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Titanium elastic nailing versus anatomical plating in displaced fracture mid shaft clavicle in adult patients- A prospective study

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ABSTRACT

Introduction

The common surgical procedure for treating displaced midshaft clavicle fractures is anatomical plate fixation(LCP). Titanium elastic nail (TENS) is a newer method for midshaft clavicle fracture fixation which is minimal invasive and leaves a smaller scar. In this study, the result of midshaft displaced clavicle fractures fixed either with anatomical plates or intramedullary titanium elastic nail was analysed interms of union rates, functional outcome (Constant Murley score) and complications.

Methods

We enrolled 40 adult patients of closed displaced fracture mid shaft clavicle in this study who presented from June 2020 to December 2022. 20 patients underwent TENS fixation and 20 patients underwent LCP fixation.All patients were followed for minimum 6 months. Functional outcome, union rate, and complications were documented and analyzed.

Results

There was no significant difference in the functional outcome (Constant and Murley Score) ,union rates or complications between the two groups.

Conclusion

The intramedullary nailing process is less invasive than plate fixation, requires smaller incisions, and has a shorter hospital stay with no statistically significant difference in functional outcome and union rates. Therefore, TENS methods is viable option for mineshaft clavicle fixation with similar outcomes to plating.

Key-words: Midshaft clavicle fractures, Clavicle plating, Intramedullary clavicle nailing, Titanium elastic nailing system, LCP, TENS

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INTRODUCTION:

Clavicle fractures make up 2.6% of all fractures and are the most frequent injuries among active people who engage in sports, high-speed falls, or violent collisions.[1] The majority of clavicle fractures (80% to 85%) are midshaft fractures, where the narrow cross section of the bone combined with typical compressive stresses to the shoulder causes bony failure.[2]

Studies that examined the outcomes of conservative treatment for displaced middle third clavicle fractures discovered poor outcomes.Numerous fixing procedures have attracted attention and can be broadly grouped into two categories: intramedullary nailing and plating. However, it is still unclear whether either approach is appropriate for a given type of fracture.The requirement for more extensive soft tissue exposure and stripping, supraclavicular nerve injury, marginally greater infection rates, and risk of refracture after plate removal are all drawbacks of plating.[3]

A titanium elastic nail is the newest intramedullary device that exhibits biomechanical characteristics similar to those of a clavicle. It is exhibiting good outcomes in several trials, but it also has drawbacks such medial entry site discomfort, nail migration, and entry point infection.[4-6]

Currently The cornerstone of surgical treatment is anatomical locking compression plating. There are two distinct surgical techniques for clavicle plating that have been documented, in which the plate is either positioned on the superior or antero-inferior surface of the clavicle.[7] Thus, it was necessary to evaluate the efficiency of both implants for midshaft clavicle fractures in terms of morbidity and functional outcome.Smaller incision, less soft tissue dissection, and load-sharing fixation with relative stability that promotes thick callus growth are all benefits of utilizing an intramedullary nail.[8] In contrast, numerous studies have observed technique-specific problems as medial implant protrusion and discomfort.[9]

OBJECTIVES

The primary objective was to evaluate the union rates and functional outcome utilizing the Constant scoring after both plating (LCP) and nailing (TENS) techniques. The secondary objectives were evaluate various complications that could occur with either technique.

METHODS

This is a single center study done at tertiary level hospital during the period of June 2020 to December 2022 with minimum 6 months of follow up.Institutional ethics committee approved for the study & informed consent was obtained from all the patients.All patients(40) 18 year or older having closed displaced mid shaft fracture of clavicle were included.Patients were randomized into two groups plating (LCP) or nailing (TENS).Open fractures, pathological fractures, non-union, ipsilateral limb pathology and with ipsilateral neuro-vascular injury were excluded.20 patients were included in the LCP and 20 patients in the TENS group.

The functional outcome was assessed using Constant and Murley shoulder scoring system during follow-up after LCP and intramedullary nailing for clavicle fractures at 6 weeks, 3 months and 6 months.The Constant-Murley score (CMS) is a 100-points scale composed of a number of individual parameters. These parameters define the level of pain and the ability to carry out the normal daily activities of the patient.The test is divided into four subscales: pain (15 points), activities of daily living (20 points), strength (25 points) and range of motion: forward elevation, external rotation, abduction and internal rotation of the shoulder (40 points).The higher the score, the higher the quality of the function[10] .

The collected data was tabulated and analyzed in accordance with objectives of the study. Statistical analysis was done by using IBM SPSS Version 20 for windows. Chi square test and independent t test was used for analysis of categorical variables and continuous variables respectively. A p-value <0.05 was considered as statistically significant.

Clavicle plating was done using the anterior approach and anatomical locking clavicle plate was placed on the antero-superior surface.The method first detailed by Jubel et al was used to do elastic intramedullary nailing.[11] Rehabilitation of

the injured limb was started right away for both TENS and LCP group patients, depending on patient pain tolerance. Follow-up clinical and plain radiographic examinations were done at two weeks, six weeks, and subsequently every month. We assessed the healing of the fracture, the size and condition of the surgical site, the functional status of the injured shoulder, and any problems such implant migration, loosening, or failure at six months after surgery.

RESULT

A total of 40 cases of displaced fracture midshaft clavicle were included who met the inclusion criterion. 20 (50%) cases underwent intra-medullary nail fixation with TENS(TENS) and 20(50%) cases underwent open reduction with anatomical locking plate(LCP).All patients were followed up for minimum of 6 months. Age, sex, and demographics were matched for in both the groups (Table 1).

Table 1 : Patient Demographics

	TENS Group	LCP Group	P value
Number of patients(n)	20	20	
Mean age in years(range)	35.5(18-56)	34.5(18-52)	0.07
Gender			0.465
Male	16	15	
Female	14	15	
Side Affected			0.091
Left	11	13	
Right	9	7	

The average duration of hospital stay was more in the LCP (Table 2).The average union time was not statistically different between the two groups. The constant shoulder score was measured at the end of 3 months and 6 months. The constant shoulder score at 3 months and 6 months was not statistically different.

Table 2 :Outcomes

	TENS Group	LCP Group	*P value*
Duration of hospital stays (days)	5.13±2.45	8.25±4.0	0.01
Average union time(weeks)	10.27±2.38	10.98±3.45	0.438
Constant and Murley Score			
3 months	81±4.25	80±6.80	0.136
6 month	90.67±8.25	92.74±7.64	0.287

Table 3: Complications

	TENS Group	LCP Group	*P value*
Superficial Infection	1	2	0.346
Skin Irritation	1	0	0.080
Loss of sensation over clavicle	0	2	0.60
Non union	0	1	0.128

1 patient in the TENS group and 2 patients in the LCP group developed superficial infection which was treated with antibiotics therapy.(Table 3) 1 patient in LCP group developed non union which underwent re surgery with bone grafting.The fracture eventually united at 3 months without further complications.

DISCUSSION

Historically, nonoperative treatment has been the treatment of choice midshaft clavicle fractures with good results.Considering the extremely low incidence of nonunion rates Neer and Rowe advised conservative treatment for clavicular fractures in the 1960s.[12-13] But conservatively treated mid shaft fractures have some degree of malunion.Due to the growing unhappiness among patients treated conservatively after a clavicle malunion, these fractures are increasingly being treated operatively using various surgical fixation methods.[14-20]Among operative methods open reduction with plating is the standard treatment for displaced mineshaft clavicle fracture.[21-22] Literature shows good results with plating.[23] In this study also good functional outcome and union rates was achieved with plating. However, plate fixation is associated with soft tissue dissection, periosteum stripping, post operative skin numbness, wound dehisce, cosmetically unacceptable scar due to large incision.[24-25] Because of these complications intramedulary fixation of midshaft clavicle fracture was described as less invasive and more biological form of fixation.[26] Jubel et al. provided the first description of the application of TENS for clavicle fractures.[11] Functional results and union rates via TENS fixation are comparable to those seen with plate fixation.This study showed that for displaced midshaft clavicle fractures, intramedullary TENS treatment was clinically equivalent to plate fixation. The continuous shoulder score did not significantly differ between the plating and TENS groups both at 3 months and at 6 months post-operatively. In this study, there was no statistically significant difference between the average union time in the TENS group and the LCP group.

Superficial and deep infection, hardware prominence, non-union, and cosmetically poor scars are complications associated with plate fixation.In this study, the plating group experienced 2 superficial infection, while the TENS group experienced only 1 superficial infections.Employing intramedullary TENS for clavicle fracture results in excellent patient satisfaction rates, good shoulder function, and favourable radiological outcomes [25,26]. In the TENS group, we had no nonunion, compared to one case in the plating group.Hence although union rates , functional outcome and complications are comparable between TENS and LCP group ,TENS is associated with smaller incision ,less soft tissue dissection, less periosteal stripping ,lesser blood loss ,shorter operating time and better cosmetic scar.

CONCLUSIONS

For the fixation of midshaft clavicle fractures, anatomical locking clavicle plates and intramedullary TENS are both viable options. Even though the union rates, functional outcomes and complications were similar in the two groups, the less invasive and cosmetically better scar makes TENS a better treatment choice.

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