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Comparison of Functional Outcomes for Mid-Third Clavicle Fractures Treated with Primary Open Reduction and Plate Fixation or Nonoperative Treatment at Bhuj, Kutch, Gujarat

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Abstract

Aim: The aim of present study was to evaluate 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. *Material and Methods:* This prospective study was conducted in the department of orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat, India. In this study, 32 patients between 17 and 62 years of age who had an acute displaced mid-shaft clavicular fracture were randomized to obtain either primary open reduction and plate fixation or nonoperative treatment. Functional assessment 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 significantly reduced after open reduction and plate fixation as compared with nonoperative treatment. Constant scores were significantly enhanced after open reduction and plate fixation than after nonoperative treatment A chief complication was originate in 35% of patients in the conservative group while they were not present in operative group. *Conclusion:* Open reduction and plate fixation diminish the rate of nonunion after acute displaced mid-shaft clavicular fracture compared with nonoperative treatment and is connected with better functional outcomes. Open reduction and plate fixation using precontoured locking plate have low implant-related complications.

Keywords: Clavicular Fractures; Conservative; Kutch; Open Reduction.

Introduction

A clavicle fracture is a frequent traumatic injury around shoulder girdle due to their subcutaneous position. Most patients with a clavicle fracture are mainly young adults and have a history of a fall straight 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 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 [5,6].

Nonsurgical treatment was measured sufficient to decrease pain and allow the fracture to unite. The radiographic union is likely by 12 weeks [7]. In recent past few years, several researches 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 explain any strength deficits following the nonoperative care of displaced mid-shaft fractures and tended to focus on radiographic and surgeonbased results.

Though, few recent studies used a patient-oriented outcome measure and worried for patient satisfaction [9]. Some found noteworthy residual strength deficits following the conservative treatment of these fractures. Moreover, time to unite the fracture in the conservative group was establish much prolonged than early studies [10]. Most of the recent studies validate operative treatment over nonoperative in case of displaced fractures. The aim of this present study was to make a comparison of nonoperative management with fixation with precontoured locking plate among displaced, middle third clavicle fractures.

Materials and Methods

This prospective study was conducted in the department of orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat, India. Patients were selected from patients attending outpatient department and Emergency department of orthopedics. Total 32 cases of displaced mid-shaft fractures of clavicle were included in this study including both male and female, during January 2061-December 2016. Twelve cases were operated with internal fixation with a precontoured locking plate, and 20 patients were followed with conservative treatment.

Criteria for Selection of Cases

Inclusion Criteria

Patients aged 17-62 years with fresh displaced clavicle fractures of middle third presenting to emergency/OPD of Gujarat Adani Institute of Medical Science, Bhuj, were included in this study.

For Operative Group

Surgery was undertaken in general anesthesia. Precontoured locking plates were used in all cases.

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 adjacent 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 detached in 12-15 days after surgery. Shoulder joint movements 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 malformation to the shoulder girdle, but that function will typically be normal. Shoulder joint movements were started afterward. Heavy tasks were prohibited; contact sports were limited for 3 months after injury. Heavy laborers were permitted 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 by the constant shoulder score, which is scored from 0 to 100, with a lower score representing a higher level of functional disability.

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 measured to be unified 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 1].

Complications

In this study, complications were classified in two groups, major complications and minor complications.

Major Complication

Major complication was defined as obstacle requiring inpatient treatment and predictable to cause in an additional morbidity of 2 months or more [Table 2].

Functional Outcome

The functional outcome was assessed by Constant and Murley [13] score [Table 3].

Table 1: Duration of Union

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)

ORIF: Open reduction and internal fixation

Table 2: Complication occur during study duration

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

ORIF: Open reduction and internal fixation

Table 3: Functional Outcome by Constant and Murley score

Functional outcome	ORIF (%)	Conservative treatment (%)
Excellent	10 (83.3)	8 (40)
Good	1 (8.3)	6 (30)
Fair	1 (8.3)	4 (20)
Poor	0 (0)	2 (10)
Total	12 (100)	20 (100)

ORIF: Open reduction and internal fixation

Discussion

Clavicle fractures are typically treated conservatively. In a study conducted to analyze the results of conservative treatment by Hill et al. [10] in 1997, Nordqvist et al. [14] in 1998 and Robinson et al. [15] in 2004 found deprived results following conservative treatment of displaced middle third clavicle fracture. 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 improved outcome in the operative group in terms of early and advanced union, lower obstacle rates, and enhanced shoulder scores. This study was compared mainly with two studies. The first study of Böstman et al. [5] which treated displaced middle third clavicle fractures. 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[6]. In this study, greater part 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 standard duration of the union in operative group was 16.5 weeks, and 27.2 weeks in the nonoperative group. In Canadian analysis [6] 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 rational 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 present 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 [6], non-union reported in 3.2% in the operative group as compared to 14.3% among the nonoperative group. The non-appearance of nonunion in our operative group necessitates additional studies to be conducted with bigger sample sizes as this complication is no longer a prevalent one in operative groups as considered earlier. In operative 12 patients postponed 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 restriction and then residual sequelae. In present study, patient developed this complication in operative group while in 20 nonoperated patients 5 patients (25%) developed symptomatic malunion. In Canadian study [10] no patient in the operative group presented with symptomatic malunion while 9 out of 49 patients (18.3%) developed this complication.

Plate fracture and plate loosening had not occurred in this study. In Böstman *et al*. study, [5] of patients treated with semi tubular plate, 1.9% of the patients had entrenched breakage and 6.8% had loosened. The reason for this difference seems to be due to two factors. First, not as much of stress on our precontoured fixation device because of S-shape better suited for clavicle anatomy thus causing less stress in the in general construct, second, superior potency of locking plate as compared to the semi-tubular plate.

The functional outcome according to Constant and Murley [13] was found to be significantly elevated in operative group. In this study, standard constant score in the operative group was found to be 93.7 and 85.9 in nonoperative group. Canadian Orthopaedics Trauma Society [6] found an normal constant score of 96.1 in operative group and 90.8 in the nonoperative group. The advantage of stiff internal fixation and early mobilization of fresh displaced clavicle fracture is that it gives instant pain release and prevents the development of shoulder rigidity, 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 requirement for knowing the prevalence of nonunion and symptomatic malunion in operative group. With the accessibility of improved biomechanics of newer implants, plate breakage, plate loosening, mechanical failure, and implant reaction are also uncommon complications.

Conclusion

Clavicle fractures are frequently treated conservatively, but there are precise 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 gives a more rigid fixation and yielded superior 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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