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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 leads 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

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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. close 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 anaesthetic 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.

Flynn *et al.*'s formula. (4)

Diameter of nail=width of the narrowest point of the medullary canal on Antero-posterior and lateral view X 0.4mm

Patients were operated using traction table under fluoroscopic guidance. After proper reduction of fracture, small skin incision was given on both medial and lateral side of distal thigh around 2 cm proximal to distal epiphyseal plate. Then titanium elastic nail of proper size (2-3.5mm) with curve ends were introduced from both medial and lateral side simultaneously till fracture site after it one nail was passed across the already reduced fracture site followed by another one. The nails were progressed in such a ways that medial side nail was introduced in to the neck of femur just below the physis and lateral nail was progressed just below the trochanter physis. After satisfactory reduction and positioning of nails there ends were bent in such a ways that they never project beyond distal epiphysis plate on IITV and also there ends should not be sharp otherwise they may irritates the skin. Finally introduction site were closed.

Postoperatively patients were encouraged quadriceps strengthening and knee bending exercises as soon as patients can tolerate (usually within 24 hours of surgery) and for few days patients was kept non-weight bearing than partial weight bearing allowed depending on the stability of fracture and callus formation but full weight bearing was allowed only after radiological evidence of firm union. Patients was followed at 2, 6, 12 and 24 week. The final outcome based on the above observations was done as per Flynn's criteria (Table 1). (5)

Table 1: Flynn's criteria # TENS Outcome score

Results variables at 24 Weeks	Excellent	Satisfactory	Poor
Limb length inequality	<1.0 cm	<2 cm	<2 cm
Mal-alignment	5 degree	10 degree	>10 degree
Unresolved pain	Absent	Absent	Present
Other complications	None	Minor and resolved	Major and lasting

Results

In our study total 22 patients with shaft femur fracture were operated between July 2016 to June 2017 with titanium elstic nailing at deptt. Of orthopedics, Gajra raja medical college, Gwalior, Madhya Pradesh. There were 14 boys and 8 girls and all children's were between ages of 4 to 15 years. Most of the patients (18) patients had motor vehicle accident as mode of injury, 3 pateints had fall from height while playing, 1 patients was with physical assault. No case with bilateral and segmental fracture was seen. In all patients 17 patients were having midshaft fracture, 3 patients were present with proximal femur fracture, 2 patients were present with distal femur fracture. In 64% cases (14) right side was involved. In our study transverse fracture were present in 12 patients, oblique fracture in 7 patients and spiral fracture in 3 patients. All of our patients underwent surgery within 7 days of trauma and duration of surgery was less than 60 minutes in all cases. All cases were operated in a closed manner with small incision and minimal blood loss. Average stay in hospital is around 3.5 days.

In our study union was achieved in < 3 months in 16 (73%) patients and 3-6 months in 6 (27%) patients with average time of union was 11 weeks. Full weight bearing was started in 10 weeks in most of the patients and also full movements was achieved in 10 weeks in most of the patients.

Results were excellent in 16 (72.7%) patients, satisfactory in 5 (22.7%) patients, poor in 1 (4.5%) patients as per FLYNN

Criteria ^[5].

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 (63.6%) 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 ^[11].

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 10th 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 4th month, Flynn *et al.* also reported pain at site of insertion in around 16.2% of cases with nail insertion ^[5]. 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 ^[3].

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

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