

# Comparative Analysis between Locking Compression Plate and Titanium Elastic Nail Fixation for Clavicle Fractures

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## Abstract

**Background:** Clavicle fracture is one of the most common fractures of young active individuals; most of the clavicle fractures are managed by the conservative method previously, but after understanding the fracture, biomechanics of clavicle surgical management found to have a good functional outcome and early mobilization of the patient. Fracture pattern-like displaced comminuted, shortening <2 cm all have an impact on union and functional outcome.

**Methods:** This is a prospective study of 40 cases of the clavicle fracture treated by ORIF with locking compression plate and closed reduction internal fixation/open reduction internal fixation (ORIF) with an elastic nail. The period of study follow-up extends from 2017 to 2019 in the Department of Orthopedics, KAPV Medical College Hospital, Tiruchirapalli.

**Results:** In our study, we evaluated 40 cases of clavicle fracture treated by ORIF with locking plate (20 cases) and titanium elastic nailing (20 cases). All the 20 cases of plating, two cases had a superficial infection and treated by higher antibiotics and one case after fracture healing implant exit done. The infection was settled. All the 20 cases of nailing, 18 cases are good outcome, one case are non-union, and two cases were superficial infection after higher antibiotics infection was settled.

**Conclusion:** Locking compression plate is recommended for displaced midshaft comminuted clavicle fracture. When compared to elastic nailing, locking compression plate has an excellent functional outcome and minimal complication.

**Key words:** Clavicle fracture, Locking compression plate and screws, Titanium elastic nail

## INTRODUCTION

The clavicle provides the junction between the chest and the upper limb, so it plays an important role in the whole function of the shoulder girdle. Morphologically, the clavicle normally presents a characteristic S-like shape resulting from the junction of two opposite curves at the level of the midshaft. The bone is thinner and consequently weaker at this junction, which is why most fractures occur at this level.<sup>[1]</sup> Fractures of the clavicle are common and

account for 2–15% of all adult fractures and 33–45% of all injuries involving the shoulder girdle. The midshaft is the most frequently affected site, encompassing 69–82% of all clavicle fractures and most fractures that occur in the midshaft are displaced.<sup>1</sup> In young adults, these fractures are usually related to sports or vehicle accidents, whereas in children and elderly, they are usually related to falls.<sup>[2]</sup> In general, clavicle fractures are treated conservatively and have a variable outcome. Hill *et al.* and Robinson *et al.* reported that non-operative treatment of midclavicular fractures leads to subjectively, clinically, and radiographically unsatisfactory results in 10–30% of patients. Hill *et al.* showed that the displacement of >20 mm resulted in 15% non-union and 18% of the patients had thoracic outlet syndrome following union.<sup>[3]</sup> Hence, more recently, there has been a trend toward surgical fixation. The gold standard for surgical treatment has been open reduction and plate fixation through a large incision.<sup>[4]</sup> However, surgical procedures using plate fixation

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have shown major complications such as hematoma, infections, implant failures, and non-union.<sup>[5]</sup>

### Aim

The aim of the study was to study the functional outcome of clavicle fractures managed by ORIF with locking plate and closed reduction internal fixation (CRIF)/open reduction internal fixation (ORIF) with titanium elastic nail (TENS).

## MATERIALS AND METHODS

This is a prospective study of 40 cases of the clavicular fractures treated by ORIF with locking plate and CRIF/ORIF with TENS nailing. Patients were explained about the procedures, complications, and post-operative protocols. Informed consent has been obtained from all patients. The period of study and follow-up extends from 2017 to 2018, in the Department of Orthopedics, KAPV Medical College, Tiruchirapalli.

### Inclusion Criteria

The following criteria were included in the study:

- Age - 17 years and above.
- Displaced clavicle fractures.
- Soft tissue compromise (tenting of skin) at the level of fracture.
- Associated injuries.

### Exclusion Criteria

The following criteria were excluded from the study:

- Age <17 years.
- Age >60 years.
- Severely comminuted fractures.
- Open fractures.
- Old fracture nonunion.
- Pathological fractures.

Allocation into plate fixation group or TEN fixation group was done alternatively (i.e., every even number patient underwent TEN fixation). Thus, each group was allocated 40 patients each. All the patients were operated within 4 weeks from the date of injury.

### Clinical Evaluation

- The patient usually presents with affected upper limb adducted across the chest and hold by another limb.
- Proximal clavicle fracture end usually prominent and may tent the skin, must assess the integrity of the skin.
- Crepitus may be felt.

### Radiological Evaluation

- Standard AP X-ray enough to diagnosis the presence of fracture clavicle and displacement.

- X-ray beam cephalad tilts to 30° give adequate images without the overlap of the thoracic anatomy.

### Computed Tomography Scan

- In proximal third fractures to differentiate medial epiphyseal injury from Sternoclavicular joint dislocation.
- In distal third fractures to rule out intraarticular fractures.

### Surgical Methods

#### *Open Reduction and Internal Fixation with Locking Compression Plates and Screws*

Clavicle locking plates are commercially available. Plates are placed the anterior or superior surface of the clavicle (Tension site). The upper limb is supported by arms sling for 5–10 days, solid union possible by 1–1.5 months. Day-to-day activities of daily living permitted, but the arm should not be elevated above the head until union.

#### *Intramedullary Fixation with TENS*

TENS nail size of 2–3 mm usually used. With the help of C-arm entry point made 1.5 cm lateral to sternal end of the clavicle, posterolateral entry can be made 2–3 cm medial to acromioclavicular joint. In difficult time, a small incision was made at the fracture site to negotiate the nail into the intramedullary cavity.

## RESULTS

Age group varied from 20 to 50 years of age. The incidence of fracture was observed maximum between 25 and 35 years of age. Male predominance was noted in this study, 40 patients. Moreover, the left-sided fracture was common. RTA was the commonest mode of injury in our study. 80% of patients are middle third of clavicle fracture. 90% of patients present within 24 h of injury. Intramedullary nail fixation provides short operating time short hospital stay. Average time of fracture was 14 weeks. In patients who had undergone plate osteosynthesis, it was 10 weeks, whereas in who had undergone nail fixation, it was 14 weeks. One patient developed non-union, two patients developed delayed union, and one patient nail got migrated. 2 Patients had skin irritation [Table 1]. However, all these patients eventually had fair range of movements by the end of 14 weeks. Following intense physiotherapy with active exercise, the range of movements was increased. Restoration of all movements was at 14–16 weeks. In the plate osteosynthesis, two patients had infected, one patient had delayed union, and one patient had implant pull out after fracture healing [Table 2]. All patients in plate osteosynthesis, active range of movements was started as earlier and restoration of all the movements was 8–10 weeks. 82% of cases were noted as excellent grade in overall results.

**Table 1: Distribution of ORIF with locking plate complication**

Complications	Number of cases
Infection	2
Delayed union	1
Stiff shoulder and superficial infection	1
Implant pull out after fracture healing	1
Non-union	0

**Table 2: Distribution of CRIF/ORIF with elastic nailing complications**

Complication	Number of cases
Skin irritation	2
Delayed union	2
Non-union	1
Nail migration	1
Infection	2

CRIF: Closed reduction internal fixation, ORIF: Open reduction internal fixation

## DISCUSSION

Clavicle fractures are usually treated conservatively. In a study conducted to analyze the results of conservative treatment by Hill *et al.*, in 1997,<sup>[6]</sup> Nordqvist *et al.*, in 1998,<sup>[7]</sup> and Robinson *et al.*, in 2004,<sup>[8]</sup> found poor results following conservative treatment of displaced middle third clavicle fracture. Furthermore, a meta-analysis of literature from 1975 to 2005 by Zlowodzki *et al.* found non-union rates to be exponentially higher than that claimed earlier.<sup>[9]</sup> Hence, for specific indications such as displacement with or without comminution in middle third clavicle fracture (Robinson Type-2B1, 2B2), non-operative approach is not optimum. Functional outcome of midshaft clavicle fractures is not only related to its union but also to its length. Clavicle acts as a “strut” that keeps the upper limb away from the torso for efficient shoulder and upper limb function, while also transmitting forces from upper limb to the trunk. Thus, displaced or comminuted fractures carry a risk of symptomatic malunion<sup>[6]</sup> and poor functional outcome with cosmetic deformity. The recent trend is shifting toward internal fixation of these displaced midshaft clavicle fractures.<sup>[1,10]</sup> In our study, the rehabilitation time, and clinical and radiological union were shorter compared to TENS nail. The average time required for functional recovery is >10 weeks in TENS nail used and about 8 weeks when plate osteosynthesis was used. The duration of hospital stays more in plate osteosynthesis compare to TENS nail. Majority of the clavicle fracture presenting to our center were resulting from road traffic accidents (75%), remaining are accidental fall and another mode of injuries. The patients presented within 24 h of injury from the site of the accident. Male and female ratio was 4:1 and left

side was more common.<sup>[11]</sup> The fact that males are more prone to registrar and transfer agents compared to female because in our society females travel less. Restoration of shoulder function depends on the fracture fixation and post-operative rehabilitation. Open reduction and internal fixation with plate osteosynthesis helps in maintaining length, opposition, and alignment and a good range of movements was achieved. Hence, comminuted fracture clavicle treated by plate osteosynthesis had good functional outcome compared to TENS nail.

## CONCLUSION

Even though increased popularity of surgical methods, most of the clavicle fractures managed by conservative methods till now. Non-surgical methods are nowadays used in elderly patients with less physiological demand. Increasing evidence of the good functional outcome of surgical methods favors fixation for young individuals and elderly patients with physiological demand. Good anatomical reduction for comminuted fractures and no need for implant exit are merits of plating. Surgical scar and chances of infection are more in plating. Intramedullary fixation, minimally invasive, and time consuming are the merits of elastic nailing. Need for implant exit and inadequate fixation for comminuted fractures are demerits of nailing. In conclusion, locking compression plate is recommended for displaced midshaft comminuted clavicle fractures. When compared to elastic nailing, locking plate has an excellent functional outcome and minimal complications.

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