

## Operative Treatment by Plate and Screws Versus Conservative Treatment of Closed Displaced Fracture of the Mid Third of Clavicle in Adults: Comparative Study

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### ABSTRACT:

#### BACKGROUND:

Clavicle fractures are common injuries in young active individuals, the mid third of the clavicle is most commonly fractured part(80% of clavicle fracture)

#### OBJECTIVE:

To compare the outcomes of operative and non operative management of displaced and or comminuted closed fracture of the mid third of clavicle in young adults

#### PATIENTS AND METHODS:

This prospective observational study of 24 patients of fracture of the mid third of the clavicle was conducted in Alkindy teaching hospital from July 2015 to January 2017 and divided into two groups; one managed by operative treatment with plate and screws and the other by non operative sling immobilization after taking the consent and the patients were seen at 2, 4, 6 weeks, 3, 6, and 9 months

#### RESULTS:

The mean time of functional recovery in the operative group was 3.75 weeks while in the non operative group was 8.09(P value=0.005) which is highly significant, the mean time of fracture healing(radiological union) in the operative group was 14.25 while in the non operative group was 28.72 with P value 0.005 which is statistically highly significant, there was no significant differences between the two groups in the range of movements although the adduction was better in the operative group but not significant P value=0.120, the DASH score was 11.25, 22.25 in the operative and non operative group respectively which is highly significant P value=0.005.

#### CONCLUSION:

Operative fixation of the clavicle results in improvement in the functional outcome, shorter time of union, lower complication rate in 9 month follow up .

**KEY WORDS:** mid third fracture clavicle, non operative , operative treatment.

### INTRODUCTION:

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 (footballs, hockey) are frequent, and they account for approximately 2.6% of all fractures.<sup>(1,2,3,4,5)</sup>

In one study the annual incidence in males was highest in the under 20 age group, decreasing with each subsequent age cohort the incidence in females was more constant, with peaks seen in teenager(sports, motor vehicle accidents) and the elderly (osteoporotic fractures from simple falls).<sup>(6)</sup>

The majority of clavicle fractures(80% to 85%) occur in 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.<sup>(7,8)</sup>

Lateral third fractures are second most common type (15% to 20%) and although they can result from the same mechanisms of injuries as that seen in mid shaft fractures they occur in more elderly individuals from simple falls.<sup>(9,10)</sup>

In fracture of the mid third of the clavicle the medial clavicular fragment is elevated by the sternomastoid muscle while the distal fragment is held inferiorly by the deltoid and medially by the pectoralis major.<sup>(11)</sup>

Several classifications for fracture clavicle like Allman classification<sup>(12)</sup>, also Neer divided distal clavicle fractures into three subgroup<sup>(13,14)</sup> and AO/OTA Fracture and Dislocation Classification which we depend on this

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classification, the clavicle is designated as segment 15.<sup>(12)</sup> Fig 1

For many years the standard of care in North America is Nonoperative Treatment by the “figure-of-eight” bandage.<sup>(15)</sup>

Several indications for primary fixation of mid third of clavicle fractures include ,Displacement 2 cm, Shortening 2 cm, Increasing comminution (3 fragments), segmental fractures, open fractures, impending open fractures with soft tissue compromise, obvious clinical deformity

and associated injuries like vascular injury requiring repair, progressive neurologic deficit, ipsilateral upper extremity injuries/fractures, multiple ipsilateral upper rib fractures, “floating shoulder” and bilateral clavicle fractures<sup>(16)</sup>

Two common surgical approaches applicable to the fixation of clavicle fractures, each with its own advantages and disadvantages, anteroinferior<sup>(17)</sup> and Anterosuperior<sup>(18)</sup>

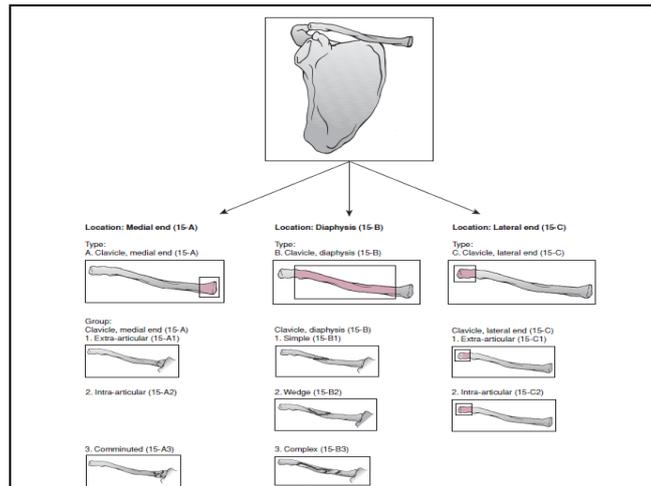


Figure 1: AO/OTA classification of clavicle fracture<sup>(12)</sup>

### AIM OF STUDY:

To compare the outcomes of operative and non operative management of displaced and or comminuted closed fracture of the mid third of clavicle in young adults

### PATIENT AND METHODS:

This prospective observational study of 24 patients with closed displaced or comminuted fracture of mid-shaft of the clavicle in adults was conducted in the orthopedic department of Alkindy teaching hospital after taking the informed consent of the patients in a time from July 2015 to January 2017.

The patient were divided into two groups; the first group with 12 patients (11 males and only one females) are managed by operative fixation with open redaction and internal fixation by pre reconstruction plate and screws and the second group with 12 patients (10 males and 2 females) are managed by conservative treatment with sling immobilization. The cause of conservative treatment decision was patient refusal in 10 patients and anesthetic contraindications in 2 patients.

Distribution of patients according to the number, age, sex, injured side, and AO classification are discussed in the table (1)

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**Table 1: Descriptive data(number, mean age, sex, injured side, AO classification, and mechanism of injury).**

Data	Operative	Non operative
Number	12	12
Mean age, range	29.75,(17-45)	30.38(19-48)
Sex		
Male	11	10
Female	1	2
injured side		
right	6	5
left	6	7
AO classification		
15B1	2	3
15B2	8	7
15B3	2	2
Mechanism of injury		
RTA	8	7
Fall on the hand	3	5
Direct fist	1	-

Inclusion criteria:

1. Age between 17 and 50 years old.
2. Closed fracture.
3. Displaced or comminuted fracture.

Exclusion criteria:

1. Pathological fractures
2. Nonunion
3. Open fractures
4. Fractures in children
5. Associated injuries
6. Previous scar
7. Undisplaced fractures

The patients in the two groups are subjected to proper history taking and clinical examination.

All patients have AP view of the involved shoulder with the patient standing and the direction of beam 20 degree cephalic with cassette behind the shoulder.

For non operative group (12 patients) sling was applied to the injured shoulder and patients were encourage to move the joints of the hand, wrist, and elbow from the first day, after 14 days passive exercises with the arm to the side (pendulum exercise) were started and after 6 weeks resisted exercises after removal of the sling were started, While those group with operative treatment (12 patients) prophylactic antibiotics (ceftriaxone 1 g) was given 1 hour pre

induction, general anesthesia was used, The patients were positioned in the semi setting position .

We consider the anterosuperior approach in all the operative cases, because several biomechanical studies that have suggested that the optimal location for plate placement is superior. after incision the myofascial layer over the clavicle was incised and elevated in one continuous layer ,a reconstruction plate 3.5 mm of sufficient length is then applied to the superior surface, the plates were contoured with the aid of plate benders, following fixation, closure of both soft tissue layers with interrupted, nonabsorbable sutures then dressing was done. Fig (1).

Postoperatively , the arm was placed in a standard sling for comfort , the wound was checked and stitches remove after 14 days ,the sling was discontinued, and unrestricted range-of-motion exercises were allowed, but no strengthening, resisted exercises, or sporting activities were allowed at 6 weeks postoperatively, radiographs were taken to ensure bony union.

Contact sports avoided for 12 weeks postoperatively.

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**Figure 1: Preoperative intraoperative and postoperative x ray of 35 years male with fracture right clavicle.**

Follow up ,all patients in both groups were seen after 2 weeks, 4 weeks, 6 weeks, and 3 months and 6 months postoperatively and the following parameters were assessed:

1. Time taken for functional recovery: pain free movements in all directions
2. time taken for fracture healing(radiographic union):bridging callus or absence of fracture line
3. range of motion of the shoulder joint
4. Specific complications (nonunion ,symptomatic malunion, droopy shoulder, and decrease range of motion were the possible complications.)
5. Disabilities of the Arm, Shoulder ,and Hand(DASH score)

### RESULTS:

The mean time for functional recovery in the operative group was (3.75 weeks), while in the

non operative group was( 8.09 weeks ) . (P value=0.005)

The mean time for fracture healing which was documented radio graphically in the operative group was( 14.25 weeks), while in the non operative group was (28.72 weeks)(P value=0.005). Radiological union was defined as visible bridging callus or absence of a visible fracture line.

Disabilities of the , Shoulder, Arm and Hand in the operative group were significantly superior (11.25)than in the non operative group(22.25) at all times till final follow up,( P value=0.005 ).

The following table demonstrate the difference in the two groups regarding the time of functional recovery, time of radiological union. and DASH score tab 2

**Table 2: Difference in the two groups in the mean time of functional recovery, mean time of fracture healing, and mean DASH score.**

	Operative	Non operative	P value
Time of functional recovery(mean)	3.75	8.09	0.005
Time of fracture healing(mean)	14.25	28.72	0.005
DASH score(mean)	11.25	22.25	0.005

Regarding the range of movements there was no significant differences between the two groups in abduction , flexion ,extension, internal rotation . and external rotation except in the adduction; patients in the operative group have better range

of adduction than the non operative group; the mean range of adduction was 32.91 in the operative group and 22.12 in the non operative group ( P value=0.120) which is statistically not significant. Tab 3

**Table 3: Range of movement in both groups (mean).**

Movement	Operative group	Non operative group	P value
Abduction	165.83	164.16	1.000
Adduction	32.91	22.9	0.120
Flexion	103.33	99.5	0.025
Extension	41.66	41.11	1.000
Internal rotation	72.08	69.58	0.800
External rotation	80.16	78.33	0.870

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Complications in the operative group were incisional numbness in one patient (8.33%) and hard ware irritation in one patient(8.33%).

Complications in the non operative group were non union in one patient (8.33%), symptomatic

mal union in 4 patients( 33.33%), droopy shoulder in 2 patients (16.66%), complex regional pain syndrome in 3 patients(25%).tab 4

**Table 4 : Complications in both groups.**

Complications	Operative group	Non operative group
Non union	-	1
Symptomatic mal union	-	4
Droopy shoulder	-	2
Complex regional pain syndrome	-	3
Hard ware irritation	1	-
Incisional numbness	1	-

### DISCUSSION:

The mean time for fracture healing (radiological union) was shorter in the operative group ( mean= 14.25 weeks ) than the non operative group ( mean= 28.72 weeks ) so we agree to the study of McKee MD et al <sup>(19)</sup> who described the mean time for fracture healing were 14 to 16 weeks in the operative patients and 24 to 28 weeks in the non operative patients , also our study showed the same results in a study of Canadian Orthopedic Trauma society <sup>(20)</sup> which reported that the mean time to radiographic union was 28.4 weeks in the non-operative group compared with 16.4 weeks in the operative group. In other study of Shen WJ <sup>(21)</sup> the mean time of radiological union in the operated patients by plating was 10 weeks.

The complications in the non operative group include non union in one case (8.33%), symptomatic mal union in 4 cases (33.33%), droopy shoulder in 2 cases (16.66%) and complex regional pain syndrome in 1 case (8.33%), while the complications in the operative group include hard ware irritation in one cases (8.33%) and incisional numbness in one case (8.33%), this parallel to the complications data from Canadian Orthopedic Trauma society reports <sup>(22)</sup>, these data reported two non unions in the operative group compared with seven in the non operative group. Symptomatic mal union developed in nine patients in the non operative group and in none in the operative group. Most complications in the operative group were hardware-related (five patients had local irritation and/or prominence of the hardware, three had a wound infection, and one had mechanical failure). At one year after the injury, the patients in the operative group were more likely to be

satisfied with the appearance of the shoulder with the shoulder in general than were those in the non operative group in one hundred and eleven patients (sixty-two managed operatively and forty-nine managed non operatively) completed one year of follow-up

Zlowodzki et al.<sup>(8)</sup> found that the nonunion rate for non operatively treated displaced mid shaft clavicle fractures was 15.1% and 2.2% for the operatively treated patients while in our study the rate of non union was lower in both groups and this difference may be due to number of patients included in our study

McKee MD et al <sup>(19)</sup> reported non union in the non operative group were 14-24% and this results were not highly different from our results about the non union(8.33%) and the cause of this difference may be due to the difference the number of the samples that included in each study.

In a study of Robinson <sup>(18)</sup> the rate of nonunion was significantly reduced after open reduction and plate fixation (one nonunion) as compared with non operative treatment (sixteen non unions) : In a prospective, multicenter, stratified, randomized controlled trial, 200 patients between sixteen and sixty years of age who had an acute displaced midshaft clavicle fracture were randomized to receive either primary open reduction and plate fixation or nonoperative treatment. and this results were not different to our results

No infection was seen in the operative group, and no iatrogenic pulmonary injuries were reported . All surgical wounds healed at 14 post operative days, none of the operative patients developed neurovascular injuries and only one case of non

union that developed were treated by plating and bone graft after 9 months

The DASH score in the operative group was superior (mean=11.25) than in the non operative group (mean=22.25), which is not greatly different to a study of Mirzatooei F<sup>(22)</sup> which reported that the mean DASH score for the operative and non operative groups were 8.6 and 21.3, respectively.

Regarding the range of movements no difference between the two groups in abduction, flexion, extension, internal rotation, and external rotation, the operative group shows better range in adduction (mean=32.9) than the non operative group (mean=22.9) which is statistically not significant and this is similar to the result of Wang et al<sup>(23)</sup> and Duan et al<sup>(24)</sup>.

#### CONCLUSION:

Operative fixation of displaced mid third clavicle fracture results in improved functional outcome, shorter time for union, lower complication rate, and early return to patient activity level compared with the non operative group at 6 months of follow up and primary operative intervention in displaced and comminuted fracture of the mid third of the clavicle in adult may be of immense importance.

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