

Original Article

The outcome of Extra-articular Distal Humerus Fracture treated with Pre-contoured Lateral Column Metaphyseal Plate

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Extra-articular humerus fracture is one of commonest fractures in adults. Most often by treated by operative measures because of deforming forces. Between Sept 2014 to Feb 2018, 20 patients with metaphyseal extra-articular distal humerus fractures were treated using the Extra Articular Distal Humerus Plate. At final follow-up, average range of motion of elbow joint was 0°- 120° flexion and 90°/ 80° supination/pronation. Only 4 patients did not regain full extension until final follow-up and had average fixed flexion deformity of 10°. The mean DASH score at 1 year was 18.3.

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Key words : Distal Humerus Fracture, Precontoured Plate.

Extra-articular distal humerus fracture occurs at an anatomical watershed between humerus shaft and intercondylar region. It accounts for approximately 16% of humerus fracture^{1,2}. Conservative management via cast or functional bracing, though advocated, may not provide adequate stability and acceptable alignment due to periarticular location, small size of the distal fragment, associated comminution and osteoporotic nature of bone in older individuals³⁻⁵. Moreover, there is an increased chance of varus deformity and joint stiffness in fractures managed conservatively. Hence, the goal of treatment is to achieve stable fixation with correct alignment and to allow early range of movement of elbow and shoulder^{6,7}. Standard 4.5 mm narrow dynamic compression plate fails to provide adequate stability in such fracture pattern^{8,9}. Dual plating either in an orthogonal or in a parallel fashion is generally accepted for management of such fracture pattern but its application is fraught with dangers of extensive soft tissue stripping and long operating time, which may risk the development of non-union and infections^{5,10}. To minimize the surgical duration and soft tissue devitalization, a single pre-contoured, anatomical shaped Extra-articular Distal Humerus Locking Plate (EADHP) is crafted which provide adequate construct stability, and therefore, can allow early range of movement.

In this retrospective study, we aimed to evaluate the clinical and radiographic results after fixation of fractures of the distal humerus shaft with this single column system.

MATERIALS AND METHODS

Between Sept 2014 to Feb 2018, 20 patients with metaphyseal extraarticular distal humerus fractures—AO 12 A/B/C and AO 13A—were treated using the EADHP (Table 1). Inclusion criteria for the patients were: fractures of the distal humeral shaft which could not be fixed with conventional LCDCP's with minimum of six/ eight cortices distally, age >18 years, closed fractures of the distal humeral shaft, with or without radial nerve palsy, recent fractures and non-unions. For this study, we used the 3.5 mm EADHP system. It is a "J" shaped plate precontoured for application on posterolateral surface of distal humerus and

Table 1 — AO/OTA classification of patients' fractures

AO/OTA classification	Number (n=20)	Percentage (%)
12A1	4	20
12A2	7	35
12A3	2	10
12B1	1	5
12B2	3	15
12C1	1	5
13A2	2	10

is available separately for right and left sides. Proximally, the plate has 3.5 mm combi-hole system with locking and nonlocking screw options. Distally, it curves along lateral supracondylar ridge thus avoiding the olecranon fossa and has five locking screw holes angled medially for achieving purchase in trochlea and capitellum. All the patients were operated in lateral decubitus position under general anaesthesia or brachial block; through midline posterior incision and triceps splitting approach extending 4 cm distal to tip of the olecranon. Radial nerve was identified and protected between the long and lateral head

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of triceps prior to plate fixation. Lag screw fixation was used in case of wedge or comminuted fractures. Bone grafting required in old or non-union cases. Closure was done in layer over suction drain. Postoperatively, the patients were given a padded dressing and a cc sling; posterior splintage was added only if necessitated by the fixation construct. Gentle passive mobilization of shoulder and elbow was started from first postoperative day, once the pain subsided. Active and assisted range of motion exercise of arm within sling was encouraged within the first week. Patients were followed clinically and radiologically at 2 weeks, 6 weeks, 3 months, 6 months and yearly. Clinically, union (assessed by absence of tenderness on palpation of fracture site), range of motion of elbow joint and functional outcome using Disabilities of the Arm, Shoulder and Hand (DASH) score was assessed for each patient. Radiologically, union was determined by bridging callus over fracture site on at least 3 cortices and the absence of implant loosening or failure (Fig 1).



Fig 1 — Pre-operative and postoperative X-ray of distal humerus fracture treated by EADHP

RESULTS

It is a retrospective study of 20 patients (male: female 13:7) with extra-articular distal humeral shaft fractures who were operated using the EADHP system from September 2014 to April 2018. Road traffic accident (11 patients) was the most common mode of injury, followed by fall from height (9 patients) and non-union (2 patients). AO/OTA classification of these fractures is given in Table 1. One patient had Type I open wound, 3 patients had associated radial nerve palsy and 7 patients had associated fractures at other sites. 18 patients were operated within 5 days of injury, whereas other 2 cases who had non-union following conservative management were operated at around 8 months after injury. The 3 radial nerve palsy patients had continuity of the nerve intra-operatively and all of them showed spontaneous recovery within an average time of 6 months. However, one patient with no neuro deficit developed postoperative radial neurapraxia who gradually recovered within 3 months from date of surgery. Average duration of follow-up was 18 months. The mean time to radiographic fracture union was 12 weeks. At final follow-up, average range of motion of elbow joint was 0°- 120° flexion and 90°/80° supination/pronation. Only 4 patients did not regain full extension until final follow-up and had average fixed flexion deformity of 10°. The mean DASH

score at 1 year was 18.3. There were no patients with secondary loss of reduction at the fracture site, non-union, ulnar nerve problems, superficial or deep infection.

DISCUSSION

Open reduction and internal fixation is the treatment of choice for distal humerus fractures. Dual plating either in an orthogonal or in a parallel fashion is generally accepted for management of such fracture pattern but it requires almost circumferential exposure of both the medial and lateral column. Such an enormous soft tissue dissection although is justifiable for intra-articular fractures seems unreasonable for extra-articular shaft fractures¹¹. Preservation of soft tissue envelope is important for fracture healing and it has changed the earlier concept of anatomic reduction and rigid fixation¹². Although, there have been no comparative studies of dual column vs. single column fixation for distal humerus fractures, several studies have suggested higher infection and non-union rates in dual column plating due to greater soft tissue dissection and a longer operative time^{5,10}. Standard single column plating techniques fail to achieve adequate stabilization owing to inadequate distal purchase. Moreover, plating over medial aspect of humerus with scanty soft tissue coverage often leads to a high incidence of implant-related complications such as ulnar neuropathy¹³ Levy *et al*¹⁴. used modified Synthes Lateral Tibial Head Buttress Plate (Synthes, Paoli, PA) that allowed for a centrally placed posterior plating of the humeral shaft that angled anatomically along the lateral column to treat far distal humeral shaft fractures¹¹. Thus evolved EADHP as an absolute game changer for extra articular distal humerus fractures as it provides stable fixation by minimal soft tissue dissection as well as minimizes complications of dual plating. Additionally, locked plates proved to have improved mechanical stability¹⁵. Owing to greater screw

hole density distally, EAHDP also allows placement of adequate number of screws in the distal fragment thus improving stability. As compared to trochlea, the posterior aspect of lateral column is non-articular and thus EAHDP is placed without risk of injury to the cartilage or risk of impingement with flexion and extension of elbow¹¹. In our series, we have used triceps splitting posterior approach. It can be extended proximally by elevating the triceps off humerus and mobilizing the radial nerve. Distal extension can be accomplished by detaching a thin wafer of bone from the olecranon at the level of triceps insertion¹⁶ or by a distally based tongue muscle flap¹⁷ and exposure can be improved by flexing the elbow and retracting the olecranon posteriorly with reduction forceps, if there is an intra-articular extension of the fracture. This enhanced exposure also provides complete visualization of the radial nerve on both sides of the inter-muscular septum and since it exploits a relatively blood less plane, this approach can be performed without a tourniquet¹¹.

DASH score was used to assess the functional outcome. This questionnaire asks the patient about symptoms as well as their ability to perform certain activities. It does not matter which hand or arm is used to perform the activity. The mean DASH score at 1 year was 18.3. The normal DASH score in the general population has been reported to be around 10 with a standard deviation of 14.68¹⁸.

Our study also has few limitations viz small sample size and lack of studies to compare the strength between single column vs. double-column locking plate. As EADHP is pre contoured plate, it does not seat equally well in all patients. In such cases bending of plate is required. Caution should be taken so that plate bending is done after blocking the screw holes with locking sleeves and bending the plate only in between the screw holes¹¹. More research work must be carried out in plate designing, so that it fits well in Indian population.

CONCLUSION

The EADHP system using posterior triceps splitting approach is an effective modality for treatment of extra-articular distal humerus fractures as it provides stable fixation with adequate exposure of the radial nerve and posterior surface of humerus yielding satisfactory results and an early return to function.

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