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Original article

# Closed vs open nailing for displaced middle third fracture of clavicle. Does it matter?

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ABSTRACT

*Background:* Intramedullary nailing for fractures of middle third clavicle has become increasingly popular. Though open nailing has been widely described, closed nailing finds less mention.
*Objectives:* In this study we compared closed nailing with open nailing in fractures of middle third of clavicle to assess if the former holds any advantage.
*Material and methods:* 34 patients with closed nailing were compared to 31 patients with open nailing in terms of operative time, length of incision, pain, time to union and functional outcome.
*Results:* Only operative time and length of incision were significantly more in open group than in closed group.
*Discussion:* We believe that closed reduction can be attempted in all patients undergoing nailing for middle third clavicle fracture but surgeon should have a low threshold to open the fracture if closed reduction fails as functional outcome and time to union remains unaffected.


## 1. Introduction

Fracture of middle third of clavicle is one of the most common injuries an orthopaedic surgeon confronts.[1] Though conservative treatment is most common, certain situations like open fracture, polytrauma, floating shoulders and need for early mobilization in displaced isolated injuries may warrant operative intervention.[2] Plate fixation has traditionally been operative treatment of choice but nail fixation has proven to be less invasive and better alternative with fewer complications.[3–8] Most of the techniques of nailing involve open reduction of the fracture with antegrade or retrograde nail insertion.[3,5,6] Though we believe that closed reduction will be tried in majority before proceeding to open reduction it is less often described in the literature.[9,10] Orthopaedic principles prefer closed reduction of any long bone fracture with the view that the preserved biology around the fracture will promote healing. Hence, we compared closed nailing with open nailing in fractures of middle third of clavicle to evaluate if this principle holds true in clavicle fractures as well.

## 2. Materials and methods

This was a prospective cohort study with the objective of comparing the outcomes of closed vs open titanium elastic nailing (TENS) for displaced middle third clavicle fractures. The primary outcome measure was to assess the rate of union and functional outcome after closed and open nailing while operating time, length of incision, pain and time to discharge were assessed as secondary outcome measures. Local ethical committee approval was taken. Informed consent was obtained from each patient included in the study and the study protocol conforms to the ethical guidelines of the 1964 Declaration of Helsinki and revised in 2008. Those adult patients with non-comminuted, displaced, middle third fracture of clavicle were included in the study (Fig. 1). Displaced fractures were defined as >5 mm gap between the fracture fragments on standard AP and 30° ceplalad views for clavicle. Any paediatric patients, those with compound injuries, polytrauma or ipsilateral upper limb injuries were excluded from the study as they may interfere with the rehabilitation process. Similarly, patients with medial or lateral end fractures and segmental fractures were excluded from the study.

### 2.1. Surgical technique

A standard surgical and post-operative protocol is followed in this institute. All cases were performed by a single experienced

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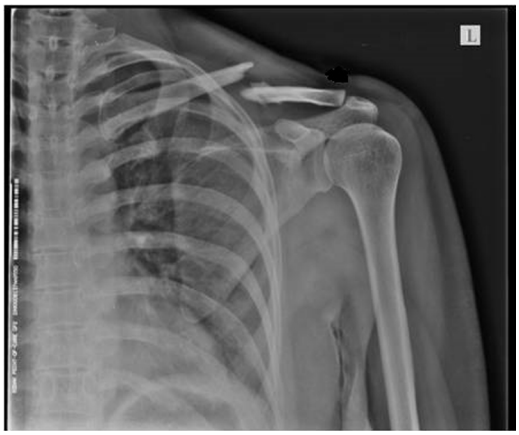

**Fig. 1.** Preoperative X-ray of mid shaft fracture of the clavicle.

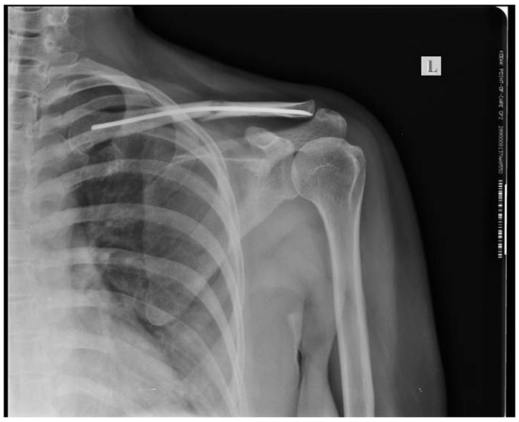

**Fig. 3.** Fracture union in progress with TENS in situ.

trauma surgeon. The principles of surgical techniques were similar to those described previously.[11,12] Size of the nail to be inserted was decided preoperatively by measuring the diameter of the medullary canal. Measurements were taken at 2.5 cm from either end of the bone and at middle third. The smallest measurement of the three was considered and nail of the size 0.5 mm less than the diameter was selected for insertion. A prophylactic single dose of intravenous third generation cephalosporin was administered preoperatively. Patient was placed supine. A 1 cm transverse incision was taken about 2 cm lateral to the sterno-clavicular joint. A drill hole was made into the anterior cortex using a 2.7 mm drill bit and the medullary canal was entered using awl. A preselected size of TEN was advanced along the medullary canal unto the fracture site under image intensifier control. Closed reduction of the fracture was attempted by elevating the inferiorly displaced lateral fragment. If the alignment was satisfactory under the image intensifier guidance the nail was advanced in a controlled fashion. We prefer a gentle tap on the T-handle to advance the nail in controlled fashion rather than a vigorous push. Continuous visualization under image intensifier using antero-posterior and oblique views aided advancement of the nail. The bend tip of the nail was rotated to negotiate the entry into the lateral fragment. The nail was advanced only when the surgeon was absolutely sure that it has engaged the lateral fragment. If the fracture could not be reduced by closed method then open reduction was performed. For open reduction a two cm incision was taken at the fracture site. The fracture ends were reduced under vision using bone holding clamps and the nail was then advanced into the lateral fragment. The medial end of the nail was bent and buried in the soft tissue to facilitate easy removal at a later date (Fig. 2). The incision site was sutured. All patients were discharged on the next day after the operation. Sutures were removed after 2 weeks.

The patient was kept in an arm-sling support for 4 weeks. Intermittent pendulum movement was started after 2 weeks and range of shoulder movement was started after 6 weeks. All patients were followed up after every 2 weeks. VAS score was noted on the day of discharge and at every visit to assess pain. Similarly functional assessment was made using Constant–Murley score for shoulder at 3 months and 6 months. The radiographs were taken at monthly interval to assess status of union (Figs. 3 and 4). Patients were also assessed for any complications like infection, hardware related problems, etc. The minimum follow up of the patients in this study is 6 months.

### 2.2. Statistical analysis

SPSS 17.0 version (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Chi square test was used demographic data. Independent *t* test, Mann Whitney test, Wilcoxon signed test and Friedman test were the tests used.

## 3. Results

In the study period between June 2010 to December 2013, 128 consecutive adult patients presented with fracture of middle third of clavicle out of which 52 were treated conservatively due to simple, non comminuted fracture pattern and displacement of less

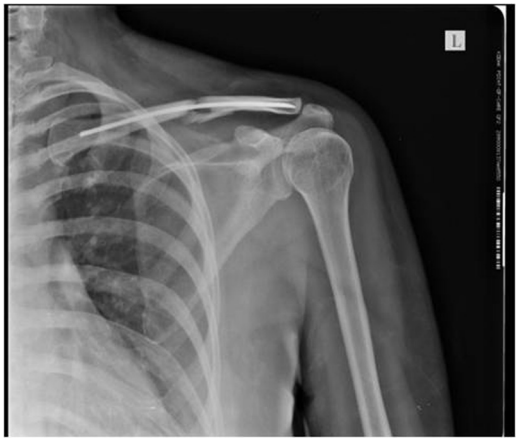

**Fig. 2.** Post-operative X-ray of fracture middle third clavicle with TES in situ.

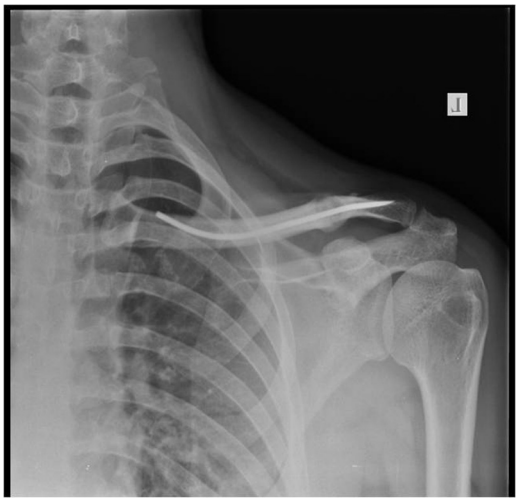

**Fig. 4.** Fracture union with TES in situ.