

Fracture Shaft Humerus: Plating OR Nailing?

Choudhari P, Baxi M, Patidar S

Investigation performed at Department of Orthopaedics, Sri Aurobindo Medical College and Post Graduate Institute, Indore, Madhya Pradesh, India

Abstract

Background: Conservative management of fracture shaft humerus yield in satisfactory results in most of the cases. Dilemma between dynamic compression plating and ante grade intra-medullary nailing occurs when a surgery is indicated.

Method: A total of 42 patients with fracture shaft humerus were treated surgically. 22 were subjected to plating and 20 were subjected to intra-medullary nailing. Functional outcome of patients were recorded using Constant and Murley score along with other parameters such as duration of surgery, intra-operative blood loss, complications and union time.

Results: Mean duration of surgery in plating group was 125.13 minutes and in the nailing group was 51.95 minutes. Average amount of blood loss in plating group was 209.09 ml and in nailing group was 60.5 ml. In the plating group 17 (77.27%) patients had complication free recovery period. 2 (9.09%) patients were found to have post-operative radial nerve palsy. 3 (13.63%) patients reported with superficial surgical site infection with wound dehiscence. In the nailing group 17 (85%) patients had uneventful recovery. 2 (10%) reported pain at shoulder and 1 (5%) patient complained of decreased abduction of shoulder at 1 year follow up. As per the Constant and Murley score, in the plating group 14 (63.63%) patients yielded excellent, 4 (18.18%) good, 2 (9.09%) fair and 2 (9.09%) poor results. Whereas, in the nailing group 14 (70%) patients yielded excellent, 4 (20%) good, 1 (10%) fair and 1 (10%) poor results. Mean radiological union time in plating group was 15.63 weeks and in the nailing group was 14 weeks.

Conclusion: Both intra-medullary nailing and dynamic compression plating are excellent methods for surgical fixation of shaft humerus fractures. Both of these methods yield in comparable results in terms of functional outcomes and union rates. Intra-medullary nailing holds edge over plating in terms of lesser blood loss, lesser operative time, shorter stay in hospital and less incidence of complications such as radial nerve palsy.

Keywords: Shaft humerus, dynamic compression plate, intra-medullary interlocking nailing

Address for Correspondence: Dr Pradeep Choudhari, 7/3/3, Ahilaya Mata Colony, Near Charak Hospital, Rani Sati Gate, Indore-452003, India.

Email: pchoudhari@rediffmail.com

How to site this article: Choudhari P, Baxi M, Patidar S. Fracture Shaft Humerus: Plating OR Nailing? OrthopJMPC 2016;22(1):8-14.

Introduction

Fractures of shaft humerus are those fractures which lie distal to the surgical neck of the humerus and proximal to the supra-condylar ridge distally [1]. These are frequently encountered injuries in practice with an overall incidence of 1-2% [2] of all the fractures and 14% of all fractures occurring in

humerus [3]. These occur in all the age groups with equal incidence in both the genders, while in the elderly, higher incidences are seen among females [4, 5]. High energy trauma caused by falls and motor vehicle accidents are the main etiological factors associated with these fractures in younger population, whereas low energy trauma is the commonly implicated mechanism in the elderly [4].

The first recorded evidence of these fractures date back to 17th century B.C., during the time of ancient Egypt. Writings on papyrus suggest occurrence of shaft humerus fractures and their treatment by conservative methods [6]. Nothing much has changed since ages, as most of the fractures are still treated in a similar fashion as conservative measures have remained the mainstay of the treatment. A good final outcome in these is credited to adequate coverage of the shaft with muscle and soft tissues. The wider acceptability parameters for adequate union are also encouraging for employment of non surgical measures. Acceptable parameters include 30° of varus angulation, 20° of anterior bowing, 15° of mal-rotation, and 3 cm of shortening [7].

But in recent times, in view of fulfilment of the demands of modern patients like early relief from pain, quicker return to function and faster union, a surgery is warranted in some cases. Also what encourages the surgical treatment is the fact that benefits of non-surgical treatments are not that angelic as once thought [8, 9]. In certain scenarios outcomes of surgery can be beneficial. What constitutes the absolute indications for surgery in these cases are fractures associated with neuromuscular injury, open fractures, multiply injured patient, floating elbow, a pathological fracture and failure to achieve satisfactory reduction through non-operative treatment [8,10]. Once an operative management is planned, plating or intra-medullary nailing are commonly employed measures. The precise indications for each of these procedures are unclear. Various outcome studies report benefits of one procedure over the other for both nailing and plating [11, 12].

In this study, we aim to present a comparative analysis of two series of patients operated with dynamic compression plating and ante-grade intra-medullary

interlock nailing respectively with focus over their functional outcomes, complications and other important parameters.

Materials and Methods

In this prospective study, a total of 42 patients with fracture shaft humerus treated surgically from December 2013 to November 2015 were included. Skeletally immature patients, patients not fit for surgery, patients with associated fractures, head injury; pathological or open fractures were excluded from the study. All patients with displaced fracture of humerus were selected for Surgery. Randomization was done using computer tables and patients were allocated to either plating (open reduction and internal fixation with compression plating) or nailing (closed reduction and internal fixation with ante-grade intra-medullary interlocking nailing) group. These patients were subjected to surgery three days following admission after obtaining fitness for surgery. Patients were positioned in supine position on a radiolucent table for nailing and anterolateral plating while prone position with arm hanging by side of the table used for posterior plating. All the procedures were carried out under regional anaesthesia.

As a rule, patients subjected to plating were approached with a standard anterolateral approach for fractures spanning over proximal two thirds of shaft. While distal third fractures were addressed through posterior midline approach to the shaft of humerus. After adequate reduction fixation was done with a 4.5 mm dynamic compression plate or a 4.5 mm locking compression plate with or without lag screws depending upon the fracture morphology. Reduction was visualized under IITV guidance. Minimum six cortices proximally and six distally were fixed with screws. A suction drain was put prior to closure.

Patients undergoing intra-medullary interlock nailing were approached with a skin incision given over anterolateral corner of acromion, followed by location of entry point under IITV guidance. Sequential reaming was done with reamer of 1 mm diameter above the determined nail diameter. Nail length and diameter was determined intra-operatively under fluoroscopy guidance. Two locking bolts proximally and two distally were inserted.

Limb was immobilized for initial 48 hours, following which range of motion exercises were encouraged. Removal of drain in cases of plating was done 48 hours following surgery. Full range of motion was allowed after suture removal. Patients were followed up at 6, 12, 24 weeks, 1 year and every 6 months subsequently. Functional outcome of patients were recorded using Constant and Murley score on each follow-up [13]. Radiological union was determined by taking radiographs at each follow-up. Bridging of three of the four cortices and disappearance of the fracture line on the plain radiographs in two standard orthogonal projections (antero-posterior and lateral) was considered as radiological union.

Statistical analysis was done using Graphpad Software (Trial Version) to see the difference in frequency of discrete variables in two groups.

Results

A total of 42 patients underwent surgery. 22 patients were operated with plate fixation and 20 with intra-medullary interlock nail insertion. There was no demographic difference in two groups. The mean age in plating group was 39.65 years (range 22 to 69 years) in nailing group was 41.09 years (range 20 to 62 years).

Gender - Majority of patients in both the groups were males. In the plating group 15 (68.18%) patients were male and 7

(31.81%) were female. In the nailing group 12 (60%) patients were male and 8 (40%) were female.

Mode of injury - Road traffic accidents were the most common mode of injury. 16 (72.72%) and 13 (65%) of fractures were attributed to road traffic accidents in plating and nailing groups respectively.

Duration of surgery - Mean duration of surgery was found to be more in the plating group (125.13 minutes) in comparison with nailing group (15.95 hours). There exists a statistically significant difference in these two groups. Surgical time is calculated as time taken for surgery from incision to closure of wound.

Amount of blood loss - Average amount of blood loss was higher in plating group (209.09 ml) in comparison with nailing group (60.5 ml). This difference was found to be statistically significant. Amount of blood loss is calculated by Volume of blood in Suction Flask.

Complications - In the plating group 17 (77.27%) patients had complication free recovery period. 2 (9.09%) patients were found to have post-operative radial nerve palsy. 3 (13.63%) patients reported with superficial surgical site infection with wound dehiscence. In the nailing group 17 (85%) patients had uneventful recovery. 2 (10%) reported pain at shoulder and 1 (5%) patient complained of decreased abduction of shoulder.

Mean duration of hospital stay - Mean duration of hospital stay was more in plating group (9.68 days) as compared to nailing group (4.65 days). This difference was statistically significant.

Constant and Murley score - In the plating group 14 (63.63%) patients yielded

excellent, 4 (18.18%) good and 2 (9.09%) fair and 2 (9.09%) poor results. Whereas, in the nailing group 14 (70%) patients yielded excellent, 4 (20%) good, 1 (10%) fair and 1 (10%) poor results.

Union Time - Although the mean radiological union time was shorter in nailing group (14 weeks) as compared to plating group (15.63

weeks), this difference was not statistically significant.

These results are further elaborated in Table 1, Figure 1 and 2.

Attributes		Plating Group	Intra-medullary	p value
Number of Patients (total=40)		22	20	
Age	Range (years)	22-69	20-62	
	Mean (years)	39.65	41.09	0.6351
Gender	Male	15	12	
	Female	7	8	
Mode of Injury	Traffic Accidents	16	13	
	Other	6	7	
Mean Duration of Surgery (minutes)		125.13	51.95	0.0068
Mean Amount of Blood Loss (ml)		209.09	60.5	<0.001
Mean Duration of Hospital (days)		9.68	4.65	0.0010
Complications	Number of Cases	5	3	
	Superficial Infection	3	0	
	Radial Nerve Palsy	2	0	
	Shoulder Pain	0	2	
	Decreased Shoulder	0	1	
Constant and Murley Score	Excellent	14	14	
	Good	4	4	
	Fair	2	1	
	Poor	2	1	
	Mean Grading	13.64	11.95	0.4338
Mean Radiological Union Time		15.63	14	0.06

Table 1: Table showing various results of the plating and nailing group

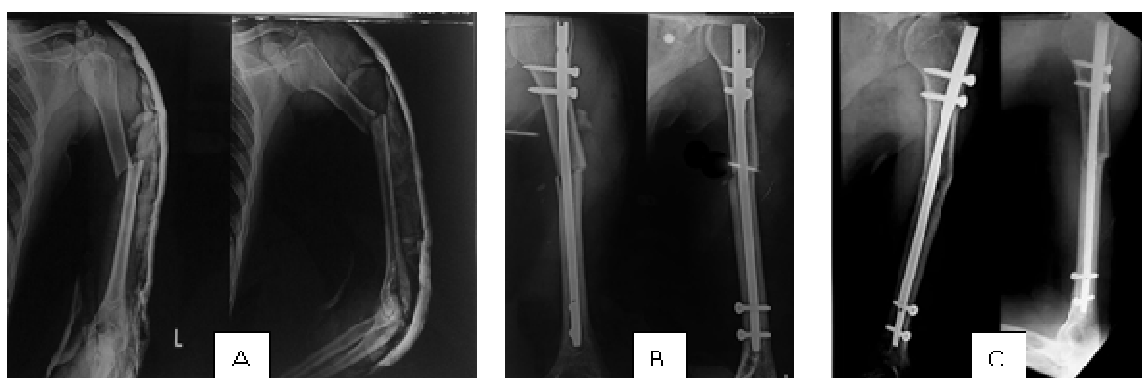


Figure 1 : 45 year old male with fracture shaft humerus treated with intra-medullary nailing. A: Pre-operative radiograph; B: Immediate post-operative radiograph; C: Radiograph on 1 year follow-up

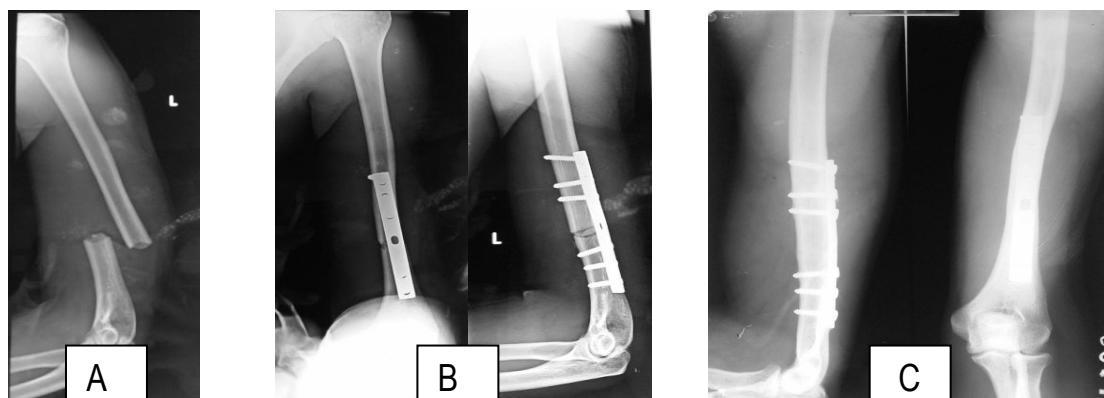


Figure 2: A 25 year old male with fracture shaft humerus treated with plating. A: Pre-operative radiograph; B: Immediate post-operative radiograph; C: Radiograph on 1 year

Discussion

Most of the humeral diaphyseal fractures are conservatively manageable, dilemma occurs when a surgery is indicated. Both compression plating and intra-medullary nailing are a surgical standard of care in such fractures. But a consensus regarding which method is better has not yet been established. In a meta-analysis of 3 studies comprising of 155 patients, Bhandari et al. could not establish a conclusive method [11]. In a series of 84 such fractures treated either with plating or intra-medullary nailing, Chapman et al. concluded both as predictable methods for fracture stabilization and ultimate healing. [12].

Traditionally, compression plating is regarded as gold standard of surgical treatment [14], yielding in high union

rates, less complications and early return to function [15]. It can be used effectively even in fractures with proximal and distal extensions. But on the flip side, it is associated with extensive soft tissue handling, periosteal stripping, longer durations of surgery, high infection rate and radial nerve palsy [16-18]. In our study the duration of surgery was more in plating group. The incidence of radial nerve palsy in various studies is reported from 6-15% [19-

21]. Similarly, in our series 2 (9.09%) patients were complicated with radial nerve palsy.

Use of intra-medullary nailing provides with advantage of biological fracture healing such as preservation of fracture haematoma, minimal handling of soft tissue and stripping of periosteum [21]. Nailing also provides advantage in terms of lesser operative time and decreased blood loss [17, 18]. Thus, making it a handy tool in management of injured patients. The same was observed in our study regarding lesser operative time and blood loss in the nailing group. Nailing has certain disadvantages. Is associated with insertion site morbidity such as impairment of shoulder movements [18, 21], impingement at acromion [17] and incursion of rotator cuff [17, 18]. Likewise, we observed shoulder pain in 2 (10%) cases and decreased shoulder movements in 1 (5%) case operated with intra-medullary nailing. Incidence of non-union is higher due to propensity of shaft humerus for residual fracture site distraction following nailing [22] and thus ultimately leading to higher re-operation rates [11, 12, 23]. Although in our series none of the patients reported non union and none were subjected to re-surgery.

In a randomized controlled trial, Changulani et al. in their series of 47 patients reported similar union rates in both the groups, but

shorter healing time in nailing group and lesser shoulder mobility in plating group [24]. Similarly in this study we found that there no significant dissimilarities between both the groups in terms of union time and functional outcome but intra-medullary nailing is superior to plating in terms of lesser surgical time and lesser blood loss. Whereas it is associated with more shoulder morbidity as compared to plating.

There are certain limitations of the study. Sample size and secondly follow up period is too less for effective analysis and placing a firm conclusion.

Conclusion

Both intra-medullary nailing and plating are excellent method for surgical fixation of shaft humerus fractures. Both of these methods yield in comparable results in terms of functional outcomes and union rates. Intra-medullary nailing holds edge over plating in terms of lesser blood loss and operative time and less incidence of complication such as radial nerve palsy.

References

1. Schemitsch EH, Bhandari M. Fractures of the diaphyseal humerus. Skeletal trauma, 3rd edn. WB Saunders, Toronto. 2001:1481-511.
2. Brinker MR, O'Connor DP. The incidence of fractures and dislocations referred for orthopaedic services in a capitated population. J Bone Joint Surg Am. 2004; 86(2):290-7.
3. Lovald S, Mercer D, Hanson J, Cowgill I, Erdman M, Robinson P, Diamond B. Complications and hardware removal after open reduction and internal fixation of humeral fractures. Journal of Trauma and Acute Care Surgery. 2011; 70(5):1273-8.
4. Ekholm R, Adami J, Tidermark J, Hansson K, Törnkvist H, Ponzer S. Fractures of the shaft of the humerus an epidemiological study of 401 fractures. Journal of Bone & Joint Surgery, British Volume. 2006; 88(11):1469-73.
5. Tytherleigh-Strong G, Walls N, McQueen MM. The epidemiology of humeral shaft fractures. Journal of Bone & Joint Surgery, British Volume. 1998; 80(2):249-53.
6. Sullivan R. The identity and work of the ancient Egyptian surgeon. J R Soc Med. 1996; 89(8):467-473.
7. Klenerman L. Fractures of the shaft of the humerus. Journal of Bone & Joint Surgery, British Volume. 1966; 48(1):105-11.
8. Denard A, Richards JE, Obrebsky WT, Tucker MC, Floyd M, Herzog GA. Outcome of nonoperative vs operative treatment of humeral shaft fractures: a retrospective study of 213 patients. Orthopedics. 2010; 33(8).
9. Rutgers M, Ring D. Treatment of diaphyseal fractures of the humerus using a functional brace. Journal of orthopaedic trauma. 2006 Oct 1; 20(9):597-601.
10. Templeman DC, Sims SA. Humeral shaft fractures. Surgical treatment of orthopaedic trauma. New York: Thieme Medical Publishers, Inc. 2007:263-84.
11. Bhandari M, Devereaux PJ, D Mckee M, H Schemitsch E. Compression plating versus intramedullary nailing of humeral shaft fractures—a meta-analysis. Acta orthopaedica. 2006 Jan 1; 77(2):279-84.
12. Chapman JR, Henley MB, Agel J, Benca PJ. Randomized prospective study of humeral shaft fracture fixation: intramedullary nails versus plates. Journal of orthopaedic trauma. 2000 Mar 1; 14(3):162-6.
13. Constant CR, Murley AG. A clinical method of functional assessment of the shoulder. Clinical orthopaedics and related research. 1987 Jan 1; 214:160-4.
14. Mauch J, Renner N, Rikli D. [Intramedullary nailing of humeral shaft fractures--initial experiences with an unreamed humerus nail]. Swiss surgery= Schweizer Chirurgie= Chirurgie suisse= Chirurgia svizzera. 1999 Dec; 6(6):299-303.
15. Tingstad EM, Wolinsky PR, Shyr Y, Johnson KD. Effect of immediate weightbearing on plated fractures of the humeral shaft. Journal of Trauma and Acute Care Surgery. 2000 Aug 1; 49(2):278-80.
16. Ingman AM, Waters DA. Locked intramedullary nailing of humeral shaft fractures. Implant design, surgical technique, and clinical results. Journal of Bone & Joint Surgery, British Volume. 1994 Jan 1; 76(1):23-9.
17. Watanabe RS. Intramedullary fixation of complicated fractures of the humeral shaft. Clinical orthopaedics and related research. 1993 Jul 1; 292:255-63.
18. Hall RF, Pankovich AM. Ender nailing of acute fractures of the humerus. A study of closed fixation by intramedullary nails without reaming.

- J Bone Joint Surg Am. 1987 Apr 1; 69(4):558-67.
19. Garcia A, Maeck BH. Radial nerve injuries in fractures of the shaft of the humerus. The American Journal of Surgery. 1960 May 31; 99(5):625-7.
 20. Kettelkamp DB, Alexander H. Clinical review of radial nerve injury. Journal of Trauma and Acute Care Surgery. 1967 May 1; 7(3):424-32.
 21. Christensen NO. Kuntscher Intramedullary Reaming and Nail Fixation for Nonunion of the Humerus. Clinical orthopaedics and related research. 1976 May 1; 116:222-6.
 22. Brumback RJ, Bosse MJ, Poka A, Burgess AR. Intramedullary stabilization of humeral shaft fractures in patients with multiple trauma. J Bone Joint Surg Am. 1986 Sep 1; 68(7):960-70.
 23. Bolano L. E., Iaquinto J. A., Vasicek V. Operative treatment of humerus shaft fractures: A prospective randomized study comparing intramedullary nailing with dynamic compression plating. Presented at the Annual Meeting of the American Academy of Orthopaedic Surgeons. 1995
 24. Changulani M, Jain UK, Keswani T. Comparison of the use of the humerus intramedullary nail and dynamic compression plate for the management of diaphyseal fractures of the humerus. A randomised controlled study. International orthopaedics. 2007 Jun 1; 31(3):391-5.