



E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2021; 7(1): 926-929  
© 2021 IJOS  
[www.orthopaper.com](http://www.orthopaper.com)  
Received: 15-11-2020  
Accepted: 05-01-2021

**Dr. Chetan L Rathod**  
Associate Professor, Department  
of Orthopedics, Dhanalakshmi  
Medical College Perambalur,  
Tamil Nadu, India

**Dr. Rajesh Kumar**  
Assistant Professor, Department  
of Orthopedics, Dhanalakshmi  
Medical College Perambalur,  
Tamil Nadu, India

## Clinical management of humerus fracture using intramedullary humerus nailing system

**Dr. Chetan L Rathod and Dr. Rajesh Kumar**

**DOI:** <https://doi.org/10.22271/ortho.2021.v7.i1n.2590>

### Abstract

**Introduction:** Intramedullary nail fixation has gained popularity and interest for the treatment of operative proximal humeral fractures. A diaphyseal fracture of the humerus is a common event accounting of approximately 3-5% of all fracture. Hence the present study was conducted with the aim to check the efficacy of interlocking nails in the treatment of diaphyseal fracture of humerus in adults.

**Materials and Methods:** A total of 40 patients who satisfied the criteria were included in the study. All the patients were followed up at monthly interval for the first 3 months later at 2 monthly intervals till fracture union and once in 6 months till the completion of study. They were examined in details clinically and special stress was laid on shoulder and elbow range of movements and subjective complaints.

**Results:** The overall results were analysed at the end of the study. The excellent result was obtained in the 24 patients, good result was obtain in 12 patients and poor result was found in 4 patients. Along the humerus fracture, there were 10 patients who had associated fracture.

**Discussion and Conclusion:** Compared to other surgical modalities, closed intramedullary interlocking nailing is the least invasive surgical technique and has got least chance of post-operative infection and also reduces the hospital stay. Excellent results were seen in patients with associated injuries when humeral diaphyseal fractures were fixed with intramedullary interlocking nail as shown in the reduction in operative time and early rehabilitation. The advantages of intramedullary nailing are minimal surgical exposure, better biological fixation, and minimal disturbances of soft tissues and early mobilization of neighbouring joints.

**Keywords:** Disphyseal fracture, humerus, fracture, Intermedullary nail, grading

### Introduction

The humerus is the long bone of your upper arm. It extends from your shoulder to your elbow, where it joins with the ulna and radius bones of your forearm. A humerus fracture refers to any break in this bone. Any hard blow or injury to your arm can result in a humerus fracture, but some are more likely to cause certain types. A high-impact collision, such as a car accident or football tackle, is more likely to cause a distal humerus fracture <sup>[1, 2]</sup>.

Humerus fractures can also be pathologic fractures, which happen as the result of a condition that weakens your bones <sup>[3]</sup>. This leaves your bones more vulnerable to breaks from everyday activities that wouldn't usually cause any injuries. Things that can cause pathologic humerus fractures include: osteoporosis, bone cancer, bone cysts or tumors, bone infection <sup>[4]</sup>.

Humerus fractures comprise 1-7% of all fractures and are the third most common fractures in the elderly, after hip and wrist fractures. Isolated humeral shaft fracture counts for 1-3% of all fractures and in many patients is due to closed trauma <sup>[5]</sup>. Fortunately, non-operative methods are effective in treating the majority of humeral shaft fractures. In patients with surgical indication two different models are available: compression plate and intramedullary nailing (with open and closed approaches) and each one has its advantages and disadvantages. With plate and screw fixation, we may achieve more rigid fixation; however, in intramedullary nailing, fracture site soft tissue manipulation is much less <sup>[6, 7]</sup>.

Intramedullary nail fixation has gained popularity and interest for the treatment of operative proximal humeral fractures. Historically, these implants have been used for fixation for pathologic humeral diaphyseal fractures; however, an evolution in implant design and surgical technique now allows for predictable capture of tuberosity fracture segments while maintaining the benefit of percutaneous device placement <sup>[8]</sup>.

**Corresponding Author:**  
**Dr. Chetan L Rathod**  
Associate Professor, Department  
of Orthopedics, Dhanalakshmi  
Medical College Perambalur,  
Tamil Nadu, India

Additionally, as a result of the device implantation from proximal to the fracture site, disruption of the vascular supply to fracture segments and the humeral head can be minimized and may contribute to improved tuberosity healing and diminished rates of avascular necrosis. Ultimately, with advancements in implant design and greater understanding of surgical technique, an increasing number of 3- and 4-part fractures can predictably be managed with intramedullary fixation<sup>[8, 9]</sup>.

A diaphyseal fracture of the humerus is a common event accounting of approximately 3-5% of all fracture. Hence the present study was conducted with the aim to check the efficacy of interlocking nails in the treatment of diaphyseal fracture of humerus in adults.

### Materials and Methods

The present study was done in the department of Orthodontics, Dhanalakshmi medical college Perambalur, Tamilnadu, India, from May September 2019 to April 2020. The present is the prospective study conducted on the patients diagnosed with traumatic diaphyseal humerus fracture. The ethical committee of the institute was informed about the objective of the study and the ethical clearance certificate was obtained from them.

The inclusion criteria were as follows: Acute diaphyseal fracture of humerus, age more than 16 years, segmental fracture and compound fracture of Gustilo's Type I. The exclusion criteria were as follows: Age less than 16 years, compound fracture of Gustilo's type II & III, medically unfit for the surgery, fracture with neurovascular deficits. A total of 40 patients who satisfied the criteria were included in the study.

A Careful history was elicited from the patients and/or attendants to reveal the mechanism of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. In general condition, the vital signs were recorded. Care was taken to detect shock and any associated injuries. Local examination of the injured arm, revealed the attitude of the limb to be flexed at the elbow, adducted at the shoulder and supported with the other hand at the elbow. Swelling, deformity, loss of function and nerve injury were looked for and noted.

Palpation revealed tenderness, abnormal mobility, crepitus and shortening of the affected arm. Distal vascularity was assessed by radial artery pulsations, capillary refilling, pallor and paraesthesia at fingertips. Radial nerve was tested by active wrist and meta-carpo-phalangeal joint dorsiflexion. Sensation in the autonomous zone of 1st web space was checked for any abnormality.

Standard radiography of the humerus, i.e., anteroposterior and lateral views, were obtained. The shoulder and elbow joints were included in each view. The limb was immobilized in a U-Slab with sling. Injectable analgesics were given. The operative procedure and its advantages were explained in detail to each patient and an informed consent was obtained. The patients posted for surgery were subjected to routine investigation and were referred to the physician for fitness for surgery.

All cases were treated surgically with humerus intramedullary interlocking nailing by using Antegrade approach. The nails conical proximal end has thread on inner side which provides secure fixing of the threaded bolt for attaching insertion handle for the insertion and removal of the nail, positioning grooves precisely align the insertion handle with the nail. The

humeral diaphyseal will admit a straight nail, but in a intramedullary nail it is bent at proximal one third at an angle of 50 to compensate for the deviation of the entry portal from the centre line of the medullary canal. This has allowed easy insertion and extraction and provides good alignment from both shoulder and elbow approaches.

Solid Nail has got two holes at the proximal end and is accessible from lateral to medial which present the least risk to soft tissues, avoiding the danger of injuring the long tendon of biceps. Where as in cannulated nails there are three holes in the proximal end and two in the distal end which are accessible from anterior to posterior because, the radial nerve may be injured when screws are inserted laterally and the main neurovascular bundle also lies medially. 6mm is a solid nail and 7 and 8 mm nails are cannulated. All holes are 4mm in diameter in 7 and 8 mm humeral nails which accommodate 4mm locking bolts and 3mm locking bolts in 6mm nails. It's overall 2mm wall thickness and its diameter gives the nail a certain flexibility under bending and torsion which is necessary for fracture healing. At the same time they provide the necessary strength under functional stress. The tapered tip is designed for safe insertion. It slides along the length of medullary canal.

### Post-operative management

A crepe bandage was applied over the affected arm and an arm pouch was given. Postoperatively the patients were asked to move their fingers and wrist joint. The wound was inspected on the 3rd postoperative day. The patients were discharged on the 6th post-operative day i.e. after 5 days of IV antibiotics; with the arm in an arm pouch and advised to perform shoulder, elbow wrist and finger movements. They were prohibited from lifting weight or putting additional stress on the affected limb. Sutures/staples were removed on 12<sup>th</sup> postoperative day during follow up and check x-ray in antero-posterior and lateral views were obtained.

### Follow up

All the patients were followed up at monthly interval for the first 3 months later at 2 monthly intervals till fracture union and once in 6 months till the completion of study. They were examined in details clinically and special stress was laid on shoulder and elbow range of movements and subjective complaints. X-ray were obtained in AP and lateral views and signs of union were looked for. The fracture was considered to be radio logically united, when there was no visible fracture line and evidence of callus bridging the fracture site. The functional outcomes were assessed by modified Rommens *et al.* criteria.

### Results

The present study was conducted with the aim to check the efficacy of interlocking nails in the treatment of diaphyseal fracture of humerus in adults. A total of 40 patients were included in the study. All the included patients satisfied the inclusion criteria. All the patients were available for the follow up period. The detail history was recorded prior to the surgery. The patients with age less than 16 years were excluded from the study.

The age of the patients ranges from 16 to 60 years with majority of the patients were in the age range of 3<sup>rd</sup> decade of life. The average age of the patients was 37.4 years. Both males and females were included in the study. Majority of the patients were males. There were 24 males and 16 females. Owing to the side of the fracture, the right side were affected

more as compared to left. There were 22 patients who had fracture on right side and 18 patients had fracture on left side.

**Table 1:** Age distribution of the patients

Age distribution of the patients	No. of patients
16 – 20	4
21 – 30	8
31 – 40	18
41 – 50	8
51 - 60	2
Total	40

When the mode of injury was enquired for the fracture of humerus fracture, maximum number of the patients had fracture due to road traffic accident and next reason was due to fall. Total of 24 patients had road traffic accident as the reason for the fracture of humerus. Level of fracture when assessed was found that maximum number of patients had fracture at the level of middle third of humerus bone. Majority of fractures were transverse and oblique i.e. 28. There were 6 comminuted fractures, 6 spiral fractures in this series.

The overall results were analysed at the end of the study. The excellent result was obtained in the 24 patients, good result was obtained in 12 patients and poor result was found in 4 patients. Along the humerus fracture, there were 10 patients who had associated fracture. There were 2 patients with upper third radius fracture, there were 2 patients with head injury, there were 4 patients who had forearm fracture and 2 patients had rib fracture.

**Table 2:** Pattern of the fracture of the humerus

Fracture pattern	No. of cases
Spiral	6
Comminuted	6
Oblique	14
Transverse	14
Total	40

**Table 3:** Overall result evaluation of the study

Overall results	No. of cases
Excellent	24
Good	12
Poor	4
Total	40

## Discussion

Fractures of the proximal humerus continue to increase in frequency with projected rates of emergency visits annually to exceed 275,000 by 2030 [8]. Although most fractures can be treated non-operatively, displaced fractures or those at risk for non-union may benefit from surgical intervention. Currently, the most common implant utilized for the surgical management of proximal humeral fractures remains plate fixation; however, concerns exist around hardware complications such as intraarticular screw penetration as well as elevated reoperation rates have created interest in alternative fixation methods for these fractures including all suture fixation, external fixation and percutaneous pin pinning [10, 11].

In this study we have treated 40 acute Humeral Diaphyseal Fractures with antegrade intramedullary interlocking nail to determine clinical outcome and complications of nailing. We have evaluated our result and compared them with those obtained by various other studies opting different modalities of treatment for fracture diaphyseal of humerus including

intramedullary interlocking nailing.

Majority of the fractures were sustained due to Road traffic accidents i.e. 24 patients in our study and in comparison to the other study it appears to be the commonest mode of injury. The results were in accordance with Mc Cormack *et al.* and Tingstad EM *et al.* [12]. Assessment of the level of fracture stated that majority of the patients had fracture in the middle third area. The results were in accordance with previous study done by Rodriguez *et al.* Our findings are in accordance with those of various other authors who found that middle third was the most commonly affected site.

In the present study 36 patients with excellent or good result out of 40 patients in our series. Overall results obtained by various authors using intramedullary interlocking nailing have reported the results comparable with this present series. The results obtained by various authors using various modalities of treatment have varied from 75% to 100% excellent or good results. Our study had a 90% overall excellent or good result. In this series our result was comparable to the results achieved by the other authors.

The causes for poor result were because of the impingement of the nail over the rotator cuff caused the stiffness of the shoulder and pain with movement. This could be avoided by proper selection of the nail size and burying the nail well inside the bone and proper repair of the rotator cuff before closure and active commencement of shoulder and elbow exercises postoperatively. Patient education and a well-planned rehabilitation programme are required to obtain better results. If these principles are adhered intramedullary interlocking nail fixation of humerus diaphyseal fractures results in fewer complication and greater patient satisfaction.

## Conclusion

Compared to other surgical modalities, closed intramedullary interlocking nailing is the least invasive surgical technique and has got least chance of post-operative infection and also reduces the hospital stay. Excellent results were seen in patients with associated injuries when humeral diaphyseal fractures were fixed with intramedullary interlocking nail as shown in the reduction in operative time and early rehabilitation. The advantages of intramedullary nailing are minimal surgical exposure, better biological fixation, minimal disturbances of soft tissues and early mobilization of neighbouring joints.

## References

1. Fernandez DL, Jupiter JB. Fractures of the distal radius: A practical approach to management: Springer Science & Business Media 2002.
2. Salzer M, Knahr K, Locke H, Stärk N, Matejovsky Z, Plenk H, Punzet G, Zweymüller K. A bioceramic endoprosthesis for the replacement of the proximal humerus. Archives of orthopaedic and traumatic surgery 1979;93:169-84.
3. Patel B, DeGroot H. Evaluation of the risk of pathologic fractures secondary to metastatic bone disease. Orthopedics 2001;24:612-7.
4. Fausto-Sterling A. Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at. Signs 2005;30:1491-527.
5. Hedin H. Surgical treatment of femoral fractures in children Comparison between external fixation and elastic intramedullary nails: A review. Acta Orthopaedica Scandinavica 2004;75:231-40.
6. Kivi MM, Soleymanha M, Haghparast-Ghadim-

- Limudahi Z. Treatment outcome of intramedullary fixation with a locked rigid nail in humeral shaft fractures. *Archives of Bone and Joint Surgery* 2016;4:47.
7. Lekic N, Montero NM, Takemoto RC, Davidovitch RI, Egol KA. Treatment of two-part proximal humerus fractures: intramedullary nail compared to locked plating. *HSS Journal* 2012;8:86-91.
  8. Sears BW, Johnston PS, Garrigues GE, Boileau P, Hatzidakis AM. Intramedullary nailing of the proximal humerus—not just for 2-part fractures.
  9. Cai P, Yang Y, Xu Z, Wang Z, Zhou X, Yang T. Anatomic locking plates for complex proximal humeral fractures: anatomic neck fractures versus surgical neck fractures. *Journal of shoulder and elbow surgery* 2019;28:476-82.
  10. Greiwe R. Proximal humerus fractures: Percutaneous fixation, proximal humeral nailing, and open reduction and internal fixation. *Shoulder and Elbow Trauma and its Complications*: Elsevier 2015, P83-112.
  11. Bogunovic L, Cherney SM, Rothermich MA, Gardner MJ. Biomechanical considerations for surgical stabilization of osteoporotic fractures. *Orthopedic Clinics* 2013;44:183-200.
  12. 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;49:278-80.