



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 425-430
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www.orthopaper.com
Received: 08-11-2019
Accepted: 12-12-2019

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Surgical management of diaphyseal fractures of shaft of humerus by IMIL nailing in adults

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i1h.1900>

Abstract

Fractures of diaphyseal fracture humerus shaft in adults is itself a great dilemma and becomes more difficult to treat. So in this new era of fast paced technologies, an aggressive approach is required to treat such fractures in view of early rehabilitation and return to occupation. This prospective randomized study was conducted at department of Orthopedics in Jagadguru Jayadeva Murugarajendra medical college Davanagere Karnataka to evaluate outcomes of intramedullary interlocking nail as primary fixation method in diaphyseal fracture shaft of humerus in adults. Surgery duration was less in intramedullary nail because in most of the cases fractures were easily reduced, minimal surgical exposure and associated less closure time. Intra operative image intensifier use was significantly more because of distal screw locking and determination of nail length.

Post operatively aim of the treatment was to do early mobilization and early fracture union due to preservation of fracture hematoma. In follow up of cases at 6 week, 3, 6, 12 month as per functional outcomes patients had very mild difficulty in performing activities of daily living. On concluding the outcome as per Rommen *et al.* Criteria at 23.5 weeks excellent score was found in 76.6% cases of interlocking nail while it was poor in 3.3% cases and remaining had moderate outcomes.

Keywords: Humerus, Diaphyseal humerus fracture, Fracture, interlocking nail, Rommen *et al.* criteria

1. Introduction

Humeral shaft fractures are a very common event and accounts for 1- 3% of all fractures ^[1]. Of these, about 10% are open fractures & 20% of those are humeral shaft fractures. Incidence is 11.5 per 100,000 people annually, or 0.011% ^[2].

There are 2-3 frequency peaks ^[1, 3, 4].

- During Adolescence
- In the 3rd decade of life in men as a result of moderate to severe trauma
- In the 5th - 7th decades of life, especially in women after a simple fall.

Humeral shaft fractures are mostly fracture of the diaphysis. This study is meant to analyze the statistically functional outcomes, union rates and complications of intramedullary interlocking nail fixation for diaphyseal fracture shaft of humerus in adults.

Intramedullary nail is advantageous

1. It is more biological method of fixation as it is less invasive.
2. It is a load sharing implant so patient can bear weight early.
3. It doesn't disturb the fracture hematoma so causes secondary healing and less chances of non union. However, complications like malalignment, anterior knee pain, Implant failure, infection have been reported.

Material and methods study design

This prospective randomized study was conducted on patients who were admitted in department of orthopedics Bapuji hospital and Chigateri hospital attached to Jagadguru Jayadeva Murugarajendra medical college Davanagere Karnataka.

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Duration of study

October 2017 to October 2019.

Informed consent was taken from the patients who are included in this study for the selection criteria.

Method of collection

The ethical committee of Jagadguru Jayadeva Murugarajendra medical college Davanagere Karnataka was informed about the intended work and permission was obtained to conduct the work.

Number of cases

In this study 30 patients attending Orthopaedics OPD in bapuji and chigateri Hospital during October 2017-October 2019 of diaphyseal fracture shaft of humerus in adult and willing to undergo the study were taken. These will be selected based on inclusion and exclusion criteria.

Eligibility criteria Inclusion criteria

- All Age of the patient 18 and above.
- All Diaphyseal humeral fractures Upper 1/3, middle 1/3 & lower 1/3.
- Failed internal fixation with plating & failed conservative management of shaft of humerus fractures

Exclusion criteria

- Fracture of proximal and distal ends of Humerus.
- Patients medically unfit for surgery.
- Patients not giving valid consent for surgery.

We have selected 30 cases for this study and excluded patients aged less than 18 years and open fractures of Gustilo's type III. And we used interlocking nail for stabilization of the fracture of the humerus.

Patients underwent full investigations pertaining to pre-anesthetic checkup and temporary immobilization by POP slab and antibiotics along with tetanus prophylaxis were administered perioperatively. Following fitness for anesthesia, patients were taken up for surgery and the study was recorded in a proforma.

Following the treatment patients were followed up at outpatient department at regular intervals for clinical and radiological evaluation. The patients were followed up till fracture union and functional recovery. If necessary, subsequent follow up was done.

Surgical position

A standard operating table was used; patient was taken in supine position. Turn the head to the contralateral side to increase exposure of the shoulder. Obtain rotational alignment by placing the shoulder in an anatomic position and rotating the distal fragment so that the arm and hand are pointing towards the ceiling and the elbow flexed to 90°

Nail diameter

Nail diameter was determined under image intensifier control, or by placing the Measuring Device on the humerus and position the square marking over the isthmus. If the transition to the cortex was still visible to the left and right of the marking, the corresponding nail diameter was used.

Incision & entry portal

Make a longitudinal skin incision from the lateral point of the acromion process and extend it distally, centred over the tip of the greater tuberosity. Incise the fascia of the deltoid and

palpate the greater tuberosity.

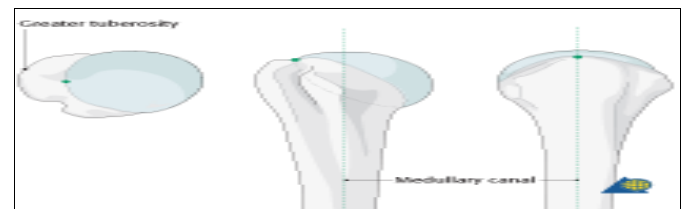


Fig 1: Showing entry point for ante grade humerus nailing



Fig 2: C-arm Image of entry through bone awl

Awl was inserted through medial to the greater tuberosity to gain access to the medullary canal under C-ARM control to make Advance the curved awl until it is seated within the humeral head, and rotate the humerus internally and externally to confirm containment of the awl by image intensification. The entry portal should be centered on anteroposterior and lateral views to ensure that the nail will be in the midplane of the humerus.

Technique

Awl was removed and canal opener was used to open the medullary canal further. Ream the proximal metaphysis of the humerus to a diameter 1mm more than the nail to be inserted. Then a ball tipped guide wire of 1.8 mm is passed and fracture is reduced by gentle manipulation. The position of the guide wire and reduction of the fracture were confirmed by Image intensifier. Proper nail length can be verified radiologically pre-operatively and on the table using the guide rod method. With the distal end of the rod 1-2 cms proximal to the olecranon fossa, overlap the second guide rod of the same length extending proximally from the humeral entry portal.

Subtract the length (in mm) of the overlapped guide rod from 500 mm to determine the correct nail length. The selected nail is attached to the Fig. The nail is passed through the medullary canal. When the nail reaches the fracture, maintain reduction manually and gently advance the nail across the fracture. Advance the nail distally until it is 1 to 2 cm proximal to the olecranon fossa, take care to avoid splitting the distal humerus or creating a supracondylar fracture from wedging the tip of the nail too close to the olecranon fossa. Confirm nail position in the distal fragment by anteroposterior and lateral image intensification views by internally and externally rotating the arm. Seat the nail so that its proximal end is beneath the bone to avoid subacromial impingement.

Proximal and distal interlocking: The proximal interlocking is done with the help of Jig lateral to medially. The distal interlocking is done by free hand technique in an anteroposterior direction. Ideally the 3.4 mm locking screw

will be used distally for 7mm&8mm and 2.9mm for 6mm nail & 3.9 proximally. The Jig is removed and locking confirmed

by the Image intensifier and the wound closed after securing complete hemostasis.

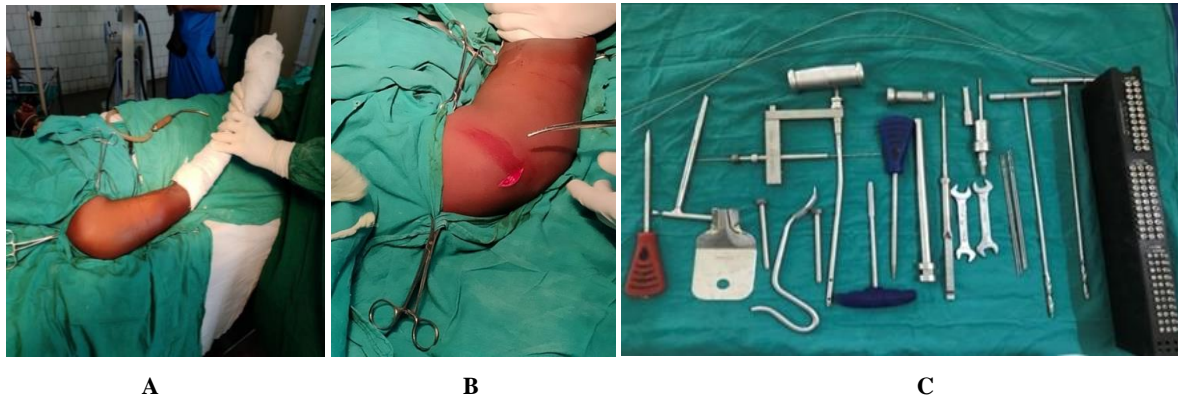


Fig 3: Instrument of Intramedullary Nail Humerus



Fig 4: A preoperative radiograph of a 33 year old male with h/o RTA who sustained fracture of rt proximal to middle 1/3rd humerus, b. deltoid splitting approach used for insertion of a nail, c. Immediate post-operative radiograph showing inter locking tibia nail in-situ, d. Radiograph after 1 month showing signs fracture union, e. radiograph after 3 months of procedure f. radiograph after 6 months follow up showing sings of fracture union. G, H, I. Clinical picture of patient in shoulder extension position, overhead abduction position, external rotation position after 6 month of nailing. This patient had good functional outcomes without any complications.

Table 1: Age distribution of patients

Age group (years)	No. of Patients	Percentage (%)
18-20	2	6.6
21-30	9	30
31-40	6	20
41-50	4	13.3
51-60	6	20
61-70	1	3.3
71-80	2	6.6
Total	30	100

In this series 2 (6.6%) patients were between 18-20 years, 9 (30%) patients were between 21-30 years, 6 (20%) patients were between 31-40 years, 4 (13.3%) patients were between 41-50 years, 6 (20%) patients were between 51-60 years, 1 (3.3%) patient was between 61-70 years, 2 (6.6%) patients were between 71-80 years of age.

Sex distribution

Out of 30 patients 20(66.6%) patients were male and 10(33.3%) patients were female. This shows Males are more predominantly affected with Humerus fractures as compared to female. It shows a male preponderance with the ratio being M:F 2:1

Table 2: Sex distribution

	Male	Female	Total
No. of Patients	20	10	30
Percentage	66.6	33.3	100

Mode of injury

In our study, the most common mode of injury is RTA. i.e. 12 (40%) patients out of 30. This also shows the nature of involvement of Humerus shaft fractures as a part of a polytrauma patient.

Table 3: Mode of Injury

Mode of injury	No. of patients	Percentage (%)
Road traffic accident (RTA)	12	40
Fall from height	9	30
Blunt trauma/assault	6	20
Minimal trauma	3	10
Fire arm injury	--	--
Sports injury	--	--
Total	30	100%

Table 7: Associated injuries

Associated Injury	No.	Percent	Type of fixation
Old DCP implant Failure	1	3.3	I/R & ORIF with IMIL
3yr old Non-union old broken nail	1	3.3	Exchanging Nailing
Rt 6 th , 7 th , 8 th , Rib #	1	3.3	Rib Binder
Rt Distal Radius #	1	3.3	CRIF with Ex-FIX
Rt Proximal 3 rd Ulna #	1	3.3	TBW with Kwire
Rt Neck of fibula #	1	3.3	Long Knee Brace
Lt Intertrochanteric Femur #	1	3.3	CRIF with short PFN
Lt Femur Upper 3 rd Shaft #	1	3.3	CRIF with IMIL Femur
Rt Tibia Shaft Middle 3 rd #	2	6.6	CRIF with IMIL tibia
Head Injury	3	10	Conservative
None	17	56.6	Nil

Complications

In our study a total of 21 patients (70%) had no complications relating to surgery or post surgery. 2 (6.6%) cases were

Side of involvement

In our study, Right side is more commonly involved than the left. i.e. 22(73.3%) out of the 30 cases.

Table 4: Side of involvement

Side	No. of Patients	Percentage (%)
Left	8	26.6
Right	22	73.4
Total	30	100

Site of injury

In this study, the most common site of injury was Middle/3 a total of 17(56.6%) patients, next most common being upper/3-middle/3 junction - 6 (20%) and Upper/3 being 4(13.3%), middle/3-lower/3 was least common 3(10%).

Table 5: Site of injury

Anatomical Level	No. of Patients	Percentage (%)
Upper / 3	4	13.3
Middle/3	17	56.6
Upper1/3-Middle 1/3 Junction	6	20
Middle /3-Lower 1/3 Junction	3	10
Total	30	100

Type of fracture

In this study the most commonly experienced type of fracture was Transverse type 15 (50%) patients. 2nd most common was Oblique fractures in 11 (36.6%) patients.

Table 6: Type of Fracture

Type of Fracture	No. of Patients	Percentage (%)
Comminuted	1	3.3
Long Spiral	1	3.3
Oblique	11	36.6
Segmental	2	6.6
Transverse	15	50
Total	30	100

Associated injuries

Humerus fractures are known to be associated with various other associated injuries, as it being a part of a polytrauma patient. The management of each associated injuries were done accordingly either in the same sitting or in a different sitting as per the fitness, age, blood loss and on the basis of risk of surgical complications for each patient.

having shoulder stiffness which is most common complication and 2 (6.6%) cases were operated with open reduction.

Table 8: Complications Encountered

Complication encountered	No. of Cases	Percentage
Shoulder stiffness	2	6.6
Infection- superficial	1	3.3
Infection - deep	0	0
No distal locking	1	3.3
Splintering of distal fragment	1	3.3
Non union due to implant failure	1	3.3
Stiff Elbow & shoulder stiffness	1	3.3
Open reduction	2	6.6
None	21	70
Total	30	100

Range of Motion

In our study we found that 21 patients (66.6%) had full range of shoulder movements. Others 6 patients (20%) had 10°-30° of residual abduction which accordingly hampered the functional outcome. 2 patients (6.6%) had Only shoulder Stiffness and 1 patient (3.3%) had both shoulder and Elbow

Stiffness due to associated fractures of the forearm.

Table 9: Range of Motion

Range of Motion	No. of Patients	Percentage (%)
Full 140°	21	70
130°	2	6.6
120°	2	6.6
110°	2	6.6
Only shoulder Stiff	2	6.6
Shoulder with Elbow Stiffness	1	3.3
Total	30	100

Time of fracture union

In our study, 23 (76.6%) patients had solid union in less than 26 weeks, 6 (20%) cases had delayed union (27-36 weeks) and 1 (3.3%) case ended up in non union. Non union was because of improper fracture reduction (gap in the fracture site was more than 0.5 mm).

Table 10: Time of Fracture Union

Time of fracture union (in weeks)	No. of Patients	Percentage (%)
16-20	9	76.6
21-26	14	
27-36	6	20
Non-union	1	3.3
Total	30	100

Results (Functional Outcome)

In our study it was seen that 23 (76.6%) patients had Excellent results, 6 (20%) patients had good results and 1 (3.3%) had Poor results. This was according to Rommen *et al.* grading series.

Table 11: Results

Results	No. of Patients	Percentage (%)
Excellent	23	76.6
Moderate	6	20
Poor	1	3.3
Total	30	100

Discussion

The management of fracture shaft of humerus has always been a challenging problem to the Orthopaedic surgeon, they are most frequently associated with multiple injuries, leading to complications of rotation, infection, delayed union, non-union & radial nerve injury (Neuropraxia).

There is no agreement on the standard reference on the ideal method of treatment for humeral shaft fracture but most surgeons agree that intramedullary nailing is the best method of internal fixation of fractures of long bone including humerus, femur, Tibia.

The main aim of treatment is to achieve anatomical alignment and maintain limb length, preservation of fracture haematoma, preservation of soft tissue, with minimal incision in fixation of humeral shaft fracture and also preventing the exposure of radial nerve which is said to cause Neuropraxia and finally give good union. In some reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of humeral shaft.

In this study we have included a total of 30 patients randomly selected as all the 30 cases operated with IMIL nailing. This study is having a short term follow up of minimum of 1 year, upto maximum of 24 months and hence its overall a preliminary assessment. We evaluated our results and

compared them with those obtained by various other studies that have compared this modality of treatment and also with studies that have used various different modalities of treatment.

Conclusion

When indicated internal fixation of shaft of humerus fractures with Unreamed interlocked intramedullary gives good results. It shows to be the method of choice for internal fixation of osteoporotic and pathologic fractures.

In our study it is noted that internal fixation of humerus fractures with IMIL should be based on Patients age, compliance, time of presentation, type of fracture, quality of bone. Above Mentiond study showed that IMIL was preferred for Type I, II compound fractures, fresh midshaft and upper 1/3 fractures, oblique, segmental and pathological fractures.

Nailing is technically a most challenging procedure, but if done right by following all the steps properly, the associated complications like shoulder- elbow stiffness, shoulder impingement syndrome, nonunion, etc. can be reduced significantly and this procedure can prove to be a better modality of treatment in experienced hands.

We therefore conclude that in such cases *imil nailing is better option, but patient selection is very important*. The fallacies in our study are, the sample size is small and we have not taken retrograde nailing into consideration, also the follow up was only 1 to 2 years.

References

1. Stuby FM, Hontzsch D. Humerus shaft Fractures. Z. Orthop. Unfall. 2009; 147(3):375-86.
2. Court-Brown CM, Rimmer S, Prakash U, McQueen MM. The Epidemiology of open long bone fracture. Injury. 1998; 29(7):529-34.
3. Cole PA, Wijdick CA. The Operative treatment of diaphyseal humeral shaft fractures. Hand Clin. 2007; 23(4):437-48.

4. Schittko A. Humerus Shaft Fractures. Unfallchirurg, 2003; 106(2):145-58.
5. Rommens PM, Verbruggen J, Broos PL. Retrograde locked nailing of humeral shaft fractures. A review of 39 patients. J Bone Joint Surg. 1995; 77B:84-9.
6. Rodriguez. Fixation of fractures of shaft of the humerus by DCP or IMIL nail. J. Bone Joint Surg (Br). 2000; 82B(7):1085.
7. McCormack RG, Brien D, Buckley RE, McKee MD, Powell J, Schemitsch EH. Fixation of fractures of shaft of the humerus by dynamic compression plate or intramedullary nail. A prospective randomized trial. J Bone Joint Surg. 2000; 82B:336-9.
8. Koch PP, Gross DF, Gerber C. The result of functional (sarmiento) bracing of humeral shaft fractures J Shoulder Elbow Surg. 2002; 11(2):143-7.
9. Shyamasunder BN, Sharath KR. The Functional outcome of antegrade undreamed humeral interlocking nailing in adults. J Orthop. 2005; 2(1)e2.
10. Wali MG, Baba AN, Latoo IA, Bhat NA, Baba OK, Sharm S. Internal fixation of shaft humerus fractures by dynamic compression plate or interlocking intramedullary nail: a prospective, Randomised study, StratTraum Limb Recon. 2014; 9:133-140.
11. Kasturi A, Chokkarapu R, Nadadur S, Kolusu N. Comparison of Outcomes of Dynamic Compression Plate And Interlocking Intramedullary Nail For Fracture Shaft of Humerus: A Prospective Study: Journal of Research in Orthopedics and Sports Medicine. 2015; 1(1):34-7.
12. Loya Lava Kumar S. Dynamic compression plating versus intramedullary interlocking nail technique: a prospective study in a tertiary care centre. International Surgery Journal Kumar LLS. IntSurg J. 2016; 3(2):653-657.
13. Rodriguez Merchan EC. Compression plating versus Hackethal nailing in closed humeral shaft fractures failing nonoperative reduction. J. Orthop Trauma. 1995; 9(3):194-7.
14. Kumar R, Singh P, Chaudhary LJ, Singh S. Humeral shaft fracture management, a prospective study; nailing and plating, Journal of Clinical Orthopedics and trauma. 2012; 3:37-42.