

# Plating Of Fresh Displaced Midshaft Clavicular Fractures

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## Citation

S Venkatachalam, G Packer, C Sivaji, A Shipton. *Plating Of Fresh Displaced Midshaft Clavicular Fractures*. The Internet Journal of Orthopedic Surgery. 2006 Volume 5 Number 1.

## Abstract

Between 2000 and 2005, 56 fresh midshaft clavicular fractures in adults with initial shortening of more than 20 mm were treated with primary internal fixation using reconstruction plates. The inclusion criterion was shortening of clavicle of more than 20 mm on the initial radiographs. The exclusion criteria were children less than 16 years, compound injuries, floating shoulder, neurovascular injury or impending skin perforation. The follow up period varied from six months to 24 months. Superficial infection developed in two patients. Deep infection occurred in one where the plate had been removed and replated once infection settled. Two patients had hardware failure which had to be replated. The outcome was assessed by complications, Constant score and patient satisfaction questionnaire. Constant scores were excellent in the study group and 96% of the patients were satisfied with the operation. Plating of fresh midshaft clavicular fractures with shortening of more than 20mm in adults produces satisfactory results.

## INTRODUCTION

Clavicle fractures account for 2.6% of all fractures. They constitute one in every 20 adult fractures. More than 75% of clavicular fractures are located in the midshaft (1). There are many treatment methods suggested for clavicle fractures although majority are traditionally treated non operatively. Fractures of the middle third of the clavicle show a rotatory posterosuperior angular displacement of the medial fragment whereby the trapezius muscle had been penetrated and soft tissue interposition prevented fragments from contacting each other. In the same way overlap in multiple fragment fractures results in a shortening of the shoulder girdle at the fracture site which leads to poor cosmetic and functional results (2).

In an Allman (3) I fracture, the distal fragment is pulled distally and medially due to the influence of the weight of the upper extremity and the pectoralis major muscle, while the proximal fragment is elevated due to the force of the sternocleidomastoid.

The incidence of non-union in midclavicular fractures is usually quoted as being 0.1-0.8% (4) with non-operative treatment. More recent data, based on detailed classification of fractures, suggest that the incidence of non union in displaced midshaft clavicular fractures is between 10-15% especially in those with an initial shortening of more than 20mm (5). Malunion with shortening and rotational

deformity can be debilitating for the patient and challenging for the surgeon as it does not remodel in adults. It can be associated with orthopaedic, neurologic and cosmetic problems. Emphasis in literature has been more on non union until it was reported that patients with a shortening of greater than 15mm had statistically significantly more pain (2, 6).

This paper analyses the result of operative fixation of freshly displaced clavicular fractures with an initial shortening of more than 20mm in a district general hospital. We selected this criterion because there is no paper analysing the results of fixation based on this indication even though there is published evidence proving that the results of conservative management are not good with this type of fracture.

## MATERIALS AND METHODS

From 2000 to 2005, 56 adult patients with an acute non-pathological fracture of the midshaft of the clavicle with an initial shortening of 20mm or more (Fig 1) were treated surgically at Southend District General Hospital, Essex, United Kingdom.

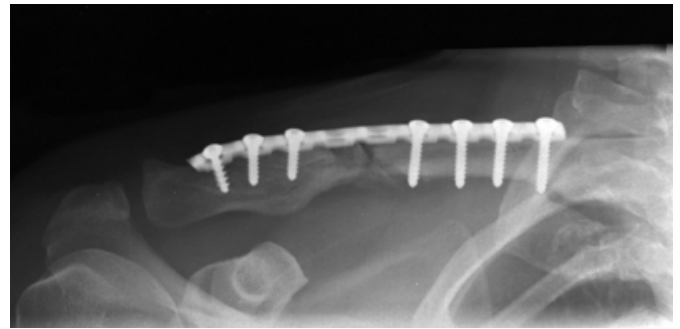
**Figure 1**



Thirteen patients sustained the fracture following a fall. Road Traffic Accidents accounted for 35 of the clavicular fractures, five secondary to sports injuries and three were due to an assault. There were 39 fractures on the right side. Thirty nine patients were affected on their dominant side. Twenty eight patients were involved in light work, 26 were heavy manual workers and two were unemployed

Patients were operated on the next available trauma list. The decision to operate was taken by the consultant in the trauma clinic based on the clavicular shortening of more than 20mm on initial radiographs. Patients less than 16 years, compound injuries, floating shoulder, neurovascular injury or impending skin perforation were excluded from the study. Informed consent was taken in the clinic and patients were admitted on the day of the operation. The timing of the operation was three days post injury on an average. The surgery was performed under general anaesthesia with patient in beach chair position by the surgeon. A longitudinal incision along the superior border of clavicle was made. Larger branches of supraclavicular nerve were protected. The fracture was reduced by open method and fixed with a reconstruction plate and screws with the aim of restoring the clavicular length and to obtain at least 6 cortices purchase on each side (Fig 2). Lag screws were used for the large butterfly fragment. None of the cases had to be bone grafted primarily.

**Figure 2**



Post operatively, the limb was put in a triangular sling and mobilised within pain limits straight away. The patients were encouraged to do pendulum exercises and were advised to avoid lifting heavy weights at the time of discharge. The average length of inpatient stay was 1.8 days. The patients were discharged the following day and followed up at two weeks for wound check, six weeks, 12 weeks and 24 weeks and as required until there was clinical and radiological union.

### RESULTS

There were 41 males and 15 females, the average age being 34.3 years (Range 16-65 years). Dominant side was fractured in 67% of the patients. The follow up varied between six months to 24 months. All the fractures healed in anatomical position.

Patient outcomes were assessed based on Constant score, complications, and patient satisfaction questionnaire. Two wounds had a superficial infection. The wounds were dressed regularly and healed in two weeks. One patient developed deep infection, for which the metal work had to be removed and replated with reconstruction plate after the infection settled. Two patients had hardware failure identified during follow up. Both fractures were replated on the anterior surface of the clavicle with reconstruction plates and did not need bone grafting.

Five patients had removal of plate due to prominent metal work and one was removed due to patient's choice. The plates were left in situ for a minimum of one year before removal.

The results were analysed by a Physiotherapist as a neutral observer using a Biodex machine. Constant score was used to assess outcome in 37 patients. Since it was impossible to allocate a preinjury score, the injured side was compared with the uninjured side. The Constant score ranged from 73-94 in these 37 patients and the mean score was 89.3. The

rest of the patients were assessed for outcome based on clinical case notes and telephonic questionnaire as they were unable to come for the appointment. There were no nonunions/ neurovascular complications or pulmonary injury due to surgery/shoulder droop/loss of strength/re-fracture.

The patients were asked specific questions about the scar, satisfaction with the operation, level of activity and return to work, pain on sleeping on the affected side, cosmetic abnormality.

Three patients (5.4%) considered the scar as poor out of which one had a scar hypertrophy. Fifty four patients (96.4%) thought that the operation helped them get back to their work and activities of daily living while two thought the contrary of which one of them had a claim going through. Fifty three patients (94.6%) felt that they would have the operation on the opposite side if their clavicle fractured.

### DISCUSSION

In this retrospective assessment we present the outcome and complications of plating of displaced midshaft clavicle fractures with an initial shortening of >20 mm in a district general hospital. Fractures of the clavicle account for 5-10% of all fractures, representing 35-45% of shoulder girdle injuries (7). According to Allman, midshaft fractures are the commonest type of clavicle fractures accounting for 80%. They occur at the site of lowest resistance of the bone, when it passes from a prismatic cross-section to a flattened one.

The clavicle does have several important functions, each of which can be expected to alter in nonunion or malunion. The long clavicle facilitates the placement of the shoulder in a more lateral position, so the hand can be more effectively positioned to deal with the three dimensional environment.

In treating fractures of middle third of clavicle, several factors should be considered: the patient's age and general conditions, fracture anatomy, occupation, personality of the patient, and other concomitant injuries (8).

Neers' (4) nonunion rate of 1% is misleading in that the patient population was mixed with regard to age, clavicular fracture site and severity of fracture. In Robinson's series (9) the non-union rate was between 4.5-9.5% for type 2B1/2 fractures. In Hill's series (3) 15% developed non-union. They found that 31% of the study group treated with non operative treatment were not satisfied with the management. In White and Anson study (10), the incidence was as high as 13% in

high energy fractures of the clavicle. Shortening of clavicle exceeding 17mm can result in abduction weakness due to restriction of the scapula in the adducted position by the shortened clavicle (3). Potential drawbacks of conservative management can be overcome by surgical treatment with the recovery of a normal anatomic profile.

Several methods of internal fixation have been suggested in the past. Intramedullary fixation of clavicle is technically more demanding because of the absence of clear-cut medullary cavity and does not offer rotational stability though produces better cosmetic results. Complication rates of intramedullary fixation can be as high as 75% (11).

Displaced fractures of clavicle with shortening of 20mm or more should not be treated the same way as undisplaced or minimally displaced fractures. It is very rare to achieve success with conservative treatment of such fractures (12, 13). A meta-analysis of recent studies reduced the risk of non union by 86% in the operative group compared to non operative group (11). The deforming force of sternocleidomastoid is very strong (14) and cannot be overcome by external supports provided by the figure of eight bandage.

Operative fixation allows earlier rehabilitation with a high level of patient satisfaction with respect to shoulder function. Pain relief is faster and there is no problem of shoulder straps. Rigid internal fixation may also allow patients to return to certain occupations and driving earlier. Reconstruction plates can be contoured best to the three dimensional anatomy of the clavicle

Primary fixation of the clavicle is a relatively easy procedure. Treating nonunions and malunions are more difficult and challenging than fresh fractures. However, the use of open reduction in the treatment of fresh fractures remains controversial; with wide geographical and institutional variation in the choice of treatment. There is still a reluctance to treat fresh clavicle fractures with primary internal fixation in significant number of institutions.

Stable operative fixation performed in carefully selected clavicle fractures can be a safe and effective treatment method to restore shoulder function with minimal complications (15). We have analysed the results of plating of fresh midshaft clavicular fractures with an initial shortening of 20mm or more in this study. In our series the union rate was 100%. We found the deep infection rate (1.8%) and hardware failure (3.6%) in par with most of the internal

fixation for trauma. 96% of the patients were satisfied with the operation. We accept that this a relatively small series and it is a retrospective study and that all the patients were not examined. Having found dealing with delayed unions/non unions relatively difficult to deal with in the past, our department's policy of treating displaced midshaft clavicle fractures with more than 20 mm shortening was changed to primary internal fixation with reconstruction plates in the year 2000 and the results support the change in our policy.

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