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Outcome of Fractures SOF in Children Treated with Early Hip Spica: A Prospective Study

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Abstract

Background: In children, femoral shaft fractures are usually treated by initial performance and durability for 3 to 4 weeks, followed by an additional period of immobilization in a hip spica cast until union occurs. However, such treatment would involve prolonged hospital stays, thereby increasing the cost and occupancy of hospital beds. Early hip spica cast application of femoral shaft fractures in children is a valuable alternative to the traditional treatment method. It allows for a short hospital stay, thereby avoiding all the problems associated with prolonged hospitalization. ***Methods:*** This prospective study was conducted on 20 patients. Multicentered based non-randomized evaluations were performed in Modernized District Hospital, Joypurhat, and Rajshahi Medical College Hospital, Rajshahi, Bangladesh, from January 2020 to April 2022. With femur shaft fractures over two years. All the children of both sexes from 2 to 12 years of age with fractures shaft of the femur presented within day one of injury. Follow-up was done in OPD for up to 6 months. The functional result was assessed according to Flynn's scoring criteria. ***Results:*** The mean age of the patient was 5.65 years, ranging from 2 to 12 years. The male-female ratio was 3:1. The mean duration of hospital stay was 4.1 days. Radiological union in all cases was achieved in a mean time of 7.65 weeks. Full weight-bearing was possible in a mean time of 10.07 weeks. The result was excellent in sixteen patients (80%), successful in two (10%), and poor in two patients (10%). ***Conclusions:*** Early spica cast is a simple, effective, and definite treatment method with minimal complications and acceptable results in the pediatric age group.

Keywords: Femur fracture, Pediatric, Skin excoriation, Spica cast.

INTRODUCTION

Injury has drawn the attention of policy-makers and development activists of Bangladesh since the Bangladesh Health, and Injury Survey revealed an annual estimate of 70,000 injury-related deaths in Bangladesh, the children being the worst victims (43% of the total injury-related deaths) [2]. The socioeconomic impact of injury-related disability is magnified in low-income countries, where there are often poorly developed trauma care and rehabilitation systems and little or no social welfare infrastructure. Cost-effective treatment providing this population is a big challenge [3]. In pediatric fracture, femoral fractures have a negative impact on the patient and their family network [4]. They account for 1.6% of all fractures in a pediatric population [5]. Seventy percent of femoral fractures involve the shaft. Femur fractures are the most common orthopedic injuries that require the hospitalization of children. Fractures of the femoral shaft in children are usually treated by initial traction for 3 to 4 weeks, followed by an additional period of immobilization in a hip spica cast till union occurs. However, such treatment would involve prolonged hospital stays, thereby increasing the cost and occupancy of hospital beds. Because of the characteristics of fracture in children, early hip spica immobilization for the treatment of femoral shaft fracture is an alternative to the conventional treatment method. It has the advantages of avoiding prolonged hospital stay, reducing costs, and preventing separation anxiety in children.

MATERIALS & METHODS

This prospective study was carried out at the Modernized District Hospital, Joypurhat, and Rajshahi Medical College Hospital, Rajshahi, Bangladesh, from

January 2020 to April 2022. This study subjects children of 2-12 years with closed or Gustilo type 1 open diaphyseal femur fractures. A hip spica was applied on day 1 to day 7 depending on the shortening of the affected limb, swelling of the thigh, stability of fracture, and availability of the patient. The cast should be placed with the child's hips flexed at approximately 45 degrees and 20 degrees of abduction; the knees should be flexed to 45 degrees. Some external rotation is needed to correct the rotational deformity of the distal fragment. The patients were allowed to go home after cast application. The parent/guardian was given written and verbal instructions about proper cast care. Patients were followed in the outdoor department weekly for the first 3 weeks. Fourth, fifth, and sixth visits were arranged after 6 weeks, 3 months, and 6 months. The functional result was assessed according to Flynn's scoring criteria (Table I). The excellent and successful results were considered as satisfactory. The poor results were considered as unsatisfactory [6].

RESULTS

Out of the total 20 cases, 15 (75%) were male, and 5 (25%) were female. The age of the patients ranged from 2 to 12 years, with mean age 5.65 years. Right side involvement was 65%, and left side involvement was 35%. There was no case with bilateral femur involvement. The majority 18 (90 %) of the injuries, were closed type, and the rest 2 (10%) were open type. In terms of the type of fracture, 12 (60%) were transverse fractures, 6 (30%) were Oblique fractures, and 2 (10%) were minimally comminuted. Mechanism of injury was a motor vehicle accident 10 (50%), pedestrian-motor vehicle collision 7 (35%), and fall from a height 3 (15%). Interval between injury and casting of 16 (80%) patients within 3 days, 2 (10%) between 4-5 days, and 2 (10%) between 6-7 days. The mean interval between injury and casting was 2.85 days (Table 2). 16 (80%) of the patients stayed in the hospital for 0-5 days, and the rest 4 (20%) patients 6-10 days. The mean duration of hospital stay was 4.1 days.

Table 1: Flynn's scoring

Flynn's scoring criteria	Excellent	Successful	Poor
Limb length discrepancy	<1.0 cm	<2.0 cm	Poor >2.0 cm
Malalignment	5°	10°	>10°
Pain	Absent	Absent	Present
Complication	Absent	Mild	Major complication and/or extended period for resolvable morbidity

Statistical analysis was performed using SPSS software. Statistical significance was defined as a *p*-value <0.05 with 95% confidence interval.

Table 2: Time interval between injury and casting

Time interval	Frequency	Percentage	Mean ± SD
1-3 days	16	80	2.85 ± 1.69
4-5 days	2	10	
6-7 days	2	10	

Table 3: Relation between Age and Union

Age (years)	No. of children	Percentage	Average union time ± SD
1-5	11	55	7.45 ±1 1.036
6-10	7	35	8.14 ± 1.773
11-12	2	10	12.00 ± 0.000
Total	20	100	7.65 ± 1.663

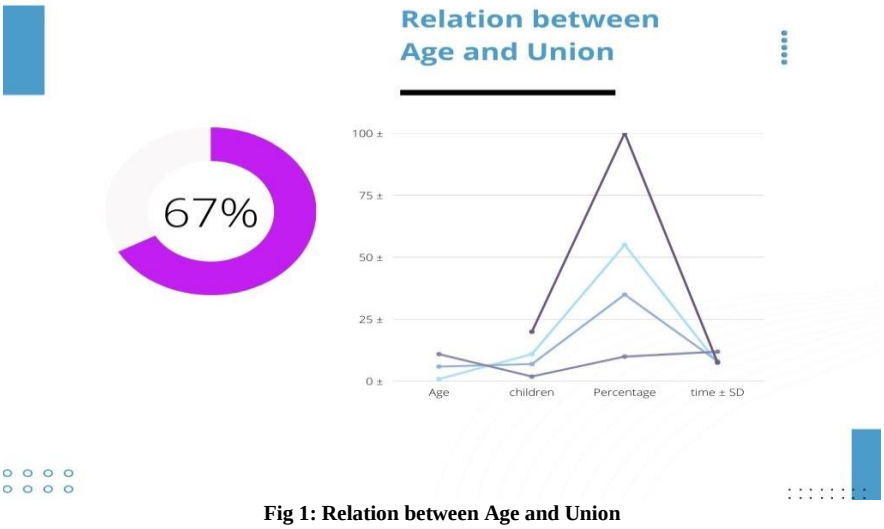

Fig 1: Relation between Age and Union

Table 4: Full weight-bearing

Weight-bearing time (wks)	Frequency	Percentage	Mean ± SD
8- 12 weeks	15	75	**10.07 ± 2.47**
13- 16 weeks	5	25	

In terms of minor/major complications like skin irritation due to cast was 3 (15%) of the patients, and at the end of the followed-up period, 16 (80%) of the patients had leg length inequality by <1 cm, 3 (15%) by < 2cm, 1(5%) by >2 cm.

Table 5: Incidence of limb length discrepancy

Limb length inequality	Frequency	Percentage
<1cm	16	80
<2cm	3	15
>2cm	1	5

12 (60%) of the patients exhibited a wide range of knee motion (130-140º), 6 (30%) patients had slightly restricted knee motion (110 - 129º), and 2 (10%) had moderately restricted knee motion (90 - 109 º) (Table 6). 16 (80%) of the patients returned to routine preinjury activities, 3 (15%) patients to preinjury activities with mild limitations, and 1 (5%) to routine activities with moderate limitations.

Table 6: Range of knee motion

ROM	Frequency	Percentage
130-140	12	60
110-129	6	30
90-109	2	10

16 (80)% of the patients had excellent outcomes, 2(10%) patients had a successful outcome, and 2 (10%) had poor outcomes according to Flynn's scoring criteria.

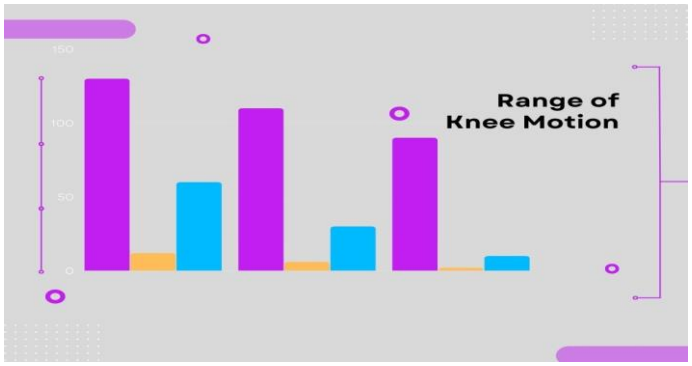

Fig 2: Range of knee motion. Final assessment revealed that 90% of children had satisfactory result and 10% had unsatisfactory

Follow-up

Fig-3: ***Pre-Operative X-ray***

Fig-4: ***Patient after application of hip-spica***

Fig-5: ***X-ray after 2 weeks***

Fig-6: ***X-ray after 6 months of injury***

DISCUSSION

The goal of treatment in fracture of the femoral shaft in children is to achieve union without a discrepancy in limb length and deformity. To achieve this, many treatment options are available. Determining the ideal treatment for each child depends on the age of the child, the location and type of fracture, the family environment, the knowledge and ability of the surgeon, and to a lesser degree, financial considerations [7].

Conservative treatment of femur shaft fractures in children is skin traction followed by a hip spica and also early reduction and hip spica cast gaining popularity as a successful treatment modality [8]. Regarding demographic data, in the present study, the mean age of the children was 5.65 years with a male to female ratio of 3:1. Similar findings have been reported in international literature [9]. Right side involvement was 65%, and left side involvement was 35%. There was no case with bilateral femur involvement in this study. Shah *et al*., [9] reported right femur fractured in 17 (68%) and the left one in the remaining 8 (32%). In children, femoral shaft fractures often result from automobile accidents, falls from high places, and other high-energy trauma. In this study, the mechanism of injury was found 10 (50%) of the patients sustained injury from motor vehicle accidents, 7 (35%) from pedestrian- motor vehicle collisions and 3 (15%) due to falls from a height. Shah *et al*., [9] reported in their study motor vehicle vs. pedestrian 35%, motor vehicle accident 35% and 30% fall. Regarding the configuration of fracture in this study, 12 (60%) were transverse fractures, 6 (30%) were short obliques, and 2(10%) were minimally comminuted fractures. In the study of Muzzafar and colleagues [8], transverse fractures 62.50%, short oblique 12.50%, and minimally comminuted 20%.

In this study, the interval between injury and casting of 16 (80%) patients within 3 days, 2 (10%) between 4-5 days, and 2 (10%) between 6-7 days. The mean interval between injury and casting was 2.85 days. Shivana and Swami [10] reported average interval between injury and casting was 3.3 days. The study of Alzubady11 reported spica cast is a simple, safe, effective, and definitive treatment method. It is cheap and associated with a short hospital stay. In this study, the hospital stays of 16 (80%) patients were 1-5 days, and 4 (20%) patients stayed 6-10 days. The mean duration of hospital stay was 4.1 days. In the series of Shah *et al*., [9] the hospital stay ranged from 3-15 days, and in the series of Muzzafar and colleagues [8], the median hospital stay was 5 (ranged 2-9) days. Early spica application had the advantage of shorter hospital stay and overall lower cost of treatment. Union has really never been a problem in pediatric femoral fractures. The main challenge is malunion, especially angular deformity, rotational malunion, and leg length discrepancy [12]. In this study all fractures were united, and there was no delayed or nonunion. The mean union time was 7.65 weeks near similar to the study of Tripathi, Ali, and Bachhar [13], where the mean duration of fracture healing was 8.55 weeks. Esenyel *et al*., [14] treated 207 patients with hip spica casting, and there was no nonunion or delayed union. In this study, there was a full range of knee and hip movement of 12 (60%) patients and 6 (30%) with mild restriction, 2(10%) with moderate restriction, similar to the study of Bashir and Nand [15].

The primary problems with early femoral casting were shortening and angulations of the fracture.[14] In this series, we had malalignment like angulations less than 5 degrees towards varus/valgus or Antero/posterior angulations of 15 (75%) of cases and 3 (15%) cases exist between 5 to 10 degrees, and only 2 (10%) cases more than 10 degree which was similar to the study of Bashir and Nand [15]. Full weight-bearing was possible in 15 (75%) of cases within 8- 12 weeks and rested 5 (25%) of cases within 13- 16weeks. The mean duration of full weight-bearing was 10.07 weeks. Ruhullah and colleagues [16] reported a mean duration of weight-bearing 10 weeks. Lee *et al*., [17] treated 63

children by the early spica method. Shortening of >2 cm was the commonest complication of early (within 7 days of injury) spica casting in 43% (22/51) of the patients [17]. Patients with unacceptable shortening after spica casting required cast removal and traction for 2 weeks before recasting. In this series, 16 (80%) of the patients had leg length inequality by <1 cm and 3 (15%) of the patients had leg length inequality by <2 cm and 1(5%) of the patients had leg length inequality by >2cm. In the study of Alzubady and Almuhana [11] 30% of patients had leg length inequality, Muzzafar and colleagues [8] reported 20% of patients developed leg length inequality.

The final outcome of the study, according to Flynn's scoring criteria, demonstrated that (80%) of the patients had excellent outcomes, 2 (10%) patients had a successful outcomes, and 2(10%) had poor results. Similar findings reported in Dulgeroglu *et al*., [17] were excellent in 35 cases (72%), good in 9 patients (19%), and moderate in 4 cases (9%). Sidiqui *et al*., [18] compared the results of femur shaft fractures in children with skin traction followed by spica cast versus early spica cast. The results of their treatment were satisfactory in 81% and unsatisfactory in 19% of cases. Three (14.3%) patients developed more than 2 cm shortening and two (9.5%) patients' had unacceptable angulation; the latter was corrected by wedging the cast. All the patients had a shortening between 8-18 mm (average 10.5 mm). Although they found satisfactory results treated with an early spica cast and good results in children treated with skin traction followed by a spica cast. There were fewer complications in this group, and the hospital stay was prolonged, making the treatment costs. Singh and Associates [19] suggested that early closed reduction and placement of hip spica cast is a safe and reliable treatment option. As per review literature, many authors did not find much difference in the outcome between early spica cast and skin traction followed by spica cast in conservative treatment of femur shaft fracture in children [20]. Al-Mohrij and colleagues [21], in their study conducted in Saudi Arabia, concluded that hip spica casting without traction for femoral fracture in children aged 0-4 years produces excellent results and continues to be the treatment of choice. The major advantage of early spica is a short hospital stay allowing cost containment and rapid return to the child's everyday environment. However, frequent follow-up with repeated radiographs is required in the first 3 weeks to detect shortening and displacement of the fracture in the spica cast.

CONCLUSIONS

Early hip spica cast may be the preferred method for the treatment of femoral shaft fractures in children aged 2 to 12 years.

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