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A study of surgical management of intercondylar fractures of distal humerus in adults using pre-contoured locking compression plate through trans-olecranon approach

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Abstract

Introduction: Intercondylar fractures of distal humerus are uncommon injuries and present the most difficult challenge among fractures of lower end of humerus. Distal humerus fractures with intra-articular extension are complex injuries that require meticulous approach for fixation. The principle involves anatomical reduction and absolute fixation with perfect stabilization of extra osseous implants. The functional outcome has been greatly influenced by the early graduated rehabilitative exercise.

Aim and Objectives: The Aim of the present study is to evaluate the Functional Outcome of Surgical Management of Intercondylar Fractures of distal humerus in Adults by Open Reduction and Internal Fixation using pre-contoured locking compression plates through trans-olecranon approach.

Material and Methods: Prospective study includes 20 Adult patients with intercondylar fracture of distal humerus admitted to KVG Medical College, Sullia between the periods January 2014 to January 2016 satisfying inclusion criteria.

Results: In this study of 20 cases, there were 10 males and 10 females with average of 50.8 years. 12 cases were due to RTA and 8 due to direct fall. There was a predominance of left side (13). Out of 20 Cases, 3 (15%) were of B1 type, 1 (5%) were of type B2, 6 (30%) were of C1, 5 (25%) of C2 and 5 (25%) were of type of C3. Excellent results in 12 (60%), good in 4 (20%), fair in 3 (15%) and poor results in 1 (5%) case, according to MEPS.

Conclusion: Anatomically pre-shaped distal humerus locking plate system is useful in providing stable fixation for complex distal articular fracture and facilitating early postoperative rehabilitation. Clinical and radiological results show good healing rate with good range of motion.

Keywords: Intercondylar, ORIF, Pre-contoured LCP, Trans-olecranon, distal humerus

Introduction

Approximately 7% of all adult fractures involve the elbow; of these, approximately one-third involve the distal humerus. Distal humerus fractures, therefore comprise approximately 2% of all fractures. Distal humerus fractures remain as one of the most challenging injuries to manage. They are commonly multi fragmented, occur in osteopenia bone and have complex anatomy with limited options for internal fixation.

Treatment outcomes are often associated with elbow stiffness, weakness and pain. A painless, stable and mobile elbow joint is desired as it allows the hand to conduct the activities of daily living, most notably personal hygiene and feeding. Therefore, starting with a highly traumatized distal humerus and finishing with a stable, mobile and pain free joint requires a systematic approach.

Thought is required in determining the operative indications, managing the soft tissues, selecting a surgical approach, obtaining an anatomic articular reduction and creating a fixation construct that is rigid enough to tolerate early range of motion^[1].

In the early and middle parts of twentieth century, operative treatment was combined with de vascularizing exposure, inadequate fixation, and cast immobilization. The result was often elbow stiffness and delayed healing. In this context, non-operative treatments, such as the so-called bag-of-bones technique (a short duration of immobilization in either a cast or a collar

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and cuff followed by mobilization as tolerated) were established as treatment alternatives [2].

Depending upon the frequency of comminution and displacement, open reduction and internal fixation with 1/3 tubular plate, pre-contoured LCP, reconstruction plate, Kirschner wire and double tension band wiring can be done individually or in combination.

The result of operative fixation of fractures of the distal humerus remained unpredictable until improved techniques for the fixation of small, articular fractures as developed by the Arbeitsgemeinschaft für Osteosynthesefragen/association for the study of internal fixation (AO/ASIF) and others were applied. On the basis of the results reported in the more recent series, fixation with two plates at 90 degrees angle with one another has become the standard against which all other treatments are measured. Despite the confidence in operative fixation that believes this shift in treatment preference, these remain challenging fractures to treat effectively and best managed by surgeons with interest and experience in skeletal trauma involving upper extremity. Even the most experienced surgeons, however may be intimidated with certain fracture characteristics, including poor bone quality, fractures involving the distal most aspects of the bone columns and fragmentation of articular surface in sagittal and coronal planes. Some have even suggested total elbow arthroplasty as an alternative to operative fixation.

Although it is wise to be prepared to perform a total elbow arthroplasty in the event that a complex fracture is not amenable to internal fixation, one must keep in mind the functional limitations and eventual failure associated with total elbow arthroplasty. A surgeon treating a healthy active patient with a fracture of distal humerus should make every attempt to reconstruct and preserve the distal humerus [3].

The quality of elbow function following intercondylar fractures is related to the degree to which normal anatomic relationships are restored. Residual elbow stiffness still remains the worst complication of intercondylar fractures as it is poorly tolerated because of lack of compensatory motions in adjacent joints.

The aim of the present study is to evaluate the functional outcome of surgical management of intercondylar fracture of distal humerus in adults.

Materials and Methodology

This study includes 20 cases of intercondylar fracture of distal humerus admitted in KVG Medical College, Sullia, between January 2014 to January 2016 satisfying inclusion criteria.

Inclusion criteria

- Patients with intercondylar fracture of the distal end of the humerus who has given their consent for the procedure.
- Patients above the age of 18 years
- Patients medically fit for surgery.

Exclusion criteria

- Compound fractures of the distal humerus
- Old fractures of the distal humerus
- Patients not willing for surgery
- Patients medically unfit for surgery.

Surgical technique

The patient was taken for surgery after routine investigations and after obtaining fitness towards surgery from Physician and informed consent. All the patients were put in lateral position with arm supported and forearm hanging. Pneumatic

tourniquet/ Esmarch tourniquet is recommended. Painting and draping of the part was done. The distal end of the humerus was approached using trans-olecranon approach. Elbow was exposed posteriorly through an incision beginning approximately 5cm distal to the tip of the olecranon and extending proximally midline of the arm approximately 8cm above the tip of the olecranon. The skin and subcutaneous tissue were reflected to either side carefully to expose the olecranon and triceps tendon. The ulnar nerve is isolated and fascia over the flexor carpi ulnar is longitudinally split over 5cm to enhance the nerve mobility. Then gently retracted from its bed with a moist tape. Prior to performing the olecranon osteotomy, the proximal ulna was predrilled with 3.2mm drill bit and then partially tapped for a 6.5mm AO cancellous bone screw. An intra-articular olecranon osteotomy was made in a shallow 'V' or Chevron fashion in the center of the olecranon sulcus that is approximately 2cm from the tip of the olecranon. The osteotomized olecranon fragment was elevated proximally leaving a margin of the triceps tendon on either side to suture upon completion of the surgery. The fracture hematoma was cautiously removed. Condyles were reduced and held with a bone holding clamp, reduced condyle was provisionally fixed with Kirschner wire, AO cannulated cancellous screw of 4mm was inserted across the reduced condyles. Medial and lateral pillars were reconstructed using pre-contoured bi columnar LCP applied at posterolateral and medial aspect of distal humerus. The stability of the internal fixation was tested by putting the elbow through a range of motion. The olecranon osteotomy was reduced under direct vision and held with reduction clamp. 6.5mm AO cancellous screw was introduced from the tip of the olecranon. Periosteum was stripped from the shaft of the ulna distal to the osteotomy site and transverse hole was drilled approximately 3-5cm distal to osteotomy site. A No.16 stainless steel malleable wire passed through the thin transverse hole and crossed over the posterior surface of the olecranon in a figure of eight manner and then passed behind the triceps tendon and around the neck of the screw and tightened. At the completion of the fixation the elbow was again put through a range of motion to test the security of the internal fixation. The tourniquet was let down and haemostasis carefully secured and over a large suction drain the wound was closed in layers. Pressure bandage was applied and limb immobilized with above elbow plaster of Paris slab.

Results

The present study consists of 20 cases of intercondylar fractures of distal humerus treated by open reduction and internal fixation with pre-contoured bi columnar locking compression plate through trans-olecranon approach in KVG Medical College between January 2014 to January 2016.

The range of age was between 22- 70 years, with mean age of 50.8 years. The maximum incidence was in the fourth and fifth decade. There were 10 (50%) females and 10 (50%) males with a Male: Female ratio of 1:1. Right upper limb was involved in 7 (35%) cases and Left upper limb in 13 (65%) cases. In this series 8 cases (40%) were due to direct fall injury, 12 cases (60%) were due to road traffic accident. There were 3 (15%) cases of type B1 fractures, 1 (5%) cases of type B2 fractures, 6 (30%) cases of type C1 fractures, 5 (25%) cases of C2 fractures and 5 (25%) cases of type C3 fractures and no cases of type A1, A2, A3 & B3 fractures. 1 case had associated distal end radius fracture of the same side that was treated with Closed Reduction and Below Elbow Cast. 1 patient had associated Ulna fracture of same side that was treated ORIF with DCP. 1 case of elbow dislocation was

reduced in emergency OT. One case with radial nerve palsy which was recovered with conservative treatment. One case of chest trauma was managed conservatively with rib binder. 2 patient had an associated head injury which was treated conservatively after CT Brain was done. There were no cases of intraoperative complications and 2 patient had superficial infection, 1 patient had non-union, 1 had implant failure and 1 had ulnar neuropathy. In the present study there were 12 cases (60%) had excellent result, 4 (20%) had a good result, 3 (15%) had fair and 1(5%) had a poor result as per Mayo Elbow Performance scoring system. In the present study there were no type A fractures, 4 cases were of type B out of which 3 had excellent and 1 had a good result. There were 16 cases of type C fractures, out of which 9 had excellent, 3 had well and 3 had fair results and 1 had a poor result.

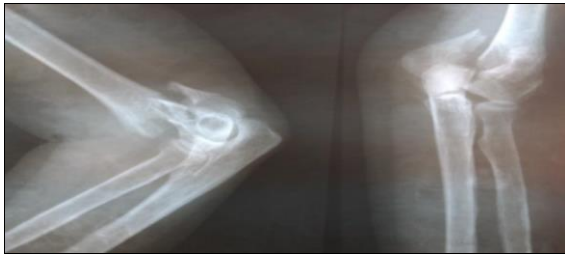


Fig 1: Pre-operative x ray

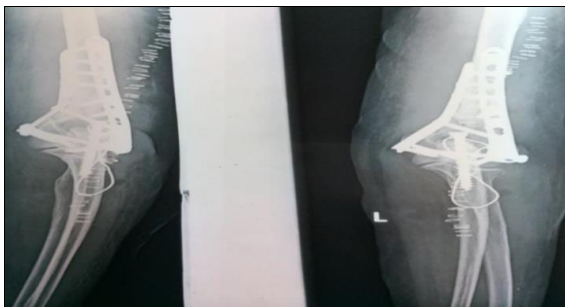


Fig 2: Immediate post op x-rays



Fig 3: Check x ray after 6 month



Fig 4: Check x ray after 12 month

Discussion

Intercondylar fractures of the distal humerus are difficult to treat because of the nature of injury and the fact that most surgeons do not have a great deal of experience with them^[4, 5]. Most intra-articular fractures of the distal humerus are often displaced and therefore the successful treatment demands an anatomic reduction, stable fixation and the ability to allow early elbow motion^[6, 7]. As the elbow joint tolerates immobilization poorly, the functional outcome after surgical treatment is unavoidably worsened by prolonged immobilization. Despite being uncommon, distal humerus fractures pose the greatest challenge in terms of surgical fixation and absolute anatomical reduction. Surgical expertise is of paramount importance. Good functional outcomes are expected with intelligent surgical approach and early rehabilitation. Articular surface restoration and reconstruction of elbow joint is mandatory to restore maximum joint function. This can be safely achieved by stabilization of fracture fragments with plate osteosynthesis based on restoration of joint congruity.

In this study, we used Locking Compression Plates to reconstruct both the medial and lateral columns as the locking plates provide a fixed plate screw construct with multiple screw options for easy application in distal complex fractures thereby providing angular stability. There is no consensus that whether the orthogonal or parallel plating is superior for fixation^[8]. We used orthogonal plating because it provides better mechanical stability although it requires more extensive soft tissue dissection.

In this study, fractures were commoner in the fourth and fifth decade with average age being 50.8 years (22-70) compared with the studies conducted by Muhammad Noman Iqbal *et al.*^[9] i.e. 37 years, Abhilekh Mishera *et al.*^[10] i.e. 38 years, Nasir Muzaffar *et al.*^[11] i.e. 39.68 years, Imran Mangi *et al.*^[11] i.e. 35 years.

In this study had a male with 50% and 50% female patient, compared with other studies as Muhammad Noman Iqbal *et al.*^[9] i.e. 56% male and 44% female, 62.96% male and 37.03% female, Abhilekh Mishera *et al.*^[10] i.e. 68.18% male and 31.81% female, Nasir Muzaffar *et al.*^[11] i.e. 60% male and 40% female, Imran Mangi *et al.*^[12] i.e. 52% male and 48% female.

This study accounted about 35% incidence of fractures on right side and 65% of the fracture on left side, compared with other studies like Muhammad Noman Iqbal *et al.*^[9] i.e. 68% right and 32% left, 40.74% right and 59.25% left, Abhilekh Mishera *et al.*^[10] i.e. 40% right and 60% left, Nasir Muzaffar *et al.*^[11] i.e. 24% right and 76% left, Imran Mangi *et al.*^[12] i.e. 52% right and 48% left.

In this study, 40% of the cases were due to direct fall and 60% of cases had road traffic accident compared to Muhammad Noman Iqbal *et al.*^[9] i.e. 16% of direct fall and 84% of RTA, 59.25% of direct fall and 40.74% of RTA, Abhilekh Mishera *et al.*^[10] i.e. 93.33% of direct fall and 6.67% of RTA, Nasir Muzaffar *et al.*^[11] i.e. 44% of direct fall and 56% of RTA.

In this study, functional outcome was based upon Mayo Elbow Performance Score. It was excellent in 12 patients (60%), good in 4 patients (20%), fair in 3 patients (10%), and poor in 1 patient (5%). Our study is compared with other like Singh *et al.*^[10] i.e. Excellent (4 patients), Good (13 patients), Abhilekh Mishera *et al.*^[10] i.e. Excellent (15 patients), Good (3 patients), Nasir Muzaffar *et al.*^[11] i.e. 22 patient in excellent and good.

In this study, there were no intra-operative complication. There were two cases of superficial infection of surgical site,

which resolved with appropriate antibiotics and did not require debridement. One case of ulnar neuropathy was seen which resolved spontaneously in 8 weeks after conservative treatment. One patient had a non-union, in which bone grafting was done. One patient had Implant failure in which there was back-out of 6.5mm AO cannulated screw in TBW of olecranon Osteotomy. Our study was compared with studies conducted by Muhammad Noman Iqbal *et al.* ^[9] i.e. 1 patient (4%) Ulnar neuropathy, Abhilekh Mishra *et al.* ^[10] i.e. 1 patient (5%) with superficial infection, Nasir Muzaffar *et al.* ^[11] i.e. 4(16%) superficial infection, 1(4%) deep infection, 1(4%) ulnar neuropathy, 2(8%) implant failure, 2(8%) metal prominence & Imran Mangi *et al.* ^[12] i.e. 1(4%) ulnar neuropathy and 1(4%) stiffness, 3(12%) metal prominence.

Conclusion

Inter condylar fractures demands careful evaluation, classification of fracture type and preoperative planning. Open reduction internal fixation should be done as early as possible. Delay in open reduction internal fixation with extensive soft tissue dissection leads to increased chances of elbow stiffness due to periarticular fibrosis. During open reduction internal fixation, anatomic nature of articular surface should be given prime importance. Anatomically pre-shaped distal humerus locking plate system is useful in providing stable fixation for complex distal articular fracture & facilitating early postoperative rehabilitation.

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