Outcome of Mid 1/3rd Clavicular Fracture After Open Reduction and Internal Fixation

M. A. Wajid, M. Usman Sarwar

Abstract

Aim: To assess functional outcome after open reduction and internal fixation of clavicaular fractures

Methods: This is a prospective cohort study of ORIF (Open reduction and internal fixation) of middle 1/3rdclavicular fracture of patients who met the strict criteria for internal fixation of clavicular fractures. We had 9 patients from Feb 2010- November2012 who underwent the procedure. The patients were followed at 2 weeks, 6 weeks and 3 months after surgery. If there was any complication, the patients were followed till resolution of symptoms. The functional out come was measured using Quick DASH score, union rate, return to function and surgery related complications.

Results: Outcome was measured using Quick DASH score (The Disabilities of the Arm, Shoulder and Hand questionnaire) at 2 weeks,6 weeks and 3 months follow up. Out of nine cases, one patient lost to follow up and remaining eight cases were followed. There was no case of non-union/ delayed union at three months. There was significant improvement in the Quick DASH score from 2 weeks to 3 months. The mean score after 2 weeks was 59.9 (Range 50-75) after 6 weeks 24.1 (range 20.5-29.5) and at 12 weeks post op 5.1(range 2.3-6.8) Three cases had temporary hypoesthesia, which resolved spontaneously and in one of these cases there was hypertrophic scar, which was managed conservatively.

Conclusion: Although traditionally, non-operative treatment has been the mainstay of treatment for mid 1/3rdclavicular fractures however in certain selected patients and in certain fracture configuration, there is higher incidence of inadequate outcome in terms of union rate, cosmesis and functional ability if treated conservatively. In these patients, ORIF is a viable option to minimize the poor outcome

Introduction

Clavicle fracture is one of the most common long bone fractures. 69-82% of all Clavicular fracture involves Middle 1/3rd of Clavicle.[1-2] For an undisplaced or minimally displaced fracture non-operative treatment is optimal which may be a broad arm sling or any other configuration of bandage.

However, in all displaced clavicle fractures “reduction is practically impossible to maintain, and a certain amount of deformity is to be expected, generally compatible with satisfactory return of function in the shoulder.”[3] It is widely held belief and standard text books state that displaced fractures “generally do well with non-operative management”.[3] Most of the impression about the outcome of these fractures is based on radiographic outcome which is based on assumption that radiographic union means good functional outcome. However, patient based and other validated instruments have shown that the outcomes are not excellent in all cases. [4]

Anderson et al in a prospective randomized study has shown that dissatisfaction in patients treated with figure of 8 bandages was 26% compared to 7% in those treated with sling. [5]

In comminuted and completely displaced fractures (displacement >100%) and shortening > 2 cm the risk of non-union, cosmetic deformity and poor outcome is increased. Closed treatment of displaced middle 1/3rd fractures gives poor results.[6]

Of all surgical procedures the best evidence of efficacy is presently available for plate fixation and elastic stable intramedullary nailing. [7]

Objective of Study

Primary objective was to assess the functional outcome using validated clinical scoring systems with respect to function, mobility and pain in patients treated with ORIF of Clavicular fracture at 2 weeks, 6 weeks and 3 months follow up using Quick DASH score. [8]TheQuick DASH score is a self-report outcome measure for people with upper limb musculoskeletal problems. It uses 11 items to measure physical function and symptoms. Each

For Correspondence:
Prof. M. A. Wajid, FRCS,.FRCS.(Tr & Orth)
Head of Orthopaedics
Shalamar Medical & Dental College, Lahore
Email: wajidmaw@gmail.com

item is scored with 5-point scale. Transforming to a score out of 100 by subtracting 1 and multiplying by 25 then calculate the final score. This is done to make easy comparison with other measurements scaled on 0-100 scales. Final score ranges from 0, means no disability to 100 severe disability.17 The reliability of 11 item Quick DASH is similar to 30 item DASH with acceptable internal consistency for individual patient rating (Cronbach's alpha ~ 0.90) and intra-class correlation coefficient (ICC = 0.94)

Secondary objective was to assess the non-union rate at 3 months after the ORIF of clavicle.

Operational Definitions

For the purpose of this study following are the operational definitions to assess the adverse events/ complications.

Non-union in clavicle is defined as absence of radiographic healing with clinical evidence of pain on motion at fracture site at 3 months.[9,10]

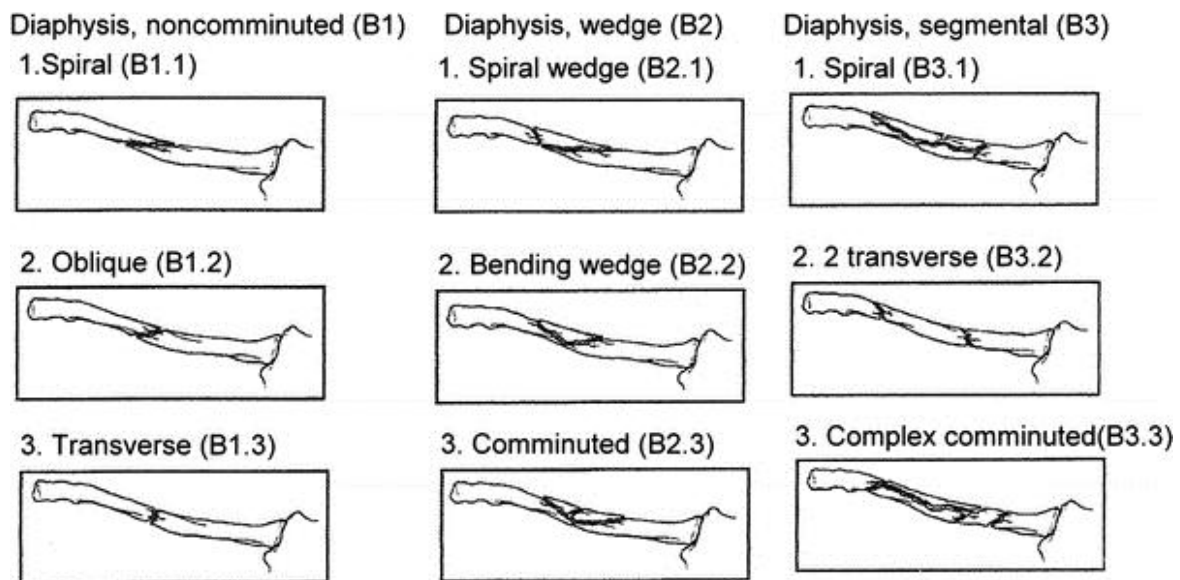
Complications: Any event that required another operative procedure or additional medical treatment.[11]

Symptomatic malunion: When fracture has healed in shortened, angulated or displaced position with weakness, easy fatigability, pain on overhead activity, neurologic symptom and shoulder asymmetry with completed or planned osteotomy.[11]

Complex regional pain syndrome: Presence of dysaesthetic pain and hyperesthesia extending into the hand of the involved limb, vasomotor changes, skin atrophy and diffuse osteopenia. .[12]

Material and Method

From February 2010 to November 2102 we prospectively recruited 9 patients. Initial demographic data was collected which included: age, side of injury, mechanism of injury, and fracture classification. An informed consent was obtained from each patient. Fractures were classified by the system of AO.



Inclusion Criteria

Pt. with mid 1/3rd Clavicular fracture with one or more of the following features: displacement greater than 100%, shortening > 2 cm, closed fracture, fracture with neurovascular injury, Z shaped fracture configuration.

Exclusion Criteria

Skeletally immature patients, patient unfit for surgery, infected area around clavicle. Previous shoulder surgery, any regional neurological problem i.e. polio or other neurological deficit

Procedure

Surgery was done under General anesthesia with pre-operative I.V antibiotics (1.5 Gram of Zeincef) at time of induction. All cases were done by senior author (MAW) Patients were positioned in beach chair position, with head stabilized on head ring and turned to opposite side. Whole upper limb was prepared. A sand bag was placed under the

scapula towards the medial scapular border to facilitate fracture reduction. Horizontal skin incision was used just over the lower border of clavicle. Supraclavicular nerves were identified and preserved in most cases (Fig 1,2,3). After fracture reduction a 3.5 mm plate was applied on antero superior aspect of the clavicle with minimum six cortices on either side (Fig 3). Position was checked under C-Arm. Wound was closed in layers and skin closed with non-absorbable suture. Postoperatively patients were allowed range of movements on 2nd or 3rd day as tolerated except overhead activities and weight lifting for six weeks.

At 2 weeks, follow up x-ray was done to check the position of implant, other surgery related problems were excluded at this visit and stitches were removed. At 6 weeks second x-ray to assess bony union and clinical assessment of fracture healing was done. Functional status was assessed at 2 weeks, 6 weeks and 3 months. If the fracture healing has already happened, no further x rays were done at 3 months.

Results

All 9 patients were men with right side affected in 6 and left side in 3 cases. Mean age at time of surgery was 34 (Range 22-51 years) there were 6 B1 fractures and 3 B2 fractures.

Out of nine cases, one patient lost to follow up and remaining eight cases were followed.

There was no case of non-union/ delayed union at three months. Three cases had temporary hypoesthesia, which resolved spontaneously and in one of these cases there was hypertrophic scar, which was managed conservatively. One patient complained of prominent hardware, which did not require hardware removal.

There was significant improvement in the Quick DASH score from 2 weeks to 3 months. The mean score after 2 weeks was 59.9 (Range 50-75) after 6 weeks 24.1 (range 20.5-29.5) and at 12 weeks post op 5.1(range 2.3-6.8)

Discussion

Most clavicle fractures heal uneventfully with non-operative treatment provided the alignment is well maintained. However, recently there is growing evidence that for displaced and/or comminuted mid shaft fractures as well as high energy fractures the rate of non union and functional out come is unacceptably high. Current studies show with a high level of evidence (level 1) that patients with dislocated fractures benefit from surgery. [13]

Choice of implants in such cases is also very important. There are a variety of implants - intra medullary and extramudllary that have been used to stabilize these fractures. Each implant has its own set of advantages and disadvantages as extramedullary implants- Plates- generally require open reduction while intramedullary devices – both antegrade and retrograde – have the advantage of small surgical incision. Of many factors, which affect the choice of implant, bone quality is one of the most important as stability of construct is of paramount importance. If surgery of elderly patients with mid clavicular fractures is indicated, internal fixation with a locking compression plate is preferable to a non-locking plate.[14]

Anterosuperior position of plate was selected in this study as this position provides best stability [15]. None of our cases had plate removal. As clavicle is a subcutaneous bone, the plate applied on its anterosuperior aspect will undoubtedly be palpable and may cause local discomfort. Canadian multicenter study showed " 13.4% complications were hardware-related." In one study,' 96% of patients who had their plate taken out recommended its removal; 86% of those who still have their plates in, were happy to keep them. As plate removal is not without its morbidity, we recommend leaving clavicle plates retained unless requested by the patient.' [16]

Limitation of Study

The main limitation of study is its small number. As there has been significant number of patients who fulfilled the criteria of > 100% displacement and > 2 cm shortening but they opted out for various reason including that prevailing view of many orthopaedic surgeons is that there is no role for operative treatment in closed clavicular fractures.

Secondly, there is no control group as well as there are other treatment options available i.e. Clavicular Pins, (it is specially designed pin for clavicle factures), K wires or other intramedullary fixations – antegrade or retrograde etc. etc. We did not study any one of these.

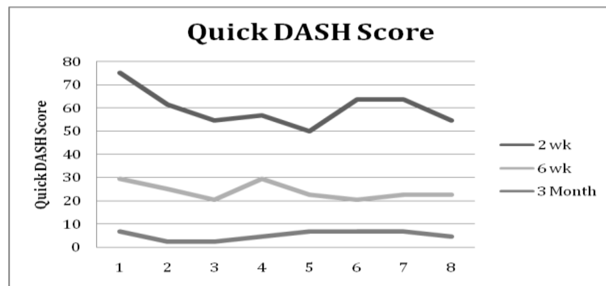
In conclusion, Conservative treatment is the mainstay of treatment for closed clavicular fractures. However we believe that ORIF with plate is a viable option in selected cases which meet the criteria for internal fixation as it is safe, has lesser rate of non union and leads to better functional result in selected patients.

Conflict of Interest

None of the authors have any conflict of interest.

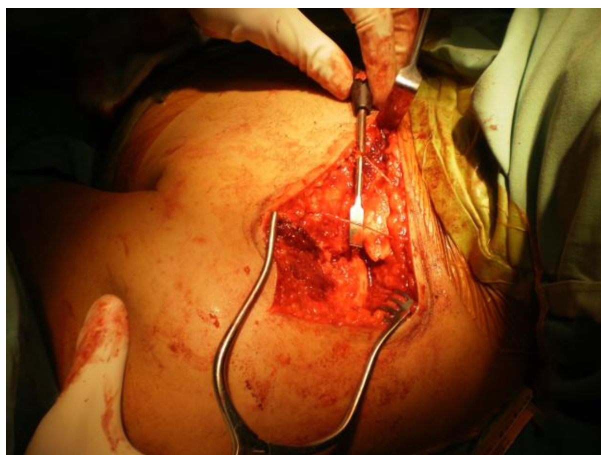
Table 1:

	Quick DASH		
Case No.	2 wks	6 wks	3 Month
1	75	29.5	6.8
2	61.4	25	2.3
3	54.5	20.5	2.3
4	56.8	29.5	4.5
5	50	22.7	6.8
6	63.6	20.5	6.8
7	63.6	22.7	6.8
8	54.6	22.7	4.5
9	63.6	Lost to follow up	

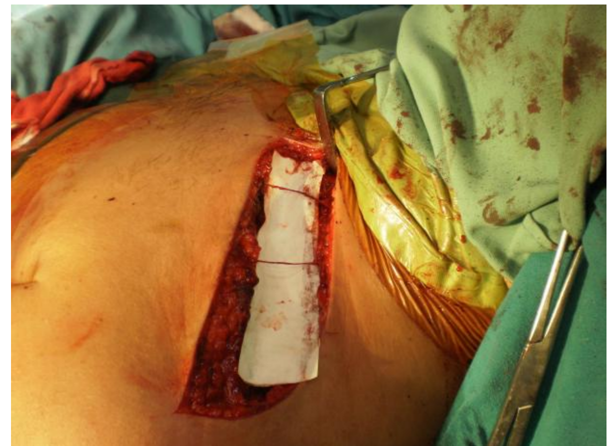


Illustrations

Illustration 1
Approach and disection of supraclavicular nerves



Approach- Left clavicle
Illustration 2
Supraclavicular nerves dissected and preserved



Left clavicle

Illustration 3

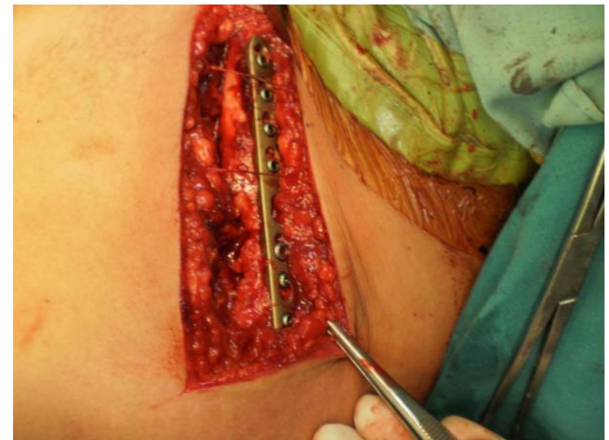


Plate applied to fracture with supraclavicular nerves traversing over the plate- Left clavicle

References

1 Nordqvist A, Petersson C: The incidence of fractures of the clavicle. Clin Orthop Relat Res 1994; 300:127-132.
2 Nowak J, Mallmin H, Larsson S: The aetiology and epidemiology of clavicular fractures: A prospective study during a two-year period in Uppsala, Sweden. Injury 2000; 31:353-358
3 Neer CS: Fractures of the clavicle, in Rockwood CA, Green DP (eds): Fractures in Adults. , ed 2. Philadelphia, PA: JB Lippincott, 1981, pp707-713
4 Canadian Orthopaedic Trauma Society: Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fracture. J Bone Joint Surg Am 2007; 89:1-10

5 Andersen K, Jensen PO, Lauritzen J: Treatment of clavicular fractures: Figure-of-eight versus a simple sling. Acta Orthop Scand 1987; 58:71-74.

6 Gossard JM. Closed treatment of displaced middle-third fractures of the clavicle gives poor results. The Journal of bone and joint surgery. 1998; 80(3:558)

7 R, Mathis S, Pelinka H, Mittermayr T, Pieske O. [Midshaft clavicle fractures: A systematic review of different treatment approaches.] Der Unfallchirurg. 2010. in press PMID:

8 Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG) Am J Ind Med. 1996 Jun;29(6):602-8.

9 Stufkens SA, Kloen P. Treatment of midshaft clavicular delayed and non-unions with anteroinferior locking compression plating. Arch Orthop Trauma Surg. 2010 Feb; 130(2): 159-64. doi: 10.1007/s00402-009-0864-2. Epub 2009 Apr 2.

10 Orthopaedic Trauma society: Non operative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures: A Multicenter, Randomized Clinical Trial J Bone Joint Surg Am, 2007 Jan 01;89(1):1-10. doi: 10.2106/JBJS.F.00020

11 The Clavicle Trial: study protocol for a multi centre randomized controlled trial. Conservative management versus open reduction and internal fixation for mid-shaft clavicle fractures in adults. Trials. 2011; 12: 57.Published online 2011 February 28. doi: 10.1186/1745-6215-12-57

12 Doro C, Hayden RJ, Louis DS. Complex regional pain syndrome type I in the upper extremity. Clin Occup Environ Med. 2006; 5(2):445-54, x.

13 Schiffer G, Faymonville C, Skouras E, Andermahr J, Jubel A. Midclavicular fracture: not just a trivial injury: current treatment options Dtsch Arztebl Int. 2010 Oct; 107(41): 711-7. Doi: 10.3238/ arztebl. 2010.0711. Epub 2010 Oct 15.

14 Pai HT, Lee YS, Cheng CY. Surgical treatment of midclavicular fractures in the elderly: a comparison of locking and non-locking plates. Orthopedics. 2009 Apr; 32(4).

15 Iannotti MR, Crosby LA, Stafford P, Grayson G, Goulet R: Effects of plate location and selection on the stability of midshaft clavicle osteotomies: A biomechanical study. J Shoulder Elbow Surg 2002; 11:457-462)

16 Janey Wang, Ramiah Chidambaram, and Daniel Mok Is removal of clavicle plate after fracture union necessary? Int J Shoulder Surg. 2011 Oct-Dec; 5(4): 85–89. doi: 10.4103/0973-6042.90998

17 Hudak PL, Amadio PC, and Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG) Am J Ind Med. 1996 Jun; 29(6): 602-8. Erratum in: Am J Ind Med 1996 Sep; 30(3): 372.