

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

### **RESEARCH ARTICLE**

# Results of early mobilisation in diaphyseal fractures of humeral shaft treated by Intramedullary nailing

Nital Gupta, Shafiq Hackla, Shabir Ahmed, Sudesh Shar
---

Titul Supu, Sharq Lucha, Shaon Timee, Saacsi Sharma, Tim Supu.

### Manuscript Info

#### Abstract

Manuscript History:

Received: 18 May 2015 Final Accepted: 22 June 2015 Published Online: July 2015

Key words:

\*Corresponding Author

••••••

Nital Gupta

Fractures of the humeral shaft are usually the result of high energy trauma. The humeral diaphyseal fracture has been constantly surrounded by the controversy of its management. The techniques of interlocking nail fixation represents a newer approach to treatment of humeral fractures which provides all the advantages of the intra-medullary nail besides that it provides better rotational control. We studied the role of early mobilisation in humeral fractures treated by interlocking nail.

#### METHODS AND MATERIAL

A prospective study was conducted in a tertiary care hospital from 2011 to 2014. Twenty patients were selected who met the inclusion criteria for the study. The post-op protocol was followed from first day and the final functional results were assessed at the end of 1 year in terms of union rate, Shoulder and elbow movements and American Shoulder and Elbow Surgeons (ASES) score.

#### RESULTS

There were 20 patients out of which 12 were males and 8 were females. The average radiological union time was 13.5 weeks. The ASES Score was > 40 in 2 patients, 30-39 in 16 patients and < 30 in rest 2. The overall result was excellent in 2, good in 16 and poor in 2 patients.

#### CONCLUSION

On the basis of this study, we found that the fixation of humeral shaft fractures with interlocking nail is a good alternative to management with other fixation methods with the advantage of early mobilisation of the extremity and low incidence of complications if done properly.

Copy Right, IJAR, 2015,. All rights reserved

#### INTRODUCTION

The humerus is the longest and largest bone of the upper extremity. About 5-10 % of all long bone fractures occur in the humerus and 60% of these fractures occur under 30 years of age. The different treatment options like non-operative includes hanging arm cast, shoulder spica, functional bracing etc. in 90% of the patients. Operative treatment like plating, External fixator and intra-medullary nailing in specific situations like failure of conservative treatment, unacceptable alignment, open fractures, segmental fracture etc. The treatment by closed locked intra-medullary nailing is able to maintain alignment of unstable fracture pattern preventing fracture shortening and rotation. It is a less invasive surgery and reaming can yield auto graft material. Mechanical advantages includes smaller bending loads than plates and less likely to fail, minimal stress shielding with cortical osteopenia, decrease chances of re-fracture and automatic reestablishment of osseous realignment.

Our study was aimed at assessing this form of treatment of fractures of humeral shaft with regard to achieving stability and union, incidence and pattern of complications, restoring functions, determining advantages and disadvantages of this procedure and effect of early mobilisation on fracture union.

# METHODS AND MATERIAL

A prospective study was conducted in a tertiary care hospital from Oct. 2011 to Dec. 2014 with follow up of 1 year. Twenty patients with the fracture of humeral shaft were included in the study. The inclusion criteria include closed diaphyseal fracture of humerus < 3 weeks old and type 1 and 2 open fractures reaching the hospital within 6 hours. The age and sex, laterality, mode of the injury and compounding of the fracture site if any were noted. Emergency toileting of the wound, antibiotics and immobilisation of the affected extremity was done. Radiographs, routine clinical investigations, pre-anaesthetic check-up was done and patient prepared for the surgery.

## SURGICAL TECHNIQUE

We used supine position with a sandbag placed under the ipsilateral scapula and shoulder in 30 degree of extension to bring the head of humerus out of acromion recess. An assistant was holding the limb with elbow flexed and shoulder extended. A longitudinal incision measuring 3cms was made over anterolateral deltoid at its origin and awl was passed about 1 cm medial to upper edge of greater tuberosity under vision to make an entry portal for the nail. Position of the awl was checked under C-arm. After achieving trial of closed reduction, a guide wire was passed in the medullary cavity and its position in the distal fragment was confirmed. Sequential reaming up to pre-determined diameter usually 1 to 1.5mm larger than nail diameter was done. While assistant maintains the reduction, the nail of the appropriate length and diameter, was passed till the proximal end is flushed with the articular cartilage of the greater tuberosity. Next the locking of the nail was performed, keeping the limb in correct rotation and axis using jig for proximal locking and free hand technique for distal locking. The incision was closed in layers and antiseptic dressing was applied.

Post-operatively, shoulder arm pouch was applied just after operation. The limb was elevated by suspension with abduction and external rotation at the shoulder on first post-op day. From 2<sup>nd</sup> post-op day, active assisted and passive movements were begin, including pendulum exercises and assisted full forward flexion within limits of the pain. Overhead abduction, external rotation and internal rotation exercise was begin on 7<sup>th</sup> post-op day. Patients were followed up at 1month, 3 month, 6 month and 1 year. The patients were assessed by American Shoulder and Elbow Surgeons (ASES) Score and radiologically by noting the evidence of union. The final functional score was assessed at 6 months and 1 year. The functional results graded as

1. Excellent: ASES score > 40, union in <12 weeks and range of motion of shoulder or elbow within 10 degree of normal.

2. Good: ASES score 30-39, painless shoulder abduction of 120 degree, loss of elbow flexion or extension of not >20 degree and union in 12-16 weeks.

3. Poor: ASES score <30, painful arc of motion either shoulder or elbow and union >16 weeks.

Complications of the procedure were also noted.

# RESULTS

20 patients were included in the study. There were 12 (60%) males and 8(40%) females. The mean age of the patients was 35.6 years with youngest being 19 years and oldest being 53 years. 11(55%) patients were having fractured right limb and 9(45%) with left limb. The middle of shaft was fractured in 14(70%) patients. The mode of injury was road traffic accident in 12(60%) patients and fall in 8(40%) patients. Fracture classification according to AO, fracture type A in 13(65%), type B in 5(25%), and type C 2 (10%) patients. Open fractures were present in 2 patients and rests were closed injuries. Associated injuries were present in 5(25%) patients. These injuries include fractures of both bones of forearm in 2 patients, haemothorax in 1 patient and closed head injury in 1 patient. The average injury to surgery interval was 7.5 days most patients being operated in 4-14 days. The average operating time was 45 minutes to 1 hour.

The average radiological union time was 13.5 weeks with majority (70%) uniting by 16 weeks. There was one case of delayed union and was treated by secondary bone grafting and dynamisation. Shoulder stiffness was most commonly encountered complication in 3 (15%) patients followed by shoulder impingement, elbow stiffness and superficial infection in one patient each. The final functional result in term of ASES Score was > 40 in 2 patients, 30-39 in 16 patients and < 30 in 2 patients. The final overall results based on union rate, ASES score and shoulder & elbow stiffness was excellent in 2(10%), good in 16(80%) and poor in 2(10%) patients.

## DISCUSSION

The humerus is the longest bone of the upper extremity. Fractures of humeral shaft occur in 20% of the patients out of which 60% of these fractures occur under 30 years of the age. Fractures of the humeral shaft in the young adult are usually the result of high energy road traffic accidents while falls from height, trivial trauma leads to fractures in osteoporotic patients. Fractures of humeral shaft can be caused by 3 main mechanisms: Direct, Indirect and Muscular forces. The AO classification is preferable in humeral shaft fractures. It classifies the fractures into type A: simple fractures, type B: wedge fractures and type c: complex fractures which are then sub classified into subtypes. The humeral diaphyseal fracture has been constantly surrounded by the controversy of its management since the times when Caldwell introduced hanging arm cast by closed methods. Many methods have been described for the treatment of humeral diaphyseal fractures. Good to excellent results have been reported in most series treated closed or with open reduction and internal fixation. Conservative methods include dependency traction, hanging arm cast, co-aptation brachial splint, skeletal traction, thoracobrachial immobilization, Velpeau dressing, thoracobrachial spica cast, simple sling and swathe immobilization and functional bracing. Surgical methods are fixation with plates

and screw, intra-medullary nailing and external fixation. Indications for the operation are fractures with unacceptable alignment, polytrama, open fractures, segmental fracture, floating elbow, vascular injury and bilateral humeral fractures to name a few.

Simple humeral shaft fractures can be treated non-operatively with good results in most cases. The non-operative treatment requires a long period of immobilisation, which carries a risk of prolonged shoulder joint stiffness and may be inconvient for the patient. Furthermore, non-union after conservative treatment of these fractures does occur in 10% of the cases and treatment of this condition can be very difficult. Now there is growing interest in treating even simple humeral shaft fractures by intra-medullary nail or plating in order to avoid these problems and to allow early mobilization and rapid return to work. As a result of recent technical advances, there is growing interest in the use of humeral intra-medullary nail which can be inserted into the humerus antegrade, from the shoulder or retrograde, from the elbow. Theoretically, fixation by intra-medullary nailing requires less invasive surgery and reaming can yield autograft material. The biomechanics are improved with higher moments of inertia and load sharing capabilities but at the cost of postoperative shoulder pain.

Hall et al (1987) in prospective study of 89 patients using intra-medullary nails achieved excellent functional results. All but one fractures united in an average time of 7.2 weeks. They concluded that intra-medullary Enders nailing can be effectively and safely in fractures recalcitrant to closed reduction. Jin Linn (1998) reported humeral locked nailing had significantly shorter operative time, less blood loss and eventual union was achieved better in nail than in plate fixation. Kropfl et al (2000) conducted prospective study of 111 humeral fractures stabilized with unreamed antegrade nailing and stated that it is a safe technique with advantage of early mobilization. Vecsei et al (2001) compared seidel nail and unreamed humeral nail (UHN). They concluded that UHN can be inserted antegradely as well as retrogradely and provides the possibility of compressing the fracture resulting high rotational stability. Karatagalis et al found a dependable solution in 39 patients treated by locked antegrade nailing particularly in segmental fractures and polytrauma patients. Park et al evaluated 34 fractures followed for average of 34 months who underwent antegrade humeral nailing through rotator cuff interval and concluded that the overall satisfaction rate was more than 90% according to ASES score and primary bone union was achieved in 32 cases. Changulani et al concluded that intra-medullary nailing can be considered a better surgical option as it offers short union time and lower incidence of serious infection, however there appears no difference in functional outcome between two groups.

Interlocked nailing gave acceptable results in 90% of the cases and complications were mainly concerning shoulder function (stiffness & impingement) which improved with physiotherapy and removal of nail after solid union. We found that the fixation of humeral shaft fractures is a good alternative to management with other fixation methods with the advantage of early mobilization of the extremity and low incidence of complications if done properly. Poor functional outcome mainly attributed to nail impingement and delayed union in our series can be markedly reduced by countersinking the nail tip & meticulous repair of rotator cuff and by avoiding fracture distraction, we can avoid the potential for delayed union.

## **CONFLICT OF INTEREST: NIL**

ETHICAL STANDARDS: According to Helsinki declaration

1. All patients gave informed consent prior to being included into the study.

2. All the procedures performed in studies involving human participants were in accordance with the ethical standards of the institution and / or national research committee and with the Helsinki deceleration and its later amendments or comparable ethical standards.

### REFERENCES

1. Bhandari M, Devereaux PJ, McKee MD, Schemitsch EH.(2006): Compression plating versus intramedullary nailing of humeral shaft fractures: A meta-analysis. Acta Orthop; 77(2):279-84.

2. Bohler L.(1965) Conservative treatment of fresh closed fractures of the shaft of the humerus. J Trauma; 5: 464-8.

3. Caldwell JA.(1940) Treatment of fracture shaft humerus by hanging cast. Gynae and Obst ; 70: 421-5.

4. Chandler RN, Rockwood CA jr. (1996) Principles of internal fixation: fractures in adult;1(4): 159.

5. Changulani M, Jain UK, Keswani T. (2007) Comparison of the use of the humerus intra-medullary nail and dynamic compression plate for the management of diaphyseal fractures of the humerus: A randomised controlled study. Int Orthop; 31(3): 391-5.

6. Crates J, Whittle AP. (1998): Antegrade interlocking nailing of acute humeral fractures. Clin Orthop relat res; 350: 40-50.

7. Flinkkila T, Hyvonen P, Siira P, Hamalainen M. (2004): Recovery of shoulder function after humeral shaft fracture: A comparative study between antegrade intra-medullary nailing and plate fixation. J Orthop Trauma Surg; 124(8): 537-41.

8. Farragos AF, Schemitsch EH, McKee MD. (1999): Complications of intra-medullary nailing for the fracture of humeral shaft: A systemic review. J Orthop Trauma; 13: 258-67.

9. Garnavos C. (2011): Diaphyseal humeral fractures and intra-medullary nailing: Can we improve outcomes? Indian J Orthop; 45: 208-15.

10. Gregory PR, Sanders RW. (1997): Compression plating versus intra-medullary fixation of humeral shaft fractures. J Am Acad Orth Surg; 5: 215-23.

11. Hall RF, Pankovich AM. (1987): Ender nailing of acute fracture of humerus: A study of closed fixation by intramedullary nails without reaming. J Bone Joint Surg ; 69: 558-67.

12. Healy WL, White GM, Mick CA.(1987): Non-union of humerus shaft. Clin Orthop ; 219:206-13.

13. Heim D, Herkert F, Hess P, Regazzoni P.(1993): Surgical treatment of humeral shaft fractures: A basal experience. J Trauma; 35:226-32.

14. Linn J. (1998): Comparative study for the treatment of humeral shaft fracture with humeral locking nail and plate fixation. J Orthop Trauma; 44(5): 859-64.

15. Klenerman L.(1966): Fractures of the shaft of the humerus. J Bone Joint Surg ; 48:105-11.

16. Kropfl A, Naglik H, Niederwieser B, Hertz H. (2000): Unreamed antegrade humeral nailing. Unfallchirug; 103(5):348-50.

17. Mueller CA, Henle P, Konrad G.(2007): The AO/ASIF Flexnail: A flexible intra-medullary nail for the treatment of humeral shaft fractures. Unfallchirug; 110(3):219-25.

18. Park JY, Pandher DS, Chun JY, Md ST. (2008): Antegrade humeral nailing through rotator cuff interval: A new entry portal. J Orthop Trauma; 22(6):419-25.

19. Pogliacomi F, Devecchi A, Costantino C, Vaienti E. (2008): Functional long term outcome of the shoulder after antegrade intra-medullary nailing in humeral diaphyseal fractures. Chir Organi Mov; 92(1):6-11.

20. Sarmiento A, Zagorski JB, Zych DO, Latta LL, Capps CA.(2000): Functional bracing for the treatment of the humeral diaphysis. J Bone Joint Surg; 82: 478-86.

21. Shyamsundar BN. (2005): The functional outcome of antegrade unreamed humeral interlocking nailing in adults. J Orthopaedics; 2(1):2.

22. Stannard JP, Harris HW, McGwin G jr, Volgas DA, Alonso JE. (2003): Intra-medullary nailing of humeral shaft fractures with a locking flexible nail. J Bone Joint Surg Am; 85(11):2103-10.



FIG 1 shows fracture of the humeral shaft

![](_page_5_Picture_2.jpeg)

FIG 2 shows post-op radiograph showing AP and lateral view of humerus having intra-medullary Nail and locking screws

![](_page_6_Picture_2.jpeg)

```
FIG 3 shows fracture callus after 16 weeks
```

![](_page_7_Picture_2.jpeg)

FIG 4 shows shoulder range of movements

![](_page_8_Picture_2.jpeg)

UNION TIME (WEEKS)	NUMBER OF THE PATIENTS (%)	
8	4(20%)	
12	10(50%)	
16	3(15%)	
20	2(10%)	
24	0(0%)	
>24	1(5%)	
TOTAL	20(100%)	

TABLE 1 shows radiological union time of the patients

POST-OPERATIVE COMPLICATIONS	NUMBER OF THE PATIENTS (%)
Shoulder stiffness	3(15%)
Shoulder impingement	1(5%)
Elbow stiffness	1(5%)
Superficial infection	1(5%)
Delayed union	1(5%)
TOTAL	7(35%)

Table 2 shows post-operative complications

Table 3 shows final functional results on the basis of ASES score

ASES SCORE	NO. OF THE PATIENTS(%)	
>40	2(10%)	
30-39	16(80%)	
<30	2(10%)	
TOTAL	20(100%)	

RESULTS	NO. OF CASES	PERCENTAGE
EXCELLENT	2	10
GOOD	16	80
POOR	2	10

Table 4 shows the overall result based on the union rate, ASES score and shoulder& elbow range of motion