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# Pediatric femoral shaft fracture treated with elastic nail

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**Abstract**
**Background:** Titanium elastic nail has emerged as an accepted procedure for pediatric diaphyseal fractures so the conservative management is giving way for operative one by ten.
**Method:** 70 patients with diaphyseal femoral fracture were treated with retrograde Titanium elastic nail. 49 males and 21 females. Age group 6-12 years. The mean follow-up was 24 months. The mean hospital stay was 2.3 days. The final result were evaluated using the criteria of Flynn at al.
**Result:** All fractures united at an average of 10 weeks. The mean hospital stay was 2.3 days. There was no case of non-union. Return to school was with an average of 8.3 weeks. Irritation at nail insertion site was the most common complication. Final limb length discrepancy LLD were seen in 11% and significant malalignment was observed in 2 cases only. Overall result observed were excellent in 51, good in 17, poor in 3 patients.
**Conclusion:** TEN is an reliable, safe, and cost-effective implant for pediatric femoral fracture. It is relatively free of complication.

**Keywords:** pediatric, fracture, titanium elastic nail, diaphyseal

## Introduction

Many treatment options are reported for pediatric femoral shaft fracture include immediate cast immobilization [1]. Skin traction on a splint [2]. Plating [3]. External fixators [4] and elastic nail [5]. Preschool children can be treated with immediate spica casting or displacement and angulation correct well by remodlling and outcome is good [6]. for children between 6-12 years there are surgical and nonsurgical options, early spica casting, and casting, plating, external fixation, and flexible intermedullary nails [7-8]. TEN becomes the treatment of choice for femoral fracture in that group of age due to excellent results and lack of serious complications. Were as external fixation has many complication, and plating require a second major surgery for removal implant [9-10]. The choice of treatment influenced by the child age, pattern and location of fracture, and surgeons experience [11-12]. This study conclude that TEN produces excellent results in treating diaphyal femoral fractures and avoids the complication due to nonsurgical treatment.

## Material and Methods

70 patient of femoral shaft fractures treated with titanium elastic nail between 2010 and 2016 with follow up period of 24 months. We excluded open fractures, underlying neuromuscular disorder, pathological fractures, metabolic bone disorder. Indication for surgery was displaced femoral shaft fracture in the age group 6-12 years. Consent was obtained from patient family for inclusion in this study. There were 49 males and 21 females. Fracture location were 46 midshaft, 15 proximal, and 9 distal fractures. Fracture patterns included 48 transverse, and 22 oblique. Associated injuries were present in 21 patients, 11 had head injuries, and 9 had fracture of other bones like forearm.

Two titanium nails were inserted across the fracture in a retrograde technique. The diameter of the nail range 1.5mm – 4.5mm. Nail diameter must be able to fill 40 % of medullary canal at the level of isthimus. We measured the internal diameter of the femoral diaphyseal by antero-posterior and lateral roentgenogram but intraoperative decision was taken by operation surgeon.

## Operative Technique

Under general anaesthesia the patient was positioned supine on radiolucent orthopedic table with traction and fluoroscopic control. the entry point is 2 cm superior to the physis by viewing the distal fumer in anterioposterior and lateral roentgenograms. A 1cm incision done through the skin, soft tissue, and periosteum. Place a drill through the incision at the opposite cortex at an angle of 45 degree, alternatively an awl may be used [13-14]. Placed the nail through breached cortex, gently tap the first nail then the second to the fracture site, check AP and lateral views to ensure proper placement of the nail. Reduced the fracture and once a satisfactory reduction is achieved advanced the nail across the fracture site [15]. Check AP and lateral views to ensure that nails have crossed fracture site. The medial nail should end at the lesser trochanter, and the lateral one end 1cm proximal to greater trochanter apophysis. Confirm fracture alignment, rotation, and nail position by XRY. The nail was cut so that 1-1.5cm outside the cortex.

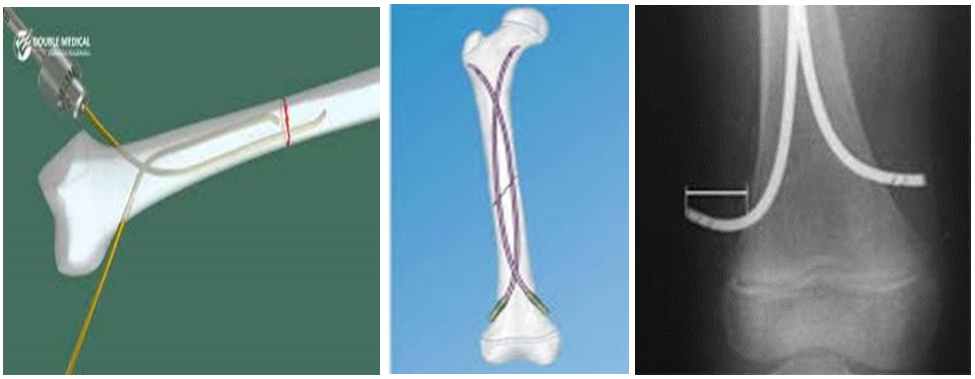

**Fig 1**

**Postoperative Management**

Only unstable fractures were immobilized for 4-6 weeks postoperatively to provide extra stability fractures. Stitches were removed after 9-11 days partial weight-bearing was allowed after 3-5 days and full weight-bearing was allowed after 8-12 weeks after union achieved. Follow-up ranged from 22 to 26 months. Each patient was seen after 7-10 days after surgery, 6 weeks, 3 months, 1 year, 2 year. At each visit patient were clinically and radiological evaluated. Rehabilitation start on the first postoperative day included hip and knee mobilization. Removal was done under g.a. after achieving solid union. All fractures were evaluated using the criteria of Flynn at al.

**Result**

All fractures healed, the union average was 10.1 weeks. No case of non-union, 3 case delayed union. The mean hospital stay was 2.3 days. closed reduction was achieved in 61 cases whereas open reduction was achieved in 9 cases. Full weight - bearing was start at 6-11 weeks. The time to return to preoperative level of activity average was 5.2 months, return to school was with an average of 8.3 weeks. The most common complication was irritation at nail insertion leading to bursitis in 6 patient, and this complication resolved after nail removal. Limb length discrepancy [LLD] were seen in 21% but LLD greater than 1cm occurs in 11% but it decreased to 3% by 24 months.

Minor malalignment was observed in 17 cases, whereas significant malalignment was observed in only 2 cases. Rotational malalignment was observed in 9 cases. The main cause of angular malalignment was comminuted fractures. Only 1 case of superficial infection was observed, and treated with antibiotics. Migration of the nail was not seen in this study. 6 cases had limitation in last 25 degree of knee flexion due to nail ends, and it was improved after nail removal. The nail were removed with an average of 11 months with no complication. 1 case of perforation of cortex of femoral neck. The results were 51 excellent, 17 good, and 3 poor. Using the criteria of FLYNN at al.


**Fig 2**

**Discussion**

Pediatric femoral diaphyseal fracture is the most disabling fracture in children. Conservative treatment by immediate spica cast, traction followed by spica cast produce good union rates [16-17] but it has disadvantages include loss of redaction, repeat redaction, prolonged immobilization, high malunion rate, and prolonged hospitalization. Operative treatment includes plate fixation, external fixation, solid intramedullary nailing, and flexible nailing Enders nail and TEN. Titanium elastic nail is a simple, load sharing, and allows mobilization and maintenance of alignment [18]. ZAKI at al treated 63 femoral shaft fractures with TEN. They concluded that TEN provide a very good stability, safe, and costeffective treatment. TEN indicates for children of all ages with femoral shaft fractures and open physis. We used postoperative immobilization in 9 patients because adequate fractures stability was not achieved and most of these cases had a degree of comminution. Plating was indicated for comminuted fractures and for malunion. External fixators were indicated for open fractures grades 2 or 3. Hospital stay decreased with TEN, the average was 2.3 days whereas it was 25 days in the nonsurgical group. Diameter of each nail should measure 40%

of the narrowest diameter of the medullary canal [19]. The two nails should be of same thickness [20]. The most common complication was skin irritation at nail insertion causing restraction of knee flexion. These problem resolved completely in all our patients once the nail were removed. Comminuted fracture is the main cause for limb length discrepancy but it is insignificant complication clinically because LLD was within 1cm only. Shortening of more than 1cm was observed in 6 patients only, and all have comminuted fractures. Inconclusion, TEN is a simple, minimally invasive operation for pediatric femoral shaft fractures, achieve excellent or good results in majority of patients with low complication rate. It is decreased the hospital stay, and the return to school is faster**.**

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