e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(1); 612-617

Original Research Article

Comparative Study between Plating and Titanium Elastic Nailing System for Mid-Clavicular Fractures in Andhra Pradesh

Rama Krishna Pabolu[1], B. Bhanu Pratap[2], Lavanya Gampa[3]

[1]Assistant Professor, Department of Orthopaedics, Narayana Medical College and Hospital Nellore Andhra Pradesh – 524003

[2]Assistant Professor, Department of Orthopaedics, SantiRam Medical College, Nandyal, Andhra Pradesh-5818502

[3]Senior Resident, Department of Anaesthesia Sadhana Orthopaedics hospital Nellore, Andhra Pradesh-524001

Received: 25-10-2023 / Revised: 23-11-2023 / Accepted: 26-12-2023

Corresponding Author: Dr. Rama Krishna Pabolu

Conflict of interest: Nil

Abstract:

Background: As the clavicle lies horizontally in the body, it is more likely to get fractured. As it does not have a medullary cavity (bone marrow), its healing is a great challenge for an orthopaedic surgeon.

Method: Out of 100 patients with clavicle fractures, 50 were treated with TENS and 50 with plating. A routine blood examination (RBS), an ECG, and a radiological study were carried out, and general anesthesia was given.

Results: Mean blood loss, timing for surgery, and size of wound were quite low in the nailing technique as compared to the plating technique, and the p value was highly significant ($p<0.00$). Surgical complications were also the least common with nailing techniques. The rate of union was 100% in both techniques. The mean dash square rate in the 1st, 2nd, and 6th months was highly significant in nail technique ($p<0.001$).

Conclusion: In the present pragmatic study, it is concluded that Both techniques have 100% union of fracture and are equally effective in treating displaced mid-clavicular fractures. But due to fewer surgical complications, the TENS technique is preferred over the plating technique.

Keywords: TENS-Titanium, elastic nailing system, plating technique, Fluoroscopy, DASH score.

Introduction

Clavicle name derives from the Latin word "clavus" means Roman key. Its normal length varies from 12 cm to 14 cm. Clavicle is the only long bone that lies horizontally in the body; hence, it is more likely to get fractured. Approximately 2% to 5% of all fractures in adults and 10 to 15% in children involve a clavicle fracture [1].

As the clavicle does not have a medullary cavity, it is devoid of bone marrow; hence the fracture of the clavicle is late to heal [2]. Despite the high frequency, the choice of proper treatment is still a challenge for orthopaedic surgeons, and it is still a matter of debate whether surgery produces better outcomes than non-surgical management [3]. The clavicle keeps the upper limb away from the body trunk and helps in body weight transmission. Due to a fracture of the clavicle, these two functions are impaired [4]. Hence, compare plating versus the Titanium Elastic Nail System (TENS) for clavicle fracture with respect to the incidence of non-union, shortening functional outcome, cosmetic aspects, and complications. Hence, an attempt is made to compare and evaluate the functional outcome of a displaced fracture of the middle third of the clavicle treated with both the technique of TENS and plating management.

Material and Method

100 (one hundred) adult patients aged between 20 to 45 years admitted to the orthopaedic department of Narayana Medical College and Hospital Nellore, Andhra Pradesh – 524003 were studied.

Inclusive Criteria: The patients having displaced and isolated fractures of the middle third clavicle Duration of fracture less than 2 weeks (<2 weeks) were selected for study.

Exclusion: Fracture was more than 2 weeks old; open fractures. Pre-existing morbidity of the ipsilateral arm, shoulder, or hand involvement of neuro-vascular injury was excluded.

Method: Out of 100 patients, 50 were selected for TENS (titanium elastic stable intramedullary nail) and 50 patients with plate technique. Routine hematological investigations and urine, stool, ECG, and radiological studies were carried out pre- and

post-surgery. The fractures of the clavicle, classified as AO and OTA, were carried out under general anesthesia.

Surgical technique for plating: Prophylactic antibiotics were given to every patient. Each patient was placed in a supine position with a large blump placed between the scapula, allowing the injured shoulder girdle to fall posteriorly, helping to restore length, and exposed to the clavicle. Reduction was done, and a 3.5 mm reconfigured LCP was contoured with bending for application to the superior surface of the clavicle or antero-inferior surface. In cases of long oblique fractures or wedge-commutated fractures. 1 ag screw was used, and care was taken to preserve soft tissue attachment. For commutated fractures, a sufficiently long plate with nine (nine) or twelve (twelve) holes was used to bridge the fracture and obtain at least six cortex fixations on each side of the fracture.

Surgical technique for TENS: Each patient was placed in a supine position. A small incision was made approximately 1 cm lateral to the steno-clavicular joint. A TEN (titanium elastic stable inter-medullary nail) was inserted (the diameter varied from 2 to 2 mm depending upon the width of the bone). Before introduction, the original curvature of the small and flattered nail tip was straightened slightly to allow better gliding in the small medullary canal.

Closed reduction was performed under fluoroscopic control using two percutaneously introduced pointed reduction clamps. The nail was advanced manually until it was just medial to the sterno-clavicular joint. Accurate maneuvering of the nail tip was necessary under fluoroscopic control to avoid penetration of the thin dorsal cortex. After reaching the end point, the fracture was compressed, and the nail was cut close to the entry point to minimize the soft tissue irritation. At the same time, leave sufficient length behind for easy extraction later on. The fascia and skin were closed in layers.

Post-operative protocol and follow-up for both groups – Intravenous antibiotics were given for 3 days, then changed to oral antibiotics for 7 days. The operative limb was immobilized in an arm sling. The wound was inspected on the 3rd post-operative day, and an x-ray was taken to study the alignment of fracture fragments and sutures removed on the 10th post-operative day. The patients were in arm slings. Rehabilitation of the affected arm was started at the end of the second week. A gentle pendulum exercise of the shoulder was allowed, but abduction was limited to 80 to 90 degrees. At 6 to 8 weeks, active range of motion in all planes was allowed.

Every post-operative patient was assessed on day 3rd, every week, until radiological reports were found to be complete. After the 6th month, 9th month, and 12th month after surgery, follow-up was done radiologically.

Radiography healing was defined as evidence of a bridging callus across the fracture site or obliteration of the fracture line. Clinically, healing of a fracture is the absence of tenderness with firm palpation over the fracture site, full range of motion, and the presence of normal strength of the upper extremity. After union shortening of clavicular length measured clinically, the linear difference of clavicle lengths from the sternum and to the acromial end between the operated and normal sides The efficacy of both methods was compared.

The duration of the study was from November 2022 to December 2023.

Statistical analysis: parameters of surgical techniques, hospital stay, and post-operative complications were compared. The statistical analysis was done in SPSS software. The ratio of males and females is 2:1.

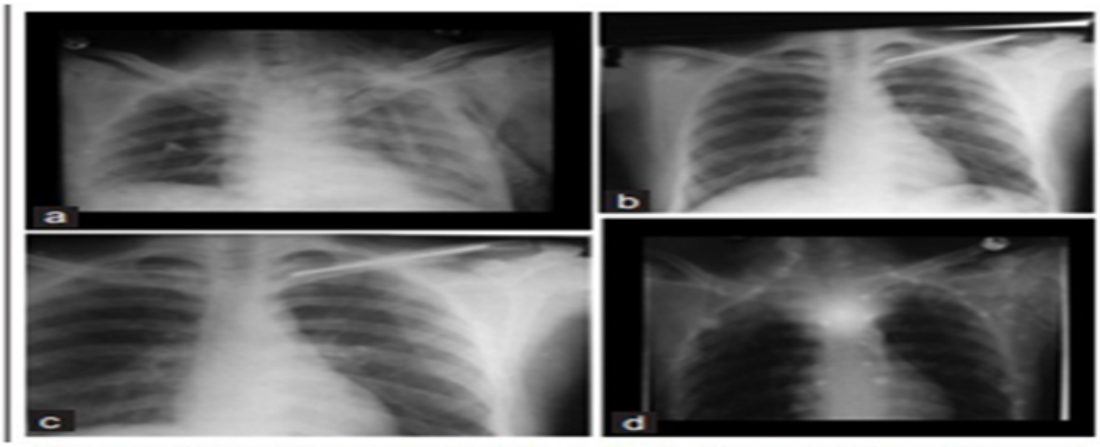

Figure-1: TENS nailing group-1 (a) Pre-operative X-ray, (b) Immediate post-operative, (c) 6 month post-operative (d) After implant removal

Figure 1:

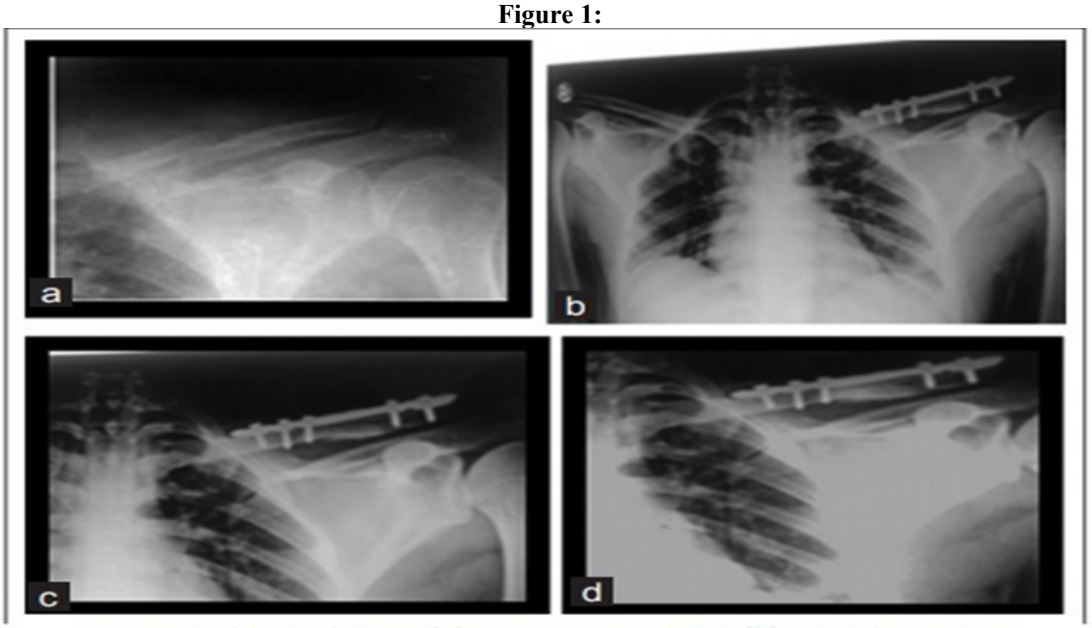

Figure-2: Plate technique (a) Pre-operative X-ray, (b) Immediate post-operative, (c) 3 months post-operative, (d) 12 months post-operative

Figure 2:

Observation and Results

Table 1:

Comparative study of operative details in both techniques

- Mean blood loss: 93 (±1.4) in plating, 57 (±2.6) in nailing, t test: 56.7, and p<0.001 (p value is highly significant).
- Mean operation time (minutes): 75 (±2.4) in the plating group, 58 (±1.5) in the nailing group; t test: 42.4; p<0.001 (p value is highly significant).
- Mean size of wound 6.86 (±1.4) cm in plating 4.48 (±1.2) cm in Nailing group, t test 9.1 and p<0.001
- Mean closed reduction: 5 (±0.3)
- Mean open reduction: 22 (±1.4) in the plating group, 14 (±1.6) in the nailing group, t test: 26.6, and p<0.001

Table 2: Comparative study of hospital stay: 6.4 (±0.3) in plating, 5.4 (±0.3), t test 12.1, and p<0.001

Table 3: Comparison of post-surgical complications

- Superficial infection: 6 (12%) in plating, 3 (6%) in nailing
- Implant infection: 6 (12%) in plating, 3 (6.6%) in nailing technique
- Mean shorting (mm): 4.4 (8.8%) in plating, 4.6 (9.2%) in nailing

Table 4: Comparison of outcomes in both techniques

1. The union rate was 100% in both techniques.
- Radiological union: 14 weeks (±0.6) in the plating group, 13 weeks (±0.4) in the nailing technique; t test: 9.80 and p<0.001
- Clinical union: 7.5 (±0.2) in plating, 7.46 (±0.2) in nailing, t test 2.25, and p<0.001 (p value is highly significant).

2. Mean quick:
- Dash score (1st month): 21.6 (±1.6) in plating technique, 16.26 (±0.4) in nailing, t test: 22.6, and p<0.001 (p value is highly significant).
- 2nd months: 2.54 (±1.4) in plating technique, 7.82 (±0.6) in nailing, t test 25.6, and p<0.001 (p value is highly significant).
- 6th months: 1.22 (±1.2) in plating, 6.14 (±0.4) in nailing technique

Table 1: Comparative study of operative details in both techniques (Total No. of patients: 100)

Sl. No	Details	Plating mean value (±SD)	Nailing Mean value (±SD)	t test	p value
1	Mean Blood loss (ml)	93 (±1.4)	57 (±2.6)	56.7	P<0.001
2	Mean operative time (Minutes)	75 (±2.4)	58 (±1.5)	42.4	P<0.001
3	Mean size of wound	6.86 (±1.2)	4.48 (±1.2)	9.1	P<0.001
4	Mean closed reduction	--	5 (±0.3)	-	-
5	Open Mean Reduction	22 (±1.4)	14 (±1.6)	26.6	P<0.001

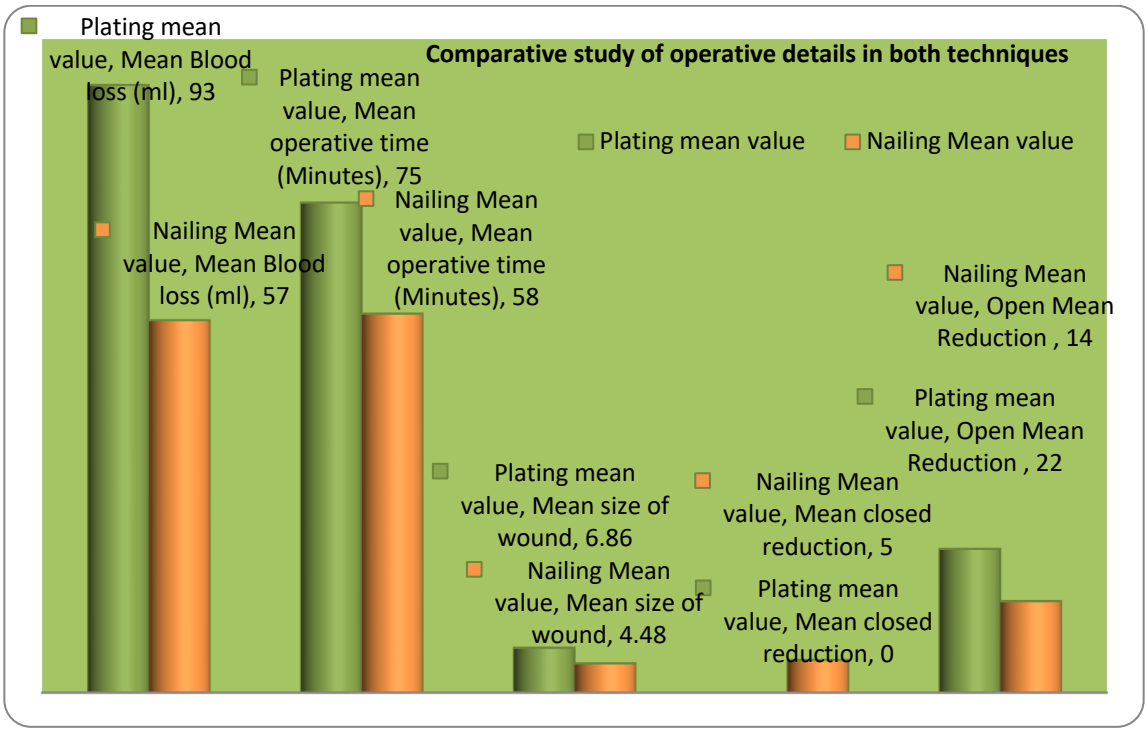

Figure 3: Comparative study of operative details in both techniques

Table 2: Comparative study of hospitals stays in both groups

No	Particulars	Plating technique mean value	Nailing Technique patients Mean value	t test value	p value
1	Hospital stay (in days)	6.4 (±0.5)	5.4 (±0.3)	12.1	P<0.001

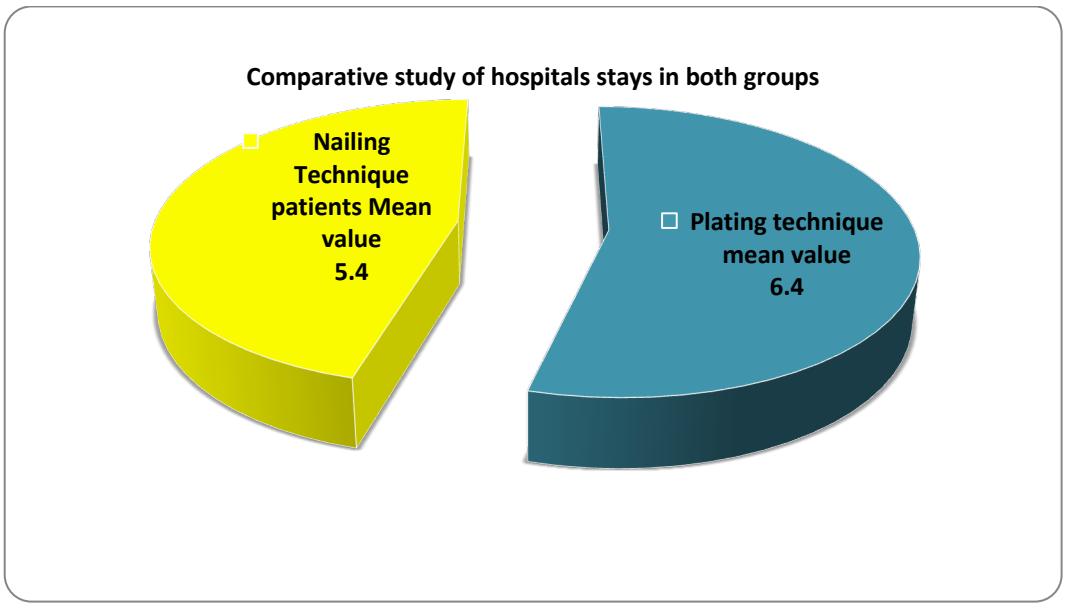

Figure 4: Comparative study of hospitals stays in both groups

Table 3: Comparative study of post-surgical complications

Sl. No	Complications	Plating technique	percentage	Nailing technique	Percentage
		(50)	%	(50)	%
1	Superficial infection	6	12%	3	6%
2	Implant irritation	6	12%	3	6%
3	Mean Shortening (mm)	4.4	8.8%	4.6	9.2%

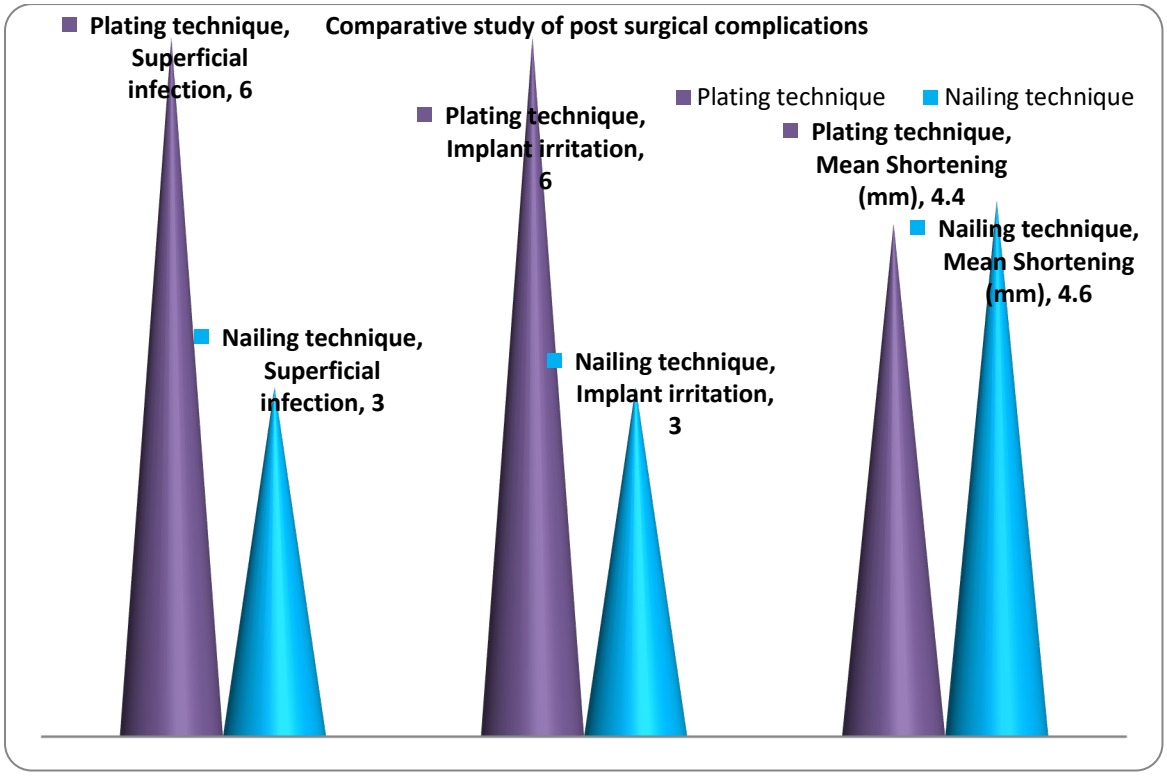

Figure 5: Comparative study of post-surgical complications

Table 4: Comparison of outcome in both techniques

Sl No	Parameter	Plating technique	Nailing technique	t test	p value
1	Union rate	100%	100%	--	--
2	Mean Union rate				
A	Radiological union	14 weeks (±0.6)	13 weeks (±0.4)	9.80	P<0.001
B	Clinical Union	7.5 week (± 0.2)	7.46 (±0.2)	2.5	P<0.001
3	Mean Quick				
A	Dash Score 1st month	21.6 (±1.6)	16.26 (±0.4)	22.8	p<0.001
B	2nd month	2.54 (±1.4)	7.82 (±0.4)	25.6	p<0.001
C	6th Month	1.22 (±1.2)	6.14 (±0.4)	27.5	p<0.001

Discussion

Present comparative study between plating TENS for mid-clavicular fractures in the Andhra Pradesh population. In comparison of operative details in both techniques Mean blood loss: 93 (±1.4) ml in plating, 57 (±2.6) ml in nailing, t test: 56.7, and p<0.001 The mean operation times (minutes) were 75 (±2.4) in plating and 58 (±1.5) in nailing; the t test was 42.4 and p<0.001. Mean size of wound (cm): 6.86 (±1.4) in plating, 4.48 (±1.2) in nailing, t test: 9.1 and p<0.001, The mean open reduction was 22 (±1.4) in plating and 14 (±1.6) in nailing; the t test was 26.6 and p > 0.001 (Table 1). In a comparative study of hospitals in both groups Duration of hospital stay (in days) was 6.4 (±0.5) in plating technique, 5.4 (±0.3) in Nailing, t test 12.1, and p<0.001 (Table 2). In a comparative study of post-surgical complications, superficial infection is 6 (12%) plating and 3 (6%) nailing. Implant irritation 6 (12%) in Nailing, Mean shorting (mm) 4.4 (8.8%) plating, 4.6 (9.2%) in Nailing (Table 3).

Comparison of outcomes in both techniques, union rate 100% techniques, Radiological union 14 weeks (± 0.6) in plating, 13 weeks (±0.4) in nailing, clinical union 7.5 weeks (± 0.2) in plating, 7.46 (± 0.2) in nailing, t test 2.5 and p<0.001. Dash Score: 1st month: 21.6 (± 1.6) in plating, 16.26 (± 0.4) in Nailing, t test 22.8 and p<0.001, 2nd month: 2.54 (± 1.4) in plating, 7.82 (± 0.4) in Nailing, t test 25.6 and p<0.001, 6th month: 1.22 (± 1.2) in plating, 6.14 (± 0.4) in Nailing, t test 27.5 and p<0.001 (Table-4) (Figure 1 and 2). These findings are more or less in agreement with those of previous workers [5,6,7].

Clavicle plays an integral role not only in the mechanics of the pectoral girdle but also in the function of the upper extremity. The majority of clavicle fractures, around 85%, occur in the mid-shaft of the clavicle, where the compressive forces applied to the shoulder and narrow cross section of the bone combine and result in a bone fracture [8]. A biomechanical study suggests that plate fixation

results in more rigid fixation as compared to nailing, and this helps in rehabilitation [9]. Plate fixation is technically easy to perform and provides rotational control. Disadvantages include large wound sizes and implant prominence. On the other hand, TENS is less invasive, has a lower rate of implant prominence, and after union, implant removal can be done as an outpatient procedure with minimal dissection [10].

In nailing, if closed reduction is achieved, this has the advantage of preserving fracture hematoma, which speeds up fracture healing. The disadvantages are that it does not provide rotational control, and TENS protrusion leads to implant irritation.

There was no difference between the two techniques in terms of the rate of union. As it was 100% in both groups, there was a difference in union duration. An earlier union was observed in the nailing technique. Post-surgical complications like superficial infection and implant irritation are more common with the plating technique.

Summary and conclusion

Both techniques are equally effective at treating displaced mid-clavicular fractures and give better function and fewer complications than non-operative treatment.

The TENS technique has more advantages and fewer complications than plating, making its use more favourable. It is recommended for athletes and young, active individuals and can be used as an alternative to conservative treatment or plate fixation.

Limitation of study: Due to the tertiary location of the present institution, the small number of patients, and the lack of the latest technologies, we have limited results.

This research paper was approved by the ethical committee of Narayana Medical College and Hospital Nellore, Andhra Pradesh (52403).

References

3. Nardqvist A, Peterson C – The incidence of fractures of the clavicle Clin. orthop. 1994, 3; 127–32.
4. Niemeier U, Zimmermann HG – Kuntscher's open intramedullary nailing of the clavicle as an alternative in the treatment of an old clavicle fracture (Chirug 1990, 61, 464–466) (in German)
5. Denard PJ, Koval KJ – Management of mid-shaft clavicle fractures in adults, Am. J. Orthop. 2005, 34; 527–36.
6. Canadian Orthopaedic Trauma Society: Non-operative treatment of displaced mid-shaft clavicle fraction J. Bone Joint Surg. 2007, 89-A, 1–10.
7. Rowe CR – An Atlas of Anatomy and Treatment of Mid-clavicular Fractures Clin. Orth. 1968, 58; 29–42.
8. Neer CS – Non-union of the clavicle fractures, JAMA 1960, 17; 1006–11.
9. Mckee MD – Optimal treatment of displaced mid-shaft fractures of the clavicle Philadelphia Sounders 2009, 49; 774–84.
10. Golish SR, Olivero JA – A biomechanical study of plate versus intramedullary devices for mid-shift clavicle fixation J. ortho. Surgery Res. 2008, 16; 328–31.
11. Liu HH, Chang CH Comparison of plates versus intramedullary nails for fixation of displaced mid-shift clavicular fractures J. Trauma 2010, 69 (6); 82–87.
12. Robinson CM – Fractures of the clavicle in adults Epidemiology and classification J. Bone. Joint Surg. 1998, 80, B 479–484.