Original Research Article

Comparative study on surgical fixation of displaced midshaft clavicle fractures by elastic intramedullary nailing versus precontoured plating

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Abstract

Background: Displacement occurs in about 73 % of all midshaft clavicle fractures and higher rates of delayed union, nonunion, shoulder pain, and shoulder weakness and residual pain are seen with non-operative treatment. The present study was conducted to compare outcomes and complications of titanium elastic intramedullary nailing and anatomically precontoured plating in displaced midshaft clavicular fractures. **Methods**: The present study was prospective in nature conducted upon patients with closed clavicular mid one-third fractures with age more than 16 years. All patients were divided in two groups and treated by titanium elastic intramedullary nailing and anatomically precontoured plating. They were assessed clinico-radiologically at 4,8 12 and 24 weeks. The functional outcome was assessed by Constant Murley score at 24 weeks. **Results**: Mean age among group 1 was 32.4±9.1 years and that among group 2 was 27.8±10.3 years. 81.3% of the study subjects in group 1 and 87.5% in group 2 were males. Most common mode of injury was RTA (62.5% in group 1 and 68.8% in group 2). Higher CMS score was seen in TENS group as compared to plating group. The difference among two groups was statistically significant ($p<0.05$). **Conclusions**: In closed mid-shaft clavicle fractures, TENS nailing is superior to clavicular plating in terms of better functional outcome, faster union, fewer complication.

Key Words: intramedullary nailing, midshaft clavicle fractures, precontoured plating

Introduction

Fractures of the clavicle account for 2.6–4 % of all adult fractures, 35 % of all injuries to the shoulder girdle, and 69–82 % of these fractures occur in the middle-third [1, 2]. Displacement occurs in about 73 % of all midshaft clavicle fractures [2]. The average age of patients sustaining a midshaft clavicular fracture is 33 years; 70 % of the patients are male [3]. A fall or a direct blow to the shoulder, giving an axial compressive force on the clavicle, is the most common trauma mechanism of injury for any clavicular fracture [4, 5]. Displaced midshaft fractures have traditionally been treated non-operatively because of early reports suggesting that clavicular nonunions were very rare and clavicular mal-union, being of radiographic interest only, was without clinical importance [6, 7]. However, recent studies have found higher rates of delayed union, nonunion, shoulder pain, and shoulder weakness and residual pain with non-operative treatment [8]. The indications for surgery include the need for earlier functional mobilization in the patient with an isolated injury, in addition to open fractures, floating shoulders and patients with polytrauma [9]. For operative treatment, the available methods of fixation are fixation with Kirschner wires, pins (Rush pin, Knowles pin, Rockwood pin), plates with screws and external fixation [10–12].

Aims & objectives- The present study was conducted to compare outcomes and complications of titanium elastic intramedullary nailing and anatomically precontoured plating in displaced midshaft clavicular fractures.

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Materials and methods

The present study was prospective conducted between June 2019 to March 2021.

Inclusion criteria

All closed clavicular mid one-third fractures with age more than 16 years were included in the study.

Exclusion criteria

Open fractures, pathological fractures and age less than 16 years were excluded from the study.

All medically fit patients were admitted and routine radiographs included standard anteroposterior view of affected shoulder. All patients were posted with valid written consent for surgery and were operated on elective basis. The patients were randomly divided in two groups according to types of surgical procedures. One is with anatomical clavicular plate- plating group and other one is titanium elastic nailing (TENS)- nailing group.

All patients were operated under general anesthesia in beach chair position.

Surgical Technique for plating

Entire upper limb from base of neck to hand were prepared and draped with sand bag between the scapula. About 7-9 cm, incision was made in the anterior aspect centering clavicle over the fracture site. The skin subcutaneous tissue and platysma were divided without undermining the edges. The overlying fascia and periosteum were divided next. The osseous ends were freed from surrounding tissue. Minimal soft tissue and periosteum dissection was done. Fracture fragments were reduced and anatomical clavicular plate was applied over the superior aspect of the clavicle and was fixed with locking screws/ cortical screws and minimum three screws in medial and lateral fragment were applied. Wound was closed in layers after ensuring meticulous hemostasis and sterile dressing was applied.

Surgical Technique For Titanium Elastic Nailing

With similar position and draping methods as for plating,a small incision was made approximately 1 cm lateral to the sternoclavicular joint. Titanium elastic intramedullary nail was inserted. 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 guidance. The nail was then advanced manually until it was just medial to the acromio-clavicular joint. 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.

Patients were discharged between 3rd to 5th postoperative day with arm sling. Rehabilitation with pendulum exercises was started at the end of 2 weeks. 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 wks active range of motion in all planes were allowed. All patients were assessed clinico-radiologically at 4,8 12 and 24 weeks. The functional outcome was assessed by Constant Murley score at 24 weeks.

Results

A total of 32 patients with displaced midshaft clavicle fractures were included in the present study as per inclusion criteria. Table-1 shows the background profile of the study subjects in the two groups. Mean age among group 1 was 32.4±9.1 years and that among group 2 was 27.8±10.3 years. 81.3% of the study subjects in group 1 and 87.5% in group 2 were males. Most common mode of injury was RTA (62.5% in group 1 and 68.8% in group 2).

Table-1 showing background factors

Background factors	Values	Group 1 (Plating) n=16	Group 2 (TENS) n=16	Significance
Age	Years	32.4±9.1	27.8±10.3	p<0.05
Sex	-Male -Female	13 (81.3%) 3 (18.7%)	14 (87.5%) 2 (12.5%)	p<0.05
Mode of injury	-RTA -Fall -Sports injury	10 (62.5%) 4 (25%) 2 (12.5%)	11 (68.8%) 3 (18.7%) 2 (12.5%)	p<0.05

Table-2 shows time taken for union. Union was seen earlier in TENS group as compared to plating group and the difference was statistically significant (p<0.05).

Table-2 showing time taken for union

Time for union (wks)	No. of cases (Plating group)	No. of cases (TENS group)	Significance
9-12	8 (50%)	13 (81.3%)	p<0.05
13-16	6 (37.5%)	3 (18.7%)	
>16	2 (12.5%)	-	

Table-3 shows CMS score among the two groups. Higher CMS score was seen in TENS group as compared to plating group. The difference among two groups was statistically significant (p<0.05).

Table-3 showing CMS score

CMS score	No. of cases (Plating group)	No. of cases (TENS group)	Significance
Excellent	6 (37.5%)	10 (62.5%)	p<0.05)
Good	8 (50%)	3 (18.8%)	
Fair	1 (6.2%)	1 (6.2%)	
Poor	1 (6.2%)	-	

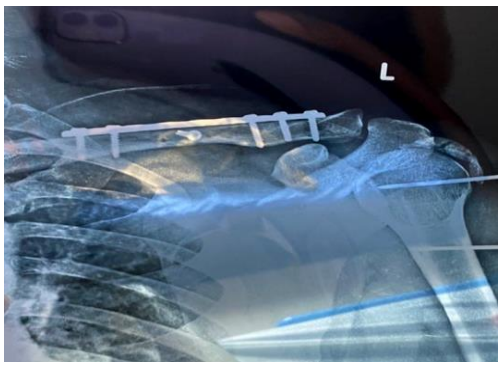

Fig 1: Radiograph showing precontoured plating of clavicular frature

Discussion

A total of 32 patients with midclavicular fracture were included in the present study. Mean age among group 1 was 32.4±9.1 years and that among group 2 was 27.8±10.3 years. 81.3% of the study subjects in group 1 and 87.5% in group 2 were males. Most common mode of injury was RTA (62.5% in group 1 and 68.8% in group 2). Union was seen earlier in TENS group as compared to plating group and the difference was statistically significant (p<0.05). Higher CMS score was seen in TENS group as compared to plating group. The difference among two groups was statistically significant (p<0.05)

Narsaria et al [13] observed that Length of incision, operation time, blood loss and duration of hospital stay were significantly less for the EIN group. American Shoulder and Elbow Surgeons (ASES) and Constant Shoulder scores were significantly higher (p < 0.05) in the plating group than the EIN group for the first 2 months but there was no significant difference found between the two groups regarding

functional and radio- logical outcome at the 2-year follow-up. Significantly higher rates of refracture after implant removal (p = 0.045) in the plating group was observed. Infection and revision surgery rates were also higher in the plate group, but this difference was insignificant (p =0.05). They commented that EIN is a safe, minimally invasive surgical technique with a lower complication rate, faster return to daily activities, excellent cosmetic and comparable func- tional results, and can be used as an equally effective alternative to plate fixation in displaced midshaft clavicle fractures.

In the study conducted by Yaseen et al [14], all patients were divided into two- plating group (n=31) and nailing group(n=28). Radiological union was faster and functional outcome p=0.02852 respectively). Nailing patients also had shorter hospital stay and reduced post operative pain compared plating group. In terms of complications, nailing group had fewer (n=3) complications than plating group(n=1).

Itagi et al [15] found in Karnataka that in 20 patients treated by TEN, excellent results were observed in 17 patients (85%) and 3 patients (15%) with good results and in the ts (80%) had excellent results, 3 patients (15%) had good results and 1 patient (5%) had fair result. They opined that use of minimally invasive TENS for fixation of displaced midshaft clavicle fractures has faster fracture healing, lesser morbidity, better cosmetic results, easier implant removal and few restoration of clavicluar length in simple fractures. Although for comminuted fractures plating remains the procedure of choice.

Bohra et al [16] found that incision length (p=0.008), operative time (p=0.02), blood loss (p=0.003) and hospital stay was significantly less for the nailing group as compared to the plating group. Implant failure, non union and hypertrophic scar was more prevalent in the plating group. The Constant Murley score was significantly higher for the nailing group (p=0.04) in the initial 6 months of the follow up, however there was no statistically significant difference in the DASH score (p=0.42) and Constant score beyond 6 month follow up. They also concluded that intramedullary nailing is a superior alternative to plate fixation for clavicle fracture because of less complications, less hospital stay, better cosmesis and functional outcome.

Conclusion

In closed mid-shaft clavicle fractures, TENS nailing is superior to clavicular plating. Nailing has better functional outcome, faster union, fewer complication, less hospital stay, better patient comfort in terms of reduced post operative pain and cosmetically more acceptable than plating.

Ethical approval

The study was approved by the Institutional Ethics Committee

References

1. CM (1998) Fractures of the clavicle in the adult. Epi- demiology and classification. J Bone Joint Surg Br 80:476–84
2. Khan LA, Bradnock TJ, Scott C, Robinson CM (2009) Fractures of the clavicle. J Bone Joint Surg (Am) 91:447–60
3. Pearson AM, Tosteson ANA, Koval KJ, McKee MD, Cantu RV, Bell JE, Vicente M (2010) Is surgery for displaced, midshaft clavicle fractures in adults cost-effective? Results based on a multicenter randomized, controlled trial. J Orthop Trauma 24:426–33.
4. Nowak J, Mallmin H, Larsson S (2000) The aetiology and epi- demiology of clavicular fractures. A prospective study during a two-year period in Uppsala, Sweden. Injury 31:353–8
5. Stanley D, Trowbridge EA, Norris SH (1988) The mechanism of clavicular fracture. A clinical and biomechanical analysis. J Bone Joint Surg Br 70:461–4
6. Neer CS (1960) Nonunion of the clavicle. J Am Med Assoc 172:1006–101
7. Canadian Orthopaedic Trauma Society (2007) Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. J Bone Joint Surg Am 89:1–10
8. Hill JM, McGuire MH, Crosby LA (1997) Closed treatment of displaced middle-third fractures of the clavicle gives poor results. J Bone Joint Surg Br 79:537–9
9. Denard PJ, Koval KJ, Cantu RV, Weinstein JN (2005) Manage- ment of midshaft clavicle fractures in adults. Am J Orthop 34:527–36
10. Lee YS, Lin CC, Huang CR, Chen CN, Liao WY (2007) Oper- ative treatment of midclavicular fractures in 62 elderly patients: Knowles pin versus plate. Orthopedics 30(11):959–64
11. Mudd CD, Quigley KJ, Gross LB (2011) Excessive complications of open intramedullary nailing of midshaft clavicle fractures with the Rockwood clavicle pin. Clin Orthop Relat Res 469(12):3364–70
12. Mueller M, Rangger C, Striepens N, Burger C (2008) Minimally invasive intramedullary nailing of midshaft clavicular fractures using titanium elastic nails. J Trauma 64(6):1528–34
13. Narsaria N, Singh AK, Arun GR, Seth RR. SethSurgical fixation of displaced midshaft clavicle fractures: elastic intramedullary nailing versus precontoured plating. J Orthopaed Traumatol (2014) 15:165–71
14. Yaseen M, Raghavendra K, Vijayakumaran R. A comparative Study on plating Versus nailing in Midclavicular Fractures. International Journal of Orthopaedics Traumatology & Surgical Sciences 2019; 05 (01):220-5
15. Itagi PB, Panegaon N. Pre-contoured LCP Vs TENS in treatment of displaced mid-clavicle fracture: Comparative study. Medpulse International Medical Journal June 2016; 3(6): 592-8.
16. Bohra I, Niyazi MS. Plate fixation versus elastic nailing for displaced clavicle fractures: A comparative study. International Journal of Orthopaedics Sciences 2018; 4(4): 834-8

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