

## Comparing non-operative management and surgical fixation in treatment of clavicle fractures

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### Abstract:

**Background:** Clavicle fractures are common among males from sport injuries and the non-operative treatment has been indicated as treatment of choice. Recently, delayed healing, pain and shoulder weakness have reported as frequent complications of non-operative treatment and many studies found better outcomes with surgical treatment. This review aimed at evaluating evidence that compared non-operative treatment and surgical intervention in management of clavicle fractures to provide evidence-based data about the best modality of treatment aiming to improve patients' outcome. **Methods:** A web-based search was achieved in MEDLINE resulted in 40 eligible studies. The reference lists of the articles and reviews were screened for relevant articles. After exclusion of irrelevant, duplicated and review studies, 7 studies were included in this review. **Results:** The outcome and success after surgical intervention compared to non-operative treatments was reported in all of the included studies. Most of the interventional studies found significant improvement in the surgical in treatment, while the majority of the non-operative group showed no improvement. **Conclusions:** The review of the evidence suggested that use of surgical fixation in treatment of clavicular fracture is superior to the non-operative treatment if there are no contraindications to the surgery.

**Keywords:** Clavicle, Fracture, Management, Surgical, Healing

### Background:

The clavicle fractures are common fractures in the upper limb, accounting for 2.6 to 10% of all fractures and about 44.1% of the upper limb fractures<sup>(1, 2)</sup>. Clavicle fractures are common among males from sport injuries. The most common cause of clavicle fracture in adults is falling down, while sport injuries is the most common cause in young and teenagers<sup>(3)</sup>.

Majority of the clavicular fractures occur in the mid shaft, and most of these fractures are displaced<sup>(4, 5)</sup>. The mid shaft fractures is thought to occur as a result of direct trauma<sup>(3)</sup>. Habitually, non-operative treatment is a treatment of choice in mid shaft clavicle fractures<sup>(6, 7)</sup>. The non-operative treatment for the clavicle fractures has good outcome<sup>(8)</sup>.

Recently it was noted that; the non-operative management of clavicular fractures result in high nonunion rates, especially in displaced fractures. Furthermore, the non-operative treatment is found to be associated with delayed healing, pain and shoulder weakness<sup>(9, 10)</sup>. Surgical treatment in the past is indicated in presence of open fractures or fragments dislocation<sup>(11, 12)</sup>. Recently, many

studies found the surgical treatment for clavicle fractures has better outcomes<sup>(1, 13, 14)</sup>.

This review aimed at evaluating all the studies that compared non-operative treatment and surgical intervention in management of clavicle fractures to provide evidence-based data about the best modality of treatment aiming to improve patients' outcome.

### Methods:

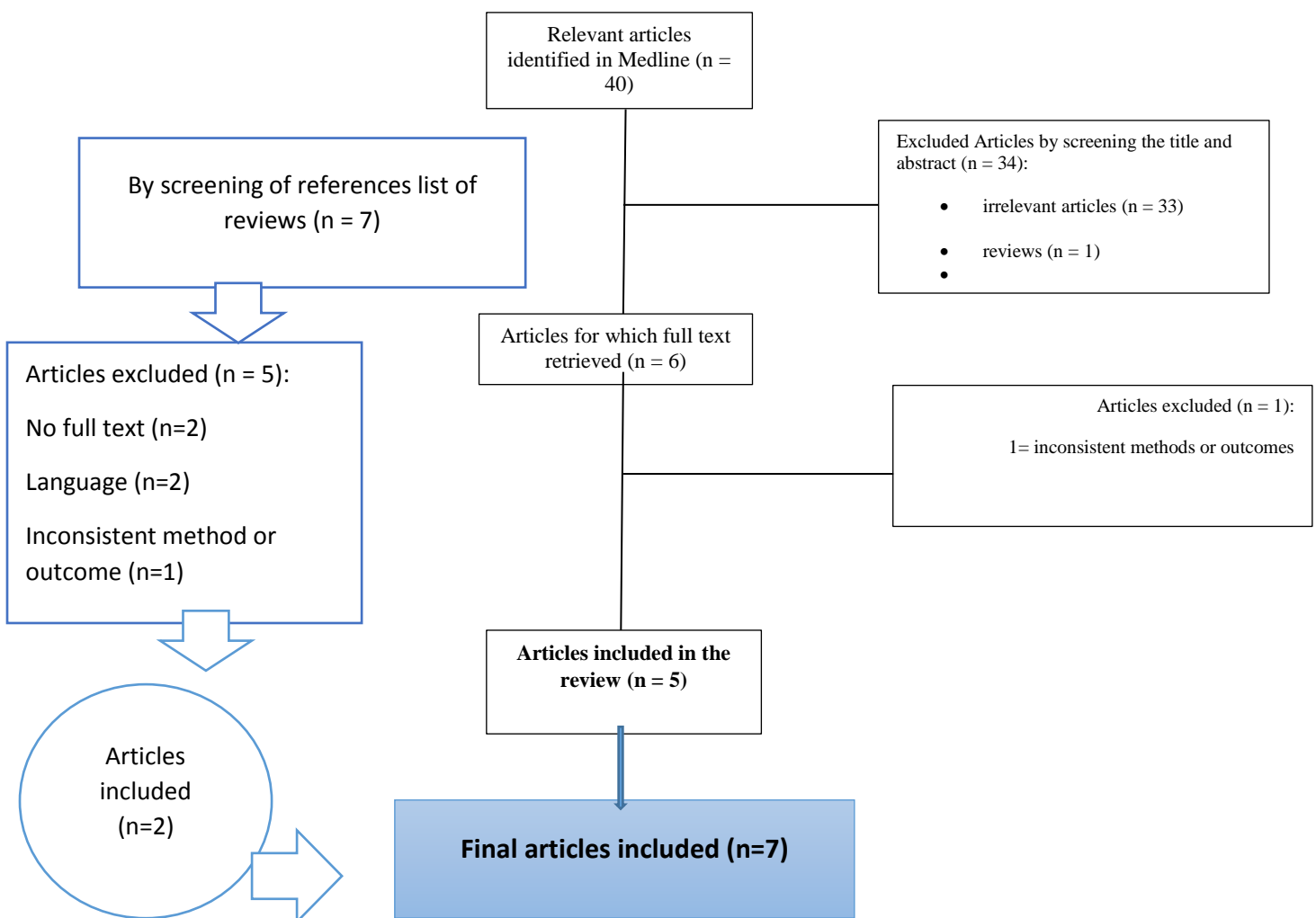
A web-based search was achieved in MEDLINE using the following search strategy "clavicle fracture" AND ("threaded Kirschner wire " OR open fixation OR fixation) AND (non-operative OR nonoperative OR non-surgical OR nonsurgical) AND (failure OR breakage OR success OR cure OR healing OR union OR complications OR osteomyelitis) which resulted in 40 studies. The reference lists of the articles and reviews were screened for relevant articles. After exclusion of irrelevant, duplicated and review studies, 7 studies were included in the review as they met the inclusion criteria, Figure (1). Included studies aimed at comparing the surgical treatment of clavicle fracture with the non-operative management.

**Results:**

Out of the 7 studies 2 were prospective non-randomized comparative trials <sup>(14, 15)</sup>, one retrospective cohort study <sup>(1)</sup>, one prospective cohort trial <sup>(13)</sup>, one Retrospective observational study <sup>(16)</sup> and the two were prospective randomized controlled clinical trials <sup>(17, 18)</sup>. The total sample size was 439 patients with clavicular fractures. The minimum age was 12 years and the maximum age was 70 years old.

Regarding the location of the fracture, all of the included studies involved patients with mid shaft clavicle fracture <sup>(1, 13-18)</sup>. A study recruited 60 patients with completely displaced mid-

shaft clavicle fracture <sup>(14)</sup>, while two studies included patients diagnosed with displaced mid shaft clavicle fracture <sup>(13, 15)</sup>. Only 4 of the included studies reported the methods that were used in the classification of the fracture <sup>(1, 14, 17, 18)</sup>. The causes of the clavicle fracture include RTA, fall and sports injury were the mechanisms of the trauma that lead to clavicle fracture <sup>(14)</sup>. In addition to RTA and falls injuries, studies reported bicycling and skiing as a causes of clavicle fractures <sup>(13)</sup>. Also, direct trauma were the mechanisms of the trauma in one included study <sup>(15)</sup>. Main sport injuries accrued in football, wrestling, skateboard, soccer, bicycle, and hockey <sup>(16)</sup>.



**Table (1): The findings of the included studies regarding management of clavicle fracture**

Reference (author year) by EndNote	Study design	Sample size	Age of patient	Type and location of fracture	Classification of the fracture	Mechanism of trauma lead to clavicle fracture	Surgical intervention	Details of non-operative management	Follow-up period	Success after surgical intervention	Success of non-operative
<i>Coppa et al.</i> <sup>(11)</sup>	Retrospective cohort study	58	Mean age 38.35 years	Mid shaft clavicle fracture	Allman's radiographic classification system (1b & 1c)	Not reported	Kirschner wire	Figure-of-eight bandage	mean follow-up of 48 months	Reduction in Displacement in 25 (89.29%) & only 3 (10.71%) cases not improved (p = 0.032)	6 cases (20.69%) improved, 23 cases (76.67%) not improved (p = 0.464)
<i>Naveen et al.</i> <sup>(14)</sup>	Prospective non-randomized comparative trial	60	20 – 50 years	Completely displaced mid-shaft clavicle fracture	Allman's radiographic classification system (Robinson type 2b)	RTA, fall, Sports injury	Plate fixation	Figure-of-eight bandage and a sling	6 months	100% (all patients had fracture union)	93%
<i>van der Ven Denise et al.</i> <sup>(13)</sup>	Prospective cohort trial	97	16 - 70 years Mean age 40.6 +/- 14.3	Displaced mid shaft clavicle	Not reported	RTA, fall, sport, Bicycling & skiing	Applying the VA-LCP anterior locking compression plate, and sling post operatively	Use of standard sling for two weeks	5 years	DASH and Constant Scores at six weeks were significant better (90.9 +/- 14.2 and 15.7 +/- 17.2)	DASH and Constant Scores at six weeks (78.7 17.0 and 24.8 16.7)
<i>Khorami et al.</i> <sup>(15)</sup>	Prospective non-randomized clinical trial	65	18-60 years	Displaced clavicle mid-shaft fractures	Not reported	Traffic accidents, direct trauma, falling down.	Plate fixation (3-5 mm DCP plate with at least six cortical screws)	figure-of-eight bandage	6 months	Average durations of union 19.3 weeks. with non-union rate= 5.7%	Average durations of union 24.4 weeks with non-union rate= 13.3%
<i>Vander Have et al.</i> <sup>(16)</sup>	Retrospective observational study	42	Mean age 15.4 (12 – 18)	Midshaft Clavicle Fractures	Not reported	Skateboard, Wrestling, Football, Bicycle, Fell off bike, motor vehicle accident, Hockey, Soccer.	Plate fixation	Sling or figure-of-8 brace	Not reported	Mean time to radiographic union 7.4 weeks	Mean time to radiographic union 8.7 weeks
<i>Judd et al.</i> <sup>(18)</sup>	Prospective, randomized study	57	17 – 40 years	Mid shaft clavicle fractures	Single Assessment Numeric Evaluation (SANE)17 and L'Insalata 18 shoulder scores	Motorcycle or motor vehicle accident, contact-sports injury, bicycle accident, fall.	Open reduction and internal fixation (ORIF)	Sling and restricted activity	1 year	Alignment with healing after 1 year 86%	Alignment with healing after 1 year 11%
<i>Smekal et al.</i> <sup>(17)</sup>	Prospective randomized Controlled Clinical Trial	60	18 – 65 years	Mid shaft Clavicle Fractures	OTA classification system	Fall, Traffic accident, Bicycle accident, Sports accident.	ESIN	Simple shoulder sling	2-year	100 % (union was achieved in all patients)	Union in 70 % , 30% nonunion

## Discussion:

Treatment of clavicle fractures can be surgical or non-surgical. This review included all randomized and non-randomized trials that compared surgical and non-operative treatment of clavicular fractures, aiming to improve the patients' outcome by using the best modality of treatment.

Regarding the type of the surgical intervention, plate fixation was used in three of the included studies<sup>(14-16)</sup>. Coppa *et al.* used kirschner wire in their study<sup>(1)</sup>. Van der Ven Denise *et al.* applied in their study the VA-LCP anterior locking compression plate, and used sling after the operation<sup>(13)</sup>. Judd *et al.* used in their study open reduction and internal fixation<sup>(18)</sup>. In Smekal *et al.* study, elastic stable intramedullary nailing (ESIN) is the surgical procedure that used in treatment of the mid shaft clavicle fractures<sup>(17)</sup>.

Regarding the non-operative management figure-of-eight bandage was used in four studies<sup>(1, 14-16)</sup>. Vander Have *et al.* used in addition to figure-of-eight, a sling to some patients<sup>(16)</sup>. The rest of three included studies used sling to their non-operative groups<sup>(13, 17, 18)</sup>.

Six of the included studies reported the follow up period of their included patients. Two studies followed the patients for 6 months<sup>(14, 15)</sup>, one study followed the patients for one year<sup>(18)</sup> and other one study followed the respondents for 2 years<sup>(17)</sup>. Coppa *et al.* reported in their study that; the mean follow up period was 48 months<sup>(1)</sup>. Van der Ven Denise *et al.* followed the patients for 5 years<sup>(13)</sup>.

The outcome and success after surgical intervention compared to non-operative treatments was reported in all of the included studies. In Coppa *et al.* study, there was significant improvement in the surgical group, while the majority of the non-operative group showed no improvement<sup>(1)</sup>. Naveen *et al.* reported in their study that; all patients in the surgical group showed reduction and the duration of reduction was shorter in this group<sup>(14)</sup>. Van der Ven Denise *et al.* reported in their study that; operative fixation to clavicle fracture has positive effects in reducing the pain and early reduction when compared to non-operative treatment<sup>(13)</sup>. In Khorami *et al.* and Vander Have *et al.* studies, the non-union rates were lower in the operative group<sup>(15, 16)</sup>. Vander Have *et al.* also reported fewer

complications in the operative group<sup>(16)</sup>. Judd *et al.* reported in their study that; surgical intervention in clavicular fracture result in higher functional rate at short term follow up<sup>(18)</sup>. In Smekal *et al.* study, the surgical intervention resulted in fewer nonunion cases, early reduction and return to daily activities and higher functional outcome<sup>(17)</sup>.

By reviewing the outcome of the included studies it was noted that; surgical intervention in treatment of clavicular fractures result in significant improvement<sup>(1)</sup>, early reduction<sup>(14, 16, 18)</sup>, fewer non-union<sup>(14, 15, 17)</sup>, pain reduction<sup>(13)</sup>, early return to daily activity<sup>(17)</sup>, better functional outcome<sup>(13)</sup> and fewer complications<sup>(16)</sup> when compared to non-operative treatment. This means that if there is no contra indications surgical treatment of the clavicle fracture is the preferred treatment.

The most common types of surgical intervention in treatment of clavicular fractures is plate fixation<sup>(14-16)</sup>. Also open reduction and internal fixation<sup>(18)</sup>, kirschner wire<sup>(1)</sup> and VA-LCP anterior locking compression plate<sup>(16)</sup> and elastic stable intramedullary nailing (ESIN)<sup>(17)</sup> are used in treatment of clavicle fractures. Regarding the non-operative treatment of the clavicle fracture, figure-of-eight bandage is the most common used method<sup>(1, 13-15)</sup>, followed by sling<sup>(13, 16-18)</sup> and restricted activity<sup>(18)</sup>.

Road traffic accidents, fall, sport injuries, bicycling and motor vehicle accidents are the most common reported causes of clavicle fractures<sup>(13-18)</sup>. Many classifications are used to diagnose clavicle fractures include: Allman's radiographic classification system<sup>(1, 14)</sup>, OTA classification system<sup>(17)</sup>, single assessment numeric evaluation (SANE) 17 and L'Insalata 18 shoulder scores<sup>(18)</sup>.

## Conclusions:

The review of the evidence suggested that the use of surgical fixation in treatment of clavicular fracture is superior to the non-operative treatment if there are no contraindications to the surgery.

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