

MANAGEMENT OF MID SHAFT FRACTURE OF CLAVICLE BY PLATING VERSUS CONSERVATIVE METHODS

¹Yousuf Mohamed Khira, ²Mohamed Abdel Fattah Mohamed , ³Hossam Fathi Mahmood
⁴Rabe Ali Nasar Altomi

Orthopedic Surgery Department, Faculty of Medicine , Zagazig University, Egypt.

Corresponding author: Rabe Ali Altomi, E-mail: Rabiehmeady2@gmail.com

ABSTRACT

Background: Direct fall on shoulder is most common mechanism of injury of fracture clavicle other mechanism include direct trauma to clavicle and fall on outstretched hand. The ideal management of the fracture of the mid-shaft of the clavicle remains a topic of debate. This study aimed to assess the better management of fracture mid shaft clavicle. **Patients and Methods:** This study included 18 patients with mid-shaft clavicular fractures. The patients were subdivided into : group A (9 patients) for conservative treatment and group B (9 patients) for operative treatment by using plate and screw fixation. Post-operative care was done. Every 2 weeks in first month and half then every month till full union. At 6 weeks post operation anterior posterior x-ray for the clavicle is done and evaluates progress of fracture union. Patients was to remove the sling and start careful full range of motion and start physiotherapy and rehabilitation. **Results:** The present study showed no significant difference regards age distribution. In the mean age in conservative group (A) was 39.55 and operative group (B) was 36.11. Left side was the majority in both groups with no significant difference between groups. Regard Robinson classification 2B1 & 2B2 were the major classes with no significant difference between studied groups. Although time of union was shorter among operative cases but there was no significant difference. There was no significant difference between groups however surgical group was better and less regard pain. There was no significant difference between groups however surgical group was better regard Return to ADL. **Conclusion:** Conservative treatment remains the treatment of choice for simple undisplaced mid-shaft clavicle fractures, for displaced and comminuted fractures the surgical intervention gives better outcomes and early functional recovery in young active adults.

Keywords: Mid Shaft Fracture; Plating ; ADL ; Robinson classification

INTRODUCTION:

Clavicle fracture ranged from 29 to 50 per 100.000 populations. Men were more commonly affected than women (2:1), and the ratio of left- to right-sided fractures was 1.28:1 (1). Fractures were most common in males aged from 13 to 20 years with a subsequent fall in incidence with age until seventh decade. In females, the incidence remained more constant with age, with smaller peaks under 20 years and over 80 years of age. The mean age for fracture in men and women was 29.2 and 45 years, respectively (2).

Simple-fall fractures occurred at a mean age of 46 years. For young adults, sport-related mechanisms were the most common cause, and these fractures occurred at a mean age of 21 years. Serious associated injuries (e.g., pneumothorax) are uncommon. Nevertheless, up to 9% of patients with clavicle fractures have additional fractures, most commonly rib fractures. Most brachial plexus injuries are associated with proximal-third fractures. Pathologic fractures of the clavicle are rare (3). Most patients with a clavicle fracture, particularly young adults, will give a history of a fall directly onto the shoulder. The majority will give a history of injury of a simple fall, fall from a height, fall during sporting activity, or a motor vehicle accident (4).

To better visualize the fracture pattern and displacement, an apical oblique radiograph is helpful. To obtain this view, a bump or roll is placed under the contralateral scapula, which places the involved scapula flat against the radiographic cassette (a true AP) the beam is then angled 20 degrees cephalad, which brings the clavicular image away from the thoracic cage (5).

For evaluation of the internally fixed clavicle, the abduction lordotic view (the arm abducted 135 degrees and the beam angled 25 degrees cephalad) is extremely helpful (6). Plate fixation is a better surgical option for clavicular fractures than pin fixation for several reasons. Intramedullary fixation fails to provide rotational control at the fracture site. Plate fixation controls length and rotation as well as providing compression in length stable fracture patterns. The stable construct obtained after plate fixation allows for early use of the upper extremity, unlike the postoperative immobilization that is often required after intramedullary pin fixation (7). Advantages of superior placement are ease of plate fixation and the position of the supero-anterior aspect of the clavicle on the tension side in most fractures (8).

Therefore, the aim of the present study was to assess the better management of fracture mid shaft clavicle.

PATIENTS AND METHODS

This study was included 18 patients with mid-shaft clavicular fractures and done at the Department of Orthopedic Surgery, Zagazig University Hospital from April 2020 to December 2020. The patients are divided into group A (9 patients) for conservative treatment and group B (9 patients) for operative treatment by using plate and screw fixation.

Inclusion Criteria:

Patients with none displaced mid-shaft clavicular fractures, displaced mid- shaft clavicular fractures with less than 2cm shortening for conservative group (A). Patients with displaced mid-shaft clavicular fractures with more than 2cm shortening, open midshaft clavicular fractures, clavicular fracture with skin tenting, clavicular fracture with ipsilateral upper limb injury, clavicular fracture with neurovascular injuries, Floating shoulder (clavicle and scapula neck fracture) and clavicular fracture in the multi-trauma patient were included in operative group (B).

Exclusion criteria:

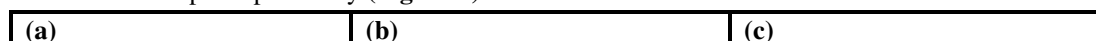
Patients with displaced mid-shaft clavicular fractures > 2cm shortening for conservative group (A). Patients with lateral third and medial third fractures clavicle in operative group (B). All patients were enrolled for history taking, general examination, local examination, radiographic evaluation and laboratory investigations.

Conservative technique:

The immobilization of upper limb of the affected side is done for 3-4 weeks. Self-mobilization of the elbow out of the sling is required several times a day to avoid stiffening of the elbow. The patient sits on a stool the operator standing behind with knee between the patient shoulder blades overlay pads of cotton in each axilla. Demotte bandage 15 cm wide are bound in front of the shoulder and cross between the shoulder blades in such a way that both shoulders are braced back. The limb is supported by a triangular sling under the elbow and forearm.

Surgical Technique:

The patient positioned in the beach chair position and a transverse incision about 8 cm along the anterior superior aspect of the clavicle. The overlying fascia and periosteum are next divided, in line with the clavicle. The division is started medial and lateral to the fracture site and soft tissue is removed from the osseous ends. The periosteum is elevated from the superior aspect of the clavicle and the inferior surface is exposed. About 3.5-mm reconstruction plate is centered accurately over the fracture site so that at least three screws (3.5-mm) can be placed in each of the proximal and distal fragments. A lag screw can be placed into the bone at roughly a 90-degree angle to the fracture line. The myofascial layer is closed with absorbable sutures in an interrupted fashion. The skin is closed with a subcuticular stitch or staples. The incision is infiltrated with local anesthesia 0.5% bupivacaine for post operation pain, and the arm is placed in a standard sling. An antero-posterior radiograph of the clavicle is made post operatively (Figure 1).



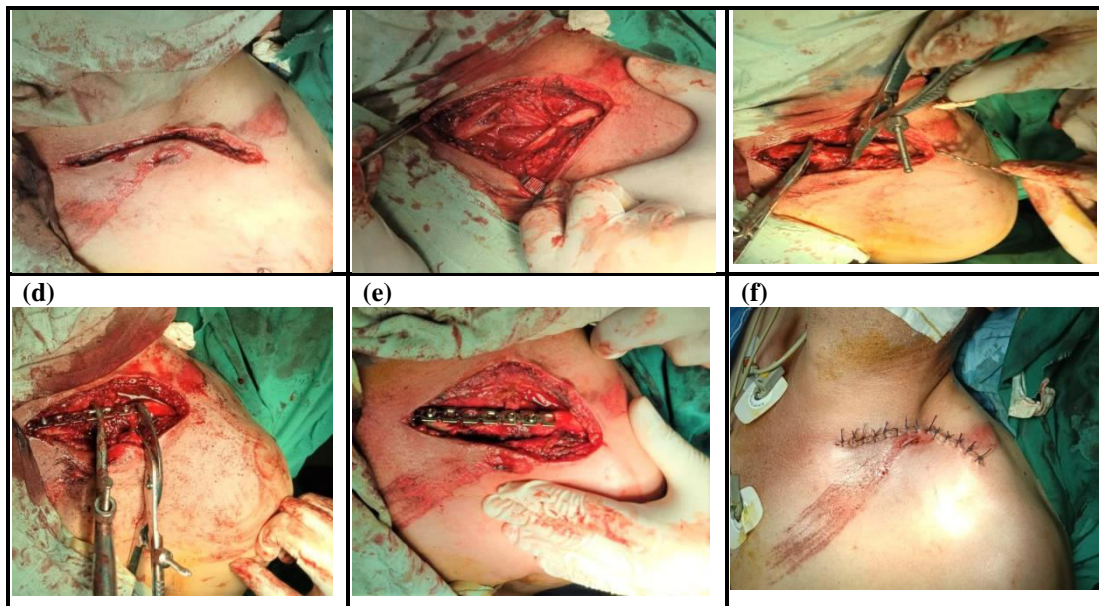


Figure (1): Surgical treatment of displaced mid-shaft clavicular fractures: (a) transverse incision is made along the superior surface of the clavicle, (b) exploration of fracture site, (c) reduction of the fracture, (d) the plate applied and secured by reduction clamp, (e) drilling and tapping then fixing the plate by screws, (f) the skin was closed by interrupted non absorbable sutures.

Follow up & Assessments:

Post-operative care was done by antibiotics, analgesics and anti-edema drugs and continued for 8 days post discharge at home. The injured limb was checked for neurovascular status. Every 2 weeks in first month and half then every month till full union. At 6 weeks post operation anterior posterior x-ray for the clavicle is done and evaluates progress of fracture union. Patients was to remove the sling and start careful full range of motion and start physiotherapy and rehabilitation.

Statistical Analysis:

Data analyzed using Microsoft Excel software and Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represented by mean \pm SD, the following tests were used to test differences for significance; Difference and association of qualitative variable by Chi-square test (χ^2). Differences between quantitative independent groups by t-test, independent predictors by logistic regression. P-value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS:

The present study showed no significant difference regards age distribution. In the mean age in conservative group (A) was 39.55 and operative group (B) was 36.11 (**Figure 2**). Left side was the majority in both groups with no significant difference between groups (**Figure 3**).

Regard Robinson classification 2B1 & 2B2 were the major classes with no significant difference between studied groups (**Figure 4**). Although time of union was shorter among operative cases but there was no significant difference (**Figure 5**).

Regarding Pain assessment, there was no significant difference between groups however surgical group was better and less regard pain (**Table 1**). There was no significant difference between groups however surgical group was better regard Return to ADL (**Figure 6**).

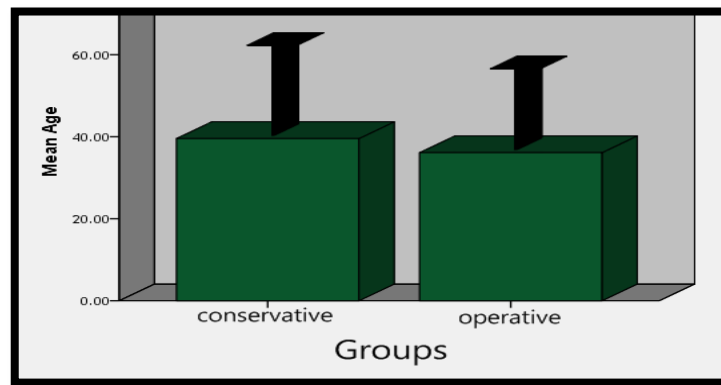


Fig. (2): Mean of Age distribution of both conservative and operative groups.

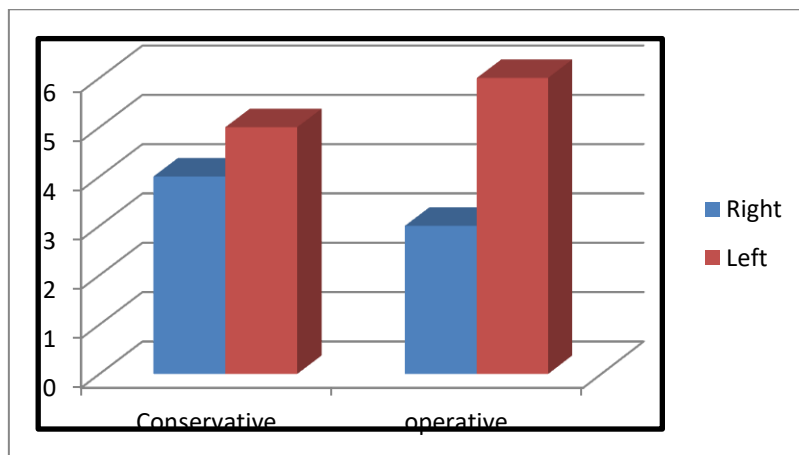


Fig. (3): Side of injury distribution of both conservative and operative groups.

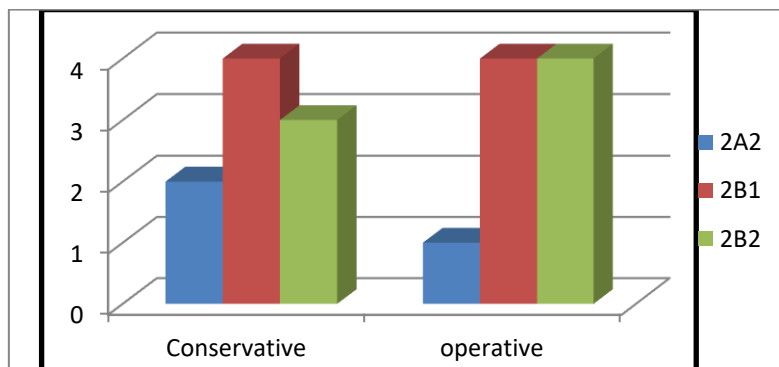


Fig. (4): Patient injury classification according to Robinson classification.

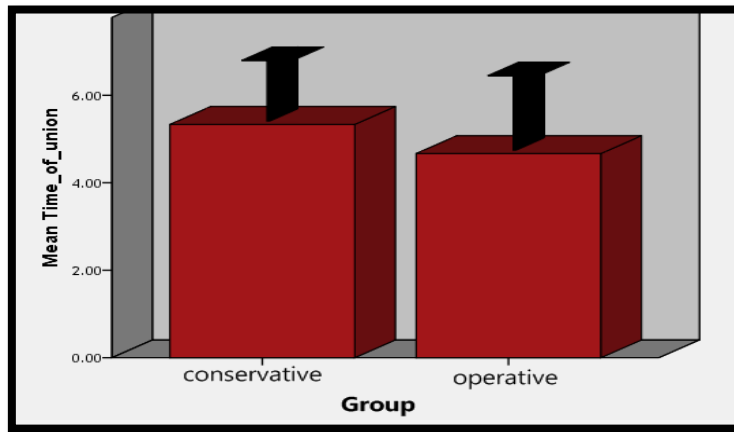


Fig (5): Time of union distribution among conservative and operative groups.

Table (1): Pain assessment distribution between studied groups:

			Conservative (N=9)	Surgical (N=9)	t/ X ²	P
Pain	No	N	2	6	4.66	0.097
		%	22.2%	66.7%		
	Mild	N	2	2		
		%	22.2%	22.2%		
	Moderate	N	5	1		
		%	55.5%	11.1%		
Total		N	9	9		
		%	100.0%	100.0%		

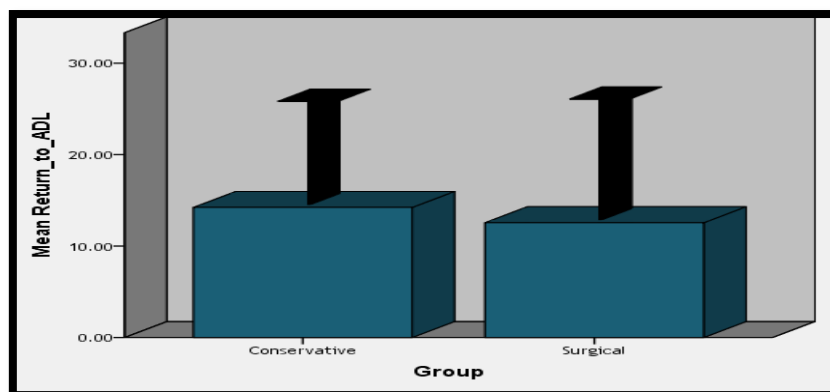


Fig. (6): Mean of return to ADL of conservative and operative groups

DISCUSSION

Non-operative treatment was the established and accepted modality of mid-shaft clavicle fractures. This was evident by extremely low nonunion rates shown by various studies done earlier. However, certain recent studies have shown suboptimal outcomes and a very high nonunion rates when displaced fractures are managed conservatively. Restoration of normal length and alignment by surgical methods can prevent these drawbacks of conservative treatment. Good outcome with high union rates and low complication rates has been reported with various surgical modalities of primary fixation of the displaced fractures (9).

The current study included 18 patients with mid-shaft clavicular fractures. The patients were divided into: group A (9 patients) for conservative treatment and group B (9 patients) for operative treatment by using plate and screw fixation.

Our study showed the mean age of patients in conservative group was 39.55, while in Operative group a mean age was 36.11 with no significant difference regarding age distribution. These in agreement with **Haque et al., (10)** reported the mean age was 31.61 ± 8.32 in Operative Group and 30.58 ± 9.56 in conservative group with no significant difference between both groups. Also, **Naveen et al., (9)** who reported that there was no statistically significant difference between the group 1 (conservative) and group 2 (Operative) with regard to age (35.20) for conservative group and 32.43 for operative, ($p = 0.219$)

The current study showed left side was the majority in both groups with no significant difference between both groups. This in agreement with **Mishra et al., (11)** revealed 12 (33.3%) patients had clavicle fracture on left side and 24 (66.7%) patients had right side clavicle fractures with no significant difference between studied groups

The current study showed Robinson classification 2B1 & 2B2 were the major classes with no significant difference between studied groups. These in agreement with **Jha et al., (12)** stated conservative (group A) was included five patients with 2B1 (50%), and five patients with type 2B2 (50%). Group B (operative) had three patients with type 2B1 (30%), and seven patients with type 2B2 (70%), with no statistically significant difference; p value > 0.05 .

The current study showed the time of union was shorter among operative cases with a no significant difference between studied groups ($P = 0.093$). These agree with **Kale et al., (13)** reported average union time in the conservative group was 9.4 weeks, which was more than the 7.8 weeks seen in the group treated operatively with a significant difference between both groups ($P < 0.05$) Also, **Haque et al., (10)** found the average time for union was 10.18 ± 0.84 weeks in the operative group whereas it was 18.37 ± 2.17 weeks in non-operative group with a significant difference between both groups.

In contrary to our results **Naveen et al. (9)** found the time to union was significantly shorter ($P < 0.05$) in patients treated surgically. The fracture united in 93% of the patients in group 1 (conservative group), whereas all patients had fracture union in group 2 (surgical group). Fracture union was early and seen in more number of patients in group 2 as compared to group 1.

The current study showed no significant difference between groups however surgical group was better and less regard pain. These results are in agree with **Herzog et al. (14)** found the incidence of chronic pain in a pediatric patient population ($n = 20$). Only one patient from the conservative group reported chronic pain. No patients from the operative group reported chronic pain. Therefore, conservative and surgical treatment alike yields similar results. Neither one is more effective than the other in reducing the amount of pain felt by patients

The current study showed no significant difference between groups ($P = 0.576$) however surgical group was better regard Return to ADL. On contrast to our results the study of **Melean et al., (15)** reported that the time until discharge for complete return to work was 3.7 ± 1.1 months for conservative groups and 2.9 ± 0.8 months for operative group with a significant difference between both group ($P = 0.003$).

Also, **Van der Ven (8)** found a significant difference between both groups with regarding the time to return to work or sports. In the operative group, 13 patients (33%) had physically heavy work versus 11 (19%) patients in the conservative group. In the operative group, patients resumed their work in 2.3 ± 1.9 versus 4.1 ± 3.1 weeks ($p=0.002$).

CONCLUSION:

Conservative treatment remains the treatment of choice for simple undisplaced mid-shaft clavicle fractures, for displaced and comminuted fractures the surgical intervention gives better outcomes and early functional recovery in young active adults.

No conflict of interest.

References:

- 1- Nowak, J; Mallmin, H; and Larsson, S. (2000). The aetiology and epidemiology of clavicular fractures: a prospective study during a two-year period in Uppsala, Sweden. *Injury*, 31(5), 353-358.
- 2- Zlowodzki, M; Zelle, B. A; Cole, P.A; and et al. (2005). Treatment of acute midshaft clavicle fractures: systematic review of 2144 fractures: on behalf of the Evidence-Based Orthopaedic Trauma Working Group. *Journal of orthopaedic trauma*, 19(7), 504-507.
- 3- Ward .L; Cohn .J; and Coupe. K. editors.(1988). Incidence of concomitant brachial plexus injury with ipsilateral clavicle fracture. Annual Meeting of the Orthopaedic Trauma Association. Canada, Poster 64.
- 4- Schimpf, M., Neira, C., & McFarland, E. G. (1999). The deceptive nature of clavicle fractures in young patients. *The Physician and Sportsmedicine*, 27(3), 119-128.
- 5- Miller: Mark, D: SRTMMF: and et al. (2013). "Review of Orthopaedics 2nd Edition." 265-271.
- 6- Chen, Y. F., Wei, H. F., Zhang, C., and et al. (2012). Retrospective comparison of titanium elastic nail (TEN) and reconstruction plate repair of displaced midshaft clavicular fractures. *Journal of shoulder and elbow surgery*, 21(4), 495-501.
- 7- Assobhi, J. E. (2011). Reconstruction plate versus minimal invasive retrograde titanium elastic nail fixation for displaced midclavicular fractures. *Journal of Orthopaedics and Traumatology*, 12(4), 185-192.
- 8- Van der Ven Denise, J. C; Timmers, T. K; Flikweert, P. E; and et al. (2015). Plate fixation versus conservative treatment of displaced midshaft clavicle fractures: functional outcome and patients' satisfaction during a mean follow-up of 5 years. *Injury*, 46(11), 2223-2229.
- 9- Naveen BM, Joshi GR, Harikrishnan B. Management of mid-shaft clavicular fractures: comparison between non-operative treatment and plate fixation in 60 patients. *Strategies Trauma Limb Reconstr* 2018; 12(1): 11-18.
- 10- Haque M, Ahmed M, Hossain M, Faisal M, Islam M, Haque S et al. Operative versus Conservative Treatment for the Management of Displaced Midshaft Clavicle Fractures in Adults. *JAFMC Bangladesh* 2017; 13 (1) : 81-85.
- 11- Mishra A, Kumar D, Yadav A, Pandey D, Sinha A. Functional outcome of conservative versus plate osteosynthesis in displaced midshaft clavicle fracture in manual labours. *Int Surg J* 2017; 4(3): 966-970.

12- Jha G, Timsina P, Yadav D, Lamichhane S, Jha S. Conservative Vs Operative Management of Displaced Midshaft Clavicle Fracture-A Comparative Study. *Biomed J Sci Tech Res* 2018; 11 (1): 8293-8303.

13- Kale S, Chaudhari P, Dhar S, Mukherjee S, Ali S. A Comparative Study of the Conservative and Operative Management of Midshaft Clavicle Fracture based on Functional Outcome and Post-Operative Complications. *Int J Contem Med Res* 2016; 3(10): 2819-23.

14- Herzog M, Whitesell R, Mac L, Jackson M, Culotta B, Axelrod J et al. Functional outcomes following non-operative versus operative treatment of clavicle fractures in adolescents. *J Child Orthop* 2017; 11(4): 310-317.

15- Melean PA, Zuniga A, Marsalli M, Fritis NA, Cook ER, Zilleruelo M et al. Surgical treatment of displaced middle-third clavicular fractures: a prospective, randomized trial in a working compensation population. *J Shoulder Elbow Surg.* 2015; 24(4):587-92.