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## GU Kiran

Assistant Professor, Department  
of Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

## H Shashidhara

Assistant Professor, Department  
of Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

## J Manjunath

Professor and Head, Department  
of Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

## Mk Akshay

Resident, Department of  
Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

## Ashrith Muralidhar

Resident, Department of  
Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

## A prospective study of functional outcome in intrarticular lower end of humerus fracture treated with dual plating

GU Kiran, H Shashidhara, J Manjunath, Mk Akshay and Ashrith  
Muralidhar

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### Abstract

**Introduction:** Lower end of humerus fractures are uncommon and intra-articular in adults, often involve both the medial and lateral columns. Treatment of these fractures is difficult and involves the risk of unfavourable results. Anatomical reconstruction and rigid fixation following early mobilization of the elbow are the prerequisite required for a good clinical outcome. The aim of this study is to evaluate the functional outcome in intra-articular fracture of the lower end of humerus treated with dual plating.

**Materials and methods:** A prospective study of 20 patients of comminuted intra-articular fracture lower end of humerus treated surgically with, dual plating using standard dorsal approach, olecranon osteotomy with a follow up period of 24 months.

**Results:** The average age was between 20 – 54 years, with mean of 37.5 years. 16 cases (80%) road traffic accident as major cause of injury. Most of the patients were male 14 (70%) with dominant limb involvement in 14 (70%) cases. According to MEP score clinical outcome was excellent in 4 (25%), good 10 (50%), fair in 5(20 %) and poor in 1 (5 %).

**Conclusion:** Open reduction and internal fixation with dual plating provides reliable, rigid fixation following an early functional mobilization of the elbow joint and acts as an extramedullary load bearing device, stabilizing fracture fragment and ensuring bony union in fracture lower end of humerus with intraarticular extension.

**Keywords:** Lower end of humerus, Dual plating, internal fixation, Olecranon osteotomy

### Introduction

Lower end of humerus fractures make up 0.5 to 2% of all fractures, but up to 30% of fractures involving the elbow joint. In adults, most of the lower end humerus fractures are intra-articular and involve both the medial and lateral columns. The distribution of lower end humerus fractures follows a bimodal age distribution. High energy injuries tend to occur among younger patients, while low-energy injuries are more common in older patients. Understanding the anatomy of the lower end humerus is critical to effective treatment of lower end humerus fractures. Divergent medial and lateral columns of bone support the lower end of humeral articular surface in an inverted-Y configuration. The traditional classification of lower end humerus fractures has centered around the terminal ends, or the condyles of the humerus. When discussing intra-articular fractures of the lower end of humerus, the term “condyle” is converted to “columns” for the sake of classification. Several classification systems for intra-articular both column fractures of the lower end of humerus have been proposed. Riseborough and Radin described 4 types of intercondylar “T-type” distal humerus fractures: Type 1 was a non-displaced fracture, Type 2 was displaced but without rotation of the fragments, Type 3 includes fragment rotation, and Type 4 involved severe comminution. Although initially relevant for its descriptive value, these classifications proved inadequate in reliably describing the fracture and directing treatment as these injuries were more frequently being treated operatively. The Orthopaedic Trauma Association’s alpha-numeric system, assigned three main types: Type A (extra-articular), Type B (partial articular), and Type C (complete articular). The OTA system’s clinical application is limited and is hindered by poor interobserver reliability beyond identification of the basic three types.

### Correspondence

#### H Shashidhara

Assistant Professor, Department  
of Orthopaedics, SSIMS-RC,  
Davanagere Karnataka, India

The indication for non-operative treatment of distal humerus fractures is limited and primarily involves patients with very low demand or in poor health. The risk of fracture displacement, mal union, and non-union is high with non-operative treatment, due to the characteristic intra articular involvement, and poor control of fracture fragments when closed treatment is done, hence we typically treat these fractures operatively. Different types of implants like K wires, 4mm cancellous screws, 3.5mm recon plates and one third tubular plates are being used during operative procedure. Pre-contoured column specific locking plates useful in osteoporotic bone fixation. Several variables are important in successful management of these fractures: restoration of articular congruity, secure bony fixation, achievement of bony healing, maintenance of a functional range of motion, and avoidance of complications such as hypertrophic ossification and ulnar neuropathy. The objective of this study was to evaluate the clinical outcome in intra articular lower end of humerus fractures treated surgically with dual plates.

### Patients and methods

This is a prospective type of study of 20 cases of lower end fracture humerus with inter condylar extension treated surgically with dual plating which were admitted To ssims-rcdavanagere, karnataka, between November 2012 to October 2015. All the patients of lower end humerus fracture with age between 20 to 54 years with medical fitness for surgery were included in the study. Patients medically unfit for surgery and those not willing for surgery, Compound fractures of the lower end of humerus, lower end of humerus fractures in children were excluded from study. All the patients who attended to casualty and orthopaedic OPD examined to rule out any associated injuries All the patients subjected for X rays of elbow joint antero posterior and lateral views to confirm the fracture and above elbow POP slab applied. After surgical profile screening patients were posted for surgery electively.

### Operative technique

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. Antiinflammatory analgesics and other supportive measures were also given as per individual requirements. 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

**Table 1:** Technical Objectives for Fixation of lower end Humeral Fractures

1. Every screw should pass through a plate.
2. Each screw should engage a fragment on the opposite side that is also fixed to a plate.
3. As many screws as possible should be placed in the distal fragments. Each screw should be as long as possible.
4. Each screw should engage as many articular fragments as possible.
5. Plates should be applied such that compression is achieved at the supracondylar level for both columns.
6. Plates used must be strong enough and stiff enough to resist breaking or bending before union occurs at the supracondylar level.
7. From Sanchez-Sotelo J, Torchia ME, O'Driscoll SW: Principle-based internal fixation of distal humerus fractures, Tech Hand Upper Extremity Surg 5:179, 2001

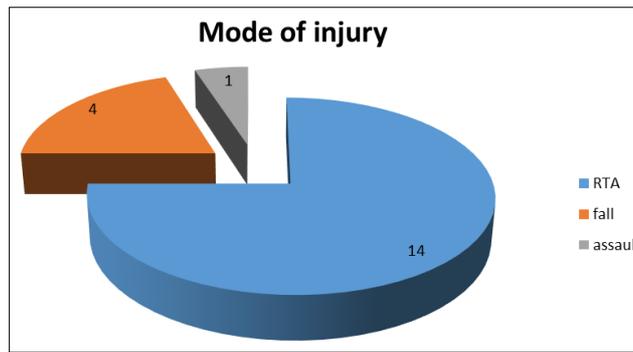
### Results

The present study consists of 20 cases of lower end humerus fracture with inter condylar extension treated by open reduction and internal fixation with Dual plating (3.5mm reconstruction plate and 1/3rd tubular plate) from November

2012 to October 2015.

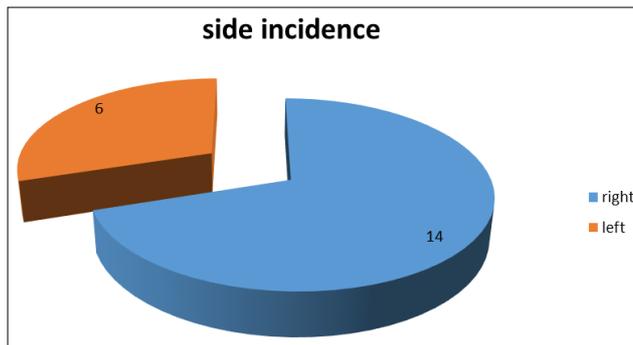
In mode of injury, 14 cases (70%) were due to road traffic accident (RTA) and 5 cases (30%) were due to direct fall injury, 1 case of assault (Table 1).

Table 2



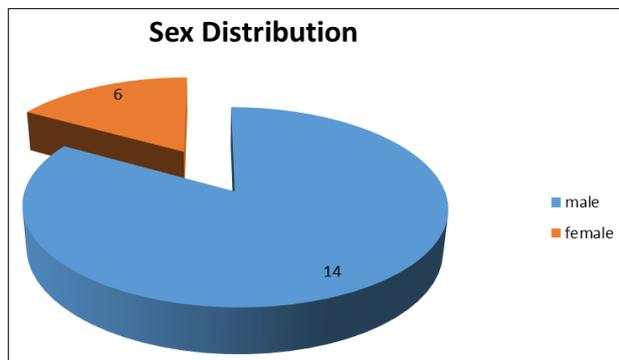
Right upper limb was involved in 14 (70%) cases and left upper limb in 6(30%) cases (Table 2)

Table 3



In sex distribution, there were 14 (70%) males and 6 (30%) females (Table 3).

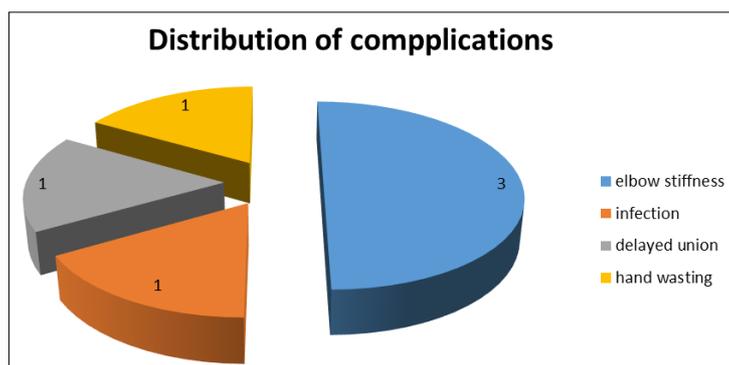
Table 4



All the cases were operated electively on regular operation theatre days. In the post - operative period one patient developed superficial wound infection in which suture removal was delayed. Heterotropic ossification with elbow stiffness occurred in three patient. Delayed union at

osteotomy site identified in one patient. Hand wasting in one patient. In our study, radiological union was seen at 4 months to 7 months. Average duration radiological union was 16.4 weeks.

Table 4



**Mayo elbow performance score**

	MEP score	number	Percentage
Excellent	91-100	5	25%
Good	75-90	10	50%
Fair	60-74	4	20%
poor	<60	1	5%

**Discussion**

In adults, most of lower end humerus fractures are intraarticular and involve both the medial and lateral columns. Due to the characteristic intra articular involvement, displacement, and poor control of fracture fragments with closed treatment, we typically treat these fractures operatively. The goal of treatment is restoring painless and functional elbow in a fractured lower end humerus which requires anatomical reconstruction and stable fixation. Though parallel plating proposed by O'Driscoll SW is more biomechanically stable than perpendicular plating technique, we did perpendicular plating technique as it requires less soft tissue dissection and time duration, technically less demanding and stability achieved by this technique is enough for bone union and early rehabilitation. 2 In our study, we treated all 20 cases with open reduction and internal fixation with dual plating in 90-90 configuration i.e., one plate on

medial boarder and another on posterior surface of lateral column. In our study, there were 14 (70%) males and 6 (30%) females comparable to study by Henley *et al* and in Wang *et al* studies showed 60% males and 40% females.3,4 In our study 14 cases (70%) were due to road traffic accident (RTA) and 5 cases (30%) were due to direct fall injury comparable to Henley *et al* study showed 61% cases due to RTA and 39% cases due to direct injury.3 Gabel *et al* reported 100% cases due to direct injury. In our study incidence of right and left upper limb involvement comparable to other studies by Jupiter *et al*. Average MEP score was 84, similar to study done by Atalar AC *et al* evaluating the functional outcome of complex lower end humerus fractures in 21 patients the mean MEP score to be 86.1.7 The complications noted in our study are hard ware protrusion at tension band wiring site in two patients and we managed with early removal of protruding K wires from TBW site after union at osteotomy site. Hypertrophic ossification with elbow stiffness occurred in one patient, managed with regular physiotherapy. Delayed union at osteotomy site identified in one patient.

**Case scenario**

**Preop and postop with follow up xrays**



**Functional outcome**





**Case senario**



**Functional outcome**



**Conclusion**

Lower end humerus fractures known for their complex nature and technical difficult in surgical management. Proper anatomical articular reconstruction, stable fixation and early post-operative physiotherapy help in restoring painless and functional elbow

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