

A Prospective Study of Functional Outcome of Clavicular Fractures Treated by Plate Osteosynthesis

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Conflict of interest: Nil

Abstract:

Introduction: Clavicle is one of the most commonly fractured bone after a road traffic accident with the middle one third being the most frequently fractured part. While traditionally, clavicle fractures have been managed conservatively, the problems with non-union and malunion has led to an increase in operative interventions. This study aims at evaluating the functional outcome of clavicular fractures managed by plate osteosynthesis.

Material & Method: This was a prospective interventional study conducted in Post-Graduate Department of Orthopaedics, GMC Jammu. All the patients with clavicle fractures who attended OPD as well as emergency wing of GMC Jammu Hospital and confirming to inclusion criteria were enrolled in the study. Data was recorded in case record form. The patients were followed for 1 year to record the final functional outcome as per constant & murley score.

Results: Out of 22 patients, 81.8% of the patients were male, most (63%) suffered a fracture of left clavicle and 72.7% of the patients had suffered an RTA. The mean time to union was found to be 12.1 weeks. Mean Constant & Murley score at 3 months post-op was 84.09.

Conclusion: In our study, the majority of clavicle fractures occurred in young adult males, with RTA being the predominant mechanism of injury. We found that patients with displaced clavicle fractures treated with plate fixation had good functional outcome scores at sequential follow-ups.

Keywords: Clavicle fractures, Plate osteosynthesis, Constant & Murley score.

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Introduction

The clavicle is an S-shaped bone and is the only osseous link between the upper extremity and the trunk. The clavicle articulates distally with the acromion at the acromioclavicular joint and proximally with the sternum at the sternoclavicular joint. Due to its superficial subcutaneous location and the numerous ligamentous and muscular forces applied to it, the clavicle is easily fractured. The midshaft of the clavicle being the thinnest segment and absence of ligamentous attachments makes it the most easily fractured location.

More than 85 percent of clavicular fractures occur by a fall onto the shoulder (Stanley D et al, 1988) [1]. Most of these fractures among the young occur in a traffic accident or a sports injury. Approximately 40 percent of injuries caused by traffic accidents occur in cyclists, more than 25 percent in car drivers or passengers, 17 percent in motorcyclists, and 17 percent in pedestrians (Robinson CM et al, 1998 May) [2].

The traditional view that most of the clavicular fractures heal with good functional outcomes fol-

lowing non-operative treatment is no longer valid. Recent studies have showed a higher rate of non-union in subgroups of patients with clavicle fractures managed conservatively.

(Hill et al, in 1997) [3] were the first to use patient-oriented outcome measures to examine 66 consecutive patients with displaced midshaft clavicle fractures and they found an unsatisfactory outcome in 31%, as well as a non-union rate of 15%.

(Robinson CM et al, in 2004) [4] estimated that the overall prevalence of nonunion at twenty-four weeks after the fracture was 6.2%, with non-union rate being 8.3% for the medial end fractures, 4.5% of the diaphyseal fractures, and 11.5% of the lateral end fractures going to non-union.

Persons with high activity level will hesitate to accept prolonged recovery and impaired shoulder function, therefore may require more aggressive treatment of clavicle fractures.

Operative treatment of displaced mid shaft clavicular fractures can be achieved successfully using

plates or intramedullary implants like rush pins, Kirschner wires or nails.

Aims and Objective:

Primary Objective: To study functional outcomes of clavicular fractures managed by plate osteosynthesis

Secondary Objectives: To evaluate union rate of clavicle fractures

Materials and Methods:

This was a prospective observational study conducted in Post-Graduate Department of Orthopaedics, GMC Jammu. The study was initiated after obtaining the institutional ethical clearance. All the patients with clavicle fractures who attended OPD as well as emergency wing of GMC Jammu Hospital and confirming to inclusion criteria were enrolled in the study. Written and informed consent was taken from all patients and data was recorded in case record form. The patients were followed for 1 year to record the final functional outcome as per constant & murley score.

Inclusion Criteria:	Exclusion Criteria:
a) Age > 18 years and < 60 years. b) Displaced Fractures (> 2 cm), with shortening (> 2 cm) c) Segmental fractures d) Open fractures e) Impending compound Fractures with soft tissue compromise f) Associated neurovascular injury g) Floating shoulder h) Bilateral clavicular fracture i) Patient motivation for rapid return of function (sports function) j) Polytrauma with requirement for early upper extremity weight bearing	a) Age <18 years and >60 years b) Undisplaced or minimally displaced fractures. c) Comminuted fractures (>3 fragments) d) Any medical contraindication to surgery (Heart diseases, renal failure or active chemotherapy). e) Not consenting

Constant & Murley Score

Category:

A) Subjective:

1) Pain - 15 Points

No pain - 15

Bearable pain - 10

Disabling pain - 5

2) Activities of daily living: - 20 Points

Ability to perform full work - 04

Ability to perform Leisure activities/Sports - 04

Unaffected sleep - 02

3) Level at which work can be done:

Up to Waist - 02

Up to Xyphoid - 04

Up to Neck - 06

Up to Head - 08

Above head - 10

B) objective:

Range of Movements: 40 Points:

a) Active flexion without pain

00 – 30 Degrees: 00

31-60 Degrees: 2

61-90 Degrees: 4

91-120 Degrees: 6

121-150 Degrees: 8

> 151 Degrees: 10

b) Functional external rotation:

Hand behind head with elbow forwards - 2

Hand behind head with elbow backwards - 4

Hand above head with elbow forwards - 6

Hand above head with elbow backwards - 8

Full elevation from on top of head - 10

c) Active abduction without pain:

With dorsum of hand on back, head of third metacarpal reaches

00 – 30 Degrees: 00

31-60 Degrees: 2

61-90 Degrees: 4

91-120 Degrees: 6

121-150 Degrees: 8

By Constant and Murley scoring system grading is done as follows:

Total score Result

90-100: Excellent

80-89: Good

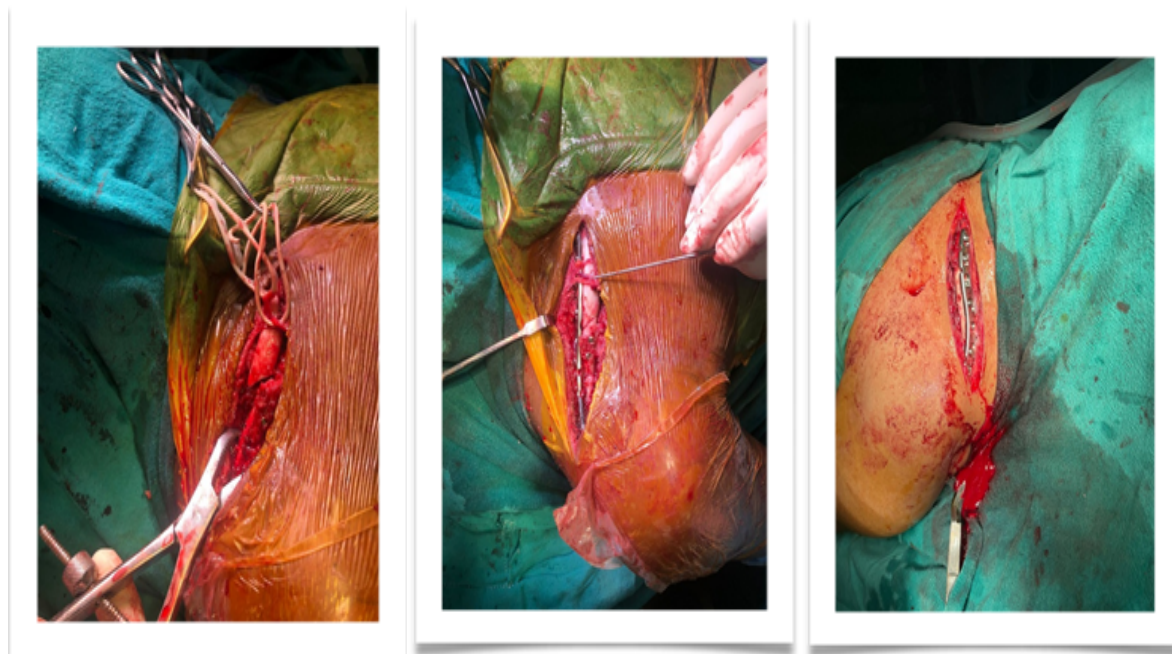
70-79: Fair

0-70: Poor

Operative Procedure:

The patient was kept in beach chair position with sand bag between the scapulae. Infiltration of incision, subcutaneous tissue was done with epinephrine solution. The incision was made along the axis of the clavicle. Subcutaneous tissue along with platysma incised together and mobilized. Myofascial layer was incised and elevated. Fracture site expose and periosteum elevated. Fracture was re-

duced using bone clamps. A comminuted wedge fragment, if any, was fixed with a lag screw. Pre-contoured reconstruction plate, anatomical clavicular plate or anterior superior lateral plates were used. The plate was placed over the superior surface of the clavicle. 2.7mm drill bit was used and screw size measured with depth gauge. Tapping was done with 3.5mm tap. 3.5 mm cortical screws are used for reconstruction and locking screws in locking plate. Minimum of six cortical purchases was attained on either side of the fracture. Myofascial layer followed by skin and sub cuticular tissue sutured. Sterile dressing applied and immobilized in a shoulder immobilizer (Campbell's Operative Orthopaedics 14th edition, pg 3034)⁵. Patients were followed up every 2 weeks till 3 months followed by quarterly intervals until 1 year.

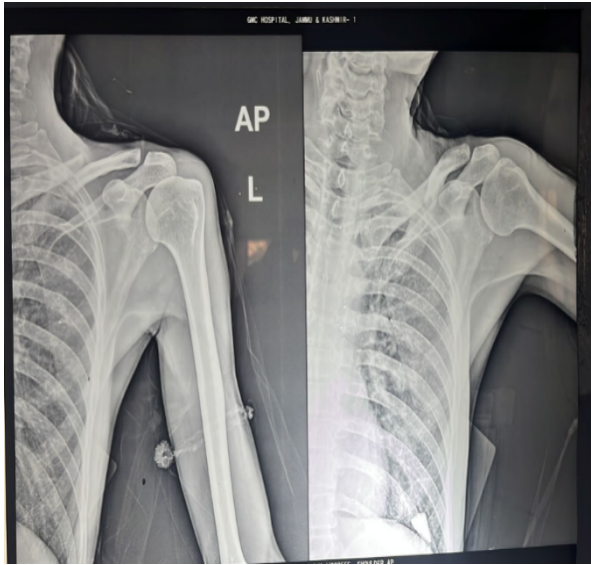


Intra Operative Pictures

Results

The study included 18 men and 4 women. Mean age of male patients was 37 years while that of female patients was 40 years. 14 patients (63%) patients had fracture of left clavicle while 8 patients (37%) had fracture involving right clavicle. Mean duration from admission to surgery was 5 days. Out of 22 cases, 3 patients had sustained injury more

than one year ago while the rest had history of recent trauma (less than one week). Average duration of surgery was 43 minutes. Patients were discharged 5 days post-op, sutures removed at 14 days. Mean duration of follow up was 7 months. Mean Constant & Murley score at 3 months post-op was 84.09. The mean union time of clavicle fractures in the study population was 12.1 weeks



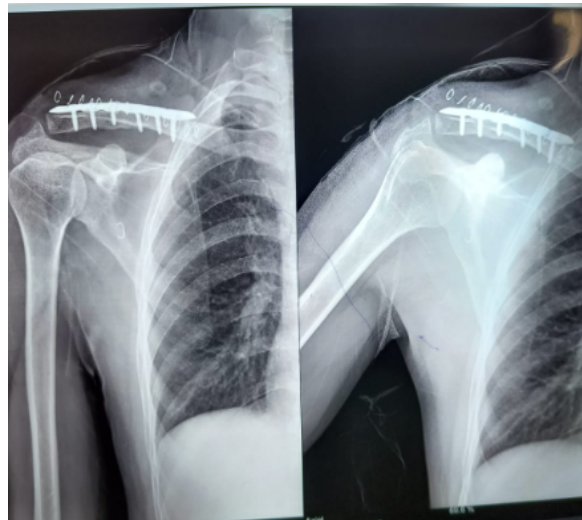
Case I: Pre-operative



Post-operative



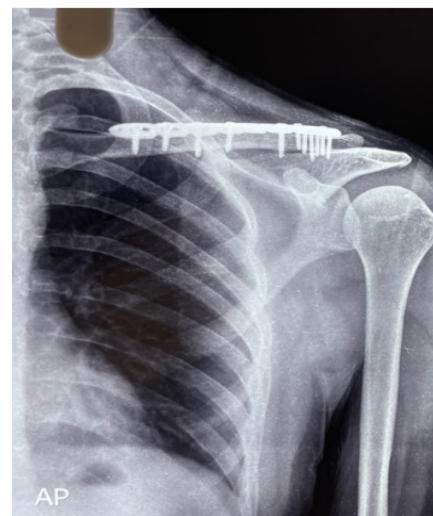
Case II: Pre-operative



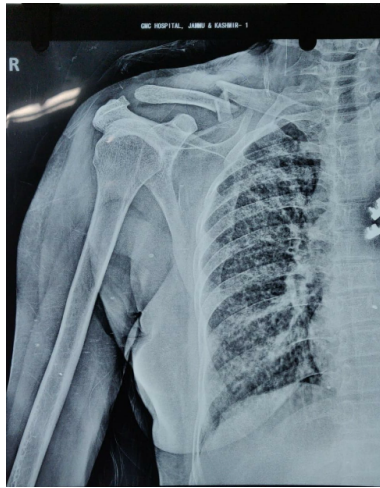
Post-operative



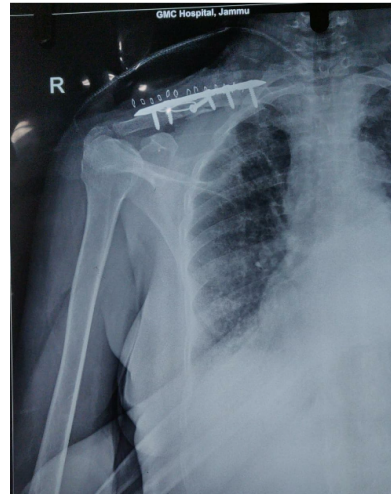
Case III: Pre-operative



Post-operative



Case IV: Pre-operative



Post-operative



3 months Post-operative range of motion



3 months post-op range of motion

Table 1: Distribution of patients according to sex (n= 22)

Sex	No. of persons	Percentage
Male	18	81.8%
Female	4	18.1%

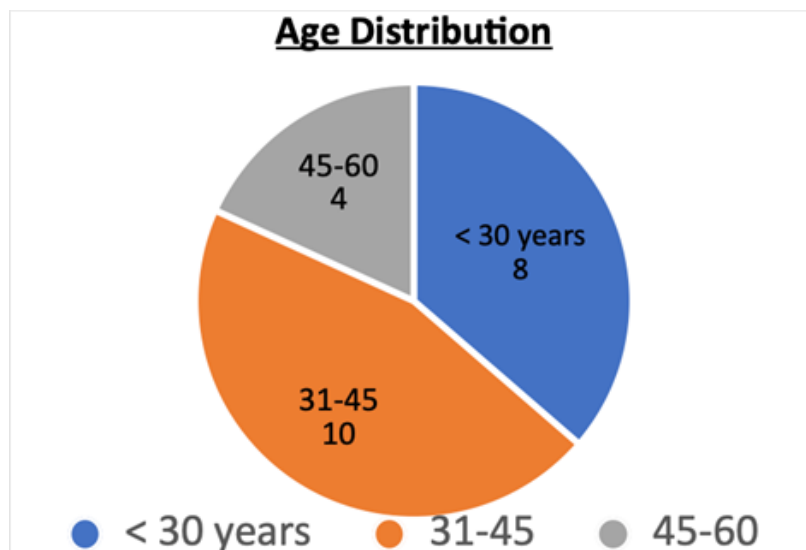


Figure 1 Age distribution of patients

Table 2: Distribution of patients according to limb involved

Side	No. of patients	Percentage
Right	8	37%
Left	14	63%

Table 3: constant & murley score

Score	No. of patients
< 70	02
71-85	09
85-100	11

Table 4: Mode of Injury

RTA	16 (72.7%)
Fall on ground	6 (27.2%)

Discussion:

Despite extensive studies, there exists no definitive management protocol for fracture clavicle. Earlier, displaced clavicle fractures were being managed conservatively, however, due to incidences of non-union, malunion and decrease in shoulder function and asymmetry of shoulder, conservative management of these fractures was criticised.

Patient satisfaction and high demands of patients have become an important consideration of operative management of clavicular fractures. Among various implants for fixation, plating was introduced to tackle these shortcomings as it provided immediate rigid fixation, facilitating early mobilization. Further pre-contoured anatomical locking clavicle plates have been designed which gave even better results. With improved implants, plate fixation became a reliable and reproducible technique.

Operative management with plating has provided a better functional outcome. It has significantly reduced malunion but has also given rise to surgery and implant-related complications, which pose a challenge to the efficacy of operative management.

A pattern of age distribution in our study showed that clavicle fracture is more common in young adults (Mean age 36 yrs). Similar results have been cited by Canadian Orthopaedic Trauma Society (Mean age 33.5 yrs) [6], Verborgt O et al, in 2005 (Mean age 28 yrs) [7], Woltz S et al, in 2017 (Mean age 38.3 yrs) [8].

In our study, RTA was most common mode of trauma (72.7%) which shows a similar trend in previous studies van der Ven Denise JC et al, in 2015 (76%) [9], Kulshrestha V et al, in 2011(51%) [10].

The mean union time in our study was 12.1 weeks, which was comparable to the available literature, Verborgt O et al, in 2005 (15 weeks) [7], Canadian Orthopaedic Trauma Society, in 2007 (16.4 weeks) [6].

Non-union rates in our study (0) were comparable to previous studies Kulshrestha V et al, in 2011 (0) [10], Woltz S et al, in 2017 (0) [8].

Constant & Murley score in our study (84.09) was comparable to previous studies by Naveen BM et al, in 2017 (83.63) [11].

Conclusion:

In our study, the majority of clavicle fractures occurred in young adult males, with RTA being the predominant mechanism of injury. We found that patients with displaced clavicle fractures treated with plate fixation had good functional outcome scores at sequential follow-ups. Hence, we conclude that early primary plate fixation for displaced clavicle fractures is a promising technique with good overall functional outcomes and patient satisfaction, especially in young, active patients.

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