

# Limb Shortening in Femoral Shaft Fractures Treated by Early Spica Cast in Children

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## ABSTRACT

**Objective:** To determine the frequency of limb shortening in diaphyseal femur fractures in children treated by early spica cast.

**Methods:** This cross-sectional study was conducted at the department of Orthopedics, Jinnah Postgraduate medical centre, Karachi. 100 children with femur fracture were enrolled in the study by non probability consecutive sampling. The inclusion criteria were patients having shaft fractures within a week duration, aged between 1 to 08 years of either gender.

**Results:** Mean age of the patients was  $4.25 \pm 2.29$  years. Boys were predominantly higher (68%) as compared to girls (32%). Mean limb length at cast removal was  $1.39 \pm 0.62$  cm. Frequency of limb shortening was found in 35% patients only.

**Conclusion:** In early age due to compensatory overgrowth and potential of remodeling process, early Hip Spica Cast technique is a safe, attractive and cost-effective method and provides excellent results in terms of union and shortening.

**Keywords:** Limb shortening, Hip Spica Cast, Children, Diaphyseal Femur Fractures.

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## INTRODUCTION:

The incidence of femoral fractures in children comprises 20 per 100,000 yearly in the United States and Europe<sup>1</sup>. Diaphyseal fractures are the most common pediatric fracture of the femur, accounting for up to 62 percent of all femur fractures<sup>2</sup>.

Diaphyseal fractures of femur in children usually occur due to falls, sporting injuries and road traffic accidents. The variety of treatment options are there in the management of pediatric diaphyseal femur fracture including immediate spica casting, traction followed by

spica casting, external fixators, internal fixation with intramedullary rush pins and flexible intramedullary nails. The treatment choice is dependent of child age, anatomical site and pattern of fracture.<sup>3</sup>

The use of surgical methods is limited by the complications causing morbidity such as infections and physical injuries<sup>4,6</sup>. Traction and casting has historically been very successful in managing fractures of the femoral shaft in children. However, ever since the article by Irani and colleagues in 1976 describing immediate spica casting in infants, surgeons have been aware that it is possible, and probably desirable, to avoid the lengthy hospital stay associated with traction and casting<sup>7</sup>. Because of compensatory over growth and potential of remodeling process in children, early hip spica cast technique for simple diaphyseal fracture of femur is a safe, attractive, cost effective procedure with short hospital stay.<sup>8,9</sup>

## METHODS:

This cross-sectional study was conducted at the department of Orthopedics, Jinnah postgraduate medical centre, Karachi.

100 children with femur fracture were enrolled in the study by non probability

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consecutive sampling. The inclusion criteria were patients having shaft fractures within a week duration, aged between 1 to 08 years of either gender, ASA physical status I and II. Patients with pathologic, subtrochanteric, supracondylar and polytrauma patient, with multiple injuries, and children with Vascular injury on Doppler Ultrasound, metabolic bone disease and neuromuscular disorder were excluded from the study.

This study was conducted after the approval from ethical committee of Jinnah Postgraduate Medical Center, Karachi. Eligible children presenting to Accident & Emergency department of JPMC, Karachi were enrolled in the study.

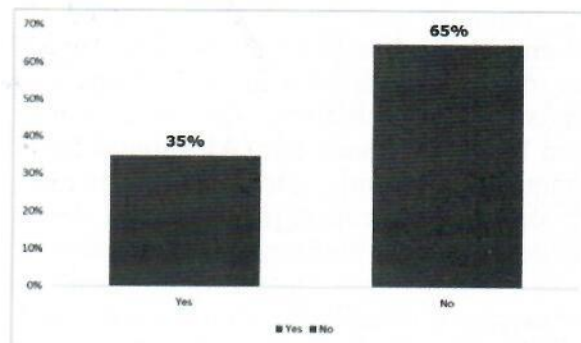
Without fluoroscopy or C-arm, gentle closed reduction using spica table and traction to restore the general alignment and length of the injured limb to match exactly the non-injured limb. The injured limb was kept straight at hip and knee with the ankle in neutral position, it was abducted to 30-40° and a one and half hip spica with Plaster of Paris (Gypsona- BSN Medical 4',6') was applied from just below the nipples to foot keeping the limb in neutral rotation throughout the whole procedure. Post-spica X-ray AP and Lateral view was taken for acceptability of reduction. (varus/valgus 30 degrees, antero posterior angulation 30 degrees and shortening 15 mm for children up to 2 years of age while 15 degrees varus/valgus, 20 degrees antero posterior angulation and 20 mm shortening for children 3 to 8 years old.). Any angulation in excess of these amounts was corrected by wedging the cast at the fracture site. For initial three weeks, the patients were advised to attend OPD at a weekly intervals and then at fortnightly till removal of spica and then monthly for a minimum of four months. After the spica cast was taken off and the fracture, a clinical examination was performed to evaluate limb length discrepancy. Limb length shortening of >1.5 cms was taken as shortening.

## RESULTS:

Mean age of the patients was  $4.25 \pm 2.29$  years. Majority of the patients (78%) were presented with  $\leq 6$  years of age. Males were predominantly higher (68%) as compared to females (32%). Mean weight of the patients was  $19.35 \pm 8.10$  Kg. Majority of the patients (73%)

**Table I:** Age and Weight of Patient n=100

Variables	Mean±SD	Minimum	Maximum
Age (years)	4.25±2.29	2	9
Weight	19.35±8.10	12.5	32



**Figure I:** Limb Shortening

**Table II:** Comparison of Age with Limb Length of Cast Removal n=100

Age (in Years)	Limb length Discrepancy		Total	P-value
	Yes	No		
<6	27(34.6)	51(65.4)	78(100)	0.879
>6	8(36.4)	14(63.6)	22(100)	
Total	35(35)	65(65)	100(100)	

were presented with  $\leq 20$  Kg of weight. Mean duration of fracture was  $3.21 \pm 1.12$  weeks. Majority of the patients (81%) were presented with  $\leq 4$  weeks of duration. There were 53% patients with ASA status I and 47% patients with ASA status II. Mean limb length at cast removal was  $1.39 \pm 0.62$  cm. Frequency of limb shortening was found in 35% patients only.

## DISCUSSION:

In this study, mean limb length at cast removal was  $1.39 \pm 0.62$  cm. Frequency of limb shortening was found in 35% patients only. In a recent study, a shortening of 0.32 cm to 2cm noted in 7(31%) cases with femoral shaft fracture at the time of cast removal<sup>8</sup>. In another study a shortening of 0.5 cm to 2.5 cm noted in 15 out of 21 (71.42%) children at the time of cast removal<sup>9</sup>.

In our study, diaphyseal fractures of the femur are common, accounting 15% of all fractures in children. Recently three studies have been published in local literature<sup>10,11</sup>. Hip spica

casting has been widely used, safe, simple and effective method for pediatric diaphyseal femur fractures. It is an economical procedure with short hospital stay, but the problem of shortening and deformity of limbs can occur with early spica cast treatment<sup>12</sup>. The results of this study has been compared with the results of other studies.

In study done by Ali et al included 100 children with diaphyseal femur fractures of aged 2 years to 12 years divided in two groups each comprising of 50 children. The children were treated by two methods i-e, (A) Thomas Splint technique and (B) early spica cast and the result were compared in terms of fracture union, degree of angulation and shortening, and found no significant difference. This study revealed 0.36 cm of average shortening in group B at one year<sup>13</sup>.

An other study conducted on 47 children consist of 26 boys and 21 girls, with average age ranged from 18 months to 6 years. This study divided the children according to telescope test in to two groups. Children with telescope test results of more than 30 mm were included in group 1. Children with telescope test results of 30 mm or less were included in group 2. The limb shortening was observed in 16 (88.9%) children in group 1 and 7 (24.1%) children in group 2. This study revealed a significantly higher number ( $p < 0.001$ ) of children with shortening in group 1<sup>14</sup>.

A systemic review conducted on 788 abstracts, accepted fracture shortening decreased from 16 mm to 18 mm before age ten years to 12 mm to 14 mm after puberty. Over all limb shortening noticed in 1.9% of patients with femur fracture<sup>15</sup>.

A comparative study conducted at LUMHS; observed the average limb shortening after removal of spica cast. In group A, fracture treated with spica cast showed (6.66%) patients developed discrepancy of more than 2 cm. In group B, fracture treated with traction followed by spica cast showed (6.66%) patients developed discrepancy of more than 2.2 cm<sup>16</sup>.

A study conduct at Singapore reported no shortening in earlier follow ups but at final follow-up, limb length discrepancy was noted in 14 (22%) of the patients, with discrepancy of 1.5 cm<sup>17</sup>.

Limb shortening remains an issue with spica casting used for diaphyseal femur fractures.

Some shortening may be desirable to accommodate for overgrowth<sup>18</sup>. Comprehensive review of articles highlighted that along with shortening, children treated with hip spica have difficulty with personal hygiene, transportation problem, difficult to accept spica or in tolerate it<sup>19</sup>.

## CONCLUSION:

In early age due to compensatory overgrowth and potential of remodeling process, early Hip Spica Cast technique is a safe, attractive and cost-effective method and provides excellent results in terms of union and shortening.

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