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Original Research Article

Comparison of union rates and functional outcomes for displaced mid-shaft clavicular fractures at Bhuj-Kutch: a prospective study

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ABSTRACT

Background: Clavicle fracture usually treated conservatively. There is a rising tendency to treat displaced mid-shaft clavicular fractures with primary open reduction and plate fixation; whether such treatment outcome in enhanced patient outcomes is contentious. The aim of this study was to compare union rates and functional outcomes for displaced mid-shaft clavicular fractures that were treated with either primary open reduction and plate fixation or nonoperative treatment.
Methods: Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. In this study, patients who had an acute displaced mid-shaft clavicular fracture were randomized to receive either primary open reduction and plate fixation or nonoperative treatment. Functional evaluation was conducted at 3 months, 6 months, and 1-year with the use of the constant scores. Union was evaluated clinically and radiographically. Complications were recorded and compared.
Results: The rate of nonunion was reduced significantly after open reduction and plate fixation as compared with nonoperative treatment. Constant scores were significantly improved after open reduction and plate fixation than after nonoperative treatment; 93.7 versus 85.5. A major complication was found in 34.9% of patients in the conventional group while they were absent in operative group.
Conclusions: Open reduction and plate fixation decrease the rate of nonunion after acute displaced mid-shaft clavicular fracture compared with nonoperative treatment and is connected with improved functional outcomes. Open reduction and plate fixation using precontoured locking plate have little implant-related complications.

Keywords: Fracture, Kutch, Open reduction, Plate fixation

INTRODUCTION

A clavicle fracture is a common traumatic injury around shoulder girdle due to their subcutaneous position. Most patients with a clavicle fracture are particularly young adults and have a history of a fall directly onto the shoulder. Fractures of the clavicle account for 2.5-5% of all fractures.[1,2] Among the upper extremity, fractures of the clavicle comprise up to 15% of all adult upper extremity fractures. These fractures involve the middle third in 69-82% of the cases and are more common in children and young adults.[3,4] Fractures of the clavicle have been traditionally treated nonoperatively. Moreover, open reduction and internal fixation (ORIF) of mid-clavicle fractures was considered the surest way to develop a nonunion.[5] 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.[6]

Nonsurgical treatment was considered adequate to decrease pain and allow the fracture to unite. The radiographic union is expected by 12 weeks.[7] In recent past few years, several publications have described about poor outcomes such as malunion and nonunion (15%) after conservative treatment of severely displaced clavicle fractures.[8,9] Early studies of outcome following clavicle injuries did not describe any strength deficits following the nonoperative care of displaced mid-shaft fractures and tended to concentrate on radiographic and surgeonbased results. However, few recent studies used a patient-oriented outcome measure and concerned for patient satisfaction. Some found significant residual strength deficits following the conservative treatment of these fractures. Moreover, time to unite the fracture in the conservative group was found much prolonged than early studies.[10-12] Most of the recent studies validate operative treatment over nonoperative in case of displaced fractures. The purpose of this study was to make a comparison of nonoperative management with fixation with precontoured locking plate among displaced, middle third clavicle fractures.

METHODS

Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat for one year from May 2015 to June 2016. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. Total 32 cases of displaced mid-shaft fractures of clavicle were included in this study including both male and female, during one and half year period of time. Twelve cases were operated with internal fixation with a precontoured locking plate, and 20 patients were followed with conservative treatment.

Inclusion criteria

Patients aged 18-60 years with fresh displaced clavicle fractures of middle third presenting to emergency/OPD of GAIMS Bhuj, were included in this study. Surgery was undertaken in general anesthesia. Precontoured locking plates were used in all cases.

Exclusion criteria

Those who were not willing to participate and those who had any systemic diseases

Surgical technique

With the patient in supine, about 7-9 cm, an incision was made in the anterior aspect over clavicle centering on the fracture site. The skin, subcutaneous tissue, platysma were divided and overlying fascia, and periosteum were next divided. The osseous ends were freed from surrounding tissue. Fracture fragments were reduced, and the plate was fixed to the medial and lateral fragment with 3.5 mm cortical screw and at least three screws in medial and lateral fragment were applied. The wound was closed in layers.

Postoperative care

Stitches were removed in 12-15 days after surgery. Shoulder joint movements (pendulum range of motion exercises) were started as soon as pain allowed usually after 3-4 days, with limb, supported in arm sling. Passive motion exercises were initiated within 6 weeks.

Technique of conservative management

After reduction figure of eight bandage was applied and limb was supported by a triangular sling under the elbow and forearm.

Post reduction treatment

Treatment is maintained for 6 weeks. All patients were counseled that there will likely be some deformity to the shoulder girdle, but that function will typically be normal. Shoulder joint movements (pendulum range of motion exercises) were started afterward. Heavy tasks were forbidden; contact sports were restricted for 3 months after injury. Heavy laborers were allowed to return to light-duty of lifting 6 weeks after injury with a return to full duty by 12 weeks

Criteria for functional results

Functional outcome was evaluated using the constant shoulder score (Constant and Murley score), which is scored from 0 to 100, with a lower score representing a higher level of functional disability.[13]

Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. Descriptive statistics included computation of percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

RESULTS

The present study included 32 patients, which were randomized into two groups. The first group of twelve patients was treated by ORIF by precontoured clavicle locking plate and twenty patients of the second group were treated by conservative measures.

Duration of union

The fracture was considered to be united when clinically there was no tenderness, no appreciable inter-fragmentary movement, radiologically presence of bridging callus, and full unprotected function of the limb was possible (Table 2).

Table 1: Demographic data of the study participants.

Method of treatment	Number	Percentage (%)
ORIF	12	37.5
Conservative treatment	20	62.5

Table 2: Duration of union among study participants.

Time of union	ORIF (%)	Conservative treatment (%)
12-24 weeks	11 (91.7)	12 (60)
More than 24 weeks	1 (8.3)	6 (30)
Not united at 32 weeks	0	2 (10)
Total	12 (100)	20 (100)

Complications

In this study, complications were classified in two groups, major complications and minor complications. Major complication: Major complication was defined as complication requiring inpatient treatment and expected to cause in an additional morbidity of 2 months or more (Table 3).

Table 3: Complications among study participants.

Complications	ORIF (%)	Conservative treatment (%)
Minor		
Hypertrophic scar	1 (8.3)	0 (0)
Visible deformity-cosmetic	0 (0)	4 (20)
Delayed union	1 (8.3)	6 (30)
Plate prominence	3 (25)	0 (0)
Major		
Nonunion	0 (0)	2 (10)
Symptomatic malunion	0 (0)	5 (25)

Functional outcome

The functional outcome was assessed by Constant and Murley score (Table 4).

Table 4: Functional outcome among study participants.

Functional outcome	ORIF (%)	Conservative treatment (%)
Excellent	10 (83.33)	8 (40)
Good	1 (8.3)	6 (30)
Fair	1 (8.3)	4 (20)
Poor	0	2 (10)

DISCUSSION

Clavicle fractures are usually treated conservatively. In a study conducted to analyze the results of conservative treatment by Hill et al in 1997, Nordqvist et al in 1998 and Robinson et al in 2004 found poor results following conservative treatment of displaced middle third clavicle fracture.[10,14,15] Hence, there seemed specific indication, like displacement, with or without comminution in middle third clavicle fracture, for which nonoperative approach is not optimum. The present study of operative and nonoperative modalities in patients with displaced middle third clavicle fractures yielded a better outcome in the operative group in terms of early and higher union, lower complication rates, and improved shoulder scores. This study was compared mainly with two studies. The first study of Böstman et al which treated displaced middle third clavicle fractures.[5] In this study, totally 103 patients were treated by early ORIF with plate and screws. Other was multicenter trials and their analysis by Canadian Orthopaedics Trauma Society. In this study, majority of the middle third clavicle fracture in operative group united between 12 and 24 weeks that is, 11 patients (91.7%) compared to only 12 fractures (60%) in conservative group. The average duration of the union in operative group was 16.5 weeks, and 27.2 weeks in the nonoperative group. In Canadian analysis mean time of fracture union was 16.4 weeks in operative group and 28.4 weeks in the nonoperative group. Universal conception that most of the clavicle fractures unite by the end of 12 weeks after conservative management, doesn't appear reasonable for displaced fractures. Long duration is required for the bridging callus to be formed across the large gap between the fragments. Open reduction by reducing the fracture gap enhances the healing and thereby reducing the union time considerably.

In our study, there was no nonunion in operative group, while in nonoperative group 2 patients (10%) undergone nonunion. In the randomized clinical trial of Canadian Orthopaedics Trauma Society, nonunion reported in 3.2% in the operative group as compared to 14.3% among the nonoperative group. The absence of nonunion in our operative group necessitates further studies to be conducted with larger sample sizes as this complication is no longer a prevalent one in operative groups as considered earlier. In operative 12 patients delayed union occurred in 1 patients (8.3%) as compared to 6 patients (30%) in nonoperative group.

Adults do not possess same remodeling potential as younger children, and most mid-shaft clavicle fractures heal with some degree of malunion. A symptomatic malunion was described as any fracture union with shortening and then residual sequelae. In our study, patient developed this complication in operative group while in 20 nonoperated patients 5 patients (25%) developed symptomatic malunion. In Canadian study no patient in the operative group presented with

symptomatic malunion while 9 out of 49 patients (18.3%) developed this complication.[10]

Plate breakage and plate loosening had not occurred in this study. In Böstman et al study, of patients treated with semi tubular plate, 1.9% of the patients had implanted breakage and 6.8% had loosened. The reason for this difference seems to be due to two factors. First, less stress on our precontoured fixation device because of S-shape better suited for clavicle anatomy thus causing less stress in the overall construct. Second, greater strength of locking plate as comparedto the semi-tubular plate. The functional outcome according to Constant and Murley was found to be significantly higher in operative group.[13] In this study, average constant score in the operative group was found to be 93.7 and 85.9 in nonoperative group. Canadian Orthopaedics Trauma Society found an average constant score of 96.1 in operative group and 90.8 in the nonoperative group. The advantage of rigid internal fixation and early mobilization of fresh displaced clavicle fracture is that it gives immediate pain relief and prevents the development of shoulder stiffness, symptomatic mal-union, and nonunion, thus, resulting in better functional outcome.

Sample size being small, low prevalence complications could not be encountered in this study. Larger sample size will be a prerequisite for knowing the prevalence of nonunion and symptomatic malunion in operative group. With the availability of improved biomechanics of newer implants, plate breakage, plate loosening, mechanical failure, and implant reaction are also uncommon complications.

CONCLUSION

Clavicle fractures are usually treated conservatively, but there are specific indications for which operative treatment is needed such as comminuted and displaced middle third clavicle fractures. It was observed that primary ORIF with plate and screws of fresh middle third clavicle fractures provides a more rigid fixation and yielded better functional outcome and resulted in high union rates. As plate fixation provides rotational stability, there is no need of immobilization for long periods. All the fractures united, and there was no nonunion in operative group. For displaced, comminuted middle third clavicle fracture plate and screws fixation and early mobilization gave excellent resulted in 83.3% patients. In a nonoperative group, nonunion rate was found to be 10%, and the excellent outcome was found only in 40% patients.

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REFERENCES

1. Nordqvist A, Petersson C. The incidence of fractures of the clavicle. Clin Orthop Relat Res. 1994;300:127-32.
2. Ali Khan MA, Lucas HK. Plating of fractures of the middle third of the clavicle. Injury. 1978;9:263-7.
3. Allman FL Jr. Fractures and ligamentous injuries of the clavicle and its articulation. J Bone Joint Surg Am. 1967;49:774-84.
4. Bajuri MY, Maidin S, Rauf A, Baharuddin M, Harjeet S. Functional outcomes of conservatively treated clavicle fractures. Clinics (Sao Paulo). 2011;66:635-9.
5. Böstman O, Manninen M, Pihlajamäki H. Complications of plate fixation in fresh displaced midclavicular fractures. J Trauma. 1997;43:778-83.
6. Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. J Bone Joint Surg Am. 2007;89:1-10.
7. Eiff MP. Management of clavicle fractures. Am Fam Physician. 1997;55:121-8.
8. Postacchini F, Gumina S, De Santis P, Albo F. Epidemiology of clavicle fractures. J Shoulder Elbow Surg. 2002;11:452-6.
9. Greene WB. Essentials of Musculoskeletal Care. 2nd ed. Rosemont, Ill: American Academy of Orthopaedic Surgeons; 2001.
10. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle-third fractures of the clavicle gives poor results. J Bone Joint Surg Br. 1997;79:537-9.
11. Ledger M, Leeks N, Ackland T, Wang A. Short malunions of the clavicle: An anatomic and functional study. J Shoulder Elbow Surg. 2005;14:349-54.
12. Liu HH, Chang CH, Chia WT, Chen CH, Tarng YW, Wong CY. Comparison of plates versus intramedullary nails for fixation of displaced midshaft clavicular fractures. J Trauma. 2010;69:82-7.
13. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987;214:160-4.
14. Nordqvist A, Petersson CJ, Redlund-Johnell I. Mid-clavicle fractures in adults: End result study after conservative treatment. J Orthop Trauma. 1998;12:572-6.
15. Robinson CM, Court-Brown CM, McQueen MM, Wakefield AE. Estimating the risk of nonunion following nonoperative treatment of a clavicular fracture. J Bone Joint Surg Am. 2004;86:1359-65.

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