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Mid Shaft Clavicle Fracture Managed With Titanium Elastic Nail System Through Minimally Invasive Technique

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Abstract
Introduction
Clavicle fractures account for approximately 2.6% of all fractures and for 44% to 66% of fracturesabout the shoulder.Middle third fractures account for 80% of all clavicle fractures.previously clavicle fracture was managed conservatively by figure of eight bangade and arm pouch sling ,by knowing the complication of conservative management treatment option is currently shift to surgical treatment.plating and naiung are the two surgical option . this study was conducted to study the result of Mid shaft clavicle fracture managed with Titanium elastic nail system through minimally invasive technique
Material method
This is a prospective study of 20 casesbetween the age group ranging from 18 to 55 years of the midshaftclavicular fractures treated by minimally invasive technique with TENS nailing. The results were evaluated on the basis of The Disability of Arm Shoulder and Hand (DASH) score was calculated on scale 0-100, considering score 0 best and 100worst
Result
A total of 20 patients met the inclusion criteria of midshaft clavicle fracturesAll fractures were united. Mean duration of radiological union was 10.3 weeks ranging from 6 to 20 weeks . There was a soft-tissue irritation at entry point in three patients. There was a hypertrophic scar formation over entry point of nail in two patients. There was a nail protrudes at the entry site of clavicle in one patients. None of the patients had infection, nonunion, and implant breakage.In the present study, mean DASHscore after 6 months of follow-up was 6.6 ranging from 0.7(best) to 40(worst).
Conclusion
Titanium elastic intramedullary nailing of the clavicle is a safe, reliable method for fixation of displacedmidshaft clavicle fractures.
Keyword*-TENS(Titanium elastic nail system),DASH(The Disability of Arm Shoulder and Hand)*

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I. Introduction

Clavicle fractures account for approximately 2.6% of all fractures and for 44% to 66% of fracturesabout the shoulder.Middle third fractures account for 80% of all clavicle fractures, whereas fractures of the lateral and medial third of the clavicle account for 15% and 5%, respectively.

The clavicle is most frequently and easily fractured bone, due to direct blow or fall on the outstretched hand.

Standard treatment for this fracture pattern is nonoperative, using an armsling or figure-of-eight bandage for externalfixation.[1] Conservatively displaced fractures are noted to have a higher incidence of nonunion in between 10% and 15%and even when they do unite, often result in an unsightly cosmetic deformity in the center of the clavicle, shoulderdropping, shoulder discomfort, and patient dissatisfaction.[2,3]

Mueller et al[4](2008) –In his study, up to 31% of cases who were treated for mid shaft clavicular fractures non-surgically lead to unsatisfactory results such as nonunion, brachial plexus irritation, shortening and limited function of the shoulder.

RobbinC.MeKeeet al[5] (2012) studied 421 patients with randomized clinical trials comparing operative versus non-operative care for displaced midshaft clavicle fractures. They concluded that operative treatment provided a significantly lower rate of non-union and symptomatic malunion and an earlier functional return compared with non-operative treatment.

Hence, more recently, there has been a trend toward surgical fixation. Surgery has

been indicated for completely displaced fractures, potential skin perforation, shortening of clavicle by more than 20 mm, neurovascular injury, and floating injury.[6] The gold standard for the surgical treatment has been open reduction and plate fixation through a large incision.[6] Other surgical optionsinclude intramedullary pinning with Kirschner wire ,ESIN (elastic stable intramedullary nailing), and external fixation.[7]

Plating is the most commonly used surgical treatment; however,plating requires relatively extensive periosteal stripping, which may jeopardise the blood supply at the fracture site, thusadversely affecting fracture healing. Surgical time is considerable, and infection rates of up to 18% have been reported and non-union. In addition, the relativelylong scar can be a cosmetic issue in some patients, and some individuals experience discomfort induced by the plateunderneath the skin, Thereafter, additional procedures required for plate removal.

The second method, intramedullary nailing of clavicle fracture is a relatively new technique done using elastic titanium nails. This technique was attractive when first presented by Jubel et al. Some articles have recommended it as a technique with little complications, rapid union rate, easy insertion and removal, small scar and no breakage.

Intramedullary devices behave as internal splints that maintain alignment without rigid fixation. Intramedullary devicehas advantages of a smaller incision, less dissection, and load sharing fixation with relative stability that helps in callusformation.[8] Due to flexibility of titanium nails is that it can manage itself in the bone and provide a 3-point fixationwithin the S-shaped clavicle.[8]This study was conducted to evaluate the results of mid shaft displaced clavicle fracture treatedby titanium elastic nailthrough minimally invasive technique.

II. Materials And Method

This is a prospective study of 20cases of the midshaftclavicular fractures treated by minimally invasive technique with TENS nailing. Patients were explained about the procedures, complications, and post-operative protocols. Informed consent has been obtained from all patients. The period of study extends from 2019 to 2020 and follow up at 4,8,12,24 weeks, in the Department of Orthopaedics, Jhalawar Medical College& SRG Hospital, jhalawar,Rajasthan.

Inclusion Criteria

The following criteria were included in the study:

- Age - 18years to 55year
- Clavicle mid-shaft fractures withdisplacement of fragments more than 2 cm on plainradiographs,
- clavicle length shortening more than 2cm on plain radiographs
- tenting of skin at the level of fracture.

Exclusion Criteria

The following criteria were excluded from the study:

- Age <18 years and >55year
- Severely comminuted fractures.
- Open fractures.
- Old fracture nonunion.
- Pathological fractures
- Ipsilateralmultiple rib fracture
- Any medical contraindication for surgery, Patient refusal , Medically unfit
- moderate to severe head injury (Glasgow coma scale <12)
- multitraumapatients
- fractures of >1 month duration
- bilateralclavicle fractures
- segmental fracture
- fractures with associated neurovascular injury.

Surgical technique for TENS

Patients were placed in supine position. A small incision was made approximately 1 cm lateral to the sternoclavicular joint. Entyr was made through entry Awl.Tip of nail was bend than TENS nail was inserted (the diameter varied from 2 to 3 mm depending on the width of the bone). Closed reduction was performed under fluoroscopic control. The nail was then advanced manually until it was just medial to the acromioclavicular joint.(**figure-1**) After reaching the end point, the fracture was compressed and the nail was cut close to the entry

point to minimize soft tissue irritation, at the same time leaving sufficient length behind for easy extraction later on. The fascia and skin were closed in layers.

All the patients were put in a shoulder sling postoperatively and followed same rehabilitation regime ofearly gentle mobilization when pain allows, with no overhead abduction for first six weeks.The results were evaluated on the basis of The Disability of Arm Shoulder and Hand (DASH) score was calculated on scale 0-100, considering score 0 best and 100worst.

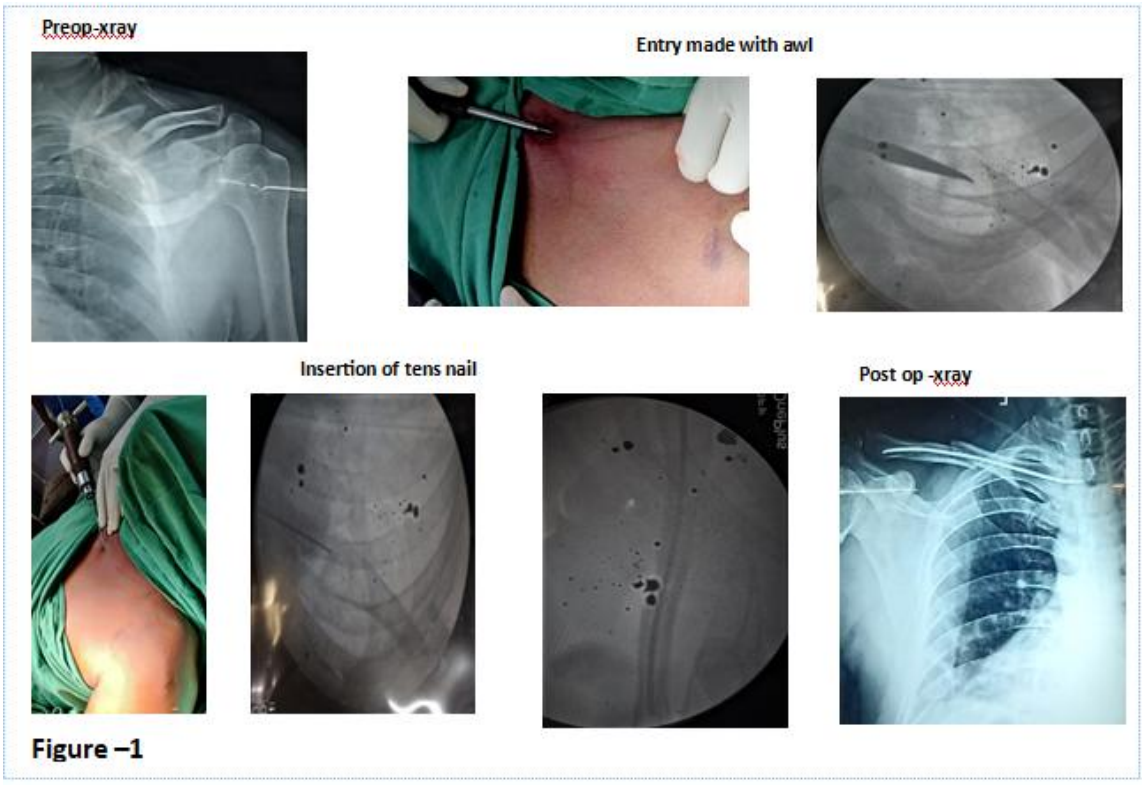


Figure –1

III. Results

A total of 20 patients met the inclusion criteria of midshaftclavicle fractures.(**table-1**) In this study,mean age of patients was 31.2 years ranging from minimum 20 years to maximum 54 years. Males were 14 and femaleswere 6 in this study. The right side was involved in 12 cases and the left side in 8 cases. Mechanism of injuries was roadside accident in 14patients, fall from height in 3 patients, fall on outstretched hand in 2 patients, and sports injury in 1 patients.According to AO classification, 30% were type B1, 70% were type B2. All patient were operated within 24-48 hours from admission to thedepartment. During surgery closed reduction succeeded in 90% and in 10%cases percutaneous reduction clamp is used. The mean time ofsurgery was 54.8 min ranging minimum 25 min to maximum 85 min. All fractures were united. Mean duration ofradiological union was 10.3 weeks ranging from 8 to 20 weeks . There was a soft-tissue irritation at entry point in three patients. There was a hypertrophic scar formation over entry point of nail in twopatients. There was a nail protrudes at the entry site of clavicle in onepatients(**table-2**). None of the patientshad infection, nonunion, and implant breakage. Most of the patients had well-aligned union, and no patients hadangulation more than 30°. In the present study, nail removal was done in 15 cases, and in 5 cases, implant was notremoved because of refusal of patients. The mean time of nail removal was 6.8 months.

The Disability of Arm Shoulder and Hand (DASH) score was calculated on scale 0-100, considering score 0 best and 100worst In the present study, mean DASHscore after 6 months of follow-up was 6.6ranging from 0.7(best) to 40(worst).

Table 1: Demographic and clinical profile of study participants (n=20).

CHARACTER	TENS NAILING GROUP(n=20)
Mean age(in year)	31.2
Gender (in number	
Male	14
Female	6
Mode of injury	

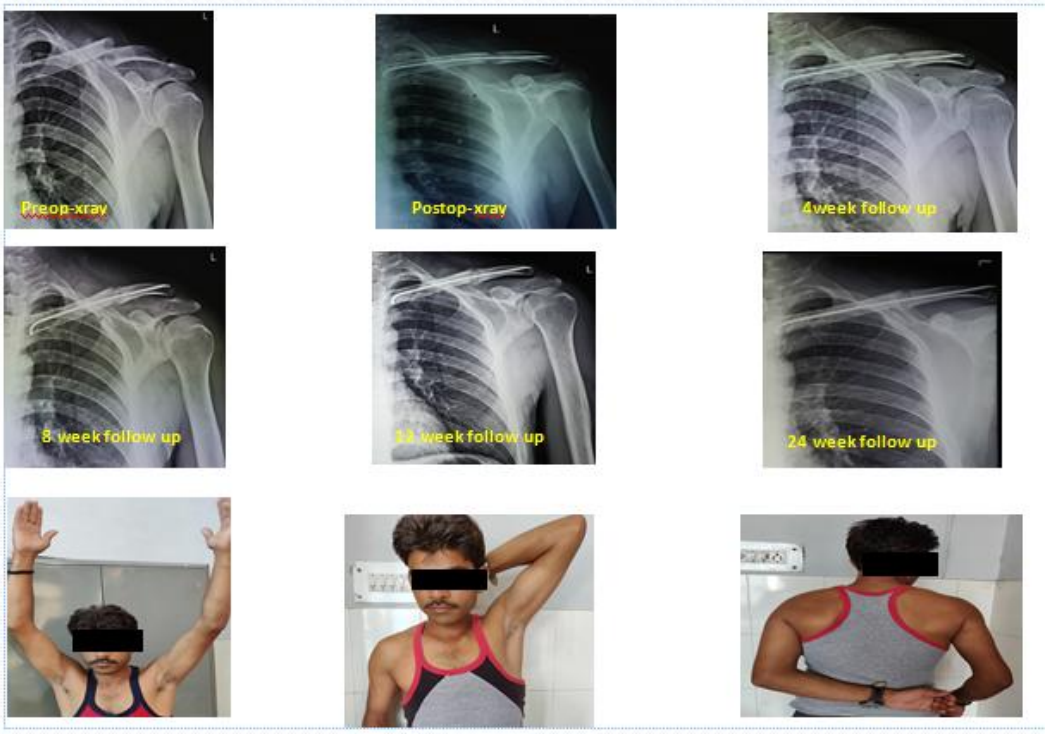
RTA	14
Fall on outstretched hand	2
Fall from height	3
Sports injury	1
Side affected (in number)	
Right	12
Left	8
Types of fracture as per OTA(%)	
B1	30
B2	70

Table 2-Complication of TENS Nail

Complications	Number of cases
Skin irritation at entry point	3
Hypertrophic scar	1
Nail protrudes at entry site	1

Case 1-28 year old male with fracture clavicle left side operated with CRIF with TENS nail.follow up taken at 4,8,12,24 weeks.(**figure-2**)

Figure-2



IV. Discussion

Clavicle fractures account for approximately 2.6% of all fractures and for 44% to 66% of fractures about the shoulder.majority ofthem (80-85%) occur in the midshafts.17,18

The intramedullary nailing with TENS provides an alternative and minimally invasive way of surgically treating clavicle fractures. The use of titanium elastic nails in the treatment of midshaft clavicle fractures was firstdescribed by Jubel*et al.*[9] In a retrospective analysis between titanium elastic nails and reconstruction plates.

TENS nailing is a simple and minimally invasive technique in fixation of displaced midshaft claviclefractures.This method of management of midshaft clavicle Fractures by minimally invasive technique with TENS nailing has got many advantages over open reduction and plating like minimally invasive technique, minimal incision minimal periosteal stripping, ,less operative time, decreased postoperative morbidity, faster recovery and cosmetically better scar.

Its relative stability allows copious callus formation during the healing process. The frequent complication includes skin irritation from the prominent medial end of the nail and this frequently leads to either

trimming of thenail or its premature removal.[10]in our study 15%cases show skin irritation and 5% show nail protrusion from entry site.

Smekal*et al*. hence do notrecommend use of ESIN in comminuted fractures with severe shortening because Multifragmentary fracture can lead to telescoping of the nail with shortening of the clavicle.[10]

Duan*et al*. in a metaanalysisof randomized controlled trials demonstrated similar functional outcome when comparing plating with intramedullary fixation.[11]They, however, showed higher symptomatic hardware-related problems with plating.[11]

Zolowodzki*et al*. in a systematic review of 2144 cases found non-union rateof 1.6% with intramedullary fixation as compared with 2.5% with plate fixation.[12]

Chen *et al*. 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 cosmesis and overall outcome in the TEN group.[13]

Smekal*et al*. showed, in a randomized control trail between intramedullary nailing and nonoperativetreatment, better DASH and Constant scores and 100% union rate with intramedullary nailing.[14]

Liu *et al*. found no significant difference between functional outcome and non-union rate following plate fixation and intramedullary fixation (titanium elastic nails) of displaced midshaftclavicle fractures.[15]

Frigg *et al*. in their study expressed concerns about the increased complication rate.[6]in our study 15%cases show skin irritation and 5% show nail protrusion from entry site.

Migration of intramedullary implant has beenreported in a number of studies.[8,10,15]

Smekal*et al*. reported that 23% of their patients had medialnail protrusion and 89% of the patients required implant removal[14]in our study 5% cases show nail protrusion for which no implant removal done.

V. Conclusion

TENs nail fixation showed better clinical outcomes in the terms ofoperative time, wound size, subjective time to pain relief, and thepostoperative functional scores of shoulder joint during the treatmentof displaced midshaftclavicular fractures hence to conclude *Titanium elastic intramedullary nailing of the clavicle is a safe, reliable method for fixation of displaced midshaft clavicle fractures.*

References

[1]. Postacchini F, Gumina S, De Santis P, Albo F. Epidemiology of clavicle fractures. J Shoulder Elbow Surg2002;11:452-6. [PUBMED]

[2]. Boehme D, Curtis RJ Jr., DeHaan JT, Kay SP, Young DC, Rockwood CA Jr., et al. Non-union of fractures of themid-shaft of the clavicle. Treatment with a modified Hagie intramedullary pin and autogenous bone-grafting. JBone Joint Surg Am 1991;73:1219-26.

[3]. Edelson JG. The bony anatomy of clavicularmalunions. J Shoulder Elbow Surg 2003;12:173-8. [PUBMED]

[4]. Mueller M, Burger C. Florczyk A, Striepens N, Rangger C. Elastic stable intramedullary nailing of midclavicular fractures in adults: 32 patients followed for 1-5 years. ActaOrthop 2007;78:421-423.

[5]. Robbin C. McKee, Daniel B. Whelan, Emil H. Schemitsch, Michael D. McKee. J Bone Joint Surg Am, 2012;94: 675-684.

[6]. Frigg A, Rillmann P, Perren T, Gerber M, Ryf C. Intramedullary nailing of clavicularmidshaftfractures with the titanium elastic nail: Problems and complications. Am J Sports Med. 2009;37:352–9. [PubMed] [Google Scholar]

[7]. Khalil A. Intramedullary screw fixation for midshaft fractures of the clavicle. Int Orthop.2009;33:1421–4. [PMC free article] [PubMed] [Google Scholar]

[8]. Mueller M, Rangger C, Striepens N, Burger C. Minimally invasive intramedullary nailing of midshaftclavicularfractures using titanium elastic nails. J Trauma 2008;64:1528-34.

[9]. Jubel A, Andemahr J, Bergmann H, Prokop A, Rehm KE. Elastic stable intramedullary nailing of midclavicular fractures in athletes. Br J Sports Med. 2003;37:480–3. discussion 4. [PMC free article][PubMed] [Google Scholar]

[10]. Smekal V, Irenberger A, Attal RE, Oberladstaetter J, Krappinger D, Kralinger F. Elastic stableintramedullary nailing is best for mid-shaft clavicular fractures without comminution: Results in 60 patients. Injury. 2011;42:324–9. [PubMed] [Google Scholar]

[11]. Duan X, Zhong G, Cen S, Huang F, Xiang Z. Plating versus intramedullary pin or conservative treatment for midshaft fracture of clavicle: A meta-analysis of randomized controlled trials. J Shoulder Elbow Surg. 2011;20:1008–15. [PubMed] [Google Scholar]

[12]. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Evidence-Based Orthopaedic Trauma Working G. Treatment of acute midshaft clavicle fractures: Systematic review of 2144 fractures: on behalf of the Evidence-Based Orthopaedic Trauma Working Group. J Orthop Trauma. 2005;19:504–7.[PubMed] [Google Scholar]

[13]. Chen YF, Wei HF, Zhang C, Zeng BF, Zhang CQ, Xue JF. Retrospective comparison of titanium elastic nail (TEN) and reconstruction plate repair of displaced midshaftclavicular fractures. J ShoulderElbow Surg. 2012;21:495–501. [PubMed] [Google Scholar]

[14]. Smekal V, Irenberger A, Struve P, Wambacher M, KrappingerD, Kralinger FS. Elastic stable intramedullary nailing versus nonoperative treatment of displaced midshaftclavicular fractures-a randomized, controlled, clinical trial. J Orthop Trauma. 2009;23:106–12. [PubMed] [Google Scholar]

[15]. Liu HH, Chang CH, Chia WT, Chen CH, Tarng YW, Wong CY. Comparison of plates versus intramedullary nails for fixation of displaced midshaftclavicular fractures. J Trauma. 2010;69:E82–7.[PubMed] [Google Scholar]

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