

ASSESSMENT OF THE OUTCOME OF EARLY VERSUS DELAYED SPICA CAST IN THE TREATMENT OF CLOSED FEMORAL SHAFT FRACTURE IN CHILDREN**Hamid A Jaff**

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Abstract

This study aimed to assess the results of early versus late spica cast in the treatment of femoral shaft fracture in children.

This is a descriptive study performed at Al-Sulaimaniya Teaching Hospital during the period between June 2009 and October 2010.

Twenty eight patients with a mean age of five years ranged (2-8 years) with closed isolated femoral shaft fractures were included in this study. They were four females and twenty four males. Fifteen patients had left sided fractures while right sided fractures were in thirteen patients. Patients having compound fractures and those with associated injuries were excluded from the study.

Ten patients were treated by skin traction for about 2-3 weeks then hip spica cast was applied. The other 18 patients treated by early spica within 2-5 days. All patients were followed for a period of about 4 months after removal of spica cast.

The study reveals that boys are affected more than girls. The causes of the fracture in this study were 15 cases (53.6%) fall from height; 8 cases (28.6 %) road traffic accident and lastly 5 cases (17.9%) for other causes like direct trauma.

Average duration of skin traction in delayed Spica cast group was 2-3 weeks.

Immediate complications after removal of the spica; patients treated with early spica were 3 cases for side way angulation, 1 case for shortening, while for anterior angulation 1 case. Patients treated with delayed spica following skin traction complicated by anterior angulation was 1 case and side way angulation was 1 case while no case of shortening reported. The patients considered here to have a shortening or angulation are only those having a deformity of more than accepted limits (20 mm shortening, 15 degrees side way angulation and 20 degrees for anterior angulation), but after 10 months of follow up for all of the patients, most of the initially observed complications were corrected to the accepted limits. The shortening which was reported initially overcome by overgrowth and only 0.8 cm length discrepancy was there. For both anterior and side way angulation, they were within the accepted limits.

In early spica, the hospitalization ranged from 2-5 days; while in delayed spica, the hospitalization time ranged from 16-23 days.

It is concluded that little significant difference in late outcome between early and delayed spica cast application regarding the complications of treatment and functional outcome, but early spica decreased the hospitalization time and the cost of treatment significantly.

Introduction

Femoral shaft fractures are frequent in children. Almost all unite rapidly, regardless of type or location of fracture, or treatment method chosen. The traditional method of treatment for fracture of the femoral shaft in a child has been to use traction in hospital for four to six weeks until the fracture healed. The time in hospital can be reduced by

applying a hip spica after about 10 days when the fracture is sticky¹.

A more dramatic way of reducing the period in hospital is to apply early spica and allow the entire care to be undertaken at home with regular review at a clinic².

The femoral shaft is surrounded by powerful muscles, which cause severe displacement of femoral shaft fractures by

these muscles pull and this requires powerful traction for their correction³.

Generally, spica cast treatment is an effective method of treatment for closed femoral shaft fracture in children. Spica cast may be applied early or delayed if applied after a period of traction and observation by x-ray³.

Non-operative treatment is the gold standard for children under 8 years because of the excellent bone union and the remodeling qualities. However, the main complication of femoral shaft fracture is the leg length discrepancy resulting from the overgrowth of the broken limb. This problem is reported by many authors whichever non-operative treatment is used and must be taken into account when choosing the therapeutic method⁴.

Patients and methods

This study was done at Al-Sulaimaniya Teaching Hospital during the period between June 2009 and October 2010.

Twenty eight patients with closed femoral shaft fracture were included in this study. All these patients were admitted to our hospital. full history and thorough examination was conducted for all.

General examination was performed to exclude associated injuries e.g. head, chest, abdomen and pelvic injuries that take a priority in the treatment.

The neurovascular component of the injured limb was then carefully assessed and compared to the contra-lateral side.

Anteroposterior and lateral views of X-rays of the injured femur were then taken as well as x-rays of pelvis and ipsilateral knee and contra lateral femur.

Treatment:

Skin traction was applied to the injured limb in the emergency unit; the patient was then admitted to the orthopedic ward after a general reassessment.

Type of specific treatment:

All patients were treated by spica cast-provided that they had no other associated injuries and they were managed by either

early or delayed reduction and spica cast application. The decision was taken randomly.

Early spica cast:

Eighteen patients were treated by this method, their age ranged between (2-8) years. Early spica cast was done within the first three days after admission to the hospital. The reduction and spica cast for all was done under anesthesia.

Initial procedures:

When the child is first seen, analgesia is given and standard radiographs are obtained, Hamilton-Russell skin traction is used until the spica can be applied, at the next convenient theatre time, or when the child has fully recovered from associated injuries as mild head or abdominal injury.

Application of the spica:

Under general anesthesia, the child is placed on a hip spica prop. An assistant holds the ankle in one hand and the calf in the other, a long legs cast is applied with the knee flexed 30 degrees, the plaster being molded to correct angulations. When the plaster has set, longitudinal traction is applied to the calf section of the cast to correct any shortening, but no attempt is made to achieve an end-to-end reduction of displaced transverse fractures. The position is checked with an image intensifier and when this is satisfactory the leg cast is extended into one-and-a-half hip spica, or, for infants, a double spica, with the hip flexed so that heel and buttock are level. Up to 20 mm of shortening, 20 degrees of anterior angulations, and 15 degrees of valgus angulations was accepted, but no posterior angulations or varus. Rotation is judged clinically; the foot should be in slight laterally rotated. The plaster under the sole of the foot is removed so that plantar flexion against it cannot cause shortening and the spica is then reinforced. Any unacceptable angulations can be corrected by wedging the spica and plastered it again. Correction of rotation is achieved by placing the foot in a slightly out-turned

position, with an additional 10 degrees lateral rotation.

After-care:

The child is allowed to return home when fit, usually the following day. The parents are shown how to care for the child.

The child is reviewed one week after the injury. If radiographs are satisfactory, the child is then reviewed three or five weeks later for removal of the plaster. During the period of study, children were followed up in the outpatient clinic. When clinical and radiographic union is present, mobilization is started. Review continues until good clinical recovery has been achieved.

Delayed spica after traction: group two
Ten patients were treated by this method, their age range between (2-8) years. skin traction is continued with daily observation of the traction and weekly X-ray examination to avoid distraction.

After 2-3 weeks when the fracture feels sticky and slight callus appear on the X-ray, a hip spica is done without the need for general anesthesia. The plaster under the sole of the foot is removed so that plantar flexion against it cannot cause shortening.

Radiological examination was done after spica application to check the fracture alignment then every two weeks until fracture union occur.

All patients were allowed to walk with a hip spica one week before the time of spica removal.

After four to six weeks, the spica is removed when there were clinical and radiological signs of union. After removal of spica, all these patients were carefully examined for status of walking, length discrepancy, deformity and angulation.

All these patients were followed every month at first then every three months for a period of six to ten months to check any deformity, length discrepancy or other complications.

Results

Twenty eight patients were followed for a period of ten to fourteen months. Age ranged from two to eight years, the mean age was 5 years. The sex distribution of the patients was 4 females and 24 males. 15 cases were left sided fractures while right side fractures were in 13 patients only (Table I).

Table I: The side of fracture & gender distribution.

Side	Male	Female	Total
Left	13	2	15
Right	11	2	13
Total	24	4	28

The causes of fracture shaft femur in children in this study were 15 cases (53.6%) for fall from height; 8 cases (28.6%) for road traffic accident and lastly 5 cases (17.8%) for other causes like direct trauma or assault. As shown in Table II.

Table II: Causes of fracture

Causes	No.	%
Road traffic accident	8	28.6%
Fall from height	15	53.6%
Others	5	17.8%
Total	28	100%

Table III shows the types of fracture shaft femur in children. There were 13 cases (46.4%) with spiral fracture, 11 cases (39.3%) with oblique fracture and 4 cases (14.3%) with transverse fracture.

Table III: Types of fracture shaft femur in children.

Types of fracture	No. of patients	Percentage
Spiral	13	46.4%
Oblique	11	39.3%
Transverse	4	14.3%
Total	28	100%

The sites of fracture shaft femur in children, according to which third of the femur is affected were 17 cases (60.72%) for the middle third, 7 cases (25%) for the proximal third and 4 cases (14.28%) for the distal third.

Table IV: Sites of fracture shaft femur in children.

Sites of fracture	No. of patients	Percentage
Proximal third	7	25%
Middle third	17	60.72%
Distal third	4	14.28%
Total	28	100%

Table V showed different types of specific treatment and the number of the patients for each type. Early spica treatment for 18 patients (64.98%), the age of these patients ranged from 2-8 years, the mean age of them was 4 years. In this study, 10 patients (35.72%) of the cases were treated with spica after skin traction, their age range was 2-8 years also, and the mean age of them was 4.5 years.

Table V: Methods of treatment.

Type of treatment	No. of cases	%
Early spica	18	64.28%
Delayed spica	10	35.72%
Total	28	100%

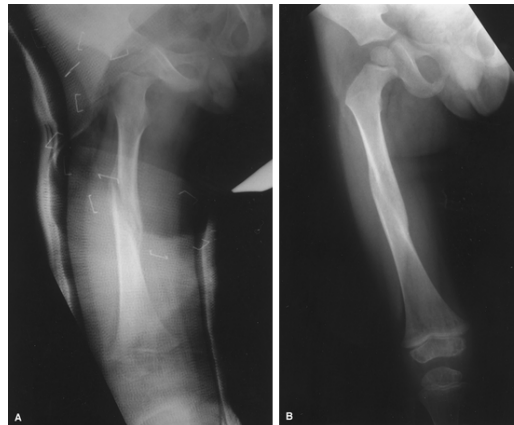
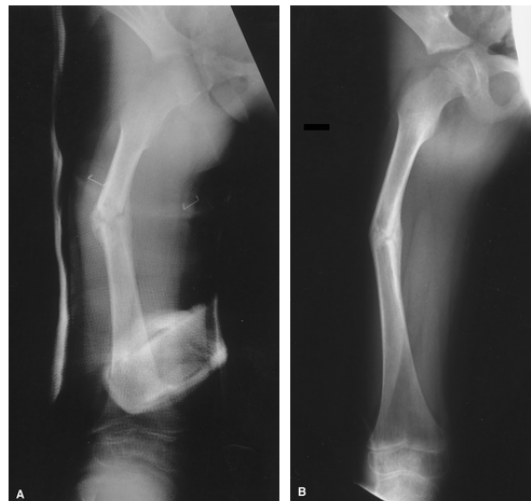
Initial observation of complications in the patients immediately after removal of the spica; patients treated with early spica were 3 cases had side way angulation, 1 case for shortening, while for anterior angulation was 1 case. Patients treated with delayed spica following skin traction complicated by anterior angulation was 1 case and side way angulation was 1 case while no case of shortening reported. In both groups no case of stiffness has been reported. The patients considered here to have a shortening or angulation are only those having a deformity of more than accepted limits (20 mm shortening, 15 degrees side way angulation and 20 degrees for anterior angulation) as shown in Table VI.

Table VI: Initial observation of complications.

Complications	Early spica	Delayed spica
Anterior angulation	1	1
Side way angulation	3	1
shortening	1	0
Total	5	3

After 10 months of follow-up for all the patients, most of the initially observed complications were corrected to the accepted limits. The shortening which reported initially overcome by overgrowth and only 0.8 cm length discrepancy was there. For both anterior and side way angulation, they were within the accepted limits. All these patients had a good status of walking and good range of movement in knee joint. In this study there was no case of delayed or non-union, no case of abnormal rotation and no case of knee stiffness.

Hospitalization time: In early spica, the hospitalization ranged from 2-5 days; while in delayed spica, the hospitalization time ranged from 16-23 days. Figures 1 & 2 showed the difference in outcome.

Figure 1: X-ray of a patient treated by early spica cast.**Figure 2: X-ray of a patient treated by delayed spica**

Discussion

This study analyses the results of two different non-operative treatment of femoral shaft fracture in children under 8 years. The first one, consisting of skin traction. The second corresponds to an immediate reduction, under general anesthesia, and early hip spica casting.

This paper compares between early and delayed spica cast application, the indication, advantages and disadvantages, complications, limitation of acceptable reduction, and remodeling and overgrowth phenomenon. The management of femoral shaft fractures in children is controversial.

Management based on age has been suggested with conservative management for children less than 5 years, surgery for more than 11 years. Treatment for 6-11 age groups is controversial.

More recently trend is to treat such fractures surgically by plating or nailing.

Surgical fixation of femoral fractures is not without risk of complications.

Complications such as infection, growth plate disturbances and implant failure have been reported. Spica cast has been used successfully for paediatric femur fractures since ages. It is much more simple and economical than operative methods⁵.

The protocol of treatment used here is simple and effective. Children without other injuries spent a total of five days roles in hospital, and this time is reduced to three days or less when the spica is removed in the outpatient clinic. Early spica treatment is also successful for children with associated mild head or abdominal injuries although they spend more time in hospital⁵.

The policy of admitting all children to hospital for reduction of the fracture under general anesthesia allows a short period of observation for other injuries and provides time for the parents to be instructed in the care of their child in a spica. The duration of admission for uncomplicated cases is only one to two days.

At late review, leg-length discrepancy was uncommon and insignificant, the rarity of leg-length discrepancy at late review supports previous reports that growth stimulation is directly proportional to the amount of shortening⁶.

Results of our study are comparable with other similar studies.

Sugi and cole have treated 191 children upto 10 years of age by spica cast. They included only middle third fractures for fear of malunion. This study applied spica at all levels of shaft and did not find any difference in rate of malunion. They accepted up to 20 degree of anterior angulation, 20 mm of shortening and 15 degree valgus angulation, but no posterior angulation or varus. At removal of spica, shortening was seen in all of their patients.

Here, we do not have long term follow-up so long term results cannot be compared.

Jamaluddin in his prospective study treated 24 children aged 3 months to 10 years having fracture shaft of femur by early spica cast. He applied cast under sedation

Angulation was within acceptable limits in all his patients, we observed the same in our study⁶.

The results of this study allow the definition of criteria for acceptable positions of the fracture during various stages of treatment. At all ages, and at all stages of treatment, anterior angulations of less than 20 degrees and angulations of valgus less than 15 degrees are acceptable⁷. Angulations in excess of these amounts or in the opposite directions should be corrected by wedging the spica. Correct rotation is achieved by placing the foot in a slightly out-turned position, with an additional 10 degrees lateral rotation for proximal fractures. Acceptable shortening is related both to the age of the child and the stage of treatment⁸. At one week review and at the time of fracture union the maximum allowable shortening was about 20 mm at all ages. Greater overlap may be corrected spontaneously,

but would hardly be acceptable to the parents at the time of spica removal.

It is important to ensure that the parents understand the natural history of recovery. They are often disturbed by the radiographic appearance of a transverse fracture with bayonet apposition and by obvious clinical shortening when the spica is removed⁹. It is necessary to explain that the children are usually stiff and uncomfortable when the spica is removed and will not use the leg for several days, and that even when they start to stand and walk they will have a severe limp due to weakness and shortening. They are told that the child's gait will improve over a few months and the leg-length discrepancy will correct over a few years¹⁰.

The protocol for the early spica treatment of femoral fractures has substantially reduced the cost of treatment and has freed beds for use by other children. It is also in accordance with the general trend towards shorter hospital admissions for children¹¹.

Patients treated with delayed spica casting will suffer a psychological trauma by prolonged hospitalization and separation from family and friends, this will be less by early spica and the child returned to the home and family to be in his normal environment¹².

Conclusion

Fracture shaft femur in children treated by early spica cast or skin traction followed by spica cast proved to obtain good results in spite of the presence of some degrees of shortening or angulation, which prove to be limited at the end of follow-up. While early spica had the superiority over delayed spica cast, in less hospitalization time which will allow more free beds for other patients.

The cost effect is much better in treating the patients with early spica cast for the family and the hospital since delayed spica needs 3-4 times more than hospitalization time needed for early spica.

Recommendations

1. Early spica casting as a treatment of choice for closed fracture shaft femur in children between 2-8 years.
2. A long period of follow-up for all patients treated with spica cast whether early or delayed in order to overcome complications.
3. The parents should be informed that the radiographic picture is deceiving and the end result is expected to be better than operative treatment.

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