Research Article

# Outcomes of operative management of midshaft clavicular fractures

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## Abstract

**Aim:** To evaluate the the radiological and functional results of clavicular plating using a precontoured clavicle plate for the treatment of middle-third clavicle fractures in a case-series **Materials and Methods:** 34 patients with Type II( Robinson) clavicle fractures encountered at a tertiary centre - SCSMGHS Hospital, Solapur were studied prospectively. Mechanism of injury was grouped into fall from height, road traffic accident, sports and direct frontal blunt trauma. Patients between 13 years and 60 years of age were included in the study. They were treated operatively by low contact plating after written informed consent .They were started on passive and active assisted range of motion exercises from post-operative day two and pendulum exercises from day three when they were discharged. Active range of motion was started from day seven and patients were encouraged to start daily activities barring lifting heavy weights. They were followed up for a mean of 14 months and outcomes were evaluated radiologically using Lane and Sandhu system and functionally using Constant Shoulder Score. **Results:** Mean age group of patients was 23 years with 20 males and 12 female patients. Etiologically, 8(23.53%) patients suffered fracture due to fall from height, 16(47.06%) due to road traffic accident, 6 (17.65%) had sports injuries and 4(11.76%) had direct frontal blow to clavicle. According to Lane Sandhu system of radiological grading, there was 1(2.94%) patient with grade 1, none with grade 2, 9(26.47%) patients with grade 3 and 24(70.59%) patients with grade four changes. Using the Constant score, excellent functional results were obtained in 14(41.18%) patients, good results in 11(32.35%) patients, fair in 7(20.59%) patients and poor results were seen in 2(5.88%) patients. Grade 1 radiological outcome in 1 (2.94%) patient showed poor functional outcome. In grade 3, 2 (5.82%) patients showed excellent, 3 (8.82%) good, 3(8.82%) fair and 1(2.94%) showed poor functional outcomes. In grade 4, 12(35.29%) patients had excellent, 8(23.53%) had good and 4(11.76%) had fair outcomes. In our series, one patient had non-union and infection giving poor functional outcome. Another patient had infection which healed on antibiotics and led to fair functional results. **Conclusion:** Primary open reduction and internal fixation of midshaft clavicular fractures resulted in excellent radiological outcomes. It also resulted in early mobilisation (as compared to conservative treatment) with good to excellent functional outcomes with few complications.

**Keywords:** midshaft clavicular fractures.

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## INTRODUCTION

Clavicle fractures are commonly found in all age groups.1 These fractures account for 5 to 10% of all fractures 1,2 and represent 45 to 50% of all shoulder girdle injuries. Approximately 80% of fractures are in the middle third; 15% are in the lateral third; and 5% involve the medial third3-6. Historically, clavicle fractures have been treated nonoperatively with good functional outcomes. Nonoperative management usually includes a figure of 8 brace or a sling. Surgical intervention was reserved for certain limited situations, including open fractures, tenting of the skin by a sharp clavicle edge, neurovascular injury, and in association with a glenoid/scapula fracture ("floating arm"). There have been studies reporting a high dissatisfaction rate with outcomes of the nonoperative treatment of clavicle fractures.[7,8] In order to decide whether to treat clavicle fractures operatively or

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conservatively, a recent comprehensive review showed some evidence on the relative effectiveness of surgical versus conservative treatment for acute middle-third clavicle fractures[9], as related to an early decrease in pain, lower risk of mal-union and better functional outcomes[10,11]. Generally, a trend in favour of a surgical therapy can be observed and includes plating using low-contact plates or minimally invasive intramedullary devices such as titanium elastic nails[12,13].

## MATERIALS AND METHODS

34 patients with Type II (robinson) clavicle fractures encountered at a tertiary centre at SCSMGHS Hospital, Solapur were studied. Mechanism of injury was grouped into fall from height, road traffic accident, sports, direct frontal blunt trauma. Patients below 13 years and above 60 years of age were excluded from the study. They were treated operatively by low contact plating after written informed consent was taken. Post-operatively they were started on passive and active assisted range of motion exercises since post-operative day two and pendulum exercises since day three when they were discharged. Active range of motion was started from day seven and patients were encouraged to start daily activities barring lifting heavy weights. Sutures were removed at day twelve. They were followed up for a mean 14 months and outcomes were evaluated radiologically and functionally. Patients were evaluated radiologically using Lane and Sandhu system and functionally using constant shoulder score. A spring balance is attached distal on the forearm. Strength is measured with the arm in 90 degrees of elevation in the plane of the scapula (30 degrees in front of the coronal plane) and elbow straight. Palm of the hand facing the floor (pronation). The patient is asked to maintain this resisted elevation for 5 seconds. It is repeated 3 times immediately after another. The average in pound (lb) is noted. The measurement should be pain free. If pain is involved the patient gets 0 points. If patient is unable to achieve 90 degrees of elevation in the scapula plane the patient gets 0 points.

## RESULTS

1. Mean age group of patients was 23 years with 20(64.71%) males and 12(35.29%) female patients.
2. Mechanism of injury and classification

**Table 1**

| | 2A1 | 2A2 | 2B1 | 2B2 |
|---|---|---|---|---|
| FFH | 2 | 1 | 5 | 0 |
| RTA | 0 | 4 | 7 | 5 |
| SPORTS | 1 | 2 | 2 | 1 |
| DFBT | 0 | 0 | 2 | 2 |

Total 8(23.53%) patients suffered fracture due to fall from height, 16(47.06%) due to road traffic accident,6 (17.65%)had sports injuries and 4(11.76%) had direct frontal blow to clavicle.

**Table 2:** Radiological evaluation

| | 2A1 | 2A2 | 2B1 | 2B2 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 0 | 0 |
| 3 | 2 | 0 | 4 | 3 |
| 4 | 1 | 7 | 12 | 4 |

According to Lane Sandhu system of radiological grading, there was 1(2.94%) patient with grade 1, none with grade 2, 9(26.47%) patients with grade3 and 24(70.59%) patients with grade four changes seen.

**Table 3:** Functional scoring

| | 2A1 | 2A2 | 2B1 | 2B2 |
|---|---|---|---|---|
| Excellent | 3 | 1 | 9 | 1 |
| Good | 0 | 4 | 2 | 5 |
| Fair | 1 | 2 | 3 | 1 |
| Poor | 0 | 0 | 1 | 1 |

Using the constant score excellent functional results were obtained in 14 (41.18%) patients, good results in 11(32.35%) patients, fair in 7(20.59%) patients and poor results were seen in 2(5.88%) patients.

**Table 4:** Radiological and functional outcomes

| | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 0 | 0 |
| 3 | 2 | 3 | 3 | 1 |
| 4 | 12 | 8 | 4 | 0 |

Grade 1 radiological outcome in 1 (2.94%)patientshowed poor functional outcome .In grade 3 ,2(5.82%) patients showed excellent,3(8.82%) good,3(8.82%) fair and 1(2.94%) poor functional outcomes. In grade 4, 12 (35.29%) patients had excellent, 8(23.53%) had good, 4(11.76%) had fair outcomes.

**Complications:** In our series, one patient (2.94%) had nonunion and infection giving poor functional outcome. Another patient had infention which healed on antibiotics and led to fair functional results. Acute Midshaft Clavicular Fracture

Figure 1

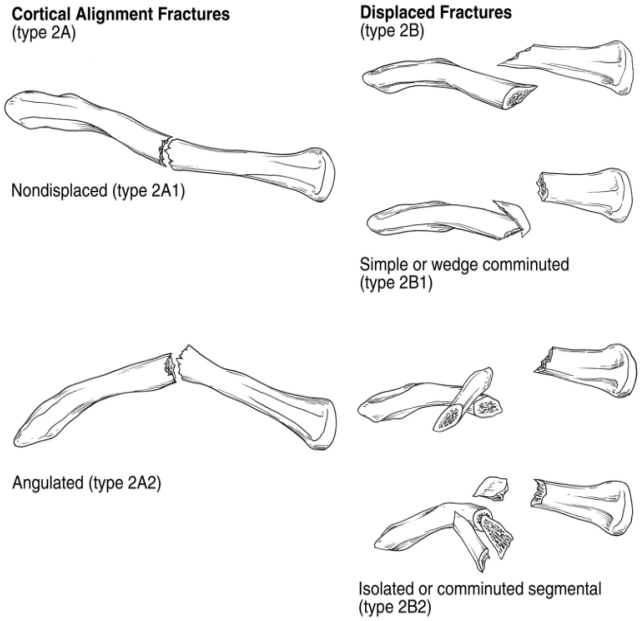


**Figure 2:** Robinson's classification system for midshaft clavicular fractures. (Reproduced with permission from Robinson CM: Fractures of the clavicle in the adult: Epidemiology and classification. J Bone Joint Surg Br 1998; 80:476-48

Clavicle fractures: Allman Classification Allman F L, JBJS (A) 49:774-784, 1967
Group 1: fracture of middle 1/3, most common
Group 2: fracture distal to C-C ligament, non-union common
Group 3: fractures of proximal end clavicle
Clavicle fractures: Neer's Classification
In: Shoulder Reconstruction, edited by Neer II, CS, 363-420, W B Saunders Co, 1990
Type 1: Middle third clavicle fracture (80%)
Type 2: Distal end clavicle fracture (15%)
Type 3: Medial 1/3 clavicle fracture (5%)
Clavicle fractures: Robinson Classification
Robinson CM, JBJS (Br) 80:476-484, 1998

| | | |
|---|---|---|
| Type 1: Medial 1/5th clavicle fractures | Undisplaced | Extra-articular<br>Intra-articular |
| | Displaced | Extra-articular<br>Intra-articular |
| Type 2: Middle 3/5th clavicle fractures | | |
| Cortical alignment fractures | Undisplaced | |
| Displaced fractures | Angulated<br>Simple, wedge comminution<br>Multifragmentary, segmental | |
| Type 3: Lateral 1/5th clavicle fractures | Undisplaced | Extra-articular<br>Intra-articular |
| | Displaced | Extra-articular<br>Intra-articular |

Lane-Sandhu scoring system

| Score | Radiologic findings |
|---|---|
| 0 | No callus |
| 1 | Minimal callus |
| 2 | Callus evident but healing incomplete |
| 3 | Callus evident with stability expected |
| 4 | Complete healing with bone remodelling |

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## DISCUSSION

C.M.Robinson[14] studied 1000 clavicle fractures. Mean age of the fracture population was 33.6years (13 to 96), the male-to-female ratio was 2.6:1 and the ratio of left- to right-sided fractures was 1.28:1.In their study simple fall caused fracture in 309 patients, fall from height in 108,sport in 234,RTA in 272,direct violence in 46 and other causes in 31. In our study, mean age group of patients was 23 years with 20(64.71%) males and 12(35.29%) female patients. Total 8(23.53%) patients suffered fracture due to fall from height, 16(47.06%) due to road traffic accident, 6 (17.65%) had sports injuries and 4(11.76%) had direct frontal blow to clavicle. Historically, clavicle fractures have been treated conservatively with sling of figure of eight bandage. A meta-analysis of 2144 clavicle fractures by Zlowodski *et al*[6] showed a non-union rate of 15% for displaced clavivle fractures treated conservatively while non-union rates for those treated with open reduction internal fixation were 2%. A multicentre prospective randomised trial by the Canadian Orthopaedic Society[5] concluded that operative fixation of a displaced fracture of the clavicular shaft results in improved functional outcome and a lower rate of malunion and nonunion compared with nonoperative treatment at one year of follow-up. Their study supported

primary plate fixation of completely displaced midshaft clavicular fractures in active adult patients. Modern studies on primary plate fixation of acute midshaft clavicular fractures have described high rates of successful results with rates of union ranging from 94% to 100% and low rates of infection and surgical complications: a recent meta-analysis of plate fixation for 460 displaced fractures revealed a nonunion rate of only 2.2%.[11,15]. In our study there was 1(2.94%) nonunion while union was seen in 33(97.06%)[6,15]. There was a clear superiority of operative fixation, with significantly superior surgeon-based (Constant shoulder score) and patient-based (DASH) outcome measures at every time-point in the study. The improvement in scores (approximately 10 points for each) was clinically relevant as well as significantly superior. Patients who underwent operative fixation also had an earlier return to normal function.[5] Similarly in our study, score excellent functional results were obtained in 14 (41.18%) patients, good results in 11(32.35%) patients. A meta-analysis of recent studies revealed that the rate of nonunion for displaced midshaft clavicular fractures was 2.2% (ten of 460 patients) after plate fixation compared with 15.1% (twenty-four of 159 patients) after nonoperative care, a relative risk reduction for nonunion of 86%14. That meta-analysis also showed that primary plate fixation was, contrary to prevailing opinion, a safe and reliable procedure[6]. Wound infection and dehiscence following plate fixation of the clavicle has been a feared complication. Out of 111 patients Canadian Orthopaedic Society study group had three patients with such complications, and all were managed with antibiotics and local wound care. One patient in the operative group experienced premature hardware failure in an all-terrain vehicle accident six weeks after fixation and required repeat fixation. In our study, there were two infections one of which resolved on antibiotics. The other led to non-union necessitating implant removal and debridement with plating with bone grafting done at a later stage.

## CONCLUSION

Primary open reduction and internal fixation of midshaft clavicular fractures resulted in excellent radiological outcomes.

It also resulted in early mobilisatio with good to excellent functional outcomes with few complications. Limitations of this study are small sample size and lack of comparative assessment with non-operative methods.

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