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Original Research Article

Comparative study of open reduction and internal fixation versus conservative management in acute clavicle shaft fracture in adults

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Abstract

Background: In adults, clavicle fractures account for 2.5–10% of all fractures. Patients over 70 years old and young male patients under 30 years old are more at risk. The most common causes are falls onto an outstretched hand or direct blows to the shoulder, particularly in sports or road traffic accidents.
Materials and Methods: In this study, 60 cases were selected and distributed in two groups. Group A was managed conservatively & group B managed operatively of clavicle shaft fractures in adults, meeting the inclusion & exclusion criteria were treated by operative & non-operative methods. Statistical analysis was executed with an unpaired t-test to assess the significant differences between the 2 groups. Twenty patients (Group A) were treated conservatively, while 40 patients (Group B) were treated operatively. Occurrence of malunion among the 60 cases, with malunion observed in 10.0% of cases (6 individuals) and absent in 90.0% (54 individual).
Result: At follow ups, 10% of total clavicular patient's management under both groups had malunion of which mean time of 3.65 months in group A and 2.98 months in group B, constant Murley score at 3 months was found to be 79.45 and 80.68 in group A and B respectively. Results also comprises of complications including implant prominence, variation in clavicle length, sensation over anterio-medial shoulder.
Conclusion: Based on our study of patients with clavicle fractures, it can be concluded that the operative group had significantly better outcomes compared to the conservatively managed group, as measured by the Murley score.

Keywords: Clavicle shaft fracture, Conservative management, Operative management.

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1. Introduction

In adults, clavicle fractures account for 2.5–10% of all fractures. Patients over 70 years old and young male patients under 30 years old are more at risk. The most common causes are falls onto an outstretched hand or direct blows to the shoulder, particularly in sports or auto accidents.[1] Approximately 80% of all clavicle fractures are middle-third (or mid-shaft) fractures.[2] Moreover, within the spectrum of adult shoulder girdle injuries, clavicle fractures account for a substantial portion, ranging from 34% to 45%.[3] Clinical presentations of clavicle fractures can manifest with varying degrees of severity, often exhibiting symptoms such as pain, swelling, ecchymosis, deformity, and functional impairment. Recognizing these signs promptly is paramount to initiating timely and appropriate intervention.

Clavicle fractures are commonly classified based on their anatomical location along the bone, typically categorized into three main segments: the central third, medial third, or lateral third. Tailoring treatment approaches according to the precise location and nature of the fracture is imperative in managing these injuries effectively.

In clinical practice, a comprehensive assessment is essential to ascertain the optimal treatment strategy for each patient, considering factors such as fracture displacement, patient age, comorbidities, and associated injuries. Treatment modalities may encompass conservative measures, including immobilization with slings, figure of 8 bandage and physiotherapy, or more invasive interventions such as surgical fixation, particularly in cases of displaced or complex fractures.[4] Minimally displaced clavicle fractures

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can be effectively managed through nonoperative means employing some form of immobilization.[5] This study aims to compare the analysis of the outcome of clavicle shaft fractures in adult patients treated with open reduction internal fixation with plate osteosynthesis & conservative management with the figure of 8 bandage.

2. Material and Methods

It was a prospective study that was carried out in the Department of Orthopaedics at Amaltas Institute of Medical Sciences, Dewas. In this study period, 60 cases were selected among which group A managed conservatively & group B managed operatively of clavicle shaft fractures in adults, meeting the inclusion & exclusion criteria were treated by operative & non-operative methods. The study was carried out for 18 months after ethical committee approval. The patient's clinical history & examination results were prospectively recorded in a case record form after receiving their written, informed consent.

To determine whether there were any significant differences between the two groups, statistical analysis was conducted using an unpaired t-test.

2.1. Inclusion criteria

1. Age>19 and< 65 years of age with closed clavicle shaft fracture.
2. Duration less than two weeks
3. Displacement, defined as at least one shaft width difference in height between the fracture parts, regardless of the reduction.
4. Angulated fracture

2.2. Exclusion criteria

1. The age of the patient is less than 18 years & more than 65 years.
2. Open fractures.
3. Pre-existent morbidity of the ipsilateral arm, shoulder, or hand.
4. Presence of neuro-vascular injury
5. Patients not consenting for the study

2.3. Non operative management

A figure of eight bandage along with a sling is given to the patient with a mid-clavicular fracture.(**Figure 1**)

Immobilization is maintained for a duration of 4 to 6 weeks.

During the immobilization period, it is recommended that patients engage in active range-of-motion exercises for the elbow, wrist, and hand.

Figure 1: A,B): Figure of eight bandage

2.4. Surgical procedure

1. Fracture approached using approch to clavicle giving skin incision centred superficial and deep dissection done. Identification and preparation: The main fracture line and major fragments are identified and cleaned of debris and hematoma. This step is crucial for clear visualization and preparation for fixation (**Figure 2**).
2. Fixation strategy: A fixation strategy is formulated based on the fracture pattern. If there is a sufficiently large free fragment (one-third of the clavicle circumference or greater), it can be reduced and fixed with a lag screw / temporary K-wire to simplify the fracture pattern.
3. Reduction: Proximal and distal fragments are reduced using reduction forceps. Temporary stabilization can be achieved with K-wires or ideally with lag screws.
4. Plate application: A pre-contoured plate of sufficient length is applied to the superior surface of the clavicle. The number of screws used for fixation depends on whether a lag screw is placed initially. Typically, three bicortical screws (six cortices) are used if a lag screw is in place; otherwise, four screws are used both proximally and distally.[6]
5. Compression and stability: Compression holes can be used for stable fracture configurations to achieve compression. For comminuted or unstable fractures, a "neutral" mode is preferred to avoid excessive compression.
6. Plate position, type, and function: Plates for fixation may be placed anteriorly or superiorly on the clavicle. Superior placement is preferred as it minimizes muscle detachment, exposing the bone between the trapezius and pectoralis major/deltoid muscles.
7. Soft tissue closure and monitoring: After fixation, it's important to close both soft tissue layers with interrupted, nonabsorbable sutures. Postoperative radiographs are taken to assess the fixation in the recovery room.

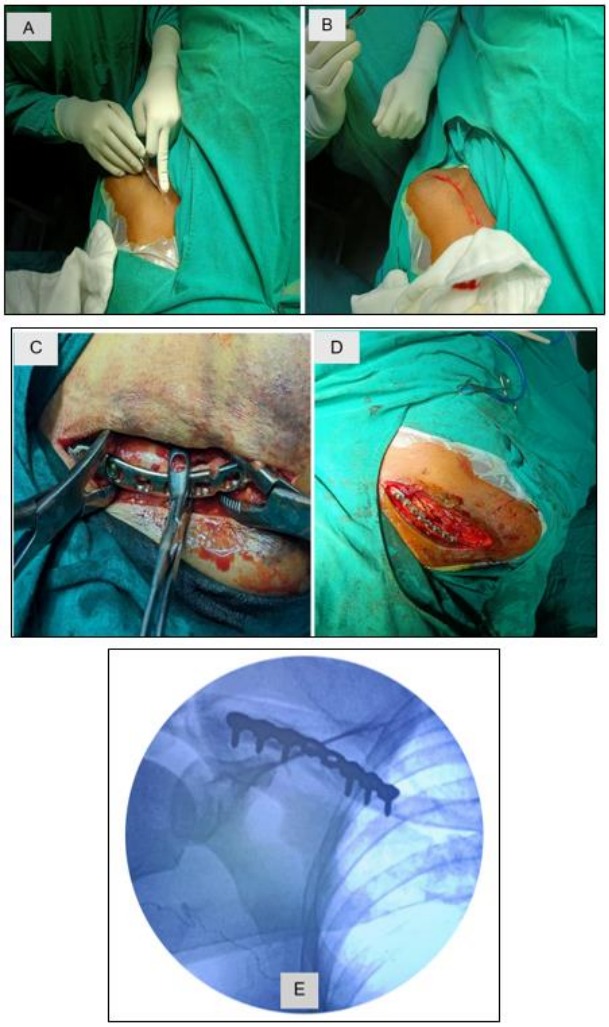

Figure 2: A): Intraop incision; **B):** Preoperative bony landmark markings; **C,D)** Intraop precontoured clavicular plate being fixed; **E)**: Immediate postop x-ray with clavicular plate fixation

2.5. Post-operative care

1. Initial postoperative care and rehabilitation:
    a. Inpatient basis: The surgery is typically performed as an inpatient procedure.
    b. Initial postoperative phase: After surgery, the arm is placed in a standard sling for comfort. Gentle pendulum exercises are allowed to prevent stiffness.
    c. Follow-up at 10 to 14 days: The patient is seen in the fracture clinic for wound check and radiographs.
    d. Sling discontinuation: At this visit, the sling is discontinued, and the patient is allowed to start unrestricted range-of-motion exercises.
    e. Restrictions on activities: However, strengthening exercises, resisted exercises, and sporting activities are restricted initially.
2. Weeks postoperative visit:
    a. Radiographic assessment: Radiographs are taken to ensure that the clavicle is healing well (bony union)(**Figure 3**, **Figure 6**).
    b. Activity progression: If the radiographs show acceptable healing (bony union), the patient can begin resisted and strengthening activities (**Figure 4**, **Figure 5**).
    c. Delayed union: If healing is delayed (delayed union), more aggressive activities are avoided.
3. Return *to sports*
    a. Contact sports (e.g., football, hockey) and unpredictable sports (e.g., mountain biking, snowboarding) should generally be avoided for 12 weeks postoperatively.

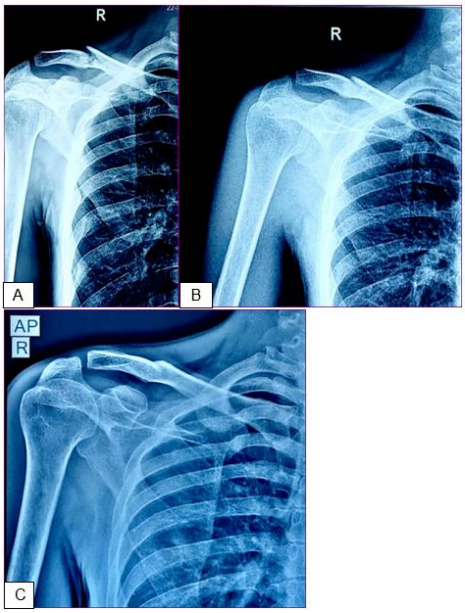

Figure 3: Showing follow up radiograph of non-operated patient (A: 1 month, B: 3 month, C: 6 month)

Figure 4: Functional outcome of non-operated patient

Figure 5: Functional outcome of surgically operated patient

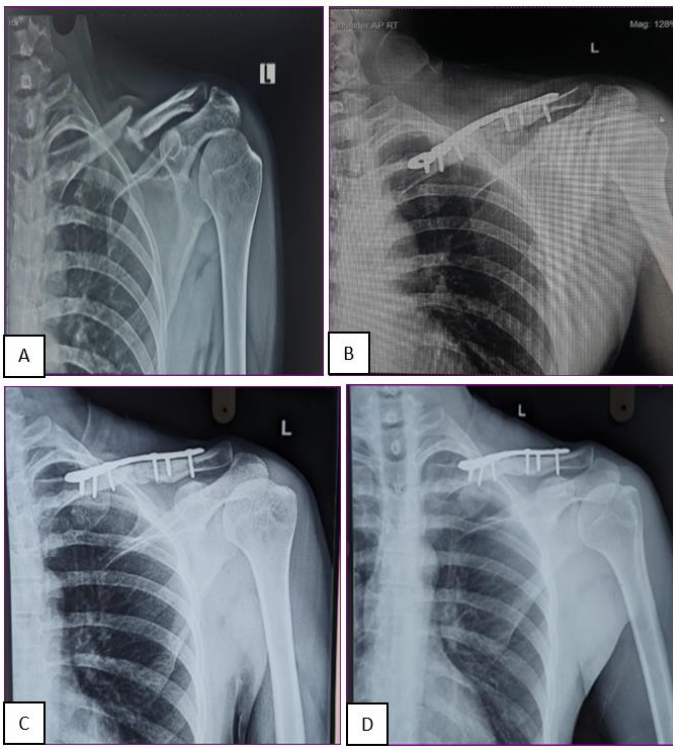

Figure 6: **A):** Pre-op x-ray of operated patient; **B):** Immediate post op x-ray; **C):** 3 month postop x-ray; **D):** 6 month post op x-ray

3. Results

3.1. Demographic details

Present study out of 60 cases average (mean) age is 40.65 years, with a standard deviation of 10.77 years, indicating variability around the mean. The ages range from a minimum of 19 years to a maximum of 60 years, showing a wide age distribution among the cases. A significant majority of the cases are male, comprising 93.3%, while females make up only 6.7%. Farmers constitute the largest group at 43.3%, with 26 individuals engaged in farming. Labourers follow at 23.3%, with 14 individuals involved in labour work. Students account for 13.3%, consisting of 8 individuals. Jobs are held by 11.7%, total 7 individuals, while housewives make up the smallest group at 8.3%, comprising 5 individuals. A majority, 56.7%, reside in rural areas, totaling 34 cases. The remaining 43.3%, amounting to 26 cases, live in urban areas.

3.2. Injury

A 73.3%, reported injuries lasting 5 days or less, totalling 44 cases. Conversely, 26.7% experienced injuries lasting more than 5 days, amounting to 16 cases. The majority, constituting 80.0%, reported injuries due to Road Traffic Accidents (RTA), totalling 48 cases. Falls from height accounted for 20.0% of the cases, with 12 incidents recorded. The majority, accounting for 63.3%, experienced injuries on the right side, totalling 38 cases. In contrast, 36.7% of cases involved injuries on the left side, amounting to 22 cases in total. Group A has a mean injury time of 3.50 days with an SD of 1.36 days, while Group B shows a higher mean injury time of 4.60 days with an SD of 1.69 days. However, the difference in mean injury times between the two groups is not statistically significant, as indicated by a t-value of 2.526 and a p-value of 0.23.

3.3. Local examination

In every instance, palpation revealed consistent results: all cases exhibited tenderness, crepitus, and abnormal mobility. Moreover, there were no cases where neurological deficits were detected upon palpation, indicating a negative finding across the board. Similarly, vascular deficits were uniformly absent in all cases, denoted as nil (**Table 1**).

3.4. Complication

Superficial infections were noted in 5.0% of cases (3 individuals), while deep infections occurred in 3.3% (2 individuals). Non-union was observed in 8.3% of cases (5 individuals), and the same percentage experienced ugly scars. Importantly, no cases reported implant failure, indicating a 100.0% success rate in implant retention (**Table 2**)

3.5. Constant and Murley score

The Constant and Murley scores across various parameters between Group A and Group B, detailing their mean scores and standard deviations (SD), along with the statistical significance of any observed differences. In terms of pain scores (0-15 scale), Group A averages 10.85 with an SD of 1.63, while Group B averages 12.03 with an SD of 1.59. This difference is statistically significant, with a t-value of 2.672 and a p-value of 0.010, indicating that Group B reports higher levels of pain compared to Group A. For activities of daily living (0-20 score), movement (0-40 score), strength (0-25 score), and total scores (0-100 score), the differences between Group A and Group B are not statistically significant. The p-values for these parameters range from 0.340 to 0.927 (**Table 3**).

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Table 1: Local examination

Local Examination		Frequency	Percent
Tenderness Palpation	Present	60	100.00%
Crepitus Palpation	Present	60	100.00%
Abnormal mobility Palpation	Present	60	100.00%
Absence of neurological deficit Palpation	Negative	60	100.00%
Absence of vascular deficit Palpation	Nil	60	100.00%

Table 2: Complication

Complication		Frequency	Percent
Superficial infection	Yes	3	5.0%
	No	57	95.0%
Deep infection	Yes	2	3.3%
	No	58	96.7%
Non-union	Yes	5	8.3%
	No	55	91.7%
Ugly scar	Yes	5	8.3%
	No	55	91.7%
Implant failure	No	60	100.0%
No	Yes	14	23.3%
	No	46	76.7%

Table 3: Constant and Murley score

Constant and Murley score	Group				t	P
	Group A		Group B			
	Mean	SD	Mean	SD		
Pain (0-15 score)	10.85	1.63	12.03	1.59	2.672	0.010
Activities of daily living (0 - 20 score)	16.95	2.28	16.90	1.81	0.092	0.927
Movement (0 - 40 score)	30.80	4.37	31.10	3.29	0.298	0.767
Strength (0-25 score)	20.85	1.90	20.65	2.02	0.369	0.714
Total (0-100 score)	79.45	5.19	80.68	4.36	0.962	0.340

4. Discussion

An increasingly common course of treatment for clavicle fractures in adolescents and young adults is surgery. Despite their degree of displacement or angulation, children's closed clavicle fractures are noted for their strong potential for remodeling and healing. As a result, they typically receive non-operative treatment and appear to improve with time. Several studies including adult patients have revealed very modest outcomes connected to conservative (non-operative) treatment, which is in contrast to the young pediatric group.[7-14] However, some reports of potentially positive outcomes—such as lower rates of non-union and satisfying patient-derived outcomes—follow surgical management in adults.

Hill *et al.* have noted unsatisfactory patient-oriented outcomes in 16 out of 52 adult patients (31%) for the conservative treatment of displaced mid-shaft clavicle fractures.[6] Nordqvist et al. who noted unsatisfactory patient-oriented outcomes in 22 out of 68 patients (32%).[7]

The limitation of our study was that it was a small prospective study including a small number of patients and done at a single centre. Larger randomized controlled trials are needed to further evaluate and validate the outcomes and complications of clavicle fracture management with plating and conservatively among clavicle fracture patients. Malunion and complication was reported in this study also outlines the occurrence of malunion among the 60 cases, with malunion observed in 10.0% of cases (6 individuals) and absent in 90.0% (54 individuals). Although malunion was relatively infrequent in this group, understanding and managing it is crucial for ensuring optimal recovery and outcomes for patients with bone injuries or fractures.

Superficial infections occurred in 5.0% of cases (3 individuals), deep infections in 3.3% (2 individuals), non-union in 8.3% (5 individuals), and ugly scars in another 8.3% (5 individuals). Importantly, no cases reported implant failure, indicating a 100.0% success rate in implant retention.[15] These findings highlight the relatively low incidence of complications overall and the effectiveness of medical interventions in preventing implant failures

5. Conclusion

Based on our study of patients with clavicle fractures, it can be concluded that the operative group had significantly better outcomes compared to the conservatively managed group, as measured by the Murley score. The conservatively treated group experienced a significantly higher number of malunions compared to the operative group. Therefore, clavicle fractures managed with surgical intervention resulted in better outcomes and fewer postoperative complications.

6. Source of Funding

None.

7. Conflict of Interest

None.

8. Ethical Clearance

Ethical No.: EC/NEW/INST/2022/2692.

References

1. 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 Biomed*. 2019;90(12):48–53.
2. Longo UG, Banerjee S, Barber J, Chambler A, Cobiella C, Corbett S, et al. Conservative management versus open reduction and internal fixation for mid-shaft clavicle fractures in adults--the Clavicle Trial: study protocol for a multicentre randomized controlled trial. *Trials*. 2011;12(1):57.
3. Ropars M, Thomazeau H, Huten D. Clavicle fractures. *Orthop Traumatol Surg Res*. 2017;103(1S):S53–9.
4. Lenza M, Taniguchi LFP, Ferretti M. Figure-of-eight bandage versus arm sling for treating middle-third clavicle fractures in adults: study protocol for a randomised controlled trial. *Trials*. 2016;17(1):229.
5. Rüedi TP, Buckley RE, Murphy WM, Moran CG. AO Principles of Fracture Management. AO Publishing; 2007.
6. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle-third fractures of the clavicle gives poor results. *J Bone Joint Surg Br*. 1997;79(4):537–9.
7. Nordqvist A, Petersson CJ, Redlund-Johnell I. Mid-clavicle fractures in adults: end result study after conservative treatment. *J Orthop Trauma*. 1998;12(8):572–6.
8. Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. *J Bone Joint Surg Am*. 2007;89(1):1–10.
9. Nowak J, Holgersson M, Larsson S. Sequelae from clavicular fractures are common: a prospective study of 222 patients: A prospective study of 222 patients. *Acta Orthop*. 2005;76(4):496–502.
10. Robinson CM, Goudie EB, Murray IR, Jenkins PJ, Ahktar MA, Read EO, et al. Open reduction and plate fixation versus nonoperative treatment for displaced midshaft clavicular fractures: a multicenter, randomized, controlled trial: A multicenter, randomized, controlled trial. *J Bone Joint Surg Am*. 2013;95(17):1576–84.
11. Lenza M, Buchbinder R, Johnston RV, Ferrari BA, Faloppa F. Surgical versus conservative interventions for treating fractures of the middle third of the clavicle. *Cochrane Database Syst Rev*. 2019;1(1):CD009363.
12. Ortho M. Analysis of displaced middle third clavicular fractures treated by plate osteosynthesis. *J Med Sci Clin Res*. 2017;5(5):21295–303.
13. Court-Brown CM, Heckman JD, Mcqueen MM, Ricci WM, Tornetta P, Mckee MD. Rockwood and Green's Fractures in Adults. Wolters Kluwer Health; 2015.
14. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. *Clin Orthop Relat Res*. 1968;58:29–42.
15. Sahasrabhojanee AA, Mehendale AM, Gupta D, Gupta P, Kakar G. Malunion of a Clavicle Fracture in a Young Adult: A Case Report and Surgical Intervention. *Cureus.* 2023;15(11):e48202.

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