

## Operative versus Conservative Treatment for the Management of Displaced Midshaft Clavicle Fractures in Adults

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### Abstract

**Introduction:** Displaced fractures of mid third clavicle are common in young athletic population and choice of management is still controversial. Recent studies have shown that these fractures do not have favourable outcomes with non-operative management and non-union rates could be as high as 20%, in addition, there is symptomatic malunion with shortening.

**Objective:** To compare the results of the operative versus that of conservative treatment for the management of displaced midshaft clavicular fractures.

**Materials and Methods:** This prospective cross-sectional study was carried out in Orthopaedic and Trauma center, CMH, Dhaka, from the period of January 2014 to December 2016 to compare results of open reduction and internal fixation by plating with that of conservative management. Total 60 patients (30 in each group) were analyzed in terms of fracture union and functional outcome. Patients in the non-operative group were managed by triangular sling with or without strapping whereas in the operative group fractures were reduced and fixed with a contoured reconstruction plate. Patients were actively followed up for 12 months and functional outcome was measured by Rowe and Oxford shoulder scoring system. Complications were monitored clinically and radiologically.

**Results:** All fractures in the operated group united compared with thirteen cases of symptomatic malunion (43.33%) in the non-operated group which is statistically significant. Rowe and Oxford scores was significantly higher in the operated group than the non-operated group in every occasion of follow-up. There was no major complication of surgery. In one patient (3.33%) plate had to be removed for hardware irritation and prominence.

**Conclusion:** Open reduction and internal plate fixation in acute displaced midshaft clavicular fractures resulted in improved outcome decreased rate of non-union and symptomatic mal-union compared with non-operative treatment.

**Key-words:** Displaced clavicle fracture, Operative versus conservative management, Oxford shoulder score, Rowe score, Reconstruction plate.

### Introduction

The clavicle fracture is a common fracture of young active adults accounting for 2.6%-4% of all fractures<sup>1</sup> mainly caused by high energy injuries sustained in road traffic accident (RTA) or sports injury. Fractures occur most commonly in the middle third of the bone (76-82%) less often in the distal (12-21%) and medial (3-6%) thirds<sup>2,3</sup>. All mid shaft fractures occur lateral to the sternocleidomastoid muscle and medial to the coracoclavicular ligaments. The medial fragment is pulled superiorly and posteriorly by the sternocleidomastoid muscle. The lateral fragment is pulled forward and rotates inferiorly due to the weight of the upper extremity and the pull of the pectoralis muscle<sup>4</sup>. Several recent studies reported worse results with conservative treatment: a non union rate of 15-20%, shoulder muscle strength loss of 18-33%, poor early functioning of the injured shoulder, and as many as 42% of patients with residual sequelae 6 months after injury<sup>5-10</sup>. Since this injury occurs most often in young active patients who want to avoid above complications, primary operative treatment has become common. Several fixations treatment are used, such as intramedullary nail, plate and screws and a locking plate and screws<sup>8,11-15</sup>. Numerous randomized studies comparing conservative to operative have been conducted<sup>5-10</sup>. Xu et al<sup>10</sup> and McKee et al<sup>5</sup> performed a meta analysis to determine

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the preferred treatment. They found a higher non union and symptomatic malunion rate after conservative treatment. Conservative management in the form of a figure of eight bandage and sling<sup>16</sup>. Recently surgical methods have been increasingly used for displaced midshaft fracture of the clavicle. Both modalities of treatment have certain merits and demerits. The aim of this study was to evaluate and compare the outcome of conservative management and surgical treatment of displaced midshaft clavicle fracture in Bangladeshi population.

### Materials and Methods

This cross-sectional prospective study was carried out in Orthopaedic and Trauma Center of the Combined Military Hospital (CMH) Dhaka from the period January 2014 to December 2016. Simple random sampling was done with the willing patients. The first case was managed by non-operative method and the second was managed by operative method and soon. All adult patients irrespective of sex were included in the study. Patients with an open fracture, fractures associated with neurovascular injury, pathological fracture and associated rib fracture or head injury were excluded from the study.

Total 60 patients (30 in each group) were included in the study. In the non-operative group, 24 patients received triangular sling and six patients received the strapping and triangular sling. Patients were encouraged to move joints from day one. From 14 days onwards pendulum and elbow range exercises were permitted. After six weeks removal of the brace and restricted exercises were encouraged.

In the operative group (n=30), surgery was performed under general anaesthesia using curvilinear anterior superior subcutaneous approach. After incision branches of supra-clavicular nerves were protected as much as possible and in most cases, fractures were fixed with 3.5mm reconstruction plate six to eight holes to ensure at least six to eight cortex fixations. In two cases where fracture sites were comminuted interfragmentary screws were used. A shoulder arm pouch was used for comfort. From 2nd postoperative day (POD) passive movements of the shoulder, elbow and wrist was permitted.

Sutures were removed between 10-14th postoperative periods. From 14th day onwards pendulum exercises and unrestricted range of movements were allowed. Physically active patients were allowed to return to normal activities after 12 weeks Patients were followed up at 6 weeks and then at 3, 6 and 12th month. From 6th weeks onwards roentgenogram was taken to judge the sign of union.



Fig-1: Operative photograph showing a fracture of the clavicle fixed with contoured recon plate, one interfragmentary screw has been used to fix the butterfly fragment.

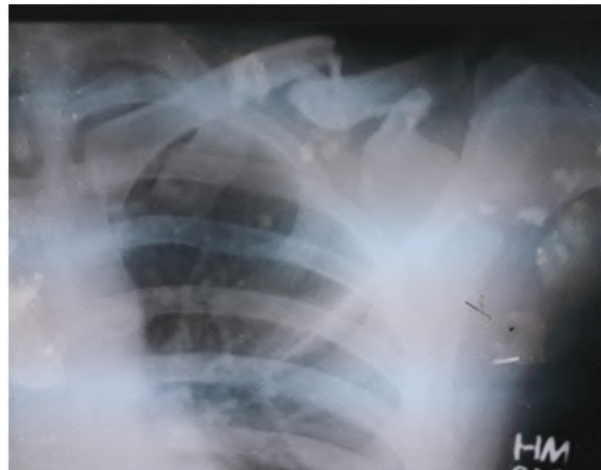


Fig-2: Plain x-ray of fracture middle third of clavicle with gross displacement.



Fig-3: Postoperative x-ray showing clavicular length restored and fixed with reconstruction plate.

Functional ability of the shoulder joint was assessed by Rowe score<sup>3</sup> and oxford shoulder score<sup>17</sup>. Rowe score (0-100) comprises stability (50 Points), motion (20 points) and function (30 points). While Oxford shoulder score (12-60) based on 12 questions on easiness of shoulder joint movement for routine activities (each question carries 1-5 points). All data were recorded in a preformed data sheet and subsequently analyzed using statistical package of social sciences (SPSS) 17.0 version. P-value <0.05 was considered to be significant.

## Results

There was no significant difference in age between the two groups (31.61±8.32 & 30.58±9.56yrs). In operative group (n=30) all patients were male whereas in the non-operative group male patients were 25. Maximum patient (14 Patient in both group=28) had clavicle fracture due to RTA, followed by 6 patients in operative and 7 in non operative group due to fall on outstretched hand, Sports injury was the causes of fracture in 10 patients of operative group and 9 in non operative group. The right side was affected in 31 cases whereas rest 29 cases were affected on the left side. But all the above criteria showed no significant difference between operative and non operative groups.

**Table-I:** Distribution of patients according to sex, site and mechanism of injury

Variables		Operative Group (n=30)	Non-operative Group (n=30)	Statistical Significance
Sex	Male	30	25	Not Significant
	Female	0	5	Not Significant
Mean age (years)		31.61±8.32	30.58±9.56	Not Significant
Side of injury	Rt	16	15	Not Significant
	Lt	14	15	Not Significant
Mechanism of injury	RTA	14	14	Not Significant
	Fall from height	06	07	Not Significant
	Sports injury	10	09	Not Significant

**Table-II:** Distribution of functional score between operative and non operative group

Period	Scoring System	Score		Statistical Significance
		Op Group (n=30)	Non-Op Group (n=30)	
02 weeks	Rowe score	69.91±8.26	64.25±10.16	significant
	Oxford shoulder score	39.65±6.32	34.35±7.62	significant
06 weeks	Rowe score	74.15±9.17	69.62±8.53	significant
	Oxford shoulder score	44.65±7.42	39.65±7.18	significant
03 month	Rowe score	80.21±5.14	72.74±9.62	significant
	Oxford shoulder score	48.85±6.19	43.04±7.54	significant
06 month	Rowe score	90.95±8.66	83.46±9.21	significant
	Oxford shoulder score	52.21±5.14	44.17±8.15	significant
12 month	Rowe score	91.63±7.72	83.81±9.27	significant
	Oxford shoulder score	55.52±5.41	48.38±7.94	significant

**Table-III:** Distribution of outcome according to management

Variables	Operative Group (n=30)	Non-operative Group (n=30)	Statistical Significance	
Average time of Union (weeks)	10.18±0.84	18.37±2.17	significant	
Average time taken to return normal activity (weeks)	12.14±2.33	23.46±3.71	significant	
Raw score grading (on 12 month)	Excellent (90-100)	19	10	significant
	Good (70-89)	10	10	
	Fair (40-69)	1	09	
	Poor (<40)	00	01	

**Table-IV:** Distribution of complications

Variables	Operative Group (n=30)	Non-operative Group (n=30)	Statistical Significance
Symptomatic malunion	00	13(43.33%)	significant
Muscle wasting	00	08(26.66%)	significant
shortening	00	05(16.66%)	significant
Droopy shoulder	00	02(6.66%)	Not significant
Complex regional pain syndrome	00	02(6.66%)	Not significant
Hardware irritation	01	00	Not significant

Functional ability of the affected shoulder as assessed by Rowe's and Oxford shoulder scoring system on each follow up summarized in Table-II. The difference of score in the operative and the non-operative group was significant. And on 12 months as per the Rowe score outcome was excellent in 19 patient of operative group whereas it was excellent in 10 patient of the non-operative group and the difference is statistically significant.

The average time for union was  $10.18 \pm 0.84$  weeks in the operative group whereas it was  $18.37 \pm 2.17$  weeks in non-operative group and time taken to return to the normal activity it was  $12.14 \pm 2.33$  weeks in operative group and  $23.46 \pm 3.71$  weeks in non-operative group. Both outcomes are statistically significant (Table-III).

Regarding complications, there were symptomatic malunion on 13 patients (43.33%) muscle wasting in 8 patients (26.66%) shortening in 5 patients (16.66%) droopy shoulder and complex regional pain syndrome each in 2 patients (6.66%) of non-operative group. There were no such complications in operative group. But in the operative group there was a case of hardware irritation and prominence associated with mild pain; the plate was removed on 9th month after which the patient was asymptomatic with normal shoulder activity on the 12th month. There were no other complications like wound infection, hypertrophic scar or keloid, implant failure, neurovascular deficit in any patient of operative group. Patient satisfaction was achieved in 10 patients (33.33%) of non-operative group whereas it was in 29 patients (96.66%) of the operative group and the difference is statistically significant.

## Discussion

The percentage of malunion in the non-operative group of midshaft clavicle fracture as found in this study was 43.33% compared to 0% in operative group. Other complications like muscle wasting (26.66%), shortening (16.66%) were also significantly higher in non-operative group. Regarding functional ability as observed by Rowe's score and Oxford shoulder score on many occasions, it was significantly better in operative group.

Robinson and co-workers reported nonunion rate of 21% for the displaced comminuted midshaft fractures when managed conservatively<sup>18</sup>. Hill et al<sup>19</sup> published an unsatisfactory outcome rate of 31% and Nowak et al<sup>18</sup> found 46% patients experienced symptomatic outcome when their midshaft clavicle fracture was managed conservatively. The findings of these studies

simulate the outcome of this study. A multicenter randomized controlled study also favours these findings by reporting that early primary plate fixation of completely displaced midshaft clavicle fractures results in improved patient-oriented outcomes, earlier return to function and decreased rate of non-union or mal-union.

The definitive indication for acute surgical intervention in midshaft clavicle fracture includes skin tenting, open fractures with neurovascular compromise, floating shoulder. Outside these indications, the management of displaced fractures of midshaft (Edinburgh type 2B) still remains somewhat controversial. Recent literature<sup>20</sup> is challenging the traditional belief that midshaft clavicle fracture uniformly heals without a functional deficit. This paradigm shift was well supported by progressive classification system have led many authors to recommend acute surgical fixation of these fracture subtypes<sup>18</sup>.

Therefore, relative indication for acute surgical treatment may include younger active patients with clavicle shortening greater than 1.5 to 2 cm, significant concentric deformity or multiple trauma situations. Open reduction and internal fixation (ORIF) of clavicle fracture can be performed with either plate or intramedullary pin fixation. Plate fixation can provide immediate rigid fixation, helping to facilitate early mobilization<sup>10</sup>. A meta-analysis of current data on displaced fractures suggested a relative risk reduction of 87% and 86% for no-union as compared with conservative treatment by use of intramedullary pin fixation and plate fixation respectively<sup>22</sup>.

However, surgical fixation of clavicular fracture is not without complication. Although no major complications encountered in this study but authors have reported complications like non-union, infection, neurovascular injuries, hardware failure and re-fracture of clavicle<sup>22,23</sup>.

Due to the limited soft tissue envelope, the plating used for ORIF can be prominent especially in these individuals. The rate of removal of hardware for prominence is reported to be 8%<sup>20</sup> whereas it was 3.33% (one patient) in this study. Positioning the hardware along the anterior surface of the clavicle as opposed to more traditional superior position can reduce the hardware irritation. Intramedullary pin fixation or use of recently introduced anatomically contoured clavicle plate may reduce the need of hardware removal<sup>20</sup>. In this series, patients average time of union and average time taken to return to normal activity were significantly earlier in the operative group which is very important for active individuals like soldiers.

This small-scale study population was mainly soldiers with an active lifestyle; many probably didn't comply with the non-operative treatment protocol. This may have resulted in poorer outcome in the non-operative group. The major strength of this study was the excellent follow-up rates (90-100%). However, multicenter large study including patients of all age groups will definitely help to establish the superiority of ORIF of mid third clavicle fracture over conservative management.

## Conclusion

It can be concluded from this study that plating in displaced mid third clavicle fracture is a predictable method to maintain anatomic reduction, achieve union with the restoration of optimum shoulder function and minimum complication compared to conservative management. Patient will feel better if the individual can return to normal activity earlier without any complication.

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