



ORIGINAL RESEARCH PAPER

Orthopaedics

FUNCTIONAL OUTCOMES OF TITANIUM ELASTIC NAILING IN PEDIATRIC LOWER LIMB LONG BONE FRACTURES: A PROSPECTIVE STUDY

KEY WORDS: Pediatric fractures, femur, tibia, titanium elastic nailing, functional outcome

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ABSTRACT

Diaphyseal fractures of the femur and tibia are among the most common major pediatric injuries. While conservative treatment has been traditional, titanium elastic nailing (TEN) has emerged as a minimally invasive and effective alternative. This prospective study included 30 children (aged 5–15 years) with diaphyseal femoral and tibial fractures, managed by flexible intramedullary nailing at a tertiary care hospital between November 2024 and November 2025. Functional outcomes were assessed using Flynn's criteria. Follow-up was conducted at 6, 12, and 24 weeks. The mean age of patients was 8.7 years; 66.7% were boys. Falls (66.7%) were the most common mechanism of injury. Most fractures were transverse (60%) and located in the middle third (73.3%). The mean time to radiological union was 7.2 weeks. Limb length discrepancy was observed in 13.3% of cases, and malalignment in 6.7%. Skin irritation occurred in 40%. According to Flynn's criteria, 80% had excellent outcomes, 20% satisfactory, and none poor. Titanium elastic nailing provides stable fixation, early mobilization, and favorable functional outcomes in pediatric diaphyseal fractures. Complications were minimal and largely related to technical factors. TENS is a safe and effective method of fixation in children aged 5–15 years.

1. INTRODUCTION

Pediatric diaphyseal fractures of the femur and tibia are common and disabling injuries, often resulting from falls and road traffic accidents (1). Traditional management with traction and spica casting, though effective in younger children, is associated with complications such as malunion, joint stiffness, prolonged hospitalization, and psychosocial burden (2).

In recent decades, operative stabilization has gained popularity to avoid prolonged immobilization and facilitate early mobilization. Titanium elastic nailing (TEN), first described in the 1980s, is based on the principle of elastic stable intramedullary fixation. It provides a load-sharing, minimally invasive option that preserves the physis and periosteum, and has shown favorable results in several studies (3).

Although international literature is extensive, data from the Indian subcontinent remain limited. This study aimed to evaluate the functional outcomes and complications of TEN in pediatric lower limb diaphyseal fractures.

2. MATERIALS AND METHODS

Study Design And Setting: This prospective study was conducted at Dr KN Singh Memorial Institute of Medical Sciences And Hospital, from November 2024 to November 2025.

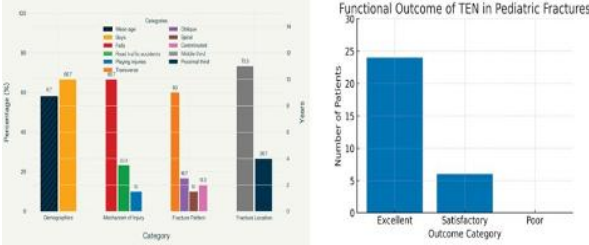
Participants: Thirty children aged 5–15 years with diaphyseal fractures of the femur or tibia were included. Exclusion criteria were metaphyseal/epiphyseal fractures, pre-existing deformities, or bone pathology.

Procedure: Closed reduction and fixation with two pre-bent titanium elastic nails were performed under fluoroscopic guidance. Postoperatively, patients were mobilized early, with partial weight-bearing initiated around 4 weeks and full weight-bearing after radiological union.

Follow-up And Outcome Measures: Patients were followed at 6, 12, and 24 weeks. Outcomes were assessed clinically (pain, mobility, deformity, limb length discrepancy) and radiologically (union, alignment). Functional results were graded according to Flynn's criteria (3).

3. RESULTS

Category / Variable	Detail / Distribution
Demographics	Mean age 8.7 years (range 5–15); 66.7% boys
Mechanism Of Injury	Falls: 66.7%, Road traffic accidents: 23.3%, Playing injuries: 10%
Fracture Pattern	Transverse: 60%, Oblique: 16.7%, Spiral: 10%, Comminuted: 13.3%
Fracture Location	Middle third: 73.3%, Proximal third: 26.7%
Union Time	Mean time: 7.2 weeks (all fractures united)
Complications	Skin irritation: 12 (40%), Limb length discrepancy: 4 (13.3%), Malalignment : 2 (6.7%), Deep infections: None
Functional Outcome	Excellent: 24 (80%), Satisfactory: 6 (20%), Poor: 0 (0%)



4. DISCUSSION

Titanium elastic nailing demonstrated favorable outcomes in pediatric femoral and tibial diaphyseal fractures, consistent with published studies (3,4). Our mean union time of 7.2 weeks compares favorably with Bhaskar (5) and Singh (6), who reported 8–10 weeks. Early mobilization and return to daily activities were achieved in most children, reflecting the advantages of load-sharing intramedullary fixation.

Complications in this series were minor and primarily related to technical factors such as nail prominence, consistent with earlier studies (7). No deep infections occurred, in line with prior reports. Compared to conservative methods, TEN offers significant benefits in terms of shorter hospital stay, earlier rehabilitation, and psychosocial well-being (1,2,8). However, unstable comminuted fractures and obese children remain more challenging, requiring careful selection and technique

(9).

LIMITATIONS:

This was a single-center study with a relatively small sample size and short follow-up. Long-term outcomes, including growth disturbances, require further evaluation.

5. CONCLUSION

Titanium elastic nailing is a safe, effective, and minimally invasive technique for managing pediatric femoral and tibial diaphyseal fractures. It provides reliable union, early mobilization, and favorable functional outcomes with minimal complications.

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