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A COMPARATIVE STUDY OF CONSERVATIVE MANAGEMENT AND PLATING IN MID-SHAFT CLAVICLE FRACTURE MANAGEMENTA NON-RANDOMIZED CONTROLLED TRIAL

Orthopaedics

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ABSTRACT

Background: Clavicle fractures are common injuries, accounting for 2.6–4% of all fractures, with a predominance in young active males. While conservative treatment is effective for most undisplaced fractures, the optimal management of displaced midshaft fractures remains debated. This study evaluates and compares the outcomes of operative and conservative management in such cases.**Methods:** A prospective study was conducted on 20 patients with displaced midshaft clavicle fractures. Patients were randomly allocated into two groups: operative fixation with a plate and screws (n=10) and conservative treatment using a figure-of-eight bandage or sling immobilization (n=10). Clinical and radiological outcomes were assessed at regular intervals. Union time, functional recovery (Constant–Murley and DASH scores), complications, and patient satisfaction were analyzed.**Results:** The mean age of patients was 36 years, with a male predominance. Road traffic accidents were the most common mode of injury. The operative group demonstrated faster fracture union (mean 11.3 weeks vs. 14.2 weeks in the conservative group) and superior functional outcomes at early follow-up. Nonunion and malunion were more frequent in the conservative group, while operative patients experienced complications such as surgical site infection and hardware prominence. At final follow-up, functional outcomes were comparable, though patients treated operatively reported higher satisfaction due to earlier return to activities.**Conclusion:** Operative fixation of displaced midshaft clavicle fractures provides faster union, better early function, and greater patient satisfaction compared to conservative management. However, long-term outcomes converge, and treatment choice should be individualized considering fracture pattern, patient demand, and risk of surgical complications.

KEYWORDS

Clavicle Fracture, Midshaft Clavicle Fracture, Operative Fixation, Plate And Screw Fixation, Conservative Management, Functional Outcome, Fracture Union

INTRODUCTION

Fractures of the clavicle primarily occur in young male adults, accounting for approximately 2.6–4% of all fractures, with a 70% male predominance. The most common mechanism of injury is a direct fall onto the shoulder, frequently sustained during sports activities or traffic accidents.[1] In fractures of the middle third, the proximal (medial) fragment is typically displaced superiorly by the sternocleidomastoid muscle, while the weight of the upper extremity pulls the distal (lateral) fragment inferiorly, increasing deformity. A thorough neurovascular assessment of the ipsilateral upper limb and chest auscultation is mandatory in high-energy injuries due to the proximity of vital structures.[2]

Midshaft clavicle fractures are among the most common skeletal injuries, representing 3–5% of all fractures, with an annual incidence of 64 per 100,000 population. Approximately 70–80% of clavicular fractures involve the shaft, 15–30% occur laterally, and only 3% medially. Open clavicle fractures are rare, comprising just 0.1–1% of cases. The incidence is nearly double in men compared to women, with peak occurrence between 30 and 40 years of age.[3]

Nonunion in midclavicular fractures has been reported at 0.1–0.8% in older studies where patient age and fracture displacement were not adequately considered. More recent data, incorporating fracture classification, suggest a nonunion rate of 10–15% in comminuted midshaft fractures in adults.[4]

The clavicle is the first bone to ossify (fifth week of fetal life) by intramembranous ossification, without a cartilaginous stage. It serves as the only bony connection between the trunk and the shoulder girdle and is the sole bone forming a synovial joint with the axial skeleton. Its characteristic S-shaped configuration contributes to both its functional role and its fracture patterns. Biomechanically, the bone is weakest in its central third, where minimal muscular or ligamentous support exists.[5]

The medial two-thirds of the clavicle provide attachment for the clavicular head of the pectoralis major and sternocleidomastoid, while the lateral one-third accommodates the deltoid, trapezius, and coracoclavicular ligaments. Other attachments include the costoclavicular ligament, subclavius muscle, and clavipectoral fascia.[6,7]

Classification Systems

Several classification systems exist for clavicle fractures. Allman (1967) proposed a system based on anatomical location, though it did not address treatment or prognosis.[8] Nordqvist (1994) added displacement and comminution.[9] Robinson (1998) developed a more detailed classification considering fracture type, displacement, angulation, intra-articular extension, and comminution, although it lacked a specific category for distal fractures.[10]

The Neer classification, based on fracture location relative to the coracoclavicular (CC) ligaments, has been widely used since the 1960s.[11,12] Craig (1990) introduced a modified Neer classification, defining five subtypes ranging from stable extra-articular injuries (Types 1 and 3) to unstable displaced or comminuted fractures (Types 2 and 5).[13] Most surgeons continue to use this system for clinical decision-making.

Recognizing limitations in interobserver reliability, Cho (2018) proposed a new system emphasizing displacement and stability.[10,12] It classifies fractures into Type I (stable, <5 mm displacement) and Type II (unstable, ≥5 mm displacement), with four subtypes (IIA–IID) based on the integrity of the CC ligaments and degree of comminution.[14]

Surgical Management

Surgical treatment of medial-end fractures is indicated when there is risk to mediastinal structures, soft-tissue compromise, multiple trauma, or floating shoulder injuries. Reduction, either closed or open, should be performed emergently if necessary. Techniques for fixation include plates, interosseous sutures, and wires. Kirschner wires are discouraged due to breakage and migration risks, whereas interosseous fixation and modified Balser plate fixation offer better stability, though often requiring hardware removal.[15]

The primary goal of operative treatment is restoration of clavicular alignment and stability of the shoulder girdle. Indications include:

1. Severe displacement with skin tenting or threatened integrity.
2. Symptomatic nonunion with functional deficit or neurovascular compromise.
3. Progressive or irreducible neurovascular injury.
4. Open fractures.
5. Displaced Type II distal clavicle fractures.
6. Polytrauma requiring early mobilization.
7. Floating shoulder injuries.
8. Neurological conditions precluding immobilization (e.g., Parkinsonism, seizures).
9. Cosmetic concerns.
10. Relative indications: >15–20 mm shortening or displacement exceeding clavicular width.[4,6]

Plate Fixation

Biomechanical studies confirm that plate fixation offers superior resistance to bending and torsional stresses compared with intramedullary devices. Commonly used plates include:

- AO reconstruction plate
- Dynamic compression plate (DCP)
- Low-contact dynamic compression plate (LC-DCP)
- One-third tubular plate
- Locking compression plate (LCP)

Reconstruction plates provide good contouring to the S-shape but are mechanically weaker. DCPs allow compression across transverse fractures, while LC-DCPs reduce disruption to blood supply. One-third tubular plates are prone to fatigue failure. LCPs provide rigid fixation, rotational stability, and compression, facilitating earlier functional recovery.[4,6,7]

Advantages: rigid fixation, compression across fracture site, suitability for comminuted fractures, and allowance for early use of the limb.[4]

Disadvantages: need for wide exposure, supraclavicular nerve injury risk, subcutaneous plate irritation, poor cosmesis, and the requirement of hardware removal. Despite these, plate fixation remains an excellent option for displaced midshaft fractures.[4,15].

Conservative Management

Medial-third fractures (Edinburgh Type I) are generally treated non-operatively due to their stable nature. A sling or figure-of-eight brace is used for 2–6 weeks, with early mobilization encouraged. Rehabilitation ensures satisfactory functional outcomes, although avoidance of contact sports for at least 4–5 months is recommended.

Advantages: fewer complications, earlier return to daily activities, and excellent results for non-displaced fractures.

Disadvantages: higher risk of nonunion in displaced fractures, delayed radiological union, potential shoulder stiffness, and malunion (usually asymptomatic).[15]

Clavicle fractures are among the most frequent skeletal injuries, with midshaft fractures constituting the majority. Historically, conservative management was considered sufficient, offering satisfactory outcomes in most cases. However, recent studies highlight higher rates of nonunion, malunion, persistent pain, and functional limitation in displaced or comminuted fractures managed non-operatively. With the rising incidence of high-energy trauma and sports-related injuries, complex midshaft clavicle fractures are becoming more common, necessitating treatment approaches that ensure reliable union and early functional recovery. Surgical fixation, particularly with plates, has been shown to restore anatomical alignment, reduce nonunion rates, and facilitate faster rehabilitation. Nevertheless, operative intervention carries inherent risks, including implant irritation, infection, and the need for hardware removal. Given the ongoing debate regarding the optimal management strategy, this study is undertaken to compare treatment modalities and provide evidence-based guidance for managing midshaft clavicle fractures. Hence in this study we aimed to compare the functional and radiological outcomes of midshaft clavicular fractures treated conservatively and surgically, using the Constant and Murley scoring system, and to assess the incidence of complications such as nonunion, delayed union, shoulder stiffness, and infection.

MATERIALS AND METHODS

Study setting:

The present study was carried out in the Department of Orthopaedics, RIMS Imphal. The institution caters to the needs of the North Eastern region in medical education by providing undergraduate and postgraduate courses in all important branches of medical specialities. The Hospital usually provides services to more than 2.4 lakh outdoor patients and admits around 31 thousand patients annually. This Hospital also receives referrals from different parts of Manipur and neighbouring states. The Orthopaedics department offers a wide range of services, including knee replacement, hip replacement, and spine surgeries. Operation theatres are equipped with the latest fracture tables and imaging facilities, including a C-arm image intensifier. According to the medical records section's register, 60 clavicular fractures are operated annually on average.

Duration of study:

The study timeline is shown in the Gantt chart (Annexure III)

Study design:

It was Non-randomized controlled trial

Study population:

All patients with clavicle fractures attended OPD and the Emergency Department of Orthopaedics, RIMS, during the study period.

Inclusion criteria:

1) Age >18years
2) Closed fractures.
3) Robinson Classification 2B1 and 2B2(displaced fractures)
4) No medical contradictions to general anaesthesia

Exclusion criteria:

1) Age < 18 years and Age>70 years
2) Open fractures with soft tissue loss
3) Pathological fractures
4) Undisplaced fractures
5) Multiply injured patients
6) Associated with neurovascular injury
7) Associated acromioclavicular joint dislocation
8) Any medical contradiction to surgery or general anaesthesia.
9) Not willing to take part in the study

Sample size:

From a study conducted by Naveen BM et al[32], the sample size was calculated using the formula

$$n = \frac{(u+v)^2(s_1^2+s_2^2)}{(m_1-m_2)^2}$$

Where,

s_1 (standard deviation of Conservative group) = 5.96
s_2 (standard deviation of Plating group) = 4.8
m_1 (mean of Conservative group) = 75.7
m_2 (mean of Plating group) = 83.63
u (Type 1 error) = 1.96
v (Type 2 error/Power of study) = 1.28(90%)
Confidence interval= 95%

The calculated sample size is 11 in each group

A minimum of 22 patients (each for clavicular Plating and

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conservative Management) who fulfil the inclusion criteria were taken as a sample during the study period.

Recruitment and allocation into two groups:
Participants were recruited in an alternative manner. The first case was underwent conservative management, and the next case was underwent plating. All the participants were allocated in two groups, Group A and Group B. Participants were taken up from the OPD and casualty in a consecutive manner. Conservative management was done in 11 patients, and the remaining 11 patients were managed by clavicular plating using anatomically contoured LCP.

Study variables:
a) Predictive variables:
- Age of the patient
- Sex
- Mode of injury
- Site of injury
- Associated injury
- Type of fracture: Robinson classification

b) Outcome variables:
- Postoperative complications
- Radiological union time

Working definitions/Parameters used:
Patients were evaluated both clinically and radiologically by using the following parameter
I. Constant Murley's score (Annexure ii)
II. DASH score (Annexure ii)
III. Radiological assessment by Schmitz evaluation of fracture healing (Annexure ii)

The complete union was defined as evidence of radiological healing with no pain or motion on manual stressing of fracture as evident at about 6 weeks. The complete radiological union was defined as complete cortical bridging between proximal and distal fragments on both radiographs. A delayed union, defined as having no evidence of union at 6-12 weeks. Nonunion, defined as the lack of clinical and radiological healing with clinical evidence of painless motion at the fracture site at one year. Radiographic malunion was defined as the loss of the anatomic contour of the clavicle.

Symptomatic malunion defined as the union of fractures in a shortened, angulated, or displaced position with weakness, easy fatigability, pain with overhead activity, neurologic symptoms, and shoulder asymmetry with a completed or planned corrective osteotomy.

Complex regional pain syndrome was diagnosed by the presence of dysesthetic pain and hyperesthesia extending into the hand of the involved limb, vasomotor changes, skin atrophy, and diffuse osteopenia.

Study tools:
- Written informed consent was taken from all participants (Annexure III).
- All details of participating individuals were recorded (Annexure I).

Procedures:
- Data collected from the study questionnaire, format enclosed (annexure I)

Conservative Management
A sling (or sling-and-swathe) was support the affected extremity. A figure-of-eight brace was used along with the sling to help stabilize the fracture fragments.

The elbow and hand remain free for activities with the figure-of-eight brace. Still, only 7% of patients treated with a sling reported dissatisfaction or discomfort compared to 26% of those patients using a figure-of-eight bandage. The tension of the brace has to be maintained with constant tightening, taking care not to over-tighten, which may lead to problems such as skin breakdown, venous congestion with oedema, or brachial plexus palsy. Strenuous activity were avoided, although the affected extremity may be used as symptoms allow. Patients treated with a sling can take their arm out of the sling periodically to perform elbow range of motion exercises to preserve elbow function.

Surgical technique for plating
Instrumentation
All instruments are of NEBULA company:-
1. 3.5mm 7 to 9 hole anatomically contoured clavicle locking compression plate.
2. 3.0mm drill bit.
3. 3.5mm universal drill guide.
4. Hand drill/pneumatic drill.
5. Depth gauge.
6. 3.5 mm locking cortical screw of varying size (12 to 20 mm)
7. 3.5 mm non-locking cortical screw of different sizes (12 to 20 mm).
8. Hexagonal screwdriver.
9. Torque limiting screwdriver
10. General instruments like retractors, periosteum elevator, reduction clamps and bone levers.

Operating procedure
After administration of anesthesia, the patient was placed in a supine position with the clavicle elevated on a sandbag. The injured extremity was prepared with 10% betadine and spirit and draped from the midline to the upper arm in a standard sterile fashion, extending from the lateral border of the acromion to the sternum. A horizontal incision was made along the superior surface of the clavicle and centered over the fracture site. The skin, platysma, and subcutaneous tissue were elevated as a single flap. The underlying myofascial layer was carefully dissected to expose the bone and raised as a continuous flap, allowing for a two-layer closure following fixation. The fracture site was exposed, interposed soft tissue was removed, and the ends were freshened to achieve anatomical reduction, which was temporarily held with a reduction clamp. A 3.5 mm locking compression plate was contoured and centered over the fracture, ensuring placement of at least three screws in both the proximal and distal fragments. The plate was secured over the superior surface of the clavicle using bone-holding forceps. In oblique fractures, a 3.5 mm lag screw was inserted across the fracture line, while butterfly fragments, if present, were fixed with interfragmentary compression screws where possible. After copious wound irrigation, meticulous layered closure was performed, beginning with the myofascial layer using interrupted absorbable sutures, followed by closure of subcutaneous tissue with 2-0 absorbable sutures, and skin closure with a subcuticular stitch or staples. The incision site was infiltrated with 0.5% bupivacaine, and the arm was placed in a standard sling. An intraoperative anteroposterior radiograph of the clavicle was obtained to confirm plate position and screw length.

Postoperative Care
All patients were given a sling for comfort in the immediate postoperative period. The wound was inspected on the third postoperative day, and sutures were removed on the tenth day. Patients were discharged with instructions to continue sling use for comfort and to begin gentle range of motion exercises for the elbow, wrist, and fingers.

Assessment
Functional assessment included standardized clinical evaluation using the Constant Shoulder Score[33–35] and the Disability of the Arm, Shoulder and Hand (DASH) score.[33,36–38] Radiological assessment was performed with both anteroposterior and 20° cephalad radiographs of the clavicle. Rehabilitation protocols and exercises were standardized across all patients and reinforced at each follow-up visit.

Follow-up
Patients were followed for one year at regular intervals of 3 weeks, 6 weeks, 3 months, 6 months, and 12 months. At each visit, both clinical and radiological evaluations were performed to assess fracture healing, functional outcomes, and complications.

Data management and statistical analysis:
Data was checked for completeness and consistency. Data was entered and analyzed using SPSS V.21 for Windows (IBM Inc). Descriptive data was presented using percentage and proportion for variables like sex, occupation, etc and in terms of mean and standard deviation for

variables like age, constant Murley's and DASH scores. The chi-square test was used to analyze the association between the grading of scores and the patient factor.

Ethical approval

All the participants were informed about the nature of the project, and those who agreed to participate were asked to sign the informed consent form. Participants were assumed to be able to withdraw from the project at any time. Approval was obtained from the RIMS Institutional Ethics Committee (Research Ethics Board).

RESULTS

Patients with displaced mid-shaft clavicular fractures were prospectively recruited over 24 months. A total of 22 patients met the criteria for inclusion in the study, of which 11 patients were operated on by LCP and 11 patients by conservative management. One patient from each group was lost to follow-up. The study was done in the Department of Orthopaedics, Regional Institute of Medical Sciences, Imphal, during the period from April 2023 to March 2025. Implant removal was done for six patients in the LCP group. The following results and observations were made at the end of the study. The data collected were then analyzed.

Age distribution

The mean age of all patients in the Conservative group was 34.5 ± 8.02 years with a range of 21 to 54 years, while that of the plating group was 33.5 ± 8.34 years with a range of 21 to 51 years. The age groups of 21-30 years and 31- 40 years comprised the highest number of patients (40%). These are represented in Table (1).

Table 1: Age-frequency distribution in two groups of patients studied

Age in Years	CONSERVATIVE GROUP	PLATING GROUP	Total
21-30	4(40%)	4(40%)	8(40%)
31-40	4(40%)	4(40%)	8(40%)
41-50	1(10%)	2(20)	3(15%)
51-60	1(10%)	0(0%)	1(5%)
Total	10(100%)	10(100%)	20(100%)
Mean ± SD	34.5±8.02	33.5±8.34	34±5.78

Sex distribution

There were seven males (70%) and three females (30%) in the conservative group and six males (60%) and four females (40%) in the LCP group, with a male-to-female ratio of 2.3:1 for the conservative group and 1.5:1 for the LCP group in our study. These are represented in table (2).

Table 2: Gender frequency distribution in two groups of patients studied

Gender	CONSERVATIVE GROUP	PLATING GROUP	Total
Female	3(30%)	4(40%)	7(35%)
Male	7(70%)	6(60%)	13(65%)
Total	10(100%)	10(100%)	20(100%)

Mode of injury

Road traffic accidents were the most common mode of injury in both groups, and they were seen in 6 cases (60%) for the Conservative group and 5 cases (50%) for the LCP group. Fall from height was next to RTA in both groups, seen in 2 cases in each group, and fall on outstretched hand was next to RTA, seen in 2 cases.

Table 3: Mode of Injury- frequency distribution in two groups of patients studied

Mode of Injury	Conservative GROUP	PLATING GROUP	Total
ASSAULT	1(10%)	0(0%)	1(5%)
FALL FROM HEIGHT	2(20%)	2(20%)	4(20%)
FOOSH	1(10%)	1(10%)	2(10%)
RTA	6(60%)	5(50%)	11(55%)
SPORTS	0(0%)	2(20%)	2(10%)
Total	10(100%)	10(100%)	20(100%)

Side of Injury

The dominant limb was predominantly involved in both groups, 60% in the Conservative group and 70% in the Plating group.

Table 4: Side of Injury- frequency distribution in two groups of patients studied

Side of Injury	Conservative GROUP	PLATING GROUP	Total
Non-dominant	6(60%)	7(70%)	13(65%)
Dominant	4(40%)	3(30%)	7(35%)
Total	10(100%)	10(100%)	20(100%)

Associated injuries

Associated injuries were seen in 2 patients (10%). All associated injuries were managed by appropriate treatment modality with resultant favourable outcome (Table 5)

Table 5: Associated Injury- frequency distribution in two groups of patients studied

Associated Injury	PLATING GROUP	Conservative GROUP	Total
Nil	9(90%)	9(90%)	18(90%)
Yes	1(10%)	1(10%)	2(10%)
Colles'fracture right	1(10%)	0(0%)	1(5%)
Fracture both bones in right leg	0(0%)	1(10%)	1(5%)
Total	10(100%)	10(100%)	20(100%)

Type of fracture

Robinson type 2B1 was the most common type of fracture in both groups, accounting for 7(70%) patients in the Conservative group and 6(60%) patients in the plating group. These are represented in table (6).

Table 6: Type of Fracture- frequency distribution in two groups of patients studied

Type of Fracture	CONSERVATIVE GROUP	PLATING GROUP	Total
2B1	7(70%)	6(60%)	13(65%)
2B2	3(30%)	4(30%)	7(35)
Total	10(100%)	10(100%)	20(100%)

Duration of hospital stay

Maximum patients in the Conservative group were discharged on the same day, whereas maximum patients in the LCP group were hospitalized for 4 to 5 days with a mean of 5.07±1.03 days. These are represented in table (9).

Table 7: Duration of Hospital Stay- frequency distribution for plating group of patients studied

Duration of Hospital Stay(DAYS)	PLATING GROUP
2-3	0(0%)
4-5	6(60%)
6-7	4(40%)
Total	10(100%)

Complications

In the Conservative group, there was 2(20%) case of Malunion, 1(10%) case of non-union, 1(10%) case of delayed union ; whereas in LCP group, there was 1(10%) case had infection, 1(10%) case had malunion and 2(20%) cases had skin irritation. There were no intra-operative complications in the case series of our study for the PLATING group. These are represented in table (11).

Table 8: Complications

Complication	CONSERVATIVE GROUP	PLATING GROUP	Total
Nil	6(60%)	6(60%)	12(60%)
Yes	4(40%)	4(40%)	8(40%)
Infection	0(0%)	1(10%)	1(5%)
Mal union	2(20%)	1(10%)	3(15%)
Nonunion	1(10%)	0(0%)	1(5%)
Skin Infection	0(0%)	0(0%)	0(0%)
Skin Irritation	0(0%)	2(20%)	2(10%)
Delayed union	1(10%)	0(0%)	1(5%)
Total	10(100%)	10(100%)	20(100%)

Union time

Maximum patients of the Conservative group and LCP group had union within 10 to 15 weeks, with a mean of 15.20± 2.11 weeks for the Conservative group and 12.21±3.44 weeks for the LCP group. There was one nonunion patient in the Conservative group.

Table 9a: Union Time in Weeks- frequency distribution in two groups of patients studied

Union Time in Weeks	Conservative GROUP	PLATING GROUP	Total
<10	0(0%)	2(20%)	2(10.5%)
10-15	7(77.77%)	6(60%)	13(68.4%)
>15	2(22.22%)	2(20%)	4(21.05%)
Total	9(100%)	10(100%)	19(100%)

DASH Score

The functional evaluation calculated by DASH score at 6 months was less than 10 for 6(60%) cases, 10-15 for 3(30%) cases and more than 15 for 1(10%) case in Conservative group whereas for LCP group, DASH score at 6months was less than 10 for 6(60%) cases, 10-15 for 3(30%) cases and more than 15 for 1(10%) case.

Table 10: DASH score at 6 Months- frequency distribution in two groups of patients studied

Dash at 6 Months	Conservative GROUP	PLATING GROUP	Total
<10	6(60%)	6(60%)	12(60%)
10-15	3(30%)	3(30%)	6(30%)
>15	1(10%)	1(10%)	2(10%)
Total	10(100%)	10(100%)	30(100%)

Constant Murley Score

In the functional evaluation by Constant Murley Score, the maximum number of patients in the Conservative group had a score of less than 10 for 6(60%) patients, and the maximum number of patients in the LCP group had a score within 10-15 for 6(60%) patients.

Table 11: CONSTANT MURLEY SCORE- frequency distribution in two groups of patients studied

Constant Murley score	Conservative GROUP	PLATING GROUP	Total
<10	6(60%)	3(30%)	9(45%)
10-15	2(20%)	6(60%)	8(40%)
>15	2(20%)	1(10%)	3(15%)
Total	10(100%)	10(100%)	20(100%)

Comparison of study variables of both groups

The union time for the Plating group was 12.21±3.44 weeks, whereas that of the Conservative group was 15.20±2.11 weeks. There was no statistically significant association for union time between the two groups (p-value = 0009).

The mean DASH score for the Conservative group was 9.67±13.68, whereas that of the Plating group was 9.13±3.09. There was no statistically significant association for the DASH score between the two groups (p-value = 0.884).

The mean Constant Murley Score for the Conservative group was 11.13±8.46, whereas that of the Plating group was 11.07±2.37. There was no statistically significant association for the Constant Murley Score between the two groups (p-value <0.001).

Table 12: Comparison of study variables in two groups studied

Variables	CONSERVATIVE GROUP	PLATING GROUP	Total	P Value
Union time in weeks*	15.20±2.11	12.21±3.44	13.76±3.17	0.009**
DASH at 6 months	9.67±13.68	9.13±3.09	9.40±9.75	0.884
Constant Murley score	11.13±8.46	11.07±2.37	11.10±6.11	0.977

**Nonunion case ignored

This prospective study was conducted over a period of 24 months in the Department of Orthopaedics, RIMS, Imphal, to compare surgical (locking compression plate, LCP) and conservative management of displaced mid-shaft clavicular fractures. Twenty-two patients were included, with 11 in each group, though one from each was lost to follow-up. The mean age was 34 years, with a male predominance (65%), and road traffic accidents were the most common cause of injury. Robinson type 2B1 fractures were the most frequent, and the dominant limb was more often involved.

Union occurred earlier in the plating group (mean 12.2 ± 3.4 weeks) compared to the conservative group (15.2 ± 2.1 weeks), a statistically significant difference (p = 0.009). Implant removal was required in six patients of the surgical group. Complications were reported in 40% of patients in both groups. Conservative treatment showed higher rates of malunion (20%), nonunion (10%), and delayed union (10%), whereas plating was associated with infection (10%) and skin irritation (20%). Functional outcomes assessed by DASH and Constant-Murley scores showed no significant differences between the groups at six months. Thus, plating provided faster union but similar functional results compared to conservative management.

DISCUSSION

This prospective study was conducted on displaced midshaft clavicle fracture patients aged 18–70 years in the Department of Orthopaedics, Regional Institute of Medical Sciences, from April 2023 to March 2025. Patients were randomized into two groups: those managed conservatively with a figure-of-eight bandage and those treated surgically using a 3.5 mm anatomical locking compression plate (LCP). Follow-up was maintained for one year, and outcomes were assessed based on demographic parameters, radiological union, DASH score, Constant score, complications, and overall satisfaction.

In this study, the majority of patients were males (65%), comparable to Postacchini et al., who reported 68% male predominance with left-sided involvement in 61% of cases. Similarly, the non-dominant side was affected in 65% of patients in our series. Road traffic accidents (55%) were the most common mechanism of injury, consistent with Toogood et al., who also found higher prevalence in young adults with a mean age of 29 years. Our mean age was slightly higher at 34 years, with peaks in the 21–30 and 31–40 year age groups.

Robinson's classification was used for fracture typing. Type 2B1 fractures (65%) predominated, followed by 2B2 (35%). Both subtypes achieved union, except for one case of nonunion in the conservative group. Previous studies report nonunion rates of 1–15% in displaced fractures (Khan et al.) and up to 20–33% in comminuted injuries (Brinker et al.). Zlowodzki et al., in a meta-analysis, demonstrated significantly lower nonunion rates with plating (2.2%) compared to conservative care (15.1%). Similarly, Woltz et al. reported improved union with fixation, though without superior functional outcomes.

In our series, the conservative group had 1 nonunion (10%), 2 malunions (20%), and 1 delayed union (10%). Strict bandaging protocols and early intervention may explain the relatively favorable outcomes. However, patient discomfort and compliance issues with the figure-of-eight bandage contributed to malunion. In contrast, the plating group showed faster union (mean 12.2 weeks vs. 15.2 weeks) and fewer union-related complications, likely due to stable fixation, extraperiosteal plate placement, and minimal soft tissue stripping.

Functional outcomes differed significantly. Operatively treated patients demonstrated better Constant and DASH scores ($p < 0.001$), similar to findings from the Canadian Orthopaedic Trauma Society and Hill et al., who reported improved functional recovery and reduced nonunion rates with plating.

Nonetheless, plating was associated with unique complications. In our study, 10% had superficial infection and 20% experienced skin irritation. Implant prominence and cutaneous hypoaesthesia, well documented in previous studies (Shen et al., Wang et al.), were also observed, though none resulted in implant failure. Huang et al. noted poor conformity of pre-contoured plates in certain clavicular shapes, which was confirmed intraoperatively in 67% of our cases requiring additional manual bending.Overall, our findings support that plating offers faster union and better functional recovery but carries higher risks of implant-related complications. Conservative treatment remains effective but is associated with greater risks of malunion and nonunion, particularly in displaced fractures.

The present study has several strengths. It was conducted prospectively with clearly defined inclusion and exclusion criteria, thereby minimizing selection bias. Randomization of patients into operative and conservative groups ensured comparability, while the use of validated outcome measures such as the DASH and Constant–Murley scores provided objective assessment of functional recovery. Radiological union was assessed systematically with standard imaging protocols, and patients were followed up regularly for one year, allowing reliable documentation of healing, complications, and long-term outcomes. The use of a uniform surgical technique with pre-contoured locking compression plates and strict postoperative protocols further added consistency to the operative cohort.

However, certain limitations must also be acknowledged. The sample size was relatively small (20 patients), which may limit the statistical power of the study and restrict generalizability of the findings. Being a single-center study, the results may not fully reflect variations in surgical expertise, patient demographics, and healthcare infrastructure across other regions. Additionally, while the follow-up period of one year was adequate to assess union and functional recovery, longer follow-up might have better captured late complications such as implant failure, persistent sensory loss, or post-traumatic arthritis. Finally, patient compliance with conservative treatment posed challenges, potentially influencing outcomes in that group.

CONCLUSION

A prospective non-randomized controlled trial was conducted in the Department of Orthopaedics, RIMS, from April 2023 to March 2025, to compare the functional outcomes of displaced midshaft clavicle fractures managed conservatively and surgically. A total of 22 patients meeting the inclusion and exclusion criteria were enrolled after obtaining informed consent and ethical clearance. Patients in the conservative group were treated with a figure-of-eight bandage and sling, while those in the surgical group underwent plate osteosynthesis. All patients were followed up at 2, 6, 12, and 24 weeks, with final evaluation at 1 year post-intervention. Functional outcomes were assessed using the DASH and Constant scores, while data analysis was performed with SPSS version 22. The mean age of presentation was 34 years, with a male predominance (65%), and road traffic accidents were the most common cause of injury. Non-dominant side involvement was seen in 65% of cases. Radiological union was achieved earlier in the surgical group (mean 12.21 weeks) compared to the conservative group (mean 15.20 weeks). One case of nonunion occurred, and 20% of conservatively treated patients developed malunion. In the conservative group, 40% of patients were unsatisfied, while a similar proportion was noted in the surgical group. The mean DASH scores were 9.13 for surgical and 9.67 for conservative groups, while the mean Constant scores were 11.07 and 11.13, respectively, with no significant difference between groups. One case of wound infection and two cases of skin irritation were noted in the surgical group. Overall, the study suggests that both conservative treatment and plate fixation provide comparable outcomes in terms of fracture healing, functional recovery, and complications. Treatment decisions should therefore be individualized, considering patient-specific factors such as fracture characteristics and personal preferences. Larger studies are warranted to validate these findings.

Conflicts of Interest: Nil
Funding: Nil

FIGURES

Operative steps for plating

Fig 4: Instruments used for open reduction and internal fixation of clavicle fracture

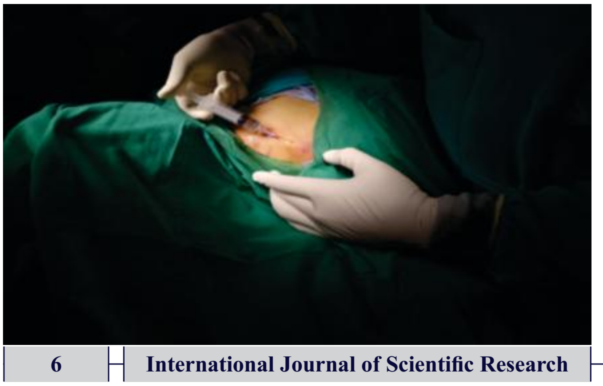

Fig 5: Skin preparation of the operative site with 10% betadine and local Anaesthesia with adrenaline

Fig 6: A Horizontal skin incision over the superior surface of the clavicle

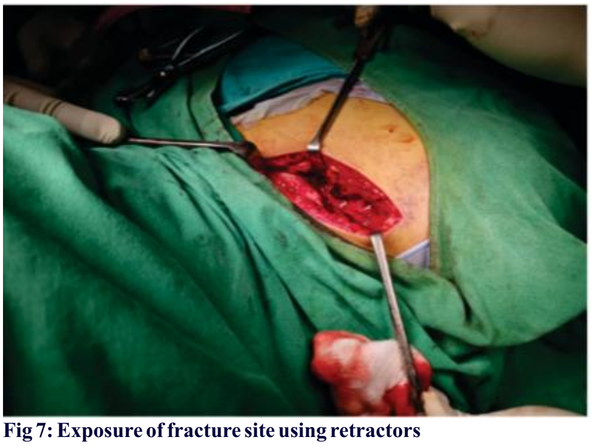

Fig 7: Exposure of fracture site using retractors

Fig 8: Open reduction of fracture site using bone-holding clamps

Fig 9: Application of LCP and screws in the reduced position

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Fig 10: Intra-operative fluoroscopic image

Fig 11: pre-operative X-Ray

Fig 12 (A) : postoperative X-Ray

Fig 12 (B) : Postoperative follow-up X-Ray at 2 week

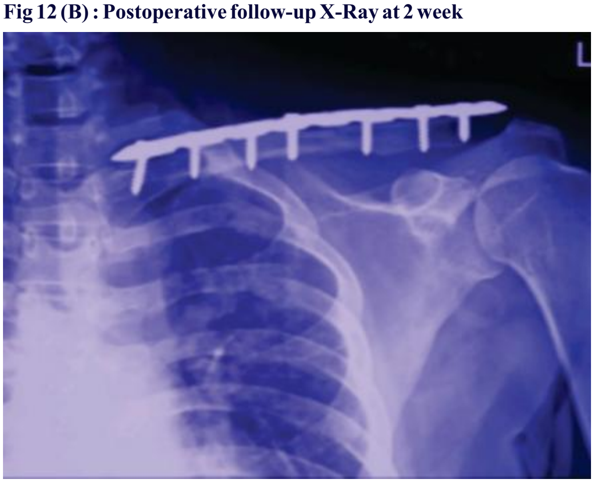

Fig 12 (C) : Postoperative follow-up X-Ray at 6 week

Fig 12 (D) : Postoperative follow-up X-Ray at 12 week

Fig 13: ROM at 6 months of operation

Fig. 14: Figure of eight bandages for conservative treatment of clavicle fracture

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Fig. 15(A): Clavicular brace with arm sling for conservative treatment of clavicle fracture

Fig. 15(B): Follow-up at 1 week with Clavicular brace with arm sling for clavicle fracture

Fig. 15©: Follow-up at 3 week with Clavicular brace with arm sling for clavicle fracture

Fig. 15(D): Follow-up at 12 week with Clavicular brace with arm sling for clavicle fracture

Fig. 15(E): Radiological follow-up at 1 st day (a), 4 th week (b) & 12 th week (c) with Clavicular brace with arm sling for clavicle fractur

REFERENCES

1. Kihlström C, Möller M, Lönn K, Wolf O. Clavicle fractures: epidemiology, classification and treatment of 2 422 fractures in the Swedish Fracture Register; an observational study. BMC musculoskeletal disorders. 2017 Dec;18:1-9.
2. Shanmuganathan, Rakashekaran, Khanna MR, Dheendayalan J. Clavicular fractures. In: Sureshan Sivananthan, Eugene Sherry, Patrick Warnke, Mark DM, editors. Mercer's Textbook of orthopaedics and trauma. 10th ed. London: 2012. p. 288-90.
3. Edward AP. Fracture of shoulder, arm, and forearm. In: Canale ST, James H Beaty, editors. Campbell's operative orthopaedics. 12th ed. Philadelphia Mosky; 2013. p. 2829-36.
4. Lazarus MD. Fractures of clavicle. In; Buchloz RW, Heckman JD, editors. Rockwood and Green's fracture in adults. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2001. p. 1041-78.
5. Craig EV, Basamania CJ, Rockwood CA. Fractures of the clavicle. In: Rockwood CA, Matsen FA, Wirth MA, Lippitt SB, editors. The Shoulder. 3rd ed. Philadelphia: Saunders; 2004. p. 455-519.
6. Johnson D, Ellis H. Pectoral girdle shoulder region and axilla. In: strandring S, Ellis H, editors. Greys Anatomy, Philadelphia: Elsevier; 2008. p. 567.
7. Lazarus MD. Fractures of the clavicle. In: Bucholz RW, Heckman JD, editors, Rockwood and Green's fractures in adults, 5th ed. Philadelphia: Lippincott Williams and Wilkins, 2001. p. 1041-78.
8. Allman FL Jr. Fractures and ligamentous injuries of the clavicle and its articulation. J Bone Joint Surg Am. 1967;49(4): 774-84.
9. Nordqvist A, Petersson C. The incidence of fractures of the clavicle. Clin Orthop Relat Res. 1994;(300):127-32.
10. Robinson CM. Fractures of the clavicle in the adult: epidemiology and classification. J Bone Joint Surg Br. 1998;80(3): 476-84.
11. NEER CS 2nd. Fracture of the distal clavicle with detachment of the coracoclavicular ligaments in adults. J Trauma. 1963;3:99-110.
12. Neer CS 2nd. Fractures of the distal third of the clavicle. Clin Orthop Relat Res. 1968;58:43-50.
13. Bishop JY, Jones GL, Lewis B, Pedroza A; MOON Shoulder Group. Intra- and interobserver agreement in the classification and treatment of distal third clavicle fractures. Am J Sports Med. 2015;43(4):979-84.
14. Cho CH, Kim BS, Kim DH, Choi CH, Dan J, Lee H. Distal clavicle fractures: a new classification system. Orthop Traumatol Surg Res. 2018;104(8):1231-5.
15. Van der Meijden OA, Gaskill TR, Millett PJ. Treatment of clavicle fractures: current concepts review. Journal of shoulder and elbow surgery. 2012 Mar 1;21(3):423-9.
16. Duan X, Zhong G, Cen S, Huang F, Xiang Z. Plating versus intramedullary pin or conservative treatment for midshaft fracture of the clavicle: a meta-analysis of randomized controlled trials. Journal of shoulder and elbow surgery. 2011 Sep 1;20(6):1008-15.
17. Dhakad RK, Panwar M, Gupta S. Plating versus conservative treatment in midshaft fractures of the clavicle: A comparative study. Journal of clinical orthopaedics and trauma. 2016 Oct 1;7:166-70.
18. Daniilidis K, Raschke MJ, Vogt B, Herbort M, Schliemann B, Günther N, Koesters C, Fuchs T. Comparison between conservative and surgical treatment of midshaft clavicle fractures: outcome of 151 cases. Technology and Health Care. 2013 Jan 1;21(2):143-7.
19. Jha GK, Timsina P, Yadav D, Lamichhane S, Jha S. Conservative vs operative management of displaced midshaft clavicle fracture: a comparative study. Biomedical Journal of Scientific & Technical Research. 2018;11(1):8293-303.
20. Micheloni GM, Tarallo L, Porcellini G, Catani F. Comparison between conservative treatment and plate fixation for displaced middle third clavicle fracture: clinical outcomes and complications. Acta Bio Medica: Atenei Parmensis. 2019;90(Suppl 12):48.
21. Altamimi SA, McKee MD. Non-operative treatment compared with plate fixation of displaced midshaft clavicular fractures: Surgical technique. JBJS. 2008 Mar 1;90(Supplement_2_Part_1):1-8.
22. Kashif KLA, Bradnock TJ, Scott C, Robinson CM. Current concepts review Fractures of the clavicle. J Bone Joint Surg Am 2009;91:447-60.
23. Kulshrestha V, Roy T, Audige L. Operative versus non-operative management of displaced midshaft clavicle fractures: a prospective cohort study. Journal of orthopaedic trauma. 2011 Jan 1;25(1):31-8.
24. Böhme J, Bonk A, Bacher GO, Wilharm A, Hoffmann R, Josten C. Current treatment concepts for mid-shaft fractures of the clavicle-results of a prospective multicentre study. Zeitschrift fur Orthopadie und Unfallchirurgie. 2011 Jan;149(1):68-76.
25. Asadollahi S, Hau RC, Page RS, Richardson M, Edwards ER. Complications associated with operative fixation of acute midshaft clavicle fractures. Injury. 2016 Jun 1;47(6):1248-52.
26. Subramanyam KN, Mundargi AV, Gopakumar KU, Bharath T, Prabhu MV, Khanchandani P. Displaced midshaft clavicle fractures in adults–is non-operative management enough? Injury. 2021 Mar 1;52(3):493-500.
27. Qvist AH, Væsel MT, Jensen CM, Jensen SL. Plate fixation compared with non-operative treatment of displaced midshaft clavicular fractures: a randomized clinical trial. Bone Joint J. 2018 Oct;100(10):1385-91.
28. Navarro RA, Gelber JD, Harrast JJ, Seiler III JG, Jackson KR, Garcia IA. Frequency and complications after operative fixation of clavicular fractures. Journal of Shoulder and Elbow Surgery. 2016 May 1;25(5):e125-9.
29. Guerra E, Previtali D, Tamborini S, Filardo G, Zaffagnini S, Candrian C. Midshaft clavicle fractures: surgery provides better results as compared with non-operative treatment: a meta-analysis. The American journal of sports medicine. 2019 Dec;47(14):3541-51.
30. Woltz S, Stegeman SA, Krijnen P, van Dijkman BA, van Thiel TP, Schep NW, de Rijcke PA, Frölke JP, Schipper IB. Plate fixation compared with non-operative treatment for displaced midshaft clavicular fractures: a multicenter randomized controlled trial. JBJS. 2017 Jan 18;99(2):106-12.