



Original Research Article

Fracture clavicle- Functional evaluation with internal fixation

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ABSTRACT

Introduction: Fracture of clavicle is one of the most common fractures of the shoulder girdle which was treated previously by various conservative methods like figure of 8 bandage and arm sling. However, apart from complications like malunion and non-union, prolonged immobilization led to complications like shoulder stiffness and thereby delayed return to activities. Gradually, many techniques of internal fixation like plating and intramedullary fixation of clavicle have been developed, each one having its own merits and demerits. In this scenario, this study intends to observe the patients who have sustained middle third clavicle fractures treated with plating and their outcomes.

Aim: To observe the functional outcome of fractures of middle third of clavicle, which are treated surgically by plating and complications of the plating technique

Methods and Materials : 30 patients of age from 18 years to 60 years with midshaft clavicle fractures are treated with plate osteosynthesis. They are followed serially and complications encountered are noted. Their functional outcome is calculated using Quick dash score and Constant-Murley score at regular intervals.

Results: There is an increased preponderance of fracture clavicle among male patients. Most of the patients are between 30 to 50 years of age. The average time taken for fracture union is 10.5 weeks. The average Constant-Murley score and Quick dash score were 91.1 and 5.96 respectively. There are a few complications like hardware prominence.

Conclusion: Plating technique for the treatment of midshaft clavicle fractures helps in early recovery and rehabilitation of patients. It prevents complications like shortening, stiffness of the shoulder etc.

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1. Introduction

Fractures of clavicle bone account for about 2.6% of all the fractures.^{1,2} Fractures of middle third of clavicle are more common. They constitute 80 to 85 percent of all the clavicle fractures. These clavicle fractures were treated conservatively by using different methods like figure-of-8 bandage, arm sling etc., previously. Now-a-days there is a shift of paradigm from conservative treatment to internal

fixation of fractures in order to facilitate early mobilization.

There are different methods of fixation of clavicle fractures. There are external fixation techniques which are less commonly used. There are intramedullary fixation techniques and plating techniques for fixing clavicle fractures. Intramedullary fixation can be done using K-wires, TENS and even cannulated cancellous screws.³ However, with intramedullary devices, there are chances of migration of the k-wires leading to loss of fixation, lack of adequate compression at the fracture site.

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With plating technique, compression can be achieved better at fracture site, length of the bone can be maintained better. There is no risk of migration of the implants. But there are certain disadvantages with this technique too. Opening the fracture site, risk of neurovascular injury are some of the disadvantages with plating.³ There are two methods of plating clavicle, viz, anterosuperior plating and anteroinferior plating. Antero superior plating is more familiar technique and it is biomechanically a superior method. Anteroinferior plating allows easier contouring of the plate and avoids injury to neurovascular structures during drilling.⁴

In this scenario, this study has been planned to know the outcome of middle third clavicle fractures fixed internally using plating techniques.

2. Aim

The aim of the study is to observe the functional outcome of fractures of middle third of clavicle, which are treated surgically by plating and complications of the plating technique.

3. Materials and Methods

3.1. Study design

Prospective study which is hospital based.

3.2. Study area

Department of Orthopaedics, in a tertiary care hospital, Visakhapatnam.

3.3. Study period

2 Years.

3.4. Study population

Patients with middle third clavicle fractures who have met the inclusion criteria and those who have given consent.

3.5. Sample size

30 Cases.

3.6. Inclusion criteria

1. Age of the patient should be above 18 years and below 60 years.
2. Fractures involving middle third of clavicle.
3. Segmental fractures clavicle.
4. Displacement and shortening more than 2cm.
5. Fractures associated with neurovascular injury.

3.7. Exclusion criteria

1. Age of the patient below 18 years and above 60 years.
2. Undisplaced fractures.
3. Medical co-morbidities which make patient unfit for surgery and which may affect the outcome of surgery
4. Bilateral clavicle fractures by default.
5. Other fractures involving shoulder girdle along with clavicle fracture.

3.8. Ethical considerations

Institutional Ethical Committee Approval was taken.

The patients who presented with middle third fracture clavicle are admitted in casualty and are evaluated under standard protocol. Fracture is immobilized in a clavicular brace. After thorough pre-operative evaluation and pre-anaesthetic check-up and appropriate consent procedures, patients are surgically treated. Using the anterior approach to clavicle, the fracture is exposed and reduced under vision. After appropriate reduction is achieved, it is fixed using plates [Figure 1]. For fixation, recon plates and precontoured locking compression plates (LCP) are used. Patients with segmental fractures of clavicle are fixed with additional interfragmentary screws.

Post-operative dressings were done on 2nd and 5th post-operative days (POD). Suture removal is done on 12th POD. Post-operative x-rays are assessed at immediate post-operative period, 1st month and 3rd month. Patients are evaluated functionally using the quick dash score and Constant-Murley Score at 2 weeks, 1 month and 3 months intervals. The data obtained is tabulated in an excel sheet. Statistical mean of union time and functional scores is noted. The results are tabulated as bar diagrams.

Proper rehabilitation and physiotherapy are needed to prevent shoulder stiffness. Pendulum exercises are started on POD-3, Shoulder range of motion (ROM) exercises were initiated at 2 weeks and patients are advised to avoid sports and lifting weights till 12 weeks. Postoperatively, functional evaluation is done using Quick Dash score⁵ and Constant-Murley Score⁶ at regular intervals.

Quick dash score has eleven items to measures physical function and symptoms in people with musculoskeletal disorders related to upper limb.⁴ Constant-Murley Score is one of the most widely used scores to assess the shoulder function, especially in post-traumatic cases. There are different components like functional assessment (40 points), strength measures (25 points), ROM score (20 points), and pain score (15 points) in it.⁴

4. Results

Majority of the patients in our study are aged between 30 and 50 years [Figure 5]. There is increased male preponderance of clavicle fractures in our study with 27 males and 3 females [Figure 6]. Out of 30 cases, there is one

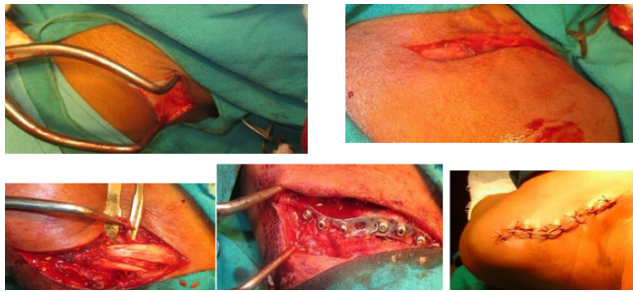


Figure 1: Intraoperative images showing surgical approach to clavicle and superior plating.

case affected by the involvement of brachial plexus. This patient is excluded when scores are being estimated. There are no cases of open fractures.

The average time taken for the fracture to unite is 10.5 weeks in our study [Figures 3 and 4]. Absence of tenderness at the fracture clinically is considered to assess the union of fracture.

The average time taken by most patients to perform their activities of daily living is 2 to 3 weeks. The average time taken by the patients in this study was around 3.4 weeks. Two patients with shoulder stiffness returned to their day-to-day activities after 6 weeks and 9 weeks respectively.

Most of the patients assumed their occupational activities and acquired their pre-injury status by 11 to 12 weeks. One patient required more than 16 weeks to return to work, as he did not follow the advised physiotherapy protocol and presented with shoulder stiffness.

4.1. Constant murley score

The mean Constant Murley score is around 91.1 in the present study. The score of the injured limb is compared with that of the normal upper limb and based on the difference, the outcome is graded as excellent, good, fair and poor. The functional outcome is good among majority of the patients [Figure 2, Table 1].

Table 1: Functional outcome based on constant murley score

Outcome	No. of patients	Percentage
Excellent(E)	18	62 percent
Good(G)	10	34.4 percent
Fair(F)	1	3.44 percent

There are two cases of shoulder stiffness as the patients are not compliant to the physiotherapy explained at the time of discharge. They are advised shoulder ROM exercises. They showed improvement in subsequent follow-ups.

4.2. Quick dash score

The average quick dash score of this study is 5.96. The best quick dash score in the study is 2.3 and worst is 13.6.



Figure 2: Shoulder range of motion of a patient

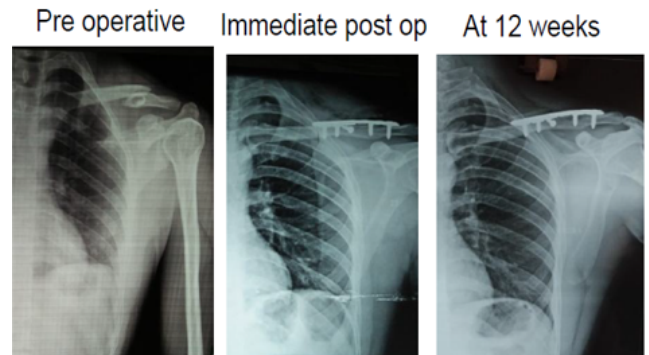


Figure 3: Serial x-rays of patient and x-ray at 12 weeks showing bony union

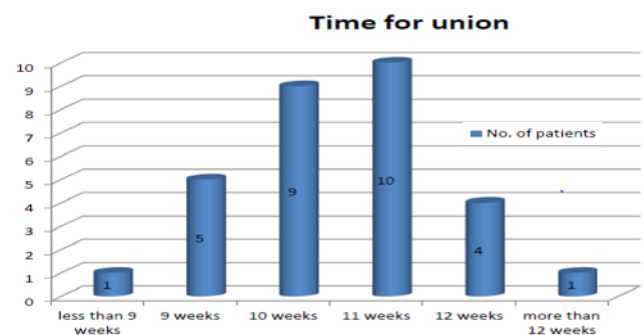


Figure 4: Time for union

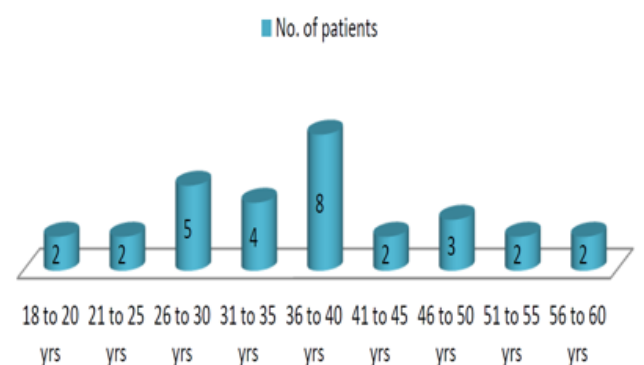


Figure 5: Age distribution of the patients

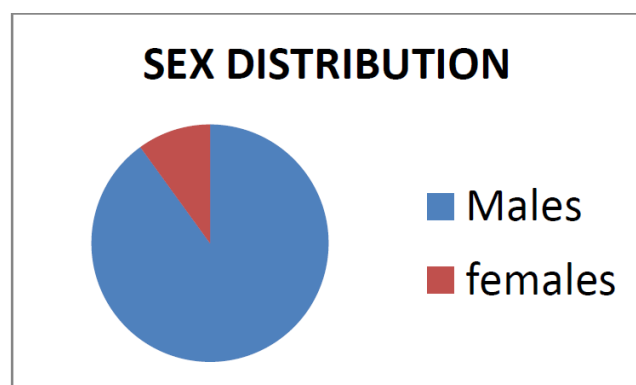


Figure 6: Sex distribution

4.3. Complications

There are two cases of hardware prominence. They are treated by implant removal. There is one case complicated by superficial infection. It is treated with antibiotics. There is a case of delayed union where the patient is not compliant with the immobilization instructions. The fracture united by 16 weeks after prolonging immobilization and avoiding lifting of weights. There are two cases of shoulder stiffness as the patients are not compliant with the physiotherapy protocol. Pendulum exercises are advised to them and their scores are poorer compared to other people at the end of the study, though they have showed slight improvement. There is one case of delayed union and hypertrophied scar. One case presented with brachial plexus injury and he is referred to higher center.

5. Discussion

Fracture clavicle is one of the fractures which was treated conservatively. Though early studies by Neer et al and Rowe et al showed lesser non-union rates in conservatively managed cases,^{7,8} a study by Zlowodzki et al, conducted from 1975 to 2005 showed increase in rates of non-union in clavicle fractures treated conservatively compared to those which were treated with internal fixation.⁹

Plating and intramedullary fixation are the methods available to fix clavicle fractures, each having its own merits and demerits. A study by Partha Saha et al. showed that the fractures treated with plating had lesser shortening and better Constant-Murley scores in the early follow up compared to TENS treatment of clavicle.¹⁰ However, the disadvantages are increased operative time, implant complications, excessive soft tissue dissection in case of plating.

The average time of fracture healing in this study is 10.5 weeks. A similar study which was done by Akshay Bharadwaj et al showed that fracture clavicle which was fixed with plating united faster than those treated conservatively. The time taken for the fracture to unite in

their study was 15.6 weeks in group treated by plating and 22.8 weeks in the group treated conservatively.¹¹ The average union time was 12 to 14 weeks in another study performed by Ethiraj et al., where precontoured LCP was used for internal fixation of clavicle fracture.¹²

The union time in the present study is better compared to that of the above mentioned studies. However, the study by Syed Ibrahim et al. showed that the average time of union is around 8.2 weeks. Another study done by B.M. Naveen et al. also showed faster union in 9.27 weeks in the operative group in contrast to 11 weeks in the non-operative group.¹³

The average Constant-Murley score observed in our study is 91.1. About 18 out of 29 patients (about 62%) have excellent outcomes. 10 patients have good outcome. Stiffness of shoulder lead to inferior outcome in one patient in our study. A study performed by Robinson et al, showed better Constant-Murley score of 92 in operated group as compared to 87.8 in conservatively treated group.¹⁴ Similar difference between surgically treated group and conservatively treated group is observed in study done by Akshay Bharadwaj et al and B.M. Naveen et al.^{11,13}

When quick dash scores are compared, it was 7.1 in study done by Syed Ibrahim et al¹⁵ and 3.2 in the study by Robinson et al.¹⁴ The quick dash score in our study is 5.96.

Most frequently encountered complication in plating of fracture clavicle is hardware prominence. About 6% of the patients had hardware prominence in the studies done by B.M. Naveen et al, similar to our study, where it is 6.7%.¹³ Better soft tissue coverage helps in preventing hardware prominence.

Shoulder stiffness in this study is around 6.7% which is better than that of the studies by Saidapur et al and K.B. Ravi et al, where, the rate of shoulder stiffness is around 8% and 10% respectively.^{16,17} Initiation of pendulum exercises and shoulder mobilization prevents stiffness of the shoulder. The rate of infection is around 3.3% in this study which was relieved with antibiotics. K.B. Ravi et al and Zlowodzki et al showed similar results in their study.^{9,16}

In the present study, 18 cases (60%) are treated with precontoured plate and 12 cases (40%) are treated with recon plate. Advantage of using precontoured locking plate is that, it can be used in osteoporotic bones and unicortical fixation is sufficient, thereby minimizing the risk of injury to the underlying neurovascular structures.

This study is designed to know outcome following fixation of middle third clavicle fracture by plating. Further studies are needed to compare different modalities of fixation, explore the outcomes following newer techniques like MIPPO, intramedullary elastic nail fixation¹⁸ etc.

6. Conclusion

This prospective study of 30 patients of fracture middle third clavicle shows good functional results with plating technique. The fracture union time and time needed to return

to day-to day activities is reduced. The functional outcome is also found to be good. Though hardware prominence is one of the major complications, it can be addressed by proper soft tissue cover. Chances of neurovascular injury during plating can be minimised by using guarded drill bits. It is advisable to start pendulum exercises and shoulder mobilization as early as possible to prevent shoulder stiffness to improve the functional outcome.

7. Limitations of the Study

The study evaluates only plating technique in fixation of clavicle fractures. It does not evaluate other methods of fixation.

8. Source of Funding

None.

9. Conflict of Interest

None.

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