



Original Research Article

## Comparison of Compression Plating and Antegrade Unreamed Interlocking Nailing In the Surgical Management of Fractures Diaphyseal Shaft of the Humerus

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### ABSTRACT

**The Context:** The fracture shaft humerus does not have any age and sex differentiation. It also indicates a high impact of injury. The study was started with the objective To study the mechanism of injury, To compare the rate of healing, To compare the functional outcome, To compare the complications, To compare the morbidity

**Aim:** The aim of the study was to know whether Dynamic Compression Plating or Antegrade unreamed interlocking nailing is the better treatment option in the surgical management of fractures diaphyseal shaft of the humerus.

**Method:** It is a comparative study in which patients were randomly assigned to two groups and outcome was compared.

**Results:** We followed 34 patients for a minimum of 6 months (average of 6 months, range 6 to 24 months). Among them 11 had excellent results, 9 had good result, 8 had fair result and 6 had poor result.

**Conclusions:** Though both modalities of treatment offer good union, rate of secondary complications are more in Interlocking group. This makes Dynamic Compression Plating a more favourable option.

**Key Words:** Antegrade undreamed interlocking nailing, Dynamic compression plating, Humerus.

### INTRODUCTION

Many uncomplicated fractures of the humeral shaft are usually treated conservatively. Careful Management avoids complications and end results are satisfactory. The humeral shaft is totally covered with muscles and fracture fragments are well vascularised. Malunions with angle

of less than 20 degrees are functionally and cosmetically well tolerated. The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described on fractures in patients with multiple injuries; open fractures; fractures associated with vascular or neural injuries or with lesions of the shoulder, elbow or

forearm in the same limb; bilateral upper extremity injuries; fractures for which closed methods of treatment have failed and pathologies fractures. [1-5] Closed intramedullary nailing is widely accepted for the stabilization of femur and tibia. Recently it is being applied to the fractures of the humerus. Plate fixation gives high rates of union. [1] But it requires extensive open operation with stripping of soft tissues from the bone. It also provides less secure fixation, especially in osteoporotic bone and if crutch walking is required. Closed intramedullary nailing avoids all these problems, but they have to be closed interlocking nails.

In our study that is why in order to know which of these two modalities would produce better result we decided to undertake a randomized controlled study to know the efficiency of each method so as to know which method was the better of the two.

## **MATERIALS AND METHODS**

The study was conducted at Metropolitan Hospital, Kokkalai, Thrissur during August 2007 - August 2009. All patients with fracture shaft humerus contained between the superior border of insertion of Pectoralis Major muscle to an area immediately above supracondylar ridge, who were indicated for surgical management.

### **Inclusion criteria;**

1. All fractures of diaphyseal shaft of humerus indicated for surgical treatment.
2. Patient of age 18 years and above

### **Exclusion criteria:**

1. Patient aged 17 or below
2. Fracture of upper and lower ends of humerus
3. Patients with treatment other than Dynamic Compression Plate or interlocking nail

4. Patients who were lost to follow up or died before fracture united.

We used either Dynamic Compression Plate or interlocking nail for 37 patients between August 2007 to August 2009 admitted at Metropolitan Hospital for stabilization of fracture of the humeral diaphyseal shaft. 2 patients were lost to follow up and 1 patient was excluded from study as he suffered an attack of myocardial infarction in the postoperative period and was in coronary care unit for long time, leaving with us 34 patients The 34 humeri of these 34 patients were prospectively randomized into the two categories of Dynamic Compression Plate or Interlocking Nail by taking alternate cases.

All the surgeries were conducted in the same centre by same group of surgeons who were all trained in both the procedures. The study was approved by Institutional Ethics committee. Informed consent was taken from all the subjects. Of the 34 patients 16 were operated by Antegrade unreamed interlocking nail and 18 were fixed using Dynamic compression plate. The age of our patients varied from 22 years to 83 years, the average being 38 years. There were 29 males and 5 females. 28 patients had suffered fractures in motor vehicle accidents, 4 were domestic injuries and 2 were industrial. The right arm was involved in 19 patients and left arm in 15 patients.

## **RESULTS**

We followed 34 patients for a minimum of 6 months (average of 6 months, range 6 to 24 months). Among them 11 had excellent results, 9 had good, 8 had fair and 6 had poor result. Among the 11 patients with excellent results, 5 were treated by interlocking and 6 by Dynamic compression plating. Among the 9 patients with good results, 5 were treated by interlocking and 4 by dynamic compression plating. Lastly of the 6 patients with poor results, 1 belonged

to interlocking group and 5 to the DCP. The chi square test did not show any significant difference because of the small sample size, however taking the percentage into consideration, the nail group showed better results than the plate group. (Table 1)

**Table 1: Comparative results in both groups**

	Plate	Nail	Total
Excellent	6(33.3%)	5(31.25%)	11
Good	4(22.2%)	5(31.25%)	9
Fair	3(16.7%)	5(31.25)	8
Poor	5(27.8%)	1(6.25%)	6
Total	18	16	34

We evaluated the patients using Jeffrey W Mast criteria, which includes anatomy, economy and function that is elbow movements are into consideration to evaluate the results. This was done after the fracture had united both clinically and radiographically. [6]

26 fractures healed within 4 months, 7 fractures healed within 6 months and 1fractursfailed to unite. So, the average being 15 weeks and 10 to 24 weeks. In the DCP group the average was 17 weeks, range-12 to 24 weeks. In the interlocking group the average was, range was 13.6 weeks, range- 10 to 20 weeks. So the healing rate was faster in the interlocking group as compared to the DCP group. (Table 2)

**Table 2: Distribution of time taken for healing of fractures**

	Plate	Nail	Total
Healed within 4 months	12	14	26
Healed within 6 months	5	2	7
Non union	1	0	1

## COMPLICATIONS

The patient with non-union belonged to the DCP group and the cause was that the patient had started heavy weight lifting after 4 weeks leading to hypertrophic non-union. He was advised bone grafting, which bone grafting, which he refused. There were no non-unions in the interlocking group. He had a poor result.

Radial nerve palsy was present in 7 patient pre operatively, 2 in interlocking and 5 in DCP group. Out of these 2 in interlocking group interlocking group recovered by 3 weeks and 3 of the DCP group recovered by a maximum of 6 months. Out of these 5 patients 4 had excellent to fair result whereas 1 had poor results. 1 patient had no recovery up to 18 months post operatively and 1 patient with radial nerve palsy developed posttraumatic neuralgic amyotrophy about 8 weeks after the fracture. Both had poor results.

There were two postoperative transient radial nerve palsy in interlocking group which recovered fully by 10 days and 6weeks respectively and had no effect on their final outcome. [7-10] (Table 3)

**Table 3: Details of radial nerve palsy**

	Plate	Nail	Total
Preoperative palsy	5	2	7
Recovered	3	2	5
Not recovered	2	0	2
Postoperative palsy	0	2	2
Recovered	—	2	2

There was one patient with suspected vascular injury with absent radial and ulnar pulse. A colour Doppler was done and found to be normal. He was kept under observation and recovery uneventfully. He had a C3 type of fracture whose communicated fragments were thought to be responsible for the spasm of the brachial artery. He had a fair result.

The compound type I wound in a fracture of the interlocking group healed uneventfully and there was no infection in any patient of this group. Whereas there were no compound fractures in the DCP group but 1 superficial infection developed which was debrided immediately. Wound healed but the patient had a poor result.

There was 1 patient with breakage of interlocking nail because out of the 2 distal locking holes only 1 was locked and the other was at the fracture site. The breakage

occurred at this unlocked distal hole. But however when the patient came for follow up the fracture had united uneventfully.

Another patient required re-operation and removal of nail as it was causing shoulder impingement. After removal the abduction improved from 40 degrees to 100 degrees.

There were 3 patients with adhesive capsulitis of the shoulder in the interlocking group whereas there was only 1 patient in the DCP group and the cause in this patient being poor physiotherapy of the shoulder because of the uncooperative patient. About 13 patients in the interlocking group had some or the other residual pain in the shoulder.

In DCP group there was 1 patient with implant failure with screw back out due to improper technique. This patient went on to have non-union. He was re operated by DCP again with bone grafting and the fracture united.

There was one patient in the interlocking group, which had an iatrogenic fracture of the greater tuberosity of the humerus during antegrade nail insertion. However fracture united and had no effect on the final outcome.

**Table 4: Details of complications in both groups**

	Plate	Nail
Iatrogenic palsy of radial nerve	0	2
Non-union	1	0
Intra operative comminution	0	2
Infection	1	0
Severe impingement	0	1
Adhesive capsulitis of shoulder	1	3
Secondary surgery	1	1
Total	4(22.2%)	9(56.25%)

There was one patient in which there was communication at the fracture site because of nail insertion. The fracture united but the patient had shoulder stiffness giving a poor result.

The test of significance could not be applied, as the sample size was small. But the nail group had 56.25% complications as

compared with to 22.2% in the plate group. (Table 4)

## DISCUSSION

Most surgeon believe that intramedullary nailing is the best internal fixation for femoral and tibial shaft fractures, but there is no agreement about the ideal procedure for fractures of the humeral shaft. Plate osteosynthesis requires extensive dissection with the risk of radial nerve damage.

The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described as fractures in patients with multiple injuries; open fractures; fractures associated with vascular or neural injuries or with lesions of the shoulder, elbow or forearm in the same limb; bilateral upper extremity injuries; fractures for which closed methods of treatment have failed and pathological fractures. In several reported series as well in our patients, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft. [1, 3, 4, 5]

The study is having a short term follow up of a maximum of 2 years and therefore discussion is essentially a preliminary assessment.

In previous reports the incidence of non- union has ranged from 2% to 4%. [7] In our DCP group the incidence of non-union was 5.5%. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 80%. [8] In our series the incidence of non-union in the interlocking nail group was 0%.

The incidence of radial nerve palsy with fracture shaft humerus varies from 6% to 15%. [9,10] In our series the incidence was 17%, which correlated well with them. Out of these 66% i.e., 4 out of 6 nerves recovered which tallied with Seddon's and

Pollock's series of 70% and 68% respectively.

In the DCP group the incidence of iatrogenic radial nerve palsy was 2% to 5%, [7] but there were no such cases in our study. Where as in interlocking group 2 of our patients had neuropraxia i.e. 12.5%. This incidence in various studies varies from 2.6% to 14.3%. [11] They had neuropraxia, which fully recovered.

There was no problem with infection in our patients with only 1 patient having superficial infection (2.9%), which responded well to debridement and antibiotic treatment.

The failure of fixation in a case of DCP was due to poor technique due to inadequate hold. When this fracture was replated with the addition of 2 extra holes and bone graft the fracture united at 6 months without complications. The patient with implant failure in interlocking group went on to unite uneventfully despite the nail breakage at one of the two distal interlocking sites.

The rate of iatrogenic comminution with interlocking nail during operation with various studies varied from 7.7% to 10%. [9] In our series there were 2 iatrogenic fractures out of 16 (12.5%) patients treated with interlocking. One occurred at fracture site due to hoop stress and the other at the greater tuberosity due to wrong entry portal.

Persistent pain after shoulder approach is common. [1, 5, 8, 12, 13] Habernek and Orthner [14] in 1991 reported good results with Seidel's interlocking nail but later withdrew their support in 1998, [15] as they had not assessed the shoulder functions of their patients properly.

The cause of pain could be disruption of the rotator cuff in its avascular zone within 1 cm of its insertion to the greater tuberosity that may lead to poor healing. [16] 3 patients had developed adhesive capsulitis and 13 of our 16 patients

in the interlocking group reported some or the other pain in the shoulder. Our study confirms that antegrade insertion can lead to problems with shoulder function and range of movement probably because of damage to rotator cuff.

The sample size of our study is small with only 34 patients included in the final study is the limitation in this study. The union rates are comparable in both the groups with the results in the excellent, good and fair category similar (p value not significant,  $p > 0.05$ ). There were more poor results in the DCP group, but they were because of no recovery of radial nerve in 2 patients with one of these developing traumatic neuralgic amyotrophy. One patient had hypertrophic non-union because of heavy weight lifting from the 4<sup>th</sup> week onwards. Only 2 patients one with superficial infection and the other with adhesive capsulitis had true poor results. The complications were more in the interlocking group with most of them pertaining to poor shoulder function or pain and this difference in the complications was significant.

## CONCLUSION

Though interlocking intramedullary nailing is good for specific conditions like pathological fractures, segmental fractures or with associated lower limb fractures with early weight bearing with crutches, we still consider DCP fixation to be better than antegrade intramedullary interlocking nailing in treating fractures of the diaphyseal shaft of the humerus. The early healing and better mobility increase the economical output of the society at large.

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*Conflict Of Interest: None.*

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