

A STUDY ON FUNCTIONAL OUTCOME OF LATERAL END OF CLAVICLE FRACTURE TREATED WITH HOOK PLATE IN A TERTIARY CARE HOSPITAL, HYDERABAD

P. Agnesh¹, Mohammed Abbas Ali¹, Thakur Shankar Singh¹, M. Srinivas², N. Ravikiran³

Received : 14/06/2023
Received in revised form : 24/07/2023
Accepted : 08/08/2023

Keywords: Fracture Clavicle, Lateral End Fracture of Clavicle, Hook Plate, Functional Outcome

Corresponding Author:
Dr. N. Ravikiran,
Email: drnrikiran@gmail.com

DOI: 10.47009/jamp.2023.5.4.335

Source of Support: Nil
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (4); 1686-1690



¹Assistant Professor, Department of Orthopaedics and Traumatology, Osmania Medical College, Hyderabad, Telangana, India

²Postgraduate, Department of Orthopaedics and Traumatology, Osmania Medical College, Hyderabad, Telangana, India

³Associate Professor, Department of Orthopaedics and Traumatology, Osmania Medical College, Hyderabad, Telangana, India

Abstract

Background: 15% of all clavicle fractures involve the lateral end of the bone. 1 These fractures are unstable because of four displacement forces that prevent the union, which are linked to the destruction of the coracoclavicular ligaments. Surgery is advised for unstable distal clavicular fractures because the non-union rate is about 30%, resulting in discomfort and reduced shoulder girdle and upper limb function. To treat these injuries surgically, clavicle hook plates are currently accepted. This study analyses the results of clavicle hook plates compared with the literature. We will be analyzing the results based on clinical outcomes and radiological assessment to ascertain the efficacy of this procedure. The aims and objectives are to study fracture union clinically and radiologically in lateral end clavicle fractures, to evaluate the functional outcome of the clavicle hook plate for fractures of the lateral end of the clavicle, to assess functional outcomes in terms of shoulder range of movements, Complications associated with implant failure. **Materials and Methods:** This study is a descriptive analysis approved by the Institution Review Board and the Ethic Committee to evaluate the results of hook plate fixation for fractures of the lateral end of the clavicle. 1st November 2020 to 31st May 2022. **Result:** Thirty-two patients were followed prospectively from November 2020 to May 2022, of which 25 were males, and 7 were females. Eighteen patients returned to pre-injury status at a mean of 53.5 weeks (24-104 weeks). Six patients returned to pre-injury level at six months, two at nine months, and four at 12 months of surgery. Though the remaining four patients returned to work within one year, returning to pre-injury took 1 ½ to 2 years. **Conclusion:** A hook plate is a good option for the treatment of unstable lateral end clavicle fractures.

INTRODUCTION

15% of all clavicle fractures involve the lateral end of the bone.^[1,2] These fractures are unstable because of four displacement forces that prevent the union, which are linked to the destruction of the coracoclavicular ligaments. Surgery is advised for unstable distal clavicular fractures because the non-union rate is about 30%, resulting in discomfort and reduced shoulder girdle and upper limb function.^[3,4] To treat these injuries surgically, clavicle hook plates are currently accepted. This study analyses the results of clavicle hook plates compared with the literature. We will be analyzing the results based on clinical outcomes and radiological assessment.

Biomechanism of Fracture of the Lateral end of Clavicle:

A lateral impact force on the shoulder's point is the cause of the injury. Displaced fractures are caused by more significant trauma, like a fall from a height, a car accident, or a brutal hit.^[5] Displacements are secondary to four displacing forces.^[6]

The weight of the arm.

The pull of pectoralis major, pectoralis minor, and latissimus dorsi.

The scapular rotation affects the distal segment.

Trapezius muscle, which draws the medial part posterior and superior

Incidence

About 10% to 20% of all clavicle fractures are lateral one-third fractures.^[3] Another study found a higher

prevalence of 21% to 28%, with the initial and highest peak incidence occurring in males under 30. Neer found a 10% prevalence of concomitant head and neck injuries among patients with distal clavicle fractures. Coracoid and first rib fractures, lung injury, brachial plexus injury, and subclavian vein injuries are possible additional findings.^[7-9]

Treatment Options

The following are surgical indications for a lateral end clavicle fracture:

Early:

1. Double disruption of the shoulder suspensory complex
2. Fracture in a young active person
3. Athlete
4. Manual laborer

Late:

1. Symptomatic nonunion
2. Symptomatic malunion
3. AC joint arthritis

Aims and Objectives

1. To study fracture union clinically and radiologically in lateral end clavicle fractures
2. to evaluate the functional outcome of the clavicle hook plate for fractures of the lateral end of the clavicle
3. to assess functional outcomes in terms of shoulder range of movements.
4. Complications associated with implant failure.

MATERIALS AND METHODS

This study is a descriptive analysis approved by the Institution Review Board and the Ethic Committee to evaluate the results of hook plate fixation for fractures of the lateral end of the clavicle.

Inclusion Criteria

- Patients with lateral end clavicle fracture
- Patients with an age group of 18 -60 years

Exclusion criteria

- Patients of age less than 18 years and more than 60 years
- Patients who had open fractures
- Patients who had associated brachial plexus injury
- Patients who had associated acromioclavicular joint disruption
- Severely ill patients.

Methods

This study is a descriptive analysis of patients from 1st November 2020 to 31st May 2022.

We reviewed all patients who fit our criteria and had undergone surgery with our local customized hook plate and in our hospital.

1. All patients were either from the Out-patient department or Emergency
2. Preoperative shoulder X-rays in AP and Axillary view were taken.
3. The injuries were classified as per the inclusion criteria.

4. All surgeries were performed in a specified manner
5. A locally available hook plate was used.
6. Specified postoperative protocol was followed for all patients.
7. One examiner measured the outcome based on the Quick DASH questionnaire at 6-, 12-, and 24-week intervals.
8. Radiological assessment was done at 6, 12, and 24-week intervals.
9. Wound sepsis, time taken to the bony union, and reaching pre-fall injury status were also noted

Our hook plates were locally available - a 4 -7 hole, 3.5mm, known for right and left side for optimal sizing and screw positioning for everyone.

Surgical Procedure

All procedures were done with the patient supine with a bolster placed beneath the scapula.^[10,11]

The only soft tissue dissection was the cutting of the deltoid fascia, while the AC joint was left undissected.^[12,13] AC depth was measured with a depth gauge, and the appropriate hook plate was used.^[14,15]

Ligament repair was not done in any of the cases, and the deltoid and trapezium fascia were resutured at the time of closure.^[16,17]

Pendulum exercises were started on the 2nd post-operative date and passive.^[18-20]

Mobilization started as the patient tolerated it. Active exercises were formed within three weeks, and a full range of movement was created after three weeks.^[21-23]

We have used the Quick DASH score as they reflect the subjective and objective perspective of the shoulder function. The quick DASH scores range from 0-100, where zero is the best score and indicates excellent results. The forms were filled in at each visit and at which time they were evaluated for signs of implant failure, irritation, impingement, or infection.^[24-29]

X-rays were taken preoperative, immediately postoperative, and subsequently at six weeks and six months. Placement of plate, reduction of AC joint or fracture, implant loosening, osteolysis at the tip of the hook, cut out of the hook, and the union was assessed at serial intervals.^[30-32]

Signs to elicit subacromial impingement were done at each visit, including the Neer impingement sign, Hawkins-Kennedy sign, and Jobe supination test. Zanca's view was taken to assess the coracoclavicular reduction compared to the opposite side.

RESULTS

Thirty-two patients were followed prospectively from November 2020 to May 2022, of which 25 were males, and 7 were females.

Table 1: sex distribution

Gender	No. Of patient
Male	32
Female	7
Total	32

The mode of injury was a road traffic accident in 28 patients and a fall from height in 4 patients.

Table 2: Mode of injuries

Mode of injury	No. Of patient
Road traffic accidents	28
Fall from height	4
Total	32

Five patients had Diabetes mellitus, and two patients had hypertension.

At the last follow-up, 27 patients had an excellent outcome according to the Quick DASH score. Three had a good outcome, and 2 had a poor outcome. The score ranged from 2.3 to 2.5 (avg was 7.26). The constant score is obtained from subjective and objective scoring, including pain, activities of daily living, range of movement, and muscle power. An excellent score is 100, and zero indicates a poor score.

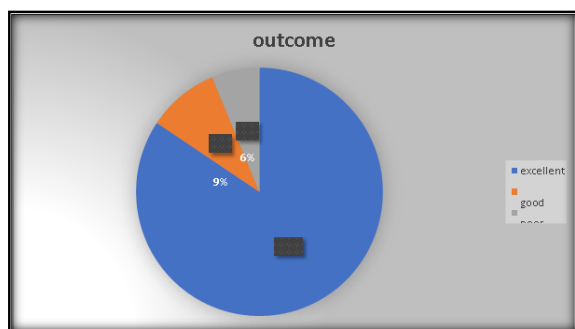


Figure 1: results



Figure 2: A 42-year male patient with a history of failure on right shoulder

Quick DASH is an abbreviated version of DASH and contains only 11 questions out of the 30 in

DASH.^[28,29] The quick DASH is statistically equal to the DASH score.

Of the three patients who did not have excellent, patient No.17 had an excision of the lateral end of the clavicle for painful non-union with arthritis of the AC joint, and the last follow-up was at 24 weeks 9 (there has been a gradual improvement of scores throughout the six post-op weeks). Patient No.23 had shoulder stiffness and hydrostatic saline distension at 12 weeks and is due shortly to have the implant removed because of osteolysis. Patient No.32 had developed bilateral shoulder stiffness (probable idiopathic frozen stiffness) and had the implant removed recently, which will be reassessed in 6 weeks. Ten patients had their implants removed during this study for impingement and osteolysis.

Union in the fracture cases was seen at a mean duration of 13 weeks (6-24 weeks).

None of the patients had an infection.

Three patients developed calcification of the CC ligament or AC joint capsule. Two had calcification of coracoclavicular ligament and 1 had calcification of AC joint capsule.

The complications seen in our study were:

1. Impingement 3
2. Osteolysis at the tip of the hook 14
3. Cut out of the hook 1
4. Calcification 3

One of the three patients with non-union was found to have developed arthritis of the AC joint at the last follow-up.

In all 10 cases where the implants were removed, no increase in the CC distance (demonstrated by stress Zanca views) was observed, implying the healing of the AC joint capsule and ligament.

Return to pre-injury status was seen in 18 patients of the 22.

Eighteen patients returned to pre-injury status at a mean of 53.5 weeks (24-104 weeks). Six patients returned to the pre-injury group at six months, while two returned at nine months and four at 12 months of surgery. Though the remaining four patients returned to work within one year, returning to pre-injury took 1 ½ to 2 years. This may be due to the presence of mild pain at the operated site or due to the development of painful osteolysis.

Of the two patients yet to return to pre-injury status, one is awaiting implant removal for impingement, and one recently underwent implant removal.

DISCUSSION

The hook plate, Kirschner wires, tension band wires around the coracoid and clavicle, trans fixation of the clavicle to the coracoid with screws 49, and other implants have all been used in the past.^[3,10,31] Some surgeons recommend excising the clavicle's lateral end in chronic painful dislocations.^[12,13] The rate of migration for Kirschner wire fixation is higher,^[10] whereas the Bosworth screw required extensive surgical exposure but offered a firm fixation that resulted in rotation loss and screw cut-out.^[11]

Hook plates are an effective and suitable treatment option for lateral end clavicle fractures.^[3]

According to the Quick DASH scores^[29] used in this study, the outcomes for 27 participants were excellent. 2 patients had poor outcomes, whereas three patients had good outcomes. These findings are comparable to those of other hook plate studies.^[3,31,32] The following complications have been identified: 3 cases of impingement and 3 cases of frozen shoulder. While the specific cause of shoulder stiffness is uncertain, these findings are comparable to those of other investigations.^[3,31,32] It appears that shoulder stiffness is a result of a post-traumatic frozen shoulder.

Reducing subacromial space or irritation of the subacromial bursa may cause impingement pain.

The average time required to return to pre-injury level was 51 weeks, partly due to patients' lack of personal initiative, lack of prompt follow-up, and inability to attend physiotherapy appointments due to financial constraints.

CONCLUSION

From the analysis of this study, the following were noted:

1. Hook plate is a good option for the treatment of unstable lateral end clavicle fractures
2. Limited use of instrumentation
3. Short duration of the procedure
4. Low incidence of complications
5. Good objective and subjective outcomes
6. Stability to the AC joint is attained without ligament repair or reconstruction.
7. Short learning curve
8. Implant removal is advisable, but the decision depends on the presence or absence of osteolysis and impingement.

REFERENCES

1. Renger RJ, Roukema GR, Reurings JC, Raams PM, Font J, Verleisdonk EJMM. The Clavicle Hook Plate for Neer Type II Lateral Clavicle Fractures. *Journal of Orthopaedic Trauma* [Internet]. 2009;23(8). Available from: http://journals.lww.com/jorthotrauma/Fulltext/2009/09000/The_Clavicle_Hook_Plate_for_Neer_Type_II_Lateral.5.aspx
2. MacDonald PB, Lapointe P. Acromioclavicular and sternoclavicular joint injuries. *Orthopaedics Clinics of North America*. 2008;39(4):535–545.
3. Meda PVK, Machani B, Sinopidis C, Braithwaite I, Brownson P, Frostick SP. Clavicular hook plate for lateral end fractures: - a prospective study. *Injury*. 2006 Mar;37(3):277-283.
4. Rockwood and Green's Fractures in Adults, 7th edition - home [Internet]. [cited 2010 Nov 27]; Available from: http://www.rockwoodadultsfractures.com/pt/re/bucholz7e/home.htm;jsessionid=MwDFCDeKBQNP21m3pZ1135htv8JbTXTV2xh9JlyhLK27vTzQN8Jf16283095_95!18119562818091!-1
5. Repair of Complete Acromioclavicular Separations using the Acromioclavicular-Hook Plate.pdf.
6. Salem KH, Schmelz A. Treatment of Tossy III Acromioclavicular Joint Injuries Using Hook Plates and Ligament Suture. *Journal of Orthopaedic Trauma* [Internet]. 2009;23(8). Available from: [http://journals.lww.com/jorthotrauma/Fulltext/2009/09000/Treatment_of_](http://journals.lww.com/jorthotrauma/Fulltext/2009/09000/Treatment_of_.)
7. Javed O, Maldonado KA, Ashmyan R. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 25, 2022. Anatomy, Shoulder
8. Wong M, Kiel J. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 25, 2022. Anatomy, Shoulder and Upper Limb, Acromioclavicular Joint. [PubMed] and Upper Limb, Muscles. [PubMed] 3. Tossy_III_Acromioclavicular_Joint.4.aspx
9. Kashii M, Inui H, Yamamoto K. Surgical Treatment of Distal Clavicle Fractures Using the Clavicular Hook Plate. *Clinical Orthopaedics and Related Research* [Internet]. 2006;447. Available from: http://journals.lww.com/corr/Fulltext/2006/06000/Surgical_Treatment_of_Distal_Clavicle_Fractures.28.aspx
10. Weinstein DM, McCann PD, McIlveen SJ, Flatow EL, Bigliani LU. Surgical Treatment of Complete Acromioclavicular Dislocations. *The American Journal of Sports Medicine*. 1995 Jun;23(3):324-331.
11. *synthes_clavicle_hook.pdf* [Internet]. [cited 2010 Nov 18]; Available from: http://www.shoulderdoc.co.uk/documents/synthes_clavicle_hook.pdf
12. De Baets T, Truijen J, Driesen R, Pittevels T. The treatment of acromioclavicular joint dislocation Tossy grade III with a clavicle hook plate. *Acta Orthop Belg*. 2004 Dec;70(6):515-519.
13. Ejam S, Lind T, Falkenberg B. Surgical treatment of acute and chronic acromioclavicular dislocation Tossy type III and V using the Hook plate. *Acta Orthop Belg*. 2008 Aug;74(4):441-445.
14. Sunderamoorthy D, Saldanha K, Madhusudhan S, Waseem M. Hook plate in clavicular pathology in a DGH. *Injury Extra*. 2007 Jan;38(1):3-4.
15. Robinson CM. Fractures of the clavicle in the adult: EPIDEMIOLOGY AND CLASSIFICATION. *J Bone Joint Surg Br*. 1998 May 1;80-B (3):476-484.
16. Potter F, Fiorini A, Knox J, Rajesh P. The migration of a Kirschner wire from shoulder to spleen: brief report. *J Bone Joint Surg Br*. 1988 Mar 1;70-B (2):326-327.
17. Lyons F, Rockwood C. Migration of pins used in operations on the shoulder. *J Bone Joint Surg Am*. 1990 Sep 1;72(8):1262-1267.
18. NORRELL H, LLEWELLYN RC. Migration of a Threaded Steinmann Pin from an Acromioclavicular Joint into the Spinal Canal: A CASE REPORT. *J Bone Joint Surg Am*. 1965 Jul 1;47(5):1024-1026.
19. Mazet R. MIGRATION OF A KIRSCHNER WIRE FROM THE SHOULDER REGION INTO THE LUNG: Report of Two Cases. *J Bone Joint Surg Am*. 1943 Apr 1;25(2):477-483.
20. Rokito AS, Zuckerman JD, Shaari JM, Eisenberg DP, Cuomo F, Gallagher MA. A comparison of nonoperative and operative treatment of type II distal clavicle fractures. *Bull Hosp Jt Dis*. 2002;61(1-2):32-39.
21. Swanson KE, Swanson BL. A minimally invasive surgical technique to treat distal clavicle fractures. *Orthopedics*. 2009 Jul;32(7):509.
22. Pujol N, Philippeau JM, Richou J, Lespagnol F, Gravelleau N, Hardy P. Arthroscopic treatment of distal clavicle fractures: a

- technical note. *Knee Surg Sports Traumatol Arthrosc.* 2008 Sep;16(9):884-886.
23. Robinson CM, Akhtar MA, Jenkins PJ, Sharpe T, Ray A, Olabi B. Open reduction and endo button fixation of displaced fractures of the lateral end of the clavicle in younger patients. *J Bone Joint Surg Br.* 2010 Jun 1;92- B (6):811- 816.
 24. Macheras G, Kateros KT, Savvidou OD, Sofianos J, Fawzy EA, Papagelopoulos PJ. Coracoclavicular screw fixation for unstable distal clavicle fractures. *Orthopedics.* 2005 Jul;28(7):693-696.
 25. Flinkkilä T, Ristiniemi J, Hyvönen P, Hämäläinen M. Surgical treatment of unstable fractures of the distal clavicle: A comparative study of Kirschner wire and clavicular hook plate fixation. *Acta Orthopaedica.* 2002 Jan 1;73(1):50-53.
 26. Flinkkilä T, Ristiniemi J, Lakovaara M, Hyvönen P, Leppilähti J. Hook- plate fixation of unstable lateral clavicle fractures: a report on 63 patients. *Acta Orthop.* 2006 Aug;77(4):644-649.
 27. Tambe A, Motkur P, Qamar A, Drew S, Turner S. Fractures of the distal third of the clavicle treated by hook plating. 2006 Feb 1;30(1):7-10.
 28. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder, and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. *BMC Musculoskeletal Disorders.* 2003;4(1):11.
 29. Beaton DE, Wright JG, Katz JN, The Upper Extremity Collaborative Group. Development of the QuickDASH: Comparison of Three Item-Reduction Approaches. *J Bone Joint Surg Am.* 2005 May 1;87(5):1038- 1046.
 30. Gummesson C, Ward M, Atroshi I. The shortened disabilities of the arm, shoulder, and hand questionnaire (QuickDASH): validity and reliability based on responses within the full-length DASH. *BMC Musculoskeletal Disorders.* 2006;7(1):44.
 31. McClelland D, Krishnamurthy S, Dodenhoff R. CONSTANT SCORE ASSESSMENT OF SHOULDER FUNCTION - IS STRENGTH MEASUREMENT USEFUL? *J Bone Joint Surg Br.* 2002 Jul 1;84- B(SUPP_II):197-d.
 32. Katolik LI, Romeo AA, Cole BJ, Verma NN, Hayden JK, Bach BR. Normalization of the Constant score. *Journal of Shoulder and Elbow Surgery.* May;14(3):279-285.