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Research Article

Prospective Study of Functional Outcome of Displaced Middle Third Clavicular Fractures Treated by Plate Osteosynthesis

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Abstract

Introduction: Clavicle fractures are common injuries seen among adults (2- 5%).1 Fracture of the middle 1/3rdof clavicle constitutes for 70-80% of fractures, lateral end fracture contributes to 15-30% and medial end fractures contribute to 3% of fractures which are least common.

Open reduction and internal fixation (ORIF) with plating provide early functional recovery with less incidence of non-union and malunion. Non-surgical management is not considered optimum for managing clavicle fractures.

Aim of the study: To know the functional outcomes of surgical management of middle third displaced clavicle fracture by ORIF with locking compression plate.

Materials and methods: The current study was conducted in the Department of Orthopaedics, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India.

Study period: 16 months from August 2022 - November 2023

Type of study: prospective Interventional study

The study was interventional, as surgery was done to patients - that is treatment of middle 1/3rd of clavicular fractures using plate method

Conclusion: This interventional study concluded that use of locking plates for displaced midshaft clavicle fractures results in union with very good functional outcome and is associated with low complication rates.

Keywords: Clavicle Mid-Shaft Fracture; Precontoured Locking Plates; Plate Osteosynthesis

Introduction

Clavicle fractures are common injuries seen among adults (2-5%) [1]. Fracture of the middle 1/3rdof clavicle constitutes for 70-80% of fractures, lateral end fracture contributes to 15-30% and medial end fractures contribute to 3% of fractures which are least common.

Patients with high activity levels and routine work may not accept the conservative treatment due to prolonged recovery time and restricted shoulder movements. Early fixation of the clavicle provides better shoulder functions and comfort to the patient. Surgical interventions for middle 1/3rd clavicle fracture include plate osteosynthesis fixation (POF) and intramedullary nailing like "TENS" nailing.

Open reduction and internal fixation (ORIF) with plating provide early functional recovery with less incidence of non-union and malunion. Non-surgical management is not considered optimum for managing clavicle fractures.

Surgical treatment of middle shaft fracture has less incidence of non-union compared to conservative treatment [6].

Certain recent studies indicated that the incidence of nonunion and malunion rates in displaced middle 1/3rd clavicle fracture is around 15–20%, with low shoulder outcome scores if managed conservatively [7-9]. So, internal fixation of these fractures helps to to achieve early return of function. But Internal fixation of these fractures also has certain complications. Nonunion, skin irritation, implant breakage, paresthesia around surgical scar and infection are some common complications especially with plate fixations.

Aim of the study

To know the functional outcomes of surgical management of middle third displaced clavicle fracture by ORIF with locking compression plate.

Materials and Methods

- The current study was conducted in the Department of Orthopaedics, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India.
- Study period: 16 months from August 2022 – November 2023
- Type of study: prospective Interventional study
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Inclusion criteria

- middle third displaced clavicle fractures
- Patients of age >18years and < 55years
- Unilateral clavicle fractures
- Displacement >2cm

Presence of comminution

Exclusion criteria

- Patients with pathological fractures, medial and lateral end clavicle fractures.
- Patients with vascular injury, neurological deficit, floating shoulder, Polytrauma patients.

Operative procedure

Anesthesia : Under general anesthesia/ regional anesthesia.

Position and preparation : the patient is positioned in beach chair with a sandbag placed between medial boarder of scapula and spine .Shoulder is then prepared and draped, and an incision is made over the site of the fractured clavicle.

Surgical approach (anterior approach)

Land marks and skin incision- sternal notch is the most medial landmark and ac joint is the most lateral landmark,make an incision following S - shape clavicular anatomy ,beginning from medial end .length of the incision depends upon extend of the fracture.

The supra clavicular nerve branches were identified during thesubcutaneous dissection and protected, which is usually difficult.

The platysma was divided to expose the clavicle periosteum at thedeltotrapezial fascia.

The periosteum was then minimally dissected to expose thefracture site. Bone fragments were not detached from the periosteum. Plate was then kept in position (antero-superiorly) on the reduced bone and temporarily fixed with plate holding forceps.The plate is secured over the bone on superior surface, aim for atleast 3 screws in medial and lateral fragments in most cases, ensuring preservation of soft tissue attachments. Closure involved suturing the deltotrapezial fascia with interrupted number-1 absorbable sutures as a distinct layer, followed by skin closure.

Postoperative care and rehabilitation

- The arm sling pouch given immediate post op for upto 2weeks.
- Pendulum movements of shoulder was started within two days withlimb rested in arm sling.
- Sterile dressing were done on 2nd and 5th post op day.
- Suture removal was done on the 12th to 14th post operative day.

After two weeks, the wound status was assessed and use of the sling was discontinued and active assisted range-of-motion exercises of the shoulder in the scapular plane were started. After four weeks, full active motion was initiated.

When there were clinical and radiographic signs of union noted (usually at six to eight weeks), strengthening and resistive exercises of the rotator cuff, deltoid and trapezius were started.

After clinical and radiological union, most patients were allowed to participate in sports activities usually by three to four months.

All the patients were reviewed on 2nd week, 4th week and 12th week At 3 months follow up, patients functional outcome were assessed using DASH questionnaire.

Radiological evaluation of the union was done by taking serial x- rays. Radiological union was assumed to be achieved when there were bridging trabeculations across the fracture site on three of four cortices at the fracture line.Any changes in the alignment, screw pullout or implant failure were also noted.Functional outcome was based on DASH score.

Results

- **AGE:** 30% of the patients were aged 31 to 40 years, 26.67% were aged 21 to 30 years and mean age group is 35.06 years.
- **GENDER:** In my study ,90% of the patients were males.
- **COMORBIDITIES:** 13.33% of the patients had DM, and HTN. 70% had no comorbidities.
- **MODE OF INJURY:** 96.67% of the patients had road traffic accident.

Mode of injury	Frequency	Percent
SPORTS	1	3.33%
RTA	29	96.67%
Total	30	100.00%

Table a

Duration of surgery

63.33% of the patients underwent surgery for 60-70 mins.

DURATION OF SURGERY	Frequency	Percent
60-70 MIN	19	63.33%
70-80 MIN	9	30.00%
80-90 MIN	2	6.67%
Total	30	100.00%

Table b

Duration of surgery

63.33% of the patients underwent surgery for 60-70 mins.

Duration of surgery	Frequency	Percent
60-70 MIN	19	63.33%
70-80 MIN	9	30.00%
80-90 MIN	2	6.67%
Total	30	100.00%

Table c

Union time

Fracture union time was 11 to 12 weeks for 36.67% of patients.

Union Time	Frequency	Percent
9 to 10 weeks	10	33.33%
10 to 11weeks	9	30.00%
11 to 12 weeks	11	36.67%
Total	30	100.00%

Table d

Non-Union

3.33% of the patients had non-union.

In this study ,if the fracture doesn't show progressive signs of healing for 3 consecutive months, this fracture is considered as non union .

The U.S FDA (Food and Drugs Administration) defines non union as established when a minimum of 9months has elapsed since fracture with no visible progressive signs of healing for 3months.

Dash score pre-OP and post OP

There is significant improvement in DASH score after surgery. Mean DASH score before surgery was 66.4 and it was 15.2 after surgery.

	Dash before	Dash after
Mean	66.4	15.2
Variance	67.28276	10.23448
Observations	30	30
Pooled Variance	38.75862	
Hypothesized Mean Difference	0	
df	58	
t Stat	31.85161	
P(T<=t) one-tail	0.000	

Table e

Discussion

The current study was done on 30 patients with displaced middle 1/3rd of clavicular fractures.

Summary of current study findings and comparison with other studies:

- 30% of the patients were aged 41 to 50 years, 26.67% were aged 21 tov30 years.
- 90% of subjects were males.
- 96.67% had road traffic accident. 63.33% underwent surgery for 60-70 mins.
- 50% had right sided fracture of clavicle.
- 60% had 2C AO/OTA of fracture of clavicle. 26.67% had associated minor injuries.
- 16.67% had associated RIB fractures
- Fracture union time was 11 to 12 weeks for 36.67% of patients.
- 3.33% had non-union
- Mean DASH score is 15.2 at 3months
- 10% developed infection postoperatively.
- 10% had more than 7 days of hospital stay.
- There is significant association between age and infection. Patients aged above 50 years developed infection due to co morbid conditions like DM
- There is a significant association between age and duration of hosp stay,as they were treated with IV antibiotics for superficial infection,so the duration of hospital stay was prolonged

Summary and Conclusion

The current study was done on 30 patients with middle 1/3rd of clavicular fractures. This interventional study concluded that use of locking plates for displaced midshaft clavicle fractures results in union with very good functional outcome and is associated with low complication rates.

All the patients were discharged in stable condition.

A Interventional randomized prospective study is suggested to prove the superiority of operative management over conservative treatment.

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