Original Article

Primary Hip Spica Versus External Fixator for Management of Femoral Diaphysealfractures in Children

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Objective: To compare the results of primary hip spica (HS) to external fixation (EF) for treatment of femoral shaft fractures in children aged 5-10 years in terms of Hospital stay, time to union and Radiological assessment.

Methods: Forty children of age 5-10 years with fracture shaft of femur were divided into two groups; Hip Spica (HS) and External Fixator (EF) which were treated with hip spica & external fixator respectively. Both groups were compared for duration of hospital stay, time for radiological union, radiological assessment, functional outcome, complications and parent/children satisfaction.

Results: Mean duration of hospital stay in Group HS was 1.5 days and in Group EF was 2.0 days ($p < 0.03$). Time for radiological union was lower in Group HS compared to Group EF (8-weeks vs 10-weeks; $p<0.05$) regarding angular deformity at fracture site, in group HS 80% children got sagittal plane angular deformity at fracture site with mean of 16.5° and in group EF 65% children had 11.3° of sagittal plane angular deformity ($p>0.05$). In group HS 70% and in group EF 60% of children had coronal plane angular deformity with the mean of 11° &10° respectively($p>0.05$). There was no rotational deformity in any case of both groups. Patient satisfaction was higher in group EF.

Conclusions: External fixation is better than primary hip spica for treatment of close femoral shaft fracture in children 5-10 years of age because it is associated with lesser complications and it is better tolerated.

Keywords: femoral shaft fracture, external fixator, primary hip spica.

Introduction

Femoral diaphyseal (shaft) fracture is a common pediatric injury with reported incidence of 28 per 100,000 children per year.[1] They usually result from violent injuries especially road traffic accidents and falls from height.[2] Treatment is aimed to allow healing in an acceptable position with minimal disruption to the muscles and joints there by restore the child to normal functions as quickly and effectively as possible.

Non-operative methods of treatment include immediate spica cast application, traction and delayed spica cast immobilization. Operative methods include external fixation, flexible intramedullary nailing and plating.[3] Choice of treatment depends upon age of patient, fracture type (open vs closed), parent's acceptance and surgeon preference.[4] In recent times, surgical intervention has been gaining popularity over nonsurgical treatment as it shortens hospital stay, allows early mobility and has better patient and parent satisfaction.[5] The main disadvantages of external fixation are over growth, pin tract infections and increased risk of refracture.[6] Contrary to this, non-surgical treatment in the form of spica casting is still preferred treatment option because it is cost effective in school going children.[7] The purpose of present study is to compare the results of non-operative (primary hip spica) to operative (external fixation) treatment of femoral shaft fractures in children aged 5-10 years.

Method

This prospective, descriptive, randomized study carried out in the Department of Orthopaedic Surgery, Services Hospital, Lahore from October 2012 to December 2013.Informed consent was obtained from the parents of all participants. Forty patients of age 5-10 years with closed femoral shaft fractures were randomly assigned numbers. Patient with odd numbers were placed in HS group those with even number were placed in EF group. Group HS, children were treated with hip spica, and in Group EF they were treated with external fixator. Children with open femoral fractures, metaphyseal or epiphyseal extension of femoral shaft fractures, segmental femoral shaft fracture and multiple fractures and children with head, chest and abdominal injuries were excluded from study. The deomgraphic profile of the patient is shown in (**Table-1)**.

Table-1: Demographic profile.

		Group- HS	Group-EF
	Age (Years)	7.6±1.6	7.1±1.2
	Gender (M/F)	15/7	13/5
Mode of injury n(%)	Fall from height	14 (35.0%)	17 (42.5%)
	Road traffic accident	4 (10.0%)	5 (12.5%)
Fractures level distribution n(%)	Middle third	11 (27.5%)	13 (32.5%)
	Proximal third	4 (10.0%)	3 (7.55%)
	Distal third	4 (10.0%)	5 (12.5%)
Type of fractured n(%)	Transverse fracture	14 (35.0%)	17 (42.5%)
	Oblique	2 (5.0%)	3 4.5%)
	Spriral fracture	1 (2.5%)	3 (7.5%)
Side of fractured n (%)	Right	14 (35.0%)	9 (22.5%)
	Left	9 (22.5%)	8 (20.0%)

History and examination was done once patients were stabilized as per ATLS protocols. Pediatric size Thomas Splint was applied in emergency settings before specific management. AP and lateral X rays of injured limb with joint above and below the injury were obtained. In Group HS, half hip spica was applied under sedation and analgesia with injured limb in 45°flexion at hip and 70° flexion at knee. The hip was abducted at 30°. However for more proximal fracture the abduction was increased up to 45°. EF group was fixed in AO external fixator with Shanz screw size 4mm. Two proximal and two distal Shanz screws were inserted under Image Intensifier after General Anesthesia. In two cases the fracture side had to be opened due to soft tissue inter position. In both groups, post-operative radiographs were done and children were discharged from the hospital with instructions of either plaster care or external fixator care 24-48 hours after the procedure. All children were followed at three weekly intervals with fresh radiographs of affected femur. The first follow up visit however was after 02 weeks. At each follow up children/ parents problems were discussed, any complication detected, radiograph assessed and further instruction were given. In Group HS, spica cast was removed when on radiographs fracture callus achieved the density of normal cortical bone. In Group EF, full weight bearing was started with the help of stick when there was sufficient callus at fracture site. When radio density of callus approached that of normal cortical bone the fixator was removed and regular dressing was done for pin tracts. Hospital stay, time for radiological union, radiological assessment, functional outcome, complications and parent/children acceptance for these methods of treatment was noted. Data was analyzed using SPSS V20.0, Inc, USA. Frequency and percentage were calculated for categorical data while mean and standard deviation was calculated for numerical data. Student t test and chi square/fisher exact tests were used to test the difference between groups.

Pit Falls of the Treatment:

Both method of treatment had some pitfalls e.g patients in HS group had to face problem of mobility in the bed and nursing care. There was difficulty in changing clothes in this group. Parent had to face soaking of spica with urine and foul smell which was mainly because of wetting by urine and excreta. Another pitfall of this statement was the breakage of spica at hip level. Four patients developed loss of reduction at fracture side in HS group and were re manipulated at two weeks follow up.

In EF group mobility and nursing care was relatively a minor issue then HS group. These patients had more issues regarding pain and fever which was mainly because of pin tract infection. Which was superficial and didn't progress to osteomyelitis. **(Table -2)**

Table-2: Pitfall of the two treatment.

Problem n(%)	Group- HS	Group-EF
Restricted mobility in bed	20 (100%)	6 (30%)
Inability to walk	20 (100%)	12 (60%)
Fever	2 (10%)	4 (20%)
Difficulty in cloth changing.	20 (100%)	0 (0%)
Plaster soakage with excreta	4 (20%)	0 (0%)
Problem in taking bath / cleaning	20 (100%)	20 (100%)
Inability to attend school	20 100%)	20 (100%)
Sinability to carry out indoor playing activities.	20 (100%)	10 (50%)
Plaster problem (sores, impingement)	6 (30%)	0 (0%)
Pin tract infection / discharge	0 (0%)	2 (10%)
Loss of reduction	4 (20%)	0 (0%)
Pain due to stiffness (Hip, Knee) or pin tract	5 (25%)	10 (50%)

Results

Mean duration of hospital stay in Group HS was 1.5 days and in Group EF was 2.0 days ($P < 0.03$). Time for radiological union was lower in Group HS, with mean 8 weeks (Range 7-9 Weeks) as compared to mean 10 weeks (Range 9-11 weeks) in Group EF ($P < 0.05$).

In Group HS 80% children got sagittal plane angular deformity at fracture site with mean of 16.5° and in Group EF 65% children had 11.3° of sagittal plane angular deformity (P > 0.05). In Group HS 70% and in Group EF 60% of children had coronal plane angular deformity with the mean of 11° and 10° respectively (P > 0.05). In EF group 02 cases out of 20 cases developed pin tract infection but none of them reach to the state of osteomyelitis.

Fortunately, they responded very well to the one week course of antibiotics. In HS group 04 patients developed loss of reduction that was mainly because of loosening of hip spica at hip joint level. Among these 04 cases 03 cases had fracture at the proximal third of shaft of femur and 01 at the mid shaft level. All these patients were remanipulated at 02 weeks follow up. There was no case of refracture. Functionally, children in both groups regained full range of hip and knee movements within three weeks of removal of fixation. Clinically there was no rotational deformity in any case in both groups.

Discussion

Ideal treatment of femoral shaft fractures in children as defined by Staheli and Sheridan[8] is the method that controls length and alignment, prevents excessive elevation or compression of extremity, comfortable to handle for children as well as for parents and results in minimal psychological effects. Spica casting is associated with psychosocial impacts for children and their parents as has been reported by Hughes et al.[9] External fixation is a good alternative for the operative management of femoral shaft fractures in children. It provides good stability, is less invasive and allows early mobilization.

Time of radiological union was more in external fixator (70 days) than spica cast (56 days). Feld et al managed femoral shaft fracture with external fixator with average time of 67 days.[10] In Group HS 80% children got sagittal plane angular deformity at fracture site with mean of 16.5° and in Group EF 65% children had 11.3° of sagittal plane angular deformity (P > 0.05). In Group HS 70% and in Group EF 60% of children had coronal plane angular deformity with the mean of 11° and 10° respectively (P > 0.05). Wallace ME et al in their series concluded that in children under 13 years of age mal union of as much as 25° in any plane will be remolded enough to give normal alignment of the joint surfaces.[5] They received 28 children with unilateral middle third fracture of femoral shaft who had an angular deformity after union of 10°-26°. At average follow up of 45 months. The average correction was 85% of the initial deformity. They found that 74% correction occurred at physis and only 26% at fracture site.[11]

Commonest complications reported in previous studies include delayed union, refracture, pin tract infection and malunion.[12] With recent advances in material and design of external fixator pin along with use of sharp drill bits, hydroxyapatite-coated pins, early use of antibiotics for pin sit infection has resulted decrease incidence of complications.[13] In our study, there was no case of refracture. Rate of refracture cited in literature is 1%-22%.[14]

It was because we progressively destabilized the fixator from 2 weeks postoperative time onwards which resulted in gradual load transfer to the bone from the fixator. Conversely, pin tract infection was major complication involving 10% of cases and cause of pain at pin site and fever in some patients in external fixator group. However, it was superficial infection in all cases and healed with proper pin care and oral antibiotics (amoxicillin). Kirschenbaum et al in a series of 10 femoral fractures reported, a 30% incidence of pin tract sepsis.[15] Tolo mentioned a 50% incidence of pin tract sepsis using Hafman fixator.[16] Gregory et al reported a 34 tibial and femoral shaft fracture in children treated with external fixator. They reported pin site infection rate of 10.3%.[17]

Main complication in spica group were plaster sores in 30%, loss of fixation. Remanipulation and change of cast was done in 4(20%) cases. Plaster sores usually occur due to improperly molded plaster edges or soakage and wetting of cast with excreta. Plaster soakage and softening causes loss of fixation that require remanipulation and change of cast. It was noted in our study that out of 04 patients which resulted in loss of reduction 03 had fracture in the proximal third of femoral shaft and one in the middle showing that maintaining the reduction with spica is much difficult in proximal femoral shaft fractures. After remanipulation the spica cast was applied in more flexion and abduction at hip that is 45°.

Regarding parent satisfaction in Group HS, majority of the parents were not satisfied with the method of treatment because it was difficult for them to properly take care of the children, especially cleaning the child, cleaning clothes and turning the child in bed. They were also annoyed with the smell coming out of plaster cast soaked with urine. Plaster sore were also troublesome, requiring repeated dressing. Finally, parents were concerned about limping gait pattern in

majority of Group HS children. However all these patients regain nearly normal range of motion at hip and knee during the follow up period of 06 months and there was no residual limp in any case.

Conclusion

We conclude that for children of 5-10 years age, external fixation is better treatment option for close femoral shaft fracture as it is associated with lesser complications and it is better tolerated.

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