International Journal of Research in Orthopaedics
Palanivel A. Int J Res Orthop. 2021 Mar;7(2):335-338
http://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20210499

Functional outcome of displaced middle third clavicular fractures treated by plate osteosynthesis

A. Palanivel*

Chief Civil Surgeon, Government District Head Quarters Hospital Nagapatinnam, Tamil Nadu, India

Received: 15 January 2021
Accepted: 06 February 2021

***Correspondence:**
Dr. A. Palanivel,
E-mail: dr_palanivel123@yahoo.com

ABSTRACT

Background: Clavicle fracture is a common traumatic injury around the shoulder girdle due to its subcutaneous position. Recent studies have shown a higher rate of nonunion and shoulder dysfunction in subgroups of patients with clavicle fractures. The purpose of the study was to prospectively analyse the functional outcome of mid-third displaced clavicular fractures treated by open reduction and internal fixation with plate osteosynthesis. To study the outcome of displaced middle-third clavicular fracture streated by plate osteosynthesis.
Methods: This was a prospective comparative on-randomized study was conducted in Government District Head Quarters Hospital Nagapattinam with a follow-up ranging from September 2018 to January 2019 5 months. Thirty-four cases of middle third displaced (Robinson type 2b1 and 2b2) clavicular fractures are treated with plate osteosynthesis. We used a reconstruction plate, a locking compression plate, and a 1/3rd tubular plate for study.
Results: The mean time to union was 9.5 weeks. At the latest follow-up, the entire patients returned to the pre-injury activity level. One case had a superficial infection which was treated with intravenous antibiotics. There is no difference between the reconstruction group and the locking compression plate group in terms of functional outcome and union rate. We also noticed that road traffic accident and direct injury to the shoulder causes Robinson type 2b2 fractures.
Conclusions: Open reduction and rigid internal fixation of displaced midshaft clavicular fracture have resulted in a good fracture union rate and excellent functional outcome.

Keywords: Clavicular fracture, Locking compression plate, Plate osteosynthesis

INTRODUCTION

The clavicle is the bony link from the thorax to the shoulder girdle and contributes to movements at the shoulder girdle. A clavicle fracture is a common traumatic injury around the shoulder girdle due to its subcutaneous position. It is caused by either low-energy or high-energy impact.[1] The traditional view that most of the clavicular fractures heal with good functional outcomes following non operative treatment is no longer valid. Recent studies have shown a higher rate of nonunion and shoulder dysfunction in subgroups of patients with clavicle fractures. Because of this, these fractures should therefore be considered as a spectrum of injuries with various functional outcomes, each requiring cautious assessment and individualized care. Fracture of the clavicle is common, accounting for 5 to 12% of all fractures.[2] About 80 to 85% of these fractures are in the middle third of the bone, where the typical compressive forces applied to the shoulder and the narrow cross-section of the bone combines and result in bony failure. Displaced mid shaft clavicle fractures are common and are generally treated non-operatively.[3] Non-operative treatment of these fractures with axial shortening is associated with the nonunion, delayed union, and malunion. Other complications are severe pain, neurological complications, loss of shoulder function, and protuberant callus forming swelling and stretching of the skin which is cosmetically unacceptable.[4] The proponents of early fixation of fresh clavicular fractures to prevent complications like malunion and nonunion emphasize the value of accurate reduction

and rigid fixation in affording quick pain relief and promoting early functional recovery.[5] Persons with high activity level will hesitate to accept prolonged recovery and impaired shoulder function, therefore may require more aggressive treatment of middle third clavicle fractures. Prompt fixation of these clavicle fractures permits increased patient comfort and early shoulder mobility.[6] In cases of associated scapula fractures, fixation of the clavicle provides restoration of shoulder mechanics leading to improvement of function. Operative treatment of displaced mid shaft clavicular fractures can be achieved successfully using plates or intramedullary implants like rush pins, Kirshner wires, or nails.[7,8]

METHODS

This was a prospective comparative on-randomized study was conducted in Government District Head Quarters Hospital Nagapattinam with a follow-up ranging from September 2018 to January 2019 (4 months). After the institutional ethical committee approval, Thirty-four cases of middle third displaced (Robinson type 2b1 and 2b2) clavicular fractures are treated with plate osteosynthesis. We used a reconstruction plate, locking compression plate, and 1/3rd tubular plate for study.

Inclusion criteria

Age >18 years and <60 years. Fracture specific displacement >2 cm. Shortening >2 cm. Increasing communition >3 fragments. Segmental fractures. Open fractures. Impending compound fracture with soft tissue compromise.

Exclusion criteria

Age <18 years and >60 years, un displaced or minimally displaced fractures. Any medical contraindication to surgery (heart diseases, renal failure, or active chemotherapy).

Operative procedure

Place the patient in the supine position with a sand bag between the scapulae. Keeping the sand bag allows the shoulder girdle to falls backward. It restores the length and increases the exposure to the clavicle. Make an incision along the axis of the clavicle, centering the fracture site. Sub cutaneous tissue along with platysma was incised together and mobilized. Myofascial layer was incised and elevated. Fracture site exposed. Periosteum elevated. Fracture ends freshened. Fracture reduced using bone clamps. If there is a comminuted wedge fragment fix it with a lag screw. Precontoured reconstruction plate or anatomical clavicular plate was used. The plate was placed over the superior surface of the clavicle. 2.7 mm drill bit was used. Screw size measured with a depth gauge. Tapping was done with a 3.5 mm tap. 3.5 mm cortical screws are used for reconstruction and locking screws in the locking plate. A minimum of six cortical purchases was attained on either side of the fracture. Myofascial layer followed by skin and subcuticular tissue sutured. Sterile dressing was applied and immobilized in a shoulder immobilizer.

Statistical analysis

Statistics were obtained using SPSS for Windows statistical program release 21 (SPSS Inc., Chicago, IL, USA). Pearson Correlation was used to find out the relationship between variables. The Wilcoxon signed-rank test was used to compare pre-and post-operative values of Quick DASH, EQ-5D, VAS pain, and ROM. The Mann-Whitney test was used to compare inclination and overhang between categories of glenoid notching. The Spearman correlation was used to evaluate relations between arm lengthening and outcome. Kruskal-Wallis analysis of variance (ANOVA) was used to evaluate relations between notching and glenoid loosening. Values for continuous data are presented as median (minimum, maximum). The statistical significance level was designated at $p<0.05$.

RESULTS

In our study 34 cases of displaced middle-third clavicular fractures were treated with plate osteosynthesis using locking compression plate and reconstruction plate. Out of the 34 cases, 29 patients are male and 5 patients were female. The age of the patient varies from 20 years to 50 years. Out of the 34 patients, 24 patients sustained an injury to the right side and the remaining 8 patients on the left side.

Table 1: Age distribution.

Age (years)	Number
20-25	13
26-30	10
31-35	6
36-40	1
41-45	3
46-50	0
51-55	1
56-60	0

Table 1 shows out of the 34 cases, 13 patients age was between 20 to 25 and 10 patients age was between 26 and 30. In the majority of the cases, RTA (25) was the cause for injury followed by accidental fall. In the majority of the cases fall on an outstretched hand (FOOSH) was the common cause of injury followed by direct impact. Direct injury to the shoulder causes severely comminuted fractures. In all cases of road traffic accidents, there was communication at the fracture site.

In the majority of cases (75%) operative time was less than one hour. Average blood loss: average blood loss during the surgery was less than 100 ml (Table 2).

Table 2: Time of surgery.

Time of surgery	Number
30-60 minutes	26
60-90 minutes	08

Out of 34 cases 16 cases united in 8 weeks and by 12 weeks all cases united except one. In one case there was implant failure and fracture mal union occurred (Table 3).

Table 3: Time of union.

Time of union	Number
<8 weeks	02
8 weeks	14
10	14
12	03
>12 weeks	01

Out of the 34 patients 24 patients returned today activities after 2-3 weeks. Out of the 34 cases, 30 patients returned to work within 3 months (Table 4).

Table 4: Functional outcome.

Day today activities	Number
2-3 weeks	24
3-4 weeks	09
>4 weeks	01

DISCUSSION

The patients treated with early, rigid fixation of their clavicle fractures shared a high post-operative constant score, early pain resolution early return to activity, and high patient satisfaction rating. Plating has the advantage of maintaining the length, especially in comminuted fractures. There is little chance for hardware breakdown and migration. Clavicle nailing is an option for mid-third clavicle fractures.[9] Intramedullary nailing is difficult in the clavicle because of the anatomical shape. Nailing has the advantages of less soft tissue dissection and periosteal disruption hardware migration.[10] In our study the clavicle fracture are more common in males than females. There were 29 male and 5 female patients. This is comparable with other studies by 11. Rowe where out of 34 patients 32 were male and two were females.[11] In a study by Jupiter et al out of 20 patients 16 were males and 4 were females. From this, we can conclude that it is more common for inactive individuals.[12] In our study right side clavicle is commonly involved than the left side. This is also comparable with the study by Khan et al where out of 34 cases 28 were on the right side and 6 were left side. From this, we can conclude that the dominant hand involves usually. In our study, the average age group was 27.5 years.[13] This again indicates clavicle fracture is more common in active, working-age group. In our study road traffic accident was the most common cause for clavicle fractures. Fall on an outstretched hand was the commonest mechanism of injury. We studied the fracture pattern (intra operative finding) based on the mode of injury and mechanism of injury.[14,15] The average time of union was 9.5 weeks. It is also comparable with other studies like Neer et al. Most of our patients return to work at 2 and a half months. We assessed the functional outcome using a constant score. We got excellent results in all patients except one in which we used 1/3rd tubular plate.[16] The patient came after 6 months for evaluation of pain, fracture found to be mal united after implant breakage. The patient was not willing for implant removal. He was treated with analgesics. The mean constant score in our study was 95.14. It is also comparable with other studies by Nordqvist et al. In our study, 4 patients complained of hardware irritation.[17,18] We considered stability more than cosmesis so our choice was superior plating than antero inferior plating which has less hardware irritation.[19] In our study proper follow up was not possible upto 1 year due to irregularity of the patients. Open fractures were not included in our study. Even patients who presented with non-union of mid third clavicular fractures were excluded from the study.[20]

CONCLUSION

Internal fixation of clavicle middle third fractures by plate osteosynthesis has the advantage of early pain resolution, early return of shoulder function, and potentially early return to work. Clavicle fractures should therefore be viewed as a spectrum of injuries with diverse functional outcomes, each requiring careful assessment and individualized treatment. Plate osteosynthesis should be preferred for the treatment of indicated middle-third clavicle fracture inactive individuals. In our study Open reduction and rigid internal fixation of displaced mid shaft clavicular fracture has resulted in a good fracture union rate and excellent functional outcome.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Canadian Orthopaedic Trauma Society. Non operative treatment compared with plate fixation of displaced mid shaft clavicular fractures. A multicenter, randomized clinical trial. J Bone Joint Surg Am. 2007;89:1-10.
2. Ngarmukos C, Parkpian V, Patradul A. Fixation of fractures of the midshaft of the clavicle with Kirschner wires: Results in 108 patients. J Bone Joint Surg Br Vol. 1998;80(1):106-8.
3. Chen CH, Chen IC, Wang C. Semi tubular plates for acutely displaced mid clavicular fractures: a retrospective study of 111 patients followed for 2.5 to 6 years. I Orthop Trauma. 2008;22:463-6.
4. Cho CH, Song KS, Min BW, Bae KC, Lee KJ. Reconstruction plate versus reconstruction locking

compression plate for clavicle fractures. Clin Orthop Surg. 2010;2(3):154-9.
5. Modi N, Patel AD, Hallam P. Outcome of 62 clavicle fracture fixations with locked compression plate: is this the right way to go? Injury Extra. 2011;42(9):118.
6. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987;(214):160-4.
7. Craig EV, Basamania CJ, Rockwood CA. Fractures of the clavicle. In: Rockwood CA, Matsen FA, Wirth MA, Lippitt SB, eds. The shoulder. 3rd edn. Philadelphia: Saunders; 2004:455-519.
8. Crenshaw AH. Fractures of the shoulder, arm, and forearm. In: Canale ST, edr. Campbell's operative orthopedics, 10th edn. St. Louis Mosby; 2003:2985-3071.
9. Douraiswami B, Naidu D K, Thanigai S, Anand V, Dhanapal R. Open reduction and plating for displaced mid-third clavicle fractures. A prospective study. J Clin Orthop Trauma. 2013;4(4):174-9.
10. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle-third fractures of the clavicle gives poor results. J Bone Joint Surg Br. 1997;79(4):537-9.
11. Rowe CR. An atlas of anatomy and treatment of mid clavicular fractures. Clin Orthop Relat Res. 1968;58:29-42.
12. Jupiter JB, Leffert RD. Non-union of the clavicle associated complications and surgical management. J Bone Joint Surg. 1987;69:753-60.
13. Khan KLA, Bradnock TJ, Scott C, Robinson CM. Fractures of the clavicle. J Bone Joint Surg Am. 2009;91:447-60.
14. Lazarus MD. Fractures of the Clavicle. In: Bucholz RW, Heckman JD, eds. Rockwood and Green's fractures in adults, 5th edn. Philadelphia: Lippincott Williams and Wilkins; 2001:1041-1078.
15. Mishra A, Kumar D, Yadav A, Pandey D, Sinha A. Functional outcome of conservative versus plate osteosynthesis in displaced midshaft clavicle fracture in manual labors. Int Surg J. 2017;4(3):966-70.
16. Neer CS II. Nonunion of the clavicle. J Am Med Assoc. 1960;172:1006-11.
17. Nordqvist A, Petersson CJ, Johnell I. Mid clavicular fractures in adults: result study after conservative treatment. Orthop Trauma. 1998;12:572-6.
18. Robinson CM, Court-Brown. CM, Mcqueen MM, Wakefield AE. Estimating the risk of non-union following non-operative treatment of a clavicular fracture. J Bone Jt Surg. 2004;86:1359-65.
19. Robinson CM. Fractures of the clavicle in the adult Epidemiology and classification. J Bone Joint Surg. 1998;80:476-84.
20. Robinson CM, Goudie EB, Murray IR, Jenkins PJ, Ahktar MA, Read EO, et al. Open reduction and plate fixation versus non operative treatment for displaced mid shaft clavicular fractures: a multicenter, randomized, controlled trial. J Bone J Surg Am. 2013;95(17):1576-84.

Cite this article as: Palanivel A. Functional outcome of displaced middle third clavicular fractures treated by plate osteosynthesis. Int J Res Orthop 2021;7:335-8.