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Outcome of Femoral shaft Fractures Managed by Interlocking Nail

KEYWORDS: femur shaft fractures, diaphyseal fractures, interlocking nail, load sharing device, intramedullary nailing.

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ABSTRACT

Background: To study the management of femoral shaft fractures by interlocking nail.

Materials and Methods: This retrospective study includes 30 cases of diaphyseal fractures of femur shaft treated with closed interlocking intramedullary nailing between September 2014 and march 2016.

Conclusion: From this sample study we concluded the femur interlocking nail is a good implant for the treatment of femoral shaft fractures because of its load sharing, closed insertion, rotational stability, restoration of anatomic length alignment and early mobilization.

INTRODUCTION

Femur is one of the longest and strongest bones in human body and is one of the principal load-bearing bones of the body. Due to its larger size, rich vascularity and muscular attachments a fracture may lead to a significant blood loss. Fractures can cause prolonged morbidity, extensive disability unless adequately treated and mortality. Morbidity arises from femoral shortening, knee stiffness, malalignment, quadriceps contracture and other complications of fracture. Mortalities are infrequent but can occur due to open wounds fat embolism and multi organ failure especially in poly trauma patients. Femoral shaft fractures in adults are almost always the result of high-energy trauma. As the incidence of high energy trauma is increasing with industrialization and urbanization. Both morbidity and mortality can be reduced by prompt reduction and internal fixation of fracture[1]. So an appropriate device for stabilization of femoral shaft fractures is essential .Stabilization of femoral shaft fractures is gold standard in its management. With tubular anatomy of femur intramedullary nailing appears better than plating. Nailing can tolerate more torsional and bending forces better than plates. Being a load sharing devices intramedullary nails cause less cortical osteopenia. Currently interlocking intramedullary nailing is considered to be best choice of treatment for femoral diaphyseal fractures[2]. In this study; we evaluate the results of femoral shaft fractures managed with interlocking nail and its outcome of results.

MATERIALS AND METHODS

This retrospective study includes 30 cases of diaphyseal fractures of femur shaft treated with closed interlocking intramedullary nailing between September 2014 and March 2016. All the cases were treated by same procedure. The inclusion criteria was all Patients of age above 18 years with diaphyseal fractures of femur (Both closed & Grade 1 compound) and both males and females. We excluded the patients of age less than 18 years and Pathological fractures. The most common mechanism of injury is road traffic accident

The youngest in our series is 19 years old and the oldest is 65 years. Maximum numbers of patients in this study are of young reproductive group and mean age is 30.44 years. In the present study it is seen that femoral shaft fractures are more common in males than females. In the present series femoral shaft fracture involvement is equal on both sides. Intra–operatively reduction of the fracture was achieved through closed means in 86.66% (26) of cases. Open reduction was performed in 4 patients where closed reduction was not possible.

On admission general condition of the patients were assessed and stabilized hemodynamically. After excluding major associated injuries like head injury, abdomen and chest injuries patients were assessed in detail for orthopaedic injury. All patients were evaluated clinically and radiologically. X-rays of entire thigh including hip and knee joints were taken in two planes, anteroposterior and lateral views. Skin traction was applied to the fractured limb and immobilized over Bohler braun frame till surgery.

Patients were operated as early as possible once the general condition of the patient was stable and was fit for surgery and anesthesia.

Appropriate nail size was assessed clinically and radiographically. Length of IM nail corresponds approximately to the distance between the tip of greater trochanter and the lateral epicondyle of femur. This can be measured directly on the uninjured extremity with a long ruler or on a radiograph.

All the patients were operated on a fracture table in supine position under image intensifier. Prophylactic antibiotics and anti-inflammatory drugs were given after surgery. Post operatively no external immobilization was given and patients were advised not to weight bear on affected limb. Patients were encouraged to do knee movements as soon as possible after the surgery. Patients were discharged following sutures removal after 10 days. They were assessed radiologically on 1st post-operative day, at 6 weeks, 12 weeks, and between 4 months to 1year monthly. Clinical and radiological union results were evaluated by THORESEN'S CRITERIA (table-1).

Features	Results			
	Excellent	Good	Fair	Poor
Malalignment of femur (degrees)				
Varus/valgus	< 5	5	10	>10
Antecurvatum / 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 of knee (degrees)				
Flexion	>120	120	90	<90
Extension Deficit	5	10	15	>15
Pain/Swelling	None	Sporadic Minor	Significant	Severe

Table - 1 .THORESEN'S CRITERIA

OPERATIVE PROCEDURE

In all the cases spinal anaesthesia was used and positioned supine on the fracture table. Hip adducted and flexed to about 15°. Incision is centred on the tip of the greater trochanter and extended 4 cm proximally and slightly posterior, distal extension carried out if necessary(fig-1). Using the C arm image intensifier, entry was made at the lateral aspect of piriform fossa at the junction medial wall of

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greater trochanter with diamond bone awl (fig-2,3,). This was confirmed both in the AP and lateral views. Ball tipped guidewire was inserted through the entry point passed up to 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 (fig-4). Reaming of the canal done in 1mm increments using flexible intramedullary reamers. Ball tipped guidewire replaced by a straight wire. The desired nail was mounted onto the proximal jig(fig-5). Alignment of proximal jig holes to nail holes confirmed before insertion.

After assembling the selected nail to jig it is introduced as far as possible manually into the medullary canal with the help of the mounted insertion instruments. Using the image intensifier by gentle blows with a hammer nail is counter sunk in the bone passing through fracture line (fig-6).

Nail entry was confirmed in both AP and lateral planes. Distal locking (fig-7) done using freehand technique under C arm imaging. Locking of the bolts were checked in both the views. The cortex was drilled using a 4mm drill bit and 4.5mm locking bolts were inserted. Proximal locking done using the proximal jig. The cortex was drilled using a 4mm drill bit and 4.5mm locking bolts were inserted. Wound closed in layers.

Fig-1: SKIN INCISION

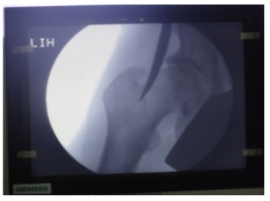

Fig-2: ENTRY POINT

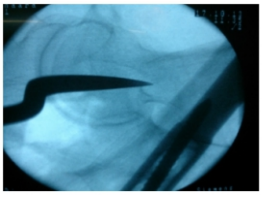

Fig-3:GUIDE WIRE INSERTION

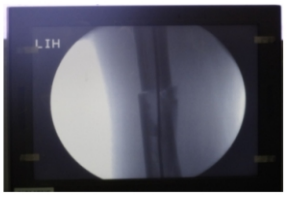

Fig-4:GUIDE WIRE ACROSS# SITE

Fig-5: NAIL INSERTION

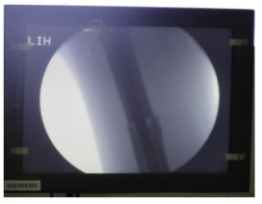

Fig-6: NAIL IN-SITU

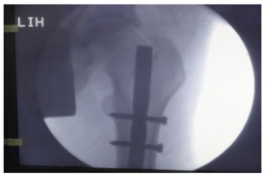

Fig-7: PROXIMAL LOCKING

Fig-8:DISTAL LOCKING

DISCUSSION

Femoral shaft fractures are usually the result of high energy trauma. Affected people are younger who are in the productive age group and are prone to be an economic and social burden to their families and to the society if the recovery is not satisfactory. In many of these cases the bone unites with shortening, angulation, or displacement if treated conservatively. An adequate reduction and rigid immobilization by some form of internal fixation is essential in femoral shaft fractures.

Internal fixation of fractures of the femoral shaft has gained widespread acceptance as implants and technology have improved.

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.

Introduction of closed locked intramedullary nailing has revolutionized the management of fractures of femur because of its minimal surgical exposure and less demanding surgical skills, facilities and early ambulation.

The incidence of femoral shaft fractures was 9.9 per 100,000 person-years. During the period of September 2014 and March 2016, over 62 diaphyseal fractures of femur shaft were treated in orthopaedic department at ASRAM Hospital ELURU. After excluding fractures below 18 years of age and fractures of Gustilo Anderson's 2&3 grades, pathologic fractures, 30 patients were selected for the present study. Most of our patients were of younger age group, 20(66.6%) patients between 18- 30yrs, the average age being 30.44 years, which correlate the fact that younger population is at increased risk of femoral fractures. Ours is slightly higher when compared to **THORESEN**[3] (1985), **WISS**[4] et al (1986) i.e. 28 and 29 years respectively.

In our patients significant male dominance 25 out of 30 (83.3%) was seen as compared to 24 (51.06%) females out of 47 patients in **THORESEN**[3] series. In the series of **Arpacio lu MO et al 2003**[5] et al showed sex distribution of 35 men and 11 women, whereas in the series of RC Meena[7] and others, male to female ratio was 8:1.

Regarding side of fracture occurrence left 15(50%)and right 15(50%) sides are equally predominant but in the series of **WISS**[4] et al (1986) and **JOHNSO**[6] et al (1984) right side was more involved. In the series of **Arpacioğlu MO et al 2003**[5],out of 46 patients 31 patients had fracture in the right side,13 in the left and 2 cases were bilateral.

In 25 out of 30 patients (83.3%) fractures are of road traffic accidents and more male patients sustained femoral fractures 23(93%) highlighting the fact that males are prone to road traffic accidents. Out of 5 patients in females 3 (60%) sustained fractures because of domestic fall. In **THORESEN**[3] et al series 65.9% were due to high energy trauma and 34.04% was due to low energy trauma. In the series of **RC Meena & others 2006**[7], out of 108 cases RTA was the mode of injury in 91 cases.

In our series the level of fracture is dominated by middle 3rd in 20(66.6%) patients followed by 8(26.6%) middle lower 3rd junction fractures and 2(6.66%) upper middle third junction. Other reported series of conventional nailing, this figure ranged from 60-80% and 50% in the series of **THORESEN**[3] et al. Fracture pattern in our study was transverse in 16 (53.33%) out of 30 patients, 10 (33.3%) comminuted, 2(6.66%) spiral and 2(6.66%) oblique. In the study of **THORESEN**[3] et al comminuted fractures were the common followed by transverse and then the spiral pattern. In the series of **WISS**[4] et al comminuted fractures predominated.

Admission – operation interval in our study varied from 2-15 days. Mean interval being 5.06 days .The optimal time for nailing of closed femoral diaphysis fractures has been suggested by **BRUMBACK**[8] et al (1988) as 7-10 days for elective admissions and immediately for patients with polytrauma to allow prompt mobilization. The mean duration of hospital stay in our study was 16 days average which is high when compared to **WISS**[4] et al series where it was 12days only and relatively low compared to **GROSS & KEMPF**[9] series (21 days). Intra operatively reduction was achieved by closed means in

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26(86.6%) cases and 4(13.3%) needed open reduction due to late operation interval.

The reduction of the fractures were good in 28(93.3%) of patients and acceptable in 2(6.6%) when compared to **THORESEN**[3] et al where 3(6.3%) patients had poor reduction. Post operatively two patients out of 30 in this study had superficial infection (6.66%) and this was controlled by parenteral antibiotics, one had deep infection. It is higher as compared to infection rates in **WISS**[4] et al series with 0.9% and in **CHRISTIE**[10] et al series it was 0.8%.

The average time of radiological union was 18 weeks in the present study whereas in **GROSS KEMPF**[9] et al (1985) and in **THORESEN**[3] et al(1985) series it was 18 weeks and 16 weeks respectively. The average union rate was same in our series compared to the series of the above authors but with **WISS**[4] et al (1986) it is 26 weeks which is very high compared to ours. In our study no patient was permitted to weight bear fully on affected limb before 6 weeks, which is at par with **THORESEN**[3] et al series (30 days). One of our case developed non union and 4 cases required dynamization for delayed union compared to 10 cases in **THORESEN**[3] et al series. All the patients in this study had no problems relating to malalignment, stiff knee and pain. Shortening less than 2 cms occurred in 2(6.6%) patients which is very low compared to **GROSS and KEMPF**[9] where 11(21.1%) patients out of 52 had shortening. In our study 25 patients (83.3%) had full range of knee and hip movements. None reported any fatigue due to prolonged walking.

Final outcome was excellent in 25 out of 30 patients 83.33%, good in 3 patients 10%, fair in one patient 3.33% and poor in 1patient 3.33% which is better outcome as compared to **THORESEN**[3] et al series where recovery rate excellent, good, fair, poor are 63.8%, 17. 02%, 14.8%, 4.2% respectively. In our series younger age group patients had a better functional outcome.

CONCLUSION

The incidence of femoral shaft fractures is on the rise because of fast and high speed transportation and modern lifestyles. Internal fixation is the mainstay of treatment. Conventional plating is associated with high risk of infection, pseudo arthrosis, malunion, decreased knee motion and loss of fixation. Interlocking techniques lead to fewer complications of non-union/malunion, lesser soft tissue dissection, and earlier fracture healing and lesser chances of infection. Fractures in any zone from the sub trochanteric to distal supracondylar part of the femur are accessible to nailing. This study conducted to analyze the results of fractures of femur treated by interlocking nail AO type.

In our series of 30 cases of femoral shaft fractures treated by interlocking nail 25 patients had excellent outcome, 3 patients had good outcome, fair and poor one each. Most of the patients in this series were younger age group; more than 80% were below 50 years.

Our aim was to treat these fractures by closed interlocking intramedullary nailing, early mobilization and to assess the outcome of interlocking nailing in the treatment of these fractures.

Incidence in males was more as compared to females. Right side being more predominant in this study. All the patients were mobilized post operatively as early as possible depending upon the fracture stability, general condition, and pain tolerance.

The present series shows that closed fractures of the femoral shaft, managed with interlocking intramedullary nailing, involve minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, lower rates of infection, delayed union, non-union and malunion compared to other treatment modalities.

Early mobilization of the patient helps in healing of the fracture and prevents joint stiffness. The procedure promotes early union as it does not disturb the anatomy and physiology of vascularity at the fracture site. Minimal hospital stay and early return to activities.

From this sample study we concluded the femur interlocking nail is a good implant for the treatment of femoral shaft fractures because of its load sharing, closed insertion, rotational stability, restoration of anatomic length alignment and early mobilization.

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