



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2023; 9(1): 411-416
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<https://www.orthopaper.com>
Received: 26-12-2022
Accepted: 22-01-2023

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Study of outcome of distal humerus fracture treated with plating

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DOI: <https://doi.org/10.22271/ortho.2023.v9.i1f.3325>

Abstract

Background and Aim: Bicondylar intraarticular fractures of the distal humerus, because of their rarity and often associated significant displacement, comminution, and osteopenia, present the orthopaedician with a difficult injury to treat successfully. But modern techniques of open reduction and internal fixation provide stable construct to allow early post-operative motion without compromising bone healing. The aim of the present study is to evaluate the functional outcome of surgical management of the distal humerus with extra and intraarticular extension in adults using plating.

Material and Method: A total of 20 patients were included in the study. All the included patients had fractures of the distal humerus, aged >18 during the period of 2020-2021 in our hospital. Fracture is classified according to AO-OTA Classification. All are treated by open reduction and plating. Length and type of plate were selected as per fracture pattern. Post-Operatively above elbow cast was given to decrease pain and edema. The patients are followed up at regular intervals of 4,8,12 and 16 weeks and results were evaluated using the Mayo Elbow Performance Score for the results of treatment.

Results: We had 25% excellent, 50% good results, 10% fair & 15% poor results.

Discussion and Conclusion: Open reduction internal fixation should be done as early as possible. Delay in open reduction internal fixation with delayed soft tissue dissection leads to increased chances of elbow stiffness due to periarticular fibrosis. For a successful internal fixation of the closed distal humeral fracture, it is necessary to maintain anatomic and stable reconstruction of the articular surface and of both humeral columns using two 90-90° plates. Operative treatment with rigid anatomical internal fixation should be the line of treatment for all grades of extra and Intercondylar fractures, more so in young adults, as it gives the best chance to achieve good elbow function.

Keywords: Distal, fracture, humerus, plating

Introduction

In the last 20 years, advances in the science of fracture care have had a dramatic effect on the care of a difficult class of fractures. The injured elbow joint presents more difficulty than almost any other because it really is three joints that move synchronously. The elbow joint is a ginglymus or hinge type of synovial joint consisting of three components humerus, ulna, and radius together to form complex cubital articulation and all with continuous synovial lining. The Humero-ulnar articulation is primarily responsible for alignment, stability, and strength. The Humero-radial and proximal radioulnar joints facilitate forearm and hand motion and positioning. Distal humerus fractures are uncommon injuries that account for fewer than 2% of all adult fractures. There is a bimodal distribution with respect to the patient's age and gender. Peaks of incidence were described in males, aged 12 to 19 years and in females aged 80 and older. The most common causes of these fractures are falls in the elderly population and sports injuries or road traffic accidents in younger patients.

The complex shape of the elbow joint, the adjacent neurovascular architecture, and the sparse soft tissue envelope combine to make these fractures difficult to treat. Acceptable results have been reported in a majority of patients treated by open reduction and internal fixation. The majority of the distal humerus fractures (96%) have a complex pattern involving both the columns and the articular surface (AO type C injuries). The only reliable method for restoring the normal alignment and contour of the distal humerus is operative exposure and direct manipulation of fracture fragments. Depending upon the amount of comminution and displacement, open reduction and internal fixation with medial and lateral anatomical plates,

1/3 tubular plate, extra-articular distal humerus plate, reconstruction plate, cannulated cancellous screws, K wire, and double tension band wiring can be done individually or in combination.

Surgical management with conventional plates is mechanically unstable because of an inappropriate number of screws in the short distal fragment with the additional risk of impingement of the plate on the olecranon fossa. Dual plating increases the stability at the risk of soft tissue stripping of the bone. Oblique plates used by Moron increase purchase in the distal fragment but compromises the fixation of the proximal fragment.

The aim of the present study is to evaluate the functional outcome of surgical management of distal humerus with extra and intraarticular extension in adults using plating.

Materials and Methods

A: Sample design: Interventional Prospective study

B: Sample size: 20 approx. (Incidence 1-2/months)

C: Duration: August 2020 to August 2021

Criteria for patient selection

Inclusion criteria

1. Patients with age group >18yrs of either sex.
2. Patients having fresh (Within 3 weeks) distal humerus fracture.
3. Closed fractures
4. Open grade I/II fractures

Exclusion criteria

1. Age < 18 years
2. Patient with local site infection
3. Open grade III fractures
4. Not giving consent
5. Medically unfit patient

Treatment protocol

All the patients will be treated according to the protocol which consists of-

1. Standard A.P. & lateral plain X-ray.
2. Open wounds will be taken to the operation theatre for wound debridement on an emergency basis as early as possible.
3. Polytrauma patients will be fixed as soon as their general condition allowed for surgery.
4. Elbow range of movement exercises will be started according to the implant used and stability of fixation of the fracture, postoperatively.
5. Patients will be discharged with an AE slab depending on the stability of fixation.
6. Weightlifting and routine work will be allowed according to union status radiologically and clinically.
7. Patients will be followed up depending on the clinical examination as well as the x-ray findings.

Classification

All fractures will be then classified using the AO classification of fracture distal shaft humerus.

Type A: extraarticular

- **A1:** avulsion
- **A2:** simple
- **A3:** wedge or multi-fragmentary

Type B: Partial articular, the fracture is involving one part of the articular surface, yet the rest of the joint is still attached to

the metaphysis and diaphysis

- **B1:** lateral sagittal
- **B2:** medial sagittal
- **B3:** frontal/coronal

Type C: complete articular, the fracture is distributing the joint surface and separated from the diaphysis

- **C1:** both the articular and the metaphyseal portions are simple
- **C2:** simple articular with a fragmentary metaphyseal component
- **C3:** multi-fragmentary articular

Indications

Thus the indications for surgery in our study are:

- Failed conservative methods
- Unstable fracture
- Fracture in patients with polytrauma

Contraindications

- Pathological fractures.
- Malunited fractures.
- Infected fractures.
- Poor skin condition.
- Poor general medical condition of the patient (where patients cannot tolerate surgery).

Position

- Patient in lateral position with arm supported and forearm hanging.
- As per AO classification and fracture pattern incision will be planned. In most of the patients, a posterior trans-olecranon approach will be used to give better exposure to the articular surface. In some patients triceps reflecting and splitting approach can be taken.

Operative procedure

- **Type of anesthesia:** General anesthesia and brachial plexus block can be used.
- Painting and draping of the part will be done.
- The distal end of the humerus will be approached using the trans-olecranon approach for partly articular and intra-articular distal humerus fractures (AO type B and type C). Triceps reflecting and splitting approach can be taken for extraarticular fractures (AO type A).
- Elbow will be exposed posteriorly through an incision beginning 5cm distal to the tip of the olecranon and extending proximally midline of the arm 8cm above the tip of the olecranon.
- Reflection of the skin and subcutaneous tissue to either side carefully will be done to expose the olecranon and triceps tendon.
- The ulnar nerve will be isolated and fascia over the flexor carpi ulnaris will be longitudinally split over 6cm to enhance nerve mobility. Then gently retracted from its bed with moist tape.
- Distal end of the humerus will be exposed through the Transolecranon approach, triceps reflecting, and splitting approach.
- An intra-articular olecranon osteotomy will be made in a shallow V or Chevron fashion in the center of the olecranon sulcus that is approximately 2cm distal from the tip of the olecranon,
- Fragments of the humerus will be assembled in 3 steps –

- i. Reduction and fixation of condyle together.
- ii. Fix the medial or lateral epicondylar ridge to the humeral metaphysis, if it is fractured.
- iii. Reassembled condyles are fixed to the humeral metaphysis.
 - Medial and lateral pillars will be reconstructed using contoured 3.5 mm distal humerus medial and lateral anatomical plates reconstruction plate and screws, anatomical extra-articular distal humerus plates, 1/3 tubular plate, and 4 mm CC Screws.
 - To enhance the mechanical strength the plates will be placed as close to 90° to each other as possible.
 - The stability of the internal fixation will be tested by putting the elbow through a range of motion.
 - The olecranon osteotomy will be reduced under direct vision and held with a reduction clamp.
 - Two 2mm k wires will be introduced from the tip of the olecranon.
 - A No.18 stainless steel malleable wire will be passed through a thin transverse hole and crossed over the posterior surface of the olecranon in a figure-of-eight manner and then passed around the k-wires and tightened.
 - At the completion of the fixation the elbow will be again put through a range of motion to test the security of the internal fixation.
 - The wound will be closed in layers over a large suction drain.

- Pressure bandage will be applied, limb immobilized with the above elbow splint.

Postoperative management

- Postoperative patients will be immobilized with an AE slab from the next postoperative day morning.
- Postoperative analgesic is given according to the patient's complaint.
- Intravenous antibiotics will be given for 1st 5 days then shifted to oral antibiotics.
- After that patients will be discharged with oral antibiotics and analgesics and with AE slab and called on the 12th to 14th postoperative day for suture removal.
- After suture removal we will give AE slab to patients whose fractures are fixed with plating for 3 weeks followed by elbow mobilization and will be advised to come at 1 month.

Follow-up regime

- Patients will be called for follow-up for the duration of 1 month and clinical status and fracture union noted.
- X-rays will be taken to confirm the progress of the union.
- The elbow range of motion will be noted. Any complaints regarding pain are noted.
- Patients will be regularly followed up at regular intervals till the fracture is completely united.
- All patients will be called for regular physiotherapy for improvement of elbow movements.



Fig 1: Position of the patient



Fig 2: Posterior midline incision



Fig 3: Posterior midline incision



Fig 4: Isolation of ulnar nerve

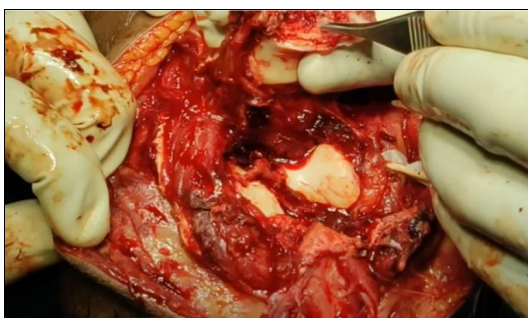


Fig 5: Chevron osteotomy



Fig 6: Fracture configuration

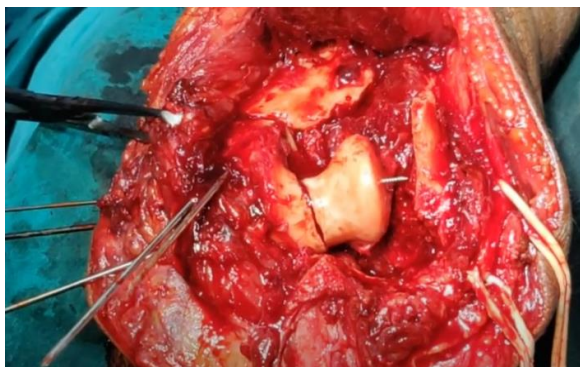


Fig 7: Intercondylar fragment fixation & lateral column stabilization

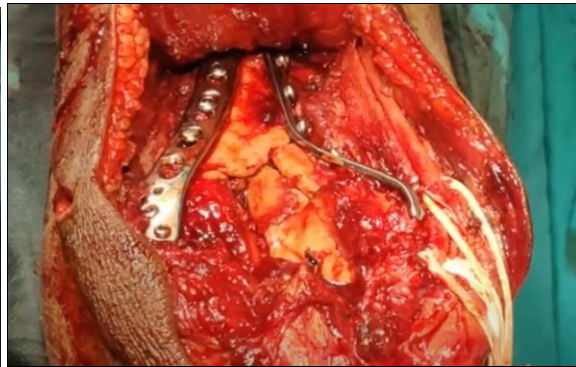


Fig 8: Dual plating

Results

This study includes 20 patients having Distal Humerus fracture treated with open reduction and internal fixation with plate. These included closed as well as open injuries. This chapter takes into account observations of the study and effect of various factors on results. The study includes patients operated from August 2020 to August 2021 at Department of orthopaedics, medical college and ssg hospital vadodara.

Table 1: Mode of injury

Mode of Injury	Patients	Percentage (%)
Fall	10	50
RTA	7	35
Assault	3	15
Total	20	100

Most of patients had sustained fracture with Fall.

Table 2: Classification of fractures: AO classification:

Type of Fracture	Patients	Percentage (%)
A1	0	0
A2	3	15
A3	0	0
B1	0	0
B2	3	15
B3	0	0
C1	9	45
C2	3	15
C3	2	10
Total	20	100

- 9 (45%) patients had Distal Humerus fracture with AO classification C1.
- 3 (15%) patients had Distal Humerus fracture with AO classification A2.
- 3 (15%) patients had Distal Humerus fracture with AO classification B2.
- 3 (15%) patients had Distal Humerus fracture with AO classification C2.

Table 3: Complications

Complication	Patients	Percentage (%)
None	12	60
Non union	3	15
Infection	3	15

- 3 (15%) patients got infection. All infections were superficial and healed eventually.
- 3(15%) patients went under non-union.
- 5(25%) patients had palpable implant.
- No other complications such as mal-union, ulnar nerve palsy, myositis ossificans etc were seen.

Table 4: Result

Results	Patients	Percentage (%)
Excellent	5	25
Good	10	50
Fair	2	10
Poor	3	15
Total	20	100

- Majority of patients are having good results 10 (50%).
- 5 patients had excellent result (25%).
- 3 patients had poor results (15%).



Fig 9: Pre-operative X-ray

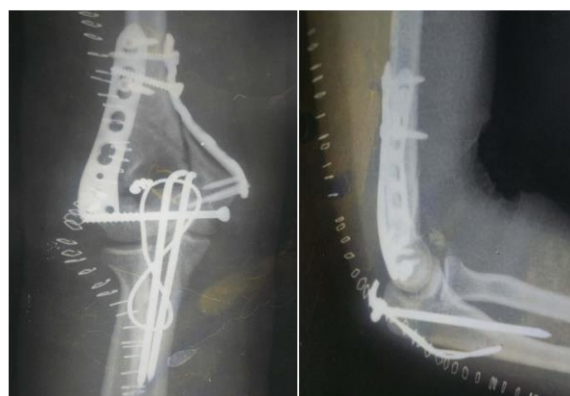


Fig 10: Immediate Post-op X-ray



Fig 11: X-ray at 4 month Follow up



Fig 12: Movement at final follow up

Discussion

In our study, functional outcome based upon Mayo Elbow Performance Score, the score is excellent in 5 patients (25%), good in 10 patients (50%), fair in 2 patients (10%), and poor in 3 patients (15%).

Our results are comparable to the work reported in the literature.

Thus, analysis of the results of this study shows factors affecting results are:

- **Rigid internal fixation/early Mobilization:** Good surgical technique, precise anatomical reduction, stable internal fixation and early mobilization had given good results.
- **Line of management:** With better fixation devices, improved operative techniques and antibiotics, we obtained acceptable results.
- Precise reduction, stable fixation and early mobilization had given good results in this study.
- **Type of trauma / fracture:** Soft tissue damage and associated bone necrosis, increased time for healing. Associated injury to vital structures had caused delay in fixation and finally poor results.

Thus, taking these results into consideration, open reduction and internal fixation of distal humerus with plating remains the best treatment for fractures of distal humerus in adults.

Conclusion

In this study carried out in 20 cases of distal Humerus fractures, we came to the following conclusions:

- Fractures of the distal humerus are common in adult males.
- The common mode of injury is domestic fall on elbow and Road traffic accident is next common mode of injury.
- Inter condylar fractures demands careful evaluation, classification of fracture type and pre-operative planning.
- Trans-olecranon approach provides best visualization of articular surface.
- Open reduction internal fixation should be done as early as possible. Delay in open reduction internal fixation with delayed soft tissue dissection leads to increased chances of elbow stiffness due to periarticular fibrosis.
- For a successful internal fixation of closed distal humeral fracture, it is necessary to maintain anatomic and stable reconstruction of the articular surface and of both humeral columns using two 90-90° plates. Operative treatment with rigid anatomical internal fixation should

be the line of treatment for all grades of extra and Intercondylar fractures, more SO in young adults as it gives best chance to achieve good elbow function.

- Nearly 85% distal humerus fracture united at the average period of 14 to 24 weeks and 15% fractures were non united due to mild or moderate instability during implant fixation, intra articular comminution, open grade fractures, infection, and predisposing factors like diabetes.
- During open reduction internal fixation, anatomic nature of articular surface should be given prime importance.
- Early vigorous, active physiotherapy is a must for good results. Stable fixation allows early, active and aggressive postoperative mobilization.

Sources of funding: Nil.

Conflict of interest: None declared.

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How to Cite This Article

CP Yogesh, VK Nihit Gadodia. Study of outcome of distal humerus fracture treated with plating. *International Journal of Orthopaedics Sciences*. 2023;9(1):411-416.

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