

ORIGINAL RESEARCH

Functional outcomes of dual plating of distal humerus fractures with triceps tongue method

¹Dr Abhishek Garg, ²Dr Anand Gupta, ³Dr Sirshendu Roy, ⁴Dr Rahul Sharma, ⁵Dr Manmeet Malik, ⁶Dr Puneet Yadav, ⁷Dr Gaurav Kumar Agrawal

¹Senior Resident, ^{2,3}Fellow National Board (FNB)Trauma, ⁴⁻⁷Junior Resident, Dept. of Orthopaedics, PGIMS, Rohtak, Haryana, India

Correspondence:

Dr Abhishek Garg

Senior Resident, Dept. of Orthopaedics, PGIMS, Rohtak, Haryana, India

Email: abhi.garg003@gmail.com

ABSTRACT

Background: Fixation of intra-articular distal humerus fractures has remained a challenge to orthopaedic surgeons due to complicated anatomy of elbow, comminution at fracture site and osteopenia of articular surfaces. We aimed to evaluate the functional outcomes and complications after dual plating for distal humerus fractures with triceps tongue technique. **Materials and Methods:** We conducted a retrospective study which consisted of 20 cases of distal humerus fracture with intraarticular extension and treated with open reduction and internal fixation with dual column plating using triceps tongue technique. Triceps Tongue approach allows exposure of distal humerus articular surface by forming an inverted V-shaped flap of distal triceps at the musculotendinous junction. **Results:** Union was achieved in all cases. Mean time of fracture union was 14.65 ± 1.82 weeks. There was no case of non-union although elbow stiffness occurred in one patient. The mean MEPS score was 83.45 ± 9.18 with a range of 70-95. **Conclusion:** Triceps Tongue approach is a simple and less technically demanding approach for the surgeon that can be used in management of the majority of the distal humeral fractures, giving adequate exposure of the surgical field, aiding in proper reduction of fracture fragments and thus obviating the need for an olecranon osteotomy.

Key words: Distal humerus fracture, Triceps Tongue approach, Olecranon osteotomy, Dual plating

INTRODUCTION

Intercondylar distal humerus fractures in young adults are difficult to treat due to the relatively complex anatomy at the elbow, small fracture fragments with comminution and chances of elbow stiffness.^{1,2} In young adults, these fractures occur due to high-energy trauma and require operative fixation with anatomical reduction of the elbow joint and stable fixation enough to provide early mobilization at the elbow with satisfactory results.^{3,4} In the past, many treatment methods were used for distal humerus fractures including nonoperative treatment and percutaneous methods using Kirschner wires that needed prolonged periods of cast, increasing the risk of local complications such as joint stiffness, mal-union and non-union. Presently, internal fixation with dual plating provides the most acceptable outcome for distal humeral fractures due to reconstitution of elbow joint congruity and the stability of the fixation provides the early mobilization of the affected joint.^{5,6,7} Plethora of surgical approaches have been mentioned in the literature by various authors, including olecranon osteotomy, triceps-reflecting anconeus flap, Bryan Morrey (Mayo), paratricipital and triceps

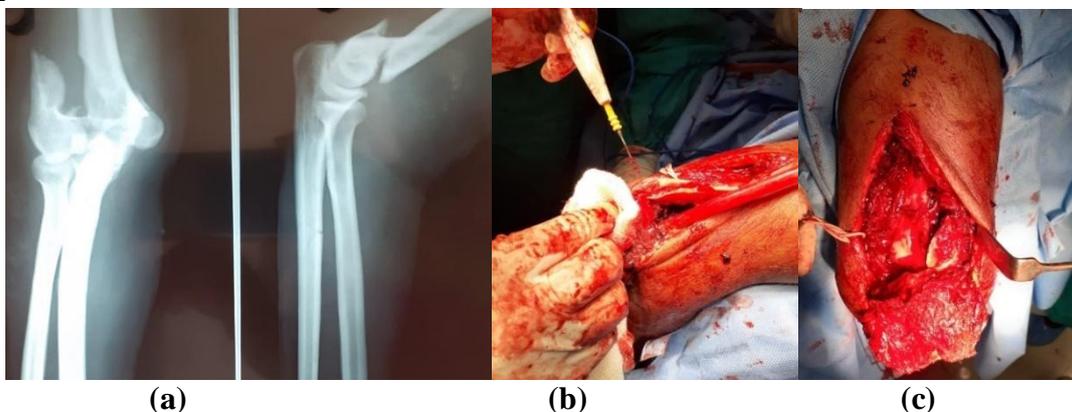
tongue. The olecranon osteotomy has been the gold standard in complex distal humerus fractures as it is the most extensive approach providing the maximum visualization of the articular surface of the distal humerus. However, this olecranon osteotomy approach has its own set of complications like malunion, nonunion, additional implant. Furthermore, implant loosening can arise from performing the olecranon osteotomy.^{8,9} We aimed to evaluate the functional outcomes and complications after dual plating for distal humerus fractures with triceps tongue technique.

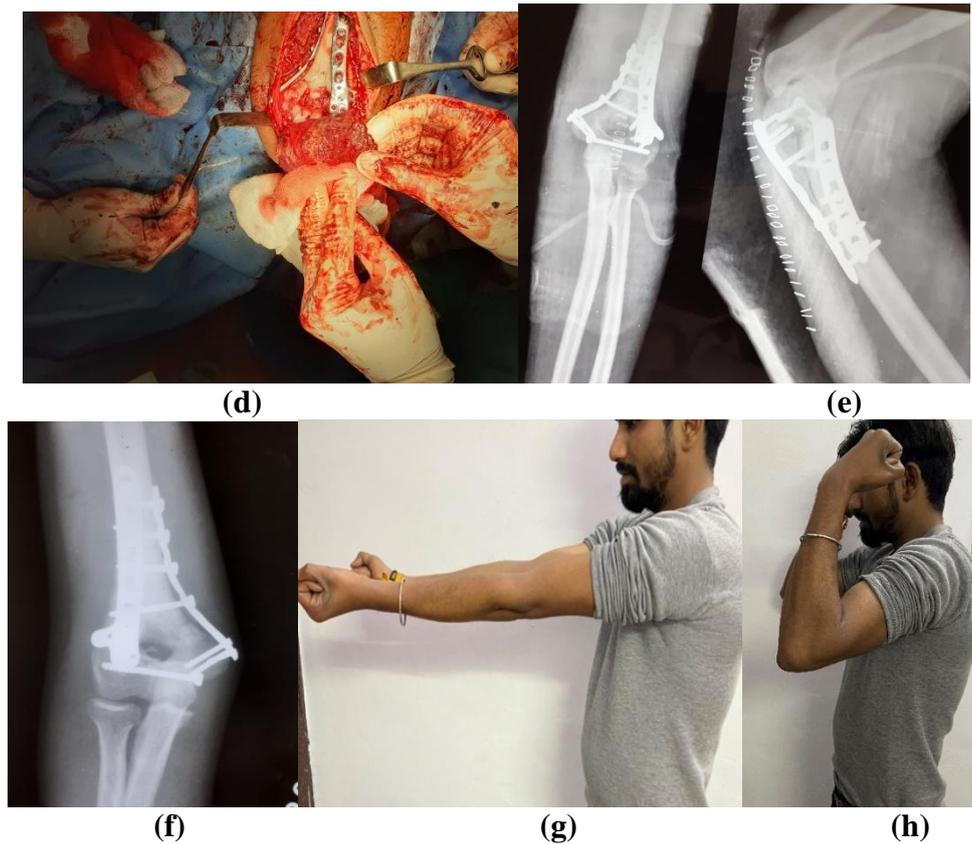
MATERIALS AND METHODS

The present retrospective study was conducted in the Department of Orthopaedics, PGIMS Rohtak and included 20 cases aged between 20-70 years, who were operated for distal humerus fractures over last 3 years with dual plating by triceps tongue technique. Patients were retrospectively followed up with all their previous surgical records and radiographs. Patients were clinically examined and functional outcomes were noted. Patients with single distal humerus fracture, all distal humerus fractures with intra articular extensions based on AO classification, and those without pain or arthritis of elbow before surgery were included in the study. Patients with age more than 70 years, patients having elbow stiffness before surgery, having congenital or acquired deformity of injured limb before surgery, pathological fractures and open fractures were excluded from the study.

Radiographs were taken in two planes, anteroposterior view and lateral view before planning for surgical fixation for distal humerus fractures. All the surgeries were performed under general anaesthesia in lateral decubitus position with application of tourniquet. A Posterior longitudinal midline incision was given over posterior aspect of elbow with slight curvature over olecranon prominence avoiding incision over the tip of olecranon. Full-thickness skin flaps were elevated. The ulnar nerve lying on the back of the medial epicondyle was fully dissected out and protected throughout the surgery. Triceps tongue technique was used for exposure of the fracture site which included transection of triceps at the musculotendinous junction (V-Y incision). Triceps tongue technique is advantageous as it allows fracture reduction and fixation without performing olecranon osteotomy. It is essential to preserve a thick portion of the tendon on all sides of the tongue for tendon-to-tendon repair to be used during closure at the end of the surgery. The intra-articular fracture fragments were reduced and temporarily fixed with K wires followed by fixation with partially threaded cannulated screws. When satisfactory reduction was achieved, definitive fixation was performed by the dual plating system. We used both parallel and orthogonal plating techniques in the patients (Fig. 1,2).

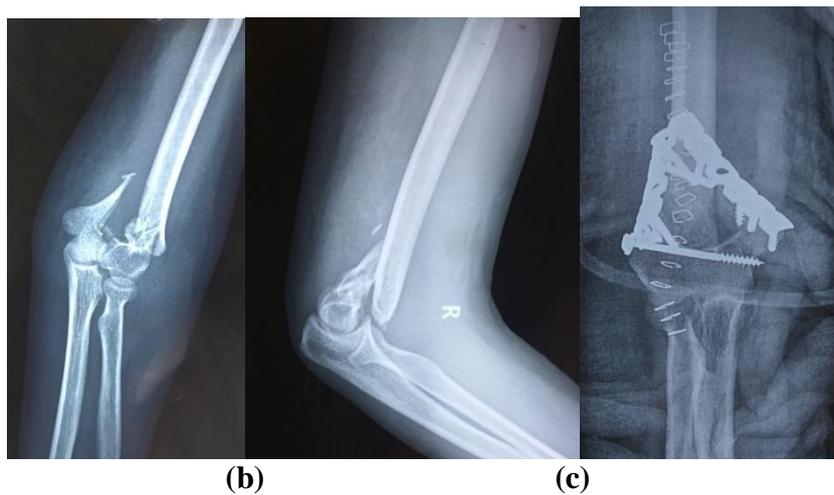
Fig 1





- (a) Preoperative X-ray showing intra articular distal humerus fracture
- (b) Triceps tongue being made at musculotendinous junction
- (c) Triceps tongue made and flaps retracted
- (d) Intraoperative picture showing fracture fixation with dual plates
- (e) Immediate post op showing dual column plating
- (f) Showing healed fracture
- (g) (h) Showing elbow ROM at follow up

Fig 2



- (a) (b) Preoperative xray showing intra articular distal humerus fracture
- (c) Immediate post op showing dual plate fixation

A posterior above elbow slab was applied at the time of surgery. Passive elbow mobilization exercise was started only 3 days after surgery while a full range of elbow exercises were started after suture removal. The functional results of elbow were assessed Mayo Elbow

performance Score (MEPS) and total range of motion of elbow joint at least 6 months after surgery and patient's satisfaction based on surgical outcomes were assessed individually. Statistical analysis was done with SPSS version 16 using descriptive statistical methods including the Pearson Chi squared test and student-t test. A p value of <0.05 was considered as statistically significant.

RESULTS

The mean age was 41.65 ± 14.39 with a range of 20-70 years. There were 13 males (65%) and 7 females (35%). Right side was involved in 12 patients (60%) while left side was involved in 8 patients (40%). 16 patients (80%) had Road side accident (RSA) as mode of trauma for their fracture while 4 patients (20%) had simple fall as the mechanism of injury for their fracture. The study had 9 patients (45 %) of C2 and 11 patients (55%) of C3 according to AO classification. All the patients had closed fractures. The choice of implants was based on surgeons' preference and financial constraints of the patient. Precontoured anatomical column specific locking compression plates (LCP) were used in this study in all the patients. Mean time of fracture union was 14.65 ± 1.82 weeks. Range of motion at elbow at final follow up was 122 ± 15.46 degrees (Table 1).

Table 1: Showing demographic profile and results

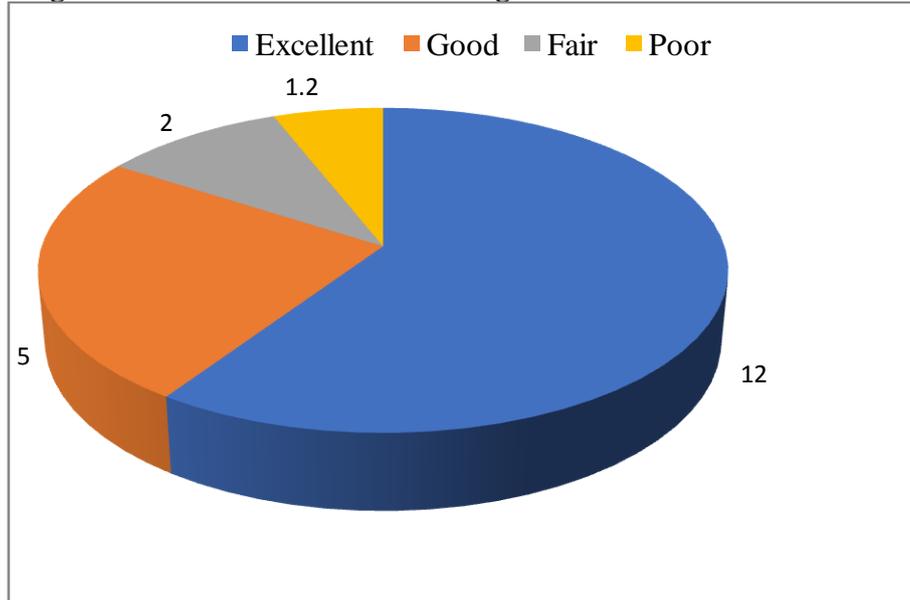
Parameter	Number
Mean Age	41.55 ± 14.39
Sex	M=13 F=7
Side	R=12 L=8
Mode of Injury	RSA-16 Fall- 4
Fracture classification (AO)	C2- 9 C3- 11
Mean time of fracture healing (weeks)	14.65 ± 1.82
Mean Range of Motion (degrees)	122 ± 15.46
Mean MEPS score	83.45 ± 9.18

One patient had decreased ROM due to stiffness at the elbow joint due to poor compliance of physiotherapy exercises. 1 patient had superficial infection which was managed with intravenous antibiotics. No deep infection and no case of non union was noted in this study. No case of neurovascular injury post injury was reported in the present study (Table 2).

Table 2: Complications

Complication	No of patients
Superficial infection	1
Deep infection	0
Non union	0
Elbow stiffness	1

Final results using MEPS scoring system (Fig 3) showed excellent outcome in 12 patients(60%), good results in 5 patients(25%), fair result in 2 patients (10%) and poor result in 1 patient (5%).The mean MEPS score was 83.45 ± 9.18 with a range of 70-95.

Fig 3: Showing Functional Outcomes according to MEPS**DISCUSSION**

Treatment of the distal humerus fractures is debatable, with advocates of nonsurgical management in brace as well as surgical fixation using plates.^{10,11} Sarmiento et al in their series on functional bracing of comminuted extra articular distal humerus fractures had shown radiological union of the fracture in 96% patients with good functional results, thus advocating the use of functional cast bracing for these fractures.¹² Irrespective of the treatment method chosen, any substantial damage to the distal humerus usually results in limitation of motion, pain and possibly instability. Open reduction and internal fixation of distal humerus is influenced by several factors like the stability of fixation, bone quality, type of fixation, comminution at the fracture site and condition of soft tissues after injury.^{13,14}

The triceps tongue approach to the distal humerus was originally described by Van Gorder and is a useful approach for distal humerus fractures providing advantages over other approaches used for distal humerus fracture fixation. Being less technically demanding for the surgeon, it provides good visualization of the distal humerus articular surface and meta diaphyseal region for fracture fixation. By avoiding an olecranon osteotomy, the ulna is not violated, additional implants are avoided that are needed for olecranon osteotomy fixation and surgical time is reduced, thus reducing the blood loss and other surgical complications.¹⁵ But for complex intraarticular distal humerus fracture triceps tongue approach may not provide the required exposure for fracture fixation for which olecranon osteotomy would still be needed. A commonly reported complication with the triceps tongue approach is the triceps weakness post surgery. However, data presented by Na et al in their study showed all 21 patients had grade V or IV triceps strength post elbow arthroplasty with the triceps tongue approach.¹⁶ The mean age in our study was 41.65 ± 14.39 which is comparable to Reddy et al who had mean age of 42.66 years in their study.¹⁷ Our results are also comparable to Mani KC et al who had average age of 36.72 ± 14.99 of their patients in their study.¹⁸ In our study we had male preponderance as we had 13 males (65%) which is comparable to Wang et al who had 60% males and 40% females in their study.¹⁹ Male predominance is probably due to their increased involvement in outdoor physical activities and more active life as compared to females. In our study, right was involved in 60% patients that is in corroboration to results of Wang et al and Reddy et al who also had involvement of right side more than left side.^{17,19} Right-sided predominance is probably due to direct fall injury on to the predominant side that is right in our series. Orthogonal plating in distal

humerus fractures were propagated by the AO (Association for the Study of Internal Fixation) group whereas O'Driscoll et al. advocated parallel plating for distal humerus and also noted that orthogonal plating could not resist varus loads at distal humerus.^{20,21} Helfett did not compare the two plating systems, but suggested that two plate construct at right angles were biomechanically better for the management of distal humerus fractures with better functional outcomes and patient satisfaction.²² Due to the characteristic intra articular involvement and poor control of fracture fragments with closed treatment, these fractures require operative fixation. Primary goals for operative intervention are to restore articular congruity and elbow stability to decrease the incidence of posttraumatic arthritis and elbow stiffness.²³ The correct placement of plates, correct size and number of screws help in obtaining a stable and painless elbow, thus preventing complications such as stiffness or nonunion. The distal humerus consists of three columns that form a triangle: medial, lateral and transverse intercondylar; its stability depends on the integrity of this triangle.²⁴ The mean MEPS score in our study was 83.45 ± 9.18 . Our results corroborate with the results of Mani KC et al who had mean MEPS score of 81.62 ± 10.28 (range 54-100) in their respective study.¹⁸ Mani KC et al in their study noted 2 (3.70%) cases of deep infection (osteomyelitis) and 3 (5.55%) cases of superficial infection which were treated with antibiotics and debridement, one case of non union and 2 cases of delayed union. In our study we noted 1 case of superficial infection. No case of non union was seen. 1 case of elbow stiffness were seen in our study.¹⁸ Final results using MEPS scoring system in our study showed excellent outcome in 12 patients (60%), good results in 5 patients (25%), fair result in 2 patients (10%) and poor result in 1 patient (5%). Our results are comparable to results of Reddy et al who showed excellent outcome in 15 patients (42.86%), good results in 13 patients (37.14%), fair result in 5 patients (14.29%) and poor result in 2 patients (5.71%) using MEPS scoring system.¹⁷ Limitation of our study is small number of cases and short term follow-up.

CONCLUSION

Triceps Tongue approach is a simple and less technically demanding approach for the surgeon that can be used in management of the majority of the distal humeral fractures, providing adequate visualization of the surgical field, aiding in proper reduction of fracture fragments and thus obviating the need for an olecranon osteotomy. It is easy to learn and requires no additional implants. However, major limitation of this approach is limited access to the anterior capitellum and trochlea articular surfaces thus making it difficult to manage fractures involving trochlea and anterior capitellum with this approach.

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