

## Surgical Management of Clavicle Fracture in Tertiary Care Centre: A Clinical Study

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Received: 25 July 2018 Accepted on: 31 August 2018

### Abstract

**Introduction:** Clavicle fracture is one of the commonest traumatic injuries around shoulder girdle due to its subcutaneous position. Despite the poor outcome like mal-union and non-union in severely displaced clavicle fracture cases traditionally non-operative management has been in practice. However, surgery can lead to accurate reduction, rigid fixation and quick pain relief with very few complications. **Material and Methods:** This was a prospective study which was carried out in the departments of orthopaedics in Rajshree Medical Research Institute, Bareilly from June 2017 to May 2018. Study population included fifty patients (50) of either sex above 18 years suffering from clavicle fracture. **Results:** Results of the current study showed that 80% cases of among clavicle fracture belonged to middle 3<sup>rd</sup> while 20% of cases belonged to lateral 3<sup>rd</sup> of clavicle. Plates and cortical screws were used to manage all the fracture of middle 3<sup>rd</sup> of clavicle. Further, majority of patients received locking compression plate (48%), followed by reconstruction plate (16%) and dynamic compression plate (16%). Twenty eight patients (56%) with middle third clavicle fracture treated with plate and screws while six patients (12%) with lateral 3<sup>rd</sup> clavicle patients had excellent functional outcome. **Conclusion:** Clavicle fractures can be treated conservatively. However, there may be specific indications which indicate necessity of surgical procedure like displaced lateral third clavicle fracture, displaced middle third clavicle fracture and comminuted. Longer period of immobilization until union is required for the internal fixation methods as intramedullary fixation do not control rotation. A lesser period of immobilization is required for primary open reduction and internal fixation with plate and screws of fresh middle third clavicle fractures as it provides a more rigid fixation.

**Keywords:** Clavicle Fracture; Surgery; Functional Outcome; Complications.

### Introduction

Clavicle is a bony link which articulates thorax to shoulder girdle and facilitates the movements of shoulder girdle. Clavicle fracture is one of the commonest traumatic injuries around shoulder girdle due to its subcutaneous position [1,2]. Despite the poor outcome like mal-union and non-union in severely displaced clavicle fracture cases traditionally non-operative management has been in practice [1-3].

Low-energy or high-energy impacts are among the most common aetiological factors for clavicle fractures. Studies suggest that among all types of fracture incidence clavicle fracture is 5 to 10% and there is a high incidence of injuries to the shoulder girdle up to 40% [4,5]. Middle 3<sup>rd</sup> of the clavicle is most common site of clavicle fracture (70% to 80%) followed by lateral 3<sup>rd</sup> (12 to 15%) and medial third (5% to 8%). Fractures of the clavicle have been traditionally treated non-operatively [4].

Various methods of closed reduction have been attenuated; however, practically open reduction is

impossible to avoid deformity and disability in adults [1]. Different studies in recent past years recorded poor outcomes like mal-union and non-union upto 15% cases of clavicle fracture treated with traditional non-operative method [6].

Early fixation of clavicle fracture is advisable to avoid various complications like non-union, mal-union etc. This may be attenuated via surgery which causes accurate reduction and rigid fixation and leads to quick pain relief. Moreover, promote early functional recovery can be achieved by surgery [4,5].

Therefore, the present study was designed to assess the role of open reduction and internal fixation in clavicle fractures via various surgical procedures, clinically evaluate the results of various surgical procedures over fracture clavicle. To discuss merits and demerits of the various surgical procedures. Finally draw conclusions of overall study.

### Material and Methods

This was a prospective study which was carried out in the departments of orthopaedics in Rajshree Medical Research Institute, Bareilly from June 2017 to May 2018. Study population included fifty patients (50) of either sex above 18 years suffering from clavicle fracture.

#### Inclusion Criteria

Adult male and female patients above 18 years who require surgical intervention for Robinsons 8 type 2B and 3B displacement and comminuted middle third clavicle fracture and displaced lateral third clavicle fracture were included for this study after taking written consent from them.

#### Exclusion Criteria

Patients with clavicle fracture less than 18 years of age, not willing for surgery and unfit for surgery. A detailed clinical history including general examination, medical history and history of injury were recorded prior to the surgery. Complete clinical, local and radiological examinations were done while biochemical parameters were examined before the surgery in all patients.

Standard surgical and anesthetic protocols were followed for the surgeries. Middle 1/3rd fractures were treated with plate and screw fixation, while lateral 1/3rd clavicular fractures are fixed with

tension band wiring. All the cases were done under general anesthesia.

Postoperatively all cases were managed with antibiotics, oral fluids, immobilization with arm pouch and other supportive care. Sutures were removed on 10th postoperative day. Rehabilitation was initiated at weeks and followed up at 4-6 weeks. The whole rehabilitation process was designed to arrange active range of motion by 6-8 weeks of postoperative period. Further, clinical and radiological follow up of cases were done at four weekly intervals till radiological union is achieved. The functional outcome was assessed by Constant and Marley Score [2,3].

### Results

Results of the current study showed that 80% cases of among clavicle fracture belonged to middle 3<sup>rd</sup> while 20% of cases belonged to lateral 3<sup>rd</sup> of clavicle (Table 1).

Table 2 shows that majority of middle 3<sup>rd</sup> of clavicle fracture patients belonged to 21 to 30 years age group followed by 31 to 40 years of age group. There were 4 patients of middle 3<sup>rd</sup> of clavicle fracture more than 60 years of age. The average age of patients of middle 3<sup>rd</sup> of clavicle fracture were 37.6±6.2 years. On the other hand, maximum patients of lateral 3<sup>rd</sup> of clavicle fracture were up to 40 years. Rest of the patients of lateral 3<sup>rd</sup> of clavicle fracture were between 41 to 60 years. The average age of patients of lateral 3<sup>rd</sup> of clavicle fracture were 38.4±4.6 years.

**Table 1:** Distribution of clavicle fracture according to site of fracture

Site of fracture	No. of cases	Percentage (%)
Middle 3 <sup>rd</sup>	40	80%
Lateral 3 <sup>rd</sup>	10	20%
Medial 3 <sup>rd</sup>	0	-

**Table 2:** Distribution of clavicle fracture according to age group

Age in years	No. of middle 3 <sup>rd</sup> of clavicle fracture	Percentage (%)	No. of lateral 3 <sup>rd</sup> of clavicle fracture	Percentage (%)
21-30	15	30%	2	4%
31-40	12	24%	4	8%
41-50	5	10%	1	2%
51-60	2	4%	3	6%
>60	6	12%	-	-
Total	40	80%	10	20%

It is evident from table 3 that majority of middle 3<sup>rd</sup> of clavicle fracture were due to road traffic accident (48%), while 24% of middle 3<sup>rd</sup> of clavicle fracture were caused by falling on shoulder from two wheelers. Whereas, majority lateral 3<sup>rd</sup> of clavicle fracture were due to road traffic accident (14%) followed by simple fall of shoulder (6%).

Results of the present study revealed that 84% of clavicle fractures were found in male population while 16% of clavicle fracture belonged to female population (Table 4).

Classification of fractures as per Robinson Classification showed that there was no type-1 medial 3<sup>rd</sup> fracture among the clavicle fracture patients. In type-2 middle 3<sup>rd</sup> fracture type 2 B1 (displaced with simple or single butterfly fragment) occurred in 28% patients and type 2 B2 (displaced with comminuted or segmental) fracture were recorded in 52% patients. In lateral third clavicle fracture there were type 3 B1 (displaced with extra articular) occurred in 16% patients and type 3 B2

fracture (displaced with intra articular) were found in 4% patients (Table 5).

Table 6 shows that 94% of clavicle fracture patients including both middle 3<sup>rd</sup> of clavicle fracture and lateral 3<sup>rd</sup> of clavicle fracture patients went for surgery within one week. Whereas, 6% of clavicle fracture patients went for surgery in second week.

Plates and cortical screws were used to manage all the fracture of middle 3<sup>rd</sup> of clavicle. Further, majority of patients received locking compression plate (48%), followed by reconstruction plate (16%) and dynamic compression plate (16%) (Table 7).

It is evident from figure 1 that there plate prominence was most common minor complication recorded in 8 clavicle surgery patients, followed by hypertrophic scar (5), delayed union (5), restricted movement of shoulder (2) and plate loosening (1). Further, major complication of plate breakage was encountered in 2 patients.

**Table 3:** Distribution of clavicle fracture according to mode of injury

Mode of injury	No. of middle 3 <sup>rd</sup> of clavicle fracture	Percentage (%)	No. of lateral 3 <sup>rd</sup> of clavicle fracture	Percentage (%)
Fall on shoulder from two wheelers	12	24%	-	-
Road traffic accident	24	48%	7	14%
Simple fall of shoulder	2	4%	3	6%
Fall on over starched hand	1	2%	-	-
Hit by train	1	2%	-	-
Total	40	80%	10	20%

**Table 4:** Distribution of clavicle fracture according to sex

Sex	No. of middle 3 <sup>rd</sup> of clavicle fracture	Percentage (%)	No. of lateral 3 <sup>rd</sup> of clavicle fracture	Percentage (%)
Male	35	70%	7	14%
Female	5	10%	3	6%
Total	40	80%	10	20%

**Table 5:** Classification of clavicle fracture according to Robinson classification

Type	No. of cases
Type 1 Medial 3 <sup>rd</sup>	0
Type 2 Lateral 3 <sup>rd</sup>	
B1	14
B2	26
Type 3 Middle 3 <sup>rd</sup>	
B1	7
B2	3

**Table 6:** Distribution of clavicle fracture according to admission surgery interval

Time of surgery	No. of middle 3 <sup>rd</sup> of clavicle fracture	Percentage (%)	No. of lateral 3 <sup>rd</sup> of clavicle fracture	Percentage (%)
<7 days	37	74%	10	20%
7-14 days	3	6%	-	-

**Table 7:** Type of implant used

Types of plate	No. of cases	Percentage (%)
Reconstruction plate	8	16%
Locking compression plate	24	48%
Dynamic compression plate	8	16%

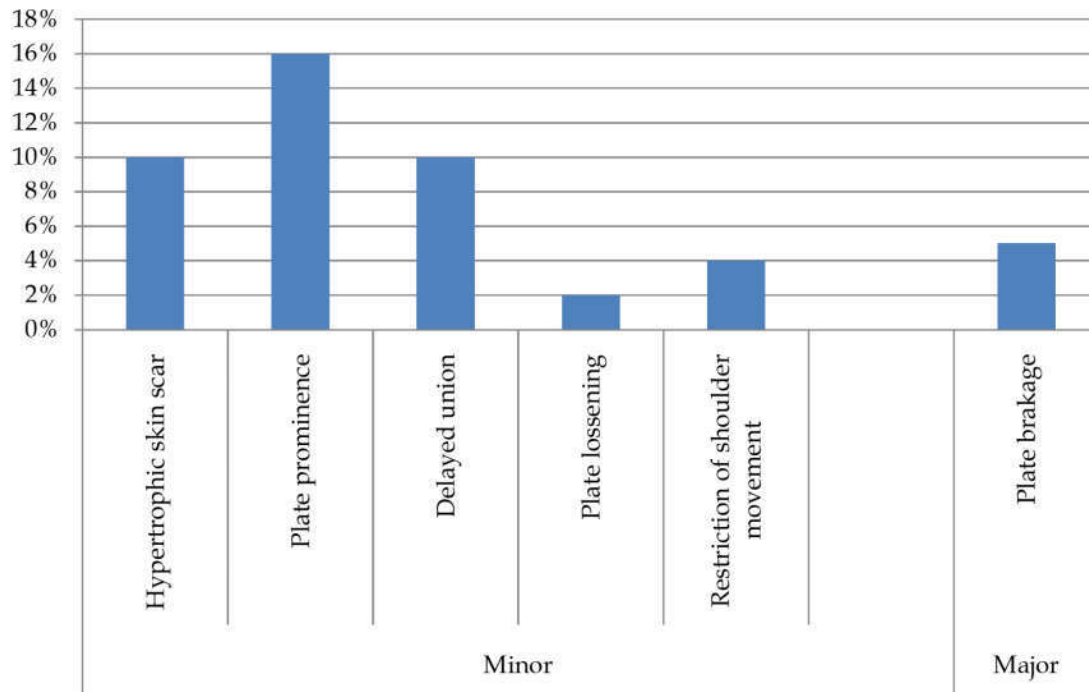


Fig. 1: Complications of clavicle surgeries

Table 8: Functional outcome

Functional outcome	No. of middle 3 <sup>rd</sup> of clavicle fracture	Percentage (%)	No. of lateral 3 <sup>rd</sup> of clavicle fracture	Percentage (%)
Excellent	28	56%	6	12%
good	8	16%	2	4%
Fair	4	8%	2	4%
Poor	-	-	-	-
Total	40	80%	10	20%

It is evident from table 8 that 28 patients (56%) with middle third clavicle fracture treated with plate and screws while 6 patients (12%) of lateral 3<sup>rd</sup> clavicle fracture fixed with tension band wiring had excellent functional outcome. Whereas, good functional outcome was observed in 8 patients (16%) and fair functional outcome was recorded in 4 patients. In addition, 2 patients of lateral 3<sup>rd</sup> clavicle fracture fixed with Kirschner wire and tension band wire 2 patients (10%) had good functional outcome results.

## Discussion

Results of the current study revealed that majority of the patients 80% belonged to middle 3<sup>rd</sup> of clavicle fracture, while 20% of clavicle fracture patients had lateral 3<sup>rd</sup> of clavicle fracture. These findings are consistent with the previous studies of Botsman et al. [4] and Kao et al. [5].

Further, findings of the current study showed that 68% of fracture patients of middle 3<sup>rd</sup> of clavicle fracture and lateral 3<sup>rd</sup> of clavicle fracture were from younger population up to 40 years. These findings are very similar to the findings of the earlier studies of Botsman et al. [4] and Kao et al. [5]. These fracture were more common in younger population may be due active life style of young people in comparison of other age groups.

Fracture of clavicle was caused predominantly by the road traffic accidents and falling from two wheelers. These findings are consistent with the previous study of Postacchini F et al. [6] and Stanley D et al. [7] in which they recorded similar mode of injury in clavicle fracture patients. These findings may be due constantly increasing road traffic incidences especially due to two wheelers.

Distribution of clavicle fracture in the present study showed it was more common in male population compare to female population. These

findings are similar to the findings of Botsman et al. [4] and Kao et al. [5] as they recorded similar high prevalence of clavicle fracture in male subjects in comparison of female subjects. This increase incident of clavicle fracture in male population may be due to male subjects are more active in Indian society compare to female subjects [8].

Robinson classification showed that type 2 B2 was more common among middle 3<sup>rd</sup> clavicle fractures. On the other hand, type 3 B1 was more common among lateral 3<sup>rd</sup> clavicle fractures. These results are in agreement with the earlier study of Botsman et al. [4] and Kao et al. [5] as they observed identical displacement in their studies. This classification may be helpful in planning of surgery.

Majority of clavicle fracture patients went for surgery within one week. Whereas, 6% of clavicle fracture patients went for surgery in second week.

Similarly, Bostman et al. [4] operated within 3 days of clavicle fracture in their study. Alike, Coupe BD et al. [9] conducted surgery of all clavicle fracture patients within one week. This early surgery of clavicle fracture cases might be helpful in better rehabilitation as well as lesser complications.

Findings of the current study showed that various types of plates were incorporated for the surgery of clavicle fracture patients. Further, there was an insignificant difference between the outcomes of use of different types of plates. These findings are similar to the findings of the earlier study of Botsman et al. [4] in which they recorded similar outcome of each type of plate incorporated to adjust the contour of the clavicle.

Complications are found in most of the surgeries. Similarly, few complications were recorded in the present study. Which are very similar to the study of Der Tavitian et al. [10] as they recorded alike complications in their study.

Functional outcome of the present study was excellent for the majority of the patients whom went for surgery with different types of plates and procedure. Rest of the patients showed good and fair category functional outcome. Moreover, no patient was found under poor functional outcome category.

These findings are in agreement with the findings of the earlier studies of Lazarus MD et al. [11] and Collinge et al. [12] in which they recorded similar better functional outcome in patients of clavicle surgery. This observation demonstrates the efficacy of the procedures in question and indicates that the mentioned procedures are quite ample to practice.

## Conclusion

- Clavicle fractures can be treated conservatively. However, there may be specific indications which indicate necessity of surgical procedure like displaced lateral third clavicle fracture, displaced middle third clavicle fracture and comminuted.
- Longer period of immobilization until union is required for the internal fixation methods as intramedullary fixation do not control rotation.
- A lesser period of immobilization is required for primary open reduction and internal fixation with plate and screws of fresh middle third clavicle fractures as it provides a more rigid fixation.
- Locking compression plates were used in the current study as it provides strong fixation which may be due to locking between the screw and plate. Moreover, it helps in blood supply preservation due to negligible contact between plate and cortical bone. Further, it provides stable fixation to the specific side as it precontoured to the shape of the clavicle. It is essential to put the locking compression plates superiorly and three screws must be applied on both sides medially as well as laterally.
- Dynamic compression plates are strong. However, excessive prominence is given through the skin due to dynamic comparison plates which cannot be contoured.
- All the fractures united and there was no non union.
- Removal of all implants is advisable for all the cases of surgery of clavicle fracture.

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