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A CLINICAL STUDY 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, malunion, non-union or implant failure. **AIMS:** To assess the time taken for fracture union and the functional outcome in patients with fracture shaft of femur. **METHODS AND MATERIALS:** We studied a total of 30 patients of fracture shaft of femur admitted in the Orthopedic Department of Kempegowda Institute of Medical sciences Bangalore 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 was 2 years. **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 was seen 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 malunion and maintains length of the bone, also enables early mobilization & return to routine activities.

KEYWORDS: 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. Fracture femur results from the drawbacks of fast life and violence. They are major source of mortality and morbidity in patients with such injury.

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 be life threatening, because of open wounds, hemorrhagic shock, fat embolism, ARDS or multiple organ failure.

AIMS AND OBJECTIVES: To evaluate the functional outcome of fractures of the shaft of the femur treated with closed intramedullary interlocking nailing.

- 1) Early mobilization, to prevent fracture disease and enhance fracture healing.

- 2) To prevent rotational deformity.
- 3) Also to study the
 - a) Intra-operative difficulties and complications.
 - b) Post-op complications.
 - c) Time to fracture union.
 - d) Period of ambulation.
 - e) Range of motion.

METHODOLOGY: The present study was carried out between November 2011 and November 2013 in Kempegowda Institute of Medical Sciences. 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 & Grade I, II Gustillo Anderson compound fracture.
- Segmental fracture.
- All Comminuted fracture (Winkist Hansen classification)

EXCLUSION CRITERIA:

- Age group <18 yrs.
- 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.

Patients admitted with fractures of shaft of femur after meeting inclusion and exclusion criteria are selected for study. After clinical assessment of signs and symptoms, x rays and pre- operative investigations are done

After prior informed consent, a pre-operative anesthetic evaluation is done, pre-op planning of fixation is made and nail length is measured.

Under anesthesia, closed reduction and internal fixation with intramedullary interlocking nails done using c-arm.

Post-operatively mobilized without weight bearing on 2nd to 4th day, patients are advised active quadriceps exercises, Hip and knee flexion-extension exercises. Partial weight bearing started at 6weeks. Full weight bearing was possible by 8-12 weeks depending on the fracture configuration, callus response.

Assessment was done at regular intervals of 6weeks, 12weeks and 6 months. At each follow-up visit, patient is evaluated clinically, radiologically and complications are noted.

Based on these data the final outcome is assessed according to Thoresen et al criteria.¹

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ETHICS: Since closed intramedullary interlocking nailing of femur is worldwide accepted procedure so there are no ethical issues associated with the procedure .A prior informed written consent is taken for surgery and anesthesia.

RESULTS:

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

SEX	CASES	PERCENTAGE
MALE	23	76.7
FEMALE	7	23.3
Sex Distribution		

MODE OF INJURY	CASES	PERCENTAGE
RTA	26	86.67
FALL	4	13.33
Mode of Injury		

SIDE INCIDENCE	CASES	PERCENTAGE
RIGHT	18	60
LEFT	12	40
Side Incidence		

TYPE OF FRACTURE	NUMBER OF CASES	PERCENTAGE
CLOSED/SIMPLE	24	80
OPEN/COMPOUND	6	20
Type of Fracture		

LEVEL OF FRACTURE	NUMBER OF CASES	PERCENTAGE
PROXIMAL 1/3 RD	5	16.67
MIDDLE 1/3 RD	19	63.33
LOWER 1/3 RD	6	20
Level of Fracture		

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

NAIL DIAMETER (mm)	NUMBER OF CASE	PERCENTAGE (%)	SEX	NUMBER OF CASE	PERCETAGE (%)
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
Nail Diameter					

NAIL SIZE -LENGTH (mm)	NUMBER OF CASE	PERCENTAGE	SEX	NUMBER OF CASE	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
Nail Length					

WEEKS	PARTIAL WEIGHT BEARING	FULL WEIGHT BEARING
6-12	21	0
13-16	09	21
17-20	0	09
Weight Bearing		

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

Complication	No. of Patients	Percentage
Fat Embolism	2	6.67%
Superficial infections	2	6.67%
Delayed union	2	6.67%
Restriction of movement at Knee joint (in degrees)		
91-120	3	10 %
<90	2	6.67%
Shortening 1cm	2	6.67%-
>1-2 cm	1	3.3%
Complications		

No cases of breakage of screws/ nail, deep infections, nonunion and implant failure were noted in our study series.

FUNCTIONAL OUTCOME	NUMBER OF CASES	PERCENTAGE
EXCELLENT	23	76.67%
GOOD	4	13.33%
FAIR	3	10%
POOR	0	0
Functional Outcome - According to Thoresen et al scoring system		

ILLUSTRATION- 1:

PRE-OP

IMMEDIATE POST-OP

6 MONTHS FOLLOWUP

FULL WEIGHT

Hip- Extension
Knee- Extension

SQUATTING

Hip- Flexion
Knee- Flexion

SITTING CROSSLEGGED

Hip- Flexion
Abduction
External rotation
Knee- Flexion

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ILLUSTRATION 2

DISCUSSION: 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

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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 30 years in our current study.

In the study of Wiss et.al mean age was 29 year¹.

Series of Thoresen of 48 cases of femoral shaft fractures stated a mean age of 28 years².

White et al observed mean age of 28 years in their study³.

Most of the patients were manual laborers and agriculturist whose early return to work was important.

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 Male predominance (83.7%) found in his 111 patients series.

Alho et al reported 55% male predominance in 120 patients.⁴

SIDE INCIDENCE: In the series of Johnson and Greenberg right side was predominantly involved⁵. In the series of Wiss et al of comminuted fractures right side was predominantly involved¹.

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 al⁶ also had 77% of cases because of motor vehicular accidents.

This observation by various authors implies that fracture shaft femur is usually a result of high energy trauma. So it is commonly associated with other injuries.

FRACTURE PATTERN: 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 comminuted fractures predominated.¹

In our series, 63.33% of fractures 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, 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 2.83 days. The compound fracture (Grade II) was thoroughly debrided and open interlocking was done in the same setting. Blumberg et al reported that time from injury to surgery in their series was an average of 3.5 days.⁷

TIME DURATION OF HOSPITAL STAY: The average time of hospital stay in our study was an average of 11.43 days, compared to Wiss et al 12 days.¹

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AVERAGE TIME FOR UNION:

The average time for union in our series was 21.3 weeks ranging from 16 – 24 weeks.

Gross Kempf et al, (1985) reported union at 18 weeks, Thoresen et al, (1985) at 16 weeks, Wiss et al (1986) obtained at 26 weeks.^{1, 2, 8}

COMPLICATIONS: The incidence of infection following open nailing was reported by Wiss et al 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 were encountered one preoperative and another immediate post-operatively. 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.

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.

In our series shortening of between 1-2 cm was seen in 3 patients. Hansen ST Jr and Lhowe reported significant shortening in 7 % cases.⁹

FUNCTIONAL OUTCOME: The functional outcome in our present study was 90% for excellent and good results.

STUDY	PERCENTAGE OF EXCELLENT/GOOD RESULT
PRESENT STUDY	90
Johnson et al ⁴	96.1
Gross Kempf et al ⁶	90
Wiss et al ¹	.92
Klauss et al ¹⁰	97

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COMPARATIVE STUDIES:

	Number of cases	Duration of Hospital stay	Shortening >1cm %	Union weeks	Deep Infection%
Present study	30	11.43	10	21.3	0
Thoresen et al ²	48	-	7.5	16	0
Gross Kempf et al ⁶	49	21	7.5	18	2.1
Winqvist & Hansen ⁵	245	26	7.3	14	0.4

CONCLUSION: 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.
- Fracture site vascularity not further hampered.
- Stable fixation.
- Faster rate of fracture union.
- Lower rate of complications like infection & non-union.
- Allows early mobilization & return to routine activities.

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