

Outcome of Paediatric Femoral Shaft Fractures Treated with Titanium Elastic Nailing- A Prospective Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Conservative management has always been used for paediatric fractures. However surgical management has shown outstanding results. Closed reduction and titanium elastic nailing is one of the procedures that is used for management of paediatric injuries. We undertook this study to see the outcome paediatric fractures treated with Titanium Elastic Nailing.

Methods: A prospective study conducted at Krishna institute of medical sciences, Karad. 30 children with femoral fracture managed with TENS were included in this study. Patients were followed up till 12 months post-operatively for limb length discrepancy, pelvic asymmetries, rotational deformity, axial angulation, and hip and knee range of motion (ROM). Scoring criteria for TEN By Flynn et al. [11] was used and results were classified as excellent, satisfactory or poor

Results: There were 19 boys and 11 girls in this study. The mean duration of surgery was 50 min. Radiological union was achieved in average time of 7 weeks. Full weight bearing was achieved in a meantime of 7 weeks. As per the Flynn et al. [11] criteria the results were excellent in 24 patients, successful in 5, and poor in 1 patient. One patient had varus angulation, 3 patient had entry site irritation and 2 had limb length discrepancy.

Conclusion: The TENS is an efficient and acceptable form of treatment in selected cases of femoral diaphyseal fractures in children.

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1. INTRODUCTION

The management of femoral fractures in paediatric age group (0-18 years) has always been a matter of debate. Several conservative as well as surgical treatments have been proposed [1]. However the treatment of choice is typically based on patient's age, fracture type [2], associated injuries, and the physical characteristics of the child. Diaphysis fractures of femur in children less than six years of age are usually treated with conservative methods, such as casting, tractions or Pavlik harness [3]. These methods show good clinical and radiological results and represent the gold standard treatment [4]. However conservative treatments are not suitable in specific cases such as polytraumatized patients, unstable fracture with risk of redisplacement and difficulty to obtain an acceptable reduction. Other concerns associated with conservative treatments like the long hospitalization, the necessity of general anaesthesia and treatment in the operating theatre, prolonged weight bearing restrictions and the high cost have ignited an increasing interest in surgical management [5]. During the past few decades some forms of internal fixation in the form of plate fixation, Rigid IM nailing, Enders nailing, Titanium nailing have been advocated but the controversy regarding the ideal implant still exists. For the age group 6 to 16 which implant is superior to other is still a matter of dilemma [6]. Intramedullary nailing with titanium elastic nails (TENS) offers several advantages, including early union, lower rate of malunion, spare of the physis, early mobilization and weight bearing, mini- invasive approach with easy implant removal, and high patients' and parents' satisfaction rates [7,8,9]. Good results at mid-term follow-up have been reported in children older than six years of age [10]. We undertook a prospective study to evaluate the outcome of paediatric femoral fracture managed with TENS.

2. MATERIALS AND METHODS

This was a prospective study conducted at Krishna institute of medical sciences, Karad after obtaining approval from ethics committee. 30 children with femoral fracture managed with TENS were included in this study. Patients were followed up till 12 months post-operatively for limb length discrepancy, pelvic asymmetries, rotational deformity, axial angulation, and hip and

knee range of motion (ROM). Scoring criteria for TEN by Flynn et al. [11] was used and results were classified as excellent, satisfactory or poor.



Fig. 1. TENS

2.1 Operative Procedure

Traction was applied using a fracture table with the help of fluoroscopic guidance to reduce the fracture. Appropriate 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, 2 cm proximal to the distal epiphyseal plate. Elastic nails were pushed right up to fracture site. Then one of the nail was 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 [11,12]. 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 quadriceps exercises were begun as soon as the patient could tolerate it. Non-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.

3. RESULTS

Ages of children ranged from 4-14 years (mean 8 years). There were 19 boys and 11 girls. 25 of the cases had fractures due to fall from height and 5 due to RTA. The mean duration of surgery was 50 min, the average hospital stay was 7 days. All patients were available for evaluation after a period of 12 months follow up. Radiological union was achieved in average time of 7 weeks. Full weight bearing was achieved in a meantime of 7 weeks. As per the Flynn et al. [11] criteria the results were excellent in 24 patients, successful in 5, and poor in 1 patient. One patient had varus angulation, 3 patient had entry site irritation and 2 had limb length discrepancy. Functional range of movement was achieved within a mean duration of 8 weeks. Out of 30 cases 10 had spiral fracture, 5 had oblique fractures, 8 had transverse and 7 had comminuted fractures. No post-operative difference was observed due to fracture pattern hence this signifies remodelling of the bone in this is age group.

Table 1. Flynn et al. [11] criterion for assessment of results

	Excellent	Satisfactory	Poor
Limb length discrepancy	<1 cm	<2 cm	>2 cm
Malalignment	Up to 50	5-100	>100
Pain	None	None	Present
Complications	None	Minor	Major.

Table 2. Frequency and percentage of respondent

Sex	Frequency	Percentage
Male	19	63.3
Female	11	36.7
Total	30	100

Table 3. Frequency and percentage of mechanism

Mechanism	Frequency	Percentage
Fall	25	83.3
RTA	5	16.7
Total	30	100

Table 4. Clinical outcome

Clinical outcome	No of cases	Percentage
Excellent	24	80
Satisfactory	5	16.7
Poor	1	3.3
Total	30	100

4. DISCUSSION

Femoral shaft fractures constitute about 2% of paediatric injuries. Ample modalities have been suggested for its management and they include plates, external fixators, IM nails, TENS etc. Widely used plate osteosynthesis is associated with larger dissections, longer time of immobilization, increased risk of infection and delayed union [13,14]. The external fixator has risks of pin track infection and generally takes longer for weight bearing to be started [15,16]. As far as IM nails are concerned they have been associated with AVN of femoral head, coxa valga [17,18].

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 haematoma there by decreased risk of infection.

In a study conducted by Flynn et al. [11] they found TENS was beneficial over hip spica in treatment of femoral shaft fractures in children [6].

In another study, Buechsenschuetz et al. [19] 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. [20] 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. [21]. 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 [9] 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 angulation, refractures and infection. Entry site irritation and pain is the most commonly complication of TENS [9,11]. Entry site irritation was noted in cases where longer nails were used and shorter nails led to angulation of fracture. In this study we had

3 cases with entry site irritation, 2 had LLD and 1 had varus angulation.

We conclude with saying that the advantages of TENS is 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.



Fig. 2. a,b: PRE-OP AP and lateral radiographs

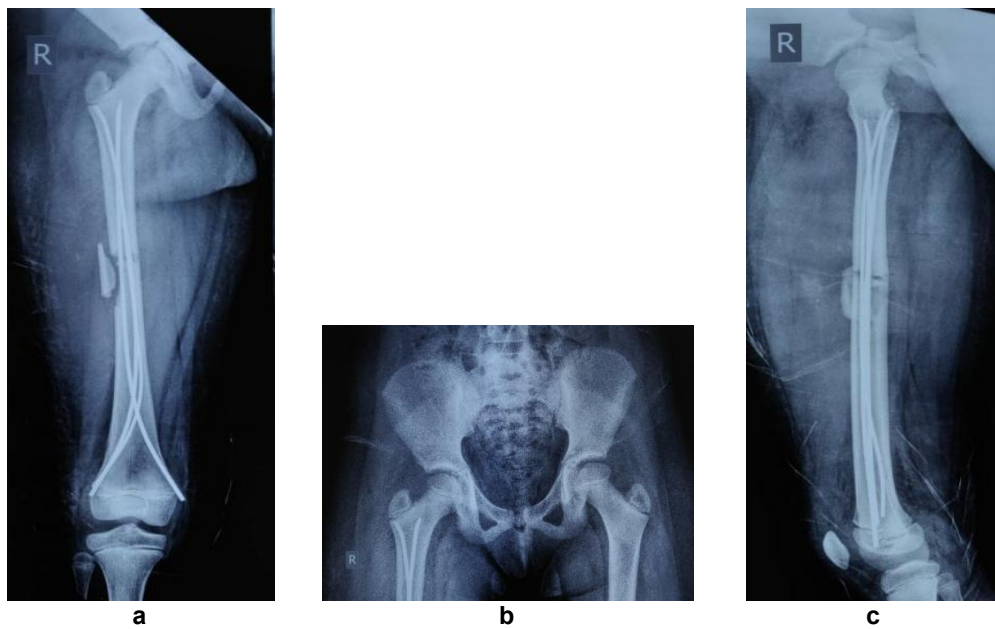


Fig. 3. a,b,c: Three Month Post-Operatively (AP, PBH-AP and LATERAL)



a



b

Fig. 4. a, b: Clinical photos at three month follow up

5. CONCLUSION

The TENS is an efficient and acceptable form of treatment in selected cases of femoral diaphyseal fractures in children.

CONSENT

As per international standard or university standard written parents' consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This was a prospective study conducted at Krishna institute of medical sciences, Karad after obtaining approval from ethics committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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