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Functional Outcome of Shaft of Femur Fracture Fixation with Elastic Nail in Children Between 05 to 10 Years of Age

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ABSTRACT

Introduction: Femoral fractures are one of the most common issues in the childrens population. Between 6-16 age, there's no strong agreement as to the favored therapy. The therapy of femoral fractures in children has progressively changed towards a more operative tactic within the past two decades. This is because healthcare criteria demand more rapid mobilisation , early discharge and return to family with normal activity. Operative treatment results in short hospitalization and early mobilization, which has psychological, social, educational and economic advantages over conservative treatment.

Aims & Objectives: The aim of our study is to determine the frequency of functional outcome with Flynn's criteria in shaft of femur fracture stabilization with elastic nails in pediatric population between 5 to 10 years of age presenting in a tertiary care hospital.

Place and Duration of Study: We conducted 'Descriptive case series', in the unit of Orthopedic Surgery, Services Hospital, Lahore from 01-09-2021 to 01-03-2022.

Material & Methods: Sixty patients ranging from 5-10 yrs of age, fulfilling the selection criteria were enrolled after the informed consent in the study through the emergency of the Department of Orthopedic Surgery, Services Hospital, Lahore. Surgery for femoral fracture was performed in these patients under general anesthesia by a single surgical team with the assistance of the researcher. The children were followed up at 1, 2, 3, and 6 months. After 6 months, patients were evaluated according to Flynn's criteria for femoral fracture outcomes with nailing and results were noted as excellent, satisfactory and poor. All the information was recorded in proforma. Data was entered and analyzed using SPSS version. 25.P-value ≤0.05 was taken as significant.

Results: Out of 60 patients, 23.3 % (n=14) were in age group of 5-7 years and 76.7 %(n=46) were in age group of 8-10years and mean age was 8.17±1.01years**.** 65.0 %(n=39) were male and 35.0 %(n=21) were females. Out of 60 patients, 21.7 % (n=13) had road traffic accident, 63.3 %(n=38) had history of fall and 15.0 %(n=9) had miscellaneous cause of injury. The frequency of functional outcome according to flynn's criteria was excellent in 51.7 %(n=31).

Conclusion: We concluded that elastic nail is moderately simple to utilize and an compelling treatment for fractures of femoral shaft in legitimately chosen children by applying Flynn's criteria for functional outcome and can further be compared with other treatment modalities.

Keywords: fistula, genitourinary, surgical outcome, vesico-vaginal, iatrogenic fistula

INTRODUCTION

Femoral shaft fractures constitute the more frequent lower extremity fractures in children[1].Pediatric femoral fractures account for 1.6% of all fractures in children. Femoral fracture rates are bimodally distributed, with a male to female ratio of 2:6:1. In early childhood, there is the first peak, and in late-teen, there is the second peak[2]. Elastic intramedullary nailing often known as a titanium elastic nail (TENs), is a second option for treating certain paediatric long bone fractures. Titanium nails are favoured over plaster cast and stainless-steel nails for youngsters above the age of six[3,4]. There are various alternatives for healing femoral-shaft fractures in adolescents. Elastic stable intramedullary nailing has grown into the conventional therapy for fractures of diaphysis of femur in children for a variety of reasons,
including surgery that is minimally invasive, no need for casting, early mobilisation and discharge, and growing cost-effectiveness considerations[1,5].
Govindasamy et al., observed that with elastic nails (n=48), excellent results can be achieved in 83% children who presented with femoral shaft fracture[6]. Another research published by Mahar et al., it was reported that with elastic nails (n=16), excellent

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results can be achieved in 81.25% children who presented with femoral shaft fracture[7]. But Kawalkar and Badole also observed that with elastic nails (n=11), excellent results can be achieved in 54.5% children who presented with femoral shaft fracture[8].

Rationale of this research is to assess the functional outcome of shaft of femur fracture fixation with elastic nail in children between 5 to 10 years of age. Through literature, it has been observed that the success rate of elastic nails for femoral fractures is >80%. But conflicting rate of success has been reported in previous studies. Also, previous studies were done on small sample size. There is also one study conducted before in this regard, but the results are not reliable as that study was done in 16 patients only. So there is a great need to conduct a study to evaluate the role of elastic nails (TENs) for femoral shaft fracture in our local paediatric population. So we conducted this study to determine and implement the apparently more appropriate & successful method instead of applying other methods like spica, traction, external fixation and plating in local pediatric population. This will assist in both enhancing our expertise in this procedure and provide a better outcome. Our objective was therefore to determine the frequency of excellent functional outcome of shaft of femur fracture fixation with elastic nail in children between 5 to 10 years of age presenting in a tertiary care hospital.

MATERIAL AND METHODS

Study Design: Descriptive case series.

Place of study: Department of Orthopedic Surgery, Services Hospital, Lahore.

Study Duration: Six months from 01-09-2021 to 01-03-2022 after approval of CPSP wide number CPSP/REU/OSG-2019-068-2258

Sample Size: Sample size (n) of 60 patients has been estimated by keeping 95% confidence level, 14% margin of error and expected percentage of excellent outcome i.e. 54.5% with elastic nails in children with femoral shaft fracture[8].

Sampling Technique was non-probability, consecutive sampling.

Inclusion criteria:

Patients of age 5-10 years, both genders presenting with femoral shaft fracture (as per operational definition)

Exclusion criteria:

- Patients presenting after 14 days with infection or need for debridement.
- Needing redo surgery for previous failed surgery.
- Patients with osteomalacia, bone malignant disease, muscular or skeletal dystrophy (on medical record and history

Sixty patients ranging between 5-10 yrs age after providing informed consent & fulfilling selection criteria, were enrolled in the study through Emergency of Department of Orthopedic Surgery, Services Hospital, Lahore. Then, patients' fractures were set under general anesthesia by a single surgical team with assistance of researcher. The youngster was positioned straight on a operative table, with the injured leg adducted by 100 degrees. Manual traction and gentle rotation were used in conjunction with the use of an F-tool (a radiolucent device) to perform closed reduction. The arms of the F-tool wassubsequently re-adjusted in accordance with the fracture geometry and thigh bulk, and alignment was validated in both axes by an image intensifier. In a majority of instances, the F-tool was utilised to make an entry for the setting of skin cuts and splitting the fascia-lata. Then onward, elastic nails (TENs) were introduced through the distal metaphyseal end of femur to stabilize the fractures. The sutures were removed on the eleventh day. (Fig-2 and Fig-3) The kids were checked in at 1, 2, 3, and 6 months. After 6 months, patients were evaluated according to Flynn's criteria and results were noted as excellent, satisfactory and poor. Patients who did not improve were treated according to usual procedure. SPSS version 25 was used to analyze the data. Age, body weight, and length of injury were among the numerical factors whose mean ± standard deviation was computed. The frequency and proportion of each factor—gender, injury etiology, and great functional outcome were determined. Data was classifed for effect modifiers like age, sex, duration of fracture, weight of child, and cause of injury. The Chi-square test was used to compare the outstanding functional outcome in each stratified group after stratification. A P-value of less than 0.05 was deemed significant.

RESULTS

The patients' ages were split up, and it was discovered that out of sixty individuals, 23.3% (n=14) were in age group of 5-7 years & 76.7% (n=46) were in age group of 8-10 years and mean age was calculated as 8.17±1.011 years (Table-1) Distribution of body weight and duration of injury was done which was 15.13±2.189 kg and 1.783±0.825 days respectively. Distribution of gender (Fig-1) was done, out of 60 patients, 65.0 % (n=39) were male and 35.0% (n=21) were females. (Table-2) Frequency of cause of injury was done,

21.7 %(n=13) had road traffic accident, 63.3 %(n=38) had history of fall and 15.0 %(n=9) had miscellaneous cause of injury. The frequency of functional outcome according to flynn criteria as excellent was 51.7 %(n=31) with respect to both age and gender. (Table-2 and Table-3 respectively). All patients remained in contact for followup and no patient dropped out in the pre defined follow up period .

Age group	Frequency	Percent
5-7 years	14	23.3
8-10 years	46**	76.7
Total	**60**	**100.0**

Table-1: Distribution of age (N= 60)
Mean±SD =8.17±1.011years

Age group	Excellent functional Outcome		Total	p-value
	Yes	No		
5-7 years	8	6	14	0.640
	13.3%	10.0%	23.3%	
8-10 years	23	23	46	
	38.3%	38.3%	76.7%	
Total	31	29	60	
	51.7%	48.3%	100.0	

Table-2: Using the Chi square test, stratification for functional outcome according to age (N= 60)

Gender	Excellent functional outcome		Total	p-value
	Yes	No		
Male	19	20	39	0.533
	31.7%	33.3 %	65.0%	
Female	12	9	21	
	20.0%	15.0%	35.0%	
Total	31	29	60	
	51.7%	48.3%	100.0%	

Table-3: Using the Chi square test, stratification for functional outcome according to gender (N= 60)

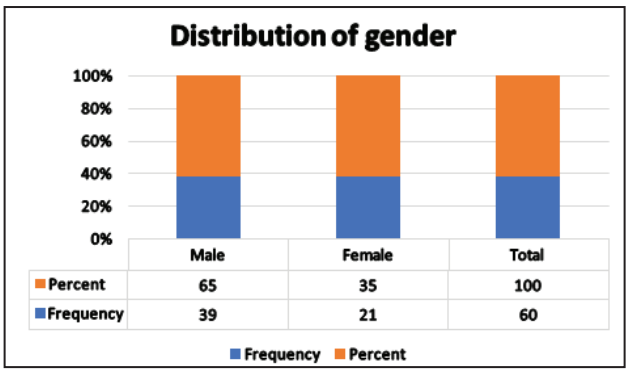

Fig-1: Distribution of gender

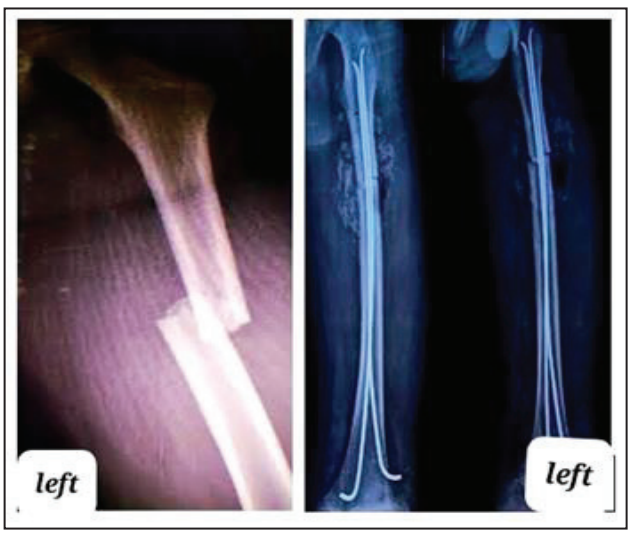

Fig-2: Pre and post operative radiographs of shaft of femur fracture of 10-year-old child, managed with elastic nail

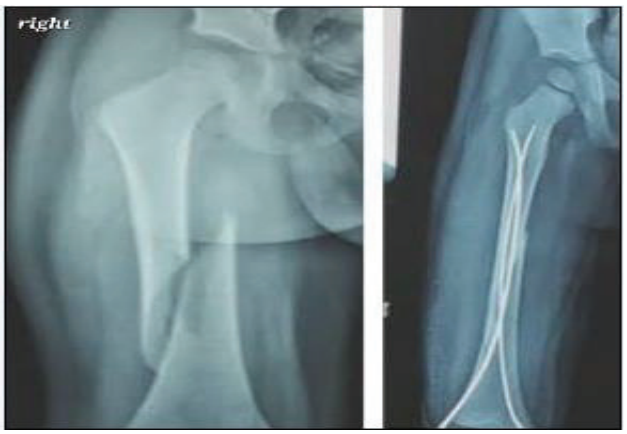

Fig-3: Pre and postoperative radiographs of shaft of femur fracture 7-year-old child, managed with elastic nail

DISCUSSION

The optimal treatment option for shaft of femoral fractures continues to be a continual problem for the orthopaedic community. On youngsters approaching skeletal maturity, antegrade nailing is employed. The majority of the time, external fixators are

employed to treat open fractures[5,6]. Nancy group introduced elastic stable intramedullary nailing (ESIN) for femoral fractures in 1979[6]. Titanium implants are increasingly being utilized for ESIN because of its great biocompatibility and flexibility, this minimizes the amount of irreversible nail distortion during insertion and increases the development of callus by minimizing stress buffering. TENS works as an inner splinting device preserves length and alignment, allowing for quick mobilization while allowing for ample fracture site movements for callus formation and has a potentially low risk of osteonecrosis, injuries to the body, and re-fracture. The use of TENS is growing as the benefits are realized and the disadvantages are less relative to other ways to achieve fixation. Conservative management leads to challenges such as malunion, joint stiffness, and delayed functional recovery in older children, as well as prolonged hospitalisation resulting in the cost to the family, as well as a spike in hospital bed utilisation ratio, has resulted in the introduction of surgical stabilisation for such kinds of fractures[9,10].

TENS is an elastic, dependable intra-medullary nail that uses the symmetric support action of two intramedullary elastic nails with the same coefficient of elasticity to deliver three-point fixation, rotational, transitional, axial and bending balance by opposing disengagement and compression loads at the fracture site[11,12]. In the current study, out of 60 patients, 23.3 %(n=14) were in age group of 5-7 years and 76.7 %(n=46) were in age group of 8-10years and mean age was 8.17±1.011years**.** Distribution of body weight and duration of injury was 15.13±2.189 kg and 1.783±0.825 days respectively. Out of 60 patients, 65.0 %(n=39) were male and 35.0 % (n=21) were females. Out of 60 patients, 21.7 % (n=13) had road traffic accident, 63.3 %(n=38) had history of fall and 15. 0 %(n=9) had miscellaneous cause of injury. Frequency of excellent functional outcome of shaft of femur fracture fixation was 51.7 % (n=31).Govindasamy R, et al. published a study in which all fractures were reunited within 12 weeks after stabilisation without any delayed union/non-union. Children with a transverse type of fracture geometry experienced a quicker bony-union and were more than others. Males had a higher rate of fracture reunion than girls. Santosha and colleagues discovered that all 31 fractures in their series recovered around 12 weeks, with no delayed healing[13]. Kocher et al found that all fractures healed at a mean of 88 days after injury in 42 individuals treated with ESIN[14]. Newton and Mubarak[15] found that the average hospitalisation stay was 20.6 days before casting. With the practice of titanium type of flexible nails, Ligier and Heinrich[15,16,17] observed hospitalisation lengths ranging from 4.5 to 8 days, whereas Fabiano et al. reported a mean hospitalisation duration of 9.4 days[18]. Basant et al. additionally revealed an average hospital stay of 8.1 days[19]. The time in the hospital was comparable to previous studies found in the literature, but on the lower side, most likely as a result of early operative intervention and aggressive rehabilitation.

Prevailing research indicates that practically all femoral bony breaks heal successfully using TENs[16,17]. According to Abbot et al., 17.5% of patients experienced serious problems, whereas 30% experienced moderate difficulties[19]. Studies showed the performance of TENS in 234 femoral fractures and observed that it was good in 65% of scenarios, satisfactory in 25%, and unsatisfactory in 10%[19,20]. According to Nishant Kumar[21], all 20 cases of paediatric femoral shaft fractures treated with TENS had successful results.

In children aged 6 to 16, An interior brace that distributes load, sustains reduction, is unlikely to put at risk the femoral head's growth areas or blood supply, and reduces morbidity and effects is optimal. Plating provides firm fixation, but it necessitates greater contact with greater blood loss, re-surgery to remove the implant, and scarring. Because this is a load-bearing device, re-fracture is a possibility. The key benefits are that they are readily accessible in various diameters and are affordable. Because we only included youngsters in our study who had undamaged periosteal layers and TENS does not disrupt the hematoma at fracture site when used as a closed treatment, the risk of spreading infection is quite minimal. When used retrogradely, there is little risk of femoral head avascular necrosis[22,23,24]. According to Kong et al., the most prevalent problem is malalignment[23]. As an outcome, problems are uncommon. Over a 5-year period, Cage et al assessed 79 femoral fractures with titanium elastic stable intramedullary nailing and difficulties were specifically recorded to provide guidance on how to avoid these complications. Pain/irritation at the incision area occurred in 41 instances., as did radiographic malunion, re-fracture, transitory neurologic impairment, and superficial wound infection[24].Four years of age and fifteen kilograms of weight appear to be the cutoff points in terms of choice between conservative and surgical treatment, with most surgeons considering treatment with TENs for children weighing fifteen to fifty kilograms.[25] According to Flynn's scoring technique, the

functional outcome in Sinha et al.'s population study was outstanding in 75.5% of our instances, good in 17% of cases, and negative in 7.5% of cases; in our study, we achieved 51.7% exceptional outcome[26]. Prior to unification, ten patients underwent re-surgery[25].

CONCLUSION

We came to the conclusion that elastic nail is moderately simple to utilize and an compelling treatment for fractures of diaphysis of the femur in legitimately chosen children by applying Flynn's criteria for functional outcome and can further be compared with other treatments modalities.

Limitations of study: The study's restricted duration of six months, its exclusive focus on the Orthopedics Department of Services hospital Lahore, Pakistan, small sample size of sixty patients with only closed fracture being assessed that may affect the study's generalizability.

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