

The role of clavicle hook plate in fracture lateral end of clavicle

Abhay Manchanda^{1,*}, Ashok Nagla², Anand Gupta³, Noor Arshad⁴, Viral Patel⁵

^{1,2}Associate Professor, ³Consultant, ^{4,5}PG Resident, Dept. of Orthopaedics, Index Medical College, Hospital & Research Centre, Indore

***Corresponding Author:**

Email: abhayortho@gmail.com

Abstract

Background: Fracture of lateral end clavicle constitutes merely 15% of clavicle fracture, only a third of these fractures are displaced (Neer's Type 2/Edinburgh Type 3B1).⁽¹⁾ No single treatment technique has been hailed as the most preferred technique to manage fracture lateral end clavicle, yielding consistently good union, with least complications.

Objective: This initial study attempts to evaluate the role of Clavicle Hook Plate, in the treatment of lateral end clavicle fractures, whether it promises to be the most preferred technique.

Material and Methods: To evaluate the results and long term effects in use of this plate we performed a retrospective analysis with a mean follow up of 24 months (2 years) of 16 consecutive patients with acute displaced lateral clavicle fractures, treated with the clavicle hook plate.

Results: Our short term results in all patients were good to excellent. None underwent non-union. Impingement symptoms were detected in 3 patients, our 2 patients had skin issues and 1 had significant infection, warranting premature implant removal. Sixteen patients were re-evaluated at a mean follow-up period of 2 years. The Constant-Murley score was 97 and the DASH score was 3.5.

Conclusions: Clavicle hook plate presents as a reasonably good primary treatment choice in treating the acute displaced lateral clavicle fractures. Proper selection of patients with good skin conditions and infection control are essential, in this part of the world.

Introduction

Fracture of lateral end of clavicle is 15% of the total clavicle fracture, although conservative management of clavicle fractures has been very well accepted by the society but lately patients are turning more demanding.

Usually one third of these fractures get displaced (Type 2 Neer's or Type 3B1 Edinburgh).⁽¹⁾ The clavicle hook plating has emerged as a revolutionary surgical option for such fractures.^(2,3,4,5,6,7,8,9,10,11) It has been amply proven by time that union has never been a bothersome issue in these fractures, but even a decade ago it was convincingly shown in a study that long term complication of the clavicle fracture can occur like acromio-clavicular joint problems.⁽¹¹⁾

To assess the role of hook plate in lateral end clavicle fractures, we studied & followed the chosen patients for an average period of 24 months. 16 patients presented in our out-patient department, with acute lateral clavicle fractures, who had displacements beyond the limits of acceptability, hence were treated with the clavicle hook plating.

Material and Methods

16 consecutive patients were selected who had displaced fractures, in a tertiary care teaching hospital & who had been operated for hook plate were retrospectively evaluated. This medical college hospital caters 8.4 lacs of rural population in central M P, India. 90% of the population includes farmers and semi-skilled labourers. Although less than 50% of the population is below the poverty line, yet majority

patients are high demanding as far as range of movements and heavy weight lifting ability is concerned. Hence quality with economy, is the desired health management protocol here.

It was ensured that operating consultant himself followed up the cases personally, until the last clinical evaluation which was done by any other consultant to eliminate any bias. The movements (active & passive both) were started on 3rd and 7th post-operative day. Union was assessed periodically after 3 and 10 weeks, Following which these patients were advised resumption of normal duties, except heavy weight(>20 kgs) lifting for total 3 months or radiological sound union.

The case sheets were analysed and post-operative x-rays were re-analysed. Following the initial evaluation, we examined the patient in OPD. Range of shoulder movements were carefully evaluated as passive and active function separately to be included with subjective perceptions for DASH and Constant-Murley scoring.

The Hook-Plate: This plate is a 3.5mm pre-contoured stainless steel/titanium, dynamic compression, locking/non locking plate, with a wider anterolateral end and a lateral extension with a step low, into a hook which can be slid below the acromion. The objective being that the plate itself rests along the superior surface of the fractured clavicle fragments while the hook anchors below the acromion. These plates are available with 6 or 8 holes and the hook depth being 15mm.

Surgical Technique: The patients were operated in supine position, thin sandbag underneath the operable shoulder or the head end of the table is tilted 30 degree upwards. Usually under general anaesthesia although intersclene block can also be preferred. The arm is kept on the affected side, free to move. A lazy curved skin incision, placed coronally, centring the fracture was given in all the cases. Skin flaps were elevated, taking extra care to keep the flap as thick as possible to ensure its viability. The fracture fragments were neatly dissected with minimum soft tissue periosteal elevation. The fragments were reduced carefully and were temporarily fixed with smooth K-wires. Without opening the AC joint, it was located under image intensifier. The soft tissue dorsal to the AC joint to allow was slit just enough insertion of the hook of the plate. First the hook the plate hook depth is manoeuvred below the acromion. The shaft of the plate was placed on the superior aspect of the clavicle and fixed with a k-wire, the reduction of fragments were confirmed by rotating image intensifier to get oblique views of fracture. The plate since is well pre-contoured, hence aligns well with the clavicle, but was bent to suit if need be. The tendency of the plate is to slide anteriorly which can be negated by a pointed thin spike put in a screw hole and pulling it posteriorly to its optimum location. Our initial screws were normal screws, to get the plate in tight contact with clavicle, and then later fixed with locking screws. Adequate precaution was taken to avoid injury to the underlying neurovascular bundle. The wound closed without tension, with subcutaneous sutures, to hold over the plate.

Results

All sixteen patients with a displaced lateral clavicle fracture, were operated with the clavicle hook plate. Mean age was 38 years (range 23-55) male to female ratio was 10:6. All patients had an Edinburgh Type 3B1/ Neer Type II fracture. Mean time to operation was 2 days (range 0-5 days) and the operating time was 47 minutes 30 to 70 minutes, incision to closure. All patients were discharged on the day of or the day after operation. All the patients were followed up for average 1.6 years.

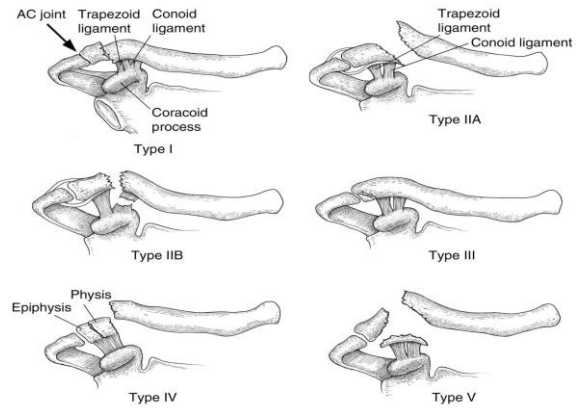


Fig. 1: Neer's classification for clavicle fracture

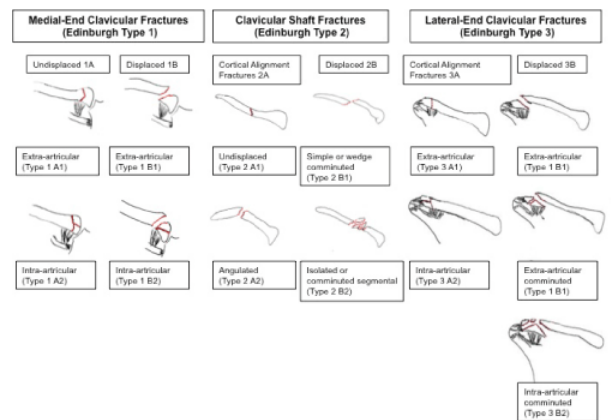


Fig. 2: Edinburgh classification of clavicular fracture



Fig. 3: Hook plate



Fig. 4



Fig. 5



Fig. 6

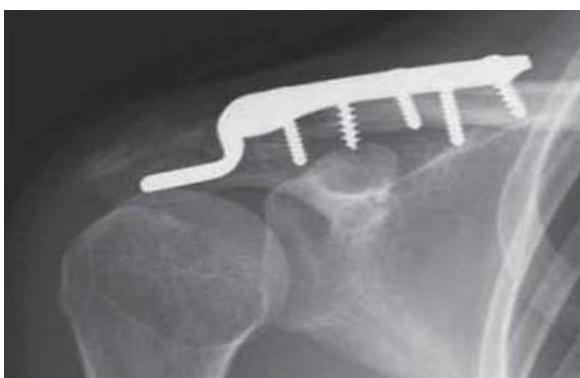


Fig. 7



Fig. 8

Discussion

In our study, there were 16 patients, out of which 6 patients (37.5%) were female and 10 patients (62.5%) were male with male to female ratio is 10:6. If we divide the patients in age groups 6 patients (37.5%) were between the age group of 31-40 years, 4 patients (25%) were between the age group of 21-30 years, 4 patients (25%) were between the age group of 41-50 years and 2 patients (12.5%) were between the age group of 51-60 years with the mean age of 38 years.

On comparing the patients on the basis of time between the injury and the operation, all the patients had duration between 0-5 days, with the meantime 2.3 days. The mean intra-operative time from incision to closure was 47 minutes.

We followed up the patients for an average time of 1.6 years and evaluated with the DASH and constant Murley score. The mean DASH score was 1.27 and Constant Murley score was 85.87.

In our study, we had complications in 5 patients (31.25%) out of total 16. During follow up 1 patient reported skin incision irritation pain and 3 of these patients were diagnosed with impingement and this resolved shortly after plate removal the patients with impingement has symptoms of discomfort and pain between 70 and 130 degree of elevation (abduction in the plane of scapula). Impingement was confirmed by impingement test i.e., local injection of 2% lidocaine 2ml, under the acromion, in sub-acromial space, bringing relief to the pain instantly.

One patient suffered infection, probably due to uncontrolled diabetes. This patient ultimately required implant removal, despite suitable intravenous antibiotics being injected after pus culture and sensitivity. The organism grown was staphylococcus aureus, though sensitive to regular antibiotics, couldn't be controlled until the plate was removed.

The single patient with skin irritation was probably due to incision just overlying the plate and screws. Locking screws that merge in the plate thickness do have an advantage. Despite all patients were advised to remove the plate after clinical and radiological consolidation.

Our results were comparable with Flinkkila et al,⁽⁶⁾ he compared K-wire fixation to hook plating. Although the functional results were same, still they advised hook plates because of migration and infection in the former group. Lee et al⁽⁵⁾ compared K-wiring with tension band wiring to hook plate fixation. Their results showed that the group with the hook plate had earlier regained of pre-injury activities. The K-wire fixation group had 30% complications mainly related to hardware failure.

Neer has described fracture lateral clavicle as an unstable clavicle fracture needing operative treatment because of increased incidence non-union and rate of delayed union. His explanation is by that the deforming forces around the fracture, and interposition between the fracture fragments, along with continuous motion at

the fracture ends^(22,24,25) contribute to the aforesaid prognosis.

The clavicle hook plate is an easy to use implant that withstands forces that are applied to the fracture fragments. By its shape it keeps the lateral end of the clavicle aligned, thereby reducing the clavicle with the ligaments and minimizing movement at the fracture ends without interfering with rotation of the clavicle.⁽¹²⁾

The results published in several studies^(2,3,4,5,6,7,8,9,10,11) show good results regarding bony union and in terms of shoulder function. Shoulder function is checked with the use of Constant-Murley & DASH scores. The DASH score is below 5 and the Constant-Murley score comes around 90. Non-union is seldom, below 10% which is comparable to our study.

Conclusions

Clavicle plate in our short study, has risen as without a doubt tried and true essential treatment decision in treating the severely displaced parallel clavicle fractures. A strict convention of legitimate choice of patients, with great nearby skin conditions, dealing with all systemic ailments (obligated to bring about post-agent issues) are taken after moreso, in this part of the world, can avoid difficulties later.

Reference

1. Robinson CM: Fractures of the clavicle in the adult. Epidemiology and classification. *J Bone Joint Surg Br.* 1998;80:476-484. 10.1302/0301-620X.80B3.8079.
2. Haidar SG, Krishnan KM, Deshmukh SC: Hook plate fixation for type II fractures of the lateral end of the clavicle. *J Shoulder Elbow Surg.* 2006;15:419-423. 10.1016/j.jse.2005.11.012.
3. Renger RJ, Roukema GR, Reurings JC, Raams PM, Font J, Verleisdonk EJ: The clavicle hook plate for Neer type II lateral clavicle fractures. *J Orthop Trauma.* 2009;23:570-574. 10.1097/BOT.0b013e318193d878.
4. Lee KW, Lee SK, Kim KJ, Kim YI, Kwon WC, Choy WS: Arthroscopic-assisted Locking Compression Plate clavicular hook fixation for unstable fractures of the lateral end of the clavicle: a prospective study. *Int Orthop.* 2009.
5. Lee YS, Lau MJ, Tseng YC, Chen WC, Kao HY, Wei JD: Comparison of the efficacy of hook plate versus tension band wire in the treatment of unstable fractures of the distal clavicle. *Int Orthop.* 2009;33:1401-1405. 10.1007/s00264-008-0696-7.
6. Flinkkila T, Ristiniemi J, Hyvonen P, Hamalainen M: Surgical treatment of unstable fractures of the distal clavicle: a comparative study of Kirschner wire and clavicular hook plate fixation. *Acta Orthop Scand.* 2002;73:50-53. 10.1080/000164702317281404.
7. Tambe AD, Motkur P, Qamar A, Drew S, Turner SM: Fractures of the distal third of the clavicle treated by hook plating. *Int Orthop.* 2006;30:7-10. 10.1007/s00264-005-0019-1.
8. Meda PV, Machani B, Sinopidis C, Braithwaite I, Brownson P, Frostick SP: Clavicular hook plate for lateral end fractures:- a prospective study. *Injury.* 2006;37:277-283. 10.1016/j.injury.2005.10.017.
9. Muramatsu K, Shigetomi M, Matsunaga T, Murata Y, Taguchi T: Use of the AO hook-plate for treatment of

- unstable fractures of the distal clavicle. *Arch Orthop Trauma Surg.* 2007;127:191-194. 10.1007/s00402-006-0284-5.
10. Bhangal KK, Evans SC, Gibbons E: Treatment of Displaced Lateral Clavicle Fractures with the AO Hook Plate. *European Journal of Trauma.* 2006;5:468-470.
11. Flinkkila T, Ristiniemi J, Lakovaara M, Hyvonen P, Leppilahti J: Hook-plate fixation of unstable lateral clavicle fractures: a report on 63 patients. *Acta Orthop.* 2006;77:644-649. 10.1080/17453670610012737.
12. Kiefer H, Claes L, Burri C, Holzwarth J: The stabilizing effect of various implants on the torn acromioclavicular joint. A biomechanical study. *Arch Orthop Trauma Surg.* 1986;106:42-46. 10.1007/BF00435651.
13. Eberle C, Fodor P, Metzger U: [Hook plate (so-called Balsler plate) or tension banding with the Bosworth screw in complete acromioclavicular dislocation and clavicular fracture]. *Z Unfallchir Versicherungsmed.* 1992;85:134-139.
14. Moneim MS, Balduini FC: Coracoid fracture as a complication of surgical treatment by coracoclavicular tape fixation. A case report. *Clin Orthop Relat Res.* 1982;133-135.
15. Kona J, Bosse MJ, Staeheli JW, Rosseau RL: Type II distal clavicle fractures: a retrospective review of surgical treatment. *J Orthop Trauma.* 1990;4:115-120. 10.1097/00005131-199004020-00002.
16. Kaipel M, Majewski M, Regazzoni P: Double-Plate Fixation in Lateral Clavicle Fractures-A New Strategy. *J Trauma.* 2010.
17. Goldberg JA, Bruce WJ, Sonnabend DH, Walsh WR: Type 2 fractures of the distal clavicle: a new surgical technique. *J Shoulder Elbow Surg.* 1997;6:380-382. 10.1016/S1058-2746(97)90006-9.
18. Jackson WF, Bayne G, Gregg-Smith SJ: Fractures of the lateral third of the clavicle: an anatomic approach to treatment. *J Trauma.* 2006;61:222-225. 10.1097/01.ta.0000196804.23024.a3.
19. Mall JW, Jacobi CA, Philipp AW, Peter FJ: Surgical treatment of fractures of the distal clavicle with polydioxanone suture tension band wiring: an alternative osteosynthesis. *J Orthop Sci.* 2002;7:535-537. 10.1007/s007760200095.
20. Yamaguchi H, Arakawa H, Kobayashi M: Results of the Bosworth method for unstable fractures of the distal clavicle. *Int Orthop.* 1998;22:366-368. 10.1007/s002640050279.
21. Ballmer FT, Gerber C: Coracoclavicular screw fixation for unstable fractures of the distal clavicle. A report of five cases. *J Bone Joint Surg Br.* 1991;73:291-294.
22. Neer CS: Fracture of the distal clavicle with detachment of the coracoclavicular ligaments in adults. *J Trauma.* 1963;3:99-110. 10.1097/00005373-196303000-00001.
23. Robinson CM, Cairns DA: Primary nonoperative treatment of displaced lateral fractures of the clavicle. *J Bone Joint Surg Am.* 2004;86-A:778-782.
24. 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;61:32-39.
25. Neer CS: Fractures of the distal third of the clavicle. *Clin Orthop Relat Res.* 1968;58:43-50.
26. Nadarajah R, Mahaluxmivala J, Amin A, Goodier DW: Clavicular hook-plate: complications of retaining the implant. *Injury.* 2005;36:681-683 31. Chandrasenan J, Badhe S, Cresswell T, Beer J. The Clavicular Hook Plate: Consequences in Three Cases. *European Journal of Trauma and Emergency Surgery.* 2007;5:557-559. 32.

Kaipel M, Majewski M, Regazzoni P. Double-Plate Fixation in Lateral Clavicle Fractures-A New Strategy. J Trauma. 2010.

27. ElMaraghy AW, Devereaux MW, Ravichandiran K, Agur AM. Subacromial morphometric assessment of the clavicle hook plate. Inj.