



(CASE REPORT)



Outcome of surgical management of clavicle shaft fracture in adult

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Abstract

Background: Traditionally treatment clavicle fracture has been via non-operative methods in both children and adult. But the management in the adult remains controversial in terms of displacement, comminution, malunion, cosmetic deformity, functional deficit. Such subsets of patients can be optimally treated by open reduction and internal fixation with plate and screws.

Objective: To study the outcome of middle third clavicle fracture treated with plating and screws in terms of functional Scoring of Constant and Murley.

Method: In this hospital based, interventional, prospective study conducted at Morang Sahakari Hospital, Biratnagar, Nepal from October 2022 to July 2024, 31 patients with middle third clavicle fracture satisfying all the inclusion criteria were treated by open reduction and internal fixation with plate and screws.

Result: There were 31 patients, 28 males and three females aged from 17 years to 45 years old with mean age 30.65 ± 7.09 . Most of them sustained injury in RTA and were closed type of fracture and nine had associated injuries. Most of the fractures united by 17 weeks. The average Constant and Murley score was 93.38 and patients were satisfied with the treatment.

Conclusion: This small series shows that selected patients of displaced middle third clavicle fracture can be treated with operative reduction and internal fixation using plate.

Keywords: Fracture clavicle; Plate fixation; Constant and Murley score

1. Introduction

Clavicle fracture is a common traumatic injury around shoulder girdle due to their subcutaneous position. Fracture of the clavicle account for 2.6% -12% of all fractures and for 44% to 66% of fracture about the shoulder. About 82% of these fractures are in middle third and less often in lateral third 18% and medial third 5%.² The annual incidence of clavicular fracture is 50-64/100,000 per population and has increased in last decade in western world with mobile and energetic life.³

Fractures of the clavicle have been traditionally treated with closed reduction, even for displaced fracture. However, it is difficult to maintain reduction by the available methods like sling, figure of eight brace, and some deformity is expected. This affects the function of shoulder and the patient need. Recent studies have indicated that outcomes of conservative management are not always excellent, especially with high energy injuries and raised the question whether acute clavicle fracture should be fixed internally.^{4,5}

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In our country, there is rise in high energy trauma due to increase in incidence of road traffic accidents. These patients need individualized treatment of their clavicle fractures, especially surgical fixation. However, very less studies are available in our country for the management of fracture clavicle. So the purpose of this study is to see the outcome of the most common fracture midshaft of the clavicle by the plate and screws.

2. Material and methods

This hospital based interventional, prospective study was carried out from October 2022 to July 2024 at the department of orthopaedics in Morang Sahakari Hospital, Biratnagar, Nepal. During this period 31 patients of clavicular fractures were treated surgically by clavicular plates and screws. Adult male and female between age group of 16-60 years with displacement more than 20mm, an imminent lesion of the skin by a sharp edge of the clavicle, neurovascular injuries and painful mal-union, painful non-union were included in the study.

The patients who presented with middle third fracture clavicle were admitted and evaluated under standard protocol. Fracture was immobilized in a clavicular brace and thorough pre-operative evaluation and pre-anesthetic check-up was done. After obtaining appropriate consent, patients are treated surgically. Using the anterior approach to clavicle, the fracture was exposed. After obtaining appropriate reduction, it was fixed using plates. For fixation, recon plates and pre-contoured locking compression plates (LCP) were used. Additional inter-fragmentary screws and bone grafting were done according to the need of the fracture fixation.

The functional outcome were assessed by Constant and Murley score⁶ and radiological union with x-rays at 6 weeks, 12 weeks, 24 weeks and till union of fracture was observed.

3. Results

Majority of the patients 18 (58.1%) were in age group 26-35 years. Seven (22.5%) were in age group 16-25 years and the rest six (19.4%) in age group 36-45 years. The youngest patient was of 17 years and the oldest was of 45 years. The mean age of the patients was 30.65 years with SD 7.09 years (Range 17-45 years). The majority of patients were male 28 (90.3%) and the female were three (9.7%). In this study, 16 patients (51.6%) had fracture over right side and 12 patients (38.7%) had it on left side while three patients (9.7%) had on both side. The majority of the patients 29 (93.5%) suffered RTA while two (6.5%) had history of fall from height. Majority of the midshaft clavicular fractures 22(71%) were not associated other injury, three (9.7%) patients each of soft tissue injury and head injury. One (3.2%) patients each of right distal radius fracture, right humerus fracture and right supracondylar femur fracture. So total nine (29%) patients had associated injury.

In 18 patients (58.1%), reconstruction plates were used. In seven patients (22.6%), clavicular plates and semi tubular plates were used in six (19.4%). One clavicular locking plate failure occurred at eight weeks and re-plating with reconstruction plate and bone grafting was done. Inter-fragment screws were applied in only two cases (6.5%). One was long spiral fractures and other was with butterfly fragment. Bone grafting was done in two cases (6.5%). Both the cases were comminuted fractures.

Table 1 COMPLICATIONS

Complications	No. of patients	Percentage
Infection	1	3.2 %
Hypertrophic scar	1	3.2 %
Malunion	1	3.2 %
Implant Failure	1	3.2 %
Loosening of screw	3	9.6 %
Delayed union	5	16.1 %

We encountered complications in total seven (22.58 %) cases (Table 1). There were three (9.6%) cases of loosening of screw without history of trauma and sign of infection. One case healed with malunion by 20 weeks. The second case of

loosening of screw led to implant failure and was managed by implant removable and plating with bone grafting at 12 weeks leading to delayed union at 32 weeks. The third case of loosening of screw healed uneventfully by 18 weeks. Total five cases of delayed unions were present. Two as described above, third with brachial plexus injury, fourth with hypertrophic scar and fifth with comminuted fracture

Most of the patients 26(83.9%) underwent surgery within five days. And the remaining five (16.1%) patient's surgery was done after five days. Surgery was done in minimum one day and maximum 10 days. Average period required to undergo surgery was days 2.48 days.

The mean operating time was 80.48 minutes (range 60-100 minutes). The mean period of hospital stay was 14.41 days (range 4-24 days). We had advised all the patients for discharge on 3rd POD except those with associated injuries requiring treatment. But most of them were associated with medico legal case and wished to discharge after suture removable which was done on 14th post up day.

The fracture considered to be united when clinically there was no tenderness, and radiographically the fracture line was not visible and full unprotected function of the limb was possible. In this study, 10 (32.3%) patients had their fracture united at or before 12 weeks and rest 21 patients (67.7%) beyond 12 weeks. The mean duration of union was 16.38 weeks.



Figure 1 Pre-operative x-ray, post-operative x-ray and x-ray at 24 weeks

The functional outcome was assessed by Constant and Murley score at 24 weeks. The majority of the patients 24 (77.4%) as per Constant and Murley Score were categorized as Excellent, and three (9.7%) were Good, and two (6.5%) each were Fair and Poor (Figure 1). The average Constant and Morley Score at six months of follow up was $93.38 \pm 0.886SD$.

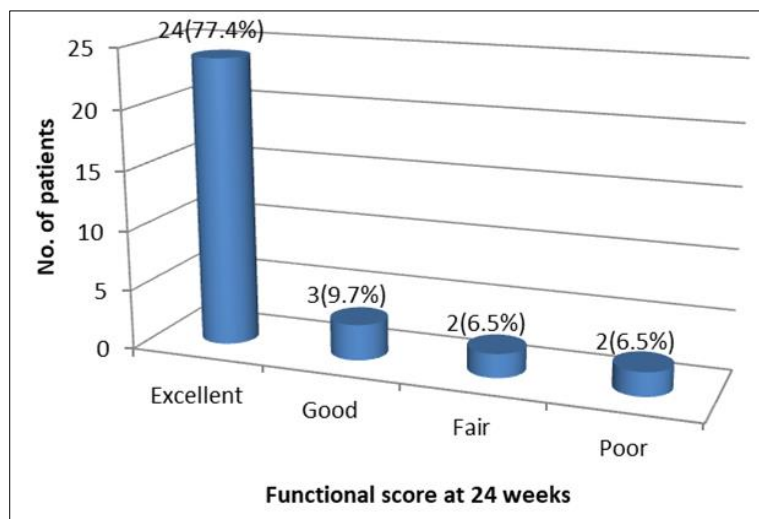


Figure 2 Bar diagram showing Functional outcome in different patients

4. Discussion

Clavicle fractures are usually treated conservatively. Out of many conservative methods, better patient satisfaction was demonstrated by Arm Sling and Figure-of-Eight.⁷ In a study conducted to analyze the results of conservative treatment by Hill et al. in 1997, Nordqvist et al. in 1998 and Robinson et al. in 2004 found poor results following conservative treatment of displaced middle third clavicle fracture.^{8,9,10} Nonunion rate of 4.5-9% in Robinson's series, 15 % in Hill's series were found in displaced clavicle fracture managed conservatively. Moreover, shortening and overlapping more than 2cm leads to greater risk of nonunion, pain, poor cosmetic result and functional deficits.¹¹ These drawbacks can be overcome by surgical fixation achieving near normal anatomic, cosmetic and functional profile.¹² Among surgical management, plate fixation gives the advantage of immediate rigid stabilization, pain relief, facilitates early mobilization and return to normal work.

Majority of the patients 18(58.1%) were in age group 26-35 years. Seven (22.5%) were in age group 16-25 years and the rest six (19.4%) in age group 36-45 years. Mean age of the patients was 30.65 years with SD 7.09 years (range 17-45 years). Similar mean age was present in Series of Bostman,¹³ Dhoju,¹⁴ and Douraiswami Series.¹⁵

The majority of patients in this study were male 28 (90.3%) and the female were three (9.7%). Similarly, male dominance was seen in all the most of the studies.^{13,14,15,16} It may be because of male being more mobile and involved into more outdoor activities compared to female.

In this study, 16 patients (51.6%) had fracture over dominant right side and 12 patients (38.7%) had it on left side while three patients (9.7%) had on both side. In Dhoju series,¹⁴ 11 patients (55%) had fracture of dominant right side and nine patients (45%) of the left side.

In Shen series, right clavicle fractured in 122 patients (52.58 %) and left clavicle in 110 (47.42 %). In Douraiswami series, right clavicle was fractured in 18 cases (72%), left clavicle in six cases (24%) and one had bilateral clavicle fracture.¹⁵

The majority of the patients 29 (93.5%) in the present study sustained injury during RTA while two (6.5%) had history of fall from height. In Dhoju Series,¹⁴ fracture in 10 cases (50%) occurred due to RTA and nine cases (45%) resulted fall from height and one case (5%) due to buffalo assault.

Nine patients (29%) had associated injuries in my study. Three (9.7%) of the patients had soft tissue injury and other three (9.7%) had head injury. In Dhoju series,¹⁴ five patients (25%) had associated injuries. Three had ribs fracture one had metacarpal fracture and the fifth had tibia fracture. In Douraiswami Series,¹⁵ two patients had rib fracture, one had metatarsal fracture and one had displaced radius fracture.

In my series, two comminuted (6.5%) cases were managed by bone grafting to prevent nonunion and an interfragment screw were applied in one long spiral fracture (3.2%) case to enhance compression at fracture site and one with butterfly fragment. In Dhoju series,¹⁴ interfragment screw was applied in four cases (20%) and bone graft was done in two comminuted cases (10%). In Bostman et al. study,¹³ bone graft was done in four cases (3.8%)

In Douraiswami series,¹⁵ interfragmentary screws were used in three cases with butterfly fragments.

In this study 10 (32.3%) had their fracture united at or before 12 weeks and rest 21 patients (67.7%) beyond 12 weeks. The mean duration of union was 16.38 week. This was similar to Dhoju Series but was more than Shen series.^{14,16}

I encountered complications in total seven (22.58 %) cases. There was one case (3.2%) of surgical site infection presented at 12 weeks, which was removed and managed conservatively leading to delayed union by 25 weeks. There were three (9.6%) cases of loosening of screw without history of trauma and sign of infection. One case healed with malunion. The second case of loosening of screw lead to implant Failure which was managed by implant removable and plating with bone graft done at 12 weeks, which ultimately healed by delayed union at 32 weeks. The third case of loosening of screw healed uneventfully. Total five delayed unions were present which ultimately united. Implant removal was done in three cases (9.6%) for hardware removal after one year interval. In Bostman et al. study,¹³ 24 (23%) suffered complications. Infection rate was 7.8%. Reoperation in 14 cases. Nonunion in two cases (1.94%). Two patients were treated with semi tubular plate had implant breakage at 2nd and 7th postoperative weeks respectively. Both cases were treated by replating using dynamic compression plate with bone grafting. Implant loosening in seven cases (6.8%) which resulted in malunion but reoperation was not performed. In Shen series,¹⁶ Bending and loosening of plate occurred in 14 patients (6%). Nonunion was in seven patients (3%). Deep infection in one case (0.43%), managed by

implant removal and debridement. And four (1.72%) cases of superficial infection were managed by debridement and antibiotics. No implant failure occurred. In Dhoju Series,¹⁴ there was one case of infection (5%) managed with early removal of implant and one case (5%) of frozen shoulder managed with MUA and physiotherapy. No patients had implant loosening, implant failure, nonunion. Reoperation was done in five cases (25%), all for implant removal. In Douraiswami series,¹⁵ none of the case got infected. Prominence of plate was seen in one case due to implant failure which united with malunion. All patients were satisfied with treatment and 84% returned to work by eight weeks.

In my study, most of the cases were done on next day while rests were delayed for surgical fitness due to associated injuries. Average period required for surgery was 2.48 days. In Dhoju series,¹⁴ all the cases were done on the next day of admission except two; one had complication of previous rush pin fixation and another case was with associated injury requiring surgical fitness.

The majority of the patients 24 (77.4%) as per Constant and Murley Score were categorized as Excellent, and three (9.7%) were Good, and two (6.5%) each were Fair and Poor. The average Constant and Murley Score at six months of follow up was 93.38. In Dhoju series,¹⁴ Constant score was 97.45 with SD 3.1 in one year follow up. In Douraiswami series,¹⁵ mean DASH score dropped from 1.85 at eight weeks to 0 at 12 weeks.

5. Conclusion

Clavicle fractures are usually treated conservatively but there are specific indications for which operative treatment is needed like neurovascular damage, skin tenting, open fracture, shortening and overlapping more than 20mm. In this study, primary open reduction and internal fixation was done with plate with three cortical screws on each fragments providing a more rigid fixation, predictable union, optimal function and less period of immobilization. But plate fixation needs increased soft tissue stripping, increased damage to supraclavicular nerve, increased infection rates, second operation for hardware prominence and risk of refracture after plate removal. Proper use of interfragmentary screw to achieve compression and to hold butterfly fragment can be done. In my study, surgical outcome was good, though was associated with complications like infection, and delayed union which healed over period of time. However, proper patient selection, proper patient compliance with good counseling is required to have better outcome.

Limitation of this study

- This was a prospective study in a single institution with small sample size.
- I used only plate and screw fixation in operative group.
- Duration of follow up was only six months. So I could not assess the long term result

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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