

A STUDY OF SHORT TERM COMPLICATIONS OF TITANIUM ELASTIC NAIL IN THE TREATMENT OF DIAPHYSEAL FRACTURE OF FEMUR IN CHILDREN

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Abstract

Background: Femoral shaft fracture is the most common major pediatric orthopedic injury that most orthopedic surgeons will treat routinely and is the most common pediatric orthopedic injury requiring hospitalization. **Materials and Methods:** This was a prospective study conducted at Darbhanga Medical College; Patients of 0-18 years with diaphyseal femoral fractures attending the orthopedic emergency of the hospital between April 2022 to March 2023 were included in the study after obtaining consent from their parents. **Result:** Out of 30 cases 12 had spiral fracture, 5 had oblique fractures, 7 had transverse and 6 had comminuted fractures. 84 % of the patients had injury on the right side. 63 % children had fracture in the mid- shaft, 21% in the upper third while 16 in the lower third. **Conclusion:** We conclude with saying that the advantages of TENS are in rehabilitation and healing with abundant callus which is attributed to nonrigid fixation achieved with it.

INTRODUCTION

Femoral shaft fracture is the most common major pediatric orthopedic injury that most orthopedic surgeons will treat routinely and is the most common pediatric orthopedic injury requiring hospitalization. Management of femoral diaphyseal fractures in the age group of 6-14 years is highly controversial. This fracture has traditionally been treated non-operatively with either early spica cast or a period of traction followed by application of hip spica cast until the time of fracture union. This is the accepted standard of care for young children (usually age <6 years), but complications such as mal- union, joint stiffness, angulations, shortening and delay in functional recovery are not uncommon in older children if managed in this manner. Moreover, conservative treatment results in prolonged hospitalization causing more burdens on the hospital and financial losses to the family and parents.^[1]

During the past few decades, some forms of internal fixation in the form of plate fixation, rigid intramedullary nailing, enders nailing, titanium nailing have been advocated but the controversy regarding the ideal implant to treat pediatric femoral fractures still exists.^[1] The ideal device to treat most femoral fractures in children would be a simple, load sharing internal splint that allows mobilization and maintenance of alignment and extremity length until bridging callus forms. Titanium elastic nails offered these features. Though titanium elastic nails (TENS)

fixation is a good treatment option it is not free of complications.^[2,3]

This endeavor is an honest effort from the orthopedic team of a tertiary center of Bihar to analyze the short-term complications of titanium elastic nailing in pediatric diaphyseal femoral fracture and to look in to factors causing them, with the hope that it may possibly provide a way to minimize these complications.

MATERIALS AND METHODS

This was a prospective study conducted at Darbhanga Medical College, Bihar. Ethical clearance was obtained from the Institutional Ethics Committee prior to the initiation of the study. The study was conducted over a time span of 12 months that included the planning, data collection, post-operative evaluation and report dispensing phase. Patients of 0-18 years with diaphyseal femoral fractures attending the orthopedic emergency of the hospital between April 2022 to March 2023 were included in the study after obtaining consent from their parents. All the study participants were managed with TENS. Patients were followed -up till 12 months post-operatively for limb length discrepancy, pelvic asymmetries, rotational deformity, axial angulations, and hip and knee range of motion (ROM). Scoring criteria for TEN by Flynn et al,^[4] was used and results were classified as excellent, satisfactory or poor.

Operative procedure: Traction was applied using a fracture table with the help of fluoroscopic guidance to reduce the fracture. Appropriately sized elastic nails of 2 mm to 3.5 mm diameter were selected. Elastic nails were bent in an even curve. The tip of the nail was further bent 2 cm from one end at an angle of 40 degree. This helps the nail to bounce off the opposite cortex into the canal rather break it. After skin incision, insertion points were made one on medial and another on lateral side of distal femur, 2cm proximal to the distal epiphyseal plate. Elastic nails were pushed right up to fracture site. Then one of the nails were passed across the reduced fracture site which was followed by second nail. The nails were directed in such a way that medial nail was introduced into the neck and lateral just below trochanteric apophysis in a fan shaped manner. Two divergent nails provide adequate fixations and stability in adolescent femur. [4, 5] The distal end of nail should never project beyond distal epiphyseal plate on IITV to prevent knee pain and problems of nail protrusion and care should be taken to avoid pending the distal end of nails. Knee bending and quadriciceps exercises were begun as soon as the patient could tolerate it. No weight bearing

ambulation was started with in first few days, though partial weight bearing was permitted only after radiological evidence of callus formation. Full weight bearing was allowed only on radiological evidence of a firm union.

RESULTS

Mean age of the patients was 8.4 years with a standard deviation of 2.8 years. The age range was 3 to 16 years. Male female ratio was almost 1. Mechanism of injury was fall from height in majority of the cases, rest suffered RTA. Almost all cases reported within 24 hours of the injury. The mean duration of surgery was 60 minutes and the average hospital stay was 7.8 days. Out of 30 cases 12 had spiral fracture, 5 had oblique fractures, 7 had transverse and 6 had comminuted fractures. 80% of the patients had injury on the right side. 63 % children had fracture in the mid- shaft, 21% in the upper third while 16 % in the lower third. Mean interval between injury and TENS nail fixation was 4 days (2 days to 6 days). Time of nail removal varied from 6 months to 14 months with a mean of 8 months.

Table 1: Table showing various complications noted in the study participants over duration of 12 months

Complication	Number (Percentage)
1. Pain at the site of nail insertion	14 (46.67%)
2. Inflammation or bursitis	2 (6.7%)
3. Superficial infection	1 (3.3%)
4. Deep seated infection	1(3.3%)
5. Knee swelling	2 (6.7%)
6. Knee stiffness	1 (3.3%)
7. Limb length discrepancy	2 (6.7%)
8. Proximal nail migration	2 (6.7%)
9. Varus angulation	4(13.33%)
10. Delayed union	0
11. Non union	0
12. Breakage of nail	1 (3.3%)

All patients were available for evaluation after a period of 12 months follow up. Radiological union was achieved in an average time of 7 weeks; hence full weight bearing was allowed and achieved in about 7 weeks. Functional range of movement was achieved within a mean duration of 8.6 weeks. As per the Flynn et al,^[4] criteria the results were excellent in 22 patients, successful in 7, and poor in 1 patient. Various short-term complications noted among the study participants have been shown in [Table 1]. No post-operative difference was observed due to fracture pattern hence this signifies remodeling of the bone in this is age group.

DISCUSSION

The treatment of pediatric shaft femur fracture has been drastically changed over the last two decades. Internal fixation of pediatric shaft femur fracture by elastically stable intra- medullary nail (ESIN) is gradually replacing conservative treatment. A better understanding of the elastic nailing procedure,

overall promising results published in different international journals and patient's demand probably has instilled confidence in our minds to begin this apparently new mode of fixation. However, starting titanium nailing in our set up was not a smooth sailing initially but we gradually did overcome the initial hindrance.^[6]

TENS appears beneficial over other surgical methods particularly in this age group because it is simple, is a load sharing internal splint that doesn't disrupt open physis, permits early mobilization and maintains alignment at the fracture site imitated by the elasticity of the fixation and promotes faster external bridging callus formation. The periosteum is not troubled and being a closed procedure, there is no disturbance of fracture hematoma there by decreased risk of infection. In a study conducted by Flynn et al,^[4] they found TENS was beneficial over hip spica in treatment of femoral shaft fractures in children.^[7] In another study, Buechsenschuetz et al,^[8] came to a conclusion that titanium nail was superior in terms of union, scar acceptance and overall patient

satisfaction compared to conservative management. Likewise, Ligier et al,^[9] treated 123 femoral shaft fractures with elastic intramedullary nail. In that study all fractures united. Entry site irritation developed in 13 cases. Lascombes et al,^[10] stated that TENS could be indicated in all femoral diaphyseal fractures of children with age more than six years till epiphysis closed excluding severe Type III open fractures. Narayanan et al,^[11] found good outcome in 79 femoral fractures stabilized with TENS. Despite the wide base of literature showing TENS as an efficient procedure, it comes with complications like entry site irritation, pain, limb length discrepancy, fracture angulations, refractures and infection. Entry site irritation and pain is the most commonly complication of TENS.^[4,11]

CONCLUSION

We conclude with saying that the advantages of TENS are in rehabilitation and healing with abundant callus which is attributed to non-rigid fixation achieved with it. This results in quick fracture union and timely return to full weight bearing while considerably dropping hospital stay and treatment charge.

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