

Olecranon Osteotomy Approach for Open Reduction Internal Fixation Analysis of 24 Cases of Fracture Distal Humerus.

Sanjay Kumar¹, Ajay Bharti², Apoorva³, Avneesh kumar⁴

¹Associate Professor, Dept. of Orthopaedics, G. S. V. M. Medical College, Kanpur, Uttar Pradesh, India.

²Professor, Dept. of Orthopaedics, G. S. V. M. Medical College, Kanpur, Uttar Pradesh, India.

³Senior Resident, Dept. of Orthopaedics, G. S. V. M. Medical College, Kanpur, Uttar Pradesh, India.

⁴Junior Resident, Dept. of Orthopaedics, G. S. V. M. Medical College, Kanpur, Uttar Pradesh, India.

Received: March 2018

Accepted: March 2018

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ABSTRACT

Background: This study was done for the analysis of the functional outcomes of distal humerus fractures managed by open reduction internal fixation by reviewing 24 cases of fractures of distal humerus which were surgically managed by olecranon osteotomy approach during December 2012 to September 2016. **Methods:** 16 male patients and 8 female patients with a mean age of 38.12±15.06 years were included in this study. A mean follow up time of 10.2 months (range 3-18 months) was done. 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 fractures of distal humerus managed by open reduction internal fixation using the olecranon osteotomy approach. **Results:** According to AO foundation (AO) Classification there were no cases of type A or type B, 5 cases of type C1, 6 cases of type C2 and 13 cases of type C3 fractures. Out of 24 patients 9(37.5%), 9(37.5%), 6(25%) obtained Excellent, Good, Fair MEP score respectively. **Conclusion:** No patient fell under poor category of MEP score.

Keywords: Fracture Distal Humerus, Olecranon Osteotomy.

INTRODUCTION

Distal humerus fractures constitute between 0.5% and 7% of all fractures and 30% of all elbow fractures.^[1] Upto 96% of these injuries are intercondylar, or AO type C, distal humeral fractures involving the articular surface.^[2] These fractures are very difficult to treat. The surgeon has to face multiple challenges while operating these fractures which include the complex elbow joint anatomy itself, comminution of the articular surface and frequently, osteopenic or osteoporotic bone stock. The keys to achieving a good surgical outcome are anatomic reduction of the joint surface, restoration of the overall anatomic axes of the extremity and stable fixation which allows early mobilization of the elbow. As the elbow joint capsule is very prone to scarring, early motion is extremely important after open reduction and internal fixation of these fractures and immobilization beyond 3 weeks has been associated with poor outcome.^[2,3]

The olecranon osteotomy approach is considered the gold standard for treating intercondylar distal humerus fractures as it provides excellent articular exposure. Triceps sparing approach as described by Bryan and Morrey, is another method to approach the posterior elbow.

Aims and objectives

To study the functional outcome of intra articular distal humerus fractures managed by olecranon osteotomy approach by using the following parameters:

- Accuracy of articular reduction
- Functional range of movement
- Operative time
- Immediate, early and late complications

MATERIALS AND METHODS

This was a prospective hospital based study, done in the Orthopaedics Department at LLR and Associated Hospital, GSVM Medical College, Kanpur. Ethical committee clearance was obtained at the Institute. All the patients had given written informed consent for participation in this study. This study was conducted from December 2012 to September 2016.

Study design

Name & Address of Corresponding Author

Dr Ajay Bharti,
L-17 G. S. V. M. Medical College Campus,
Kanpur-208002
(UP) India.

This study was done both retrospectively and prospectively.

A group of patients in the age group 12-72 years who were operated by olecranon osteotomy approach were included in this study.

Inclusion criteria

- All closed and Type-1 (Gustillo and Anderson) open distal humerus fractures.
- Fractures with intraarticular involvement

Exclusion Criteria

- Type-IIB & III (Gustillo and Anderson) open distal humerus fractures.
- Patients with open physis.
- Cases with associated vascular injuries.
- Non co-operative patient.
- Injuries which were over 3 weeks old.
- All pathological distal humeral fractures which includes fractures secondary to neoplastic or infective (active or sequealae) pathology.

Patients

This study consisted of 24 patients with a mean age of 38.12±15 years. Open reduction internal fixation via olecranon osteotomy approach was used to treat the distal humerus fractures in these patients. This study was conducted in department of orthopaedics at LLRH and associated hospital G.S.V.M. Medical College, Kanpur during December 2012-September 2016. Of the 24 patients there were 5 cases of type C1, 6 of type C2, 13 of type C3 and none of type A & B by AO classification. 6 patients had compound injury of GUSTILO ANDERSON type 1.

Surgical treatment

These distal humerus fractures were treated by open reduction internal fixation by using technique according to AO principle. Intraarticular chaverson osteotomy was performed approximately 2cm distal to tip of the olecranon for the olecranon osteotomy approach, used for the distal humerus fracture management in this study.

Postoperative management

The subcutaneously placed suction drain was removed by 24 to 48 hours postoperatively. The upper limb was immobilised for 3-7 days after surgery and rehabilitation of the elbow was immediately started in patients who had a stable fixation. Early elbow immobilisation had to be delayed for a week in some cases because adequate stabilisation could not be achieved. Active elbow flexion and extension exercises lasting for 20-30mins were begun 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 following which full range of motion was allowed. Once the fracture was completely healed, full weight bearing exercises were allowed. Indomethacin 75mg once a day was given for 3 weeks postoperatively to prevent heterotopic ossification.

Elbow rehabilitation

Elbow rehabilitation is an important part of the surgical procedure and it should be well supervised to prevent extensor mechanism disruption and the stiffness resulting from prolonged immobilization of the elbow.

Ring et al (2003) in their study followed the regimen with gravity assisted active elbow range of motion, including active extension, that was started the morning following surgery.^[12]

Mishra et al and O'Driscoll et al followed a physical therapy program which included both active and passive range of 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 the initial first six weeks.^[44,45]

RESULTS

The patients were followed up for a mean time of 10.2 months (3-18 months). 24 patients with distal humerus fracture were treated by olecranon osteotomy approach. The mean age was 38.12±15.06 years. According to AO classification, there were 5C1, 6C2, 13C3 fractures. 6 patients had Gustilo and Anderson type 1 fracture. Operative details of these patients are shown in the table.

| | No. of Patients n=24 |
|-----------------------|----------------------|
| Age | 38.12±15.06 Yrs |
| Blood loss | 222.78±34.93 ml |
| Flexion | 104.16±9.16 degree |
| Extension | 12.87±4.83 degree |
| ROM | 91.04±13.51 degree |
| MEPS | 82.91±11.60 |
| DASH | 36.00±8.26 |
| Duration of operation | 92.67±8.73 minuts |

Quality analysis of MEPS

| | Excellent (90 & above) | Good (75-89) | Fair (60-75) | Poor (<60) |
|--------|------------------------|--------------|--------------|------------|
| N = 24 | 9 (37.5%) | 9 (37.5%) | 6 (25%) | 0 |

The comparison was done on the basis of duration of surgery, DASH score, MEPS, flexion, extension and range of motion by using the MANNWHITNEY TEST which was significant for type C1 and C2 fractures and highly significant for type C3 fractures as illustrated in the table mentioned above.

DISCUSSION

Intra-articular distal humerus fractures are complex fractures and difficult to treat. The functional outcome can be variable. As the incidence of these fractures is less, only a few studies, with a considerable number of patients have been reported. It is generally agreed that ORIF is the standard treatment, with the objectives, as described by O'Driscoll, being:

- 1) Restoration of diaphyseal bone stock
- 2) Union between the distal fragments and the shaft
- 3) Soft tissue healing without infection
- 4) Stable, mobile articulation.^[47]

Prolonged immobilization results in elbow stiffness and leads to decreased range of motion which in turn gives a poor long-term functional outcome. Therefore, the key to obtain a good result is stable fracture fixation to allow early elbow range of motion postoperatively.^[27,48]

Various surgical approaches have been described for the operative management of fractures of distal humerus. All these approaches involve a posterior skin incision with various strategies of working through or around the triceps. The different surgical approaches are olecranon osteotomy, triceps splitting, TRAP approach, para tricipital and triceps reflecting approaches.^[23,25]

The surgical opinion for the optimal approach to distal humerus is widely variable 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.

24 patients with AO type A, type B, Type C distal humerus fractures were treated by olecranon osteotomy approach. In this study, 12 prospective and 12 retrospective 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 because of triceps injury or wound laceration or contamination.

The mean age of patients included in this study was 38.12 years (age group of 28-45 years).

The majority of our patients were males, that is, 16 out of 24 patients. This male dominance was also seen in other studies, done by Ali AM et al and eugene et al.^[38,49] The higher male incidence reflects the male subjectivity to more outdoor activities, making them more prone to injury because of road traffic accidents (50.7%), which is the most common mode of injury in our study and in the study done by Chen G. et al, followed by slip and fall on the ground (25.35%).^[10,40]

In our study, the incidence of open fractures was 6 patients, and all the patients underwent definitive surgical fixation within a week by olecranon osteotomy approach. The incidence of open fractures in our study was comparable to previous studies by eugene et al, Ali AM et al and

J.A.Fernandez et al.^[38,42,49] Ali AM et al reported 3 open injury cases in his study on 22 patients. All patients were operated by definitive fracture fixation on the day of trauma.

In our study, 5 cases were of type C1, 6 cases of type C2 and 13 cases of type C3 fractures. No cases of type A and B. In this study, X-rays of good quality were done for each patient and classified accordingly. 6 type C2 fractures, 5 type C1 fractures and 13 type C3 fractures were operated. Eugene et al reported 5 out of 8 (62.5%) cases in his series as AO/OTA type-C2.⁴⁹ 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.^[38,43]

Wilkinson and Stanley⁵⁰ demonstrated that the difference of visualization between the olecranon osteotomy approach and the triceps-sparing 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.

The average surgical time was 92.62 minutes.

The outcome assessment in our study was done by using the scoring systems. In current study, two scoring systems were used, Mayo Elbow Performance Score (MEPS) and Disability of arm, shoulder and hand (DASH). MEPS⁵¹, a physician rated questionnaire, uses clinical and functional measurement. Disability of arm, shoulder and hand (DASH)⁵², a patient rated questionnaire, assesses the condition subjectively. Currently, there are no control or normal values for the DASH scores. The mean DASH score for the olecranon osteotomy approach was 36 while mean DASH score was 17.9 points in the study done by Eugene et al.^[49]

The average MEPS was 82.91 for the olecranon osteotomy approach. In this study according to MEPS, the results were graded as excellent in 9 (37.5%) patients, good in 9 (37.5%), fair in 6 (25%) patients. No poor result was obtained.

The average elbow range of motion in this study was from 12.81° with extensor lag to 104.7° (90°-130°) of flexion. The mean flexion of the study at final follow up was 104.79° (range 30-140°) with mean extension of 12.81° (range 0-40°). The mean arc of motion was 91.84°.

The mean flexion after the olecranon osteotomy approach was 104.16°.

The mean extension after the olecranon osteotomy approach was 12.87°.

Thus the average arc of motion was 91.84° which is comparable to the results in other studies.

In our study, 5 (20.83%), 6 (25%) and 13 (54.16%) patients had type C1, C2 and C3 fractures respectively out of the 24 patients who were operated by olecranon osteotomy approach.

| | |
|------------------------------------|---|
| Ulnar nerve neuropraxia | 2 |
| Radial nerve neuropraxia | 1 |
| Soft tissue infection | 3 |
| Implant prominence | 3 |
| Delayed union of olecranon process | 1 |
| Heterotopic ossification | 3 |

- 1. Wound related complications (7.04%).**
3 patients out of 24 patients suffered wound related complications. The MEPS was 95, 85 and 60.
- 2. Ulnar nerve Neuropraxia**
The incidence of ulnar nerve neuropraxia was 8.33%. It completely recovered after two months. This incidence is similar to the incidence(10%) reported by Allende et al.^[53] Chen G. et al. in his study reported 2 patients out of 34 patients (6%) of olecranon osteotomy group with ulnar nerve paraesthesia which recovered by 3 weeks.^[40]
- 3. Radial nerve Neurapraxia**
There was only one patient with radial neurapraxia (4.16%). He recovered completely after 3 months.
- 4. Implant Prominence**
The incidence of Implant prominence was 12.5%. Implant removal was advised after 1 year follow-up, however the patient was not willing for the same.
Zhang et al. in his study on 36 patients with distal humerus fractures operated by olecranon osteotomy approach, reported 6 out of 36 patients with implant prominence.^[43] Jupiter et al reported 5 patients with symptomatic olecranon implants.^[17] Mckee et al noted that 27% of patients operated by olecranon osteotomy required reoperation for symptomatic implant removal.^[54]
- 5. Delayed union**
All the patients with distal humerus fracture in our study had healed both clinically and radiologically by the end of 3 months (range;2.5-4), both at fracture and the osteotomy site, except in 1 patient (incidence 4.16%) which had delayed union of the osteotomy site at 3 months followup. Tension band wiring was revised after 6 months.
Zhang et al and Chen G et al reported delayed union in 2 / 36 and 2 / 33 patients operated by olecranon osteotomy approach.^[43,40]
- 6. Heterotopic Ossification**
The incidence of heterotopic ossification was 12.5% as noted on X-rays on 3 months follow-up due to the post-operative elbow message done by the patient. Elbow arthrolysis with removal of the implant was advised but the patient denied for it.
Zhang et al and Chen G. et al reported 4 out of 36 cases and 4 out of 33 cases respectively of HO in their study on patients with distal humerus fractures operated by olecranon osteotomy

technique. Gofton et al. observed that 13% of patients with type C fractures of distal humerus suffered postoperative HO.^[40,43]

CONCLUSION

This study was done for the analysis of functional outcome of distal humerus fractures managed by open reduction internal fixation (ORIF) using the olecranon osteotomy approach. All patients were admitted in the department of orthopaedics at G.S.V.M. Medical College, Kanpur. Total 24 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 24 patients, 16 were males and 8 were females. Out of 24 fractures, 6 were open (type 1 Gustilo and Anderson). Road traffic accident was the most common mode of injury, incidence being 50.7%. AO type C2 fracture was the most common fracture encountered in our study (n=13). The operative time was 92.62 mins. The outcome assessment of olecranon osteotomy approach was good as assessed by MEPS and DASH. All patients were allowed for early mobilisation, by 5th postoperative day. To conclude, in our study it was observed that olecranon osteotomy approach is good for fixation of type C3 distal humerus fractures because of the good exposure provided by it. Although our study is promising, more number of patients is necessary to confirm our findings.

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How to cite this article: Kumar S, Bharti A, Apoorva, Kumar A. Olecranon Osteotomy Approach for Open Reduction Internal Fixation Analysis of 24 Cases of Fracture Distal Humerus. *Ann. Int. Med. Den. Res.* 2018; 4(3):OR01-OR06.

Source of Support: Nil, **Conflict of Interest:** None declared