



ISSN (P): 2521-3466  
ISSN (E): 2521-3474  
© Clinical Orthopaedics  
[www.orthoresearchjournal.com](http://www.orthoresearchjournal.com)  
2023; 7(3): 01-04  
Received: 03-05-2023  
Accepted: 08-06-2023

**Dr. Ajaz Ahmad Ganai**  
Resident Orthopaedics,  
Teerthanker Mahaveer  
University, Moradabad, Uttar  
Pradesh, India

**Dr. Mariya Shafiki**  
Resident Pathology, Govt.  
Medical College, Srinagar,  
Jammu and Kashmir, India

**Dr. Imran Jan**  
Registrar Orthopaedics,  
Rajawadi Municipal General  
Hospital, Mumbai, Maharashtra,  
India

## A comparative study between plating versus titanium elastic nail system in the management of mid-shaft clavicle fractures

**Dr. Ajaz Ahmad Ganai, Dr. Mariya Shafiki and Dr. Imran Jan**

**DOI:** <https://doi.org/10.33545/orthor.2023.v7.i3a.407>

### Abstract

**Introduction:** Clavicle fracture is one of most common bony injuries. Despite of high frequency, choice of proper treatment is still a challenge. So a comparative randomized study was planned to compare Plating verses TENS for clavicle fracture management.

**Materials and Methods:** In this study a total of 44 patients with displaced mid-shaft clavicle fractures were enrolled. Patients were randomly distributed in two groups A (plating group) and B (nailing group) with equal number of patients 22 in each group. Outcomes were assessed in terms of union, Visual analog scale for pain and complications Shoulder function was assessed using DASH score and Constant Murley score.

**Results:** In group A 14 (64 %) patients had union in about 9-12 weeks with mean union time 13.6 weeks with 2 (9 %) having non-union, 4 (18%) having delayed union and 2 (9 %) having mal-union. In group B 16 (73 %) patients had radiological union within 9-12 weeks & 6 (27 %) patients had union at 13-15 weeks. In group A the wound infection was reported in 3 (14 %) patients during the early post-operative period which was controlled by intravenous antibiotics, hypertrophic scar was found in 2 (9 %) cases. TENS group (Group A) was better in terms of infection as no such complication was found.

**Conclusion:** In the management of acute displaced midshaft clavicular fractures, TENS is superior to plating. Surgery with TENS results good functional outcome compared with surgical plating treatment.

**Keywords:** Clavicle fracture, displaced clavicle, plate fixation, TENS

### Introduction

The clavicle is located between the ribcage (sternum) and the shoulder blade (scapula). It is the bone that connects the arm to the body. Clavicle fracture is one of the most common bony injuries. Approximately 2% to 5% of all fractures in adults and 10% to 15% in children involve the clavicle [1]. 69-82% of these occur in middle third of clavicle, 73 % of which are displaced mid-shaft clavicular fractures) [2].

Clavicle fractures may be caused by direct or indirect trauma. The most common mechanism is an indirect one, involving a fall directly onto the lateral shoulder. A less common mechanism for clavicle fractures is a fall onto an outstretched hand.

Despite of high frequency, choice of proper treatment is still a challenge for orthopedic surgeon [3]. Conservative or non-surgical treatment is the norm for middle-third clavicle fractures, and is recommended for not displaced fractures given the generally low incidence of non-union after conservative treatment of these fractures with rates ranging from 0.03% to 5.9%. There are numerous conservative treatment options available, the most common being the use of a sling or 'figure-of-eight' bandage (also known as figure-of-eight splint, or back-pack bandage), or a combination of these two methods.

Recent literatures support surgical management of displaced midshaft clavicle fracture [4, 5] over the traditional conservative management. Various modalities for fixation of clavicular fractures like dynamic compression plate (DCP) [6], tubular plates, reconstruction plates [7], Knowles pin [8], rock wood pin [9], titanium elastic nail [10], external fixator [8-10] have been described.

Plate fixation and intramedullary nailing are the two commonly used surgical techniques [4, 5] but conflicting evidences, regarding their efficacy over each other, exists.

**Corresponding Author:**  
**Dr. Imran Jan**  
Registrar Orthopaedics,  
Rajawadi Municipal General  
Hospital, Mumbai, Maharashtra,  
India

Studies suggest that plate fixation provides more rigid stabilization and stronger construct, facilitating early rehabilitation, as compared to nails<sup>[11]</sup> but in terms of soft tissue preservation, callus formation and infection rates, intramedullary fixation has been found more promising<sup>[12]</sup>.

The aim of this prospective study was to compare the functional outcomes of plate fixation and intramedullary fixation for displaced mid-shaft clavicular fracture.

### Materials and Methods

The present study was prospective study conducted from august 2016 to February 2018 at a tertiary care Centre. In this study a total of 42 patients with displaced mid-shaft clavicle fractures were enrolled. The mean age of the study population was 34.72 years.

### Inclusion criteria

- Age >16 and <65year of age
- 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
- Brachial plexus injury

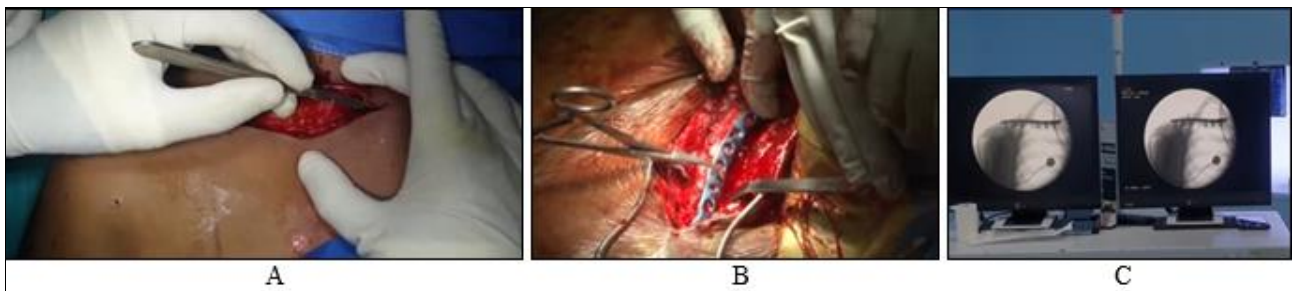
Patients were randomly distributed in two groups A (plating group) and B (nailing group) with equal number of patients 21 in each group.

### Procedure

The patients were made to lie in supine position on the table. Primary painting, draping was done and the affected region was kept free for intraoperative manipulation.

### Plate fixation

An incision was made transversely just under the fracture site. Soft tissue dissection was made carefully to a minimum injury (Figure 1A). After reduction of fractures, a pre contoured locking plate was fixed on the anterosuperior surface of the bone, starting medially using bi-cortical screws (Figure 1B). The wound were closed in layers.

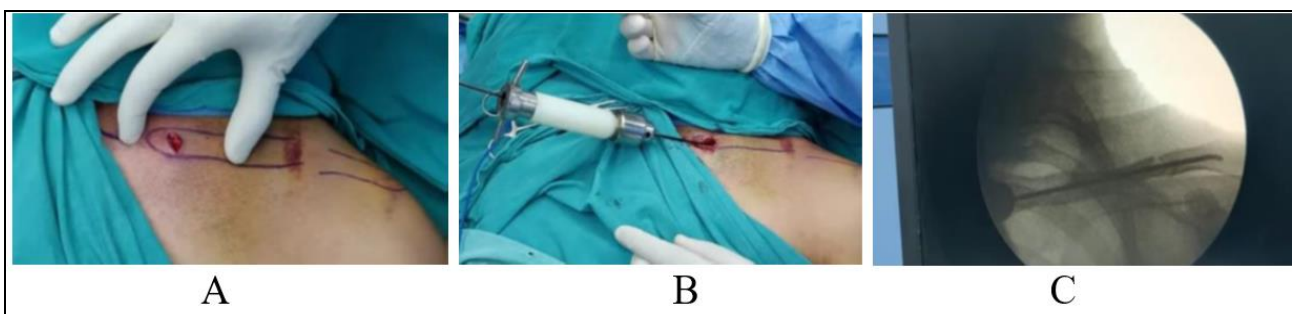


**Fig 1:** A (Dissection), B (Plate fixation) and C (Fluoroscopic view)

### Nailing technique

Vertical Incision was made 2 cm lateral to sternoclavicular joint (Figure 2A), and entry was made in the anterior cortex of the bone by a small bone awl (Figure 2B). Proper anterior-posterior (AP), caudal & cranial views were taken throughout the

procedure. Appropriate-sized TENS was inserted from medial end and were passed through the fracture site and advanced until the tip of the nail was engaged in supero-lateral cortex of lateral end of clavicle. The size of nail was measured using this formula =  $0.4 \times \text{canal diameter}$  in mm.



**Fig 2:** A (Vertical Incision), B (Entry made in the anterior cortex of the bone by a small bone awl) and C (Fluoroscopic view)

### Post-operative protocol and follow-up

For both the groups Intravenous Antibiotics was given for 3 days and changed to oral antibiotics for 7 days. Operated arm was immobilized in an arm sling. The wound was inspected at 3rd post-operative day and x ray was taken to study the alignment of fracture fragments. Patients were discharged with the arm sling. The patients were followed up at 2 weeks, 1 month, 6 month and 1 year. Rehabilitation of the affected arm was started at the end of 2 weeks. A gentle pendulum exercise of the shoulder in the arm sling was allowed. At 4 to 6 weeks

gentle range of motion of the shoulder was allowed but abduction in limited to 80 to 90 degree. At 6 to 8 weeks active range of motion in all planes were allowed.

Outcomes were assessed in terms of union, Visual analog scale for pain and complications Shoulder function was assessed using DASH score and Constant Murley score.

### Results

In this study a total of 44 patients were studied among whom 22 belonged to each group. The demographic and clinical profiles

of patients were depicted in Table 1. There was no significant difference between two groups in respect to these demographic and clinical profiles.

**Table 1:** Demographic and clinical profiles of patients

Demographic characters		Group A (Plating group, N=22)		Group A (Nailing group, N=22)	
		No. of patients	Percentage	No. of patients	Percentage
Age group	18-30 years	5	23	11	50
	31-50 years	9	41	8	36
	51-65 years	8	36	3	14
Gender	Male	17	77	16	73
	Female	5	23	6	27
Mechanism of injury	RTA	13	59	12	55
	Fall	7	32	8	36
	Sports	2	9	2	9
Side of injury	Right	15	68	17	77
	Left	7	32	5	23
OTA Classification	B1	12	55	11	50
	B2	10	45	11	50

Mean operating time required was 60.37 minutes in group A patients and in group B patients mean operating time was 30.42 minutes and the difference was significant. Mean blood loss in group A was 159.22 ml and mean blood loss in group B was 47.3 ml. The mean pain VAS score in group A was 3 and in group B was 2 and the difference was significant.

In group A (plate group) 14 (64 %) patients had union in about 9-12 weeks with mean union time 13.6 weeks with 2 (9 %) having non-union, 4 (18%) having delayed union and 2 (9 %) having mal-union. In group B (TENS group) 16 (73 %) patients had radiological union within 9-12 weeks & 6 (27 %) patients had union at 13-15 weeks.

In group A the wound infection was reported in 3 (14 %) patients during the early post-operative period which was controlled by intravenous antibiotics, hypertrophic scar was found in 2 (9 %) cases. TENS group (Group A) was better in terms of infection as no such complication was found.

DASH score and Constant score were assessed throughout the follow up and it was found that the Constant score was significantly higher for the group B (69.9) as compared to the group A (56.3) during the initial 6 months follow up.

## Discussion

The clavicle has an integral role not only in the mechanics of the pectoral girdle but also in the function of upper extremity. Clavicle fractures accounts for approximately 2.6% of all fracture [1, 13-16]. The majority of clavicle fractures (80-85%) occur in midshaft of bone where the typical compressive forces applied to the shoulder and narrow cross section of the bone combine and result in the bony failure [17-19]. Most of the (97%) in this group are mild to moderate displaced and can be treated conservatively. However 3% of middle third clavicle fractures are completely displaced and shortened. This small group of fractures accounts for 90% of nonunion of the middle third fractures and therefore may warrant early open reduction and internal fixation. Our study was done to compare the rate of union and functional outcome in displaced midshaft clavicle fractures by surgical management using TENS versus plating.

There are numerous methods for fracture clavicle fixation out of which plating and nail fixation are the most commonly used and most extensively researched. Numerous studies have been conducted which favour plating over nailing, however there are no less studies which suggest nailing to be an equally effective alternative Lee YS *et al.* [8] conducted a prospective comparative study on 62 elderly patients and observed that fixation with

Knowles pin has more advantage over plate fixation because of small incision, less complications and shorter hospital stays. In a similar study conducted in 2008 on 88 patients (56 patients in the Knowles pin group and 32 patients in the plating group), pins were observed to be more advantageous in terms of healing and high shoulder scores. Ferran *et al.* [20] in 2010 randomly allotted 17 patients to the intramedullary fixation group and 15 patients to the plating group. During the mean follow up of 12.4 months, no statistically significant difference was observed between the groups in terms of constant scores ( $p=0.0365$ ) and oxford scores ( $p=0.773$ ).

Saha *et al.* [21] in a prospective comparative study on 80 unilateral displaced midshaft clavicular fracture, observed faster union, less operative time, few complications and less blood loss for the nailing group in 24 months follow up. Adrade *et al.* [22] divided 59 patients into plate group (33 patients) and nailing group (26 patients). No statistically significant difference between the groups was observed in terms of DASH score, Constant Murley score, union and patient satisfaction.

In our study, intramedullary nailing was found to be superior in terms of less operative time, blood loss, hospital stay and incision length. The problem of hypertrophic scar and wound infections were comparatively more prevalent in the plating group.

## Conclusion

In the management of acute displaced midshaft clavicular fractures, TENS is superior to plating. Surgery with TENS results good functional outcome compared with surgical plating treatment.

## Conflict of Interest

Not available

## Financial Support

Not available

## References

1. Nordqvist A, Petersson C. The incidence of fractures of the clavicle. *Clin Orthop.* 1994;3:127-32.
2. Khan LA, Bradnock TJ, Scott C, Robinson CM. Fractures of the clavicle. *J Bone Joint Surg (Am).* 2009; 91:447-460.
3. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. *Clin Orthop.* 1968;58:29-42.
4. Smekal V, Oberladstatter J, Struve P, Krappinger D. Shaft

- fractures of the clavicle: current concepts. Arch Orthop Trauma Surg. 2009; 129:807-815.
5. Kim W, McKee MD. Management of acute clavicle fractures. Orthop Clin North Am. 2008; 39:491-505.
  6. Kabak S, Halici M, Tuncel M, Avsarogullari L, Karaoglu S. Treatment of mid-clavicular nonunion: comparison of dynamic compression plating and low-contact dynamic compression plating techniques. J Shoulder Elbow Surg. 2004; 13:396-403.
  7. Shen JW, Tong PJ, Qu HB. A three-dimensional reconstruction plate for displaced midshaft fractures of the clavicle. J Bone Joint Surg Br. 2008; 90(11):1495-1498. doi: 10.1302/0301-620X.90B11.21096.
  8. Lee YS, Lin CC, Huang CR, Chen CN, Liao WY. Operative treatment of midclavicular fractures in 62 elderly patients: Knowles pin versus plate. Orthopedics. 2007; 30(11):959-964.
  9. Mudd CD, Quigley KJ, Gross LB. Excessive complications of open intramedullary nailing of midshaft clavicle fractures with the Rockwood clavicle pin. Clin Orthop Relat Res. 2011; 469(12):3364-3370.
  10. 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.
  11. Golish SR, Oliviero JA, Francke EI, Miller MD. A biomechanical study of plate versus intramedullary devices for midshaft clavicle fixation. J Orthop Surg Res. 2008; 16(3):28.
  12. Liu PC, Chien SH, Chen JC, Hsieh CH, Chou PH, Lu CC. Minimally invasive fixation of displaced midclavicular fractures with titanium elastic nails. J Orthop Trauma. 2010; 24(4):217-223.
  13. Neer CS. Non-union of the clavicle. JAMA. 1960;17:1006-11.
  14. Lenza M, Belloti JC, Andriolo RB, Gomes Dos Santos JB, Faloppa F. Conservative interventions for treating middle third clavicle fractures in adolescents and adults. Cochrane Database of Systematic Rev. 2009;2:CD007121.
  15. Neviasser JS. The treatment of fractures of the clavicle. Surg Clin North Am. 1963;43:1555-63.
  16. Nowak J, Holgersson M, Larsson S. Can we predict long-term sequelae after fractures of the clavicle based on initial findings? A prospective study with 9 to 10 years follow-up. J Shoulder Elbow Surg 2004;13:479-86.
  17. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop. 1968;58:29-42.
  18. Allman FL. Fractures and ligamentous injuries of the clavicle and its articulation. J Bone Joint Surg Am. 1967;49:774-84.
  19. McKee MD. Optimal treatment of displaced midshaft fractures of the clavicle. Philadelphia, Saunders. 2009;1:126-32.
  20. Ferran NA1, Hodgson P, Vannet N, Williams R, Evans RO. Locked intramedullary fixation vs plating for displaced and shortened mid-shaft clavicle fractures: a randomized clinical trial. J Shoulder Elbow Surg. 2010; 19(6):783-9.
  21. Saha P *et al.* Plate versus titanium elastic nail in treatment of displaced midshaft clavicle fractures - a comparative study. Indian J Orthop. 2014; 48(6):587-593.
  22. Andrade-Silva FB1, Kojima KE1, Joeris A2, Santos Silva J1, Mattar R Jr1. Single, superiorly placed reconstruction plate compared with flexible intramedullary nailing for midshaft clavicular fractures: a prospective, randomized

controlled trial. J Bone Joint Surg Am. 2015; 97(8):620-6.

#### How to Cite This Article

Ganai AA, Shafiki M, Jan I. A comparative study between plating versus titanium elastic nail system in the management of mid-shaft clavicle fractures. National Journal of Clinical Orthopaedics 2023; 7(3): 01-04.

#### Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.