

# Lisfranc Joint Injury

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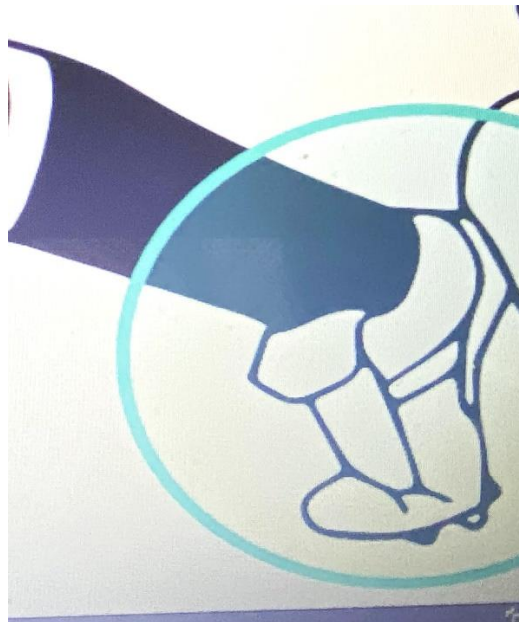
A mid-foot injury, especially a tarsometatarsal injury, can easily be taken for a sprain especially when one sees it as the result of a straightforward twist or a fall. Bones and ligaments are often involved in injuries of the middle part of the foot with subsequent damage to the cartilage covering those bones. The severity of a mid-foot injury can vary widely from the involvement of one joint to the involvement of many joints but also associated to broken bones and torn ligaments. A picture presenting either mild or extensive bruising.

A French surgeon (gynecologist), Jacques Lisfranc de St Martin, who was serving in the army of Napoleon Bonaparte in the 1800's, observed well these midfoot injuries among soldiers falling off their horses, in the cavalry and he, even performed amputations at this level as well. He coined his name at this part of the foot prone to injury. We will try to review the anatomy and understand the mechanism of injury from the simple form to its more complicated form, especially when a sprain can relate to multiple fracture-dislocations, just after a twist or a fall. Such injury can be seen as well in motor-vehicle accidents or gunshot wounds etc.

So, injuries to the tarsometatarsal (TMT) joint complex, "Lisfranc joint," are not common, and can be often missed and leading to osteoarthritis and long-term disability. The risk of such adverse outcomes increases substantially when TMT joint complex injuries are diagnosed late or managed improperly. Jacques L Lisfranc, coined his name to that joint.

A cluster of small bones forms an arch in the mid region of the mid-foot extending the articulations tarso-metatarsal to the metatarsal and the toe's phalanges. A group of four tarsal bones, the Cuboid, and three cuneiforms (Medial, Middle and lateral) are connected with a tight connective tissue, assuring joint stability in this

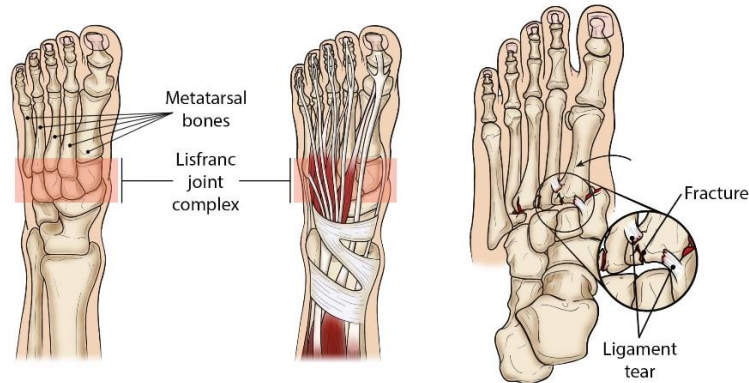
area and establishing a longitudinal arch, able to transfer the forces from the calves to the front of the feet. The bases of the first metatarsal (great toe to the third Metatarsal articulate with the cuneiform bones, forming a transverse arch called also Roman arch. In this arc, the second metatarsal base acts as a keystone articulating with the other five bones. The foot can't tolerate any displacement of that joint formed by the second metatarsal base and the middle cuneiform. This joint is supported by a complex of ligaments called the "Lisfranc ligaments" and formed by three components: a dorsal ligament, an interosseus ligament and a third ligament on the plantar surface. These three ligaments serve as a strong supporting structure to the joint formed by the medial cuneiform and the base of the second metatarsal. The interosseus ligament is the strongest structure of the this joint complex while the weakest of all is the plantar ligament which also branches to the second and third metatarsal.



This Planted position of the foot during the sport activity, in the equinism while jumping or twisting brings all the stress to the TMT Lisfranc complex.

Any twisting injury or fall may contribute to a traumatism to these structures (Bone, Cartilage and Ligaments) causing a tarsometatarsal joint insult which can be differentiated by the direction of the forces responsible of the injury. The Lisfranc injury at the tarsometatarsal joint is appreciated through the

displacement of the bones on impact... in another way, the degree of displacement at the Lisfranc Joint, will determine the amount of disruption of the specific ligaments.



**Lisfranc joint complex:** Tarso-metatarsal joints involving the medial, intermediate and lateral cuneiforms as well as the cuboid bone joining the metatarsals bridging with the toe phalanges and together forming the longitudinal arch support of the foot.

The Lisfranc joint-complex injury may happen through a simple twisting injury or in a fall while the foot is kept in downward position of the foot (equinism). Very common in soccer or football or basketball or other competition sports. I have seen some with wrestling, basketball etc.... it can happen with a direct trauma. The last ten years has seen more vehicle built in the concept of protecting the passengers as a hole with multiple air-bags in the wheel, the doors, the dashboard etc.... leaving the extremities (ankles and feet) more exposed to injury. 20% of these injuries may be missed or can be mis-diagnosed, rendering more difficult their late treatment.

Symptoms related to a Lisfranc fracture-dislocation relate to pain in the mid-foot, swelling and deformity with the inability to bear weight on the injured extremity. Bruising or extensive ecchymosis is often encountered. The intensity of these symptoms may vary according to the severity of the impact and how long ago it happened. The symptoms can be proportional to the amount of destruction of the tarsal bone or the disruption of the inter tarsal bone and ligamentous structures involved. It is important to rely on the clinical history and keep in mind, the past medical history. Any previous trauma or sport injury to the foot or any other medical problems.

Clinically, a deformity may be present with mild or extensive swelling or ecchymosis, pain and bony crepitation as well as instability at the tarso-metatarsal joints. A

neuro-vascular evaluation is also necessary prior to ordering radiographic studies to assess a diagnosis of Fracture-dislocation at the Lisfranc joints. Regular X-rays and CT-Scan as well as MRI may become necessary to appreciate the details of the different fractured bones and the extension of the soft tissue injury while understanding the pattern of injury and prepare an appropriate treatment. An associated ankle injury may be observed as well as a fracture of other tarsal bones like the calcaneus and the talus, the metatarsals and phalanges bones.

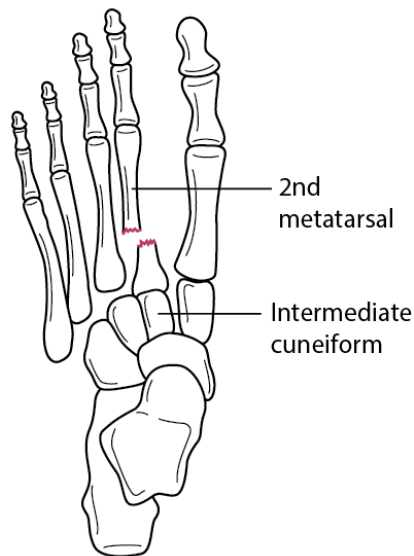
The treatment of such injury is based on the severity. Surgical or non-surgical. I like in my practice, to be able to apply a Jones dressing after seeing a patient suffering with Lisfranc injury, in the ER or on the field, because it is expected to generate a lot of swelling. Stable or unstable injury? If we are dealing with a stable injury, a protected weight bearing with crutches or a posterior splint can be offered while ligamentous or bony stability is being investigated. The foot can be also placed in a Cam-walker boot for comfort. Pain medication or anti-inflammatory medication until a final work-up determine the kind of treatment necessary: Conservative or Surgical.



Lisfranc injury demonstrating a substantial gap at the Lisfranc with bony fragments between the first and the second metatarsal base, more there is also a lateral dislocation of the lesser metatarsals with fractures. Such dislocation can be homolateral where all the metatarsal dislocate laterally or medially or even divergent where the great toes column goes medially and the lesser metatarsal dislocate laterally.

Such injury requires stabilization and accurate reduction with internal fixation. If it is missed and untreated, such individual may never be able to ambulate properly and the foot may be deformed. A late reconstruction will be more difficult on a neglected injury. Ligaments injury is almost always present in an unstable pattern.

We can't stop re-enforcing that the Lisfranc Joint is part of the middle region of the foot where a group of little bone forms an arch on the top of the foot and meet the metatarsals and extend to the toes. The bones are held in place with strong ligaments and a connection between the mid-foot and the forefoot is assured this way. This complex of ligament was described by Lisfranc and it bears his name but there is no connective tissue holding the first metatarsal to the second metatarsal. This appears to represent a weak area placing at risk the tarsometatarsal area forcing fractures and dislocations.



An other variant of Lisfranc fracture-dislocation of the midfoot where the medial column(big toe) is intact as well as second metatarsal base still articulating with the intermediate cuneiform but a dialocation of the lateral tarsometatarsal joints.

This area of the foot exhibit little motion in the forefoot although, it is a joint which plays an important role in stabilizing the arch, especially while one pushes up during the walking phase of the gait. The midfoot transfers then the forces generated from the calf to the front of the foot and any instability may force the foot to collapse or make the foot loses support of the arch. Often, degenerative arthritis may also follow such injury, especially among heavy smokers or people with osteoporosis and/or Diabetes Mellitus, necessitating a fusion of the involved area.

The Lisfranc joint involves bones and ligaments in the mid-foot at the tarsometatarsal joint and can be mild to severe. A simple Lisfranc can be mistaken for a sprain especially if it follows a simple sprain, or a fall and even a straightforward twist. One has to know that even a simple Lisfranc injury is a

severe injury that may take many months to heal and still may require surgical treatment.

Let us understand better the anatomy of the mid-foot where a cluster of small bones forms an arch on the top of the foot and five long bones (metatarsals) extend to the toes. The toes are held with strong ligaments (Lisfranc Ligaments complex) stretching across and down the foot, holding the first and the second metatarsal in place. There is little motion allowing this joint to stabilize the arch during the phases of the walking motion (gait). The mid-foot will be affected if there is disruption of different joints associated with fractures and ligaments disruption.



Lisfranc Injury with fracture of the medial cuneiform, increase in space between the bases of the first and second metatarsal base and widening of the tarso metatarsal lesser joints.

Lisfranc injuries tend to damage also the cartilage, ligaments and bones articular surfaces, complicating the healing with degenerative changes, even after successful surgical treatment. A simple twist and fall may result in a low energy injury with sport injuries like by example after a lay-up, the basketball player lands on the foot of an opponent in a flexed downward position (push up position or flexed downward). He becomes unable to bear weight on the extremity with progressive swelling and pain at the Lisfranc joints. More deformation may be seen with direct trauma on the foot with multiples fractures in the foot.



The discoloration or ecchymosis on the location may suggest a Lisfranc injury.

Pain with a stress examination of the midfoot is generally present. A “piano key test” will be positive when pain can be elicited with the foot held by the toes while the toes are flexed or extended. This test will produce pain. Another test which can be positive is the single limb heel rise which becomes positive when the Lisfranc joint is injured.

We have already suggested radiographical studies like standard X-rays, multiple views, CT-Scans and MRI studies will help in diagnosing such injury. Changes in the alignment of the metatarsophalangeal joints. Standing and weight-bearing views can be helpful to determine any mis-alignment and comparison views with the opposite extremity can be helpful.

The severity of a Lisfranc Fracture dislocation, will dictate the need for a surgical treatment with stabilization of the fracture-dislocations. If there are no fracture or dislocation, a non-surgical treatment can be offered with non-weight bearing cam-walker or a cast for 6-8 weeks and then progressive weight bearing in a Cam-walker or an orthotic. Follow-up radiographies will demonstrate further progress and proper healing.





Radiograph showing dislocation of the lateral tarsometatarsal joints dislocation, the medial column appears to be stable but will need to be investigated as well/ Sometimes the medial column can dislocate medially giving what we call a divergent tarsometatarsal joint dislocation. If all the metatarsometatarsal joint dislocate laterally, this is then a Convergent dislocation tarsometatarsal joints. Those joints will need to be evaluated separately to detect fractures associated. Evaluation for stabilization of these joint will be wanted in order to stabilize the mid-foot.

Fractures and dislocations will need accurate reduction and internal fixation or even fusion to stabilize the tarsometatarsal involved unstable joint. It is important to re-align the joint anatomically and restore proper stability. Many procedures can be offered depending on the pattern of injury. Proper anatomical reduction and stabilization of the joints are mandatory in the best way possible, with K-wires, plates and screws transfixing the joints until proper fusion if desired. Occasionally, the hardware may be removed when the objective for a stable fusion is achieved in 6 months to a year. If the fusion is not solid, hardware can fail or bend occasionally demonstrating a need to have them removed. I will expose some examples of fusion for better understanding.

Medial column (first Ray) with screws fixation through the tarsometatarsal joint while plates and screws are used to stabilize other tarsometatarsal joints.





Homolateral fracture dislocation of the tarsometatarsal joints with stabilization with plates and screws, achieving a nice alignment of the Tarso-metatarsal joints. (cuneiform and metatarsal). A fusion can also be obtained if desired the same way. In this case, the articular cartilage will be curetted prior to the application of the plate and screws. The hardware may be removed then if needed or if the patient experiences pain while wearing his shoes.

Weightbearing can be initiated progressively, 2-3 months after either of the procedures (ORIF or Fusion). A period of rehabilitation may be needed prior to return to full work activities. Most patients may recover well but some may have persistent midfoot pain even if the surgical treatment was successful. Athletic patients may return to some level of sport activities but in a long range, degenerative changes can be expected to settle despite of a nice fixation. Many others may develop some chronic pain.

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References:

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