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Supracondylar Intercondylar Distal Humerus Fractures in Adults managed by Triceps Reflection and Olecranon Osteotomy Approach: Double Plating Technique

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Intercondylar fractures of the humerus are some of the most difficult and controversial fractures to treat. Before the last two decades the consensus favoured non-operative management because of the poor operative results. In the last quarter century improved outcomes have been reported with surgery for distal humerusfractures. This study is aimed to compare the outcome of olecranon –osteotomy and triceps-reflection approach in supracondylar intercondylar distal humerus fractures managed by double plating technique in adults. A prospective study was conducted on 30 cases aged from 16 – 54years. 19 (63%) were males and 11 (36.7%) were females, we used two approaches olecranon- osteotomy approach and triceps- reflection approach in each 15. 22 (73.3%) were adopting sedentary work, 8 (26.7%) were manual workers. Patients were evaluated by history taking, physical examination, investigation, consent taking and image. The results of treatment were assessed by a modification of the method adopted by Mayo-Elbow performance score (MEPS). All patients were followed up from six weeks, to six months. Elbow motion was allowed 1-2 days postoperatively and full union was obtained from 14-30 weeks. The outcome of olecranon osteotomy and triceps-reflection approaches in supracondylar intercondylar distal humerus fractures managed by double plating technique in adults. Internal fixation by double plating technique give satisfactory results in management of intercondylar fractures of distal humerus. Better functional outcomes of distal humerus fractures that were exposed using the triceps-reflection approach rather than olecranon-osteotomy approach.

Keywords: Humerus Fractures, Olecranon Osteotomy, MEPS and Triceps Reflection.

INTRODUCTION

Distal humerus fractures although less common, are on an increasing trend over the last few decades (Beazley and Baraza, 2017). Riseborough and Radin compared conservative and surgical management of these fractures and came to a conclusion in favour of nonsurgical management (Riseborough and Radin,1969 ; Nestorson et al.2019). However over last few years, with comprehensive understanding of elbow anatomy and newer implant design, enough evidence has been accumulating in favour of surgical fixation. Open reduction and internal fixation (ORIF) of these fractures are now well recognized management. Hence, exposure of fracture fragments to reconstruct anatomy becomes paramount for good outcome (Kamrani et al. 2012). Consequently, the surgical approach becomes very crucial. These fractures have been principally approached from posterior side and various posterior approaches have been mentioned. Various approaches, namely triceps-

reflecting anconeus pedicle (TRAP), Bryan and Morrey's triceps reflecting, and Campbell's triceps-splitting, have been described with pros and cons of each (O'Driscoll,2000; Zlotolow et al. 2006 ; Goel et al.2010). In TRAP and triceps-reflecting approaches, the entire extensor mechanism have to be reflected, have limited exposure and also have well documented triceps weakness and triceps avulsion (McKee et al.2000 ; Cheung and Steinmann,2009). Triceps splitting allows very limited articular visualisation which makes it undesirable for such injuries. The Triceps Reflectionand olecranon osteotomy approach which provides maximum articular surface visualisation, gives better command on fracture fragments and has minimal consequences on extensor mechanism, is often employed for such fracture (Wilkinson and Stanley, 2001; Lee et al. 2014). However, the olecranon osteotomy approach has additional potential complications such as non-union at osteotomy site, implant issues and resurgeries (Coles et al.2006; Nestorson et al.2019). In this study, we evaluated the outcome of olecranon osteotomy and triceps-reflection approach in supracondylar intercondylar distal humerus fractures managed by double plating technique in adults.

MATERIALS AND METHODS

A prospective study was conducted from January 2019 to July 2019. 30 cases were treated using double plating technique. The study was conducted on 30 cases aged from 16 – 54years. 19 (63%) were males and 11 (36.7%) were females, we used two approaches olecranon-osteotomy approach and triceps- reflection approach in each 15. 22 (73.3%) were adopting sedentary work, 8 (26.7%) were manual workers.

Inclusion criteria were skeletally mature patients. 2- age: 17 - 60 years.

Exclusion criteria was skeletally immature patients., open fractures, pathological fractures and periprosthetic fractures.

Causes of the fracture were Fall dawn stairs 9 (30.0%), Motor bike accident 8 (26.7%), Road traffic accident 6 (20.0%), Motor car accident 5 (16.7%), Direct trauma2 (6.7%).The right side was affected in 53.3% of patients, while the left side was affected in 46.7 % of patients. There were no associated injuries which need special intervention. Fixation of the fractures was done after stabilization of the patient's general condition with a mean time lapse between injury and fixation 1-2 days. Patients were evaluated by history taking, physical examination, investigation, consent taking and image.

Triceps- reflection approach

A straight posterior incision in the midline of the limb was done extending from 7 cm distal to the tip of the olecranon to 9 cm proximal to it. The ulnar nerve was identified proximally at the medial border of the medial head of the triceps, and dissected free from its tunnel distally to its first motor branch. The medial aspect of the triceps was elevated from the humerus, along the intermuscular septum, to the level of the posterior capsule. The superficial fascia of the forearm was incised distally for about 6 cm to the periosteum of the medial aspect of the olecranon. The periosteum and fascia were carefully reflected as a single unit medially to laterally. The medial part of the junction between the triceps insertion and the superficial fascia and the periosteum of the ulna were the weakest portion of the reflected tissue. Care was taken to maintain continuity of the triceps mechanism at this point. To expose the radial head, the anconeus was reflected subperiosteally from the proximal ulna; the entire joint was widely exposed. During closure, the medial collateral ligament was carefully repaired if its release was necessary. The wound was closed in layers, and a radyvac was put in the wound of all cases.

Olecranon Osteotomy :

A straight posterior incision in the midline of the limb extending from 7 cm distal to the tip of the olecranon to 9 cm proximal to it. The ulnar nerve was identified proximally at the medial border of the medial head of the triceps, and dissected free from its tunnel distally to its first motor branch. The distal apex of the chevron osteotomy was centered with the bare area of the olecranon articular surface. The anconeus was divided with electrocautery in line with the lateral limb of the osteotomy. We started osteotomy with a thin oscillating saw then we completed the osteotomy by an osteotome (Figure 20). To decrease risk of damage to the articular cartilage on ulna and humerus.

Elbow motion was allowed 1-2 days postoperatively and full union was obtained from 14-30 weeks. The results of treatment were assessed by a modification of the method adopted by Mayo-Elbow performance score (MEPS). All patients were followed up from six weeks, to six months.

Statistical analysis:

Data were statistically described in terms of mean standard deviation (SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student t test for independent samples. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5. p values less than 0.05 was considered statistically significant.

RESULTSAND DISCUSSION

The last decade has seen advances in the understanding of elbow anatomy, improvement in surgical approaches, new innovative fixation devices and evaluation of postoperative rehabilitation protocols (Palvanen et al.1998). Fractures of the distal humerus account for 2% to6% of all fractures. These fractures occur in different age distribution, with fractures in younger patients occurring as a result of high-energy mechanisms and fragility fractures occurring in the elderly as a result of low-energy falls (Cheung and Steinmann, 2009). Classification systems used are the Jupiter and Mehne system, which is based on fracture patterns observed intraoperatively, and the system proposed by Davies and Stanley, which combines the aforementioned classifications system (Bryan and Morrey, 1982; Zlotolow et al. 2006). Whatever system used, it is important to pay particular attention to the mode of trauma. Condition of the soft tissues, bone quality, and lastly the age and physical demands of patients (McKee et al.2000; Kamrani et al. 2012).

All of these fractures represent a challenge to the surgeon because of the distal location and predilection toward articular involvement. Because of these issues, multiple treatment strategies have emerged with the majority of current recommendations including open reduction and internal fixation (ORIF). ORIF of the fracture allows the surgeon to restore anatomic alignment of the fracture fragments and permit early range-of-motion exercises that may aid in the return of a functional range of motion of the elbow postoperatively (Coles et al.2006; Beazley and Baraza, 2017). Different methods of internal fixation of the fracture fragments have evolved over time in an attempt to best restore anatomic alignment of the distal humerus, given its complex anatomy while also providing stable fixation to permit early rehabilitation of the injured extremity (Lee et al. 2014). The aim of this study was to compare the triceps-reflection approach with olecranon osteotomy regarding their effects on the functional outcomes of intercondylar fractures of the distal humerus managed with open reduction and internal fixation (ORIF), by reviewing 30 cases of intercondylar distal humerus fractures surgically managed with either of the approaches during 2018-2019.

In our study, the medical records and radiographs of 19 male and 11 female patients, aged, 17-54 years old, and a follow-up time of 6 months, were prospectively reviewed. Flexion, extension, arc of flexion/extension, pronation, supination, arc of pronation/supination and the Mayo Elbow Performance Score (MEPS) were used to assess the functional outcomes of intercondylar distal humerus fractures treated with ORIF through the triceps-reflection approach or olecranon osteotomy. According to the AO Foundation (AO) classification, there were 8 cases of C1, 16 cases of C2 and 6 cases of C3 fractures. At the time of review, 27 cases united and 3 cases developed delayed union. In the triceps-reflction group 9 of patients obtained good,3 obtained excellent,3 obtained fair MEPS, while in olecranon- osteotomy group 11 of the patients obtained good,4 obtained fair MEPS. The rate of excellent/good MEPS remained above in the group of patients treated with ORIF via triceps-reflction (9 good,3 excellent MEPS) than those treated with ORIF via olecranon-ostetomy 11 good MEPS. Our results are agree with Ali et al.(2008) who revealed a management of inter-condylar fractures of the humerus using the extensor mechanism reflection posterior approach, Twenty two patients with intra-articular fractures of the distal humerus were operatively treated using the extensor mechanism-reflection approach as described by Schildhauer et al. All fractures were AO type C (six AO type C1, 11 C2 and five C3). There were 16 males and six females with a mean age of 32.5years. Internal fixation was achieved with bilateral plates and screws. The results were evaluated after a mean follow-up period of 30 months using Mayo Elbow Score. The attainable results were graded as excellent in 13 patients (59.2%), good in six (27.3%), fair in two patients (9%) and poor in one (4.5%). The average range of flexion was 120° ± 8° (range: 100 to140), extension 6° (range: 0 to 15). Eighty-two percent of patients had normal muscle strength in comparison to the contralateral side and 18% had good muscle strength. The average time to union was 2.4 ± 1.6months

(range: 2 to 4). No implant failure, neurovascular deficit or nonunion was noted. Their findings indicate that the tricipital reflection approach for intercondylar fractures of the distal humerus preserves muscle strength, allows early motion of the elbow joint, giving satisfactory results when careful preoperative planning and strict adherence to the principles of fracture management are followed; however, they do not recommend this approach in the management of multifragmentary (C3) fractures.

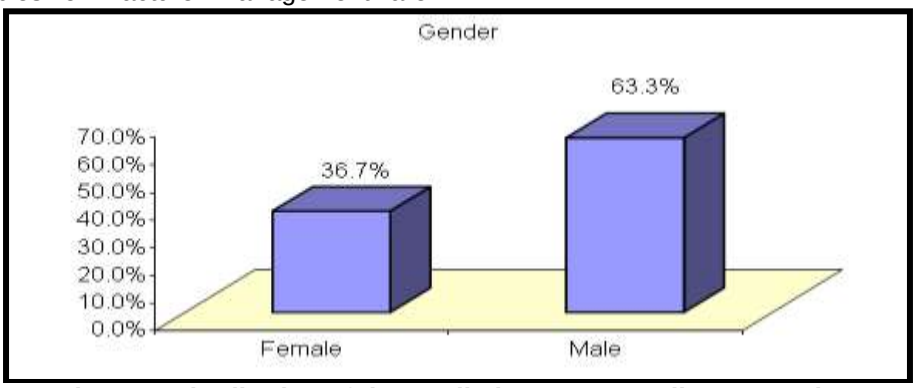

Figure1: Distribution of the studied cases according to gender.

Table 1: Distribution of the studied cases according to age and etiology

		No = 30
Age	Mean ± SD	27.53 ± 10.36
	Range	17 – 54
Etiology	Direct trauma	2 (6.7%)
	Fall dawn stairs	9 (30.0%)
	Motor bike accident	8 (26.7%)
	Motor car accident	5 (16.7%)
	Road traffic accident	6 (20.0%)

Table 2: Distribution of the studied cases according to MEPS, MEPG

		No.= 30
Mayo Elbow Performance Score (MEPS)	Mean ± SD	78.73 ± 7.79
	Range	65 – 93
Mayo Elbow Performance Grade (MEPG)	Fair	7 (23.3%)
	Excellent	3 (10.0%)
	Good	20 (66.7%)

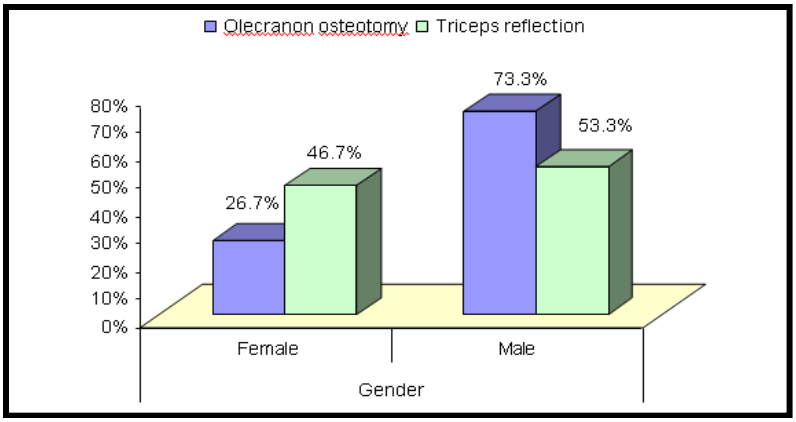

Figure 2: Gender distribution according to approaches chart.

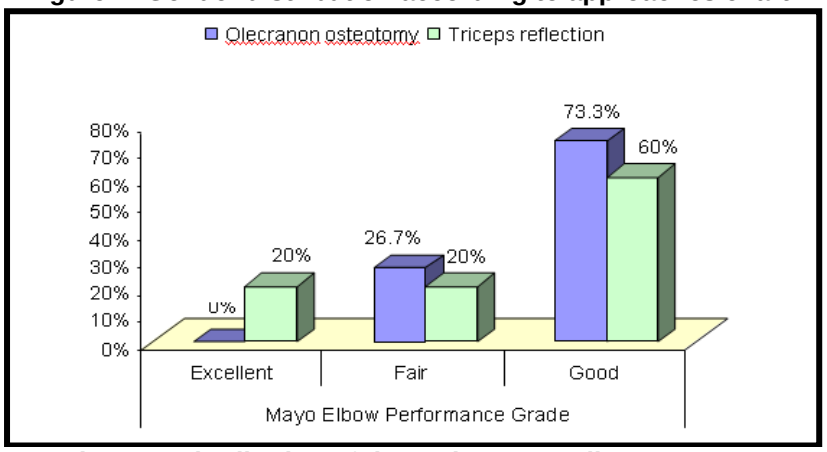

Figure3: Distribution of the patient according to MEPG.

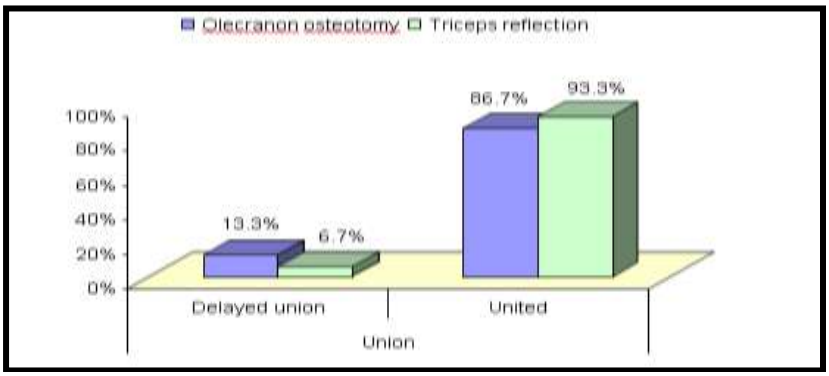

Figure 4: Distribution of the patient according to post-operative union

Simillary, Zhang and Zhong (2014) who compared approaches to expose type C fractures of the distal humerus for ORIF in elderly patients: six years clinical experience with both the triceps-reflection approach and olecranon osteotomy. Although open reduction and internal fixation (ORIF) is a standard fracture treatment method, the optimal way to expose a fracture prior to ORIF is debated. They compared the effects of two exposure methods, the triceps-reflection approach and olecranon osteotomy, on the functional outcomes of ORIF-treated type C distal humerus fractures in elderly people.

CONCLUSION

Internal fixation by double plating technique give satisfactory results in management of intercondylar fractures of distal humerus. Better functional outcomes of distal humerus fractures that were exposed using the triceps-reflection

approach rather than olecranon-osteotomy approach.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

All authors read and approved the final version.

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