

Original Article

Comparative study of functional outcome of Dynamic compression plating with Intramedullary Interlocking nailing in close fracture shaft of humerus in adults

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ABSTRACT

Background and objective: To compare the results of dynamic compression plating and intramedullary interlocking nailing in treatment of closed fracture shaft humerus in adults with reference to study Functional outcome, Rate of healing, Complications between two groups.

Methods: 48 adult patients with closed fracture shaft humerus were randomly assigned in to two groups after informed consent. Both groups were investigated in usual manner. Group A (ILN group) with 25 patients were treated with intramedullary interlocking nailing and group B (DCP group) with 23 patients were treated with Dynamic compression plating. The patients were followed up every four weeks till radiological union was seen. Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire was used for functional outcome measurement.

Results: Time taken for radiological healing is more in DCP group but it was statistically not significant. According to DASH score functional outcome assessment more excellent result found in DCP group than ILN group. Postoperative complication rate is higher in ILN group which was statistically significant.

Conclusion: Both dynamic compression plating and interlocking nailing are good with respect to union of the fracture but with respect to the functional outcome and rate of complications, we are of the opinion that dynamic compression plating offers better result than interlocking nailing.

Key words: Humerus shaft fracture, interlocking nailing, dynamic compression plating, DASH Score

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

MATERIAL AND METHODS

After approval from ethical committee 60 patients of fracture shaft humerus were enrolled in the study of age 18 and above. They were randomly divided into two groups each having 30 patients.

ILN = Patients operated with Interlocking nailing (n=30)

DCP= Patients operated with Dynamic Compression Plating (n= 30)

Inclusion criteria

Age 18 and above of both sex

Only the diaphyseal humeral fractures.

Fresh fractures

Exclusion Criteria

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.

Primary requirements

Written informed consent was taken.

A thorough history and clinical examination was done. 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.

Preoperative evaluation

Pre-operative planning and investigations were done and the patients were posted for open reduction and internal fixation with DCP or interlocking nailing.

Approaches for procedure

a) For DCP Anterolateral approach was used in patients with fractures of the upper and middle thirds of the shaft of the humerus (15 patients). Posterior approach was used in patients with fractures of the lower thirds of the shaft (6 patients). Anterior approach was done for MIPPO technique (2 patients).

b) Only antegrade nailing was done in case of interlocking nailing group, none of the cases were treated by retrograde nailing. A 7.5 mm nail was used in 5 patients; 7 mm nail was used in 16 patients, whereas 6mm nail was used for 4 patients.

Materials used

For DCP: 4.5 mm narrow DCP with screws

FOR ILN: 7, 7.5,8 mm nail with bolts of appropriate length

10 patients was lost to follow up and 2 patients were excluded from the study as they expired leaving us with 48 patients, 23 were fixed with DCP and 25 were fixed by interlocking nail. The duration from injury to treatment varied from 1 to 10 days (average being 4 days). Fracture classified according to AO classification of fracture shaft humerus

Follow up and criteria for follow up

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 ever was earlier.

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

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.

RESULTS

Total 48(100%) study subjects comprises of DCP GROUP 23(48%) and Interlocking nailing 25(52%).

Surgical Approach used

In DCP anterolateral approach was used in 15 patients, posterior approach was used in 6 patients and MIPPO technique used in 2 patients with anterior approach. Among the interlocking group only antegrade nailing was done. Average time taken for surgery was 90 minutes for DCP and 70 minutes interlocking nailing group. The average duration of follow up in our study was 10.30 months. Range (6 to 14 months). Average time taken for radiological healing in the interlocking Group was 13.41 weeks and 15.42 weeks in DCP. So the healing rate was relatively faster in the interlocking group as compared to the DCP group. There was no statistically significant difference in the time taken for radiological union. P = 0.061. 1 fracture treated with ILN remained uninvited.

Table 1: Sex of the patient

Sex	ILN Group	DCP Group	Total
F	5(20%)	6(26%)	11(23%)
M	20(80%)	17(74%)	37(77%)
Total	25(100%)	23(100%)	48(100%)

Chi sq. = 0.25 p value = 0.61

Sex of the patient related to incidence of shaft humerus fracture is statistically non-significant. (Table 1)

Table 2: Age of patients

Group	N	Mean	Std.Deviation	t value
ILN	25	35.72	11.70	t value=0.42
DCP	23	36.32	11.11	p=0.85

Age of the patient related to incidence of shaft humerus fracture was statistically non-significant. (Table 2)

Table 3: Mode of injury

Mode of injury	ILN Group	DCP Group	Total
Domestic	2(8%)	3(12%)	5(10%)
Fall	4(16%)	5(24%)	9(20%)
RTA	19(76%)	14(60%)	33(68%)
Sports injury	0(0%)	1(4%)	1(2%)
Total	25(100%)	23(100%)	48(100%)

Chi = 1.98 p = 0.57

RTA is major cause of fracture shaft humerus in adults (Table 3)

Fig 1: Details of Radial nerve palsy

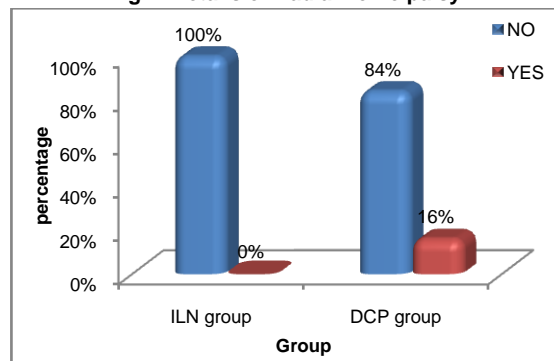
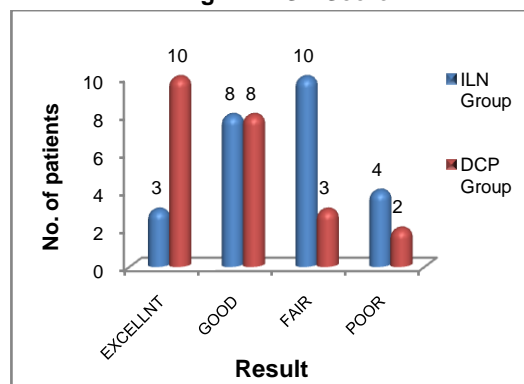


Table 4: Time taken for radiological healing

Groups	No	mean	Std. Deviation	p-value
ILN	24	13.41	3.01	p=0.015 p = 0.0613
DCP	23	15.42	2.21	

Time taken for radiological healing is statistically non-significant in both groups. (Table 4)

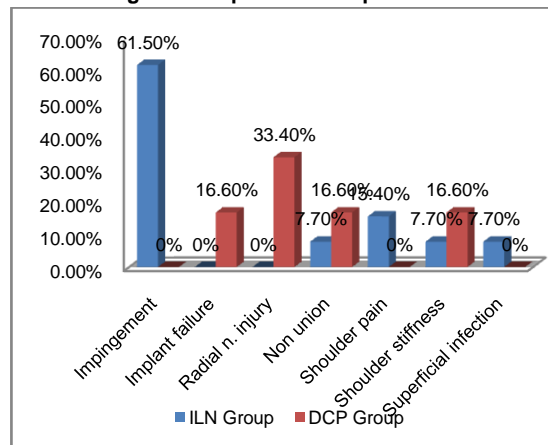
Fig 2: DASH Score



Chi = 8.136 p = 0.04

Excellent results more found in DCP group. Functional outcome with dash score assessment is statistically significant.

Fig 3: Post-operative complications



Chi = 13.02 p = 0.04

Postoperatively in the DCP group there were 13 complications and in the interlocking group there were 5 cases with complications. Complications were more in the interlocking group, which was statistically significant ($p=0.004$).

DISCUSSION AND RECOMMENDATION

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 damage [5] 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, 7, 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, 14, 15, 16]. In our series the incidence of non-union in the interlocking nail group is 7.7%. The incidence of radial nerve palsy with fracture shaft humerus varies from 6% to 15% [17, 18, 19]. In our series the incidence was 8%. Out of the 3cases, 2 cases recovered (66.6%).In the DCP group the incidence of post-operative radial nerve palsy is 2% to 5%[11,12], In our study 2 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% [5, 20] in the interlocking group. In our study no patient reported in interlock in nailing group.

2 patient having superficial infection (4.1%) among 48 patients (1 in DCP and 1 in ILN group), which

responded well to debridement and intravenous antibiotics for 2 weeks according to culture report. The failure of fixation in a case of DCP was due to poor technique due to inadequate hold, distally plate was off from bone. Revision surgery with tightening of distal screws done with which got united after 6 months.

Habernek and Orthner [24] 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 [25].

3 patients had developed shoulder pain/stiffness and 8 of our 25 patients in the interlocking nailing group reported some or the other shoulder pain (impingement). 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. The sample size of our study is small with only 48 patients included in the final study. 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. 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 ILN 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. The fallacies in our study are, the sample size is small

and we have not taken retrograde interlocking nailing into consideration.

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