Functional outcome of titanium elastic nailing for pediatric femoral shaft fracture

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Abstract

Background: Femoral shaft fracture is common injury among children’s. The common cause of injury is either motor vehicle accidents or sport trauma, physical assault or some other rare causes. Usually it is treated conservatively in small children’s but in adolescents intra-medullary nailing with TENS nail is gaining popularity so we have selected this age group’s femoral shaft fracture for further exploration in our study.

Results: Femoral shaft fracture’s treatment with TENS nailing is gaining popularity because of comparative easy, minimal invasive and less time consuming procedure with good functional and radiological outcomes.

In our study, final outcome was excellent in 16 cases (72.7%), satisfactory in 5 cases (22.7%) and poor in only 1 case (4.5%).

Conclusion: Based on our study, our conclusion is that close reduction and internal fixation with titanium elastic nailing is standard method of treatment in femoral shaft fracture in children’s between 4-14 years of age group as it is minimal invasive, less time consuming procedure without any damage to growth plate in growing child’s which provides comparatively stable fixation. It also allows early mobilization which helps in early bony union.

Keywords: children’s, fracture, shaft femur, TENS nail, close reduction

Introduction

Femoral shaft fracture is common injury among children’s, which is around 1.6% of all bony injuries in children’s [1]. The common cause of injury is either motor vehicle accidents or sport trauma, physical assault or some other rare causes [2]. The aim of treatment of femoral shaft fracture is anatomical realignment with proper functioning of hip and knee joints. Traditionally femoral shaft fracture in children’s younger than 4 years are treated conservatively because of power of rapid healing and spontaneous correction of angulation in most of children’s and in children’s more than 14 years of age it is treated with intra-medullary nailing with satisfactory results. But in age group between 4-14 years of age where intra-medullary nailing can’t be done because of skeletal immaturity and also conservative treatment may lead to loss of reduction, limb length discrepancy, deformities, malunion and other psychosocial complication of plaster application, also elder children’s not tolerate plaster application for long duration. So in this age group of children’s Titanium elastic nailing system gaining popularity because of comparative stable elastic fixation, comparative easy and minimal invasive procedure without damaging growth potential of growing children’s [3].

Aims and Objectives

Aim of the study was to assess the functional and clinical outcome after closed reduction and internal fixation with titanium elastic nail in femoral shaft fractures of children’s between 4 to 14 years of age.

Materials and Methods

This was a prospective study conducted at the Department of Orthopedic Surgery, Gajra raja medical college, Gwalior (Madhya Pradesh) during period of July 2016 to June 2017. Study was done in all children between 4-14 years of age irrespective of sex with shaft femur.
Fractures meeting the following inclusion and the exclusion criteria.

**Inclusion Criteria**
1. Age between 4-14 years
2. Children’s of both sex
3. Diaphyseal fracture
4. Closed fracture
5. Children’s where follow up is possible for minimum 6 months.

**Exclusion Criteria**
1. Age less than 4 years and more than 14 years
2. Metaphyseal fracture
3. Open fractures, pathological fracture
4. Fracture with other associated injuries
5. Children’s who have lost follow up within 6 months.

After admission of all the children’s with femoral shaft fracture in emergency ward vitals stabilization was done and fracture were temporarily stabilized by skin traction or Thomas splint. Plain radiographs was taken in both AP and lateral views with hip and knee joints, written informed consent was taken from parents, who fulfills our inclusion criteria for inclusion in study and patients were prepared for surgery. All the preoperative investigations and pre anesthetic checkup was done. All patients were operated as early as possible once the patients become fit for surgery. Diameter of nail were calculated using Flynn’s formula.

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### Results variables at 24 Weeks

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limb length inequality</td>
<td>$&lt; 1.0 \text{ cm}$</td>
<td>$&lt; 2 \text{ cm}$</td>
<td>$&lt; 2 \text{ cm}$</td>
</tr>
<tr>
<td>Mal-alignment</td>
<td>5 degree</td>
<td>10 degree</td>
<td>$&gt; 10 \text{ degree}$</td>
</tr>
<tr>
<td>Unresolved pain</td>
<td>Absent</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Other complications</td>
<td>None</td>
<td>Minor and resolved</td>
<td>Major and lasting</td>
</tr>
</tbody>
</table>

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**Complications**: One patient has nail protrusion due to long nail and which was removed at 4th month after fracture union. No deep infection, no angular or rotational deformity, no limb length discrepancy, pain, limp or gait abnormality occurs in any patient.

**Discussion**

In our study average age is 8.5 year. In study done by Flynn JM et al. mean age was 10.2 years [6]. Sex incidence of our study is 14 boys and 8 girls (36.3%), which is also comparable with study as Bhasker et al. which examined total 60 patients with 63.4% [38] were boys and 36.6% [22] were girls [7]. In our study motor vehicle accident is main mode of injury with total 81.8% [18] patients, and in our comparative study of Flynn et al. was having 58.1% cases with RTA and other cases with fall from height or physical assault [6]. In our study increased incidence of RTA may be due to recent increase in no. of vehicles in developing country, poor road conditions and lack of street light or untrained drivers. Average duration of surgery in our study is less than 60 minutes, which is comparable with study done by Saikia et al. where duration of surgery ranged from 50-120 minutes with average was 70 minutes [1]. In our study average time of union is 11 weeks, whereas Saikia et al. reported average union time as 8.7 weeks and
Bhasker et al. reported 12 weeks \[1\].

In our study we started weight bearing by average 10\textsuperscript{th} weeks whereas Saikia et al. allowed weight bearing average by 8.8 weeks \[2\].

In our study only 1 patient developed pain at the site of entry due to nail protrusion which was resolved after nail removal at 4\textsuperscript{th} month, Flynn et al. also reported pain at site of insertion in around 16.2\% of cases with nail insertion \[3\]. None of our patient developed deep infection, rotational or angular deformity or limb length discrepancy whereas Khazzam et al. reported overgrowth of more than 2 cm in 3 patients and Flynn et al. reported 10 cases with minor angulation \[4\].

In our study, final outcome was excellent in 16 cases (72.7\%), satisfactory in 5 cases (22.7\%) and poor in only 1 case (4.5\%). Flynn et al. had excellent outcome in 65\% cases, satisfactory in 25\% cases and poor in 10\% cases, Saikia et al. also reported excellent outcome in 59\%, satisfactory in 27.2\% and poor in 13.6\% cases in their studies. (2, 5).

Conclusions

Based on our study, our conclusion is that close reduction and internal fixation with titanium elastic nailing is standard method of treatment in femoral shaft fracture in children’s between 4-14 years of age group as it is minimal invasive, less time consuming procedure without any damage to growth plate in growing child’s which provides comparatively stable fixation. It also allows early mobilization which helps in early bony union.

Fig 1: Clinical photographs of patient treated with TENS nailing for shaft femur fracture

References