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Original Article

Outcomes of Management of Pediatrics Both Forearm Bone Fractures by Using Titanium Elastic Nailing System

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Abstract

Background: *Forearm fractures include 25% of all infantile complaints. Forearm fractures account for 30 to 50% of all paediatric fractures and boys were more prone to forearm fractures. Paediatric diaphyseal bone fractures can be treated conventionally through closed manual reduction and casting as the abilities of the paediatric bones to remodel.Titanium Elastic Nails (TENS) is extensively used in children because it is innocuous. The aim of the study to recognize the management of pediatric bone forearm fractures using TENS.*

Materials and methods: *A prospective study was carried out in the Department of Orthopedics, Chattagram Maa-O-Shishu Hospital Medical College from January 2018 to June 2022. A total of 45 patients (n=45) were enrolled in this study. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from the hospital. The information was kept confidential only to be used for the study purpose.*

Results: *Around three-fourths of the study population (34,75.6%) were male and only eleven patients were female and forty-two patients (42,93.3%) had no complaints of strenuous activity. Fractures involved the middle third in the most of the patients (22,48.9%). Closed reduction and internal fixation with titanium elastic nail system were done in forty-four patients (44,97.8%) and the result was excellent in most of the patients (42,93.3%) and satisfactory in three patients (3,6.7%.)*

Conclusion: *Closed reduction and internal fixation with TENS appears to be acceptable treatment preference for the fixation of paediatric bone fractures. It provides exceptional functional consequences in terms of the range of motion and grip strength without chief complications.*

Key words: Bones; Forearm fractures; Paediarics; TENS.

INTRODUCTION

Fractures are more common in children than other injuries. The most frequent fractures in children are forearm fractures.[1] Forearm fractures comprise 25% of all infantile grievances. Some writers state that forearm fractures account for 30 to 50% of all paediatric fractures.[2] However, there are many types of bone fractures, there are four major categories, such as; displaced, non-displaced, open and closed.[3]. Some studies revealed that boys were more prone to forearm fractures and the threat of fracture among children below 16 years of age had been stated to be 42% in boys and 58% in girls.[3,4] The distal radius is one of the prime fracture sites. Forearm fractures can be categorized as the anatomical location (Distal, middle and proximal), the bones convoluted or the existence or lack of radioulnar joint enhancement. Fractures of both the radius and ulna are the most common fractures

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of the upper extremity.[5] Paediatric diaphyseal bone fractures can be treated conventionally through closed manual reduction and casting as the abilities of the paediatric bones to remodel. These distinctive features of paediatric bones support fixing the angular distortion. 5% of all diaphyseal include the radius and ulna. The reduction is believed effective based on the reappearance of pronation to normal bounds.[6,7] Residual rotational losses of a maximum of 15 degrees have been recorded in half of the patients' post-conservative involvement of forearm fractures.[8] Titanium Elastic Nails (TENS) are intended for the fixation of diaphyseal fractures where the canal is fine or the elasticity of the implant is dominant. TENS is also used to treat metaphyseal and epiphyseal injuries, such as radial neck fractures and is used to fix small bones, like carpal and tarsal bones. In the case of paediatric application, the elasticity of the elastic nails permits them to be implanted at a point which evades distortion of the bone growth plate.[9] TENS is extensively used in children because it is harmless and more competent in contrast to plating.[10] This approach preserves the periosteum, letting bone heal within a closed and intact biological setting.[11,12] Axial and rotational stability is the lacking site of TENS, however, in the case of secondary bone healing, they are relatively more stable.[13] TENS are widely used in paediatric fractures because of the thick periosteum and the improved potential for bone alteration in children, but they are not regularly used in adults due to axial loading and lack of resistance to rotational force. TENS are relatively suitable for the stabilization of proximal forearm fractures, which standbys the massive soft tissue separation and evades the necessity of PIN injury.[11,12] The study aims to understand the outcomes of the management of pediatric bone forearm fractures using Titanium Elastic Nailing.

MATERIALS AND METHODS

A prospective study was carried out in the Department of Orthopedics, Chattagram Maa-O-Shishu Hospital Medical College from January 2018 to June 2022. A total of 45 patients (n=45) were enrolled in this study following the inclusive criteria. After taking a careful history, enough clinical examinations were taken for confirmation. All observations were noted in the clinical data sheet. The results were calculated and interpreted through appropriate statistical analysis with the help of a statistician and presented in a table with other illustrations. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from the hospital.The information was kept confidential only to be used for the study purpose.

Inclusion criteria

- Patients aged 4-16 years
- Patients with displaced fractures or grossly rotated fractures
- Patients with failed closed manipulation reduction
- Patients who had type I open or compound fractures
- Patients who had given consent to participate in the study.

Exclusion criteria

- Patients with isolated forearm bone fracture
- Patients with type II and III compound fractures or fractures with neurovascular injury
- Unable to answer the criteria question
- Exclude those affected with other chronic diseases blood disorder, congenital heart diseases etc.

Operational techniques

A patient was put in the supine positionon the operating table with the affected arm positioned on a radiolucent arm table. Titanium elastic nails of appropriate diameter were chosen. The nail diameters were about two-thirds of the medullary isthmus of each bone. Then, theawl was used to make an entry point in the bones. The accessopinion in the radius was proximalt other a dialstyloid. The ante grade entry point in the ulna can be lateral approach through the proximal metaphysis. The retrograd eentrance in the ulna was through the distal metaphysis. As the radius is often more difficult to reduce, it should be splinted first. A radial nail was inserted manually with the inserter for TEN into the medullary canal, with the nail tip at right angles to the bone shaft. Then, the nail was rotated 180° with the inserter and the nail tip was aligned with the axis of the medullary canal. The radial nail tip was aligned with the medullary canal of the proximal fragment. Then, the nail was advanced with smooth oscillating movements until the tip reaches the proximal fragment metaphysis. The Ulna nail was then introduced and progressed similarly to the radius nail. When the nails were correctly positioned in the opposite metaphysis, protruding nail ends are cut approximately 1 cm from the bone. In most of our cases, closed reduction was done. In a few cases, mini-incision was specified over the fracture site for the reduction and internal fixation with titanium elastic nailachieved.

RESULTS

Among the study population (n=45) the minimum age of the child was four and the maximum age of the child was sixteen. Around three-fourths of the study population (34,75.6%) were male and only eleven patients were female [Table I]. As per Price et al. criteria, forty-two patients (42,93.3%) had no complaints of strenuous activity and three patients (3,6.7%) had mild complaints of strenuous activity [Table II]. Fractures involved the proximal third of the shaft of forearm bones in sixteen patients (16,35.6%), fractures involved the middle third in the majority of the patients (22,48.9%) and the distal one-third involved in seven patients (7,15.6%) [Table III]. Closed reduction and internal fixation with titanium elastic nail system were done in forty-four patients (44,97.8%), in one patient, closed reduction failed, a mini-incision was given over the fracture site and internal fixation with titanium elastic nail system was done [Table IV]. The result was excellent in most of the patients (42,93.3%) and satisfactory in three patients (3,6.7%) [Table V].

Table I Distribution of the study population based on Characteristics (n=45)

Characteristics	(n,%)
Age	
Maximum	16
Minimum	4
Sex	
Male	34,75.6%
Female	11,24.4%

Table II Distribution of the study population based on Price et al. criteria (n=45)

Symptoms	(n,%)
No complaintswithstrenuousactivity	42,93.3%
Mild complaints with strenuousactivity	3,6.7%

Table III Distribution of the study population based on level of fractures

Leveloffracture	(n,%)
Proximalone-third	16,35.6%
Middleone-third	22,48.9%
Distalone-third	7,15.6%

Table IV Distribution of the study population based on the type of surgical procedure

Type of surgical procedure	(n,%)
Closed reduction	44,97.8%
Open reduction	1,2.2%

Table V Distribution of the study population based on outcomes

Outcome	(n,%)
Excellent	42,93.3%
Good	3,6.7%

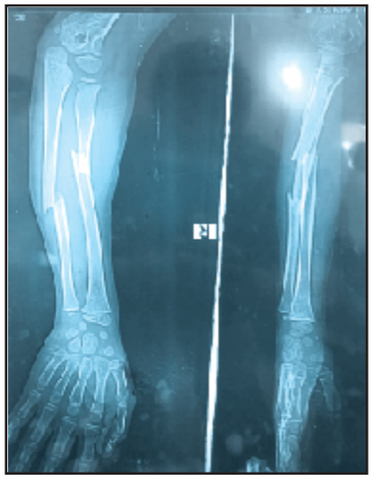

Figure 1 Immidiate X-ray

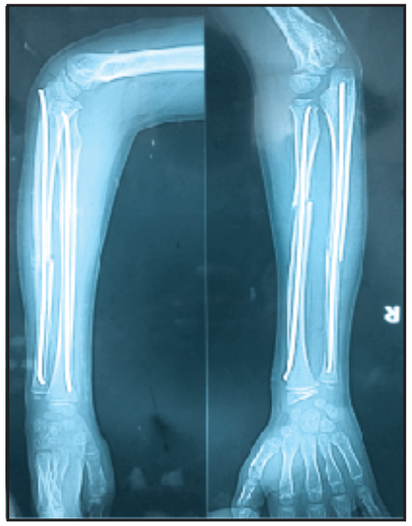

Figure 2 At 4 weeks follow-up

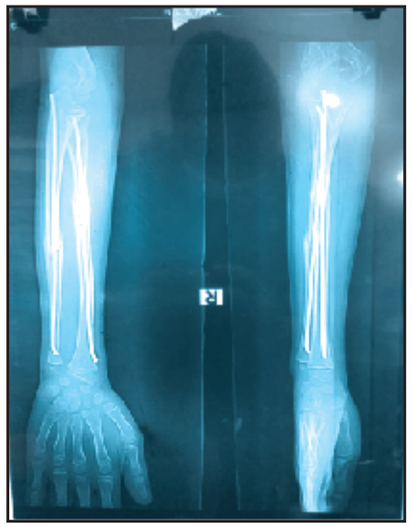

Figure 3 At 8 weeks follow-up

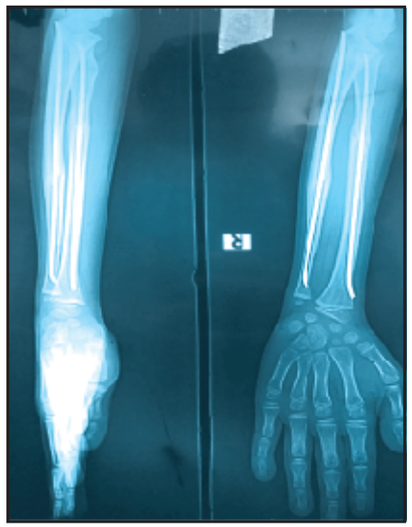

Figure 4 At 12 weeks follow-up

Figure 5 Full forearm Range of Motion (ROM) at 12 weeks

DISCUSSION

Forearm fractures are very popular in children and the prevalence of fractures in shaft forearm bones is more common in 6-16 years old children, with the maximum incidence in children between 12-16 years old.[14] The incidence of distal radial fractures in children appears to be growing, however, it is arduous to clarify the exact reason for this steady increase over the past 40 years.[15,16] In this current analysis, the minimum and the maximum age of the patients was 4 and 16 years old. Another article revealed that patients' age ranged from 1.2 to 18 years. Most female patients were <12 years old and most male patients were ≥12 years old.[17] Another related finding showed that patients' age was between 5 to 15 years old.[18] Another study conducted in Amritsar found that majority of the children were in the age group of 11-14 years with a mean age of 11.2 years.[19] An acceptable functional outcome was found in a closed reduction for the treatment of forearm fractures in children aged 4 to 12 years in another article.[20] In the present finding, most of the patients were male (34,75.6%) and a few (11,24.4%) were female. Another finding suggested that about 80% of patients were male and around one-fifth of the patients (19.18%) were female.[17]. A study carried out in Odisha, India found that most of the patients were male.[21] A related analysis found an almost similar result, male dominance in the study.[19] A related study found the male and female ratio was 3:2.[22] In the present study, most of the patients (42,93.3%) had no complaints and three patients (3,6.7%) had mild complaints of strenuous activity. A study conducted in Odisha depicted that 87.5% of patients had no complaints, 10% had mild complaints and only 2.5% had mild complaints with regular activities. A similar study found that 92% had no complaints & 8% had mild complaints.[19] A study conducted in Paris, France showed no complications were recorded in the study group.[23] In this current analysis, fractures involved the proximal third of the shaft of forearm bones in sixteen patients (16,35.6%), fractures involved the middle third in the majority of the patients (22,48.9%) and the distal one-third involved in seven patients (7,15.6%). Another similar article found that out of 40 patients, fractures involved the proximal third of the shaft of forearm bones in 15 patients, fractures involved the middle third in 19 patients and the distal third involved in 6 patients.[18] A journal of Pediatric Orthopaedics found that there were 12 distal-third, 11 proximal-third and 8 middle-third radius shaft fractures had been seen in children.[24] Another article suggested that 75 o 84% of forearm fractures occurred in the distal third, 15 to 18% occurred in the middle third and 1 to 7% occurred in the proximal third of the forearm.[25] In this current analysis, closed reduction and internal fixation with titanium elastic nail system were done in forty-four patients (44,97.8%), in one patient, closed reduction failed, a mini-incision was given over the fracture site and internal fixation with titanium elastic nail system was done. A related study found closed reduction and intramedullary fixation in 97% of patients who underwent image intensifier guidance and 6% of patients who needed open reduction and intramedullary fixation.[19] Another related analysis found that closed reduction with a titanium elastic nail system was achieved in about 93% of patients.[18] In present study showed that the majority of the patients (2,93.3%) results came out excellent, and satisfactory in three patients (3,6.7%). Another study revealed that 87.5% of patients experienced excellent outcomes, and 2.5% of patients experienced fair results.[18] Another relevant article found that all patients had excellent outcomes in terms of fracture union.[19] The titanium elastic nailing system is an operative and minimally invasive approach to the fixation of forearm fractures with excellent outcomes with lesser complications.

LIMITATION

The study was conducted in a single hospital with small sample size. So, the results may not represent the whole community.

CONCLUSION

Forearm fractures are the most common fractures in children due to fall injuries. Open reduction and plate osteosynthesis is the standard treatment for forearm fractures. Closed reduction and internal fixation with TENS seems to be satisfactory treatment option for the fixation of paediatric bone fractures. It provides excellent functional outcomes in terms of the range of motion and grip strength without major complications.

RECOMMENDATION

There is a necessity for setting a screening docket to cover all age groups for treatment of cases. Furthermore, strategies should be implemented to accelerate government programs.The burden of long-termfractures should be put to the notice of the concerned authorities.To get robust data, multicenter studies are in great need of policymakers to interpret the demonstrable scenario and to take necessary steps towards mitigating this problem.

DISCLOSURE

All the authors declared no competing interest.

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