



# Missed Lisfranc Dislocation in a Patient with Tibia and Fibula Fracture

## Tibia ve Fibula Kırığı Olan Hastadaki Gizli Lisfranc Çıkığı

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### ABSTRACT

Lisfranc injury is a rarely seen, hardly diagnosed and frequently missed injury. Emergency physicians are increasingly exposed to malpractice lawsuits due to delayed referral or inadequate management of this injury that leads to permanent sequelae. We report here the case of a boy with spiral fractures of both the tibia and fibula due to an ice-skating injury, who additionally had Lisfranc ligament injury of the foot. Emergency physicians should maintain a high index of suspicion for a Lisfranc injury in a patient with midfoot swelling and/or tenderness. Many Lisfranc injuries are missed at first glance as gross luxation or lateral deviation of the midfoot is usually not present. The forefoot may appear normal; or acute tenderness along the Lisfranc joint may be mistakenly attributed to co-existing fractures as it was in our case.

**Keywords:** Tarsometatarsal injury, foot, hindfoot, midfoot, lisfranc, dislocation

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### ÖZET

Lisfranc yaralanması nadir görülür, teşhisi zordur ve sıklıkla atlanan bir yaralanmadır. Kalıcı sekele yol açan bu yaralanmada gecikmiş sevk veya yetersiz tedavi nedeniyle artan bir şekilde acil hekimlerine malpraktis davaları açılmaktadır. Bu vaka sunumunda, buz pateni yaparken düşmesine bağlı ayaktaki lisfranc ligament yaralanması ile ilişkili tibia ve fibula spiral kırığı olan bir erkek hakkında bilgi sunmak istedik. Acil hekimleri ayak orta bölümünde şişme ve/veya hassasiyeti olan hastada Lisfranc yaralanmasından yüksek oranda şüphelenmelidirler. Orta ayak bölümünde genellikle lateral deviasyon veya belirgin çıkık görülmediği için bazı lisfranc yaralanmaları ilk bakışta atlanabilir. Ayak ön bölümü normal olarak görülebilir veya lisfranc eklemine tek başına akut hassasiyet olması bizim vakamızda olduğu gibi eşlik eden kırıklara bağlı atlanabilir.

**Anahtar Kelimeler:** Tarsometatarsal yaralanma, ayak, arka ayak, orta ayak, lisfranc, çıkık

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### Introduction

The Lisfranc ligament extends from the medial cuneiform to the base of the second metatarsal. The Lisfranc joint is the junction between the midfoot and the forefoot, and the Lisfranc ligament is the single connection between the medial and middle columns of the foot (1). Lisfranc injuries are injuries to the tarsometatarsal joints that separate the midfoot from the forefoot (2).

Although Lisfranc injuries make up only 0.2% of all fractures, the Lisfranc joint is an area of concern for radiologists and emergency physicians due to the often subtle presentation of injury on radiography, with about 20% of Lisfranc joint injuries missed on initial anteroposterior and oblique radiographs (1). Moreover, missed Lisfranc fracture-dislocations are one of the most accepted reasons for malpractice lawsuits against radiologists and emergency physicians (1). The complex bony and ligamentous anatomy of this joint and the different forms and mechanisms of injury make radiographic interpretation challenging and diagnosis difficult (3). Delayed diagnosis may cause long-term impairment and poor functional outcome as a result of dorsalis pedis artery and/or deep peroneal nerve damage, which may cause deformity due to reduced arch height, chronic pain, arthritis, or soft tissue injury (1). We report here the case of a boy with spiral fractures of both the tibia and fibula due to an ice-skating injury, who additionally had Lisfranc ligament injury of the foot.

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## Case Report

A 16-year-old boy presented to the ED with a complaint of pain and deformity in his right foot. He said that he had injured his foot a few minutes ago while ice-skating. He denied taking any medications. There were no contributing factors and no previous medical history.

Examination of the right foot revealed severe swelling and moderate deformity above the ankle on palpation. Severe tenderness to palpation was present both above the ankle and over the dorsum of the midfoot. He was unable to bear weight. The skin was intact, findings of the motor and sensory examination were normal, and distal pulses were normal.

Radiography showed spiral fractures of both the tibia and fibula (Figures 1a, b). The patient consulted with orthopaedic surgeons, and was sent home after a foot splint. He was admitted after 3 days for control. When the foot splint was removed, we observed plantar ecchymosis. Re-examining the anteroposterior and lateral radiographs, we identified Lisfranc dislocation (Figure 1c). The patient re-consulted with orthopaedics and it was decided to follow up with a foot splint without surgery (Figures 1d-f). The patient's consent was obtained for the publication of the case.

## Discussion

The tarsometatarsal articulation was named after Jacques Lisfranc, a French physician and field surgeon in Napoleon's army who rescued a magistrate who had fallen off his horse (1, 3). Lisfranc injuries can be caused either by direct or indirect trauma. Direct or crush injuries to the dorsum of the foot are infrequent and are generally complicated by vascular compromise (4). Indirect forces are the cause of the majority of injuries, resulting from either a rotational force applied to the forefoot, with a fixed hindfoot or axial loading on a plantar-flexed, fixed foot. Common causes of indirect trauma include falls from a height, motor vehicle accidents, equestrian accidents, parachute accidents, and athletic injuries (4). In our case, the reason of the injury was an indirect rotational force due to ice skating. Lisfranc fracture-dislocations may occur both from lower-energy mechanisms, such as trips and falls; or high-energy injuries, such as motor vehicle collisions, falls, and sports involving fixation of the forefoot (horseback riding, windsurfing, skiing, and skating) (5).

An anatomical and radiological case control study has shown that the medial aspect of the tarsometatarsal joint, between the medial cuneiform and the base of the second metatarsal, is the key to the stability of the Lisfranc joint (6). The mortise of this joint was significantly less deep in patients in the injury group compared with the controls (6).

The clinical diagnosis of Lisfranc injuries is possible by means of the following signs and symptoms: 1) limited or no weight-bearing ability; 2) significant oedema along with pain on palpation of the tarsometatarsal joints (2); 3) plantar ecchymosis (can be pathognomonic for these injuries); and 4) pain with gentle passive supination and pronation of the forefoot with abduction of the forefoot with the hindfoot held fixed: this manoeuvre is specific for tarsometatarsal injuries (3, 7).



**Figure 1** a. anteroposterior ankle, b. lateral foot, c. anteroposterior midfoot radiographs of the patient (initial admission), and d. anteroposterior ankle, e. lateral foot, f. anteroposterior midfoot radiographs of the patient on the third day after the foot splint

The first radiographs ordered for a suspected Lisfranc injury are anteroposterior, 30° oblique, and lateral radiographs. Weight-bearing views and comparison views may be helpful if radiographs are negative. The base of the second metatarsal should always be carefully examined for fractures, avulsions, and displacement (3). Separation between the base of the first and second metatarsals or between the medial and middle cuneiforms is the most frequently observed radiographic finding. Any fracture of the base of the first three metatarsals is suspicious for a Lisfranc joint injury. Any displacement of more than 2 mm between the base of the first and second metatarsals needs further assessment for a Lisfranc injury and a comparison view with the uninjured foot. The medial cortex of the second metatarsal should line up perfectly with the medial border of the second cuneiform.

Lisfranc fracture-dislocations can be divided into two categories radiologically: the homolateral type is the more common and metatarsals are dislocated to the same side (laterally); in divergent displacement, the first metatarsal is shifted medially and all the other metatarsals are dislocated laterally. There are two specific radiological signs of Lisfranc injury. The 'fleck' sign, a bony fracture fragment seen in the interspace between the first and second metatarsal bases, is an avulsion fracture of the second metatarsal base at the attachment of the Lisfranc ligament (1). This radiographic finding is diagnostic for a Lisfranc joint injury. The 'dorsal step-off' sign can be seen better in lateral radiographs and generally appears after the foot is placed in extreme plantar flexion with an axial load. It is dorsal dislocation of the proximal base of the second metatarsal (1).

In Lisfranc injury, the lateral edge of the medial cuneiform does not line up with the lateral border of the first metatarsal (3). This malalignment can be the only sign of injury to the tarsometatarsal joint in more subtle presentations, which can easily be missed (5). We saw this sign in our case. Nonetheless, Lisfranc dislocations should be distinguished from midfoot (Lisfranc) sprains. In sprains, there is ligamentous damage without diastasis. For this reason, the sprain may

be overlooked on radiographs at first sight due to subtle or unappreciable findings.

Associated fractures that may aid in the evaluation for Lisfranc fracture-dislocations are seen in the talus, calcaneus, navicular, cuboid and cuneiforms (1). On the contrary, the fractures were not in the hindfoot in our case; thus, they masked our diagnosis. Nithyananth et al. (8) studied high-energy open Lisfranc injuries and described associated midfoot and forefoot injuries in 22 patients. However, none of them had tibia and fibula fractures, which our patient had.

The physician's responsibility in the ED is to suspect the diagnosis, prove the injury radiographically, and to determine whether compartment syndrome exists with the fracture (3). Any suspected Lisfranc fracture-dislocation requires orthopaedic consultation as the treatment requires operative fixation (5). The goal in treating tarsometatarsal fracture-dislocations is to restore a painless, stable, and functional foot, with precise anatomical reduction necessary to minimise future disability (7). Non-operative treatment is suitable for Lisfranc injuries with <2 mm diastasis between the base of the first and second metatarsals (1). With these cases, the foot is considered functionally stable and management can range from weight-bearing using orthotics for arch support to non-weight-bearing status in a cast for 6 to 12 weeks. Definitive treatment should be delayed until the soft tissue swelling has resolved (2). Non-operative management may leave patients prone to midfoot degenerative arthritis. Operative treatment is suitable for Lisfranc injuries with >2 mm diastasis between the base of the first and second metatarsals. The progression of posttraumatic arthritis is associated with the quality of the anatomical reduction obtained and the extent of the damage to the articular surface of the tarsometatarsal joints (2).

Despite the low incidence of Lisfranc injuries, it carries a high potential for chronic secondary disability (7). Delayed referral from the ED or inadequate management usually results in permanent sequelae in the form of chronic pain, deformity, and difficulty wearing shoes. The most common complication after injury to the tarsometatarsal joint is posttraumatic arthrosis (7). Severe fracture-dislocations can give harm to vessels or cause vascular spasm at the level of the ankle (posterior tibial artery). Thus, serial vascular examinations are important. Compartment syndrome should be suspected in the case of tense swelling of the foot with diminished pulses. These cases need immediate surgical intervention (3). A high incidence of fusion across tarsometatarsal joints, non-anatomical reduction, osteomyelitis, the deformity of toes, planus foot, and mild discomfort on prolonged walking are the unfavourable outcomes present in patients with high-energy open Lisfranc injuries (8).

## Conclusion

Emergency physicians should maintain a high index of suspicion for a Lisfranc injury in a patient with midfoot swelling and/or tender-

ness. Many Lisfranc injuries are missed at first glance as gross luxation or lateral deviation of the midfoot is usually not present. Multiple studies have shown that partial dislocation of the Lisfranc joint is the commonest injury pattern. The forefoot may appear normal; or acute tenderness along the Lisfranc joint may be mistakenly attributed to co-existing fractures as was in our case.

## Conflict of Interest

No conflict of interest was declared by the authors.

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## Author Contributions

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## Çıkar Çatışması

Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.

**Hakem değerlendirmesi:** Dış bağımsız.

## Yazar Katkıları

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