

# Study of Functional and Radiological Outcome of Midshaft Clavicle Fractures Managed Operatively With Plating

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## Abstract

**Introduction:** Clavicle is one of the commonly fractured bones. Shortcomings of conservative treatment are non-cosmetic bump in addition to non-union in few cases. Shortcomings of operative treatment are hypertrophic scar and hardware-related issues in addition to surgical site infection possibility. Hence, we decided to carry out prospective follow-up study.

**Materials and Methods:** A prospective follow-up study was done in 57 consecutive patients from February 2016 to January 2017 at MIMER Medical College, Talegaon Dabhade. Patients were operated with precontoured 3.5 mm dynamic compression plate over superior aspect of clavicle. Patients were followed up at 2, 4, 6, 12, and 24 weeks after operation.

**Results:** In our study, mean time for radiological union was 39.4 days only with operative treatment. In our study, only there was only one case of non-union of 51 patients were present (<2%). Overall, satisfaction rate after operative treatment was quite high in our study. There were hardware problems in 10 cases of 51 patients, that is, about 19.60% of cases. These included screw loosening (4 cases) and hardware prominence in 6 cases (i.e. 11.76%). Hypertrophic scar in 2 cases (3.92%) and infection in 1 case (1.96%) were seen. Range of motion of shoulder was near normal.

**Conclusion:** Open reduction and internal fixation of midshaft clavicle fractures give good functional and radiological outcomes with high patient satisfaction rate without any major complication.

**Key words:** Clavicle, Malunion, Non-union, Plating

## INTRODUCTION

Clavicle is one of the commonly fractured bones which accounts for about 2–3% of all fractures and up to 40–45% of all fractures of the shoulder girdle fractures.<sup>[1]</sup> In India, almost all clavicle fractures including displaced or comminuted ones are managed conservatively traditionally

even in the laborers or daily wage workers who rely on good shoulder function for their livelihood. However, there is 10–15% non-union rate in severely displaced or comminuted fractures if conserved according to literature.<sup>[2]</sup> However, it is still not clear whether surgery produces better outcomes than non-surgical treatment.<sup>[3]</sup> Robinson has classified clavicle fractures into three types based on their location along the bone. Fracture of middle third is about 70–80% of all these.<sup>[4]</sup> Shortcomings of conservative treatment are non-cosmetic bump in addition to non-union in few cases.<sup>[5]</sup> Shortcomings of operative treatment are hypertrophic scar and hardware-related issues in addition to surgical site infection possibility.<sup>[6]</sup> Hence, we decided to carry out prospective follow-up study to evaluate the outcome of operative treatment of midshaft clavicle fractures.

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## MATERIALS AND METHODS

A prospective follow-up study was done in 57 consecutive patients from February 2016 to January 2017 at MIMER Medical College, Talegaon Dabhade, provided patients fulfilled the inclusion criteria and gave informed consent before study to participate in the study. Appropriate ethical clearance was obtained. All patients were followed up regularly for 6 months. Of the original 57 patients, three did not follow-up, one sustained head injury, one sustained fracture of ipsilateral limb, and one died due to unrelated cause. Hence, only 51 patients remained in the study. Inclusion criteria were midshaft fractures in skeletally mature patients. We excluded patients with immature skeleton (<18 years age), open fractures, pathological fractures, associated head injury, neurovascular injury, or ipsilateral limb injury. Patients were operated with precontoured 3.5 mm dynamic compression plate (DCP) over superior aspect of clavicle without damage to underlying neurovascular structures after open reduction of fracture. Limb was immobilized in a simple sling in patients. Rehabilitation was started immediately after plate fixation. Pendulum exercises were started initially followed by passive range of motion (ROM) for 2 weeks, followed by active assisted and full active ROM according to clinical and radiological signs of union of fracture. Usually, after 12–14 weeks, all patients returned to their original level of activity. Functional outcome was measured with constant score and DASH score while radiological assessment was done by radiologist. The fracture was considered as united when there was no tenderness at fracture site and X-ray showed bridging callus. Adverse event and complications were also noted. Patients were followed up at 2, 4, 6, 12, and 24 weeks after operation. Yes/no type of subjective questions pertaining to pain/complications, quality of life, and return to work, whether they would recommend surgery to someone else, were prepared for general satisfaction questionnaire outcome at the end of study. Depending on response, grading as poor, fair, good, very good, and excellent was done.

All statistical significances were established as  $P < 0.05$ . Two sampled *t*-test for gender, fracture type on functional outcome score, and side of fracture were done. Paired *t*-test was used for ROM of operated and normal shoulder.

SPSS software version 20.0 was used for statistical analysis.

## RESULTS

Mean time for radiological union was 39.4 days (range 32–179 days) [Table 1].

Beyond 180 days, in the absence of clinical and radiological signs of union, one case was considered as non-union. After bone grafting, it also united. There were hardware prominence problems in 10 cases. Hypertrophic scar was seen in 2 cases. Superficial infection was seen in one case which resolved with oral antibiotics alone. Paresthesia in 2 cases also resolved in 10–12 weeks. Mean constant and DASH scores were  $95.35 \pm 6.26$  (range 81–98) and  $0.98 \pm 2.19$  (range 0–9.2), respectively. There were no other complications in our patients.

Overall, satisfaction rate was quite high (90.2%) [Table 2].

Thus, there was no gross restriction of movements of shoulder on affected side [Table 3].

## DISCUSSION

Conservative management has been mainstay of management of middle third clavicle fractures irrespective of displacement or comminution in India. However, there are many cases of non-union (15%) in displaced clavicle fractures according to literature. Furthermore, there are other problems such as malunion, decreased ROM of shoulder, and lower satisfaction rate after conservative

**Table 1: Demographic details**

Variable	Number of patients (%)
Gender	
Male	33 (64.71)
Female	18 (35.29)
Side	
Dominant	27 (52.94)
Non-dominant	24 (47.06)
Robinson type	
2B1	34 (66.67)
2B2	17 (33.33)

**Table 2: General satisfaction questionnaire outcome**

General satisfaction	Number of patients n=51 (%)
Excellent	34 (66.67)
Very good	12 (23.53)
Good	3 (5.88)
Fair	2 (3.92)
Poor	2 (0)

**Table 3: Range of motion**

Range of motion in degrees	Affected side	Normal side
Mean abduction	174.09	175.95
Mean ext. rotation	83.64	85.127
Mean int. rotation	66.608	68.608
Mean flexion/extension	174.35	176.17

management (one-third not satisfied).<sup>[7]</sup> According to literature, there is a significant reduction in malunion cases and non-union cases (only 2.2%) if operative treatment is performed.<sup>[8]</sup> Hence, we evaluated results of operative treatment at our Medical College Hospital and compared it with literature studies.

In our study, demographic variables were comparable to other studies. In our study, mean time for radiological union was 39.4 days only with operative treatment. In study conducted by Naveen *et al.*, time for union in clavicle fractures treated conservatively was 11.29 weeks, i.e., 79.03 days.<sup>[9]</sup>

In our study, only there was only one case of non-union of 51 patients were present (<2%). According to literature, there is risk of 15–20% that displaced clavicle fractures treated conservatively can go into non-union and about 2.2% if treated operatively.<sup>[9]</sup> Thus, our results are consistent with literature. Overall, satisfaction rate after operative treatment was quite high in our study. This is consistent with literature.<sup>[10]</sup> Mean constant and DASH scores were correlating with literature. Open reduction and internal fixation of clavicle can be performed with either plate or intramedullary pin fixation. However, since plate fixation can provide immediate rigid fixation, we performed plating over intramedullary pin fixation.<sup>[11]</sup>

There were hardware problems in 10 cases of 51 patients, that is, about 19.60% of cases. These included screw loosening (4 cases) and hardware prominence in 6 cases (i.e., 11.76%). This can be explained by the fact that clavicle is subcutaneous bone, and there is less soft tissue envelope over implanted hardware contributing to hardware problems.<sup>[12]</sup> To decrease hardware problems recently, there are studies which advocate positioning hardware along the anterior surface of clavicle as opposed to superior surface of clavicle.<sup>[13]</sup> However, we placed plate along superior surface only as it was decided in study protocol already, and we did not want to divulge from our methods decided while we got ethical committee approval. In literature also rates for early removal of prominent hardware is around 8% and wound problems due to hardware are about 5%.<sup>[13]</sup> Hypertrophic scar in 2 cases (3.92%) and infection in 1 case (1.96%) are also thus consistent with literature due to subcutaneous location of hardware. However, we

did not encounter any major complications such as neural or vascular damage, implant breakage, skin necrosis, deep infections, or adhesive capsulitis of shoulder in any case.<sup>[13,14]</sup> ROM of shoulder was near normal in almost all patients who were operated with plating.

## CONCLUSION

Open reduction and internal fixation of midshaft clavicle fractures give good functional and radiological outcomes with high patient satisfaction rate without any major complication. However, there was no control group in our study and follow-up period was short; hence, we cannot comment about late complications of procedure.

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