

# Functional Outcome of Intramedullary Fixation with Titanium Elastic Nails in Diaphyseal Fractures of Femur in Children

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## ABSTRACT

**Objective:** To examine the functional outcome of intramedullary fixation with titanium elastic nails in diaphyseal fractures of femur in children.

**Study Design:** Retrospective/Observational study.

**Place and Duration of Study:** Pir Abdul Qadir Shah Jilani Institute of Medical Sciences, Gambat from 1<sup>st</sup> April 2017 to 30<sup>th</sup> September 2018.

**Materials and Methods:** A total of 16 patients of both genders presented with diaphyseal femur fractures were included. Patient's ages were ranging from 5 to 15 years. Surgery was carried out within 3 days of admission by a qualified orthopaedic surgeon. Nail size was decided per-operatively according to Flynn's Formula (Nail Diameter = 80% of cavity diameter/2). Post-operative back-slab was applied for 3 to 4 weeks. Patients were discharged on second post-operative day and followed up at 2 weeks, 6 weeks, 12 weeks and 24 weeks after surgery.

**Results:** Thirteen patients had excellent outcome and 3 patients had satisfactory result. No patient in our experience showed poor outcome. The mean time for full weight bearing was 6.9 week. Hospital stay was a mean of 05 days. Only 01 patient had superficial infection which subsided with appropriate antibiotics.

**Conclusion:** TENS is an ideal device to treat pediatric femoral shaft fractures. TENS is a simple, safe, minimal invasive technique with fewer complications.

**Keywords:** Diaphyseal femur fracture, Titanium elastic nail, Outcome

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## INTRODUCTION

Diaphyseal fractures of femur are one of the common childhood injuries and are among the most common causes of hospitalization of children in orthopaedic and trauma units.<sup>1</sup> Management of Femoral diaphyseal fractures in children of school going age is controversial.<sup>1,2</sup> A wide range of surgical and non surgical options are available for treatment of these fractures in this age group such as spica casting, traction, casting, external fixation, plating and more recently flexible intramedullary nailing.<sup>1,3</sup> Children younger than school going age (<5 years) are usually treated with conservative measures however for older children (5 to 15 years) surgical treatment has gained popularity<sup>1</sup> as conservative treatment necessitates either a long stay at hospital for traction or immobilization in an uncomfortable cast that is not well tolerated in this age group.<sup>4</sup> In 1982 Metaizeau and his team from Nancy (France) developed the technique of flexible stable intramedullary pinning using titanium pins (FSIMP)<sup>5,6</sup> since then with few alterations overtime this method of fixation has become more and more popular. Theoretically closed flexible intramedullary nailing with titanium elastic nails can be considered superior to any other surgical method of fixation because it provides relative stabilization and functional reduction without disturbing fracture hematoma in comparison of open reduction and fixation methods, and it also avoids the disturbance to growth plates as opposed to rigid nailing. Good functional reduction, relative axial stability, Preservation of fracture hematoma, thick periosteal covering and excellent blood supply of femoral diaphysis are supposed to ensure good prognosis in terms of healing and prevention of deformity.<sup>7,8</sup>

Purpose of this study was to study the post-operative outcome in the pediatric patients undergoing closed intramedullary nailing with titanium elastic nails at department of orthopaedic and musculoskeletal trauma, PAQSJIMS Gambat in terms of rate of union, residual deformity and time out of school.

## MATERIALS AND METHODS

The study was conducted at Department of Orthopaedics and Musculoskeletal Trauma, PAQSJIMS Gambat from 1<sup>st</sup> April 2017 to 30<sup>th</sup> September 2018. A total of 16 patients with diaphyseal femur fractures were included. Pediatric patients of school going age of either sex presenting to Emergency or OPD with closed diaphyseal femur fractures and reporting early (within 2 weeks) after initial injury were included. Those patients below 5 years or above 15 years of age, open fractures, pathological fractures and patients after 2 weeks of injury were excluded. All patients underwent standard pre-operative protocols according to the institutional policy. Surgery was carried out within 3 days of admission by a qualified orthopaedic surgeon with minimum of 2 years experience. Nail size was decided per-operatively according to Flynn's Formula (Nail Diameter = 80% of Cavity diameter/02).<sup>4,7</sup> Post-operative Back-slab was applied for 03 to 04 weeks. Patients were discharged on second or third post-operative day and followed up at 02 weeks, 06 weeks, 12 weeks and 24 weeks after surgery. Clinical and radiological union were assessed at each visit, Full weight bearing was allowed after substantial evidence of callus formation, and patients were evaluated for any angular deformity and limb length discrepancy after 24<sup>th</sup> week of surgery (after attainment of radiological

consolidation). The data was entered and analyzed through SPSS-20.

**RESULTS**

Eleven (68.75%) patients were males while 5 (31.25%) were females. Majority of patients 62.5% patients were ages 5 to 10 years. Seven (43.75%) patients had fracture due to road traffic accident and 9 (56.25%) due to fall from height. In our study 6 (37.5%) fractures were on left side while 10 (62.5%) fractures were on right side. Fracture type were recorded as transverse, oblique, spiral and communited and found in 9 (56.25%), 2 (12.5%), 4(25%) and 1 (6.25%) patients respectively. All patients were operated closed no patient in our experience required open reduction. Mean hospital Stay was 05 days (Table 1). Time of union ranged from 6 to 12 weeks with an average of 7.5 weeks. The mean time for full weight bearing was 6.7 week. Shortening was found in 4 patients out of which 3 patients had 1cm and 1 patients had >1cm. Angulation was observed in 5 patients and all of 5 patients had <5°. Only 01 patient had superficial infection at site of entry which subsided with appropriate antibiotics (Figs. 1-2). The final outcomes were analyzed by the Flynn Criteria at 24 weeks and we recorded 13 patients had excellent outcome and 03 patients had satisfactory result. No patient in our experience showed poor outcome (Table 2).

**Table 1:** Baseline characteristics of all the patients

Variable	No.	%
<b>Gender</b>		
Male	11	68.75
Female	5	31.25
<b>Age (years)</b>		
5 -10	10	62.5
11 -15	6	37.5
<b>Injury</b>		
Road accident	7	43.75
Fall from height	9	56.25
<b>Fracture side</b>		
Left	6	37.5
Right	10	62.5
<b>Fracture type</b>		
Transverse	9	56.25
Oblique	2	12.5
Spiral	4	25
Communited	1	6.25

**Table 2:** Final outcomes according to Flynn's criteria

Flynn's score	No.	%
Excellent	13	81.25
Satisfactory	3	18.75
Poor	-	-



**Fig. 1:** Pre operative and post-operative



**Fig. 2:** Post-operative at final follow-up and after removal of Nails.

**DISCUSSION**

Femoral shaft fractures are among the most common diaphyseal fractures in children with an estimated annual incidence of 19 fractures per 100,000 children. Several observational studies have identified a bimodal age distribution for femoral shaft fractures with peaks in the toddler age group, where falls are the predominant cause of injury, and in the adolescent age group, where motor vehicle collisions cause most of the fractures<sup>9,10</sup>. In the present study duration 16 cases of diaphyseal fracture of femur in children were treated with titanium elastic nail in which majority of patients were males 68.75% with age group 5 to 15 years. A study conducted by Khajotia<sup>11</sup>. regarding TENS for diaphyseal femur fractures reported 84% patients were males with ages ranging from 5 to 15 years. In our study 56.25% fractures were due to fall from height followed by road traffic accident 43.75%. Many of other studies regarding diaphyseal fracture of femur in pediatric illustrated that the road traffic accidents and fall from height were the most common causes of injuries<sup>12, 13</sup>. Out of all children (ages <15 years) with diaphyseal fracture of femur included in our study we analyzed that the rate of road traffic accidents as the cause of injury, was higher in older children (11 to 15 years of

age), this attributes the unsupervised use of MVAs specially motor bikes in this age group.

In our study the most common fracture type was transverse 56.25%. This was similar to another study in which transverse fracture type was the most common type of fracture<sup>14</sup>. Our study illustrated that time of union ranged from 6 to 12 weeks with an average of 7.5 weeks. The mean time for full weight bearing was 6.7 week. These findings are slight better than a study conducted by Saikia et al<sup>2</sup> that observed radiological union in all cases were achieved in a mean time of 8.7 weeks. Full weight bearing was possible in a mean time of 8.8 weeks. All cases were operated closed in our study, that may have contributed for these improved outcomes.

In our study, shortening was found in 4 patients out of which 3 patients had 1cm and 1 patients had >1cm. Angulation was observed in 5 patients and all of 5 patients had <5°. Only 01 patient had superficial infection which subsided with appropriate antibiotics. A study conducted by Hossain et al<sup>14</sup> reported that leg length inequality, which was about 0.5 cm present in three patients. In our study the final outcome were analyzed by the Flynn Criteria at 24 weeks and we recorded 81.25% had excellent outcome and 3 patients had satisfactory result. No patient in our experience showed poor outcome. These results were similar to several studies conducted regarding TENS for diaphyseal fractures of femur in children rated excellent 80 to 90% with very low rate of poor results 5 to 10%.<sup>15-19</sup>

## CONCLUSION

TENS is an ideal device to treat pediatric femoral shaft fractures TENS is a simple, safe, minimal invasive technique, has fewer complications, does not interfere with growth and blood supply of femoral head, leads to non-interference of fracture hematoma, minimal periosteal stripping and rapid bone healing. It is associated with shorter hospital stay, rapid return to daily activity and school, avoids long and uncomfortable immobilization and cosmetic damage is minimal being limited to small scars at the sites of introduction of nails.

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