ORIGINAL ARTICLE

Comparison of Mal-Union between Titanium and Stainless Steel Elastic Nail Fixation of Pediatric Femoral Fractures

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ABSTRACT

Aim: To compare the mal-union between Titanium and Stainless Steel Elastic Nail Fixation of Pediatric Femoral Fractures.

Methods: This comparative study was conducted at Department of Orthopedic Surgery, Bahawal Victoria Hospital, Bahawalpur from March 2016 to September 2016.Total 136 patients with closed femoral Fractures (within 7 days of fracture), both sex male and female and having age from 4 to 15 years were selected.

Results: Average age of the patients of group A was 9.94±3.67 years and average age of group B was 9.65±3.82 years and average age of the all patients was 9.79±3.74 years. Malunion was noted in 6(8.82%) patients and 16(23.53%) patients of group A and B.significantly higher percentage of malunion was noted in study group B as compared to study group A with p value 0.0344.

Conclusion: Results of this study showed that children with femoral shaft fracture had higher rate of malunion while managed with Titanium elastic nails as compared to stainless steel elastic nails.Titanium elastic nail group found with higher number of male patients with malunion as compared to stainless steel group but insignificant difference was detected in female patients of both groups.

Keywords: Fracture, femur, titanium, stainless steel, nails, malunion

INTRODUCTION

The femur is known as the strongest bone in human body and the largest muscle mass surrounds it.It consists of primary and secondary ossification centers.[1]traces of ossification were firstly shown by it among the long bones. At 7th week of life of fetal, it starts from the mid of femoral body.It quickly extends distally and proximally.At the 20th year of life, the last to fuse is the distal ossification center.[2]The primarily weak woven bone turns into a stronger lamellar bone due to remodeling of femur during childhood.[3]Till 16 years of age, the femoral shaft diameter and relative cortical thickness increases geometrically and strength increases rapidly.

In the common population about 1.4-1.7% of all the fractures isdiaphyseal femoral fractures in children.[4]Out of every 100000 children, 19 children presents with fracture of femoral shaft.[5]

Most of cases of femoral shaft fractures presents in 2 and 17 years of life and most of the cases are reported in summer months.[6]Direct and indirect traumas and pathologic process can cause fractures of femur.[1]Physical abuse, falls and pedestrian injuries are the examples of direct trauma.Femoral indirect trauma can be the result of rotational force.[7-9]Bone cysts, malignancies, non-ossifying fibromas and osteogenesis imperfecta can cause pathologic fractures to the femur in children.[8] The mechanism of fracture of femur in children varies according to the age.About 42% of infants and 3% of children in walking age are reported to have femoral injuries due to physical abuse.[10]

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MATERIAL AND METHODS

This comparative study was conducted at Department of Orthopedic Surgery, Bahawal Victoria Hospital, Bahawalpur from March 2016 to September 2016.

Femoral Fractures: Fracture of femur shaft on x-ray.

Mal-union: At 3 months follow up after surgery, mal-union is defined as shortening more than 5mm, antero-posterior and medial-lateral angulation more than 10^0 (on goniometer) on x-ray.

Inclusion Criteria:

- All patients with closed femoral Fractures (within 7 days of fracture).
- Male or female patietns.
- Age range from 4 to 15 years.

Exclusion Criteria:

- Multiple long-bone fractures of the lower extremity.
- Patients with systemic disease like diabetes mellitus, thalassemia (on history).

Data collection procedure: Total 136 children with femoral shaft fracture were selected for this study after taking written consent from ethical committee of hospital and written informed consent from the parents of every patient.

Selected cases were divided into 2 groups A and B randomly.Patients of group A were managed with titanium elastic nail and patients of group B were managed with stainless steel elastic nail. At 3 months follow-up, all the patents were assessed for mal-union as per operational definition. Findings were noted in term of mal-union (Yes/No) in pre-designed proforma. Demographic profile of the patients was also be recorded in pre designed proforma.

Data analysis procedure:
Collected data was analysed by using SPSS V.16. Mean was calculated for age and duration of fracture. Frequencies were calculated for gender, type of fracture and malunion. Chi-square test was used to compare the malunion rate between both groups.Stratification was done for age, duration of fracture and gender.Post stratification chi-square test was applied to see the association these variables with malunion.P-values ≤ 0.05 was considered statistically significant.

RESULTS

Average age of the patients of group A was 9.94 ± 3.67 years and average age of patients of study group B was 9.65 ± 3.82 years and average age of the all patients was 9.79 ± 3.74 years.

Malunion was noted in 6 (8.82%) patients and 16 (23.53%) patients of group A and B.significantly higher percentage of malunion was noted in group B as compared to group A with p value 0.0344 (Table 1).

Out of 51 male patients of group A malunion was noted in 6(11.76%) patient and out of 45 patients of group B, malunion was noted in 13(28.89%) patients. The difference between the frequency of malunion between the both groups was statistically significant with p value 0.0428. There were 17 female patients in study group A and 23 in study group B. Zero malunion rate was noted in group A and 3(13.04%) patients found with malunion. But the difference was statistically insignificant with P value 0.2481 (Table 2).

Patients of both study group were divided into two age group i.e. age group 4-10 years and age group 11-15 years.Total 34 patients of group A and 37 patients of group B belonged to age group 4-10 years. Malunion was observed in 1(2.94%) patients of group A and in 9(34.32%) patients of group B.difference between the frequency of malunion was significant with p value 0.0144.

In age group 11-15 years, 34 patients belonged to group A and 31 patients belonged to group B. In group A, malunion was observed in 5(14.71%) patients and in group B malunion was observed in 7(22.58%) patients. Difference between the frequency of malunion was statistically insignificant with p value 0.5272. (Table 3)

Table 1: Comparison of frequency of mal-union between the both groups

Group	Mal-union		Total	P value
	Yes	No		
A (Stainless Steel)	6 ((8.82%)	62 (91.18%)	68	0.0344
B (Titanium)	16 (23.53%)	52 (76.47%)	68	

Table 2: Comparison of frequency of mal-union between male and female patients of both groups

Group	Malunion		Total	P. Value
	Yes	No		
Male patients				
A	6 (11.76)	45 (88.24%)	51	0.0428
B	13 (28.89%)	32 (71.11%)	45	
Female patients				
A	0	17 (100)	17	0.2481
B	3 (13.04%)	20 (86.96%)	23	

Table 3: Comparison of frequency of mal-union for different age groups.

Group	Malunion		Total	P. Value
	Yes	No		
Age group 4-10 years				
A	1 (2.94%)	33 (97.06%)	34	0.0144
B	9 (24.32%)	28 (75.68%)	37	
Age group 11-15 years				
A	5 (14.71%)	29 (85.29%)	34	0.5272
B	7 (22.58%)	24 (77.42%)	31	

Table 4: Comparison of frequency of mal-union for 1-3 days duration of fracture

Group	Malunion		Total	P. Value
	Yes	No		
1-3 days duration of fracture				
A	2 (6.25%)	30 (93.75%)	32	1.0000
B	3 (9.09)	30 (90.9%)	33	
4-7 days duration of fracture				
A	4 (11.11%)	32 (88.89%)	36	0.0130
B	13 (37.14%)	22 (62.86%)	35	

In present study maximum duration of fracture was 7 days.Patients were divided into two group i.e., 1-3 days of duration of fracture and 4-7 days duration of fracture. Total 32 patients of group A and 33 patients of group found with 1-3 days of duration of fracture. Malunion was seen in 2(6.25%) patients of group A and in 3 (9.09%) patients of group B.difference between the frequency of malunion

between group A & B was statistically insignificant with p value 1.00.Total 36 patients of group A and 35 patients of group B were found with 4-7 days duration of fracture. Malunion was seen in 4(11.11%) patients and 13(37.14%) patients of group A and B.The difference between the frequency of malunion was statistically significant (P = 0.0130) (Table 4).

DISCUSSION

Femoral shaft fractures in children have been treated conservatively in the past based on the presumption that complication if any arises will be compensated by excellent remodeling potential of the children bone.However over the recent years surgeons are becoming more and more familiar with the operative techniques and excellent results have been obtained. Therefore, majority of the paediatric femoral shaft fractures are now treated operatively. Operative intervention results in shorter hospital stay and has economic and social benefits over conservative treatment[11].

Management of fracture of femur in children should be managed with simple device, load sharing internal splint that allows mobilization and maintenance of alignment and limb length until bridging callus forms.[12]The implant should neither endanger the physis nor the blood supply to the femoral head. it should promote, rapid healing and should provide for ability to remodel.[13,14]

In present study mean age of the children with Femoral Fracture was 10.42 ± 3.854 years.Similar (7.9 years) mean age of children with femoral fracture was reported by Kanthimathi et al.[15] The objective of this stud was to compare the mal-union between Titanium and Stainless Steel Elastic Nail Fixation in fractures of femur in children.

Titanium group was found with higher rate of mal-union as compared to stainless steel group (25% vs 8.3% P = 0.025).Malunion is 3 times higher in titanium group as comparer to stainless steel group.In one study by Wall et al,[16]56 children with Femoral Fracture were managed with titanium elastic nail and 48 children managed with stainless steel elastic nail, malunion was noted in 23.2% and 6.3% children respectively in titanium group and stainless steel group.Findings of this study are similar with the findings of our study.This outcome may be the result of more flexible titanium nails as compared to stainless steel nails.But on the other hand, in one study by Gyaneshwaret al[151] 17 patients of femoral shaft fracture were managed with titanium nails and the same number of patients was managed with stainless steel nails.On follow up, no significant difference in malunion rate in both groups was noted.Results of this study are in agreement with my study.

Rios *et al*[17] have reported no statistically significant difference between the malalignment in patients of femoral shaft fracture when titanium and stainless steel nails were used. Goyalet al[18] also found statistically insignificant difference for malunion in cases of femoral shaft fracture while using when titanium and stainless steel nails

CONCLUSION

Results of this study showed that children with femoral shaft fracture had higher rate of malunion while managed with Titanium elastic nails as compared to stainless steel elastic nails.Titanium elastic nail group found with higher number of male patients with malunion as compared to stainless steel group but insignificant difference was detected in female patients of both groups.

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