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10.2478/AMB-2025-0048

CASE REPORTS

USE OF MINIMAL INTERNAL FIXATION IN AN OPEN COMMINUTED SECOND TO FIFTH METATARSAL FRACTURE BY ANGLE GRINDER: A CASE REPORT

G. P. Georgiev[1], S. Rangelov[1], L. Gaydarski[2], V. Stoyanov[3], B. Landzhov[2]

[1]Department of Orthopedics and Traumatology, University Hospital Queen Giovanna – ISUL, Medical University – Sofia, Bulgaria
[2]Department of Anatomy, Histology and Embryology, Medical University – Sofia, Bulgaria
[3]Department of Orthopedics and Traumatology Uni Hospital – Panagyurishte, Bulgaria

Abstract. *Open comminuted fractures of the metatarsal bones are surgical emergencies that pose a significant challenge for traumatologists. These injuries typically result from high-energy trauma, with common causes including machinery such as lawnmowers, motor saws, and angle grinders. Factors such as the extent of soft tissue damage, neurovascular injury, and fracture stability must be carefully evaluated before surgery. Herein, we present a rare case involving a 37-year-old male who sustained open comminuted fractures of the second to fifth metatarsal bones, along with injuries to the tendons of the long extensors of the toes, the muscle belly of the short extensor, and the dorsal nerves of the foot, following from a trauma with an angle grinder. At the six-month follow-up, the patient reported no complaints and had achieved full weight bearing with the injured foot. In summary, while metatarsal fractures are common in the emergency setting, open fractures of the central and fifth metatarsals are relatively rare. Optimal management requires thorough evaluation and strict adherence to the Gustilo-Anderson protocol, focusing on the accurate injury assessment, infection prevention, soft tissue coverage, fracture stabilization, and effective rehabilitation.*

Key words: *open metatarsal bone fractures, comminuted fractures, fracture fixation, injury, foot*

Corresponding author: *Georgi P. Georgiev, MD, PhD, DSc, Department of Orthopedics and Traumatology, University Hospital Queen Giovanna – ISUL, Medical University – Sofia, 8 Bialo More Str., Sofia, Bulgaria, tel.: +359884493523, email: georgievgp@yahoo.com*

ORCID: *0000-0001-8343-0337*

Received: *03 February 2025;* ***Accepted:*** *11 February 2025*

INTRODUCTION

Fractures of the metatarsal (MT) bones account for approximately 88% of all foot and ankle fractures and up to 7% of all bone fractures. These injuries typically occur in individuals between their second and fifth decade of life, with a higher prevalence in females [1-3]. MT fractures may result from direct trauma (e.g., a heavy object falling on the foot in industrial settings), indirect trauma (when the leg and hindfoot twist while the forefoot is fixed – often referred to as a "tennis fracture"), or stress injuries (from chronic overloading in athletes, ballet dancers, or soldiers, known as "march fractures") [1-3].

Managing open, comminuted MT fractures presents a significant challenge for foot surgeons [4]. Open fractures of the foot are surgical emergencies [5]

that typically result from high-energy trauma and can be caused by accidents involving equipment such as lawnmowers, motor saws, or angle grinders [5]. These fractures are managed according to the Gustilo-Anderson protocols [6]. Reconstructive surgery for such injuries carries a high risk of severe complications [4]. Before deciding on a surgical approach, factors such as the extent of soft tissue damage, the neurovascular condition of the foot, and the stability of the fracture must be thoroughly evaluated [4]. An important consideration is the use of appropriate antibiotics for infection prophylaxis [7, 8].

The present case report features a 37-year-old male who sustained an open comminuted fracture of the second to fifth MT, along with injuries to the extensor tendons of the second to fifth toes and the associated nerves, following trauma with an angle grinder.

CASE REPORT

We present the case of a 37-year-old male who was admitted to our department following forefoot trauma caused by an angle grinder. Radiographic imaging – including anteroposterior and oblique views – revealed a severely comminuted fracture of the shafts of the second to fifth MT, with significant bone loss (Figure 1). Physical examination showed a contused, lacerated wound on the dorsal aspect of the foot, characterized by irregular, jagged edges without significant bleeding (Figure 2a). Tetanus prophylaxis was administered via an intramuscular injection of 0.5 mL of tetanus toxoid, and preoperative blood tests were within normal limits.

Fig. 1. Preoperative X-rays of the injured foot: (a) anteroposterior (AP) view and (b) oblique view

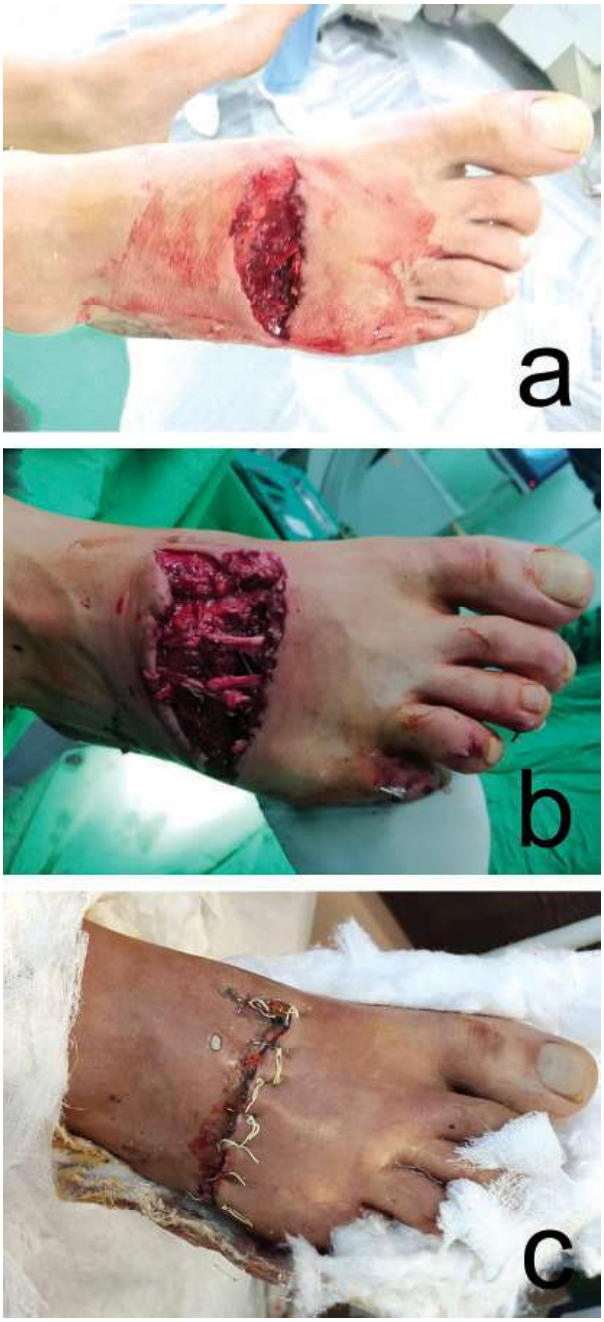

Fig. 2. Photographs of the injured foot: (a) preoperative view, (b) intraoperative view, and (c) 7th day post-injury

Approximately six hours after the injury, the patient was taken to the operating room for surgical debridement and fracture repair. Intraoperative inspection revealed a complete laceration of the long extensor tendons and a rupture of the muscle belly of the short extensor of the toes (Figure 2a). Additionally, all the nerves on the dorsum of the foot were damaged, with large defects noted. Thorough debridement and lavage were performed, and the second to fifth MT were fixed with intramedullary K-wires – one for the fifth MT and two for each of the other MTs (Figure 3). The lacerated long extensor tendons

and the ruptured short extensor muscle were repaired with sutures (Figure 2b). Skin sutures were tightened on the third day.

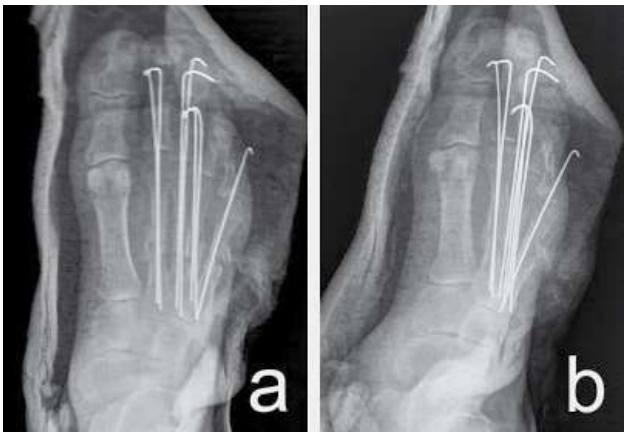

Fig. 3. Postoperative X-rays of the injured foot: (a) anteroposterior (AP) view and (b) oblique view

Postoperatively, the patient was placed on triple antibiotic therapy (Ceftriaxone 2 g, Amikacin 1 g, Metronidazole 500 mg orally three times a day) for five days before discharge, followed by an additional seven days of clindamycin 600 mg three times daily for ten days. Regular postoperative bandage changes were performed (Figure 2c) untill skin sutures were removed during the third week. Cast immobilization was maintained until the K-wires were removed 45 days after surgery. The patient declined further dorsal nerve reconstruction, and a standard rehabilitation protocol was initiated. With primary tendon and muscle repair followed by physical therapy, the patient eventually regained full range of motion in the toes. At the six-month follow-up, the patient reported no complaints and had regained full weight-bearing capability in the injured foot (Figures 4 and 5).

Fig. 4. Follow-up X-rays of the injured foot at six-month follow-up post-operation: (a) anteroposterior (AP) view and (b) oblique view

Fig. 5. Photograph of the injured foot at the six-month follow-up

DISCUSSION

Currently, there is not a single, universally applicable classification system for MT fracture, since such fractures can occur in any part of the MT [1-3]. Shortening and angulation of the foot indicate an injury to the MT shaft. MT can be divided into three groups: the first MT, the central MT (including the second, third, and fourth), and the fifth MT. Injuries to the fifth MT are the most common, followed by those of the central MT, while first MT fractures are the least common [1-4]. Fractures of the first and fifth rays are usually isolated injuries, whereas central MT fractures are more complex and warrant investigation of adjacent joints, such as the Lisfranc joint. MT fractures can also be classified by location – capital, subcapital, midshaft, and base fractures [2].

Although MT fractures are a common presentation in the emergency department, the combination of open fractures of the central and fifth MT resulting from high-energy machinery accidents is quite uncommon [1-3]. The Gustilo-Anderson classification system is widely used to assess the severity of open fractures and guide treatment decisions. In this system, Grade I is defined as a skin wound less than 1 cm long with clean borders; Grade II is a laceration of 1 cm or longer without significant soft tissue damage; and Grade III involves severe soft tissue damage. Grade III fractures are further subdivided into Grade IIIa (with sufficient soft tissue coverage over the fractured bone), Grade IIIb (with extensive loss of soft tissue, periosteal stripping, and bone exposure), and Grade IIIc (where the fracture is associated with an arterial injury that necessitates surgical repair) [6]. In the current case, two of the three MT groups are affected – the central and the fifth – and according to the Gustilo-Anderson classification, the injury is clas-

sified as Type IIIb, characterized by a wound larger than 3 cm, extensive soft tissue damage, and severe contamination [6, 7].

Intramedullary K-wire fixation is considered the gold standard for surgical treatment of open MT fractures [1, 3]. Mini-external fixators have also been used to manage complex MT fractures, particularly those accompanied by soft tissue loss [4]. Open fractures can lead to serious complications, including soft tissue infections, delayed union, nonunion, malunion, skin loss, non-healing wounds, vascular compromise and gangrene, severe scarring, loss of function, nerve injury, and osteomyelitis [4].

CONCLUSION

Fractures of the MT are commonly seen in the emergency department, though open fractures of the central and fifth MT are relatively rare. It is essential to thoroughly evaluate the patient's condition and adhere to the Gustilo-Anderson protocol for managing open injuries. Key aspects of managing open fractures include accurately assessing the injury, preventing infection, ensuring adequate soft tissue coverage, stabilizing the fracture, and implementing effective postoperative rehabilitation. K-wires remain the gold standard for treating diaphyseal fractures of the MT, often resulting in satisfactory postoperative outcomes.

Funding: *The authors did not receive any financial support from any organization for this research work.*

Ethical statement: *This study has been performed in accordance with the ethical standards as laid down in the Declaration of Helsinki.*

Conflict of interest: *The authors declare that they have no competing interests.*

Consent for publication: *Consent form for publication was signed by the patient and collected.*

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