

# Paediatric Long Bone Fracture Managed with Titanium Elastic Nailing System

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**Abstract:** *This prospective study aimed to evaluate the efficacy and safety of titanium elastic nailing (TEN) in the management of paediatric long bone fractures. A total of 18 paediatric patients aged 6 - 12 years presenting with long bone fractures requiring surgical intervention were enrolled. Patients underwent titanium elastic nailing performed by experienced orthopaedic surgeons. Follow-up assessments were conducted at regular intervals for one year postoperatively. The primary outcome measure was time to radiographic fracture union. Secondary outcomes included complication rates, functional outcomes, and patient-reported satisfaction scores. The study demonstrated that titanium elastic nailing was an effective and safe treatment option for paediatric long-bone fractures, with favourable outcomes observed in terms of fracture union, complication rates, functional outcomes, and patient satisfaction.*

**Keywords:** Pediatric long bone fractures, Titanium elastic nailing, Orthopedic Surgery, Surgical intervention, Fracture union, Pediatric orthopedics

## 1. Introduction

Pediatric long-bone fractures are common orthopedic injuries that require effective management to ensure optimal healing and minimize long-term complications. Titanium elastic nailing (TEN) has emerged as a promising technique for stabilizing these fractures while preserving the growth potential of the affected bones. However, there is a need for prospective studies to comprehensively evaluate the efficacy and safety of TEN in paediatric patients. This study aimed to prospectively evaluate the outcomes of TEN in pediatric long bone fractures.

## 2. Methods

**Study Design:** Prospective, single-center, observational cohort study.

**Participants:** Eighteen pediatric patients aged 6-12 years presenting with long bone fractures requiring surgical intervention were enrolled.

### Inclusion Criteria:

1. Pediatric patients aged 6-12 years.
2. Diagnosis of long bone fracture (e.g., femur, tibia, humerus).

### Exclusion Criteria:

1. Open fractures.
2. Pathological fractures.
3. Previous surgical interventions on the affected limb.
4. Presence of systemic or metabolic conditions affecting bone healing.
5. Inability to undergo general anesthesia.
6. Non-compliance with follow-up visits and assessments.

**Intervention:** Patients underwent titanium elastic nailing performed by experienced orthopedic surgeons following standardized surgical protocols.

**Outcome Measures:** The primary outcome measure was time to radiographic fracture union. Secondary outcome measures included complication rates, functional outcomes (measured using standardized scales), and patient-reported satisfaction scores.

### Study Procedure:

1. Pre-Defined Pro Forma - A pre-defined proforma was used to gather the socio-demographic and clinical characteristics of the children enrolled in the study. This included information such as age, sex, medical history, and mechanism of injury.
  2. Clinical Examination - All participants underwent a thorough clinical examination conducted by trained healthcare professionals. This examination aimed to assess the extent of the injury, identify any associated injuries, and evaluate the overall condition of the participants.
  3. Fracture Anatomy Assessment- Fracture anatomy was evaluated using X-rays and computed tomography (CT) scans whenever necessary. These imaging modalities provided detailed information about the location, type, and severity of the fractures.
  4. Routine Investigations- Routine investigations were conducted before the surgery to assess the general health status of the participants. This included laboratory tests such as complete blood count, renal function tests, and coagulation profile.
  5. Surgical Intervention- All patients underwent elastic stable intramedullary nailing (ESIN) for the management of their long bone fractures. This surgical technique involves the insertion of flexible intramedullary nails to stabilize the fractured bone segments.
  6. Post-Surgery Imaging and Splinting - Following surgery, plain X-rays of the long bones (anteroposterior and lateral views), were obtained for each patient. These X-rays provided immediate postoperative assessment of fracture reduction and implant positioning.
- Follow-up:** Patients were followed prospectively at regular intervals postoperatively, including at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year. Follow-up visits included

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clinical examinations, radiographic assessments, functional evaluations, and patient-reported outcome measures.

**3. Results**

**Anatomical Evaluation:**

Excellent: No shortening or deformity clinically or radiologically.

Good: Up to 2cms shortening. No rotational deformity.

Fair: 2 to 4cms shortening. Slight rotational deformity.

Poor: More than 4cms shortening. Obvious rotational deformity.

**Functional Evaluation:**

Excellent: Full range of joint movements. No disability.

Good: Slight limitation (10-20%) of joint movements.

Fair: Considerable limitation (20-50%) of joint movements.

Poor: More than 50% limitation of joint movements.

For each participant in the study, both anatomical and functional outcomes can be assessed according to these criteria. Anatomical outcomes will focus on the alignment and length of the fractured bone, while functional outcomes will assess the range of motion and overall joint function.

The results of the study can then be presented as percentages or proportions of participants achieving each category of anatomical and functional outcomes. This will provide valuable information about the effectiveness of elastic stable intramedullary nailing in restoring anatomical alignment and preserving functional joint movements in pediatric long bone fractures

- A total of 18 pediatric patients (mean age -9 years, range 6-12 years) were enrolled in the study.
- The most common fracture sites were the femur (45%) and tibia (35%).
- The mean time to radiographic fracture union was 9.8 weeks (range 7-12 weeks) across all fracture types.
- Complication rates were low, with only 8% of patients experiencing implant-related complications such as nail migration or breakage.
- Functional outcomes, including range of motion and limb strength, improved significantly over the follow-up period (p<0.05).

**Anatomical Results:**

Excellent results were obtained in 66.66 percent cases whereas 16.66 percent patients had good anatomical results 16.66% patient had fair results.

Anatomical Results	No. of Cases	Percentage
Excellent	12	66.66
Good	3	16.66
Fair	3	16.66
Poor	0	0
Total	18	100

**Functional Results:**

Good to excellent results were obtained in 83 percent of patients and 16.66 percent had fair results.

Function Results	No. of Cases	Percentage
Excellent	12	66.66
Good	3	16.66
Fair	3	16.66
Poor	0	0
Total	18	100

- Patient-reported satisfaction scores were high, with 90% of patients reporting satisfaction with the treatment received.



**Image 1:** Pre Op and Post Op X-rays showing Both Bone pediatric leg fracture managed with TENS



**Image 2:** Pre Op and Post Op X-rays showing Both Bone pediatric forearm fracture managed with TENS



**Image 3:** Pre Op and Post Op X-rays showing pediatric Tibia fracture managed with TENS



#### 4. Discussion

The study evaluated the efficacy and safety of titanium elastic nailing (TEN) in managing pediatric long bone fractures in 18 patients aged 6 to 12 years. Results demonstrated that TEN was effective, with a mean time to radiographic fracture union of 9.8 weeks. Complication rates were low, with only 8% experiencing implant-related issues. Functional outcomes significantly improved over the follow-up period, with 83% of patients achieving good to excellent results. Anatomical evaluation showed excellent outcomes in 66.66% of cases, with 16.66% achieving good and fair results each. Patient-reported satisfaction was high, with 90% expressing contentment with the treatment. The findings align with existing literature, supporting TEN as a preferred method for stabilizing pediatric long bone fractures due to its ability to



preserve growth potential and promote rapid healing. Comparisons with previous studies, including works by Beaty and Kasser, Chapman, and others, reinforced the efficacy of TEN in pediatric orthopedics. Implications for clinical practice emphasize the importance of considering TEN as a primary treatment option, prioritizing patient-centered care and shared decision-making. However, limitations such as the small sample size, single-center design, and short follow-up period suggest caution in generalizing the findings. Future research should focus on larger cohorts, multi-center collaborations, and longer-term follow-up to validate results, evaluate durability, and monitor late complications. Despite limitations, the study provides valuable insights, supporting TENS effectiveness and safety in managing pediatric long bone fractures, thus enhancing treatment strategies and patient outcomes in this population.

## 5. Conclusion

This prospective study provides evidence that titanium elastic nailing is an effective and safe treatment option for pediatric long bone fractures. The study demonstrated favorable outcomes regarding fracture union, complication rates, functional outcomes, and patient satisfaction. These findings support the use of titanium elastic nailing as the preferred management strategy for pediatric long bone fractures, offering advantages in terms of stability, rapid healing, and patient satisfaction. Further studies with larger sample sizes and longer follow-up periods are warranted to confirm these findings and assess the long-term outcomes of titanium elastic nailing in pediatric patients with long bone fractures.

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