

# A Study on Clinical Outcome of Management of Diaphyseal Forearm Fractures in Children Using Titanium Elastic Nailing System and Conservative Management by Plaster Cast

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## ABSTRACT

**Background&Aim:** The most common mode of management for forearm fractures in children remains conservative management with closed reduction and immobilization with above-elbow plaster cast. But malunion, stiffness of joints and compartment syndrome are complications of conservative management with plaster cast. The titanium elastic nailing system (TENS) has changed the treatment scenario. Our aim was to compare titanium elastic nailing and conservative management by plaster cast in management of forearm fractures in children. **Methods:** 40 patients in the age group 5 to 15 years with diaphyseal forearm fractures were managed by internal fixation using TENS and another 40 patients managed conservatively by plaster cast. Prospective follow-up were done for six months and outcome were analyzed. **Results:** 35 (87.5 %) cases have excellent functional outcome, 4 (10%) have good and 1 (2.5%) has fair outcome in patients treated with TENS. In patients treated conservatively with POP cast, 23 (77.5 %) cases have excellent functional outcome, 7 (17.5%) have good and 2 (5%) have fair outcome. **Conclusion:** TENS has many merits over a more traditional conservative management in terms of functional outcome with minimal complications.

**Keywords:** Diaphyseal, forearm, Fractures, children, Titanium Elastic Nailing, Plaster cast.

## INTRODUCTION

Fractures in children present significant challenges to the orthopedic community. Epidemiologic studies have shown that 18% of children will experience a fracture by the age of 9, with children between the ages of 5 and 14 having the highest fracture incidence.<sup>[1]</sup> Due to the high incidence of fractures in children, it is important to treat them adequately but also to recognize the potential psychosocial impact a fracture can have on a child, possibly limiting physical activity and affecting their grades in school. Fracture of both bone forearm are the third most common fracture in children and account for 40% of all pediatric fractures.<sup>[2,3]</sup> Historically, closed reduction and plaster cast application has been the gold standard in management of these fractures due to the unique property of the growth potential of the immature bones. But there are increased chances of re-displacement leading to shortening, angulation and

rotation, particularly in older children. As a result, there is a rising trend towards increased surgical management of these fractures in an effort to improve clinical outcomes. Surgical treatment with TENS is a minimally invasive procedure that spares physis, provides 3 point fixation and hence mostly does not requires Plaster of Paris (POP) splint/cast, thereby allowing early mobilization to achieve excellent functional outcomes.<sup>[4-6]</sup>

## MATERIALS AND METHODS

From October 2016 to September 2018, 80 pediatric patients with displaced diaphyseal forearm fracture were treated with titanium elastic nail system and conservative management by Plaster cast.

### Inclusion criteria

- Children aged 5-15 years with displaced diaphyseal forearm fracture
- Children aged 5-15 years with compound forearm fracture (Grade 1 and Grade 2)

### Exclusion criteria

- Children older more than 15 years age
- Children younger than 5 years of age

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- Children having physeal injury
- Cases having ulnar fracture with radial head fracture
- Children aged 5-15 years with compound forearm fracture (Grade 3)
- Fracture both bone forearm with distal radioulnar joint disruption

Patients who were included for management by conservative methods were given sedation and manipulation and reduction of the fracture was carried out. Then immobilisation was done with above elbow POP cast. The patient was observed for any immediate complications like swelling, ischemia. The patient was advised to report immediately to hospitals if there is any bluish discoloration of fingers or severe pain is felt. Active and passive movements of fingers started. The POP cast was removed after 4 weeks. Patients were reviewed at end of 1st week, 4th week, 6th week, 3rd month and 6<sup>th</sup> month for functional and cosmetic outcome.

In surgical management by TENS, the patient was put in the supine position on operating table with the affected arm placed 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, the awl was used to make entry point in the bones. Entry point in the radius was either just proximal to the radial styloid or through Lister’s tubercle.<sup>[2]</sup> The antegrade entry point in the ulna can be either at the posterior aspect of the olecranon or a lateral approach through the proximal metaphysis.<sup>[2]</sup> The retrograde entry point in the ulna was through the distal metaphysis. Because the radius is often more difficult to reduce, it should be splinted first. 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 through 180° with the inserter, and the nail

tip was aligned with the axis of the medullary canal. The nail was advanced up to the fracture site with oscillating movements. 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. Ulna nail was then introduced and progressed in similar manner such as 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 few cases, where closed reduction could not be achieved, mini-incision was given over fracture site for the reduction of fracture and internal fixation with titanium elastic nail done.

## RESULTS

In this study, 35 (87.5 %) cases have excellent functional outcome, 4 (10%) have good and 1 (2.5%) has fair outcome in patients treated with TENS. In patients treated conservatively with POP cast, 23 (77.5 %) cases have excellent functional outcome, 7 (17.5%) have good and 2 (5%) have fair outcome. While comparing TENS with conservative management, Mann-Whitney U Score was found to be 561 and p-value was less than 0.05. In patients treated with TENS, 4 (10%) cases have superficial infection and was treated with local antibiotics and healed, 2 (5%) cases of neuropraxia involving the superficial radial nerve were detected which resolved after several weeks with no long term complication. In patients treated conservatively with POP cast, 4 (10%) cases have malunion and cosmesis is poor in 2(5%) cases. 3 (7.5%) cases have severe restriction of rotational movements of forearm. 8 (20%) cases have less than normal range of flexion movements around elbow.(table1)

Table 1: Functional outcome by price et al. Criteria<sup>[7]</sup>

Functional outcome	Conservative		Tens	
	Number of cases	Percentage	Number of cases	Percentage
Excellent	23	57.5%	35	87.5%
Good	14	35%	4	10%
Fair	3	7.5%	1	2.5%
Poor	0	0%	0	0%
Mann-Whitney U Score And p-value	Mann-Whitney U Score was 561 And p-value was less than 0.05			

## DISCUSSION

Fracture both bone forearm is one of the common fracture in children. Most frequently used methods for treatment of both bone forearms are closed reduction and application of cast, open reduction and plating and open or close reduction with internal fixation by titanium elastic nails, K-wire and ender’s nail. The aim of the treatment is to

achieve functionally and cosmetically satisfactory results and to avoid complications. Current literatures have not established the superiority of one method over the other. In this study, we evaluated the treatment of both bone forearm fractures treated by Conservative method and TENS and provided clinical recommendations for optimal treatment, focusing specifically on paediatric age group. As per price et al

criteria,<sup>[7]</sup> patients treated with TENS had excellent functional outcome in 35 (87.5%) cases, good in 4 (10%) cases, fair in 1 (2.5%) case. Eventually all cases achieved a good range of movements and had no functional deformity or complaints. As per Price et al criteria,<sup>[7]</sup> in patients treated with POP Cast, 23 (57.5%) cases had excellent, 14 (35%) cases good and 3 (7.5%) cases had fair result. Calder and Barry did elastic stable intramedullary nailing diaphyseal forearm fractures in children with excellent outcome.<sup>[8]</sup> Malek IA, Webster R, Garg NK, Bruce CE, Bass A has achieved good functional outcome, and complications were modest and transient.<sup>[9]</sup> In the study done by Houshain S, Bajaj SK, in single bone fixation of both bone forearm with radiological union at a median of 6.7 weeks and at follow-up, a full range of elbow & wrist movements were found in all cases.<sup>[10]</sup> Lascombes et al. obtained excellent results and full range of motion in 92% patients of 85 patients of forearm fracture treated with elastic intramedullary nail.<sup>[11]</sup> Vishwanath C and Satheesh GS obtained excellent functional results in the majority of patients of diaphyseal forearm fractures treated with TENS.<sup>[12]</sup>

## CONCLUSION

This technique of treating pediatric forearm fracture by TENS has many merits over a more traditional conservative management in terms of functional outcome with minimal complications, and cosmesis. It has also advantage over traditional POP cast like maintenance of fracture reduction; promote fracture union and devoid of cast complications.

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