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UNICOLUMNAR OBLIQUE METAPHYSEAL LOCKING PLATES FOR THE MANAGEMENT OF EXTRAARTICULAR DISTAL HUMERUS FRACTURES – A RETROSPECTIVE STUDY

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ABSTRACT

The current study advocates the use of unicolumnar fixation technique with single oblique metaphyseal locking plate for the treatment of extra-articular distal humerus fractures. These plates have provided promising results as far as fracture union, functional outcomes and rapid recovery rates are concerned. We conducted a retrospective study involving 37patients with extra-articular distal humeral fractures, who attended at the Department of Orthopaedics, IMS & SUM Hospital, Bhubaneswar from July 2017 to June 2020 and operated with unicolumnar oblique locking compression plates were included in the study. Standardised radiographs, functional assessment criteria (DASH Score, MEP Score) and post-operative complications were analysed. In the current study, we included 37 patients of which 21 were male patients and 16 were female patients. The mean age of the participants was 33.6 years (range= 18-63yrs). All patients had adequate fracture healing on follow-up X-ray. The mean duration of surgery was 120.36+/-21.65(110-150) minutes. The mean DASH score at final follow-up was 15.3+/-6(11.5-30). The mean MEP score at final follow-up was 95.4+/-6(80-100). The mean time taken for complete union was 12.6+/-5.4(11-28) weeks. The management of extra-articular metaphyseal distal humeral fractures by unicolumnar fixation with a single oblique metaphyseal locking plate

is a better alternative to bicolumnar fixation. The major advantages of this method of fixation includes adequate stability, better functional outcomes, reduced complication rates, shorter surgical times and less soft tissue injury, hence shorter hospital stay and speedy recovery.

Keywords: Extra-articular, distal humerus, Functional outcome, Unicolumnar fixation

INTRODUCTION

Extra-articular distal humeral fractures (EADHF) of shaft are not among the commonly encountered injuries of humerus. They are difficult to manage and have been subjected to controversies as regards their management **[1, 2]**. The main goals of management includes - stable fixation, restorstion of correct length, axis and rotational alignment and to achieve early range of motion of elbow and shoulder joints. Surgical management provides superior and more predictable functional in these fractures **[3-5]**. The complex anatomy and complicated morphology of the factures in distal humerus poses many challenges during surgery **[6]**. There are several studies available in literature regarding the surgical fixation of EADHF **[7-11]**, only few studies **[12-13]** are available regarding the use of unicolumnar metaphyseal locking plates. The current study was conducted retrospectively in our institution to evaluate the functional outcome of the EADHF using unicolumnar oblique locking plates. Bicolumnar plating in 90^0 or 180^0 configuration is another viable option **[14]**, but it involves greater soft tissue handling and use of extra hardwares resulting in higher incidence of non-union, infection and elbow stiffness **[15-16]**. In the current study, we share our experience while using unicolumnar oblique locking compression plates for the management of adult EADHF.

MATERIALS AND METHODS

We conducted a retrospective study involving 37patients with EADHF, who attended the Department of Orthopaedics, IMS & SUM Hospital, Bhubaneswar from July 2017 to June 2020 and operated with unicolumnar oblique locking compression plates were included in the stud. Standardised radiographs, functional assessment criteria (DASH Score, MEP Score) and post-operative complications were analysed. Clinical, radiological, demographics and other data were obtained from hospital records. All patients with pathological fractures, associated vascular injury, compartment syndrome, history of prior surgical interventions to the same limb, age < 15 years and open fractures were excluded from our study. All the procedures we have done in lateral decubitus position under

general or brachial anaesthesia, with a midline posterior triceps-reflecting approach. All the patients were subjected to supervised active assisted and passive exercises from the first post-operative day. Regular clinical and radiological follow-ups were done in outpatient basis in all the patients. At the final follow-up, patients were evaluated clinically and radiologically for range of motion, activity level, fracture union and any associated complications. The elbow function was assessed using the MEP (Mayo Elbow Performance Score) **[17]** and DASH (Disabilities of the Arm, Shoulder and Hand) score.

RESULTS

All the data are analyzed using SPSS-20 software. All the data are summarized in tables. In the current study, we included 37 patients of which 21 were male patients and 16 were female patients. At the time of surgery, the mean age of the patients was 33.6±13.5 years (range 18 to 63 years), with 24 males and 13 female patients. Road traffic accident was the most common mode of injury seen in 27(72.97 %) of the patients followed by fall in 10(27 %) of the patients. Two (5.4%) patients had associated radial nerve palsy at the time of presentation. AO type12B2 was the most common fracture pattern, seen in 15(40.54 %) followed by 12A2 in 9(24.32 %), 12A1 in 7(18.9 %), and 12B1 in 6(16.21 %). Surgical procedure was performed with a mean delay of 8.7±4.9 days (range 3 to 21 days) from the time of injury **(Table 1)**.The average follow-up ranged from 9 to 27 months(mean of 18±5.4 months). Lag screws had been used for fixation in 18 patients with an average of 1.7 screws per patient. Radiological union of the fracture ranged from 11 to 28 weeks (average of 12.6±5.4weeks). Two patients who had radial nerve palsy at the time of presentation had complete anatomical continuity of the nerve noted at the time of surgical procedure and all of them recovered completely. In one patient it recovered at 4 months and at 6 months in other patient. Besides this, one patient developed radial nerve praxia post-operatively and it recovered completely within 6 weeks' period. At the final follow up, mean flexion at elbow was 126 ± 11.07^0 (range of 100 to 145^0). All the patients had flexion extension arc movement of more than 100^0 at the elbow joint at final follow up. MEPS of the patients ranged from 80 to 100 at final follow up with an average score of 95.4±6. On the basis of MEPS 27 patients had excellent, 9 had good and one patient had fair results **(Table 1)**.

Table 1: Study Variables

Variables	values
Age(years)	33.6+/-13.5(18-63)
Sex	M:F = 24:13
Mode of injury	RTA:Fall = 27:10
Delay in Surgery following injury(days)	8.7+/-4.9(3-21)
Duration of Surgery(minutes)	120.36+/-21.65(110-150)
Blood loss(ml)	50-400
Radial nerve injury prior to surgery	2(5.4%)
DASH score at final follow-up	15.3+/-6(11.5-30)
MEP score at final follow-up	95.4+/-6(80-100)
Time to union(weeks)	12.6+/-5.4(11-28)

Patient profile

Figure 1: Pre-op x-ray showing extra-articular distal humerus fracture

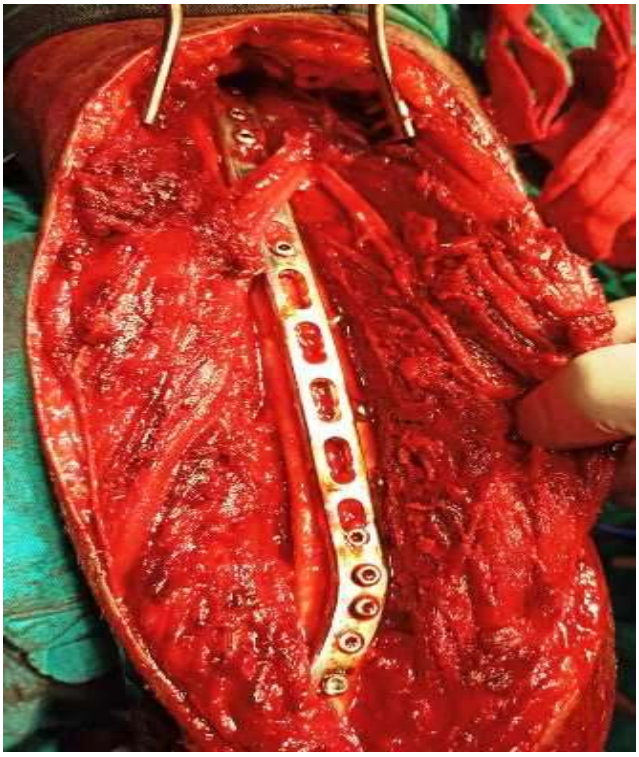

Figure 2: Intra-op image following stabilization with lag screws &oblique plate system

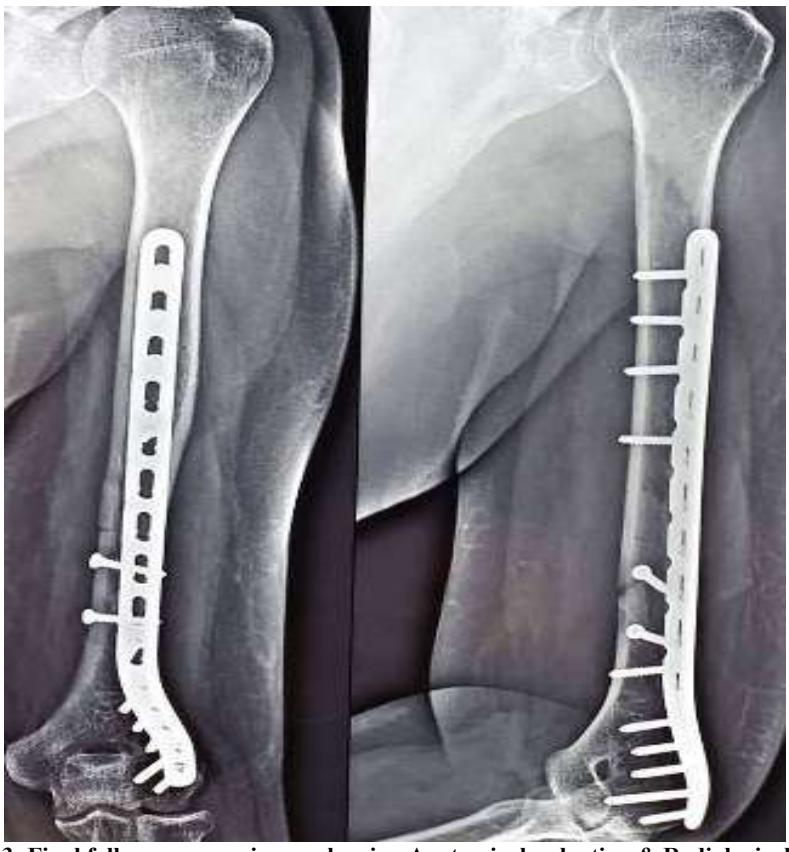

Figure 3: Final follow-up x-ray image showing Anatomical reduction & Radiological Union

DISCUSSION

Different techniques have been used for plate osteosynthesis of EADHF (Extra-articular distal humerus fractures). Conventional 4.5 mm plates do not allow appropriate number of screw placement in the short distal fragment with added disadvantage of impingement on the olecranon fossa **[18]**. Presence of strong torsional strain in this region puts conventional plates at the risk of failure **[19, 20]**. Dual plating improves stability and gives rigid fixation but requires excessive soft tissue stripping with risk of non-union and infection **[21]**. El Mahboub N *et al*. in their study involving 30 patients of EADHF managed with dual plating, had delayed union in two patients that required bone grafting, while as one patient in our series had delayed union. One patient developed deep SSI and two had superficial SSI. In our series only one patient had superficial SSI. The range of motion arc at elbow was more than 100^0 in only 46.7% of their patients while > 95% of our patients had motion arc of more than 100^0 at final follow-up. The mean MEPS in our series was 95.4 while as it was only 79.7 in series of dual plating **[22]**. To solve the problem of conventional plating in EADHF, Moron MC used oblique posterior platting at an angle of 5^0 to 8^0 to long central axis of humerus in his small series of 8 patients **[23]**. Based on the same principal Yang Q *et al*., **[24]** fixed these fractures in 19 patients with oblique metaphyseal locking compression plating. All the fractures united, with excellent results in 84 %. Due to obliquity of the plate the proximal end of the plate tends to go off the bone medially, making fixation of proximal fragment insecure in long oblique and spiral fractures which extend proximally towards diaphysis. Saragaglia*et al*., **[25]** developed an inverted Y or Lambda plate to achieve bi-columnar fixation, but lacked locking holes making it vulnerable to failure in comminution and osteoporosis.With the advent of anatomically pre-contoured locking plates, which are fixed angle stable constructs, the fixation of peri-articular fractures has improved and dual plating is rarely required **[26]**. Scolaro JA *et al*., **[27]** in their experimental biomechanical model showed pre-contoured EADHLCP had significantly greater bending and tortional strength than 3.5 mm locking plate. However, bi-columnar plating is superior in very low type EADHF. Levy JC *et al*., **[28]** in their study involving 15 patients used lateral tibial head buttress plate with some modifications, that hadan angular offset of 22º to rest on lateralcolumn of distal humerus distally and on the center of shaft proximally,

had excellent results without any case of non-union or hardware failure. EADHLCP is a fixed angle locking plate which has resolved the short comings of conventional plates, dual plating and oblique metaphyseal platting for EADHF. It's distal angular offset and increased screw hole density in distal part which accommodate five locking screws with distal two screws directed towards trochlea a capitulum, increases stability especially of the small distal fragment. Bi-columnar plate fixation carries risk of ulnar nerve injury at the time of dissection and even neuropathy, in case the nerve constantly rubs against the plate **[29, 30]**. There is a relative safety to radial nerve with use of EADHLCP using lateral para-tricepetal approach **[31]**. Our study is in support of using EADHLCP in the management of EADHF with advantage of reduced soft tissue injury and stable fixation allowing early return to function. It yields excellent functional results with least complications as compared to conventional implant and techniques. Small sample size, lack of case control comparing different implants and different techniques are the limitations of this study. A randomized control trail is warranted comparing different implants and techniques for EADHF.

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