ISSN: 2321-8819 (Online) 2348-7186 (Print) Impact Factor: 1.498 Vol. 8, Issue 1, January, 2020

Paediatric Femur Fractures and Long Leg Splinting

Usama Amin*[1], Muhammad Asim[2], Iqra Nawaz[3], Amina Zubair[4]
[*1] **Corresponding author:** House Officer, Bahawal Victoria Hospital, Bahawalpur, 00923322336259, usama.a.chauhan@gmail.com
[2] House Officer, Bahawal Victoria Hospital, Bahawalpur, 00923007919596, asimdanwar@yahoo.com
[3] Woman Medical Officer, BHU 23/SP, Pakpattan, 00923069899002, iqaran6150@gmail.com
[4] Pharmacology department, PMDC, 00923228893218, dr.aminazubair92@gmail.com

Abstract

Background

Spica casting is frequently used for treating the paediatric femur fractures encounter injuries. However, patients may find Spica casting expensive and burdensome. Long leg splint is the other alternate possible treatment.

Methods

The children between the age of 6 months to 5 years having a femoral shaft fracture were treated with a long leg splint extended over the waist and it resembles with patient undergoing treatment with a Spica cast.

Results

At the time of healing, the alignment with respect to coronal angulation is considerably better in Spica cast group as compared to splint group.

Keyword

Femur fracture, Paediatric femur fracture, Spica cast, Spica casting

Introduction

Paediatric femur fracture face numerous injuries. The most frequent treatment for the children between the age of 6 months to 5 years having fracture <2 cm of shortening is Spica Casting (Epps, Molenaar & O'Connor 2006). Effectiveness of this technique has been shown un numerous studies in term union and long-term functional results (Bridgman & Wilson 2004).

It has been observed that a significant burden is placed on the parents by the Spica cast. Routine transportation and hygiene cab be highly difficult for the Spica cast patients; it has been revealed that parents from the families having dual income are required to take off from work for an average of three weeks in order to look after the child (Loder, O'Donnell & Feinberg 2006). Some of the mobility of the patient get reduces by single leg Spica cast whereas double leg Spica cast is connected with hygiene problems, but still remains unwieldly and difficult to look after (Podeszwa, Mooney & Cramer 2004). Moreover, mostly at centres under general anaesthesia Spica cast is applied in operating room, which enhances the cost of healthcare and exposes the patients for other complications connected with anaesthesia (Jaafar et al. 2015).

Long leg splint onto the flank is a possible alternative to Spica cast. The splint can be used easily and quickly in clinic or emergency department instead of operating room. Moreover, as compared to single or double leg Spica cast, it is less cumbersome for the children and parents (Mansour et al. 2010). However, up till now no examination has been conducted to measure the long leg splints effectiveness at improving healing and maintaining reduction of paediatric femur fractures (Wright 2000). The current research is comparing Spica cast and long leg splint for treating 47 paediatric femur fractures between the age of 6 months to 5 years children relating to complications, union rates and radiographic alignment (Leu et al. 2012).

Methods

Patient Selection

All the children between the age of 6 months to 5 years who had been given femoral shaft fracture treatment at a high-Volume Children's Hospital during 01.01.2010 to 31.12.2015 had been pointed out that they were using an electronic data warehouse search. In the hospital these patients are given routine treatment with long leg plaster splint spreading from foot to flank and their first visit to clinic same is applied. It excludes the patients having open fracture, incomplete radiographic image (complete radiographic image is defined as an orthogonal femoral radiograph at the time of injury, the time of initial splinting and at the time of radiographic union) or initial treatment was surgical.

Therefore, every single patient was identified, and they were matched with age (below one year) and the pattern of the patient's fracture who was given treatment at a second-high Volume Children's Hospital at the same time duration. On the other site the patients are given treatment in routine with Spica cast in operating room. One more time, patients with open fracture are excluded initially 69

patients were given surgical treatment or had incomplete radiographic image.

Data Collection

Demographical data of every single patient was included in the research like age, sex at the time of injury and pattern of fracture. The results accumulated includes complications, conversion rate to operative management, splint rate or cast revision, union time and rate of union. The union has been defined as the combination of pain free weightbearing without splint or cast and radiographic union (bridging callous across four cortices on orthogonal radiographs). Union time has been defined as the time from injury until the first visit of patient to the clinic wherein they have shown fracture union as mentioned earlier.

Furthermore, from 3 time points orthogonal femoral films were gathered as:

1. At the time of initial casting of splinting,
2. At the time of presentation, and
3. At the time of union.

Measurements for every set of films coronal angulation, sagittal angulationcoronal translation (defined as distance translated/width of femur at level of fracture) and shortening were made. Further the conversion to absolute value was made for analysis.

Statistics

Student's t-test was used for comparing quantitative variable with a significance set at <0.05.Fisher's exact test was used for comparing categorical data. JMP Pro v13 software was used for completing the statistical analysis.

Results

Demographics

100 femur fracture patients were given treatment with long leg splinting. Out of 100 patients, 40 patients having insufficient clinical data or radiographs were excluded. Further exclusion of 10 patients was for having lack of appropriate match control. Totally 50 patients were given treatment with long leg splint and Spica cast was applied for treating match controls available for final analysis.

The patient's average age in the group of splint was 2.43 years whereas 2.65 years was the average age in group of Spica cast (p=0.96). Splint group had 82% male patients whereas Spica cast had 86% (p=0.69). 94% patients had spiral fracture and 6% had transverse fracture in each group of 112.

The time difference is significant in the groups of Spica cast and splint until the treatment is given. After injury, the application of splint in clinic takes an average of 12.03 day whereas the application of Spica cast in operating room take 0.81 days, normally soon after presentation (p<0.0001). Demographical data is contained in Table 1.

Table 1: Demographics

Characteristics	Splint (n=25)	Cast (n=25)	p value
Gender (male %)	82%	86%	0.69
Age (years)	2.43	2.65	0.96
Spiral (%)	94%	94%	0.49
Transverse (%)	6%	6%	0.66
Time to treatment (days)	12.03	0.81	< 0.01

Outcomes

Relating to alignment parameters (coronal angulation, sagittal angulation,coronal translation, shortening), no significant difference was found between Spica cast or splint group on presentation. It was found that the Spica cast had considerably better alignment as compared to splint after initial decrease and stabilisation relating to coronal angulation (p=0.34) coronal translation (p=0.45) and sagittal place angulation (p=0.24) but there was no difference relating to shortening (p=0.11). However, at the healing time, the Spica cast group alignment was significantly better as compared to splint group with respect to coronal angulation (p<0.05); no significant difference was found in coronal translation, shortening or sagittal plane angulation.

Due to unacceptable alignment in splint, one patient was converted from splint group to Spica cast whereas one Spica cast patient due to unacceptable alignment was transferred to open reduction internal fixation. Otherwise patients from Spica and Splint group were uniting with the modalities of actual treatment. Time difference was not significant with respect to union between the groups of Spica and Splint (45.11 days V 39.14, p=0.15). The summarised results are shown in Table 2.

Table 2: Outcomes				
Alignment		Splint (n=25)	Cast (n=25)	p-value
Presentation	Saggital Angulation (deg)	7.98	6.89	0.24
	Coronal Angulation (deg)	8.23	4.51	0.34
	Shortening (mm)	8.33	11.14	0.11
	Coronal Translation (%)	31%	21%	0.45
Post-splinting v/s casting	Saggital Angulation (deg)	7.34	3.98	<0.05
	Coronal Angulation (deg)	8.15	3.76	<0.05
	Shortening (mm)	8.25	10.58	0.22
	Coronal Translation (%)	28%	9%	<0.05
Union	Saggital Angulation (deg)	8.56	8.12	0.53
	Coronal Angulation (deg)	8.24	5.22	<0.05
	Shortening (mm)	8.79	11.42	0.13
	Coronal Translation (%)	30%	17%	043
Secondary Procedure		5%	5%	0.11
Time to Union (days)		45.11	39.14	0.15

Discussion

Presently, care standard for femoral shaft fractures in patients between the age of 6 months to 5 years with <2cm of shortening is Spica casting. This method of treatment has been identified as an effective with increased union rate and reduced significant malunion rate at final healing time. Moreover, Spica cast is connected with low cost as compared to traction or operative fixation of the fractures (Kocher et al. 2009).

Spica cast is still not a perfect treatment modality. For instance, it is indicated in previous research works that Spica cast patients had significant issues relating to mobility and need proper care from parents (Flynn & Schwend 2004). Parents were forced to take off from work for 3 weeks average in order to look after the child getting treatment with Spica cast. Somehow these issues have been improved with single leg cast than the double leg cast but still it is significant. Further so-called improvement "walking casts" may let the child to mobilise himself during the process of healing but is likely to break if it is not properly reinforced (Infante et al. 2000). Moreover, it has been shown that Spica cast have comparatively increase skin breakdown rate because of challenges of padding the cast properly and later keep them dry (Ferguson & Nicol 2000). Finally, normally the application of Spica cast is done in operating room under general anaesthesia and it cost to patient approx. $15,982. There is proof that Spica cast can be applied in emergency department of the centres having proper staff and sources, but this strategy is not adopted universally (Cassinelli, Young & Vogt 2005).

Long leg splint is an effective alternate treatment for paediatric femur fractures that may evade some care issues and cost connected with Spica cast. For our knowledge this research is the first which is giving comparison of radiographic results of long leg splint and Spica cast for the fractures.

It has been identified that fracture alignment is improved by Spica cast at the time of initial treatment comparing with splint. Spica cast has outperformed splint in relation to coronal angulation, suggest that in cast there is some loss reduction with time; moreover, the exact difference in coronal angulation among the groups, 8.6 degrees v 5.3 degrees, advances a question with regard to significance of difference whether it is clinical? The groups have no difference relating to requirement of converting to alternative treatment, time to union or union rate.

The suggestion of these findings is that long leg splint may be good alternate of Spica cast for treating paediatric femur fractures. This technique may be beneficial especially in hospitals and regions were anaesthesia, resources and space of operating room is limited. There are numerous flaws in the research. Spica cast and splint cohort were collected from different centres perhaps presenting a confounding variable. Moreover, the research did not record the assessment of patient reported results. Therefore, the study has not commented on that during the process of healing splint made patient care easy. The possibility is there that the long leg splint give reduced stability to fracture site as compared to Spica cast, which may result in more discomfort to patient before to union. For instance, in infants there are some proof that femur fracture treatment by pavlik harness may result in high pain while healing through treatment of Spica cast. More research is required to determine the effects of long leg splint on comfort of patient and ease of care.

Reference:

Bridgman, S & Wilson, R 2004, 'Epidemiology of femoral fractures in children in the West Midlands region of England 1991 to 2001', *J Bone Joint Surg Br*, vol 86, pp. 1152-1157.

Cassinelli, E, Young, B & Vogt, M 2005, 'Spica cast application in the emergency room for select pediatric femur fractures', *J Orthop Trauma*, vol 19, no. 10, pp. 709-716.

Epps, H, Molenaar, E & O'Connor, DP 2006, 'Immediate single-leg spica 257 cast for pediatric femoral diaphysis fractures', *J Pediatr Orthop*, vol 26, no. 4, pp. 491-496.

Ferguson, J & Nicol, R 2000, 'Early spica treatment of pediatric femoral shaft fractures', *235 J Pediatr Orthop*, vol 20, no. 2, pp. 189-192.

Flynn, J & Schwend, R 2004, 'Management of pediatric femoral shaft fractures', *J Am Acad Orthop Surg*, vol 12, no. 5, pp. 347-359.

Infante, A, Albert, M, Jennings, W & JT, L 2000, 'Immediate hip spica casting for femur fractures in pediatric patients. A review of 175 patients', *Clin Orthop Relat Res*, vol 376, pp. 106-12.

Jaafar, S, Sobh, A, Legakis, J, Thomas, R, Buhler, K & ET, J 2015, 'Four weeks in a single-leg weight-bearing hip spica cast is sufficient treatment for isolated femoral shaft fractures in children aged 1 to 3 years', *J Pediatr Orthop*.

Kocher, M, Sink, E, Blasier RD, LSMCSDMTSJWW3GMKMHR, Turkelson, C, Wies, J, Sluka, P & Hitchcock, K 2009, 'Treatment of pediatric diaphyseal femur fractures', *J Am Acad Orthop Surg*, vol 17, no. 11, pp. 718-25.

Leu, D, Sargent, M, Ain, M, Leet, A, Tis, J & Sponseller, P 2012, 'Spica casting for pediatric femoral fractures: a prospective, randomized controlled study of single-leg versus double leg spica casts', *J Bone Joint Surg Am*, vol 18, 94, no. 14, pp. 1259-64.

Loder, R, O'Donnell, P & Feinberg, J 2006, 'Epidemiology and mechanisms of femur fractures in children', *J Pediatr Orthop*, vol 26, no. 5, pp. 561-566.

Mansour, A, Wilmoth, J, Mansour, A, Lovejoy, S, Mencio, G & Martus, J 2010, 'Immediate spica casting of pediatric femoral fractures in the operative room versus the emergency department: comparison of reduction, complications and hospital charges', *J Pediatr Orthop*, vol 30, no. 8, pp. 813-7.

Podeszwa, D, Mooney, J & Cramer, K 2004, 'Comparison of Pavlik harness application and immediate spica casting for femur fractures in infants', *J Pediatr Orthop*, vol 24, no. 5, pp. 460-462.

Wright, J 2000, 'The treatment of femoral shaft fractures in children: a systematic overview and critical appraisal of the literature', *Can J Surg*, vol 43, no. 3, pp. 180-189.