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Evaluation of functional outcome after plate fixation of midshaft fracture of clavicle

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Abstract
Background: Non operative treatment of midshaft clavicle fracture has been reported with high prevalence of symptomatic malunion and nonunion in the recent studies. The purpose of our study is to study the union and functional result of displaced clavicle fracture treated with plating and to study the complications associated with clavicle fracture and surgical management.
Methods: We prospectively evaluated 32 patients who have undergone plating for midshaft clavicular fracture from January 2013 to June 2017.
Results: All the fracture united and there is excellent functional outcome in 22 (68.7%) patients, good functional outcome in 6 (18.7%) patients and 4 (12.5%) patients had fair functional outcome. All the patients were relatively satisfied with the treatment.
Conclusion: In our study on 32 patients with midshaft clavicle fracture fixed with plating, we found that this technique provides a rigid stabilization of the fracture, leading to good fracture union. It also aids in an early mobilisation of shoulder, preventing its stiffness. Their outcome seems better than those reported with conventional conservative treatement. This surgical fixation of midshaft clavicle fracture also help in early rehabilitation, and are associated with great patient satisfaction.

Keywords: Clavicle, midshaft fracture, plating, functional outcome

Introduction
Clavicle fracture is a common traumatic injury around shoulder girdle in young active individuals due to its subcutaneous position. The mechanism of injury is usually fall on to the outstretched upper extremity or direct blow or high velocity impact [1]. Most commonly clavicle bone fractures in midshaft region.
Undisplaced clavicle fracture can be treated conservatively with figure of "8" bandage but when displaced fracture was treated conservatively it was associated non-union in case of 20%, and mal-union in 1-5% cases so with time surgical interventions specially open reduction and internal fixation with plating gained popularity.
In modern time also a significant number of orthopaedicians prefer conservative treatment for mid shaft clavicle fracture except in floating shoulder, open fracture with neurovascular deficit and puckered skin in displaced fractures. But with advent of precontoured plate clavicle fixation has become easier and safer. It is now preferred for plating of displaced clavicle fractures. However, the degree of displacement of the fragments in a fractured clavicle that requires operative treatment is still a matter of debate [2].
In modern time the plate fixation has gained popularity, gives a good stable fixation, leading to early mobilisation of shoulder and ability to return back to work early [2].

Aims and objectives
To study the union and functional results of displaced clavicle fracture treated with plating and complications associated with clavicle fracture and their surgical management.

Material and methods

The study is prospective study and conducted at the Department of Orthopaedics and trauma centre, GR medical college and JAH group of hospitals, Gwalior, (MP). Study has been done from January 2013 to June 2017.

Inclusion Criteria

1. Age >18years.
2. Displaced midshaft fractures.
3. Closed fractures.

Exclusion Criteria

1. Age < 18 years.
2. Open fractures.
3. Associated head injury / neurovascular injury.
4. Established non-union from previous fracture.

Method of study

A total of 32 patients admitted for fracture of displaced midshaft clavicle fracture and managed by plating have been evaluated in this study. The data of prospective cases has been collected from follow-up, serial radiographs and clinical assessment; Data thus collected was analyzed using oxford shoulder score [ANNEXURE-I] and radiological score [ANNEXURE-III].All the required demographic information was collected pre-operatively including name, age, sex, date of admission, address etc. A detailed history with emphasis on symptoms, mode of injury, duration since the injury and other associated injuries was taken. The history of significant co-morbid diseases such as diabetes, hypertension, asthma, cardio vascular diseases, COPD, hypertension, diabetes mellitus, seizure or previous fracture (if any) was also taken. All patients were subjected to a detailed physical examination.

Plain radiograph of clavicle with shoulder in anteroposterior view was taken to assess the site of fracture and the fracture type (displacement and comminution). And preoperative functional assesement were done by using Oxford Shoulder Score (OSS) [ANNEXURE-II]. The affected upper limb was immobilized in an arm pouch. All patients were operated as early as possible after clearance from anaesthesia side.

Technique for plate and screw fixation

Patient in supine position with one towel/small pillow in between the scapula. Entire upper limb from base of neck to hand were prepared and draped. About 7-9 cms, incision was made in the anterior aspect centering of clavicle over the fracture site. The skin subcutaneous tissue and platysma were divided without undermining the edges. The overlying fascia and periosteum were next divided. The osseous ends was freed from surrounding tissue. Minimal soft tissue and periosteum dissection was done. Fracture fragments were reduced and plate was applied over the superior aspect of the clavicle.

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 neuorvascular structure underneath it. The plate was fixed to the medial and lateral fragment with 3.5mm cortical screw and at least three screws in medial and lateral fragment were applied. Wound was closed in layers after ensuring meticulous hemostasis and sterile dressing was applied [6, 7, 8, 9].

Post Operative care and Follow up (5)

Intravenous antibiotics were continued for 2 days. Analgesics and tranquilizers were given according to the needs of the patient. The operated upper limb was immobilized in an arm pouch. Check x-rays were taken to study the alignment of fracture fragments. Patients were discharged with the arm pouch. The wound was inspected at 3rd postoperative day. Suture removal was done on 14th postoperative day. Rehabilitation of the affected arm was started at the end of 2 weeks. Gentle pendulum exercises to the shoulder in the arm pouch were allowed. At 4 to 6 weeks gentle active range of motion of the shoulder was allowed but abduction in limited to 80 degrees. At 6 to 8 weeks active range of motion in all planes were allowed. Patients were followed up till radiological union. The functional outcome were assessed by Oxford Shoulder score [ANNEXURE-2] and Radiological outcome by Radiological score [ANNEXURE-3].

Results and observations

The present study consists of 32 patients of mid shaft clavicle fracture where all patients were treated surgically ORIF with plating and screw between January 2013 to June 2017. All the patients were available for follow-up and they were followed regularly till fracture union. Results were analyzed both clinically and radiographically.

Mode of injury

In mid shaft clavicle fractures among them 7 patients (21.9%) were due to fall on shoulder from two wheeler, 23 patients (71.9%) were due to road traffic accident, in 2 patient (6.2%) it was due to assault.

Age incidence

There is almost equal distribution in all age group of the patients with Mid Shaft Clavicle Fracture i.e. 11 patients (34.3%) in the age group of 20-29 years, 9 patients (28.1%) in the age group of 30-39 years, 4 patients (12.5%) in the age group of 40-49 and 8 patients (25%) in the age group of 50 or more. The youngest patient was 20 years and oldest patient was 69 years. The average patient age was 38 years.

Sex incidence

In Mid Shaft Clavicle Fracture the majority were males, 26 patients (81.2%) and females were 6 patients (18.7%).

Associated injuries

In Mid Shaft Clavicle Fracture 11 patients (34.4%) had associated lower limb (femur and tibia fracture) injuries, upper limb injuries (radius and metacarpal fracture) other injuries including spine fracture, facial injuries and abdominal injuries.

Complications

In Mid Shaft Clavicle Fracture fixation 4 patients (12.5%) plate prominence had occurred. In 1 patients (3.1%) infection (deep) occurred after 8 weeks of surgery, and after 10 weeks that plate was exposed on which later on implant removal was done. 1 patient (3.1%) had hypertrophic scar, Delayed union occurred in 1 patient (3.1%).

Functional outcome

The functional outcome is assessed by Oxford Shoulder score. In this study all of the 32 patients with Mid Shaft Clavicle Fracture had acceptable functional outcome.

Table 1: Showing functional outcome

Functional outcome Total -48 points	Frequency	Percentage
Excellent (40-48)	22	68.7 %
Good (30-39)	6	18.7 %
Fair (20-29)	4	12.5 %
Poor (0-19)	0	0 %
Total	32	100 %

Discussion

There were many studies done for evaluation of outcome of conservative treatement of midshaft clavicle fracture by Hill *et al*. [4] in 1997, Nordqvist *et al*. [3] in 1998 and Robinson *et al*. [11] in 2004 and all of them found poor result. Also the study done by Edwards *et al*. [12] in 1992 for Conservative treatment of displaced lateral third clavicle fracture has higher rate of non union and residual shoulder dysfunction. In our study we have done our evaluation and compared our results, with the similar other studies on midshaft clavicle fracture treated surgically with plating.

Mode of injury

Majority of mid shaft clavicle fractures in our study, 23 patients (71.9%) were due to road traffic accident, this is comparable with similar studies of Tsang *et al*. [10] where 74% patients were of RTA.

Age Incidence

In the study there is almost equal distribution in all age group of the patients with Mid Shaft Clavicle Fracture i.e. 11 patients (34.3%) in the age group of 20-29 years, 9 patients (28.1%) in the age group of 30-39 years, 4 patients (12.5%) in the age group of 40-49 and 8 patients (25%) in the age group of 50 or more. The youngest patient was 20 years and oldest patient was 69 years. The average patient age was 38 years. In Tsang *et al*. (10) study average age was 45 years.

Sex Incidence

In this study, the patient with Mid Shaft Clavicle Fracture the majority were males, 26 patients (81.2%) and females were 6 patients (18.7%). which is comparable with Tsang *et al*. [10] study 75% patients were male and 25% patients were female.

Associated injuries

In Mid Shaft Clavicle Fracture 11 patients (34.4%) were having other associated injuries. In similar study done by Tsang *et al*. [10] 19 patients were having associated injuries such as multiple fractures, head injuries, rib fractures, hemopneumothorax, etc.

Functional outcome

In this study of the Mid Shaft Clavicle Fracture, 22 patients (68.7%) had excellent, 6 patients (18.7 %) had good and 4 patients (12.5%) had fair functional outcome. In similar study done by Tsang *et al*. [10] 78 patients (95%) had an uneventfull recovery with average DASH score of 26.35.

Complications

One patient (3.1%) plated with was broken at 8 weeks postoperatively, Delayed union occurred in 1 patient (3.1%).1 patient (3.1%) had deep infection.There was cosmetically unacceptable skin scar in 1 patients (3.1%). Plate prominence through the skin was reported in 4 patients (112.5%). Complications in our study is also comparable with study done by Tsang *et al*.

Pre op x-ray | 2 weeks post op x-ray | 10 weeks post op x-ray

Clinical photographs after bone union in clavicle fracture

Conclusion

In our study on 32 patients with midshaft clavicle fracture fixed with plating, we found that this technique provides a rigid stabilization of the fracture, leading to good fracture union. It also aids in an early mobilisation of shoulder, preventing its stiffness. The open reduction allows fracture approximation even in severe comminution. Primary open reduction and internal fixation with plate and screws of fresh Mid Shaft clavicle fractures provides a more rigid fixation and does not require immobilization for longer periods. Their outcome seems better than those reported with conventional conservative treatement. This surgical fixation of midshaft clavicle fracture also help in early rehabilitation, and are associated with great patient satisfaction. In this study early primary plate fixation of Mid Shaft clavicular fractures results in improved patient-oriented outcomes, improved surgeon-oriented outcomes, earlier return to function, and decreased rates of nonunion and malunion. Though a larger study with more number of patients and with frequent follow-up is needed, but as per our results, Plating of midshaft clavicle fracture is affirmatively recommended for better outcomes.

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