The Professional Medical Journal
www.theprofesional.com

DOI: 10.29309/TPMJ/18.4457

ORIGINAL PROF-4457

PAEDIATRIC FEMUR FRACTURE;

RETROGRADE ELASTIC INTRAMEDULLARY NAILS VERSUS IMMEDIATE HIP SPICA CAST IN TREATMENT OF PAEDIATRIC FEMUR FRACTURE: A PROSPECTIVE, RANDOMIZED STUDY

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Article received on:
26/10/2017
Accepted for publication:
15/02/2018
Received after proof reading:
04/05/2018

Abstract… Objectives: To evaluate the outcome of retrograde flexible intramedullary nails in treatment of paedriatic diaphyseal fractures in comparison with the traditional treatment of immediate hip spica cast. **Hypothesis:** We hypothesised that in children with femur fracture who are managed with flexible intramedullary nails have better outcome in comparison to those managed with immediate hip spica cast. **Study Design:** Randomized control trail. **Place & Duration of Study:** Lady Reading Hospital, Peshawar from June 2016 to October 2017. **Methods:** A group of forty-eight children aged 6-12 were randomly allocated either elastic intramedullary nail or immediate hip spica casting and were followed up to six months. Fracture alignment (coronal and sagittal angulation, leg length discrepancy), time for fracture union, recovery mile stones (time to start weight bearing with aids, independent walking, knee range of movement) and the presence of complications including surgical site infection were recorded and compared between two groups. **Results:** Children treated with elastic intramedullary nails in comparison with those treated with immediate hip spica had early union ($p<0.001$), shorter time to start weight bearing with support or independently ($p<0.001$). Leg Length discrepancy ($p<0.001$), coronal and sagittal angulation ($p<0.001$ and $p=0.02$) was significantly higher in hip spica group. Difference observed between the two groups regarding knee range of movement ($p=0.085$) and surgical site infection ($p=0.076$) was not significant. **Conclusion:** Children aged 6-12 years treated with elastic intramedullary nail for femoral diaphyseal fracture had earlier union, reduced rate of shortening, malunion and allowed earlier rehabilitation.

Key words: Femoral Shaft Fractures, Elastic Intramedullary Nails, Hip Spica Cast.

Article Citation: Khan UZ, Ali MA, Shah FA. Paediatric femur fracture; retrograde elastic intramedullary nails versus immediate hip spica cast in treatment of paediatric femur fracture: a prospective, randomized study. Professional Med J 2018; 25(5):639-642. **DOI:**10.29309/TPMJ/18.4457

INTRODUCTION

Paediatric femoral shaft fractures are among the most common lower extremity injuries treated by orthopaedic surgeons in children.[1] Currently, variety of non-operative and operative treatment has been favored with aim to avoid complication secondary to these fractures such as malunion, leg length discrepancy, malalignment and growth disturbances.[2,3]

Majority of the time paediatric femoral fractures sustained in under six years of age can be treated non operatively because of quicker healing and excellent remodeling potential to spontaneous correct angular deformities whereas operative treatment is favored in children above 12 years.[3] Children between 6-12 years are treated with either traction, hip spica, elastic intramedullary nail or external fixators in cases of open fracture.[3-5] The ideal treatment in children between 6-12 years of age is still debatable but recently, there has been more inclination towards operative treatment in children over's 6 years of age with retrograde elastic intramedullary nailing compare to the traditional method of traction followed by hip spica.[4,5] This study aimed at comparison of elastic intramedullary nails with hip spica in treatment of femoral diaphyseal fractures.

MATERIALS & METHODS

This prospective randomized trial was conducted in Lady Reading Hospital Peshawar from June 2016 to October 2017. Children between 6-12 years with closed diaphyseal femur fracture were enrolled into the study and were randomly allocated into group A (Elastic intramedullary nail)

and group B (Immediate hip spica cast). Children with segmental, pathological fractures or with metabolic bone disorders and neuromuscular disorders were excluded from our study.

In Group A standard, elastic intramedullary retrograde nailing was performed according to technique described by Flynn and colleagues.[5] It was performed under General anesthesia on traction table under image intensifier guidance with single dose of intravenous antibiotic at induction. Fractures were stabilized with two flexible nails of appropriate diameter in retrograde manner through small incisions 2.5-3 cms proximal to distal femoral physic. One nail was inserted through towards the greater trochanter and the other directing towards the femoral neck. Stitches were removed after two weeks and partial weight bearing was advised at two to four weeks and encouraged to full weight bearing as tolerated at 6-8 weeks depending on fracture pattern and callus formation at fracture site.

In group B, hip spica cast was applied on same or following day of presentation to the hospital under general anesthesia. One and half hip spica was applied with hip at 20-30 degrees flexion and limb in 10-15 degrees external rotation under fluoroscopy guidance. Follow up at 2nd week was arranged to assess for displacement and spica related problems. Spica was continued for 6 to 8 weeks depending on age of the patient. After cast removal patients were advised to non-weight bear for 2 to 3 weeks with hip, knee and ankle mobilizing exercise followed by weight bearing as tolerated.

Follow up visit were arranged at 2 weeks, 6 weeks, 12 and 24 weeks after discharge where data recorded included patients details (age, gender), variables related to fracture (involved side, fracture pattern), fracture alignment (coronal and sagittal angulation, leg length discrepancy), details of fracture union, recovery mile stones (time to start weight bearing with aids, independent walking, knee range of movement) and the presence of complications including surgical site infection. Orthopaedic consultants and trainee medical officers in outpatient department measured aforementioned parameters.

Fracture angulation in sagittal and coronal planes was assessed by drawing line on anteroposterior and lateral radiographs and measured with a goniometer. Leg length discrepancy was measured with measuring tape from anterior superior iliac spine to tip of medial malleolus and then was compared with contralateral side. Knee range of movement was assessed by passive flexion and extension and measured with a goniometer. Clinical and radiological parameters were used to assess delayed union and non-union. Radiological union was defined as appearance of callus on at least three out of four cortices and clinical union as no pain on movements at fracture ends.

Data was analyzed in SPSS software. Chi-square test and independent sample test were used for comparing categorical data and means respectively between two groups.

RESULTS

During the study period 50 children were included in our study. Two patients one from each group lost follow up were excluded from this study. 24 patients (15 boys & 9 girls) with mean age of 8.2 ±1.8 years were treated with flexible intramedullary nail whereas remaining 24 patients (12 boys & 12 girls) with mean age 8.5 ±1.5 years. The difference between the two groups was not significant in terms of age, gender, side and pattern of fracture ($p>0.005$) (Table-I).

Union occurred early in nailing group (6.23 ± 0.991 weeks) in comparison to hip spica (8.13 ±1.326) which was significantly early ($p<0.001$) (Table-II). Leg length discrepancy (LLD) at 6 months was significantly higher in hip spica group ($P<0.001$) (Table-II). Coronal plane angulation was significantly higher in spica group (mean 8.57) than in flexible nail group (mean 8.57) ($p<0.001$), similar trend of significant difference in sagittalangulation was noted ($p=0.02$) (Table-II).

Compared with children treated with hip spica, those who were treated with flexible nails started

early weight bearing with support or independently (p<0.001) (Table-II). The knee range of moment in nailing group 125.5 ±15.4 degrees and in spica cast group 131.1 ±2.5degrees with no significant difference(p=0.085). Three children (12.5%) in nailing group developed post-operative superficial wound infection with no similar problem in hip spica cast group (p=0.076) (Table-II).

Parameter	Group A (n= 24) (Nail group)	Group B (n=24) (Spica group)
Age (years)	8.2 ±1.8 years	8.5 ±1.5 years
Gender	Male 15 (60.5%) Female 9 (37.5%)	Male 12 (50%) Female 12(50%)
Involved femoral side	Right 10 (41.6%) Left 14 (58.3%)	Right 13 (54.1%) Left 11 (45.8%)
Fracture pattern	Transverse 10 (41.6%) Oblique 7 (29.1%) Spiral 7 (29.1%)	Transverse 11(45.8%) Oblique 10 (41.6%) Spiral 3 (12.5%)

Table-I. Characteristics of patients & variables related to fracture
Data are presented as mean ± standard deviation or number (%)

Parameter	Group A (n= 24) (Nail group)	Group B (n=24) (Spica group)	P value
Union (Weeks)	6.23 ± 0.991	8.13 ±1.326	P<0.001*
LLD at 6 months (cms)	0.53 ± 0.453	1.35 ±0.402	P<0.001*
Coronal plane angulation (degrees)	3.19 ± 2.35	8.57 ±4.12	P<0.001*
Sagittal plane angulation (degrees)	3.45 ± 2.16	7.19 ±5.16	P=0.002*
Knee range of movement (degrees)	125.5 ±15.4	131.1 ±2.5	P=0.0853*
Time to start weight bearing with aids (weeks)	3.33 ±1.44	7.38 ±1.04	P<0.001*
Time to start weight bearing independently (weeks)	6.78 ±1.14	9.87 ±1.56	P<0.001*
Infection	3 (12.5%)	0	P=0.0764**

Table-II. Comparison of outcome between two groups
Data are presented as mean ± standard deviation or number (%), * Independent sample t -test
**** Chi-square test**

DISCUSSION

Various factors influence the decision to treat paedriatic femoral shaft fractures which are age of child, type and location of fracture available facilities including surgical expertise. Recently, there is more inclination towards operative management because of enhance recovery, shorter rehabilitation period, less immobilization and less psychological impact to the children.[6]

In our study, we noticed better results with retrograde flexible nail comparing to immediate hip spica in terms of union time, leg length discrepancy, malunion and time to start walking with aids or independently.

Earlier union and shorter rehabilitation in terms of independent walking was observed in flexible nail group comparing to spica cast. This could be due to better anatomical reduction in surgically treated children. Earlier fracture healing and early weight bearing led to enhanced recovery which in return led to quicker return to normal routine life activities in these patients. Greisberg et al and Flynn et al have shown similar results in terms of earlier recovery.[7,8]

Leg length discrepancy was significantly higher in hip spica group in comparison to those managed surgically at six months follow up. Jauquier N. et al. have shown similar results at one year follow up.[9]

Our study demonstrates higher coronal and sagittal angulation in spica group compared to flexible nail group. Similar findings were published

by Saseendar S. et al and Flynn et al.[8,10] Saseendar S. et al compared the rotational alignment of fractures treated by the two modalities however we excluded rotational mal alignment from our comparative outcome as in our setting it was difficult to get proper imaging.[10]

There was no significant difference between two groups in restoration of knee joint range of movements which was similar to those of shemshaki et al.[11]

There were three children who developed surgical site infection (12.5%) in flexible nail group and they were all superficial treated with oral antibiotics without need for any surgical intervention which have been also reported by other authors.[10,11]

The strength of this study is prospective and randomized design but we acknowledge that this study has certain limitations. We had relatively small sample size with short follow up. This was single center study where we couldn't estimate hospital stay and treatment costs.

CONCLUSION

Our study supports management of femoral diaphyseal fracture in children aged 6-12 years with retrograde intramedullary nails in terms of union time, decrease rate of shortening, malunion and allows earlier rehabilitation.

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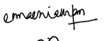
1	Umar Zia Khan	Principal Author	
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