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Original Article

Comparison of Postoperative Loss of Reduction after Percutaneous Kirschner Wire Fixation and Conservative Approach in Displaced Distal Radius Fracture in Children

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Abstract

Background: To compare frequency of post-operative loss of reduction in percutaneous Kirschner wire fixation and conservative approach in displaced extra-articular non-physeal distal radius fractures in children.

Methods: In this comparative study children of age 5-15 years, with displaced extra-articular non-physeal distal radius fractures, were included. Patients were divided in two groups randomly on basis of lottery method. In group A, patient were operated with closed reduction and percutaneous Kirschner wire fixation using fluroscope. In group B, patients were conservatively managed in cast after closed reduction under flouroscope by the senior orthopedic surgeon. Postoperative loss of reduction in both groups was recorded. Follow-up conducted at 2nd and 4th week and loss of reduction was observed radiologically . The loss of reduction was recorded on study performa by the researcher trainee. Chi square test was applied to compare the difference between the loss of reduction in two groups. Effect modifiers like age, gender, unilateral or bilateral was controlled by stratification. Post stratification Chi square test was applied. P-value < 0.05 was considered statistically significant.

Results: Out of 60 patients, 28 (46.7%) were male children.The mean age of the patients in our study was 10.18±3.372 years. Loss of reduction of reduction was observed 50 times more in conservative approach as compared to operative patients.

Conclusion: The postoperative loss of reduction is less common in displaced extra-articular non-physeal distal radius fracture in children after percutaneous kirschner wire fixation as compared to fractures treated by conservative approach.

Key Words : Loss of reduction, Percutaneous kirschner wire fixation, Displaced distal radius fracture

Introduction

In children, distal radius fracture is among the most common orthopaedic injuries.[1,2] Generally closed reduction and cast immobilization is considered the mainstay of treatment in forearm fractures of children.[3] However this may at times have poor end results as about 1/3rd of these reductions demonstrate displacement in first few weeks.[4,5] Use of percutaneous Kirschner wire fixation after closed reduction supported by cast in these injuries result in good stabilization and prevent displacement of fracture.[6,7] Usual Mechanism of injury is a direct fall in or around the house.[3,4] Generally closed reduction and cast immobilization is considered as optimal treatment in forearm fractures of children.[5,6,7] However this may at times give suboptimal outcome like malunion, limitation of range of motion and angular deformity.[8,9] About 33 percent of these reductions demonstrate displacement in early two or three weeks.[10-12]

Single most important risk factor for displacement of reduction include translation of fracture to radial or ulnar side more than half of diameter of bone.[13,14] Amount of initial displacement, failure to achieve anatomic reduction, associated fracture of distal ulna and poor casting also play role in loss of reduction of distal radius fracture.[15,16] Studies have shown that percutaneous Kirschner wire fixation after closed reduction supported by cast in these injuries result in good stabilization and prevent displacement of fracture.[17-19]The rationale of present study was to apply the use of percutaneous Kirschner wire fixation after closed reduction in displaced extra-articular non-physeal distal radius fractures in children instead of conservative approach because it was not in local practice and it provide more stable construct and there was less chance of reduction after this method.

Patients and Methods

Children of age 5-15 years with displaced extra-articular non-physeal distal radius fractures admitted through accident and emergency department of

Benazir Bhutto hospital Rawalpindi were included in the study in a duration of six months from February to August 2015. Patients were divided in two groups randomly on basis of lottery method. In group A, patient were operated by the senior orthopedic surgeon with closed reduction and percutaneous Kirschner wire fixation using fl0roscope. In group B, patient were conservatively managed in cast after closed reduction under flouroscope. Postoperative loss of reduction in both groups was recorded by the researcher trainee radiologically. Follow-up conducted at 2nd and 4th week and loss of reduction was observed radiologically . The loss of reduction was recorded. Chi square test was applied to compare the difference between the loss of reduction in two groups. Effect modifiers like age, gender, unilateral or bilateral was controlled by stratification. Post stratification Chi square test was applied. p-value < 0.05 was considered statistically significant.

Results

A total of 60 patients with distal radial fractures presenting in accident and emergency, who gave informed written consent and met the inclusion and exclusion criteria were included in this study.

Table 1 Comparison of loss of reduction between conservative and K-wire groups

Group	Loss of Reduction		p-value
	Yes	No	
Conservative	18	12	0.02
K-wire	9	21	

Table 2 Comparison of loss of reduction between conservative and K-wire groups in patients according to age

Group	5-10 years of Age (n=31)			10-15 years of Age (n=29)		
	Loss of Reduction		p-value	Loss of Reduction		p-value
	Yes	No		Yes	No	
Conservative	10	5	0.104	8	7	0.077
K-wire	6	10		3	11	

Twenty eight (46.7%) patients were male children while 32 (53.3%) were female children. The mean age of the patients was 10.18±3.372 years. Twenty two (36.7%) patients had unilateral fractures while 38 (63.3%) had bilateral fractures. Loss of reduction of reduction was observed 50 times more in conservative approach as compared to operative patients(Table 1-4;Figure 1&2)

Table 3:Comparison of loss of reduction between conservative and k-wire groups in patients suffering from unilateral fractures (n=22) **and bilateral fractures** (n=38)

Group	Male patients (n=28)			Female patients (n=32)		
	Loss of Reduction		p-value	Loss of Reduction		p-value
	Yes	No		Yes	No	
Conservative	10	6	0.127	8	6	0.093
K-wire	4	8		5	13	

Table 4 Comparison of loss of reduction between conservative and K-wire groups in male patients (n=28) **and female patients** (n=32)

Group	Unilateral Fractures (n=22)			Bilateral Fractures (n=38)		
	Loss of Reduction		p-value	Loss of Reduction		p-value
	Yes	No		Yes	No	
Conservative	7	4	0.03	11	8	0.194
K-wire	2	9		7	12	

Figure 1: Conservative treatment in displaced distal radial fractures

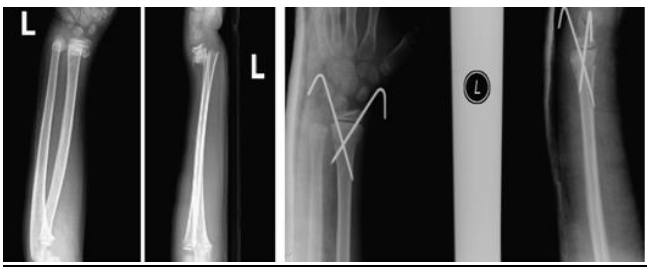

Figure 2: K wire fixation in displaced distal radius fractures

Discussion

In children, fractures are remarkably different from fractures in adults. The management of distal forearm fractures in children has changed much from commonly used conservative treatment to a wide variety of operative treatment options for displaced fracture patterns. At our hospital, an above elbow POP cast is used for displaced distal forearm fractures in children. Follow up of these patients is advised at two weeks to evaluate the loss of reduction. If these patients do have a loss of reduction, a redo manipulation is considered. [12] However, in our study displaced distal fractures of forearm were managed with percutaneous kirschner wire fixation and loss of reduction was significantly less as compared to other group. Since this procedure is minimally invasive, technically less demanding and relatively quick, it is a good treatment alternative for unstable distal forearm fractures in paediatric patients.[6]

In a study conducted by Dy CJ et al, a total of sixty seven children had fracture reduction treated by above elbow cast and sixty one underwent fracture fixation with help of Kirschner wires. Pinning of both-bone distal forearm fracture in children had reduced fracture re-displacement. [8] Functional outcome in this study also was analogous to our study results.

A study conducted by Hagert E et al reviewed forty eight children retrospectively who had loss of reduction of their distal forearm fractures after closed reduction. According to this study, the complete displacement of such fracture and which cannot be reduced entirely, was predictor for element of re-displacement. They suggested that serious contemplation be given to primary wire fixation in these group of patients. [19] Their results also are corresponding with our results. However according to a study by Luscombe re-manipulation was necessary in only eleven fractures (9.8%). All totally displaced fractures that needed redo manipulation had been in addition managed with Kirschner wire fixation. They recommended that K-wire fixation in displaced fractures does not help to decrease loss of reduction and re-manipulation frequency.[11] The study that was most comparable to our study was that of study of Herrera-Perez M et al , who studied forty cases in two groups. [2] In 'group 1' of twenty patients, K-wire fixation was done after closed reduction. In 'group 2' of twenty patients, only cast immobilization was done after closed reduction. Loss of reduction rate was 10% in 'group 1' and five times more, 50% in 'group 2'. 2 This study showed that Kirschner wire fixation prevent loss of reduction and has a affirmative effect in the maintenance of the initial reduction.

Conclusion

1.The postoperative loss of reduction is less common in displaced extra-articular non-physeal distal radius fracture in children after percutaneous kirschner wire fixation as compared to conservative approach.

2.After percutaneous kirschner – wire fixation, various suboptimal outcomes like malunion, limitation of range of motion, disruption of distal radio ulnar joint and angular deformities can be minimized for better care of paediatric patients.

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