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Original Article

Comparison of Efficacy of Above Elbow POP Versus Below Elbow POP in Distal Forearm Displaced Fractures in Children

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Abstract

Background: To compare the efficacy of above elbow versus below elbow POP cast in distal forearm displaced fractures in children.

Methods: In this randomized controlled trial 264 patients were selected using consecutive non-probability sampling and were randomized into two groups, one group underwent manipulation under anaesthesia (MUA) and above elbow POP while the other group underwent MUA and below elbow POP. Efficacy was checked at 1 week by X-rays showing presence of re-displacement.

Results: Fifty six percent patients were male while 44% patients were female. Bone involvement stood at 14.8%, 54.9% and 30.3% for Ulna only, Radius only and combined Ulna and Radius, respectively. Efficacy was 70.45% in the below elbow group as compared to 52.2% in above elbow group (p=0.002).

Conclusion: Below elbow cast is better than above elbow cast in the treatment of displaced distal forearm fractures in children in terms of re-displacement.

Key words: Below elbow cast, Displaced fractures, Forearm fractures

Introduction

Fractures of the forearm are regarded as the commonest fracture in children. Majority (75% to 84%) of fore-arm fractures occur in distal third, 15% to 18% in the middle-third and 1% to 7% in the proximal-third. Distal radius is the most commonly fractured bone. Conservative management is most widely accepted. The incidence of this fracture increases with age.[1,2]Most common mechanism of injury of these fractures is due to low-energy falls accounting for 52.3%. Healing occurs fast, nonunion is rare and some degree of displacement is accepted due to tremendous remodeling ability. These fractures are conventionally managed with reduction and above elbow POP cast, pinning and above elbow POP and by open reduction - internal fixation. Re-displacement occurs in 39% of the cases.[3] The overall manipulation rate remains 14.04%. Pre-operative translational deformity and residual deformity on intra-operative films are the most important factors predicting re-displacement.[4] The Cast Index (CI) is the reliable radiographic measurement to predict re-displacement. A CI >0.81 is prone to re-displacement.[5] There is structural deficit in growing bones of these children presented after low energy trauma.

Above elbow POP is used to neutralize the effects of supination and pronation by the above elbow muscle attachments by immobilizing the elbow joint to prevent re-displacement. But there is new trend towards using below elbow POP in management of these fractures. A well molded below elbow cast can prevent pronation and supination and can be used safely for displaced distal forearm fractures. Below elbow cast treatment is comparable in terms of re-displacement, union time and movement of wrist, to the above elbow cast.[6-12]

Patients and Methods

This randomized controlled trial (RCT) was conducted at the Department of Orthopaedics, Benazir Bhutto Hospital, Rawalpindi, from December 2016 to November 2017. The inclusion criteria were patients of both genders aged 4-12 years with one day history of trauma and displaced fractures confirmed by X-rays, antero-posterior (AP) and Lateral views with isolated radius: >5 degree angulation on AP/lateral views, >50% loss of opposition on AP/Lateral views or Both bone fractures: >10 degree angulation of either bone on AP/lateral views or >50% loss of opposition of either bone on AP/Lateral views or isolated ulna: >10 degree angulation on AP/lateral views. Also included were those with >50% loss of opposition on AP/Lateral views. Exclusion criteria were undisplaced and torus fractures, open fractures, pathological fractures, any previous manipulations or polytrauma. Sample size was calculated using WHO sample size

calculator taking level of significance 5% and power of study 80%. Diagnosis was confirmed by X-rays. Patients were randomized into two groups by lottery method.Group A underwent reduction under general anaesthesia and above elbow POP cast while group B underwent reduction under general anesthesia and below elbow POP cast.All patients were advised follow-up after one week. At follow-up visit X-rays were done to observe for re-displacement of fracture and re-manipulation was performed where indicated.Chi-square test was used to compare efficacy between the two treatment groups. P-value of ≤0.05 was considered significant. Effect modifiers like age gender and bone involved were controlled by stratification and post-stratification Chi-square test was applied.

Results

A total of 264 patients were included in the study.Mean age of patients was 8.05±2.59 years. 148 (56%) were male and 116 (44%) were females. Radius was most common bone involved (55%) (Table 1). Comparison of efficacy between above elbow cast and below elbow cast was done by Chi-square test and was found to be statistically significant (p-value <0.05)(Table 2-4).

Table 1: Bone involvement

Bone involved	No(%)
Radius	145(55)
Radius + Ulna	80(30)
Ulna	39(15)

Table 2: Comparison of efficacy of above and below elbow POP cast

	Efficacy		p-value
	No	Yes	
Below Elbow Cast	39	93	0.002
Above Elbow Cast	63	69	

Table 3: Comparison of efficacy of above and below elbow POP cast in different age groups

	Age	Efficacy		p-value
		No	Yes	
Below Elbow Cast	4-8 years	20	53	0.004
Above Elbow Cast		38	37	
Below Elbow Cast	9-12 years	19	40	0.0196
Above Elbow Cast		25	32	

Table 4: Comparison of efficacy of above and below elbow POP cast according to involvement of bone

	Involvement of bone	Efficacy		p-value
		No	Yes	
Below Elbow Cast	Radius only	21	53	0.055
Above Elbow Cast		31	40	
Below Elbow Cast	Ulna only	6	12	0.366
Above Elbow Cast		10	11	
Below Elbow Cast	Radius and Ulna	12	28	0.024
Above Elbow Cast		22	18	

Discussion

The mean age of patients in our study was 8.05±2.59 years which is comparable to other studies where mean age was found to be 8.76±2.31 years and 8.05±2.27 years.[8]Efficacy which was defined as no re-displacement was significantly more in the below elbow group where efficacy was 70.45% as compared to the above elbow group where it was 52.22%. These results are also comparable to other studies in terms of efficacy of the below elbow cast whereas the number of patients requiring re-manipulation after one week is greater than that presented in other studies. In present study 29.5% patients belonging to the below elbow cast group required re-manipulation at one week as compared to 2.3% in one study[8]. While 47.8% patients of above elbow cast group required re-manipulation in our study as compared to the 9.5% of other studies.[4, 8, 13, 14, 15]

There were 56% male patients and 44% female patients in present study which was comparable with other studies which showed male dominance. In the study conducted by Paneru SR et al. 77% of the patients were males and 22.4% of the patients were females.[8, 16]

In present study the patients belonging to the age group of 9-12 years did not show statistically significant difference between below and above elbow cast although efficacy in the below elbow group was much more than that in the above elbow group.Patients with involvement of both bones showed statistically significant difference between below and above elbow groups, while those with involvement of only radius or only ulna did not show statistically significant difference but efficacy was still predominantly more in the below elbow group.

The discrepancy in the number of patients requiring re-manipulation can be attributed to the larger sample size of present study whereas other studies have had smaller samples. It can also be suggested that this

discrepancy arises from the difference in the management approach of the treating physicians, which may have resulted in sub-optimal reduction and/or casting[17-19] This difference in the number of patients requiring re-manipulation can also be said to be due to differing types of fractures and the quality of casting material available. The casting material available here and the foreign countries is significantly different with the plaster of paris of low quality and containing impurities.[20]

Conclusion

Below elbow cast is better than above elbow cast in treatment of displaced distal forearm fractures in children in terms of re-displacement and re-manipulation.

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