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Original Research Article

STUDY OF PLATING FOR CLAVICULAR FRACTURES BY PRE CONTURED LCP

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ABSTRACT

Background: Recent studies have shown that displaced mid-shaft elavicular fractures do not have assured favourable outcomes with non-operative management and nonunion rates could be as high as 20%. In addition many malunite with significant shourtening. Non-union or malunion causes functional deficit and many of them may benefit from primary internal fixation. This study was under taken to evaluate the efficacy of pre contured plate LCP in treating clavicular fractures.

Materials and Methods: In this study 35 patients with clavicular fractures were choosen between 20-50 years of age treated with pre contured LCP. 5 cases were established non-union after treatment with conservative methods.

Results: The mean age of patient was 30 years with Male predominance (80%) Left side (53%) and (82%) of cases were middle third of shaft of clavicle fracture and the commonest mode of injury fall from out stretched hand, motor accidents. All the cases treated with pre contured LCP and functional results assessed according to constant and Murley score and Radio graphs excellent in 25 cases and good in 10cases.

Conclusion: This study shows stable fixation with pre contured LCP and showed clinically and radiologically excellent results.

Keywords: Clavicul fractures, internal fixation, pre contured locking compression plate LCP. MESHTERMS: Clavicular fractures, LCP.

INTRODUCTION

Clavicle fractures account for approximately 4% of the middle third of the bone (76-82%) and less often in the distal (12-21%) and medial (3-6%) thirds.[1-2] Historically we were taught, "All clavicle fractures do well with non-operative treatment". Such treatment is usually successful and till recently most of the available literature showed that more than 95% of clavicle fractures achieve union with acceptable cosmetic and functional results.[3] "Operative treatment is not only meddlesome but can increase the nonunion rate significantly", much of this thinking came from the original work of Neer and Rowe et al,[2,4] in the 1960s when operative techniques were variable and not standardized or refined.[2,4] Fracture of the clavicle have in traditionally treated non operatively by closed reduction, the present consersus that great majority of clavicular fracture eal without non operative treatment is no longer valid. Recent studies in the adult literature have shown a greater prevalence of symptomatic malunion, nonunion, and poor functional outcornes after nonsurgical management of displaced fractures.[2] Also persistent wide separation of fragments with interposition of soft tissue may lead to failure of closed reduction. There is 15% nonunion rate in widely displaced fractures of middle-third of the clavicle treated without surgery and all fractures with initial shortening of more than 2cm resulted in non-union.[3] Many published articles document the success of open reduction and internal fixation for nonunion of displaced clavicle fractures with low complication rates. Most of these authors used plate (DCP, Reconplate) screws, pin fixation of clavicular fractures. The shape of the clavicle bone is 'S' shaped and plate pre contured to the shape of clavicle LCP were used in this study and evaluated the functional out come of treating clavicular fracture with LCP.

Aims and Objectives

(MAIN OBJECTIVE): To study the operative management of clavicle fracture by pre contured LCP.

Secondary objectives

1. To determine the functional outcome of the clavicular fractures treated with open reduction and internal fixation with LCP.
2. To access the duration of union.
3. To access the complications associated with clavicular fractures and their management.

MATERIALS AND METHODS

It is a prospective study conducted on 35 cases of clavicle fracture with age group 20-50 admitted in Dist. Head quaters Hospital Nalgonda for treatment.

Inclusion Criteria

1. All clavicle fracture displaced comminuted sufficient skin teethring.
2. Established nonunion treated by conservative methods for a period of 6-12 months.

Exclusion Criteria

1. Pathological fractures
2. Open fractures
3. Undisplaced fractures
4. Associated head injures
5. Associated with neurovascular injury
6. Associated acromioclavicular joint dislocation
7. Any medical condition contraindicated for surgery (heart diseases, renal failure) All the patients were selected from the admission in the department of orthopedics at Dist head quarters Hospital Nalgonda who fulfilled the inclusion and exclusion criteria. The selected patients were then recruited for the study after a wanth informed consent taken and counseled about the all post operative complication. Out of 35 patients in our study 30, (acute fractures) 5 established nonunion 22 male patients and 13 were female patients. In post operative the patients relived by clinical and radiological results evaluated according to constant and murley scoring and plain radiographs. Union was evaluated radiologicaly complication revealed and functional assessment was conducted at 2, 3, 4, 6 months.

After admission clinical history taken regarding the mode of injury, and x ray taken to study the anatomy of fracture, and examined for neuro vascular status of limb and associated injury like chest injury, fracture, Ribs head injury.

All surgeries were performed in the elective theatre using standard aseptic precaution. Under GA/Interscelaene block patient in supine position on ot table with a soft bin under the shoulder. The part draped, about 7 to 9 c.m insion taken over the anterior part of clavicle centering the fracture site and sub cutaneous tissue and peristeoum on clavical stripped and fractured fragments aligned in position by precontured lcp plate 7 to 9 holes fixed medial and lateral fragments with 4m.m locking screws, 3.5 cortical screws and 3 screws on either side of fracture fixed. the averge time of duration of surgery was less then 1hr. All the patiants are mobilized shoulder movements started at the end of 2weeks. At b 4 to 6 weeks active rage of movements at shoulder was allowed but abduction was limited to 80. at 6 to 8weeks active rage of movements in all planes ware allowed.

Studies from our cases plate is placed superiorly on the bone it functions as a tension band and theoretically is effective because it is sufficiently rigid to withstand both the bending and the torsional forces at the middle third of the clavicle. It can also be bent to the contour of the clavicle. Additional fixation with interfragmentary screws and circlage wire can beachieved with a plate for oblique and communited fractures. Complication such as screw loosening and plate failure were not observed in the precontoured group distincet scars on clavicular region or currently considerd major complications due to the increased cosmetic demand.

RESULTS

In a study of 35 cases of clavicle fractures treated with locking compression plate. In this study the average age was 30 years. Rehabilitation of the affected arm was started at the end of 2 weeks.

At 4 to 6 weeks gentle active range of motion of the shoulder was allowed but abduction was limited to 80 degrees. At 6 to 8 weeks active range of motion in all planes were allowed.

In this study we have included patients ranging from the age of 20-50. Among them we had the highest number of patients in the age group of 21-30 years (67%). The mean age was 30 years. (table 1)

In the present study among 35 patients, 29 (80%) were males and 6 (20%) were females. (table 2).

In our study the mode of injury was RTA and fall constituted 50% each. (Table 3)

In our study left sided fracture was noted in 19 patients (53%) where as 16 patients (47%) had clavicular fractures on the right side. (table 4).

In the present study according to the Robinson classification, 2A2 category was seen in 4%, 2B1 was seen in 82%, 2B2 was seen in 16.7% of the subjects. (Table 5).

In the present study 21 cases (69%) of the subjects had < 5 Days interval between trauma and surgery. (Table 6)

In the present study 2(6%) of the patient had hospital stay of 0–5 days. 63.3% had a stay of 5–8 days, 24% stayed for 8–10 days. Mean hospital stay was of 7 days. 2 cases staged for a period of 14 days. (Table 7)

In our study most of the patients i.e., 21 (69%) of them achieved radiological union in 14 weeks and 14 patients (31%) achieved union in 20 weeks. non-union nil. (Table 8)

In our study, 3 patients had complications. Plate promise and restriction of shoulder movements were

noted. Superficial infection were noted in 1 patients. (Table 9)

In our study as per the Constant and Murley scoring system, in 25 patients (82%) the functional outcome was Excellent, 9 patients Good category, 1 patient Fair functional outcome. (Table 10)

Table 1

Age in Years	No of Patients	%
21-30	23	67
31-40	9	23
41-50	3	10
Total	35	100

Table 2

Gender	No of Patients	%
Female	6	20
Male	29	80
Total	35	100.0

Table 3

Mode of Injury	No of Patients	%
Fall	18	51
RTA	17	49
Total	35	100.0

Table 4

Side affected	Total
Left	19(53)
Right	16(47)
Total	35

Table 5

Robinson Classification	Total
2A2	2(4%)
2B1	26(82%)
2B2	7(14%)
Total	35(100%)

Table 6

Time Interval between trauma and surgery in days	Total	Mean (days)
<3	9(18%)	
<5	21(69%)	4
<1 week	5(13%)	
Total	35(100%)	

Table 7

Duration Stay in hospital days	Total	Mean (days)
0-5	2 (6%)	7
5-8	21 (63.3%)	
8-10	10 (24%)	
11-14	4 (6.7%)	
Total	30 (100%)	

Table 8

Time of radiological union in weeeks	Total
14	21(69%)
14-20	14 (31%)
Non union	Nill
Total	35(100%)

Table 9

Complications	Total
Infection superficial	1
plate breakage with nonunion	Nill
Plate prominance	3
Restriction of shoulder movements	3
Non union	Nill

Table 10

Result	Total
Excellent	25
Good	9
Fair	1
Total	35(100%)

Table 11

Study	Complications
Ramesh et al. (7)	Plate loosening-1 Plate prominence-2 Delayed union-1
H. Jaing et al.(9)	Dysesthesisa in the area of incision-10 Hypertrophic scarring -5, Painful shoulder-2 Limitation of shoulder movements-1
Canadian Orthopedic trauma society (COTS) (11)	Wound infection -3 patients Hardware irritations (removal required)-5 patients Transient brachial plexuses injury-8 Nonunions-2
Virtanen et al (12)	Refracture -1 Delayed unions-3
Present study	Dccp infection -Nill Nonunion- Nill Plate breakage-Nill Plate prominence-3 Restiction if shoulder movements-3

DISCUSSION

Age distribution of patients studied

1. In this study we have included patients ranging from 20–50 years of age, amongst them we had the highest number of patients in the age group between 21–30 years and mean age was 36 years with standard deviation of 6.
2. In a similar kind of study conducted by Ramkumar Reddy et al,[6] most were in the age group between 19–39 years (66%) while 2 patients were above the age of 50. Average age was 33.8 years.
3. In a study conducted by Ramesh et al,[6] among 20 patients, 45% were in the age group of 21–30 years. The youngest patient was 19 years and the oldest was 60 years old.
4. In a study conducted by Bostman et al,[6] the average age of the patients was 33.4 years. Then youngest patient was 19 years and the oldest patient age was 62 years old.

Sex distribution

1. In the present study among 35 patients, 29 (80%) were males and 6 (20%) were females.
2. In a study conducted by Ramkumar et al,[5] all the 30 patients were Males.
3. In the study by Bostman et al,[7] the males were most commonly affected, that is 73.79% compared to females who constituted 26.21%.

Mode of injury

1. In our study the mode of injury was RTA and fall constituted 50% each.
2. In a study by Ramkumar et al,[6] the mode of injury in 56% cases were road traffic accidents and in 44% patients it was due to a fall.
3. Ramesh et al,[6] observed that 60% of fractures were seen because of RTA and the rest 40% were due to a fall.

Type of fracture

1. In the present study according to the Robinson classification, 2A2 type was seen in 4%, 2B1 was seen in 82%, 2B2 was seen in 14% of the subjects.
2. Ramkumar et al,[6] stated that patients with Robinson Type-2 B1 were 56.6% and Type-2B2 were 43.7%.
3. In a study by Ramesh et al,[6] Robinson Type-2B1 were seen in 80%, Type-2B2 constitutes another 20%.

Time interval between trauma and surgery in days

1. In the present study 69% of the subjects had within <5 days' time interval between trauma and surgery, 18% had within 3 days' time interval and 5% had 1 week or more days.
2. In a study by Ramkumar et al,[6] 93.3% patients were operated within 5 days and 6.7% were operated after 5 days.

Duration of union

1. In our study most of patients i.e., 21 (69%) of them achieved radiological union in 14 weeks and 14 patients (31%) achieved union in 14–20 weeks. With the mean interval for duration being 16 weeks with standard deviation of 6. non union nil.
2. In a study conducted by Ramesh et al,[6] the union was achieved in a mean interval of 9 weeks.
3. In a study conducted by H. Jiang et al,[8] the union was achieved in a mean interval of 12 weeks.
4. Lazarus MD et al,[9] stated that radiological unions occurred approximately between 6 to 12

weeks. All the lateral third clavicle fracture (4 patients) united at the end of 12 weeks.

Functional outcome of the clavicular fractures treated with open reduction and internal fixation with LCP

1. In our study as per Constant and Murley scoring system 25 (77%) of the study subjects showed Excellent, 9 (13%) of them showed Good, 1 patient (7%) had Fair (13%) outcome. Even the patients who had nonunion were assessed with Constant and Murley scoring because the functional outcome assessed by the scoring is independent of clinical or radiological union.
2. Reddy et al,[5] observed that functional outcome according to Constant and Murley score is excellent in 19 patients (63.3%) and good in 11 patients (36.7%).
3. Ramesh et al,[6] stated that functional outcome according to Constant and Murley score is excellent among 85% of the study group.
4. Mckee et al.[10] In a multicentre trial, Canadian Orthopedic society had 132 patients with displaced midshaft fractures randomized to either nonsurgical treatment or primary plate fixation. Surgical treatment was found to be significantly superior to non-surgical treatment according to the functional tests used.
5. Functional outcome in the patients observed in our study is similar to the above studies and further justify our finding that operative management provides excellent results.

Clavicle fractures are regularly treated conservatively. Studies conducted by Hill* et al,[4] in 1997, Nordqvist et al,[5] in 1998 and Robinson et al in 2004 found poor results following conservative treatment of displaced middle third clavicle fracture. There were various operative methods for the treatment of clavicle midshaft fractures like intramedullary K-wire fixation or Steinmann pin fixation and plate fixation. The procedures like intramedullary K wire or Steinmann pin fixation result in low resistance to torque, carry risks of pin loosening and infection. Plates such as Sherman plates, dynamic compression plates, and semi tubular plates can be effective in obtaining anatomical reduction, applying direct compression to the fracture site, and producing resistance to torque. However, it is very difficult to hold the plates to clavicle in severely comminuted cases.

In contrast, reconstruction plates can be manipulated to fit the contour of the clavicle to obtain firm fixation. With the plates, penetration of the opposite cortex with screw may cause damage to the subclavian artery and brachial plexus.

The present study on surgical management of clavicle midshaft fractures by locking plate is compared with Bostman et al,[7] study who treated middle third clavicle fractures by early open reduction and internal fixation with plate and screws in 103 patients. It is also comparable with Cho et al,[16] study where 41 patients with a clavicle midshaft fracture were treated by internal fixation with a reconstruction locking compression plate.

In our study, pre-contoured locking plates were used in treatment of clavicle midshaft fractures instead of recon plate. The advantages with these plates include strong fixation due to locking between the screw and plate, and blood supply preservation due to minimal contact between plate and cortical bone.[10] When LCPs are used to treat clavicle midshaft fractures, the risks of injury to the subclavian artery or brachial plexus can be reduced because fixation can be achieved without the tip of the screw reaching the opposite bone cortex and periosteal stripping can be minimized using self-tapping screws,[11] to promote rapid union.

Complications such as screw loosening and plate failure were not observed in the pre-contoured LCP group. Distinct scars on the shoulder are currently considered major complications due to the increasing cosmetic demand. Had hypertrophic scarring after surgery and complained of discomfort in carrying out their daily activities.

This study had some limitations because of the small number of cases.

CONCLUSION

1. The anatomical reduction with reconstruction of clavicular length and alignment of shoulder girdle which is the goal of surgical treatment can be attained with LCP osteosynthesis of the clavicle. The strong fixation due to locking between the screw and plate, blood supply preservation due to minimal contact fixation which can be achieved without tip of screw reaching the opposite bone cortex potentially reduces the risks of injury to the subclavian artery and brachial plexus and hence the plates are pre-contoured and do not require any more desirable option.
2. The functional outcome as assessed by Constant and Murley,[3] scoring of clavicular fractured treated in our study with open reduction and internal fixation with LCP showed 80% of the study subjects having excellent outcome.
3. 69% achieved clinical and radiological union in 14 weeks, 31% achieved union in 14–20 weeks and nonunion, plate breakage nil.
4. Complications we encountered in our study included, 1 case of superficial infection, 3 cases of plate prominence with scar at operation site, 1% plate breakage, 10% of the total study subjects had nonunion (including the one patient with plate breakage).
5. All the study subjects attained early mobilization.
6. So the present study recommends that operative management of acute clavicular fracture, non union by using precontoured LCP as a superior treatment modality. All fractures united and there was no delayed union and non union.

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