

Conservative Management on Paediatric Bone Forearm Fractures in Tertiary Care Hospital**Aarti Ronak Motiani¹, Mehta Rajeshri Rajendra², Patel Nihar Anilkumar³, Seema Suketu Shah⁴**¹Assistant Professor, Department of Pediatrics, Dr. M.K.Shah Medical College and Research Centre, Chandkheda, Ahmedabad, Gujarat, India^{2,4}Associate Professor, Department of Pediatrics, Dr. M.K.Shah Medical College and Research Centre, Chandkheda, Ahmedabad, Gujarat, India³Assistant Professor, Department of Orthopaedics, GMERS Medical College, Godhra, Panchmahal, Gujarat, India

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Abstract:**Background and Aim:** One of the most common fractures in children is a fracture of the shaft of both forearm bones. There is frequently disagreement on how to treat these fractures. Though there is a growing trend towards surgical treatment of these injuries, conservative care remains popular due to the advantage of good bone remodelling potential in children. The purpose of this study was to emphasise the necessity of cautious care in both bone forearm fractures in children.**Material and Methods:** The current study was a prospective investigation into the functional effects of conservative treatment for paediatric diaphyseal forearm fractures. This one-year study was conducted at the Orthopaedic Department of the Tertiary Care Teaching Institute of India. Plain X-ray pictures and medical records were used to collect and corroborate data. The study comprised 50 youngsters in total.**Results:** The results showed that 37 patients (74% were boys) and 13 (26% were girls). There were 32 complete radius fractures and 12 incomplete. There were 31 complete ulnar fractures and 17 incomplete ulnar fractures. Angle deformities were significantly reduced before and after treatment (p0.05).**Conclusion:** Treatment of paediatric diaphyseal completes both bone forearm fractures yields excellent results; consequently, these fractures can be safely and efficiently treated with conservative therapy. Conservative care can achieve excellent clinical outcomes in the treatment of malaligned diaphyseal forearm fractures in older children and early adolescents. An angulation of 20° or more in children over the age of 10 should not be recognised in order to achieve a satisfactory functional and cosmetic outcome.**Keywords:** Angulation, Diaphyseal Forearm, Fracture, Forearm.

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Introduction

Forearm bone shaft fractures in children are among the most common fractures, and these fractures are known to be unstable. [1-3] the effective outcome of both-bone forearm shaft fractures requires the restoration of anatomic alignment and full recovery of pronation and supination. [4] Although closed reduction and casting has been a popular and preferred treatment strategy in these fractures, there is an emerging trend towards surgical intervention.[5] According to research published by Thomas EM et al. in 1975 and Kay S et al. in 1986, the failure rate of non-operative therapy of mid-shaft fractures in paediatric populations ranged from 39% to 64%. [6,7] According to Daruwalla JS and Carey PJ et al., around 60% of children have some residual loss of mobility due to fracture malunion. [8] Around 75% to 84% of forearm

fractures occur in the lower third, with another 20% to 25% occurring in the middle third and up to 10% occurring in the proximal third. [9] A significant proportion of qualifying fractures occur bilaterally, and up to 13% have an accompanying supracondylar fracture. [10] Greenstick fractures account for somewhat more than half of these diaphyseal forearm fractures. In 14% to 18% of forearm fractures, the distal growth plate of the radius bone is injured. [11] An earlier study of 500 consecutive fractures in the paediatric age group found that the location of a forearm fracture became more proximal with increasing skeletal age, and that physeal fractures were more common in adolescents than in younger people. [12] Forearm rotation is the most commonly lost movement following these types of fractures. [13]

After conservative care of forearm fractures, more than 50% of patients had residual rotational losses of higher than 15°. [14] The purpose of this study was to emphasise the necessity of cautious care in both bone forearm fractures in children.

Material and Methods

The current study was a prospective investigation into the functional effects of conservative treatment for paediatric diaphyseal forearm fractures. This one-year study was conducted at the Orthopaedic department of the Tertiary Care Teaching Institute of India. The minimal time of follow-up to study the outcome was six months following the injury. The following were the study's inclusion criteria. Diaphyseal forearm fractures of one or both forearm bones in children aged 6 to 14 years, fractures without external injuries treated with closed techniques, and forearm fractures without any accompanying ipsilateral humeral bone fracture. To eliminate elbow fractures and fractures at the junction of the metaphysis and the distal half, a fracture is termed to be diaphyseal if it occurs within the middle third of the forearm. In this investigation, permissible angulations were 25° or less and less than 1 cm bayonet approximation with adjusted pronation and supination. Anteroposterior and lateral views of the whole length of the radius and ulna bones, including the elbow and wrist joints, were included in forearm radiographs. In the first three weeks, radiographs were taken twice. Forearm complex fractures, extra-diaphyseal fractures, fractures associated with same side humeral fractures, pathological fractures, Monteggia or Galeazzi fractures, and patients with only partial radiography views of the radius and ulna were also excluded. All patients received closed manual reduction under sedation, as well as a full-length cast above the elbow. They were treated as outpatients. After the initial treatment, none of these patients required further manipulation. The average length of casting was 4.6 weeks.

During the final visit, the functional and radiological outcomes were evaluated, with the arc of movement of the forearm being the most relevant factor, quantified in terms of pronation and supination. The patient's forearm rotation was tested by having him grasp a pen and then supinate and pronate his forearm. A goniometer was used to calculate the arc of supination and pronation. Patients were asked subjectively if they had experienced any symptoms or limitations in function. At the final appointment, the radiographic alignment of the fracture was measured. The maximal angulation of each bone in the AP or lateral view was designated as angulation. Union was defined by two criteria: no pain at the location of injury and radiographs demonstrating healthy callus formation throughout all four cortices.

Criteria-based outcome measurement Excellent: no problems when performing strenuous physical labour and/or losing 10° rotational movement. Mild symptoms with significant physical work and/or loss of 11°-30° rotational mobility are considered good. Mild subjective discomfort during regular activities and/or a 31°-90° loss of rotational mobility are considered fair. Poor: all other outcomes.

Statistical Analysis

The collected data was assembled and input into a spread sheet programme (Microsoft Excel 2007) before being exported to the data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). The confidence level and level of significance for all tests were set at 95% and 5%, respectively.

Results

The study comprised a total of 50 patients. The average age was 9 years 3 months. There were 37 male patients (74%), and 13 female patients (26%). The most common mode of injury, accounting for 96%, was a fall from a height of less than 1m, and one child was involved in a road traffic accident and the other suffered a minor domestic injury). There were 41 diaphyseal both bone fractures and nine single-bone fractures (7 patients had isolated radius fractures and the other two had isolated ulna fractures). The middle of the radius (n=30) was the most commonly fractured region, followed by the upper third (n=8) and the distal third (n=6). The most prevalent location for ulnar fractures was again in the middle third (n=30), followed by the upper third and lower third locations (both equal n=9) (Tab. 1). There were 32 complete radius fractures and 12 incomplete. There were 31 complete ulnar fractures and 17 incomplete ulnar fractures.

All of the fractures healed in 10 to 12 weeks on average, with no malunion. Four patients developed a superficial infection, and three experienced pain as a result of nail prominence. Supination and pronation were restricted in eight cases. Elbow flexion and extension, palmar flexion, and wrist dorsiflexion were all normal (Table 1).

Angular deformity of the radius and ulna in the lateral plane of radiographs after closed manual reduction and casting. 15% of cases in radius were neutral, 70% were volar, and 14% were dorsal. In the ulnar, 21% were neutral, 49% were volar, and 30% were dorsal.

The degree of coronal plane deformity of the radius and ulna in radiographs after closed manual reduction and casting. In radius fracture, neutral was 44%, radial deviation was 36%, and ulnar deviation was 20%. The ulnar bone had 53% neutral, 33% radial deviation, and 14% ulnar

deviation. The degree of deformity of the radius and ulna in radiographs after closed manual reduction and casting. Inradius bone 0-5 degrees was 35%, 6-10 degrees was 8%, and 11-20 degrees was 0%, which is statistically significant. In the ulnar bone, 0-5 degrees were 21%, and 16-20 degrees were 5%. 11-15 and greater than 20 were not statistically significant.

The degree of deformity of the radius and ulna in radiographs after closed manual reduction and casting. Inradius bone 0-5 degrees was 35%, 6-10 degrees was 8%, and 11-20 degrees was 0%, which is statistically significant. In the ulnar bone, 0-5 degrees were 21%, and 16-20 degrees were 5%. 11-15 and greater than 20 were not statistically significant. Radiographs showing the degree of angular distortion of each bone in the lateral plane after closed manual reduction and casting. Inradius bone 0-5 degree was 18%, 6-10 degree was 54%, and 11-15 degree was -20%. 16-20 were 5%, while

more than 20 were 1%. In the ulnar bone, 0-5 degrees were 54%, 6 to 10 degrees were 25%, 11-15 degrees were 18%, and 16 to 20 degrees were 0%.

Functional results At the most recent visit, all patients had a full arc of motion in both elbow and wrist joints as compared to the unaffected extremity. In 41 of 50 patients (82%), rotational mobility was equivalent to the noninjured extremity. Eight patients experienced some mobility restriction (4 patients had limited pronation, 3 patients had restricted supination, and 1 patient had both abated). According to the evaluation criteria, there were 42 excellent outcomes (84%), 7 excellent outcomes (14%), 1 reasonable outcome (2%) and no poor outcomes. Four of the seven patients who achieved excellent results had restricted pronation, two had restricted supination, and one had both pronation and supination restricted.

Table 1: Gender wise Distribution of study Population

Gender	Number	Percentage (%)
Male	37	74
Female	13	26
Total	50	100

Table 2: Outcomes among the cases based on prince criteria

Outcomes	Symptoms	Loss of forearm rotation (in degree)
Excellent	No complaints with strenuous activity	<15
Good	Mild complaints with strenuous activity	15-30
Fair	Mild complaints with daily activities	31-90
Poor	All other results	<90

Discussion

Children frequently incur diaphyseal lower arm fractures. Closed reduction and casting have been the primary treatment approaches in more than 90% of these patients. Due to the rapid healing time and predictable remodelling occurring in this age range, completely angulated fractures of the middle third of both forearm bones in young children less than 8 or 9 years old can generally be efficiently treated using closed procedures. [15]

Conservatively treated diaphyseal fractures have an angulation deformity rate ranging from 10 to 60%. In 10-50% of cases, angulation malalignment of both forearm bones is associated with impedance of forearm rotation. [16] It has been calculated that 14.8% of patients treated conservatively had an unsatisfactory outcome with forearm pivot disability and cosmetic abnormalities. [17]

Despite the fact that two instances reported cosmetic concerns, we detected no limitation of pronation or supination during our assessment. An established certainty for early remodelling capability is a 10-20° angulation in diaphyseal

fractures and a 20-30° angulation in metaphyseal fractures.

Clinical research on diaphyseal malunions suggests that angulation alone is a poor predictor of forearm mobility. Other factors, such as undiagnosed malrotation and interosseous membrane contracture, may contribute to the loss of forearm movement. Most daily living exercises could be completed with 100 forearm rotations divided equally between pronation and supination. [18]It was determined that 2 of 17 patients with tenacious malunion had a utilitarian or corrective problem. [19] The radius has been emphasised as playing a key role in forearm movement. [20] This demonstrates that palmar and torsional abnormalities of the radius are frequently associated with poor functional outcomes, particularly in terms of pronation. A previous examination confirmed these findings, demonstrating that a bad result is mostly associated with palmar angular distortion of the radius shaft. [21] Recent investigations, such as those by Cruz Jr AI et al. and Smith VA et al., have called for surgical treatment in cases when acceptable alignment cannot be attained. [5,22] The choice to

transition to surgical therapy is problematic since angulation acceptability criteria vary. Along with this, the tremendous remodelling potential and improvement in functional ROM with time in cases managed conservatively, particularly in the hands of skilled paediatric orthopaedic surgeons, contribute to the disagreement among treating physicians.

Residual volar abnormalities of the radius were more likely to cause a restriction in pronation. Deformities coordinated towards the same plane did not always limit forearm rotation, while deformations in the frontal plane of the two bones being angulated one way did not. According to Franklin CC et al., successful treatment of paediatric forearm fractures should result in painless, complication-free outcomes with functional pronation/ supination. It has been demonstrated that 15 to 20° of angulation in middle third forearm fractures might result in significant loss of forearm rotation. [23,24]

In our investigation, 8 of 9 patients with forearm supination and pronation limitations had restricted pronation and supination with combined deformity coordinated in a comparable plane. A previous study found that complete bayonet apposition had no effect on functional result. We agree with this assertion because one of our patients with 5 mm pike apposition had a dorsally and radially angulated ulna with forearm obstruction, yet this had no effect on his functional outcome. [25] Caruso G et al. discovered that conservative care is a safe and effective therapeutic option for forearm fractures. When casting fails to produce a suitable reduction, open reduction is recommended. [26]

Conclusion

Treatment of paediatric diaphyseal fractures of both bone forearms yields very good results; hence, these fractures can be treated safely and successfully with conservative therapy. Conservative care can achieve excellent clinical outcomes in the treatment of malaligned diaphyseal forearm fractures in older children and early adolescents.

An angulation of 20° or more in children over the age of 10 should not be recognised in order to achieve a satisfactory functional and cosmetic outcome. An angulation of up to 20° can be considered appropriate and managed conservatively in young children older than 10 years.

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