IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 8 Ver. 13 (August. 2018), PP 12-16
www.iosrjournals.org

A prospective study of conservative management of femoral shaft fractures in paediatric patients upto 12 years age

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Abstract: *Femoral fractures are among common injuries in the paediatric age group treated by an orthopaedic surgeon. In the last two decades there was an increased interest in the operative treatment of paediatric fractures. Controversy persists regarding the age between 0 to 12 years[3] So we performed a study to find out whether conservative management is justified in paediatric patients with femoral shaft fractures or not. This was a prospective interventional study in which all children between 0-12 years of age with diaphyseal fractures of femur admitted in department of orthopaedics, RIMS hospital, Imphal- were included in the study. The study was conducted from September 2014 to August 2016. The aim of our study was to evaluate the functional outcome after traction and hip spica application in diaphyseal femoral fractures between 0 to 12 years. In our study a total of 30 cases were included and the final outcome was excellent in 20 cases, satisfactory in 9 cases and there was one patient had poor outcome.*

Keyword- *Diaphyseal fracture, Flynn's criteria , Hip spica casting,*

Date of Submission: 15-08-2018 Date Of Acceptance: 03-09-2018

I. Introduction

Femoral fractures are among common injuries in the paediatric age group. These fractures typically occur either in early childhood when weak woven bone is changing to the stronger lamellar bone or during adolescence when children are subject to high-energy trauma from motor vehicle accidents or from sports.[1] Bimodal distribution peaks at 2 and 17 years of age. Boys have higher rate of fracture than girls at all ages. Femoral shaft fractures represent approximately 1.6% of all bony injuries in children.[2]

In the last two decades there was an increased interest in the operative treatment of paediatric fractures. There is a little disagreement concerning the treatment of long bone fractures in adolescents older than 12 years (locked intramedullary nailing). Controversy persists regarding the age between 0 to 12 years, with several available options: immediate spika casting, traction followed by hip spica, intramedullary nailing, external fixation, flexible stable intramedullary nails and plate fixation. Whatever the method of treatment, the goals should be to stabilise the fracture, to maintain length and alignment, to promote bone healing, and to minimise the morbidity and complications for the child and his/her family.[3] So we performed a study to find out whether conservative management is justified in paediatric patients with femoral shaft fractures or not. The aim of our study was to evaluate the functional outcome after traction and hip spica application in diaphyseal femoral fractures between 0 to 12 years.

II. Materials And Methods:-

This was a prospective interventional study in which all children between 0-12 years of age irrespective of sex with diaphyseal fractures of femur admitted in department of orthopaedics, RIMS hospital, Imphal- meeting the inclusion and the exclusion criteria (as given below) were included in the study(Fig 1). The study was conducted from September 2014 to August 2016.

Inclusion criteria

1. Patients between 0-12 years
2. Diaphyseal fractures
3. Closed fractures
4. Patients where follow up of 6 months is possible
5. Fresh cases admitting within 1 week of injury

Exclusion criteria:
1. Metaphyseal fractures
2. Open fractures
3. Pathological fractures
4. Fractures with head injury

Fig 1: Diaphyseal fracture shaft of femur

III. Results And Observations: -

In our study a total of 30 cases which satisfy the inclusion criteria were included. No patients were lost to follow-up. Results of our study were assessed based on Flynn's criteria (TABLE 1). In our study 15 (50%) of the patients were 0-5 years, 13 (43.3%) were 5-10 years and 2 (6.7%) were 10 to 12 years age group with the average age being 6 years. There were 20 (66.7%) boys and 10 (33.3%) girls in the present study. Male to female ratio was 2:1. In our study RTA was the most common mode of injury accounting for 11 (40%) cases, self fall accounted for 11 (36.7%) cases and fall from height accounted for 7 (23.3%) of the cases. In our study, 18 (60%) patients had right sided fracture and remaining 12 (40%) had left sided fractures. In our study, transverse fractures accounted for 16 (53.3%) cases, communited fractures 2 (6.7%), oblique fractures 9 (30%), spiral fractures 3 (10%) and there were no segmental fractures. Fractures involving the middle 1/3rd accounted for 18 (60%) cases, proximal $1/3^{rd}$ 7 cases (23.3%) and distal $1/3^{rd}$ 5 cases (16.7%). In our study union was achieved in <3 months in 23 (76.7%) of the patients and 3 – 4.5 months in 6 (20%). Average time to union was 11.5 weeks. After 24 weeks 90% (27 patients) had full range of movement (Fig 2), 6.7% (2 patients) had mild restriction of movement and 3.3% (1 patient) had moderate restriction of movement. The average time of full weight bearing was 11.5 weeks. One patient had major complication required second operation and 10 patients had minor complication. The final outcome was excellent in 20 (66.7%) cases, satisfactory in 9 (30%) cases and there was one patient had poor outcome.

Fig 2: Full range of movement after 24 weeks

Table 1: Flynn's criteria

Results Variables at 24 weeks	Excellent	Satisfactory	Poor
Limb-length inequality	< 1.0 cm	< 2.0 cm	>2cm cm
Malalignment	5degree degrees	10 degrees	>10 degrees
Unresolved pain	Absent	Absent	Present
Other complications	None	Minor resolved resolved	Major lasting morbidity

Table no 2 : Association of incidence of complications with clinical variables

Clinical variables	**Total number of patients (n=30)**	**Complications**		**P value**
		Absent (n=19)	**Present (n=11)**	
Age in years				
• O-5	15(50%)	9(47.4%)	6(54.5%)	0.537
• 5-10	13(43.3%)	9(47.4%)	4(36.4%)	
• 10-12	2(6.7%)	1(5.2%)	1(9.1%)	
Gender				
• Male	20(66.7%)	15(79%)	5(45.5%)	0.173
• Female	10(33.3%)	4(21%)	6(54.5%)	
Mode of Injury				
• RTA	12(40%)	2(40%)	2(18.2%)	0.414
• Fall	11(36.7%)	9(45%)	7(63.6%)	
• Fall from height	7(23.3%)	2(10%)	2(18.2%)	

There was no significant association observed between clinical variables (Age, Gender, Mode of injury and Pattern of Fracture) and Incidence of complications (TABLE 2).

IV. Discussion

The ideal treatment of femoral shaft fracture in children is defined as one that can control length and alignment, is comfortable for child and convenient for family and causes the least psychological impact possible.

In the present study 15 (50%) of the patients were 0-5 years, 13 (43.3%)were 5 to 10 years and 2(6.7%) were 10 to 12 years age group with the average age being 6 years. Flynn JM et al[4] in their study assessing 49 cases of childrens ranged from 6-16 years with a mean age of 10.2 years. Ramachandra K et al[5] studied children ranged from 9-12 years with a mean of 10.2 years Saikia KC et al[2] studied childrens from 6-16 years with a mean of 10.8 years.

There were 10 (33.3%) girls and 20 (66.7%) boys in the present study. The sex incidence is comparable to other studies in the literature. Moroz LA et al[6] in their study there were 171(74.7%) males and 58(25.3%) females. Bhaskar A et al[7] in their study out of 60 patients there were 38(63.4) boys and 22(36.6) girls.

In the present study RTA was the most common mode of injury accounting for 11 (40%) cases, self fall accounted for 11 (36.7%) cases and fall from height accounted for 7 (23.3%) of the cases. Flynn JM et al[4] in their study assessing 234 cases, 136(58.1%) were following RTAs, 46(19.6%) were following self fall and remaining 43(28.8%) were as a result of fall from height. Bandyopadhyay R et al[8] in their study of 70 patients 42 patients (60%) the mechanism of injury was due to motor vehicle accident, 22 (31.42%) were due to fall from height while remaining 4 (8.58%) were due to sports injury.

Transverse fractures accounted for 16(53.3%) cases, communited fractures- 2(6.7%), oblique fractures - 9(30%), spiral fractures – 3(10%) and there were no segmental fractures in our study. In their study Moroz LA et al[6] out of 234 fractures they observed there were 114 transverse (48.7%), 47 short oblique (20%), 29 spiral (12.4%), 14 butterfly (6%), and 28(12%) comminuted fractures. The fracture pattern could not be determined in two (0.9%) cases. Ramachandra K et al[5] in their series, 17 fractures (56.66%) were transverse fractures, 5 (16.66%) were oblique and 8 (26.66%) were spiral fractures.

Fractures involving the middle third accounted for 18 (60%) cases, proximal third 7 (23.3%) and distal third 5 (16.7%) of cases in our study. Moroz LA et al[6] studied 234 fractures, upper third of the femoral shaft fracture occurred in 33 cases (14.1%), the middle third in 165 (70.5%), and the lower third in 35 (15%). The site of the fracture could not be determined in one (0.4%) case. El-Adl G et al[3] studied 20 femoral shaft fractures out of which 15 were middle third, 5 proximal third and 5 were distal third fractures.

In our study union was achieved in <3 months in 23 (76.7%) of the patients and 3 – 4.5 months in 6 (20%). Average time to union was 11.5 weeks. Saikia KC et al[2] reported average time for union as 8.7 weeks. Bhaskar A et al[7] in their study average time to union was 12 weeks femur.

In the present study, unsupported full weight bearing walking was started in <12 weeks for 24 (80%) of the patients, between 12 and 18 weeks in 5 (16.7%) and at 20 weeks in 1 (3.3%) patient. The average time of full weight bearing was 11.5 weeks. Saikia KC et al[2] in their study allowed full weight bearing was at average of 8.8 weeks. Singh R et al[9] in their study allowed full weight bearing depending on the clinical and roentgenographic progress of fracture union with an average time of 8.3 weeks.

All patients had full range of hip and ankle motion in the present study and 2 (6.66%) patients had mild restriction in knee flexion at 12 weeks, but normal range of knee flexion was achieved at 8 months. Case number 9 developed moderate restriction of knee movements due to prolonged immobilization. Flynn JM et al[4] reported 2 (0.9%) cases of knee stiffness out of 234 fractures treated with titanium elastic nails.

This is the most common sequel after femoral shaft fractures in children and adolescents. One (3.33%) patient had shortening (1cm) and one (3.33%) had lengthening (1.2cm). No patient in our study had major limb length discrepancy (i.e. > ± 2cm). Khazzam M et al[10] reported, three patients had overgrowth of more than 2 cm. Saigal A et al[11] reported limb length discrepancy >2cm in one patient. Ferguson J et al[12] noted more than 2cm shortening in 4 children after spica treatment of pediatric femoral shaft fracture. In the present study, limb length discrepancy of more than 10mm was present in 2 (10%) cases. Comparing to limb length discrepancy in conservative methods, limb length discrepancy in our study was within the acceptable limits.

Some degree of angular deformity is frequent after femoral shaft fractures in children, but this usually remodels after growth. One (3.33%) patient presented with varus (4°) angulation. Flynn JM et al[4] reported 10 (4.3%) cases of minor angulation out of 234 fractures treated with titanium elastic nails. Singh R et al[9] reported angulation in both anteroposterior and varus/valgus planes was seen in two cases and one case, in which two different diameter nails had to be used, had posterior bowing of 10° and 10° of varus tilt.

Herndon WA et al[13] compared the results of femoral shaft fractures by spica casting and intramedullary nailing in adolescents. They noticed varus angulation ranging from 7 to 25° in 4 patients treated with spica casting and no varus angulation in surgical group. The varus malalignment that occurred in our study was within the acceptable limits.

A difference of more than 10° has been the criterion of significant deformity. No patient in our study had significant rotational deformity.

In the present study, the final outcome was excellent in 20 (66.7%) cases, satisfactory in 9 (30%) cases and there was one patient had poor outcome. Flynn JM et al[4] treated 234 femoral shaft fractures and the outcome was excellent in 150(65%) cases, satisfactory in 57 (25%) cases and poor in 23 (10%) of the cases. Singh P et al[14] treated 112 patients of femoral fractures, 86 had excellent results, 24 had satisfactory results, and 2 had poor results. Saikia KC et al[2] in their study of 22 children with femoral diaphyseal fractures reported 13 (59%) excellent, 6 (27.2%) satisfactory and 3(13.6%) poor results. Singh R et al[9] treated 35 fractures and outcome was excellent in 25(71.4), satisfactory in 8(22.8) and poor in 2(5.8) patients.

CONFLICT OF INTEREST

In our study there was no conflict of interest.

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Dr. Roel Langshong." A prospective study of conservative management of femoral shaft fractures in paediatric patients upto 12 years age"."IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 8, 2018, pp 12-16.