International Journal of Orthopaedics Research
www.orthopaedicsjournal.in
E-ISSN: 2663-0923, P-ISSN: 2663-0915
Received: 05-06-2024, Accepted: 26-06-2024, Published: 20-07-2024
Volume 6, Issue 2, 2024, Page No. 4-8

Functional outcome of shaft clavicle fracture treated by tens nailing

Praveen M Anvekar, Rachappa Betageri, Naroju Akshay kumar*
Department of Orthopaedics, S S Institute of Medical Sciences & Research Centre, Jnanashankara, Davangere, Karnataka, India

Abstract
Background: Most acute displaced clavicular fractures conventionally have been treated non-operatively with the expectation of a high probability of fracture union, good functional outcomes, and a high level of patient satisfaction. However, the outcome of non-operative treatment is not as favourable as once thought and there has been a growing trend to treat these fractures surgically. Displaced midshaft clavicle fractures can be treated with TENS nailing. We studied the clinical outcome of displaced shaft clavicle fractures managed by TENS nailing.
Materials & Methods: A prospective study was carried out between July 2022 to April 2024 in SS Institute of Medical Sciences & Research Centre Davangere, Karnataka. Where 50 patients with displaced clavicle fractures were treated surgically by Closed reduction and TENS nailing. They were followed up for a period of 1 year 10 months and evaluated clinical outcome using DASH score and MORELEY score.
Results: Out of 50 cases 41(82.0%) had excellent results without complications. 3 cases had medial migration of nail, no case of infection or non union.16 cases had scar at entry point and over fracture site.34 cases had 1cm scar at entry point.
Conclusions: In present study cases of displaced clavicle fractures, were effectively treated surgically with CRIF with TENS nail gave excellent results and to be considered the best modality for displaced clavicle fracture management.

Keywords: Displaced clavicle fracture, TENS- titanium elastic nailing system

Introduction

In adults, clavicle fractures comprise 3% of all fractures. Of shoulder-region injuries, clavicle fractures comprise 37 to 45%, AC joint dislocations 8%, proximal humerus fractures 33%, scapular fractures 5%, and glenohumeral (GH) joint dislocations 17% [1, 2]. The incidence of clavicle fractures is 50-64/100000, and AC joint dislocations 8/100 000. Both injuries are more common among men [1, 3]. Traditionally, clavicle fracture have been treated nonoperatively with a sling. During recent decades, increasing interest in operative treatment has arisen [4]. Fortunately, over the last seven years some randomized controlled trials comparing operative to nonoperative treatment in midshaft clavicle fractures have emerged. On the strength of these studies, it appears that nonoperative treatment results in more nonunion than does operative treatment, but any concrete influence on shoulder function has been unclear [5, 6].
The aim of this study series was to analyse the functional outcome for acute clavicle fractures in adults treated with TENS nailing, prospectively assess long-term results after surgery.

Materials & Methods

A prospective study was carried out between July 2022 and April 2023 in SS Institute of Medical Sciences & Research Centre, Davanagere, Karnataka, where 50 patients with displaced clavicle fractures were treated surgically by TENS nail. They were followed up for a minimum period of 1 year by the main author and evaluated for clinical and functional outcome using Dash score and Constant Moreley score. A written consent for participation in this prospective study was obtained from all patients. All the cases were operated with TENS nailing.

Inclusion Criteria

- Midshaft clavicle fractures
- Displaced (>2cm) clavicle fractures (Allman Group I)
- Comminuted fractures
- Ipsilateral upper limb injury, Floating shoulder
- Shortening >2cm on radiograph
- Clavicle fractures associated with neurovascular injury
- Written informed consent

Exclusion Criteria

- Displacement < 2cm,
- Open fracture
- Old fractures
- Proximal end and medial end fractures
- Pediatric age group< 12yrs

Technique: Supine position was given on radiolucent table with small bolster beneath the scapula on operating side with C –arm at head end. 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. Proper anterior-posterior (AP), caudal & cranial views were taken throughout the procedure15 (Fig.1).

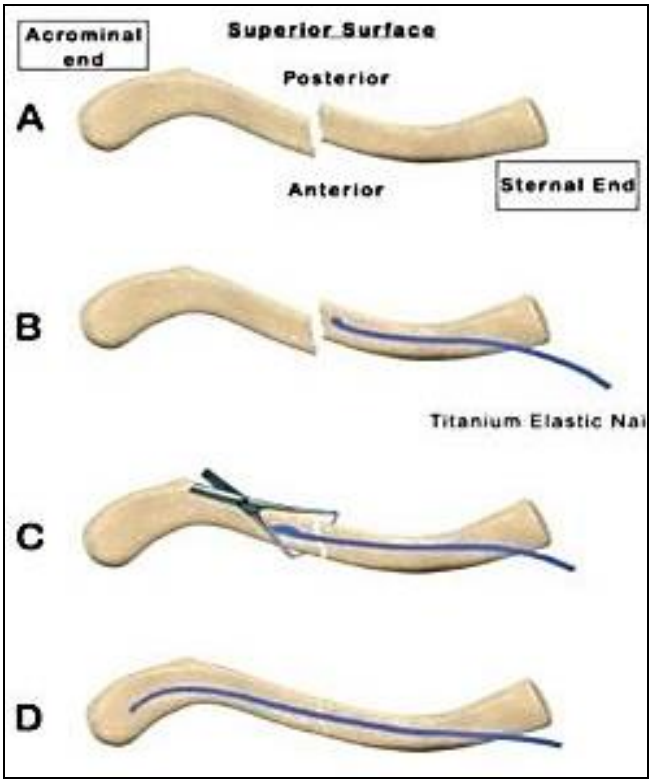

Fig 1: Antegrade flexible intramedullary nailing for fixation of displaced midshaft clavicle fractures

A size 2-3 mm titanium elastic nail is inserted from medial end and passed through the fracture site and advanced until the tip of the nail was engaged in superolateral cortex of lateral end of clavicle (Fig. 2)

Clavicular fracture was protected by standard sling for comfort and pendulum exercises were allowed in the immediate post-operative period. Patients were permitted for free shoulder movement as much as they could during the postoperative period. Sutures were removed on 12th postoperative day and x-rays done at 6 weeks. Overhead activity was restricted for 3 weeks. After 6 weeks when radiological union was seen, strengthening exercises were started. In this study, all the fractures healed in 6 to 8 weeks postoperatively.

Patients were followed for 6 months postoperatively and then titanium nails were removed.

Preoperative and postoperative radiographs of a patient

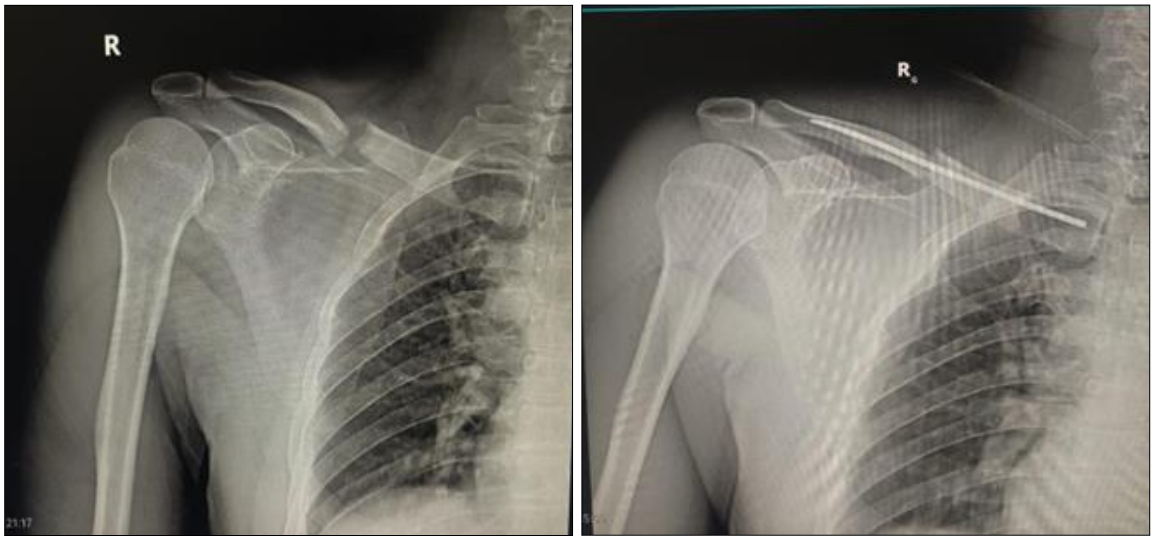

Fig 2

Dash score and Constant Morely score was used to assess the clinical outcome of our patients.

It contains a questionnaire in which pain, activity level, arm positioning, strength of abduction, forward flexion, lateral elevation, external rotation and internal rotation are measured.

Statistical Analysis: Descriptive statistics such as mean, SD and percentage was used to present the data. Microsoft excel was used to prepare the tables and graph.

Table 1: Demographic details of the patients.

Particulars	Mean No. of patients	Percentage
Age	18-66 years, 32.1 Years	
Gender		
Male	46	92%
Female	04	8%
Mode of Injury		
RTA (Road Traffic Accident)	45	90%
Fall from height	05	10%
Laterality		
Right	21	42%
Left	28	56%
Bilateral	01	2%
Comminution	42	84%
CRIF with nailing	34	100%
ORIF with nailing	16	100%
Duration from injury to operation	1-2 days	

Demographic details of the patients who participated in the study is shown in [Table 1]. Most of the patients were in the age group between 21 and 40 years (63%). The youngest was 18 years and oldest was 66 years with an average age of 32.1 years. There were 46(92.0%) males and 4 (8.0%) females. 45(90.0%) of the fractures were sustained following Road Traffic Accident (92%) and 5 cases (8%) following fall from height. Right clavicle was fractured in 21 (42.0%) cases and left in 28 (56.0%) cases and bilateral clavicle fracture in 1 (2.0%) cases. 42 (84.0%) cases had comminution at fracture site. All the cases had displacement more than 2 cm. On an average the timing of surgery was 1 days post injury. 13 (26.0%) cases had associated injuries. 6 (12.0%) cases had rib fractures, 1(2.0%) had scapula fracture, 2(4.0%) cases had tibia fracture, 1(2.0%) case had patella fracture and 2 (4.0%) cases had facial bone fractures with head injury. Cases with isolated clavicle fracture were in hospital for an average of 3 days. Those patients requiring treatment for associated major injuries like head injury stayed for long time ranging from 14 days to 44 days.

Table 2: Demographic details of the patient

Particular	Mean No. of patients	Percentage
Operation time	30-45 min	
Bone union	6-24 weeks	
Return to activity	8-20 weeks	
Complications		
Medial migration	03	6%
Hypertrophic Scar	00	0%
Painful shoulder	03	6%
Motor limitation	00	0%
Nonunion	00	0%
Satisfaction with appearance	41	82%
Dash Score		
Constant morely score	3.1-5.3	
	4.2	88%

The mean operative time was 37.5 min (range, 30 to 45 min). Bony union was achieved in 48 (96.0%) cases after surgery at an average of 12 weeks (range, 8 to 24 weeks). These Patients returned to their daily routine activities from the time of injury on an average of 14 weeks (range, 8 to 20 weeks). 3 cases presented with medial migration of nail at 6 weeks, 16 scars were present on entry point and fracture site both. 34 cases had 1 cm scar over entry point. Postoperative complications were noted in the follow up. The complications were dysesthesia in the area of the incision in 2(4.0%) cases, painful shoulder in three cases. Patients were specifically questioned about their satisfaction or dissatisfaction regarding the appearance of the healed surgical scar, appearance of shoulder. None of the patients were dissatisfied by the appearance of shoulder in the follow up.

Results

Total 50 cases were included, out of which 46 were male and 04 were female patients. Among these, 21 patients had right sided claviclular fractures, 28 patients had left sided fractures and 1 patient had bilateral fractures. Average age of the study population was 18-66 yrs. Most cases were operated within 24-48 hours after trauma. In 34 cases, closed reductions and nailing were done, while in 16 cases, open reductions and nailing were done. Titanium Elastic Nails used in this study were comparatively cheaper as compared to plates and affordable to poor patients. Mid shaft clavicular fractures having displacement less than 2 cm were excluded from this study and were treated conservatively. Fractures with displacement between 2-5 cms were operated by closed reduction and nailing, while fractures with displacement more than 5 cms were operated by open reduction and nailing. To assess the clinical outcome of our patients after union of the fracture, constant score and dash score was used. Clinical union was achieved in 3-5 weeks, while radiographic union was achieved in 6-8 weeks with average 6.9 ± 0.9 weeks. There was no post-operative infection in this study. One case had medial migration of titanium nails at 6 weeks, but callus had already begun to form. There was no case of non-union. Six patients had scars at both the entry points and fracture sites. The remaining 24 patients had about 1 cm scars only at the entry points. Most of cases of extent of displacement of fractures were belongs to 2-5 cms (80%)

Discussion

Clavicular fractures are very frequent and account for approximately 2.6% of all fractures, majority of them (80-85%) occur in the mid shafts. 17,18 OTA (Orthopeadic Trauma Association) classification of mid shaft clavicular fractures is as follows: A type Simple fractures, two fragments, B type - Fractures with a bending wedge, C type - Complex fractures. TENS is a very simple and reliable technique in fixation of displaced midshaft clavicular fractures. Operative time is 25-30 minutes which is less as compared to plating where 55-60 minutes is needed. The strength of this study is that with minimal invasive technique, midshaft clavicular fractures are fixed by closed nailing or minimal open reduction at fracture site. The limitations of this study were the need of image intensifier to confirm the position of nail and a radiolucent table. This method of management of midshaft clavicular fractures has got many advantages over open reduction and plating like minimally invasive technique, less operative time, decreased postoperative morbidity, faster recovery and cosmetically better scar. The present study shows that management of midshaft clavicular fractures treated by closed nailing is definitely a novel approach. Titanium nails are cheaper as compared to plates and easily affordable to poor patients. TENS would be choice of treatment modality in midshaft clavicular fractures displaced more than 2 cms and patients requiring early mobilization in form of overhead activity and early return to his normal activities. Overhead activity was started 3 weeks postoperatively. With conservative methods, patients have to wear clavicular braces for minimum of six weeks, delaying rehabilitation programme. Duan and his colleagues concluded that there were no significant differences of outcomes between plating and intramedullary nailing, but plating had a higher complication rate than nailing1.

In Muller *et al.* 6study, 31 midshaft clavicular fractures treated by intramedullary nailing with titanium elastic nail system(TENS), found that intramedullary fixation of midshaft clavicle fractures with Titanium elastic nails was a safe, minimally invasive with excellent cosmetic and functional results Zhang B and his collegues20 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 collegues21 in 2015 [21], concluded thatthe 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.

Comminuted fractures of midshaft clavicle were also treated by TENS. Many times difficult was encounters in negotiating the lateral fragment, so small incision was taken at the fracture site and distal fragment was reamed and then nail (TENS) was passed.

Conclusion

The specific advantages of TENS over plating are that it is minimally invasive, needs lesser operative time, is cosmetically better and early mobilization. However, with the shorter operative times and better cosmetic appearances, titanium elastic nails are the treatment of choice in displaced midshaft clavicle fractures.

References

1. 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(6):1008-1015.
2. Frigg A, Rillmann P, Perren T, Gerber M, Ryf C. Intramedullary nailing of clavicular midshaft fractures with the titanium elastic nail: problems and complications. Am J Sports Med,2009:37(2):352-359.
3. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle-third fractures of the clavicle gives poor results. J Bone Joint Surg Br,1997:79(4):537-539.
4. Khalil A. Intramedullary screw fixation for midshaft fractures of the clavicle. IntOrthop,2009:33(5):1421-1424.
5. McKee MD, Pedersen EM, Jones C, Stephen DJ, Kreder HJ, Schemitsch EH, *et al*. Deficits following nonoperative treatment of displaced midshaft clavicular fractures. J Bone Joint Surg Am,2006:88(1):35-40.
6. Mueller M, Rangger C, Striepens N, Burger C. Minimally invasive intramedullary nailing of midshaft clavicular fractures using titanium elastic nails. J Trauma,2008:64(6):1528-1534.
7. Schuind F, Pay Pay E, Andrianne Y, Donkerwolcke M, Rasquin C, Burny F. External fixation of the clavicle for fracture or non-union in adults. J Bone Joint Surg Am,1988:70(5):692-695.
8. 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 EvidenceBased Orthopaedic Trauma Working Group. J Orthop Trauma,2005:19(7):504-507.
9. Grassi FA, Tajana MS, D'Angelo F. Management of midclavicular fractures: comparison between nonoperative treatment and open intramedullary fixation in 80 patients. J Trauma,2001:50(6):1096-100.
10. Leppilahti J, Jalovaara P. Migration of Kirschner wires following fixation of the clavicle--a report of 2 cases. Acta Orthop Scand,1999:70(5):517-519.
11. Lyons FA, Rockwood CA, Jr. Migration of pins used in operations on the shoulder. J Bone Joint Surg Am,1990:72(8):1262-1267.
12. Naidoo P. Migration of a Kirschner Wire from the clavicle into the abdominal aorta. Arch Emerg Med,1991:8(4):292-295.
13. Jubel A, Andermahr J, Schiffer G, Tsironis K, Rehm KE. Elastic stable intramedullary nailing of midclavicular fractures with a titanium nail. Clin Orthop Relat Res,2003:(408):279-285.
14. Kadakia AP, Rambani R, Qamar F, McCoy S, Koch L, Venkateswaran B. Titanium elastic stable intramedullary nailing of displaced midshaft clavicle fractures: A review of 38 cases. Int J Shoulder Surg,2012:6(3):82-85.
15. Terry Canale S, James H. Campbell, s Operative orthopedics. Philadelphia, Pensylvania: Mosby Elsevier,2013:2833:0098-7484.

16. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res,1987:(214):160-164.
17. Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. J Bone Joint Surg Br,1998:80(3):476-84.
18. Craig EV. Fractures of the clavicle. In: Rockwood CA, Matsen FA, editor(s). The Shoulder. 3rd ed. Philadelphia: WB Saunders, 1998, 428-82A.
19. Thyagrajan DS, Day M, Dent C, Williams R, Evans R. Treatment of mid shaft clavicle fractures: a comparative study. Int J Shoulder Surg,2009:3(2):23-27.
20. Zhang B, Zhu Y, Zhang F, Chen W, Tian Y, Zhang Y. Meta-analysis of plate fixation versus intramedullary fixation for the treatment of mid-shaft clavicle fractures. Scand J Trauma Resusc Emerg Med,2015:23:27.
21. Zehir S, Zehir R, Şahin E. Comparison of novel intramedullary nailing with mini-invasive plating in surgical fixation of displaced midshaft clavicle fractures. Arch Orthop Trauma Surg,2015:135:339–344.