

Management of midshaft clavicular fracture with help of locking plates: a prospective study

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Abstract

Background and Aim: One of the most common human skeleton fractures is middle shaft clavicular fracture. It had been traditionally treated non-operatively. The present study was undertaken to study the part of surgical treatment in fresh displaced or comminuted clavicular fracture. **Materials & Methods:** A total of 25 patients with midshaft clavicular fractures were included in the study. All the patients were planned to be treated with locking compression plates and screws. **Results:** Of the total 25 patients; 20 patients had direct injury to the clavicle as the cause of the fracture whereas 5 patients had indirect injury to the clavicle. The functional outcome of the treatment: 85% had excellent outcome, 10% had good functional outcome and 5% had fair outcome. **Conclusion:** This study shows rigid fixation with locking compression plate and screws for fresh displaced or comminuted middle third clavicle fracture gives immediate pain relief and prevents the development of shoulder stiffness and non-union.

Keywords: Clavicle, Fracture, Compression plated, Screws

Introduction

Clavicular fractures are common injuries and account for approximately 2.6% to 5% of all fractures in adults. Middle-third fractures are the most common type, representing approximately 80% of all clavicular fractures, of which 48% are displaced and 19% are comminuted [1,2].

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. The clavicle is an S-shaped bone that acts as a strut between the sternum and the glenohumeral joint. It also has a suspensory function to the shoulder girdle. The shoulder hangs from the clavicle by the coracoclavicular ligament [3]. Clavicle fractures are common injuries in adults, accounting for 5% of all fractures and 44% of all shoulder fractures. Clavicle fractures are a standout amongst the most widely recognized hard wounds. They represent 3% to 5% of grown-up breaks and 45% of wounds to the shoulder support [4,5].

A weak spot in the clavicle is present at the midclavicle region, which accounts for most fractures occurring in this region. Midshaft clavicle fracture is a standout amongst the most widely recognized wounds of the skeleton, speaking to 3% to 5% of all breaks and 45% of shoulder wounds [6].

Numerous muscular and ligamentous forces act on the clavicle, and knowledge of these differing forces is necessary to understand the nature of displacement of clavicle fractures and why certain fracture patterns tend to cause problems if not reduced and surgically stabilized.

Traditionally, clavicular fractures have been treated with conservative methods, but the outcome was poor, leading to patient dissatisfaction. The incidence of non-union of midclavicular fractures is usually quoted as being from 0.1 to 0.8%, and the mainstay of treatment has long been nonoperative [7].

These data, however, are based on studies in which clavicle fractures were not adequately classified regarding patient age and fracture displacement.

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There are 2 common techniques for treating displaced mid-shaft clavicle fractures, namely, open reduction and plate fixation and open/closed reduction with intramedullary nail fixation. In particular, plate fixation can help obtain firm anatomical reduction in severe displaced or comminuted fracture [8].

Studies have found both these techniques to be superior to conservative management. clavicle is associated with delayed union or non-union, brachial plexus compression resulting from hypertrophic callus formation, compression or laceration of the great vessels, trachea, or esophagus, injuries to the neurovascular bundle and the pleural dome, poor cosmetic appearance, pneumothorax [7].

Hence the aim of the present study was to study the surgical management and to assess its functional outcome in fresh displaced mid shaft clavicular fractures.

Materials & Methods

Type of study and study settings- The present prospective study was carried out at the orthopaedic department in the medical college at Gujarat. A total of 30 patients of mid shaft clavicular fractures were treated surgically.

Inclusion criteria- Adult male and female patients who were above the age of 18 years who required surgical intervention for the displacement at middle third clavicular fracture were included for this study.

Exclusion criteria- patient smaller than 18 years, presence of open fracture, fracture in lateral or medial third of clavicle, undisplaced fractures, association of any head injury, established non-union from previous fracture, presence of any medical contraindication, lack of consent.

Informed consent- A written informed consent was obtained from each of the included patients and proper procedure of the study was clearly explained to them.

Demographic information- General information like name, age, sex, occupation and address were noted. Then a detailed history was elicited regarding mode of injury like fall on the shoulder, Road traffic accident, direct injury to shoulder and fall on outstretched hand.

Enquiry was made to note site of pain and swelling over the affected clavicle. Past medical illness and family history were also recorded. General condition of the

patients was examined for pallor, pulse rate and blood pressure. Respiratory and cardio vascular system were examined for any abnormalities.

Preoperative preparation of patients- Patients were kept fasting for 6 hours before surgery. A written informed consent for surgery was taken. The neck, chest, axilla shoulders and arm were prepared. Tranquilizers were given as advised by the anesthetist.

A systemic antibiotics usually Inj. Taxim 1gm intravenously were administered 30 minutes before surgery to all patients. All patients were operated under general anaesthesia.

Surgical Technique

- i. Patient in supine position with one towel in between the scapula. Entire upper limb from base of neck to hand were prepared and draped.
- ii. About 7-9 cms, incision was made in the anterior aspect centering of clavicle over the fracture site.
- iii. The skin subcutaneous tissue and platysma were divided without undermining the edges.
- iv. The overlying fascia and periosteum were next divided. The osseous ends were freed from surrounding tissue.
- v. Minimal soft tissue and periosteum dissection was done.
- vi. Fracture fragments were reduced and plate was applied over the superior aspect of the clavicle.
- vii. At the junction of the medial and middle third of the clavicle, the inferior surface is exposed so that a protective instrument can be inserted during drilling to prevent injury to neurovascular structure underneath it.
- viii. The locking compression plate was fixed to the medial and lateral fragment with locking screws/ cortical screws and atleast three screws in medial and lateral fragment were applied.
- ix. Wound was closed in layers after ensuring meticulous hemostasis and sterile dressing was applied.

Post operatively, analgesics and tranquilizers were given as per the requirements of the patient and check X-ray was taken to check for the alignment and fixation. The patient was discharged the next day with an arm pouch At 4 to six weeks active range of movements were started as tolerated by the patient with a limited abduction of 90 degrees.

After 8 weeks active full range of movements were encouraged in all planes. Patients were followed up regularly every 4 weeks for three months and one after 6 months.

Results

A total of 25 patients with the fresh clavicular fracture were included in the study. All the patients were treated surgically with locking plates and screws for the middle third clavicular shaft fracture. All the patients were available for follow up and there was regular interval follow up for next 6 weeks. All the patients were present for the follow up. The results were analysed both clinically as well as radiologically. Reasons for the fracture were as follows: direct injury was the reason in 20 patients. Of the 20 patients; 11 had fracture due to fall from the two wheeler vehicle, 5 had fracture due to fall on the shoulder due to slip, 4 patients had fracture due to road side accident. Indirect injury occurred in 5 patients the reason for indirect injury was hand stretching.

Majority of the patients were in the age group of 20 to 29 years. The youngest patient was of age 20 years and the oldest patient was of age 60 years. The average age was found to be 30 years. Majority of the patients were affected on left side (80%) as compared to right side (20%).

Table-1: Summary of Injury Mode

Injury Mode	No. of affected patients
Fall from two wheeler	11
Road side accident	4
Fracture due to slip	5
Outstretched hand fracture	5
Total	25

Table-2: Age incidence

Age	No. of affected patients
20 – 29	10
30 – 39	5
40 – 49	4
50 – 59	6
Total	25

To assess the site and type of the fracture the plain radiograph with shoulder in anteroposterior view was taken. In the present study we followed the Robinson classification. Type 2 middle third fractures were found in all the cases. Type 2 B1 (displaced with single fragment) was found in 20 patients and type 2 B2 (displaced with comminuted fragments) was found in 5 patients.

Table-3: Classification of the fracture

Type	No. of cases	
Type -2 middle third fracture	B1	20
	B2	5

When the functional outcome was assessed 85% had excellent outcome, 10% had good functional outcome and 5% had fair outcome.

Discussion

Fracture clavicle is now a common injury around the shoulder joint. Clavicle fracture accounts about 2.6% of all fracture and 44% in shoulder fracture. Among all the clavicle fracture mid shaft fracture accounts about 81%.¹⁸ The incidence of fracture clavicle is increasing day-to-day due to the motor vehicle accidents and sports activity [2,9]. Since these fractures are usually seen in active people who needs to use the shoulder joint for

day-to-day activity and due to need of early return to work the patients now a day's choose operative management rather than conservative management. Open reduction and plate fixation gives patient early pain-free movement thus helps the patient return to their daily work soon. In the past days, the management of midshaft clavicle fracture was entirely conservative but due to various complications of conservative

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management like nonunion, malunion, cosmetic values and the effect in shoulder biomechanics the trend has now shifted to operative management for displaced midshaft clavicle fracture [10-15]. Recent meta-analyses of randomized controlled trials comparing surgical vs nonoperative treatment of displaced clavicular fractures show greater prevalence of nonunion, symptomatic malunion, and poor functional outcomes after nonsurgical management [16].

It was the mainstay of treatment for all clavicle fractures in middle third irrespective of displacement and comminution as clavicle has excellent power of remodelling. Conservative treatment with figure-of-8 bandage aligns the displaced fragments in an acceptable manner and results in a good functional outcome. Clavicle fracture accounts about 2.6% of all fracture and 44% in shoulder fracture.

Among all the clavicle fracture mid shaft fracture accounts about 81%. The incidence of fracture clavicle is increasing day-to-day due to the motor vehicle accidents and sports activity. Since these fractures are usually seen in active people who needs to use the shoulder joint for day-to-day activity and due to need of early return to work the patients now a day's choose operative management rather than conservative management. Open reduction and plate fixation gives patient early pain-free movement thus helps the patient return to their daily work soon. However, a recent meta-analysis revealed higher nonunion rates for displaced fractures treated non-operatively (15%) than operatively (2.2%) with modern internal fixation techniques.

Multiple recent trials have also revealed higher incidence of residual pain, nonunion, malunion, shoulder weakness, decreased shoulder endurance, inferior patient and surgeon-oriented outcome scores, and lower overall satisfaction after non-operative management of mid-shaft clavicle fractures.

There is conservative treatment for the clavicular fracture. There are specific indications for the clavicular fractures like displacement with or without comminuted fracture. In 1968 Neer's study on fracture clavicle showed that the nonunion rate in conservative management was only 1% [10].

This study became the base for conservative management of fracture clavicle. Later on there were many studies which showed that the rate of nonunion was much higher in patients who underwent conservative management then what Neer's study showed.

The study done by Robinson showed nonunion in 9.5% of cases similarly the study done by Hill et al and White et al showed nonunion rate of 15% and 13% respectively [2,17,18].

A study done in 2007 by McKee et al compared non operative treatment with plate fixation for displaced midshaft clavicle fracture showed good result in patients who had undergone plating. In his study two (3.2%) out of 62 patient with plate fixation had nonunion. The rate of nonunion was much higher i.e. 7 (14.2%) out of 49 patient in patients with nonoperative management. The wound site infection rate was 4.8% that was treated with antibiotics [16].

Majority of the patients were in the age group of 20 to 29 years. The youngest patient was of age 20 years and the oldest patient was of age 60 years. The average age was found to be 30 years which was similar to the study done by Bostman et al 33.4 years (19-62 years), Ankur Mittal et 41.5 years (16-59 years), Prabhu Mitiraj et al 32 years (19-55 years) and Wali PC and Nesari SS study 37.3 years (22-65 years) [20,21,22]. These all studies show that the fracture clavicle usually occurs in young and active people.

In the present study the patients with middle third clavicle fracture the mechanism of injury was due to fall on the shoulder from two wheeler in 11 patients, Road traffic accident in 5 patients, simple fall on the shoulder in 4 patients (20%), Fall on outstretched hand in 5 patients (15 %). In Bostman et al study the mechanism of injury was due to fall from the two wheeler in 38 Patients (36.8%), slipping and fall in 24 Patients (23.30%), motor vehicle accident in 19 patients (18.45%) and sports in injury 22 patients (21.36%) [23].

In this study majority of the middle third clavicle fracture cases united between 8 to 12 weeks i.e.18 Patients (90%). In 2 Patients (10%) delayed union occurred as there was a displaced butterfly fragment which united with the main fragment at the end of 16 weeks. There were no non-union.

Conclusion

The use of locking compression plates did not result in any complications. The advantages of reconstruction LCPs include strong fixation due to locking between the screw and plate, and blood supply preservation due to minimal contact between plate and cortical bone. With conventional screws and plates, fracture site stability is provided by friction between the plate and bone cortex.

Bony union could be achieved with LCP clavicle and the clinical outcomes were satisfactory. Overall, operative procedures using LCP, which can be shaped to match the contour of the clavicle, can be effective in the treatment of clavicle midshaft fractures.

What this study adds to exiting knowledge- Despite the widespread use of locking plate osteosynthesis in clavicle fracture treatment, there is little clinical information about outcome and potential benefits of its use. Open reduction and plate fixation is a good option for displaced mid shaft clavicle fracture which help the patient for early pain-free movement of shoulder. Use of anatomical contoured clavicle plate provides fixation of clavicle to its normal contour and provides better fixation and stability.

Contribution from authors

- Dr Anil J Nayak, formulated the aims & objectives with study design and helped in data collection from medical record department.
- Dr Mahesh Khandelwal contributed to the preparation of the manuscript and Data analysis.

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