

# Functional outcome of postoperative intercondylar fracture of distal humerus fracture managed by bicolumnar plating in tertiary medical centre of Jharkhand

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## Abstract:

**Background:** Historically, the treatment outcome of the distal humeral fractures remained problematic because of lack of understanding of bony anatomy, lack of precontoured locking plates, and higher rates of infection. Till today, the treatment of the distal humerus fractures has remained a challenging problem in spite of advanced techniques and implant designs because of complex regional anatomy with limited options for internal fixation, articular comminution, and quality of architecture of inherent bones

**Aim and Objective:** The purpose of this study was to assess the efficacy, technical requirements, functional outcome, radiological and clinical union, and complications of distal humerus fracture treated with bicolumnar plating

**Materials and Methods:** This prospective study was conducted at Rajendra institute of medical sciences Ranchi from June 2018 to December 2019. Thirty five patients having displaced distal humerus fractures were admitted and included in the study. Fractures were classified according to the AO classification, all the patients were treated primarily with bicolumnar plating, and the functional outcome was assessed using Mayo Elbow Performance Score (MEPS). The collected data were entered into MS Excel and then were analyzed, statistically evaluated in Statistical Package for the Social Sciences 20

**Results:** We got 48.85% excellent, 57.15% good outcome in patients treated within 10 days of trauma 10 days and 14.28% excellent and 14.28% good outcome in patients treated after 10 days. We used conventional plates in 40% and locking plates in 60% of the patients. 60% of the patients required >120 min for surgery and 40% required 2.86% implant prominence, 2.86% stiffness with conventional and locking plates respectively.

**Conclusion:** Open reduction and internal fixation is the treatment of choice for distal humerus fracture mainly in the type B and type C fractures. Careful examination of ipsilateral shoulder and wrist is essential to rule out other associated fractures. Fracture types influence the final functional outcome along with stable internal fixation that is C1 fractures have better functional outcome than C3 fractures

**Key Word:** distal humerus fracture, bicolumnar plating, intercondylar fracture.

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## I. Introduction

Distal humerus fracture is one of the most complicated and challenging fracture of upper extremity and it accounts for approximately 2% of all fractures. It has bimodal age distribution with peak incidence between 12 to 19 years usually in males, and 80 years and older in females(1).

The complex anatomy of elbow joint, displaced multiple fragments and intra-articular extension of fracture make these cases challenging to treat and carry a high complication rate. Early attempts at open reduction and internal fixation of these difficult fractures fell into disrepute because of inability to obtain a stable fixation which led to prolonged postoperative immobilisation(2).

High-energy injuries such as road traffic accidents, fall from height, sports, industrial accidents, and firearms have been the causative factor for distal humeral fractures in adults. Low-energy injuries such as fall from standing height causes fractures of distal humerus in most of the elderly patients. Historically, the treatment outcome of the distal humeral fractures remained problematic because of lack of understanding of bony anatomy, lack of precontoured locking plates, and higher rates of infection. Till today, the treatment of the distal humerus fractures has remained a challenging problem in spite of advanced techniques and implant

designs because of complex regional anatomy with limited options for internal fixation, articular comminution, and quality of architecture of inherent bones.(3)

Displaced distal humerus fractures are a surgical challenge because of the high frequency of comminution and underlying osteoporosis . As with any fracture fixation, anatomical reduction of the articular surfaces and sufficient primary stability are required to allow rehabilitation to start as quickly as possible, so as to avoid stiffness. Recently introduced locking compression plate (LCP) systems for treating distal humerus fractures provide undisputed theoretical mechanical advantages. However, they do not allow all possible clinical scenarios to be addressed: very distal fractures, comminuted fractures, osteoporosis, etc (4)

Throughout the last two decades, the treatment of these fractures has progressed from nonoperative procedure to anatomic reduction and internal fixation based on the Association for Osteosynthesis (AO)/Association for the Study of Internal Fixation principle of orthogonal plate fixation with early mobilization and better performance. The risks of functional impairment and deformity are very high following conservative treatment of these distal intra-articular fractures of the humerus, and stable internal repair may be challenging to attain due to the severity of the fractures and the resulting osteoporosis.(5)

The functional outcome of distal humerus fractures is related to the ability to restore the normal anatomy and to allow early movement. Various methods of limited internal fixation have been described using Kirchner wires, screw fixation and single plates. These methods do not allow enough stability for early movement and have unpredictable results. The improved techniques for fixation recommended by the AO/ASIF have lead to early mobilisation with predictable results. The plating of two columns with plates preferably at 90° to one another, has become the standard to compare other treatments to(6).

### **Aim and objective**

The purpose of this study was to assess the efficacy, technical requirements, functional outcome, radiological and clinical union, and complications of distal humerus fracture treated with bicolumnar plating

### **Methodology**

This prospective study was conducted at Rajendra institute of medical sciences Ranchi from June 2018 to December 2019. Thirty five patients having displaced distal humerus fractures were admitted and included in the study. Fractures were classified according to the AO classification, all the patients were treated primarily with bicolumnar plating, and the functional outcome was assessed using Mayo Elbow Performance Score (MEPS). The collected data were entered into MS Excel and then were analyzed, statistically evaluated in Statistical Package for the Social Sciences-20;

### **Inclusion criteria were**

- (a) The patients with closed distal humerus fractures,
- (b) mature skeleton, and Patients who were medically fit for surgery.

### **Exclusion criteria were**

- (a) Compound fractures,
- (b) Patients not willing for surgery,
- (c) Pathological fractures,
- (d) Infections.

After hemodynamic stabilisation, individuals were subjected to a complete examination, which included screening for head, abdominal, and pelvic damage, as well as regular preoperative examinations. All of our patients were initially immobilised with an above-the-elbow slab. Anteroposterior and lateral images of the elbow with the humerus were captured. For a better knowledge of fracture anatomy, patients with significant comminution required a CT scan/3D CT scan.

Patients were operated on in a lateral decubitus posture, with their upper arms supported by a cushioned post/bolster and a tourniquet applied to their upper arms. Fixation was done with 4 mm CC screws and bicolumnar plating using a posterior approach with Chevron osteotomy. K wire and tension band wiring were used to secure the osteotomy, and the wound was closed in layers.

Strict limb elevation was given postoperatively to decrease swelling, and vigorous finger movements were commenced. A one-week above-elbow slab was used to allow soft tissue to recover. On day 3, the suction drain was removed and the first wound check dress was applied. Antibiotics were given intravenously for 3–5 days. Physiotherapy was started after surgery depending on the fixation's stability, and in most cases, range of motion (ROM) of the elbow was started after 7–10 days to allow soft tissues to heal and minimise wound gaping. The sutures were removed after 10–14 days.

The first follow-up occurred at 6 weeks, with additional follow-ups occurring at 3 months, 6 months, 1 year, and 2 years. The functional MEPS (excellent >90, good 75–89, fair 60–74, and bad 60) was recorded at each follow-up to compare whether the result had improved or deteriorated. Xrays were taken at each follow-up

appointment to check for union, delayed union, non-union, and implant failure. We also measured elbow range of motion and discussed the function of physiotherapy in achieving complete range of motion.

## II. Result

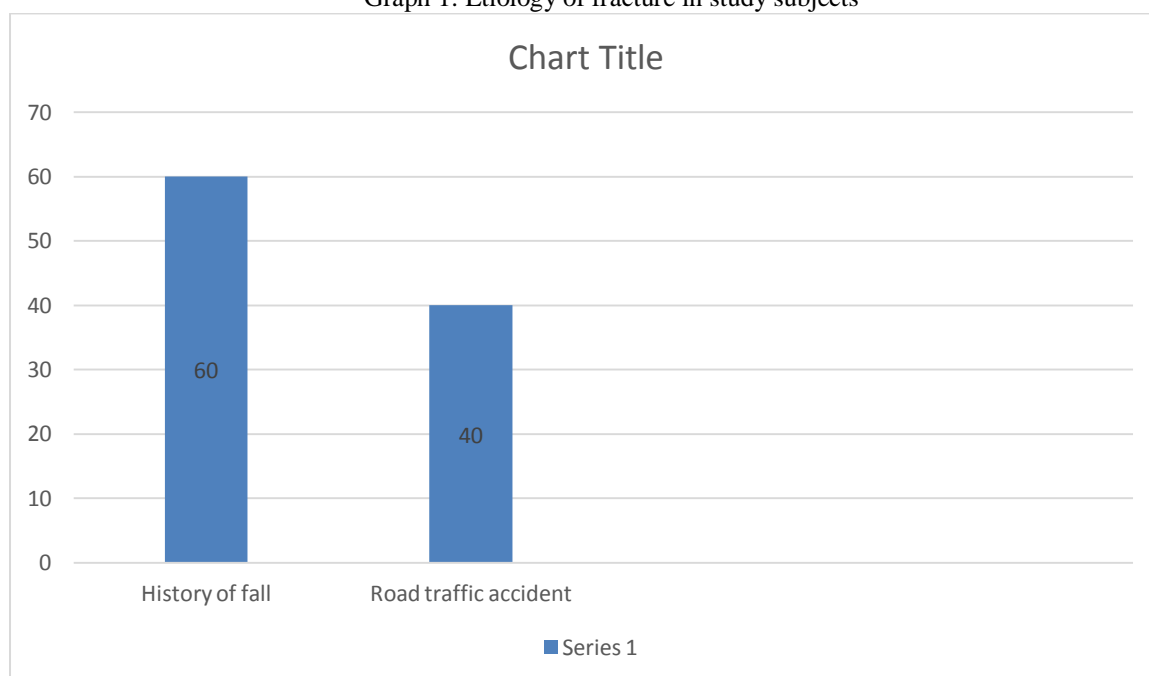
Out of 35 patients, 15 were male and 20 were female. The most common age group was >60 years (37.14%) followed by 31–45 years (34.29%);

**Table 1:** Distribution of study subjects as per

Fracture side	no	%
right	16	45.71
left	19	54.28
Total	35	100

In our study left-sided fractures were seen in 54.28% of cases; rest 45.71% subjects had fracture in right side.

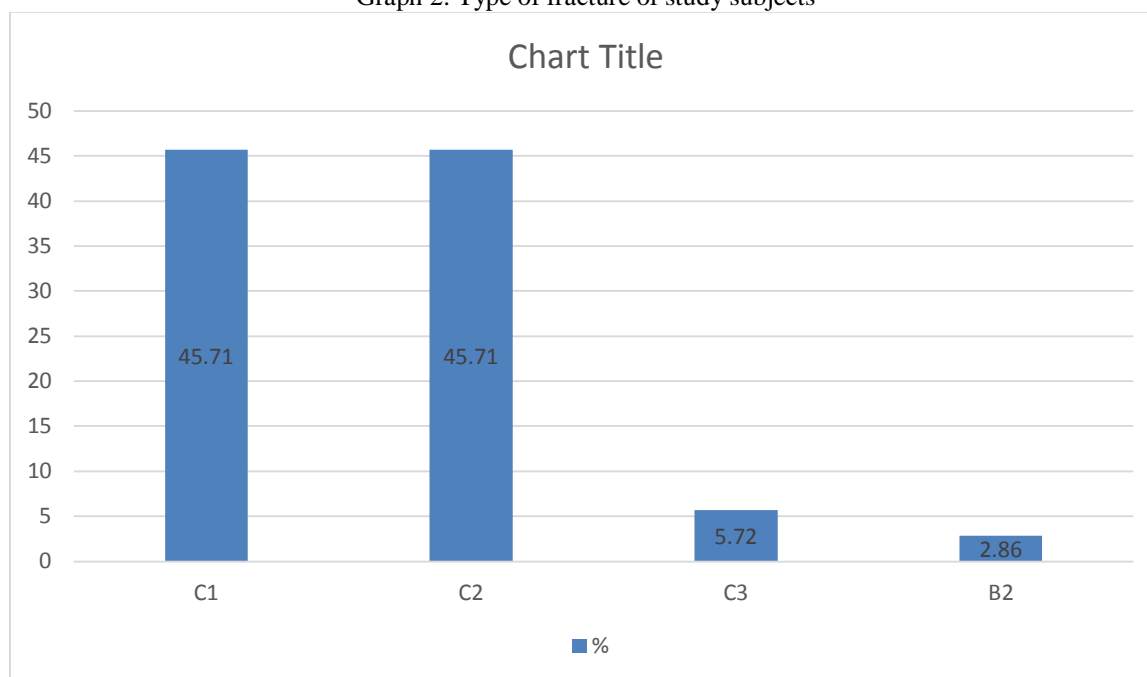
**Graph 1:** Etiology of fracture in study subjects



and In present study history of fall and road traffic accidents (RTA) was seen in 60% and 40% of cases, respectively.

In the present study, 45.71% of patients had C1, 45.71% had C2, and 5.72% had C3 type fractures and the remaining 2.86% had B2 fracture.

Graph 2: Type of fracture of study subjects



Associated fractures were seen in 20% of patients, in that 14% were distal end radius (DER) fractures, and Monteggia and proximal humerus fractures were 3% each. Duration of trauma was 10 days in 20% of the cases, with an average of 8.68 days and the range from 2 to 17 days.

We got 48.85% excellent, 57.15% good outcome in patients treated within 10 days of trauma 10 days and 14.28% excellent and 14.28% good outcome in patients treated after 10 days. We used conventional plates and locking plates in 60% of the patients. 60% of the patients required >120 min for surgery and 40% required 2.86% implant prominence, 2.86% stiffness with conventional and locking plates respectively.

42.85% of patients with C1 fractures and 37.14% of patients with C2 fractures showed excellent-to-good functional outcome; 34.28% of patients with conventional bicolumnar plate and 51.42% of patients with locking bicolumnar plate showed excellent-to-good functional outcome; and the difference was not statistically significant ( $P = 0.836$ ). The mean MEPS was 76.85 at 3 months, 81.85 at 6 months, and 84.42 at 1 year, and we observed 37.14% excellent outcome, 48.58% good outcome, 11.42% fair outcome, and 2.86% poor outcome.

### III. Discussion

Because of osteoporotic condition, the peak incidence of fracture was found to be in the age group of > 60 years (37.14 percent), which is comparable to the study by Ditsios et al.[8] the majority of the patients were female, accounting for 57.14 percent, which is similar to the studies by Pantalone et al.(7) and Biz et al.(8) Larger female sex distribution could be related to increased female carrying angle of elbow, bimodal age distribution, osteoporotic falls, and falls of old age females in villages strolling on uneven roads, as most of the patients were referred from rural because this is a tertiary care facility. The number of fractures on the left side was higher, which is similar to Kumar et al.(9) The mechanism of injury was determined to be a fall in 60% of patients, with the remaining 40% reporting road traffic incidents, which is similar to Biz et al study.(8) 1 cases was B2 subtype, 16 cases were C1, 16 cases were C2, and 2 cases were C3 subtype; this is similar to Kural et al study.(10) A total of 20% of the patients had related fractures, with DER fractures accounting for 14% and Monteggia and proximal humerus fractures accounting for 3% each. As a result, as recommended by Gradl and Jupiter(11), a thorough clinical examination of other joints, such as the ipsilateral wrist and shoulder, is required to diagnose any concomitant injuries. We used CT scans in 17.14 percent of patients and 3D CT scans in 51.42 percent of patients to better understand the fracture anatomy prior to surgery in order to save time and accomplish precise reduction. Gradl and Jupiter(11) proposed using a CT scan to classify articular comminution and plan preoperatively. The time between injuries and surgery is critical for a better functional outcome; among patients treated before 10 days, we had 48.85 percent excellent and 57.15 percent good outcomes, which is comparable to Sailesh et al.(12) For surgery, 60% of the patients needed more than 120 minutes, and 40% needed less than 120 minutes. Because of the difficulty in reducing, maintaining reduction in osteoporotic bones, and time consumption in bending, contouring conventional plates, most C2, C3 fractures and use of

conventional plates required more time, which is similar to the study by Kelkar and Rajput(13) with a mean operating time of 120.33 minutes. Because additional fracture comminution might lead to excessive callus formation, which can compress the ulnar nerve, anterior transposition of the ulnar nerve was performed in 29% of patients, mostly in types C2 and C3. After the anterior transposition, we found no ulnar nerve palsy. One patient developed ulnar nerve neuropraxia in the nonulnar nerve transposition group, which was totally recovered in 6 weeks, while Patel et al.(14) also detected one case of neuropraxia. Preventing postoperative ulnar nerve injury requires careful dissection and treatment of the ulnar nerve during surgery. Patel et al.(14) found similar intraoperative, early postoperative, and late postoperative problems. With standard plating, we saw greater problems (unstable fixation, nonunion, and screw backout). Nonunion was treated with bone grafting, stiffness was treated with CPM exercises, superficial skin infections were treated with antibiotics and dressings, deep infections were treated with debridement and wound wash, and implant prominence was treated by removing the implant after the fracture had healed. Because it is a fixed angle implant, locking bicolunar plates provide more solid fixation and hold the fracture fragments better until union occurs, resulting in fewer problems.

We saw clinical union in 60% of patients after 3–6 months and 40% of patients after 1–3 months, with an average of 13.94 weeks and a range of 10–24 weeks. Clinical union was determined by the lack of pain, discomfort, no mobility at the fracture site on inspection, full range of motion at surrounding joints, and the capacity to carry out everyday activities without pain. The callus formation on three cortices in two perspectives was used to measure radiological union; this is comparable to Kumar et al (9) with a 14.6-week average union time. Thirteen patients (37.14%) had MEPS>90, seventeen patients (48.58%) had MEPS 75–89, four patients (11.42%) had MEPS 60–74, and one patient (2.86%) had MEPS 60–74.

#### **IV. Conclusion**

Open reduction and internal fixation is the treatment of choice for distal humerus fracture mainly in the type B and type C fractures. Careful examination of ipsilateral shoulder and wrist is essential to rule out other associated fractures. Fracture types influence the final functional outcome along with stable internal fixation that is C1 fractures have better functional outcome than C3 fractures. Preoperative CT scan is very essential for planning of surgery, and early surgery is recommended to get better elbow ROM and good functional outcome. Locking compression plate is the better option to treat distal humerus fractures with good functional outcome and less complications as compared to conventional plates. Anatomical reduction, stable fixation, and early elbow mobilization are the prerequisite for the better functional outcome

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