

Determination of Outcomes of Using Elastic Intramedullary Nailing in Femur Shaft Fractures in Children Aged 5-11 Years.

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ABSTRACT:

Objective: to examine the efficacy and safety of inserting flexible elastic intramedullary nails into the femoral shafts of children (aged 5-11) who have had injuries to this area.

Methodology: This descriptive longitudinal study was carried out from February 2025 to July 2025 in the Orthopedic Surgery Department at Sheikh Zayed Medical College and Hospital in Rahim Yar Khan. In all, 62 patients were chosen using a non-probability consecutive sampling technique. Participating children ranged in age from 5 to 11 years old and were of either sex. They had femoral shaft closed fractures that were at least 3 cm below the lesser trochanter and 3 cm above the distal physis, sustained in a severe accident.

Results: A total of 62 patients were examined. The predominant cause of injury was road traffic accidents, occurring in 45 instances (72.58%). The children's ages varied from 5 to 11 years, with a mean age of 7.14 ± 0.90 years. The majority of patients, 43 (69.35%), were aged between 5 and 7 years. There were 46 males (75.29%) and 16 females (24.71%). The average body weight was 24.35 ± 4.66 kg. The mean duration of symptoms before to treatment was 6.48 ± 2.45 days. According to the Flynn and Schwend rating system, results were classified as good in 57 patients (91.93%) and satisfactory in 5 patients (8.07%). Complications arose in 10 instances (16.12%), comprising limb length discrepancies of 1-2 cm in 3 cases, skin irritation at the nail entry site in 4 cases, and superficial wound infections in 3 cases. No patient experienced malunion or implant migration.

Conclusion: Flexible intramedullary nailing was a safe, successful, and dependable way to fix femoral shaft fractures in kids aged 5 to 11. The treatment led to good functional recovery and adequate bone healing, with no significant problems and only a few small ones that were easy to deal with.

Keywords: Outcome, Femoral Shaft Fracture, Road Traffic Accident (RTA), Elastic Intramedullary Nail.

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Introduction:

The femur is an important component for both stability and movement, being the primary bone in the lower limb that bears the body's weight. A femoral fracture is among the most common orthopedic injuries that necessitate hospitalization in children.¹ More than 20% of orthopedic injuries requiring hospitalization are femoral shaft fractures, which make up almost 2% of all fractures in children. These injuries significantly affect families and healthcare systems,

as they often require prolonged immobilization or surgical management, leading to increased use of financial and medical resources.² Another study found that fewer than 2% of all pediatric fractures were femoral shaft fractures, making them one of the most prevalent orthopedic injuries in children. Automobile accidents account for about 90% of these fractures in kids.³ Fall from height and, less often, injuries sustained while playing sports are other significant causes. Furthermore, it is important to investigate child maltreatment as an additional potential etiology in younger children who present with femoral shaft fractures.⁴ Kids are more active than adults, and their bones are still growing, which makes them more likely to break their femurs. Fractures of the femoral neck are especially difficult to manage because injury to the growth plate of the femoral head can cause major problems, such as early physeal closure and growth disruption. Consequently, the selection of an effective treatment modality for juvenile femoral neck and shaft fractures is of significant clinical importance.⁵ The treatment approach for femoral shaft fractures in children depends mainly on the patient's age, body weight, and fracture pattern. Flexible elastic intramedullary nailing (EIN) is considered the treatment of choice for children aged 5 to 11 years and weighing less than 50 kg. The fracture configuration also plays a significant role in surgical decision-making. Length-stable patterns, such as transverse fractures, are well suited for EIN due to their resistance to shortening, whereas length-unstable fractures may shorten

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or angulate, making them more difficult to manage with flexible nailing.⁶ This study is to evaluate the efficacy of flexible elastic intramedullary nailing in various forms of juvenile femoral fractures. Even though there are many ways to treat femoral shaft fractures in kids, they are nonetheless hard for orthopedic surgeons to deal with. This can lead to longer hospital stays, slower recoveries, and possible skeletal asymmetry.⁷ External fixation, open or submuscular plating, stiff intramedullary nailing, and flexible intramedullary nailing (EIN) are the main surgical alternatives. External fixation is often utilized for unstable diaphyseal fractures however, it can cause problems such pin tract infection, malunion, loss of reduction, and refracture.⁸ Other documented problems are nonunion, a slight angular deformity, and a difference in limb length.⁹ The Nancy group initially used flexible intramedullary nailing in 1982. Since then, it has been a common way to treat femoral shaft fractures in children. It has a lot of benefits, such as being easy to insert, causes less bleeding, allow for early rehabilitation, and shorter hospital stay. The method is also cheap and doesn't hurt the growth plates in the greater trochanteric and distal femoral areas.¹⁰ Furthermore, it is considered a stable, safe, and surgeon-preferred method due to its simplicity and favorable outcomes.¹¹ This study was approved by the College of Physicians and Surgeons Pakistan (CPSP) and the Institutional Review Board of Sheikh Zayed Medical College, Rahim Yar Khan.

The rationale for current study is that pediatric femoral shaft fractures represent a significant health problem, causing substantial social and economic impact on affected children, their families, and the healthcare system. Children with femoral shaft fractures between the ages of 5 and 11 will be studied to determine the functional outcomes and consequences of elastic intramedullary nailing. Additionally, local guidelines for cost-effective therapy will be developed.

Objective:

To examine the efficacy and safety of inserting flexible elastic intramedullary nails into the femoral shafts of children (aged 5-11) who have had injuries to this area.

Methodology:

This descriptive longitudinal study carried out at Rahim Yar Khan's Orthopedic Surgery Department at Sheikh Zayed Medical College and Hospital between February 2025 and July 2025. During study period Sixty-two patients were recruited using a non-probability consecutive sampling technique. Children of either gender, aged between 5 to 11 years were included, all of them had post-traumatic closed fractures of the femoral shaft, which were at least 3 cm proximal to the distal physis and 3 cm distal to the lesser trochanter. The Institutional Review Board (IRB) was consulted for the required ethical approvals before the trial started. Patients with comminuted, open, or pathological fractures, as well as those without a femoral diaphysis fracture were excluded. Children under the age of five or those older than eleven at the time of injury were not included. After all patients had radiographs taken from the appropriate angles, the diagnosis was confirmed both clinically and radiographically.

Results:

Demographic information of the patients collected is shown in table 1. We obtained consent from parents or legal guardians of the patients. Each patient received intravenous antibiotics every eight hours for three days following surgery, followed by oral antibiotics. Follow-up examinations were performed clinically—initially biweekly, subse-

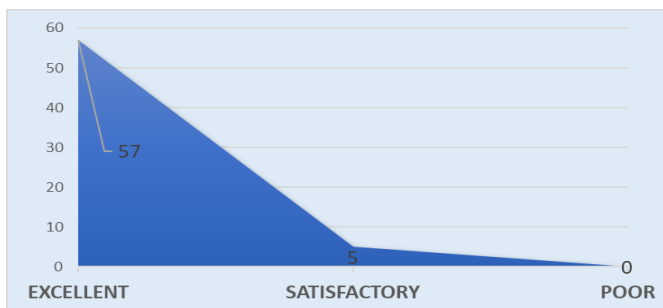
quently monthly—to evaluate healing and functional recovery. Flynn's criteria were used to look at functional outcomes. The data were processed and analyzed with SPSS version 23. Stratification was used to account for effect modifiers, and the chi-square test was used. A p-value of 0.05 or less was statistically significant.

Table-I: Demographic data of the patients.

Parameters	(n)	(%)	Cumulative Percentage	P-Value
Gender				
Male	46	75.29	75.29	.00014
Female	16	25.81	100	
Age (years)				
5 - 7	43	69.35	69.35	.0023
8 - 11	19	30.65	100	
Types of fractures				
Transverse	36	58.06	58.06	.00002
Oblique	20	32.26	90.32	
Spiral	6	9.68	100	
Total	62	100		

In the present study, 62 patients were included after they met all of the inclusion and exclusion criteria. The majority of injuries (40 instances, or 64.52% of the total) were caused by road traffic accidents (RTAs). Six cases (9.68%) and sixteen cases (25.80%) of injuries occurred as a result of fall from height. With an average age of 7.14 ± 0.90 years, the children's ages varied from 5 to 11 years. Of the total number of patients, 43 (or 69.35%) were children aged 5 to 7. There were 46 men (or 75.29%) and 16 females (or 25.80%). The average weight of the participants in the research was 24.35 ± 4.66 kg, and the average number of days before symptoms were reported was 6.48 ± 2.45 days. With 36 patients (58.06%) experiencing transverse fractures, oblique fractures in 20 patients (32.26%), and spiral fractures in 6 patients (9.68%), the most common form of fracture configuration. On average, patients spent 2.00 ± 0.50 days in the hospital. Around 10.00 ± 2.00 weeks elapsed between radiological union and the removal of the nails. Ten patients, or 16.12%, experienced problems. Three patients experienced a 1-2 cm difference in limb length, four patients reported skin irritation at the site of nail insertion, and three patients had superficial surgical site infections. However, there were no instance of implant migration or malunion observed during this study. As to the Flynn and Schwend rating system, 57 patients (91.93%) had an excellent ultimate outcome, whereas 5 patients (8.07%) had a satisfactory one, none of the patient in this series showed bad outcome, graph 1.

Graph-I Showing outcomes of patients as per Flynn and Schwend rating system.



Discussion:

Long bone fractures are relatively common during the growing years, particularly between 5 and 11 years of age. Although children's bones have a strong potential for remodeling and regeneration, improper healing can result in deformity. Improvements in orthopedic implants and biomechanical methods have made it much easier to treat femoral fractures in children. These methods provide stable fixation with few problems and excellent satisfaction rates. The Nancy group initially used the flexible intramedullary nailing technique in 1982. Since then, it has been the best way to treat juvenile femoral shaft fractures since it is easy to use, doesn't require much surgery, and always works well.¹² In this study, 10 patients (16.12%) experienced mild problems, none of which influenced fracture union or end results. Skin impingement was noted in four cases, although no instances of nail migration were recorded. This good profile can be explained by following standard operating procedures and doing the right planning before the operation. Lascombes et al. observed similar findings, stressing that meticulous selection of nail diameter in relation to the medullary canal aids in preventing issues such as migration and skin irritation.¹³ According to the Flynn and Schwend rating system, 57 instances (91.93%) in our sample had excellent results and 5 cases (8.07%) had satisfactory outcomes. Khan et al. have reported similar results.¹⁴ who found excellent results in 52% of cases, good in 40%, and poor in 8%. Likewise, Rahman et al.¹⁵ reported excellent outcomes in 24 patients (92.3%) and satisfactory in 2 patients (7.7%), with no poor results. El-Sayed et al.¹⁶ also demonstrated similar findings, with excellent results in 26 patients (87%), satisfactory in 3 (10%), and poor in 1 (3%) following elastic nailing. These findings are consistent with the outcomes of the present study, although their sample size was smaller. Comparable results were also observed in the studies conducted by Jadaan M et al.¹⁷ Due to its small sample size, brief follow-up duration, and reliance on a single center (the Department of Orthopedic Surgery at Sheikh Zayed Medical College/Hospital in Rahim Yar Khan), this study has certain limitations. Future studies involving larger populations, multiple centers, and inclusion of older or heavier children are recommended to further validate the efficacy and safety of this technique across broader patient groups.

Conclusion:

It may be concluded that flexible intramedullary nailing is a simple, safe, effective, and minimally invasive approach for treating femoral shaft fractures in children aged 5 to 11 years. The procedure produces improved functional and radiological outcomes with a low frequency of minor issues. Because of its durability and ease of use, it is a popular treatment option for juvenile femoral shaft fractures in this group. Nonetheless, further broad and multicenter study is required to confirm these findings and develop complete therapeutic guidelines for their regular use.

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Mohsin Bilal	Statistical analysis
Waqar Ahmed Cheema	Revision
M. Danish Zafar	Data collection