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Open reduction and internal fixation of fractures of the clavicle in adults in terms of functional and radiological outcome in the valley of Kashmir

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Abstract

Purpose: To assess the functional and clinical outcomes of open reduction and internal fixation of Clavicular fractures in valley of Kashmir.

Methods: This study was conducted in Skims Medical College from October 2010 to October 2019 and 30 subjects were studied. All of the patients were treated by ORIF.

Results: The patients in our study ranged in age from 19-55 years, with a mean age of 30.93 years at the time of surgery. Of all the patients in our study, 21 patients were males and 9 were females. Of the 30 patients, 14 patients had fractured their right clavicle, whereas 16 had fractured their left clavicle. The average Quick Dash score at 12 weeks was 3.779 and at 24 weeks was 1.44. A total of 6 patients suffered from complications related to the procedure. Dysesthesia occurred in 4 patients and hardware irritation in 2 patients.

Conclusion: Clavicle fractures have since long been considered as benign injuries, with a good outcome if treated conservatively. However, several reports now challenge this view, and there has been a resurgence of interest in operative treatment for fractures that are displaced, comminuted, or that display significant shortening.

Keywords: Clavicle, fracture, locking plate, displaced

Introduction

The clavicle is the flat subcutaneous bone also known as collar bone and is the first bone to ossify in the membrane. It is one of the most commonly fractured bones, accounting for 2.6 to 4% of all fractures^[1, 2]. The incidence of clavicle fractures in adults is 71 per 100,000 men and 30 per 100,000 women^[3].

The incidence of fracture distribution is higher in older females especially after 75 years age and incidence in males is bimodal with a high incidence in young males less than 25 years old, and a high incidence in older males more than 55 years old^[4, 5].

Mid shaft fractures of the clavicle account for approximately 75% to 80% of all clavicle fractures, and typically involve young age. Distal third fractures represent about 15% to 25% of clavicle fractures. Medial third fractures are least common, accounting for less than 5% of clavicle fractures^[1, 2, 6].

Clavicle mid-shaft fractures have classically been treated non-operatively, with a figure of -8 brace and an arm pouch for the Ipsilateral extremity. This belief was reinforced by a study in 1960, by Neer, who reported a non-union rate of just 0.1% with non-operative treatment^[7]. Although the figure of -8 brace is still widely used, several studies have demonstrated similar union rates and increased satisfaction in patients treated with a simple arm sling^[8, 9, 10].

However, not all types of clavicle fractures are amenable to conservative treatment. Recent studies have shown that closed treatment of displaced middle-third fractures of the clavicle gives poor results^[11, 12, 13, 14, 15]. Hill JM *et al.*^[11] (1997), in their study of displaced middle third fractures of the clavicle, reported 15% incidence of non-unions and 31% unsatisfactory results after conservative treatment. This result also concluded that almost 30% of the patients with a malunion of the clavicle are dissatisfied with their result.

Zlowodzki *et al.* (2005) ^[14], in a systematic review of 2144 mid-shaft clavicle fractures, found a higher patient satisfaction rate when a sling was selected for limb immobilization, they also reported a non-union rate for displaced mid-shaft clavicle fractures of 15.1%. In the same study, the authors also came to conclusion that clavicular plating is the gold standard of operative treatment of clavicle fractures. Khorami M *et al.* (2014) ^[32] in their comparison of results of treatment of midshaft clavicle fractures between operative treatment with plate and non-operative treatment found that average duration of union were 19-3 and 24-4 weeks in operative and non-operative groups respectively (p = 0.0006). This study recommends operative treatment in mid-shaft clavicle fractures only when there is a definitive indication.

It has also been shown that presence of scapular winging (dynamic or static), in association with anterior rotation of distal clavicle fragment, is a prognostic indicator of poor outcome following non-operative care. ^[21].

Studies have also shown that operative treatment results in a lower rate of fracture non-union and improved patient – oriented outcomes with non operative treatment. ^[17, 18, 19]. Often, the pain relief associated with stabilising the fracture is dramatic ^[26].

The non-union rate of fractures of the lateral end of the clavicle can rise to 37% upon instituting non operative treatment. ^[16]. The non-union rate of fractures of the diaphysis and medial end have also been proven to be higher than that previously reported ^[17].

When opting to surgically fix the clavicle, there are several techniques of fixation that can be implemented. These include internal fixation with screws, pins, wire-loops, or plates; and external fixators. Bone grafting may also be used. ^[22, 23, 24, 25].

This study evaluated functional results and complications, if any of plating clavicular fractures.

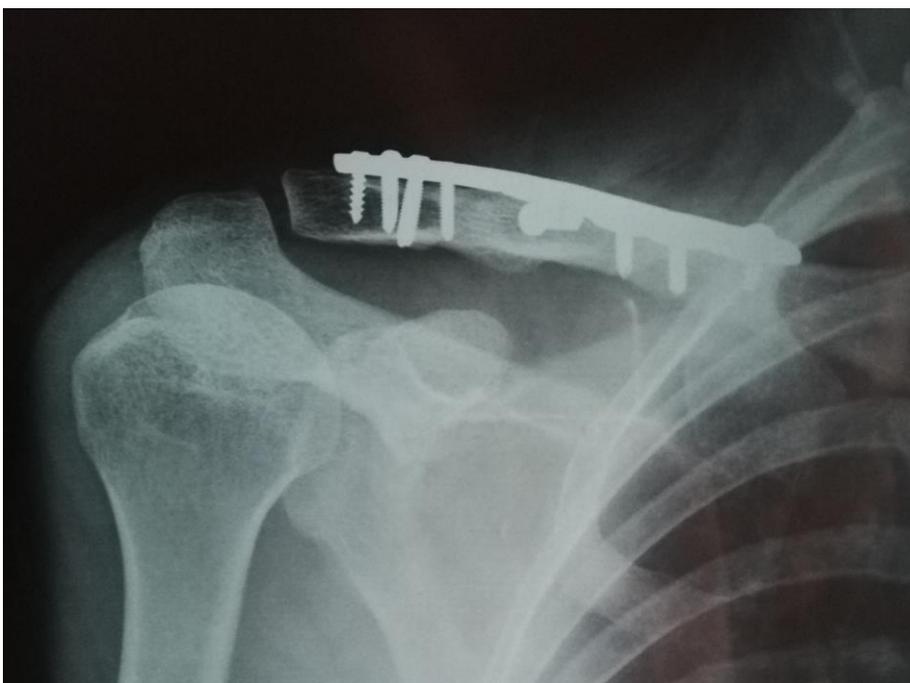
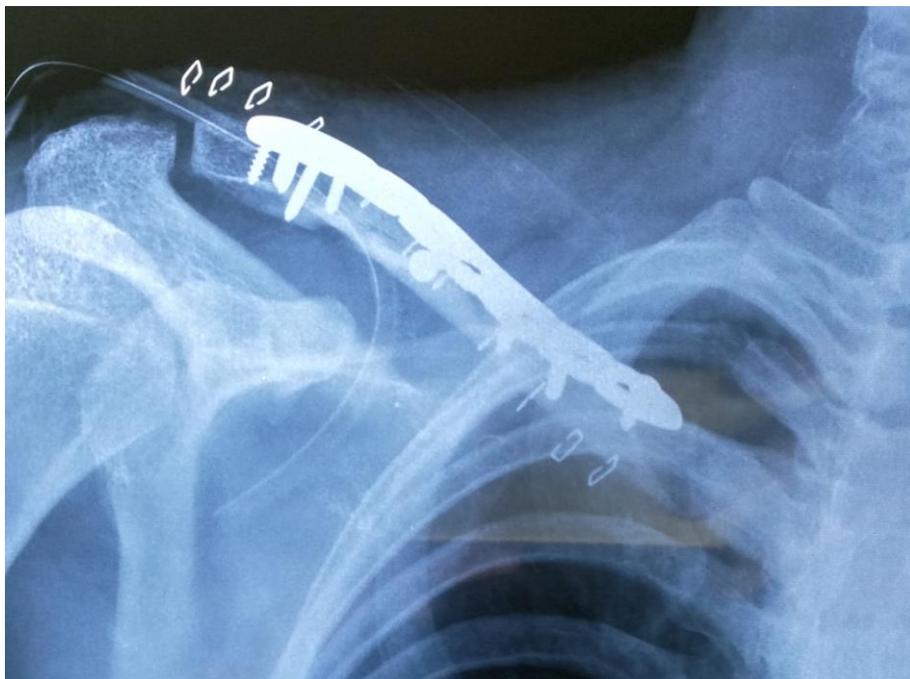
The aim of this study was to evaluate the functional and radiological results.

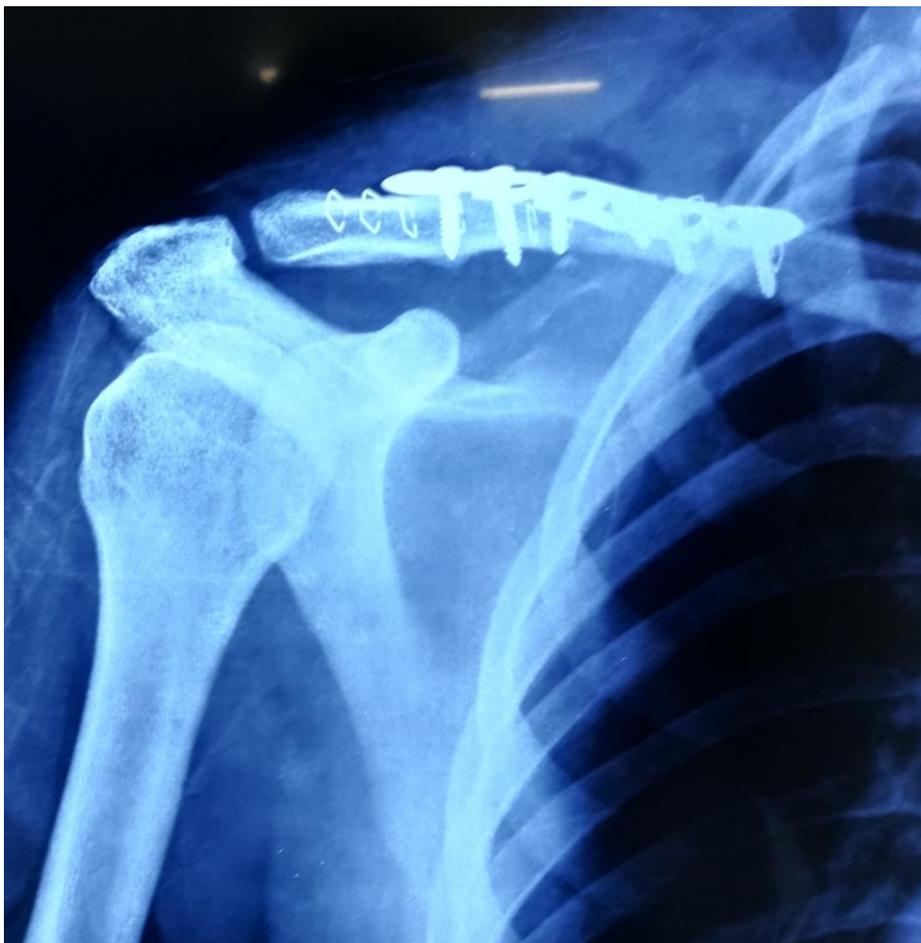
Material and Methods

This study was conducted in Skims Medical College from October 2010 to October 2019 and 30 subjects were studied. All of the patients were treated by ORIF. Inclusion criteria ^[28, 32] were patient's age above 16 years, either sex and any of the defined indications i.e 3A. Comminuted (>3 fragments), 3B. Displaced (>2cm), 3C. Shortening (>2cm), 3D. Segmental fractures, 3E. Impending open fractures (tenting of skin), 3F. Scapular winging of initial examination and 4. Medically fit to undergo surgery. Exclusion criteria were 1. patient refusal 2. patients less than 18 years of age 3. Associated injuries of shoulder girdle 4. open fractures 5. Pathological fractures 6. Established non-union from previous fractures 7. Non-compliant or substance abusers ^[29, 30] 8. clinically important

neuromuscular upper limb disability 9. previous operations to shoulder or clavicle 10. previous fractures around the clavicle 11. medically unfit to undergo surgery because of co morbidities, or associated injuries and fractures of lateral 1/3 of clavicle.

Operative procedure: The surgery was performed under general anaesthesia and the patient was positioned in either the supine, or the beach –chair position, with the head and neck tilted away from the surgical site. A bump was placed behind the scapula to aid in reduction. The arm was prepared in the field to allow for traction and manipulation to assist in the reduction. Pre-operative intra-venous antibiotic (cefazolin 1 gram) was given to the patient, at least 30 minutes before making the skin incision. The skin inferior to the fracture site was incised after pulling it up to the fracture site, so as to allow it to fall 1 to 2 cm below the clavicle when released and thus prevented the wound from being in contact with the plate on clavicle. ^[27]. The subcutaneous tissue and platysma were kept together as one layer and extensively mobilized, especially proximally and distally. Sharp dissection was taken down to the one, with care to identify, and if possible, preserve the cutaneous supraclavicular nerves. when necessary, they are sacrificed. The myofascial layer over the clavicle was incised and elevated in one continuous layer. Care was taken to preserve the soft tissue attachments to any major fragments, by minimizing sub-periosteal stripping. Comminuted fragments, especially the often seen antero-superior fragment was teased back into position, as much as possible, maintaining its soft tissue attachments. The fractured bone was reduced and the reduction was held with the aid of a reduction clamp. The pre-contoured plate was placed on the tension side of the bone for the clavicle, this is the antero-superior position. Biomechanical studies have shown this position to provide best stability. ^[31] The clavicle was drilled cautiously keeping in mind the relation of the subclavian vessels to the inferior surface of clavicle. At least 3 cortices on either side of the fracture were held by cortical, or locking screws. Once plating was completed, the fascia was repaired over the plate if possible. Skin incision was closed. Antiseptic dressing was applied, and arm was rested in an arm sling. On first post-operative day clinical assessment was done. Condition of the wound was assessed. Pendulum exercises of the shoulder were started, with arm still resting in the arm sling. The patient was discharged on the second post-operative day [pre and post-operative radiographs]. All the patients were followed up at 2 weeks, 6 weeks, 12 weeks and 6 months. Their Quick Dash scores were documented and stored, so as to plot their progress following surgery. At final follow-up both constant and quickdash scores were recorded. [pre and post operative and follow-up photographs shown in figs].





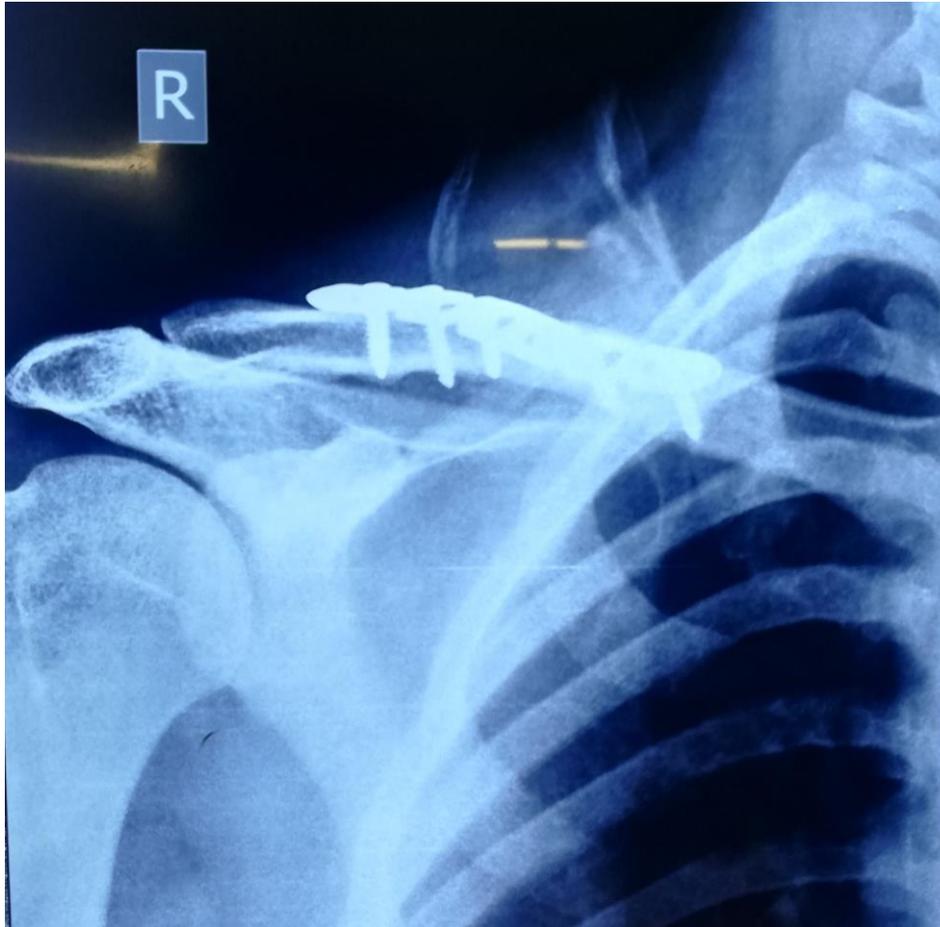


Fig 1-6: Showing pre-operative, post-operative and radiograph at 6 months

Results

The patients in our study ranged in age from 19-55 years, with a mean age of 30.93 years at the time of surgery. Of all the patients in our study, 21 patients were males and 9 were females. Of the 30 patients, 14 patients had fractured their right clavicle, whereas 16 had fractured their left clavicle. Of the 30 patients, 26 patients had a Robinson type 2B1 fracture configuration, whereas the 4 other patients had a type 2B2 configuration. The most common mode of trauma in our study was fall from standing height, followed by road traffic accident, followed by fall from height; sports injury was seen in one case. The average time to surgery from the time the patient sustained his/her injury was 9.1 days. The average operative time in our study was 84.83 minutes. The 7-hole superior clavicle locking compression plate was the most commonly used length of implant. The average duration of hospital stay was 6.43 days, and it ranged from 4-12 days. The time to union in our patients ranged from 8-16 weeks. Average time to union in our study was 12.9 weeks. Union was assessed by the presence of bridging cortices on Ap xray projection, and painless range of motion of the shoulder. The Quick Dash score was calculated each time on follow-up at 2, 6, 12 and 24 weeks. The average Quick Dash score at 12 weeks was 3.779 and at 24 weeks was 1.44. A total of 6 patients suffered from complications related to the procedure. Dysesthesia occurred in 4 patients and hardware irritation in 2 patients.

Discussion

The mean age in our study was 30.93 years. This was comparable to the study conducted by Balaji *et al.* (2013), and to other similar studies conducted in the past. The study

conducted by H. Jiang *et al.* (2012) had a higher mean age of 45 years.

In our study, males comprised the majority of patients, with 70% being men and the rest, women, thus comparable to the study conducted by Wun-Jer Shen *et al.* (1999), and other similar studies conducted in the past, where males comprised the majority of patients. The study conducted by Oliver Verborgt *et al.* (2005) has an overwhelming majority of males (87.2%) due to the fact that they studied a population of semi-professional athletes.

In our study, the mean duration of surgery was 84.83 minutes. This is slightly higher than the mean operative time of similar studies conducted in the past. This could be attributed to the fact that two surgeons carried out the operations and impetus was placed on preserving the supraclavicular nerves.

In the present study, most of the fractures operated upon were type 2 B1 Robinson. The higher incidence of type 2 B1 fractures in this study corresponds with that of other studies also.

The mean time to radiographic union in our study was 12.9 weeks, from the date of surgery. This is comparable to the study conducted by H. Jiang *et al.* in 2012. A study conducted by Wun-Jer Shen *et al.* in 1999, reported a mean time to union of only 10 weeks. This could probably be because the author operated upon most of his cases within 3 days of injury. Rapid fixation of fresh fractures could possibly be the reason for comparatively shorter time of union reported by the study.

Among all the different studies evaluated, road traffic accident was, by far, the commonest cause of the clavicle fractures. In the present study, we found that the most common cause of sustaining these injuries was fall from

height. Road traffic accidents was the next most common mechanism of injury in the studied patients. In our study, we found fall from height the third most common cause of these fractures. This was followed by sports injuries.

In our study, the mean quick dash score measured at the end of 6 months was 1.44. This was better than the study conducted by CM Robinson *et al.* However, the study conducted by Balaji *et al.* reported a mean quick dash score of 0.0 at final follow up. The constant Shoulder Score in our study was 94.8, at final follow up. This is comparable to other similar studies conducted in the past.

A few complications were encountered during the course of our study. They were dysesthesia of skin inferior to the incision (13%) and hardware irritation (7%). The rate of occurrence of dysesthesia in our study (13%) is comparable to one study, and much lower than the recent study conducted by H. Jiang *et al.* in 2012. This could be due to differences in care exercised by various surgeons while dissecting the supra-clavicular nerves.

Our report of only two cases (7%) having hardware irritation is lower than other studies studying the same effect on their operated patients. This can largely be attributed to the modified anterior skin incision used in our patients. This can largely be attributed to the anterior skin incision used in our patients, that results in a scar that does not lie over either the clavicle or the implant. In present study, there was no case of infection, plate pull out or non-union.

Ten of our total patients reported to hospital at or after 1 week of their injury. Patients were then admitted and evaluated for anaesthesia and surgery, which lead to delay in fixation. Seven of our total patients reported in our hospital within 2 to 6 days of their injury. Patients were then admitted and evaluated for anaesthesia and surgery, which lead to delay in fixation. Thirteen of our total patients were admitted in hospital on the day of injury. Among the 13 patients, 9 patients were operated with in 2 to 5 days after regular anesthesia checkup. Rest 4 patients were operated within 6 to 9 days, these patients needed additional investigations for anaesthesia clearance.

Conclusion

Clavicle fractures have since long been considered as benign injuries, with a good outcome if treated conservatively. However, several reports now challenge this view, and there has been a resurgence of interest in operative treatment for fractures that are displaced, comminuted, or that display significant shortening. Conservative management of these fractures may result in cosmetically displeasing end results, delayed union, non union, chronic shoulder pain and impaired shoulder function.

The advantage of internal fixation of these fractures is that it rapidly restores anatomy and provides stable fixation, resulting in early pain resolution, a high rate of bony union and a lower complication rate, when compared to the literature documenting conservative means for clavicle fracture management.

Still, most of the clavicle fractures are best managed conservatively. Operative treatment is beneficial to a subset of patients, in whom functional expectations and fracture characteristics have both been taken into account before taking the final decision.

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