

Case Report

An unusual presentation of multiple metatarsophalangeal joint irreducible dislocation: A case report

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Abstract

Dislocations of multiple metatarsophalangeal joints are a rare injury, as the compact arrangements of tissues around the joint make it a stable condyloid joint. There are a few cases in the literature showing four or all metatarsophalangeal dislocations. We present a case of a male patient who sustained a fall from height resulting in dorsiflexion injury of the metatarsophalangeal joint. Closed reduction techniques failed; therefore, we had to perform an open reduction of the dislocation. Two dorsal incisions are used to address the injury. It was found that the plantar plate and buttonholing of the capsule prevented its reduction. A dorsal approach prevents further injury to the plantar plate, but the capsule had to be incised to achieve reduction.

Level of Evidence V; Case Report.

Keywords: Foot injuries; Multiple metatarsophalangeal joint; Fracture dislocation; Open fracture reduction.

Introduction

The metatarsophalangeal joints consist of the synovial condyloid joint in which the metatarsal heads articulate with the phalanges. Their anatomy is similar to the metacarpophalangeal joints of the hand. The metatarsophalangeal synovial joint is covered by a fibrous capsule and strengthened by collateral ligaments. Additional support comes from the extensor tendons on the dorsal side and the fibrous plantar plates on the plantar side⁽¹⁾. To note, the plantar plate type 1 collagen composition is similar to that of the meniscus in the knee and the annulus fibrosis in the intervertebral disc. The metatarsophalangeal joint allows a range of motion in flexion, extension, and some abduction and adduction⁽²⁾.

The hallux metatarsophalangeal joint is stabilized by its capsule and the ligaments surrounding the tendons. The stabilizing components are the fibrous capsule, the collateral ligament complex, the sesamoid-phalangeal ligaments, the inter-sesamoid ligament, the plantar plate, and the extensor hood. The surrounding tendons crossing the joint, the flexor

hallucis brevis and longus, abductor and adductor hallucis, and extensor hallucis brevis and longus, provide additional stability. There is documented variability in sesamoid anatomy and configuration.

The anatomical stability from the second to the fifth metatarsophalangeal joints is provided by the fibrocartilage ridge, the plantar plate, approximately 2cm in length and 2mm in thickness, and rectangular in shape⁽³⁾. The plantar plate arises from the plantar side of the metatarsal and is inserted into the plantar aspect of the proximal base of the phalanx. Additional stability is provided by the collateral ligament, accessory collateral to either side, the medial and lateral collateral ligaments, and the deep transverse intermetatarsal ligaments. The collateral ligaments originate from the distal tubercle of the metatarsal and are inserted into the proximal part of the inferior side of the proximal phalanx on the medial and lateral sides, respectively. Accessory collateral ligaments originate along with the dependent portion of the collateral ligament and are inserted into the plantar plate. The lateral

Study performed at the SP Medifort Hospital, Trivandrum, Kerala, India.

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collateral ligament was found to be thicker and stronger than the medial collateral ligament (Figure 1).

The compact arrangement of capsule, fibrous covering, ligamentous complex, flexor and extensor tendons makes the metatarsophalangeal joint a stable joint with good range⁽⁴⁾. To dislocate a metatarsophalangeal joint, there should be a violent, high-velocity injury force.

Case presentation

We present the case of a 31-year-old active male who sustained a fall from a height of around 30 feet and landed on his foot. His history revealed that he landed on his forefoot with dorsiflexion force. He was received in the emergency

room 90 minutes post-injury. Primary evaluation showed a chest injury and pneumothorax. Intercostal drainage was inserted, and the patient was admitted to the critical care unit. His right foot revealed gross deformity at the forefoot level with a wound over the medial aspect of the hallux and the plantar aspect of the base of the second toe. Initial trauma protocol radiographs showed dislocation of the first through fourth metatarsophalangeal joints of the right foot with no associated fractures. A trial of closed reduction was attempted under sedation and muscle relaxation, but was unsuccessful. After wound irrigation, a splint was applied, and a computed tomography was performed for further evaluation of the metatarsophalangeal injury (Figures 2 and 3).

After clinical and radiological evaluation, the patient was scheduled for closed or open reduction under general anesthesia once the general condition stabilized. On post-injury day 2, the patient was scheduled for the procedure, and assistance from the plastic surgery team was requested (Figure 4).

Intraoperative findings: After skin incision, the tendons retracted along with the sheath. The metatarsal head was not reducing due to obstruction from the plantar plate and capsule. The capsule is incised, and the plantar plate is levered under the metatarsal. The levered metatarsal head is reduced to the phalanx base. The reduced joint is unstable because capsule support is lost (Figures 5 and 6).

The third metatarsal fracture was stable and was checked under C-arm; hence, it was planned for conservative management. After successful reduction and fixation of the first through fourth metatarsophalangeal joints, the incised capsule was repaired with 3-0 Vicryl.

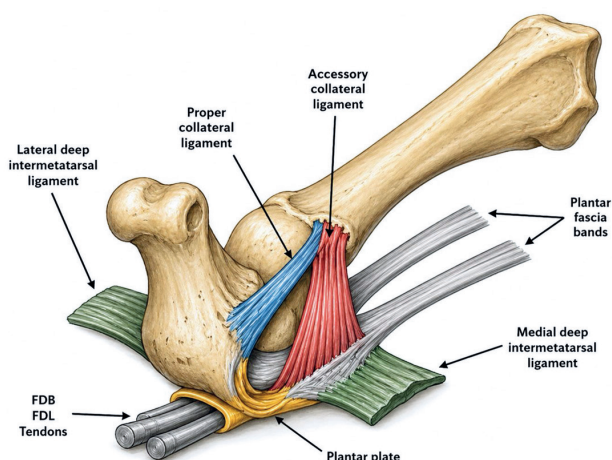


Figure 1. Anatomy of the metatarsophalangeal joint.



Figure 2. Illustration of the deformity noted along the base of the toes (plantar, dorsal, and side aspects). The blue-marked area-metatarsal head is palpated. Lacerated wound over the medial aspect of the hallux at the metatarsophalangeal joint. The medial structures are disrupted, and metatarsophalangeal reduction can be palpated but unstable.

The medial stabilizing structures of the hallux were approximated and sutured before skin closure. The skin was closed with loose nonabsorbable sutures, and a below-knee plaster cast was applied. Wound inspection on postoperative days 2 and 4 showed a clean wound.

The patient was discharged on postoperative day 4. The plan was to leave the K-wires and the cast for eight weeks and to start weight-bearing after 12 weeks. Also, serial radiographs are recommended at 1, 2, 3, 4, and 6 months follow-up (Figure 7).

Discussion

The metatarsophalangeal joint is one of the most stable joints in the body, yet it takes immense force during the gait cycle. Simultaneous push-off from all five rays is needed for normal gait. The stability described is provided by the surrounding structures.

It needs violent force to dislocate multiple metatarsophalangeal joints. A missed or inappropriately treated metatarsophalangeal dislocation can lead to abnormal gait and persistent pain.



Figure 3. Radiographs and computed tomography showed the subluxed, unstable hallux metatarsophalangeal joints and plantarly dislocated second, third, and fourth metatarsals. Base of the third metatarsal fracture. The fifth metatarsophalangeal joint is reduced.

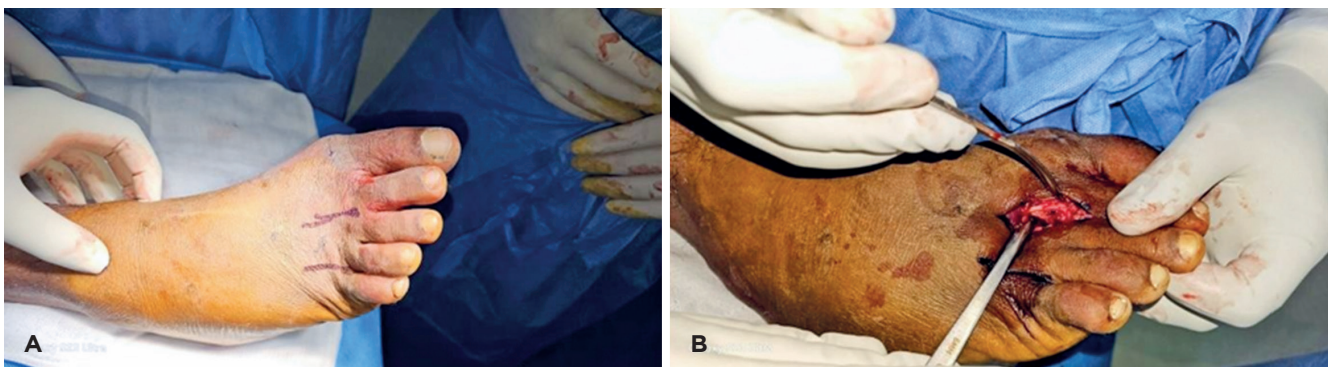


Figure 4. (A) Planned incision between the second and third toes and between the fourth and fifth toes. The hallux reduction can be palpated through an open wound. (B) The metatarsal is elevated using a lever, the plantar plate is levered under the metatarsal, and the capsule had to be incised to reduce the joint.



Figure 5. Initial levering of the metatarsal head did not reduce it due to obstructions from the plantar plate and capsule.

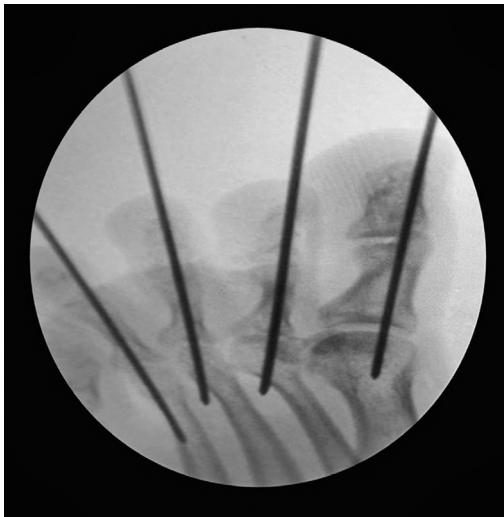


Figure 6. Open reduction and each metatarsophalangeal joint reduction is visually confirmed, and one axial K-wire is inserted in a slight dorsiflexed position.

This case was particularly challenging because it involved an unusual injury pattern with failed closed reduction. Metatarsophalangeal joint dislocations are usually reduced in the emergency room under sedation or muscle relaxation with closed manual reduction⁽⁵⁾. When dislocations are irreducible,



Figure 7. Postoperative anteroposterior and oblique radiographs.

surgeons often need to consult the literature and seek peer input for further management. To date, very few similar cases have been reported, with fewer than five describing dislocation of the first through fourth metatarsophalangeal joints⁽⁶⁾.

In a few cases in the literature, multiple dislocations required open reduction and temporary internal fixation using K-wires. Dorsal incisions are used for exploration and reduction in which the plantar plate or transverse metatarsal ligament was found to be obstructing the reduction. A plantar approach is also described in the literature, allowing reduction and repair of the plantar plate. The plantar plate repair will stabilize the joint and may not require an additional K-wire for stabilization^(7,8). In our case, K-wires are used for stabilizing the joint. The order of reduction is not cited anywhere; we reduced the second metatarsophalangeal joint and followed the same technique through the fourth joint. The hallux metatarsophalangeal joint is fixed last, with disruption of the medial supporting structures, resulting in joint subluxation.

Multiple metatarsophalangeal joint closed dislocations are a very rare injury. Initial management is by closed reduction under anesthesia. Joint reduction is established by correction of gross deformity, anteroposterior and oblique view radiographs. If closed reduction fails, open reduction is advised. Dorsal incision is used over the joint. The structures that prevent reduction include the plantar plate, the transverse metatarsal ligaments, and the capsule. These structures may need to be incised for reduction and repaired afterward. If the joint is unstable after reduction and repair, a K-wire temporary stabilization is advised.

Authors' contributions: Each author contributed individually and significantly to the development of this article: JT *(<https://orcid.org/0009-0000-2591-996X>) Conceived and planned the activities that led to the study, data collection, interpretation and analysis, wrote the article and survey of medical records; NTJ *(<https://orcid.org/0009-0005-9423-8945>) Performed the surgeries, interpreted the results of the study, participated in the review process, and clinical examination; SR *(<https://orcid.org/0009-0005-2388-9759>) Performed the surgeries and participated in review process. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID) .

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