Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Non-union Clavicular Fractures Treated With Anatomical Locking Plate.

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Received: December 2016
Accepted: December 2016

ABSTRACT

Background: The study aimed to analyze the outcomes of clavicle fractures in adults with established non union of mid third clavicle treated surgically and outcome of fracture union in terms of functionality of shoulder. **Methods:** 14 Non union clavicle fractures were treated in the Orthopedics Department at our tertiary institute. The average duration of surgery was 6 months from the date of injury. All the clavicle fracture non unions were operated using anatomical plate on superior side. None of the fractures had undergone any bone grafting. The shoulder function was evaluated using standard Constant Murley scoring system and American shoulder and elbow score (ASES). **Results:** Average time since injury was 11 months (range 6- 22 months). The majority 88% of patients had road traffic accidents. All 14 patients had optimum patients outcome scores with improvement in constant score from 46 pre-operatively to 89 postoperatively whereas ASES score improved from 46.6 pre-operatively to 94.0 postoperatively. The majority of non-union clavicle fractures were dissatisfied due to cosmetic, overhead-restricted endurance in shoulder activities and clavicular shortening. **Conclusion:** The operative treatment of non-union clavicle yields significantly improved outcomes with respect to shoulder function.

Keywords: Non-union Clavicle fractures.

INTRODUCTION

Clavicle fractures form 2.6 % of all fractures[1-4] combined and 75 % of them are located at mid-shaft.[5,9] The non union rate in mid-shaft clavicle fractures is less than 1%.[12,13] Traditionally these fractures have been treated non-operatively, even when displaced.[6,7] The fractures often go into malunion and shortening which can affect the shoulder function significantly. The fractures can lead to non union which can be a disability in young active patients.[8]

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The aim of this study is to present the outcome of surgical treatment of mid-shaft non-union clavicular fracture in adults by open reduction and internal fixation with superior surface placement of locked reconstruction plate.

MATERIALS AND METHODS

This retrospective study involved 14 patients with completely displaced mid-clavicular fractures who underwent open reduction and internal fixation with superior plating in our hospital between June 2012 and July 2016. The study includes all patients with non-union mid-clavicular fractures, whatever the type of fracture (transverse, oblique, or comminuted).

Inclusion criteria:

1) Un-united fractures of midshaft clavicle.
2) Minimum 6 months since index injury.
3) Lateral and medial third clavicle fractures.
4) Consenting patients.

Exclusion criteria:

1) Acute fractures.
2) Pathological fractures.
3) Previous surgeries.
4) Ipsilateral concomitant limb fractures.
5) Smokers and alcoholics.

All operations were performed under general anaesthesia with inter-scalene block in semi beach chair position with the head turned away from the side of the operation. The incision was made over the antero-superior aspect of the clavicle. The fracture was reduced and stabilized by an anatomical locking plate placed superiorly. Inter-fragmentary screws were inserted if necessary. All atrophic non unions had iliac crest bone grafting done. The limb was supported with an arm sling post operatively. The patient was advised to carry out gentle pendulum exercises only. The x-rays were advised immediately postoperatively and at 6 and 12 weeks unless delayed union was found. Union was considered to have occurred if clinically the fracture site was non-tender and, no abnormal movement was demonstrable, and radiologically when callus was visible.

(a)

(b)

(c)

Figure 1: Clavicular plate fixation(a,b,c).

The variables studied were mode of injury, injury-surgery interval, preoperative and postoperative Constant Murley[10] and American shoulder and elbow score[11] (ASES) along with and time required for union were recorded. The scores were calculated postoperatively at 6 months after surgery. The constant score[10] is a simple, 100-point score, and gives a reliable indication of shoulder function. It assesses pain (15), activities of daily living (20), range of movement (40) and power (25). The Constant score of the post-operative shoulder was compared with the preoperative shoulder at follow-up.

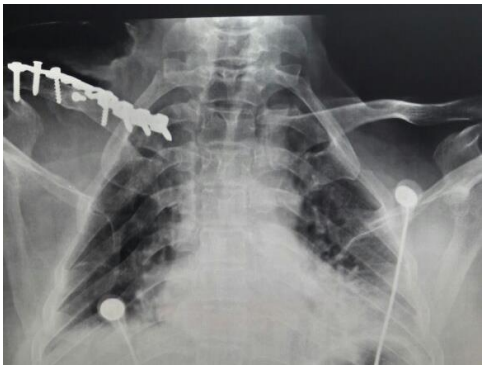
In ASES score[11], the final pain score is calculated via an independent formula while the raw score from the functional questions is multiplied by a coefficient (to get the final score for the functional questions). The pain and functional portions are then summed to obtain the final ASES score with higher scores indicating better outcomes

RESULTS

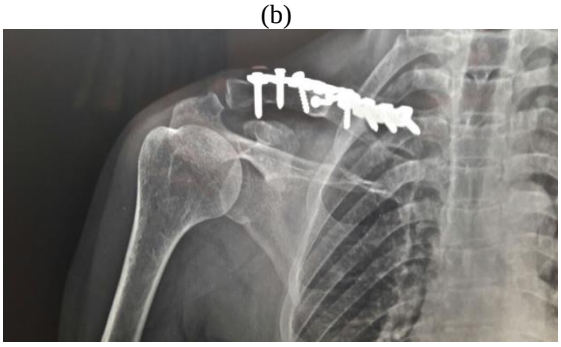
This study includes 14 patients, 32 male and 2 female, with the mean age of 31 years. Average time since injury was 11 months (range 6- 22 months). 22% of patients had road traffic accidents while 88 % had history of fall on outstretched hand . 6 clavicles were fractured on the right side and 8 on the left. 9 cases had atrophic non unions necessitating bone-grafting whereas 5 cases had hypertrophic non-union. All 14 patients had optimum patients outcome scores with improvement in constant score from 46 pre-operatively to 89 postoperatively whereas ASES score improved from 46.6 pre-operatively to 94.0 postoperatively

One patient developed an early wound infection, which was successfully managed by antibiotics. All patients were followed up until clinical and radiological union. Radiological union was defined as visible bridging callus or absence of a visible fracture line. The average time of union was 10 weeks (8-20 weeks). Union was delayed beyond 12 weeks in 4 cases. All the patients were relatively satisfied with the procedure. None of the patients had implant loosening or implant failure.

(a)



(b)



(c)

Figure 2: Preoperative(a), immediate postoperative (b) and united fracture(c) x-rays.

DISCUSSION

Clavicle fractures form 2.6 % of all fractures combined and 75 % of them are located at mid-shaft.[9]The non union rate in mid-shaft clavicle fractures is less than 1%.[12,13] In contrast recent studies point at a non-union rate of 15% with patient outcomes turning out to be highly unsatisfactory (32%) as compared to studies like Altamimi et al[14] and Hill eta al.[15]

Neer[16] and Rowe[17] reported non union in less than 0.5% in their huge series with 2235 and 566 patients respectively. Malunion was also getting recognized more with its distinct cosmetic look. Nowak et al[18] studied complications in 208 adults with mid-clavicular fractures and found that, at ten years after the injury, ninety-six patients (46%) still had symptoms despite the fact that only fifteen (7%) had nonunion. This proved that patients can have major poor outcome following a clavicular mal-union because of symptoms specifically weakness and easy fatigability with overhead activities.

Mckee et [19,20] showed clavicular shortening led to patient dissatisfaction. They noted poor abduction endurance. They concluded that some shortening with inferior displacement and anterior rotation of the lateral fragment seen in most cases. Thus shortening has a negative effect on muscle tendon unit.

Lazarides and Zafiropoulos et al[21] objectively showed that shortening of more than 18 mm in male patients and 14 mm in female patients was associated with poor clinical outcome . Ledger et al[22], 31 Eskola et al[23] Hill et al.[24] and Wick et al[25] also reported - poor clinical outcome if the shortening was more than 15 or 20 mm.

Most of the complications like brachial plexus palsy, vascular injury, Infection, plate failure, hypertrophic or dysesthetic scars ,implant loosening or pneumothorax are rare in operative group.[26-28] Patients were more satisfied following operative intervention.[27] Correlation can exist between the degree of scapular mal-alignment due to clavicular shortening and shoulder dysfunction. [28-30]

The incidence of nonunion of the clavicle has been reported to be between 0.4 to 4.0%.[16,17] Nonunion is higher in the middle-third fractures of the clavicle followed by lateral-third fractures.[31-33] Nonunion is characterized by failure to show clinical or radiographic progression of healing at four to six months.[34-36] Nonunion may be either atrophic or hypertropic, the former being a more common pattern than the latter.[37]

In our series of 14 cases of non union, there was one case of infection, excellent function with average constant murley score of 95.33 and all fractures had united in 20 weeks. None underwent reoperation for any complications. None had dissatisfaction except few (4 cases out of 14) who complained of prominent hardware not necessitating removal.

We conclude that superior plating of non united clavicular fractures heals optimally with higher patient satisfaction.

CONCLUSION

Superior Anatomical plate fixation results in better outcomes and better patient satisfaction in non-union mid clavicular fractures.

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How to cite this article: Kohli S, Vishwakarma N, Chauhan S, Salgotra K. Non-union Clavicular Fractures Treated With Anatomical Locking Plate. Ann. Int. Med. Den. Res. 2017; 3(2):OR05-OR08.