



STUDY OF TENS NAIL IN PAEDIATRIC RADIUS AND ULNA FRACTURE

Orthopaedics

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ABSTRACT

Introduction: Forearm is considered as a functional joint, therefore near anatomical reduction is essential to regain normal supination and pronation. In older children many forearm fractures can be treated conservatively, but failures continue to occur despite good orthopaedic intentions. The fracture which are irreducible or unstable fracture which tends to re-displace needs surgical interventions. Among various surgical treatment one is internal fixation using TENS. Various studies in the recent shows excellent to good clinical outcomes using TENS. **Aims:** Our study is intended to evaluate the clinical and radiological outcomes in paediatric both bone forearm fracture using TENS. **Materials and methods:** A total of 30 patients are included in our study. All are investigated, undergone preanesthetic check-up and taken for TENS application under image intensifier. Nail diameter taken as 33-40% of narrowest diameter of diaphysys were introduced proximally in ulna and distally in radius under image intensifier in closed manner. Postoperatively, patients encouraged for active shoulder, elbow and finger movements and suture removal done after 2 weeks. All patients are followed up to 24 week, when implant removal was done. **Results:** In our study 90% patients show excellent functional results. **Conclusion:** We conclude that TENS in both bone forearm fractures in adolescent age group in terms of union and range of motion is a minimally invasive and effective method of fixation.

KEYWORDS

INTRODUCTION

Diaphyseal fractures of both-bone forearm are common in paediatric age group. The standard management of these fractures remains conservative treatment with closed manipulation and immobilization with above-elbow plaster cast for 4-6 weeks.^[1] Although the fracture unites readily, malunion is very common. Stiffness of joints and compartment syndrome are other complications of conservative management with plaster cast^[2]. Other modalities of treatment have been proposed for the treatment of both-bone forearm fractures in children and adolescents such as closed reduction and K-wire fixation and open reduction with plate fixation. The advent of elastic nail fixation has revolutionized the treatment of displaced fractures of both-bone forearm. Surgical management with elastic intramedullary nail in pediatric both-bone forearm fracture has been first described by Metaizeau and Ligier.⁽³⁾ Biomechanically, these implants have shown to act as internal splints.^[4] The titanium elastic nailing system (TENS) provides the following four properties: flexural stability, axial stability, translational stability, and rotational stability. All four properties are essential for achieving optimal results.^[5] The elastic stable intramedullary nailing has benefits of immediate stability to the involved bone segment which permits early mobilization and returns to normal activities with low complication rate^(6,7). Controversy exists as to what constitutes acceptable angulation, displacement, and rotation. A variety of surgical techniques are available to achieve adequate stabilization of these types of fractures, including plating, external fixation and intramedullary nailing. The wide variety of surgical options available is explained by the unique properties and problems in management of this fracture in children, who have an open physics with the bone still growing. Children aged 10°, malrotation displacement >50%.⁽¹⁰⁾.

MATERIAL AND METHODS

From June 2019 to March 2020, 30 pediatric patients with displaced diaphyseal forearm fracture were treated with titanium elastic nail system. Patients were followed up at 4, 8, 12, and 24 weeks. An unacceptable alignment was defined as less than 50% cortical contact between the fragments and greater than 10 degree of angulation in either the dorsal-volar or radial-ulnar plane. Early range of motion exercises was started, and results were evaluated as per Daruwala grading of surgical results. Follow-up examination of patients included progress of fracture healing, range of motion (ROM), angular deformities, and measurement of limb length. Union was assessed clinically by the absence of pain and tenderness. Radiological assessment included the presence of a bridging callus and partial obliteration of the fracture line on two views. Angular deformity was measured on conventional antero-posterior and lateral radiograph.

Table 1- Daruwala grading of surgical results for pediatric forearm fracture

Classification	Criteria of limitation (in degree)
Excellent	Movements equal on both sides
Good	< 20 of limited rotation on injured side
Fair	20 -40 of limited rotation on injured side
Poor	>40 of limited rotation on injured side

surgical techniques:

Under general anaesthesia, patient was put in the supine position on operating table with the affected arm placed on a radiolucent arm table. A closed reduction is attempted. If the reduction cannot be maintained because of instability, a percutaneous intramedullary nailing is performed without opening the fracture site. If an acceptable reduction cannot be obtained, then open reduction through limited approach and intramedullary fixation is performed. 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.^[2] 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.^[2] 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. Postoperatively, plaster of Paris slab was given for 2 weeks.

RESULTS

All of the fractures healed within an average of 7 weeks (range: 6-9). No non-unions or delayed unions were found. No notable

complications were encountered in the study patients. No deep infection was seen in our patients. As per Daruwala criteria,^[8] 27 patients showed excellent results, 2 showed good results, and 1 showed fair result.

DISCUSSION

In our study, out of 30 patients, Closed reduction and internal fixation with titanium elastic nail system was achieved in 24 patients (80%) under image intensifier guidance. Two patients have open fracture. In 4 patients, closed reduction failed, so mini-incision was given over fracture site and internal fixation with titanium elastic nail system done. Amit et al described the results of treatment of 20 unstable diaphyseal fractures of the forearm in adolescent patients treated with closed intramedullary nailing. All fractures healed within 6 weeks. Cross-union, non-union, infection, refracture, or significant loss of motion range were not reported. Amit et al favoured that technique rather than plate fixation because of the appropriate reduction, reduced complication rate, negligible cosmetic defect, and the ability to perform rod removal under local anaesthesia. In a study by Kapila *et al.*, out of 50 cases, closed reduction and intramedullary fixation in 47 patients (94%) under image intensifier guidance and 3 (6%) patients required open reduction and intramedullary fixation. Three out of our forty patients had pain due to nail prominence. We did early implant removal after bony union. Meantime of implant removal was 8.2 months (range: 6–12 months).

CONCLUSION

Closed reduction and TENS was successful in 24 cases. Open reduction was completed in four fractures of both bones. Bone union was achieved in all patients at an average of 7 weeks. The ROM of the forearms was evaluated using the Daruwala grading criteria. Excellent results were reported in 90% without significant complications after a mean follow-up of 20 months. In conclusion, independent of the age group all unstable and potentially unstable fractures of the paediatric forearm shaft should be approached surgically, as the functional results after this study found to be excellent. This somewhat aggressive attitude is justifiable with the use of titanium elastic nails allowing for a minimally invasive technique allowing for the maximum freedom of motion at the earliest. Although the fracture of both bones of the forearm in children can be managed conservatively, they often lead to malunion with restriction of movements at either elbow or wrist joint. In comparison to conservative method, titanium elastic nail system showed excellent results in terms of bony union, functional outcome with minimal complications, and cosmesis. Therefore, this minimally invasive method of TENS may be considered as an attractive and effective alternative for displaced forearm fractures in pediatric age group.

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