



## **Comparative study of dynamic compression plate versus interlocking nail in treatment of fracture of shaft of humerus**

**<sup>1</sup> Dr. Pappu Marandi, <sup>2</sup> Dr. Amar kumar, <sup>3</sup> Dr. RN Suman**

<sup>1</sup> Senior Resident, LHMC, Delhi, India

<sup>2</sup> Senior Resident, ESICH, Delhi, India

<sup>3</sup> Associate Professor, PMCH, Patna, Bihar, India

### **Abstract**

Surgical fixation of a fracture of the shaft of humerus can be achieved by Plating or Nailing. Plating provides satisfactory result, but requires extensive dissection, and meticulous radial nerve protection. The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and use of a load sharing device support. This study compares the two more commonly used interventions: locking/dynamic compression plating and locked intramedullary nailing. Patients admitted were randomly assigned to either ILN group (Group A) or DCP group (Group B). In group a, internal fixation with interlocking nail done. In the plating group (Group B), fixation was done with 4.5 mm dynamic/locking compression plates using either anterolateral or posterior approach. All the cases were regularly followed up. Functional outcome is determined on the basis of disability arm shoulder and hand score (DASH). Union was present in 18 (90%) patients in the ILN group whereas in the DCP group, union was present in the 17 (85%) patients. Average union time is 7.83 with standard deviation of 1.54 weeks in the ILN group and 8.64 with standard deviation of 1.96 weeks in the DCP group. DASH score for the ILN group is 33.74 with standard deviation of 14.18 whereas it is 27.66 with standard deviation of 10.32 in the DCP group. The DASH score of the two groups is statistically insignificant ( $p > .05$ ). Both the modalities of treatment are good as far as union of the fracture is concerned, but considering the rate of complications we concluded that dynamic compression plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint.

**Keywords:** DCP, ILN, dash

### **Introduction**

Fractures of the shaft of the humerus account for approximately 3%-5% of all fractures in adults. Out of which 60% involve middle third of the diaphysis, 30% involve proximal third of the diaphysis and 10% involve distal third of diaphysis. Most can be treated conservatively as Charnley stated, it is perhaps the easiest of the major long bones to treat by conservative methods, but the current emphasis is on holistic approach to patient care, therefore the approach for the management of fracture shaft of humerus has changed from splintage and prolonged immobilization to internal fixation and early mobilization, with return to normal function as early as possible. The closed treatment methods available are (1) Hanging cast (2) Coaptation or U-shaped brachial splint (3) Velpeau dressing (4) Shoulder spica cast (5) Skeletal traction (6) Functional brace (7) Above elbow POP shoulder hood. The two modalities of internal fixation in fracture shaft of humerus are plate osteosynthesis and intramedullary nailing.

Surgical fixation of a fracture of the shaft of humerus can be achieved by plating, nailing or by external fixation. Plating provides satisfactory results but requires extensive dissection, and meticulous radial nerve protection. The plate may fail in osteoporotic bone. With the success of intramedullary fixation of fractures of the femur and tibia<sup>1</sup>, there was speculation that intramedullary nailing might be more appropriate for humeral

shaft fractures than plating.

The theoretical advantage of intramedullary nailing<sup>2</sup> included less invasive surgery, an undisturbed fracture hematoma and use of a load sharing device support. There is always a tug of war with certain advantages and disadvantages of both procedure between advocates of nails and plates more so in fracture shaft of humerus. This study compares the two more commonly used interventions: locking/dynamic compression plating and locked intramedullary nailing.

### **Aims and Objectives**

The aims and objectives of this study is to evaluate the results and functional outcome of locking/dynamic compression plating and interlocking nailing for the management of fracture shaft of humerus.

### **Materials and Methods**

Design of the study: This is a prospective study.

Place of the study: Patna medical college and hospital, Patna

Period of study: September 2014 to September 2016.

### **Inclusion Criteria**

- Patient aged 18 years and above.
- Only the diaphyseal humeral fractures.
- Fresh fractures (10 days).

**Exclusion Criteria**

- Fracture of upper and lower ends of humerus.
- Patients treated conservatively.
- Pathological fractures.
- Segmental fractures.
- Fractures with associated neural or vascular injury.
- Patients with history of a previous humerus fracture.
- Grade III open fractures.

Patients admitted were randomly assigned to either ILN group (Group A) or DCP group (Group B). In group A, internal fixation with interlocking nail done. In the plating group (Group B), fixation was done with 4.5 mm dynamic/locking compression plates using either anterolateral or posterior approach, depending on the fracture configuration and the surgeon preference. Fixation of at least six cortices, preferably eight cortices, both proximal and distal to the fracture was obtained in every patients.

Follow up: - All the cases were regularly followed up. Following parameters were recorded during follow up: Pain at the fracture site, Fracture union, Functional outcome, complications like non-union, infection, implant failure and nerve injury were noted. Functional outcome is determined on the basis of disability arm shoulder and hand score (DASH)<sup>3</sup>.

**Based on score it is divided into four grades**

**Table 1**

Grades	Score
Excellent	0 – 2
Good	21 - 40
Fair	41 - 60
Poor	> 60

To compare results of study with other standard studies we have used chi-square test. By using this test we have calculated P value.

**Observation and Results**

In all, 40 patients with fracture shaft of humerus were treated operatively in department of orthopaedics Patna medical college and hospital. Most of the patients were between 20 -39 years. The average duration of follow up in our study in Group B was 10.15 months and in Group A it was 10.4 months. The average interval between injury and internal fixation was 8.1 days in the Group A and 8.5 days in the Group B.

**Location of Fracture**

**Table 2**

Anatomical location of fracture	Number of patients	Percentage
Upper third	2	5%
Junction of upper and middle third	5	12.5%
Middle third	24	60%
Junction of middle and distal third	8	20%
Lower third	1	2.5%

**Types of Fracture**

Type of fractures in these two groups is statistically

insignificant (p >.05).

**Table 3**

	Group - A	Group - B	Total
Closed	15(75%)	16(80%)	31(77.5%)
Compound	5(25%)	4(20%)	9(22.5%)

**Distribution of Types of Fracture**

**Union Time**

The average union time in Group-A was 7.83 weeks, whereas in Group B average union time was 8.64 weeks. The average of two groups is statistically not significant (p>.05).

**Union Percentage**

Union was present in 18 patients in the group A and in the 17 patients in the group B. Nonunion was present in 3 patients in group B and in 2 patients in the group A.

**Complications**

There is one superficial and deep infection in group A whereas in group B, 4 patients were having superficial infection and 1 patient were having deep infection. Shortening occurred in 3 patients in group A and in 2 patients in the group B. There was non-union in 3 patients in group B and in 2 patients in the group A. Radial nerve and axillary nerve neuropraxia occurred in 1 patient in group A and there was only radial nerve neuropraxia in 2 patients in group B. All patients with nerve injury recovered. Impingement occurred in 3 patients in the group A. There was failure of implant in one patient in group B. The difference of complications between the two groups is insignificant (p >.05).

**Functional Outcome**

Based on the DASH score the functional outcome of both groups were calculated, and divided into four categories. The functional outcome of the two groups is statistically insignificant (p >.05).

**Table 4**

Functional outcome	Group a	Group b	Total
Excellent	3(15%)	3(15%)	6(15%)
Good	10(50%)	12(60%)	22(55%)
Fair	3(15%)	2(10%)	5(12.5%)
Poor	2(10%)	0	2(5%)

**Discussion**

We treated a total of 40 patients in the Department of Orthopaedics, Patna medical college and hospital, Patna between the period of September 2014 to September 2016. 20 patients were treated by humerus interlocking nail (GROUP A) and 20 patients were treated by dynamic/locking compression plating (GROUP B). Chapman *et al.* (2000)<sup>[4]</sup>, Mc Cormack *et al.* (2000)<sup>[5]</sup>, S Raghevendra *et al.* (2007)<sup>[6]</sup>, Ting Teng Chao *et al.* (2005)<sup>[7]</sup>, Changulani *et al.* (2007)<sup>[8]</sup>, Putti *et al.* (2009)<sup>[9]</sup>, Singiseti *et al.* (2010)<sup>[10]</sup>, Naveen *et al.* (2013)<sup>[11]</sup>, Wali *et al.* (2014)<sup>[12]</sup> also had compared the results of dynamic compression plating and interlocking nail for the fracture shaft of humerus.

**1. Sex Distribution:** Majority of the patients in both group

were males (75 % males in the group A and 75% males in the group B), so there was total 75% males and most were in the age group of 20 - 39 years (50% in the group A and 55 % in the group B). Total 63.63% males was there in the McCormack *et al.*, M. Changulani *et al.* has 79.2% males in the DCP group and 86.9% in the ILN group.

**2. Mean Age Distribution:** Mean age of group A was 38.75 years as compared to 38.8 years of group B. In McCormack *et al.* mean age of DCP group was 49 years as compared to 40 years in the nailing group. In Putti *et al.* mean age was 39 years in the DCP group and 36 years in the ILN group.

**3. Mode of Injury:** In this study 62.5% patients sustained injury due to road traffic accident, 27.5% patients due to fall on ground, 10 % patients due to direct trauma. In the McCormack *et al.* study, 63.63% patients sustained trauma due to the road traffic accident, 25 % patients by fall on ground, and 11 % patients by other causes. Singiseti *et al.* has mentioned that 85% of the trauma was due to the road traffic accident. Putti *et al.* has also reported road traffic accident as major cause of fracture (82.35%).

**4. Type of Fracture:** In this study, 77.5% of fracture is closed type of fracture whereas 22.5% of fracture is open type. McCormack *et al.* has mentioned 86.36% of fracture as closed type of fracture and 13.66 % of fracture as open type.

**5. Union Time:** The average union time in interlocking nailing group (Group A) was 7.83 weeks whereas in Group B average union time was 8.64 weeks. Changulani *et al.* has reported union time of 8.9 weeks in the DCP group and 6.3 weeks in the ILN group. In Wali *et al.* union time is 15.2 weeks for the DCP group and 13.60 weeks for the ILN group.

**6. Union Percentage:** Union was present in 18 patients (90%) and nonunion was present in 2 patients (10%) in the group A. whereas in group B union was present in 17 patients (85%) and nonunion was present in 3 (15%) patients. Changulani *et al.* has reported union in 39 patients (88.63%) out of 44 patients. Among 39 patients, 21 patients (87.5%) was in the DCP group and 18 patients (85.7%) was in the ILN group.

**7. Implant Failure:** There was one implant failure in the group B. Implant failure leading to re-operation was required in the 16% cases (Chapman *et al.*), 33.33% cases (McCormack *et al.*) and 1 % cases (Putti *et al.*) in the respective studies. Singiseti *et al.* reported no implant failure in his series. Changulani *et al.* reported no implant failure in the DCP group and 1 (4.7%) implant in the ILN group. S Raghavendra reported 1 (5.55%) implant failure in the DCP group whereas no implant failure was present in the ILN group.

**8. Non Union Percentage:** Nonunion was present in 2 (10%) patients in group A and in 3 (15%) patients in the group B. Wali *et al.* reported nonunion in 8% patients in each group. McCormack *et al.* reported 1 (4.34%) nonunion in the DCP group and 2 (9.52%) nonunion in the ILN group. Singiseti *et al.* reported 1 (6.5%) nonunion in the DCP group and 1 (5%) nonunion in the ILN group. Putti *et al.* reported 6% nonunion in the DCP group. 1 patient from the Group A and 2 patients from the Group B of nonunion were lost, the remaining 1 patient from either group was treated by plating with bone grafting.

**9. Post Operative Nerve Injury:** Radial nerve injury (Neuropraxia) was present in 1 (5%) patients in the ILN group

and in 2 (10%) patients in the DCP group. Wali *et al.* reported radial nerve injury in the 2 (8%) patients in the DCP group. Changulani *et al.* reported radial nerve injury in the 1 (4.16%) patients in the DCP group. Putti *et al.* reported radial nerve palsy in the 2 (12.5%) patients in the ILN group.

**10. Impingement:** Impingement was present in the 3 (15%) patients in the ILN group. S Raghavendra *et al.* was reported in the 2 (11.11%) patients in the ILN group. McCormack *et al.* reported impingement in the 3 (14.28%) patients in the ILN group. Putti *et al.* also reported impingement in the 1 (6.25%) patients in the ILN group.

**11. Functional outcome:** The functional outcome is assessed by using the DASH Score. The mean DASH score of the group B is 27.66 with standard deviation of 10.32 whereas it is 33.74 with standard deviation of 14.18 for the ILN group. The minimum score for the DCP group is 8.33 and maximum is 50 whereas in the ILN group minimum score is 16.66 and maximum score is 62.50. 3 patients in the DCP group and 3 patients in the ILN group were having excellent result, 12 patients in the DCP group and 10 patients in the ILN group were having good functional outcome. 3 patient in the ILN group and 2 patients in the DCP group were having fair functional outcome, 2 patients in the ILN group were having poor functional outcome. Naveen *et al.* reported excellent functional outcome in 6 patients, good functional outcome in 5 patients, fair in 5 patients, poor in the 2 patients in the DCP group whereas excellent functional outcome was present in the 5 patients, good in 4 patients, fair in 3 patients, poor in 4 patients in the ILN group. Wali *et al.* calculated the functional outcome using American shoulder and elbow surgeons score, which was 44.1 in the DCP group and 43.2 in the ILN group. McCormack *et al.* analysed the functional outcome by the ASES Score, which was 48 in the DCP group and 47 in the ILN group.

## Summary and Conclusion

### Summary

40 patients with fracture shaft of humerus were treated operatively in the department of orthopaedics, patna medical college and hospital, patna.

- Most of the patients (52.5%) were in the age group 20 - 39 years. Mostly patients (75%) were male. Road traffic accident was the most common (62.5%) mode of injury.
- The fracture was located in the middle third of shaft in the 24 patients (60%). 77.5% fractures were closed type. Union was present in 18 (90%) patients in the ILN group whereas in the DCP group, union was present in the 17 (85%) patients. Average union time is 7.83 with standard deviation of 1.54 weeks in the ILN group and 8.64 with standard deviation of 1.96 weeks in the DCP group.
- Impingement was present in the 3 patients in the ILN group. Axillary nerve neuropraxia was present in 1 patient in the ILN group.
- DASH score for the ILN group is 33.74 with standard deviation of 14.18 whereas it is 27.66 with standard deviation of 10.32 in the DCP group. The DASH score of the two groups is statistically insignificant (p value is >.05).
- Functional outcome is excellent in 3 (15%) patients, good in 10 (50%) patients, fair in the 3 (15%) patients and poor

in the 2(10%) patients in the ILN group whereas it is excellent in 3(15%) patients, good in 12(60%) patients and fair in 2(10%) patients in the DCP group. The functional outcome of the two groups is statistically insignificant (p value is >.05).

### Conclusion

We came to the conclusion that both the modalities of treatment are good as far as union of the fracture is concerned, but considering the rate of complications we concluded that dynamic compression plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint. We therefore concluded that in cases where both dynamic compression plating and interlocking nailing can be done, we would prefer to use locking /dynamic compression plate.

### References

1. Campbell's operative orthopaedics, Page no-2856
2. Rockwood C, Matsen F III. The Shoulder. Philadelphia: WB Saunders, 1990:161
3. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG) Am J Ind Med. 1996; 29(6):602-8. Erratum in: Am J Ind Med 1996; 30(3):372. The Institute for Work & Health are the copyright owners of the DASH and QuickDASH Outcome Measures (<http://www.dash.iwh.on.ca/>)
4. Chapman JR, Bradford HM, Agel J, Benca PJ. Randomized prospective study of humeral shaft fracture fixation: intramedullary nails versus plates. J Orthop Trauma. 2000; 14:162-166.
5. McCormack RG, Brien D, Buckley RE, McKee MD, Powell J, Schemitsch H. Fixation of fracture of the shaft of humerus by dynamic compression plate or intramedullary nail. J Bone Joint Surg. 2000; 82B:336-339.
6. Raghvandra Bhalodiya S. Internal fixation of fractures of the shaft of the humerus by dynamic compression plate or intramedullary nail: A Prospective study.
7. Ting- Cheng Chao. Wen-Ying Chou. Humeral shaft fractures treated by dynamic compression plates, ender nails and interlocking nails. International orthopaedics (SICOT), 2005.
8. Changulani M, Jain UK, Keswani T. Comparison of the use of the humerus intramedullary nail and dynamic compression plate for the management of diaphyseal fractures of the humerus. A randomised controlled study. Int Orthop. 2007; 31(3):391-5. Epub 2006 Aug 10
9. Putti AB, Uppin RB, Putti BB. Locked intramedullary nailing versus dynamic compression plating for humeral shaft fractures. J Orthop Surg (Hong Kong), 2009; 17:139-41.
10. Kiran Singiseti M. Ambedkar Nailing versus plating in humerus shaft fractures: A Prospective comparative study. International orthopaedics (SICOT), 2010.
11. Naveen PR, Chaitanya PR. Comparative study between the dynamic compression plating and the intramedullary interlocking nailing in diaphyseal fractures of the

- humerus in adults. Journal of evolution of medical and dental sciences, 2013.
12. Mir Wali GR, Asif Baba N, Irfan A. Latoo and Others. Internal fixation of shaft humerus fractures by dynamic compression plate or interlocking intramedullary nail: a prospective, randomised study. Strat Traum Limb Recon, 2014.