



Treatment of 5th metacarpal neck fractures with titanium elastic nail using local anesthesia and hematoma block

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Abstract

Aim: Surgical treatment of 5th metacarp neck fractures using titanium elastic nail (TEN) is performed under general anesthesia or axillary block. In this study, our aim is to present the clinical and radiological results of patients who underwent surgery under local anesthesia for the TEN entry site and hematoma block for fracture reduction.

Materials and Methods: There were 14 patients who had 5th metacarpal neck fractures treated with intramedullary TEN (titanium elastic nail) and met the inclusion criteria were evaluated retrospectively. Radiologically, metacarpal shortness and volar angulation angles at the time of admission, after reduction in the ER and after surgical intervention when the fusion had been achieved were evaluated. Clinically, rotational deformity, range of motion of the affected finger were evaluated according to Quick DASH scores.

Results: The patients, all male, were aged between 18 and 46 (mean 26) years and had injuries on the dominant side. The volar angulation after surgical intervention a mean of 17.2° (10-22°) was achieved at the final follow-up. The metecarpal shortness was determined to be mean 4.4 mm (1.8-7.3mm) on first presentation, 3 mm (2-5 mm) after reduction in ER, and 2 mm (1.2-3.3mm) at the final follow-up examination in surgically treated group compared to healthy side. Radiological bone union was observed in mean 35 days. Finger flexion and extension were determined to be full at the end of the 3rd month and no rotational deformity was observed. The mean Quick DASH score of the patients was 1.5 (1.2-2).

Conclusion: 5th metacarpal fractures with TEN under hematoma blockage and local anesthesia and leaving the proximal end out of the skin is a safe method for the treatment of such fractures.



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Introduction

Metacarpal and phalanx fractures constitute approximately 10% of all fractures, and metacarpal fractures constitute 30% of these. The most frequently seen type is 5th metacarpal neck fracture [1]. These fractures are more common in males, reaching a peak between the ages of 20 and 40 years. The most frequent mechanism of injury is throwing a punch [2].

Metacarpal fractures can usually be treated with conservative methods, and with appropriate rehabilitation, successful results can be obtained. Surgical treatment is required for open fractures, multi-fragmented fractures, when there is >30° dorsal angulation, >5mm shortening, and when reduction cannot be obtained or maintained with closed methods [3]. When there is malrotation and volar angulation in the metacarpal, grip strength is reduced and there

may be extension loss in the 5th finger [4,5]. Therefore, when treating 5th metacarpal neck fractures, it is important that the appropriate metacarpal length is provided and fracture healing is obtained without rotation [6]. Besides, the patient expectations should be taken into consideration [7]. The surgical technique should cause the least amount of soft tissue damage and allow early movement. Antegrade or retrograde nailing and plate fixation are surgical methods used for the treatment of these kinds of fractures. Antegrade intramedullary nailing following closed reduction with K-wire or titanium elastic nail (TEN) is method as a surgical procedure for the treatment of neck fractures of 5th metacarpal [8].

General anesthesia or regional blockage were the choice of anesthesia used for both implementation of the technique and hardware removal [7,9] and they are economic burden for the patient. Hematoma block, however, seems to be safe, reliable and easy method for closed reduction for distinct fractures [10,11,12]. The literature is lacking of a

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report of this kind of anesthesia for metacarpal fractures. The aim of this study was to evaluate the clinical and radiological results of 5th metacarpal neck fractures treated with the TEN fixation method following closed reduction under hematoma block and local anaesthesia.

Materials and Methods

The study was carried out with the permission of Ethics Committee of Giresun University Research Hospital.

A total of 28 patients were evaluated retrospectively who were diagnosed with a metacarpal fracture and were treated surgically in our hospital between 01.01.2019 and 01.01.2022. The patients included in the study were those aged 18-60 years, with a 5th metacarpal neck fracture who underwent surgery in the Orthopedics and Traumatology Department due to not achieving proper closed reduction in emergency room (ER), and were followed up postoperatively for at least 6 months with regular attendance at follow-up examinations. A total of 14 patients were excluded from the study; 4 patients <18 years and 3 patients >60 years, 3 patients with an open fracture and accompanying tendon injury, 2 patients with fracture of more than one metacarpal, 2 patients with K-wire fixation. Thus, 14 patients were included for analysis, who had a 5th metacarpal neck fracture (Figure 1), were applied with local anesthesia and hematoma block, and were treated with the closed reduction and titanium elastic nail (TEN) fixation method.

Radiological and clinical evaluations were performed. In the radiological evaluation, the volar angulation of the fracture and the development of metacarpal shortness were compared after reduction in ER and after fracture fusion postoperatively. Clinically, the patients were evaluated in respect of whether or not there was rotational deformity, the range of motion (ROM) of the affected finger, and the Quick DASH scores. Postoperative complications like skin irritation, pin site infection, non-union, paraesthesia were also analyzed. The number and duration of fluoroscopy shots during the operation were recorded. Clinical and radiological examinations were performed at the end of the second month, then at the final follow-up visit (>6 months) only clinical examination was made.

Surgical technique

The operation was performed under fluoroscopic control without using a tourniquet. With the patient positioned supine, local anesthesia was applied to the fracture hematoma and the incision region in the proximal of the 5th metacarpal. After being diluted with 9 ml of isotonic solution, 1 ml of 2% lidocaine (20 mg/ml) was administered, with 6 ml applied to the fracture hematoma and 4 ml applied to the K-wire insertion site. The dorso-ulnar side of the proximal 5th metacarpal was opened with a 1cm mini-incision. To avoid damaging the dorsal branch of the ulnar nerve, blunt dissection was performed as far as the bone. A cortical entry point was created with an awl in the proximal of the metacarpal. Under fluoroscopic control, closed reduction was obtained with the Jahss maneuver. A 2.0 mm TEN was advanced in a controlled way in the medullar canal. The TEN tip section was oriented

to the dorsal cortex to correct volar angulation. The TEN was cut to be left outside the skin, and then the skin was sutured. After all the surgical procedures, a short-arm splint was applied with the wrist in 20-30° extension, the metacarpophalangeal (MCP) joint in 90° flexion and the interphalangeal joints in 0° extension. All patients were discharged from the hospital after the procedure.

First radiographic examination was made immediately after surgery (Figure 2). The angle between the cortices of the proximal and distal fracture ends was measured on the oblique hand direct X-ray. Follow-up examinations were performed in the first, third, and sixth week. The splint was removed at the first week examination, and then MCP joint exercises were started. When radiographic bone union was observed, the TEN was removed in the clinic without anesthesia. The average removal time for the TEN was 32 days (28 - 37).

Results

All the patients evaluated were male with a mean age of 26 years (range, 14-43 years), and the affected hand was the dominant side (1/14 left, 13/14 right). In all the patients, the injury was the result of punching a hard surface. The volar angulation of the fracture was mean 46.2° (range,



Figure 1. Pre operative A-P and oblique X-Ray of 5th metacarpal neck fracture.



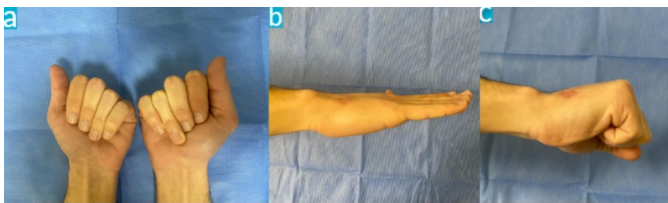
Figure 2. Postoperative A-P and oblique X-Ray of 5th metacarpal neck fracture.

Table 1. Preop and postop evaluation.

	Volar angulation (degree)	Metacarpal shortness (mm)
First presentation	46.2 (33-60)	4.4 (1.8-7.3)
After reduction	46.2 (30-48)	3 (2-5)
Final follow-up examination	17.2 (10-22)	2 (1.2-3.3)

Table 2. Demographics and operation details.

Patient (n)	14
Age (years)	26 (14-43)
Side (dominant/ nondominant)	14 dominant side
Operating time (minutes)	15 (5-28)
Fluoroscopy shots (n)	7 (5-14)

**Figure 3.** The function of the hand is restored without any rotational deformity (A) with full extension (B) and full flexion (C).

33-60°) on first presentation, mean 40.6° (range, 30-48°) after reduction in ER, and 17.2° (range, 10-22°) at the final follow-up examination. The metacarpal shortness of the fracture was compared with the unaffected hand, and was determined to be mean 4.4 mm (range, 1.8-7.3 mm) on first presentation, 3 mm (range, 2-5 mm) after reduction in ER, and 2 mm (range, 1.2-3.3 mm) at the final follow-up examination (Table 1).

In all the fractures, radiological bone union was observed in mean 35 days (21-42), there was no pain on palpation, and the TEN was removed. No infection or sensory loss was observed in the incision region. In 1 patient, hypertrophic scar was observed at the incision site. Finger flexion and extension were determined to be full at the end of the 3rd month and no rotational deformity was observed (Figure 3). The mean Quick DASH score of the patients was 1.5 (range, 1.2-2). The mean operating time was 15 minutes (range, 5-28 minutes) and the mean number of fluoroscopy shots was 7 (range, 5-14) (Table 2).

Discussion

The most important finding of this study is that the application of closed reduction and intramedullary fixation with local anesthesia and hematoma block in 5th metacarpal fractures provides similar clinical and radiological results with other methods in the literature.

Indications of surgery for distal metacarpal fractures are accepted as above 40 degrees of volar angulation since it is considered intolerable functionally. However, above 30 degrees of volar angulation have been shown to be linked with decreased flexor digiti minimi grasping and ROM [3].

Although conservative treatment is functionally satisfying, 4-6 weeks of cast application may impair the daily life of patients who may seek other ways treatment [7]. She et al. reported that intramedullary fixation using a single elastic nail had better functional results than other methods due to early functional rehabilitation [13]. This kind of surgical procedure which may be applied with local anesthesia becomes an important alternative for the patient from this point of view.

In the treatment of metacarpal neck fractures, the literature predominantly cites the use of bent K-wires as the fixation material. However, titanium elastic nails (TEN) are also mentioned as a fixation method in the literature [14]. In this series of patients, TEN were preferred over K-wires due to the blunt and pre-shaped distal tip of TEN. The rationale for this choice was that the surgical procedure was performed under local anesthesia and hematoma block, with the anesthetized area being quite limited. It was hypothesized that the blunt and pre-shaped tip of TEN, if exits through the fracture ends during reduction, would cause less soft tissue irritation and thereby would result reduced intraoperative pain.

Surgical procedures of metacarpal fractures are usually performed under general anesthesia or brachial plexus block [9]. However, hematoma block for fracture reduction have been shown to be an effective and reliable method of pain control. Mydrezi et al. reported hematoma block as a more reliable method than general anesthesia for closed reduction of distal radial fractures [11]. Ross et al. have also stated hematoma block as a safe and reliable method for closed reduction for ankle fractures [15]. We applied intramedullary fixation of fifth metacarpal with TEN under hematoma blockage. Pain management for insertion of pin site also was achieved with local anesthesia which is used in the literature [12,16]. Only two of our patients needed extra sedation during surgery. This procedure allowed the patients to be discharged immediately after the surgery which seems to be an advantage both economically and socially.

Effectiveness of using single IM implant for these fractures had been a concern for enough stability, maintaining anatomical reduction and regaining desired hand function. However Eisenschenk et al. have reported a single K-wire thicker than 1.6 mm provided sufficient fixation. They also reported it was technically easier than double wire technique [9]. A 2.0 mm thick TEN was standart implant applied in our series which was enough for stability.

IM devices used for fixation for these fractures have been usually left subcutaneously [17]. This led to extra surgical procedure for the removal of the implant which caused time and economic burden for both the surgeon and the patient. Leaving proximal end of the TEN has provided the advantage of removing it easily without anesthesia or surgical intervention. Pin site infection might have been a concern but we have not encountered infection of this sort or any other in our patients.

Intramedullary fixation for 5th metacarpal neck fractures is well defined in the literature. No ROM difference with the contralateral 5th metacarpophalangeal joint, the mean Quick DASH score of 1,5 and 17o of volar angulation we have achieved in our patients are comparable to litera-

ture [7,8,9,18] Although the 2 mm shortening observed in our results is slightly greater compared to antegrade intramedullary nailing studies, it remains within acceptable limits. Bearing these in mind, IM nailing of these fractures with single TEN under hematoma blockage and local anesthesia may be good choice for the personalized treatment certain patients seek.

Although a formal cost analysis was not conducted in this study, it is believed that the anesthesia method used for surgery and the early discharge of patients postoperatively could offer time savings and economic benefits. However, the use of TEN nails instead of K-wires as the intramedullary fixation material present a cost disadvantage.

The primary limitation of this study is limited number of patients with no control group to evaluate the clinical outcomes although both the number of patients and clinical outcomes are similar to those reported before in the literature [9,17]. Additionally, the absence of a comprehensive cost analysis makes any interpretation of the costs subjective.

Conclusion

In conclusion, IM fixation of fifth metatarsal fractures with TEN under hematoma blockage and local anesthesia and leaving the proximal end out of the skin is a safe, timesaving and economically favorable method for the treatment of such fractures.

Conflict of interest

The authors have no conflicts of interest to declare.

Financial disclosure

The authors declared that this study has received no financial support.

Ethical approval

Ethical committee approval was received from the Clinical Research Ethics Committee of Giresun University (approval number: E-53593568-771-22204104).

Author contributions

Concept – T.D., H.K.; Design – T.D., H.K.; Supervision – T.D.; Materials - T.D., M.D., S.A.; Data Collection and/or Processing - T.D., M.D., S.A.; Analysis and/or Interpretation - T.D., M.D., H.K.; Literature Search - T.D., M.D., H.K., S.A.; Writing Manuscript – T.D.; Critical Review – T.D., M.D.

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