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## A prospective study of management of middle shaft clavicle fracture in general population by precontoured locking compression plate

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### Abstract

**AIM:** This study has been undertaken to study the role of precontoured locking compression plate in fixation of mid third clavicle fractures.

**Materials and Methods:** We reviewed the results 20 cases of midshaft clavicle fracture treated with precontoured locking compression plate during period from September 2019 and September 2020 in JJM Medical College, Bapuji hospital and Chigateri general Hospital Davanagere.

**Results:** Out of 20 patients operated with precontoured LCP, out of which one patient developed plate prominence, one had implant failure, none of them developed non-union. Union was evaluated clinically and radiographically.

**Conclusion:** This implant has been provided with compression mechanism to achieve maximum compression, fast fracture healing and early mobilization.

**Keywords:** Mid clavicle fracture, precontoured LCP, faster healing

### Introduction

Clavicle is the horizontally placed collar bone that connects the upper limb to the trunk and plays a very important role in mobility and anatomical stability of upper limb. Its subcutaneous position makes it vulnerable to traumatic injuries [1]. Fractures which involve the clavicle are very common and account for almost 5-10% of all the fractures and up to around 45% of those which involve the shoulder girdle. Fractures of the mid shaft of the clavicle account for about 80% of all the clavicular fractures. 2-5% of all the fractures in the adults and 10-15% in children are estimated to be due to fractures of the clavicle [2].

Most of these fractures occur due to a direct blow to the anterior chest wall or by falling on the outstretched hand. The most common site of clavicle fracture is said to be the mid shaft, which is followed by the lateral ends [3, 4]. Some of these fractures are usually unstable due to the displacing forces which act on the fractures, an inferior force acting on the lateral fracture and an anterosuperior force acting on the medial clavicle fragment.

Midshaft clavicular fractures, which are undisplaced and minimally displaced have traditionally been treated conservatively. Surgical treatment of acute mid-shaft clavicle fractures was not favoured due to relatively frequent and serious complications. However, the prevalence of non-union or malunion in displaced mid-shaft clavicle fractures after conservative treatment is higher than previously presumed and fixation methods have evolved [5]. Surgery is accepted more and more as primary treatment for displaced mid-shaft clavicle fractures, mainly because the results of operative treatment is superior both clinically and functionally [6].

There are various methods of treating clavicle mid-shaft fractures such as intramedullary K-wires or Steinmann pins fixation and plate fixation. In particular, locking compression plate fixation can help obtain firm anatomical reduction in severe displaced or comminuted fractures [7]. There are various plates including Sherman plates, dynamic compression plates and semitubular plates. Among them a reconstruction plate or a precontoured locking compression plate are the most preferred.

We have taken up this study to gain a deeper understanding of the outcome and problems associated with this procedure to evaluate the functional outcome after fixation of displaced clavicular fractures with locking compression plates.

### Materials and Methodology

Patient of both sexes belonging to adult age group in general population presenting with middle shaft clavicle fracture to the Orthopaedic Department of Bapuji Hospital and Chigateri General hospital attached to J.J.M. Medical College, Davangere from September 2019 to September 2020.

#### Inclusion criteria

- Patients greater than 18 years.
- Displaced clavicle fracture (ALLMAN GROUP III).
- Bilateral clavicle fractures.
- Open clavicle fracture.
- Clavicle fracture associated with neurovascular injuries.
- Failure to maintain reduction of middle third clavicle with conservative management.
- Patient Willing to follow up in our department.
- Written informed consent for precontoured plate.

#### Exclusion criteria

- Patient age less than 18 years of age.
- Hemopneumothorax.
- Multiple rib fractures.
- Flail chest.
- Medically unfit for surgery.

#### Surgical technique

- Under general anaesthesia patient in supine position on table in beach chair position with towel in between the scapula.
- Entire upper limb from neck to hand were prepared and draped.
- About 8-10cm incision made over anterior aspect of clavicle with centering the fracture site.
- The skin subcutaneous tissue and platysma were divided without undermining the edges.
- The overlying fascia and periosteum were next divided. The osseous ends were freed FOM surrounding tissue.
- Fracture fragments were reduced and precontoured PLTE was applied over superior aspect of the clavicle.
- At the junction of medial and middle third of the clavicle, the inferior surface is exposed and protective instrument can be inserted during drilling to prevent injury to neurovascular structures.
- The precontoured locking compression plate was fixed to medial and lateral fragment with atleast three 4mm locking screws for each fragment.
- Wound sutured in layers and sterile dressing was done.

#### Post op protocol

- Wound inspected dressing done on post op day 2 and 5, IV antibiotics given and sutures removed on post op day 10.
- Limb was kept in arm sling for 3 weeks and gentle pendulum exercises to the shoulder in arm pouch were started.
- At 4-6 weeks gentle active range of motion of shoulder was allowed but abduction is limited to 80 degrees.
- At 6-8 weeks full range of motion of shoulder in all directions were allowed.

- Regular follow up done at 4, 8 12 weeks 6months and one year.
- Local examination of clavicle for tenderness, shoulder movements assessed and fracture union was assessed radiographically by taking serial radiographs.
- Functional outcome assessed by constant and Murley score.

### Results

In this study 20 patients were studied, out of which 15 males (75%) and 5 females (25%). Average age is between 20-50 years. Mode of injury was road traffic incident in 18 patients (90%), 2 patients (10%) were due to simple fall on shoulder.

The present study consists of 20 patients of fresh fracture of clavicle, which were treated surgically by precontoured locking compression plate for middle third clavicle fracture. All patients were available for follow-up and followed at intervals of 4 weeks, 8 weeks 12 weeks and 6 months. Results were analysed both clinically and radiographically.

In this study, ALLMAN classification was followed. The fracture was considered be united when there was no tenderness clinically and radiographically fracture line was not visible. In this study, 18 patients (90%) united at the end of 8 weeks, 1 patient had delayed union and one patient had implant failure due to repeated trauma.

Age in years	No of patients (%)
21-30	10(50)
31-40	4(20)
41-50	4(20)
51-60	2(10)
Gender	
Males	15(75)
Females	5(25)

### Discussion

Clavicle fracture is one of the most commonly encountered fractures in present day scenario of trauma care. As the lifestyle of a citizen changes, his requirements, needs, wants and understanding towards a medical condition completely changes with time. With the era where a person immobilised for a long duration would face utter economic distress, the conservative means of treating most of the fractures including clavicle fractures has become obsolete. Moreover, there have been a few studies which have reported a poor outcome and higher rates of non-union of the fractures by the conservative methods. 11-13 Patients seek for faster and better functional outcome and are ready for the risk of surgery. With the advent of better surgical techniques, sterile maintenance, better post op protocols the results of surgical management are far superior compared to conservative means.

Management of clavicular features may be of different types such as intramedullary, plates and external fixators. Like K wire, Steinman pin, recon plate, new generation pre-contoured anatomical plates. The main purpose of these surgical treatments is the anatomical reduction and reconstruction of the clavicular length and alignment of the shoulder girdle. In order to prevent stress to the implant, it is necessary that it is strong in comparison to the bone strength. Therefore precontoured plates are preferred as they involve locking between the screw and the plate. As there is minimal contact between the plate and the cortical bone, there is no hindrance to the blood supply as well as minimizing the risk of injury to the subclavicular artery or brachial plexus, more so because tip of the screw does not reach the opposite bone cortex.

Periosteal stripping is minimized to promote rapid union. In this study we have prospectively analysed outcome of middle third clavicle fracture treated with precontoured locking compression plate. We have taken into account statistically the age distribution, gender, mode of injury, time taken for union, range of movements achieved at the end of study.



**Fig 1: Pre Op X-Ray**



**Fig 2: Intra-Op Picture**



**Fig 3: Immediate Post-Op**



**Fig 4: 1 Month Post Op**

Most of our cases were belong to adult age group, average age being 40 years signifying that young active adults are most commonly involved in traumatic incidences. This was in accordance with study by Zlowodzki *et al.*, who also reported a higher rate of clavicular fractures in males rather than in females, and that too among the younger age group [8].

A male predominance was observed in our study with 15 cases that is about 75% of our study group being male patients and rest female. 90% of the cause was due to road traffic accidents. This inclines our thought towards males being involved in vehicular accidents more than females. In 18 patients fracture union occurred at the 8 weeks and one patient had delayed union and one patient had implant failure? The range of movement attained at the end of the follow up in the patients was calculated to be full and free in 18 patients, 2 patients had 20 degree restriction.

All the patients were assessed with Constant and Murley score and DASH SCORE for final outcome and performance in daily activities. Results were excellent in 14 cases, good in 5 cases, fair in one case.

We found no patient with poor result. Very good results were observed in another study performed on Korea by Lee *et al.*, where most of the patients returned to their work within 6 months of their surgery [9].

Georgiui *et al.* conducted a study on 29 patients and found LCP to be more effective and reliable due to their low profile nature [10]. Bhundekar *et al.*, in their study reported that fractures treated with LCPs showed early return to function, better cosmesis and less hardware removal [11].

In this study, precontoured locking plates were used as it is contoured to the shape of the clavicle. It is necessary to put the plate superiorly and at least three screws to be applied medially and three screws laterally. The advantages of locking plates include strong fixation due to locking between the screw and plate, blood supply preservation due to minimal contact between plate and cortical bone, reduced risk of injury to subclavian vessels and brachial plexus as tip of the screw need not reach the opposite cortex, periosteal stripping is minimised to promote rapid union and contouring of plate not needed and hence surgical time is reduced and post-operative plate prominence and hardware related problems are also reduced. The advantage of rigid internal fixation and early mobilisation of fresh displaced clavicle fracture is that it (displaced



comminuted middle third and displaced lateral third clavicle fracture) gives immediate pain relief and prevents the development of shoulder stiffness and non-union.

### Conclusion

Precontoured locking compression plate has been provided with compression mechanism to achieve maximum compression, fast fracture healing and early mobilization.

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