

Original Research Article

A prospective comparative study of functional outcome in patients treated with interlocking nailing and dynamic compression plating for fracture shaft of humerus in adults

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ABSTRACT

Background: Aim of the study was to compare the functional outcome in patients with fracture shaft of the humerus treated with dynamic compression plating (DCP) and those treated with intramedullary interlocking nailing.

Methods: Of 44 patients with humeral shaft fracture were included in this study and were divided in the following two groups of 22 patients: Group A: Patients treated with DCP by triceps splitting approach and group B: Patients treated with standard intramedullary interlocking nailing. All patients were followed up at 6 weeks, 3 months and 6 months post operatively. Functional outcome was assessed using Rodriguez-Merchan criteria on follow up at 6 months post op.

Results: The mean age of patients in group A was 39.05 ± 13.13 years and group B was 38.73 ± 12.95 years. According to Rodriguez-Merchan criteria, 8 (36.4%) and 12 (54.6%) patients in group A had excellent and good functional outcome respectively and 4 (18.2%) and 10 (45.4%) patients in group B had excellent and good functional outcome respectively.

Conclusions: DCP offers better functional outcome than interlocking nailing.

Keywords: Humeral shaft fractures, Rodriguez-Merchan criteria, DCP, Intramedullary interlocking nail

INTRODUCTION

Humeral shaft fractures account for 1 to 3% of all fractures in adults and for 20% of all humeral fractures.¹ These fractures have an annual incidence from 13 to 14.5 per 100,000 people. Non-operative treatment is still the standard treatment for isolated humeral shaft fractures although this method can present unsatisfactory results, such as, non-union and shoulder impairment. Surgical treatment is recommended for patients with neurovascular injuries, brachial plexus injuries, open fractures, for patients with multiple injuries, and for floating elbow and unsatisfactory reductions.²⁻⁴ Arbeitsgemeinschaft für osteosynthesefragen (AO)-orthopaedic trauma association (OTA) type A fractures, proximal third oblique fractures and distal third shaft fractures. Surgical options for treatment of humeral shaft fractures include open

reduction and internal fixation with a compression plate, intramedullary nail osteosynthesis and minimally invasive plate osteosynthesis. Open reduction and internal fixation (ORIF) with plates and screws continues to be considered the gold standard for surgical treatment. Plate fixation permits direct visualization, anatomic decrease, and rigid fracture fixation of the fracture and facilitates the identification exploration, and protection of the radial nerve. 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.^{5,6} The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and reaming can yield auto graft material, permits preservation of periosteal blood supply and limits disruption of fracture

biology.^{7,8} The conflict between the need for absolute anatomical reduction and, at the same time, the desire for soft tissue preservation has been going on for a long time. Precise reduction and absolute stable fixation have its biological price. The current study was done to compare the functional outcome in patients with fracture shaft of the humerus treated with dynamic compression plating and those treated with intramedullary interlocking nailing.

METHODS

This study is a prospective comparative study. The patients who underwent surgery for humerus shaft fractures in the department of orthopaedics of Ruby Hall clinic, Pune, during the period of October 2018 to June 2020 were considered as study participants.

A total of 44 patients were included in this study. The patients were divided in the following two groups of 22 patients: Group A: Patients treated with dynamic compression plating (DCP) by triceps splitting approach and Group B: Patients treated with standard intramedullary interlocking nailing.

All patients were advised postoperative shoulder and elbow exercises on 3 weeks and radiographs were taken at regular intervals 6 weeks, 3 months and 6 months during follow up. 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 radiographs. The time taken for clinical and radiological union was noted. Rodriguez-Merchan criteria were used to compare the postoperative results of IMIL Nail and plating procedure at follow up.⁹ Patients were assessed prospectively at period of 6 weeks, 3 months and 6 months. Functional outcome will be assessed at 6 months follow up.

A statistical significance among the study groups is assessed with the help of Fisher test, student 't' test and Chi square test. $P < 0.05$ is taken as significant. Appropriate

statistical software, including but not restricted to MS excel, SPSS ver. 20 were used for statistical analysis

Inclusion criteria

Inclusion criteria included patients who had acute fractures of humeral shaft, patients aged above 18 years, fractures 2 cm below surgical neck and 3 cm above olecranon fossa, multiple injuries and angulation more than 15 degrees.

Exclusion criteria

Exclusion criteria for the study excluded patients who had open physis, age less than 18 years and fractures involving proximal 2 cm and distal 3 cm of the humeral diaphysis.

RESULTS

Demographic details shown in the Table 1.

Table 1: Demographic distribution of patients in group A and B.

Characteristics	No. of patients in group A	No. of patients in group B
Age (Years)		
21-30	6	7
31-40	8	6
41-50	4	3
51-60	2	4
>60	2	2
Sex		
Male/female	14/8	12/10
Laterality of fracture		
Right/left	9/13	8/14

Distribution of patients according to functional outcome according to Rodriguez-Merchan criteria, 8 (36.4%) and 12 (54.6%) patients in group A had excellent and good results respectively while 1 (4.5%) patient each had fair and poor results. 4 (18.2%) and 10 (45.4%) patients in group B had excellent and good results respectively while 6 (27.3%) and 2 (9.1%) patients had fair and poor results respectively (Table 2). There was significant improvement in group A compared to B as per Chi-square test ($p > 0.05$).

Table 2: Distribution of patients according to functional outcome (Rodriguez-Merchan criteria).

ROM	Shoulder ROM				Elbow ROM			
	Group A		Group B		Group A		Group B	
	No.	%	No.	%	No.	%	No.	%
Excellent	17	77.3	12	54.5	17	77.3	20	90.9
Good	5	22.7	6	27.3	5	22.7	2	9.1
Fair	0	-	4	18.2	0	-	0	-
Poor	0	-	0	-	0	-	0	-
Total	22	100	22	100	22	100	22	100

Table 3: Shoulder ROM and Elbow ROM results of Rodriguez-Merchan criteria in group A and B.

Rodriguez Merchan criteria	Group A		Group B		P value
	No.	%	No.	%	
Excellent	8	36.4	4	18.2	<0.05
Good	12	54.6	10	45.4	<0.05
Fair	1	4.5	6	27.3	<0.05
Poor	1	4.5	2	9.1	<0.05
Total	22	100	22	100	

The range of movement of shoulder joint and elbow function was excellent in 17 (77.3%) patients and good in 5 (22.7%) patients of group A. The range of movement of shoulder joint was excellent and good in 18 (81.8%) patients and fair in 4 (18.2%) patients of group B. The elbow function was excellent in 20 (90.9%) patients and good recovery was found in 2 (9.1%) patients of group B (Table 3).

DISCUSSION

There are several methods of operative intervention for fracture shaft of humerus, the internal fixation methods can be plating and interlocking intramedullary nailing. Plating is preferred option where radial nerve exploration is contemplated and interlocking nailing in communitied, segmental and pathological fractures in plating technique an extensive surgical approach is required for open reduction of fractures.^{4,10} Intra-medullary nailing method provides with the advantage of biological fracture healing such as minimal handling of soft tissue, preservation of fracture hematoma, and stripping of periosteum, lesser operative time and decreased blood loss, thus making it much preferable choice of treatment in these injured patients.^{11,12} However, nailing has certain disadvantages like insertion site morbidity such as impairment of shoulder movements, impingement at acromion and the incursion of the rotator cuff.¹¹⁻¹³

Naveen et al study observed among 34 patients, 11 had excellent results, 9 had good results, 8 had fair and 6 had poor results. Among the 11 patients with excellent results, 6 patients were treated by dynamic compression plating and 5 were treated by interlocking nailing. Among the 9 patients with good results, 5 patients were treated by dynamic compression plating and 4 were treated by interlocking nailing.¹⁴

Kumar et al prospective study reported functional activity at elbow as assessed by American shoulder and elbow surgeon score and constant and Murley score for shoulder function activity score was 66.66% in plating group and 60 of interlocking group showed excellent result. Good result shown by 26.66% of plating, 33.33% of nailing group.¹⁵

In present study, according to Rodriguez-Merchan criteria, out of 22 patients in each group, 8 (36.4%) and 12 (54.6%) patients in group A had excellent and good results

respectively while 1 (4.5%) patient each had fair and poor results. 4 (18.2%) and 10 (45.4%) patients in group B had excellent and good results respectively while 6 (27.3%) and 2 (9.1%) patients had fair and poor results respectively. There was significant improvement in Group A compared to group B as per Chi-square test ($p > 0.05$).

CONCLUSION

Internal fixation with various fixation devices allows early mobilization and good functional recovery. Operative treatment results with dynamic compression plate and interlocking nail were comparable in many senses with some pits and fall in each group. But considering the functional outcome and rate of complications, dynamic compression plating offers better result than interlocking nailing.

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Conflict of interest: None declared

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

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