



## Pediatric Forearm Fractures: A Prospective Study of Conservative Management

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### Abstract

**Introduction:** Forearm fractures are the most common fractures in children, accounts 30% to 40% of all fractures. Most of these fractures are treated by close reduction and immobilization. Both national (80%) and international (58.8%) literature shows marked variation in the outcome of conservative management of forearm fractures. Operative management becomes popular due to complications of conservative treatment, which includes re-displacement, compartment syndrome, residual deformation and loss of mobility.

**Materials and Methods:** The study was conducted at Department of Orthopedic unit 2 of Abbasi Shaheed Hospital. All children of less than 14 years of age with forearm fractures were included. Data was collected through a self-administered proforma. Closed reduction and POP cast was done under sedative analgesia. Patients were followed up initially after 3 days and a check X-ray was done and re-manipulation was performed if needed. Then patients were followed every week for four weeks and fresh X-ray was done on every visit. Data was analyzed by using IBM SPSS v.20.

**Results:** The study included thirty patients with forearm fractures, males being dominant. The mean age was 7.47 years. Majority of males 16 (76.2%) and females 8 (88.8%) had combined fractures of radius and ulna. The most common cause of injury was fall during play 22 (73.3%). Majority of the children 21 (70%) had fractures of radius shaft. Shaft of ulna was fractured in 18 (60%) children. Satisfactory outcome was achieved in 23 (76.7%) of the participants. Re-displacement was seen in 3 (10%) patients during follow-up.

**Conclusion:** Conservative management for pediatric forearm fractures is a successful treatment with high success and low complication rate. Therefore we recommend conservative management for pediatric forearm fractures.

**Keywords:** Radius fractures; Conservative management; Forearm fractures

### Introduction

Forearm bone fractures are the most common fractures in children accounting for 30% to 40% of all fractures [1]. More than 75% of forearm fractures are distal third fractures [2,3]. These fractures occur most commonly in children of age group 6 years to 10 years, males being involved more than females [4,5]. Fall on outstretched hand especially during play has been found to be the commonest mechanism of injury in these fractures, other mechanism include road traffic accidents [4,6]. There is a wide variety of fracture types in children due to pliability in their bones than in adults [7]. Buckle fractures in which longitudinal force causes the cortex to bulge into the transition zone between metaphyseal and diaphyseal bone, green stick fractures may involve both cortices but the thickened periosteal sheath remains intact and they are considered stable while complete cortical disruption can also occur in children which results in adult type fractures which are considered unstable and pose a great challenge in their management [7,8].

Treatment depends upon the type of fracture. Most of the forearm fractures are treated by close reduction and immobilization with variable outcome [2,8]. Both national (80%) and international (58.8 %) literature shows marked variation in the outcome of conservative management of forearm fractures [3,6,9]. Operative management becomes popular due to complications of conservative treatment, which includes re-displacement, compartment syndrome, residual deformation and loss of mobility [1]. The criterion for acceptable reduction varies with position of fracture and age. Younger children have more remodeling capacity therefore greater degree of angulations and mal-rotation is acceptable. Children whose radiographic evaluation exceeds these criteria's should be

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**Figure 1:** AP (Antero-posterior) and Lateral view radiographs of an 8 year old boy showing distal fracture of radius and ulna before reduction.



**Figure 2:** Radiographs of an 8 year old boy after cast removal showing callus formation in previously fractured distal radius and ulna.

considered for operative treatment [10].

Due to limitation of resources in our setup like non availability of c-arm, we couldn't opt for closed reduction and elastic nail fixation in pediatric forearm fractures. Therefore we manage them conservatively by closed reduction and plaster casting. No such study has been conducted in our setup to determine the outcome of conservative management of pediatric forearm fractures. Therefore there is a need to look at the outcome of conservative management of pediatric forearm fractures. If the desired outcomes are not being achieved, we will look for better alternative in our hospital. We will also look for the cause of failure and associated complications. This will help to save children from deformity and loss of mobility in future by timely decision.

### Materials and Methods

This was a prospective cross-sectional study, conducted in a period of three months from 1<sup>st</sup> April 2019 till 30<sup>th</sup> June 2018. The study was conducted at department of Orthopedics unit II, Abbasi Shaheed Hospital after approval from the institute ethical committee. Non-probability convenience sampling technique was used. All children of less than 14 years of age presenting in the emergency department of Abbasi Shaheed Hospital on call days of orthopedic unit II with forearm fractures were included. Fractures of radius/ulna alone or both bones were included. Fractures of proximal, middle and distal bone parts were included. Follow-up cases and previously treated patients by any other hospital or bone setter, open fractures, Intra articular fractures, Monteggia and Galeazzi fractures were excluded. A total of thirty children meeting the inclusion criteria were included. Data was collected through a self-administered proforma which included variables regarding patient's demographics, mechanism of injury, immediate treatment, fracture details (i.e. bone involvement, part of bone involved) check X-ray findings, follow-up X-ray findings, complications during and after cast removal, need for surgical intervention, range of motion after cast removal, measures to correct deformity or loss of mobility in case of complication. A written informed consent was taken from each participant. Closed reduction and POP cast was done under sedative analgesia by the resident surgeon. Patients were followed up initially after 3 days and a check X-ray was done. If the acceptable alignment was not achieved re-manipulation was performed and then patient was followed every week for four weeks and fresh X-ray was done on each follow up visit containing both anteroposterior and lateral views. X-rays were evaluated by the trainee resident and consultant both. Preservation of reduction till consolidation within the criteria described by Price CT10 was considered as successful outcome. The criterion is as follows: In cases of unsuccessful reduction the best possible alignment achieved was considered acceptable. Data was

**Table 1:** Gender wise distribution of fractures.

Part of bone involved	Males (N, %)	Females (N, %)
Proximal Radius & Ulna	2 (9.6%), 0(0%)	0 (0%), 0(0%)
Middle Radius & Ulna	15 (71.4%), 13(72.2%)	6 (66.7%), (50.0%)
Distal Radius & Ulna	4 (19.0%), 5(27.8%)	3 (33.3%), (50.0%)

analyzed through IBM SPSS v.20. Ordinal data is presented in the form of mean and standard deviation and nominal data is expressed in frequencies and percentages.

### Results

A total of thirty children with complete fractures of radius, ulna or both were included. Out of thirty children 21 (70%) were males. The mean age of the patients was 7.47 years and range was 1 year to 13 years. In males 16 (76.2%) had combined fractures of radius and ulna. Radius alone was fractured in 4 (19%) patients. Only 1 (4.8%) child had solitary fracture of ulna. In females 8 (88.8%) had both radius and ulna fractured. Radius alone was involved in 1 (11.2%) of the patient. None of the patient had isolated fractured ulna. The most common cause of injury was fall during play 22 (73.3%) followed by road traffic accidents 4 (13.3%) and 4 (13.3%) had miscellaneous causes. Majority of the children had fractures of radius shaft constituting 21 (70%). Proximal radius was fractured in 2 (6.7%) and 7 (23.3%) children had distal radius fractures. No child had proximal ulna fractured. Shaft of ulna was fractured in 18 (60%) children while distal ulna was fractured in 6 (20%) cases. Shaft fractures of radius and ulna were the most common fractures in both genders see Table 1.

Satisfactory outcome was achieved in 23 (76.7%) of the participants and 7 (23.3%) resulted in un-satisfactory outcome at the end of follow up. The fracture of distal end of radius and ulna showed better success rates as compared to proximal and middle portion see Table 2.

Satisfactory reduction was not achieved in 4 (13.3%) patients even after re-manipulation. Re-displacement was seen in 3 (10%) patients during follow-up. Re-displacement was observed during the first week in 1 (33.3%) patient and in the second week in 2 (6.7%) patients. In unsuccessful cases residual deformity was seen in 4 (13.3%) cases, decreased range of motion was observed in 2 (6.7%) cases while in one patient no post cast complication noticed. In all the successful cases no post cast complication was encountered. Overall satisfactory range of motion was observed in 24 (80%) of cases. Functional outcome was excellent in 21 (70%), good in 2 (6.7%), fair in 7 (23.3%) and none had poor outcome. None of the patient with successful outcome had fair or poor functional outcome. All unsuccessful cases had fair outcome. Radiographic sign of callus formation was seen during second week in majority of the cases 15 (50%). Union was achieved in

**Table 2:** Outcome.

	Satisfactory (N, %)	Non-satisfactory (N, %)
Radius		
Proximal	1 (50%)	1 (50%)
Middle	16 (76.2%)	5 (23.8%)
Distal	6 (85.7%)	1 (14.3%)
Ulna		
Proximal	0 (0%)	0 (0%)
Middle	14 (77.8%)	4 (22.2%)
Distal	5 (83.3%)	1 (16.7%)

all the cases and none of the patient showed non-union. Patients with unsatisfactory functional outcome were advised physiotherapy. Due to short duration of our study follow up could not be done.

## Discussion

As boys are more actively participated in sports and outdoor activities, they are at greater risk of injury. Most of our patients were male in accordance with other studies [5,6]. We applied below elbow cast for distal third fractures. Previous work has shown that there is no significant difference on outcome and complications between below and above elbow cast for distal third fractures [2,12]. The most common mechanism of injury was fall while playing. It is similar to other studies [6,7,13]. In our study radial and ulnar shaft were the most commonly fractured parts in forearm fractures. Mansoor et al. [4] and Tarmuzi et al. [14] had reported similar results. But these results are in contradiction to Rennie et al. [15] and some others who observed fractures of distal radius and ulna to be the most common ones [16]. The overall success rate was 76.7% for our study which is lower than 86% which Tarmuzi et al. [14] reported. Functional outcome demonstrated in our study was lesser than Tarmuzi et al. [14]. In our study we had excellent outcome in 70% of patients while Tarmuzi et al. [14] had reported 85%. Fractures of distal part showed success rate of 85.7% and 83.3% for radius and ulna respectively. The success rate for distal part of radius was better than Hellebrekers et al. [3] who reported 58.8% success rate only. Diaphyseal fractures showed satisfactory outcome in 76% of radius fractures and 77.8% in ulna fractures. These results are in consistence with work done by Waqar et al. [6]. Reduction was unsuccessful in 13.3% of the participants in the first attempt. This percentage is very high as compared to reported by Nataranjan [17]. This could be due to smaller sample size of our study as compared to other study [16]. Only 10% of patients had re-displacement. This is similar to other study.

## Conclusion

Our results showed that conservative management for pediatric forearm fractures is a successful treatment with high success and low complications rate. Therefore we recommend conservative management for pediatric forearm fractures with regular follow-up to correct any re-displacement and prevent any deformity.

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