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## Outcome of fracture clavicle management by either plating or nailing a randomized comparative study

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### Abstract

**Background:** Fracture of clavicle account for 2-6% of all adult fractures and approximately 80% of the site involved in adult patients is mid-shaft clavicle. Despite of high frequency, substantial controversies exist in surgeons regarding the optimal fixation pattern for treating these injuries and further research is necessitated. So a comparative randomised study was planned to compare Plating versus TENS for management of mid-shaft fracture clavicle.

**Methods:** Study was conducted in Department of Orthopaedics, Mahatma Gandhi Medical College and Hospital, Jaipur from January 2018 to June 2019. Patients aged from 18-55 years with closed displaced fracture were included in the study. Patients were then randomized into two groups- Group A treated with Plate and Group B treated with TENS. Outcome was assessed by DASH score, cosmetic result, clinical and radiological fracture healing time.

**Results:** A total of 40 patients were in the study, out of which 22 patients were treated with precontoured plate and 18 patients were treated with TENS. The mean blood loss in plating group was 97.27 ml and nailing group was 62.22 ml ( $p < 0.05$ ). The mean operative time in plating was 77.27 and in nailing was 61.67 ( $p = 0.005$ ). Mean wound size in plating was 7.22 cms and nailing was 4.55 cms ( $p < 0.05$ ). We had 100% union rate in both the groups. The mean time for clinical and radiological union in plating group was 7.9 weeks and 14 weeks whereas in nailing group it was 7.55 weeks and 13 weeks ( $p = 0.40$  and  $p = 0.070$ ). We had excellent outcomes in 14 patients (63.63%), good outcome in 6 patients (27.27%) and poor outcome in 2 patients (9.09%) in the plating group whereas in the nailing group we had 12 patients (66.66%) with excellent, 6 patients (33.33%) with good outcome. No poor outcome in nailing group. We had superficial infection in 4 patients (18.18%) in plating group and 2 patients (11.11%) in nailing group. Implant irritation occurred in 4 patients (18.18%) in plating and 2 patients (11.11%) in nailing groups. Shortening was 4.5 mm in plating and 4.8 mm in nailing group.

**Conclusions:** We conclude that though nailing has advantage over plating during surgery and postoperative period, on long term follow up there is no significant functional difference between plating and nailing for displaced middle third clavicle fractures.

**Keywords:** Clavicle fracture, precontoured plate, titanium elastic nail

### Introduction

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<sup>[1]</sup>. Studies indicate that 29 to 64 per 1, 00,000 suffer from a clavicle fracture each year<sup>[1, 2]</sup>. A weak spot in mid clavicular region accounts for most of fractures. Despite of high frequency, choice of proper treatment is still a challenge for orthopaedic surgeon<sup>[3]</sup>. In particular it is not clear whether surgery produces better outcomes than non-surgical management. In this scenario, a comparative randomised study was planned to compare Plating versus Titanium Elastic nail System (TENS) for clavicle fractures and compare with respect to incidence of nonunion, shortening, functional outcome, cosmetic aspects and complication. The aim of the study is to analyse the result of TENS management and surgical treatment by plating of displaced mid-shaft clavicle fracture. It also aimed to compare the functional outcome of displaced fracture of the middle third of clavicle treated with TENS and Plating management.

### Materials and Methods

The Study was conducted in department of orthopedics, Mahatma Gandhi Medical College and Hospital, Jaipur. The study period was from January 2018 to June 2019.

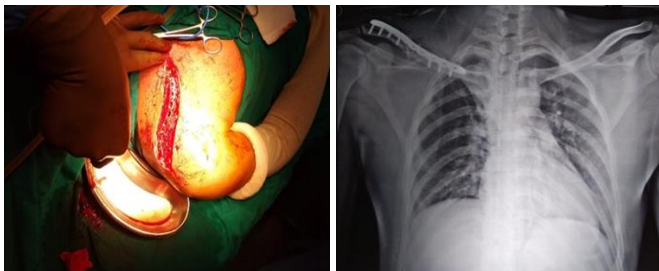
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Patients aged from 18-55 years with closed displaced and isolated fracture of middle third clavicle were included in this study. Those who were not medically fit for surgery, not gave consent, have pathological fracture, with neurovascular deficits, with concomitant injury, with previous fracture clavicle non-union were excluded. Patients coming to the emergency department of orthopedic or OPD of the Mahatma Gandhi Medical College and Hospital, Jaipur within the study period and who qualified the inclusion criteria were randomized in two groups- One group were treated with Plate and second group with TENS. Simple randomization was used for patient's allocation to groups. During the study period 40 clavicle fractures, which require surgical treatment were analyzed.

Patients were admitted from the emergency or orthopaedic OPD and sent to the orthopaedic trauma ward. All the cases were initially investigated with radiograph to assess fracture type and post traumatic clavicular shortening and routine blood investigations, ECG and cardiological check up was done. Pre anaesthetic fitness was obtained from the anaesthesia department. In both the groups patients were operated under general anaesthesia.

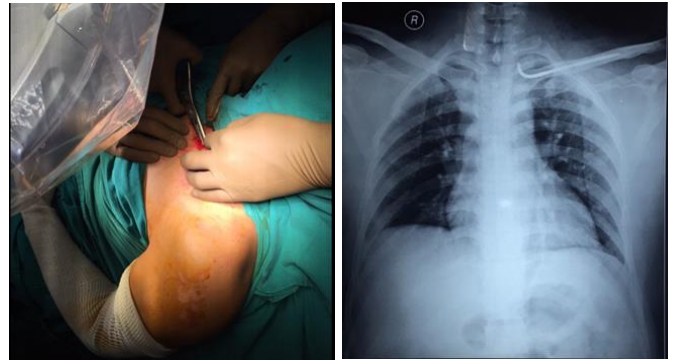
### Surgical technique for plating

After giving prophylactic antibiotics, patient was placed in the supine position with a sand bag placed between the scapula, allowing injured shoulder girdle to fall posteriorly, reducing the fracture and maintaining the length of clavicle. After reduction was done, LCP was used for application to the superior surface of the clavicle.



### Surgical technique for TENS

Patients were placed in supine position. A small incision was made approximately 1 cm lateral to the sterno-clavicular joint. A TEN (Titanium elastic stable intramedullary nail) was inserted (The diameter varied between 2 to 3 mm depending upon the width of bone). Before introduction, the original curvature of the small and flattened 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 then advanced manually until it was just medial to the acromioclavicular joint. Accurate manoeuvring 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 soft tissue irritation, at the same time leaving sufficient length behind for easy extraction later on. The fascia and skin were closed in layers.



### Postoperative protocol and follow up

For both the Groups (A and B) intravenous antibiotics was given for 3 days and changed to oral antibiotics for 7 days. Operated limb was immobilized in a pouch arm sling. The wound was inspected at 3rd post operative day and x ray was taken to study the alignment of fracture fragments. Suture removal was done on 14th postoperative day. Patients were discharged with the pouch arm sling. Rehabilitation of the affected arm was started by the end of 2 weeks. A gentle pendulum exercise of the shoulder in the arm sling was allowed. At 6 wks gentle range of motion of the shoulder was allowed. At 12 wks active range of motion in all planes were allowed. All patients were reviewed on 2<sup>nd</sup> week, 4<sup>th</sup> week then on 12<sup>th</sup> week and 24<sup>th</sup> week after surgery. X-ray was taken for all patients at each follow up for evaluation of fracture healing and implant position.

### Results

Statistical analysis of results were performed using student t test. The results are analysed under the following headings.

**Table 1:** Intra operative details

S No.	Parameter	Plating	Nailing	P value
1	Mean blood loss (ml)	97.27	62.22	<0.05
2	Mean operative time (mins)	77.27	61.66	0.005
3	Mean wound size (cms)	7.22	4.55	<0.05
4	Closed reduction	-	6	-
5	Open reduction	22	12	-

**Table 2:** Duration of hospital stay

S. No.	Parameter	Plating	Nailing	P value
1	Mean duration of hospital stay	6.18	5.22	0.414

**Table 3:** Post-operative complications

S. No.	Complication	Plating	Nailing
1	Infection:		
	-Superficial	4 (18.18%)	2 (11.11%)
	-Deep	0	0
2	Non union	0	0
3	Mal union	0	0
4	Implant failure requiring removal	0	0
5	Implant irritation	4 (18.18%)	2 (11.11%)
6	Re-osteosynthesis	0	0
7	Secondary procedures	0	0
8	Mean shortening (mms)	4.5	4.8

**Table 4:** Outcome we measured the final outcome by union rate, union time (Clinical and radiological) and Quick DASH scoring.

S. No.	Parameter	Plating	Nailing	P value
1	Union rate	100%	100%	-
2	<b>Mean union time:</b>			
	Clinical union	7.90 weeks	7.55 weeks	0.40
	Radiological union	14 weeks	13 weeks	0.070
3	<b>Mean quick DASH score</b>			
	1 month	22.98	16.89	0.28
	3 months	13.73	7.95	0.38
	6 months	9.29	6.20	0.68

## Discussion

Clavicle plays an integral role not only in the mechanics of pectoral girdle but also in the function of upper extremity. Clavicle fractures accounts for approximately 2.6% of all fractures [1, 4-7].

Majority of the clavicle fractures around 85% occur in mid-shaft of the clavicle bone, where the compressive forces applied to the shoulder and narrow cross section of the bone combine and result in bone failure [3, 4, 8, 9].

Theoretically, both plate osteosynthesis and titanium nailing have their own advantages. A biomechanical study suggest that plate fixation results in more rigid fixation when compared to nailing and this helps in having an early rehabilitation [10]. Plate fixation is technically easy to perform and provides rotational control. Disadvantages include large wound size and implant prominence.

On the other hand, Titanium elastic nailing is less invasive, has lesser rate of implant prominence and after union implant removal can be done as an outpatient procedure with minimal dissection [11]. Further, in nailing if closed reduction is achieved this has an advantage of preserving the fracture hematoma which speeds up fracture healing. Disadvantages are that it does not provide rotational control. TEN protrusion leading to implant irritation is also of concern.

Liu *et al.*, (2006) did a retrospective comparative analysis of 110 patients (aged 1665 years) with clavicle fractures of which 59 patients are operated with plating (Reconstruction plate) and 51 patients were operated TEN and demonstrated no significant differences in functional outcome between the two groups. They also observed no significant difference in complication rate between the two groups [12].

LazaridesS, Zafiropoulos [13] reviewed 272 patients with middle third clavicle fractures and found that patients with shortening of more than 18 mm had residual shoulder pain and unsatisfactory results mainly due to altered biomechanics of the shoulder joint that occurs with clavicular shortening.

We evaluated 40 cases of displaced middle third clavicle fractures of which 22 patients are treated with plate osteosynthesis and another 18 patients with intramedullary TEN nailing.

TEN Nailing resulted in decreased blood loss ( $p < 0.05$ ), decreased operative time ( $p = 0.005$ ), decreased wound size ( $p < 0.05$ ) and decreased hospital stay ( $p = 0.41$ ) when compared to plating. Moreover, the mean Quick DASH score of nailing patients at 30 days after surgery is 16.89 when compared to Quick DASH score of 22.98 for plating at 30 days after surgery. This suggests better patient acceptability and satisfaction in the nailing group. However, the mean Quick DASH score at 6 months after surgery in nailing and plating are 6.2 and 9.29 respectively indicating that there is no significant difference in shoulder function and disability on a long term follow up.

There was no difference between two groups in terms of rate

of union. All cases had 100% union. There was a slight difference in union time. The mean time period for clinical and radiological union in plating group was 7.90 weeks and 14 weeks whereas the mean time period for union in nailing group was 7.55 weeks and 13 weeks. Both these were statistically not significant ( $p > 0.05$ ).

Based on the functional outcome at 6 months, in plating group, we had 14 patients with excellent outcome, 6 patients with good outcome and 2 patients with poor outcome. In nailing group, 12 patients with excellent outcome, 6 patients with good outcome.

Complications like superficial infection is noted in 4 patients (18.18%) in plating when compared to 2 patients (11.11%) in nailing group. Moreover minor complications like implant irritation occurred in 4 patients (18.18%) in plating and 2 patients (11.11%) in nailing group.

Shortening do occurs in both plating and nailing. In our study, the mean shortening in plating group was 4.5 mm and in nailing group was 4.8mm. However these amount of shortening did not have any effect on the functional outcome of the patients in our study.

## Limitations

Our study has limitations as it involves limited number of subjects. Therefore statistical significance of our study can be questioned. However our study shows some basic information comparing plating and nailing for clavicle fractures. Our study supports further randomised control trials and with a large number of samples to arrive at a definite conclusion.

## Conclusion

Hence we conclude that though nailing has advantage over plating during surgery and postoperative period, on long term follow up there is no significant functional difference between plating and nailing for displaced middle third clavicle fractures.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by institutional ethics committee.

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