

Hospital Based Observational Assessment of the Midshaft Clavicle Fracture Treated with Precontoured Locking Compression Plate

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to assess the midshaft clavicle fracture treated with precontoured locking compression plate.

Methods: This study was prospective and observational study, conducted in Department of Orthopaedic for the period of 2 years. During study period 50 midshaft clavicle fractures were treated with precontoured locking compression plate at our hospital.

Results: Mean age was 44.26 ± 12.58 years, majority were male (80%), had road traffic accident (82%) and unilateral clavicle fracture (96%). In present study, mean operation time was 44.36 ± 13.67 minutes and return to activity was noted in 7.73 ± 4.46 weeks. Complications noted were Dysthesia (6%), Wound dehiscence (4%) and Painful shoulder (8%). Majority fractures were healed at 12 weeks (52%), only 6 fractures (18%) required 14 weeks for healing. At 1 year follow-up, excellent Constant score was noted in 84% patients.

Conclusion: Use of precontoured locking compression plates in unstable displaced comminuted fractures in middle third of clavicle give fracture stability, early union, allows early mobility and there by prevents shoulder stiffness and without motion limitation.

Keywords: precontoured locking compression plates, comminuted fractures, midshaft clavicle, early union, early mobility

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Introduction

Clavicle fractures represent 2.6 to 4 % of all fractures in adults. 18% take place in the lateral third, 2% in the medial third, and the remaining 80% are mid-shaft fractures. Of this, about 50% are displaced. [1] Open reduction and internal fixation with plates and intramedullary nails are the most commonly used options in displaced mid-shaft fractures. [1-5] Plates appear to be more popular: different types have been reported, such as tubular plates, dynamic compression plates (DCP), reconstruction plates, and more recently precontoured locking plates.

Traditionally, clavicle fracture have been treated non-operatively with a sling. During recent decades, increasing interest in operative treatment has arisen. [6] Fortunately, over the last seven years some randomized controlled trials comparing operative to nonoperative treatment in midshaft clavicle fractures have emerged. On the strength of these studies, it appears that non-operative treatment results in more nonunion than does operative treatment, but any concrete influence on shoulder function has been unclear. [7,8]

The most commonly used system of classification of clavicular fractures is that of Allman. It is divided into 3 groups: Group I: Middle-third fractures, Group II: Lateral-third fractures, Group III: Medial-third fractures. Fractures of the clavicle have been traditionally treated nonoperatively. [9] Although many methods of closed reduction have been described, it is recognized that reduction is practically impossible to maintain and a certain amount of deformity and disability is expected in adults. [10] Most clavicle fractures occur in the mid-diaphyseal region since this represents a potential weak spot. The cross section of the bone is narrowest here and the enveloping soft tissue structures which absorb and nullify the force of injury are most scarce here. Multiple 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. [11]

The consensus that great majority of clavicle fractures heal with non-operative treatment is no longer valid. The amount of pain and disability

during the first three weeks of conservative treatment has been underrated and the common view that, nonunion does not occur, is wrong. [12] Pressure from a displaced fragment on the retroclavicular part of the brachial plexus may cause symptoms after conservative treatment. Recent studies have shown that higher rate of nonunion and specific deficits of shoulder functions in subgroups of patients with these injuries. Hence they can be treated as a spectrum of injuries requiring careful assessment and individualized treatment. [11]

The aim of the present study was to assess the midshaft clavicle fracture treated with precontoured locking compression plate.

Materials and Methods

This study was prospective and observational study, conducted in Department of Orthopaedic, Netaji Subhas Medical College and Hospital, Bihta, Patna, India for the period of 2 years. During study period 50 midshaft clavicle fractures were treated with precontoured locking compression plate at our hospital.

Inclusion criteria: Patients of 19- 60 years age, of either gender, with isolated closed fractures of midshaft clavicle fractures with displacement > 2 cm, shortening > 2 cm and Robinson classification 2B1 and 2B2 (displaced fractures). Exclusion criteria: Open fracture. Fracture in proximal or distal third of clavicle. Pathological fractures and other injuries around shoulder girdle. Associated Neuro-vascular injury. Clavicle fractures treated with other fixation modalities.

A written informed consent was obtained at the time of admission. All the patients were treated operatively with open reduction and internal fixation

using locking compression plate, and all the patients had regular follow- up visits to our out-patient department (OPD) for the entire duration of treatment.

Detailed history recording and thorough general physical examination, local examination, X-ray of chest with both shoulders antero-posterior (AP) view, plain radiograph of clavicle AP view, 300 cephalo-caudal views were performed, and documentation of injuries were done in emergency room. All the patients were given arm pouch in emergency room (ER) for temporary fracture splinting. Surgical profile and pre-anaesthetic evaluation were performed prior to admission. All our patients were operated under general anaesthesia, in supine position with sandbag under the scapulae. Clavicle fracture was treated with precontoured locking compression plate. Antibiotics and analgesics were given for 5 days. The operated upper limb was immobilized in an arm pouch. Check x-rays were taken to study the alignment of fracture fragments. The wound was inspected at 2nd post-operative day and discharged later with an arm pouch. Pendulum movements/ Codman's exercises were started from 3rd post-operative day. 2nd week: The sling was discontinued, and unrestricted range of motion exercise was allowed. Follow-up was done every two weeks till 3 months followed by every month till 6 months and every 2 months till one year. Sports activities and heavy weighting are avoided till 12 weeks. The functional outcome was assessed by constant and Murley score.

Data was collected and compiled using Microsoft Excel, Statistical analysis was done using descriptive statistics.

Results

Table 1: General characteristics

Parameters	Mean/N	Percentage
Mean Age (years)	44.26 ± 12.58	
Gender		
Male	40	80
Female	10	20
Mode of Injury		
RTA	41	82
Fall from Height	9	18
Laterality		
Right	27	54
Left	21	42
Bilateral	2	4

Mean age was 44.26 ± 12.58 years, majority were male (80%), had road traffic accident (82%) and unilateral clavicle fracture (96%).

Table 2: Surgical characteristics and complications

Parameters	Mean/N	Percentage
Operation time (min)	44.36 ± 13.67	
Return to activity (weeks)	7.73 ± 4.46	
Complications		
Dysthesia	3	6
Wound dehiscence	2	4
Painful shoulder	4	8

In present study, mean operation time was 44.36 ± 13.67 minutes and return to activity was noted in 7.73 ± 4.46 weeks. Complications noted were Dysthesia (6%), Wound dehiscence (4%) and Painful shoulder (8%).

Table 3: Radiological union in weeks

Union in weeks	N	%
8	4	8
10	11	22
12	26	52
14	9	18

Majority fractures were healed at 12 weeks (52%), only 6 fractures (18%) required 14 weeks for healing.

Table 4: Constant score

Constant score	Interpretation	N	%
<30	Unsatisfactory	0	0
30-39	Fair	0	0
40-59	Good	2	4
60-69	Very good	6	12
>70	Excellent	42	84

At 1 year follow-up, excellent Constant score was noted in 84% patients.

Discussion

Fracture of clavicle is a common skeletal injury around shoulder region due to its subcutaneous location. It has been reported that fractures of the clavicle account for approximately 2-4 % of all fractures.¹³ The middle-third fractures are most common and account for approximately 80–85% all clavicular fractures. Clavicle fractures mostly occur in male individuals younger than 30 years, with an increased incidence, regardless of sex, above age 70 years. [13] Conservative treatment was recommended for non- displaced clavicular fractures in adults in the form of immobilization in an arm sling or figure-of-8 bandage with early rehabilitation. [14] Several researches have compared operative and non-operative therapy of clavicular fractures in adult athletes, which show substantial postoperative strength benefits, functional outcomes, quicker time for returning to normal activity, and decreased nonunion rates with operative treatment. [15,16] 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. [17]

The narrow cross section of the bone in the middle shaft combined with typical muscle forces acting over it predispose to fracture the bone in this locality. For midshaft fractures, we found statistically significant improvements in function and time to radiographic union with plating, an elastic stable intramedullary nail (ESIN), and the Sonoma CRx intramedullary nail over nonoperative treatments. [18] Plate fixation provides immediate rigid fixation with rotational stability and may be less technique-sensitive. However, hypertrophic scarring, skin irritation due to implant prominence, infections and implant failure are potential drawbacks. [19] Mean age was 44.26 ± 12.58 years, majority were male (80%), had road traffic accident (82%) and unilateral clavicle fracture (96%). In present study, mean operation time was 44.36 ± 13.67 minutes and return to activity was noted in 7.73 ± 4.46 weeks. Complications noted were Dysthesia (6%), Wound dehiscence (4%) and Painful shoulder (8%). Neer [20] reported a nonunion rate of 1% in displaced midshaft clavicle fractures treated conservatively but recent studies have shown that this is much higher. Non-union rate of conservatively treated displaced midshaft clavicle fractures was 4.5-9% in study by Robinson et al [21] 15% in study by Hill et al. [22] Plate osteosynthesis imparts immediate rigid stabilization, pain relief, and early mobilization and return to pre-injury activity levels. Superior placement of plate provides

more biomechanical stability compared to anterior plate placement especially in the presence of inferior cortical comminution but is associated with greater risk of injury to underlying neurovascular structures and plate prominence which may necessitate its removal. [23]

Majority fractures were healed at 12 weeks (52%), only 6 fractures (18%) required 14 weeks for healing. At 1 year follow-up, excellent Constant score was noted in 84% patients. In study by Kakkar RS et al [24] all 32 patients achieved fracture union within 6 months follow up period. As per Constant-Murley scoring, 56.25% cases had excellent results, 34.37% cases had good, 6.25% cases had fair and 3.12% of the cases had poor results respectively. Open reduction and internal fixation surgery with pre-contoured locking compression plates in the displaced midshaft clavicle

Fractures restores the anatomy, biomechanics and contact loading characteristics of the clavicle and significantly reduces the incidence of non-union with improved functional outcomes resulting in better patient satisfaction. In study of 100 patients, Karki P et al [25] noted that union was achieved in 98% patients with an average duration of 4.16 ± 1.23 months. Functional results were excellent in 80% and good in 17%. There were two major complications, one requiring reoperation and hardware removal due to deep infection while other went into nonunion. One patient sustained re-fracture within 2 weeks following implant removal after another trauma Treatment of displaced midshaft clavicle fracture with locking compression plate provides better biomechanical stability, good fracture union rates, high postoperative constant score, early pain resolution, early return to activity, high patient satisfaction rates and excellent functional outcome. These benefits of plating outweigh complications when used in specific indications like displaced with or without comminuted middle third clavicle fracture (Robinson Type 2B1, 2B2). [26]

Conclusion

Use of precontoured locking compression plates in unstable displaced comminuted fractures in middle third of clavicle give fracture stability, early union, allows early mobility and there by prevents shoulder stiffness and without motion limitation.

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