

## A Study of Surgical Management of Diaphyseal Fractures of Femur in Children using Elastic Nails

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### **Abstract**

**Background:** Fractures of the femoral shaft are common in children with lower limb trauma. Due to the need for early recovery and rehabilitation of patients, the care of juvenile femoral fractures has gradually shifted towards surgical procedures over the past decade, with the recognition that prolonged immobility may be hazardous to children as well. This study was designed to evaluate the outcomes and complications of elastic nail-assisted surgical treatment of femoral diaphyseal fractures in children aged 5 to 15 years.

**Material and Methods:** In this prospective study, 20 patients of diaphyseal fractures of femur in children aged 5 to 15 years were treated by elastic nails during the period between 2020 to 2022. The outcomes & complications were evaluated.

**Results:** Fractures were prevalent in men and were most prevalent between the ages of 5-8 years, followed by 9-12 years. In 12 patients, a common mechanism of damage from RTA was seen. The left side was largely affected. In 18 patients, the reduction of closed type was the most common. In 15 patients, the maximum length of hospital stay was between 5 and 10 days. In 15 cases, the maximum duration of union was 14 weeks. Four patients underwent limb amputations. One individual got limb lengthening. One patient was diagnosed with Infection, one with Varus Malalignment, and one with Knee Pain. 15 patients had an outstanding outcome, 4 had a satisfactory outcome, and 1 had a negative outcome.

**Conclusion:** The diaphyseal fracture of the femur in children aged 5 to 15 years can be efficiently treated with elastic nails, since functional outcomes are excellent and complications are limited.

**Keywords:** Children, Femur Fracture, Elastic Nailing.

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### **Introduction**

1.6% of all childhood bone injuries are femoral shaft fractures, including subtrochanteric and supracondylar fractures [1]. Current treatment options for early spica fractures include casting, traction, external fixation, ORIF with plating,

flexible intramedullary nails, and reamed intramedullary rods [2]. Children with femoral shaft fractures are typically treated with three weeks of traction, followed by immobilisation with a plaster cast. Extended bed rest, which isolates the kid

from normal activities, and the cost of the therapy during the hospital stay are the two significant disadvantages of this treatment [3].

Several physicians' expertise and time have demonstrated that children with diaphyseal femur fractures seldom recover with conservative therapy. Infrequently are angulations, malrotation, and shortening successfully rectified [4]. While plating femoral shaft fractures provides a secure repair, it necessitates a larger incision, which increases the risk of bleeding and scarring. Due to the fact that it is a load-bearing device, refracture is possible. Proximal femoral abnormalities and avascular necrosis of the femoral head have been linked to antegrade nailing treatments [5,6]. Elastic internal fixation, such as flexible intramedullary nailing, improves fracture healing by permitting some mobility, which stimulates callus formation [7].

Children's elastic nail restoration is straightforward, successful, and minimally intrusive. It permits stable fixation, speedy healing, and a quick return to regular activities for the youngster. The functional results are outstanding, and there are few problems. This study was designed to evaluate the outcomes and complications of elastic nail-assisted surgical treatment of femoral diaphyseal fractures in children aged 5 to 15 years.

## **Materials and Methods**

This prospective study was carried out on 20 children in the department of Orthopaedics at Viswabharathi Medical College & Hospital from July 2020 to June 2022 after receiving clearance from Institutional ethics committee.

### **Inclusion criteria:**

1. Isolated diaphyseal fractures of femur in children with age group of 5-15years.

2. Closed diaphyseal fractures of femur in children.
3. Both males and females

### **Exclusion criteria:**

1. Patients below 5 years and above 15 years.
2. Patients who have lost follow up.
3. Patients who received conservative care.
4. Open diaphyseal fractures of femur in children.

## **Pre-operative evaluation**

### **Immediate Management**

At admission to the hospital, consent was sought from all participants and a comprehensive history was taken from the patients or companions to ascertain the mechanism of injury and the degree of trauma. Each patient had a thorough examination. Their overall condition was caused by a systemic disease and its collateral consequences. The patient's proforma contains documentation of every discovery. For the immobilisation of all patients with diaphyseal femur fractures, the Thomas splint is employed. The abnormalities, edema, and ecchymosis were examined in great detail. Crepitus, tenderness, and bony irregularity are all heightened. Femoral and dorsalis pedis pulse measurements were used to estimate the distal vascularity. The damaged femur was elevated in a Thomas splint and kept immobile. Analgesics were employed to relieve inflammation and discomfort.

## **Pre-operative planning**

Before surgery, the patient had the usual blood tests for haemoglobin percentage, total and differential WBC counts, fasting blood sugar, blood urea, serum creatinine, bleeding and clotting time, HIV, and HbsAg. Albumin and sugar levels in the urine were examined. ECGs and blood pressure readings were performed on each subject. The portion was

prepared on the day of operation. Prior to surgery, all patients got an intravenous antibiotic and a tetanus toxoid injection. Physician fitness was achieved for all patients. Patients were operated on after giving their consent and undergoing a pre-anesthesia checkup.

### Radiographic examination

Standard radiographs of the hip, knee, and pelvis with the femur in the AP and LAT views, respectively.

### Surgical procedures

There was a period of one to seven days between the date of the injury and the date of the procedure. In order to achieve 3 point fixation, elastic nails were used to treat all patients' paediatric femoral fractures after preoperative evaluation to identify the kind of fracture present. The size of the isthmus of the medullary canal diaphyseal femur determines whether two or one elastic nails are used to heal the fracture. General anaesthesia is administered to children under the age of eight, whereas spinal anaesthesia is administered to children above the age of eight.

### Results

In the present study, fractures were common in age group between 5-8 yrs (50%) followed by 9-12 yrs (40%).

**Table 1: Age distribution**

Age in years	No. of cases	Percentage
5-8	10	50
9-12	8	40
13-15	2	10

Fractures were more common in males with 75% of cases.

**Table 2: Sex distribution**

Sex	No. of cases	Percentage
MALE	15	75%
FEMALE	5	25%

Common mechanism of injury in this study was RTA (60%).

### Post – operative care and rehabilitation

Anti-inflammatory analgesics were used to treat inflammation and pain following surgery. All patients received oral antibiotics, such as augmentin 325 mg syrup every day for 3-5 days, after receiving intravenous cefotaxime 500 mg twice day for 1-3 days. Patients were instructed to do strong knee movements on day two while elevating the injured leg. The dressings were changed on days two and six after surgery. The ap and lat views of immediate post-operative X-rays were collected. When the sutures are taken out, the patient is freed, and after six weeks, they can bear some weight and move their knees fully flexed

### Radiographic assessment

X-rays were taken at 6 weeks to look for any displacement and to check for consolidation at the fracture site. The fracture was deemed united when there was no subjective complaints, no clinical pain, or the fracture line was not visible on radiographs. There were routine check-ups at 6 weeks, 3 months, and 6 months. The Flynn's criteria is used to evaluate the results [8].

**Table 3: Mode of Injury**

Mode of Injury	No. of cases	percentage
RTA	12	60%
FALL	8	40%

Left side is predominantly involved than right with 12(60%) cases

**Table 4: Side Affected**

Side	No. of cases	percentage
LEFT	12	60%
RIGHT	8	40%

In this study predominantly involved type of fracture is transverse with 9(45%) cases and followed by spiral type with 7(35%) cases

**Table 5: Type of Fracture**

Type of fracture	No. of cases	percentage
Transverse	9	45%
Spiral	7	35%
Oblique	4	20%

In this study predominantly involved type of reduction is closed type with 18(90%) cases.

**Table 6: Type of reduction**

Type of reduction	No. of cases	percentage
CLOSED	18	90%
OPEN	2	10%

In this study, the duration of hospital stay of 5-10 days was observed in 15 (75%) cases followed by 11-16 days in 2 (10%) cases and >16 days in 3 (15%) cases

**Table 7: Duration of hospital stay**

No. of days	No. of cases	Percentage
5-10	15	75%
11-16	2	10%
>16	3	15%

In this study, the time to union of 14 weeks was seen in 15 (75%) cases, 12 weeks in 3(15%) cases and 16 weeks in 2 (10%) cases

**Table 8: Time for Union**

Time for union	No. of cases	Percentage
12 weeks	3	15%
14 weeks	15	75%
16 weeks	2	10%

In this study, limb lengthening was seen in 1 (5%) case, limb shortening in 4 (20%) cases, infection in 1 (5%) case, Varus Malalignment in 1 (5%) case and knee pain in 1 (5%) case.

**Table 9: Complications**

COMPLICATION	No. of cases	Percentage
Limb lengthening	1	5%
Limb shortening	4	20%
Infection	1	5%
Varus Malalignment	1	5%
Knee pain	1	5%
Non-union	0	--

In this study, Excellent results were seen in 15 (75%) cases, Satisfactory in 4 (20%) cases and poor results in 1 (5%) case.

**Table 10: Results**

Result	No. of cases	Percentage
Excellent	15	75%
Satisfactory	4	20%
Poor	1	5%

## Discussion

The goal of the current study was to evaluate the effectiveness of elastic nail fixation for treating paediatric femoral shaft fractures. In the current study, the average age of the patients was 9.25 years, with 10 (50%) of them being between the ages of 5-8 and 8 (40%) being between the ages of 9 and 12. In the research by Cramer KE, *et al.* [5], the mean age was 8.5 years.

The current study included 15 males and 5 (25%) girls. Comparable to previous research in the literature, the sex incidence. In the research by Cramer KE, *et al.*, there were 14 (26.92%) females and 38 (73.07%) boys.

RTA was the most frequent method of injury in the current research, accounting for 12 (60%) cases, whereas falls accounted for 8 (40%) instances. 20 femoral shaft fractures were the subject of a research by Bar-on E, *et al.*. In 15 (75%) cases, motor vehicle accidents were the source of the injuries. Transverse fractures made up 9 (45%) of the cases in our research, oblique fractures 4 (20%), and spiral fractures 7 (35%) instances. In their study, Heinrich SD, *et al.* [4] reported 35 transverse fractures (44.87%) and 14 oblique fractures (17.94%), whereas Cramer

KE, *et al.* [5] noted 35 transverse fractures (61.4%) and 16 spiral fractures (28.07%).

In our study, closed reduction was carried out in 18 instances (90%) and open reduction in 2 cases (10%). In Heinrich SD, *et al* [4] study in 5(6.41%) fractures, open reduction was done to facilitate passing the nail across the fracture site. In the current study, an average hospital stay was 9.4 days. A research on the treatment of femoral shaft fractures in children and young adults using cast braces was done by Gross RH, *et al.* [10]. In their investigation, a hospital stay lasted an average of 18.7 days.

The average time to union in the current research was 13.9 weeks. The average duration to union was 7.7 months in the plating group and 4 months for flexible intramedullary nailing, according to Aksoy C *et al*'s analysis of the results of compression plate fixation and flexible intramedullary nail insertion [11]. In the research by Cramer K. E. *et al.*, all patients' fractures were healed within 12 weeks [5]. In the current investigation, all patients had complete range of hip mobility. One patient experienced a temporary limitation of 10 degrees in knee flexion at 12 weeks, but normal range of knee

flexion was restored at 6 months. One instance of knee stiffness in patients receiving spica casting was recorded by Flynn J. M. *et al.* [8] and needed adjustment under anaesthesia.

In the current investigation, we only found one case of limb extension, which was a 1cm case, and 4 (20%) occurrences of limb shortening. After receiving conservative therapy, Beaty *et al.* [12] reported that two patients developed overgrowth of more than 2.5 cm, needing epiphysiodesis. According to Ozturkman Y *et al.* [13], four patients had mean leg lengthening of 7mm, whereas two children had mean leg shortening of 6mm. Average limb lengthening of 7mm was found by Cramer KE *et al* in their investigation.

One patient with a 10 degree varus deformity participated in our investigation. In their study, Heinrich SD, *et al.* [4] identified one kid with a 5 degree varus angulation, and 11% of fractures had an average varus or valgus malalignment of 6 degrees. In their study, Cramer KE, *et al.* [5] found that 49 children had no angulation and 4 children had angulation of less than 15 degrees in either plane. One infant had 5 degrees of varus angulation, according to Ozturkman Y, *et al* [13].

## Conclusion

As Functional results are excellent and complications are minimal, this can be considered as an excellent technique for the treatment of diaphyseal fractures of the femur and can be recommended in children aged 5 to 15 years

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