

# Comparison between Interlock Nailing and Plating for Fracture Shaft Humerus

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## ABSTRACT

**Introduction:** Fractures of the humeral shaft are common and accounts for 1-3% of all fractures and have bimodal distribution. study was planned to compare the outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus.

**Material and methods:** This randomized interventional study was conducted in the Department of Orthopedic Surgery at Shri Vasant Rao Naik Government Medical College and Hospital, Yavatmal, Maharashtra, between June 2012 to May 2014. Total 48 patients were surgically treated with either DCP or interlocking nailing between the above-mentioned study periods. The patients were followed up every second week till radiological union was seen. Patients were also assessed clinically.

**Results:** In the present study, out of 48 patients 8 were lost to follow up and 2 patients expired leaving us with 38 patients with the distribution being 18 in DCP and 20 in interlocking group. Average time taken for radiological healing was 15.05 weeks. The healing rate was relatively faster in the interlocking group as compared to the DCP group. Complications were more in the interlocking group, which was statistically significant ( $p=0.009$ ).

**Conclusion:** Though interlocking intramedullary nailing is good for specific conditions like pathological fractures, segmental fractures or with associated lower limb fractures which require early weight bearing with crutch walking, we still consider DCP fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

**Keywords:** Interlock Nailing, Plating for Fracture, Humerus

## INTRODUCTION

Fractures of the humeral shaft are common and accounts for 1-3% of all fractures and have bimodal distribution. One group consists of mostly young males of 21 to 30 years age group and the other of older females of 60 to 80 years. The predominant causes of humeral shaft fractures in young age group are high energy traumas and in case of second group mainly simple fall or rotational injuries.<sup>1,2</sup>

Fractures of humeral shaft have traditionally been regarded benign, with high percentage of primary healing with conservative methods, using either a hanging arm cast or a functional brace. Operative treatment for humerus fractures has usually been reserved for the treatment of non-union, unacceptable reduction of fractures, compound fractures, associated with forearm fractures, for polytrauma patients, fractures with neurovascular complications and patients with obesity who are at risk of developing varus angulations. The advantages of operative management are early mobilization and patient comfort. But, operative management carries the risk of technical errors and post-operative complications like infections, nerve injuries etc.<sup>3,4</sup>

The optimal method of humeral shaft fracture fixation remains in debate. Two techniques under study include intramedullary

nailing and dynamic compression plate fixation. Open reduction and internal fixation (ORIF) with plates and screws continues to be considered the gold standard for surgical treatment. It is associated with a high union rate, low complication rate, and rapid return to function. It provides satisfactory results but requires extensive soft tissue dissection, and meticulous radial nerve protection. The plate may fail in osteoporotic bone.<sup>2,4</sup>

Due to concerns about soft tissue dissection required for ORIF, a less invasive technique that allows indirect reduction and percutaneous plating of the anterior humerus has been developed. Anterior plating is a simple, safe, and effective treatment for humeral shaft non-union. It does not require radial nerve visualization or extensive soft tissue dissection, and the healing time is similar to that of other methods used for treating humeral shaft non-union. This is an alternative approach to osteosynthesis of humeral shaft non-union, in which the plate is placed on the anterior surface of the bone. The biological benefits of less damage to the soft tissues via an approach that uses a plane between nerves certainly contributed to good results.<sup>5-7</sup>

With the dynamic success of intramedullary fixation of fractures of the femur and tibia, there was speculation that intramedullary nailing might be more appropriate for humeral shaft fractures than dynamic compression plating. The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and reaming can yield auto graft material. The biomechanics are improved, with higher amounts of inertia and load-sharing device support.<sup>8,9</sup>

With this background current study was planned to compare the outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus.

## MATERIAL AND METHODS

This randomized interventional study was conducted in the Department of Orthopedic Surgery at Shri Vasant Rao Naik Government Medical College and Hospital, Yavatmal, Maharashtra, between June 2012 to May 2014. Total 48 patients were surgically treated with either DCP or interlocking nailing between the above mentioned study period. Patients above 18

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years having fractures of diaphysis of humerus indicated for surgical treatment and fractures less than 14 days were included in the study. Patients excluded from studies were fracture of upper and lower ends of humerus; patients with preexisting shoulder and elbow problems; Pathological fractures; Compound fracture. And who were lost to follow up or died before the fracture union.

The patients who met the inclusion and exclusion criteria were included in the study after taking informed consent. Ethical clearance was obtained. A thorough history and clinical examination was done. The fractures of humerus were classified according to the AO classification system. The status of radial nerve injury was recorded. Roentgenogram of the arm with shoulder and elbow was taken in both anteroposterior and lateral views. The humeral shaft fracture was temporarily immobilized with a U-slab and arm pouch. We used either dynamic compression plate or interlocking nail for stabilization of fracture of the humeral diaphysis. Patients were prospectively randomized into two categories of dynamic compression plating (Group P) or interlocking nailing (Group N) by a computer generated list. In each group 24 patients were included. Once the patients were randomized, pre-operative planning and investigations (CBC, LFT/KFT, RBSL, BG, HIV, HBsAg and ECG) were done.

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. Only ante grade nailing was done in case of interlocking nailing group. In the first group, 4.5 mm narrow DCP was used, and in second group standard intramedullary interlocking nail was used.

The patients were followed up every second week till radiological union was seen. At every follow up clinical examination was done to assess status of the surgical wound, pain, tenderness, range of motion of shoulder and elbow stability of the fracture and clinical union. Roentgenograms were taken in AP and Lateral views to look for signs of radiological union. In the present study we concluded clinical union when the fracture site had become stable and pain free. The union is confirmed radiologically when plain X-ray showed bone trabaculaeor cortical bone crossing fracture site on at least three surfaces on orthogonal radiograms. The time taken for clinical and radiological union was noted.

If there are nonclinical and radiological signs of union by 16 weeks, the fracture were categorized as delayed union and if absence of fracture union after 32 weeks after injury was categorized as non union. Return of 5/5 power was regarded as complete recovery.

The functional outcome was measured by the "Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery which ever was earlier. The Dash scoring system is a very useful tool to measure function of the upper limb developed by the American Academy of Orthopedic Surgeons (AAOS) & has been validated by various studies.<sup>10</sup>

During study 8 patients were lost to follow up and 2 patients expired. Of the 38 fractures, 18 were fixed with DCP and 20 were fixed by interlocking nail. Descriptive and inferential statistics were used to compare the outcome in both groups.

## STATISTICAL ANALYSIS

Microsoft office 2007 was used for the statistical analysis. Mean and percentages were used to interpret the data. Comparison was made with the help of chi square test.

## RESULTS

In the present study out of 48 patients 8 were lost to follow up and 2 patients expired leaving us with 38 patients with the distribution being 18 in DCP and 20 in interlocking group. The age of the patients in the DCP group ranged from 22 to 60 years with a mean of 37.28 years. The age in the interlocking group ranged from 23 to 70 years with a mean age of 35.05 years. The most common mode of injury in both groups is RTA 27 (71.1%), with fall being the second most common cause 7 (18.4%).

In the DCP group 7 associated injuries of which 4 were lower limb fractures, 1 upper limb fracture, 1 clavicular fracture and 1 abdominal injury. Of the 12 associated injuries in the interlocking group, 8 were lower limb fractures, 1 upper limb fracture, 1 rib fracture, 1 abdominal injury and 1 patient had paraplegia due to fracture dislocation of spine

Pre operative radial nerve palsy was present in 3 patients. All the 3 of them in the DCP group of which 2 recovered completely. The mean duration between trauma and surgery was in DCP group 4.15 days and in ILN group 2.95 days.

Average time taken for surgery was 82 minutes for DCP and 70 minutes interlocking nailing group. The average duration of follow up. In the present study was 11.4 months. Range (6 to 17 months).

Average time taken for radiological healing was 15.05 weeks. In the interlocking group 14.05 and DCP to 16.06. So the healing

Variable	ILN (n:20)	DCP (n:18)	Significance
Age (mean ± SD)	35.05 ± 11.44	37.28 ± 11.18	P value : 0.5 Non significant
Male: Female	14:6	13:5	P value 0.8 Non significant
Side Left: Right	8: 12	7: 11	P value 0.9 Non significant
Level of injury			
Lower 1/3	5 (25.0%)	4 (22.2%)	P value :0.62 Non significant
Middle 1/3	11 (55%)	10(55.6%)	
Upper 1/3	2 (10.0%)	1(5.6%)	
Junction M3/L3	1 (5%)	2 (11.1%)	
Junction U3/L3	1 (5%)	0	
Junction U3/M3	0	1 (5.6%)	
AO classification			
A1	1 (5%)	2 (11.1%)	p=0.294, Non Significant
A2	1 (5%)	4 (22.2%)	
A3	9 (45.0%)	3 (16.7%)	
B1	1 (5%)	3 (16.7%)	
B2	4 (20.0%)	3 (16.7%)	
B3	1 (5%)	0	
C1	1 (5%)	0	
C2	1 (5%)	2 (11.1%)	
C3	1 (5%)	1 (5.6%)	

**Table-1:** Baseline variables in both groups

rate was relatively faster in the interlocking group as compared to the DCP group. Two fractures treated with DCP remained ununited. Among the 38 patients 10 had excellent results, 12 had good results, 10 had fair results, 6 had poor results.

Intraoperatively the interlocking group had 4 complications and the DCP group had only 2 complications. Postoperatively in the DCP group there were 6 complications and in the interlocking group there were 13 cases with complications. Complications were more in the interlocking group, which was statistically significant ( $p=0.009$ ).

## DISCUSSION

Most surgeons agree that intramedullary nailing is the best internal fixation for femoral and tibia shaft fractures, but there is no agreement about the ideal procedure for fractures of the humeral shaft. Plate osteosynthesis requires extensive soft tissue dissection with the risk of radial nerve damage. In the present study, 38 patients were included, out of which 20 were treated with interlocking nail and 18 with DCP.

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 fracture. In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft.<sup>1-3</sup> In the present study failed closed reduction and associated injuries were the most common indications.

In the Present Study, there was no significant difference in the time taken for union. No difference in union rates has been found in some prospective studies whereas plate fixation shows fewer non-unions than nailing in others. In M Changulani et al study union time was found to be significantly lower with interlocking as compared to DCP but there was no significant difference between the union rate.<sup>11</sup> In H Raghavendra et al<sup>12</sup> and Chaudhari et al<sup>1</sup> study also no significant difference was found. In K Singiseti and M Ambedkar study<sup>2</sup> there was a significant difference between the two groups with tendency for earlier union in plating group.

In the present study, the incidence of non-union in DCP group was 11.11%. In previous reports the incidence of non-union after plating has ranged from 2% to 4%. In McCormack et al<sup>13</sup> study the incidence of non-union in plating group was 4.4%. In K Singiseti and M Ambedkar study<sup>2</sup> it was 6.25%, in M Changulani et al<sup>11</sup> study 12% and in Subhash Puri et al<sup>14</sup> study 6.7%. In present study, the incidence of non-union in the interlocking nail group is 0%. In McCormack et al study the incidence of non-union in interlocking group was 9.5%. In K Singiseti and M Ambedkar<sup>2</sup> study it was 5%, in M Changulani et al study<sup>11</sup> 14.3% and in Subhash Puri et al<sup>14</sup> study 13.3%.

In the present study, excellent to good results were seen in eight patients in interlocking group and fourteen patients in DCP group. There were fairer and poor results in the interlocking nailing group compared to DCP group. With the P value, less than 0.05 there was a statistically significant difference between the two groups. In K Singiseti and M Ambedkar<sup>2</sup> study thirteen out of 20 patients of the interlocking nail group had good to excellent results while 15 out of 16 patients of the plating group had similar results at the final follow-up for the study. This difference was found to be statistically significant. In S Raghavendra et al<sup>12</sup> studied patients operated with plating fared significantly better than those operated with interlock nailing

Variable	ILN (n:20)	DCP (n:18)	Significance
Time taken for radiological healing (mean $\pm$ SD)	14.05 $\pm$ 3.18	16.06 $\pm$ 3.10	P value : 0.06 Non Significant
DASH score			
Excellent	2 (10%)	8 (44.4%)	P value :0.04 Significant
Good	6 (30%)	6 (33.3%)	
Fair	8 (40%)	2 (11%)	
Poor	4 (20%)	2 (11%)	
(mean $\pm$ SD)	43.1 $\pm$ 28.1	24.05 $\pm$ 19.44	P value 0.02; Significant

**Table-2:** Comparison of outcome in both groups

Variable	ILN (n:20)	DCP (n:18)	Significance
Intraoperative complications			
# greater tuberosity with	1 (5%)	0	p=0.365, Non Significant
Communion at # site	1 (5%)	0	
Difficult reduction of	1 (5%)	1 (5.6%)	
Problem in locking	1 (5%)	1 (5.6%)	
Radial nerve entrapped in #	0	1 (5.6%)	
Nil	16 (80%)	16 (88.9%)	
Postoperative complications			
Impingement	8 (61.5%)	0	p=0.009; Significant
Implant failure	1 (7.7%)	1 (16.6%)	
Radial nerve injury	0	1 (16.6%)	
Non union	0	2 (33.4%)	
Shoulder Pain	2 (15.4%)	0	
Shoulder stiffness	1 (7.7%)	2 (33.4%)	
Superficial infections	1 (7.7%)	0	
Total	13 (100%)	6 (100%)	

**Table-3:** Comparison of Complication in both groups

when the overall results were analyzed. Whereas in McCormack et al study<sup>13</sup> and Chaudhari et al<sup>1</sup> study non statistically significant difference was noted in both groups.

## CONCLUSION

There were fairer and poor results in the interlocking nailing group compared to DCP group. The complications were more in the interlocking nailing group with most of them pertaining to poor shoulder function or pain and this difference in the complications was significant. Though interlocking intramedullary nailing is good for specific conditions like pathological fractures, segmental fractures or with associated lower limb fractures which require early weight bearing with crutch walking, we still consider DCP fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

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