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Functional outcome in surgical management of midshaft clavicle fractures fixed with precontoured plate in adults

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Abstract

Background: Fractures of clavicle are one of the most common fractures in traumatic injury around shoulder girdle as the bone is sub cutaneous throughout. Fractures of middle third clavicle generally occur either by high energy or low energy impact. These fractures have been treated traditionally by non-operative methods. Although many close reduction methods have been described it has been recognised that complete reduction is practically impossible. Open reduction and internal fixation have become the mainstay of treatment for most of the midshaft fractures, as these operative methods restores the anatomy, biomechanics and contact loading characteristics of the clavicle.

Objectives: To study the functional outcome of surgically managed clavicle fractures with precontoured locking plate.

Methods: A prospective study of 60 cases of midshaft clavicle fractures in adults, Managed surgically by open reduction and fixation with precontoured plate during the period from May 2014 to April 2016 satisfying the inclusion and exclusion criteria were studied. The functional outcome was evaluated using the *Constant and Murley* scoring system.

Results: In our study we achieved 93.4% excellent to good results, 5% fair results, 1.6% Poor results. The results were comparable to other studies.

Interpretation & Conclusion: The operative results were satisfactory in 93.4% cases, with good to excellent functional outcome. This study shows rigid fixation with precontoured plate and screws for fresh displaced or comminuted middle third clavicle fracture gives good anatomical reduction, immediate pain relief and prevents the development of shoulder stiffness and non-union and thus on the whole shows good functional outcome by early mobilisation and hence patient to their functional activities.

Keywords: Clavicle–injuries, fractures- fixation, internal–methods, precontoured plate

1. Introduction

Clavicle fractures 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. The clavicle is an S-shaped bone that acts as a strut between the sternum and the glenohumeral joint. It also has a suspensory function to the shoulder girdle. The shoulder hangs from the clavicle by the coracoclavicular ligament [1]. The most commonly used system of classification of clavicular fractures is that of Allman.

Midshaft fractures have traditionally been treated non-operatively. Surgical treatment of acute midshaft fractures was not favoured due to relatively frequent and serious complications. However, the prevalence of non-union or mal-union in dislocated midshaft clavicular fractures after conservative treatment is higher than previously presumed and fixation methods have evolved.

Surgery is accepted more and more as primary treatment for dislocated mid shaft clavicular fractures, mainly because the results of non-operative treatment are interpreted as inferior to operative treatment both clinically and functionally. 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 nonunion [2].

Several studies have examined the safety and efficacy of primary open reduction and internal fixation for completely displaced midshaft clavicular fractures and have noted high union rate

with a low complication rate [3]. In a large number of complex clavicle fractures a satisfactory outcome is possible with a low complication rate using a locked compression plate. Primary internal fixation of displaced comminuted mid-shaft clavicular fractures leads to predictable and early return to function [5]. 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 no longer accepted. Pressure from a displaced fragment on the retroclavicular part of the brachial plexus may cause symptoms after conservative treatment. The purpose of this study was to assess the functional outcome of midshaft clavicle fractures treated with pre contoured locking compression plate.

2. Materials and Methods

Patients admitted from May 2014 to April 2016 in R L Jalappa Hospital and Research centre with clavicle fractures satisfying the inclusion criteria patients above 18yrs with middle third clavicle fractures displaced and comminuted fractures were included in the study, Pathological fractures were excluded from the study. Standard preoperative protocol was followed. Follow up from the time of admission to a minimum of 6 months of postoperative period were considered.

3. Operative Technique

All cases who satisfy the inclusion criteria are operated with locking precontoured plate using standardized protocol.



Fig 1: Intra operative photographs

4. Post-Operative Protocol

Postoperatively all patients were put on injectable anti-biotic, analgesics and arm pouch. On the 3rd post-operative day primary wound inspection was done. Patients are discharged after 5 days of uneventful post-operative stay in hospital. Patients were followed up on 10th post-operative day for suture removal, after one month, 6 weeks, 3 months, 6 months of surgery to assess functional outcome by using Constant and Murley scoring system.

5. Observation and Results

Among 60 patients with middle third clavicle fracture treated with locking compression plate and screws, 56 fractures united at an average of 12 weeks. 3 patients had delayed union, 1 patient had plate breakage for which implant removal and replating was done.

The functional outcome according to Constant and Murley score after fracture union in surgically treated middle third clavicle fractures were excellent in 76.7 patients, good in 16.7 patients, fair in 3 patients, poor in 1 patient.

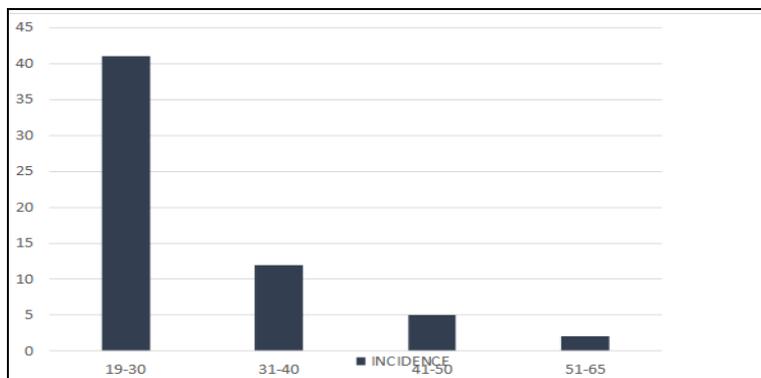


Fig 2: Incidence
~ 459 ~



Fig 3: Mode of Injury

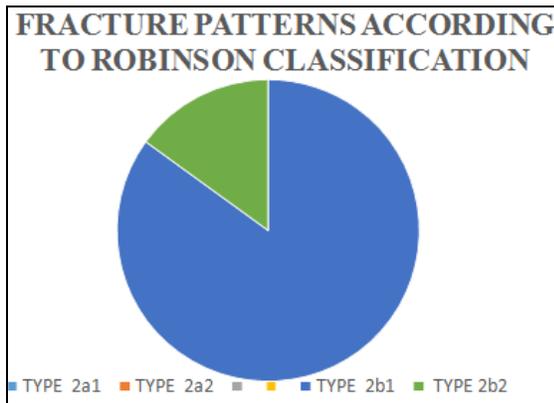


Fig 4: Fracture Patterns According to Robinson Classification

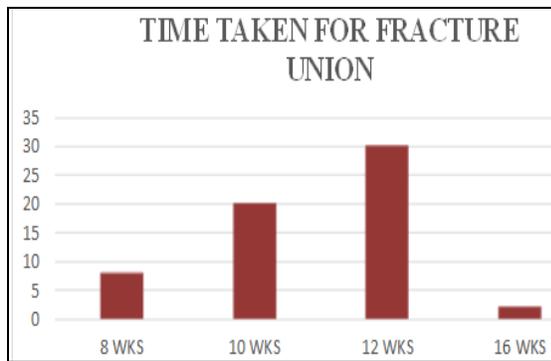


Fig 5: Time taken for fracture union

6. Functional Outcome

In this present study of 60 patients with midshaft clavicle fractures were treated surgically with precontoured locking compression plate. Excellent results were achieved in 46 cases (76.7%), good in 10 cases (16.7%), fair in 3 cases (5%), poor in 1 case (1.6%). Excellent results were seen in most of the clavicle fractures who complete, painless shoulder range of movements by three months. One patient who had poor result is due to implant failure due to breakage of the implant. Patient in this case had an ipsilateral proximal tibia fracture fixed with LCP and started weight bearing on the fractured upper limb less than two weeks after fixation.

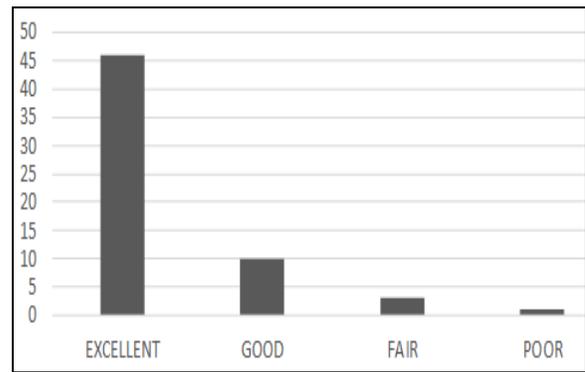


Fig 6: Functional Outcome

7. X Rays AND Clinical Photographs

Case 1

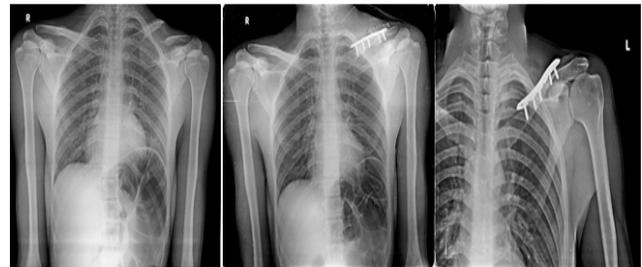


Fig 7: Pre-operative and post-operative xray films



Fig 8: ROM 6 Weeks after Surgery

Case 2

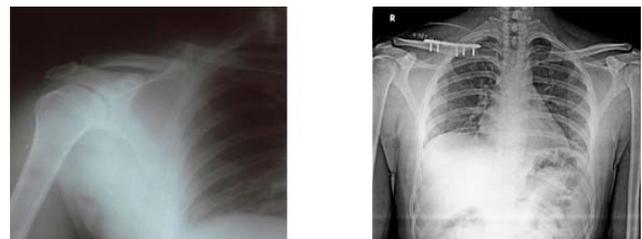


Fig 9: Pre-operative and post-operative xray films



Fig 10: ROM 6 Weeks after Surgery

Case 3:



Fig 11: Pre-operative and post-operative xray films



Fig 12: ROM 6 Weeks after Surgery

8. Discussion

Clavicle fractures are usually treated conservatively. In a study conducted to analyze the results of conservative treatment by Hill *et al* [6], in 1997, Nordqvist *et al* [7] in 1998 and Robinson *et al* [8], in 2004 found poor results following conservative treatment of displaced middle third clavicle fracture. There are specific indications like displacement, with or without comminuted middle third clavicle fracture (Robinson Type-2B1, 2B2).

The present study of patients with middle third clavicle fractures is compared with Bostman *et al* [9] study which treated only middle third clavicle fractures, in this totally 103

patients were treated by early open reduction and internal fixation with plate and screws. It was also compared with Cho *et al* [10]. Study where 41 patients with a clavicle midshaft fracture were treated by internal fixation with a reconstruction plate (19 patients) and reconstruction LCP (22 patients).

Middle third clavicle fracture commonly occurred between the age group of 19 to 30 years in 41 patients (68.3%). The youngest patient age was 19 years and oldest patient age was 55 years. The average patients age was 32 years. In Bostman *et al* [9] study patients average age was 33.4 years and the younger patient age was 19 years and oldest patient age was 62 years. In Cho *et al* [10] study, in reconstruction plate group the mean age was 45 (range 22-70) and that of the locking compression plate was 46 (range 19-69). From this we can infer that clavicle midshaft fractures occur in young and active patients. In this study only 1 patient had associated injury in the form of scapular fracture and was managed conservatively. This associated injury was also caused by Road Traffic Accident.

In this study all Patients with midshaft clavicle fractures were of closed type. This is comparable to Bostman *et al* [9], and Cho *et al* [10]. Study which also showed all their patients were closed fractures.

In this present study, Robinson Type-2B1 (Displaced with simple or butterfly fragment) were more common and there were 51 patients (85%). Type-2B2 (Displaced with comminution) occurred in 9 patients (15%).

In Bostman *et al* [9]. Study Robinson type-2B1 was common in 81 patients (78.64%). Robinson type-2 B2 occurred only in 22 patients (21.36%). In Cho *et al* [10]. Study, in reconstruction plate group there were 7 Patients with B1 type and 12 Patients with B2 type and that of the locking compression group had 9 B1 type and 13 B2 type.

9. Time interval for surgery

Most of the patient in our study were operated in two days from the time of injury i.e. 55 patients

(91.7%). 5 patients (8.3%) were operated in the second week due to other co morbid conditions in R.L.JALAPPA Hospital & Research centre, tamaka, kolar.

10. Duration of union

In this study majority of the middle third clavicle fracture cases united between 12-14 weeks i.e. 58 Patients (96.7%). In 2 Patients (3.3%) delayed union occurred as there was a displaced butterfly fragment which united with the main fragment at the end of 16 weeks. There were no non-union. Lazarus MD [11]. Stated radiological union occurred approximately between 6 to 12 weeks. In Cho [10]. *et al* study, bony union for reconstruction plate was 14.6 weeks and that of locking compression plate was 13.2 weeks.

11. Functional outcome

The functional outcome according to Constant and Murley [12]. In this study of total 60 Patients of fresh middle third clavicle fracture fixed with locking compression plate and screws showed excellent results in 46 Patients (76.7%) and good functional outcome in patients 10 Patients (16.7%). Fair functional outcome in 3 Patient (5%). Poor Functional outcome in 1 patient where plate loosening occurred and the patients had some pain over the shoulder in overhead activities and decrease in strength in shoulder abduction. The advantage of rigid internal fixation and early mobilization of fresh displaced clavicle fracture is that it (displaced/ comminuted middle third) gives immediate pain relief and prevents the

development of shoulder stiffness and non-union.

12. Complications

There was one major complication in this study. One patient who had is due to implant failure due to breakage of the implant. Patient in this case had an ipsilateral proximal tibia fracture fixed with LCP and started weight bearing on the fractured upper limb less than two weeks after fixation. Both Bostman *et al* and Cho *et al* [10]. didn't have any major complications.

13. Conclusion

In this review, the 60 cases of midshaft clavicle fractures treated with precontoured locking plate.

Midshaft clavicle fractures are common due to road traffic accidents. Clavicle injuries are common in middle aged men. Age groups between 19-30 years were most commonly injured. The mean age of present study was 37.3 years. Midshaft clavicle fractures more common in male than female. Understanding the mechanism of injury is essential for anatomical reduction and fixation. Clavicle alignment (length, rotation) has to be maintained for lateral stability of the shoulder. Anatomical reduction with restoration of the articular congruence is essential in all fractures. Open reduction and internal fixation restores the congruity of the clavicle. The operative results were satisfactory in 93.4% cases, with good to excellent functional outcome. Functional results were much better in younger age groups and men. Poor results were seen in one patient only.

Excellent results are obtained with stable fixation of fracture. Precontoured locking plate for clavicle helps in fixation of clavicle to its normal anatomical contour and stability. Functional results improve when the normal bend of the clavicle is restored while plating. Chances of non-union due to soft tissue interposition were avoided by surgical treatment. Delayed union of three cases, were possibly due to unsatisfactory reduction at time of surgery.

Functional outcomes are better with surgical management of middle third clavicle fractures with locking compression plate. The successful use of locking compression plate for middle third fractures of clavicle requires careful assessment of fracture pattern, patient selection, meticulous operative technique, appropriate choice of fixation, judicious internal fixation, careful post-operative monitoring and aggressive early institution rehabilitation. The final functional result of treatment of middle third fractures not only depends on anatomical reduction but also depends on surrounding soft tissue injuries and mobilization.

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