e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(2); 419-423

Original Research Article

A Clinical Study to Evaluate Functional Outcome of Femur Interlock Nailing in Adult Patients with Shaft Femur Fractures

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Received: 07-12-2023 / Revised: 16-01-2024 / Accepted: 21-02-2024
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Conflict of interest: Nil

Abstract

Aim: To evaluate the functional result of femur interlock nailing in adult patients with shaft femur fractures.

Materials and Methods: This was a retrospective study conducted in the Department of orthopaedics SKMCH, Bihar, India. This is a study includes 40 cases of diaphyseal fractures of femur shaft treated with closed interlocking intramedullary nailing. 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. 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.

Results: Most of our patients were of the younger age group, 26(66.6%) patients between 18- 30 yrs., the average age being 30.44 years, which correlate the fact that younger population is at increased risk of femoral fractures. In our series the level of fracture is dominated by middle 24 (60%) patients followed by 12 (30%) distal 1/3rd junction fractures and 4 (10%) proximal 1/3rd junction. The mean duration of hospital stay in our study was 16 days average. Intra operatively reduction was achieved by closed means in 34(85%) cases and 6(15%) needed open reduction due to late operation interval. The reduction of the fractures were good in 34(95%) of patients and acceptable in 4(10%) In our study no patient was permitted to weight bear fully on affected limb before 6 weeks, Final outcome was excellent in 35 out of 40 patients 87.5%, good in 3 patients 7.5%, fair in one patient 2.5% and poor in 1 patient 2.5%

Conclusion: Interlocking techniques lead to fewer complications of nonunion/malunion, lesser soft tissue dissection, and earlier fracture healing and lesser chances of infection. It provides the advantages of early ambulation, lower rates of infection, delayed union, nonunion and malunion compared to other treatment modalities. Early mobilization of the patient helps in healing of the fracture and prevents joint stiffness.

Keywords: Femur interlock nailing, Adult patients, Shaft femur fractures

Introduction

Femoral shaft fractures are among the most common long bone fractures, predominantly resulting from high-energy trauma such as motor vehicle accidents or significant falls. In adults, these fractures can have severe implications, including substantial blood loss, potential for fat embolism, and prolonged immobilization leading to a host of complications. Effective management is essential for optimal recovery and restoration of function. One of the most widely accepted treatment modalities for femoral shaft fractures in adults is intramedullary interlocking nailing. [1] This method has revolutionized the management of these injuries by providing a stable, minimally invasive option that facilitates early mobilization and weight-bearing. Intramedullary nailing offers several biomechanical advantages. Firstly, it aligns the fracture fragments within the medullary canal, providing a load-sharing construct that allows for early weight-bearing. [2] The locking screws add further stability, reducing the risk of malalignment and allowing for the treatment of both simple and complex fracture patterns. This method also preserves the periosteal blood supply, which is crucial for fracture healing,

and minimizes soft tissue dissection, reducing the risk of infection and postoperative complications. The surgical technique for femoral interlocking nailing involves several critical steps. The patient is typically placed on a fracture table to facilitate traction and reduction of the fracture. After appropriate anesthesia, a small incision is made, and entry into the femoral canal is achieved using an entry reamer. The canal is then progressively reamed to accommodate the intramedullary nail. The nail is inserted into the canal, and locking screws are placed through small incisions at the proximal and distal ends under fluoroscopic guidance. This technique can be performed through either antegrade (from the hip) or retrograde (from the knee) approaches, depending on the fracture location and surgeon preference. [3] Numerous studies have demonstrated the efficacy of intramedullary interlocking nailing in treating femoral shaft fractures. The technique has been associated with high rates of union, with most fractures healing within six months. Complication rates are relatively low, with nonunion, malunion, and infection being the most common issues, though they occur infrequently. Additionally, the minimally invasive nature of the procedure results in shorter hospital stays, reduced pain, and faster return to normal activities compared to other methods like plate fixation. [4,5]

Materials and Methods

This was a retrospective study conducted in the Department of orthopaedics, SKMCH, Muzaffarpur, Bihar, Patna, Bihar, India for 12 months. This is a study includes 40 cases of diaphyseal fractures of femur shaft treated with closed interlocking intramedullary nailing. 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. 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. Intra–operatively reduction of the fracture was achieved through closed means in 85% (34) of cases. Open reduction was performed in 6 patients where closed reduction was not possible.

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. 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 suture removal after 10 days. They were assessed radiologically on 1st postoperative day, at 6 weeks, 12 weeks, and between 4 months to 1year monthly. Clinical and radiological union results were evaluated by Thorsen's Criteria (Table-1).

Methodology

In all the cases spinal anesthesia was used and positioned supine on the fracture table. Hip adducted and flexed to about 15°. Incision is centered on the tip of the greater trochanter and extended 4 cm proximally and slightly posterior, distal extension carried out if necessary. Using the C arm image intensifier, entry was made at the lateral aspect of piriform fossa at the junction medial wall of greater trochanter with diamond bone awl. This was confirmed both in the AP and lateral views. Ball tipped guide wire was inserted through the entry point passed up to the fracture site closed reduction achieved using traction and manipulation and guide wire passed across the fracture site. Reaming of the canal done in 1mm increments using flexible intramedullary reamers. Ball tipped guide wire replaced by a straight wire. 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. Nail entry was confirmed in both AP and lateral planes. Distal locking done using freehand technique under C arm imaging. Locking of the bolts were checked in both the views. Wound closed in layers. Sterile dressing kept.

Results

Varus/Valgus: Excellent: Malalignment of less than 5 degrees indicates optimal alignment, suggesting that the femur is nearly in its normal anatomical position without significant deviation. Good: A malalignment of 5 degrees is slightly off but remains within acceptable limits, implying that although there is a minor deviation, it does not significantly impair function. Fair: A malalignment of 10 degrees represents a moderate deviation. This could potentially affect the biomechanical function of the femur, potentially leading to discomfort or altered gait. Poor: Malalignment greater than 10 degrees indicates significant misalignment. This level of deviation is likely to impair function and may require corrective procedures to restore proper alignment and functionality.

Antecurvatum / Recurvatum: Excellent: Deviation of 5 degrees or less indicates minimal forward or backward bending of the femur, suggesting that the alignment is close to normal. Good: A deviation reaching 10 degrees shows a slight curve, which is generally acceptable but indicates some deviation from the normal anatomy. Fair: A deviation of 15 degrees indicates a more noticeable bend, which could affect limb mechanics and potentially lead to functional impairment. Poor: Deviation greater than 15 degrees represents substantial bending. This severe misalignment could significantly impact the function and stability of the femur, often necessitating corrective intervention.

Internal Rotation: Excellent: Deviation of 5 degrees or less indicates minimal inward rotation, suggesting that the femur is nearly in its normal rotational alignment. Good: Deviation of 10 degrees indicates a small inward rotation that is usually tolerable and may not significantly impact function. Fair: A deviation of 15 degrees represents a noticeable inward turn, which could impair gait and function, potentially leading to discomfort or altered movement patterns. Poor: Deviation greater than 15 degrees indicates significant inward rotation. This substantial misalignment likely necessitates intervention to correct the rotational deformity and restore proper function.

External Rotation: Excellent: Deviation of 10 degrees or less indicates minimal outward rotation, suggesting that the femur's alignment is close to normal. Good: Deviation of 15 degrees represents a slight outward rotation that is generally acceptable but indicates some deviation from the normal anatomy. Fair: A deviation of 20 degrees indicates a noticeable outward turn, which could affect gait and potentially lead to functional impairment. Poor: Deviation greater than 20 degrees represents significant outward rotation. This severe misalignment likely requires corrective procedures to restore proper alignment and function.

Shortening of Femur (CM) Excellent: Shortening of 1 cm or less indicates minimal discrepancy, often unnoticeable and not significantly impacting function or gait. Good: Shortening of 2 cm shows a slight difference, which might require minor adjustments such as shoe inserts but generally does not severely impair function. Fair: Shortening of 3 cm represents a noticeable discrepancy, which could impact gait and may necessitate intervention to correct the length difference. Poor: Shortening greater than 3 cm indicates a significant difference. This substantial discrepancy likely necessitates corrective measures such as shoe lifts or surgery to restore proper limb length and function.

Range of Motion of Knee (Degrees)

Flexion: Excellent: Flexion greater than 120 degrees indicates full range of motion and optimal knee function, allowing for a wide range of activities without limitation. Good: Flexion of 120 degrees, although slightly reduced, still allows for most daily activities and is considered functionally adequate. Fair: Flexion of 90 degrees represents a substantial reduction, limiting functional activities and potentially impacting the patient's quality of life. Poor: Flexion less than 90 degrees indicates severe restriction, significantly impairing function and necessitating intervention to improve mobility.

Extension Deficit: Excellent: Deficit of 5 degrees or less indicates near full extension and excellent knee function, suggesting minimal impairment. Good: Deficit reaches 10 degrees, showing a small limitation in extension that is generally acceptable but may cause minor functional impairment. Fair: Deficit of 15 degrees represents a moderate restriction in knee extension, potentially affecting activities requiring full extension. Poor: Deficit greater than 15 degrees indicates significant limitation, severely impairing the ability to fully extend the knee and perform certain activities.

Pain/Swelling Excellent: No pain or swelling indicates a fully successful outcome with optimal healing, suggesting the patient is experiencing minimal discomfort and good functionality. Good: Sporadic minor pain or swelling is generally acceptable and does not significantly impact function, indicating occasional discomfort but overall good recovery. Fair: Significant pain or swelling represents a moderate problem that affects daily activities and may require ongoing management to alleviate symptoms. Poor: Severe pain or swelling indicates a major issue that severely impairs function, necessitating further intervention to address the underlying cause and improve the patient's condition.

Table 1: Thoresen's criteria

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

Most of our patients were of the younger age group, 26(66.6%) patients between 18- 30 yrs., the average age being 30.44 years, which correlate the fact that younger population is at increased risk of femoral fractures. In our series the level of fracture is dominated by middle 24 (60%) patients followed by 12 (30%) distal 1/3rd junction fractures and 4 (10%) proximal 1/3rd junction. The mean duration of hospital stay in our study was 16 days average. Intra operatively reduction was achieved by closed means in 34(85%) cases and 6(15%) needed open reduction due to late operation interval. The reduction of the fractures were good in 34(95%) of patients and acceptable in 4(10%) In our study no patient was permitted to weight bear fully on affected limb before 6 weeks, Final outcome was excellent in 35 out of 40 patients 87.5%, good in 3 patients 7.5%, fair in one patient 2.5% and poor in 1 patient 2.5%

Discussion

Femoral shaft fractures are usually the result of high energy trauma. An adequate reduction and rigid immobilization by some form of internal fixation is essential in femoral shaft 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. 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. Over 40 diaphyseal fractures of femur shaft were treated in the orthopedic department.

Most of our patients were of the younger age group, 26(66.6%) patients between 18- 30 yrs., 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 Thorsen [3] (1985), Wiss et al. [4] (1986) i.e. 28 and 29 years respectively. In our patients significant male dominance 34 out of 40 (85%) was seen as compared to 24 (51.06%) females out of 47 patients in the Thorsen3 series. In the series of Arpacio lu Mo et al. [5] 2003 et al. showed sex distribution of 35 men and 11 women, whereas in the series of RC Meena6 and others, male to female ratio was 8: 1. Regarding the side of fracture occurrence, left 15(50%) and right 15 (50%) 4 sides are equally predominant but in the series of WISS et al. [4] (1986) and Johnso et al. [7] (1984) right side was more involved. In the series of Arpacioğlu MO et al. [5] 2003, out of 46 patients 31 patients had fracture in the right side,13 in the left and 2 cases were bilateral. In 34 out of 40 patients (85%) fractures are of road traffic accidents and more male patients sustained femoral fractures 34(85%) highlighting the fact that males are prone to road traffic accidents. Out of 6 patients in females 4 (66.66%) sustained fractures because of domestic fall. In Thorsen et al. [3] series 65.9% were due to high energy trauma and 34.04% was due to low energy trauma. In the series of RC Meena[7] & others 2006, out of 108 cases RTA was the mode of injury in 91 cases. In our series the level of fracture is dominated by middle 24 (60%) patients followed by 12 (30%) distal 1/3rd junction fractures and 4 (10%) proximal 1/3rd junction. Other reported series of conventional nailing, this figure ranged from 60-80% and 50% in the series of Thorsen et al [3]. Fracture pattern in our study was transverse in 20 (50%) out of 40 patients, 12 (30%) comminuted, 4 (10%) spiral and 4 (10%) oblique. In the study of Thosren et al. [3] comminuted fractures were the common followed by transverse and then the spiral pattern. In the series of Wiss et al. [4] 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 et al. [8] (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 et al.[4] series where it was 12 days only and relatively low compared to Gross & Kempf[9] series (21 days). Intra operatively reduction was achieved by closed means in 34(85%) cases and 6(15%) needed open reduction due to late operation interval. The reduction of the fractures were good in 34(95%) of patients and acceptable in 4(10%) when compared to Thorsen et al. [3] where 2(5%) patients had poor reduction. Post operatively two patients out of 40 in this study had superficial infection (5%) and this was controlled by parenteral antibiotics. It is higher as compared to infection rates in Wiss et al. [4] series with 0.9%and in Christie et al.[10] series it was 0.8%. The average time of radiological union was 18 weeks in the present study whereas in Gross Kempf et al. [9] (1985) and in Thorsen et al.[3] (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 et al.[4] (1986) it is 26 weeks which is very high

compared to ours. [10] In our study no patient was permitted to weight bear fully on affected limb before 6 weeks, which is at par with Thorsen et al.[3] series (30 days). One of our case developed non-union and 4 cases required dynamization for delayed union compared to 10 cases in Thorsen et al.[3] 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(5%) patients which is very low compared to Gross and Kempf [9] where 11(21.1%) patients out of 52 had shortening. In our study 35 patients (87.5%) had full range of knee and hip movements. None reported any fatigue due to prolonged walking. Final outcome was excellent in 35 out of 40 patients 87.5%, good in 3 patients 7.5%, fair in one patient 2.5% and poor in 1 patient 2.5% which is better outcome as compared to Thorsen et al. [3] 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

Interlocking techniques lead to fewer complications of nonunion/malunion, lesser soft tissue dissection, and earlier fracture healing and lesser chances of infection. It provides the advantages of early ambulation, lower rates of infection, delayed union, nonunion 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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