Evaluation of the functional outcomes of surgical treatment in displaced, closed, and isolated distal clavicle fractures in adults, A comparative retrospective study

Study Protocol

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Rational

The clavicle stands out as one of the most distinctive long bones, possessing various notable characteristics in its structure and shape that render it susceptible to fractures. Fractures of the clavicle rank high among the most common bone injuries, comprising 2-5% of all adult fracture, and therefore, are among the most frequent fractures seen in orthopedic practice. [1,2]

Previous epidemiologic studies indicate that clavicle fractures account for up to 5% of all adult fractures and up to 44% of all shoulder girdle fractures [1,3,4]. Distal third fractures (DCFs) account for 15-20% of all clavicle fractures and are observed in both young people with high velocity trauma and the elderly due to falls (bimodal distribution).[5]

Furthermore, DCFs are classified according to Neer classification system, into five types depending on the position of the fracture line relative to the coracoclavicular (CC) ligament. Among these, type II and type V fractures represent unstable distal clavicle fractures (UDCFs), characterized by considerable displacement resulting from the separation of the coracoclavicular ligament from the proximal fragment. Specifically, Type 2 indicates that the fracture is immediately medial to the coracoclavicular ligaments or between the two ligaments, with one ruptured, but do not involve the acromioclavicular (AC) joint. [6]

As such, it was found that non-operative treatment of an unstable distal clavicle fracture (Neer 2) results in a high disunion rate of up to 33%, and subsequently, surgical therapy is often recommended. [6–10]

Several approaches have been proposed including anterior and bra-strap approaches [11–13], with trans- or extra-articular (k-wire) fixation being the most prevalent, although this involves a high risk of problems, including pain migration and loss of reduction [6,14,15]. Moreover, it was found that Plate fixation is precarious because the distal fragment is often tiny and the metaphyseal bone is soft. As a result, a hooked plate with an extension under the acromion has been designed to provide more robust attachment. However, the main concern is subacromial impingement or rotator cuff damage. [16]

In this regard, while significant research has been conducted on clavicle fractures and their treatment options, no definitive guidelines or optimal approach have been

established. Hence, the aim of this study was to analyze and compare the clinical and radiological results between the two surgical technique, the Tension Band Wiring (TBW) and Hook plate ones, and evaluate the functional outcomes of surgical treatment in displaced, closed, and isolated distal clavicle fractures in adults.

Material and methods

This study is a comparative retrospective study of 38 patients who had unstable distal clavicle fracture (Neer 2) featured in Figure 1. treated either with TBW technique (Figure 3 and 4) or A.O Hook plate fixation (Fugure.2), and presented to the orthopedic department of Tishreen University Hospital, in Lattakia, Syria, between August 30, 2019 and August 30, 2022.

Data was extracted from the medical records of patients in the form of case sheets, discharge cards, x-rays, etc. The type of fracture was determined by Neer's classification. [6]

We included patients who met the following criteria: Patients with unstable distal third clavicle fracture (Neer type 2), aged between 18 and 65 years old. Nevertheless, Patient who had open fractures, pathological fractures, fractures associated with brachial plexus or pulmonary or vascular injury, acromioclavicular joint disruption, and musculoskeletal disease that affects the joint, were excluded.

Preoperative shoulder x-rays in AP with (10-15) ° cephalic tilt (ZANCA View) and axillary view were taken. In addition, Basic lab tests were done for all patients on admission. We used A.O Hook plate with (4-7) holes, (3.5) mm screws and (12.15.18) mm of hook depth, and 2 Kirschner-wires of (2.0) mm and stainless steel wire of (18) gauge in the TBW technique.

Specified postoperative protocol was followed for all patients contained:

1. Arm immobilization with a sling inside the operation room under anesthesia.
2. I.V antibiotics and analgesic
3. A sterile wound dressing was applied routinely.

The surgical stitches were removed after (10-14) days after surgery, and all patients were subjected to the rehabilitation and physical treatment.

One examiner measured the outcome based on Constant-Murley score [17] at 1.5-,3 ,6-,9- and 12- month intervals. In this system, both subjective and objective clinical data are included, with a maximum score of 100 points, as the following: Pain (15 points), activities of daily living (20 points), range of motion of the shoulder (40 points), and muscle power (25 points) were evaluated.

Furthermore, Radiological assessment was performed immediately after surgery, followed by evaluations at 3, 6, 12, and 24-week intervals to monitor healing progress and implant positioning. Recorded complications included infection, non-union, mal-union, pin migration, hardware impingement, and stiffness. The final outcome was assessed based on union status, time to fracture union, shoulder joint range of motion, ability to perform daily activities, and return to pre-injury status.

In the TBW group: The fixation method involved trans-articular fixation through the acromioclavicular joint, supplemented with an additional cerclage wire tension band for enhanced stability. Following surgery, the operated shoulder was supported with a triangular sling for a period of 4 to 6 weeks. Gentle mobilization was permitted once pain subsided, although full range of motion was limited due to pin impingement until implant removal.

In the Hook plate group: The operative procedure, as outlined in prior studies[18–20], involved creating a tunnel in the sub-acromial space posterior to the acromioclavicular joint and inserting the hook into this tunnel. If necessary, the plate was contoured to match the clavicle's shape, with careful consideration given to the appropriate depth of the hook. Dynamic compression was utilized to secure the plate in place. Following surgery, the shoulder was supported with a triangular sling for a period ranging from 2 to 4 weeks. Mobilization commenced at the earliest opportunity, typically resulting in full range of motion within three to four weeks. It is worth mentioning that across both groups, heavy manual labor was prohibited until evidence of solid fracture union was observed.

Ethical Considerations

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. Ethical approval for this study (Ethical

Committee 2022-OS-108) was provided by the Ethical Committee of Tishreen University Hospitals, Latakia, Syria on 18th September, 2022. In addition, the investigators ensured that the study conforms to the principles of the Declaration of Helsinki (last revised in 2013) and was conducted in accordance with the ICH Guideline for Good Clinical Practice.

Statistical analysis

The Student's t-test, chi-square test with Yates' correction, Fisher's exact test, and Friedman test were used to compare the two groups. The statistic software SPSS 10.0 (SPSS, Inc., Chicago, IL) was used to analyze the data; p values below 0.05 were considered significant.

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