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Comparative study of functional outcome of dynamic compression plating and interlocking intramedullary nailing for fructure shaft of humerus

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ABSTRACT

Background: Fracture of the diaphysis of humerus and its complications are a major cause of morbidity in trauma patients. Fracture of the humeral shaft account for 20% of humeral fractures & about 3% of all fractures. There is a debate between the choices of operation in humeral shaft fractures.
Methods: A comparative study of management of acute humeral shaft fractures treated by Dynamic Compression Plate (DCP) and Intra Medullary Interlocking Nail (IMILN) fixation over a period of one half years. 18 patients of IMILN and 20 patients of DCP were included after considering inclusion and exclusion criteria. Functional scoring criteria were used for postoperative assessment & the average follow up period was one year.
Results: A high rate of excellent & good results & a tendency for early union was seen with the plating group than nailing group.
Conclusions: Plating shows better results than nailing.

Keywords: Shaft, Humerus, Nail, Plate

INTRODUCTION

Fracture of the diaphysis of humerus and its complications are a major cause of morbidity in trauma patients. Fracture of the humeral shaft account for 20% of humeral fractures and about 3% of all fractures.[1] Fracture humerus are treated both non-operatively and operatively. It is generally agreed that most fractures of humeral shaft are treated best non-operatively although there are indications for primary and secondary operative treatment in some situations.[2-4] Recent advances in internal fixation techniques and instrumentations have led to expand the surgical indication for humeral shaft fractures.

Objectives and aims

1. To compare the outcomes of each methods of fixation (dynamic compression plate & interlocking intramedullary nailing) for the fracture shaft of humerus.
2. To know if there is any statistically significant difference in the results of these two methods.
3. Pre and post-operative clinical as well as radiological study in diaphyseal fractures shaft humerus.

METHODS

A comparative study of management of acute humeral shaft fractures by intramedullary interlocking nailing & dynamic compression plating was under taken at our institution over a periods of one and half years. The average follow up period was one year. An informed consent from patients and department permission were

obtained according to local hospital regulation. 46 patients with acute humeral shaft fractures requiring operative intervention, were treated with either by interlocking nailing or plating procedure. A randomization attempt was made by allocating each patient to either of groups depending on the criteria.

Inclusion criteria

Inclusion criteria were only the diaphyseal humeral fracture; patient aged 18 years and above; fresh fractures.

Exclusion criteria

Exclusion criteria were fractures of proximal & distal end of humerus within 4 cm; patients age less than 18 years; pathological fractures; segmental fractures; patients who were lost to follow up.

All the patients had appropriate clinical and radiological assessment before a decision to after surgical intervention was made. All the fractures were classified according to AO classification.

Study place and duration of study

Katihar Medical College, Katihar from June 2015 to December 2016

Out of 46, 25 patients were treated by DCP, 3 were early stage of follow up and 2 were lost to follow up at the completion of the study. 21 patients treated by IMIL Nail, 1 were in early follow up and 2 were lost to follow up. After applying the inclusion and exclusion criteria we include 20 patients of DCP and 18 patients of nail for final analysis in the study. A 4.5 mm DCP was used in the plating group. The choice of surgical approach antero-lateral or anterior for the plating group. An inter locking technique was used with an intramedullary nail and care was taken to minimize damage of the rotator cuff during nail insertion. All patients were advised postoperative shoulder and elbow exercises on 3 weeks and radiographs were taken at regular intervals 2 weeks, 4 weeks, 8 weeks, 6 months and 12 months during follow up.

Rodriguez –merchan criteria were used to compare the postoperative results of IMIL Nail and plating procedure at follow up. It was originally described for comparison of compression plating versus Hackethal nailing in closed humeral shaft fractures.[5] The overall rating of excellent, good, fair and poor out comes was based on scores of shoulder & elbow movements along with pain and disability after the procedure (Table 1).

Table 1: Criteria for evaluating functional results.

Rating	Elbow range of movement	Shoulder range of movement	Pain	Disability
Excellent	Extension 5º Flexion 130º	Full range of movement	None	None
Good	Extension 15º Flexion 120º	<10% loss of total range of movement	Occasional	Minimum
Fair	Extension 30º Flexion 110º	10-30% loss of total range of movement	With activity	Moderate
Poor	Extension 40º Flexion 90º	>30% loss of total range of movement	Variable	Severe

RESULTS

Demographics

The youngest in our series was 18 years old, while the oldest was 65 years. Maximum incidence was seen in the age groups 21-30 & 31-40 years (Table 2). Males accounted for 80% and females 20% with no obvious side predilection was noted. Road traffic accidents account for about 90% at the fractures followed by domestic & other causes. All the fractures could be grouped as A3 and B2 of AO classification & 70% involved the middle third of the humeral shaft. Associated medical problems included hypertension in 5 patients, schemic heart disease in 1 patient & diabetic mellitus in 3 patients.

Indications

More than 80% of the patients in our study needed operative intervention due to failure of acceptable fracture reduction & alignment by closed methods (Table 3).

Complications

Preoperative radial nerve palsy was seen in 3 cases (7.8%) in our series. All cases of preoperative radial nerve palsy recovered fully by stabilization, it indicates a neuropraxia type of injury. The radial nerve was explored to check its integrity in only one cases where open reduction was done for plating. No post-operative radial nerve palsy was seen in the interlocking nailing group. Postoperative radial nerve palsy was seen 2 cases in the plating group (10%) (Table 4 and 5).

There was 2 case of infection in the plating and 1 case of nailing. Both cases were controlled by regular antiseptic dressing and parental antibiotics and eventually went on to union.

Table 2: Age incidence.

Age groups (years)	Number of patients	Percentage (%)
18 -20	3	7.8
21 - 30	10	26.3
31 - 40	15	39.4
41 - 50	7	18.4
51 - 60	2	5.2
61 - 70	1	2.6
71 and >	0	0

Table 3: Indications for operative management.

Indications	Number of patients	Percentage (%)
Humeral fractures with multiple injuries	10	26.3
Fractures with unacceptable reduction	22	57.8
Secondary displacement of fracture reduction with non – operative treatment (on or before 6 weeks)	4	10.5
Open fractures	2	5.2
Humeral with ipsilateral forearm fractures	0	0
Pathological fractures	0	0

Table 4: Complications of plating.

Complications	Number of patients	Percentage (%)
Infection	2	10
Radial nerve palsy	2	10
Delayed union (>16 weeks)	3	15
Nonunion	1	5
Implant faliure	0	0
Restriction of shoulder joint rom	0	0
Restriction of elbow joint rom	1	5

Table 5: Complications of interlocking nail.

Complications	Number of patients	Percentage (%)
Fissure/avulsion at insertion point	0	0
Opening of splinter at fracture site	2	11.1
Radial nerve palsy	0	0
Infection	1	5.5
Delayed union (>16 weeks)	9	50
Nonunion	1	5.5
Restriction of shoulder rom	2	11.1
Restriction of elbow rom	0	0

Table 6: Time taken for union with plating.

Time taken for union	No of patients	Percentage (%)
<16 weeks	17	85
>16 weeks	3	15

Table 7: Time taken for union with interlocking nail.

Time taken for union	No of patients	Percentage (%)
<16 weeks	9	50
>16 weeks	9	50

Table 8: Results of plating (Radriguez – Merchan criteria).

Results	Number of patients	Percentage (%)
Excellent	6	30
Good	12	60
Fair	1	5
Poor	1	5

Table 9: Results of interlocking nail (Radriguez– Merchan criteria).

Results	Number of patients	Percentage (%)
Excellent	3	17
Good	8	44
Fair	5	27
Poor	2	12

Time for union

85% of plating patients & 50% of nailing patients showed evidence of union on or before 16 weeks (Table 6 and 7). One case of nonunion plating (5%) was treated by bone grafting as a secondary procedure. One case of nonunion interlocking (5.5) was treated with closed exchange nailing with reaming.

Functional results

18 out of 20 patients of plating group had good to excellent results while 11 out of 18 patients of the interlocking nailing had similar results at the final follow up for the study (Tables 8 and 9).

DISCUSSION

The accepted indications for surgical management of humeral shaft fractures are –

1) Unsatisfactory alignment or reduction by closed reduction.
2) Associated injuries of the limb required early mobilization.
3) Segmental fractures.
4) Pathological fractures.
5) Fractures with major vascular injuries.
6) Humeral shaft fractures with radial nerve palsy developing after closed manipulation or cast application.
7) Polytrauma.
8) Floating elbow.[2,4,6-8]

In our study the common indications for surgery were – unsatisfactory alignment or reduction by closed methods with multiple injuries.

Fracture of humeral shaft more common in males, & younger age group mainly 21–30.[1] Road traffic accident was common (90%) cause for such fractures in our study.[1] It was also noted with different geographical locations.[1,4,8]

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 communited, segmental and pathological fractures in plating technique an extensive surgical approach is required for open reduction of fractures.[9-11] But recently minimally invasive plating methods have been reported.[12-14] The external fixation technique is less popular in treatment of humeral shaft fractures, but it may be used in open injuries.[4] Infections, nonunion, & radial nerve palsy are generally concerned with plating group.[5,7,15] But meta-analysis results of plate fixation from pooled data did not show higher risks of non-union, infection, or radial nerve palsy.[16] Restriction of shoulder movement & risk of delayed union have been suggested as a concerns with the intramedullary techniques.[5,7,10,15-17] Impairment of shoulder movement due to proximal migration of nail, rotator cuff injuries, adhesive capsulities or due to unexplain cause.[17-20] This problem can be potentially minimised by retrograde technique but it may cause elbow movement restriction and fractures at the insertion points.[7,15,19] some report increased incidence of elbow stiffness with plating group.[17]

In our study shows higher rate of excellent & good results with plating group patients, many. other reports also shows same results.[10,19] But another series has suggested that both groups had predictable results and neither of them is markedly superior.[17] In recent study, no difference between the two groups in terms of the rate of union and functional outcome but a shorter union time with interlocking was suggested.[18] In our study shows earlier union time with plating procedure.

CONCLUSION

No single treatment option is superior in all circumstance for a particular fracture & each case to be individualised plating has been shown to have better results compare to interlocking nails in treatment of closed humeral shaft

fractures. A tendency of earlier union is seen with plating group.

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