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Research Article

HIP SPICA CASTS IN THE MANAGEMENT OF FEMORAL SHAFT FRACTURES IN YOUNG CHILDREN

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Abstract:

Shaft fractures occur frequently in young children leading to hospital admission. Most of them are treated using closed non-operative methods. Rich blood supply of the shaft allows rapid healing and favorable outcome.

Objective: *To compare primary hip spica cast versus secondary hip spica cast in management of fracture shaft of femur in children less than 6 years of age in terms of frequency of limb length discrepancy.*

Study Design: *Randomized control trial*

Settings: *Orthopedic department of Allied and DHQ hospital FSD.*

Duration of Study: *May, 2018 to Dec, 2018*

Subjects & Methods: *All children of age 6 months to 6 years with femoral shaft fracture were admitted and randomly divided into two groups. One was treated with primary hip spica cast done within 24 hours and other was treated with secondary hip spica cast after initial traction. After six weeks of follow-up limb length discrepancy was assessed.*

Results: *Total 310 cases fulfilling the inclusion/exclusion criteria were enrolled. Mean and standard deviation for age was calculated as 36.43±16.117 months. Gender distribution showed 81.6% (n=253) male and 18.4% (n=57) females. Limb shortening was seen in 9% (n=28) patients including 5.2% (n=8) from the primary hip spica group and 12.9% (n=20) from the secondary hip spica group.*

Conclusion: *The outcome of primary hip spica cast in femoral shaft fractures in children is better with low frequency of limb length discrepancy as compared to secondary hip spica cast, and it can be used in population as an effective method.*

Key Word: *Shaft fractures, Pediatric fractures, Primary Spica Cast, Secondary Hip Spica, Limb Length discrepancy, limb shortening.*

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INTRODUCTION:

The annual rate of femoral shaft fractures in children is about 20 per 100,000 with boys having higher rates of fracture than girls.[1] Most of them occur in the middle third of the shaft of femur and are closed injuries which traditionally have been treated by closed reduction methods. Few degrees of angular deformity and few centimetres of shortening are acceptable in children according to their age group, because children have tremendous re-modelling potential.[2]

A variety of methods are used for the treatment of paediatric diaphyseal femur fractures. These include immediate spica casting; traction followed by spica casting; external fixators used with large open skin and muscular wound; osteosynthesis with plate and internal fixation with intramedullary rod or flexible intramedullary nailing. Choice of treatment depends upon the age of patient, anatomical site of fracture, pattern of fracture and preference of the surgeon. Traditionally, children with fracture below 6 years of age are treated with immediate hip spica and adolescent children are treated with operative methods for open reduction. [3,4]

Most commonly some form of initial traction followed by spica cast immobilization has treated shaft of femur fractures in children. Since reported in 1959 by Dameron and Thompson, interest in use of immediate or early spica cast has been increased.[5] The advantages of this approach are short hospital stay and low cost of treatment, avoidance of complications of traction and surgical fixation and rapid return of patient to their families.[6]

Primary hip spica cast can lead limb shortening (4%), malunion, skin breakage, foot drop and even compartment syndrome, so preliminary skeletal traction is recommended before primary spica cast application.[7] Jauquier N, et al reported limb length discrepancy of more than 2 cm in 3% cases after immediate hip spica cast while limb shortening was seen in only 10% cases if hip spica cast was applied after initial traction.[8] But in another study by Rush JK showed that after applying initial traction as in the case of secondary hip spica, the femur length shortening more than 2cm was reported in only 2% cases but with longer hospital stay and increase in the cost of treatment.[9]

As studies comparing primary and secondary hip spica cast in the management of paediatric femoral shaft fracture show variable results regarding limb length discrepancy, this study was designed to compare limb length discrepancy after primary versus secondary hip

spica cast in the management of fracture shaft of femur in children less than 6 years of age. Spica cast application is a simple, effective and definite method of treatment with minimal complications and have acceptable results in paediatric age group. It remains universally used in all aged groups, but is especially suited for children under the age of 6 years, when there is still significant potential for remodeling and the weight of child and cast allow for easy carrying and transfer.

MATERIALS AND METHODS:

This randomized control trial was conducted in the orthopedic department of Allied and DHQ hospital Faisalabad after approval from the hospital ethical review committee May, 2018 to Dec, 2018. All children of both gender of age 6 months to 6 years admitted through emergency department with closed and type 1 open fracture shaft of femur diagnosed on radiographs reported by an independent consultant were included in the study after informed consent was taken from parents/guardian. Femur shaft fracture was defined as the break in the continuity of bone (shaft of femur) seen on radiograph. Primary hip spica was defined as hip spica cast applied immediately after stabilizing the patient in emergency within 24 hours while secondary hip spica was defined hip spica cast applied after initial traction of 2 weeks. Limb length discrepancy was defined as shortening of leg more than 2cm confirmed by radiographs at 6 weeks follow-up.

Children with multiple fractures on seen on radiograph, with head or abdominal injury, or with pathological fracture confirmed by history and radiography were excluded from the study. Sample size of 310 patients (155 in each group) calculated using WHO sample size calculator, with expected percentage of limb length discrepancy for two populations $P_1 = 3\%$, $P_2 = 10\%$ ⁽⁸⁾, 80% power of study and 5% level of significance.

Sample collection done through non-probability consecutive sampling and were randomly divided into two groups using computer generated random number tables: primary hip spica cast patients in group A, and secondary hip spica cast patients in Group B. All patients were managed initially following advance trauma life support (ATLS) protocol in the emergency; later after consultant opinion hip spica was applied under sedation. After application of spica cast, immediately post-operative radiographs of femur were taken in emergency department and and was reviewed by the consultant for any shortening or overlap. After application of the spica cast each patient was called after 6 weeks for assessment for

limb length discrepancy. Age, gender, and side of limb fracture along with address and contact numbers were taken to ensure follow up. All the information was recorded and maintained using a predesigned performa.

All the collected data was entered and analysed on SPSS 17. Mean and standard deviation was calculated for quantitative variables like age. Frequency and percentage was calculated for all qualitative variables like gender and limb length discrepancy. Chi-square test was used to compare limb length discrepancy between two groups. Effect modifiers like age and gender were controlled by stratification. Post-stratification chi-square test was applied. P-value less than and equal to 0.05 was taken as significant.

RESULTS:

A total of 310 cases fulfilling the inclusion/exclusion criteria were enrolled to determine the outcome of primary Spica cast and secondary hip spica cast in femoral shaft fractures in children in terms of frequency of shortening.

Age of patients included in the study whole patients including from 6 to 72 months with a mean \pm SD of 36.43 ± 16.12 months. In the primary hips spica group ranged from 6 to 72 months with a mean \pm SD of 34.86 ± 17.17 months while age range in secondary hip spica group ranged from 10 to 71 months with a mean \pm SD of 38 ± 14.88 months. (Table No. 1).

Table: 1 Descriptive statistics of age in months (n=310)

Group	N	Min	Max	M Mean	Std. deviation
Pri hip spica	155	6	72	34.86	17.168
Sec hip spica	155	10	71	38.00	14.884
Total	310	16	72	36.43	16.117

About 8% (n=25) were between 6 months to 1 year, 52.9% (n=164) were between 1-3 years and 39% (n=121) were between 4-6 years. (Table No. 2)

Table: 2 Age distribution (n=310)

Age Group	Pri hip spica cast (%)	Sec hip spica cast (%)	Total (%)	p-value
< 1 year	18 (11.6%)	7 (4.5%)	25 (8.1%)	0.069
1-3 year	80 (51.6%)	84 (54.2%)	164 (52.9%)	
4-6 year	57 (36.8%)	64 (41.3%)	121 (39.0%)	
Total	155	155	310	

About 81.6% (n=253) of the patients in our study were male and 18.4% (n=57) were females. (Table No.3)

Table: 3 Gender distributions (n=310)

Gender	Primary hip Spica Cast(%)	Secondary Hip Spica Cast(%)	Total	p-value
Male	122 (78.7%)	131 (84.5%)	253 (81.6%)	0.187
Fesmale	33 (21.3%)	24 (15.5%)	57 (18.4%)	
Total	155	155	310	

A total of 32.6% (n=101) patients had right-sided fracture of femur while 67.4% (n=209) had left sided fracture. (Table no. 4)

Table: 4: Fracture side distribution (n=310)

Side of injury	Primary hip Spica Cast	Secondary Hip Spica Cast	Total	p-value
Right	44 (28.4%)	57 (36.8%)	101 (32.6%)	0.115
Left	111 (71.6%)	98 (63.2%)	209 (67.4%)	
Total	155	155	310	

Frequency of limb shortening was recorded in 9% (n=28) of patients including 5.2% (n=8) from the primary hip spica group and 12.9% (n=20) from the secondary hip spica group. It showed p value of 0.017, which was statistically significant. (Table No.5)

Effect modifiers including age, gender and side of injury were stratified and post stratification chi-square was applied shown in table 6, 7 and 8.

Table: 5 Frequency of shortening of length (n=310)

Limb length Discrepancy	Group		Total	p-value
	Primary hip Spica Cast (%)	Secondary Hip Spica Cast (%)		
Yes	8 (5.2%)	20 (12.9%)	28 (9%)	0.017
No	147 (94.8%)	135 (87.1%)	282 (91%)	
Total	155	155	310	

Table: 6 Frequency of shortening of length related with age groups

Age Distribution	Limb Length Discrepancy	Primary hip spica cast (%)	Secondary hip spica cast (%)	Total	P-Value
< 1 year	Yes	0 0.0%	2 (28.6%)	2	0.018
	No	18 100.0%	5 (71.4%)	23	
	Total	18	7	25	
1-3 year	Yes	5 6.2%	9 (10.7%)	14	0.306
	No	75 93.8%	75 (89.3%)	150	
	Total	80	84	164	
4-6 year	Yes	3 5.3%	9 (14.1%)	12	0.106
	No	54 94.7%	55 (85.9%)	109	
	Total	57	64	121	

Table: 7 Frequency of shortening of length related with gender

Gender	Limb Length Discrepancy	Group		Total	P-Value
		Primary Hip Spica Cast (%)	Secondary Hip Spica Cast (%)		
Male	Yes	7 (5.7%)	15 (11.5%)	22	0.107
	No	115 (94.3%)	116 (88.5%)	231	
	Total	122	131	253	
Female	Yes	1 (3.0%)	5 (20.8%)	6	0.031
	No	32 (97.0%)	19 (79.2%)	51	
	Total	33	24	57	

Table: 8 Frequency of shortening of length related with side of injury

Side Of Injury	Limb Length Discrepancy	Group		Total	P-Value
		Primary Hip Spica Cast (%)	Secondary Hip Spica Cast (%)		
Right	Yes	3 (6.8)	6 (10.5)	9	0.517
	No	41 (93.2)	51 (89.5)	92	
	Total	44	57	101	
Left	Yes	5 (4.5)	14 (14.3)	19	0.014
	No	106 (95.5)	84 (85.7)	190	
	Total	111	98	209	

DISCUSSION:

Femur fractures specially of the shaft are very common in children accounting for about 8% of all pediatric long bone fractures. Such fractures usually result from direct violence in most of the cases. Low energy traumas like fall from small heights or sports related injuries in younger children and high-energy trauma like road traffic accidents in older children are the common modes of injury in such fractures. There is some degree of consensus for the management of these fractures below 6 years of age exists but opinion still differs for this age group.

Fixation of such fractures by any surgical means certainly requires more than two anesthesia and two operations along with the risk of surgical complications. Management in a hip spica cast primarily or after an initial short period of traction requires a single short general or regional anesthesia. Virtually, any method of treatment will be successful if healing of the fracture and resumption of usual activities define success because children fractures are doomed to heal.

We planned this study with the view that there are variable results in previous studies regarding use of primary spica cast and secondary hip spica cast in fracture shaft of femur in children in terms of shortening of the limb so reason to research was to confirm the results. Spica cast application can be adopted as effective method.

In this study, out of a total of 310 cases, frequency of shortening of limb length was recorded in 9% (n=28) patients that included 5.2% (n=8) from the primary hip spica group and 12.9% (n=20) from the secondary hip spica group.

Since reported in 1959 by Dameron and Thompson, interest in use of immediate or early spica cast has

been increased.[5] The advantages of this approach include shorter hospital stay and cost of treatment, avoidance of complications of traction and surgical fixation and rapid return of patient to their families.[6] A study showed limb length discrepancy more than 2cm in 3% cases having immediate hip spica cast while those having hip spica cast after initial traction had 10% cases. While at the same time another study showed that after applying initial traction as in the case of secondary hip spica the femur length shortening more than 2cm was reported in only 2% cases but it had increase in length of hospital stay and cost of treatment. Primary hip spica cast has a tendency towards shortening (4%) and malunion, skin breakdown, foot drop or even compartment syndrome, so preliminary skeletal traction was recommended before spica cast application. [8]

Another study in which all patients had Spica cast application within 24 hours of presentation has variable results in terms of shortening. Shortening of 6.8% versus 4.8% was seen in emergency department versus operating room department respectively. [3]

Tripathi RB, et al reported that management of femoral shaft fractures in children by primary hip spica cast without initial traction is a safe, simple, reliable and cost-effective method of treatment and recorded overall satisfactory results in about 91% cases. They concluded that primary hip spica cast method of treatment for pediatric femoral shaft fractures is safe, easily applicable and cost effective provided due care is adopted during application of the cast and strict regular follow up is done in initial phase. It can be easily practiced even at district hospital level by medical officers with short period of training at any orthopedic center. [10]

R.P Singh et al in a study at Nepal Medical College Kathmandu in 220 cases had satisfactory outcome in more than 90% cases in a follow up period of 2-5 yrs. [11] P Chaudhary et al in a study at Bir Hospital Kathmandu (2004-2006 AD) in 45 patients; had excellent result in almost 100% cases with very few minor complications.[12]

However, after the results the current study revealed i.e. the outcome of primary hip spica cast and secondary hip spica cast in femoral shaft fractures in children in terms of frequency of shortening in our population, we are of the view that primary hip spica

cast method of treatment for pediatric femoral shaft fractures is safe, easily applicable and cost effective and suitable for our population with satisfactory frequency of union while low frequency of shortening of limb length.

CONCLUSION:

Primary hip spica cast in femoral shaft fractures in children has a better outcome with less frequency of limb length discrepancy and more satisfaction rate when compared to secondary hip spica cast and it should be recommended to other consultants.

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