

Internal Fixation of Middle Third Clavicle Fractures

P. Ramesh Vyravan¹, B. Nellaiyappan², M. Mohankumar³

ABSTRACT

Introduction: Clavicle is the bone which connects the axial and appendicular skeleton. It's the first bone to ossify. The integrity of clavicle is essential for proper function of shoulder. Hence clavicle fractures have to be fixed for better functioning of the same side shoulder.

Materials and methods: The aim is to study the functional and radiological outcome of mid third clavicle fractures treated by internal fixation. We had 57 cases. Allman classification was used to classify the fracture. The period of the study was between 2009 – 2013. The implant used was 3.5 mm reconstruction plate. The cases were followed up regularly at the intervals of 6, 12, 18 and 24 weeks. X ray was taken immediate post op and during every follow up. Post operatively evaluated using constant and Murley scoring system.

Results: Total number of cases were 57. Among the 15 non unions which were operated 9 were post traumatic and rest were natively treated with traditional bone setters. Complications are three plate failures, one sub-acute infection and two cases with stiff shoulder.

Conclusion: Ambulatory treatment of fracture with arm support while maintaining satisfactory and acceptable alignment of fracture is the mainstay of treatment today. Clavicle fractures with indications give good results with operative treatment.

Keywords: Clavicle fracture, Midthird, Surgical Fixation, Open reduction and internal fixation, Reconstruction plate

INTRODUCTION

Clavicle fractures are the most common long bone fractures. There is still controversy whether they should be operated or treated non operatively. Clavicle fractures if occurs in children can be treated conservatively. But in active adults treating them operatively gives better outcomes. Also it reduces the post treatment complications like shoulder arthritis if treated conservatively.¹

Some important anatomic features of clavicle are 1) Clavicle is the first bone to ossify. 2) Only long bone lying horizontal. 3) Only long bone with two primary centres. 4) Only long bone with membranous ossification. 5) It is subcutaneous throughout. 6) Only structure crossing it is supraclavicular nerve, occasionally piercing it.² 7) Only bone of shoulder girdle forming synovial joint with the trunk.³

During evolution man evolved from quadrupeds like monkeys. As evolution advanced man started walking with using the both front limbs for activities other than walking. Hence

he has to train in such a way that the upper limbs have to reach the space in front, back or all round and grasp objects. For this requirement he needs a support of the limb so that the specialized functions can be performed unhindered. That stability and ability to perform the specialized and normal day today activities by the upper limbs is given by the clavicles. Because clavicle is a bone which supports the appendicular skeleton and also connects axial to the appendicular skeleton.

Clavicle fractures have deforming forces which make it very difficult to reduce the fracture closed and even if able to reduce it will very difficult to maintain reduction. In middle third fractures the medial fragment will be displaced superiorly by the pull of sterno mastoid muscle and posteriorly. The lateral fragment pulled inferiorly and anteriorly due to the weight of the shoulder.¹

Lateral third clavicle fractures rarely need surgical treatment because they heal well due to presence of intact ligaments and periosteal sleeve. But certain clavicle fractures of lateral end need surgical treatment if they are associated with floating shoulder, ipsilateral poly trauma, multiple rib fractures and bilateral clavicle fractures. Our study is able to convincingly prove that operative treatment is the best treatment option for clavicle fractures.

MATERIALS AND METHODS

The aim is to study the functional and radiological outcome of mid third clavicle fractures treated by internal fixation. Initially the cases were evaluated fully and x ray were taken. We included all the middle third clavicle fractures based on Allman classification. All man classification divides the clavicle fractures into three broadly as lateral end, medial end and middle third fractures. Middle third fractures are sub divided into undisplaced, displaced and comminuted.

The study was a prospective study from 2009 to 2013. Total-

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ly 86 cases were selected. Using the exclusion criteria (Table 2) we excluded cases with cervical spondylosis, peri-arthritis shoulder, frozen shoulder, diabetes mellitus and head injury patients who are not fit to be operated immediately. The cases were evaluated fully. X ray of the affected side clavicle was the routine x ray and based on that we classify the cases. The absolute indications (Table 3) which we followed in our study are - fractures with neurovascular compromise, open fractures, poly trauma, fractures medial to coraco clavicular ligament, floating shoulder, multiple ipsilateral rib fractures, symptomatic nonunion, bilateral clavicle fractures. The relative (Table 3) indications include – displacement more than 1 cm, shortening more than 2 cm, cosmetic reasons mainly females and comminution. After that pre op evaluation and planning was done and surgical stabilization was performed. The patient was positioned in beach sir position in a radio-lucent table. The incision is anterior to the clavicle centering over the fracture site. Platysma was separated in deep dissection. We used a 3.5 reconstruction plate. The plate was contoured and applied superoirlly.¹⁰ X ray was taken immediate post op and and the limb was immobilized in arm sling. Light weight activities were allowed from post op day one. Heavy activities like lifting weights etc were discouraged till there is radiological union.

We followed up the cases at 6 weeks, 12 weeks, 18 weeks and 24 weeks. During every follow up we evaluated the patient clinically and radiologically. We used the Constant and Murley scoring system. The signs of union⁴ are if there is no pain at fracture site with fairly good range of motion in the affected side shoulder with no fracture line visible in x ray

RESULTS

Total number of cases 86. After applying exclusion criteria we had totally 57 clavicle fractures in 46 patients with 11 bilateral cases. Among these males were 31 and females were 15 and among the bilateral we had 8 males and 3 females. 29 cases were excluded. The excluded cases include cervical spondylosis –13, head injury –11, frozen shoulder –1, peri-arthritis shoulder– 4. Among the cases with proper indications nonunion were – 15, floating shoulder – 11, displaced > 2cm – 11, bilateral – 9, SCV compression – 2, cosmetic like swelling – 3, Comminution – 5, shortening – 1.

All the patients were fixed with 3.5mm reconstruction plate of appropriate length. If needed plates were contoured. In comminuted fractures bone grafting was done. The plates were put in the superior aspect.¹⁰ Bone grafting was also done in nonunion cases. Both iliac and synthetic bone grafts were used. Mostly synthetic ones were used to reduce the morbidity of the patient. Among the 15 non unions which were operated 9 were post traumatic and rest were natively treated with traditional bone setters. Among the 11 floating shoulder patients 8 had both scapula fracture and ribs fracture and rest had scapula fracture alone. Among the 11 displaced fractures 6 had gross displacement with skin tether-

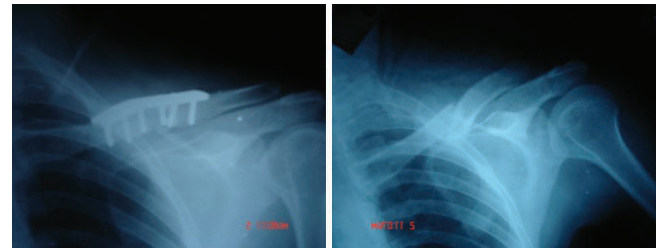


Figure-1: Pre operative Clavicle x ray AP view showing middle third displaced fracture; **Figure-2:** Post operative x ray AP view showing plate insitu with united fracture.

First bone to ossify in human
Only long bone lying horizontal
Only long bone with two primary centres
Only long bone with membranous ossification
It is subcutaneous throughout
Only structure crossing clavicle is supraclavicular nerve, also occasionally pierce it in middle
Only bone of shoulder girdle forming synovial joint with trunk
Table-1: Clavicle – Important facts

Shoulder of affected side having before trauma
- Cervical Spondylosis
- Peri Arthritis
- Frozen Shoulder
- Diabetes Mellitus
Also patients with head injury, non-co-operating patients
Table-2: Exclusion criteria

Fractures with NV compromise
Open fractures
Poly trauma
Fracture medial to coraco clavicular ligament
Floating shoulder
With multiple ipsilateral ribs fracture
Symptomatic non union
Bilateral clavicle fractures
Relative
More than 1cm displacement
More than 2cm shortening
Cosmesis, mainly females
Comminution
Table-3: Indications: absolute

ing. All the 3 cases with cosmetic reasons were females and all were initially treated non operatively. The complications are three plate failures, one sub-acute infection and two cases with stiff shoulder.

DISCUSSION

We had excellent result of 79%, good result in 9%, fair result in 6%, and poor result in 6%. In our series 45 patients had excellent outcome. At the end of 12 weeks they had excellent clinical and radiological union and on clinical examination the patients had excellent to normal shoulder movements on

the affected side. They were able to do their daily activities without any morbid disability. By reviewing literature we found good union will be achieved in 95% of cases.^{6,7,8,9}

We had 5 cases of non-union that is 9 %. By reviewing the literature we found that the non-union rate is found to be between 0.1% to 15%.^{4,5} The reason for non-union is among the five cases three were comminuted, one was implant failure and one sub clinical infection. The patient with sub clinical infection was treated with antibiotics and then plate was removed and refixed with bone grafting. Among the three implant failures one was due to stress raisers at the fracture site and the one due to plate breakage.

We had one more implant failures in whom the plate was broken at the fracture site because of sports injury who when playing had a fall on the affected side again within 8 weeks of first fall. During follow up he had excellent union but because of impact of the injury might have caused the breakage. All the broken plates were removed and re fixation done with bone grafting.

According to literature the delayed union rate is 2.7% in middle third fractures.⁴ In our series the delayed union rate is 3 % that is in one case in our series. The reason for delayed union is there is one plate hole over the fracture site and hence acted as a stress raiser. The patient was followed up upto 20 weeks and treated with arm sling and rest to the limb and the fracture united un eventfully at the end of 19 weeks.

CONCLUSION

Clavicle is an essential continuity between axial and appendicular skeleton. For proper use of upper limbs the stability was provided by the clavicle on either side. When there is no stability bio mechanically there will be difficulties of the upper limbs. Hence proper and anatomic reduction and restoration of normal stability of the affected side limb is essential. Traditionally clavicle fractures were treated conservatively with rest to the limb and strapping. By these options they unite uneventfully but the same side shoulder will be affected and resulting in pain and disability because the length of the clavicle could not be restored by these conservative options.

So the individuals will be having morbid disability. The clavicle which is an essential support for us to perform our daily activities hence can be treated operatively better with the advanced options available.

Middle third clavicle fractures with good indications if treated by operative fixations give excellent result.¹

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