



## Triceps Sparing Approach for Open Reduction Internal Fixation Analysis of 47 Cases of Fracture Distal Humerus

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### ABSTRACT

The purpose of the study was to analyze the functional outcome of fractures of distal humerus managed with open reduction internal fixation by reviewing 47 cases of fracture distal humerus surgically managed with triceps sparing approach during December 2012 to September 2016. The medical reports and radiographs of 26 males and 21 females patients with a mean age of  $34.87 \pm 14.11$  years and a mean follow up time of 10.2 months (range 3-18 months) were retrospectively and prospectively reviewed. Flexion, extension, range of motion, Mayo Elbow Performance Score (MEPS), Disability of Shoulder Arm and Hand score (DASH SCORE), duration of surgery and blood loss were used to assess the functional outcome of fracture distal end humerus treated with ORIF through the triceps sparing approach. according to AO foundation (AO) Classification there were 2 cases of type A, 2 cases of type B, 17 cases of type C1, 20 cases of type C2 and 6 cases of type C3 fractures. Out of 47 patients, 24(51%), 16(34%), 7(15%) obtained excellent, good, fair MEP score respectively. No patient fell under poor category of MEP score.

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### Introduction

Fractures of the distal humerus are uncommon injuries, constituting between 0.5% and 7% of all fractures and 30% of all elbow fractures.<sup>1</sup> Up to 96% of these injuries are intercondylar, or AO type C, distal humeral fractures involving the articular surface.<sup>2</sup> These fractures are notoriously difficult to treat, presenting the surgeon with multiple challenges including the complex anatomy of the elbow joint itself, articular surface comminution and frequently, osteopenic or osteoporotic bone stock. Anatomic reduction of the joint surface, restoration of the overall anatomic axes of the extremity and stable fixation allowing for early elbow mobilization are keys to achieving a good surgical outcome. Early motion is critically important after open reduction and internal fixation (ORIF) of these fractures<sup>3</sup> because the elbow joint capsule is very prone to scarring, and immobilization past 3 weeks has been linked with poorer outcomes.<sup>2</sup>

Olecranon osteotomy is considered gold standard for treating intercondylar distal humerus fracture because it provides excellent articular exposure. One alternative technique to approach through the posterior elbow is triceps sparing approach describe by Bryan and Morrey, which was first used in total elbow arthroplasty. In this technique the triceps mechanism is spared and reflected from the medial to the lateral direction without being detached. Satisfactory functional outcome has been achieved when using this technique to treat complex type C fracture of distal humerus.

### Aims and Objectives

To study the functional outcome of Triceps Sparing approach for management of intraarticular distal humerus fractures to meet out following parameters:

- Accuracy of articular reduction
- Functional range of movement

c) Operative time

d) Immediate, early and late complications

### Material and Methods

This prospective study was hospital based, conducted in the Department of Orthopaedics at LLR and Associated Hospital, GSVM Medical College, Kanpur. A clearance from ethical committee of institute was obtained. Written informed consent would be obtained from all the patients or their family for participation in the study. The study was conducted from December 2012 to September 2016.

### Study Design

Retrospective and Prospective study.

A group was generated in the age group 12-72 years operated by triceps sparing approach.

### Inclusion Criteria

- All closed as well as Type-I (Gustillo and Anderson) open fractures of distal humerus.
- Fractures with intraarticular involvement.
- Patients in age group 18-60 years.

### Exclusion Criteria

- Type-IIB & III (Gustillo and Anderson) open fractures of distal humerus.
- Patients with open physis.
- Fractures with associated vascular injuries.
- Uncooperative patient.
- More than 3 weeks old injury.
- All pathological distal humeral fractures that include secondary to neoplastic, infective (active or sequelae) pathology.

### Patients

47 patients with mean age of  $34.87 \pm 14.11$  years were included in this study. According to the medical report and radiograph of 47 patients with fracture distal humerus treated by ORIF via triceps sparing in department of orthopaedics

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G.S.V.M. Medical College, and associated LLR hospital Kanpur during December 2012- September 2016. Of the 47 patients there were 21 patients retrospective. 3 patients had compound injury of GUSTILO ANDERSON type 1.

### Surgical Treatment

ORIF was performed using technique according to AO principle. The triceps sparing approach was used in 47 cases.

### Post Operative Management

The subcutaneous drain was removed between 24 to 48 hrs after surgery. The extremities were immobilised for 3-7 days and rehabilitation of elbow was started immediately in patients who had stable fixation. For some patients early immobilisation of elbow was delayed for a week because adequate stabilisation was not achieved. Active elbow flexion and extension exercise lasting for 20-30mins were begin and gradually increased to 3 or 4 times a day while the patient was in hospital and thereafter discharged. The ROM was set at 0°-30°-110° for extension and flexion during week 1 and 2 and 0°-20°-120° during week 3 and 4 and 0°-10°-130° during week 5 and 6 after which full ROM was allowed. Full weight bearing exercises were only allowed after the fracture was completely healed. Indomethacin 75mg once a day for 3 weeks postop was prescribed to prevent heterotopic ossification.

### Elbow Rehabilitation

Elbow rehabilitation is an important part of the surgical procedure, however it should be supervised so as avoid disruption of the extensor mechanism and the stiffness resulting from prolonged immobilization.

Ring et al (2003) in their study followed the regimen with gravity assisted active elbow range of motion, including active extension, that was initiated the morning after surgery.<sup>12</sup>

Mishra et al and O'Driscoll et al followed a physical therapy program including active and passive motion on the third post operative day on the healing of pain. All patients were permitted active use of hand and were instructed not to lift anything heavier than a glass of water or a telephone receiver for first six weeks.<sup>44,45</sup>

### Results

|                       | No. of Patients<br>n=47 |
|-----------------------|-------------------------|
| Age                   | 34.87±14.11 Yrs         |
| Blood loss            | 121.61±19.85 ml         |
| Flexion               | 105.42±12.99 degree     |
| Extension             | 12.76±7.63 degree       |
| ROM                   | 92.65±19.07 degree      |
| MEPS                  | 86.38±10.45             |
| DASH                  | 34.51±9.50              |
| Duration of operation | 8.63±7.02 minutes       |

Mean follow up time for this study was 10.2months (3-18months). Total of 47 patients were treated with triceps sparing approach. The average age was 34.87±14.11 years. According to AO Classification, there were 17C1,20C2,6C3 fractures. 3 patients were of gustilo type1 fracture. Operation details for the patients are shown in the table

### Quality analysis of MEPS

|        | Excellent<br>(90&above) | Fair<br>(60-75) | Poor<br>(<60) |
|--------|-------------------------|-----------------|---------------|
| N = 47 | 24 (51%)                | 7(15%)          | 0             |

These were compared on the basis of duration of surgery, MEPS , DASH score , flexion , extension and ROM by using the MANNWHITNEY TEST which was significant for type C1 and C2 fracture and highly significant for type C3 fracture as illustrated in above mentioned table.

### Discussion

Intra-articular fractures of the distal humerus are difficult to treat and functional outcome can be variable. Because of the low incidence of these fractures, only a few series, with a considerable number of cases, have been reported. It is generally agreed that open reduction and internal fixation is standard treatment, with the aims, as described by O'Driscoll, being:

- 1) soft tissue healing without infection
- 2) restoration of diaphyseal bone stock
- 3) union between the distal fragments and the shaft
- 4) stable, mobile articulation.<sup>47</sup>

Poor long-term functional outcome is most commonly associated with decreased range of movement because of stiffness from prolonged immobilization. Therefore, the key is stable fixation to allow early movement of the elbow postoperatively.<sup>27,48</sup>

Numerous surgical approaches have been described for the fixation of distal humerus fractures. All of these involve a posterior skin incision with various strategies of working through or around the triceps. The various approaches are olecranon osteotomy, TRAP approach, triceps splitting, triceps reflecting and paratricipital approaches.<sup>23,25</sup>

As of now the surgeon opinion regarding the optimal approach to distal humerus is widely divergent and there are no randomized control trials in the literature to solve this dilemma. The quality of evidence in literature is either level III or level IV.

The experience reported with the use of the triceps-sparing approach to treat distal humerus fracture in adult patients is scant.

In this study there is 21retrospective and 26 prospective cases were included. Only closed and open Grade-I (Gustillo and Anderson) fractures were included as the open fractures of higher grade would have lead to confounding of the result due to triceps injury or laceration or contamination.

The average age in our series being 34.87±14.11 years. The majority of the patients were in the age group of 28-45 years which reflects a more active lifestyle in this age group.

The majority of the patients were males (26) patients. This male dominance was also seen in other studies done by Ali AM et al and eugene et al.<sup>38,49</sup> The higher male incidence reflects the male subjectivity to more outdoor activities, making them more prone to injury due to road traffic accidents which is the most common mode of trauma in our study and in study done by Chen G.et al followed by slip on ground.<sup>10,40</sup>

In current study, the incidence of open fractures was 3 patients, and all the patients underwent definitive fixation within a week by triceps sparing approach because only open grade-I (Gustillo and Anderson) fractures were included in our study. The incidence of open fractures encountered was comparable to previous studies by eugene et al, Ali AM et al and J.A.Fernandez et al.<sup>49,38,42</sup> Ali AM et al in his series of 22 patients, reported 3 cases of open injury in his study. All patients underwent definitive fixation on day of injury.

In our study there were 17 cases of type C1, 20 cases of type C2 and 6 cases of type C3 fractures. Rest 4 cases were of type A and B ,In current study, good quality of X-rays of each patient were done and they were classified accordingly.

Eugene et al reported 5 out of 8 (62.5%) cases in his series as AO/OTA type-C2.<sup>49</sup> Ali AM et al and Zhang et al,

had also reported a high incidence of AO/OTA type-C2 fractures of distal humerus, i.e. 11 out of 22 (50%) and 25 out of 67 (37.3% ) respectively.<sup>38,43</sup>

In the present study, the triceps-sparing approach allowed to visualize and reduce the fragments properly comparable to study done by Ek ET et al.<sup>39</sup> It has been demonstrated by Wilkinson and Stanley<sup>50</sup> that the difference of visualization between the triceps-sparing and the olecranon approach is the lack of visualization of an 11% of the surface and that even the olecranon osteotomy leaves a 43% of the surface unseen. According to Eugene et al also that triceps sparing approach provide adequate exposure to fracture site<sup>49</sup>.

The mean operative time was 78.63 minutes.

The outcome assessment of the study was done using the scoring system. In current study, two scoring systems were used. Mayo Elbow Performance Score (MEPS),<sup>51</sup> which is physician rated questionnaire uses clinical and functional measurement. Disability of arm, shoulder and hand (DASH)<sup>52</sup>, which was a patient rated questionnaire assess subjective component of the condition. At present there are no control or normal values for the DASH scores. The average DASH for Triceps sparing approach was 34.51 while mean DASH score was 17.9 points in the study done by Eugene et al.<sup>49</sup>

The average MEPS for triceps sparing approach was 86.31. In this study according to MEPS, the results were graded as excellent in 24(51%) patients, good in 16(34%), fair in 7(15%) patient. No poor result was obtained in this group.

The mean flexion for Triceps sparing approach was 105.42°.

The mean extension for triceps sparing approach was 12.76°.

Out of 47 patients which was operated by triceps sparing approach 17 (36.17%), 20 (42.53%) and 6 (12.7%) patient were type C1, C2 and C3 respectively on the basis of duration of surgery, MEPS, DASH, Score, flexion, extension and ROM.

### Complications

|                          |   |
|--------------------------|---|
| Soft tissue infection    | 2 |
| Ulnar nerve neuropraxia  | 1 |
| Heterotopic ossification | 1 |
| Implant prominence       | 1 |
| Radial nerve neuropraxia | 1 |

**1. Wound related complications** -out of 47 patient, 2 patient got wound related complications.

### 2. Ulnar nerve neuropraxia

Incidence for ulnar nerve neuropraxia was 4.25% which was fully recovered after two months.

### 3. Heterotopic Ossification

The incidence rate of heterotopic ossification was 2.12% asnoted on X-ray in 3 months followup, according to the Hastings classification scale<sup>54</sup>. Elbow arthrolysis with implant removal was planned but patient refused for procedure.

### 3. Implant Prominence

The incidence Rate of Implant prominence 2.12%. Implant removal was planned at 1 year follow-up , but patient was not willing for implant removal.

### 4. Delayed union

All the fractures in our study had healed both clinically and radiologically by the end of 3 months (range;2.5-4).

### 5. Radial nerve Neurapraxia

There is only one complication of radial neurapraxia was seen in 1 patients (4.16%) which got recovered fully after 3 months.

### Summary & Conclusion

The study to analyze the functional outcomes of fracture of distal humerus managed with open reduction internal fixation by reviewing 47 cases of fracture distal humerus surgically managed with triceps sparing approach. All patients were admitted in the department of orthopaedics, G.S.V.M.College, Kanpur.

Total 47 patients were included in the study,age ranged from 12 -72 years.

Most of the patients (66.7%) were of physically active age group.

Out of the 47, 26 were males and 21 being females.

Out of 47 fractures, 3 were of open (Gustilo and Anderson grade 1).

Most common cause of injury was RTA (road traffic accident) being 50.7%.

The maximum number of fractures in our study were AO type C2 (n=20).

Operative time in triceps sparing approach was 78.63 mins.

The outcome assessment of the triceps sparing with MEPS were good.

The outcome assessment with DASH were good.

Complication rate was minimum with almost all complications managed at regular follow up

All patients were allowed for early mobilisation that is on day 5.To conclude, Our study revealed that triceps sparing approach is a fast approach, easy to perform and makes it possible to achieve good reduction and thus great results.

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