

A Study to evaluate the Functional Outcomes after the Surgical Management of Intra Articular Fracture of Distal Humerus

Ashish Kumar Gupta, Anoop Tiga*

ABSTRACT

Introduction: 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. Objectives of the study were to assess the functional outcome and to compare the results after surgical management of intra articular fracture of distal humerus using Mayo elbow performance index. & to assess the range of movements, pain and union. **Methods:** Retrospective Evaluation study with Review and Reports of 50 cases / patients, who were diagnosed & surgically managed. Fractures were classified as per AO type A to C (except C3 comminuted) and were included in this study in whom internal fixation was done using triceps reflecting Bryan Morrey approach with some modification in few cases. **Results:** No patient achieved complete extension. No limitation in the pronation-supination was detected. Radiographic assessment Postoperative and follow up radiographs showed adequate fracture reduction and fracture healing in all patients. No step off more than one mm was seen. All patients had completed postoperative physical therapy at the time of the study and had achieved maximum function of elbow. **Conclusion:** Triceps reflecting Bryan Morrey approach is a simple and effective approach that can be used in management of the majority of the distal humeral fractures as it provides adequate visualization and reduction fracture fragments with no adverse effect on triceps muscle strength

Keyword : Distal humerus , Bryan and Morrey approach , MEPI , AO classification
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INTRODUCTION

Intra articular fractures of distal humerus constitute 0.5-7% of all the fractures and 30% of fractures around elbow¹. 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.

Non-surgical treatment can be justified in cases of hemiplegia sequelae involving the ipsilateral upper limb, advanced osteoporosis and fractures with extensive bone loss but to avoid fixation failure, stiffening is almost assured and arthrolysis will have to be performed later on. Malunion, stiffness, and osteoarthroses are very common following conservative management. Preferred treatment for displaced, intra-articular, intercondylar fractures of the distal part of the humerus is open reduction and internal fixation. Adequate exposure of the articular surface of the distal humerus and elbow joint is required for operative stabilization of bicolumnar distal humerus fractures.

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 intricate 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 period². The standard surgical techniques are used for fixation of both columns, using a combination of reconstruction plates, dynamic compression plates, locking compression plates and screws and k-wires. In rare situations, primary total elbow replacement may be considered In this study we report the

Assistant Professor, Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, CG, India

Corresponding Author: Dr. Anoop Tiga, Assistant Professor, Department of Orthopaedics, Raipur Institute of Medical Sciences, Raipur, CG, India. E-mail: iipoona189@gmail.com

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outcome of a series of intercondylar fractures of distal humerus in adults, treated by open reduction and internal fixation.

Aims and Objectives of the study were to assess the functional outcome and to compare the results after surgical management of intra articular fracture of distal humerus using Mayo elbow performance index. & to assess the range of movements, pain and union.

METHODOLOGY

This study was carried out as a Retrospective Evaluation study. Review and Reports of 50 cases /patients, who were diagnosed & surgically managed by various local secondary / Tertiary Medical Institutes and Hospitals over a period of last one year were included in the study. The Hospitals and Tertiary Medical Institutes were Randomly Selected . Data and Case files / Reports were duly obtained after the permission of Medical Superintendent of the respective Hospitals after fulfilling the conditions of maintaining Professional Secrecy of the cases / Patients. The medical charts

of 50 patients who were treated by open reduction and internal fixation with distal humerus locking compression plates were included in this retrospective analysis.

Inclusion Criteria

1. Patients with intra-articular fractures of the distal humerus
2. Patient aged more than 18 years.
3. Patients who give consent for surgery.

Exclusion Criteria

1. Patient with co-morbid conditions and not fit for surgery.
2. Non-compliant patient
3. Unacceptable surgical risk
4. Extreme osteoporosis
5. Severe comminution or bone loss

Fractures were classified by AO classification. Physiotherapy started from 3rd day post-op with passive ROM exercises. Patient was followed & Clinical outcome was assessed using MEPI (Mayo Elbow Performance Index) score and radiological union.

In all the data acquired, Demographic data was taken for each case / patient: age, sex, body mass index (BMI), co-morbid conditions etc.

Each patient had underwent a standard pre-operative assessment, including physical examination, routine laboratory tests, radiography and computed tomography.

All patients were subjected to radiographs of the involved elbow in AP and lateral views with CT-Scan of the elbow. Fractures were classified as per AO type A to C (except C3 comminuted) and were included in this study in whom internal fixation was done using triceps reflecting Bryan Morrey approach with some modification in few cases.

Generally, intra-articular fractures of the distal humerus is accessed by the posterior approach, which gives excellent exposure of the articular fragments of the distal humerus. This approach requires reflection of the extensor mechanism, typically through either a triceps splitting approach or an olecranon osteotomy or a triceps reflecting approach. The transolecranon exposure for distal humerus fractures is a very popular technique that is suggested for improving articular visualization and allowing accurate reduction. There are several modifications to this technique, such as the chevron shaped olecranon osteotomy, commonly advocated by the AO group. The chevron osteotomy increases rotational and translational stability at the time of surgery and increases the contact area for achieving the bony union. It has the advantage of same exposure of articular surface of distal humerus without disturbing the articular surface of olecranon, thereby reducing the chances of elbow stiffness and improving the range of movements postoperatively. To avoid complications, it is strongly advisable that the osteotomy should be fixed by tension band wiring with two tightening loops. Alternatively, a pre-contoured olecranon plate may be used. Significant osteotomy complications have prompted recommendations for alternative exposure techniques. Distally, intra-articular exposure is dependent on triceps mobilization, and there are many modifications in the posterior elbow surgical approaches. These are triceps splitting at midline, triceps reflecting van Gorder or Bryan Morrey, triceps reflecting anconeus pedicle (TRAP), anconeus flap trans-olecranon (AFT), and paratricipital approaches. In our study, we are using triceps reflecting

Bryan Morrey approach for intra-articular exposure and fixation of fracture distal humerus with some modification in 4 selected cases.

In this procedure, the extensor mechanism comprising the triceps tendon, forearm fascia, and periosteum are reflected as one unit from the medial to lateral off the olecranon i.e. thin bone sleeve is lifted. In some cases triceps tendon was split into two and only medial or the lateral triceps tendon sleeve with bony chip was reflected. The ulnar nerve is first identified and protected. A periosteal elevator is used to dissect the triceps muscle from the posterior humeral cortex. With a scalpel, the forearm fascia, periosteum, and triceps tendon are reflected directly off the olecranon from medial to lateral as a continuous sleeve. The triceps may be removed along with a thin wafer of bone to facilitate bone to bone rather than tendon to bone healing at the triceps insertion site. Now the entire triceps muscle with the posterior capsule is reflected upwards and laterally, and the elbow is flexed to expose the joint. At the end of the procedure the triceps tendon is reinserted back on to the olecranon by means of non-absorbable sutures passed through transosseous drill holes in the olecranon. The triceps repair needs protection for 4–6 weeks postoperatively hence following the operation, the elbow was immobilized in a splint at 90° of flexion. The arm was kept elevated for 3-4 days in order to reduce the edema and inflammation. The splint was subsequently removed and active assisted ROM exercises were initiated after suture removal. Ice was applied following the exercises. On average the patients were discharged at the end of the first week. At this point the splint was removed and a hinged elbow brace was used to protect the internal fixation. Indomethacin prophylaxis for heterotopic ossification was given for 10 days. Patient were advised to avoid active elbow extension against resistance to prevent triceps suture failure. Patients were followed-up on a weekly basis for the first six weeks. Then the patients were seen every month for follow-up until the 3rd postoperative month.

Basic patient demographics, mechanism of injury and AO fracture classification were recorded. The functional outcome of patients was assessed using MAYO and Quick DASH (Disability of arm, shoulder and hand) scoring system with strength of triceps using MRC Grades. Postoperative radiographs were reviewed for evidence of bony union or complications (non-union, avascular necrosis, implant failure, etc.). This information was entered into a Microsoft Excel database for statistical analysis. After medical evaluation and pre-anesthetic check-up, informed written consent was taken from patient and were taken up for surgery. Patients were operated under general anesthesia or supraclavicular and axillary block in lateral decubitus position. Patients were operated under upper arm pneumatic tourniquet, with routine deflation after 2 h for procedures that exceed this length of time.

RESULTS

Mean duration of follow-up was 10 months (range 3 months-18 months) with Mean age of 42.73 years (range 25-70 years).

21 were females, and 29 were males.

Mean tourniquet time was 106 min (range 70 to 130 min).

Strength of the triceps muscle (power) was assessed by using MRC grading. The mean Quick DASH score was 4.15 (range, 0-11.4).

The mean Mayo score was 90 (range 75-100), indicating an excellent performance. Mean Range of motion in our study was 24-114 degree, with only Three cases had worse range of motion.

Mean flexion in our study was 116 degree, Range 90 to 140 (normal range 120-145 degree) with Mean flexion deficit compared to other uninjured side.

Mean extension in our study was up to 24 degree, range 10 to 40 degree (normal 5 to -15 degree) with extension deficit of 27, range 15 to 45 degree compared to other side.

No patient achieved complete extension. No limitation in the pronation-supination was detected.

Radiographic assessment Postoperative and follow up radiographs showed adequate fracture reduction and fracture healing in all patients.

No step off more than one mm was seen. Overall Outcomes as per MEPI IS shown in Table 1 & Complications observed is shown in Table 2.

Majority had satisfactory functional results.

DISCUSSION

Intra articular fractures of distal humerus constitute 0.5-7% of all the fractures and 30% of fractures around elbow³. The primary goal in management of intra articular fractures of distal humerus is to achieve stable and mobile elbow. In the present study, of the 50 cases taken up for the study, Mean duration of follow-up was 10 months (range 3 months-18 months) with Mean age of 42.73 years (range 25-70 years).

21 were females, and 29 were males.

Most of the cases were in the productive age group for they are the working population. Males predominated for they are the predominant working group. In this study, 40 cases sustained right sided injuries, mostly because right side is the most common dominant side.

Fractures sustained in road traffic accident (most common) were more comminuted and associated with other injuries like lower limb fractures in 4 and head injury in 3 cases.

A variety of approaches have been described for reduction and fixation of distal humeral fractures. A posterior approach with an olecranon osteotomy has been widely used and it offers best fracture exposure.⁴ Trans-olecranon and triceps reflecting approaches are similar in their functional outcomes but complication rates are higher in transolecranon approach.⁵ As more familiarity is gained with fracture patterns and reduction techniques, a triceps-reflecting approach may be selected to reduce complications.^{6,7} Post-operative physiotherapy plays an important role in the outcome. With early mobilization of

the elbow, the range of supination and pronation movements are usually unaffected. The rate of recovery is rapid in the first 6 months, slows exponentially during the subsequent 6 months and is minimal in the second year⁷. open reduction and internal fixation of intra articular fractures of distal humerus by orthogonal plating technique is an excellent surgical technique, in restoring articular surface, providing a rigid stable construct allowing early rehabilitation, decreasing morbidity and attaining good functional outcome. Macko *et al* reported elbow symptoms due to prominent k-wires in 75% of their 20 cases and skin breakdown in 20% of the cases. 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. Since Bryan and Morrey approach is anconeus preserving, they do not have this disadvantage.⁵

Some important points to ponder over In surgical management of intra articular fractures of distal humerus,

1. Anatomical reduction of the articular surface, rigid and stable internal fixation of the distal humerus, medial and lateral columns, accurate reconstruction of the trochlea and capitellum are of prime importance in achieving an excellent outcome.
2. Operative treatment of these fractures is a major procedure and preliminary planning is necessary for success.
3. For open reduction and internal fixation of intra articular fracture of distal humerus, posterior approach with olecranon osteotomy is considered best approach. As more familiarity is gained with fracture patterns and reduction techniques, a triceps-reflecting or triceps-splitting approach may be selected to reduce complications.
4. Orthogonal plating of medial and lateral columns is the preferred technique to have a stable and rigid anatomical construct allowing early mobilization.
5. Post-operative physiotherapy and rehabilitation play a vital role in functional outcome.

CONCLUSION

Triceps reflecting Bryan Morrey approach is a simple and effective approach that can be used in management of the majority of the distal humeral fractures as it provides adequate visualization and reduction fracture fragments with no adverse effect on triceps muscle strength.

We therefore conclude that the triceps reflecting approach to treat distal intra-articular humerus fractures does not lead to functional disadvantages. Operated cases may suffer from post-traumatic arthritis of the elbow later in life. Hence, a longer follow-up will be required. In conclusion, this triceps reflecting approach provides an excellent exposure as well as a good functional outcome as quantified by DASH Score without any dysfunction of extensor apparatus of elbow. Short duration of follow up and relatively small sample size is the limitation of this study. A further study with larger sample size and longer follow up will be required to provide proper guidelines.

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Table 1: Outcomes as per MEPI

Grade	Score	No. of Cases (n=50)	Percentage
Excellent	>90	37	74
Good	75-89	13	26
Fair	60-84	-	-
Poor	<60	-	-

Table 2: Complications observed in the study

Transient Ulnar Nerve palsy	5
Infection	4
Hypertrophic Ossification	1
Non Union of Fractures	-
Non Union of Osteotomy	-
Hardware Pain	10
Delayed Union of Osteotomy	3

Majority had satisfactory functional results

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