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Original Research Article

A Comparative Study between Functional Outcome in Conservative & Surgical Management of Pediatric Diaphyseal Femur Fracture

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Abstract:

Background & Method: The aim of this study is to a comparative study between functional outcome in conservative & surgical management of pediatric diaphyseal femur fracture. Intervention will be done as per availability of operation theatre as soon as possible. After pre-anaesthetic workup patients those selected for flexible nailing will be shifted to OT. After proper effect of anaesthesia patient will be transferred to traction table, then parts preparation, cleaning, painting and draping will be done.

Result: In Titanium Elastic Nail System (TENS) group, there were 13(65%) children functional outcome were Excellent, 5(25%) children functional outcome were good and 2(10%) children functional outcome were poor.

In HIP Spica Cast group, there were 3(15%) children functional outcome were excellent, 2(10%) children functional outcome were good and 15(75%) children functional outcome were poor. Good and Excellent results were seen in 90% of patient in Titanium Elastic Nail System (TENS) group and Good and Excellent results were seen in 25% of children in HIP Spica Cast group. There was statistically significant association seen between the functional outcome in both the groups ($P<0.05$) shows that, TENS in shaft femur fracture in children has better outcome both functionally and radiologically when compared to conservative management.

Conclusion: Treatment for pediatric femoral shaft fractures has changed dramatically over the past several decades. The shift from non-operative treatment with prolonged traction followed by spica casting to immediate HIP spica casting or operative fixation has decreased lengths of hospitalization and the time to return to normal activities. Patient feels very much comfortable after TEN treatment as compare to HIP spica treatment. Parents of children, treated with TEN, remained much happier than the other group. Convenience of micturition & defecation in TEN group, also make it better than HIP spica treatment. Thus TEN treatment proved to be superior than HIP spica cast treatment for diaphyseal femoral fractures.

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Keywords: conservative, surgical, pediatric, diaphyseal & femur fracture.

Study Designed: Comparative Study.

1. INTRODUCTION

Femoral shaft fractures in children are common and frequently lead to hospitalization and require anaesthesia for performing an orthopaedic procedure. Fractures of femur in children occur most frequently in the middle third of the shaft. According to Hinton et al, the annual rate of femoral shaft fractures in children is 19.5 per 1,00,000[1]. Femoral shaft fractures treatment goals in children are achieving bone union with length, alignment and limb's function restoration, without losing movements of adjacent joints. Femoral shaft fracture is an incapacitating pediatric injury. Femoral shaft fractures, including subtrochanteric and supracondylar fractures, represent approximately 1.6% of all body injuries in children The annual rate of femur shaft fractures in children was 1 per 5000[2]. However, incidence appears to show minor variations in its geographical distribution. Orthopaedic surgeons have long maintained that all children who have sustained a diaphyseal fracture of femur recover with conservative treatment, given the excellent remodeling ability of immature bone in children. But time and experience of many surgeons have shown that diaphyseal femur fractures in children do not always recover completely with conservative treatmen[3]. Angulations, shortenings and malrotations are not always corrected by conservative treatment.These fractures are commonly treated by conservative approach, with reduction and early immobilization with plaster cast or preceded by skin or skeletal traction. This procedure is not exempted from complications, with reduction loss and the shortening of the affected limb.

Different treatment approaches can be used for their successful treatment depending on the child's age, type of fracture, surgical facilities available, associated injuries, and socioeconomic factors. Various treatment options are available, including closed reduction with hip spica casting and surgical stabilization with intramedullary devices, submuscular bridging plate and screws, and external fixators[4]. Although spica casting is effective in <5-year-old children, rigid antegrade interlocked intramedullary nail is the best option for skeletally mature teenagers. Nonetheless, the most suitable treatment option for school going children is controversial[5].

Complications associated with closed reduction with hip spica castings, such as malunion, joint stiffness, angulation, shortening, and delays in functional recovery, are common in older children. Moreover, conservative treatment options require prolonged hospitalization, increasing burden on the hospital authorities and causing financial losses to the patient's family [6]. In the last decade, there has been a gradual trend towards new treatment approaches that allow rapid mobilization. Most orthopedic surgeons have recognized the adverse psychosocial effects associated with prolonged hospitalization and spica cast immobilization on children and their families. These psychosocial factors, along with the increasing emphasis toward minimizing the hospital stay and its consequences, have

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generated interest for the internal and external fixation of pediatric diaphyseal femoral fractures, even though the combination of traction and cast immobilization provides favorable results.

2. MATERIAL & METHOD

This study will be done prospectively in the Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M. P.) from July 2020 to June 2021.The cases will be selected on the random basis, those having diaphyseal femur fracture in pediatrics.

Sample Size: A Total number of 40 patients will be selected. Approx. 20 will be managed by spica cast and approx. 20 will be operated by intramedullary nailing. In this study intervention will start after approval of institutional ethics committee.

Inclusion criteria

- Closed diaphyseal femur fracture
- Children age between 4 to 10 years
- Parents of patients willing to give informed consent.

Exclusion criteria

- Compound fracture
- Polytrauma
- Lack of complete follow-up
- Fracture of proximal most and distal most femur.
- Children age < 4 and > 10 years
- Pathological fracture
- Infection
- Refusal to give consent for any intervention

METHOD

Intervention will be done as per availability of operation theatre as soon as possible. After pre-anaesthetic workup patients those selected for flexible nailing will be shifted to OT. After proper effect of anaesthesia patient will be transferred to traction table, then parts preparation, cleaning, painting and draping will be done. Then reduction will be achieved under C-arm guidance and two flexible nail would be passed in retrograde manner. I/V antibiotic will be given for 3 days.

Statistical Analysis

Data will be entered in Microsoft Excel and analyzed using SPSS Version 16.0 and EPI INFO version 7.0. Baseline and follow-up VAS, MODQ, Flynn's table were analyzed using paired student t-test. A p value of < 0.05 will be considered to be statistically significant.

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3. RESULTS

Table 1: Distribution of patients according to age group in both the groups

Age Group	Group				Total	
	TENS		HIP Spica			
	No.	%	No.	%	No.	%
4-5 years	7	35.0%	13	65.0%	20	50.0%
5-6 years	3	15.0%	6	30.0%	9	22.5%
8-10 years	10	50.0%	1	5.0%	11	27.5%
Total	20	100.0%	20	100.0%	40	100.0%
Mean±SD	7.20± 2.26		5.20± 1.51		6.23± 2.14	

Pearson Chi-Square = 10.164, DF = 2, P value = .006, Significant

The above table shows the distribution of patients according to age (mean age = 6.23± 2.14) in both the groups.

In Titanium Elastic Nail System (TENS) group, there were 7(35.0%) children in the age group 4-5 years, 3(15.0%) in the age group 5-6 years and 10(50.0%) children in the age group 8-10 years.

In HIP Spica Cast group, there were 13(65.0%) children in the age group 4-5 years, 6(30.0%) in the age group 5-6 years and 1(5.0%) children in the age group 8-10 years.

The mean age in Titanium Elastic Nail System (TENS) groups was 7.20±2.26 years and in HIP Spica Cast groups it was 5.20±1.51.

There was statistically significant association seen between the age and conservative & surgical management of pediatric diaphyseal femur ($P<0.05$), showing that the higher shaft femur fracture in age group 4-5 years.

Table 2: Distribution of patients according to Mode of Injury in both the groups

Mode of Injury	Group				Total	
	TENS		HIP Spica			
	No.	%	No.	%	No.	%
Accidental fall from height	10	50%	11	55%	21	52.5%
Accidental fall while playing	6	30%	3	15%	9	22.5%
Road traffic accidents	4	20%	6	30%	10	25.0%
Total	20	100%	20	100%	40	100%

Pearson Chi-Square = 1.448, DF = 2, P value = .485, Not Significant

The above table shows the Distribution of patients according to mode of injury in both the groups.

In **Titanium Elastic Nail System (TENS) group**, there were 10(50%) children who injured accidental fall from height, 6(30%) were injured accidental fall while playing and 4(20%) were injured due to road traffic accidents (RTA).

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In **HIP Spica Cast group,** there were 11(55%) children who injured accidental fall from height, 3(15%) were injured Accidental fall while playing and 6(30%) were injured due to Road traffic accidents (RTA).

Fall from height was the most common mode of injury (52.5%) of both the groups followed by fall while playing (22.5%), road traffic accidents (25.0%).

The above association found to be statistically not significant (p>0.05) which shows the mode of injury of children of both groups are comparable.

Table 3: Distribution of patients according to time of interval (In Days) between trauma and surgery in both the groups

Time of interval	Group				Total	
	TENS		HIP Spica			
	No.	%	No.	%	No.	%
≤ 24 hours	14	70.0%	16	80.0%	30	75.0%
2 - 4 days	4	20.0%	1	5.0%	5	12.5%
5 – 7 days	2	10.0%	3	15.0%	5	12.5%
> 7 days	0	0.0%	0	0.0%	0	0.0%
Total	20	100.0%	20	100.0%	40	100.0%
Mean±SD	1.95±1.73		1.80±1.85		1.88±1.77	

Pearson Chi-Square = 2.133, DF = 2, P value = .344, Not Significant

The above table shows the Distribution of patients according to time interval (days) between trauma and surgery in both the groups.

In **Titanium Elastic Nail System (TENS) group**, there were 14(70.0%) children's time interval between trauma and surgery were ≤ 24 hours, 4(20.0%) children's time interval were 2-4 days, 2(10.0%) children's time interval between trauma and surgery were 5-7 days.

In **HIP Spica Cast group**, there were 16(80.0%) children's time interval between trauma and surgery were ≤24 hours, 1(5.0%) children's time interval were 2-4 days, 3(15.0%) children's time interval between trauma and surgery were 5-7 days.

The mean time interval between trauma and surgery in Titanium Elastic Nail System (TENS) groups was 1.95±1.73 years in HIP Spica Cast groups it was 1.80±1.85

The above association found to be statistically not significant (p>0.05) which shows the time of interval between trauma and surgery of children of both groups are comparable.

Table 4: Distribution of patients according to type of fracture in both the groups

Type of fracture	Group				Total	
	TENS		HIP Spica			
	No.	%	No.	%	No.	%
Closed	17	85.0%	17	85.0%	34	85.0%

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Open	3	15.0%	3	15.0%	6	15.0%
Total	20	100.0%	20	100.0%	40	100.0%

Pearson Chi-Square = 0.000, DF = 1, P value = 1.000, Not Significant

The above table shows the Distribution of patients according to type of fracture technique in both the groups.

In Titanium Elastic Nail System (TENS) group, there were 17(85.0%) children whom type of fracture were closed and 3(15%) children whom type of fracture were open

In HIP Spica Cast group, there were 17(85.0%) children whom type of fracture were closed and 3(15%) children whom type of fracture were open

The above association found to be statistically not significant (p>0.05) which shows the type of fracture of children of both groups are comparable.

Table 5: Functional outcome (based on Flynn criteria)

Functional Outcome	Group				Total	
	TENS		HIP Spica			
	No.	%	No.	%	No.	%
Excellent	13	65.0%	3	15.0%	16	40.0%
Good	5	25.0%	2	10.0%	7	17.5%
Poor	2	10.0%	15	75.0%	17	42.5%
Total	20	100.0%	20	100.0%	50	100.0%

Pearson Chi-Square = 17.477, DF = 2, P value = .000, Significant

The above table shows the distribution of children according to Functional Outcome in both the groups.

In **Titanium Elastic Nail System (TENS) group,** there were 13(65%) children functional outcome were Excellent, 5(25%) children functional outcome were good and 2(10%) children functional outcome were poor.

In **HIP Spica Cast group,** there were 3(15%) children functional outcome were excellent, 2(10%) children functional outcome were good and 15(75%) children functional outcome were poor.

Good and Excellent results were seen in 90% of patient in Titanium Elastic Nail System (TENS) group and Good and Excellent results were seen in 25% of children in HIP Spica Cast group.

There was statistically significant association seen between the functional outcome in both the groups (P<0.05) shows that, TENS in shaft femur fracture in children has better outcome both functionally and radiologically when compared to conservative management.

4. DISCUSSION

Paediatric femoral shaft fracture is the most common injury for hospitalization during the paediatric age group. The femoral shaft fractures in this age group vary according to age and

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there are controversies between conservative and surgical treatments. While in adults femoral fractures are mostly treated with surgery.

During the last few decades, there had been an increasing trend toward surgical management of children's fractures that were previously treated conservatively. Although hip spica casting is a safe and effective treatment for many pediatric femoral shaft fractures, the associated complications, such as skin irritations, malunion, joint stiffness, and prolonged immobilization, are common [7]. Numerous studies have also increased awareness regarding adverse psychosocial, educational, and economic effects of spica cast immobilization on the affected children and their families [8]. Recently, ESIN has been advocated by many studies for treating pediatric femoral shaft fractures [9]. Although many studies have compared ESIN and spica casting in several countries, only a few have been conducted in Iraq [10]. Furthermore, surgical treatment with ESIN in lower-age group (3-year-old) patients has been evaluated in few studies in other countries [11].

Conservative method had been the treatment of choice for femur shaft fractures, but the union was at the expense of an extended period of immobilization, loss of school attendance, intolerance and prolonged hospital stay. To overcome these issues, now surgical approach is gaining popularity.

Titanium elastic nailing system (TENS) is a titanium made flexible nail that is a load shearing implant, acts as a brace and maintains length and alignment. Due to its elasticity, it provides micromotion at the fracture site, which helps in the rapid development of bridging callus, early mobilization and early weight-bearing. Because the surgery is closed, there is no disruption of the fracture hematoma or periosteum, reducing the risk of infection and nonunion. It also combines the advantages of titanium such as lightweight, more strength, corrosion resistance and MRI compatibility.

5. CONCLUSION

Treatment for pediatric femoral shaft fractures has changed dramatically over the past several decades. The shift from non-operative treatment with prolonged traction followed by spica casting to immediate HIP spica casting or operative fixation has decreased lengths of hospitalization and the time to return to normal activities. Patient feels very much comfortable after TEN treatment as compare to HIP spica treatment. Parents of children, treated with TEN, remained much happier than the other group. Convenience of micturition & defecation in TEN group, also make it better than HIP spica treatment. Thus TEN treatment proved to be superior than HIP spica cast treatment for diaphyseal femoral fractures.

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