

An Observational study to Compare the Clinical Outcomes of Antegrade and Retrograde Nailing in Humerus Fracture.

Narendra Kumar Sinha¹

¹Associate Professor, Department of Orthopedics, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India

Received: 01-08-2021/ Revised: 23-08-2021 / Accepted: 09-10-2021

Abstract

Background: Fractures of the humeral shaft account for approximately 3% of all fractures. Intramedullary nailing is a minimally invasive osteosynthesis procedure. **Aim:** This study aimed to compare antegrade nailing with retrograde nailing with respect to clinical aspects of both the procedures. **Methods:** Patients aged 18 years or above with fracture humerus were consented to be enrolled for the study, excluding patient younger than 18 years of age, or patients with open fracture, or those with pre-existing elbow or shoulder problems. Clinical history of all patients were noted along with all clinical variables like mode of injury and associated injuries. Patients were followed up at 8,12,16 weeks and were assessed clinically and radiologically. Clinical outcomes of the patients were compared statistically. **Results:** We included 88 patients in this study, 34 underwent antegrade nailing and 54 underwent retrograde nailing. According to Orthopedic Trauma Association classification majority of the patients belonged to Type A. Operating bleeding was 80 ml in antegrade nailing and 50 ml in retrograde nailing, with no statistical difference. Operating time was found to be lower in antegrade nailing. However, fracture healing rate and time to healing were better in retrograde nailing (96% and 11.9 weeks), with statistical significance. **Conclusion:** Retrograde nailing had better perioperative and postoperative parameters like fracture healing rate and time to healing.

Keywords: Intermedullary nailing, fracture humerus, trauma, healing time.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Fractures of the humeral shaft account for approximately 3% of all fractures and represent an incidence of 19 per 100,000 person-years.[1] The occurrence shows a bimodal age distribution with a peak observed in the third decade mainly in males as a result of violent high-velocity injuries and a larger peak in the seventh decade mainly occurring in females, generally resulting from simple fall and attributed to osteoporotic bone.[2] Fractures of the humerus can occur proximally, at the shaft, or distally. The majority of both proximal and midshaft humerus fractures are nondisplaced and can be treated nonsurgically. The primary causes of fracture include traffic accident, accidental falls, and violent injury. The incidence of proximal humerus fractures increases with age, with more than 70 percent occurring in patients over 60 years of age and the highest incidence among 73 to 78 year olds.[3] In elderly individuals, falls are the most common cause of proximal humerus fractures; approximately 87 to 93% of fractures occur after a fall from standing. Based on available evidence and broad clinical experience, approximately 70 to 80% of humeral shaft fractures can be treated non-surgically, but some require functional bracing or use of traction for adequate treatment.[4] Intramedullary nailing is an alternative minimally invasive osteosynthesis procedure. It offers the possibility of antegrade and retrograde nailing options depending on fracture height or preference of entry point. Through this study we wanted to compare antegrade nailing with retrograde nailing with respect to clinical aspects of both the procedures.

*Correspondence

Dr. Narendra Kumar Sinha

Associate Professor, Department of Orthopedics, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India

E-mail: nkaditi@gmail.com

Materials and Methods

Study Design and sampling

This prospective study was conducted at Department of Orthopedics, at Vardhman Institute of Medical Sciences, Pawapuri. The study was approved by institutional research and ethical research committee. The study was conducted over a period of 02 years from August 2017 to July 2019. Informed consent was taken from all the participants after explaining the study protocol.

All patients who presented in the emergency ward and later to OPD ward, satisfying our eligibility criteria were enrolled for the study. Patients either underwent antegrade nailing or retrograde nailing, the modality was decided by the treating surgeon. Although there was no absolute criteria for selecting the method of nailing, retrograde nailing generally was preferred for patients with fractures of the distal humerus shaft. Then these patients were prospectively followed for a minimum period of 8 months during which any change in patient symptoms was noted. All consecutive patients aged 18 years or above, who presented with fracture humerus during the study period who consented to be enrolled for the study were included. Only those patients underwent surgical procedure if the fracture was unstable, loss of reduction after attempted closed reduction, fracture shaft humerus in polytrauma, segmental fracture and fracture humerus with radial nerve injury after manipulation. We excluded patient younger than 18 years of age, or patients with open fracture, or those with pre-existing elbow or shoulder problems. All nails used were stainless steel with average size of 6mm.

Data Collection and Data Analysis

All patients received initial management and pre-operative assessments were done using x-rays. Appropriate nail size and diameter were assessed pre-operatively using x-rays. At the time of enrollment, demographic information of the patient was noted from the medical records. Clinical history of all patients were noted

along with all clinical variables like mode of injury and associated injuries. Perioperative and postoperative notes and parameters were recorded. Patients were followed up at 8, 12, 16 weeks and were assessed clinically and radiologically and radiographs showed bridging callus across three cortices. We entered the data in to SPSS software, version 11 (SPSS Inc, Chicago, IL). The values obtained for each method were compared with use of 95% confidence intervals, which provide a statistical upper limit below which one would expect the true difference to lie. Student's t tests was used to compare continuous variables. Chi-square test or Fisher exact test if

cell counts were less than five was used to compare categorical variables.

Results

We included 88 patients in this study. 34 underwent antegrade nailing and 54 underwent retrograde nailing. Average age of patients who underwent antegrade nailing was 48.5 years and that of retrograde nailing was 49.8 years. According to Orthopedic Trauma Association classification majority of the patients belonged to Type A. [Table 1]

Table 1: Characteristics of patients included in the study.

Variable	Antegrade nailing	Retrograde nailing
Number of patients	34	54
Males:Female	20:14	32:22
Average age	48.5±14.2 years	49.8±16.3 years
OTA classification		
Type A	18	39
Type B	9	10
Type C	7	5
Trauma type		
Motor vehicle accident	9	10
Motorcycle accident	18	24
Fall	4	8
Pedestrian	1	8
Others	2	4
Associated injuries		
Head injuries	5	8
Chest/Abdomen	11	19
Fractures	18	27

Motor vehicle and motorcycle accidents was the most common mode of trauma in our patient population, followed by falls. Fracture of other bones were the most common associated injuries seen in the patients. Operating bleeding was 80 ml in antegrade nailing and 50

ml in retrograde nailing, with no statistical difference. Operating time was found to be lower in antegrade nailing. However, fracture healing rate and time to healing were better in retrograde nailing (96% and 11.9 weeks), with statistical significance [Table 2].

Table 2: Peri-operative and post-operative differences.

Variable	Antegrade nailing	Retrograde nailing	P value
Operative bleeding (mL)	80±18	50±27	0.48
Operation time (mins)	62.4±18.8	72.9±10.8	<0.01
Fracture healing time	31 (91%)	52 (96%)	0.02
Time to healing (weeks)	12.2±4.2	11.9±3.4	0.03

Discussion

The success of intramedullary nailing in the upper extremities caused enthusiasm an attempt for intramedullary nailing of the humeral shaft. Although there are many reports in the literature of good results with nailing techniques, problems with insertion site morbidity and union rates have dampened the original enthusiasm for this modality of treatment. The first interlocked humeral nail was described by Derweduwen in 1979, but experience remained small.[5] In the 1980s, the Seidel nail was introduced. Literature has reported views ranging from great enthusiasm to strong criticism of this modality. Criticism was based mainly on concerns regarding the large diameter of the nail and that it had to be inserted in ante grade fashion. In ante grade nailing large entry portal in the humeral head and reaming are always necessary. If the distal bolt are loosened then it creates rotational instability, with proximal migration of the nail and shoulder impingement. Russell-Taylor nail's retrograde insertion proved to be easy and trustworthy, but problems with this modality include the targeting device which is bulky, the solitary interlocking possibility proximally and distally, and absent inter fragmentary compression. Shoulder pain has been reported after ante grade intramedullary nailing in 16% to 37% of patients in more recent studies, and Bhandari et al. found that reoperation and shoulder impingement were significantly more common after intramedullary

nailing than after plate fixation. 88 patients with acute humeral fractures were followed up for a mean of 8 months. The decision as to which fracture would be stabilized through ante grade or retrograde nail insertion was left to the treating surgeon. In about 61% of the cases retrograde insertion was preferred. Retrograde humerus nailing is best performed with the patient in a prone position. The distal part of the triceps tendon and muscle is split longitudinally and the humerus cortex is opened just proximal to the olecranon fossa. The entry point is carefully enlarged with a burr to avoid supracondylar fractures. Even then the risk for this complication is rather high and occurs mostly in young females with narrow medullary canals. Ante grade nailing is performed with the patient in a supine or in beach- chair position. Exposure is through a small anterolateral Trans deltoid approach, starting at the acromion, and should not extend more than 6 cm distally to avoid axillary nerve injury. Depending on the nail design, straight nails are inserted just medial to tip of greater tuberosity of the humerus, and proximally angled nails are inserted at the bone-cartilage transition of the humeral head. Distal interlocking of the nail has to be performed with great caution to prevent injuring the median nerve, the radial nerve, or the brachial artery. An ante grade approach is most commonly used for intramedullary nail fixation of humeral shaft fractures in adults. The specific portal placement is controversial,

however. Several authors have postulated that shoulder pain after ante grade nailing is caused by the transverse incision through the rotator cuff. Alternatives to ante grade humeral nailing should be considered in patients who have pre-existing shoulder pathology or who require upper extremity weight bearing for ambulation.[6] Because of the frequency of shoulder pain after ante grade insertion, retrograde insertion has been advocated to avoid this complication; however, retrograde insertion has been associated with distal humeral fracture propagation. The traditional starting point for retrograde humeral nailing is in the midline, 2 cm above the olecranon fossa. More recently, insertion through the superior aspect of the olecranon fossa has been recommended. Newer self-locking expandable nails are reported to be easier to insert, while providing bending and torsional stiffness equal to that of locked nails. Few clinical studies are available to allow evaluation of these nails. Franck et al described the use of an expandable nail for fixation of 25 unstable humeral shaft fractures in elderly patients with osteoporotic bone; all fractures healed without complications.[7] Stannard et al used a flexible locking nail inserted through an extra articular ante grade or retrograde portal for fixation of 42 humeral shaft fractures, with healing in 39; 86% had full range of motion, and 90% had no pain.[8]

Conclusion

In our experience, retrograde nailing had better perioperative and postoperative parameters like fracture healing rate and time to healing. Future research should focus on weighing the benefits against complication rates of both the procedures and compare the long term functional outcomes of both the procedures.

Conflict of Interest: Nil

Source of support: Nil

References

1. Huttunen TT, Kannus P, Mattila VM. Surgical treatment of humeral-shaft fractures: a register-based study in Finland between 1987 and 2009. *Injury*. 2012; 43(10):1704-8.
2. Tytherleigh-Strong G, Walls N. The epidemiology of humeral shaft fractures. *J Bone Joint Surg Br*. 1998; 80(2):249-53.
3. Palvanen M, Kannus P, Niemi S, Parkkari J. Update in the epidemiology of proximal humeral fractures. *Clin Orthop Relat Res*. 2006; 442:87.
4. Kristiansen B, Angermann P, Larsen TK. Functional results following fractures of the proximal humerus. A controlled clinical study comparing two periods of immobilization. *Arch Orthop Trauma Surg*. 1989; 108:339.
5. Derweduwen J. A new intramedullary compression device for fractures and pseudarthrosis of the long bones. *Acta Orthop Belg*. 1979; 45:659-665.
6. Denard A Jr, Richards JE, Obremskey WT. Outcome of nonoperative vs operative treatment of humeral shaft fractures: a retrospective study of 213 patients. *Orthopedics*. 2010; 33-7.
7. Franck WM, Olivieri M, Jannasch O, Hennig FF. Expandable nail system for osteoporotic humeral shaft fractures: preliminary results. *Journal of Trauma and Acute Care Surgery*. 2003; 54(6):1152-8.
8. Stannard JP, Harris HW, McGwin G, Volgas DA, Alonso JE. Intramedullary nailing of humeral shaft fractures with a locking flexible nail. *J Bone Joint Surg Am*. 2003; 85(11):2103-10.