

Study of the Outcome of Titanium Elastic Nail System in Diaphyseal Femoral Fractures in Children

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Abstract

Introduction :- Since the last two decades, there has been a growing tendency towards a more operative approach in patents over six years of age. Titanium Elastic Nail System has now become the choice of stabilization in pediatric long bone fractures, particularly the femoral shaft fractures.

Methods :- Twenty children (14 boys, 6 girls) aged 6-16 years with femoral diaphyseal fractures (all closed) were treated with Titanium Elastic Nail System (TENS). These fractures were in the proximal third (n=4), middle third (n=14) and in the distal third (n=2). All patients underwent surgery within ten days of their injury and were followed up in the OPD upto 24 months post the surgery. The results were evaluated using Flynn's scoring criteria.

Results :- All 20 patients were available for evaluation upto a mean of 24 months (22-26 months) of follow up. Radiological union in all cases were achieved in a mean time of 8.5 weeks and full weight bearing was possible in a mean time of 10 weeks. Mean duration of hospital stay was 12 days. The results were excellent in 12 patients (60%), successful in seven (35%) and poor in one patient (5%). All patients had early return to school.

Conclusions :- Titanium Elastic Nail System is an effective form of intramedullary fixation in the treatment of paediatric diaphyseal femoral fractures in properly selected patients.

Key words: Titanium Elastic Nails, Paediatric diaphyseal femoral fractures.

Introduction

A femoral shaft fracture is the most common major paediatric orthopaedic injury requiring hospitalization. The treatment has traditionally been age-related, influenced by the location and type of the fracture and associated injuries [1,2]. Because of rapid healing and spontaneous correction of angulation most of the femoral shaft fractures in children younger than six years of age can be treated conservatively [1,2]. The problem arises when operative stabilization becomes necessary due to failure to obtain or maintain an acceptable reduction of the fracture by conservative methods. The best treatment between 6 and 16 years of age is a matter of debate. Since the last two decades, there has been a growing tendency towards a more operative approach in patents over six years of age [1,2]. The previous methods of operative stabilization of paediatric femoral shaft fractures included external fixation, compression plating and rigid intramedullary nailing [3-7]. Ender's nails and titanium elastic nails are the two types of flexible intramedullary nails used over the

years [8]. Titanium Elastic Nailing, which is variously known as Elastic Stable Intramedullary Nailing, has become the choice of stabilization in pediatric long bone fractures, particularly the femoral shaft fractures.

Materials and Methods

This longitudinal study was conducted on 20 patients enlisting in the casualty or inpatient department of orthopaedics at a medical college and tertiary health care center between August 2007 and December 2010 with the aim of studying the outcomes of Titanium Elastic Nail System in paediatric diaphyseal femoral fractures. Only those patients were included in the study who were between 6-16 years of age, had traumatic fractures of only the diaphysis of the femur (Simple transverse, oblique, spiral diaphyseal fractures) with no associated fracture of the lower limb and no associated neurovascular compromise. Patents were excluded from the study if they had severely comminuted fractures, fractures of the neck of the femur, inter trochanteric fractures and distal end of femur fractures, fractures extending into the metaphysis and epiphysis and polytrauma patients.

Only those patients satisfying the inclusion and exclusion criteria were included in the study. All the patients were explained about the surgical procedure, the purpose of the study and Informed consent was taken. All the patients were immobilized in a Thomas Splint before the surgery and 8 out of the 20 patients were immobilized in a Thomas

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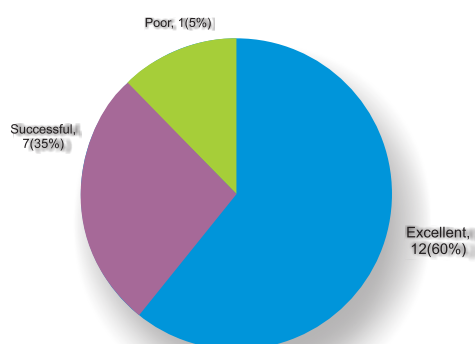
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Table 2 : Protocol for Epidural Steroids used in this study

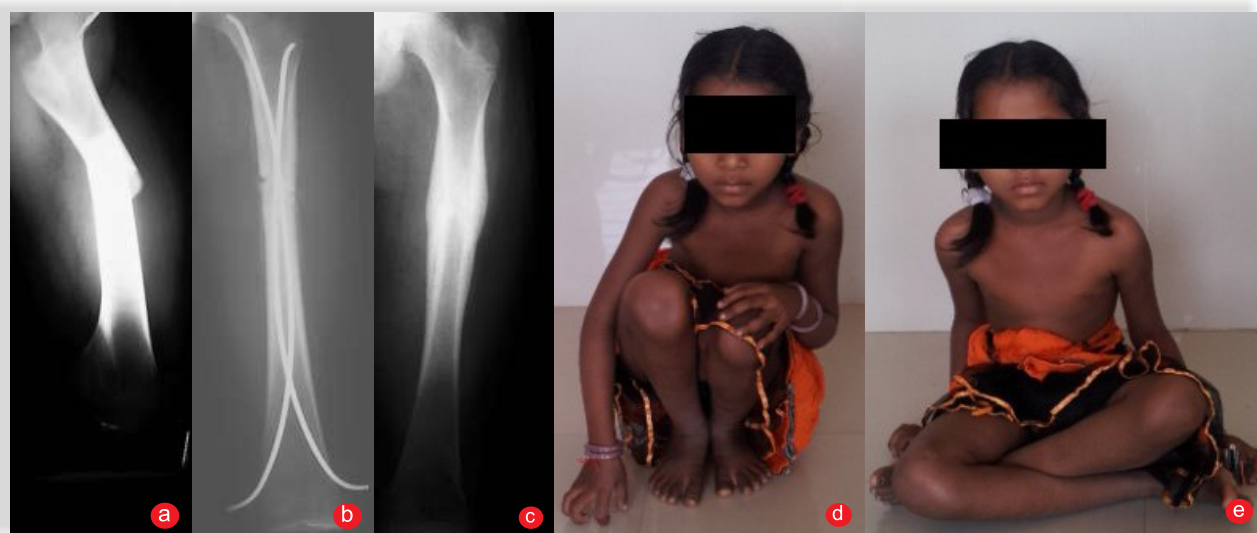
	Excellent	Successful	Poor
Limb length discrepancy	<1cm	<2.0 cm	>2.0cm
Sequence disorder	5°	10°	>10°
Pain	Absent	Absent	Present
Complication	Absent	Mild	Major complication and/or extended period for resolvable

splint after the surgery (for upto 1 month) due to the highly unstable fracture patterns. Twenty children (14 boys, 6 girls) aged 6-16 years with femoral diaphyseal fractures (all closed) were treated with Titanium Elastic Nail System (TENS). These fractures were in the proximal third (n=4), middle third (n=14) and in the distal third (n=2). Majority of the fractures were as a result of fall associated with no other injury in this series. All the fractures were treated by retrograde titanium elastic nail fixation.



The surgery was performed with the patient under general

Figure 2: nine year old girl presented with fracture shaft femur (a). She was treated with TENS nailing (b) with union seen at 6months follow up when the implant was removed (c). Functional outcome at final follow up is shown in d and e.



anesthesia on a fracture table in supine position and the c-arm was so adjusted that anteroposterior and lateral views of the injured femur would be obtained intraoperatively. Two Titanium nails of the same size were inserted in all cases. The diameter of the nail was assessed preoperatively on radiographs taking the nail diameter as 40% of the isthmus (narrowest part of the medullary canal). After painting and draping of both the legs incision was taken over the planned entry site which was approximately 2 cm above the distal epiphyseal plate. Two Titanium nails of same size were inserted after proper contouring through precisely marked entry points using C-arm.

The nails were inserted up to the fracture site after which the closed reduction of the fracture was done and nails were inserted one after the other and fracture reduction was ensured during the whole procedure using C-arm guidance. The nails were driven proximally so that both were divergent and the tips got anchored minimum 1 cm distal to the physis. Postoperatively patients were nursed in supine position with the operated leg immobilized in a Thomas Splint in 8 out of the 20 patients. The Thomas Splint was removed at approximately 3-4 weeks post op and mobilization along with Partial weight bearing was started. Full weight bearing was started by eight to ten weeks post-op taking in view the type of fracture and callus formation. The duration of follow up was upto 24 months. Nail removal was usually done at 7-9 months post op after fracture union.

Results

All 20 patients were available for evaluation after 6 months of follow-up. Radiological union in all cases was achieved in a mean time of 8.5 weeks. Full weight bearing was possible in a mean time of 10 weeks. Mean duration of hospital stay was 12 days. All the results were calculated using Flynn's criteria (Table 1). The results were excellent in 12 patients (60%),

successful in 7 (35%) and poor in 1 patients (5%) (Figure 1). All patients had early return to school. 3 patients had Nail Irritation due to slightly larger nail size, 1 patient had a Varus angulation of more than 10 degrees. No patients of ours had postoperative infection. There was no implant failure.

Discussion

Femoral shaft fractures constitute less than 2% of all pediatric fractures and the ideal choice of treatment has remained a constant challenge to the orthopedics fraternity. Conservative treatment for paediatric diaphyseal femoral fractures was preferred in children and young adolescents until recently. However, to avoid the effects of prolonged immobilization, to reduce the loss of school days and for better nursing care, the operative approach has been gaining popularity for the last two decades [1,2,5]

Flynn et al. found TEN advantageous over hip spica in treatment of femoral shaft fractures in children [5]. Buechsenschuetz et al, documented titanium nail superior in terms of union, scar acceptance and overall patient satisfaction compared to traction and casting [9]. The Titanium elastic nail seems advantageous over other surgical methods particularly in the age group of 6-16 because it is simple, a load-sharing internal splint that doesn't violate the physis, allows early mobilization and maintains alignment [1,2]. Micromotion conferred by the elasticity of the fixation promotes faster external bridging callus formation. The periosteum is not disturbed and being a closed procedure there is no disturbance of the fracture hematoma, thereby less risk of infection [1,2]. Ligier et al. treated 123 femoral shaft fractures with elastic stable intramedullary nail. All fractures united. Thirteen children developed entry site irritation [10]. Similarly, Narayanan et al. found good outcome in 79 femoral fractures stabilized with TEN [4]. Fracture geometry and the location is an important determinant for selection of surgical techniques. Transverse, short oblique and minimally comminuted fractures are suitable for TEN as stated by Flynn et al [1]. Narayanan et al [4] stated that transverse, short oblique, short spiral fractures with minimum comminution in the 5-12 years age group were the best indications for TEN. The most common complication of Titanium elastic nail is entry site irritation and pain [4,11]. Other complications include limb length discrepancy, angulation of fracture, refractures and infection. Entry site irritation in our series was seen in three cases. We found that entry site irritation was significantly associated with long and prominent nail end (>2 cm).

Conclusion

Titanium Elastic Nail System is an effective form of

intramedullary fixation in the treatment of paediatric diaphyseal femoral fractures in properly selected patients.

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