

Clinical and Radiological Outcome of Interlocking Intramedullary Nailing in Femoral Shaft Fractures: A Prospective Study

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Abstract

Femoral shaft fractures are common high-energy injuries, typically seen in young and active adults. Conservative treatment methods have largely been replaced by surgical fixation due to high complication rates and prolonged immobilization. Interlocking intramedullary nailing has become the gold standard for these fractures, providing axial, rotational, and angular stability while permitting early mobilization and rehabilitation. A prospective, observational study was conducted in the Department of Orthopaedics, Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January 2022 and December 2024, to evaluate the clinical, radiological and functional outcomes of femoral shaft fractures managed with interlocking intramedullary nailing. A total of 40 patients aged between 18 and 60 years with acute, closed diaphyseal fractures of the femur were included. Exclusion criteria were pathological fractures, Grade III open fractures, paediatric patients, and polytrauma cases with unstable vitals. All patients underwent interlocking intramedullary nailing under spinal/epidural anesthesia. Follow-up was done at 6 weeks, 3 months, and 6 months. Clinical and radiological union, complications, and functional outcomes were assessed. Functional evaluation was performed using Thoresen's criteria. The mean age of the patients was 32 years, with males predominating (75%). Road traffic accidents accounted for 70% of injuries. AO classification revealed 32-A fractures as the most common (45%). Radiological union was achieved in 38 patients (95%), with a mean union time of 16.4 weeks. Complications included superficial infection (5%), limb length discrepancy >2 cm (5%), malunion (2.5%), and nonunion (5%). Functional outcome assessment showed excellent results in 70% of patients, good in 20%, fair in 5%, and poor in 5%. Interlocking intramedullary nailing is a safe, effective, and reliable procedure for femoral shaft fractures. It ensures high union rates, allows early mobilization, and yields excellent to good functional results in the majority of patients. Despite some complications, outcomes remain favorable compared to other treatment modalities, confirming its role as the gold standard for managing diaphyseal femoral fractures.

CBMJ 2026 January: vol. 15 no. 01 P:117-120

Keywords: Femoral shaft fracture, Interlocking nail, functional outcome, radiological union, complication

Introduction

Renal Femoral shaft fractures are among the most common long bone fractures encountered in orthopedic practice, accounting for approximately 1.6–2.9% of all fractures and frequently occurring in young adults following high-energy trauma such as road traffic accidents or falls from height.^{1,2} These fractures are associated with significant morbidity and often occur in poly trauma patients, adding to the complexity of management.

Historically, conservative treatment with traction and cast application was widely practiced. However, this method often resulted in complications such as malunion, joint stiffness, muscle wasting, and prolonged hospitalization.³ The introduction of intramedullary nails revolutionized the treatment of femoral shaft fractures, with interlocking nails further enhancing stability, allowing early mobilization, and

permitting fixation of comminuted and unstable fractures.^{4,5} Several studies have shown excellent outcomes with interlocking intramedullary nailing in

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terms of union rate, functional results, and early rehabilitation.^{6,7} However, outcome data from regional centers in Bangladesh remain limited. Therefore, we proposed this study to evaluate the clinical, radiological, and functional outcomes of femoral shaft fractures treated with interlocking intramedullary nailing and to observe associated complications.

Methods

This prospective, observational study was conducted in the Department of Orthopaedics, Community Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January 2022 and December 2024. A total of 40 patients were included in this study based on our selection criteria.

Inclusion Criteria:

- i) Age between 18 and 60 years;
- ii) Acute fracture of the shaft of femur (fracture within 3 weeks of injury);
- iii) Closed diaphyseal fractures of the femoral shaft, confirmed by radiographs;
- iv) Fractures located between 5 cm distal to the lesser trochanter and 8 cm proximal to the knee joint;
- v) Patients who were fit for anesthesia and surgery; and
- vi) Patients who gave informed written consent for participation and follow-up.

Exclusion Criteria:

- i) Open fractures (Gustilo–Anderson grade II & III);
- ii) Pathological fractures (due to tumor, infection, metabolic bone disease);
- iii) Polytrauma patients with life-threatening injuries who could not undergo definitive femoral fixation;
- iv) Associated neurovascular injury in the affected limb;
- v) Patients with severe medical comorbidities

contraindicating surgery (e.g., uncontrolled diabetes, severe cardiac disease;

- vi) Periprosthetic fractures around hip or knee arthroplasty; and
- vii) Patients lost to follow-up or unwilling to comply with postoperative rehabilitation.

Intramedullary nailing (IM nailing) is a minimally invasive surgical procedure used to stabilize long bone fractures, particularly in the femur. It involves inserting a metal rod (nail) into the hollow center (medullary canal) of the bone to hold the broken pieces in place while they heal. This technique offers several advantages over traditional plating or external fixation. Since the nail is load-bearing, patients can often bear weight sooner, reducing recovery time. The procedure was performed under general anaesthesia, and small incision was given to minimize scarring and infection risks. The nail was secured with screws at both ends to prevent rotation or shortening of the bone. During operation, pass ball-tipped guide wires were applied across fracture confirming antero-posterior and lateral position. Sequential reaming (if reamed technique) was done maintaining 1–1.5 mm > nail diameter. Nail insertion was achieved by advance nail over guide wire was used along with confirm length, rotation, and alignment. Proximal locking was done using jig, while distal locking was performed using freehand C-arm “perfect circle” technique. Then irrigation was done, and haemostasis was secured. The operation was closed in layers and sterile dressing was given to patient. Postoperative care included intravenous antibiotics were given for 48 hours, along with analgesics and if needed, physiotherapy was initiated early. Non-weight bearing mobilization began within 48–72 hours, with progression to partial and full weight bearing guided by radiological evidence of union.

Follow-up visits were scheduled at 6 weeks, 3 months, and 6 months. Clinical and radiological union was assessed. Functional outcomes were evaluated using Thoresen's criteria.

Data was collected via patient data sheet for every individual patient. Then data was scrutinized, compiled and analyzed using MS-Excel sheet. Data was expressed as mean, frequency and percentage. Data was presented in tabulated form.

Ethical clearance was obtained from the Ethical review Committee of Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh.

Results

We included a total of 40 patients in our study. The mean age was 32 years (range 18–60 years). A male predominance was observed: 30(75%) were males and, 10(25%) were females. For femoral shaft fractures, right sided fractures were in 22(55%) cases, while left sides fractures were found in 18(45%) cases. Mode of injury included road traffic accident 28(70%), fall 10(25%) and others 2(5%). Fracture patterns (as per AO classification) were: 32-A (simple) in 45% cases, while 32-B (wedge) in 35%, and 32-C (complex) in 20% cases (Table-I). Union was achieved in 38 cases (95%), mean union time was 16.4 weeks. Nonunion was observed in 2(5%) cases, while malunion found in 1(2.5%) cases. Moreover, limb length discrepancy >2 cm was observed in 2(5%) patients and superficial infection was reported in 2(5%) patients (Table-II). Functional outcome (based on Thoresen's criteria) was observed excellent 28(70%), good 8(20%), fair 2(5%), and poor 2(5%) (Table-III).

Table-I: Clinical characteristics of the patients (n=40)

Category	Frequency	Percentage
Fracture		
Right side	22	55
Left side	18	45
Mode of injury		
Road traffic accident	28	70
Fall	10	25
Others	2	5
Fracture pattern		
32-A (simple)	18	45
32-B (wedge)	14	35
32-C (complex)	8	20

Table-II: Complications observed among patients (n=40)

Category	Frequency	Percentage
Nonunion	2	5
Malunion	1	2.5
Limb length discrepancy >2 cm	2	5
Superficial infection	2	5

Table-III: Functional outcome (based on Thoresen's criteria) (n=40)

Category	Frequency	Percentage
Excellent	28	70
Good	8	20
Fair	2	5
Poor	2	5

Discussion

The present study demonstrated that interlocking intramedullary nailing provides excellent clinical and radiological outcomes in the management of femoral shaft fractures. A union rate of 95% with an average union time of 16.4 weeks, which aligns closely with previous reports by Winquist & Hansen, Brumback *et*

al. and Kempf *et al.*, as they reported union rates ranging from 94% to 97%, with mean union times ranging from 16 weeks to 20 weeks.⁴⁻⁶ Functional outcomes were observed in our study as excellent in 70% or good in 20% of cases, which seem consistent with the findings of Court-Brown & Caesar, who found similar recovery patterns in adult femoral fractures treated surgically.⁷

Complications in this study were minimal. Superficial infection (5%) resolved with conservative treatment, while limb length discrepancy (5%) and malunion (2.5%) were within the acceptable limits. Nonunion was seen in 5% of patients, which is slightly higher than some of the previous reports,^{8,9} but may be attributed to delayed presentation and poor bone quality in some patients.

The strengths of this study include prospective design and systematic follow-up. However, limitations include a relatively small sample size, single-center setting, and short follow-up period (6 months). Long-term functional results and implant-related complications could not be fully assessed. Therefore, larger multicenter studies with longer follow-up are recommended to assess long-term outcomes. Training in surgical technique and strict adherence to postoperative rehabilitation protocols can minimize complications.

Conclusion

Interlocking intramedullary nailing is an effective and reliable method for treating femoral shaft fractures, providing stable fixation, early mobilization, high union rates, and favorable functional outcomes. Despite occasional complications such as infection, nonunion, or limb length discrepancy, our results are satisfactory and comparable to global standards. Interlocking nails could be considered as the standard

of care for most adult femoral shaft fractures.^{9,10}

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