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FUNCTIONAL AND RADIOLOGICAL ANALYSIS OF MIDSHAFT CLAVICLE FRACTURE TREATED WITH TENS NAILING

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Abstract

Introduction: Clavicle fracture is the most frequently and easily fractured bone due to fall on outstretched hand or direct impact. Mainly the midshaft clavicle fracture is 80% compare to medial and lateral end clavicle fracture. Amongest all fractures the incidence of clavicle fracture is 3-5%.Tretement consist of mainly two procedure open reduction with plate or minimally invasive close reduction with TENS nail.

Material & Methods: A prospective study was conducted from November 2022 to January 2025 with 30 patients whose plain radiograps shows midshaft clavicle fractures. This study was conducted at our orthopaedic institute which a tertiary care centre.Patients treated with TENS nailing and Functional outcomes were assessed using the Constant-Murley score, and radiological healing assessed with help of follow-up X-rays. Outcomes were analyzed at 4 weeks 8 weeks, 12 weeks, and 6 months post-operation.Implant removal done within 1 year and after 6 month of surgery

Results: Among 30 patients we achieved closed reduction of fracture in 25 patients with lesser blood loss while in remaining 5 patients required open reduction of fracture site using bone holding and artery forcep.In all patient clinical union occurs at 5 weeks on an average and radiologically union occurs on an average 10weeks.

Conclusion: TENS nailing may offer a promising option for the treatment of clavicle shaft fractures as it is minimally invasive require less time for surgery (approx 30min)and patient can mobilize eary with short span of hospital stay(1day postoperatively). providing functional recovery with minimal complications and having superior cosmetic results.

Keywords: Midshaft Clavicle fracture, Titanium Elastic Nailing, Functional outcome, Radiological outcome, Prospective study, Fracture healing,Constant and Murley scoring

Introduction

Clavicle is the most frequently fracture bone either due to direct impact or fall on outstretched hand.amomg all fracture the incidence of clavicle fracture is 3-5%.various treatment modality available for clavicle fracture(1-8).there are mainly two operative approach which commonly in practice consist of open reduction using plate and close reduction using minimally invasive TENS nailing(1,5,8).although plating is standerd technique but it has some disadvantages like non-union,large scar,infection and difficulty in application and removal.whereas,minimally invasive intramedullary TENS nailing have their own advantages and disadvantages.Tiatanium Elastic Nail System(TENS) because of less complication ,rapid union rate,easy insertion and removal,small scar i.e. cosmetically superior (6,14)

Material & Methods

Study design : Prospective study.
Place of study:HBT Trauma care centre , Jogeshwari
Mumbai,Maharashtra a Tertiary care hospital
Duration of study: 25 Months
Sample size: 30

Inclusion Criteria:

- Adults aged >18years of age
- OTA type A&B
- Displaced closed clavicle fracture or comminuted clavicle fractures.
- Midshaft clavicle fracture
- Bilateral clavicle fracture
- Clavicle fracture associated with scapula fracture

Exclusion Criteria:

- Open fractures i.e. compound fracture
- Pathological fractures
- Age <18 years
- Patients with comorbidities affecting fracture healing (e.g., diabetes, smoking).
- Medial and lateral end clavicle fracture

Surgical Technique

Operative procedure: After administration of Genral Anaesthesia, the patient will be placed in supine position with injured extremity prepared with 3 stage painting (savlon-spirit-betadine) and draped from the midline to the upper arm. Care will be taken to make sure that the sternoclavicular joint will exposed well to fascilate easy entry point. Preoperatively, the shoulder region will be screened using image intensifier to confirm fracture site. A vertical skin incision will be made just lateral to the sternoclavicular joint. The subcutaneous fat will be incised. The pectoral fascia will be divided in line with the skin incision followed by careful elevation of the underlying musculature from the clavicle. The entry point will be then made using the awl and appropriate sized TENS nail will be inserted (The size of the nail will be measured using this formula = 0.4 × canal diameter in mm) on an average 2.5mm size used. Attempt will be made to close reduce the fracture. If the fracture could not be reduced by closed means, then a separate vertical incision will be used at the fracture site to achieve fracture reduction. Vertical incision will be used to open fracture site as it is parallel to Langer's lines and minimized the risk of damage to supraclavicular nerves to avoid dysesthesia of skin and scar neuromas.The nail first bend in the shape of “S” as a shape of clavicle to fascilate easy entry within narrow cavity and beyond fracture site. The nail will be used to create a path in the lateral end of the clavicle for subsequent easy access. The nail will be then passed from the medial side and across the reduced fracture into the lateral end of clavicle.The nail is cut underneath the skin to aid implant removal after complete union. Wound will be closed in layers and skin closure will be done. Sterile dressing will be done.[35]
Postoperatively the operated limb will be mobilized immediately on post-op day-1. IV antibiotics will be continued for 48 hrs and switched over to oral antibiotics on the 3rd day and continued till the 5th day. Wound will be inspected on 3rd postoperative day and Sutures will be removed on 15th postoperative day. Patient will be discharged on 2nd postoperative day but some patients will be discharged later due to associated injuries and co morbidity. Rehabilitation will be started at end of 2 weeks. Gentle pendulum

exercises to the shoulder will be allowed but abduction will be limited to 80 degrees. At 3 weeks active range of motion in all planes will be allowed. Regular follow up for every 4 week will be done. At each follow up patients will be assessed clinically, radiologically and the complications will be noted.Nail to be removed after 6 month. Local examinations of the affected clavicle for tenderness, instability, deformity and shoulder movements will be assessed. Functional assessment will be done by Constant Murley score

Fig. 1: Entry Point of TENS nailing

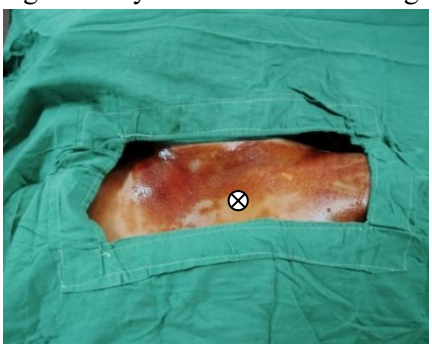
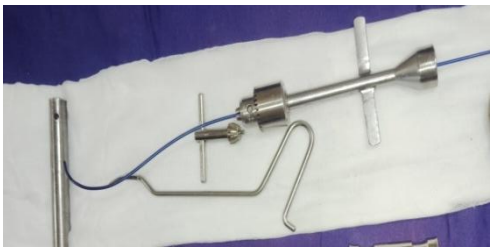


Figure 2: Pre-Operative X-Rays of a 55-year-old female patient with AO Type B1



Figure 3:Operative Instruments and Implant







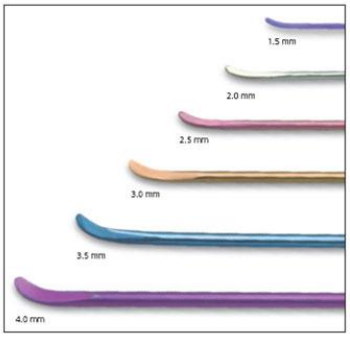
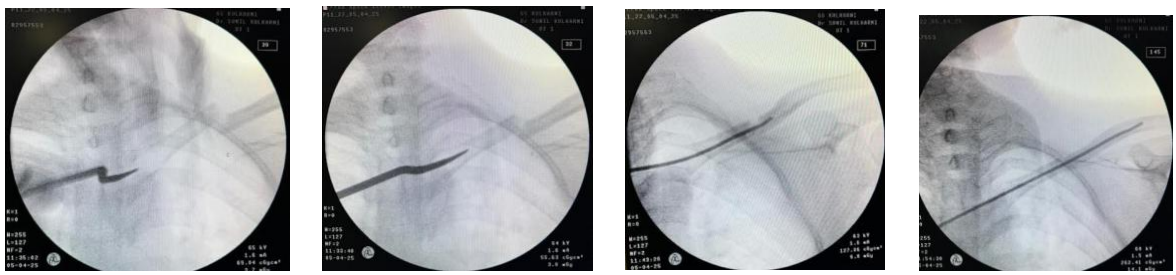


Figure 4: (1 to 4): Intraoperative images showing entry of awl from medial end of clavicle ,with TENS nail attached to the T-handle passed through entry point and reduction of fracture achieved after manual shoulder movement. TENS nail passed beyond the fracture site and final anatomical reduction in a 55-year-old female

with AO Type B1 Left Midshaft Clavicle fracture. Reduction forceps were used in some cases for fracture reduction.



1) 2) 3) 4)

Figure 5 : Post-Operative X-Rays



Figure 6: Pre operative and 5month follow up X-Rays of a -34 year-old male patient with AO Type B1 Left Midshaft Clavicle Fracture



Figure 7: Pre-Operative & 5 month follow up X-Rays of a 22-year-old male patient with AO Type B1 Left Midshaft clavicle fracture

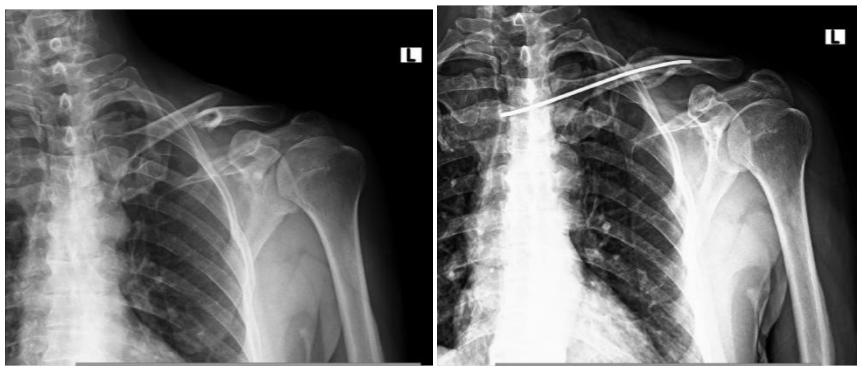


Figure 8: Pre-Operative & 5 month follow up X-Rays of a 30-year-old female patient with AO Type B1 Left Midshaft clavicle fracture

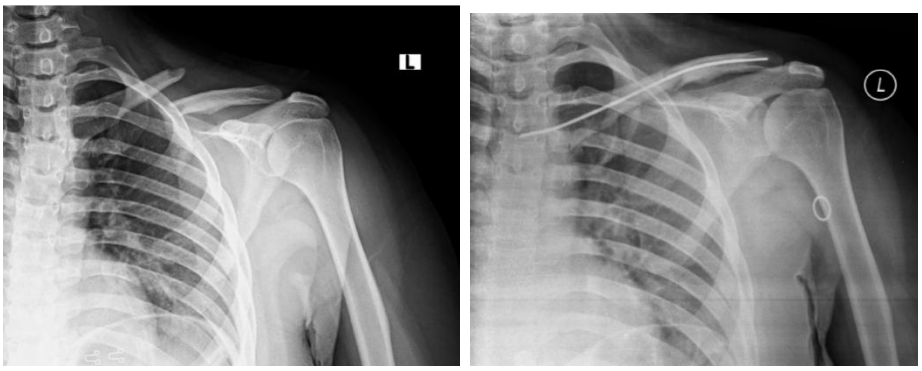
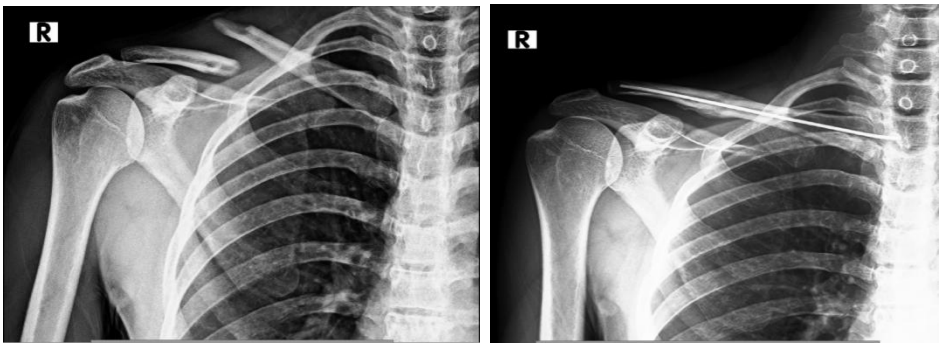


Figure 9: Pre-Operative & 5 month follow up X-Rays of a 45-year-old male patient with AO Type B1 Right Midshaft clavicle fracture



Results:

In our study ,we included 30 patients aged 18-50 years with closed midshaft clavicle fracture.15 patients were males and 15 were females (Table2)

Amongest them (12right and 18left side fracture)(Table 4),fracture result from road traffic accident,sport injury and fall.(Table3).

There were 11(type B1)and 19(type B2)fractures. (Table5).All patients were operated within 2 days following injury.The average operative time 30min (range-25-60 min)

Among 30 patients we achieved closed reduction of fracture in 25 patients with lesser blood loss while in remaining 5 patients required open reduction of fracture site using bone holding and artery forcep.In all patient clinical union occurs at 5 weeks on an average(Range-4-6), and radiologically union occurs on an average 10weeks.(Table 7)The patient were followed up post operatively and constant and murley score were calculted

Constant Murley score at follow up

In the present study at follow up at 1 month 62.77 mean Constant and Murley score was observed, at 2 months 74.97 mean Constant and Murley score was observed, at 3 months 81.90 mean Constant and Murley score was observed and at 6 months 90.73 mean Constant and Murley score was observed. At follow up statistically significant difference was observed in Constant and Murley score.(p=<0.0001***)

Discussion

Clavicle fracture which are undisplaced ,Midclavicular fractures can heal without the doctor conservatively , with the doctor, and despite the doctor!".24 The clavicle is the only long bone that is horizontal. The upper limb and the trunk are connected by this one and only bone strut. With concave forwards laterally and convex forwards medially, it has an S-shape. The bone is flat in the outer third, tubular in the middle, and serves as a transitional region between the two cross-sections. This renders the centre portion of the clavicle vulnerable, increasing the risk of fracture. The clavicle articulates medially with the sternum via the sterno-clavicular joint and laterally with the scapula through the acromio-clavicular joint.

Adults frequently sustain clavicle fractures, which make up between 2.6%and 5% of all injuries.25-28A fall on the outstretched hand or a direct hit to the anterior chest wall are the two possible mechanisms of injury.29Proximal, mid-shaft, and distal fractures are the three types of clavicle fractures. The mid-shaft is the most frequently fractured area of the clavicle, where the tiny cross section of the bone and the usual compressive stress delivered to the shoulder result in bony failure. Eighty percent of all clavicular fractures are mid-shaft fractures.30
They show signs of displacement to some extent. However, 15–25% of all fractures are distal third fractures. Medial third fractures are the least common ,making up only 0-5% of all clavicular fractures.31,32A figure-of-eight bandage or an arm sling can be used as a conservative treatment formany of these mid-shaft fractures. According to recent data, more severe fracture types may actually have a higher likelihood of malunion or non-union.33Clavicle malunion has been demonstrated by several writers to be a unique clinical entity with distinctive patient symptomatology. Therefore,the purpose of the current study was to investigate the function of intramedullary nailing using Tens nail in cases of midshaft clavicle fracture.

Conclusion

- For midshaft clavicle fractures, TENS nailing guarantees high fracture union rates, superior radiological and functional results, and a prompt return to normal life activities.
- Minimally invasive surgery hardly 1-1.5 cm incision and requiring less operative time during surgery
- As indicated by higher Constant Murley ratings, it showed notable gains in functional recovery.
- Flexible intramedullary nailing can therefore be suggested as the preferred fixing technique for mid-shaft clavicle fractures because TENS also produced better cosmetic results, quicker healing durations, and early mobilization when compared to more conventional techniques like plating.

Authors Contribution
All authors participated in each and every aspect of this study,including design,data collection,data analysis,interpretation of data ,patient contact and follow up,review and final version to be published in the gernal.

Conflict of Intrest
The authors confirm that they have no any conflict of intrest related to research ,authorship and publication of this article.

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Table1:Age distribution

Age	No of cases	Percentage (%)
≤ 20	1	3.33
21–30	13	43.33
31–40	8	26.67
41–50	8	26.67
Total	30	100.00

Table 2: Gender distribution

Gender	No of cases	Percentage (%)
Male	15	50
Female	15	50
Total	30	100

Table 3: Mode of injury

Modeof injury	No of cases	Percentage (%)
Fall	10	33.33
RTA	15	50.00
Sports Injury	5	16.67
Total	30	100

Table 4: Side

Side	No of cases	Percentage (%)
Left	18	60.00
Right	12	40.00
Total	30	100.00

Table 5:AO Classification

AO Classification	No of cases	Percentage (%)
B1	11	36.67
B2	19	63.33
Total	30	100.00

Table 6:Associated injuries

AssociatedInjuries	No of cases	Percentage (%)
BBLeg#	2	6.67
I/LScapula spine#	1	3.33
No any	27	90.00
Total	30	100.00

Table 7:Time for union

Timeforunion(in weeks)	No of cases	Percentage (%)
≤ 6	5	16.67
7–9	18	60.00
10–12	7	23.33
Total	30	100.00

Table 8: Shoulder Movement

Shoulder movement (in degree)	No of cases	Percentage (%)
Flexion		
≤ 150	23	76.67
>150	7	23.33
Abduction		
≤ 150	18	60
>150	12	40
ER		
≤ 75	21	70
>75	9	30

Table 9:Constant and Murley score at follow up

Follow up	Mean±S.D
At1month	62.77±4.90
At2 months	74.97±2.63
At3 months	81.90±2.04
At6 months	90.73±2.23

Follow up	Mean±S.D	P-value
At1month	62.77±4.90	**<0.0001**
At6 months	90.73±2.23	

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