Original Research Article

Prospective study of clavicle fracture treated with precontoured locking compression plate

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Abstract

Background: Fracture of clavicle is a common skeletal injury around shoulder region due to its subcutaneous location. There are various methods of treating clavicle mid-shaft fractures such as intramedullary K-wires or Steinmann pins fixation and plate fixation. Present study was aimed to study midshaft clavicle fracture treated with precontoured locking compression plate at a tertiary hospital. **Material and Methods:** This study was prospective and observational study, conducted in 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). **Results:** During study period 32 midshaft clavicle fractures were treated with precontoured locking compression plate at our hospital. Mean age was 43.24 ± 11.56 years, majority were male (78.13 %), had road traffic accident (81.25 %) and unilateral clavicle fracture (96.87 %). In present study, mean operation time was 46.38 ± 12.67 minutes and return to activity was noted in 7.77 ± 4.56 weeks. Complications noted were Dysthesia (6.25 %), Wound dehiscence (3.13 %) and Painful shoulder (9.38 %). No motion limitation or hypertrophic scar were noted. Majority fractures were healed at 12 weeks (53.13 %), only 6 fractures (18.75 %) required 14 weeks for healing. At 1 year follow-up, excellent Constant score was noted in 83.38 % 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

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.[1] 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.[1]

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.[2] 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.[3,4] 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.[5] There are various plates including Sherman plates, dynamic compression plates and semi tubular plates. Among them a reconstruction plate or a pre-contoured locking compression plate are the most preferred.[6] Present study was aimed to study midshaft clavicle fracture treated with precontoured locking compression plate at a tertiary hospital.

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MATERIAL AND METHODS

This study was prospective and observational study, conducted in Department of Orthopaedic, Sai Sanjeevni Hospital, Kothapeth Hyderabad, Telangana, INDIA. Study period was of 2 years (from May 2019 to June 2021). The study was approved by institutional ethics committee

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, 30^0 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 were 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

During study period 32 midshaft clavicle fractures were treated with precontoured locking compression plate at our hospital. Mean age was 43.24 ± 11.56 years, majority were male (78.13 %), had road traffic accident (81.25 %) and unilateral clavicle fracture (96.87 %).

Table 1: General characteristics

Particular	Mean/ No. of patients	Percentage
Mean Age (years)	43.24 ± 11.56	
Gender		
Male	25	78.13%
Female	7	21.88%
Mode of Injury		0.00%
RTA	26	81.25%
Fall from Height	6	18.75%
Laterality		0.00%
Right	17	53.13%
Left	14	43.75%
Bilateral	1	3.13%

In present study, mean operation time was 46.38 ± 12.67 minutes and return to activity was noted in 7.77 ± 4.56 weeks. Complications noted were Dysthesia (6.25 %), Wound dehiscence (3.13 %) and Painful shoulder (9.38 %). No motion limitation or hypertrophic scar were noted.

Table 2: Surgical characteristics and complications

Particular	Mean/ No. of patients	Percentage
Operation time (min)	46.38 ± 12.67	
Return to activity (weeks)	7.77 ± 4.56	
Complications		
Dysthesia	2	6.25%
Wound dehiscence	1	3.13%
Painful shoulder	3	9.38%

Majority fractures were healed at 12 weeks (53.13 %), only 6 fractures (18.75 %) required 14 weeks for healing.

Table 3: Radiological union in weeks.

Union in weeks	Number of cases	Percentage
8	2	6.25%
10	7	21.88%
12	17	53.13%
14	6	18.75%

At 1 year follow-up, excellent Constant score was noted in 83.38 % patients.

Table 4: Constant score

Constant score	Interpretation	Number of cases	Percentage
<30	Unsatisfactory	0	0.00%
30-39	Fair	0	0.00%
40-59	Good	1	3.13%
60-69	Very good	4	12.50%
>70	Excellent	27	84.38%

DISCUSSION

Clavicle fractures with significant shortening allow the shoulder to displace anteriorly and centrally, potentially compromising normal glenohumeral and scapulothoracic function.[7] 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.[8] 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. [9] On the other hand, intramedullary fixation is less invasive with comparatively reduced implant prominence and better cosmetic results. However, it has certain disadvantages, including the requirement of intra-operative radiation exposure, injury to neurovascular structures and the need for implant removal to prevent migration.[10] In study by Kumar A[11], 17 patients out of 20 who were treated with Anatomic locking compression plate shows union at average duration of 3 months (12 weeks). Delayed union (3 patients), plate loosening (1 patient) and plate prominence (3 patients) were noted. According to Constant and Murley score after fracture union, 15 patients show excellent functional outcome, 4 patients shown good outcome and fair outcome was seen in 1 patient. H. Shashidhara *et al.*,[12] noted that out of 50 cases 47(94.0%) had excellent results without complications. 2 (4.0%) with delayed union were treated with bone grafting and 1(2.0%) case where the plate was exposed on the medial aspect at 8 weeks follow up, plate was removed. Displaced clavicle fractures, were effectively treated surgically with pre-contoured locking compression plate and screws with lag screws gave excellent results and to be considered the best modality for displaced clavicle fracture management.

In study by Kakkar RS *et al.*, [13] 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.*,[14] 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 overweigh complications when used in specific indications like displaced with or without comminuted middle third clavicle fracture (Robinson Type 2B1, 2B2).[15] The primary limitations of our study were small sample size conducted at a single center. Larger randomized controlled trials are needed to further evaluate outcomes and complications of precontoured plates.

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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