

Outcome of Elastic Stable Intramedullary Nail in Length Unstable Diaphyseal Femur Fractures in Children: A Case Series

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ABSTRACT

Introduction

Elastic stable intramedullary nailing (ESIN) has been a common method of treatment of diaphyseal femur fracture in children. Though they are used in length stable fracture with favourable results, their use is debated in case of length unstable variants. The objective of the study was to evaluate outcome of these nails in length unstable diaphyseal femur fracture in children.

Methods

We retrospectively reviewed seven fractures in seven children treated with ESIN for functional outcome.

Results

Total of seven patients with seven unstable femur fractures were studied. There was male predominance with 71.4%. The fracture united at a mean duration of 12 wks. The overall Flynn scoring showed 71.4 % excellent and 28.6 % satisfactory result.

Conclusion

Elastic stable intramedullary nailing can be safely used in length unstable variant of femur fracture in children.

Keywords: *Elastic stable nailing, length unstable, pediatric femur fracture*

INTRODUCTION

Fracture shaft of femur is a commonly encountered injury in pediatric population. It accounts for about 5% of total long bone fractures, most commonly encountered in infants which is in 13%.¹ It is the most common musculoskeletal injuries in children requiring inpatient hospital admissions.²

Operative treatment of fracture of shaft of femur in children is guided mainly by age and weight of the patients. An ideal device for long bones of lower

limb fracture stabilization should follow biological fixation principle to promote healing as well as stable enough to allow early weight bearing and mobilization while maintaining limb length and alignment during healing. The fracture stabilization tools for femur that have been in use are external fixator, plates, intramedullary locking nails, elastic stable intramedullary nail (ESIN). Now a days, social and economic factors also play a major role in selection of a particular fixation device. The ESIN has been shown to be a versatile device being able to provide immediate fracture stability with

Table 1. Flynn outcome scoring⁶

Parameter	Excellent	Satisfactory	Poor
LLD	<1 cm	<2 cm	>2 cm
Malalignment	5°	10°	>10°
Pain	None	None	Present
Complication	None	Minor	Major

preservation of fracture biology in different patterns of fracture in both isolated as well as polytrauma patients along with its social and economic benefits.^{3,4,5,6}

Even though initial studies have marked that the fixation is stable in length unstable fracture there has been controversy to use this device in this subgroup of long bone fractures.^{7,8,9}

In this case series, authors share the outcome of treatment of length unstable diaphyseal fracture of femur in children with ESIN.

METHODS

We retrospectively reviewed 7 cases of pediatric patients with 7 length unstable diaphyseal femur fractures treated with ESIN at department of orthopedics, Maharajgunj Medical Campus treated from January 2018 to August 2019. Length unstable fracture was defined as Long oblique fracture (fracture line angulation more than 20 degree), spiral and comminuted fracture. Seven patients with 7 femur fractures with length unstable pattern as defined in xray were identified from records. All femur fracture were treated with retrograde nailing with prebent titanium elastic nails in retrograde fashion. The appropriate nail diameter with eighty percent canal fit were present. Intraoperatively all the patient had undergone stability testing with axial loading under image. The nails were left few mm outside the metaphysis for the ease of removal and no end caps were used in nails.

Patients received no immobilising devices and range of motion was started at the earliest when it was pain free to do so. Patients were discharged on touch down weight bearing on axillary crutches.



Fig 1. Case of spiral and oblique femur fracture that healed with excellent outcome after ESIN

Full weight bearing was started once early callus was seen. The sutures were removed on second postoperative week. Patient continued to ambulate on crutches. Two serial X-rays in orthogonal plane in anteroposterior and lateral views were taken at four week intervals.

The x-rays were evaluated for any unacceptable loss of reduction as well as to judge the progression of radiological union. The union was judged by formation of bridging callus formation on three or four cortices in two orthogonal films.

Two parameters were taken into consideration the first being time to union films and the second being the functional out come at the time of union. The functional outcome was assessed using Flynn outcome scoring.⁶

Results of ESIN for the treatment of pediatric femoral fracture is based on maximum allowable leg length inequality, malalignment, pain and complications. Children exceeding the criteria in any category were assigned the worse result.

RESULTS

Total of seven femur fractures of seven patients were included in the study. The age of patients ranged from 6-13 years with mean age of 9.14 years. There were predominantly male patients 5 (71.4%). The right side was predominantly involved side with 5 (71.4%) involvement.

The fractures were three cases of long spiral, two of oblique and two of comminuted pattern. The average time to union was 12 weeks with range of 8-16 weeks. The overall outcome evaluated using Flynn Scoring was 5 (71.4%) excellent and 2 (28.6%) satisfactory.

There was pin migration occurred in one case while skin irritation due to pin prominence was noted in two cases (Fig 1 and 2).

DISCUSSION

There has been a major shift in the treatment of femur shaft fracture in children of school going age.



Fig 2. Pin migration as a complication

There is an increasing trend of in favour of operative management over non operative management. This is favored by availability of device like ESIN which provide stable fixation with minimal interference to fracture biology. At the same time taking into account the social and economic factors involved in fracture treatment.

Ligier et al in 1985 published their result of treatment of 106 femoral diaphyseal fractures of all types such as spiral fractures, comminuted fractures even metaphyseal fractures. They mentioned no major operative complications as well as no fixation failure. They noticed lengthening of 4.5 cm in cases with transverse shaft fracture which they have attributed to the early mobilization. The mean duration of hospital stay was drastically reduced from 25.5 days mean to 7.5 days and the overall reduction of cost of treatment by 70%.³ This result was reproduced in another series by same authors where in 123 femurs of 116 patients were treated by ESIN. The mostly encountered complication was due to distal pin prominence.⁴

The AAOS Clinical Practice Guidelines suggest there is poor-quality evidence in support of any specific surgical treatment modality for diaphyseal femur fractures in children.⁷ For patient younger than 11 years, the guideline has the flexible nail as the main treatment. While these appear appropriate for stable fractures, proximal and distal fractures, spiral and complex fractures, and fractures in heavy children 45 kg have higher complication rates when treated by flexible nails.⁸ Similarly, in Sink et al study, 10 of the 15 (66%) patients in the unstable fracture group had either fracture shortening or angulation.⁹

In our study with seven case of length unstable femoral shaft fractures we were able to achieve 71.4% of excellent outcome. Similar findings were observed in a study conducted by Yogendra et al¹⁰ who had overall 73.68% excellent result followed by 26.31% satisfactory result. In the study of Flynn et al⁶ there was overall 67% excellent result even though they have included all types of fracture patterns. Mahesh DV et al¹¹ in their study of 20 patients with equal no of length stable and unstable fracture pattern have been able to achieve 70% excellent and 30% good result even though has shown reluctance to advocate ESIN in length unstable femoral fracture.

Our results might have been possible as we checked the stability of fixation by applying deforming force intraoperatively. The early initiation of knee range of motion as pain tolerated might have led to reduced occurrence of knee stiffness. Since hydrostatic effect of thigh muscle provide compressive effect helping to further stabilize the fracture. The elastic recoil mechanism of elastic nail provides enough mobility to promote adequate callus to aid fracture healing.

The frequently encountered inconvenience of skin irritation might be due to pin migration because of unavailability of endcaps applied to the nail tip protruding out of metaphysis and the case of pin migration might have been due to patient not adhering to advice given to avoid full weight bearing till the appearance of visible callus in the X-ray.

Though our study has shown an favorable outcome it is not without procedural fallacy. We had a small group of patients and it was a retrospective study. Further study with a randomization and comparison with other method of treatment including larger participants is needed to further validate our findings.

CONCLUSION

We opine that strict adherence to principle of stable fracture fixation in length unstable femoral fractures in children with ESIN can produce excellent outcome with minimum complication.

CONFLICT OF INTEREST

None declared.

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