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ROLE OF INTRAMEDULLARY INTERLOCKING NAIL IN FRACTURE FEMUR AMONG ADULTS – A PROSPECTIVE STUDY IN A TERTIARY CARE HOSPITAL, ANDHRA PRADESH, INDIA

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ABSTRACT

Background: Fractures of the femur are among the most common fractures encountered in orthopaedic practice since this long bone along with tibia form the principle load bearing bone in the lower extremity. They also form the strongest bones of the body, however, they are frequently fractured due to multiple causes. With recent advances in biplanar imaging, there has been a renewed interest in closed intramedullary interlocking nailing. Hence an attempt has been made to study the role of intramedullary interlocking nail in fracture femur among adults.

Aims and Objectives: To study the role of intramedullary interlocking nail in fracture femur among adults in a tertiary care hospital, Andhra Pradesh, India.

Material and Methods: **Study Design:** Prospective study **Study Area:** Tertiary care hospital, Rajahmundry. **Study Period:** 18 months (July 2011 to Dec 2012) **Study Tools:** A Predesigned and Pretested questionnaire, Measuring tape, Stethoscope, X-ray Chest and Femur, Routine blood investigations, Urine routine, ECG **Sample Size:** 102, **Statistical Analysis:** Analyzed using Microsoft Excel 2007 and Epi info version 3.5.2

Results: The age of presentation varied from 19-64 years with a Mean age of 37.39. The incidence was significantly higher in Males (42 males and 8 females), Right side (65.2%) involvement was more, RTA was the main cause of trauma. 84 (91.28%), Closed type 72 (78.24%) of injuries was more common. Majority of the cases were Oblique type 48 (52.16%). Most of the fractures occurred at middle third zone 36 (39.12%). Most common complication was Hip Pain, 16 (17.39%). Union was achieved in majority 76 (82.6%) of the cases, between 12-24 weeks. Mean union time was 16.6 weeks.

Conclusions: Closed interlocking nail fixation is the procedure of choice for femoral shaft fractures.

Keywords: Intramedullary interlocking nail, Fracture femur, Adults

INTRODUCTION

Fractures of the femur are among the most common fractures encountered in orthopaedic practice since this long bone along with tibia form the principle load bearing bone in the lower

extremity. They also form the strongest bones of the body, however, they are frequently fractured due to multiple causes. With recent advances in biplanar imaging, there has been a renewed interest in closed intramedullary interlocking

nailing. Hence an attempt has been made to study the role of intramedullary interlocking nail in fracture femur among adults.

AIMS AND OBJECTIVES: To study the role of intramedullary interlocking nail in fracture femur among adults in a tertiary care hospital, Andhra Pradesh, India.

MATERIAL AND METHODS

A Prospective study of all cases with fracture femur admitted in a tertiary care hospital, Andhra Pradesh, during a period of 18 months (July 2011 to Dec 2012) was conducted. A total of 102 cases were admitted of which 10 patients did not consent for the study and hence the number came to 92. All patients with fracture shaft of femur above 18 years of age, all closed fractures and open fractures of type I, II, IIIA (Gustilo – Anderson) who consented for the study were included while pathological fractures, fractures within 5 cm distal to lesser trochanter and 5 cm proximal to knee joint, open fractures of type IIIB, IIIC (Gustilo – Anderson), ipsilateral fractures of femur and tibia and those who failed to consent were excluded from the study. A Predesigned and Pretested questionnaire containing questions about the detailed history with special reference to the mode of injury and severity of trauma was used. This was followed by physical examination including a comprehensive orthopaedic examination of the injured limb and other limbs. The involved extremity was examined for swelling, deformity, discoloration, skin integrity, neurological, motor and vascular compromise and signs or symptoms of compartment syndrome. Medical and General surgical evaluation was sought expeditiously for all high – energy accident victims to rule out polytrauma. Radiological examination of Femur with ipsilateral hip and knee joints both preoperatively and postoperatively were taken for evaluation. X-ray Chest, Routine blood investigations, Urine routine, ECG were all done and also medical and anaesthetist opinion were

taken to explore fitness of the patients for surgery. The purpose of the study was explained in local language and a written informed consent was taken from the patients. They were free to withdraw from the study anytime they wished.

Management of diaphyseal fractures of femur

Our management followed the following fixed pattern for every patient.

Pre-Operative management include

- 1) Stabilization
- 2) Diagnosing other associated injuries

1) Stabilization of the patient

- a) Emergency care
- b) Immobilization of the affected limb
- c) Investigations

a) Emergency care

Special attention was given to cardiopulmonary status. Vital signs were monitored. The arterial status of the limb was under constant supervision in cases of the fracture distal 1/3rd of Femur. All the open injuries were thoroughly debrided in the operation theatre.

b) Immobilization of the affected limb:

Immobilization of the affected limb was done in Thomas splint, to prevent soft tissue damage, to decrease pain, and for easy mobilization of the patient. Skeletal traction was applied for open and comminuted fractures.

c) Investigations:

The following investigations were carried out routinely.

- i) Routine blood investigations
- ii) Urine routine
- iii) Special tests: ECG, Chest X-ray PA view (> 40 years)
- iv) Radiographs:

1. Anteroposterior and lateral views of the entire long bone including the joint proximal and distal to it.
2. The pelvis exposing both the hip joints: AP view.

The interval between the injury and the definitive operation ranged from 2 days to 12 days (mean 7 days).

Nail used in the study

First generation intramedullary interlocking nail

It is a hollow tubular nail with a circular cross section. Proximal end is expanded to give additional strength for proximal screw fixation. It has position slots to lock the jig. Its 2mm wall thickness gives the nail certain flexibility on bending. Proximal end has got threads on the inner side that provides secure fixation of the threaded conical bolt for attachment of jig/extractor. Nail used for femur interlocking has a curvature to the average anatomic curvature of the femur.

For locking there are 2 holes on either side, at the proximal and distal ends of the nail. Circular holes for static locking measure 5 mm. Nails in diameters of 9, 10 and 11mm with length from 340-440 mm with increments of 20 mm were used for femur interlocking.

Locking screws are self tapping, 4.5mm available from 25-95mm in 5 mm increments.

Follow up

All the patients were followed up. With each follow up, clinical and radiological examinations were performed at 6 weeks,12 weeks,18 weeks, 24

weeks. Final assessment was done at the end of 6 months.

Clinical examination included evaluation of complaints by the patients, assessment of the range of motion, assessment of the soft tissues, evaluation of the rotational alignment, leg length discrepancy and deformities, if any. Finally the functional implications were evaluated.

Radiological examination was performed in two planes and assessed for callus formation. Varus / Valgus and Flexion / Extension deformities if any were assessed. “Union” was defined as the appearance of bridging callus and trabeculations extending across the fracture site. “Nonunion” was defined as no evidence of fracture union progression in 6 months of follow up. “Delayed union” was defined as the appearance of the signs of fracture union, but the progress of union to consolidation is delayed than is otherwise expected.

FUNCTIONAL RESULTS

Functional results were graded based on the classification system for the results of treatment by **Thoresen B.O., et al., (1985)¹**

The results were designated as excellent, good, fair or poor according to the alignment of the fracture, the range of motion of ipsilateral knee, and the shortening of femur, and the degree of pain or swelling.

Classification system for the results of treatment by Thoresen B.O. et al.,¹

Particulars	Excellent	Good	Fair	Poor
Malalignment of femur				
Valgus or varus	5	5	10	>10
Antecurvatum or Recurvatum	5	10	15	>15
Internal rotation	5	10	15	>15
External rotation	10	15	20	>20
Shortening of femur(cm)	1	2	3	>3
Range of motion				
Flexion	>120	120	90	<90
Extension deficit	5	10	15	>15
Pain or swelling	None	minor	significant	severe

STATISTICAL ANALYSIS: Analyzed using Microsoft Excel 2007 and Epi info version 3.5.2

Ethical clearance was obtained from the ethical committee of the hospital.

RESULTS

Age – wise distribution of patients showed that Majority 44 (47.81%) of them were between 21 to 40 years, followed by 32 (34.78%) in 41 to 60 years and 8 (8.7%) each below 20 years and above 60 years. Mean age for fracture Femur was 37.39 years

Sex distribution: Majority 80 (86.9%) of the patients in our study were males and 12 (13.1%) were females.

Side incidence: showed right side predominance 60 (65.23%) with 32 (34.77%) on left side.

RTA was the main cause of trauma. 84 (91.28%) met with accident while 8 (8.72%) had fall from height resulting in fracture femur

Closed type 72 (78.24%) of injuries was more common than open type 20 (21.76%)

Pattern of fracture

Majority of the fractures were oblique type followed by transverse, spiral, comminuted and segmental types.

Pattern of fracture	No. of cases of fracture femur
Oblique	48 (52.16%)
Transverse	24 (26.1%)
Spiral	12 (13.0%)
Segmental	4 (4.34%)
Comminuted	4 (4.34%)

Anatomical location:

Majority 36 (39.12%) of fractures were at the middle third zone followed by the junction of middle third and lower third 32 (34.78%) and the junction of upper third and middle third 24 (26%)

Associated injuries with fracture shaft of femur:

There were 12 (13%) cases with head injury, 8 (8.7%) cases with fracture clavicle, 4 (4.3%) case each with Colles fracture and fracture pelvis, associated with fracture shaft of femur amounting to a total of 28 (30.43%).

Complications

Most common complication was Hip Pain, 16 (17.39%) followed by Superficial Infection 8 (8.7%), Delayed Union 8 (8.7%) and Shortening 4 (4.34%) Superficial infections resolved by regular dressings and antibiotics.

Weight bearing:

Patients were allowed to walk without bearing weight on the operated leg with the help of crutches/walker on an average between postoperative day 2 - day 5. Three patients with

significant comminution were advised delayed weight bearing. Weight bearing without support was advocated when clinico-radiological signs of union was observed. In 85 (92.39%) patients full weight bearing was started between 12-14 weeks.

Secondary procedure

Eight (8.7%) patients of fracture femur who showed minimal radiological signs of union at the end of 6 weeks underwent dynamisation and union occurred at 25 to 26 weeks.

Range of motion

88 (95.65%) of the 92 patients had full range of motion at the knee at union. 4 (4.35%) patients had flexion at knee around 90⁰-100⁰. All patients had full range of hip motion at union.

Union Rates

In our study of 92 cases, union was achieved in majority 76 (82.6%) of the cases, between 12-24 weeks. Only in 8 (8.7%) cases, union was achieved in <12 weeks while in 8 (8.7%) cases there was union after 24 weeks. Mean union time was 16.6 weeks.

Assessment of functional results

Result	No of cases	Percentage
Excellent	72	78.26%
Good	16	17.39%
Fair	4	4.35%
Poor	0	0%

DISCUSSION

The age of presentation varied from 19-64 years. Mean age was 37.39 which is well in accordance with the series of R.J.Brumback *et al*²(32.2 yrs) and Kenneth D. Johnson *et al.*³(26.4 yrs).In our study the incidence was significantly higher in males (42 males and 8 females). The higher percentage of males than females reflects the fact that under Indian circumstances males are more exposed to trauma because of increased outdoor activities, while women are mostly confined to the domestic activities.In our study right side involvement was more, 65.2% which is in well accordance with the series of Kenneth D. Johnson *et al*³ (62%) and Donald A. Wiss *et al*⁴ (52%). Predominant mode of injury was road traffic accidents 91.28% which is comparable with the series of Kenneth D. Johnson *et al*³ (85%) and Donald A.Wiss *et al*⁴ (69.5%).

It is evident that fractures of shaft of femur are commonly produced by high energy trauma Fractures occurred at all levels in our study. The commonest site was the middle 1/3rd(39.1%) which is similar to the series of Donald A. Wiss *et al*⁴ (38%) and R.J.Brumback *et al*² (46%). In our study, 78.2 % were closed type fractures.which is in well accordance with series of Kenneth D. Johnson *et al*³(72.2%) and R. J. Brumback *et al*² (76.2%).

Our study had all patterns of fractures with an higher incidence of oblique fractures followed by transverse fractures together making 78.2%. This is comparable to the series of Thoresen BO *et al*¹(52%).

Associated Injuries

The high incidence of associated injuries in our study could be attributed to RTA with high energy

trauma which was the main mode of injury. The percentage of associated injuries in our study was 30.4% which is comparable to that in series of Jack Wickstromet *al*⁵ (29.3%), Kenneth D. Johnson *et al*³ (44%).

Associated fractures were treated during the management of femoral shaft fractures.

Fractures were operated after 2 days to maximum of 12 days after injury, All the cases were operated under spinal anaesthesia.

In 94% of our patients, active Hip, Knee, ankle movements and quadriceps exercises were started on the 1st postoperative day. 94% of patients were mobilized with the walker from the 3rd postoperative day, touch down weight bearing of the affected extremity was allowed. Suture removal was done in all patients on 10th – 12th day. Complete relief of pain was seen in 80% of patients in two weeks. 4 cases of femur complained of pain at hip.

All the patients were followed up. With each follow up, clinical and radiological examinations were performed at 6 weeks, 12 weeks,18 weeks, 24 weeks with suitable follow-up advice. Final assessment was done at the end of 6 months. In 8 cases of delayed union final assessment was done at the end of 7 months.

Depending upon the type of fracture and stable fixation of fracture, partial weightbearing was started. In our series, partial weight bearing was started in the 94% of patients by the 6th week. Complete weight bearing was started after 12 weeks in 70%,after 14 weeks in 22% and after 16 weeks in rest 8% of the patients. The appearance of bridging callus was used to assess and allow the patient full weight bearing. The average time of full weightbearing was 13.2 weeks. Full weight bearing

has been delayed in 4(4.34%) patients as there were comminuted fractures. This is comparable to Lawrence B. Bone *et al*⁶ where in his study weightbearing has been delayed in unstable fractures.

In our study 86 out of 92 patients, (94%) recovered fully and got normal hip and knee joint movements while there was restricted mobility of hip in 4(4.34%) patients and knee in 2 (2.17%) patients. Eight (8.7%) patients of fracture femur who showed minimal radiological signs of union at the end of 6 weeks underwent dynamisation and union occurred at 25 to 26 weeks.

Time to union of a fracture was defined as time from injury to full weightbearing and healing of the fracture characterized by bridging callus seen on two radiographs with different projections—Donald A. Wiss⁴.

In our study, time to union ranged from 12 weeks to 25 weeks with an average of 16.6 weeks, which is in accordance with the series of Kempf *et al*⁷ (18 weeks), Thoresen *et al*¹ (16 weeks) and R.J.Brumbach *et al*² (16 weeks).

In our study, Superficial infections were seen in 8.7%, pain(minor) in 17.3%, delayed union in 8.7% and shortening (1 cm) in 4.3% of the cases. There were no cases of deep infection, nonunion, mal-alignment and implant failure.

In the series of Winquist and Hansen *et al*⁸, the infection rate after closed nailing was 0.9%, shortening >2cm in 2% of cases and malrotation>20 degrees in 2.3% of the patients.

In series of Douglas and Wiss⁴ nonunion was seen in 2% of cases, angulation >10 degrees in 2.5% of the patients, external rotation deformity in 7% of patients. There were no instances of deep infection or osteomyelitis.

In the series of George White *et al.* nonunion was seen in 1.1% cases, 5.5% had a mild angulatory deformity, shortening >1cm seen in 3.1% of the pts.

Final assessment was done at end of 6 months and functional results were graded based on the classification system for the results of treatment of

fracture shaft of femur by Thoresen B.O., *et al*¹.The results were designated as excellent, good, fair or poor according to the alignment of the fracture, the range of motion of ipsilateral knee, and the shortening of femur, and the degree of pain or swelling. In the current series of fracture femur, 78.24% have got excellent results, 17.39% good and 4.34% fair results. The series of Thoresen *et al*¹.had excellent results in 63.8%, good in 16.9%, fair in 14.8% and poor in 4.2%.

CONCLUSION

Fractures of the femur are the injuries sustained in high velocity trauma. Internal fixation is the mainstay of treatment. Conventional plating is associated with high risk of infection, malunion, non union, implant failure. Interlocking techniques lead to fewer complications of nonunion/malunion, lesser soft tissue dissection, earlier fracture healing and lesser chances of infection. Fractures in any zone from the Subtrochanteric to distal supracondylar part of the femur is accessible to nailing. Closed nailing results in less intraoperative blood loss, shorter operative time, earlier weight bearing and union and early return to work with reduced morbidity compared to the open techniques. Closed interlocking nail fixation is the procedure of choice for femoral shaft fractures.

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