**Functional Outcome of Intra-articular Distal Humerus Fractures in Adults Treated with Bicolumnar Plating using Pre-contoured Distal Humerus Locking Plates: A Prospective Study**

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**Abstract**

**Background:** Distal humerus fractures in adults are relatively uncommon injuries amounting to 2–6% of all fractures and 30% of all elbow fractures. The complex shape of the elbow joint, the adjacent neurovascular structures make these fractures difficult to treat. The present study is undertaken to evaluate the functional outcome of intra-articular distal humerus fractures by open reduction and internal fixation using bicolumnar plating technique.

**Materials and Methods:** A total of 20 intra-articular distal humerus fractures were operated during December 2015–June 2017 were included in the study. All the patients were operated with pre-countered distal humerus locking plates in orthogonal fashion, and outcome was measured by MEPS, rate of union, rate of complications, and final range of motion.

**Results:** In our series of 20 cases, there were 12 males and 8 females. 5 cases were due to self-fall, 14 were due to RTA, and one due to assault. Out of 20 cases, 4 (20%) were of C1 type of fractures, 14 (70%) were of C2, and 2 (10%) were of C3 type of fractures. Excellent results were seen in 12, good in 5, and fair in 3, according to MEPS. There were 2 cases of superficial infection and 2 cases of ulnar neuropathy, treated accordingly.

**Conclusion:** Operative treatment with stable anatomical internal fixation using anatomically pre-contoured distal humerus plates should be the line of treatment for all grades of intra-articular distal humerus fractures, as it gives best chance to achieve good elbow function.

**Keywords:** Intra-articular distal humerus fractures, ORIF, bicolumnar plating, MEPS.
humerus locking plates in orthogonal fashion and outcome was measured by MEPS, rate of union, rate of complications and final range of motion.

**Inclusion criteria:**
- Male and female adult patients with intra articular distal humerus fractures with age above 18 years.

**Exclusion criteria:**
- Open fractures of distal humerus.

**Operative procedure:**

**Position:**
All the patients were put in lateral position with arm supported and forearm hanging. Type of anaesthesia:
- General anaesthesia was used in 4 cases and brachial block in 16 cases.

**Approach:**
All the cases were followed by posterior approach, the exposure of joint was by olecranon osteotomy in 10 cases and triceps reflecting approach in 10 cases.

**Surgical technique:**
All cases were approached by a mid line posterior straight incision with a curve around the olecranon on the elbow. Ulnar nerve was isolated and secured with umbilical tape. Articular surface was exposed either by olecranon osteotomy or triceps reflecting approach. All the fragments were anatomically reduced and provisionally fixed with k wires. 4mm cancellous screws were used to fix the fragments. The articular surface (tie arch) was fixed to the distal humerus with pre-contoured distal humerus locking plate on medial pillar and on the posterior aspect of the lateral pillar (orthogonal plating). Osteotomy was fixed with k wires and tension band wiring or 6.5 mm cancellous screw. Wound was closed in layers with negative suction drain in situ. Above elbow plaster of Paris slab was applied. All the patients were observed in intensive care unit for 24 hours. Elbow immobilised in above elbow plaster of Paris slab.
elbow POP slab. After 48 hours, suction drain removed and dressings changed. Radiographs were taken to confirm the reduction and fixation. With adequate analgesia, passive wrist and finger exercises were started. POP continued for 3 days following which active and assisted elbow exercises are started with removable slab. Sutures removed on 14th day. All the patients were reviewed and evaluated clinically for pain, range of motion, stability and the function of the elbow. Serial radiological examination was done at 6 weeks, 12 weeks, and 6 months for the union of the fracture site and the osteotomy. Full elbow activity started at 6 weeks after radiological evidence of union was evident at the fracture. Active aggressive elbow mobilization was done.

**Result**

Among the patients, 8 were females and 12 were males. The mean patient age was 37.05 years. The left side was involved in 13 cases and right side in 7 cases. The mechanism of injury was road side accidents (14 cases) in most of cases followed by falls (5 cases). 4 associated with other injuries like ipsilateral ulna or radial or both bone fractures. Out of 20 cases, 4 (20%) were of C1 type of fractures, 14 (70%) were of C2 and 2 (10%) were of C3 type of fractures. Most of the patients were operated after 48 hours of injury. The mean duration of follow up was 12 months, ranging from 9 to 16 months. The duration of fracture healing was 3 months, ranging from 2 to 4 months. The flexion at the elbow joint ranged from 60˚ to 120˚ degree. 10 patients had a flexion beyond 90˚. More than 90˚ of range of movement is obtained in 60% of cases. Scoring of range of motion is done as per Mayo Elbow Performance Score. The final functional outcome was excellent in 12 (60%), good in 5 (25%) and 3 fair (15%). Most of the fixations were stable. 2 patients suffered transient Ulnarneuropraxia in the early post-operative period and 2 patients were having superficial wound infection. No patient suffered from iatrogenic vascular injury, Non-union, Hardware failure or heterotopic ossification. Mayo Elbow performance score

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<td><strong>Pain intensity</strong></td>
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<td>None – 45 pts</td>
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<td>Mild 30 pts</td>
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Discussion

Distal humerus constitute 2 to 6% of all the fractures and 30% of fractures around elbow. The primary goal in management of intra articular fractures of distal humerus is to achieve stable and mobile elbow. The chances of functional impairment and deformities are very high following conservative treatment of such distal intra-articular fractures of humerus. Mal-union, stiffness, and osteoarthritis are very common following conservative management. Since 1950s the trend has shifted to open reduction and stable fixation with early mobilization. Good anatomical alignment, stabilization and early mobilization can provide satisfactory results. The operative treatment poses certain difficulties due to the intrinsic anatomy of the elbow joint which is composed of three distinct articulations, proximity of neurovascular structures, minimal soft tissues attached to the fragments and long operative period [5]. In the present study, of the 20 cases taken up for the study, the average age was 37.05years, and the youngest age was 26years and the oldest age was 56 years. The male/female ratio was 3:2. Most of the cases were in the 3rd and 4th decade of age group for they are the working population. Males predominated for they are the predominant working group. In this study, 13cases sustained left sided injuries, mostly because of reflex mechanism during injury. Fractures sustained in road traffic accidents (most common) were more comminuted. In our study 10cases were operated with olecranon osteotomy approach (rationale??) and 10 cases operated with triceps reflecting approach. With all posterior approaches, the ulnar nerve was carefully dissected without excessive stripping and transposed anterior to the medial epicondyle at the end of the procedure (why (to prevent irritation of nerve from plate and soft tissue adhesions) and any criteria for this??).

The standard plating technique of orthogonal plating was used in this study for plates to be placed at orthogonal angles direct medial and posterolateral. Reconstruction plates and 1/3rd tubular plates are usually associated with implant loosening and implant failure. To overcome these problems in our study, we have used anatomically pre-contoured distal humerus plates, as these are associated with less soft tissue irritation, minimal periosteal stripping, and maximum screw slots in distal fragment to give stability between shaft and distal humerus, and strengthen the bone implant anchorage. And thus, helps in early fracture healing, and rigid fixation to allow early post-operative mobilisation, which is of paramount importance in elbow joint. Studies by Self et al. and Schemitsch et al. showed that direct medial and lateral plating is biomechanically sound[6]. Sanchez-Sotelo et al. listed several principles for distal humeral fracture fixation that we have incorporated into our treatment protocol[7]. Small osteochondral fragments can be fixed with headless screws, countersunk mini fragment screws, or absorbable screws. Our study shows no instability, increased elbow range and early mobilization. Reising K in their study of 46 consecutive patients concluded that Open reduction and internal fixation with the DHP system provides reliable, stable fixation allowing early functional mobilisation of the elbow joint, even in complex fractures and impaired bone quality, resulting in good outcomes for the majority of patients [8]. Postoperative physiotherapy (?) plays an important role in the outcome. M Dhawan et al [9], studied 108 closed intra articular fractures of distal humerus treated by operative fixation and showed that most of the elbow function was seen to be acquired at three months after the surgery and no improvement was seen after six months in spite of standard (?). Physiotherapy. Olecranon osteotomy provides a good exposure of the fracture site for distal humerus fracture fixation. However, it is not without its potential disadvantages of delayed union, non-union and other implant related complications. Macko et al reported elbow symptoms due to prominent k wires in 75% of their 20 cases and skin breakdown in 20% of the cases10. One of the complications of olecranon osteotomy is denervation of Anconeus muscle, which provides dynamic stability to the lateral side of the elbow by preventing varus and posterolateral rotatory instability. (how differently your approach in avoiding these complications?) Since Bryanand Morrey approach is Anconeus preserving, they do not have this disadvantage

Conclusion

Based on our study, it may be concluded that all grades of intra articular fractures of distal humerus requires stable anatomical internal fixation with pre-contoured distal humerus plates. It helps to achieve early fracture healing and stable fixation, to permit early and active post-operative mobilization.

References


How to Cite this Article


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Source of Support: NIL