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Titanium elastic nail system (TENS) in displaced clavicle midshaft fractures

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Abstract

Introduction: Out of all fractures in adult, clavicle fractures accounts 3-5%. These fractures are usually managed conservatively but with changing trends the surgical management (plating) has been put into practice widely. TENS has been a recent alternative new technique of fixation. The aim of this study was to investigate the effectiveness of the minimally invasive method- TENS for the management of displaced midshaft non comminuted clavicle fractures.

Materials and Methods: The study included total of 22 patients with displaced midshaft clavicle fracture. There were 16 males and 6 females. The mean age was 31.9 years.

Most surgeries were done within 24 to 48 hrs. Patients were followed for 9 months. The union was assessed Clinico-Radiologically.

Results: Average follow up was 9 months. 100% union was achieved. Clinical union occurred in 3-6 weeks, while radiographic union was achieved in 5-8 weeks. There was no postoperative infection in this study.

Conclusion: TENS is safe and minimally invasive, needs lesser operative time and showed faster functional recovery with greater patient satisfaction with cosmesis.

Keywords: Clavicle fracture, midshaft, displaced fracture, TENS

Introduction

Among all fractures, incidence of clavicle fractures accounts for 3-5% [1]. In general, clavicle fractures are treated conservatively. Hill *et al.* showed that displacement of more than 20 mm resulted in 15% non union and 18% of patients had thoracic outlet syndrome following union [2]. Mckee *et al.* noted reduced patient satisfaction due to asymmetry and cosmesis following malunion [3]. Hence there is a change in trend towards surgical fixation. Absolute indications for surgery are completely displaced fractures, shortening of clavicle by more than 20mm, potential skin perforation /tenting, neurovascular injury and floating injury [4]. Though plating technique is accepted as a standard technique, it has some disadvantages like large scar, higher nonunion rate and difficult application and removal [5]. Intramedullary fixation for clavicular fractures was first described by Peroni in 1950 [6]. Titanium elastic nail system (TENS) was first used by Jubel *et al.* [7]. TENS carries advantage of smaller incision, less soft tissue dissection, load sharing fixation with relative stability that encourages copious callous formation [8]. TENS provides three point fixation within the S-shaped clavical [5].

The present study was undertaken to investigate the effectiveness of TENS for the treatment of displaced midshaft fractures.

Materials and Methods

The present study was prospective study conducted from august 2016 to February 2018 at a tertiary care centre.

The study included total of 22 patients with displaced midshaft clavicle fracture. There were 16 males and 6 females. The mean age was 31.9 years.

Most surgeries were done within 24 to 48 hrs. Patients were followed for 9 months. The union was assessed Clinico-Radiologically.

Inclusion criteria: Midshaft, non-comminuted clavicle fracture with more than 20mm displacement/ shortening in any view.

Exclusion criteria

Floating shoulder, comminuted fractures. Proximal and distal end fractures, pediatric fractures and brachial plexus injury.

Surgical Technique

After administration of anesthesia, supine position was given on radiolucent table with small bolster under the scapula of operating side with C-arm at head end.

Vertical Incision was made 2 cm lateral to sternoclavicular joint,

and entry was made in the anterior cortex of the bone by a small bone awl (Fig.1). Proper anterior-posterior (AP), caudal & cranial views were taken throughout the procedure [10]. Appropriate sized TENS was inserted from medial end and was passed through the fracture site and advanced until the tip of the nail was engaged in supero-lateral cortex of lateral end of clavicle (Fig.2). The size of nail was measured using this formula = $0.4 \times \text{canal diameter in mm}$.

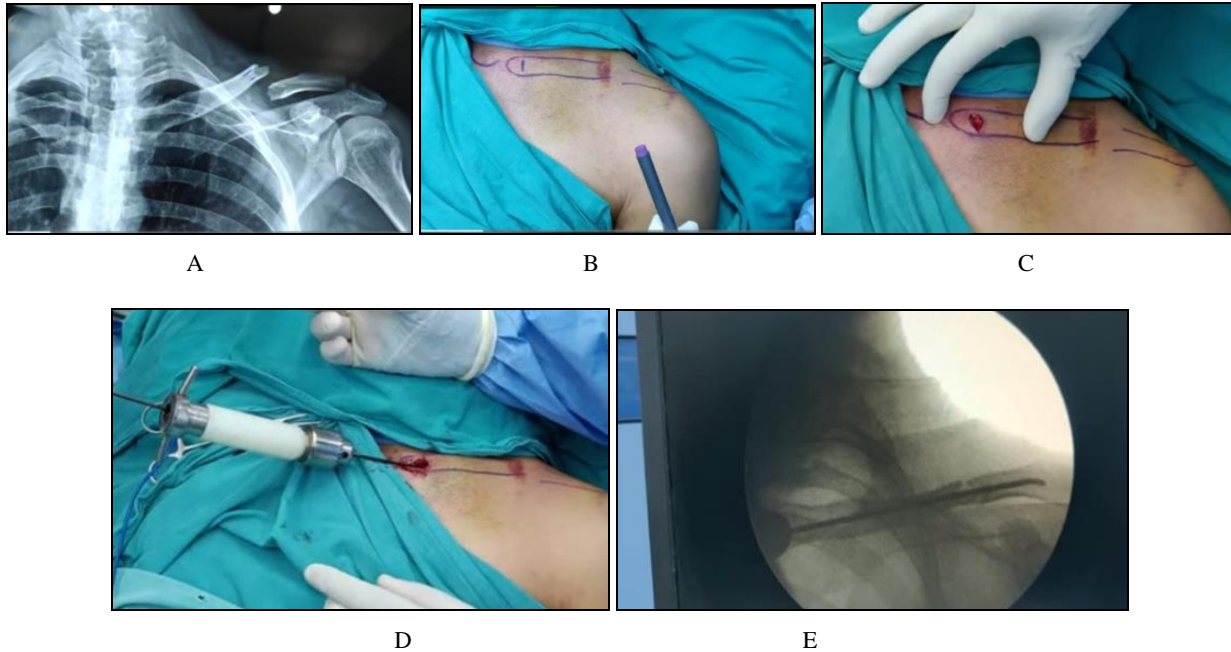


Fig 1: A) Pre operative radiology with a fracture clavicle. B) TENS entry point marked. C) Vertical incision taken. D) TENS inserted after making entry with awl. E) C arm intraoperative xray with TENS inserted

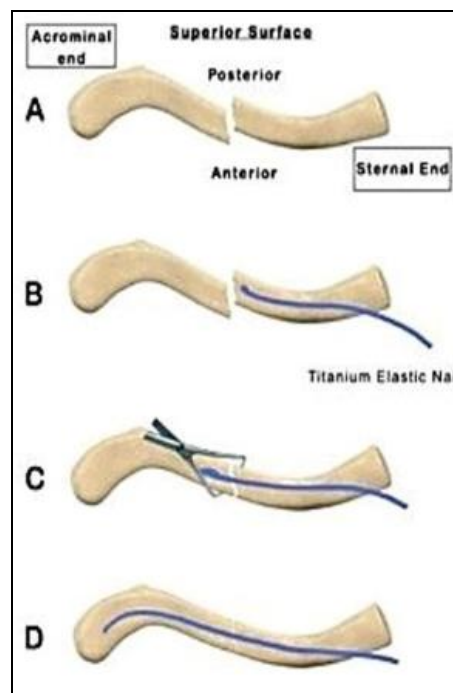


Fig 2: A) Displaced clavicle midshaft fracture B) TENS inserted proximal segment C) Percutaneous reduction done using towel clip D) TENS inserted into distal fragment

All the patients were put in a shoulder sling and pendulum exercises were allowed in the immediate post operative period. Patients were advised to avoid over head abduction for a period

of first 6 weeks. The shoulder sling was removed at 2 weeks and active assisted exercises were started. Patients were also advised not to lift any heavy weight for 6 weeks.

Results

A total of 22 patients were included out of which 16 were male and 6 were female. Among these 17 patients had right sided and 5 patients had left side fracture. The mean age was 31.9 years. The average follow up was for a period of 9 months (Fig. 3). All patients achieved clinical as well as radiological union. Clinical union occurred in 3-6 weeks, while radiographic union was achieved in 5-8 weeks. 14 patients out of 22 patients had closed nailing while 8 patients required open reduction. 7 patients out of 22 patients had removal of implant for symptomatic medial irritation, 7 to 9 months after initial surgery. There were no major complications in our series with no cases of infection, scar neuromas, non union or perforation of posterior cortex.

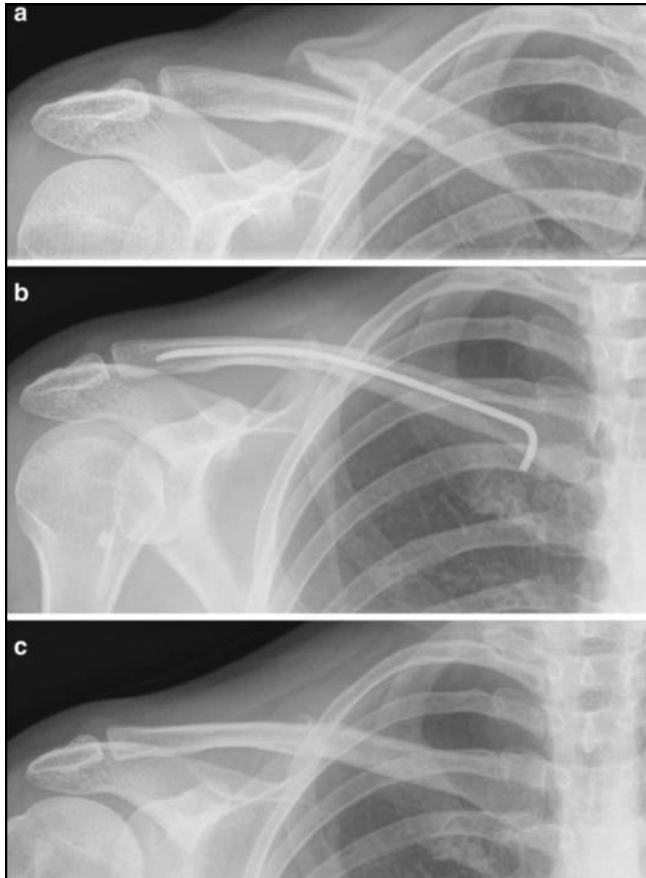


Fig 3: a). Preoperative radiograph b). Postoperative radiograph c). 9-month postoperative healed fracture with TENS removal

Discussion

Plate osteosynthesis is still considered the standard method for the surgical treatment of displaced midshaft clavicle fracture. However complications after plate osteosynthesis are fairly common. TENS is a very simple and reliable method in fixation of displaced midshaft clavicular fracture. Operative time is 25 to 30 minutes which is less as compared to plating (55 to 60 minutes). The other benefits of this technique include less operative time and blood loss, small incision, minimal periosteal stripping and load sharing properties^[11]. Titanium nails are cheaper as compared to plates and easily affordable to poor patients.

The limitations of this study were the need of image intensifier to confirm the position of nail and a radiolucent table.

Duan and his colleagues¹ concluded that there were no significant differences of outcomes between plating and intramedullary nailing, but plating had a higher complication rate than nailing. Zhang B and his colleagues^[12] in 2015, showed

that intramedullary nailing has more advantages as compared to plating with a reduced surgery time, a shorter incision, rapid union time, better shoulder function recovery at 6 months and fewer complications of symptomatic hardware, refracture after hardware removal and hypertrophic scar. Zehir S and his colleagues^[13] in 2015 concluded that the mean time of operation and mean time of fluoroscopy were significantly shorter in the intramedullary nailing group than those in minimally invasive percutaneous plate osteosynthesis (MIPPO) group. Time of hospital stay and duration for bony union was significantly shorter in the nailing group as compared to MIPPO group. Smekal *et al.*^[14] showed, in a randomized control trial between intramedullary nailing and non-operative treatment, better DASH and Constant scores and 100% union rate with intramedullary nailing.

Chen *et al.*^[15] showed a significantly shorter time to union with the TEN group with no significant difference in non-union or malunion rate between TEN and plating. They showed faster functional recovery with greater patient satisfaction with cosmosis and overall outcome in the TEN group.

Conclusion

In conclusion TENS fixation of displaced midshaft clavical fractures is a safe minimally invasive technique, needs lesser operative time, is cosmetically better and provides early good functional outcome.

Conflict of Interest

Not available

Financial Support

Not available

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