COMPARATIVE STUDY OF MANAGEMENT OF HUMERAL DIAPHYSEAL FRACTURES BY DCP PLATE AND IMIL NAIL

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ABSTRACT: AIM: The aim of our study is to compare the results and functional outcome of diaphyseal fractures of the humerus in adults by dynamic compression plate (DCP) and the intramedullary interlocking nail. METHODS AND MATERIAL: The present study was conducted from August 2010 to September 2012. 100 patients with diaphyseal fractures of the humerus were treated with compression plating using dynamic compression plate or with intramedullary interlocking nail. Postoperatively both groups received same type of physiotherapy (mobilization). They were followed up regularly until radiological union. The time taken for radiological union in the two groups was compared. After satisfactory radiological union, the functional outcome was assessed by the “Disabilities of Arm, Shoulder and Hand”. RESULTS AND CONCLUSIONS: There was no statistically significant difference in the two groups with respect to age, mode of injury, side of injury and AO type. The average age of patients in our study was 40 years. Males outnumbered the females. Road traffic accident was the most common mode of injury. The right side humerus was involved more often. There was 64 AO Type A, 28 AO type B and 4 AO type C fractures. Primary radial nerve palsy was seen in 6 patients, out of which 4 patients recovered completely. When surgery is opted as a choice of treatment, both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as functional outcome is considered, but considering the less chances of infection and and early union of fracture, we opine that Closed Reduction with IMIL Nailing offers better result than ORIF with Dynamic compression plate. We therefore conclude that in cases where both dynamic compression plating and antegrade interlocking nailing can be done, we would prefer to use CRIF with IMIL Nailing.

KEYWORDS: Humerus, Diaphyseal humerus fracture, Fracture, Dynamic compression plate, Interlocking nail, DASH questionnaire.

INTRODUCTION: Fractures of the humeral shaft are common and account to 3% of appendicular skeletal fractures. Diaphyseal fractures of humerus are the most challenging to be treated.¹ The optimal method of humeral shaft fracture fixation remains in debate.²,³ Two techniques under study include intramedullary nailing and dynamic compression plate fixation.⁴ Closed interlocking nailing involves minimal surgical intervention, biological fixation, no periosteal stripping with rotational and torsional stability, anatomical reduction, early mobilization, preservation of hematoma.⁵ With the advent of image intensifier control this method has become extremely easy. However it has a disadvantage of rotator cuff impingement and restricted elbow movements.⁵-⁶ Plate osteosynthesis has given high rates of fracture union with anatomical reduction and good compression across fracture site, with no damage to the rotator cuff and the elbow joint, but has the disadvantage of excessive periosteal stripping, extensive incision, and increased chances of infection or nerve damage, less secured fixation of the fracture in an osteoporotic bone.⁸-¹⁰ Further there is a stress
shielding of bone by the plate and reduced strength of union due to primary bone healing compared to the callus healing seen in biological fixation with intramedullary nailing. The purpose of this study is to compare the outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus and to analyze statistically significant difference in the results of these two methods.

**METHODOLOGY:** We used either dynamic compression plate or interlocking nail for 100 patients between August 2010 and September 2012 admitted at Mamata General Hospital / Medical College and Hospital, Khammam for stabilization of fracture of the humeral diaphysis. In the present study, the youngest was 18 years old and oldest 88 years old. The commonest age group affected was 21-30 years (38%) and maximum number (58%) of patients was below the age of 40 years. The mean age affected was 40 years. 64 were males and 32 were females. Patients with pre existing shoulder and elbow problems and pathological fractures were excluded in the study. Anterolateral approach was used in patients with fractures of the upper and middle thirds of the shaft of the humerus. Posterior approach was used in patients with fractures of the lower thirds of the shaft (Fig 1). Only antegrade nailing was done in case of interlocking nailing group and none of the cases were treated by retrograde nailing (Fig 2.4).

Four patients were lost to follow up leaving us with 96 patients. The majority of fractures (54%) were the consequences of motor vehicular accidents followed by fall from a height (27%). The right arm was involved in 52(54%) patients and left arm in 44(46%) patients. 3 patients had pre operative radial nerve palsy, out of which 2 patients recovered completely. The duration from injury to treatment varied from 1 to 11 days (average being 3.92 days). The fractures of humerus were classified according to the AO classification system. 12 patients in A1 group (simple spiral fracture), 16 in A2 group (oblique fracture with fracture angulation being > or = 30 degrees), 36 patients were in A3 (transverse fracture with fracture angle less than 30 degrees), 8 patients were in B1 (spiral wedge fracture - [butterfly fragment]), 20 patients were in B2 group (i.e. bending wedge), none in B3 group (fragmented wedge), 4 patients in C1 group (complex spiral), none in C2 group (complex segmental) and none in C3 group (comminuted irregular). (Fig 3) Among the 96 fractures, 56 were fixed with DCP and 40 were fixed by interlocking nail. Pre-operatively, involved limb was immobilized and neurological status assessed. Post-operatively all the cases treated with DCP plate were immobilized in a "U" slab for 4 weeks. Post operatively, patients were followed at 1st, 2nd, 3rd, 6th, 12th, 18th month and at 2 years. At follow up visit radiological union and functional outcome as measured by the “Disabilities of Arm, Shoulder and Hand” (DASH) scoring criteria were assessed.

Among the 56 patients in the DCP group the age varied from 19 to 60 years (average being 37.28 years). Posterior approach was used in 30 patients and an anterolateral approach was used for the remaining 26 patients. Among the 40 patients in the interlocking group, the age varied from 23 years to 88 years (average being 35.05 years). A 7 mm nail was used in 32 patients, whereas 6mm nail was used for 8 patients. Only antegrade nailing was done in nailing group.
Fig. 1: Anterolateral approach to middle third humerus fracture

Fig. 2: Antegrade humerus IMIL nailing

Fig. 3: Type of Fracture
RESULTS AND DISCUSSION: In most of the patients (90%) among DCP group, fracture union was within < 16 weeks. In 68% of patients union was seen within <10 weeks. The average time of union was 10.5 weeks. Two patients had implant failure (backing out of plate) and resulted in non union. They were revised with reamed antegrade interlocking nail and bone grafting. One united in 18 weeks and the second in 20 weeks. The most significant complication of plating was infection (9%). The second most common complication was delayed union (11%) and nonunion (11%), followed by iatrogenic radial nerve palsy (7%).
In intramedullary nailing the most important complications are shoulder stiffness (20%). Delayed union was observed in 10% and no case of non-union was observed. No case of deep seated infection was seen despite using in compound grade II (Gustilo-Anderson) fractures. Superficial infection was seen in one (5%) patient who was treated with regular dressing and antibiotics. No case of iatrogenic radial nerve palsy was observed. Elbow stiffness was encountered in only one case (5%) which was due to associated elbow dislocation for which closed reduction was done. Only one patient (5%) had regimental badge anesthesia due to trauma to the upper lateral cutaneous nerve of the arm which was recovered later after four months.

The functional outcome was better in IMIL group compared to plating Group. The functional outcome was excellent in 28 patients (12 in the DCP group and 16 in the interlocking group), good in 30 patients (16 in the DCP group and 14 in the interlocking group), fair in 21 patients (15 in DCP group and 06 in interlocking group) and poor in 17 patients (13 in DCP group and 4 in interlocking group) (Fig 6). There was no statistical significance in relation to functional outcome of both the groups. The commonest complication associated with interlocking group was shoulder stiffness and in the DCP plating group was infection and non union (Table 1).

Crates and Whittle\(^\text{13}\) reported 71 patients treated with antegrade interlocking nailing of which there were two non-union requiring secondary bone grafting. Two iatrogenic nerve palsies occurred and both were transient. Full shoulder function retained in 66 patients (90%). 2 patients had impingement from the proximal locking bolt and one from the prominent nail.

Modabber and Jupiter\(^\text{14}\) stated after a study that in most indication for operative management, internal fixation with plate and screws is preferred. Stable fixation, sparing adjacent joints from iatrogenic injuries and direct visualization and protection of radial nerve in most cases overweighs the potential advantage of a load sharing implant inserted through a more limited incision.

Thompson and Mikkelsen\(^\text{15}\) of the university of Copenhagen Denmark in 1998 treated 48 fractures with the interlocking nail and emphasized the importance of counter sinking the tip of the nail in the humeral head to avoid impingement of the shoulder. Al fractures united and only in 5 of the 12 nonunion did the procedures fail. Pathological fractures were all effectively treated.
Lin\textsuperscript{16} reported his comparative study of locked humeral nails with DCP plate in fracture shaft humerus, and concluded that nailing offered a less invasive technique and more favorable outcome than plate fixation.

![Comparison of functional outcome assessed by DASH scoring criteria in DCP plate and IMIL nail groups](image)

**Table 1: Comparison of complications**

| Complication                  | DCP | IMIL |
|-------------------------------|-----|------|
| Delayed Union                 | 11% | 10%  |
| Non Union                     | 11% | Nil   |
| Superficial Infection         | Nil | 5%   |
| Deep Infection                | 9%  | Nil   |
| Shoulder Stiffness            | Nil | 20%  |
| Elbow stiffness               | Nil | 5%   |
| Iatrogenic Radial Nerve Palsy | 7%  | Nil   |
| Regimental Badge Anesthesia   | Nil | 5%   |

**CONCLUSION:** When surgery is opted as a choice of treatment, both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as functional outcome is considered. Considering less chances of infection and early union of fracture, we opine that Closed Reduction with IMIL Nailing offers better result than ORIF with dynamic compression plate. We therefore conclude that in cases where both dynamic compression plating and antegrade interlocking nailing can be done, we would prefer to use CRIF with IMIL Nailing

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