

Case Report: Lisfranc/Tarsometatarsal Joint Injury

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History of present illness

The patient is a 44-year-old female who has left foot pain and swelling following acute injury. She notes symptoms following an episode where she was carrying her sick 8-year-old son down the stairs when she missed the last step and fell, twisting her left foot and falling to the ground. She then tried to stand up and put weight on her left foot, but due to severe pain she states she 'passed out' and fell again and her husband found her at the bottom of the steps. She presented at the local emergency department, where X-rays were taken and she was told she bruised her foot. Due to her pain and inability to bear weight fully, she spoke to her orthopedic surgeon, who ordered an MRI and consultation with a foot and ankle specialist. Prior to the fall, she was in her normal state of health. In addition to her left foot pain and swelling and limited weight-bearing, she notes bruising in the area. Review of symptoms was otherwise negative, outside of exacerbation of her pre-existing left knee symptoms.

Physical examination

She was noted on physical examination not to be able to stand for alignment evaluation due to left foot pain. Left knee was noted to have slight swelling. Tenderness to palpation was noted at the pes anserinus. No MCL insertion tenderness was noted. There was severe swelling throughout the left foot. There was no ankle swelling. Tenderness to

palpation was noted over multiple areas of the dorsal aspect of the left foot, as well as plantar aspect of the metatarsal heads. No tenderness to palpation was noted over the lateral or medial malleolus.

Radiographs

Left foot radiographs obtained while in the emergency department were reportedly negative for fracture.

Differential diagnosis for midfoot pain and swelling

- Tarsometatarsal joint fracture/dislocation
- Metatarsal fracture/stress fracture
- Tarsometatarsal osteochondral injury
- Cuboid/navicular fracture and/or compression injury
- Posterior tibial and peroneal tendon injury
- Soft tissue injury/hematoma/fluid collection
- Synovitis/arthritis
- Neuropathic change

Plan

Following emergency department evaluation, the patient was placed on crutches, and arrangements made for orthopedic follow-up and MR imaging.



Figure 1: Coronal and sagittal proton density-weighted TSE FS (1A, B) and coronal proton density TSE (1C) images of the left foot demonstrate comminuted fracture and bone edema at the plantar aspect of the lateral cuneiform with mild plantar displacement/distraction (arrows).



Figure 2: Sagittal proton density-weighted TSE FS (2A) and TSE (2B) images of the left foot demonstrate fracture at the plantar aspect of the second metatarsal base with intraarticular extension and slight 1 mm displacement/distraction and overlying chondral fracture (arrows).

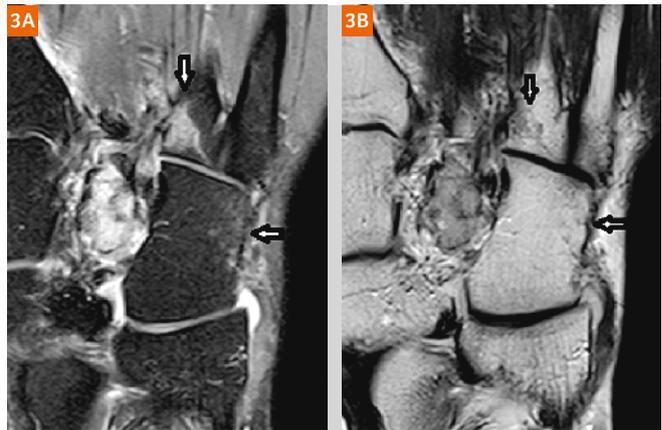


Figure 3: Fourth metatarsal base (vertical arrow) and lateral cuboid (horizontal arrow) contusion/mild impaction injury/fracture on axial proton density-weighted TSE FS (3A) and T2 TSE (3B) images.

Midfoot MRI protocol

1. Sagittal Proton Density (PD) Turbo Spin Echo (TSE)
2. Sagittal PD TSE Fat Saturation (FS)
3. Coronal PD TSE
4. Coronal PD TSE FS
5. Axial T2 TSE
6. Axial PD TSE FS

MR imaging findings

1. Comminuted fracture and bone edema at the plantar aspect of the lateral cuneiform with mild plantar displacement/distraction.
2. Fracture at the plantar aspect of the second metatarsal base with intraarticular extension and slight 1 mm displacement/distraction and overlying chondral fracture.
3. Multiple additional areas of contusion/mild impaction fracture/injury with cortical and subcortical fracture lines at the first, second, and fourth tarsometatarsal joints, as well as at the cuboid, anterior calcaneus, and calcaneal and navicular junction, with little or no displacement.
4. Complete tear and stripping of Lisfranc's ligament with possible avulsion from the second metatarsal base with possible small thin curvilinear cortical avulsion fragment. There is severe sprain and possible areas of tearing of tarsal, tarsometatarsal, and intermetatarsal ligaments about the tarsometatarsal joint.

Discussion

Lisfranc's fracture was named after Jacques Lisfranc, a field surgeon in Napoleon's army who described a fracture/dislocation injury pattern at the tarsometatarsal articulation in cavalry riders who fell from the saddle but were

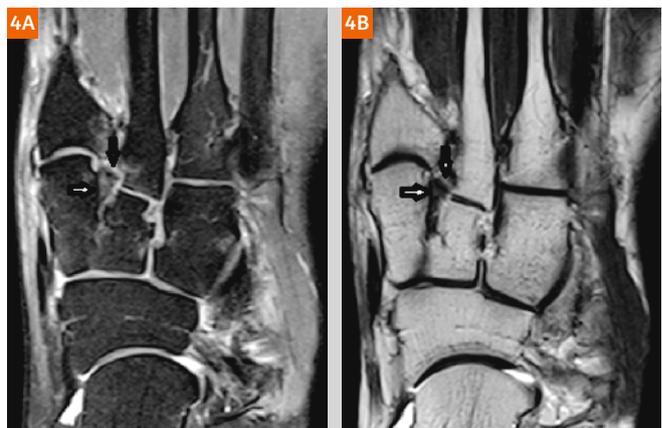


Figure 4: Tear and stripping of Lisfranc's ligament (horizontal arrow) with possible avulsion fragment (vertical arrow) from the second metatarsal base on axial proton density TSE FS (4A) and T2 TSE (4B) images.

dragged with foot still in the stirrup [1]. The term has now come to refer to any injury to the tarsometatarsal joint, with the joint now bearing Lisfranc's name.

The tarsometatarsal joint is a complex structure comprising the metatarsal bases with the three cuneiforms as well as cuboid, with numerous associated supporting ligaments including the eponymous Lisfranc's ligament which usually bridges the proximal medial margin of the second metatarsal with the distal lateral margin of medial cuneiform. The joint has been classically divided into three longitudinal columns, with the medial column composed of the medial cuneiform and the base of the first metatarsal, the middle column of the middle and lateral cuneiforms and the second and third metatarsal bases, and the lateral column of the cuboid and fourth and fifth metatarsal bases [2].

A classification system for Lisfranc injury has been described, with homolateral injury having all 5 metatarsals displaced in the same direction, isolated injury with one or two metatarsals displaced from the others, and divergent injury with metatarsals displaced and separated in sagittal and coronal planes. The homolateral pattern has been associated with cuboid fracture, and divergent injury with intercuneiform extension and navicular fracture, although multiple other complex injury patterns are also possible [3].

Lisfranc injuries can result from both indirect and direct trauma. Direct injuries, including crush and other high-energy mechanisms are frequently associated with significant soft tissue trauma, and compartment syndrome and vascular compromise are common sequela. Two classic indirect trauma mechanisms, axial loading of the foot in a fixed equinus position, as well as forced external rotation have been described, the latter corresponding to Lisfranc's originally-described injury mechanism [4].

On physical examination, pain and swelling of the midfoot, with tenderness along Lisfranc's joint with passive abduction and pronation of the forefoot with the hindfoot held fixed is the classic finding. Plantar midfoot ecchymosis and frank midfoot instability may be seen with more severe injuries, and assessment for vascular compromise and compartment syndrome should always be made with tarsometatarsal trauma [5].

Imaging

Radiographs

Conventional radiographic findings may range from frank fracture and dislocation with more severe injuries, but findings may be more subtle or absent with less severe injuries. Stress radiographs and/or fluoroscopy as tolerated may increase sensitivity.

Computed tomography

The superior bone demonstration capability of CT, in combination with 2D and 3D reconstruction techniques may be very helpful in the detection and characterization of more subtle or complex fractures.

MR imaging

MRI soft tissue demonstration capability may be useful in direct assessment for ligamentous injury, particularly when there is a high clinical concern with routine radiographs being inconclusive [6]. MRI is also helpful for suspected more acute bone injury, with benefit of acute bone and surrounding soft tissue edema and hemorrhage, when radiographically occult.

Treatment and prognosis

Non-displaced or slightly-displaced Lisfranc injury can initially be treated conservatively, but continued instability often necessitates subsequent surgery, particularly given high rates of post-traumatic arthritis. Injuries with 2 mm of displacement or more, or tarsometatarsal angulation of 15 degrees or more are treated primarily, with open/internal fixation and arthrodesis being much preferred over closed fixation, in the absence of contraindication such as skin disruption. Recent meta-analysis suggests that ORIF and arthrodesis yield "satisfactory and equivalent" results, with perhaps a slight advantage to primary arthrodesis in terms of clinical outcomes [7].

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