

# Distal humerus fractures with intercondylar extension: Surgical management by using plates

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## Abstract

Reduction and fixation of articular surfaces followed by attachment to humeral shaft. Reduction and fixation of Medial and Lateral condyles to shaft, then reconstruction of articular surfaces. 8 patients (25%) had excellent, 9 patients (30%) had good and 9 patients (30%) had fair outcome according to MAYO performance score. Nonunion is not encountered superficial infection in 5% cases treated by daily dressing and IV antibiotics. A high rate of union can be achieved in complex intra-articular fractures of distal humerus if the proper principle of stable fracture fixation are followed i.e. a posterior trans-olecranon approach and dual fixation of both columns and restoration of continuity of articular surfaces.

**Keywords:** Distal humerus fractures, intercondylar extension, fixation of articular surfaces

## Introduction

Inter-Condylar Fractures of distal end of Humerus are uncommon injuries that account for fewer than 2% of all adult fractures. The complex anatomy of the elbow joint, the adjacent neurovascular architecture and the sparse soft tissue envelop combine to make these fractures difficult to treat. Fractures of distal end of Humerus continue to be challenging problem for today's surgeons despite advances in technique and implants <sup>[1]</sup>. Acceptable results have been reported in a majority of patients treated by Open Reduction and Internal Fixation. Restoration of painless and satisfactory elbow function after a fracture of the distal humerus requires anatomic reconstruction of the articular surfaces, restitution of the overall geometry of the distal humerus and stable internal fixation of the fractured fragments to allow early and full rehabilitation <sup>[2]</sup>.

Reduction and fixation of articular surfaces followed by attachment to humeral shaft. Reduction and fixation of Medial and Lateral condyles to shaft, then reconstruction of articular surfaces. Depending upon frequency of comminution and displacement, Open Reduction and Internal Fixation with 1/3 tubular plate, Reconstruction plates, 'K' wire and double Tension Band wiring can be done individually or in Combination or Elbow Arthroplasty can be chosen. The Aim of the present Study is to evaluate the Functional Outcome of Surgical Management of Intercondylar Fractures of Humerus by Open

Reduction and Internal Fixation by using Plates <sup>[3]</sup>.

Among the Surgical Exposure options available, it was concluded that it basically depends upon the Surgeons discretion but a Trans-Olecranon approach gives a better visualization of the Fracture site and an easier articular reconstruction opportunity compared to other approaches like Triceps-Reflecting Anconeus Pedicle, Triceps Splitting or a Para-Tricipital approach <sup>[4]</sup>.

### Methodology

- Duration of study from March 2018 to March 2021.
- Sample size is 30.
- Patients between 20 and 60 years are taken.
- Duration of follow up is 2 years.

### Inclusion criteria

- Closed distal humerus fracture with intercondylar extension.
- Type 1 open fracture.

### Exclusion criteria

- Type 2 and 3 open fracture.
- Nonunion.
- Pathological fracture.
- Medically unfit patients.

### Results

8 patients (25%) had excellent, 9 patients (30%) had good and 9 patients (30%) had fair outcome according to MAYO performance score. Nonunion is not encountered superficial infection in 5% cases treated by daily dressing and IV antibiotics.

**Table 1:** Mayo performance score

Function	Points	Definition	Points
Pain	45	None	45
		Mild	30
		Moderate	15
		Severe	0
Motion	20	Arc>100°	20
		Arc 50-100°	15
		Arc<50°	5
Stability	10	Stable	10
		Moderate instability	5
		Gross instability	0
Function	25	Comb hair	5
		Feed	5
		Hygiene	5
		Wear shirt	5
		Wear shoes	5

Total score = 100, Excellent result = >90, Good result = 75-89, Fair = 60-74, Poor result = <60.



**Pre op X-ray**

**Immediate post op.**



**3 months post op**

**6 months post op**

**Fig 1: Clinical X-rays**





## Discussion

The distal humerus can be thought of as a 2 column structure supporting the articular segment. The distal portion of the lateral column (capitellum) projects anteriorly approximately 35 to 40 degrees. The medial column terminates at the medial epicondyle and, in contrast, does not curve anterior. The anatomy of the trochlea is analogous to that of a spool with distal articular segment oriented at 4 to 8 degrees of valgus relative to the long axis of the humerus <sup>[5]</sup>. Furthermore, this distal articular segment is internally rotated 3 to 4 degrees relative to the transepicondylar axis. Understanding the ligamentous anatomy is critical during exposure and plate application to avoid iatrogenic injury. The anterior bundle of the medial collateral ligament a primary elbow stabilizer, originates on the anteroinferior aspect of the medial epicondyle and inserts onto the sublime tubercle of the ulna. The medial column and medial epicondyle, therefore, can accommodate plate placement without impinging on the MCL origin. The lateral ulnar collateral ligament, the primary lateral stabilizer, originates and inserts on the lateral epicondyle and crista supinatoris, respectively. Identification and protection of the lateral collateral ligament origin allows visualization of the posterior aspect of the radiocapitellar joint and safe lateral plate application. Diagnostic modalities are plain radiograph AP and LATERAL view. CT scan of involved part to know fracture anatomy <sup>[5]</sup>.

A high rate of union can be achieved in complex intra-articular fractures of distal humerus if the proper principle of stable fracture fixation are followed i.e. a posterior trans-olecranon approach and dual fixation of both columns and restoration of continuity of articular surfaces <sup>[3]</sup>. The stability achieved by this technique permits institution of early intensive physiotherapy to restore elbow function <sup>[6]</sup>.

## Surgical Exposures

The selection of a surgical approach for the management of distal humerus fractures is dependent on several factors. These include the surgeon's experience and preferences, fracture pattern, degree of articular involvement, associated soft tissue injury, rehabilitation protocols, and whether intraoperative conversion to arthroplasty is contemplated. The ideal approach for each individual fracture should provide adequate visualization to allow anatomic reduction and the application of internal fixation to maintain elbow stability with minimization of soft tissue and bone disruption to permit early motion. Several surgical approaches will be discussed with their strengths and limitations highlighted. Approaches to the distal humerus can be categorized into olecranon osteotomies, triceps sparing (triceps-on), triceps splitting and triceps reflecting (triceps-off). Visualization of the distal humerus articular segment varies with each approach. The triceps splitting, triceps reflecting, and olecranon osteotomy expose 35%, 46%, and 57% of the distal articular segment, respectively. A thorough review of elbow anatomy and detailed approaches has been previously documented. However, for this review we will highlight some important issues surrounding each approach <sup>[7]</sup>.

## Olecranon osteotomy

Most commonly used approach for management of complex intra articular DHF, as it affords the best visualization of the particular segment. The outcomes after this approach, however, can be complicated by malunion, nonunion, and hardware concerns. The steps required to minimize postoperative complications after the creation of an olecranon osteotomy<sup>[8]</sup>. These include precontouring and fixation of a 3.5 mm reconstruction plate to the olecranon with screws directed ulnarly to avoid the proximal radioulnar joint, identification of the bare spot through medial and minimal lateral dissection and maintenance of subchondral bone before completion of osteotomy<sup>[8]</sup>.

## Triceps sparing (Triceps-On) or bilaterotricipital approach

This approach avoids any disruption of the extensor mechanism insertion on the olecranon using surgical windows along the medial and lateral sides of the triceps. The main advantages of this approach are the avoidance of an osteotomy and maintenance of triceps integrity to allow early active motion. An additional advantage of this approach is that it allows easy intraoperative conversion to a total elbow arthroplasty (TEA) if stable ORIF is deemed unlikely. Distal extension of the lateral window into the Boyd approach assists with intra-articular exposure. The main disadvantage of this approach is the limited visualization of the articular segment. This approach is best reserved for extra-articular fractures or simple intra-articular fractures with minimal comminution<sup>[9]</sup>.

## Triceps splitting

It involves a distal midline triceps tendon split with equal portions of the triceps tendon and its insertion on the olecranon reflected medially and laterally. In the comparative study of posterior elbow approaches reported that only 35% of the distal humerus articular segment could be visualized with the triceps split, which does limit its usefulness. Comparison between the olecranon osteotomy to the triceps split for DHF found no difference in functional outcomes at follow-up<sup>[10]</sup>.

## Conclusion

The complex geometry of the distal humerus compounded with the increasing number of fractures in the elderly patients will continually challenge orthopaedic surgeons. Advancements have been made in imaging, surgical techniques and fracture specific implants, however, time will determine whether patient outcomes have been improved and complications decreased. The management of distal humerus fractures should be approached in a systematic way, understanding the fracture type, its natural history, using the principles of fracture care and incorporating patient-related factors. The goals of treatment are an approach that provides adequate exposure, anatomic reduction of the joint, stable fixation to allow for early rehabilitation, and the minimization of complication.

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