

Assessment of the Treatment of Acute Fracture Shaft Humerus: A Comparative Study

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Abstract

Aim: The aim of the present study was to assess the management with interlocked nail in treatment of acute fracture shaft humerus and to compare its effectiveness with well-established method of plate fixation.

Methods: The present study of management of acute humeral shaft fractures by antegrade interlocking nail fixation and dynamic compression plating was undertaken at Department of Orthopedics for the period of 3 years. The average follow-up period was one year (range 10–24 months). 50 patients were included in the study.

Results: There was preponderance of male over female (35 Vs. 15) with majority population in 31–40 years age group. The youngest patient was of 24 years and oldest was of 68 years male. Mean age was 36.64 years. In our study, majority of cases were of road traffic accident (84%) followed by history of fall from height (12%) and only two cases of assault. Middle third shaft fractures were more common (52%) followed by lower and upper third (26% and 22%) respectively. Transverse fractures were maximum in number (46%) followed by oblique (30%). There were 6 spiral and 6 comminuted fractures. There were 38 (76%) close fractures and 12 (24%) open fractures. There were 15 cases (30%) of preoperative radial nerve palsy. Out of 15 cases, 14 had recovered completely. There was no iatrogenic nerve palsy seen in our study. Out of 10 cases explored nerve was found to be intact in 9 cases and contused in one case. Most of cases (9) of radial nerve palsy were associated with fracture of middle third shaft humerus. Majority of cases of fracture shaft humerus were associated with head injury followed by lower extremity fracture and ipsilateral forearm bone fracture.

Conclusion: For patients requiring surgical treatment of humeral shaft fractures, both dynamic compression plating and interlock nailing provide predictable methods for achieving fracture stabilization and ultimate healing. Plating requires extensive dissection, more blood loss and duration of surgery as compared to nailing. Antegrade interlock nailing performed properly is safe, effective and quick method.

Keywords: Humerus Shaft Fracture, Interlocking Nailing, Dynamic Compression Plating, Management.

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Introduction

Humeral shaft includes 1% of all fractures. 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. 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.

The usual operative modalities used are the dynamic compression plate (DCP) and intramedullary nail (IMN). The use of the dynamic compression plate requires an extensive operation with stripping of soft tissues from the bone, complications due to the proximity of the radial nerve in the usual field of dissection and less secure fixation especially in osteoporotic bones. The recent technical advances and aggressive marketing have popularized the use of the IMN nail. [4] Rockwood and Green recommend fixation of

diaphyseal fractures of the humerus by the IMN, which can be inserted antegrade from the shoulder or retrograde from the elbow. [5]

Fractures of the humeral shaft are commonly encountered by orthopaedic surgeons, accounting for approximately 3% of all fractures. [6] Treatment methods for these injuries continue to evolve as advances are made in both non-operative and operative management. It is generally agreed that most fractures of humeral shaft are treated best non-operatively, although there are indications for primary or secondary operative treatment in some situations. [7-9] The encouraging results that have been reported with recent advances in internal fixation techniques and instrumentation have led to an expansion of surgical indications for such fractures and a dilemma about the procedure of choice.

The aim of the present study was to assess the management with interlocked nail in treatment of acute fracture shaft humerus and to compare its effectiveness with well-established method of plate fixation.

Materials and Methods

The present study of management of acute humeral shaft fractures by antegrade interlocking nail fixation and dynamic compression plating was undertaken at Department of Orthopedics, Ayush Multi-Speciality Hospital, Morbi, Gujarat, India for the period of 3 years. The average follow-up period was one year (range 10–24 months). 50 patients were included in the study.

Forty-five patients with closed acute humeral shaft fracture requiring operative intervention were treated with either interlocking nailing or plating procedures. A randomisation attempt was made by allocating each patient to either of the groups depending on the criteria of odd or even hospital number.

The inclusion criteria were: (1) humeral shaft fractures which required operative intervention and

were treated with interlocking or plating procedures, and (2) patients of age of 18 years or more.

The exclusion criteria were: (1) the patient was aged less than 18 years, (2) pathological fractures, (3) segmental fractures, (iv) fractures within 4cm of proximal and distal end of humerus, and (5) patients who were lost to follow-up or at early stages of follow-up at the time of completion of the study (minimum follow up of six months required).

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

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 bone with appropriate AO principles. The choice of surgical approach (antero-lateral or posterior) for the plating group was left to the discretion of the operating surgeon.

All patients were advised on immediate postoperative shoulder and elbow exercises and radiographs were taken at regular intervals during follow-up. Rodriguez-Merchan criteria (1995) were used to compare the postoperative results of interlocking nailing and plating procedures at follow-up. It was originally described for comparison of compression plating versus Hackethal nailing in closed humeral shaft fractures. [10] The overall rating of excellent, good, fair and poor outcomes was based on scores of shoulder and elbow movements along with pain and disability after the procedure. In situations where any two different criteria fell into separate categories, the lower category was selected to classify the outcome.

Results

Table 1: Age wise and Gender wise Distribution of Patients

Age in years	Gender		Total
	Male	Female	
<30	8	2	10
31-40	18	10	28
41-50	5	2	7
51-60	1	1	2
>60	3	0	3
Total	35	15	50

There was preponderance of male over female (35 Vs. 15) with majority population in 31-40 years age group. The youngest patient was of 24 years and oldest was of 68 years male. Mean age was 36.64 years.

Table 2: Distribution according to characteristics of fracture

Mechanism of injury	N	%
Road Traffic Accident	42	84
Fall From Height	6	12
Assault	2	4
Anatomical Level of Fracture Shaft		
Upper third	11	22
Middle third	26	52
Lower third	13	26
Type of Fracture		
Transverse	23	46
Oblique	15	30
Spiral	6	12
Comminuted	6	12
Type of fracture		
Open	12	24
Close	38	76
Associated Injuries		
Head Injury	10	20
Fracture forearm bone same	8	16
Lower Extremity Fracture	8	16
Chest Injury	5	10
Blunt Abdomen	5	10
Other Associated Injury	5	10
No Associated Injury	9	18

In our study, majority of cases were of road traffic accident (84%) followed by history of fall from height (12%) and only two cases of assault. Middle third shaft fractures were more common (52%) followed by lower and upper third (26% and 22%)

respectively. Transverse fractures were maximum in number (46%) followed by oblique (30%). There were 6 spiral and 6 comminuted fractures. There were 38 (76%) close fractures and 12 (24%) open fractures.

Table 3: Distribution According to Radial Nerve Injury and Intervention

Radial nerve palsy and recovery (N=15)	N	%
Pre-operative	15	100
Post-operative	0	0
Radial Nerve Palsy Recovery		
Recovered	14	93.34
Not recovered	1	6.66
Condition of Radial Nerve on Exploration		
Intact	9	90
Contused	1	10
Lacerated	0	0
Site of Fracture Shaft Presented with Radial Nerve Palsy		
Upper third	0	0
Middle third	9	60
Lower third	6	40

There were 15 cases (30%) of preoperative radial nerve palsy. Out of 15 cases, 14 had recovered completely. There was no iatrogenic nerve palsy seen in our study. Out of 10 cases explored nerve was found to be intact in 9 cases and contused in one case. Most of cases (9) of radial nerve palsy

were associated with fracture of middle third shaft humerus. Majority of cases of fracture shaft humerus were associated with head injury followed by lower extremity fracture and ipsilateral forearm bone fracture.

Table 4: Distribution According to Approach for Surgery of fracture

Operative Procedure	Fracture	Anterior Approach	Posterior Approach	Total
Dynamic Compression Plating		18	7	25
Interlock Nailing	Close	21	0	25
	Open	4	0	

Anterolateral approach was used in 18 patients with dynamic compression plating. Posterior approach was used in 7 cases of lower third shaft fracture. Close interlock nailing was performed in 21 patients and open nailing by anterior approach in 4 patients.

Table 5: Distribution According to Radiological Union Time of Fracture

Period	Interlock Nail		Dynamic Compression Plate	
	N	%	N	%
<17 weeks	18	72	15	60
<26 weeks	5	20	7	28
<30 weeks	0	0	2	8
No union	2	8	1	4
Total	25	100	25	100

Majority of fractures in nailing and plating group were united within 17 week (18 V/s 15) respectively. There was 3 non-union in plating as compared to one in nailing group. There was highly significant difference between mean values of duration of surgery in nailing and plating group ($p < 0.01$).

Discussion

Most of humerus diaphyseal fractures heal with appropriate care, although a small but consistent number will require surgery for optimal outcome, which is usually suitable, to isolated fractures. [11] Most of the early methods of treatment focused primarily on comfort and patient mobilization. The simplest method involved binding the extremity to the patient's body with Sling and Swathe device. Although this did provide comfort and promote union, alignment was poorly controlled. The hanging arm cast, introduced later, achieved better alignment. This method relied not only on a direct splinting effect from plaster but on gravity to overcome the deforming forces. Using rigid plastic orthosis with adjustable straps popularized as functional cast bracing by Sarmiento has given excellent clinical and radiological outcome in fracture humerus. [12-14] Although complications are infrequent, nonoperative treatment requires a long period of immobilization, which carries a risk of prolonged shoulder stiffness and may be inconvenient to patient. [15,16]

There was preponderance of male over female (35 Vs 15) with majority population in 31-40 years age group. The youngest patient was of 24 years and oldest was of 68 years male. Mean age was 36.64 years. These findings were comparable with previous studies. [17,18] In our study, majority of cases were of road traffic accident (84%) followed by history of fall from height (12%) and only two cases of assault. Middle third shaft fractures were more common (52%) followed by lower and upper

third (26% and 22%) respectively. Transverse fractures were maximum in number (46%) followed by oblique (30%). There were 6 spiral and 6 comminuted fractures. There were 38 (76%) close fractures and 12 (24%) open fractures. Our findings also co-relate with previous studies. [17,19]

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. [20-23] In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft. [20,21,23] 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] There were 15 cases (30%) of preoperative radial nerve palsy. Out of 15 cases, 14 had recovered completely. There was no iatrogenic nerve palsy seen in our study. Out of 10 cases explored nerve was found to be intact in 9 cases and contused in one case. Most of cases (9) of radial nerve palsy were associated with fracture of middle third shaft humerus. Majority of cases of fracture shaft humerus were associated with head injury followed by lower extremity fracture and ipsilateral forearm bone fracture. Anterolateral approach was used in 18 patients with dynamic compression plating. Posterior approach was used in 7 cases of lower third shaft fracture. Close interlock nailing was performed in 21 patients and

open nailing by anterior approach in 4 patients. Majority of fractures in nailing and plating group were united within 17 week (18 V/s 15) respectively. There was 3 non-union in plating as compared to one in nailing group. There was highly significant difference between mean values of duration of surgery in nailing and plating group ($p < 0.01$).

Conclusion

For patients requiring surgical treatment of humeral shaft fractures, both dynamic compression plating and interlock nailing provide predictable methods for achieving fracture stabilization and ultimate healing. Plating requires extensive dissection, more blood loss and duration of surgery as compared to nailing. Antegrade interlock nailing performed properly is safe, effective and quick method. Interlock nailing is more suitable for cases of osteoporotic fractures, comminuted fractures in which plating is not preferable. In cases of fracture shaft humerus with associated radial nerve palsy if anatomical reduction is not possible, exploration of the nerve and fixation is required.

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