

Original Research

Evaluation of Functional Outcome and Complications with Ender Nailing Among Pediatric Patients Presenting with Femur Fractures at a Tertiary Care Hospital

Mohnish Gadhavi¹, Pavak Parikh²¹Associate Professor, Department of Orthopaedics, B. J. Medical College, Ahmedabad, Gujarat, India.²Senior Resident, Department of Orthopaedics, B. J. Medical College, Ahmedabad, Gujarat, India.**Corresponding Author:**

Dr. Pavak Parikh

Senior Resident, Department of Orthopaedics, B. J. Medical College, Ahmedabad, Gujarat, India.

Email: paavak20@gmail.com

Received: 12 February 2023

Accepted: 25 March 2023

Abstract**Background:** This study was conducted to assess the functional outcome of pediatric femur fractures treated with Ender nailing in the age group of 5 to 16 years.**Materials and Methods:** Using a specific proforma, we gathered the patient records. All of the patients' necessary investigations had been completed. Patients were checked on every six, twelve, and twenty-four weeks. Patients were routinely examined at follow-ups using x-rays and clinical results. In compliance with the proforma, documentation was created. The patient's respiration, circulation, and airway were evaluated as soon as they were taken to casualty. After then, a thorough examination was done to rule out any other serious injuries. plain radiographs of the AP as well as lateral views of the thigh, encompassing the hip and knee joints, in order to evaluate the fracture's size, geometry, and degree of comminution.**Results:** A total of 50 subjects were evaluated. Among them, 70 percent of the subjects were males while the remaining were females. Road traffic accidents were the major etiological factor. Transverse fractures occurred in majority of the cases. While assessing the range of motion, good range of motion was seen in 86 percent of the patients while mild and gross restriction was seen in 6 percent and 8 percent of the patients respectively. While evaluating the complications, superficial infection, knee stiffness, limb length discrepancy, angulation and nail impingement were seen in 8 percent, 14 percent, 10 percent, 4 percent and 4 percent of the patients respectively.**Conclusion:** Ender nailing system is an effective method with minimal complications and good range of motion.**Keywords:** Complications, Ender Nailing, Femur Fractures.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

INTRODUCTION

Fractures of the femoral shaft are one of the most common injuries treated by orthopedic surgeons. These fractures are often associated with polytrauma and can be life-threatening. They commonly result from high-energy mechanisms such as motor vehicle collisions (MVC) with sequelae of limb shortening and deformities if not treated appropriately. Femoral shaft fractures (FSF) typically occur in a bimodal distribution, high-energy trauma in the young population, and lower energy trauma in the elderly population. FSFs are also associated with other comorbidities necessitating a thorough advanced trauma life support (ATLS) assessment and interdisciplinary care. Intramedullary nailing (IMN) is the most common treatment for physiologically stable

patients. The goal of fixation is early healing and long-term functional recovery. Treatment of modern-day femoral shaft fractures results in excellent outcomes.¹

The etiology of pediatric femoral fractures varies with the patient's age. For younger children, a simple fall is a common cause of femoral fractures.² Injuries sustained by older children and adolescents are more likely due to high-energy trauma, with a large proportion of cases attributed to vehicle accidents.² Nonetheless, simple falls remain a plausible cause of femoral fractures in older children.³

Pathological femoral fractures are comparatively rare in children, responsible for only 12.5% of pediatric femoral fractures under the age of 4. Common causes include cerebral palsy, osteogenesis imperfecta,

osteosarcoma, and fibrous dysplasia.² Stress fractures of the femoral shaft are uncommon and give rise to only 4% of all femoral fractures in children.³

This study was conducted to assess the functional outcome and complications of pediatric femur fractures treated with Ender nailing in the age group of 5 to 16 years.

MATERIALS AND METHODS

This study examines the functional outcome and complications of employing Ender's nailing to fixate shaft femur fractures in fifty patients, aged five to sixteen, from April 2019 to May 2021. The subjects of this study were individuals who met both the inclusion as well as exclusion criteria during the study period.

Using a specific proforma, we gathered the patient records. All of the patients' necessary investigations had been completed. Patients were checked on every six, twelve, and twenty-four weeks. Patients were routinely examined at follow-ups using x-rays and clinical results. In compliance with the proforma, documentation was created. The patient's respiration, circulation, and airway were evaluated as soon as they were taken to casualty. After then, a thorough examination was done to rule out any other serious injuries. plain radiographs of the AP as well as lateral views of the thigh, encompassing the hip and knee

joints, in order to evaluate the fracture's size, geometry, and degree of comminution.

A thorough medical history including the patient's age, gender, and work, the type of injury, and any previous or related illnesses was obtained upon admission to the ward. Every patient underwent standard investigative procedures. Among them was the primary preoperative blood profile. Once a patient's overall health was stable and they were deemed fit for surgery, procedures were performed as soon as feasible. An assessment of the preoperative anesthetic is conducted following previous informed permission.

RESULTS

A total of 50 subjects were evaluated. Among them, 70 percent of the subjects were males while the remaining were females. Road traffic accidents were the major etiologic factor. Transverse fractures occurred in majority of the cases. While assessing the range of motion, good range of motion was seen in 86 percent of the patients while mild and gross restriction was seen in 6 percent and 8 percent of the patients respectively. While evaluating the complications, superficial infection, knee stiffness, limb length discrepancy, angulation and nail impingement were seen in 8 percent, 14 percent, 10 percent, 4 percent and 4 percent of the patients respectively.

Table 1: Direction of nailing

Direction	Number	Percentage
Retrograde	48	96
Antegrade	2	4
Total	50	100

Table 2: Distribution of patients according to range of motion

Range of motion	Number	Percentage
Good	43	86
Mild restriction	3	6
Gross restriction	4	8
Total	50	100

Table 3: Distribution of patients according to complications

Complications	Number	Percentage
Superficial infection	4	8
Knee stiffness	7	14
Limb length discrepancy	5	10
Angulation	2	4
Nail impingement	2	4

DISCUSSION

Femoral shaft fracture incidence is approximately 0.01% and results from high-energy trauma, often associated with polytrauma, comminuted fractures, and open fractures.^{4,5} In the last four decades, several treatment options have been used to treat femoral shaft fractures. Initially, the treatment was represented by various types of trans-skeletal traction; then, the use of plates and screws was introduced, still

indicated in special conditions.^{6,7} Nowadays, reduction and fixation with intramedullary nail, introduced by Groves in the United Kingdom and by Kuntcher in Germany⁸, is the gold-standard treatment for femoral shaft fractures. External fixation is not frequently performed to treat femoral diaphyseal fractures and there have been few studies performed on this topic, in which its use is mainly indicated to temporarily stabilize the fracture in patients who

suffer polytrauma or open fractures. In such instances external fixation can be used as a temporary treatment and subsequently converted into intramedullary nailing within two weeks after the trauma.⁹

Fractures of the femoral shaft are among the most common lower extremity fractures in children¹⁰, with an annual incidence of 20 per 100,000 in the United States and Europe.^{11,12} The mechanisms of injury include high-energy trauma—road traffic accidents, falls, high-impact sports injury, and low-energy trauma such as pathological fractures.¹³ In younger children, particularly those in pre-walking age, non-accidental injuries should be considered.¹⁴ Management of diaphyseal femoral fractures in children includes non-operative treatments such as Pavlik harness, traction, and spica casting¹⁵, and operative treatments such as submuscular plating, elastic nails, rigid nails, as well as internal and external fixation.¹⁶

This study was conducted to assess the functional outcome of pediatric femur fractures treated with Ender nailing in the age group of 5 to 16 years.

In this study, a total of 50 subjects were evaluated. Among them, 70 percent of the subjects were males while the remaining were females. Road traffic accidents were the major etiological factor. Transverse fractures occurred in the majority of the cases. While assessing the range of motion, good range of motion was seen in 86 percent of the patients while mild and gross restriction was seen in 6 percent and 8 percent of the patients respectively. While evaluating the complications, superficial infection, knee stiffness, limb length discrepancy, angulation and nail impingement were seen in 8 percent, 14 percent, 10 percent, 4 percent and 4 percent of the patients respectively.

Engstrom Z et al¹⁷ in their study described the epidemiology and treatment of pediatric femur fractures recorded in the Swedish Fracture Register (SFR). They also studied the relationship between femur fractures, age, sex, fracture pattern, injury mechanism, seasonal variation and treatment. This nationwide observational register study was based on the pediatric part of the SFR. They included all patients < 16 years of age who were registered in the SFR from 2015 to 2018. Of the 709 femur fractures, 454 (64%) occurred in boys. Sixty-two of these fractures were proximal (9%), 453 shaft (64%) and 194 distal (27%). A bimodal age distribution peak was observed in boys aged 2–3 and 16–19 years. In contrast, the age distribution among girls was evenly distributed. Younger children were mainly injured by a fall, whereas older children sustained their fracture because of traffic accidents. Non-surgical treatment prevailed among younger children; however, prevalence of surgical treatment increased with age. They found a lower ratio between boys and girls (1.8:1) compared to earlier studies. The bimodal age distribution was seen only in boys. Falls were the most common injury in younger children, whereas

traffic-related accidents were the most common in adolescents. With age, there was a corresponding increase in surgical treatment.

CONCLUSION

Ender nailing system is an effective method with minimal complications and good range of motion.

REFERENCES

1. Salminen ST, Pihlajamäki HK, Avikainen VJ, Böstman OM. Population based epidemiologic and morphologic study of femoral shaft fractures. *Clin OrthopRelat Res.* 2000 Mar;(372):241-9.
2. Fracture and dislocation compendium. Orthopaedic Trauma Association Committee for Coding and Classification. *J Orthop Trauma.* 1996;10 Suppl1:v-ix, 1-154.
3. Karakaş HM, Harma A. Femoral shaft bowing with age: a digital radiological study of Anatolian Caucasian adults. *DiagnIntervRadiol.* 2008 Mar;14(1):29-32.
4. Weiss R.-J., Montgomery S.M.A., Dabbagh Z., Jansson K.A. National data of 6409 Swedish inpatients with femoral shaft fractures: Stable incidence between 1998 and 2004. *Injury.* 2009;40:304–308.
5. Li A.B., Zhang W.J., Guo W.J., Wang X.H., Jin H.M., Zhao Y.M. Reamed versus unreamed intramedullary nailing for the treatment of femoral fractures: A meta-analysis of prospective randomized controlled trials. *Medicine.* 2016;95:e4248.
6. Kessel L. *Clinical and Radiographic Diagnosis of Watson-Jones' Fractures and Joint Injuries.* Wilson; Edinburgh, Scotland: 1992.
7. Scannell B.P., Waldrop N.E., Sasser H.C., Sing R.F., Bosse M.J. Skeletal traction versus external fixation in the initial temporization of femoral shaft fractures in severely injured patients. *J. Trauma.* 2010;68:633–640.
8. Rokkanen P., Slätis P., Vankka E. Closed or open intramedullary nailing of femoral shaft fractures? A comparison with conservatively treated cases. *J. Bone Joint Surg. Br.* 1969;51:313–323.
9. Nowotarski P.J., Turen C.H., Brumback R.J., Scarboro J.M. Conversion of external fixation to intramedullary nailing for fractures of the shaft of the femur in multiply injured patients. *J. Bone Joint Surg. Am.* 2000;82:781–788.
10. Bridgman S, Wilson R. Epidemiology of femoral fractures in children in the West Midlands region of England 1991 to 2001. *Journal of Bone and Joint Surgery British Volume.* 2004;86(8):1152–1157.
11. Sanzarello I, Calamoneri E, D'Andrea L, Rosa MA. Algorithm for the management of femoral shaft fractures in children. *Musculoskeletal Surgery.* 2014;98(1):53–60.
12. Hinton RY, Lincoln A, Crockett MM, Sponseller P, Smith G. Fractures of the femoral shaft in children. Incidence, mechanisms, and sociodemographic risk factors. *The Journal of Bone and Joint Surgery.* 1999;81(4):500–509.
13. Poolman RW, Kocher MS, Bhandari M. Pediatric femoral fractures: A systematic review of 2422 cases. *Journal of Orthopaedic Trauma.* 2006;20(9):648–654.
14. Hosalkar HS, Pandya NK, Cho RH, Glaser DA, Moor MA, Herman MJ. Intramedullary nailing of pediatric femoral shaft fracture. *Journal of American Academy of Orthopaedic Surgeons.* 2011;19(8):472–481.

15. Anderson WA. The significance of femoral fractures in children. *Annals of Emergency Medicine*. 1982;11(4):174–177.
16. Nafei A, Teichert G, Mikkelsen SS, Hvid I. Femoral shaft fractures in children: an epidemiological study in a Danish urban population, 1977–86. *Journal of Pediatric Orthopedics*. 1992;12(4):499–502.
17. Engström Z, Wolf O, Hailer YD. Epidemiology of pediatric femur fractures in children: the Swedish Fracture Register. *BMC musculoskeletal disorders*. 2020 Dec;21:1-8.