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Patient oriented outcome of surgical fixation of clavicle fractures in a rural tertiary care centre

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Abstract

Clavicle fracture is one of the most common bony injuries. They account for 2.6% to 4% of adult fractures and 35% of injuries to the shoulder girdle. Clavicular fractures have traditionally been treated non-operatively. Surgical treatment of acute midshaft fractures was not favored due to relatively frequent and serious complications. However, the prevalence of non-union or malunion in displaced midshaft clavicular fractures after conservative treatment is higher than previously presumed. Twenty-four patients with displaced clavicle fractures were treated with locking compression plate between October 2018 to September 2020 at Kamineni Institute of Medical Sciences, Narketpally. The duration of radiological union ranged from 12-16 weeks with the majority having union at 12 weeks (66.7%). The remaining (33.4%) had union at 16 weeks. Delayed union and nonunion cases were not observed in our study. The functional outcome assessment according to Constant Murley Scoring system showed excellent functional outcome in 75% and good functional outcome in 25% of the patients.

Keywords: Clavicle fracture, constant Murley score, functional outcome, radiological union, plating

Introduction

Mid-shaft clavicle fractures account for 80% to 85% of all clavicular fractures; lateral fractures contribute 15% to 20%, and medial fractures, at zero to 5%, are relatively rare. The rate of mid-shaft clavicular fractures is more than twice in men as in women. The peak incidence occurs in the third decade of life [1]. The present consensus that great majority of clavicular fractures heal with non-operative treatment is no longer valid. The amount of pain and disability during the first three weeks of conservative treatment has been underrated and the common view that nonunion does not occur is wrong. There are various surgical methods for treating clavicle mid-shaft fractures, such as intramedullary fixation using K-wires, Knowles pin, Rockwood pin and titanium elastic nails and plate fixation [2]. In particular, plate fixation can help obtain firm anatomical reduction in severe displaced or comminuted fracture. There are various plates including dynamic compression plates, pre-contoured locking compression plates and semi-tubular plates. Among them, a reconstruction plate which can be bent to the S-shaped curvature of the clavicle and pre-contoured locking compression plate (LCP), are the most preferred. The present study aims to assess the patient oriented functional outcome and time taken for radiological union of displaced clavicular fractures after surgical fixation.

Materials and Methods

The present study is a prospective study of 24 patients between October 2018 to September 2020 with acute clavicular fractures treated with surgical management with open reduction with plating at Department of Orthopaedics, Kamineni Institute of Medical Sciences, Narketpally, Telangana State.

The fractures were classified according to Allman classification. All the 24 patients managed surgically were followed up post operatively at one, three, Four and up to six months.

Twenty-four patients who fulfilled the inclusion criteria were studied. All patients were informed and explained about the injury and the treatment plan. Informed and written consent was taken from the patients before including them in the study.

Inclusion criteria

1. All patients aged 18-60 years who required surgical intervention for clavicle fractures.

2. All the fractures of clavicle with a fracture gap >2cm or displacement >2cm or shortening of clavicle length >2cm.

Exclusion criteria

1. Age <18 years and >60 years
2. Pathological fractures
3. Associated head injury
4. Established non-union from previous fracture
5. Any patient refusing surgery

Preoperative evaluation

Demographic information such as name, age, sex, occupation and address were noted. A detailed clinical history such as mode of injury like fall on the shoulder, road traffic accident, direct injury to shoulder and fall on outstretched hand was noted. Enquiry was made to note site of pain and swelling over the affected clavicle. Past medical illness and family history were also recorded.

General condition of the patients was examined for pallor, pulse rate and blood pressure. Respiratory and cardio vascular system were examined for any abnormalities.

Local examination was done in the following steps:

1. On inspection: Patients with fracture clavicle often support the flexed elbow of the injured side with the other hand. Abnormal swelling was present in the middle third for middle third clavicle fracture and laterally for lateral third fracture. The condition of the skin over the clavicle was noted for any abrasion, laceration and contusion.



Fig 1(a, b): The instruments and implants used for clavicle fracture fixation

Surgical technique

1. Patient in supine position with one towel in between the scapula. Entire upper limb from base of neck to hand prepared and draped.
2. About 7-9 cm, incision was made in the anterior aspect centering of clavicle over the fracture site.
3. The skin subcutaneous tissue and platysma were divided without undermining the edges.
4. The overlying fascia and periosteum were next divided. The osseous ends were freed from surrounding tissue.
5. Minimal soft tissue and periosteum dissection was done.
6. Fracture fragments were reduced and plate (3.5mm anatomical pre-contoured Locking compression plate) was applied over the superior aspect of the clavicle.
7. 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 neurovascular structure underneath it.
8. The locking compression plate was fixed to the medial and lateral fragment with locking screws/ cortical screws and minimum of 6 cortices in each fragment were fixed.

2. On palpation: Palpation of the entire length of the affected clavicle for tenderness in the medial, middle third or in the lateral third fracture. The fractured clavicle was also palpated for any abnormal mobility and crepitus.
3. Movements: The movements of the affected side shoulder was restricted due to pain. The distal neurovascular status of the affected upper limb was examined and also the associated injuries along with fractured clavicle were noted.
4. Radiographs: Plain radiograph of clavicle with shoulder in anteroposterior view was taken to assess the site of fracture and the fracture type (displacement and comminution). The fractures were classified according to Allman classification.
5. The affected upper limb was immobilized in an arm pouch. Routine investigations needed for anesthesia and surgery were done for all patients. All patients were operated after the patients were deemed fit for surgery after assessment by the anesthetist and physician.

Preoperative preparation of patients:

1. Patients were kept nil by mouth for eight hours before surgery.
2. A written consent for surgery was taken.
3. The neck, chest, axilla shoulders and arm were prepared.
4. An injection of systemic antibiotic usually Inj. Ceftriaxone 1gm intravenously were administered 30 minutes before surgery to all patients.
5. All patients were operated under general anesthesia.

9. Wound was closed in layers after ensuring meticulous hemostasis and sterile dressing was applied.

Post-operative care

Postoperatively, the operated limb was supported in an arm sling pouch and patient vitals monitored and checked for neurovascular status, wound soakage and any other immediate complications. Check X-ray was done on the first post-operative day and wound inspection was done on 2nd, 6th and 10th postoperative days. Intravenous antibiotics were continued for five days and switched over to oral antibiotics if wound was healthy. Sutures were removed on the 10th to 12th postoperative day. Arm sling pouch was advised till 4weeks post-operatively. Patients were advised not to lift heavy weights with the affected arm and given instructions to carry out shoulder, elbow and wrist ROM.

Follow-up protocol

The regular follow-up visits were scheduled at 1, 3, 4 and 6

months to assess the patient clinically and radiologically. The patients were examined clinically for pain and shoulder function. At the same time X-rays were done to assess fracture union, maintenance of reduction and status of implant.

The functional outcome was assessed as per Constant Murley scoring system. The scoring system has subjective as well as objective components and the patients will be graded as below with a maximum score of 100 points.

Results

The present prospective clinical study conducted on 24 patients of clavicle fractures treated surgically with open reduction internal fixation with pre-contoured S-shaped locking compression plate. All patients were treated at Kamineni Institute of Medical Sciences (KIMS) and Hospital, Sreepuram, Nalgonda district, Telangana State between October 2018 to March 2020. All the patients were available for follow-up and they were reviewed at 1, 3, 4 and six months post-operatively. The results were analyzed both clinically and radiologically.

Demographic data

Out of the 24 patients, majority of the patients, i.e. 8 patients (33.34%) were in the age group of 18-29 years. The youngest patient was 19 years old and oldest patient was 58 years old. The mean age of the patients in the study is 36 years.

Eighteen patients (75%) were male and 6 patients were female (25%).

Fifteen patients had fracture of the right (62.5%) side and nine patients had sustained fracture of the left (37.5%) clavicle.

Mode of injury

Thirteen patients (54.16%) sustained clavicle fracture in high energy road traffic accidents and six patients (25%) had low energy impact in fall from height and the remaining five patients (20.84%) were involved in sporting activities.

Classification: Allman’s classification is used to classify the clavicle fractures in this study. There are 23 cases of Middle-third fracture and one case of Lateral third fracture of the clavicle. We did not have medial-third fractures.

All the 24 patients in this study were operated by open reduction internal fixation with precontoured locking compression plate.

Duration of radiological union

The fracture was considered to be united when clinically there was no tenderness, radiologically the fracture line was not visible and full unprotected function of the limb was possible. Radiological union was assessed post-operatively at 1, 3 and 4 months follow-up on plain radiographs of the clavicle. More than half of the cases had fracture union in 12 weeks. (Table 1)

Table 1: Distribution of cases based on time for radiological union of fracture (n = 24)

Time taken for radiological union	Number of cases	%
12 weeks	16	66.67
16 weeks	08	33.33
Total	24	100

Functional outcome

The functional outcome is assessed by Constant-Murley score at the end of six months of follow-up period. In this study 18 patients (75%) had excellent functional outcome and six patients (25%) had good functional outcome. (Table 2)

Table 2: Distribution of cases based on functional outcome at final follow-up of 6 months (n = 24)

Functional outcome	Number of cases	%
Excellent	18	75
Good	06	25
Fair	-	-
Poor	-	-
Total	24	100

Complications

There were no complications in any of the cases, except for one case where there was plate bending at one-month follow-up. (Fig 2) The fracture united by 16 weeks and patient had no plate prominence or other complaints. (Fig 3).



Fig 2: At one month post-op, follow up radiograph of right clavicle AP view showing minimal plate bending



Fig 3: At 16 weeks post-op showing fracture union with minimal plate bending

Discussion

The clavicle is one of the most frequently fractured bones in the body, most often resulting from a direct blow or a fall on an outstretched arm.

Most clavicular fractures heal uneventfully without serious consequences with non-operative treatment. Historically, treatment guidelines were based on Neer [3] and Rowe’s [4] two large series that showed nonunion rates of less than 1% in conservatively managed fractures compared with nearly 4% in operatively treated fractures. These results established the concept that union rates and functional outcomes were excellent with conservative treatment of clavicular fractures and were better than those after operative treatment [1, 2].

More recent studies have questioned union rates, functional recovery, and the morbidity of malunions after conservative treatment. A prospective observational study of 868 patients

with clavicular fractures treated non-operatively found a nonunion rate of 6.2%. Risk factors identified were advanced age, female sex, 100% displacement (lack of cortical contact), and presence of comminution [5].

A meta-analysis [5] including 2144 fractures showed a nonunion rate of 15% for displaced clavicular fractures treated non-operatively, whereas the nonunion rate for ORIF was only 2%.

Thus, there appears to be a subgroup of patients, with displaced fractures who do not do well with conservative treatment as previously thought.

These concerns led the Canadian Orthopaedic Trauma Society [6] to initiate a multicenter prospective randomized trial to compare non-operative treatment and plate fixation of displaced clavicular fractures. They concluded that operative treatment resulted in improved functional outcomes and lower rates of malunion and nonunion [6].

Most clavicular fractures are still treated conservatively. Treatment, however, should not be an "all or nothing" approach, but should be aimed at providing optimal outcomes for individual patients and injuries. Recent reports in the literature have helped to more accurately predict complications after displaced fractures and to allow a frank discussion with the patient to choose the appropriate form of treatment.

Operative management usually consists of ORIF with plates and screws or intramedullary nail fixation. External fixation has been described but rarely is necessary except in unique situations.

This study has been undertaken to study and evaluate the results, patient outcome and problems associated with surgical fixation of clavicular fractures.

The present study is conducted in Kamineni Institute of Medical sciences, Narketpally which is a tertiary care center in a rural area. All the twenty-four patients with displaced clavicle fractures underwent surgical fixation with S-shaped clavicle locking plates and were followed up for six months post-operatively.

This study is comparable to similar studies conducted by Apoorv Sehgal *et al.* (2019) [7] study which is a prospective study to evaluate functional outcome after surgical fixation of 20 cases of middle and lateral third clavicular fractures treated by plate and screw fixation.

This study is also comparable with the study by Kakkar RS *et al.* (2020) [8] where 32 cases of mid-shaft clavicle fractures have been treated with ORIF using pre-contoured LCP and the radiological union time and functional outcome were studied.

This study has also been compared with the study by I. Kameshwar (2019) [9] conducted in 2019 in a rural area on 35 cases of fractures of clavicle to study the functional outcome, associated complications and the duration of union.

In the present study 24 cases of clavicle fractures have been included. Apoorv Sehgal *et al.* studied only 20 cases whereas Kakkar RS *et al.* studied 32 cases and 35 cases were observed by I. Kameshwar.

The mean age of the patients in the present study is 36 years. The mean age of the patients in the studies conducted by Apoorv Sehgal *et al.* (35.15 years), Kakkar RS *et al.* (32.5 years) and Kameshwar (30 years) shows the fracture is more common in the fourth decade.

Road Traffic accident (RTA) was the most common mode of injury seen in the studies by Apoorv Sehgal *et al.* (55%) and Kakkar RS *et al.* (84.3%), whereas Kameshwar had 51.5% cases who sustained fracture of the clavicle due to fall from height. The present study has 54.16% cases involved in RTAs followed by 25% cases affected due to fall from height and 20.84% had sports injuries leading to clavicle fracture. It can be inferred from the above data that majority of the study

population sustained clavicle fracture in RTAs followed by falls and least by sporting accidents [7-9].

Duration for radiological union

Apoorv Sehgal *et al.* reports a minimum period for union as 3.5 months and maximum as 6.5 months and mean period for union as 4.85 months. Majority of the patients (55%) had radiological union between 4-6 months and delayed union was observed in 10% of the cases. Nonunion was seen in one case. Kakkar RS *et al.* observed union at 8 weeks in 6.25% cases, 10 weeks in 15.62% cases, 12 weeks in 53.14% cases, 14 weeks in 21.87% cases and at 16 weeks in 3.12% cases with the average mean time for union at 11.42 weeks. Kameshwar observed radiological union at 14 weeks in 69% cases and 31% attained union at 20 weeks. No cases of nonunion were reported.

In the present study, union at 12 weeks was seen in 66.7% cases and 33.3% had achieved union by 16 weeks. No cases of delayed union or nonunion occurred.

Functional outcome: Assessed by using the constant-Murley score (cms)

Apoorv Sehgal *et al.* reported excellent outcomes in 5% cases, while majority (65%) had good outcome while 20% had fair and 10% cases had poor outcomes. Kakkar RS *et al.* reported excellent outcomes in 56.25%, fair in 34.37%, good outcome in 6.25% and 3.12% cases had poor outcome. I. Kameshwar observed majority (71.6%) to have excellent outcome and 25% had Good outcomes.

The present study has excellent outcome in 75% and Good outcomes in the remaining 25% population.

Complications

The present study has no complications in any of the cases, except for one case where plate bending was noticed on radiographs at one-month follow-up. The fracture united by 16 weeks and patient had no plate prominence or other complaints.

Apoorv Sehgal [7] reported the following complications - shoulder stiffness (15%), delayed union (10%), hardware prominence (10%), infection (5%) and nonunion (5%).

Kakkar RS [8] in their study on 32 cases, one case had superficial wound infection that resolved with oral antibiotics completely and one case had implant prominence for which implant removal was done post union. Kameshwar [9] encountered complications like plate prominence (5.7%) and superficial infection (2.9%).

Case 1

A 28 year old female sustained injury in a RTA and presented with pain over right clavicle with pain and difficulty in moving the right arm.



Fig 4: Preoperative x-ray showing right clavicle middle third fracture (Allman group I)



Fig 5: Immediate post-operative x-ray showing fixation of the right clavicle fracture with a pre-contoured LCP and locking screws

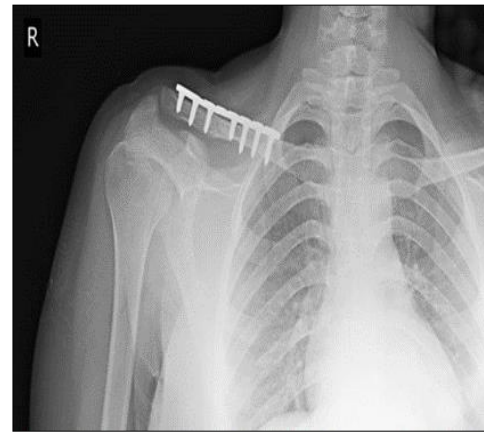


Fig 6: Post-operative x-ray with radiological union at 12 weeks



Fig 7: Rom - Flexion, extension, abduction, internal and external rotation constant Murley functional score: Excellent (90%)

Case II

A 30 year old male sustained injury due to a fall onto right shoulder and presented with pain and difficulty in moving the right arm.

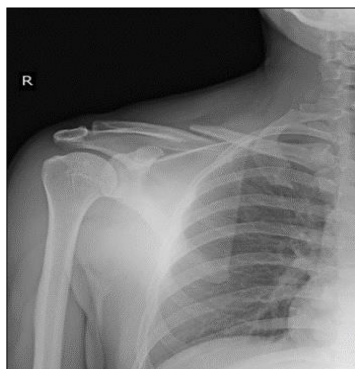


Fig 8: Preoperative x-ray showing right clavicle mid shaft fracture (Allman group I)

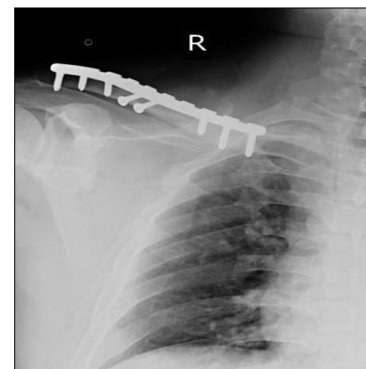


Fig 9: Immediate post-operative x-ray showing fixation of the fracture with a pre-contoured LCP and compression screws

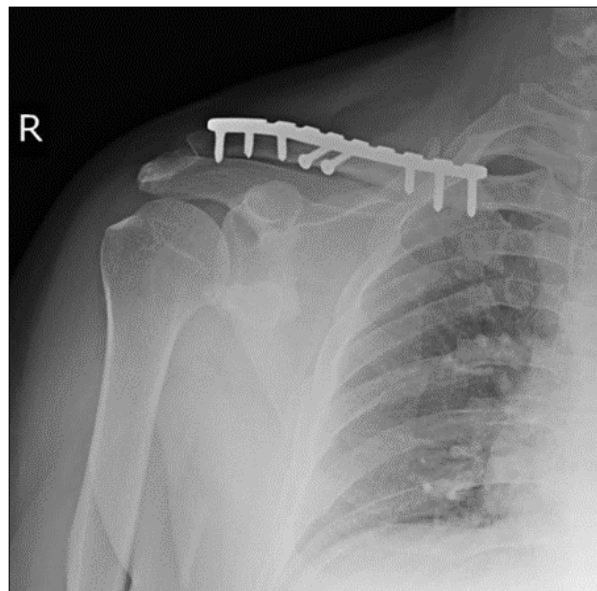


Fig 10: Post-operative x-ray with radiological union at 16 weeks



Fig 11: Rom - flexion, extension, abduction, internal and external rotation

Constant Murley functional score: Excellent (95%)

Conclusion

The present study has observed excellent and good functional outcomes with early return to daily activities after surgical fixation of displaced clavicle fractures with pre-contoured locking plates. The limitations of the study are (1) Small sample size (24 patients), (2) Different surgical modes of fixation were not compared and (3) Not a comparative study with non-operative management.

In conclusion, the study agrees with the current management of surgical fixation of selected clavicle fractures.

References

1. Robert Buchholz, James Heckman D, Charles Court-Brown. Rockwood green's fractures in adults 2006;1:1213-1216.
2. Terry Canale S, James Beaty H. Campbell's operative orthopedics 3(11):3371-3376.
3. Neer CS. Nonunion of the clavicle. Journal of the American Medical Association 1960;172(10):1006-11.
4. Row ECR. 4 An Atlas of Anatomy and Treatment of Midclavicular Fractures. Clinical Orthopaedics and Related Research (1976-2007) 1968;;58:29-42.
5. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD.

- Treatment of acute midshaft clavicle fractures: systematic review of 2144 fractures: on behalf of the Evidence-Based Orthopaedic Trauma Working Group. *Journal of orthopaedic trauma* 2005;19(7):504-7.
6. Society CO. Non-operative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. *The Journal of bone and joint surgery. American* 2007;89(1):1-0.
 7. Sehgal A, Rathore LP, Lal M, Chandel DR. Results of functional outcome of surgical treatment of fracture clavicle. *International Journal of Orthopaedics* 2019;5(3):22-7.
 8. Kakkar RS, Mehta D, Sisodia A. Functional and radiological assessment of displaced midshaft clavicle fractures treated through open reduction and internal fixation surgery using pre-contoured locking compression plates. *International Surgery Journal* 2020;7(7):2261-7.
 9. Kameshwar I. Study of Plating for Clavicular Fractures by Pre Contured LCP. *IOSR-JDMS* 2019;18(6):12-18.