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A Comparative Study of Management of Fracture Shaft of Humerus by Dynamic Compression Plate and Interlock Nailing

KEYWORDS: Diaphyseal humerus fracture, Dynamic compression plate, Interlocking nail, DASH questionnaire.

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ABSTRACT *Background and Objectives: Fracture of the shaft of humerus is common and there is a debate regarding the choice of operative intervention, which include Intramedullary Nailing (IMN) and Dynamic Compression Plate (DCP). The aim of this study is to find the difference between the functional outcome between the DCP and the IMN in diaphyseal fractures of the humerus in adults.*

Materials and Methods: This is prospective randomized controlled trial of 30 patients. All patients had closed fractures shaft humerus and were treated with either DCP or with IMN. The time taken for radiological union in the two groups was compared, complications were observed and, the functional outcome was assessed by the "Disabilities of Hand, Shoulder and Elbow (DASH) Questionnaire".

Results: The functional outcome was better in DCP compared to interlocking nailing. The mean DASH score in DCP was 20.93 and in IMN group was 32.13, which was statistically significant(p=0.048). Primary radial nerve palsy was seen in 2 patients of DCP group and 1 patient of IMN group of which 1 patient of DCP group and 1 patient of IMN group recovered completely. The average time taken for union in the DCP group was 14.5 weeks which was significantly lesser than in the interlocking group, where it was 17.31 weeks(p=0.001). Two fractures (6.66%) treated with IMN remained ununited. The functional outcome was better in patients treated with DCP than IMN. The complication associated with interlocking group were more than the DCP group.

Conclusion: Both the modalities of treatment are good as far as union of the fracture is concerned, but considering the number of complications and functional outcome, we found that DCP offers better result than IMN with respect to pain and function of the shoulder joint.

Introduction

Fractures of the humeral shaft are common. The advantages of operative management are early mobilization and patient comfort. But, operative management carries the risk of technical errors and post operative complications infections, nerve injuries etc. The optimal method of humeral shaft fracture fixation remains in debate. Two techniques under study include intramedullary nailing and dynamic compression plate fixation. Plating provides satisfactory results 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. According to recent studies the preferred method of fixation of humeral fractures is by dynamic compression plate.

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.

Materials And Methods

A randomized(open label), prospective, comparative study of management of acute humeral shaft fractures by antegrade interlocking nail fixation and dynamic compression plating was undertaken at our institution. An informed consent from patients and departmental permission were obtained. Thirty patients with closed acute humeral shaft fracture were treated with either interlocking nailing or plating procedures.

Inclusion criteria: 1. All closed Humeral shaft fractures. 2. Patients with age 21 years and above.

Exclusion criteria: 1. Active infections at surgical site. 2. Open fractures. 3. Pathological Fractures.

All patients had appropriate clinical and radiological assessment before a decision to offer surgical intervention was made. Total 40 patients were randomized by open label. All fractures were classified according to the AO classification. Of the twenty patients to be treated by interlocking nail, three were early stage follow-up loss and two were lost to follow-up at completion of the study. Of the twenty patients treated by plating, two were early follow-up loss and three lost to follow-up.

Fifteen patients of interlocking nailing and 15 patients of plating thus completed the study and were included for final analysis in the study.

An antegrade interlocking technique was used with an intramedullary nail (Russell-Taylor type) and care was taken to minimise damage of the rotator cuff during nail insertion. A 3.5-mm or 4.5-mm dynamic compression plate was used in the plating group depending on the width of the

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bone with appropriate AO principles. Antero-lateral approach was used for fractures of the upper and middle thirds of the shaft and Posterior approach was used for fractures of the lower thirds of the shaft in DCP group.

All patients were advised on immediate postoperative shoulder and elbow exercises. Follow-up was done at 6 weeks, and then 3 months, 6 months and 1 year. During follow-up period, pain, skin condition, range of motion was assessed. The functional outcome was measured by the "Disabilities of Arm, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery.

The result was then graded as Excellent, Good, Fair and Poor as follows :
Excellent – 0 to 20 Points.
Good – 21 to 40 points.
Fair – 41 to 60 points.
Poor – Greater than 60 points.
(acc. to DASH score)

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

Fig.1 Plate Fixation

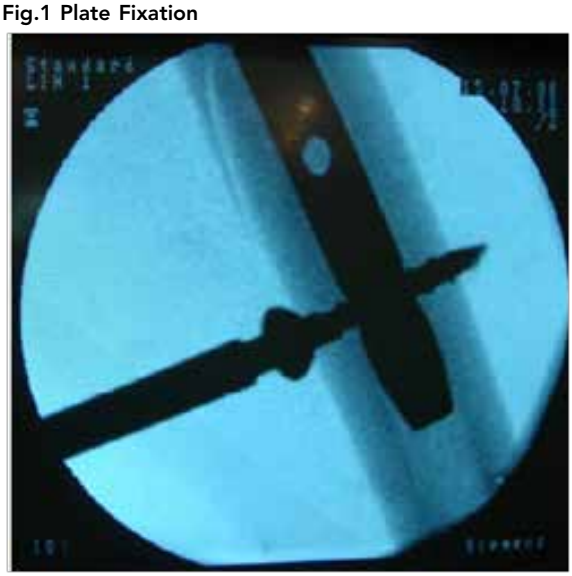

Fig. 2 Intramedullary Nailing

Results
Functional Outcome:
There was 46%(7) excellent, 26.66%(4) good, 20%(3) fair and 6.66%(1) poor results in DCP group, and 20%(3) excellent, 33.33%(5) good, 33.33%(5) fair and 13.33%(2) poor results in Nailing group.

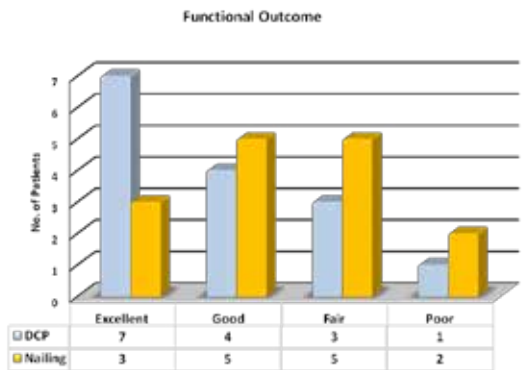

Fig.3 Functional Outcome

Statistical Analysis of DASH Score:
The mean DASH score in our study was 26.53. The mean DASH score in DCP group was 20.93 and in the IMN group was 32.13. The results were statistically significant (p= 0.048).

Group	N	Mean	Std. Dev	
DCP	15	21	15.28	t= -1.808
IMN	15	31.73	17.18	p= 0.048

Table no. 1: Statistical Analysis Of DASH Score

Time Taken for Radiological Healing:
Average time taken for radiological union in DCP group was 14.50 weeks and in IMN group was 17.31 weeks. There was high statistical significant difference in the time taken for radiological union. (p= 0.001)

1 fracture treated with DCP and 2 fractures treated with IMN remained un-united

	TOF	N	Mean (union in wks)	Std.Deviation	
Union	DCP	14	14.50	1.454	t= - 4.173
	IMN	13	17.31	2.016	p= 0.001

Table no. 2: Statistical Analysis of Radiological Healing

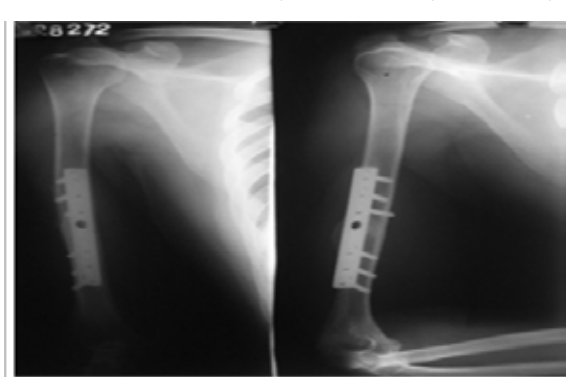

Fig. 5 Union in DCP

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Fig. 6 Union in Intramedullar Nailing

Complications:

COMPLICATIONS	IMN (n=15)	PLATING (n=15)
Nil	9 (60%)	11 (73.33%)
Impingement	3 (45%)	0 (0%)
Radial Nerve Injury	1 (6.66%)	2 (13.33%)
Non Union	2 (13.33%)	1 (6.66%)
Infection	0 (0%)	1 (6.66%)

Table no. 3: Complications

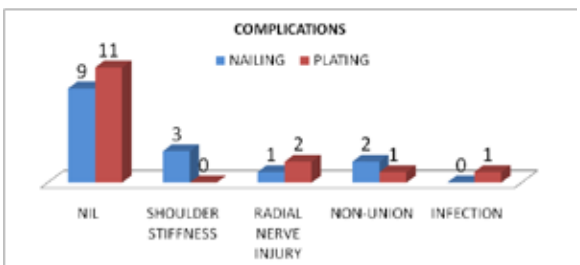

Fig. 4 Complications

Discussion:

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[1,2,6,8,9].In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft[1,2,6,9]. This study is having a short term follow up of minimum of 9 months and maximum of 20 months (mean 15.85months) and therefore discussion is essentially a preliminary assessment.

In previous reports the incidence of non-union after plating has ranged from 2% to 4%[2,10,11]. In our DCP group the incidence of non-union is 6.66%. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 8%[3,4,5,7,12]. In our series the incidence of non-union in the interlocking nail group is 13.33%.

In our series the incidence of radial nerve palsy was 10%. Out of the 3cases, 2 cases recovered (66.6%), which tallied with Seddon's and Pollock's series of 70% and 68% respectively. In the DCP group the incidence of post operative radial nerve palsy is 2% to5%[2,10,11], in our study 2 patients (13.33) had radial nerve palsy in DCP group out of which 1 recovered fully.

There was no problem with infection in our patients with only 1 patient having superficial infection (3.33%) among 30 patients, which responded well to debridement and intravenous antibiotics for 3 weeks.

DASH scores of 0-20 was taken as Excellent, 21-40 Good, 41-60 Fair and above 61 was taken as Poor. The data have indicated that 46.7 % observations from DCP group have shown excellent progress. Whereas, only 20% observations from IMN group were having excellent result. This finding clearly indicates that DCP method is better than IMN(Table no. 1). Although in the present investigation this difference was not statistically significant, the significance can be achieved by increasing the sample size.

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.

Conclusion

Fractures of the shaft humerus are one of the common fractures affecting present generation and treatment modality has to be decided carefully.

We are of the opinion that the operative treatment of the humerus fractures should be done in patients with polytrauma and in patients with failed conservative treatment. Both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as union of the fracture is concerned, but considering the functional outcome and rate of complications, we are of the opinion that dynamic compression plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint.

We therefore conclude that in cases where both dynamic compression plating and interlocking nailing can be done, we would prefer to use dynamic compression plating, as the results are better than interlocking nailing.

The fallacies in our study are, the sample size is small and we have not taken retrograde interlocking nailing in to consideration.

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