

Surgical management of fractures of the lateral third of the clavicle

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Abstract

Background

Fractures of the distal third of the clavicle are comparatively rare, accounting for only 21–28% of all clavicle fractures. Due to the rupture of the coracoclavicular (CC) ligaments, Neer Type II fractures are defined as unstable fractures, which have been shown to exhibit high non-union rates, ranging from 20–44%, resulting in complications such as persisting pain and limited range of motion (ROM). In this study, the method of fixation used was fixation by K wires

Objective

The aim of this study is to evaluate the results obtained with the use of k-wires fixation after lateral third clavicle fracture Neer type II in adults. Functional results will be assessed with using the constant shoulder score system.

Patients and Methods

This prospective study included 10 patients (mean age, 26.7±5.6 years) with acute lateral third clavicle fracture Neer type II treated with k-wires fixation in the department of Orthopedics at Al-Azhar university hospital (Bab El shearia hospital) between the period of January 2017 and February 2018, with a mean follow up of 7.5±1.5 months. Variables of each patient were recorded and analyzed with respect to age, sex, fracture type, mode of injury, limb involvement, associated injuries, follow up, complications and final outcomes.

Results

As regarded 10 patients in this study the median constant shoulder score system was 92.7 (range 85-98).

Conclusion

k-wires fixation is an excellent treatment for fractures of lateral third of the clavicle.

Keywords

clavicle, k-wires, lateral third.

Introduction

The clavicle is an s-shaped bone that serves as the only direct bony attachment of the arm to the trunk. The medial portion of the clavicle has a tubular cross section, resists axial loading, and protects the brachial plexus and other structures in the costoclavicular space. The flat lateral portion provides sites for muscle and ligament attachment. The transition between the two sections is relatively weak and at risk of fracture when the bone is overstressed.[1]

The largest epidemiologic studies of clavicle fractures were conducted in Britain in 1998 and Sweden in 2000. In these studies, 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.[2]

Clavicle fractures account for approximately 5% to 10% of all fractures and 35% of fractures in the shoulder region.

The clavicle is particularly vulnerable to fracture because of its subcutaneous position, the sparse medullary bone in the mid-shaft, and its inability to handle axial compression because of its S-shape.[3]

Fractures of the distal third of the clavicle are comparatively rare, accounting for only 21–28% of all clavicle fractures. Due to the rupture of the coracoclavicular (CC) ligaments, Neer Type II fractures are defined as unstable fractures, which have been shown to exhibit high non-union rates, ranging from 20–44%, resulting in complications such as persisting pain and limited range of motion (ROM).[3]

Therefore, primary open reduction and internal fixation (ORIF) is usually recommended for these injuries. Surgical treatment, however, is associated with a considerable rate of postoperative complications.[4]

There is a wide variety of treatment options for Neer

type II fractures, all of them based on the particular deformity and lack of stability[5].

The aim of this study is to evaluate the radiological and functional results of using k-wires fixation in treatment fractures of lateral third of the clavicle ,identify and report complications and return to work time of patients after surgical treatment of distal clavicular fracture.

Patients and Methods

From January 2017 to February 2018, ten adult patients with recent lateral third clavicle fracture Neer type II were treated with k wires fixation at Al-Azhar university hospital (Bab El shearia hospital), Cairo, Egypt. The clinical outcomes were calculated according to Constant shoulder score system.

The inclusion criterion was that patients sustained recent lateral third clavicle fracture Neer type II with no previous surgical treatment. The exclusion criteria were pathological fractures, deteriorated general health of the patient as in case of chronic liver or renal diseases and bad skin condition.

The age of patients ranged between 16 and 34 years (average age 26.7 ± 5.6).seven men (70%), and three women (30%). Four patients (40%) had fractures of their dominant right sided clavicle, while left clavicle fractures involved in six patients (60%). (As regard mode of trauma, road traffic Accident was 50% while fall from height was 30%, and fall on an outstretched hand was 20% of studied patients. Six patients were operated within one week after injury, while four cases were operated within two weeks of trauma. Displaced distal clavicular fracture was the main indication for surgery. (Table-1)

Tab. 1: Demographics and characteristics of studied patients.

Age (years)	Mean \pm SD	26.7.5	\pm 5.6
Sex	Male	7	70%
	Female	3	30%
Affected side	Lt. Side	6	60%
	Rt. Side	4	40%
Mode of trauma	RTA	5	50%
	Fall from height	3	30%
	Fall on outstretched hand	2	20%

Surgical Technique

The patient is placed in the semi sitting "beach-chair" on a radiolucent table. A small pad is placed behind the involved shoulder to elevate it into the surgical field.

The shoulder is draped with the arm free. The image intensifier is placed on the ipsilateral side as seen in (Fig 1) [6].

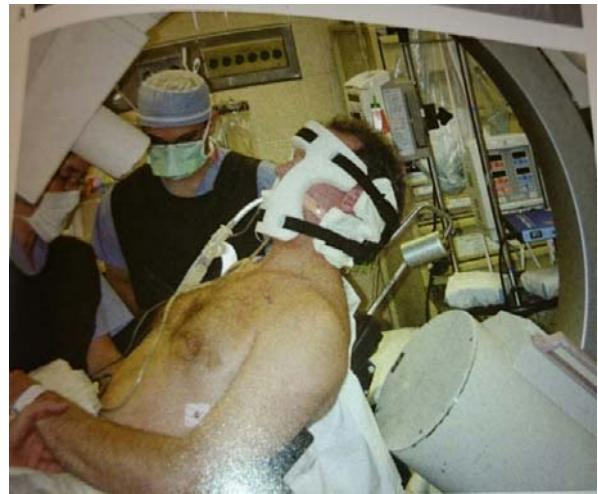


Fig 1. Photograph showing position of image intensifier during the operation.

An incision is centered over the distal clavicle, extending approximately 1cm past the AC joint. The skin and subcutaneous layer are developed, and the deltotracheal myofascial layer is incised directly over the distal clavicle and reflected anteriorly and posteriorly. The acromioclavicular joint is identified. This can be done by inserting an 18 gauge needle into the joint from the superior aspect.[7]

Reduce the fracture and hold it with bone clamps, fracture reduction is usually easily accomplished by simple elevation of the arm. After reducing the fracture by using small bone-holding forceps, a drill with two (1.8 mm) K wires were driven into the lateral fragment. The wire spare the acromioclavicular joint process, then, through the medullary canals of distal and proximal fragments until the tip perforated the anterior cortex of the clavicle⁸

During insertion, the drill was used at its highest speed, but it should not be pushed hard since the wire would find its own way out of the medullary canal because of the anterior curvature of the medial fragment. K wires left protruding and bent for easy removal later on.[8]

Results

In this prospective study, ten patients with displaced distal clavicular fractures who met the inclusion criteria, the cases were followed up for an average of 7.5 (range 6–9) months. Patients included seven men (70%) and three women (30%). The age of the patients ranged from 16 years to 34 years with an aver-

age age of 26.7 years at the date of performance of the surgery. The most common mode of injury was road traffic Accident which was a cause of fracture of 5 cases (50%). The second most common mode of injury was fall from height, which represented (30%) of all cases. Other modes of injury included two cases of fall on an outstretched hand (20%). Four patients (40%) had fractures of their dominant right sided clavicle, while left clavicle fractures involved in six patients (60%). Displaced distal clavicular fracture was the main indication for surgery. All fractures were type II, according to the Neer classification. All cases fixed with k wires. The radiological time of union post-operative for the 10 fractures ranged from 6 weeks to 8 weeks with mean time of radiological union 8.8 ± 0.9 weeks. Six patients (60%) had no complications in the post-operative period. Two patients (20%) had superficial wound infection which resolved with appropriate dressings and parenteral antibiotics, painful shoulder in 2 cases (20%), pain here was due to hardware irritation which disappeared after k wires removal.

At the end of follow-up, the mean Constant shoulder score was 92.7 ± 4.5 (85-98) points as seen in (table 2). In addition, the P value was statistically significant.

Table 2 : Statistical analysis of constant shoulder score of the study.

Variable	Pre	Post	P-value
	Mean \pm SD		
Pain (15):	6.5 ± 2.4	14.0 ± 2.1	<0.0001*
Activity (10):	2.0 ± 0.0	7.8 ± 1.5	<0.0001*
Arm positioning (10):	4.4 ± 1.5	9.4 ± 1.1	<0.0001*
Strength of abduction (25):	10.7 ± 3.3	24.2 ± 1.0	<0.0001*
ROM (40):	17.8 ± 1.8	37.2 ± 2.3	<0.0001*
Constant shoulder score (100):	41.4 ± 5.1	92.7 ± 4.5	<0.0001*

Our clinical as well as radiological results support these findings as we present excellent patient satisfaction. (Figure-2)

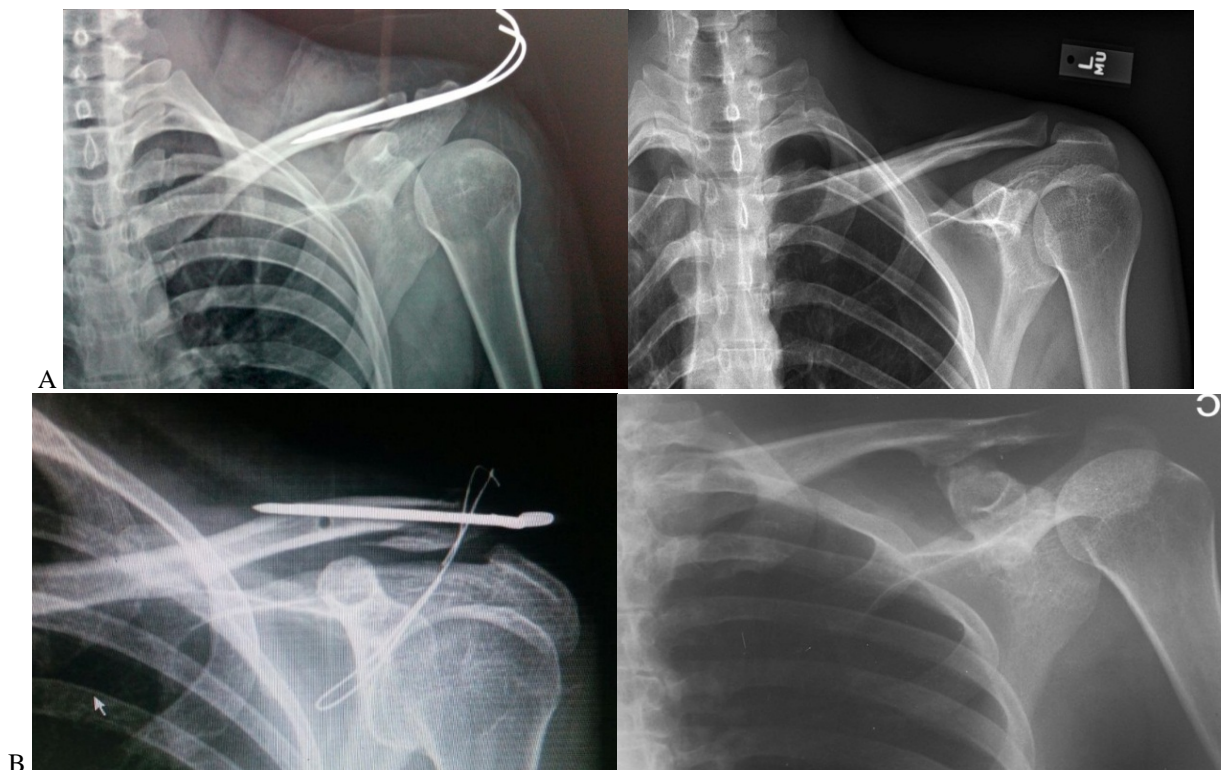


Fig. 2 A,B: Fracture distal third clavicle fixed by k wires and after removal of hardware

Discussion

There are very few published studies regarding k-wire fixation. Yu-chuan et al (2010)[9], who used K wires to fix the displaced fracture of the lateral third of the clavicle and included 14 patients. In addition, use of distal clavicular superior 3.5mm locked plate was performed by Jaron et al (2011)[10] and included 20 pa-

tients. We could compare our results with those previous two studies as follows;

In our study, there was 7 males (70%) and 3 females (30%) In comparison to Jaron et al. (locked plate) group which shown (85%) males and (15%) females and Yu-chuang et al.(k wires) group which shown (64.3%) males and (35.7%) females (fig 40). The

higher incidence of male number was probably related to higher occurrence of traffic and occupational accidents among males rather than females.

The current study showed that the rate of union of distal clavicular fracture in patients operated with KW was 100%. However, when we compared this study with earlier studies we found that the reconstruction plate's healing rate in Jaron et al. study was (94%), where locked plate was used

We followed up the patients by using constant shoulder scoring system. The mean score was 92.7 points (excellent). However; follow up of the cases in both other studies was by different scoring systems. Authors used American Shoulder and Elbow Surgeons (ASES) scoring system for Jaron et al. 94 (locked plate) study and its mean was 79 (good), however, in Yu-chuang et al. 93 (K wires) thesis they used the University of California at Los Angeles (UCLA) scoring system which was 31.4 (excellent).

Regarding complications, our study has shown lower complication rates (2 cases of painful shoulder, 2 cases of superficial infection) than those of Yu-chuang et al. group of patients (6 pin migration, 3 residual displacement, and 1 recurrent fracture). Jaron et al. had two cases of complications too (one case with nonunion and another case of fracture at the medial end of the plate)

The average age in our series was 26.7 years. On the other hand, the average age for Jaron (3.5mm locked plate) group was 45.6 years and in Yu-

chang et al. (K wires) group it was 39.5 years.

Conclusion

There are many fixation techniques of fractures of distal part of the clavicle; each method has its advantages, challenges and complications. The K-wire fixation is easy, simple, cheap technique of internal fixation of lateral clavicle end.

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