A Study to Assess Outcome of Osteosynthesis of AO Type C Fractures of Distal Humerus Using Triceps-On Approach

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Abstract: Several surgical approaches have been described for open reduction and internal fixation of complex distal humerus fractures. This study was conducted to evaluate the outcome of Alonso-llames triceps-on approach for the treatment of AO type 13 C₁ and C₂ distal humerus fractures. This prospective study included 23 patients with distal humerus fractures (16 patients with 13C₁ and seven with AO type 13C₂) who underwent ORIF using Alonso-llames triceps-on approach. The mean follow up duration was 28 months. All the twenty-three fractures were united over a mean duration of 5 months. The average flexion was 122° and the mean arc of motion was 113°. All the patients had grade 5 triceps strength and stable elbow. The mean Mayo Elbow Performance Score (MEPS) was 93 indicating excellent outcome. This approach provides a viable option for adequate exposure and fixation of distal humerus type C₁ and C₂ fractures; however, further long term studies are required to recommend this as standard approach.

Keywords: Distal humerus fracture, osteosynthesis, olecranon osteotomy, Alonso-llames approach, Triceps-on approach

1. Introduction

Various approaches have been described for adequate exposure of joint surface and fracture fragments to achieve anatomical reduction and stable fixation of complex distal humerus fractures. Chevron olecranon osteotomy approach is commonly used as it provides good visualization of fracture site, however, it is often associated with problems like delayed union or malunion of oleostomy site, hardware failure and pain secondary to prominent hardware. In order to avoid these problems, there has been increased use of alternate approaches like Bryan Morrey’s triceps-reflecting approach, O’Driscoll’s triceps-reflectinganconeus pedicle (TRAP) approach, Campbell’s triceps-splitting approach. Although these alternative approaches provide adequate exposure of fracture site and has shown good functional outcome, however, resulting triceps weakness, possible failure of repair and triceps detachment are well documented problems with these approaches. Though useful for AO type A&B distal humerus fracture fixation, we have been using Alonso-llames triceps-on approach for type C₁& C₂ distal humerus fractures. This study was undertaken to assess outcome of osteosynthesis of AO type C₁& C₂ fractures of distal humerus using Alonso-llames triceps-on approach.

2. Material and Methods

This prospective study included 23 patients with fractures of distal humerus (AO type C) who underwent open reduction and internal fixation using Alonso-llames triceps-on approach at our institution. All these patients were willing to participate in study and gave informed consent and their data was included in a longitudinal prospective registry. There were thirteen males and ten females with mean age of 32.7 years (range 26 to 58 years). Sixteen fractures were classified as 13-C₁ and seven was classified as AO type 13-C₂. The mechanism of injury was road traffic accident in fourteen patients and fall from standing height in nine patients. All the patients were operated within seven days of injury. Patients with compound fractures, associated injuries to upper extremity and previous elbow diseases were excluded from the study. All these patients underwent open reduction & internal fixation of fractures using Alonso-llames triceps-on approach.

The patient was placed in lateral decubitus position with arm hanging free over an arm support and surgery was done using tourniquet. A straight incision was made beginning at the level of junction of the middle and distal thirds of, and centered on the humeral shaft and curved around the olecranon to the radial side to end over ulnar diaphysis. An ulnar based subcutaneous flap was developed, ulnar nerve was isolated and protected using vessel loop. The ulnar nerve was followed proximally along its course on medial intermuscular septum and triceps muscle was mobilized radially. Similarly on lateral side the triceps fascia was split and muscle was mobilized from lateral intermuscular septum and humerus towards the ulnar side. Distally the anconeus was detached from radial column as required. The forearm was pronated and abducted to visualize the distal articular surface of humerus. The fracture fragments was reduced anatomically and fixed internally using intercondylar cannulated cancellous screw, and two anatomical distal humerus locking plates for either of the columns (figures 1 to 6). The ulnar nerve was transposed anteriorly and wound was closed in layers over a drain. Postoperatively, on second day after surgery, active assisted elbow flexion and extension exercises were started. The patients remained under serial follow up of the physiotherapist for up to 6 months for increasing elbow range of motion. Anteroposterior and lateral X-rays were serially taken at regular follow up intervals of 3 months to record fracture union and any implant related problems. The range of motion of elbow and strength of triceps was recorded at each visit. The stability of elbow joint in anteroposterior and mediolateral plane was evaluated at 6 and 12 months.
following surgery. Patient’s Mayo Elbow Performance Score (MEPS) was determined at the final follow up.

3. Results

The mean follow up duration was 28 months (range 18-37 months). Although all patients had some degree loss of flexion or extension, however, none of patients had loss of supination or pronation. All the fractures united with mean duration of 5 months (range 4 months to 7 months). The mean fixed flexion deformity was 7° (range 0°-16°), flexion was 122° (range 112°-138°) and the mean arc of motion was 113°. All the patients had grade 5 triceps strength and had stable elbow in the antero-posterior and medio-lateral planes at final follow up.

Two patients developed superficial wound infection in the post-operative period which subsided with antibiotics and dressings. None of the patient had implant loosening, prominent hardware, heterotopic ossification or ulnar neuropathy. The mean Mayo scores (MEPS) was 93 (range 72 to 100) indicating excellent outcome.

4. Discussion

Although there is no consensus regarding ideal surgical approach for open reduction and internal fixation of intraarticular distal humerus fractures, various approaches like triceps-splitting, triceps reflecting (TRAP), Bryan Morrey’s approach and olecranon osteotomy are common posterior approaches to the elbow. Among these, chevron osteotomy of the olecranon is still considered to be standard approach as it provides maximum visualization of the distal humerus articular surface as demonstrated by Wilkinson et al.¹

However, it is not without its potential disadvantages of delayed union, nonunion and other implant related complications, many of them leading to secondary surgical procedures.²³⁴ Moreover, this approach causes denervation of anconeous which is a dynamic stabilizer of elbow leading to varus and posterolateral rotatory instability.⁵

Similarly, potential complications of Bryan-Morrey’s approach include triceps avulsion and triceps weakness.⁶⁷ Triceps-splitting approach results in triceps weakness due to resultant fibrosis and injury to intramuscular nerve branches.⁸⁹ Although, Alonso-lames approach¹⁰ has traditionally used for AO type A and B distal humerus fractures, we extended its use to AO type C₁ and C₂ distal humerus intra-articular fractures. This approach provides good visualization of the articular surface and the fracture fragments meanwhile preserving the extensor apparatus.

Also this approach provide comparable outcome in terms of fracture union, elbow range of motion, elbow stability and triceps strength as compared to other approaches.

5. Conclusion

This approach seems to provide a viable and attractive option for adequate exposure of distal humerus fracture, however further long term studies and biomechanical analysis is required to confirm our results.

References

Figure 1: Initial radiographs show a distal humerus fracture (AO type C₂).

Figure 2: Fracture site was well reduced and fixed with dual anatomical plates by Triceps-on approach.

Figure 3: Pre operative x-ray of patient showing AO type C₂ fracture distal humerus.
Figure 4: Post operative x-ray of same patient fracture fixed with dual anatomical locking plates by Alonso-llames triceps-on approach

Figure 5: Pre operative x-ray of patient showing AO type C₂ fracture distal humerus

Figure 6: post operative x-ray AO type C₂ fracture fixed with dual anatomical locking plates by using Alonso-llames triceps-on approach.