

Original Research Article

Assessment of functional outcome of operative vs conservative management of displaced clavicle fractures

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ABSTRACT

Background: clavicle fractures account for approximately 2.6% of all fractures. Middle third fractures account for 80% of all clavicle fractures. Historically, clavicle fractures have been treated mostly nonoperatively with clavicular brace, but due to increase rate of complications such as nonunion and malunion, clavicle fractures are now increasingly being treated surgically which results in lower rate of such complications, besides improved patient oriented outcome and early mobilization.

Methods: Current study is a prospective and observational comparative study, conducted over 30 patients diagnosed with displaced clavicle fractures coming to the department of orthopaedics in a tertiary care hospital in South Rajasthan between January 2019 to June 2020. Patients were then allotted alternatively into two groups. Patients selected for conservative treatment were treated with the figure of eight clavicle brace and arm sling pouch. Patients selected for operative treatment were treated with plating. Functional outcomes were assessed using Constant and Murley score in every follow up at 3 month and 6 month; and fracture union was assessed by serial radiographs taken at sixth week, third month and sixth month.

Results: Among 30 patients, 15 patients were treated conservatively and rest 15 patients were treated surgically with plating. Functional outcome at the end of third and sixth months of follow up were measured by using Constant Murley score and found significantly higher in operative group than conservative group.

Conclusions: In our study, it was found that at the end of 6 month follow up, patients treated surgically with plating had better functional outcomes than conservatively treated patients as measured by Constant and Murley score. It was also seen that, the duration of union and the incidence of complications was less in the operative group as compared to the conservative group.

Keywords: Dispalced clavicle fractures, Hook plating, Clavicle brace, Non-union

INTRODUCTION

The clavicle is S-shaped bone, with the medial end convex forward and the lateral endconcave forward, that acts as a strut between the sternum and the shoulder joint. Clavicular fracture is one of the most common bony injuries. They account for 2.5% to 4% of adult fractures and 44 to 66% of injuries to the shoulder girdle.¹ The most commonly used system of classification for clavicular fractures is of Allman.¹ They are divided into 3 groups: group I; middle-third fractures, group II; lateral-

third fractures and group III; medial-third fractures. Fractures of the midshaft form 70% to 80% of all clavicular fractures; lateral third fractures contribute 15% to 30%, and medial third fractures contribute 3%, are relatively rare. The rate of midshaft clavicle fracture is more in men as compared to women.²

Displaced clavicle fractures have traditionally been treated non-operatively. However, the prevalence of non-union or mal-union in displaced clavicular fractures after conservative treatment is higher than previously

presumed. Surgery is accepted more and more as primary treatment for displaced clavicle fractures, mainly because the results of non-operative treatment are interpreted as inferior to operative treatment both clinically and functionally.³

In a large number of complex displaced clavicle fractures, a satisfactory outcome is possible with a low complication rate using three types of fixation depending on location of fracture, such as with intramedullary devices, plates and external fixators.⁴ Intramedullary fixation can be accomplished with smooth or threaded K-wires, Steinman pins, or cannulated screws. External fixation of the clavicle is indicated for severe open fractures with poor quality overlying skin and for treatment of clavicle fractures in the face of infection or infected non-union following plate removal. Plate fixation is superior to intramedullary fixation as it better resists the bending and torsional forces that occur during elevation of the upper extremity above shoulder level.⁸

Several studies have examined the safety and efficacy of primary open reduction and internal fixation with locking compression plate for completely displaced clavicle fractures and have noted high union rate with a low complication rate.⁵ There are various plates including Sherman plates, hook plate, dynamic compression plates and semi-tubular plates. Among them, a reconstruction plate and locking compression plate (LCP), which can be bent to the S-shaped curvature of the clavicle, are the most preferred for middle third clavicle fractures and hook plates for lateral third clavicle fractures. We have taken up this study to gain a deeper understanding of results and to assess functional outcome following operative vs. conservative treatment of displaced clavicle fractures.

METHODS

Current study is a prospective, observational, comparative study and conducted over 30 patients diagnosed with displaced clavicle fractures coming to department of orthopaedics in a tertiary care hospital in South Rajasthan between January 2019 to June 2020. General physical and local examination was carried out in all the patients and diagnosis of fracture clavicle made. Plain radiograph of clavicle with shoulder in anteroposterior view was taken to assess the site of fracture and the fracture type (displacement and comminution). The fractures were classified according to Allman classification. Patients were then allotted alternatively into two groups.

Conservative treatment

Comfort and pain relief are the main goals. After confirming diagnosis on radiograph, patient was given figure of eight clavicle brace. After bracing, patients radial pulse was checked to rule out any axillary artery compression. The figure-of-eight brace was encouraged

to be used all day (including bed-time). To support the ipsilateral upper limb, an arm pouch/sling was also given. This was done on OPD basis. The figure of eight brace was removed after 6 week. Radiographs were taken during immediate post bracing period, 6 weeks, 3 months and 6 months. Active range of motion exercises of elbow, wrist and hand were started with pendulum movements of shoulder. At 6 weeks active to active-assisted range of motion of shoulder in all plane were started.

Preoperative preparation of patients allotted to surgery group

Routine pre-anaesthetic investigations were done after admitting the patient. Patients selected for surgical fixation were made to fast for 6 hours prior to surgery after obtaining fitness for anaesthesia. A written informed consent for surgery was taken.

Surgical technique

Patient in supine position with one bump placed in the interscapular area, allowing injured shoulder girdle to fall posteriorly, which help to increase exposure of the neck chest and clavicle. Ipsilateral upper limb is draped from mid arm region to hand. An incision of around 7 to 9 cm was made over the anterior aspect of clavicle, centering over the fracture site. Lateral platysma was released and supraclavicular nerve traversing the anterior aspect of the clavicle identified and protected. The clavipectoral fascia was incised along its attachment and carefully elevated inferiorly. The fractured ends were made free from surrounding tissue. Minimal soft tissue and periosteum dissection was done. Fracture was then reduced and holded with bone clamp. For provisional fixation lag screw or mini-fragment screw was used. Internal fixation was done with an anatomic clavicle locking compression plate (LCP) (Figure 2). Slight contouring of the plate as required, was done to fit the superior edge of the clavicle. In cases of fracture of lateral third of clavicle, a hook plate (Figure 1) was used where the length of the lateral fragment was not enough to accommodate at least 2 screws. Then screws were inserted from superior to inferior, taking care to avoid injury to neurovascular structures. A bone lever is kept on the inferior surface of clavicle in order to protect the underlying structures while drilling. After achieving adequate hemostasis, wound wash was given and wound was closed in layers with vicryl and ethilon sutures and sterile dressing was done.

Post operative care

The operated extremity was placed in sling for comfort. Patients were kept nil orally for 6 hours post-operatively. Intravenous fluids, antibiotics and analgesics were given according to the need of the patient. Check radiographs were taken to study the alignment of fracture fragments post fixation. Suture/staple removal was done on 14 postoperative days. Patients were discharged with the arm sling pouch. Post op passive and active range of motion

exercises started. All patients from operative group were followed after 14 days for suture removal. Radiographs were taken at sixth week, third month and sixth month to know about progressive fracture union. For functional assessment, patients were followed at third month and sixth month.

RESULTS

Current study included 30 patients of displaced clavicle fractures, among which 15 were treated surgically either with locking compression plate or with hook plate (in case of fractures lateral third of clavicle) and other 15 patients were treated conservatively with 'figure of eight' clavicle brace and arm sling pouch. Mean age for operative group was 37.7 years (range 22 to 55) and for conservative group was 36.62 years (range 18 to 55). Operative group consisted of 12 male out of 15 patients; and conservative group consisted of 11 male out of 15 patients.

The majority of patients had right sided clavicle fractures (N=20), while in 10 patients had left clavicle fractures. Road traffic accident accounted for most of the injuries (N=21) and rest were due to fall from height. Middle third clavicle fracture was most commonly seen in 24 patients, while 6 patients had lateral third clavicle fractures. The mean time interval for operative group from admission to surgery was 2.4 day. 14 patients from operative group were operated within 3 days of admission, only 1 patient operated on fourth day from

admission. Mean duration of surgery for operative group was 95 minutes (range 75 to 140). The mean duration of stay in hospital was 5 days (range 4 to 9). All the conservative patients were managed on an outpatient basis.

Most of the fractures were united at 3 months of follow up in both the groups. However, in the operative group, 93.33% of the fractures were united at 3 months of follow up as compared to 66.66% in the conservative group. At 6 months of follow up, there were 2 patients in the conservative group which did not show signs of clinical or radiological union; while all the patients in the operative group had their fractures united. Constant Murley score at 3 month in conservative group was 66.4 and in the operative group were 76. Constant Murley score at 6 month in conservative group was 80.13 and in the operative group were 89.47. There was a statistically significant difference in Constant Murley score between two groups at 3 month and at 6 months of follow up with $p < 0.0001$ (Table 1).

In current study, in each group, complications were seen in 3 patients. In the conservative group, 2 patients had delayed union along with shoulder stiffness; and one patient had malunion. In operative group, 2 patients had keloid formation which was treated with local steroid injection by dermatology department and 1 patients had superficial skin infection over incision site which was treated with intravenous antibiotics and regular dressing for 3 days.

Table 1: Distribution of mean Constant and Murley score.

Constant and Murley score	Operative group	SD	Conservative group	SD	P value
At time of injury	29.2	2.70	28.13	2.77	0.293
At 3 months	76	4.14	66.4	4.15	<0.0001
At 6 months	89.47	4.37	80.13	4.86	<0.0001

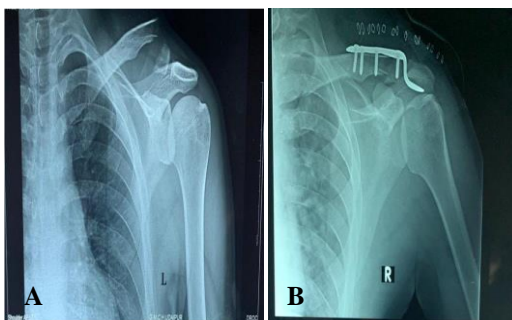


Figure 1: (A, B) Lateral third clavicle fracture treated with hook plating.

DISCUSSION

Fracture of clavicle accounts for 2.5% to 4% of adult fractures and 44 to 66% of injuries to the shoulder girdle. A vulnerable area in clavicle is present at mid-shaft

region, which leads to 80% of fractures occurring in this region, while lateral third clavicle fracture accounts for 15% and medial third clavicle fracture accounts for 5% of the total fractures.² Historically it was considered that, "all clavicle fractures do well with non operative treatment" but this dictum is no longer valid.¹



Figure 2: (A, B) Midshaft clavicle fracture treated with LCP.

Studies conducted to analyze the results of conservative treatment by Hill et al, Nordqvist et al and Robinson et al they found poor results following conservative treatment of displaced clavicle fractures. Conservative treatment of displaced lateral third clavicle fracture has higher rate of non union and residual shoulder dysfunction as showed by Edwards et al.⁹⁻¹²

The prevalence of non-union or mal-union in displaced clavicular fractures after conservative treatment is higher, so the surgical fixation is being increasingly accepted as treatment for displaced clavicle fractures, mainly because the results of non-operative treatment have been poor as compared to operative treatment both clinically and functionally.² Patient today expect a rapid return to pain free function following a fracture. Primary internal fixation of displaced clavicle fractures leads to predictable and early return to function.⁷

The results of present study are comparable with the results of Jha et al study which include 60 patients of displaced midshaft clavicle fractures which were treated surgically with plating and conservatively with clavicle bracing and sling, Bostmen et al which included 103 patients with only middle third clavicle fractures treated surgically with plating; and Ethiraj et al study which included 60 patients of midshaft clavicle fractures which were treated surgically by open reduction and internal fixation with plate.^{6,8,13}

In current study, the overall average age of patients with displaced clavicle fractures was 37.2 years (range 18 to 55 years) compared to 32.2 years in Jha et al study and 33.4 years in Bostmen study et al.^{8,13} In current study, there is male preponderance for displaced clavicle fractures which is comparable to study by et al and Bostmen et al.^{8,13} Male preponderance, possibly due to fact that male are more involved in outdoor activities and profession than female in India. In current study, 21 patients (70%) sustained fracture from a Road traffic accident while 9 patients (30%) sustained fracture due to direct fall from height which is comparable to 76.67% (RTA) and 23.33% (fall from height) in study by Jha et al and 55.25% (RTA) and 44.66% (fall from height) in study by Bostmen et al.^{8,13}

In current study, at the 6 month follow up, fracture union was seen in all patients (100%) from operative group and 13 patients (86%) from conservative group. 2 patients in the conservative group had un-united fracture, both clinically and radiologically, at 6 months of follow up. Compared to study by Jha et al union was seen in 26 patients (86%) from operative group and 25 patients (83%) from conservative group at 6 months; whereas 4 patients in the operative group and 5 patients in conservative group had ununited fracture, both clinically and radiologically, at 6 months of follow up.⁸

In current study, Constant Murely score was measured at the end of third and sixth month of follow up and was

significantly higher in operative group as compared to conservative group. Average score at 6 months follow up was 89.47 in operative group as compared to 80.13 in conservative group with $p < 0.0001$ at 6 months. In the present study out of 15 patients in operative group, 12 showed excellent result, while 3 had good result. In conservative group 3 patients showed excellent result, 10 had good and 2 showed fair result according to Constant Murley Score at the end of 6 months.

Compared to the study by Jha et al, the average value of Constant and Murley score at 6 months follow up in the conservative group was 94.47 ± 7.514 and that in operative group was 96 ± 7.909 .⁸ In the study by Ethiraj et al 60 patients of fresh middle third clavicle fracture fixed with locking compression plate showed excellent results in 46 patients, good results in 10 patients, fair results in 3 patients and poor results in 1 patient.⁶ In current study, 1 patient had superficial skin infection and 2 patients had keloid formation from operative group. 2 Patients had un-united fracture at 6 months of follow up along with shoulder stiffness and 1 patient had malunion with no significant functional restriction, apart from the appearance of bump over the region from conservative group. In the study by Ethiraj et al 1 patient had implant failure due to breakage of implant with backed out screws and loss of reduction.⁶ Jha et al in their study showed following complications, all of which were managed appropriately; delayed union, malunion, nonunion, implant failure and infection.⁸

Current study therefore shows distinct advantage of operative treatment for displaced clavicle fractures with plating, giving immediate pain relief, early union, early shoulder movements which lead to early return to work.

CONCLUSION

In current study of displaced clavicle fractures, it was found that at the end of 6 month, in patients treated surgically with plating had better functional outcomes than conservatively treated patients, as measured by the Constant Murley score. It was also seen that the duration of union was less in operative group compared to conservative group. The operative treatment for displaced clavicle fractures with plating gives immediate pain relief, early shoulder movements which leads to early return to work and causes less complication.

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