

Functional Outcome of Fracture of Shaft of Femur in Adults Treated with Interlocking Nail

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Abstract: **Background:** Femoral shaft fractures are major long-bone injuries that can cause substantial disability in adults. Interlocking intramedullary nailing provides stable fixation, facilitates early mobilization, and promotes fracture healing. **Aims:** To evaluate the radiological union, functional outcome, weight-bearing progression, and early and late complications following interlocking nailing of femoral shaft fractures in adults. **Materials and Methods:** A prospective study was conducted on 30 skeletally mature patients with femoral shaft fractures treated with interlocking intramedullary nailing from November 2022 to January 2025. Patients were followed for a minimum of 6 months. Radiological union and functional outcomes were assessed using the Thoresen and Neer scoring systems. **Results:** Most patients were aged 18–45 years (73.3%) and were male (70%). Road traffic accidents accounted for 83.3% of injuries. Radiological union occurred within 20 weeks in 73.3% of patients. Excellent outcomes were achieved in 70% according to Thoresen and 83.3% according to Neer scores. **Conclusion:** Interlocking intramedullary nailing provides reliable fracture union and favorable functional recovery in adult femoral shaft fractures.

Keywords: Femoral shaft fracture; Intramedullary nailing; Interlocking nail; Fracture union; Functional outcome

1. Introduction

Fractures of the femoral shaft are major long-bone injuries that commonly result from high-energy trauma in adults and are associated with substantial functional impairment, blood loss, and prolonged rehabilitation. Because the femur is the principal weight-bearing bone of the lower limb, restoration of length, alignment, rotation, and stability is essential for achieving satisfactory functional recovery. Over the past several decades, intramedullary nailing has become the preferred method of operative stabilization for most adult femoral shaft fractures because it provides strong biomechanical fixation while preserving the surrounding soft-tissue envelope and fracture biology. Contemporary literature continues to regard intramedullary nailing as the standard treatment, with the objectives of achieving fracture union, allowing early mobilization and weight bearing, and minimizing complications. [1,2]

Interlocking nails provide both axial and rotational stability and are particularly useful in fractures where conventional intramedullary fixation alone may not adequately control shortening or rotation. The technique also permits early rehabilitation and progressive weight bearing after adequate fixation. Deliberato et al. reported that immediate weight bearing following intramedullary nailing did not significantly increase nonunion or implant failure, supporting the potential for early functional rehabilitation in appropriately stabilized fractures. [3]

The method of fracture reduction may also influence healing. Preservation of the fracture hematoma and periosteal blood supply through closed reduction is generally advantageous. A recent systematic review demonstrated higher union rates and faster union with closed reduction compared with open reduction during intramedullary nailing. [4] Complex fracture patterns, particularly comminuted and segmental injuries, may nevertheless present greater challenges and require careful attention to reduction, nail positioning, and interlocking fixation. [5] Recent evidence from low- and middle-income settings also suggests that intramedullary nailing can provide satisfactory radiological and functional

outcomes, although postoperative complications and access to structured follow-up remain important considerations. [6]

The present study aims to assess the clinical, radiological, and functional outcomes of adult patients with femoral shaft fractures treated using interlocking intramedullary nailing. The study also seeks to evaluate the time to fracture union, functional recovery following surgery, and the occurrence of early and late postoperative complications, thereby determining the overall effectiveness of interlocking nailing in restoring limb function and enabling patients to return to their routine activities.

2. Materials and Methods

Study design: This was a prospective observational study conducted to evaluate the functional and radiological outcomes of adult patients with shaft of femur fractures treated with interlocking intramedullary nailing.

Study population: The study included skeletally mature adult patients presenting with proximal, middle, or distal one-third shaft fractures of the femur who fulfilled the predefined eligibility criteria and underwent treatment with an interlocking femoral nail.

Sample size: A total of 30 patients with femoral shaft fractures were included in the study.

Study duration: The study was conducted over a period from November 2022 to January 2025. All included patients were followed up for a minimum period of 6 months after the injury.

Study setting/location: The study was carried out in the Department of Orthopaedics at our hospital, among patients admitted with femoral shaft fractures requiring operative management.

Inclusion criteria: Skeletally mature adults with femoral shaft fractures classified under AO type 32, including proximal, middle, and distal one-third shaft fractures, were

considered eligible. Patients with closed fractures and Gustilo-Anderson type I and II open fractures were included. Only patients who were available for regular postoperative assessment and completed at least 6 months of follow-up were enrolled.

Exclusion criteria: Patients with pathological fractures, neglected fractures, malunion or non-union, and those belonging to the paediatric or adolescent age group were excluded. Patients with Gustilo-Anderson type III open fractures, pre-existing femoral deformities, and fractures managed conservatively were also excluded from the study.

Statistical Analysis

Data from 30 patients were entered into Microsoft Excel and analyzed using descriptive statistics. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Demographic characteristics, fracture patterns, weight-bearing status, radiological union, knee range of motion, associated injuries, and functional outcomes based on Thoresen and Neer scores were summarized descriptively. Given the small sample size and observational study design, emphasis was placed on describing the distribution of clinical, radiological, and functional outcomes.

3. Result

Table 1: Demographic Characteristics and Mode of Injury

Variable	Category	No. of Patients (n=30)	Percentage (%)
Age (years)	18–45	22	73.3
	46–75	7	23.3
	>75	0	0
Sex	Male	21	70
	Female	9	30
Mode of injury	Road traffic accident	25	83.3
	Fall	5	16.7

Table 2: Fracture Characteristics and Side Involvement

Variable	Category	No. of Patients (n=30)	Percentage (%)
Side involved	Right	17	56.7
	Left	12	40
	Bilateral	1	3.3
AO fracture classification	Type A	22	73.3
	Type B	7	23.3
	Type C	1	3.3
Type A subtype	A2 – Simple oblique	7*	23.3*
	A3 – Simple transverse	14*	46.7*

Table 3: Weight Bearing and Radiological Fracture Union

Variable	Time Period	No. of Patients	Percentage (%)
Partial weight bearing	Up to 12 weeks	21	70
	13–16 weeks	9	30
	17–24 weeks	0	0
Full weight bearing	Up to 12 weeks	0	0
	13–16 weeks	21	70
	17–24 weeks	0	0
Radiological fracture union	12–16 weeks	15	50
	17–20 weeks	7	23.3
	21–24 weeks	5	16.7
	>24 weeks	3	10

Table 4: Associated Injuries and Functional Range of Motion

Variable	Category	No. of Patients	Percentage (%)
Associated injury	Distal-end radius fracture	3	10
	Patella fracture	3	10
	Metacarpal fracture	1	3.3
	Tibial shaft fracture	1	3.3
	Humerus fracture	2	6.7
Knee flexion	>125°	5	16.7
	100–125°	20	66.7
	<100°	5	16.7

Table 5: Functional Outcome According to Thoresen and Neer Scores

Functional Assessment	Outcome	No. of Patients	Percentage (%)
Thoresen score	Excellent	21	70
	Good	6	20
	Fair	1	3.3
	Poor	0	0
Neer score	Excellent	25	83.3
	Satisfactory	4	13.3
	Unsatisfactory	1	3.3
	Failure	0	0

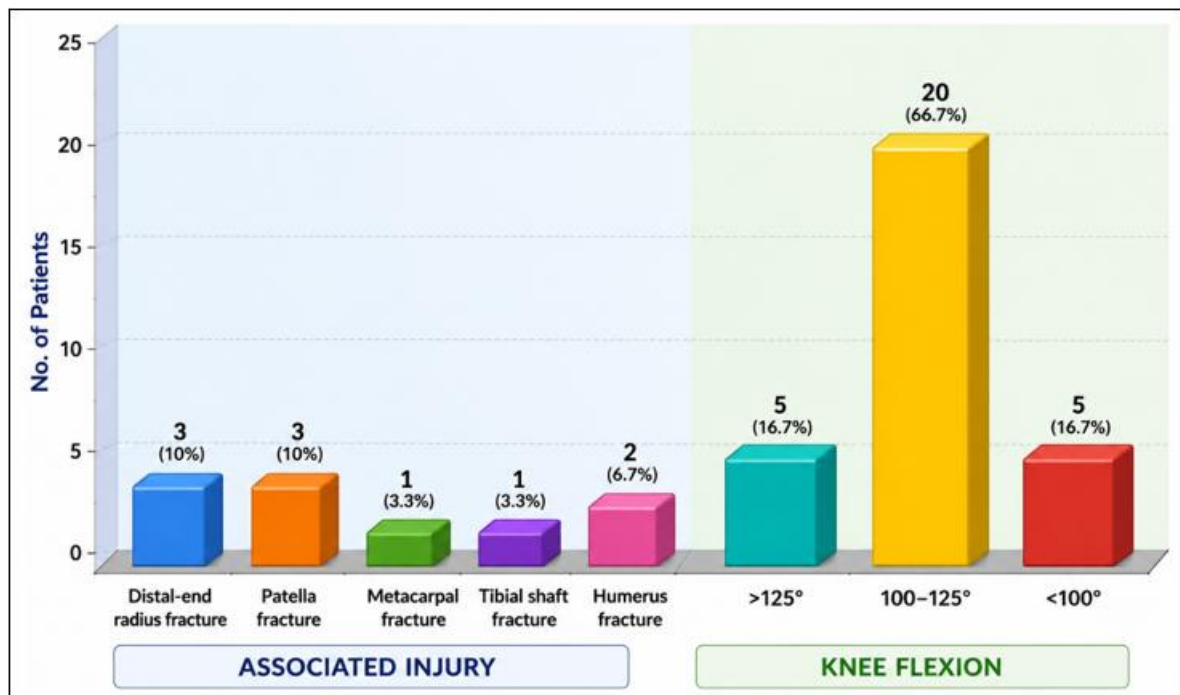


Figure 1: Distribution of Associated Injuries and Knee Flexion Range Among Study Patients



Figure 2: Functional Assessment Outcomes

Table 1: Among 30 patients, 22 (73.3%) were aged 18–45 years and 7 (23.3%) were aged 46–75 years, with a mean age of 39.23 years. There were 21 males (70%) and 9 females (30%). Road traffic accidents were the commonest mechanism, accounting for 25 cases (83.3%), followed by falls in 5 (16.7%).

Table 2: The right femur was involved in 17 patients (56.7%), the left in 12 (40%), and bilateral involvement occurred in 1 (3.3%). AO Type A fractures were most common (22; 73.3%), followed by Type B (7; 23.3%) and Type C (1; 3.3%). Among Type A fractures, A3 transverse fractures occurred in 14 (46.7%) and A2 oblique fractures in 7 (23.3%).

Table 3: Partial weight bearing was achieved within 12 weeks in 21 patients (70%) and during 13–16 weeks in 9 (30%). Full weight bearing was achieved during 13–16 weeks in 21 (70%). Radiological union occurred at 12–16 weeks in 15 (50%), 17–20 weeks in 7 (23.3%), 21–24 weeks in 5 (16.7%), and after 24 weeks in 3 (10%).

Table 4: Associated injuries included distal-end radius fracture (3; 10%), patella fracture (3; 10%), humerus fracture (2; 6.7%), metacarpal fracture (1; 3.3%), and tibial shaft fracture (1; 3.3%). Knee flexion was >125° in 5 (16.7%), 100–125° in 20 (66.7%), and <100° in 5 (16.7%).

Table 5: According to the Thoresen score, outcomes were excellent in 21 (70%), good in 6 (20%), fair in 1 (3.3%), and

poor in 0 (0%). According to the Neer score, 25 (83.3%) had excellent, 4 (13.3%) satisfactory, 1 (3.3%) unsatisfactory, and 0 (0%) failure outcomes. Overall, functional recovery following interlocking nailing was favorable.

4. Discussion

In the present study, femoral shaft fractures were predominantly seen in young adults, with 73.3% of patients aged 18–45 years and a clear male predominance (70%). Road traffic accidents accounted for 83.3% of injuries, highlighting the high-energy nature of these fractures. Similar findings were reported by Sah et al., who found a predominance of young males and road traffic accidents among patients undergoing intramedullary nailing, supporting the epidemiological pattern observed in our series [7]. A prospective study by Patel and Pethapara also reported that more than 80% of patients were below 50 years, with trauma-related mechanisms being common [8].

The right femur was involved in 56.7% of our patients, while AO type A fractures constituted 73.3%, with transverse A3 fractures being most frequent. The predominance of relatively simple fracture patterns is comparable with reports describing satisfactory outcomes following interlocking nailing in predominantly simple and moderately comminuted shaft fractures [7,8]. Recent evidence also emphasizes that fracture configuration and residual fracture-site gap can influence healing following intramedullary fixation [9].

Regarding rehabilitation, 70% achieved partial weight bearing within 12 weeks, and the same proportion achieved full weight bearing by 13–16 weeks. This relatively early progression is consistent with contemporary evidence supporting early weight bearing after stable intramedullary fixation. Deliberato et al. demonstrated that weight bearing as tolerated after femoral nailing did not adversely affect union or implant failure rates [10].

Radiological union occurred by 16 weeks in 50% and by 20 weeks in 73.3% of patients, while only 10% showed union beyond 24 weeks. These findings are broadly consistent with recent studies reporting high union rates after intramedullary nailing [9,11]. Salman et al., in a systematic review, also found more favorable union and infection outcomes with closed intramedullary nailing [12].

Associated injuries were present in several patients, reflecting the high-energy mechanism, while 66.7% achieved knee flexion of 100–125°. Proper rotational and alignment control is important for preserving hip and knee function after nailing [13]. Functionally, 70% achieved excellent and 20% good Thoresen scores, while the Neer score showed 83.3% excellent and 13.3% satisfactory outcomes. These results closely resemble Sah et al., who reported excellent Thoresen outcomes in 86.7% of patients [7], and Ali et al., who documented excellent results in 93% after closed locked nailing [14]. Overall, the favorable functional recovery in our study is consistent with systematic-review evidence supporting intramedullary nailing as an effective treatment for adult femoral shaft fractures [15].

5. Conclusion

Interlocking intramedullary nailing provided favorable clinical, radiological, and functional outcomes in adults with femoral shaft fractures. Most patients were young males and sustained fractures following road traffic accidents. The majority achieved partial weight bearing within 12 weeks and full weight bearing by 16 weeks, while radiological union occurred within 20 weeks in most cases. Functional recovery was satisfactory, with excellent outcomes observed in 70% of patients according to the Thoresen score and 83.3% according to the Neer score. Knee mobility was generally well preserved, and delayed union was uncommon. Overall, interlocking nailing appears to be an effective treatment for adult femoral shaft fractures.

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