

Case Series

Study of surgical outcome of mid third clavicle fractures surgically managed by locking compression plate

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ABSTRACT

Clavicle is one of the most frequently fractured bones in young and active individuals. They account for 2.6-12% of all fractures and for 44-66% of fractures around the shoulder. Majority of clavicle fractures are mid shaft (80-85%). Functional outcome of midshaft fracture not only depends on the union but also on its length which has to be maintained. Thus a displaced or comminuted fracture carries a risk of symptomatic malunion, non-union or poor functional outcome with cosmetic deformity. The recent trend is shifting to internal fixation of these displaced mid shaft clavicle fracture. This was a prospective study of 20 cases of fresh mid third clavicle fracture admitted to MNR medical college and hospital from August 2020 to September 2021. Cases were taken according to inclusion and exclusion criteria. Medically unsuitable and patients not willing for surgery were excluded from the study. There were 17 male patients and 3 female patients with mid 1/3 closed clavicle fracture. 12 patients had right sided clavicle fracture and 8 patients had fracture of the left clavicle. All 20 fractures were closed fractures. Majority of the patients sustained fracture due to road traffic accident (high energy trauma) in 16 cases, fall from height in 3 cases and assault in one case. The mean duration to surgery from the day of presentation and injury was 2.1 days for middle third clavicle fractures. Functional outcome as assessed by constant and Murley scoring was favourable with excellent to good result in 97% cases and fair in 3% cases. The average constant score was 93.35 in one year follow up in middle third group. This study has some limitations. The conclusions drawn from this analysis cannot be generalized because of the small number of cases. In conclusion, for middle third clavicle fractures bony union could be achieved with locking compression plates and the clinical outcomes were satisfactory. All the fractures united and there were no cases of nonunion.

Keywords: Clavicle, Locking compression plate, Plating

INTRODUCTION

Clavicle is one of the most frequently fractured bones in young and active individuals especially in those who are involved in activities or sports where high velocity falls (motor bikes and bicycle) or violent collisions (football, hockey) are frequent.¹

They account for 2.6-12% of all fractures and for 44-66% of fractures around the shoulder. Majority of clavicle fractures are mid shaft (80-85%).¹⁻³ Traditionally midshaft

clavicle fractures have been treated conservatively with a sling or a figure of eight bandage. More recently there has been increasing evidence that the outcome of a non-operatively treated (especially displaced or shortened) mid shaft fracture is not as optimal as once thought.⁴ Functional outcome of midshaft fracture not only depends on the union but also on its length which has to be maintained. Thus a displaced or comminuted fracture carries a risk of symptomatic malunion, non-union or poor functional outcome with cosmetic deformity. The recent trend is

shifting to internal fixation of these displaced mid shaft clavicle fracture.^{5,6}

A meta-analysis by Mc-Kee et al of 6 randomized clinical trials of operative versus non-operative care for displaced mid shaft clavicle fracture demonstrated a decrease in nonunion and symptomatic malunion from 23% in non-operative group to 1.4% in operative group.⁷

Objectives of the study

The objectives were to study the surgical management of displaced fractures of clavicle; to determine the efficacy of locking compression plates in the treatment of displaced mid shaft clavicle fractures; to determine the rate of union, complications, operative risks and functional outcome after fixation with above plates; and to compare the results of this study with other standard studies and draw conclusions.

CASE SERIES

The proposed study was a hospital based study consisting of 20 adult patients with displaced or comminuted mid 1/3 clavicle fractures admitted in MNR medical college and hospital, Sangareddy during the term from August 2020 to September 2021. The fractures were classified according to Robinson classification. Cases belonging to Robinson type 2b1 and 2b2 middle third clavicle fractures were selected and fixed with locking compression plate. They were followed up at regular intervals. This study included demographic variables, mode of injury, duration of hospital stay, time required for union and complications.



Figure 1: Preoperative X-ray.



Figure 2: Intraoperative plate placement.

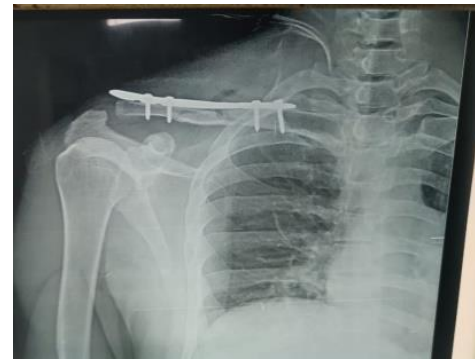


Figure 3: Postoperative X-ray.



Figure 4: Hypertrophic scar.

Inclusion criteria

All patients within the age group of 18-60 years; all comminuted/displaced mid 1/3 clavicle fractures; all clavicle fractures threatening to pierce skin; closed fractures and patients who consented to participate in study were included.

Exclusion criteria

Patients aged less than 18 years and more than 60 years; patients with lateral 1/3 clavicle fracture; pathological fractures; open fractures; head injury; patients associated with neuro vascular injury; established non-union from previous fracture; mal united clavicle fractures; or any medical contraindication to surgery or general anesthesia (heart disease or renal failure or active chemotherapy) were excluded from the study.

Surgical technique

Middle third clavicle fracture

Patient in supine position with one towel in between the scapula. Entire upper limb from base of neck to hand were prepared and draped. About 7-9 cm incision was made in the anterior aspect centering of clavicle over 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 from surrounding tissue. Minimal soft tissue and periosteum dissection was done. Fracture fragments were reduced and plate was applied over the superior aspect of the clavicle. At the junction of the middle and

lateral third of the clavicle, the inferior surface was exposed so that a protective instrument can be inserted during drilling to prevent injury to neurovascular structure underneath it. The locking compression plate was fixed to the medial and lateral fragment with locking and cortical screws and at least three screws in medial and lateral fragment were applied. Wound was closed in layers after ensuring meticulous haemostasis and skin was closed by subcuticular suture or mattress suture, sterile dressing was applied.

In this study, twenty cases with mid shaft clavicle fracture were surgically managed by closed reduction and internal fixation using locking compression plate.

All patients were evaluated clinically and radiologically before and following surgery, for an average period of follow up was 6 months.

The age of the patient in this study, ranged from 18 years to 60 years average being 33.5 years.

There were 17 male patients and 3 female patients with mid 1/3 closed clavicle fracture.

12 patients had right sided clavicle fracture and 8 patients had fracture of the left clavicle.

All 20 fractures were closed fractures. Majority of the patients sustained fracture due to road traffic accident (high energy trauma) in 16 cases, fall from height in 3 cases and assault in one case.

The mean duration to surgery from the day of presentation and injury was 2.1 days for middle third clavicle fractures.

Functional outcome as assessed by constant and Murley scoring was favourable with excellent to good result in 97% cases and fair in 3% cases. The average constant score was 93.35 in one year follow up.

The fractures united in all the patients though delayed union occurred in 3 (10%) cases which took 16-20 weeks of time period for the radiological signs of callus formation.

Complications were minimal with one case of plate prominence, 1 case of hypertrophic scar, 2 cases of infection.

DISCUSSION

Fractures of the clavicle are common, accounting for 2.6% to 12% of all fractures. More than 80% was located in the midshaft and 15-20% in lateral third. Many conservative methods of treatment have been described, but simple arm sling or figure of 8 bandage have been widely used. Neither technique reduced the fracture and the outcomes were identical, but arm sling demonstrated better patient satisfaction. Moreover, figure of eight bandage was

associated with higher complications like axillary pressure sore, neurovascular compression.

Past studies have shown high level of patient satisfaction after non operative treatment of these fractures and even more, operative treatment had higher rates of nonunion. However, recent studies have demonstrated higher rates of nonunion and poor functional outcomes after nonoperative treatment, while the results of primary operative treatment have improved considerably. The deforming force of sternocleidomastoid was very strong and cannot be overcome by external supports provided by arm sling or figure of eight bandage.

Neer's nonunion rate of 1% was misleading as more recent studies showed higher rates of nonunion in displaced midshaft clavicle fracture treated conservatively. It was 4.5 to 9.5% in Robinson's series, 15% in Hill's series and 13% in White et al study, when such fractures were managed conservatively. Moreover, shortening >2 cm and overlapping led to greater risk of nonunion, more pain, poor cosmetic and functional results.² A meta-analysis of recent studies showed reduced risk of nonunion in the operative group compared to non-operative group. Drawbacks of conservative management can be effectively overcome by surgically treating these fractures achieving near normal anatomic, cosmetic and functional profile.

Plate fixation provided immediate rigid stabilization, pain relief, facilitated early mobilization and return to pre injury activities. Superior placement of plate was biomechanically more stable especially in presence of inferior cortical comminution, but associated with greater risk of injury to underlying neurovascular structures and subsequent prominence of plate may necessitate its removal. Low complication rate was associated with inferior placement of plate, although superior placement provided biomechanically more secure fixation.

This study was an attempt to evaluate the union rate, complication and functional outcome of locking compression plate and to compare the results with other similar studies. The present study of patients with middle third clavicle fractures was compared with 4 similar studies which were published in prominent journals around the world. Patil et al study which treated 98 patients with middle third clavicle fractures with open reduction and internal fixation with locking compression plate. Jiang et al study which compared 64 operative treatment of clavicle midshaft fractures using a locking compression plate by mini invasive plate osteosynthesis technique and conventional open reduction. Thygarajan et al studied 51 patients of midshaft clavicle fractures which were divided into group 1 intramedullary fixation, group 2 underwent open reduction and internal fixation with plates and screws and group 3 treated with sling. Ferran et al did a comparative study on middle third clavicle fractures who were treated with locked intramedullary fixation and plating. This study of lateral third group was compared with 5 similar studies.

This study had some limitations. The conclusions drawn from this analysis cannot be generalized because of the small number of cases. In conclusion, for middle third clavicle fractures bony union could be achieved with locking compression plates and the clinical outcomes were satisfactory. All the fractures united and there were no cases of nonunion.

CONCLUSION

The operative methods for the treatment of clavicle midshaft fractures involve intramedullary K-wire fixation or Steinmann pin fixation and plate fixation. The procedures using the former two materials result in low resistance to torque, carry risks of pin loosening and infection, and require a long-term fixation period. Open reduction and internal fixation with plates such as Sherman plates, dynamic compression plates, semitubular plates, recon plates and locking compression plate can be effective in obtaining anatomical reduction, applying direct compression to the fracture site and producing resistance to torque. Dynamic compression plate is strong but difficult to contour and cause soft tissue irritation. Reconstruction plate is easier to contour but lack sufficient mechanical strength. Locking compression plate provides strong fixation due to lock between screw and plate, it preserves periosteal blood supply because of minimal contact between plate and cortical bone, the risks of injury to the subclavian artery or brachial plexus can be reduced and firm fixation can be possible in osteoporotic patients over 50 years of age.

Unfortunately surgical treatments for clavicle fractures leave distinct scars on the shoulder. Surgical scars are currently considered major complications due to the increasing demand for aesthetics. Two of our patients had hypertrophic scarring after surgery and complained of discomfort in carrying out their daily activities. However, none of them had associated pain or requested cosmetic surgery. However, the patients should be informed of the possible appearance of surgical scars preoperatively and surgical techniques should be improved to address the problem.

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