Section:Orthopedics

Original Research Article

A CLINICALSTUDY ON SURGICAL MANAGEMENT OF DIAPHYSEAL FRACTURE OF FEMUR WITH CLOSED INTRAMEDULLARY INTERLOCKING NAIL

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ABSTRACT

Background: Intramedullary interlocking is currently considered the treatment of choice for femoral shaft fractures, with high rates of fracture union, advantage of early stabilization which decreases the morbidity and mortality rate in patients, allows early mobilization, reduces the incidence of infection, malunoin, non union or implant failure. **Objectives of the study:** To assess the time taken for bone union and the functional outcome in patients with fracture shaft of femur.

Materials and Methods: We studied a total of 30 patients of fracture shaft of femur admitted in the Orthopaedic Department of Kakatiya Medical College, Warangal treated with closed intramedullary interlocking nailing. 23 patients were male and 7 were females and age group ranged from 18-49 years with mean age 30 Yrs. right side fractures encountered in 18 cases and 12 left side. 24 fractures were closed and 6 fractures were open type. 5 fractures were in proximal third, 19 fractures were in the middle third and 6 in distal third of femur. Duration of study 1 year{From September 2023 to August 2024}.

Results: Duration between injury and surgery was <24 Hours in 6.67%, 24-72 hours in 50% and 4-7 Days in 43.3%.Duration of hospital stay was average 11.43 days ranging from 06-22days. Mean time for union was 21.3 weeks ranging from 16-32weeks.There were two cases of superficial infection and no deep infection. Excellent to Good result in 90% cases.

Conclusion: We conclude that closed intramedullary interlocking nailing after is an excellent technique for the treatment of femoral shaft fracture. It is an excellent mode for treatment of complex, comminuted and unstable femoral fracture. It reduces the incidence of malunoin and maintains length of the bone. Minimal soft tissue injury during surgery, early rehabilitation ensures complete restoration of motion. It is a safe method in management of Type I& II compound fractures

Key-words: Fracture; shaft; femur; closed; interlocking; intramedullary; nail; diaphyseal.

INTRODUCTION

Orthopaedic surgeons often encounter diaphyseal femur fracture as a result of road traffic accidents. Most of these fractures often result from high energy trauma; one must have a high index of suspicion for complications or other injuries. Advancements in mechanization and acceleration of travel have been accompanied by increase in the number and severity of the fracture. Fracture femur results from the drawbacks of fast life and violence. They are major source of mortality and morbidity in patients with such injury. Femur fractures usually result in prolonged morbidity and extensive disability unless treatment is appropriate.[1]

The art of femoral fracture care is a constant balancing of the often-conflicting goals of anatomical alignment and early functional

rehabilitation of limb. In addition, there can be difficulty in assessing malrotation at the fracture site. They can belief threatening, because of open wounds, hemorrhagic shock, fat embolism, ARDS or multiple organ failure.[2]

Further there may be physical impairment due to fracture shortening, malalignment, and prolonged immobilization, due to traction or casting. This may lead to increased morbidity.

Management has tremendously advanced over the years. From the use of external splintsin the Hippocratic age, to the recent sophisticated instrumentation, treatment of fracture has made an impact in the surgical field.

So the aim of fracture treatment is to obtain union of the fracture, in as near anatomical position, with minimal impairment of function. The spectrum of injury is so great that no single method of treatment is relevant to all diaphyseal fracture femur.

The type and location of fracture, degree of comminution, age of the patient and patients social and economic demands and other factors influence the method of treatment. The technique chosen should cause minimal soft tissue and bone damage.[3,4,5]

The goal should be to achieve anatomic alignment and early mobilization with functional rehabilitation of limb. Many modalities of treatment have evolved over the years for this fracture. The method studied for this dissertation is Surgical Management of Diaphyseal Fracture Shaft of Femur with Closed Intramedullary Interlocking Nail.

MATERIALS AND METHODS

The present study was carried out between September 2023 to August 2024 in MGM Hospital Kakatiya Medical College, Warangal. Antegrade nailing using the Standard intramedullary interlocking nail was performed on 30 cases who presented with shaft fractures of the femur.

Inclusion criteria:

- Age group >18yrs.
- Acute isolated fracture involving the diaphysis of femur.
- Closed & GradeI, II Gustillo Anderson compound fracture.
- Segmental fracture.
- All Comminuted fracture (Winquist Hansen classification)

Exclusion Criteria

- Agegroup<18yrs.
- Grade-III Gustillo Anderson compound fracture.
- Associated with Head injury.
- Associated fractures in any of the 4 limbs.
- Pathological Fractures, Fracture Non-Union & Delayed Union.
- Patient not willing or Medically unfit for surgery.

All patients were admitted, a careful history was elicited from patient and attendants to reveal the mechanism of the injury and the severity of the medical history and preinjury functional status. The patients were then assessed clinically to evaluate their general condition and the local injury. In general condition of the patient, the vital signs were recorded. Comprehensive examination, not only of the injured limb, but also of all the limbs, to avoid missing the other associated injuries, if any, was done. The involved extremity was examined for swelling, deformity, abnormal mobility, crepitus, shortening, discoloration, skin integrity, neurological and vascular compromise, and signs or symptoms of compartment syndrome. Medical consultation was sought expeditiously for geriatric patients. General surgeon consultation was sought to evaluate all high energy accident victims to rule out polytrauma.

Radiographic evaluation included anteroposterior and lateral radiographs of the entire femur, including the hip joint and the knee joint. Application of manual traction of thelimb during radiographs will often clarify fracture morphology. The limb was then immobilized in a Thomas splint with skin traction. The patient was then taken up for surgery after investigations and as soon as the patient was medically fit for surgery.

Preoperative planning

Appropriate length of the nail to be used was assesses clinically and radiographically. Preparation of the part was done prior to surgery.

Operative procedure

Type of anesthesia: In all the cases spinal anesthesia/epidural.

Position-All pts were positioned supine on the fracture table. Hip adducted and limb in traction.

Incision - centred on the tip of the greater trochanter and extended 4 cm proximally and slightly posterior,distal extension carried out if necessary.

Entry portal- Using the C arm image intensifier, entry was made at the lateral aspect of piriformis fossa at the junction medial wall of greater trochanter. This was confirmed both in the AP and lateral views.

Guide wire insertion and fracture reduction -ball tipped guidewire was inserted through the entry point passed upto the fracture site closed reduction achieved using traction and manipulation and guidewire passed across the fracture site. This was confirmed by image intensifier in both the views.

Reaming- reaming of the canal done in 0.5mm increments starting from 8mm using flexible intramedullary reamers. Ball tipped guidewire replaced by a straight wire.

Nail insertion- the desired nail was mounted onto the proximal jig. Alignment of proximal jig holes to nail holes confirmed before insertion.

Distal locking- Done using freehand technique under C arm imaging. Locking of the bolts confirmed in both the views. The cortex was drilled

using a 4mm drill bit and 4.5mm locking bolts were inserted.

Proximal locking-Done using theproximal jig. Thecortex was drilled using a4.5mm drill bit and 6.3 mm locking bolts were inserted. Wound closed in layers.

Postoperative care

- Day1: Early active flexion and extension are essential and encouraged
- Day2:Isometric and range of motion exercises begun
- Day3: Gait training started with walker support without weight bearing.
- Day12:Suture removal
- Prophylactic antibiotics were used in all patients.
- By6 weeks, if X-rays showed signs of union progression weight bearing was started.

Follow-up

All the patients were followed up. With each follow up, clinical and radiological examinations were performed at 6 weeks,12 weeks,24 weeks and thereafter once in three 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 and varus - valgus and flexion - extension deformities. "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.

Figure 1: Incision

Figure 2: BONE AWL INSERTION

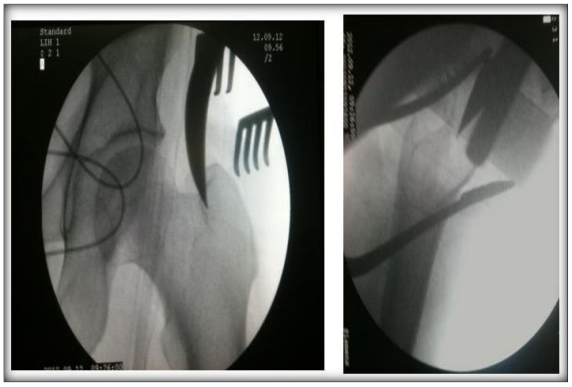


Figure 3: Guide wire insertion guide wire negotiated at fracture site under c-arm guidance

Figure 4: Guide wire into the distal fragment

Figure 5: Guide wire centralized distal fragment

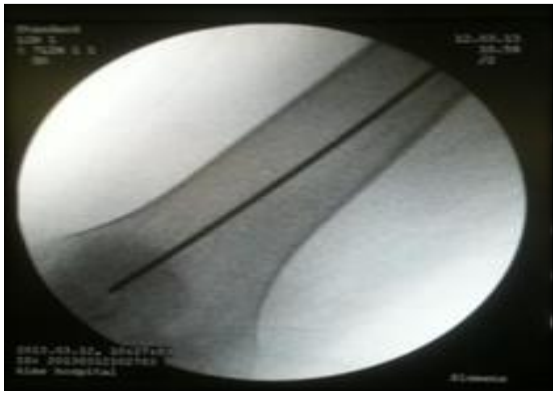


Figure 6: Guide wire insertion

Figure 7: Reeming the medullary cavity

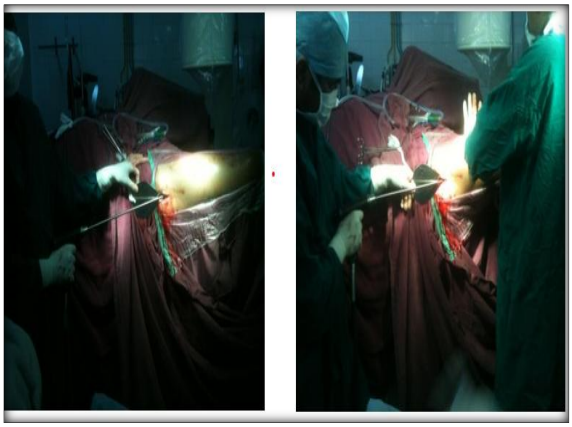


Figure 8: NAILMOUNTED ONAJIG NAIL INSERTION

Figure 9: PROXIMAL LOCKING

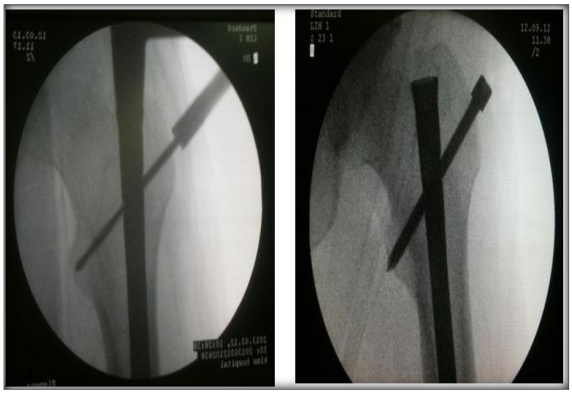
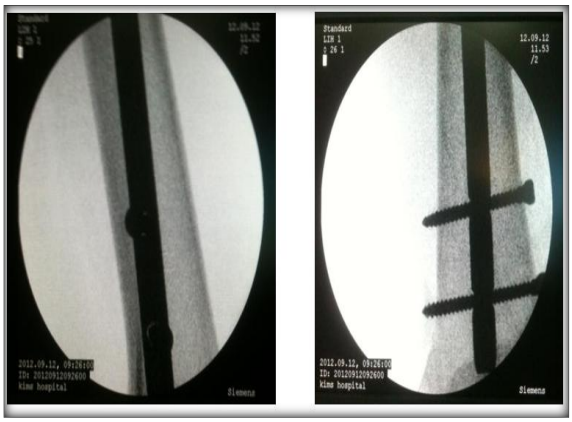


Figure 10: DISTAL LOCKING



RESULTS

Table 1: Age Distribution

AGE (years)	MALE	PERCENT AGE (%)	FEMALE	PERCENT AGE (%)
18-29	12	40	3	10
30-39	9	30	1	3.33
40-49	2	6.67	3	10

Majority of our patients were in the age group 18-29 years which is the Prime earning group in the Indian families. The mean age was 30years in our current study. Even though our study allowed all patients >18 yrs we did note encounter any case with isolated fracture shaft of femur above the age of 50yrs.

Table 2: MODE OF INJURY

MODEOF INJURY	CASES	PERCENTAGE
RTA	26	86.67
FALL	4	13.33

Table 3: Side Incidence

SIDEINCIDENCE	CASES	PERCENTAGE
RIGHT	18	60
LEFT	12	40

Table 4: Type of Fracture

TYPEOF FRACTURE	NUMBER OF CASES	PERCENTAGE
CLOSED/SIMPLE	24	80
OPEN/COMPOUND	6	20

Table 5: LEVELOF FRACTURE

LEVEL OF FRACTURE	NUMBEROFCASES	PERCENTAGE
PROXIMAL1/3RD	5	16.67
MIDDLE1/3RD	19	63.33
LOWER1/3RD	6	20

Table 6: Fracture Pattern

FRACTURE PATTERN	NO 3 OF CASES	PERCENTAGE
COMMUNITED	14	46.67
TRANSVERSE	9	30
OBLIQUE	3	10
SPIRAL	4	13.33

Table 7: Nail Diameter

NAIL DIAMETER (mm)	NUMBER OFCASE	PERCE NTAGE (%_)	SEX	NUMBER OFCASE	PERCET AGE(%)
9	6	20	MALE	0	0
			FEMALE	6	20
10	18	60	MALE	17	56.67
			FEMALE	1	3.33
11	6	20	MALE	6	20
			FEMALE	0	0

Table 8. Naillength

NAILSIZE -LENGTH (mm)	NUMBER OFCASE	PERCENTAGE	SEX	NUMBER OFCASE	PERCETAGE (%)
360	6	20%	MALE	1	3.33
			FEMALE	5	16.67
380	8	26.67%	MALE	6	20
			FEMALE	2	6.67
400	10	33.33%	MALE	6	20
			FEMALE	4	13.33
420	4	13.33%	MALE	4	13.33
			FEMALE	0	0
440	2	6.77%	MALE	2	6.67
			FEMALE	0	0

Table 9: Weight Bearing

	PARTIALWEIGHT BEARING	FULLWEIGHT BEARING
6-12weeks	21	0
13-16weeks	09	21
17-20weeks	0	09

Table 10. RADIOLOGICAL FRACTURE UNION

WEEKS	NUMBER OF CASES	PERCENTAGE
12-16	5	16.67
17-20	14	46.67
21-24	9	30
>24	2	6.67

Table 11: Complications

Complication	No.ofPatients	Percentage
FatEmbolism	2	6.67%
Breakageofscrews/nail	0	0%
Superficialinfections	2	6.67%
Deep infections	0	0%
Delayedunion	2	6.67%
Non union	0	0
ImplantFailure	0	0
Restrictionofmovementat Knee joint(in degrees)		
91-120	3	10 %
<90	2	6.67%
Shortening 1cm	2	6.67%-
>1-2cm	1	3.3%

Table 12: Shortening

SHORTENING	NUMBEROF CASES	PERCENTAGE
0	27	90%
1	2	6.67%
>1	1	3.33%

Table 13: NUMBER OF DAYS OF HOSPITAL

NUMBER OF DAYS	NUMBER OF CASES	PERCENTAGE
1-09	12	40%

10-15	12	40%
16-20	5	16.67%
21-30	1	3.33%

Table 14: DURATIONFROMINJURYTO SURGERY

DURATION	NUMBEROF CASES	PERCENTAGE
<24Hours	2	6.67%
24-72hours	15	50%
4-7Days	13	43.3%

Table 15: FUNCTIONAL OUTCOME

FUNCTIONAL OUTCOME	NUMBEROF CASES	PERCENTAGE
EXCELLENT	23	76.67%
GOOD	4	13.33%
FAIR	3	10%
POOR	0	0

PRE-OP

6MONTHSFOLLOWUP

IMMEDIATEPOST-OP

FULLCONSOLIDATION AT 10 MONTHS

SITTINGCROSSLEGGED

SQUATTING

DISCUSSIONS

The treatment of fracture diaphysis of femur has evolved from the old conservative management to the most recent methods of interlocking nails. This is the era of biological fixation. Interlocking nails have greatly expanded the indications for closed IM nailing of femoral fractures. The rationale for internal fixation is that it restores the anatomical alignment and allows early mobilization of the patient and limb.

The use of a plate to achieve osteosynthesis necessitates wide operative exposure and excessive soft tissue stripping, resulting in increased blood loss and operating time. The risk of infection is increased. Failure of the plate is common and the need for primary bone grafts adds additional morbidity to the procedure.

Early mobilization following fractures of the femoral diaphysis has been shown to have a significant advantage in terms of both joint mobility and economic impact which has very well attained by the use of interlocking nails.

AGE INCIDENCE

Majority of our patients were in the age group 18-29 years which is the Prime earning group in the Indian families. The mean age was 30years in our currentstudy. In the study of Wiss et.al mean age was 29year.[6] Series of Thoresen 7 of 48 cases of femoral shaft fractures stated a mean age of 28 years.[7]

SEX INCIDENCE

In most of the studies and in ours too the incidence was significantly higher in males.(23 males and 7 females) Wiss Fleming et.al,[6] Male predominance (83.7%) found inhis111patients series. Alho et al,[8]reported 55% male predominance in 120 patients

SIDE INCIDENCE

In the series of Johnson and Green bergright side was predominantly involved.[9]

In the series of Wiss et al of comminuted fractures right side was predominantly involved.[6]

MODE OF INJURY

The mode of injury in this series we had 26 cases of road traffic accident i.e. around 86.67%.The incidence of road traffic accident has been on the increasing scale.

Winquist et al,[10]also had 77%of cases because of motor vehicular accidents. This observation by various authors implies that fractures haft femuris usually a result of high energy trauma. So it is commonly associated with other injuries.

FRACTUREPATTERN

In the study of Thoresen et.al comminuted fractures were the commonest followed by the transverse and then the spiral pattern. In the series of Wiss et al 6 comminuted fractures predominated.

In our series, 63.33%offractures were located in the middle third, while in reported series of conventional nailing, this figure ranged from 60-80% and 50% in the series of Thoresen et al,[7] where G.K. interlocking nail was used. Even the distribution of both comminution and type of fracture is similar to those in other series, where in interlocking nails were used showed comminuted.

TIME FROM INJURY TO SURGERY

Interval between injury and surgery in our series was between 3 to 10 days. Average 6.20 days. The compound fracture (Grade II) were thoroughly debrided and open interlocking was done in the same setting. Head injury patients were operated after fitness was given by Neurosurgeons.

STUDY	INJURY TO SURGERY
PRESENT STUDY	2.83Days
Lhowe Hansen[11]	7 hours
Blumberg[12]	3.5days
Hanks[13]	7.5days

TIME DURATION OF HOSPITAL STAY

The average time of hospital stay in our study was an average of11.43days, compared to Wiss et al,[6] 12 days.

AVERAGETIMEFORUNION

The average time forunionin our series was21.3 weeks ranging from16–24 weeks.

Thoresen et al, (1985),[8] at 16 weeks , Wiss et al,[6] (1986) obtained at 26 weeks.

CONCLUSION

The incidence of infection following open nailing was reported by Wiss et al 6 as 8.3% and by John et al as 13%. The incidence of infection was drastically low in closed interlocking.

2 cases of Fat Embolism was encountered one preoperative and another immediate post operartively. Both patients recovered within 48-72 hours with supplementary oxygen , fluid management, steroid therapy, none required invasive ventilation.

In our series there were 2 cases with superficial infection and no case of deep infection.The case was managed with antibiotics did not need any surgical intervention.

STUDY	DEEP INFECTION PERCENTAGE
Wisset al[4]	8%
Lhowe et al[11]	5%
Klemm et al[14]	2.4%
PRESENT STUDY	0

SHORTENING

One of the most common complication following fracture diaphysis femur has been shortening at the fracture site. Interlocking IM nail has virtually eliminated this complications or at least got down its incidence immensely.

FUNCTIONAL OUTCOME

The functional outcome in our present study was 90% for excellent and good results. Closed Intramedullary interlocking nailing is a very effective, successful and time tested method of treatment for diaphyseal fractures of femoral shaft. It is advantageous over other methods of treatment because Fracture hematoma not disturbed. Fractures ite vascularity not further hampered. We observed Stable fixation.Faster rate of fractureunion. Lower rate of complications like infection &nonunion. Allows early mobilization &return to routine activities.

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