

## Original Research Article

# A comparative study of the management of pediatric femoral shaft fractures treated conservatively with traction or spica casting

Akash Shakya<sup>1\*</sup>, Ghanshyam Kakadiya<sup>2</sup>, Yogesh Soni<sup>2</sup>, Vinayak Garje<sup>1</sup>

<sup>1</sup>Department of Orthopaedics, ESIC and PGIMSR, Andheri (E), Mumbai, Maharashtra, India

<sup>2</sup>Department of Orthopaedics, TNMC and Nair Hospital, Mumbai, Maharashtra, India

**Received:** 10 April 2020

**Revised:** 09 May 2020

**Accepted:** 12 May 2020

### \*Correspondence:

Dr. Akash Shakya,

E-mail: [akashshakya.gmc@gmail.com](mailto:akashshakya.gmc@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Femoral shaft fractures, though not very common, are of major concern for orthopedic surgeons. the management for infants and older children is generally universal but the young patients still offer a management dilemma.

**Methods:** We present a prospective study conducted at a tertiary care hospital in India of 37 children between 1 year and 6 years to compare the two conservative methods most commonly used i.e. spica casting and traction application.

**Results:** We found that though both the methods are similar in the time for union, shortening was better controlled with traction and angulation with spica casting. The frequency of other complications was also comparable.

**Conclusions:** Both the methods give acceptable results and given the feasibility of such procedures in developing countries, both may be recommended. However, the choice thus depends on the surgeon treating the patient keeping in mind the drawbacks and limitations of each.

**Keywords:** Pediatric, Femur, Casting, Traction, Management

## INTRODUCTION

Femoral shaft fractures in the paediatric age group, though forming a minute part of the total paediatric fractures, are some of the most frequently necessitating admission. These in turn place a lot of burden on the already burdened healthcare system in the developing countries.<sup>1,2</sup> Paediatric concerns guide the management and is broadly as per the age of the patient along with other concerns like the anatomy of fracture, any neurovascular involvement and the availability and logistical issues. In the infants, the most commonly used procedure is a modified Pavlov's splint or Gallow's traction.<sup>3</sup> The management for the age group between 1 year and 6 years had traditionally been non-surgical for these patients with methods like spica casting, traction application like Thomas' traction or

Hamilton-Russell skin traction. With the advent of modern surgical procedures, these have somewhat faded in comparison specially in the older age groups i.e. after 6 years, but they still remain the most favored entity of management in setups with limited resources specially in the developing countries.

Femoral fractures form approximately 2% of the total paediatric fractures.<sup>1,2</sup> with the male to female ratio being approximately 2.6. They follow a bimodal distribution with the first peak at approximately at 3 years and the second at the adolescent age.<sup>1</sup> The causes vary accordingly with the younger age group suffering most commonly due to trauma as well as non-accidental trauma like abuse. Whereas in the older age group accidental trauma like road traffic accidents are the most common cause.<sup>1-3</sup>

The aim of the study was to determine the advantages and disadvantages of the two most commonly used conservative methods i.e. spica casting and traction in the age group of 1 year to 6 years.

## METHODS

After taking approval from the institutional ethics committee a prospective randomized controlled study was done during June 2016 to May 2018 at our tertiary care centre, TNMC and Nair Hospital, Mumbai. A total of 43 patients in the age group of 18 months to 6 years were treated at our hospital and were randomized to two groups to receive either spica casting and traction. For spica patient were given a hip spica as soon as possible. For the other group, one pound of weight for 1 week of traction per year of age were given over Thomas splint.<sup>4</sup>

### Inclusion criteria

Patients of age group 1-6 years, closed and unilateral injury, Midshaft femur fractures and trauma less than 1 week old were included.

### Exclusion criteria

Patients with neuromuscular pathology or a pathological fracture, polytrauma, neurovascular deficit, systemic disease and patient not giving consent were excluded.

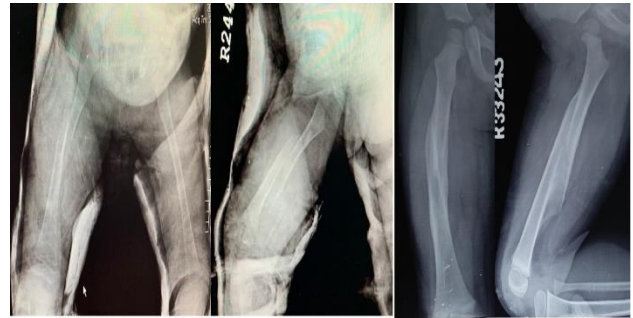
The patients were given the said treatment and admitted for observation for 2 days. All necessary precautions were taken while casting and traction application including neurovascular status and skin status. The patients were discharged after taking a radiograph on the second day. At the time of discharge, a shortening of up to 2cm, a coronal malalignment of fifteen degrees and sagittal malalignment of 25 degrees were considered acceptable.<sup>4</sup> The patients were followed up at 1 week, 2 weeks, 4 weeks and 6 weeks post trauma and radiographs taken (Figure 1 and 2).



**Figure 1: Anteroposterior and lateral radiographs on day 1 and 6 weeks in a patient treated with traction over Thomas splint.**

The traction or cast was removed before 6 weeks and mobilization started gradually. The patient was kept non-weight bearing for an additional 3 weeks. The patients

were again followed up at 5 months and 6 months for the final assessment. The patients were assessed at the follow ups for alignment, shortening and other complications that might have arisen. The data was recorded at every visit and the results were evaluated with the unpaired T tests and Fischer exact test. A p value <0.05 was considered significant.



**Figure 2: Anteroposterior and lateral radiographs on day 1 and 6 weeks in a patient treated with spica casting.**

## RESULTS

Of the 43 patients, 6 were lost to follow up over a period of 6 months. Rest of the patients, i.e. 37 were followed up for a minimum of 6 months with the mean being 7.3 months. Of these, 19 patients were treated with spica casting and 18 were treated with traction over Thomas' splint. The average age was 4.1 years (range 12 months to 59 months). Of these, 21 (56.7%) were males and 16 (43.3%) females. 20 (54.1%) had fractured their right femur and 17(45.9%) had fractured their left femur. 21 (56.7%) had a transverse fracture configuration, 10 (27.0%) had an oblique, 4 (10.8%) had a spiral and 2 (5.4%) had a comminuted configuration. The mechanism of injury was a fall in 25 (67.6%) patients, a road traffic accident in 10 (27.0%) patients and others in 2 (5.4%) patients (Table 2).

The patients were kept in the treatment modality till radiological union with spica cast for an average 5.7 weeks (range 3.9 weeks to 7 weeks) and in traction for an average 6.1 weeks (range 4.3 weeks to 7.6 weeks). The bony union took an average 5.9 weeks (3.9 weeks to 7.6 weeks). There was no instance of non-union or neurovascular complications in either group. There was 1 (5.3%) incident of pressure sores in spica group and 2 (11.1%) in traction group, the difference of which was not significant. There was 1 incident of varus malunion (20 degrees) in spica group and 2 in traction group (18 and 24 degrees). There was 1 patient with procurvatum deformity in traction group and none in spica group. There was no valgus or recurvatum malunion. The average limb length shortening in the spica group was 1.1 cm (range 1.9-0.7 cm) and in the traction group 0.8 cm (1.5-0.7 cm) there was significant difference between the two (p=0.0001) (Table 3).

**Table 1: Demographic and clinical characteristics of the patients.**

Characteristic	Spica casting (n=19)	Traction (n=18)	Total
Age (years)	3.9±1.8	4.3±1.3	4.1±2.2
Follow up (months)	8.0±0.8	7.1±1.1	7.3±1.7
Gender (male/female)	10/9	11/7	21/16
Side involved (right/left)	12/7	8/10	20/17
Fracture configuration	Transverse	10	11
	Oblique	5	10
	Spiral	3	4
	Comminuted	1	2
Mechanism of injury	Fall	12	13
	Road traffic accident	6	10
	Others	1	2

**Table 2: Results among the two groups of spica application and traction application.**

Variables	Spica	Traction	P value
Union/days of cast	5.7±0.9	6.1±1.1	0.2331*
Shortening	1.1±0.2	0.8±0.21	0.0001*
Angulation	12.2±2.3	13.6±1.1	0.0251*
Skin complication	1/19	2/18	0.6039#

\*unpaired T test, #Fischer's exact test.

## DISCUSSION

Femoral shaft fractures though not very common has a significant expenditure on health resources as almost all of the patients require admission for the fear of the disastrous complications and also for an acceptable treatment. Falls are the most common cause of fractures in the age group of <6 years.<sup>5</sup> Similar data has been obtained in our study. The male to female ratio in our study is 1.3:1 which is lower than the 2.5 obtained previously.<sup>6,7</sup> This could be explained by the rising history of falls and of road traffic accidents in the young girls. These could also represent the non-accidental injuries.

The management of these fractures has always been evolving and the existing practices challenged frequently. Although conservative methods have remained the gold standard for the infant population, the older age groups have seen a turn towards surgical options which include the use of elastic nails, plates and intramedullary nails as well as external fixators. A number of studies have been undertaken for evaluating the efficacies of each. Though most of them have proven benefits in form of early mobilization they do not necessarily translate to an eventually better long-term result. Adding to it the specific complications like nail irritation and loss of rotational alignment in elastic nailing, implant failure and periprosthetic fractures in plates and neck of femur fractures and septic arthritis in intramedullary nails, the surgical options do not always have the desired results. A second surgery for implant removal and a higher cost of

procedure also make these options somewhat unattractive. Even external fixation has pin track complications frequently. Keeping the above factors in mind there has been a shift to non-surgical methods in this population.

Previous studies have evaluated the effect of the conservative methods and found no significant differences in the alignment of fracture reduction. However, there has been an increased incidence of limb length shortening in those treated with casting. We too achieved a significant difference between the two with traction leading to lesser shortening. There was a reported incidence of 18% of shortening of more than 2.5 cm in the patients treated with spica casting.<sup>8</sup> Similar results were obtained with shortening of >2 cm.<sup>9,10</sup> This is similar to the results obtained by others.<sup>11</sup> Thus the surgeon has to keep in mind of this potential complication. This on the other hand can also be helpful as there is usually a growth stimulation post trauma and thus the actual limb length discrepancy is rendered non-significant.

Other complications of conservative methods include loss of reductions, peroneal nerve palsy, pressure sores and potential compartment syndrome. In our study, we had 5.3% incidence of pressure sores in the casting group and 11.1% in the traction group. These can be prevented by proper casting and traction technique and parent education. We also had a significant incidence (1/19) of varus malunion in the spica group and in the traction group (2/18) (p=0.0251). This is contrast to the result obtained by Wang et al.<sup>12</sup> This can be prevented by regular follow up and repeat casting if necessary. Other potential issues are the prolonged immobilization and its complications. Also, the psychosocial effects of prolonged casting/traction have to borne in mind.

From the cost point of view, the conservative methods have appeared to be a better option as the hospitalization is short and also the implant charges are absent. In addition, hospitalization for only a short period of time when the chances of complications are the highest and early discharge has a lesser deteriorating effect on the family life and psychological health of the parents. The

only thing to keep in mind is the necessity for proper follow up.

The study has a few limitations. Firstly, the study is based out of a single institute and thus may not cover the local and regional variations. Secondly, the sample size is limited and a bigger sample size could be helpful in generalizing the results. Thirdly, a cost benefit analysis needs to be done for commenting on the economic feasibility reliably.

## CONCLUSION

Our study demonstrated that spica casting is significantly better in achieving a better control over angulation and traction is better in preventing limb length discrepancy. However, there was no significant difference in the union time and other complications. Also, a shorter hospital stays and lesser apparent costs make the conservative approach an attractive one specially in a developing country with an already overwhelmed healthcare system. Both the conservative techniques have their own pitfalls and hence appropriate precautions are warranted.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

1. Flynn JM, Skaggs D. Femoral shaft fractures. In: Flynn J.M., Skaggs D., Waters P., editors. Rockwood & Wilkins' Fractures in Children. Philadelphia: Wolters Kluwer; 2014: 987-1026.
2. Loder RT, Donnell PW, Feinberg JR. Epidemiology and mechanisms of femur fractures in children. J Pediatr Orthop. 2006;26(5):561-6.
3. John R, Sharma S, Raj GN. Current Concepts in Paediatric Femoral Shaft Fractures. Open Orthop J. 2017;11:353-68.
4. Khoriaty AA, Jones C, Gelfer Y, Trompeter A. The management of paediatric diaphyseal femoral fractures: a modern approach. Strategies Trauma Limb Reconstr. 2016;11(2):87-97.
5. Nafei A, Teichert G, Mikkelsen SS, Hvid I. Femoral shaft fractures in children: an epidemiological study in a Danish urban population, 1977-86. J Pediatr Orthop. 1992;12:499-502.
6. Hinton RY, Lincoln A, Crockett MM, Sponseller P, Smith G. Fractures of the femoral shaft in children. Incidence, mechanism, and sociodemographic risk factors. J Bone Joint Surg Am. 1999;81:500-9.
7. Lee YHD, Lim KBL, Gao GX, Mahadev A, Lam KS, Tan SB, Lee EH. Traction and spica casting for closed femoral shaft fractures in children. J Orthopaedic Surg. 2007;15(1):37-40.
8. Buehler KC, Thompson JD, Sponseller PD, Black BE, Buckley SL, Griffin PP. A prospective study of early spica casting outcomes in the treatment of femoral shaft fractures in children. J Pediatr Orthop. 1995;15:30-5.
9. Martinez AG, Carroll NC, Sarwark JF, Dias LS, Kelikian AS, Sisson GA. Femoral shaft fractures in children treated with early spica cast. J Pediatr Orthop. 1991;11:712-6.
10. Casas J, Moran G, Albinana J. Femoral fractures in children from 4 years to 10 years: conservative treatment. J Pediatr Orthop B. 2001;10:56-62.
11. Rapp M. Femoral shaft fractures in young children (<5 years of age): operative and non-operative treatments in clinical practice. Eur J Trauma Emerg Surg. 2016;42(6):719-24.
12. Wang CN, Feng J, Tang ZHB, Xianhong Y. Femoral Fractures in Infants: A Comparison of Bryant Traction and modified Pavlik Harness. Acta Orthop Belg. 2014;80:63-8.

**Cite this article as:** Shakya A, Kakadiya G, Soni Y, Garje V. A comparative study of the management of pediatric femoral shaft fractures treated conservatively with traction or spica casting. Int J Res Orthop 2020;6:793-6.