

Ender's Nail fixation in paediatric femoral shaft fractures.

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ABSTRACT

Introduction: Femoral shaft fractures are among the most common major pediatric injuries treated by orthopaedic surgeons. Treatment ranges from strictly nonsurgical methods to surgical stabilization. Operative treatment of femoral shaft fractures in children with intramedullary nails (Ender's and titanium elastic nails) is increasing because it has advantage of early mobilization, rapid healing and better control of alignment.

Objectives: We evaluated the results of Ender's nails fixation in femoral shaft fractures in children. **Method:** We studied 40 children with 40 femoral shaft fractures in age group 5-15 years. There were twenty four fractures in middle third, 7 in distal third and 9 in proximal third. Twenty fractures were transverse, 8 were oblique and 6 were spiral. Communion was seen in 6 cases. They were treated by closed reduction and Ender's nail fixation. Retrograde fixation was done in 38 cases, in 2 cases antegrade fixation was done. **Result:** The mean follow up was 7.5 months. The average time to partial weight bearing was 3.8 weeks (2 to 6wks). The average time to full weight bearing was 8 weeks (6 to 12 wks). Union was achieved in all patients within a mean of 11 weeks (8 to 16 wks). Two patients had varus angulation of 8° and 6° each, whereas one had valgus angulation of 8° and one had anterior angulations of 10°. Lengthening of 1.2 cm was observed in one patient. In one case skin irritation due to nail was observed and that subsided without intervention. According to the Flynn criteria 34 had excellent and 6 had satisfactory results. No poor results were seen. **Conclusion:** Ender's nail fixation can be preferred method of treatment for femoral shaft fractures in age group 5 -15 years as the results are excellent and satisfactory. It is technically simple and can be done in a closed manner. It spares the vascularity and growth plate.

Keywords: Ender's nail, femoral shaft fracture, children, Flynn criteria

INTRODUCTION

Femoral shaft fractures are among the most common major pediatric injuries treated by orthopedic surgeons.¹ Treatment ranges from strictly nonsurgical methods (e.g. closed reduction with spica casting or traction followed by spica casting) to surgical stabilization (using intramedullary devices, external fixation, or internal fixation with plate and screws).¹ Casting with or without traction is still the preferred treatment for isolated femur fractures in children of preschool age.¹ For children above 5 years of age option of surgical treatment is increasing because it has advantage of early mobilization, reduced duration of hospital stay and reduced psychological adverse impact.

Flexible intramedullary nails (Ender's and titanium elastic nails), external fixation, compression plating and locked rigid intramedullary rod are the available options for fixing femoral fractures in children.

In the present study, we evaluated the outcomes of use of Ender's nails in treating pediatric femoral shaft fractures.

MATERIAL AND METHODS

The present prospective study was conducted in the Department of Orthopedics at Nepalgunj Medical College Teaching Hospital, Kohalpur over a period of 2 years from November 2009 to November 2011. We included children between 5 to 15 years with femoral shaft fractures from a point five centimeter (cm) distal to lesser trochanter to 5 cm proximal to distal femoral physis.

Children more than 15 years and less than five years of age, children with pathological fracture and with open fracture were excluded from study.

The results were evaluated using Flynn's scoring criteria.² Major postoperative complications were defined as nonunion, delayed union, infection, refracture, nail irritation requiring hardware removal, and nail breakage. Minor postoperative complications were defined as nail irritation that resolved without intervention, asymptomatic nail migration, and any perioperative problem that resolved without surgical intervention or early hardware removal.



Preoperative x-ray showing transverse fracture of shaft of femur in 10 years old boy

OPERATIVE TECHNIQUE

Nail diameter was theoretically chosen on the basis of 40% of the narrowest intracortical diameter but was ultimately determined intraoperatively by surgeon. Approximate length of the nail was determined by measuring on x-rays and on normal side from tip of greater trochanter to adductor tubercle. Nails were bent in an even curve. On a fracture table, close reduction was done under fluroscopic guideness. After incising the skin, insertion points were made one on medial and another on lateral side of distal femur, 2.5cm proximal to the distal epiphyseal plate. The nails were introduced right up to fracture site. Then, one of the nail was passed across the already reduced fracture site 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 were used.

RESULTS

Forty children with forty femoral shaft fractures were treated with Ender's nails. Ages of children ranged from 5 to 15 years (mean 9.87 years). There were 24 boys and 16 girls. Twenty two cases sustained right sided and 18 cases sustained left sided fractures. Eighteen patients had injury due to fall from height, 13 patients sustained road traffic accident while 9 patients had injury while playing. No cases with

bilateral fractures were seen. Among all, 24 fractures were in middle third, 7 in distal third, and 9 in proximal third. Twenty cases had transverse fracture, 8 were in oblique and 6 were spiral in pattern. Six cases showed some comminution. Among them on Winqvist³ grading system, 3 were grade I, 2 were grade II and 1 was grade III. No case of Winqvist grade IV was seen. The interval between injury and surgery varied from 2 days to 6 days (average 2.9days). The mean hospital stay was 6.9 days. The average duration of surgery was 50 minutes. In 2 cases antegrade nailing was done whereas in 38 cases nails were inserted in a retrograde manner.

Postoperatively, no patient needed any protective splint. Knee bending and quadriceps strengthening exercises were begun as soon as patient was comfortable. The average time to partial weight bearing on axillary crutches was 3.8 weeks (2to 6wks). Full weight bearing could be commenced in about 2-4 weeks time more in most of the cases. The average time to full weight bearing was 8 weeks (6 to 12 week). Union was achieved in all patients within a mean of 11 weeks (8 to 16 weeks). Full movement of knee was achieved in 9 weeks (6 to 16 weeks).

Intraoperative Complications: In one case the opposite cortex got perforated but the nail was reintroduced.

Follow up: The mean follow up was 7.5 month (6 to 16 months). By this time, all the patients had full-unrestricted activity. None of the patients had any pain, limp or gait abnormality.



Six weeks post operative x-ray of same patient showing early callus

Angular deformity more than 5 degree was observed in only 4 patients. Two patients had varus angulation 8° and 6° each whereas one had valgus angulation of 8° and one had anterior angulation of 10°. On clinical examination lengthening of more than 1cm (1.2 cm) was observed in one patient. In one case, skin irritation due to nail was observed that subsided without intervention. On clinical examination significant malrotation was not seen in any patient.

According to the Flynn criteria ² (Table-1) 34 patients had excellent result, 6 had satisfactory and no poor results were seen.

Table-1: Flynn et al²(2001) criterion for assessment of results

	EXCELLENT	SATISFACTORY	POOR
Limb length discrepancy	<1 cm	<2 cm	>2 cm
Malalignment	< 5 degree	5-10 degree	>10 degree
Pain	none	none	present
Complications	none	minor	major

DISCUSSION

There are a wide range of conservative and surgical options available for the treatment of children with femoral shaft fractures in age group 5-15 years. Conservative (spica) treatment has disadvantages such as prolonged hospital stay, shortening, angular and torsional deformity and the psychosocial implications. These are avoided in surgical treatment with Flexible intramedullary nails. ^{4,5} Many orthopedician reserve surgical management only for multiply injured patients. This study aimed to treat isolated femoral shaft fractures surgically by Ender's nails.

External fixation although is associated with minimal soft tissue dissection but it causes patient apprehension on account of external device, high rate of pin track infection and real danger of refracture after removal of fixator.⁶ Compression plating is associated with large soft tissue dissection opening of fracture site and major operation for removal. Rigid intramedullary nailing may damage the blood supply to the femoral head resulting in avascular necrosis of femoral head or causing growth arrest at the greater trochanter resulting in coxa valga.

Ender's nailing is technically simple, time saving and can be done in a closed manner.⁴ Two divergent Ender's nails provide adequate fixation and stability.⁷ The major advantages of Ender's nail is in healing with abundant callus, attributed to non rigid fixation.⁸ It spares the vascularity and growthplate. It allows early mobilization, rapid external callus formation and rapid restoration of continuity of bones. This results in rapid fracture union and early return to full weight bearing while reducing hospital stay and treatment cost.



Fourteen weeks post operative x-ray showing union

According to criterias given by Flynn² the final results in our study were excellent in 34 (85%) cases, and satisfactory in 6 (15%) cases. Outcome of our study matched with several other studies.

Our study matched with Mann et al⁹ (1986), they demonstrated excellent results with 100% union rate without any angular malunions or leg length discrepancies, however, this study was conducted in older children 9-15 years of age.

Karaoglu S and colleagues¹⁰ (1994) reported excellent results in their study, however, this study was conducted in children between the ages of 10 and 16 years.

Ozturkmen Y et al ¹¹ (2002) reported on Twenty six children (mean age 8.9 years, range 5.9 to 12.3 years) they also demonstrated excellent results with Ender's nail in approximately 85% of patients. Union was achieved in all patients within a mean of 6.6 weeks (range 5 to 12 weeks) and no observation regarding delayed union, infection, nonunion, growth arrest and refracture after nail removal was seen.

Laghvindu Shekhar et al¹² (2006) reported in 34 femoral fractures treated by Ender's nail, 20 patients (83.3%) had excellent results , 4 (16.3%) had satisfactory and none had poor result.

Kumar S et al ¹³ (2011) reported on Sixty-two femoral shaft fractures treated by elastic intramedullary nailing (titanium elastic and Ender nails) with mean age of the patients being 9.2 years. The result demonstrates 100% union rate irrespective of the age, weight and height

of the patient. They did not find any mismatch in the results of fractures stabilized with titanium elastic nails with that of Ender's nails.

Lohiya et al¹⁴ (2011) reported outcomes of flexible intramedullary nailing in 73 femoral shaft fractures. Titanium and Ender nails were used in 43 and 30 cases respectively. There were overall 59 excellent, 10 satisfactory and 4 poor results however among Ender's group only one poor result was observed.

To conclude, Ender's nailing can be preferred surgical option for the treatment of children with femoral shaft fractures in age group 5-15 years, as it can be done by closed method, outcomes are excellent and satisfactory, associated with few complications and it spares the vascularity and growth plate.

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