



A COMPARATIVE STUDY OF DISPLACED MIDSHAFT CLAVICLE FRACTURE MANAGED BY TITANIUM ELASTIC NAILS AND PRECONTOURED LOCKING COMPRESSION PLATES

Dr. Deepak Kumar Sonkar

Senior resident, Government Medical College, Gondia

Dr. Digambar S. Maraskolhe

Associate Professor, Government Medical College, Gondia

Dr. Nitin D. Thikare

Senior resident, Government Medical College, Gondia

Dr. Nikhil Ashok Halmare

Senior resident, Government Medical College, Gondia

Dr. Satishkumar Dindayal Bansod

Assiatant Professor, Government Medical College, Gondia

Dr. Nandkishor M. Harne

Assiatant Professor, Government Medical College, Gondia

ABSTRACT

Introduction: The clavicle is located between the ribcage (sternum) and the shoulder blade (scapula). 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. Recent studies have shown that results of conservative management of displaced mid shaft clavicle fractures are not as good as previously believed. There are 2 common techniques for treating displaced mid-shaft clavicle fractures, namely, open reduction and plate fixation and open/closed reduction with intramedullary nail fixation. Studies have found both these techniques to be superior to conservative management. **Materials and method:** The present study was prospective study conducted from March 2022 to March 2024 at tertiary care centre. In this study a total 48 patients with displaced mid shaft clavicle fractures managed by titanium elastic nails and precontoured locking compression plates. Patients were followed 2nd week for suture removal and monthly for 4 months and at 6 months and 9 months. Final results were computed at end of 6 months. Functional outcome was compared using Constant Score. **Result:** The final functional outcomes in terms of DASH and Constant Murley score are not influenced by the method of surgical treatment of displaced mid-shaft clavicle fractures. Nail impingement and nail backout was major concern after intra-medullary nailing. Union time was slightly better in nailing group as compared to plating group. **Conclusion:** But in the management of displaced midshaft clavicular fractures, Plating is superior to TENS with fewer complication. Surgery with Plating results good functional outcome compared with TENS treatment.

KEYWORDS : Clavicle fracture, Titanium Elastic Nailing, Plate, Closed reduction, Open reduction

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.

Clavicle fractures were considered essentially benign injuries with inherently good prognosis even if treated conservatively [1]. Recent studies have shown that results of conservative management of displaced mid shaft clavicle fractures are not as good as previously believed [2- 4]. 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 backpack bandage), or a combination of these two methods.

There are 2 common techniques for treating displaced mid-shaft clavicle fractures, namely, open reduction and plate fixation and open/closed reduction with intramedullary nail fixation [10]. Studies have found both these techniques to be superior to conservative management [5]. This led to need of

further studies to compare these two modalities of surgical treatment. Although orthopaedics journals have abundant articles comparing conservative management with surgical, there are relatively less publications comparing the two common modalities of surgical treatment.

Recent studies have drawn our attention towards these facts and have led to an increasing inclination towards primary fixation of displaced mid-shaft clavicle fractures [5-7].

Studies suggest that plate fixation provides more rigid stabilization and stronger construct, facilitating early rehabilitation, as compared to nails [9] but in terms of soft tissue preservation, callus formation and infection rates, intramedullary fixation has been found more promising [10]. The aim of this study is to evaluate the results of internal fixation of displaced mid-shaft clavicle fractures using antero-superior precontoured locking plates and minimally invasive antegrade titanium elastic nails and to compare both these modalities of treatment.

MATERIALS AND METHODS

The present study was prospective study conducted from March 2022 to March 2024 at our instution [tertiary care centre]. In this study a total 48 patients with displaced mid shaft clavicle fractures were admitted in our institute.

Inclusion criteria

- Age more than 18yrs and less than 60yrs
- Close Mid shaft fracture

- Non communitied clavicle fracture with more than 20mm displacement and shortening on x-ray

Exclusion criteria

- Age less than 18yrs and more than 60yrs
- Communitied clavicle fracture
- Pediatrics clavicle fracture
- Open fractures
- Pathological fractures

Patients were randomly distributed in two groups A (nailing group) and B (plating group) with equal number of patients 24 in each group.

Surgical technique

Patient taken on OT table in supine position or beach chair position under supraclavicular and interscalene block or general anesthesia. Primary painting, draping was done of affected sides and region was kept free for intraoperative reduction procedure.

Nailing technique

Vertical or horizontal ilncision was made 1.5 or 2cm cm lateral to sternoclavicular joint , and entry was made in the anterior cortex of the bone by a 2mm Drill bit then small bone awl. 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 under c-arm and fracture reduction and advanced until the tip of the nail was engaged in cortex of lateral end of clavicle then medial end is cut and buried subcutaneously. The size of nail was measured using this formula = $0.4 \times \text{canal diameter in mm}$.

INTRAOPERATIVE NAILING



Fig.1 A (Vertical Incision), B (Entry made in the anterior cortex of the bone by drill bit and a small bone awl) and D (Fluoroscopic view)

Plating technique

An incision 8-10cm was made transversely just under the fracture site. Soft tissue dissection was made carefully to a minimum injury with preservation of supraclavicular nerve. After reduction of fractures fix with k wire or hold with clamp and a pre contoured locking plate was fixed on the anterosuperior surface of the bone, starting medially using bicortical screws. The wound were closed in layers.

INTRAOPERATIVE PLATING

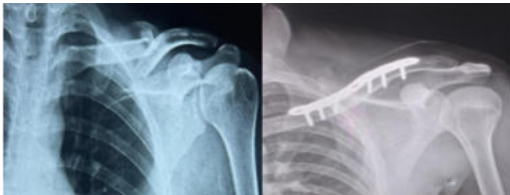


Fig.2 A (Pre op), B (Fluoroscopic view) and C (Plate fixation)

POST OPERATIVE PROTOCOL

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 or arm pouch. The wound was inspected at 3rd and 5th post- operative day. Patients were discharged with the arm sling or arm pouch.

The patients were followed up at 2 weeks for suture removal, 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 assess.

RESULTS

TABLE 1. Group wise distrubtion of cases

S.NO.	GROUP	DESCRIPTION	NO. OF CASES	PERCENTAGE
1.	A	Patients managed with closed reduction with intramedullary TENS Nail.	24	50%
2.	B	Patient managed with open reduction with locking plates.	24	50%

Patients were randomly allocated to nailing group(a) or plating group(b). 24patients ended up in plating group and rest 24 in nailing group.

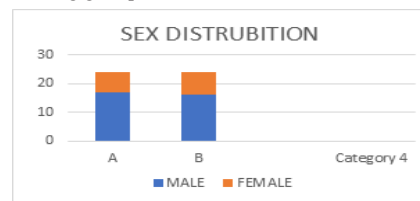


Fig. 3 Sex distribution

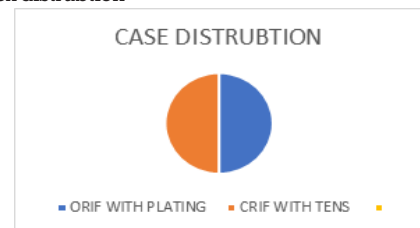


Fig.4 Case distribution

TABLE 2. SEX DISTRIBUTION

GENDER	TENS GROUP (A)	PLATING GROUP (B)	TOTAL
MALE	17	16	33
FEMALE	7	8	15
TOTAL	24	24	48

There were a total of 48 patients studied 33 of them were males and 15 females.

Table 3: Mode of Injury- frequency distribution in two groups

MODE OF INJURY	TENS GROUP(A)	PLATING GROUP (B)	TOTAL
ASSAULT	1	2	3
FALL FROM HEIGHT	7	6	13
FOOSH	2	1	3
ROAD TRAFFIC ACCIDENT	11	13	24
SPORTS	3	2	5
TOTAL	24	24	48

TABLE 4. Evaluation at presentation

S.NO.	PARAMETER	GROUP A	GROUP B
1.	TYPE OF FRACTURE	NUMBER	NUMBER
	a.2B1	17	19
	b.2B2	7	5
2.	SIDE INVOLVED		
	a.LEFT	6	9
	b.RIGHT	18	15

In group 1, 17 patients were Robinson type 2B1 fractures and 7 where 2B2 fractures. In group 2, 19 were 2B1 and 5 were 2B2 fracture.

TABLE 6. FUNCTIONAL OUT COME

S.NO.	FINAL OUTCOME	GROUP A	GROUP B
		NUMBER	NUMBER
1.	EXCELLENT	7	11
2.	GOOD	6	4
3.	FAIR	8	7
4.	POOR	3	2

In Group A, excellent outcome was seen in 7(29%), good in 6 (25%), fair in 8 (33%) and poor in 3(12.5%) cases as compared to Group B where excellent outcome was seen in 11 (48.85%), good in 4 (17%), fair in 7 (29.2%) and poor in 2(8.5%) cases. The proportion of patients with excellent and good outcome to fair and poor outcome was higher in Group B as compared to Group A and this difference was significant statistically.

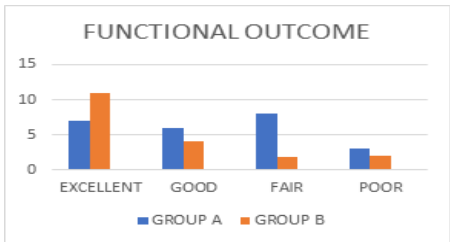


Fig.5 Functional outcome

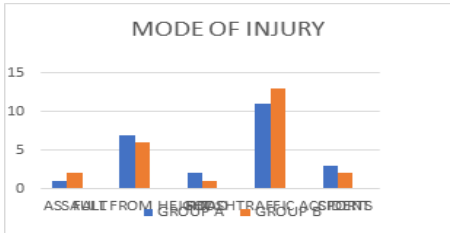


Fig.6 Mode of injury

TABLE 7. POSTOPERATIVE COMPLICATION

S.NO.	PARAMETER	GROUP A (Tens group)	GROUP B (plating group)
1	Infection	0	2
2	Implant failure	0	0
3	Wound dehiscence	0	0
4	Plate prominence	0	4

5	Nail impingement	5	0
6	Revision surgery	0	0

In group A , nail impingement seen at site of entry in 5 patient but there is no infection and implant failure or revision surgery. In group B, Plate impingement seen in 4 patient and inection seen in 2 patient which subside after given higher antibiotics .

DISCUSSION

Mostly mid shaft clavicle fracture had been treated non operatively by using clavicular brace or figure of 8 bandage. Neer and Rowe in the 1960 recommended conservative treatment for clavicular fracture in view of very small incidence of non union rates in their studies (0.1% &0.8 % respectively).

But recent studies show significantly higher non union rates in conservatively treated patient. Hence, current recommendation for treatment of mid shaft displaced clavicle fracture is operative fixation.

In a study conducted to analyze the results of conservative treatment by Hill et al. in 1997 [12], Nordqvist et al. in 1998 [1] and Robinson et al. in 2004(11) found poor results following conservative treatment of displaced middle third clavicle fracture. Also a meta-analysis of the literature from 1975 to 2005 by Zlowodzky et al. found non-union rates to be exponentially higher than that claimed earlier [8] .

A prospective comparative study was carried out in which a total of 48 cases of displaced mid-shaft fractures of clavicle were included, during the period march2022 to march 2024. 24 cases were operated with internal fixation with precontoured locking plate (comprising group B) and 24 patients were treated with TENS (comprising group A).

Majority of patients were males, irrespective of the group to which they belonged. There were 7(29.16%) females in Group A and 8(33.33%) in Group B. Group A, 17(70.83%) patients had type 2B1 fracture and 7 (29.16%) had 2B2 fracture whereas in Group II 19(79.16%) patients had type 2B1 fracture and 5(20.8%) had 2B2 fracture. Statistically, this difference between two groups was significant.

Majority patients had involvement of right side, considering both groups. Left side was involved in 25% of Group A and 37.5% of Group B patients. Statistically, this difference did not account as significant.

For plate fixation a larger incision is required, leading to a higher risk of infection and lesser cosmetic satisfaction. In our study, infection was reported in only one case of plate fixation and in none of the patients treated with nailing

The difference in functional outcome between the two groups at the end of 6 months were statically significant. 54.16% (13) of patients in Group A had excellent to good outcome whereas in Group B only 62.5% (15) patients had excellent to good outcome.

In our study no cases of implant breakage or loosening were reported. Absence of these complications in our study was likely due to locking mechanism, lower stress due to better adaptability of s-shaped plate and small sample size.

CONCLUSION

Authors found that both methods of internal fixation by TENS and plating have their own advantages and disadvantages, though the final functional outcomes in terms of DASH and Constant Murley score are not influenced by the method of surgical treatment of displaced mid-shaft clavicle fractures.

TENS is suitable for treating simple displaced fractures of the

mid-shaft clavicle because it showed a stress distribution similar to intact clavicle with a minimally invasive technique, minimal blood loss, no periosteal stripping, no scar mark and a better cosmetic outcome. TENS provides less stability compared with plate fixation, and therefore excessive exercise and weight bearing should be avoided in the early post-operative period because chances of back out of TENS increase.

On the other hand, fixation of comminuted fractures of mid-shaft fractures of clavicle, open reduction and internal fixation by LCP or LCP and Lag screw fixation remains the effective modality. Plating for mid-shaft clavicular fractures showed greater stability, but had obvious stress shielding, large scar mark and chances of infection increase. Therefore, for patients with a demand for early return to activity, plating may be preferred.

But in the management of displaced midshaft clavicular fractures, Plating is superior to TENS. Surgery with Plating results good functional outcome compared with TENS treatment.

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, Oberladstaetter J, Struve P, Krappinger D. Shaft fracture of the clavicle current concepts. Arch Orthop Trauma
5. Shen WJ, Liu TJ, Shen YS. Plate fixation of fresh displaced midshaft clavicle fractures. Injury. 1999; 30(7):497.
6. Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. J Bone Joint Surg Am. 2007; 89:1-10.
7. Kulshrestha V, Roy T, Audige L. Operative versus nonoperative management of displaced midshaft clavicle fractures: a prospective cohort study. J Orthop Trauma. 2011; 25:1-8.
8. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Evidence-Based Orthopaedic Trauma Working Group. Treatment of acute midshaft clavicle fractures: Systematic review of 2144 fractures: On behalf of the Evidence-Based Orthopaedic Trauma Working Group. J Orthop Trauma. 2005; 19:504-7.
9. Constant CR, Murley AHG. A clinical method of functional assessment of the shoulder. Clinical Orthopaedics Related Research. 1987; 214:160-4.
10. Saha P, Datta P, Ayan S, Garg AK, Bandyopadhyay U, Kundu S. Plate versus titanium elastic nail in treatment of displaced midshaft clavicle fractures A comparative study. Indian J Orthop. 2014; 48:587-93a Surg. 2009; 129:807-815.
11. Robinson CM, Court Brown, CM McQueen MM, Walkefield AE. Estimating the risk of non-union following non-operative treatment of a clavicular fracture. J Bone Joint Surgery. 2004; 86:1359-65
12. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle third fractures of the clavicle gives poor results. J Bone Joint Surgery. 1997; 79:537-40.