

Original Research Article

Comparative study of functional outcome of dynamic compression plating with intramedullary interlocking nailing in close fracture shaft of humerus in adults

Yash B. Rabari*, D. V. Prasad, Ashish M. Somanni, Pushpak Kumar

Department of Orthopaedic, Rural Medical Collage, LoniBk, Maharashtra, India

Received: 24 March 2017

Revised: 20 April 2017

Accepted: 21 April 2017

***Correspondence:**

Dr. Yash B. Rabari,

E-mail: dryash.rabari@gmail.com

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ABSTRACT

Background: Humeral shaft includes 1% of all fractures. The advantage of operative management is early mobilization and patients comfort. Most of the studies compare two main modalities of management, 1. dynamic compression plate 2. intramedullary interlocking nail, with respect to fracture union as major criteria. Very few studies have compared functional outcome with respect to shoulder and elbow joint. 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 analyse statistically significant difference in the results of these two methods.

Methods: There were 58 patients of fracture shaft humerus were enrolled during 2 May 2015 to 2 January 2017 in the study. They were randomly divided into two groups, DCP group and IMILN group, each having 29 patients and compare the functional outcome of both groups with each other.

Results: There were total 53 patients among them 26 (49.05%) treated with DCP and 27 (55.95%) treated with intramedullary interlocking nail (IMILN). The mean age of patient treated with DCP was 40.12 years (SD±8.51, Min-Max: 25-60) and treated with IMILN was 41.96 years (SD±11.04, Min-Max: 22-61). Road traffic accident was major mode of injury to shaft of humerus.

Conclusions: Dynamic compression plating is preferable technique than interlocking nailing for fracture shaft of humerus in adults.

Keywords: Humerus, DCP, IMILN, Fracture

INTRODUCTION

Humeral shaft includes 1% of all fractures.¹ Most diaphyseal fractures can be managed conservatively and good results achieved in most cases.¹ However loss of reduction in the plaster cast invariably leads to malunion. Operative treatment for humerus fractures has usually been reserved for cases of delayed union, non-union, or malunion following conservative management.² The advantage of operative management is early mobilization and patients comfort.

Surgical stabilization can be accomplished with different implants and techniques; the most common are open reduction with plate fixation or stabilization with intramedullary nails. Both techniques have certain mechanical and anatomical advantages and disadvantages.² Plating gives good results but disadvantages that it requires extensive dissection and radial nerve protection.³ The plate may fail in osteoporotic bone hence locking plate is advisable.

With the dynamic success of intramedullary fixation of fractures of the femur and tibia, there was speculation

that this technique might be more appropriate for humerus shaft fracture than plating.²

Intramedullary nails have the advantage of closed insertion techniques, intact periosteal blood supply, and load-sharing mechanical properties.² But unfortunately the success of interlocking nailing in long bones of lower limbs is not seen in humerus. Many recent studies suggest that Dynamic compression plating is best method for fixation. Most of the studies compare both modalities of management with respect to fracture union as major criteria. Very few studies have compared functional outcome with respect to shoulder and elbow joint. 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 analyse statistically significant difference in the results of these two methods.

METHODS

There were 58 patients of fracture shaft humerus were enrolled during 2 May 2015 to 2 January 2017 in Pravara Rural Hospital, LoniBk, Taluka- Rahata, Dist.-Maharashtra. They were randomly divided into two groups, DCP group and IMILN group, each having 29 patients.

The inclusion and exclusion criteria were as below mentioned.

Inclusion criteria

Inclusion criteria were all fractures of diaphysis of humerus indicated for surgical treatment; patients of age 18 years and above; fresh fractures.

Exclusion criteria

Exclusion criteria were fracture of epiphyseal and metaphyseal region of humerus; patients treated conservatively for other medical reasons; open fractures; pathological fractures; patients who were lost to follow up or died before the fracture union; patients with segmental fractures, patient with radial nerve injury.

The patients were first seen in the casualty. The history was taken followed by general and local examination of the patient. Neurovascular status was noted specially for radial nerve. Roentgenogram of the arm with shoulder and elbow was taken in both antero-posterior and lateral views. Additional roentgenograms were taken if any other injury was suspected. The humeral shaft fracture was temporarily immobilized with a U-slab and arm pouch. Pre-operative planning and investigations were done and the patients were posted for open reduction and internal fixation with DCP or closed reduction internal fixation with interlocking nailing.

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 antegrade nailing was done in case of interlocking nailing group, none of the cases were treated by retrograde nailing. In the first group, 4.5 mm narrow DCP with screws was used, and in second group standard intramedullary interlocking nail was used with 7, 7.5, 8 mm size with bolts of appropriate length. 4 patients was lost to follow up and 1 patients were excluded from the study as they expired leaving us with 53 patients. 26 were fixed with DCP and 27 were fixed by interlocking nail. The duration from injury to treatment varied from 1 to 6 days (average being 3 days). Fracture classified according to AO classification of fracture shaft humerus.

The patients were followed up every four weeks 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. The union is confirmed radiologically when plain X-ray showed bone trabeculae or cortical bone crossing fracture site on at least three surfaces on orthogonal radiograms.

The functional outcome was measured by the "Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery whichever was earlier.⁴ The DASH questionnaire has thirty questions the answers of which are graded from one to five points. The functional score is calculated by the formula.

DASH Disability / Symptom Score

$$= \frac{\{(\text{sum of n responses}) - 1\}}{N} \times 25$$

Where N = number of responses.

The best possible score is 0 and the worst possible score is 100. The functional outcome decreases as the score increases.

The result was then graded as Excellent, Good, Fair and poor as follows.⁴

Excellent – 0 to 20 Points
 Good – 21 to 40 points
 Fair – 41 to 60 points
 Poor – Greater than 60 points

The time taken for radiological union and the functional outcome in both groups were then compared.

We have used GraphPad Prism software for statistical analyses of the result.

RESULTS

There were total 53 patients among them 26 (49.05%) treated with DCP and 27 (55.95%) treated with intramedullary interlocking nail (IMLN). The mean age of patient treated with DCP was 40.12 years (SD±8.51, Min-Max: 25-60) and treated with IMILN was 41.96 years (SD±11.04, Min-Max: 22-61).

The sex of the patient is not significant statistically (Table 1).

Table 1: Sex of the patient.

Sex	DCP	IMILN
Male	22	21
Female	4	6
Total	26	27

Chi Square=0.40; p value=0.26.

Road traffic accident was major mode of injury to shaft of humerus (Table 2).

Table 2: Mode of injury.

Mode of injury	DCP	IMLN	Total
Domestic	1	2	3
RTA	22	23	45
Sport	1	0	1
Assault	2	2	4

The mean radiological healing time in patient operated with DCP was 14.42 weeks (SD±0.64) and in patient operated with IMLN was 13.35 weeks (SD±0.56).The mean radiological healing time difference in patient operated with DCP and in patient operated with IMLN was 1.08 week (t=6.43, df=50, p value =0.0001).

With DCP excellent results were more than IMLN according to functional outcome with dash score assessment which is statistically significant (Figure 1).

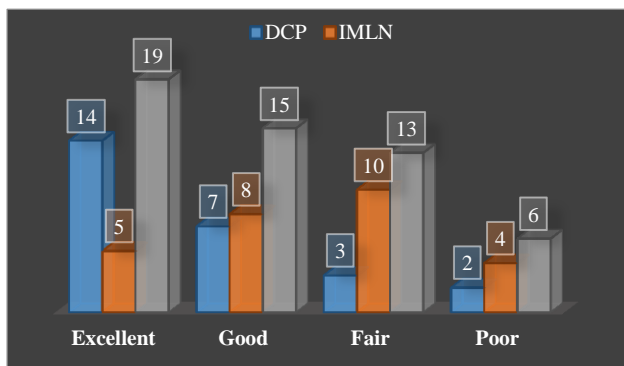


Figure 1: DASH Score.

Postoperatively in the DCP group there were 5 complications and in the interlocking group there were 21

cases with complications. Complications were more in the interlocking group, which was statistically significant (Figure 2).

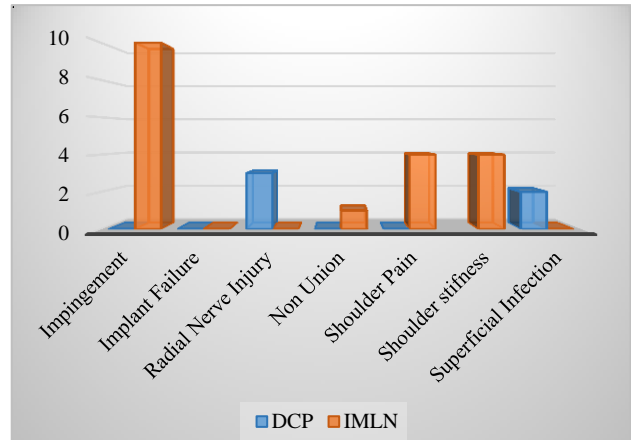


Figure 2: Postoperative complication.

DISCUSSION

Most surgeons agree that intramedullary nailing is not best fixation for humerus shaft as compare to tibia and femur shaft fracture. Plate osteosynthesis requires extensive soft tissue dissection with the risk of radial nerve damage⁵ and infection.

The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described as 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, fractures in patients with multiple injuries.^{6,7,9,10}

In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft.^{6-8,10}

This study is having a short term follow up of minimum of 6 months and maximum of 15 months (mean 10.70 months) and therefore discussion is essentially a preliminary assessment.

As per previous reports the incidence of non-union after plating has ranged from 2% to 4%.^{11,12} In our DCP group the incidence of non-union is 0%. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 8%.^{5,13-16} In our series the incidence of non-union in the interlocking nail group is 3.7%. In the DCP group the incidence of post-operative radial nerve palsy is 2% to 5%.¹⁷⁻¹⁹ In our study 3 (11.54%) cases reported with post op radial nerve palsy treated with DCP. Both DCP done with anterolateral approach, recovered with help of dynamic cockup splint and physiotherapy. The incidence of post-operative radial

nerve palsy in various studies are varies from 2.6% to 14.3% in the interlocking group.^{5,20,26} In our study no patient reported in interlock in nailing group with radial nerve palsy.

There were 2 patients having superficial infection (3.77%) among 53 patients, both were from DCP group, which responded well to debridement and intravenous antibiotics for 2 weeks according to culture report. There is no failure of fixation found in any case.

Habernek and Orthner in 1991 reported good results with Seidel's interlocking nail but later withdrew their support in 1998, as they had assessed the shoulder functions of their patients properly because of disruption of the rotator cuff in its avascular zone within of its insertion to the greater tuberosity that may lead to poor healing.^{24,25} Same result reported by Modi, Pundkar.²⁶

There were 18 (66%) patients who developed shoulder pain/stiffness or the other shoulder pain (impingement) out of 27 patient in the interlocking nailing group reported. Our study confirms that antegrade insertion of nail can lead to problems with shoulder function and range of movement probably because of damage to the rotator cuff. With respect to union rate the excellent result were found equal in both groups (p value insignificant) but, there were fairer and poor results in the interlocking nailing group compared to DCP group in functional outcome according to DASH score. The complications were more in the interlocking nailing group with most of them pertaining to poor shoulder function (impingement) or pain and this difference in the complications was statistically significant. Though better results are found with interlocking intramedullary nailing in 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.

CONCLUSION

The fracture shaft of humerus includes 1% of all fractures. Treatment modalities has to be decide carefully with type of fracture, among various surgical treatment modalities dynamic compression plating and Interlocking nailing are most commonly used by surgeons. With respect to union rate both techniques are good but there is higher complication rate in IMILN group especially considering pain and function of shoulder joint. So we finally conclude that dynamic compression plating is preferable technique than interlocking nailing for fracture shaft of humerus in adults.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Rabari YB, Prasad DV, Somanni AM, Kumar P. Comparative study of functional outcome of dynamic compression plating with intramedullary interlocking nailing in close fracture shaft of humerus in adults. *Int J Res Orthop* 2017;3:828-32.