

Prospective comparative study between nonoperative v/s plate fixation for treatment of displaced midshaft clavicular fractures

¹Dr. Ram Ratan Bissu, M.S. Orthopaedics, Sawai Man Singh Medical College and Associated Group of Hospitals, Jaipur, Rajasthan

²Dr. Vikrant Shekhawat, M.S. Orthopaedics, Sawai Man Singh Medical College and Associated Group of Hospitals, Jaipur, Rajasthan

³Dr. R.P. Assat, Sr. Professor Orthopaedics, Sawai Man Singh Medical College and Associated Group of Hospitals, Jaipur, Rajasthan

⁴Dr. Ashwini Jangir, M.S. Orthopaedics, Sawai Man Singh Medical College and Associated Group of Hospitals, Jaipur, Rajasthan

Corresponding Author: Dr. Vikrant Shekhawat, M.S. Orthopaedics, Sawai Man Singh Medical College and Associated Group of Hospitals, Jaipur, Rajasthan

Citation this Article: Dr. Vikrant Shekhawat, Dr. Ram Ratan Bissu, Dr. R.P. Assat, Dr. Ashwini Jangir, “Prospective comparative study between nonoperative v/s plate fixation for treatment of displaced midshaft clavicular fractures”, IJMSIR- September - 2023, Vol – 8, Issue - 5, P. No. 73 – 80.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Clavicle fractures are common fractures in young, active individuals, especially those who participate in sports or activities where high-speed falls (e.g., bicycling, motorcycles) or violent collisions (e.g., football, hockey) are frequent and they account for approximately 2.6% of all fracture.

The majority of clavicle fractures (80-85%) occur in the midshaft of the clavicle followed by Distal third clavicle fractures (20%) and Medial third fractures are rarest (5%). Motor vehicle accident is the usual mechanism of injury with a relatively high (20%) associated mortality rate from concomitant head and chest injuries. Most clavicle fractures heal uneventfully without serious consequences with non-operative treatment.

Aims and Objective: To assess and compare the Functional and Radiological outcome in patient of midshaft clavicle fracture treated by non-operative (conservative) and plate fixation (operative).

Material and methods: This was Hospital based, randomized, comparative, prospective, interventional study conducted in the Department of Orthopaedic, S.M.S Medical College and attached group of hospitals, Jaipur during April 2019 to JUNE 2020. Total 60 cases out of 30 cases of displaced mid shaft clavicle fracture were taken for operative group and 30 for conservative treatment. results were assessed by constant and dash score

Results and observations: Majority of fractures united at around 7 - 8 weeks with mean time of union was

7.33+/-0.76 weeks in LCP group and 8.57 +/- 1.29 weeks in conservative group.

Majority of patients had final quick dash score between 35 to 45 with mean score of 36.06 +/- 4.38 in LCP group and 40.06 +/- 3.85 in conservative group. Final Constant score of LCP group was between 90 – 95 with mean constant score 91.93+/- 3.59 and majority constant score in conservative group was between 85 – 90 with mean constant score 88.03+/-1.96.

All patients had a good range of motion. In operative group non-union was 1 which was treated by bone grafting, and implant failure was 1, plate exposed in 2 patients, infection in 2 patients, plexus injury in 1 patient which recovered spontaneously after 5-6 month and in sling group non-union was 3 and malunion was in 6 patients.

Conclusion: Although our study has its own pitfalls like small sample size and small follow up but on the basis of short-term results of our study, we can safely conclude that recontoured anatomical plate is preferred for the treatment of displaced midshaft clavicle fractures with better functional outcome and faster recovery compared to conservative mode of treatment.

Keywords: Clavicle fractures, Dash, LCP group, constant.

Introduction

Clavicle fractures are common fractures in young, active individuals, especially those who participate in sports or activities where high-speed falls (e.g., bicycling, motorcycles) or violent collisions (e.g., football, hockey) are frequent and they account for approximately 2.6% of all fractures¹.

The risk is higher in young male patients aged less than 30 years and aged over 70 years. The main causes are the direct blow to the shoulder or a fall onto a outstretched

hand specially during sports activities and road traffic accidents².

The majority of clavicle fractures (80-85%) occur in the mid- shaft of the clavicle where the typical compressive forces are applied to the shoulder and the narrow cross section of the clavicle combine and result in bony failure. Distal third clavicle fractures are the next common clavicle fractures (20%) and they tend to occur in more elderly individuals as a result of simple fall. Medial third fractures are rarest (5%) of clavicle, perhaps because of difficulty in accurately imaging and identifying them. Motor vehicle accident is the usual mechanism of injury with a relatively high (20%) associated mortality rate from concomitant head and chest injuries³.

Most clavicle fractures heal uneventfully without serious consequences with non-operative treatment and Nonsurgical treatment was considered the best option for most clavicle fractures with a good prognosis and a low incidence of non-union cases⁴⁻⁸. Other authors suggest acute fixation of displaced midshaft fractures reporting more favourable outcomes over the past two decades and a higher patient's satisfaction⁹⁻¹⁰. But more recent studies have questioned functional recovery, union rates and the morbidity of malunions after non-operative management.

Indications for surgical fixation of middle third clavicle fractures are open fractures, neurological or vascular compromise, skin tenting, widely displaced and comminuted fractures¹¹⁻¹³. Literature suggest that shortening of more than 2 cm, patients with multiple traumatic injuries, high-energy mechanism, younger athletic patients, and patients at risk of non-union should address the surgeon's choice to surgical fixation.¹⁴⁻¹⁷

Operative treatment consists of ORIF with intramedullary nail or plates and screws. Plating techniques continue to evolve. Recontoured newer

locking plates allow more accurate fitting and strength maintaining compared to previously used reconstruction plates and locking compression plates.

Results of more commonly used conservative modality have been preferred method but recent reports in literature suggesting superiority of surgical treatment led us to contemplate this study to compare the two modalities and assess outcome.

Method

This study was carried out in the Department of Orthopaedics, S.M.S Medical College and attached group of hospitals, Jaipur with due permission from the institutional ethical committee and review board and after taking written informed consent from the patient during period of April 2019 to May 2021.

Total 60 cases out of which 30 cases of displaced mid shaft clavicle fracture were operated using anatomical contoured clavicle plate and 30 treated by conservative treatment of figure of 8 bandage and arm pouch sling.

All cases with mid shaft completely displaced closed fracture clavicle of patient age group 18 yr to 60 yr were included in this study. Open fracture, pathological fracture, fracture without much displacement and fracture with neurovascular compromise were excluded from this study. Final assessment was done at 12 weeks by DASH Score 18 and CONSTANT Score 19.

Operating technique

Place the patient supine on the operating table in beach chair position. Place a sandbag between the medial border of the scapula and the spine. This will allow the shoulder to drop back and often this manoeuvre reduces fractures of the middle third.

Incision was made on anterior aspect centered over the clavicle. The length of the incision depends on the clinical indication for surgery Because the approach is

directly onto the subcutaneous surface of the clavicle, there is no interneurons plane.

Deepen the skin incision through the platysma to reach the subcutaneous surface of the clavicle. Take care to diathermy the numerous vessels present within this muscle.

The overlying fascia and periosteum are next to divide and the bone ends are freed from soft tissue. Minimum soft tissue and periosteum stripping done.

The proximal and distal fragments are mobilized with small- fragment reduction forceps and the fragments are reduced and plate was applied over superior surface. Both the myofascial and the subcutaneous layers are closed with interrupted absorbable sutures. The skin layer is closed with subcuticular stitches followed by skin suture.

Postoperative care AND FOLLOW UP

The operated limb was immobilized in arm pouch sling. Check x-ray were taken to study the alignment of fracture fragments. Dressing was done on 4th or 5th day and suture removal was done on day 12th. Rehabilitation of the affected limb was started at the end of 2 week. Pendulum exercise was allowed in arm pouch sling at 2-4 week. At 4–6-week active range of motion of shoulder was allowed with limited abduction over 90 degrees. At 6–8-week active range of motion in all plane were allowed.

Regular follow up for every 4 week was done. patient was following up till radiological union and the functional outcome was assessed by DASH and CONSTANT SCORE.56

Results

A total of 60 patients were considered for study. There are 50 males and 10 females with an average of 40.56 year (range 19 yr. to 60 yr.). RTA was the commonest mode of injury accounting for 68 % (33 cases). Right

sided fracture was recorded in 56% cases (33 cases) and left sided were noted in 44% (27 cases).

All fracture were allman type 2 (midshaft). bone union time were 6 weeks to 12 weeks. Average time for bony union were 9 weeks.

he fractures was considered to be united clinically when there is no tenderness and radiologically when the fracture line is not visible and full-unprotected function of the limb is possible.

Table 1: Distribution by duration of union

	LCP gp	Sling gp
6 week	3	1
7 week	16	5
8 week	10	11
9 week	1	7
>10 wek	0	6

Table 2: Final outcome by dash score

Dash score	LCP gp	Sling gp
<30	4	0
30-34	4	1
35-39	14	12
40-44	8	14
>45	0	3

Table 3: Final outcomes by constant score

Constant score	LCP gp	Sling gp
<85	2	2
86-90	0	25
91-95	28	3

Table 4: Complication

	LCP gp	Sling gp
Non union	1	3
Implant exposed	2	0
Implant failure	1	0
Plexus injury	1	0
Malunion	0	6
Infection	2	0

Case 1: Clinical photos

PRE OP X RAY



POST OP X RAY



RANGE OF MOTION



Case 2: Clinical photos

X RAY DAY 1



4 WEEKS FOLLOW UP



6 WEEKS FOLLOW UP



RANGE OF MOTION



Discussion

Historically, clavicle fractures have been considered best treated non-operatively with good outcomes. Vast majority of fractures healed with variable amount of cosmetic deformity. But recently there has been a trend towards operative approach to facilitate early mobilization and better functional outcome. Controversy remains concerning operative versus non-operative treatment. So, we have studied functional outcome between operative and non-operative group. Between January 2019 to June 2020.

The present study of patients with middle third clavicle fractures is compared with Bostman et al.20 study and other studies which treated only middle third clavicle fractures. In Bostman et al study totally 103 patients were treated by early open reduction and internal fixation with plate and screws.

Age group of patients

A total of 60(30 each group) patients with displaced midshaft clavicle fractures with age between 18 to 60 years were treated with either open reduction and internal fixation using anatomical locking clavicle plate (30) or managed conservatively using a sling(30). Mean age of the patient in LCP group was 31.43 +/- 8.53 whereas in conservative group was 29.77+/- 7.56.

In Bostman et al.20 study, patients average age was 33.4 years and the youngest patient age was 19 years and oldest patient age was 62 years

Sex incidence

There were 26 males and 4 females in LCP group whereas 24 males and 6 females in conservative group.

In Bostman et al.20 series also, commonly, males are the most affected (76 patients) (73.79%) compared to females (27 patients) (26.21%).

Mechanism of injury

In LCP group the mode of injury was RTA in 17 cases, fall from height in 12 cases and assault in 1 case whereas in conservative group the mode of injury was RTA in 16 cases, fall from height in 13 cases and assault in 1 case.

In Bostman et al.20 study the mechanism of injury was due to fall from the two-wheeler in 38 patients (36.8%), slipping and fall in 24 patients (23.30%), motor vehicle accident in 19 patients (18.45%) and sports injury in 22 patients (21.36%). This shows that direct injury to the shoulder is the common cause of this fracture.

Time interval for surgery

In dhakad et al.21 study 25 patients were with comminuted mid shaft clavicle fracture (100%), where 23 (92%) patients were operated in the first week and 2 patients (8%) were operated in the second week due to fixed OT days in hospital.

In Bostman et al.20 study, all the patients were operated within 3 days of injury

In our all patients were operated within 7 days of injury due to fixed OT days and anaesthetic fitness.

Associated injuries

In Bostman et al.20 series, there were no associated injuries.

In the present study of middle third clavicle fracture 7 patients had head injury,6 patients had chest injury,1 patient had spine injury,13 patient had other extremity fracture which was managed accordingly. The glenoid fossa fracture was treated conservatively.

Type of fracture

In this study, all patients with displaced mid shaft clavicle fractures were of closed type; This is comparable to Bostman et al.20 study which also showed that all their patients had closed fractures.

Duration of union

Majority of fractures united at around 7 - 8 weeks with mean time of union was 7.33+/-0.76 weeks in LCP group and 8.57 +/- 1.29 weeks in CONSERVATIVE group.

In operative versus non-operative treatment of midshaft clavicle fractures by vander have kl, perdue am, Farley fa in LCP group mean time of union was 7.4 weeks and in SLING group mean time of union was 8.7 weeks²².

In Altmani et al study of 132 patients, operative treatment with plate fixation of displaced midshaft clavicle fracture LCP group 67 patients had mean time of union 16.4 weeks and in SLING group 65 patients had means time of union 28.4 weeks.²³

Functional outcome

Majority of patients had final quick DASH score between 35 to 45 with mean score of 36.06 +/- 4.38 in LCP group and 40.06 +/- 3.85 in CONSERVATIVE group. Final Constant score of LCP group was between 90 – 95 with mean constant score 91.93 +/- 3.59 and majority constant score in conservative group was between 85 – 90 with mean constant score 88.03 +/- 1.96. All patients had a good range of motion. In operative group non-union was 1 which was treated by bone grafting, and implant failure was 1, plate exposed in 2 patients, infection in 2 patients, plexus injury in 1 patient which recovered spontaneously after 5-6 month and In SLING group non-union was 3 and malunion was in 6 patients.

Chon Hyu Cho et al (2010) studied 41 patients of midshaft clavicle fractures treated with reconstruction plate. The mean time to union was 14.6 weeks in the reconstruction plate group compared to 13.2 weeks in the reconstruction LCP group ($p > 0.05$). The mean score to Quick DASH was 33.85 points in the reconstruction plate group compared to 34.81 points in the reconstruction LCP group ($p > 0.05$). 24

Dhoju D. et. al. (2011) studied 20 patients, all fractures united in 16 weeks or less in near anatomic position with average 11 weeks and complication in 2 (5%) patients, one deep infection and one frozen shoulder which on subsequent management recovered well. There was no non-union or implant failure. The average DASH Score was 41 and Constant score was 97.45 in one year follow up and the patients were relatively satisfied with the treatment. 25

In Operative Versus Non-Operative Case of Displaced Mid Shaft Clavicle Fractures; A Meta Analysis of RCT Robin C Mckee, Daniel B, Michael D Mckee in LCP group 212 patients mean age was 25.0, non-union was 3, mal union was 0, constant score was 94.3. In SLING

group 200 patients mean age was 41.3, non-union was 29, mal union was 7, constant score was 90.2. 26

In 1995-2003 Olivier VERBORGT et. al. From University Hospital of Antwerp, Edegem, and OLV Middelaers Hospital, Deurne, Belgium studied effect of plating in 39 athletes from 1995 to 2003. At 6 weeks postoperative Constant score (max. 100 points, mean): 88 Mean DASH Score: 45. Union rate (at 18 weeks) :90%, Mean union time :12 weeks, Complications: Wound Infection 18%, Refracture 5%, Nonunion 5%, Neurologic symptoms 7%. 27

Conclusion

The conservative method of managing undisplaced or severely comminuted clavicular fracture with brace and sling gave good functional and radiological results. But conservatively treated displaced non comminuted clavicle fractures had increased rates of non-union, malunion and poor functional outcomes compared to operative group. Though better cosmesis, intramedullary fixation is not favoured due to higher complications like difficulty technique, implant impingement or migration, need for implant extraction, etc. In our study we found that open reduction and internal fixation using precontoured anatomical locking compression plate facilitated:

1. Anatomical reduction
2. Stable and rigid fixation
3. Faster union
4. Better functional outcome
5. Faster return to day-to-day activity with minimal complications

Although our study has its own pitfalls like small sample size and small follow up but on the basis of short term results of our study we can safely conclude that precontoured anatomical plate is preferred for the treatment of displaced mid- shaft clavicle fractures with

better functional outcome and faster recovery compared to conservative mode of treatment. We hereby suggest that large multicentric randomized control trials are necessary to substantiate our results.

References

1. Robinson CM: Fractures of the clavicle in the adult. Epidemiology and classification. The Journal of bone and joint surgery 1998, 80(3):476-484.
2. Stanley D, Trowbridge EA, Norris SH. The mechanism of clavicular fracture. A clinical and biomechanical analysis. J Bone Joint Surg Br 1988; 70:461-4
3. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop Relat Res. 1968;(58):29-42
4. Neer CS 2nd. Nonunion of the clavicle. J Am Med Assoc 1960; 172:1006-1011.
5. Stanley D, Trowbridge EA, Norris SH. The mechanism of clavicular fracture. A clinical and biomechanical analysis. J Bone Joint Surg Br 1988;70(3):461-464.
6. Allman FL. Fractures and ligamentous injuries of the clavicle and its articulation. J Bone Joint Surg Am 1967;49(4):774- 784.
7. Craig EV. Fractures of the clavicle. In: Rockwood CA, Green DP (eds) Fractures in adults, vol 1, 6th edn. Lippincott Williams & Wilkins, Philadelphia 2006; pp 1216-1217.
8. O'Neill BJ, Hirpara KM, O'Briain D, McGarr C, Kaar TK. Clavicle fractures: a comparison of five classification systems and their relationship to treatment outcomes International Orthopaedics (SICOT) 2011;35:909-914.
9. 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):537-539.
10. McKee MD, Pedersen EM, Jones C, Stephen DJ, KrederHJ, Schemitsch EH, Wild LM, Potter J. Deficits following nonoperative treatment of displaced midshaft clavicular fractures. J Bone Joint Surg Am 2006;88(1):35-40.
11. Lenza M, Belloti JC, Gomes Dos Santos JB, Matsumoto MH, Faloppa F. Surgical interventions for treating acute fractures or non-union of the middle third of the clavicle. Cochrane Database Syst Rev 2009;(4):CD007428.
12. McKee RC, Whelan DB, Schemitsch EH, McKee MD. Operative versus nonoperative care of displaced midshaft clavicular fractures: a meta-analysis of randomized clinical trials. J Bone Joint Surg Am 2012; 94:675-84.
13. Robinson CM, Goudie EB, Murray IR, Jenkins PJ, Ahktar MA, Foster CJ, et al. Open reduction and plate fixation versus non-operative treatment for displaced midshaft clavicular fractures: a multicentre, randomized, controlled trial. J Bone Joint Surg Am 2013; 95:1576-84.
14. Lazarides S, Zafiropoulos G. Conservative treatment of fractures at the middle third of the clavicle: the relevance of shortening and clinical outcome. J Shoulder Elbow Surg 2006;15:191-4.
15. Ledger M, Leeks N, Ackland T, Wang A. Short malunions of the clavicle: an anatomic and functional study. J Shoulder Elbow Surg 2005;14:349-54.
16. Nowak J, Holgersson M, Larsson S. Can we predict longterm sequelae after fractures of the clavicle based on initial findings? A prospective study with nine to ten years of follow-up. J Shoulder Elbow Surg 2004;13:479-86.

17. Postacchini R, Gumina S, Farsetti P, Postacchini F. Longterm results of conservative management of midshaft clavicle fracture. *Int Orthop* 2010;34:731-6.
18. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder, and hand). *Am J Ind Med* 1996;29:602-8.
19. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res.* 1987 Jan;(214):160-4
20. Bostman O, Manninen M, Pihlajamaki H. Complications of plate fixation in fresh displaced mid clavicular fractures. *J Trauma.* 1997;43:778-783.
21. dhakad et al.plate versus conservative treatment in mid shaft of clavicle –a comparative study, *journal of clinical orthopaedics & trauma* 7s(2016),166-170.
22. Vander have KL, Perdue AM, Caird MS, Farley FA Operative versus non operative treatment of mid shaft clavicle fractures in adolescents:(Department of orthopaedic surgery, University of Michigan,Ann Arbor,2000-08 ;30(4):307-12
23. Altamimi SA, McKee MD; Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. *Surgical technique. J Bone Joint Surg Am.* 2008 Mar;90 Suppl 2 Pt 1:1-8. doi: 10.2106/JBJS.G.01336. PMID: 18310682.
24. Chon hyu cho et.al.Operative treatment of clavicle midshaft fracture :comparison between reconstruction plate and reconstruction locking compression plate.*clinics in orthopedics surgery* 2010;2:154-159,
25. Dhoju D., Shreshtha D., Purajuli N. Operative fixation of displaced mid shaft clavicle fracture with plating(KUMJ)(A study of 20 patients) *Oct-Dec* 2011;9(36):286-90.
26. McKee, Robbin C.1; Whelan, Daniel B. MD, FRCS(C)1; Schemitsch, Emil H. MD, FRCS(C)1; McKee, Michael D. MD, FRCS(C)1 Operative Versus Nonoperative Care of Displaced Midshaft Clavicular Fractures: A MetaAnalysis of Randomized Clinical Trials, *The Journal of Bone & Joint Surgery: April 18, 2012 - Volume 94 - Issue 8 - p 675-684* doi: 10.2106/JBJS.J.01364
27. Olivier Verborgt , Kathleen Pittoors, Francis Van Glabbeek, Geert Declercq, Rudy Nuyts, Johan Somville Plate Fixation of Middle-Third *Bibliography* 78 Fractures of the Clavicle in the Semi-Professional Athlete(a study of 39 athletes) *Acta Orthop Belg* 2005 Feb;71(1):17-21