



FUNCTIONAL OUTCOME AFTER PLATE FIXATION OF DISPLACED MID SHAFT CLAVICLE FRACTURES

Orthopaedics

Dr Akshay Kumar Trivedi* Senior Resident, Department of Orthopaedics Chhindwara Institute of Medical Sciences, Chhindwara [M.P.] *Corresponding Author

Dr Tushaar Ghodawat Assistant Professor, LNCT MEDICAL College, Indore [M.P.]

Dr Santosh Mishra Associate Professor Gandhi Medical College, Bhopal

ABSTRACT

Background: Clavicle fracture is a common injury due to its subcutaneous and relatively anterior position comprising of 2.6% of all fractures. Both non-operative and surgical methods have been described for the management of this injury. However, there is no uniform consensus on the definite choice of treatment. Hence, this prospective study was undertaken to know the functional outcome of displaced mid shaft clavicle after plate fixation including rate of union and complications observed. **Method:** In this study we analysed 24 patients for mid shaft clavicle fracture for a period of 24 months between February 2018 and January 2020 and studied union rate, complications with serial x rays and clinical examination. **Result:** All patients underwent full history taking, Clinical examination and Radiographic views were taken. The youngest patient was 18 years of age and the oldest patient was 60 years. The average patient age was 30.57 years. 17 patients (73.91%) were males while 6 patients (26.09%) were females. In this study, 16 patients (69.56%) were operated within 2 weeks and 7 patients [30.43 %] were operated between 2 to 4 weeks... Road traffic accident was seen in 16 patients [69.56%], fall on outstretched hand 6 patients [26.08%] had fracture of clavicle due to fall on shoulder from two wheeler and 1 patient (4.35%) had a fall of heavy object on the affected clavicle. The functional outcome is assessed by modified Constant and Murley score. The mean modified Constant Shoulder Score was 65.39 with range 48-72. 17 patients (73.91 %) had very good functional outcome, good functional outcome in 5 patients (21.74 %) and mean in 1 patient (4.35 %) all patients had their fractures united by 12 weeks. Average time to union was 8.68 weeks. In this study 1 patient (4.35%) had plate loosening which required implant removal after union and in 1 patient (4.35%) had plate prominence and in another 1 patient (4.35%) superficial surgical site infection. **Conclusion:** anatomic reduction with plate fixation and early mobilization of displaced clavicle fractures is a viable treatment option, especially in young active adults with good outcomes and no major complications.

KEYWORDS

mid shaft clavicle, plating, fracture

Clavicle fractures are common injuries in young, active individuals, especially those who participate in activities or sports where high-speed falls (bicycling, motorcycles) or violent collisions (football, hockey) are frequent, and they account for approximately 2.6% of all fractures. [1]. Robinson reported in an epidemiologic study that the annual incidence in males was highest in the under 20 age group, decreasing with each subsequent age cohort [2].

The majority of clavicle fractures (72 % to 85%) occur in the mid-shaft of the bone, where the typical compressive forces applied to the shoulder and the narrow cross section of the bone combine and result in bony failure, lateral-end injuries account for 21- 28%, and medial-end injuries account for 2- 3% [3]. Older studies suggested that a fracture of the shaft of the clavicle, even when significantly displaced, was an essentially benign injury with an inherently good prognosis when treated non-operatively. In a landmark 1960 study Neer [4-7] reported non-union in only three of 2,235 patients with middle third fractures of the clavicle treated by a sling or a figure-of-eight bandage.

Rowe [8] showed an overall incidence of non-union of 0.8% in 566 clavicle fractures treated in a similar fashion. Thus, what was felt to be the most serious complication following clavicle fracture, non-union, appeared to be extremely rare. Also, malunion of the clavicle (which occurred radiographically on a predictable basis in displaced fractures), was described as being of radiographic interest only, with little or no functional consequences. A reduced rate of nonunion after primary treatment with plate fixation (2.2%) compared with non-operative care (15.1%) has been found. [9]

A clear superiority of operative fixation has been documented against conservative management in various studies. Patients who were operated upon had better outcome measures, earlier return to normal function and against the popular opinion, they were more satisfied with the cosmesis than their conservatively managed counterparts. [10] The indications for surgery include the need for earlier functional mobilization in the patient with an isolated injury, in addition to open fractures, floating shoulders and patients with polytrauma [9]. For operative treatment, the available methods of fixation are fixation with Kirschner wires, pins (Rush pin, Knowles pin, Rockwood pin), plates with screws and external fixation [11-12] are the most preferred.

We have taken up this study to evaluate the functional outcome after plate osteosynthesis of clavicle fractures.

MATERIALS AND METHOD:

We conducted a prospective comparative study in Department of orthopaedics in Index Medical College, Indore to compare outcomes and complications of closed displaced mid-shaft clavicle fractures treated with precontoured dynamic compression plates between February 2018 and January 2020, a total of 24 patients with closed displaced mid-shaft clavicle fractures were admitted in our hospital. In this study, these patients were randomized according to inclusion and exclusion criteria to be treated surgically with a 3.5-mm precontoured dynamic compression plate.

Inclusion Criteria

1. Age ≥ 18 years and ≤ 60 years
2. Closed fractures of mid-shaft clavicle
3. Comminuted and displaced fractures of clavicle
4. Time since injury less than 3 weeks

Exclusion Criteria

1. Age < 18 years and > 60 years
2. Open fractures
3. Fracture in lateral and medial third of clavicle
4. Time since injury more than 3 weeks
5. Pathological fractures
6. Undisplaced fractures
7. Associated head injury.

Pre-Operative Planning And Surgical Technique:

All patients went through radiological and clinical evaluation before surgical procedure was carried out. Inspection of skin condition and any swelling or deformity.

Palpation for tenderness and crepitus. Examination of the neurovascular status to exclude any vascular injuries and neurological injuries. Antero-posterior and lateral views of the affected leg with visualization of the ankle and knee joints were taken to assess of the fracture according to the AO classification. Routine blood investigations and pre anesthetic check-up and fitness was done.

Under anaesthesia, painting and draping was done under sterile conditions. Patient in supine position with one towel in between the scapula. Entire upper limb from base of neck to hand was prepared and draped. About 7-9 cms, incision was made in the anterosuperior aspect of clavicle centering over the fracture site. The skin subcutaneous tissue and platysma was divided without undermining the edges. Care is to taken to identify, isolate and protect any larger branches of supraclavicle nerve. The overlying fascia and periosteum was next divided. The osseous ends were freed from surrounding tissue. Minimal soft tissue and periosteum dissection was done. Fracture fragments were reduced and plate was applied over the superior aspect of the clavicle. A measured guarded drill technique was used to ensure the safety of the underlying neurovascular structures. The plate was fixed to the medial and lateral fragment with locking screws/ cortical screws and at least three screws in medial and lateral fragment were applied. Wound was closed with subcuticular sutures after ensuring meticulous hemostasis and sterile dressing was applied.

Post Operative Care

Patients were kept nil orally for 4 to 6 hours post-operatively. Intravenous fluids were given as needed. Antibiotics were continued for 5 days. Analgesics were given according to the needs of the patient. The operated upper limb was immobilized in an arm pouch.

Check X-rays were taken to study the alignment of fracture fragments. The wound was inspected at 2nd, 5th and 8th postoperative day. Suture removal was done on the 12th postoperative day. Patients were discharged from hospital with arm pouch when the patients were comfortable. Rehabilitation of the affected arm was started at the end of 2 weeks. Gentle pendulum exercises to the shoulder in the arm pouch were allowed. At 4 to 6 weeks gentle active range of motion of the shoulder was allowed but abduction was limited to 80 degrees. At 6 to 8 weeks active range of motion in all planes was allowed.

Follow Up

Regular follow up for every 4 weeks was done. Local examination of the affected clavicle for tenderness, instability deformity and shoulder movements were assessed. X-rays were taken at each follow up visits to known about progress of fracture union and implant position. Rehabilitation of the affected extremity were done according to the stage of fracture union and time duration from day of surgery. Patients were followed up till radiological union. Modified Constant and Murley score [22] was used to assess the functional outcome. Final follow up was done at the end of 6 months.

RESULTS:

In present study we studied 24 patients out of which 1 patient was lost to follow up, hence 23 patient results were analyzed. Majority of the patients with fracture clavicle i.e. 12 patients (52.17%) were in the age group of 20-29 years. The youngest patient was 18 years of age and the oldest patient was 60 years. The average patient age was 30.57 years. Majority of patients i.e. 17 patients (73.91%) were males while 6 patients (26.09%) were females. All the patients were operated as early as possible once the general condition of the patients was stable. In this study, 16 patients (69.56%) were operated within 2 weeks and 7 patients [30.43 %] were operated between 2 to 4 weeks.

In this study, there were 11 patients (47.82 %) of left sided fracture and 12 patients (52.18 %) of right-sided fracture. Road traffic accident was seen in 16 patients [69.56%], fall on outstretched hand 6 patients [26.08%] had fracture of clavicle due to fall on shoulder from two wheeler, and 1 patient (4.35%) had a fall of heavy object on the affected clavicle. Average duration of stay in the hospital was 7.52 days [Range 3-26].

The functional outcome is assessed by modified Constant and Murley score. The mean modified Constant Shoulder Score was 65.39 with range 48-72. In this study 17 patients (73.91 %) had very good functional outcome, good functional outcome in 5 patients (21.74 %) and mean in 1 patient (4.35 %). Poor outcome was not found in any individual. In this study all patients had their fractures united by 12 weeks. No non-unions were seen. Average time to union was 8.68 weeks. In this study 1 patient (4.35%) had plate loosening which required implant removal after union and in 1 patient (4.35%) had plate prominence and in another 1 patient (4.35%) superficial surgical site infection occurred which required oral antibiotics. No major complications occurred in this study.

Table I

INJURY TO SURGERY INTERVAL	NUMBER OF PATIENTS	PERCENTAGE
< 2 weeks	16	69.56%
2-4 weeks	7	30.43%
TOTAL	23	100

Side Affected:

Table II

SIDE	NUMBER OF PATIENTS	PERCENTAGE
Right	11	47.82 %
Left	12	52.18 %
TOTAL	23	100

Mode of Injury:

Table III

MODE OF INJURY	NUMBER OF PATIENTS	PERCENTAGE
Road traffic accidents	16	69.56 %
Fall on outstretched hand	6	26.08 %
Others (ex Fall of heavy object etc.)	1	4.35 %
TOTAL	23	100

Duration of Stay In Hospitals

Table IV

DURATION OF STAY	NUMBER OF PATIENTS	PERCENTAGE
< 1 Week	16	69.56 %
1-2 Weeks	4	17.39 %
>2 Weeks	3	13.04 %
TOTAL	23	100

Time To Union:

Table V

TIME OF UNION	NUMBER OF PATIENTS	PERCENTAGE
6-8 weeks	2	8.70%
8-10 weeks	16	69.56%
10-12 weeks	5	21.74%
> 12 weeks	0	0%
TOTAL	23	100

Complications:

Table VI

	TYPES	NUMBER OF PATIENTS	PERCENTAGE
Minor	Hypertrophic skin scar	0	0%
	Plate prominence	1	4.35%
	Delayed union	0	0%
	Plate loosening	1	4.35%
	Infection	1	4.35%
Major	Plate breakage	0	0%
TOTAL		3	13.05%

DISCUSSION:

In the past, conservative management was the mainstay of treatment for all clavicle fractures in middle third irrespective of displacement and comminution as clavicle has excellent power of remodelling. Conservative treatment with figure-of-8 bandage aligns the displaced fragments in an acceptable manner and results in a good functional outcome. However, a recent meta-analysis revealed higher non-union rates for displaced fractures treated non-operatively (15%) than operatively (2.2%) with modern internal fixation techniques [9]

In this study, Road traffic accident was seen in 16 patients [69.56%], fall on outstretched hand 6 patients [26.08%] had fracture of clavicle due to fall on shoulder from two wheeler, 1 patient (4.35%) had a fall of heavy object on the affected clavicle. In Bostman et al [13], study the mechanism of injury was due to fall from the two wheeler in 38 Patients (36.8%), slipping and fall in 24 Patients (23.30%), motor vehicle accident in 19 patients (18.45%) and sports in injury 22 patients (21.36%). In Cho et al. [14] study, in reconstruction plate group there were 13 Patients who sustained Road Traffic Accident, 3 Patients with slip down, 1 Patient with sports injury, 1 Patient with fall down and 1 patient with miscellaneous mode of injury. In locking compression plate group there 7 Patients with Road Traffic Accident, 3

Patients with slip down, 1 Patient with fall down and 1 Patient with miscellaneous mode.

Majority of the patients with fracture clavicle i.e. 12 patients (52.17%) were in the age group of 20-29 years. The youngest patient was 18 years of age and the oldest patient was 60 years. The average patient age was 30.57 years. In study conducted by Wg Cdr V Kulshrestha [15] all patients who were operated, aged between 21 to 46 years with an average age of 31 years. In the study conducted by Shen W J et al [16] of the 251 operated patients, the youngest patient was 18 years and oldest was 79 years with a median age of 37.3 years. In Cho et al. study [14], in reconstruction plate group the mean age was 45 years (range 22- 70) and that of the locking compression plate was 46 years (range 19-69).

In our study 17 patients (73.91%) were males while 6 patients (26.09%) were females. In the study by Modi et al [16] total 53 patients were operated of which 42 patients (79.24%) were males while 11 (20.76%) were females. In the study by Douraiswami et al [17], 25 patients were operated 20 (80%) were males and 5 (20%) were females. In Cho et al [14] Study the reconstruction plate group that 12 male and 7 female patients and in the locking compression plate group it was 17 male and 5 patients. In this study, 17 patients (73.91 %) had very good functional outcome, good functional outcome in 5 patients (21.74 %) and mean in 1 patient (4.35 %), all patients had their fractures united by 12 weeks. In study by P van der woude [19], all patients achieved both clinical and radiographic union. Clinical union was documented after a median of 75 days (range 30--850 days) and radiographic union was seen after a median of 120 days (range 50--850 days). Outcome was rated as excellent in 37 patients (77%), good in 10 patients (21%), and fair in one patient. Similar study was done by Ledger leeks et al. [20]. In this study 1 patient (4.35%) had plate loosening which required implant removal after union and in 1 patient (4.35%) had plate prominence and in another 1 patient (4.35%) superficial surgical site infection. In study by manibankar et al [21], out of 30 patients, scar problems 3 patient, malunion in 1 patient and hardware prominence in 3 patients were observed.

CONCLUSION:

In conclusion, anatomic reduction with plate fixation and early mobilization of displaced clavicle fractures is a viable treatment option, especially in young active adults with good outcomes and no major complications. There is also a need for further large multi-centre prospective randomized controlled trials in order to generalize this preference of operative fixation over non-operative management in displaced mid-shaft clavicle fractures for all patients.

REFERENCES:

1. Craig EV (1998) Fractures of the clavicle. In: Rockwood CA, Matsen FA (eds) The shoulder, 3rd edn. WB Saunders, Philadelphia, pp 428-482
2. Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. J Bone Joint Surg Br. 1998;80(3):476-484
3. Kashif Khan LA, Bradnock TJ, Scott C, Robinson CM. Fractures of the clavicle. J Bone Joint Surg Am. 2009;91:447-460.
4. 2. Neer CS. Fractures of the Clavicle. In: Rockwood CA, Green DP, eds. Fractures in Adults. 2nd ed. Philadelphia, PA: JB Lippincott; 1984:707-713. 113.
5. Neer CS. Fractures of the distal clavicle with detachment of the coracoclavicular ligaments in adults. J Trauma. 1963;3:99-110. 114.
6. Neer CS. Fractures of the distal third of the clavicle. Clin Orthop Relat Res. 1968; 58:43-50. 115.
7. Neer CS. Nonunion of the clavicle. J Am Med Assoc. 1960;172:1006-1011. 116.
8. Neviasser JS. The treatment of fractures of the clavicle. Surg Clin North Am. 1963;43:1555-1563
9. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop Relat Res. 1968;58:29-42
10. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Evidence-based orthopaedic trauma working group. 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; 19:504-507.
11. Altamimi SA, McKee MD; Canadian Orthopaedic Society. Non-operative treatment compared with plate fixation of displaced midshaft clavicle fractures. Surgical technique. J Bone Joint Surg Am. 2008;90:1-8.
12. Denard PJ, Koval KJ, Cantu RV, Weinstein JN (2005) Management of midshaft clavicle fractures in adults. Am J Orthop 34:527-536
13. Lee YS, Lin CC, Huang CR, Chen CN, Liao WY (2007) Operative treatment of midclavicular fractures in 62 elderly patients: Knowles pin versus plate. Orthopedics 30(11):959-964 11. Mudd CD
14. Bostman O, Manninen M, Pihlajamaki H Complications of plate fixation in fresh displaced midclavicular fracture. J Trauma. 1997; 43:778-783.
15. Chul-Hyun Cho, Kwang-Soon Song, Byung-Woo Min, Ki-Cheor Bae, Kyung-Jae Lee. Reconstruction Plate versus Reconstruction Locking Compression Plate for Clavicle Fractures. Clinics in Orthopedic Surgery. 2010; 2: 154- 159.
16. Kulshrestha V. Primary plating of displaced mid-shaft clavicular fractures. Med J Armed Forces India. 2008; 64(3):208-211.
17. Shen WJ, Liu TJ, Shen YS. Plate Fixation Of Fresh Displaced Midshaft Clavicle Fractures. J Bone Joint Surg Br. 2008; 90-B: 1495-B.
18. Modi N, Patel AD, P. Hallam Norfolk And Norwich University Hospital NHS Foundation Trust, Norwich, UK. Outcome Of 62 Clavicle Fracture Fixations With

- Locked Compression Plate: Is this the right way to go?. Injury. 2011; 06:266.
18. Douraiswami B, Naidu D K, Thanigai S, Anand V, Dhanapal R. Open reduction and plating for displaced mid third clavicle fractures. A prospective study. Journal of clinical orthopaedics and trauma. 2013; 174-179
19. Van der Woude P, van der Vlies CH, Jean MFH (2012) Operative treatment of displaced midshaft clavicular fracture: is it the best management Curr Orthop Pract 23[2]
20. Ledger M, Leeks N, Ackland T, Wang A (2005) Short malunion of the clavicle: an anatomic and functional study. J Shoulder Elb Surg 14(4):349-354
21. Manibankar, Naveen & Joshi, G. & Harikrishnan, B. (2017). Management of mid-shaft clavicular fractures: comparison between non-operative treatment and plate fixation in 60 patients. Strategies in Trauma and Limb Reconstruction. 12.10.1007/s11751-016-0272
22. Fialka C, Oberleitner G, Stampfl P, Brannath W, Hexel M, Vécsei V. Modification of the Constant-Murley shoulder score-introduction of the individual relative Constant score Individual shoulder assessment. Injury. 2005 Oct;36(10):1159-65