number	%
Superficial infections	2	33.3
Delayed union	1	16.7
Pain due to hardware	3	50
Nerve injury	0	0
Olecranon non union	0	0
Total patients with complications	6	100

**Table 5: Cassebaum's scale: Assessment of results.**

Rating	Motion	Range of motion	Pain	Disability	No. of cases
Excellent	Normal or near normal	0-15 to 130 or more	None	None	8
Good	Slight limitation	15-30 to 120-130	Occasional	Minimum	3
Fair	Moderate limitation	30-40 to 90-120	With activity	Moderate	9
Poor	Marked limitation	40 or more to less than 90 degrees	Variable	Severe	2

## DISCUSSION

Intercondylar fractures of the distal humerus in adults are difficult fractures to treat because of their rarity and associated significant comminution. The results of managing these fractures non-operatively are limited by failure to get anatomical reduction and early mobilization, which often results in painful stiff elbow and/or pseudarthrosis.

**Table 4: Distribution of study subjects as per the associated injuries.**

Associated injuries	Number	%
Collie's fractures	2	50
Fracture of distal ulna	1	25
Closed head injury	1	25
Total	4	100

Table 3 shows distribution of study subjects as per the complications. There were six (27.7%) cases of complications reported during the post-operative period. There were two superficial infection, delayed union in one patient, three patients had pain due to hardware. There were no cases of nerve injury or heterotrophic ossification. We report no case of olecranon non-union. The complications do cause a hindrance to the initiation of physiotherapy and hence lead to a fair to poor outcome in the final analysis.

Table 4 shows distribution of study subjects as per the associated injuries. Four of our patients had associated injuries like collie's fractures in two, and fracture of distal ulna and a closed head injury in one each. The injuries cause a delay in taking up of surgery and a delay in the start of physiotherapy. They contribute to a poor to fair results in the final outcome. There were 4 associated injuries, two of which were Colle's fractures, one closed fracture of ulna distal end and one head injury.

Table 5 shows cassebaum's scale: Assessment of results. The data on elbow motion was combined with the patient's subjective symptoms to provide an overall functional rating. An excellent rating was given for a symptom free elbow with a normal or nearly normal range of motion, a good overall rating, for good or excellent elbow motion with some subjective symptoms; a fair rating; for a fair range of motion of the elbow with or without symptoms; and a poor rating for both limited mobility and limited function.

Historically, distal humerus fractures had gained a reputation for universally poor outcomes regardless of treatment modality. Indeed it took many years to reach a consensus as to whether these injuries warranted surgery in favor of the non-surgical "bag of bones" technique as described by Eastwood.<sup>10</sup>

The advent of the smaller ASIF screws and plates, cannulated cancellous screws, has added measurably to

the versatility of the skeletal fixation, in particular with the comminuted type C3 fractures. More and more surgeons all over the world are encouraged to adopt a more aggressive surgical treatment. Presently, Open reduction and internal fixation is widely accepted as the treatment of choice for distal humerus fractures.<sup>11</sup>

The importance of stable fracture fixation and early physiotherapy was emphasized by Papaioannou, who found that functional results were significantly improved when stable fixation was achieved.<sup>12</sup>

Korner found significant impairment in the range-of motion if immobilization was carried out longer than 15 days.<sup>13</sup>

Charissoux, in his study found that 87% of his patients who required prolonged immobilization went on to give poor functional results.<sup>14</sup>

In the present study we emphasized the need for rigid internal fixation of all the inter-condylar fractures and early mobilization to avoid joint stiffness. The critical factors for successful outcome include meticulous surgical technique, stable internal skeletal fixation, and early controlled post-operative mobilization.<sup>15,16</sup>

The trans-olecranon approach with the patient in lateral position offers excellent approach of the articular surface and distal end of humerus without the soft tissue trauma, associated with the triceps splitting or tongue of triceps approach.<sup>17</sup>

We adopted this approach in all our patients. While the trans-olecranon approach requires the creation of an additional intra-articular fracture, this approach also facilitates identification of and protection of ulnar nerve. Emphasis was placed on the accurate restoration of the trochlea. The inherent stability provided by its congruent relationship with the greater sigmoid notch of the proximal part of the ulna makes its anatomical reconstruction important in restoring elbow function and offsetting later degenerative arthritis. When there is inter-condylar comminution or bone loss/bone missing from the trochlea, care should be taken not to narrow the trochlea. This may require placement of a piece of structural graft, usually obtained from the iliac crest.<sup>18</sup>

Our results are comparable with other studies such as Gupta and Gupta et al who studied 20 cases of intercondylar fracture humerus treated with open reduction and internal fixation and early mobilization and achieved good and excellent results in 15 cases (75%).<sup>19,20</sup>

Another study by Allende et al in 2004 also showed comparable results in which 40 cases were studied which were surgically treated and the inclusion criteria was similar showed good and excellent results in 34 cases (85%).<sup>21</sup>

## CONCLUSION

In surgical management of inter-condylar fractures of the distal humerus, anatomical reduction, rigid internal fixation and early post-operative mobilization are of utmost importance. Posterior trans-olecranon approach was found to be of most satisfactory approach by us. It allows good exposure of the joint and the ulnar nerve. We treated in the present series twenty two patients with excellent to fair results in 18 patients. Patients with poor results are due to either infection, hardware pain resulting in poor compliance with post-operative physiotherapy. A rigid internal fixation, restoration of articular surface, prevention of infection and early mobilization are the key to the good results in intercondylar fractures of humerus.

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