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Functional outcome of Tibial Shaft Fractures treated with Interlocking Nail: A Prospective Observational Study

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ABSTRACT

Background: Tibial shaft fractures are among the most common long-bone fractures encountered in orthopedic practice. Intramedullary interlocking nailing has become the preferred treatment modality due to its ability to provide stable fixation, facilitate early mobilization, and achieve high rates of fracture union.
Objectives: To evaluate the functional and radiological outcomes of tibial shaft fractures treated with intramedullary interlocking nailing and to assess associated postoperative complications.
Materials and Methods: A prospective observational study was conducted in the Department of Orthopaedics of a tertiary care teaching hospital over a period of one year. Fifty patients with tibial shaft fractures treated with intramedullary interlocking nailing were included in the study. Patients were followed up at regular intervals for clinical and radiological assessment. Functional outcomes were evaluated using the Johner and Wruhs criteria. Fracture union, time to union, and postoperative complications were recorded.
Results: The mean age of the patients was 36.8 ± 11.4 years, and 80% were males. Road traffic accidents were the most common mode of injury (68%). Closed fractures accounted for 84% of cases. The mean time to radiological union was 18.2 ± 3.6 weeks, with an overall union rate of 96%. According to the Johner and Wruhs criteria, functional outcomes were excellent in 62%, good in 24%, fair in 10%, and poor in 4% of patients. Excellent-to-good outcomes were achieved in 86% of cases. Anterior knee pain (12%) was the most common complication, followed by delayed union (8%) and superficial infection (6%).
Conclusion: Intramedullary interlocking nailing is an effective and reliable treatment for tibial shaft fractures, providing high union rates, satisfactory functional outcomes, and a low complication rate. It remains the treatment of choice for most adult tibial shaft fractures.

Keywords: Tibial shaft fracture; Intramedullary interlocking nail; Functional outcome; Fracture union; Johner and Wruhs criteria; Orthopaedics.

INTRODUCTION

Tibial shaft fractures are among the most common long-bone fractures encountered in orthopedic practice, accounting for approximately 4–5% of all adult fractures. Due to its subcutaneous location and limited soft tissue coverage, the tibia is particularly vulnerable to injury and associated complications. These fractures commonly result from high-energy trauma such as road traffic accidents, falls from height, and sports-related injuries, predominantly affecting young and economically productive individuals.[1]

The management of tibial shaft fractures has evolved considerably over the years. While conservative treatment with casting and functional bracing has been used successfully in selected cases, prolonged immobilization may lead to

complications such as joint stiffness, muscle wasting, malunion, and delayed rehabilitation.[2] Consequently, surgical management has become the preferred option for displaced and unstable fractures.

Among the available surgical techniques, intramedullary interlocking nailing is widely regarded as the gold standard for the treatment of most tibial shaft fractures in adults. The procedure provides stable fixation while preserving the fracture biology and periosteal blood supply. As a load-sharing device, the interlocking nail offers resistance to axial, rotational, and bending forces, allowing early mobilization and weight-bearing.[3]

Several studies have reported excellent outcomes with intramedullary interlocking nailing, demonstrating high union rates and satisfactory functional recovery. Court-Brown et al. and Bone and Johnson reported favorable results with low rates of nonunion and malalignment following intramedullary nailing.[4,5] However, complications such as anterior knee pain, delayed union, infection, and malunion may still occur and influence the overall outcome.[6]

Assessment of functional outcome is essential in determining the success of treatment. In addition to radiological union, restoration of limb function, range of motion, and return to daily activities are important indicators of recovery. The Johner and Wruhs criteria are commonly used to evaluate functional outcomes following tibial shaft fracture fixation.[7]

Given the increasing incidence of tibial fractures and the widespread use of interlocking nails, continuous evaluation of treatment outcomes remains important. Therefore, the present study was undertaken to assess the functional and radiological outcomes of tibial shaft fractures treated with intramedullary interlocking nailing.

MATERIALS AND METHODS:

Study Design and Setting

This prospective observational study was conducted in the Department of Orthopaedics of a tertiary care teaching hospital over a period of one year. The study was undertaken after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

Study Population

The study included 50 consecutive patients presenting with tibial shaft fractures who were treated with intramedullary interlocking nailing and fulfilled the eligibility criteria. All patients were evaluated clinically and radiologically at admission and during follow-up visits.

Inclusion Criteria

- Patients aged 18–65 years.
- Closed tibial shaft fractures.
- Gustilo-Anderson Grade I and Grade II open tibial shaft fractures.
- Fractures involving the diaphysis of the tibia.
- Patients willing to participate and provide informed consent.

Exclusion Criteria

- Patients below 18 years of age.
- Gustilo-Anderson Grade III open fractures.
- Pathological fractures.
- Periarticular fractures involving the knee or ankle joint.
- Previous surgery on the affected tibia.
- Patients unwilling to participate or lost to follow-**up.**

Preoperative Assessment

A detailed history regarding age, sex, mechanism of injury, side involved, and associated injuries was recorded. Clinical examination included assessment of soft tissue condition, neurovascular status, and associated skeletal injuries.

Standard anteroposterior and lateral radiographs of the affected leg, including the knee and ankle joints, were obtained. Fractures were classified according to the AO/OTA classification system. Routine preoperative investigations, including complete blood count, blood sugar levels, renal function tests, serum electrolytes, electrocardiogram, and chest radiograph, were performed.

Surgical Technique

All surgeries were performed under spinal or general anesthesia with the patient in the supine position on a radiolucent operating table. Under strict aseptic precautions, a patellar tendon-splitting approach was used to obtain the entry point at the proximal tibia.

After fracture reduction under fluoroscopic guidance, a guidewire was passed across the fracture site into the distal fragment. Sequential reaming was performed whenever indicated, followed by insertion of an appropriately sized intramedullary interlocking nail. Proximal and distal locking screws were inserted using the standard targeting jig and freehand technique under image intensifier guidance.

The wound was irrigated thoroughly and closed in layers. Sterile dressing was applied, and postoperative radiographs were obtained to confirm fracture reduction and implant position.

Postoperative Management
All patients received intravenous antibiotics for 48–72 hours followed by oral antibiotics when necessary. Analgesics and thromboprophylaxis were administered according to institutional protocol.

Quadriceps strengthening exercises, ankle pump exercises, and knee range-of-motion exercises were initiated on the first postoperative day. Partial weight-bearing with walker support was commenced depending on fracture stability and radiological appearance. Progressive weight-bearing was encouraged, and full weight-bearing was permitted once adequate callus formation was observed.

Follow-up Protocol
Patients were followed up at 6 weeks, 3 months, 6 months, and 12 months following surgery. During each visit, clinical and radiological assessments were performed.

Clinical evaluation included:
- Pain assessment.
- Range of motion of knee and ankle joints.
- Weight-bearing ability.
- Gait assessment.
- Return to daily activities.

Radiological evaluation included:
- Callus formation.
- Cortical bridging.
- Fracture alignment.
- Implant integrity.

Definition of Fracture Union
Radiological union was defined as bridging callus across at least three cortices on anteroposterior and lateral radiographs along with painless full weight-bearing.

Delayed union was considered when fracture healing had not occurred by 24 weeks. Nonunion was defined as absence of radiological progression toward union by 9 months**.**

Statistical Analysis
Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between variables were analyzed using the Chi-square test and Student's t-test wherever applicable. A p-value of less than 0.05 was considered statistically significant.

RESULTS:
A total of 50 patients with tibial shaft fractures treated with intramedullary interlocking nailing were included in the study and followed up for a minimum period of 12 months.

The mean age of the study participants was **36.8 ± 11.4 years**. The majority of patients (66%) belonged to the age group of **18–40 years**, indicating that tibial shaft fractures predominantly affected young and middle-aged adults. Patients above 50 years constituted only 14% of the study population, suggesting a higher incidence of these fractures among the economically productive age group. (Table 1)

Table 1: Age Distribution of Patients

Age Group (Years)	Number (n=50)	Percentage (%)
18–30	18	36.0
31–40	15	30.0
41–50	10	20.0

51–60	5	10.0
>60	2	4.0

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Male patients predominated in the study, accounting for 80% of cases, with a male-to-female ratio of 4:1. (Table 2)

Table 2: Gender Distribution

Gender	Number	Percentage (%)
Male	40	80.0
Female	10	20.0

Road traffic accidents were the most common cause of tibial shaft fractures, accounting for more than two-thirds of all injuries. (Table 3)

Table 3: Mode of Injury

Mode of Injury	Number	Percentage (%)
Road Traffic Accident	34	68.0
Fall from Height	10	20.0
Sports Injury	4	8.0
Assault	2	4.0

Closed fractures constituted the majority (84%), while only 16% of fractures were open injuries. (Table 4)

Table 4: Type of Fracture

Fracture Type	Number	Percentage (%)
Closed	42	84.0
Open Grade I	5	10.0
Open Grade II	3	6.0

The right tibia was affected slightly more frequently than the left side. (Table 5)

Table 5: Side of Involvement

Side	Number	Percentage (%)
Right	28	56.0
Left	22	44.0

More than half of the patients (56%) achieved fracture union between 16 and 20 weeks. (Table 6)

Table 6: Time to Radiological Union

Time to Union	Number	Percentage (%)
<16 weeks	12	24.0
16–20 weeks	28	56.0
>20 weeks	10	20.0

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A union rate of 96% was achieved, demonstrating excellent fracture healing following interlocking nailing. (Table 7)

Table 7: Fracture Union Rate

Outcome	Number	Percentage (%)
United	48	96.0
Nonunion	2	4.0

Excellent or good functional outcomes were achieved in 43 patients (86%), indicating satisfactory restoration of limb function following surgery. (Table 8)

Table 8: Functional Outcome According to Johner and Wruhs Criteria

Outcome	Number	Percentage (%)
Excellent	31	62.0
Good	12	24.0
Fair	5	10.0
Poor	2	4.0

Most patients (76%) regained more than 120° of knee flexion, reflecting good postoperative rehabilitation and functional recovery. (Table 9)

Table 9: Knee Joint Range of Motion at Final Follow-up

Range of Motion	Number	Percentage (%)
>120°	38	76.0
100–120°	9	18.0
<100°	3	6.0

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Anterior knee pain was the most common complication observed, affecting 12% of patients. Delayed union occurred in 8% of cases. The overall complication rate was low and manageable. (Table 10)

Table 10: Complications Observed

Complication	Number	Percentage (%)
Anterior Knee Pain	6	12.0
Delayed Union	4	8.0
Superficial Infection	3	6.0
Malunion	2	4.0
Nonunion	2	4.0
Implant Failure	1	2.0

DISCUSSION:

In the present study, the mean age of the patients was 36.8 ± 11.4 years, with the majority belonging to the 18–40 years age group. Similar observations were reported by Court-Brown et al., who demonstrated that tibial shaft fractures predominantly affect young adults involved in high-energy activities and road traffic accidents.[8]

Male patients constituted 80% of the study population, which is comparable to the findings of Larsen et al. and Bhandari et al., who reported a predominance of males among patients with tibial shaft fractures due to greater exposure to occupational and vehicular trauma.[10]

Road traffic accidents accounted for 68% of injuries in the present study. Similar findings have been documented by numerous authors who identified road traffic accidents as the leading cause of tibial shaft fractures in developing countries.[11]

The mean time to radiological union in the present study was 18.2 ± 3.6 weeks, with an overall union rate of 96%. Bone and Johnson reported union rates exceeding 90% following intramedullary nailing, with average healing times ranging from 16 to 20 weeks.[12] Similar outcomes have also been reported by Court-Brown et al. and Alho et al. [13,14]

Functional outcome assessment revealed excellent results in 62% and good results in 24% of patients, resulting in an overall excellent-to-good outcome rate of 86%. These findings are consistent with those reported by Johner and Wruhs, who demonstrated favorable functional outcomes following stable fixation of tibial shaft fractures.[15]

Anterior knee pain was the most common complication observed in the present study (12%). Tornetta and Collins reported anterior knee pain as the most frequent postoperative complaint following tibial intramedullary nailing, attributing it to the nail entry point and patellar tendon irritation.[16]

Delayed union occurred in 8% of patients, while nonunion was observed in 4%. These findings are comparable with those reported by Keating et al., who found delayed union and nonunion rates ranging from 5% to 10% after intramedullary nailing.[17]

Overall, the present study demonstrated excellent radiological and functional outcomes with a low complication rate, supporting the role of intramedullary interlocking nailing as the gold standard treatment for tibia.

CONCLUSION:

The present study demonstrated that intramedullary interlocking nailing is an effective and reliable treatment modality for tibial shaft fractures. It provided stable fixation, early mobilization, and a high fracture union rate of 96%, with a mean union time of 18.2 ± 3.6 weeks. Functional assessment showed excellent or good outcomes in 86% of patients, indicating satisfactory recovery and restoration of limb function. Postoperative complications were minimal and manageable, with anterior knee pain being the most common complication.

Based on these findings, intramedullary interlocking nailing remains the treatment of choice for adult tibial shaft fractures, offering excellent radiological and functional outcomes with a low complication rate.

REFERENCES:

1. Court-Brown CM, McBirnie J. The epidemiology of tibial fractures. J Bone Joint Surg Br. 1995;77(3):417-421.
2. Sarmiento A, Latta LL. Functional fracture bracing. J Am Acad Orthop Surg. 1999;7(1):66-75.
3. Bhandari M, Guyatt G, Tornetta P III, et al. Current practice in the intramedullary nailing of tibial shaft fractures. J Trauma. 2002;53(4):725-732.
4. Court-Brown CM, Christie J, McQueen MM. Closed intramedullary tibial nailing. J Bone Joint Surg Br. 1990;72(4):605-611.
5. Bone LB, Johnson KD. Treatment of tibial fractures by reaming and intramedullary nailing. J Bone Joint Surg Am. 1986;68(6):877-887.
6. Tornetta P, Collins E. Semiextended position for intramedullary nailing of the proximal tibia. Clin Orthop Relat Res. 1996;328:185-189.
7. Johner R, Wruhs O. Classification of tibial shaft fractures and correlation with results after rigid internal fixation. Clin Orthop Relat Res. 1983;178:7-25
8. Court-Brown CM, McQueen MM, Quaba AA, Christie J. Locked intramedullary nailing of open tibial fractures. J Bone Joint Surg Br. 1991;73(6):959-964.
9. Larsen LB, Madsen JE, Høiness PR, Øvre S. Should insertion of intramedullary nails for tibial fractures be with or without reaming? J Orthop Trauma. 2004;18(3):144-149.
10. Bhandari M, Guyatt G, Tornetta P III, et al. Current practice in the intramedullary nailing of tibial shaft fractures. J Trauma. 2002;53(4):725-732.
11. Toivanen JA, Honkonen SE, Koivisto AM, Järvinen MJ. Treatment of low-energy tibial shaft fractures. Injury. 2001;32(1):65-69.
12. Bone LB, Johnson KD. Treatment of tibial fractures by reaming and intramedullary nailing. J Bone Joint Surg Am. 1986;68(6):877-887.
13. Court-Brown CM, Christie J, McQueen MM. Closed intramedullary tibial nailing. J Bone Joint Surg Br. 1990;72(4):605-611.
14. Alho A, Benterud JG, Høiseth A. Intramedullary nailing of tibial shaft fractures. Acta Orthop Scand. 1990;61(2):117-121.
15. Johner R, Wruhs O. Classification of tibial shaft fractures and correlation with results after rigid internal fixation. Clin Orthop Relat Res. 1983;178:7-25.
16. Tornetta P, Collins E. Semiextended position for intramedullary nailing of the proximal tibia. Clin Orthop Relat Res. 1996;328:185-189.
17. Keating JF, O'Brien PJ, Blachut PA, Meek RN, Broekhuyse HM. Reamed interlocking intramedullary nailing of open fractures of the tibia. Clin Orthop Relat Res. 1997;338:182-191