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Comparing functional outcome of type C distal humerus fractures treated with internal fixation using olecranon osteotomy and triceps splitting approaches

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Abstract
Objective: To compare the functional outcome of distal humerus fractures AO type c treated using two different approaches (olecranon osteotomy and triceps splitting approach).
Design: Prospective study.
Methods: Total 30 patients each divided in to two groups each consisting of 15 patients1 and group 1, group 2 undergone ORIF using olecranon osteotomy and triceps splitting Approach respectively and evaluated at end of 6 months using MEPS score.
Results: Group 1 (15 patients) who undergone olecranon osteotomy has mean elbow flexion **(**119 ± 8.3), loss of elbow extension (11 ± 4.7) and group 2 (15 patients) who undergone triceps splitting approach has mean elbow flexion (104 ± 10.4), loss of elbow extension (23 ± 5.7) and were significantly different.
Conclusion: In this study we concluded that olecranon osteotomy approach provided better outcome than triceps splitting approach. Intraarticular distal humerus fractures was better visualized with olecranon osteotomy approach and allowed early mobilization.

Keywords: Comparing functional, C distal humerus, internal fixation, triceps splitting

Introduction
Distal humerus fractures common in elderly with osteoporotic bone and in adults with high energy trauma. Generally incidence of distal humerus fractures 2% [1, 2]. Most of the fractures were AO type C [4], occurred in women [1], type c fractures are relatively more compare to type a and b. Still the treatment option is Open reduction and internal fixation. The approaches affect the reduction and functional outcome. Approaches to distal humerus include triceps sparing, splitting, triceps reflecting [5, 6] and olecranon osteotomy approaches. In this study we aimed to compare the functional outcome using two approaches triceps splitting and olecranon osteotomy.

Materials and Methods
Sample size was calculated according to standardized formula which is 12 therefore rounded of to 15 in each group with 5% level of significance;10% allowable absolute error. hence 15 patients undergone triceps splitting approach and another group of 15 patients undergone 0lecranon osteotomy approach for distal humerus AO type c fractures between august 2016 to august 2018 were reviewed prospectively, Operated by 1 assistant professor and 3 training doctors in KRH hospital, Mysore, India.
Of the 30 patients 19 were females and 11 were males and mean age of 46.5 years, mode of injury being 16 road traffic accidents and 14 from self-fall. According to A0 classification [4]. There were 10 cases of type c1, c2 cases of type c3, and 8 cases of type c3. In this group 5 had Comorbidities like hypertension and type 2 diabetes mellitus. All patients' undergone operative treatment under general anesthesia and some under brachial plexus block with tourniquet application. Signed inform consent has been taken from all patients.

Surgical technique
Patients operated with 1 to 4th day of injury averaging 2 days. All patient's undergone open

reduction and internal fixation according to AO principles. First the inter condylar segment is reduced temporarily with k wires and articular surface reconstructed using 4mm cc screws passed from lateral to medially and the inter condylar segment reduced to distal metaphysis using 3.5 system distal humerus locking plate applied in 90 90 fashion both medially and dorsolateral [7, 8] (fig 3).whole procedure has been approached by intra articular chevron olecranon osteotomy [5] in one group of 15 patients and triceps splitting approach in another group of 15 patients. Olecranon osteotomy was fixed with tension band wiring in all cases [9] (Fig 4, 5).

Postoperative follow up

Above elbow splint in 90 degree elbow flexion has been applied to patients for 2 weeks in group 1 who underwent olecranon osteotomy and 3weeks in group 2(triceps splitting group) and . skin sutures were removed on POD 14.after 2wks splints are removed there by active and passive mobilization started; the patients were followed up for 6 months both clinically and radio logically. The mayo elbow performance score (MEPS) [10] was used as an objective measure of outcome.

Statistical analysis

Analysis of this study done using SPSS (trial version), descriptive were expressed as mean± SD for continuous variables while nominal variables were expressed as percentage. Statistical significance between continuous variables with a normal distribution was analyzed with T test.

Result

Patients were followed up for mean time of 24 month (range 16 -32 months) in both the groups. Radiological evidence of union was found in all patients with mean time of 16 weeks duration. The results in group 1 according to mayo elbow performance scoring [10] was excellent in 4 patients, good in 8 patients, fair in 2 patients and poor in one patient, with mean mayo score of 82 ± 8.4, the result in group 2 were excellent in 2, good in 6, fair in 4 and poor in 3 patients with mean mayo score of 72 ±13.6. The mean MAYO score was significantly different between the two groups ($p < 0.05$) (Fig 7).

The mean elbow flexion was found to be 119 ± 8.3 and the limitation of elbow extension were 11 ± 4.7 in olecranon osteotomy group (1), while elbow flexion was found to be 104 ± 10.4 and limitation of elbow extension were 23 ± 5.7 in triceps splitting group [2]. These were significantly different ($p<0.05$). (Fig 6)

Age, MEPS, elbow flexion, loss of elbow extension of both the groups have been summarized with statistical outcome (Table 1).

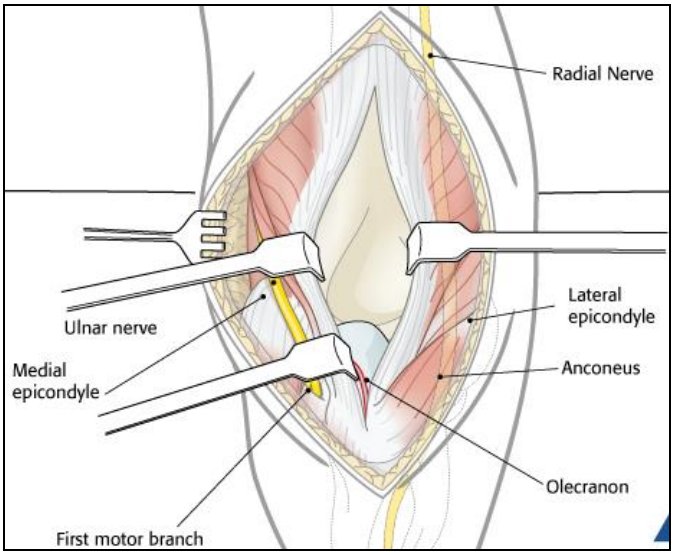

Fig 1: Triceps splitting approach

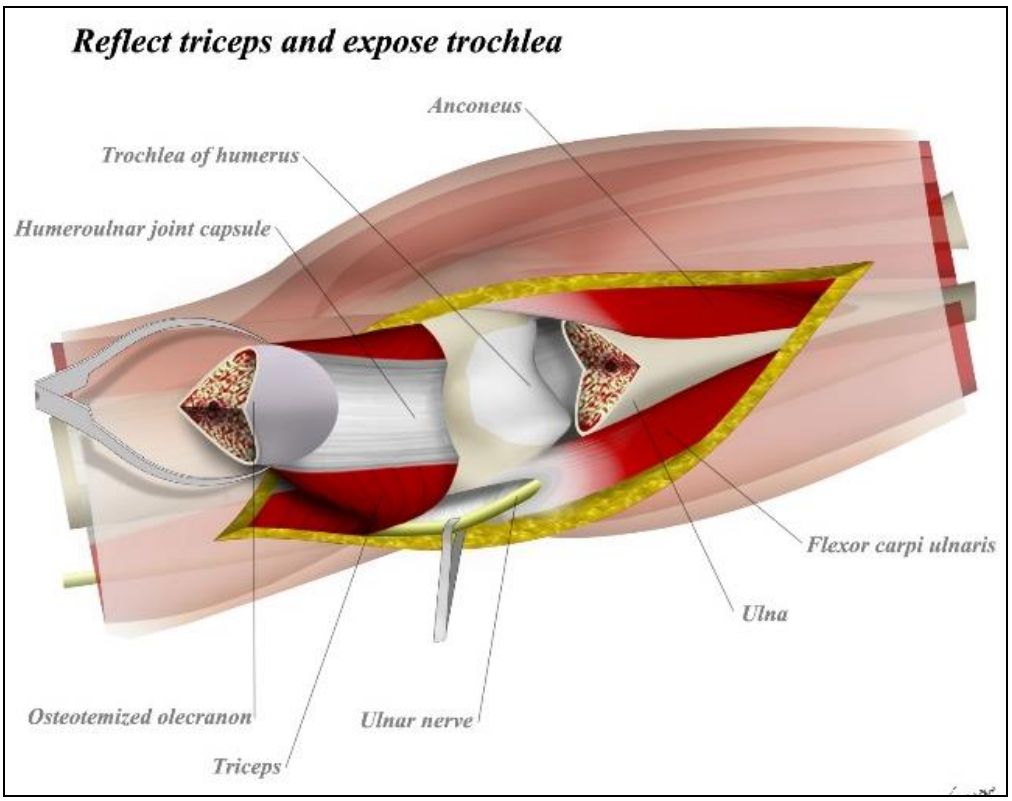

Fig 2: olecranon osteotomy approach

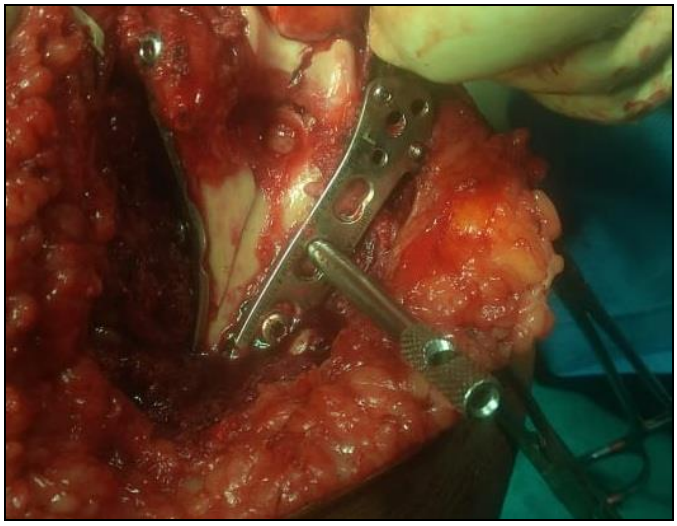

Fig 3: Dual platting in one of the patient medially and dorsolateral

Fig 4: Post op 2wks follow up showing fixation with dual plate using olecranon osteotomy approach and fixed using TBW

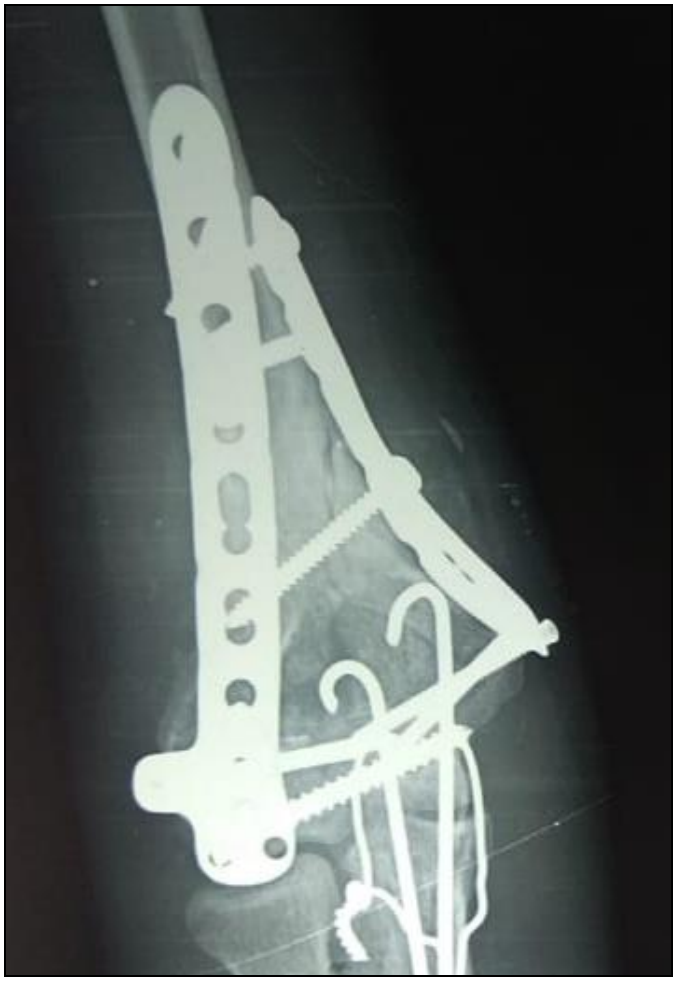

Fig 5: 2 months post op showing union of fracture fixed using olecranon osteotomy approach

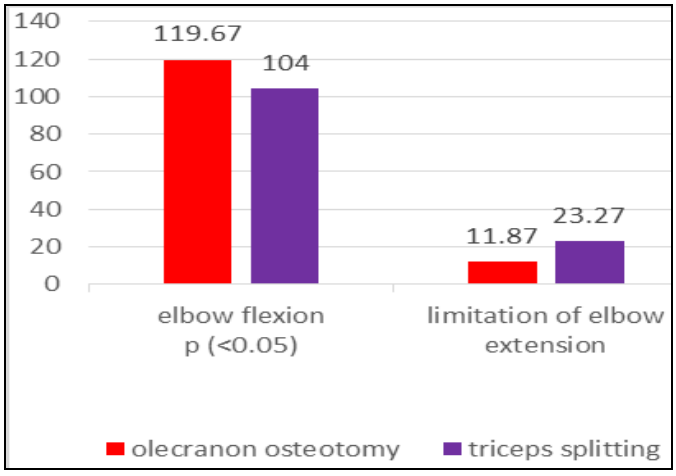

Fig 6: The mean elbow flexion and limitation of elbow extension of both groups and p values are shown and the differences in both the groups in terms of mean elbow flexion and loss of elbow extension were significant (p<0.05)

Table 1: Olecranon osteotomy (Group 1) and Triceps splitting (Group 2)

Table 1	Olecranon osteotomy (group 1)	Triceps splitting (group 2)	p values
Age	mean (48.67)	Mean (47.20)	0.635
MEPS	Mean (82.00)	Mean (72.67)	0.032
movements			
elbow flexion	119.67	104	0.01
loss of elbow extension	11.87	23.27	0.01

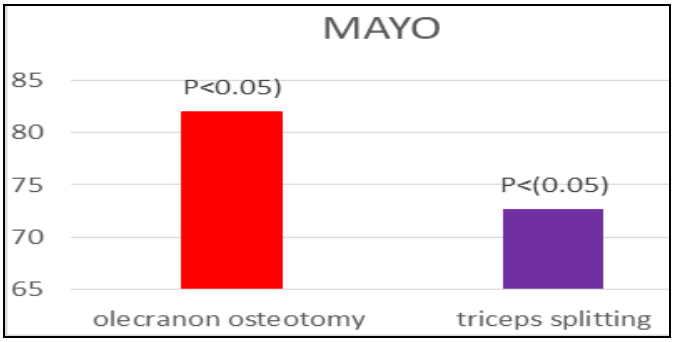

Fig 7: The mean MAYO SCORE of both the groups

Discussion

In this study we compared two groups' triceps splitting with olecranon osteotomy in treatment of type c distal humerus and evaluated according to functional score by MAYO scoring system [10]. We found significantly better functional outcome in olecranon osteotomy group.

The functional outcome following distal humerus fracture depends on restoration of joint congruency, stable fixation and early mobilization [11]. The surgical approach plays an important role in restoration of joint congruency, stable fixation [11]. The approaches available are triceps splitting, triceps sparing, triceps reflecting and olecranon osteotomy approach [5]. In this study we compared the two approaches in two groups olecranon osteotomy and triceps splitting approaches both groups has 15 patients each. In this study we used chevron osteotomy in one group (15 patients) in order to minimize nonunion risk in olecranon osteotomy [12] and tension band wiring was used for fixing back. Another group (15 patients) undergone Campbell's triceps splitting approach [13]. The disadvantage of triceps sparing approach is inadequate exposure of articular surface [14], stable articular reduction gives good functional outcome [14, 15]. The functional outcome of these distal humerus fracture is worse with increasing number of fragments. With was found in our study.

In this study all patients underwent double plating in 90 90 fashion [7]. In spite of type of fracture pattern and implant type, postoperative rehabilitation was main factor affecting functional outcome [13]. In group 1 (olecranon osteotomy) elbow range of motion was started at 2 weeks postoperatively and in group 2 (triceps splitting) range of motion started 3 weeks postoperatively. Hence early range of motion main factor in deciding functional outcome.

In this study range of motion evaluated at 2 years post operatively which resulted in mean elbow flexion of 119 ± 8.3 and mean limitation of elbow extension of 11 ± 4.7 in group 1. These values were 104 ± 10.4 and 23 ± 5.7 in group 2 respectively, and were significantly different from those in group 1 ($p < 0.005$).

Conclusion

In this study we concluded that olecranon osteotomy approach provided better outcome than triceps splitting approach. Intraarticular distal humerus fractures was better visualized with olecranon osteotomy approach [14, 15] and allowed early mobilization.

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