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Original Article

Comparative Study between Plating and Titanium Elastic Nailing System in Mid-clavicular Fractures in Andhra Population

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Abstract

Background: Although non-operative management of mid-shaft clavicle fractures is standard method, to avoid non-union or mal-union of displaced fractures of clavicle plating or titanium elastic nailing system (TENS) techniques are widely used. Hence, their post-surgical complications were studied.

Materials and Methods: Out 26, 13 were treated with TENS and 13 with plating routines blood examination electrocardiogram radiological study was carried out and operated under general anesthesia.

Results: Mean blood loss, operative timing, and size of the wound mean open reduction were highly significant in nail technique method. ($P < 0.00$) Post-surgical complications were least in nailing technique. The rate of union was 100% in both techniques. Mean Dash score rate in 1st, 3rd, and 6th months was highly significant in nail technique ($P < 0.001$).

Conclusion: Although both techniques were equally effective at treating displaced mid-clavicular fractures, due to least post-surgical complications TENS is preferred than plating technique.

Key words: Disabilities of the arm, shoulder and hand score, Fluoroscopy, Mid-shaft fracture, Plating, Titanium elastic nailing system

INTRODUCTION

The mid-shaft of the clavicle is the frequently affected site encompassing 69–82% of all clavicle fractures and most fractures that occur in the mid-shaft are displaced.[1] Mid-shaft clavicle fractures in adults have traditionally been treated nonoperatively. However, displaced or comminuted fractures carry a risk of symptomatic mal union, non-union, and poor functional out come with cosmetic deformity.[2] Early surgical intervention of mid-shaft clavicle fractures has resulted in improved outcomes and decreased rate of non-union and symptomatic mal-union compared with non-operative treatment.[3]

Operative treatment of displaced mid-shaft clavicle fractures can be achieved successfully using plates or intermedullary implants such as Rush pins Kirschner wires or nails new intramedullary technique in which a single titanium elastic a single widely used.[4] This prospective study was designed to compare the efficacy of plating and titanium elastic nailing system (TENS) techniques.

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MATERIALS AND METHODS

Twenty-six patients aged between 19 and 48 years admitted at orthopedic department of Nimra Institute of Medical Sciences, Vijayawada-521456, Andhra Pradesh were studied.

Inclusion Criteria

The patients having displaced and isolated fractures of the middle third clavicle duration of fracture <2 weeks (<2 weeks) were selected for study.

Exclusion Criteria

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

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Methods

Out of 26 patients, 13 were selected for TENS and 13 patients with plate technique. Routine hematological investigations and urine, stool, electrocardiogram, radiological study was carried out in pre-and post-surgery. The fractures of clavicle classified as AO and Orthopaedic Trauma Association surgery was carried out under general anesthesia.

Surgical Technique for Plating

Prophylactic antibiotics were given to every patient. Each patient was placed in supine position with a large blump placed between the scapula, allowing injured shoulder girdle to fall posteriorly, helping to restore length, and exposed to the clavicle. Reduction was done and 3.5 mm Recon plate LCP, one-third tubular plate was contoured with bending for application to the superior surface of the clavicle or antero-inferior surface. In case 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, sufficiently long plate with 9 or 12 holes was used to bridge the fracture and obtained at least six cortex fixation on each side of the fractures.

Surgical Technique for TENS

Each patient was placed in supine position. A small incision was made approximately 1 cm lateral to sterno-clavicular joint. A TENS was inserted (The diameter varied from 2 mm to 2 mm depending on width of the bone). Before introduction, the original curvature of 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 sternoclanicular joint. Accurate maneuvering of nail tip was necessary under fluoroscopic control to avoid penetration of 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 leaving 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. Operated limb was immobilized in an arm sling. The wound was inspected on 3rd post-operative day and X-ray was taken to study the alignment of fracture fragments sutures removed on 10th post-operative day. The patients were with arm sling. Rehabilitation of the affected arm was started at the end of 2nd week. A gentle pendulum exercise of the shoulder was allowed but abduction in limitation to 80–90 (degrees). At 6–8 weeks active range of motion in all planes were allowed.

Every post-operative patient was assessed on day 3rd, every weekly, till radiological reports found to be complete union. The after 6th month, 9th month, and 12th month after surgery, follow-up was done radiologically.

Radiography healing was defined as evidence of bridging callus across the fracture site or obliteration of fracture line. Clinically, healing of fracture is 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, as the linear difference of clavicle lengths from sternum and to acromial end between operated and normal side efficacy of both methods was compared.

Duration of study was from July 2009 to August 2012.

Statistical Analysis

Parameters of both surgical techniques hospital stay and post-operative complication were compared. The statistical analysis was done in SPSS software. The ratio of males and females was 2:1.

OBSERVATION AND RESULTS

Table 1:Comparative study of operative details in both techniques. Operative mean blood loss – 93 m (SD ± 1.8) in plating, 58 m (SD ± 2.2) in nailing technique *t*-test 20.5 and $P < 0.001$, mean operation time (minutes) 73 (SD ± 2.3) 57 (SD ± 1.4) *t*-test 14.7 $P < 0.001$.

Mean size of wound 6.87 (SD ± 1.6) in plating 4.48 (SD ± 1.3) in nailing *t*-test 4.18 $P < 0.003$, mean closed reduction observed 6 (SD ± 0.3) in nailing only, mean value of open mean reduction 19 (SD ± 1.4) in plating, and 10 (SD ± 1.7) in nailing *t*-test 14.7 $P < 0.01$.

Table 2: Comparative study of hospital stay 6.3 (SD ± 0.7) in plating 5.1 (SD ± 0.2) *t*-test 5.9 $P < 0.001$.

Table 3: Study of post-surgical complication superficial infection 2 (15.3%) in plating, 1 (7.69) in nail technique, implant irritation 2 (15.3%) in plating, 1 (7.69%) in nailing mean shorting 4.3 (33%) in plating, and 4.5 (34.6%) in nailing.

Table 4: Comparison of outcome in both techniques – union rate was 100% in both techniques. Mean union – clinical union – 7.86 (SD ± 1.1) in plating, 7.50 in nailing *t*-test 1.1 and $P > 0.2$ insignificant, radiological union – 14 (SD ± 0.6) in plating, 13 (SD ± 0.3) *t*-test 1.1

Table 1: Comparative study of operative details in both techniques

Particulars	Plating mean value	Nailing Mean value	*t*-test	*P*-value
Mean blood loss (ml)	93 (SD±1.8)	58 (SD±2.2)	20.5	<0.001
Mean operative time (minutes)	72 (SD±2.3)	57 (SD±1.4)	14.7	<0.001
Mean size of wound	6.87(SD±1.6)	4.48(SD±1.3)	4.18	<0.003
Mean closed reduction	-	6 (SD±0.3)	-	-
Open mean reduction	19 (SD±1.4)	10 (SD±1.7)	14.7	<0.001

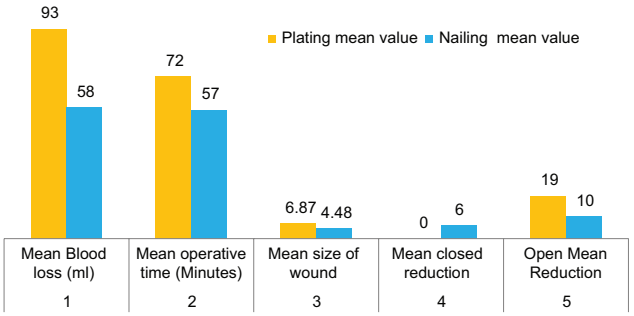
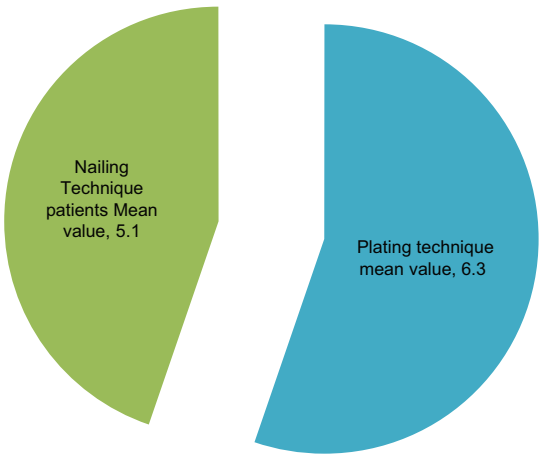


Table 2: Comparative study of hospitals stay

Particulars	Plating technique mean value	Nailing technique patients Mean value	*t*-test value	*P*-value
Hospital stay (in days)	6.3 (SD±0.7)	5.1 (SD±0.2)	5.9	<0.000



$P > 0.2$ insignificant radiological union – 14 (SD ± 0.6) in plating, 13 (SD ± 0.3) *t*-test 1.1 $P > 0.2$ (*P*-value is insignificant) 3 – Mean Quick Dash score – (a) 1st month 21.9 (SD ± 1.6) in plating, 15.29 (SD ± 0.6) in nailing *t*-test 11.5 $P < 0.001$ (b) 3rd months – 12.58 (SD ± 1.1) plating 7.79 (SD ± 0.7) *t*-test 15.3 $P < 0.001$ (c)

Table 3: Comparative study of post surgical complications

Complications	Plating technique (13)	Percentage	Nailing technique (13)	Percentage
	No		No	
Superficial infection	2	15.3	1	7.69
Implant irritation	2	15.3	1	7.69
Mean Shortening	4.3	33	4.5	34.6

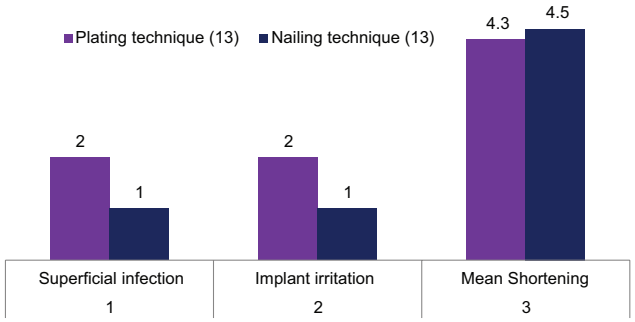
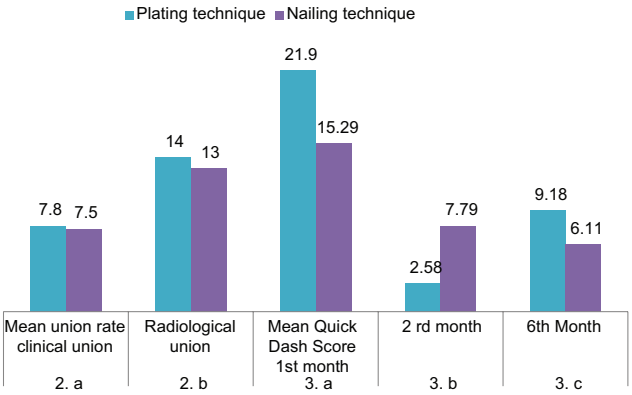


Table 4: Comparison of outcome in both techniques

Parameter	Plating technique	Nailing technique	*t*-test	*P*-value
Union rate	100%	100%	-	-
Mean union rate clinical union	7.8 weeks (SD±1.1)	7.50 weeks (SD±0.1)	1.1	<0.2 Insignificant
Radiological union	14 weeks (SD±0.6)	13 weeks (SD±0.3)	1.1	>0.2 Insignificant
Mean Quick Dash Score 1st month	21.9 (SD±1.6)	15.29 (SD±0.6)	11.5	<0.001
2nd month	2.58 (SD±1.1)	7.79 (SD±0.7)	15.3	<0.001
6th month	9.18 (SD±1.2)	6.11 (SD±0.5)	12.2	<0.001



6th months 9.18 (SD ± 1.2) in plating 6.11 (SD ± 0.5) nailing *t*-test 12.2 $P < 0.001$.

DISCUSSION

The present comparative study between plating and TENS technique in Andhra Pradesh population comparative study of operation [Figures 1 and 2] details mean blood loss (ml), 93 (SD ± 1.8) in plating, 58 (SD ± 2.2) in TENS *t*-test 20.5 $P < 0.001$ mean operation times (minutes) 73 (SD ± 2.3) in plating, 57 (SD ± 1.4) in nail technique *t*-test 14.7 and $P < 0.001$. Mean size of wound 6.87 (SD ± 1.6) plating, 4.48 (SD ± 1.3) in nail, *t*-test 4.18 $P < 0.03$ Mean closed reduction 6 (SD ± 0.3) observed in nail technique [Table 1]. The hospital stay 6.3 (SD ± 0.7) in plating, 5.1 (SD ± 0.2) in nail technique patients *t*-test 5.9 $P < 0.000$ [Table 2]. Post-surgical complications such as superficial infection and implant irritations were highest in nail technique [Table 3]. The union rate was 100% in both techniques. Mean Quick dash score was highest in plating technique at different interval of time [Table 4]. These findings are more or less in agreement with the previous studies.[5-7]

Clavicle plays an integral role not only in the mechanics of role not only in the mechanics of pectoral girdle but also in the function of the upper extremity. Majority of the 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 bone fracture.[8] A biomechanical study suggest that plate fixation results in more rigid fixation as compared to the nailing and this helps in having on rehabilitation.[9] Plate fixation is technically easy to perform and provides rotational control. Disadvantages include large wound size and implant prominence. On the other hand, TENS is less invasive, has lesser 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 an advantage of preserving fracture hematoma which speeds up fracture healing. Disadvantages are that, it does not provide rotational control, TENS protrusion leads to implant irritation.

There was no difference between two techniques in terms of rate of union. As it was 100% in both groups, but there was difference in union duration. Earlier union was observed in nailing technique. Post-surgical complication such as superficial infection, and implant irritation is more in 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. TENS technique has more advantages and lower complications than plating, making its use more favorable. It is recommended for athletes and young active individuals and can be used as alternative to conservative treatment or plate fixation.

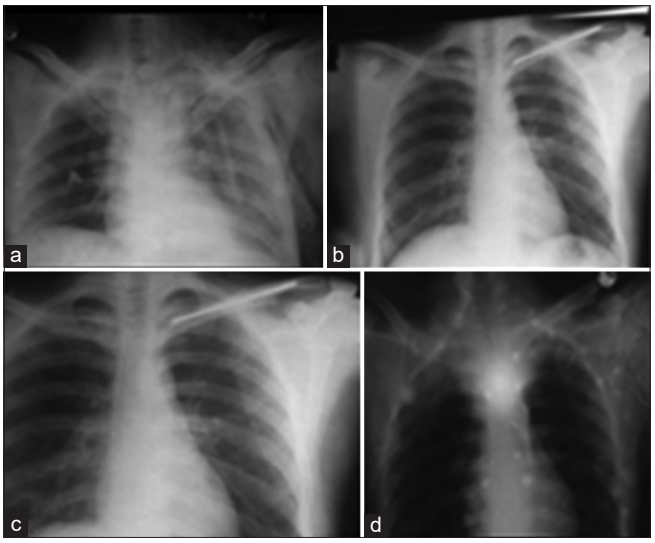


Figure 1: Titanium elastic nailing system nailing group-1 (a) pre-operative X-ray, (b) Immediate post-operative, (c) 6 month post-operative, (d) after implant removal

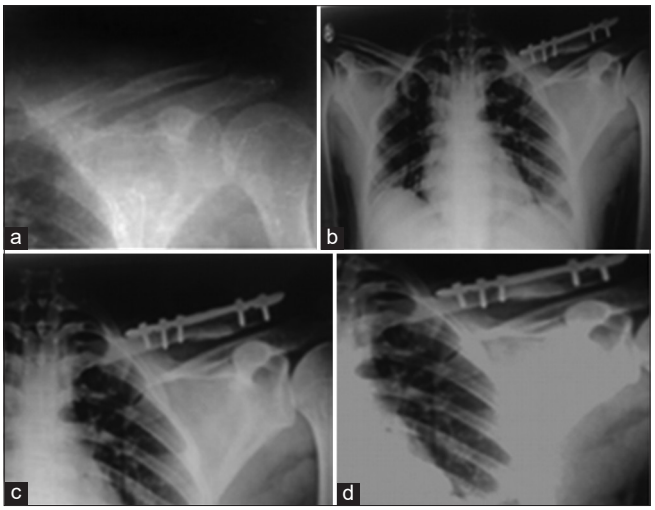


Figure 2: Plate technique (a) pre-operative X-ray, (b) immediate post-operative, (c) 3 months post-operative, (d) 12 months post-operative

This research paper was approved by Ethical committee of Nimra Institute of Medical Sciences Vijaywada-521456 (Andhra Pradesh).

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