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Original Research Article

Titanium Elastic Anchoring System for Surgical Management of Midshaft Clavicle Fracture

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Abstract

Background: About 76% of all clavicular fractures are midclavicular fractures, which are frequent clinically. A previously unknown prevalence of malunion and non-union after conservative treatment of more severe midclavicular fractures has been found by recent investigations. This study's objective was to assess the clinical results of titanium elastic nail treatment for midclavicular fractures.

Methods: A prospective hospital-based study carried out at JLNMCH, Bihar, India. 60 patients between the ages of 18 and 50 who had displaced midshaft clavicle fractures underwent intramedullary titanium elastic nailing after clinical evaluation and radiographic confirmation. Average operating time, problems after surgery, and union time were noted.

Results: 56 patients involved closed surgery using a titanium elastic nailing device, while 4 cases involved a mini-open procedure. All patients who underwent satisfactory reduction were monitored for an average of 10 months. The average length of the union was 11.2 weeks. No patient experienced a serious problem. 10 months after surgery, the titanium elastic nailing system was removed; none of our patients had a re-fracture or a non-union.

Conclusion: For dislocated midshaft clavicular fractures, intramedullary repair using a titanium elastic nailing system may be an efficient and secure procedure with few risks, positive clinical therapeutic effects, functional recovery, and cosmetic results.

Keywords: Midshaft Clavicle, Fracture, Elastic Nailing, Titanium.

Introduction

One of the most frequent bone injuries is a clavicular fracture. In adults, 35% of shoulder girdle injuries, and between 2.6% and 4% of fractures have been seen. An S-shaped bone called the clavicle serves as a strut between the "glenohumeral joint" and the sternum. It also serves as the shoulder girdle's suspensory mechanism. The coracoclavicular ligament attaches the clavicle to the shoulder [1]. The conventional wisdom that many clavicular fractures heal without surgery is no longer true. Recent research has revealed that some patient subgroups with these injuries had a greater rate of non-union and certain functional impairments in the shoulder [2]. As a result, they can be managed as a range of injuries requiring thorough evaluation and tailored care. The prevalence of nonunion following a clavicular fracture is larger than previously thought, but it still happens seldom [2]. Additionally, continued wide fragment separation with soft tissue interposition may result in the failure of closure reduction. In widely displaced fractures of the middle part of the clavicle that are not operated on, there is a 15% non-union incidence. Additionally, none of the fractures that initially shrunk by more than 2 cm healed [2].

In addition to open fractures, patients with multiple traumas, floating shoulders, other reasons for surgery include the necessity for early motor mobilization for individuals with isolated injuries [3]. Thus, surgical fixing has become more popular in recent years. Comparing intramedullary fixation and fixation with plates to non-operative care for mid shaft clavicle fractures, a comprehensive study found a relative risk reduction of 57% and 72% for nonunion [4]. With no need for hard attachment, intramedullary devices function as internal splints that preserve alignment. Several investigations have indicated that intramedullary nailing has a very high complication rate and technical obstacles [4, 5]. The main objective of this study is to assess

the functional results of titanium elastic nailing system repair of mid shaft clavicle fracture.

Objectives

- Investigating the success rate of titanium elastic nail treatment for displaced mid shaft clavicle fractures
- To examine the practical results of patients who received titanium elastic nails
- Understanding the benefits of titanium elastic nails

Methods

Study Design and Sample Size

A hospital-based study carried out at JLNMCH, Bihar, India, a total of 60 patients that met the inclusion and exclusion requirements underwent intramedullary titanium elastic nailing after clinical evaluation and radiographic confirmation.

Investigations

Each patient in our study has the following examinations. Routine blood testing is used to properly examine all the study participants. Prior to surgery, a radiological evaluation is performed. X-rays showing the chest, including an AP view of the shoulder joint. If required, take an apical and oblique view of the clavicle. Each patient and legal guardian provided written, informed consent prior to being subjected to investigations and surgical operations. Following surgery, radiological exams were performed at intervals of 6 weeks, 12 weeks, and 6 months. Patients were checked on after six, twelve, and six months.

Collection of Data

In a specially created “Case Record Form” (CRF), the whole set of information is gathered from the patients by obtaining their medical history, conducting a thorough clinical examination, and conducting pertinent tests. Finally, based on the inclusion and exclusion criteria, patients are chosen for the study after receiving their diagnosis. After surgery, all cases are monitored for a minimum of 6 to 12 months until the fracture union has occurred. Results were examined from a clinical and radiological perspective. In this study, patients of both genders between the ages of 18 and 50 are included. Patients who had closed displaced mid-shaft clavicle fractures were considered surgical candidates. Un-displaced fractures of the clavicle and open fractures were disregarded.

Surgical Procedure

To elevate the shoulder, a tiny towel is kept under the interscapular area. At the sternal end of the clavicle, a 1- to 1.5-cm incision in the skin is made in a parallel to the clavicle direction. The frontal cortex was opened with a bone awl around 1-1.5 cm lateral to the sternoclavicular joint. A titanium elastic nailing system (average diameter: 2 mm) is introduced and advanced to the fracture site with the use of a C-arm. If closed reduction is not an option, open or mini-open fracture reduction is performed by making incision at fracture site. Miniature reduction forceps or cutaneous manipulation are used to sustain the reduction temporarily. The nail is then moved gently in a rotating direction. To prevent penetration into the acromioclavicular joint, caution must be used while advancing the implant too laterally. After washing off, the medial portion of the nail is clipped, and the surrounding skin is sutured.

Results

In our investigation, falls from height (6 cases), road traffic accidents (48), and falls on outstretched hands (6 cases) were the most common modes of injury. Both the Robinsons classification and the Orthopedic Trauma Classification were used to grade the fractures. On day one, 6 patients (10%) underwent surgery. 48 patients (80%) underwent surgery between 2 and 7 days. 6 patients (10%) underwent surgery between 7 and 14 days. The surgical procedure took an average of 3 to 4 days to complete (range: 1 to 14 days). Depending on the patient's parameters, titanium elastic nails of sizes 1.5 mm (n = 12), and 2.0 mm (n = 48), respectively, were employed. Average intraoperative time ranged from 20 to 90 minutes, or 45 minutes. No patients' perioperative problems were identified. 6 patients (10%) underwent surgery between 7 and 14 days. The surgical procedure took an average of 3 to 4 days to complete (range: 1 to 14 days). Depending on the patient's parameters, titanium elastic nails of sizes 1.5 mm (n = 12), and 2.0 mm (n = 48), respectively, were employed. Average intraoperative time ranged from 20 to 90 minutes, or 45 minutes. No individuals' perioperative problems were identified. Within three days of surgery, all patients received their discharges. Implant removal took an average of 10.2 months. All patients had good anatomical decrease, recovery from function, and their appearance. Of the 60 patients, 48 had fractures because of auto accidents, six had fractures because of indirect injuries, falls on outstretched hands, and six had fractures because of falls from height. All the patients' fractures were of the closed variety (Table 1).

Table 1: Mode of injury

Mode of injury	Frequency	%
Accident	48	80
Fall	6	10
Fall on outstretched hand	6	10

In our study, 42 participants were aged 19 to 29 years, 12 were aged 29 to 39 years, and 6 were aged 40 to 49 years. In our study, there were 42 male participants and 18 female patients. In our analysis, 12 individuals had left-side fractures compared to 48 patients with right-side fractures (Table 2).

Table 2: Affected side

Affected side	Frequency	%
Left	12	20
Right	48	80

In our study, 6 patients were Robinson Type B1, and 54 patients in our study were Robinson Type B. Orthopedic Trauma Association classification type 15b1 was assigned to 54 patients, while type 15b2 was assigned to 6 patients (Table 3).

Table 3: Classification

Classification	Frequency	%
Robinson type B	54	90
Type B1	6	10
15b1	54	90
15b2	6	10

With an average shortening of 1.92 cm, 48 individuals had shortenings of 1.5 to 2 cm and 12 patients had shortenings of 2 to 2.5 cm. Radiologically, displacement was measured. All the study participants experienced displacements of at least 2 cm, with an average displacement of 2.2 cm. In our investigation the mean size of titanium elastic nailing system used is 2 mm (Table 4).

Table 4: Implant

Implant	No. Of patients	%
Titanium elastic nailing system 1.5mm	12	20
Titanium elastic nailing system 2.0mm	48	80

There was no post operative shortening in about 96% of the patients. Our Disabilities of the Hand, Shoulder, and Arm Score was excellent in 48 patients and the mean score was 3.00. Throughout our study, 2 patients developed a superficial skin infection after the fifth postoperative day and 8 patients out of 60 experienced medial skin irritation due to implant prominence, both of which were treated with an oral antibiotic.

Discussion

The only traditional indications for clavicle fracture surgery are painful nonunion, open fracture, impending open fracture, neurovascular impairment, floating shoulder, and polytrauma patients. Most of the time, a clavicle fracture that is treated conservatively heals effectively, but the real goal of treatment should be the patient's pleasure. Traditionally mid-clavicle fractures have been treated non-operatively. Following conservative therapy of displaced midshaft clavicle fractures, Hill et al. [6] and Mckee et al. [7] found unsatisfactory outcomes. Jubel et al. demonstrated that a favorable functional outcome requires the correction of clavicular shortening [8]. In their study, they found no instances of non-union or subpar functional results. In their study, they found no non-union and no functionally subpar results. Comparing plate-fixation surgery to conservative care, notable hazards include hematoma, infections, implant failures, and non-union. Bostman et al. [9]. As a result, plate fixation was replaced by minimally invasive ESIN. The amount of tension on the side of the collarbone changes in relation to arm movement and the direction of loading, making intramedullary implants excellent from a mechanical perspective [10, 11].

In our research, 54 patients' fractures had joined by the conclusion of the 12th postoperative week in individuals. By the 14th week, 6 patients (10%) had healed fractures. All six individuals were over 40, and two of them had fractures of the Robinson type B1 variety. The average DASH score in our study was 3.00, including 48 patients receiving excellent scores and 12 patients receiving decent scores. In 8 patients, prominent nails on the medial side caused skin irritation, necessitating nail removal at 14 weeks. All 8 patients had their fractures fused by that point. None of the patients in our study experienced an incision of the dorsolateral cortex. Titanium elastic intra-medullary nailing is a promising method with great functional outcomes, dependability, and a safer, minimally invasive percutaneous procedure with a propensity toward rapid healing and fewer problems.

Conclusion

All patients in the research we conducted saw significant functional improvement thanks to intramedullary nailing. In contrast with conservative treatment, minimally invasive techniques can achieve the goals of a quick and painless functional recovery with a lower risk of consequences. The average length of disability is therefore brief. Titanium elastic nailing system is a safe, minimally invasive method that produces great cosmetic and functional advantages with a short recovery time for stabilizing displaced midshaft clavicle fractures.

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