

A study of clinico-radiological outcomes of enders nail in pediatrics patients having femur diaphyseal fracture

Dr Parimal J. Patel¹, Dr Kandarpkumar K. Patel², Dr Viren A. Umrethiya³
^{1,2,3}(Department of Orthopedics, Government Medical College, Surat, Gujarat, India)

Abstract

Background: Among all pediatric injuries, femur shaft fractures account for 1.6%. The treatment of choice for children aged 6-14 years is still debatable as multiple modalities of operative interventions are available. Flexible intramedullary nailing has emerged as an accepted procedure for pediatric (age 6-14) femur shaft fractures. But orthopedic surgeons remain divided in opinion regarding its usefulness and functional outcomes.

Aim: To assess clinical and radiological outcomes of pediatric femoral shaft fractures treated with enders nail and compare its results with other literature.

Materials & Methods: 25 patients aged between 6 to 14 years having simple closed femur shaft fractures and operated with Enders nail between January 2014 to December 2014 were included in this study. Patients having metaphyseal, compound, or pathological fractures were excluded from this study. Patients having multiple fractures in the same limb were also excluded from this study. Patients were operated with close reduction and internal fixation with Ender's nail. Postoperative clinical and radiological assessment was done at 4, 8, 12 and 24 weeks. Radiological assessment was done by the visibility of fracture line, callus formation at the fracture site, and alignment of reduction. Flynn's criteria was used for clinical assessment.

Results: Of 25 patients in this study, 18 were males and 7 were females. The mean age was 10.16 years. 14 patients had left side femur fracture. The average duration of the surgery was 36 minutes and the average duration of stay in hospital was 5.2 days. 22 patients achieved union on 8 weeks and 3 patients took 12 weeks. 5 patients had pain at Ender's insertion site. Varus angulation was seen in 1 patient and 2 patients had limb length shortening of 1 cm. According to Flynn's criteria, 24 patients had excellent results and 1 patient had a good result.

Conclusion: Ender's nail is a simple, easy, rapid, reliable and effective method for the management of femoral fractures between the age of 6 to 14 years.

Keywords: Femur diaphyseal fractures, Ender's nail, Flynn criteria

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I. Introduction

Femur shaft fracture is one of the commonest fractures in the pediatric age group. Children aged less than 5 years treated with plaster of Paris cast have excellent result clinico-radiological outcomes. Adolescents aged more than 15 years having femur shaft fracture have shown excellent results with intramedullary nailing. but the best treatment for children between 6-14 years of age is still debated. Conservative management in this age group has shown various adverse physical, social, psychological and financial consequences due to prolonged immobilization, limb length shortening and deformity. various modalities for fixation of fracture are available such as external fixation, plates and screws, solid intramedullary nails and flexible intramedullary nails. In the past years, fixation with flexible intramedullary nails has become a popular technique, but still many orthopedic surgeons remain divided in opinion regarding its usefulness and functional outcomes. The current study aims to study the clinical and radiological outcomes of pediatric shaft femur fractures treated with ender's nail and compare its result with other literature.

II. Material and methods

This prospective observational study was carried out from January 2014 to December 2014 after getting permission from the ethics committee of the institute. A total of 25 patients were included in this study.

Inclusion criteria: Age 6-14 years, Patient having diaphyseal femur fractures, Simple closed fractures

Exclusion criteria: Metaphyseal fractures, Compound fractures, Pathological fractures, Multiple fractures in same lower limb

Patients diagnosed with diaphyseal femur fractures on admission to ward, a detailed history was taken and primary treatment in form of below-knee skin traction and elevation (for counter traction) was given. Pre-

operative planning for Ender’s nail size and width was done with help of Flynn et al’s formula. (Diameter of nail=width of the narrowest point of the medullary canal on anteroposterior and lateral view X 0.4mm)

Retrograde ender’s nails were inserted sparing the physis of the distal femur. Post-operatively analgesics and IV antibiotics were continued for 3 days and switched to oral antibiotics for the next 4 days. Analgesics were given according to the needs of the patient. For 6 weeks patients were immobilized with a derotation bar and after that active hip and knee mobilization started. Full weight-bearing started by 8-12 weeks depending on fracture configuration and callous response.

Follow-up assessment was done at 4,6,8, 12 and 24 weeks. At each follow-up, patients were assessed clinically and radiologically. Clinical assessment was done by following parameters: pain, range of movement at hip and knee joint, measurement of limb length, time of weight-bearing in weeks. Radiological assessment was done by following parameters: alignment (sagittal, coronal and rotational), circumferential callous formation, visibility of fracture line. We also looked for the complications e.g. infection, persistent pain, angulation more than 10 degrees, limb length discrepancy more than 2 cm, delayed/non-union, neurological damage after nailing.

The final outcome based on the above observations was done with Flynn’s criteria¹

Variables at 24 weeks	Excellent	Satisfactory	Poor
Limb length inequality	< 1 cm	< 2 cm	> 2 cm
Malalignment	5 degrees	10 degrees	> 10 degrees
Unresolved pain	Absent	Absent	Present
Other complications	None	Minor and resolved	Major and lasting morbidity

Table 1. Flynn’s criteria

III. Results

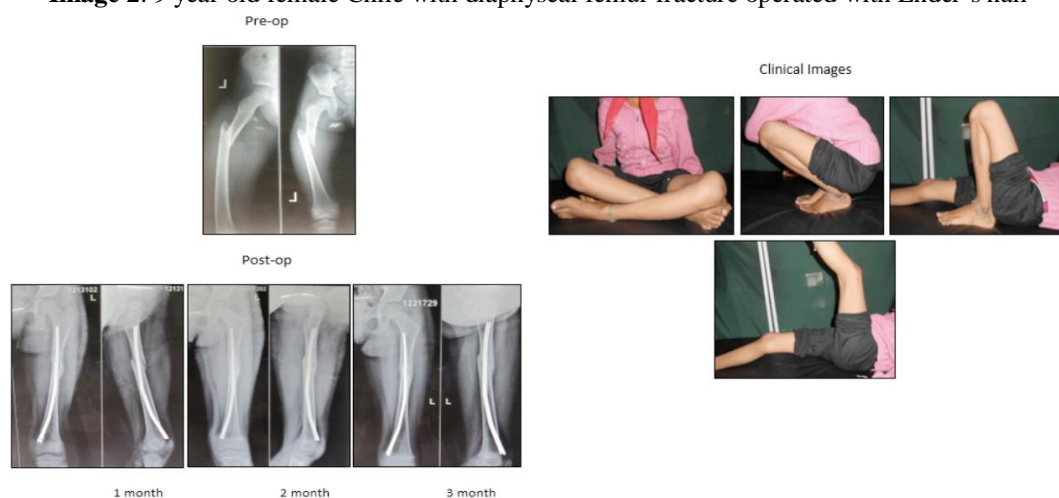
Out of 25 patients, 8(32%) patients were in the age group of 5-8 years; 12(48%) were between 9-12 and 5(20%) were in the age group of 13-16 years. 7(28%) patients were female and 18(72%) were male. 10 (40%) patients had RTA as the mode of injury whereas 15(60%) patients had fall down as the mode of injury. 11 (44%) patients had a right-sided femur fracture and 14 (56%) patients had left-sided femur fracture. 13 (52%) patients had a transverse type fracture, 9 (36%) patients had an oblique fracture, 3 (12%) patients had a spiral fracture. 5 (20%) patients were operated with a single nail and 20 (80%) patients required 2 nails for fracture fixation. Duration of surgery was less than 30 minutes for 4 (16%) patients; between 30-45 minutes for 19 (76%) patients and between 46-60 minutes for 2 (8%) patients.

Duration of stay in hospital was <3 days for 5(20%) patients; 4-6 days for 12(48%) patients and 7-9 days for 8(32%) patients. Time for union based on plain radiographs was at 8 weeks postoperatively for 22(88%) patients and 12 weeks for 3(12%) patients. 22 (88%) patients started full weight-bearing at 8 weeks and 3 (12%) at 12 weeks. 24(96%) patients had excellent outcomes and 1 patient had a satisfactory outcome based on Flynn’s criteria. In our study, 5(20%) patients had pain at operative site and 1(4%) patient had various angulation at 24 weeks of follow up.

Image 1. 10 year Male child with diaphyseal femur fracture operated with Ender’s nail.



Image 2. 9 year old female Chile with diaphyseal femur fracture operated with Ender's nail



IV. Discussion

Flexible intramedullary nailing is a widely used technique for biological fixation of diaphyseal shaft femur fracture in pediatric age group. Biological fixation allows micro movement at the fracture site which helps in callus formation. Ender's nail provides three point fixation when the apex of the bend is at the fracture site. This technique being minimally invasive, requires a shorter duration of hospital stay.

In our study 72% of the patients were male and 28% were female. In a study conducted by J.N. Ligier et al 67.7 % were male and 32.3% of patients were female.² In another study by Ozturkman et al, 73.07 % were male and 26.92 % were female.³ In our study, 40% patients had RTA as the mode of injury and 60% had fall down as the mode of injury. in the study conducted by J.M. Flynn et al, 58.1% had RTA as mode of injury and 41.9% had fall down as the mode of injury.¹ In our study, 52% patients had transverse pattern of fracture; 36% had oblique fracture and 12% had spiral fracture. There were no comminuted or segmental fractures. In a study conducted by J.N. Ligier et al. 38.2% had transverse fracture, 20.3% had comminuted fracture, 23.3% had oblique fracture, 15.4% had spiral fracture and 3.2 % had segmental fracture.² In a study by M. Khazzam et al, 47.83% patients in their study had transverse type fracture, 4.35% had comminuted fracture, 30.43% had oblique fracture, 17.39% had spiral fracture.⁴ The average duration of surgery in our study was 36 minutes compared to 39 minutes in a study by Shekhar L. Mayanger et al.⁵

The average time of union was 8.48 weeks in our study compared to 6.6 weeks and 7.4 weeks in studies carried out by ozturkman et al and Heybeli et al respectively.^{3,6} Average time of full weight bearing was 8.48 weeks in our study, whereas it was 8.7 weeks in a study conducted by M. Khazzam et al.⁴ 96% of the patients had excellent outcome and 4% had satisfactory outcome based on Flynn score. 79.17% patients had excellent outcome, 12.5% satisfactory and 8.33% had poor outcomes in a study conducted by M Khazzam et al.⁴ Whereas 65% excellent, 25% satisfactory and 10% patients had poor outcomes in study conducted by Flynn et al.¹ K. C. Saikia et al reported 59% excellent, 27.2% satisfactory and 13.6% poor outcomes in their patients.⁷ Limitations of our study were a smaller sample size and short duration of follow-up. Longer duration of follow up is required to assess long term complications such as limb length discrepancy and deformity.

V. Conclusion

Ender's nail is a simple, easy, rapid, reliable and effective method for management of femoral fractures between the age of 5 to 14 years with less disturbance to the periosteum and fracture hematoma. It allows micromotion at fracture site which leads to callus formation. Ender's nail has a shorter operative time, shorter hospital stay, lesser blood loss compared and reasonable time to bone healing to open procedures

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