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A study of functional outcome of clavicle fractures treated by clavicle plating

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Abstract

Aims

1. To identify the current pattern of clavicle fractures (presenting to this institute) requiring internal fixation with clavicle plating.
2. To determine the outcome of fixation of clavicle fractures using clavicle plating.
3. To study complications following fracture surgery and to assess possible risk factors for complications.

Objectives

1. To study patient characteristics, mechanism of injury and fracture morphology of fractures requiring internal fixation using clavicle plating.
2. To analyze outcome factors like functional score, surgical complications, radiological parameters, union status and union time of clavicle fractures.
3. To establish possible patient, fracture and implant characteristics that could contribute to the outcome.

This study is an attempt to evaluate 20 cases of clavicle plating in case of clavicle fracture and to assess the functional outcomes of clavicle plating. To ascertain whether modifiable characteristics like timing of surgery, implant positioning etc. contribute significantly to the outcome of distal radius fractures treated using clavicle plating. In our study out of 20 patients, 18 male and 02 female patients enrolled in study with mean age of 34 years (range 19-58). All patients had union at the final follow up at 4 months. Our study has a male preponderance with 90.00%. In our study dominant side (left) is involved 55.00%. In our study based on AO classification we had 0(00.00%) of type A fracture, 17(85.00%) of type B and 3(15.00%) of type C fractures. At final follow up 3 patients had excellent results and 12 patients had good results and 1 patient has poor results. No patients had difficulty in abduction up to 100 degree. 1 patient had plate exposed as a complication. In our study average duration of fracture union was 7.3 weeks. Clavicle plating remains the standard treatment in clavicle fractures. Clavicle plating does not significantly increase operative time. Clavicle plating has a significantly low hospital stay. Functional range of motion are achieved for the patients even to continue activities involving labor work. Complications of clavicle plating are minimal and are comparable to any other Orthopaedic surgical procedure. Proper reduction of fracture and surgical exposure is required for better outcomes of such fixations. Use of clavicle plates in clavicle fractures provides good to excellent results with correction and maintenance of clavicle anatomy.

Keywords: outcome, clavicle fractures, plating, enrolled

Introduction

Clavicle fractures are common injuries in young, active individuals, especially those who participate in activities or sports where high speed falls (e.g., bicycling, motorcycles) or violent collisions (e.g., football, hockey) are frequent and they account for approximately 2.6% of all fractures.

Robinson reported in an epidemiologic study that the annual incidence was highest in the under-20 age group, decreasing with each subsequent age cohort. The incidence in females was constant, with peaks seen in teenagers (e.g., sports, motor vehicle accidents) and the elderly (e.g., osteoporotic fractures from simple falls). The annual incidence of fractures in their population was 29 per 100,000 population per year.

The majority of clavicular fractures (80-85%) occur in the midshaft of the bone where the typical compressive forces are applied to the shoulder and the narrow cross section of the bone combine and result in bony failure. Distal third fractures are the next common fractures (20%) and they tend to occur in more elderly individuals as a result of simple fall. Medial third fractures are rarest (5%), perhaps because of difficulty in accurately imaging and identifying them. Motor vehicle accident is the usual mechanism of injury with a relatively high (20%) associated mortality rate from concomitant head and chest injuries.

Most clavicle fractures heal uneventfully without serious consequences with non-operative treatment. Treatment guidelines were based on Neer and Rowe’s two large series that show non-union rates of less than 1% in conservatively managed fractures with Sling or Figure-of-Eight bandage compared to nearly 4% in operatively treated patients. These results established the concept that union rates and function were excellent with conservative treatment and were better than those after operative treatment.

But more recent studies have questioned union rates, functional recovery and the morbidity of malunions after conservative management. A prospective observational study of 868 patients with clavicular fractures treated non-operatively found a non-union rate of 6.2%. A meta-analysis by Zlowodzki N, Zelle BA, Cole PA, et al. including 2144 fractures showed a non-union rate of 15% for displaced clavicular fractures treated non-operatively, whereas the non-union rate of operative treatment was only 2%. Thus there appears to be a subgroup of patients—those with displaced fractures—who do not do as well as previously thought.

These concerns led the Canadian Orthopaedic Trauma Society to initiate a multicentre prospective randomized controlled trial to compare non-operative treatment with a Figure of 8 clavicle bandage and operative plate fixation for displaced clavicular fractures. They concluded that operative treatment resulted in improved functional outcomes and lower rates of malunion and non-union. Complications occurred in 23 (37%) of 62 patients treated operatively compared to 31 (63%) of 49 treated non-operatively.

Operative treatment consists of open reduction and internal fixation with plates and screws or intramedullary nail. Plating techniques continue to evolve. Newer pre-contoured locking plates allow more accurate fitting while maintaining strength; compared to previously used locking compression plates and reconstruction plates.

Currently, most commonly used technique is superior placement of plate but when the fracture configuration allows anteroinferior plate placement is preferred because of the safe screw trajectory and less hardware irritation. In our setup at the Department of Orthopaedics, S.S.G. Hospital, Baroda, we did a study of 20 patients treated with open reduction and internal fixation using Anatomical Locking Clavicle Plate between August 2021 to August 2022.

Materials and Methods

This prospective cohort study was carried out at the Department of Orthopaedics in 1500 bedded, state run, tertiary care hospital attached to a post graduate teaching institute located in central Gujarat, from August 2021 to August 2022 after obtaining the permission from institutional Ethics committee.

Study Population

Patients of the Department of Orthopaedics enrolled under study of clavicle fractures treated with clavicle plating and consented to participate in the study defined by inclusion and exclusion criteria.

Sample size

Total 20 patients operated for clavicle Plating were identified to be included in study.

Inclusion criteria

All the following criteria were required to be fulfilled for inclusion in the study.

- Traumatic clavicle fractures fixed with clavicle plates.
- Adults (>18 years)

Exclusion criteria

- Any clavicle fracture
- Showing signs of infection at the time of presentation.
- More than 4 weeks old at the time of presentation.
- Pathological
- With history of Previous surgery in the same bone for other reasons
- In a Mentally challenged patient with poor communication skills.
- In Patients with local bony deformities or soft tissue contractures.

Follow-up Period: We followed up the patients for a minimum of four months at every four-weekly interval. At every follow-up, patients were assessed clinically for pain, swelling, mobility at fracture site, joint stiffness, signs of infection, wound status etc. and radiologically for union status, alignment and implant status.

Functional outcome was assessed at final follow up on basis of quick DASH score.

We considered the fracture united when plain radiographs showed bridging bone across the fracture in both orthogonal views and the patient was able to perform all functions with that limb without any pain.

Results

Table 1: Analysis in relation to quick dash score

| Dash score | Number of patients |
|------------|--------------------|
| <40 | 3(15%) |
| 41-70 | 12(60%) |
| 71-100 | 4(20%) |
| >100 | 1(5%) |
| Total | 20(100%) |

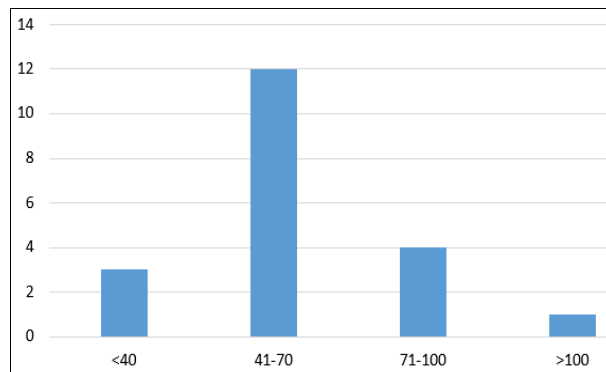


Fig 1: Show the no of patients

Table 2: Final result

| Final result | Number of patients |
|--------------|--------------------|
| Excellent | 3 (15%) |
| Good | 12 (60%) |
| Fair | 4 (20%) |
| Poor | 1 (5%) |

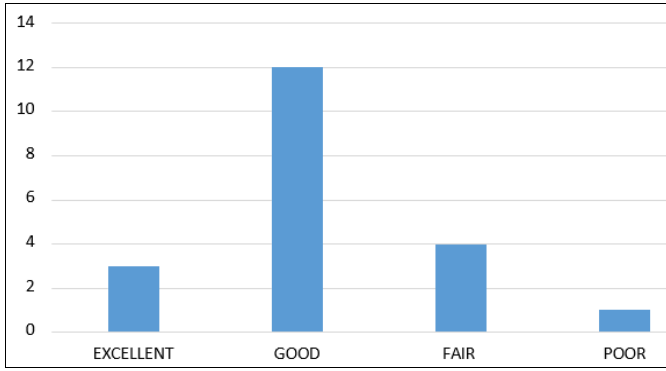


Fig 2: Show the no of patients

Table 3: Age vs Result

| Result | Age | | | | |
|-----------|-------|-------|-------|-------|-----|
| | 10-20 | 21-30 | 31-40 | 41-50 | >50 |
| Excellent | 1 | 1 | 1 | 0 | 0 |
| Good | 1 | 1 | 3 | 4 | 3 |
| Air | 1 | 1 | 1 | 1 | 0 |
| Poor | 1 | 0 | 0 | 0 | 0 |
| Total -20 | 4 | 3 | 5 | 5 | 3 |

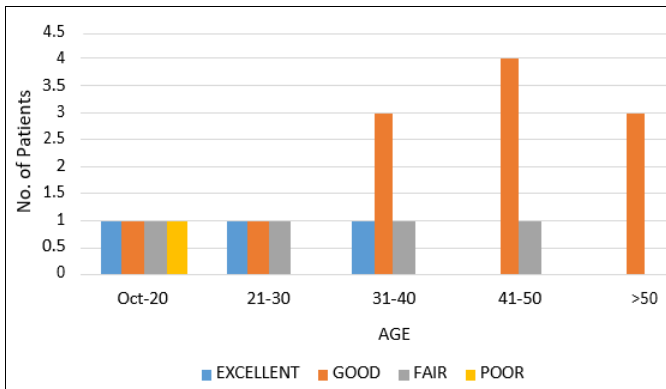


Fig 3: Show the Age VS result

Table 4: Gender vs Result

| Result | Gender | |
|-----------|--------|--------|
| | Male | Female |
| Excellent | 3 | 0 |
| Good | 10 | 2 |
| Fair | 4 | 0 |
| Poor | 1 | 0 |
| Total | 18 | 2 |

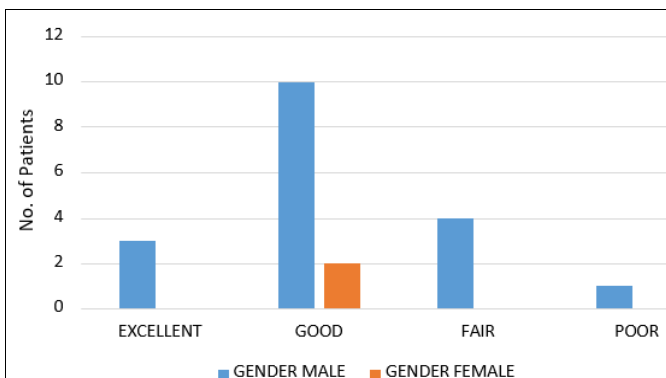


Fig 4: Show the Gender VS result

Table 5: Occupation vs result

| Result | Occupation | | | |
|-----------|------------|-----|-----------|---------|
| | Labourer | Job | Housewife | Student |
| Excellent | 3 | 0 | 0 | 0 |
| Good | 5 | 4 | 2 | 1 |
| Fair | 2 | 2 | 0 | 0 |
| Poor | 0 | 0 | 0 | 1 |
| Total | 10 | 6 | 2 | 2 |



Fig 5: Show the occupation vs result

Table 6: Trauma surgery interval vs result

| Result | Interval | | |
|------------|----------|----------|----------|
| | <7 days | 7-10 day | >10 days |
| Excellent | 3 | 0 | 0 |
| Good | 10 | 2 | 0 |
| Fair | 2 | 0 | 2 |
| Poor | 0 | 0 | 1 |
| Total (20) | 16 | 2 | 3 |

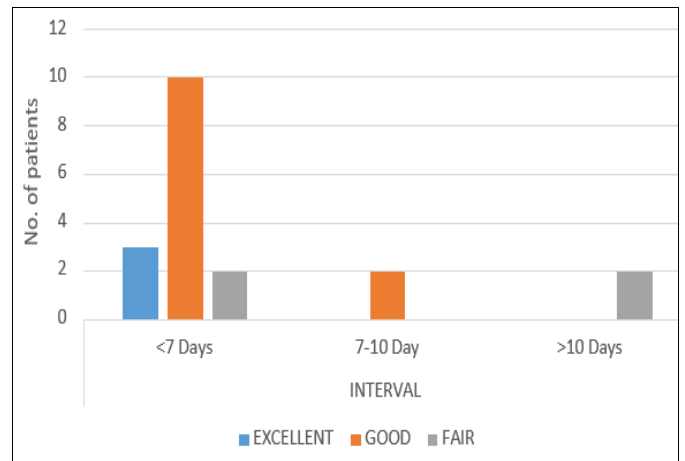


Fig 6: Trauma surgery interval vs result

Table 7: Classification vs result

| Result | Ao classification | | |
|------------|-------------------|-----------------|--------------|
| | Medial 15.1 | Diaphyseal 15.2 | Lateral 15.3 |
| Excellent | 0 | 3 | 0 |
| Good | 0 | 10 | 2 |
| Fair | 0 | 3 | 1 |
| Poor | 0 | 1 | 0 |
| Total (20) | 0 | 17 | 3 |

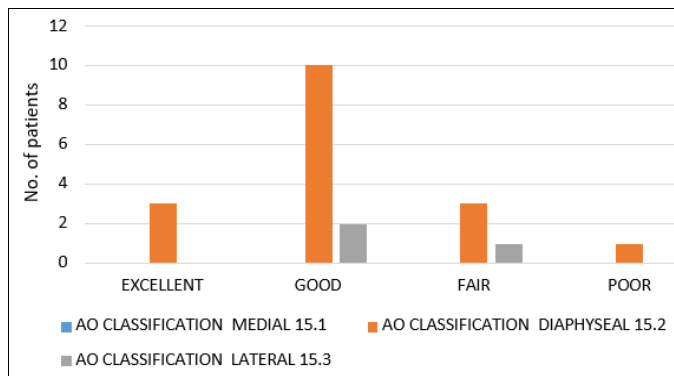


Fig 7: Classification vs result

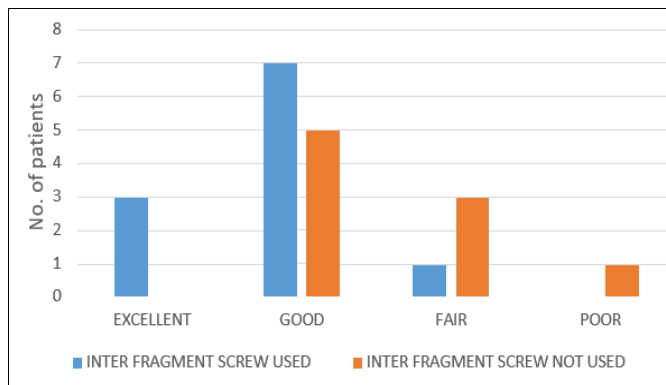


Fig 8: Inter fragment screw vs result

Table 8: Inter fragment screw vs result

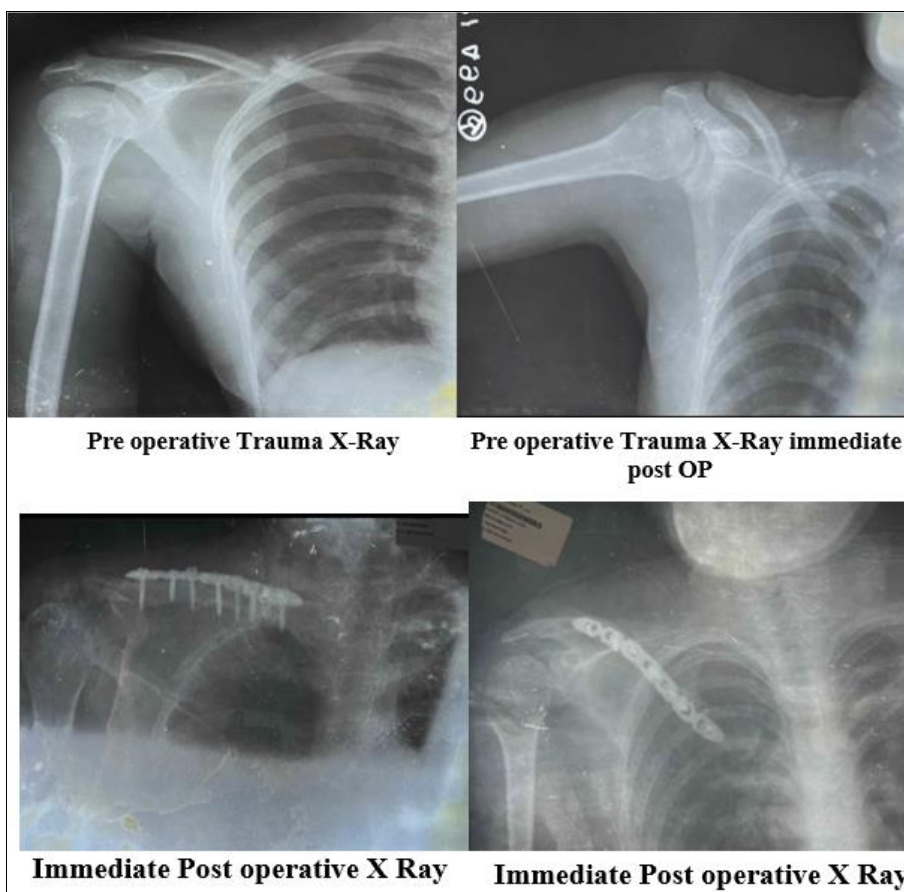
| Result | Inter fragment screw | |
|------------|----------------------|----------|
| | Used | Not used |
| Excellent | 3 | 0 |
| Good | 7 | 5 |
| Fair | 1 | 3 |
| Poor | 0 | 1 |
| Total (20) | 11 | 9 |

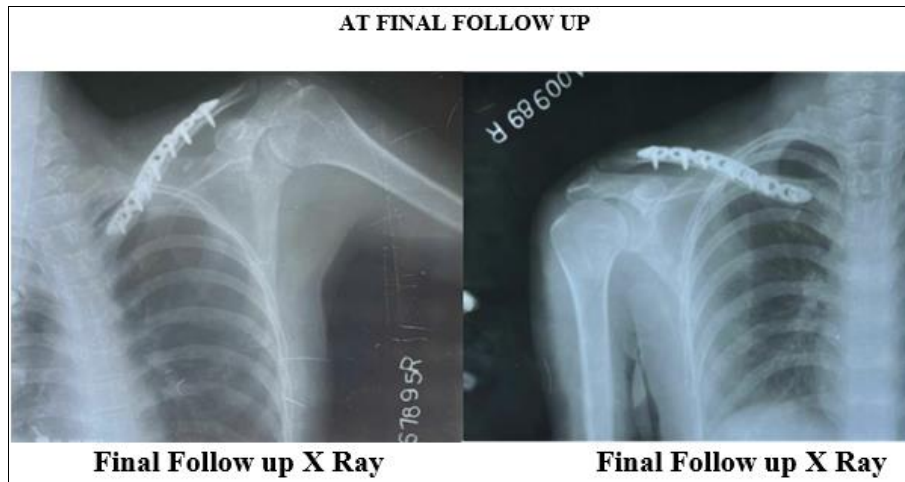
Clinical and radiological results case no. 1

19 Year/F

Closed formed shaft clacicleright side Fracture type (AO Classification) – 15.2B Average union time – 7. 3 weeks
Shoulder ROM- full
Complications – No

Outcome (Quick Dash Score): Excellent





Discussion

Between August 2021 to August 2022, 20 patients with clavicle fractures with age between 19 to 58 years were treated with open reduction and internal fixation using anatomical locking clavicle plate.

Mean age was 34 years. There were 18(90%) males and 2(10%) females. The mode of injury was road traffic accident in 14(70%) cases and fall from height in 6(30%) cases. 11(55%) cases sustained left sided and 9(45%) sustained right sided fracture.

According to AO classification system, 18 (90%) patients sustained middle third clavicle fracture, 2(10%) patients had lateral third fracture and none had medial third fracture. Majority of our patients, 10(50%) were labourers by occupation. Majority of patients, 15(75%) were operated within 7 days from injury Two patients were operated late due

to associated injuries and one patient was delayed due to failed conservative treatment. Artificial bone substitutes (hydroxyapatite granules) were used in 2 patients having severely comminuted or nonunited fractures that resulted in faster bone union. Use of interfragmentary lag screw in 11(55%) patients having segmental fractures resulted in faster bone union and better functional results. Intra-Operatively, no complications like bleeding or neurovascular injury were encountered in any patients. In postoperative period, we had no complication like delayed union, non-union, implant failure, osteomyelitis, fracture at plate end, deformity except one case of mild pain and one implant expose.

In majority of the patients, fractures were united within 7 to 8 weeks. Mean union time was 7.3 weeks. Majority had FINAL DASH SCORE around 45. All 20 patients had full range of motion at final follow up without any limitation. Out of all 20

patients, majority 14(70%) had an excellent + good result. Presented below is the comparison of present study with previous studies on Clavicle Plating.

- Operative fixation of displaced clavicle fracture with superior reconstruction plate osteosynthesis (Kathmandu university medical Journal).
- Non-operative treatment compared with plate fixation of displaced mid shaft clavicle fractures canadian orthopaedic trauma society (a study of 132 patients)
- Operative versus non-operativetreatment of mid shaft clavicle fractures in adolescents: university of michigan, ann arbor

- Results of plating for fresh displaced mid shaft clavicle fractures: santosh venkatraman, cheeplan sivaji (southand hospital essex)
- Comparison between conservative and surgical treatment of midshaft clavicle fractures: outcome of 151 cases

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Department of orthopaedic surgery, Annastift Hannover (medical school Hannover; MHH), Hannover, Germany.

Table 9: Operative fixation of displaced clavicle fracture with superior reconstruction plate osteosynthesis (Kathmandu university medical Journal) Study of 20 cases

| Parameter | Present study of 20 cases | Operative fixation of displaced clavicle fracture with superior reconstruction plate osteosynthesis (Kathmandu university medical Journal) Study of 20 cases |
|----------------------------|--|--|
| Mean age | 34yr | 31yr |
| Sex | | |
| Male | 90% | 80% |
| Female | 10% | 20% |
| Side | | |
| Right | 45% | 50% |
| Left | 55% | 50% |
| Type | 90% | 100% |
| Middle third Lateral third | 10% | |
| Intra op complication | Nil | Nil |
| Post op complication | Nil except one patients had mild pain, one imlant expose | 1 deep infection 1 frozen shoulder |
| Mean union time (wks) | 7 | 11 |
| Mean final dash score | 45 | 41 |
| Final range of motion | Full | Full |
| Final result | | |
| Excellent | 15% | 2% |
| Good | 60% | 94% |
| Poor | 5% | 4% |

Result

- Majority had FINAL DASH SCORE around 45.
- All 20 patients had full range of motion at final follow up without any limitation.
- Out of all 20 patients, majority 12 (60%) had a GOOD result and 3 (15%) had excellent result, 1 (5%) had poor result
- In our study, between 10-20 age group; 1 patient had excellent, 1 patient had good, 1 patient had fair and 1 patient had poor result.
- In our study, between 21-30 age group; 1 patient had excellent, 1 patient had good and 1 patient had fair result.
- In our study, between 31-40 age group; 1 patient had excellent, 3 patients had good and 1 patient had fair result.
- In our study, between 41-50 age group; 4 patient had good, 1 patient had fair result.
- In our study, between >50 age group; 3 patient had good result.
- Results were better in younger age group <50 years.
- In present study, there were having 18 males fracture in comparison to female only 2.
- Poor / fair results were more in male patients due to early outdoor activities.
- In this present study, 10 patients were Labourer, 6 were professional job workers, 2 were students and 2 were housewives.
- Labourers were more present in this study because of being more active group.

- Fair results are found in labour and job category.
- One poor results found in student category.
- In our present study, 16 patients were operated within 7 days of trauma, 2 patients were operated between 7-10 days and 1 patient was operated after 10 days.
- 1 patient was operated after 10 days due to poor respiratory system treated with nebulization and chest physiotherapy and late physician fitness.
- Early surgery after trauma shows better results.
- In our study, according to AO classification 17(85%) patient having diaphyseal 15.2 fracture and 3 (15%) patient were having lateral 15.3 fracture.
- In our present study 11(55%) patients were operated with interfragment screws and 9(45%) patients were operated With Out interfragment screws.
- Patients operated with interfragmentary screw shows better results compared to not used interfragmentary screw.

Conclusion

The present study was conducted at Department of Orthopaedics, Sir Sayajirao General Hospital, Vadodara. Twenty cases of fracture clavicle treated with open reduction and internal fixation using anatomical locking clavicle plate have been presented. The follow up results are analyzed and discussed.

- The patients were in the age group of 19 to 58 years with mean average age of 34 years.
- There was male predominance. Male: Female ratio was

9:1.

- Commonest mode of injury was vehicular accident (70%) and fall from height (30%).
- Majority of our patients were labourers by occupation.
- Majority of patients were operated within 7 days from injury.
- Left side was affected in majority of patients (55%).
- Majority of our patients were having Middle third fracture (85%) according to AO / OTA classification.
- 3 patients had associated medical illness.
- 5 patients had associated injury.
- Bone substitutes were used in 2(10%) patients.
- Interfragmentary screw was used in 11(55%) patients.
- Intra-Operatively, no complications were encountered in any patients.
- In postoperative period, we had no complication except one case of mild shoulder pain and one pt with implant expose.
- In majority of the patients, fractures were united within 7 to 8 weeks.
- Mean union time was 7.3 weeks.
- Majority had FINAL DASH SCORE around 45.
- All 20 patients had full range of motion at final follow up without any limitation.
- Out of all 20 patients, majority 12(60%) had a GOOD result and 3(15%) had excellent result, 1 (5%) had poor result.

The conservative method of managing un-displaced or severely comminuted clavicular fracture with brace and sling gave good functional and radiological results. But conservatively treated displaced non comminuted clavicle fractures had increased rates of non-union and poor functional outcomes compared to operatively treated patients.

Though better cosmesis, intramedullary fixation is not favoured due to higher complications like difficulty technique, implant impingement or migration, need for implant extraction, etc.

Reconstruction plates can be contoured according to the need and give stable construct, predictable union and optimum functional outcome but have disadvantages of less implant strength, increased operative time and mal-alignment leading to mal union or non-union.

Use of bone interfragmentary screws should be done carefully as proper screw placement lead to stable fixation and early union while improper placement might cause further comminution. Use of artificial bone substitutes is justified in comminuted or non-united fractures which resulted in faster fracture union.

Open reduction and internal fixation using pre-contoured anatomical locking compression plate facilitated

- Anatomical reduction
- Stable and rigid fixation
- Better implant for all types of clavicle fractures as implant is anatomically contoured
- Less operative time
- Less implant failure rate
- Less implant removal rate
- Accurate screw placement that prevents neurovascular injury
- Faster union
- Better functional outcome
- Faster return to day-to-day activity with minimal complications

Thus, it is concluded that Pre-contoured Anatomical Locking Clavicle Plate is preferred for the treatment of displaced or non-united clavicle fractures with better functional outcome and faster recovery compared to other modes of treatment.

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References

1. Campbell's Operative Orthopaedics 14th edition.
2. Rockwood and Green's Fracture in Adults 7th edition 1106-1143.
3. Text book of Orthopaedics and Trauma, 1st edition, Dr. G.S. Kulkarni.
4. Techniques recommended by AO- ASIF Group.
5. Gray's Anatomy 39th edition.
6. Human anatomy by Dr. BD Chaurasia.
7. Netter's atlas of Orthopaedic Anatomy.
8. The elements of fracture fixation, 2nd edition; Dr. A. J. Thakur.
9. Neer CS 2nd. Nonunion of the clavicle. J Am Med Assoc. 1960;172(10):1006-11.
10. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop Relat Res. 1968;(58):29-42.
11. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Treatment of acute midshaft clavicle fractures: Systematic review of 2144 fractures: on behalf of the Evidence- Based Orthopaedic Trauma Working Group. J Orthop Trauma. 2005;19(7):504-7.
12. Canadian Orthopaedic Trauma Society. Non-operative treatment compared with plate fixation of displaced mid shaft clavicular fractures: A multicenter, randomized clinical trial. J Bone Joint Surg Am. 2007;89(1):1-10.
13. Operative fixation of displaced mid shaft clavicle fracture with plating (KUMJ). (A study of 20 patients). 2011.
14. Dhoju D, Shreshtha D, Purajuli N. Operative versus non operative treatment of mid shaft clavicle fractures in adolescents: Vander have KL, Perdue AM, Caird MS, Farley FA (Department of orthopaedic surgery, University of Michigan, Ann Arbor, 2000-08).
15. Results of operative treatment of mid shaft clavicle fractures with reconstruction plate. A study of 41 patients: Chon Hyu Cho, Kyon Son Sung, Byong Hooman
16. Results of plating for fresh displaced mid shaft clavicle fractures: Santosh Venkatraman, CheeplanSivaji (Southand Hospital Essex).
17. Plate fixation of middle-third fractures of the clavicle in the semi-professional athlete. A study of 39 athletes, 1995-2003).
18. Olivier Verborgt, Kathleen Pittoors, Francis Van Glabbeek, Geert Declercq, Rudy Nuyts, Johan Somville. From University Hospital of Antwerp, Edegem, and OLV Middelaers Hospital, Deurne, Belgium
19. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). American journal of industrial medicine. 1996;29(6):602-608.

20. Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. The Journal of bone and joint surgery. 1998;80(3):476-484.
21. Non operative Vs. Operative management of displaced mid shaft clavicle fractures: Robbin C. Mckee, Emil H. Schulsmitsch. JBJS: April'12:18;94(8)675-684
22. Non operative Vs plate fixation of mid shaft clavicle fractures: JBJS. 2007 April;89:1-10
23. Ali Khan MA, Lucas HK. Plating of fractures of the middle third of the clavicle. Injury. 1989;4:263-267.
24. Andersen K, Jensen PO, Lauritzen J. Treatment of clavicular fractures. Figure-of-eight bandage versus a simplesling. Acta Orthop Scand. 1987;58:71-74.

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