

Outcome of Precontoured Anatomical Plate in Displaced Middle Third Clavicular Fractures

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Abstract

Introduction: Non operative treatment for middle third clavicle fractures remained the mainstay for until last two decades. But due to the prevalence of nonunion, symptomatic malunion and shortening for displaced fractures, now the trend has shifted towards operative management. Our study is aimed at prospectively evaluating the functional outcome of 120 patients treated with open reduction and plating with precontoured anatomical plate. In addition to patient demographics, this study also estimates the rate of fracture union, lists the complications of clavicular plate fixation, estimate the time of clinical and radiological union of fracture and functional outcome in terms of DASH score.

Methodology: 120 patients from 16 years to 60 years of age, with displaced (>2cm) and/or shortened (>2cm) or comminuted middle third clavicular fractures were included in this prospective observational study conducted in Bir Hospital and National Trauma Center over a period of four years. Open reduction and internal fixation with precontoured anatomical plate was done. Postoperatively the arm is held in a sling for about 3 weeks with intermittent pendulum exercise of the arm after one week or as soon as the pain is tolerable and passive and active range of motion exercise started after four weeks of the surgery. Patients were followed up on 2, 6, 12 and 24 weeks. Functional outcome was assessed using DASH score and radiographs taken. Statistical analysis was done using SPSS v 22 for Windows.

Results: Mid clavicular fractures were more common in males than in females and left side was more common than right. Younger age group was more commonly affected. All fractures united in a mean radiological union period of 7.1 weeks. 6 cases developed pain, 23 had hardware prominence, 5 case developed superficial infection and none had shoulder stiffness. DASH score was at a significant negligible level by 24 weeks. 98% of patients returned to their work by 12 weeks.

Conclusion: Open reduction and internal fixation with pre-contoured anatomical plate in displaced middle third clavicular fractures is a safe procedure that avoids complications associated with non-operative management and provides good functional outcome with early return to pre-injury activities.

Keywords: Clavicle, Precontoured Anatomical Plate, Middle Third Clavicle Fractures.

Introduction

Clavicle fractures make up two to five percent of all fractures in adults and ten to fifteen percent of all fractures in children. A bimodal population distribution is at higher risk that includes young male patients less than thirty years of age and elderly patients more than seventy years old [1]. The Allman classification divides this fracture into proximal third, middle third, and distal third. Middle third fractures (8.1%) are the most common followed by distal third fractures (15%) and proximal third (4%) occurring the least [1].

Earlier it was thought that union rates and function were excellent with conservative management. More recent studies have however, questioned union rates, functional recovery and the morbidity of

malunion after conservative treatment. Open reduction and internal fixation with precontoured anatomical plates have advantages of stable fixation, less chances of malunion and nonunion and earlier full range of motion with earlier return to preinjury conditions. Our institution has recently been inclined towards surgical management of displaced middle third clavicular fractures. This study aims to determine the functional outcome of ORIF with a precontoured anatomical plate in displaced middle third clavicle fracture.

Methodology

This is a prospective observational study conducted in National Trauma Center and Bir Hospital from July 2014 to June 2018. Displaced clavicular fractures in age group 16-60 years with shortening more than 2cm or bony spike without any associated polytrauma were included in the study. Medial or lateral third fractures, pathological fractures, open fractures or those associated

with neurovascular injuries were excluded from the study. Patients who met the criteria were enrolled in the study after Internal Review Board approval and informed consent was taken. Statistical analysis was done using SPSS v22 for Windows.

Surgery was done in supine position and precontoured anatomical plate was placed superiorly on the clavicle with at least 4 cortices fixation on either side of fracture. Post-operatively, the arm was held in a sling for about three weeks with intermittent pendulum exercise started as soon as the pain was tolerable. Passive and active range of motion exercises were started after four weeks of surgery. Then, movement of the shoulder was gradually encouraged and patient returned to normal activities eight to twelve weeks after the surgery or when there was radiological union.

Follow up radiographs are taken after 2 weeks, 6 weeks, 12 weeks and 24 weeks of the surgery. Clinical assessment with DASH scores was done at 6 weeks, 3 months and 6 months of surgery. Implant was removed after 1 year.

Results

126 cases fulfilled the inclusion criteria and were included in the study. However, 6 cases were lost in follow-up and only 120 cases were included in the final result. 80% of the patients were male and only 20% were females. The mean age was 27.041 ± 10.57 for males and 27.5 ± 8.31 for females. The highest number of cases was in the age group 16-30 years (73.3%) and showed decreasing incidence as age advanced.

Fall on shoulder accounted for 60% of the cases. Road traffic accidents, fall on outstretched hand, physical assault etc. were the other leading causes. Left clavicle was more frequently injured than right (60% vs. 40%).

Mean duration of surgery was 66 ± 10.03 minutes with range 44-84 minutes. Mean duration of hospital stay following surgery was 4.63 days with a standard deviation of 1.79 days and a range of 2-9 days. Most of the cases were discharged on the 4th or 5th day. Mean duration for radiological union was 7.1 weeks with standard deviation of 1.54 weeks and range of 6-12 weeks.

Superficial infection was noted in 5 cases which were managed with dressing and antibiotics. Mild to moderate pain was noted in 6 cases. 23 cases reported hardware prominence. No other complications were noted. DASH score at 6, 12 and 24 weeks were 19.8 ± 1.76 , 7.57 ± 1.95 and 4.96 ± 1.42 respectively.

Discussion

Historically, clavicle fractures were managed conservatively with the principle of "watchful expectancy and skillful neglect". However the recent trend has been operative management. Precontoured anatomical plates have the advantages of more accurate fitting while maintaining strength unlike 3.5mm reconstruction plates. In our study, majority of cases were young adults with age less than 30 years, in both men and women. These are the prime earning group in our society so their early return to work is very important and this is possible with open reduction and internal fixation with locking plate.

Mechanism of injury treated in our study was fall on shoulder in majority of cases, accounting for 60% of cases. Stanley et al reported

that 94% had fractured the clavicle from a direct blow on the shoulder and only 6% had fallen on the outstretched hand [2]. Males were the predominant group in midthird clavicular fractures, accounting for 80% of cases. This could be due to higher rates of contact sports and motor vehicle accidents among males than in females.

There were 16 cases (53.7%) of left sided clavicle fractures compared to 46.3% of right sided clavicle fracture. This observation is consistent with multiple epidemiological studies by several authors which show more involvement of left clavicle.

Mean duration of hospital stay in our study was 4.63 days with a range of 2-9 days. This was comparable to another study by Dhoju D et al, who reported an average hospital stay of 3.9 days with a range of 2-10 days [3]. Mean time of radiological union in our study was 7.1 weeks with a range of 6-12 weeks. This value was comparable to a study done by Douraiswami et al who reported an average of radiological union within 6.8 weeks [4].

Overall complication rate in our study was 16.67%. The incidence is less than the meta analysis by McKee et al who reported 37% of overall complications rate in operatively treated cases of middle third clavicle fractures [5]. They had 2 cases of nonunion, 8 cases of transient brachial plexus symptoms and 2 cases of abnormality of the acromioclavicular or sternoclavicular joint and no cases of malunion. In our study, we had no cases of nonunion or symptomatic malunion or brachial plexus injury. Nonunion rate in studies done by Collinge C et al, Chin-en Chin et al, Verborqt O et al and Wg Cdr V Kulshrestha who studied on ORIF with anatomical plate in displaced mid-shaft clavicular fractures was one out of 58 patients, zero out of 26 patients, two out of 39 patients and zero out of 20 patients respectively [6-9]. These results are similar to our study. Following operative management of displaced midshaft clavicular fractures with precontoured anatomical plates, we have seen significant improvement in the functional outcome of the patients. This has been demonstrated by the decrease in DASH score in subsequent follow-up visits. Mean DASH score in our study was 4.96 at 24 weeks. This is comparable to the study by Raju Vaishya et al, who had mean DASH score of 11.63 at 2nd month postoperatively and 4.6 at the end of 6th month [10].

Conclusion

There is a rise in the incidence of mid-shaft clavicle fracture due to road traffic accidents (RTA). While traditionally believed that conservative management will suffice in such cases, now the trend is towards operative fixation. In our study, we found that open reduction and internal fixation with precontoured anatomical plate rather than open reduction

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