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Diagnostic Challenges of Two Types of Rare Orthopedic Lower-leg Injuries

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Objectives:

By the end of this discussion on Maisonneuve and Lisfranc injuries, you will be able to:

1. Differentiate between a Maisonneuve and a Lisfranc injury/fracture
2. Identify the various exams needed to assess these types of injuries/fractures
3. Apply appropriate interventions for the patient with these types of injuries/fractures

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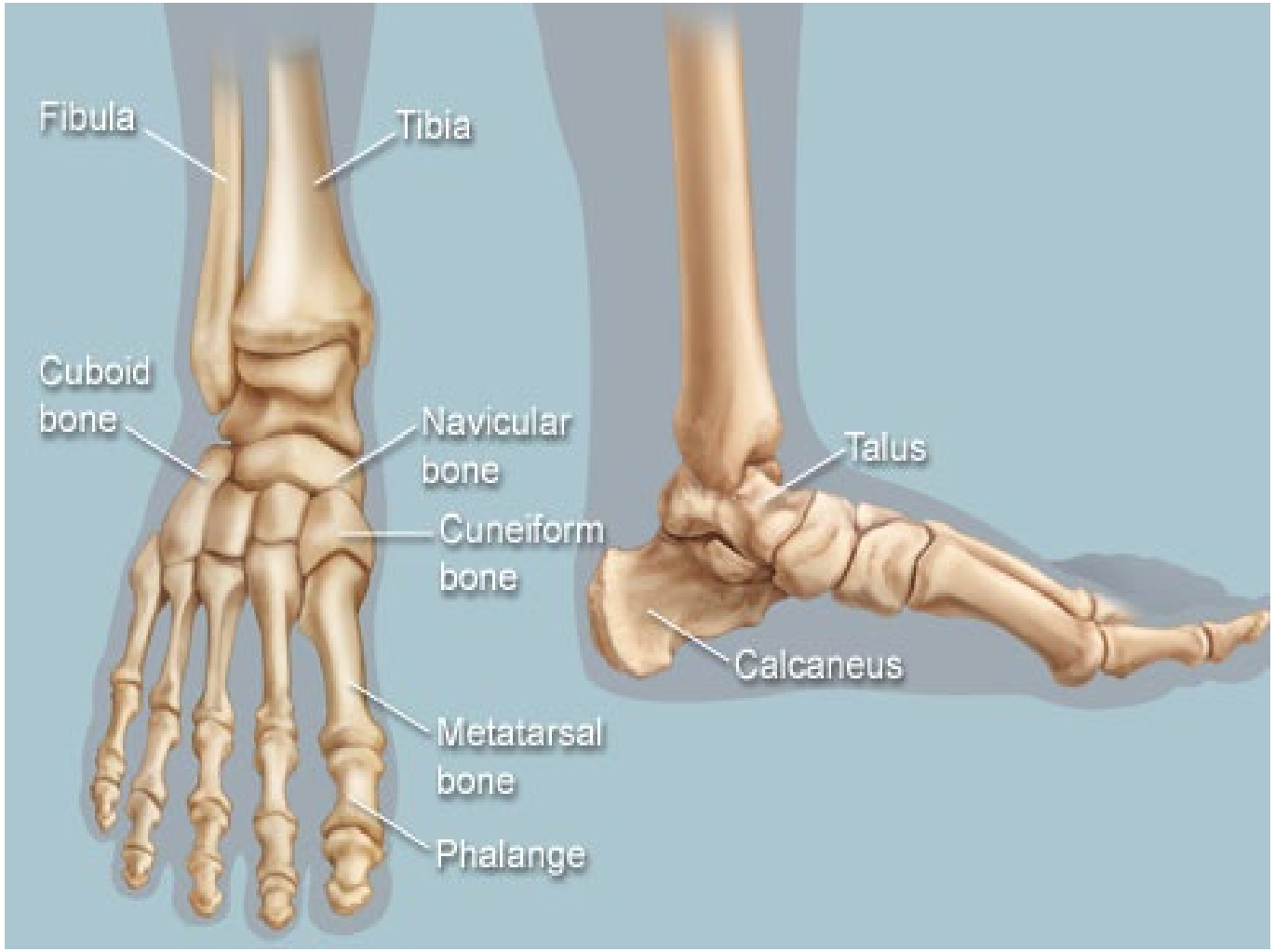
Case Study #1

63 yo female presented in the Emergency Department complaining of right ankle pain after a fall a few hours earlier. She was walking up a flight of stairs when she tripped and fell over one stair, landing on both knees. She noticed immediate right ankle pain, swelling and the inability to bear weight on her right leg. On exam she had no open wounds or bruising near the ankle, however there was pain over the anterior-inferior tibiofibular ligament (AITFL) area with dorsiflexion and external rotation. She also had tenderness in the proximal fibula area with palpation. She had good neurovascular circulation. Vital signs were stable. Her past medical history included hypertension and IDDM and utilizes an insulin pump.

Anatomy of the ankle bones



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High Ankle Injury – that can lead to a Maisonneuve Fracture/Injury

Mechanism of injury that leads one to suspect a high ankle sprain

- High Ankle Injury- Maisonneuve Fracture

- A rare clinical finding after an ankle injury first described by French surgeon Jules Maisonneuve in 1840 and accounts for about 5% of ankle fractures usually treated with surgery

- The main type of injury that causes this fracture is the severe pronation-external rotation of the ankle often seen in contact sports ex. football, soccer, etc., but can also be seen in other ankle injury scenarios that disrupt the syndesmosis ligaments.

- The patient often presents with pain, swelling and sometimes ecchymosis around the medial malleolus, as well as tenderness around the proximal fibula, calf and shin with an inability to bear weight on the affected leg

He et al. (2020) Richmond et al. (2018)

Even if no actual fracture of the ankle is seen on Xray, it doesn't mean that there is no ligament damage*

The medial structure is the first to be affected which can include a rupture of the deltoid ligament

This impact injury can then lead to the rupture of the anterior inferior tibiofibular ligament (AITFL)

Next it can cause the rupture of the interosseous ligament and membrane leading to syndesmotic injury. Which can then lead to the fracture of the proximal fibula

*Not all Maisonneuve fractures have had every sequence of ligament ruptures as described here. However, this is the most common sequence of events leading to the proximal fibular fracture.

Richmond et al. (2018)

Assessing for Maisonneuve injury/fracture

Assess for any neurovascular issues. This is an emergent situation and the orthopedist must be called immediately

Assess the mechanism of the injury

Squeeze test – palpated below and above the injury, especially the proximal fibula area

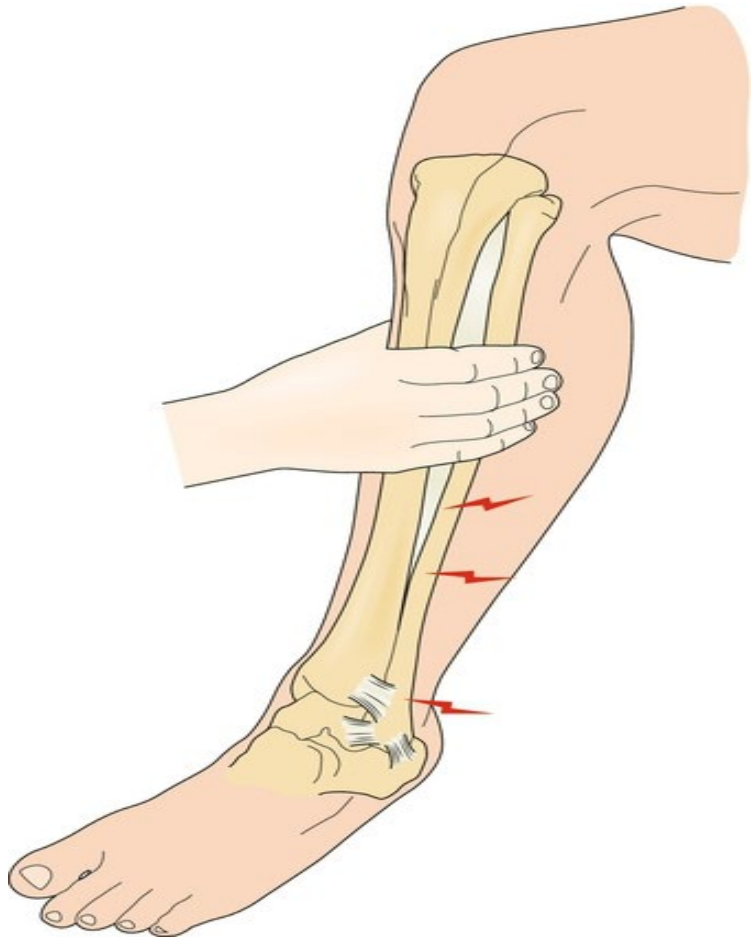
Plain Xray films of ankle with AP, mortise and lateral views, which also may require a stress view to see if there is widening of the syndesmotic space and displacement

Plain Xray AP and Lateral of the tibia-fibula area

CT or MRI of ankle to assess fracture, misalignment and ligament injury not seen on plain films

O'Neil, J (2019), Richmond et al (2018)

Squeeze Test



Diagnosis of Maisonneuve injury/fracture is made based on:

-Widening of the medial tibiotalar space or there is a medial malleolus fracture

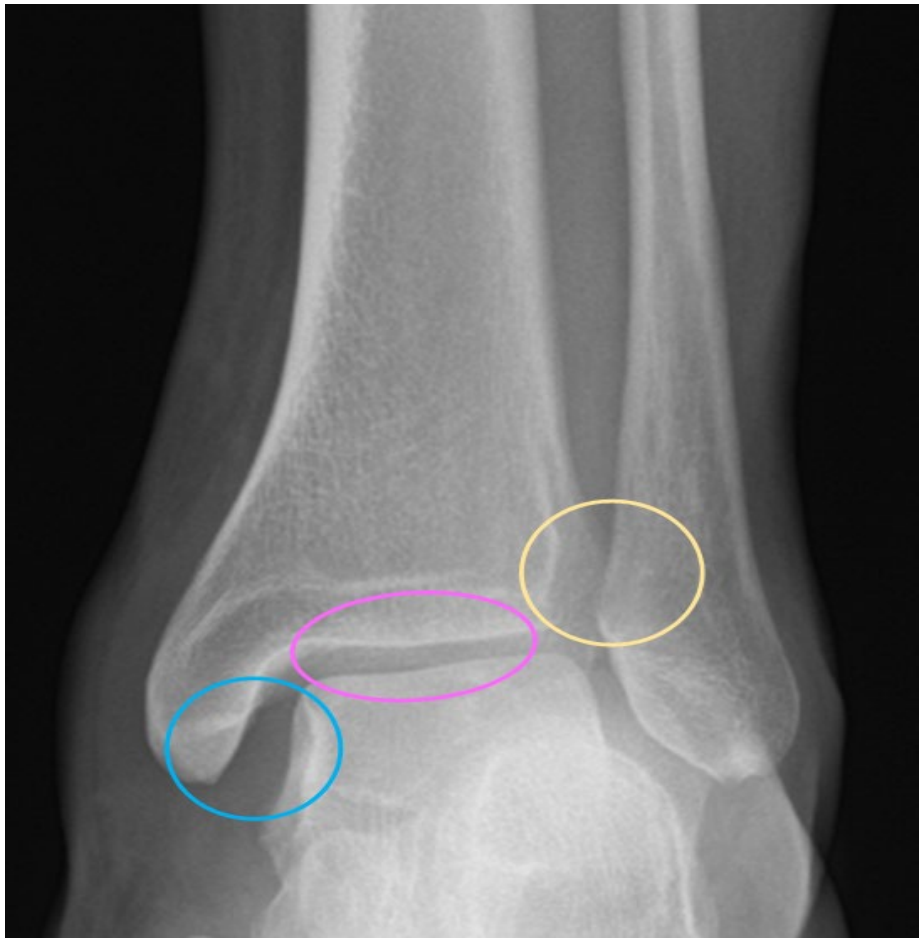
-Widening of the syndesmosis joint between the tibia and fibula

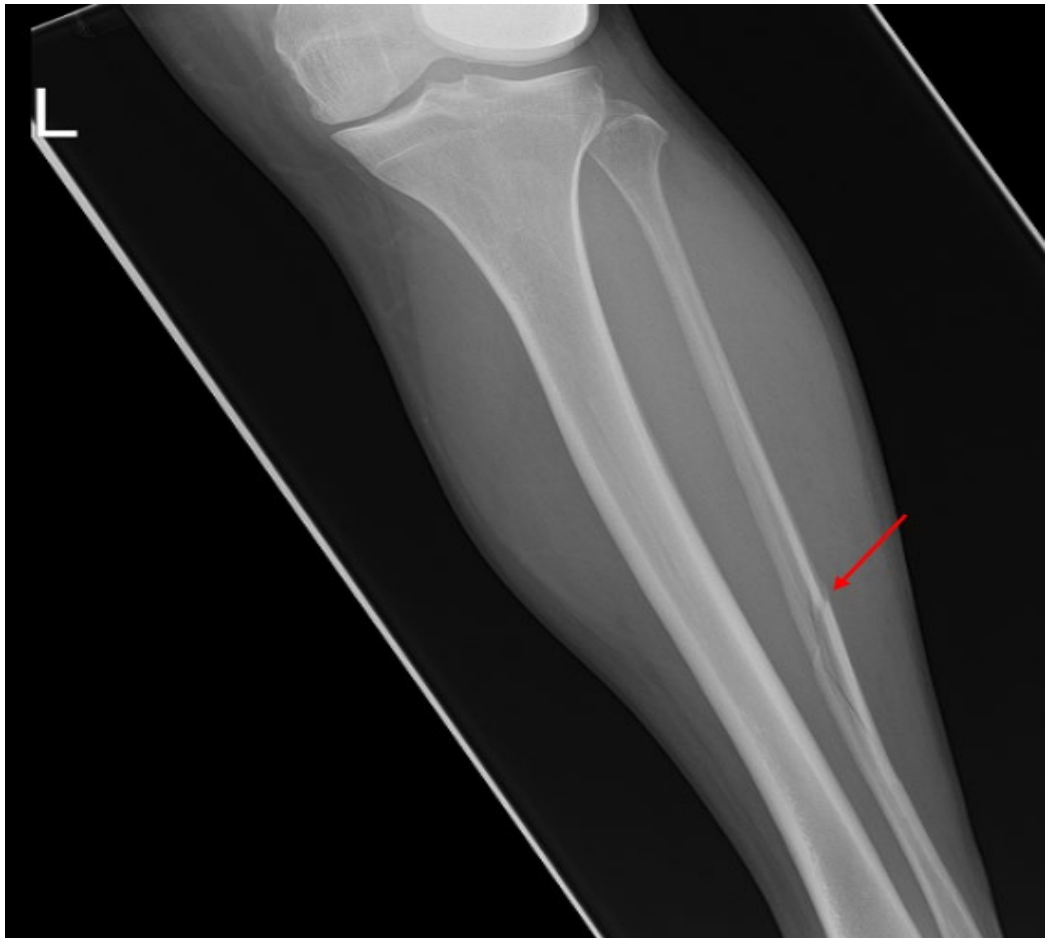
-Fracture of the upper third of the proximal fibula

O'Neil, J (2019), Richmond et al. (2018)

Normal ankle Xray

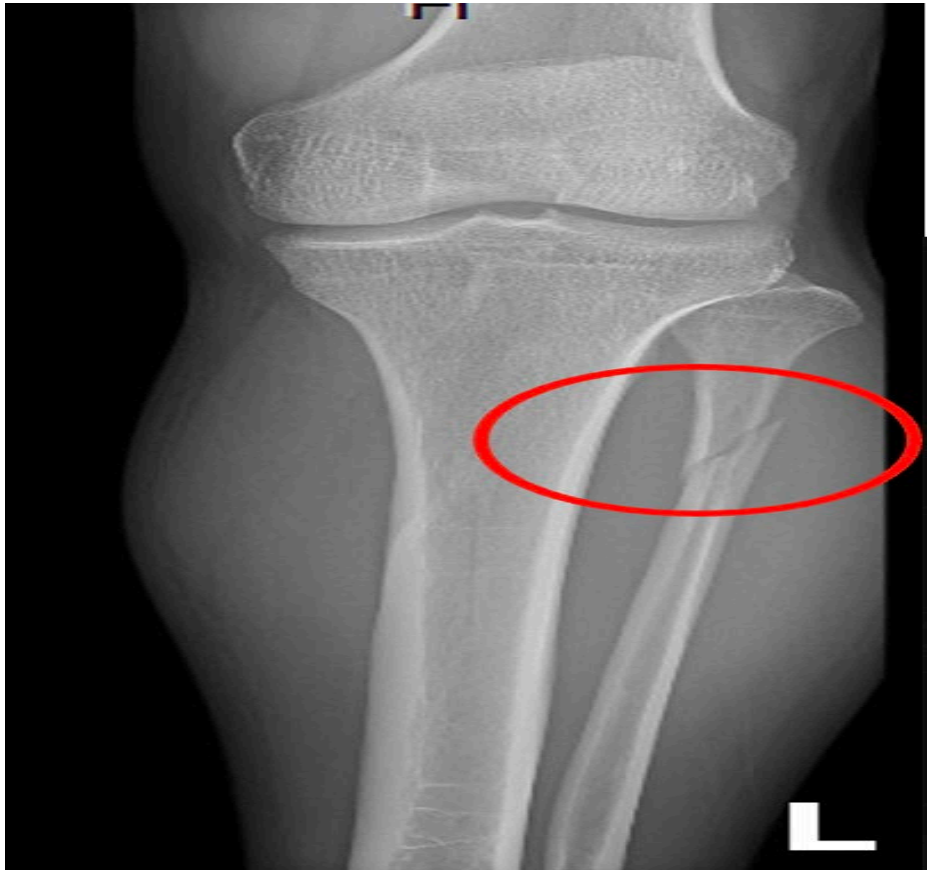
Maisonneuve Fracture
https://geekymedics.com/





Maisonneuve Fracture

https://cookcountyem.com/blog/2022/4/7/3j8o5jnbd081sjqwhzibm9pd4lp7me



Grading the High Ankle Fracture

Grade I

Partial injury of the AITFL
No widening seen on Xray
Treatment: CAM boot and conservative treatment

Grade II

Injury of the AITFL and IOM
May have no widening on Xray
Grade IIa – Cam boot and conservative treatment
Grade IIb – Surgical intervention if ankle unstable

Grade III

Complete injury or tear to AITFL, IOM, PITFL, deltoid muscles
Widening seen on Xray
Requires operative treatment
If there is a proximal fibula

Treatment of a High Ankle Injury with a Maisonneuve Fracture in the Emergency Department

Xray shows widening and/or fracture will need to alert orthopedist

The Orthopedist will make the decision to:

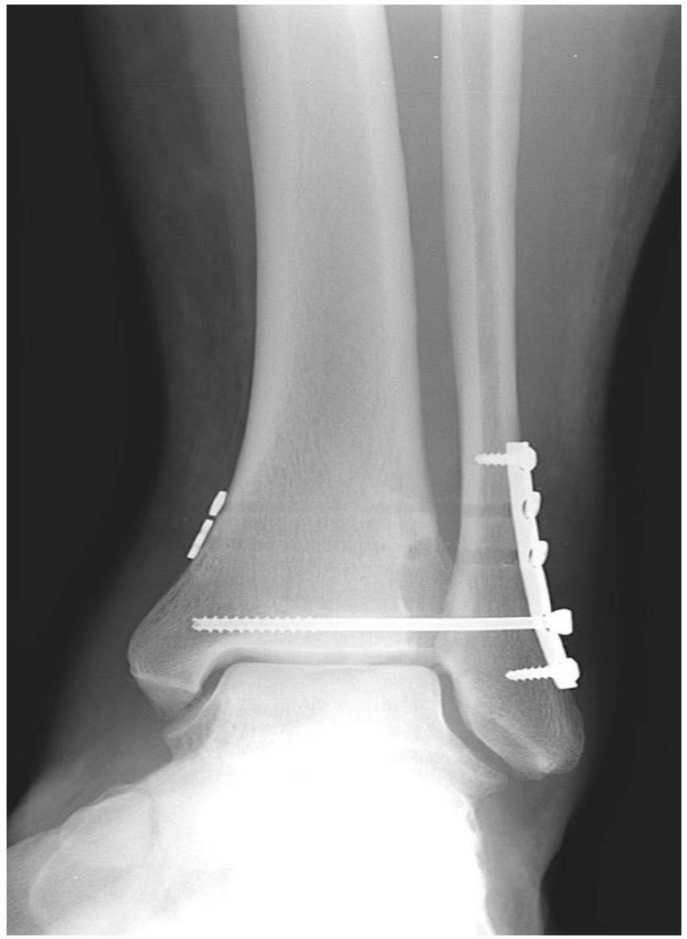
Do an immediate surgical repair, often an open reduction and internal fixation of the ankle area is usually done, especially if there is a question of major mortise and syndesmosis injury.(Grade IIb or Grade III)

Or request a short leg non-weight bearing splint be placed and crutches given and patient is to follow up with the orthopedist if not being admitted for surgery

Post-op or post-injury will require physical therapy and healing time can take 6-8 weeks or longer

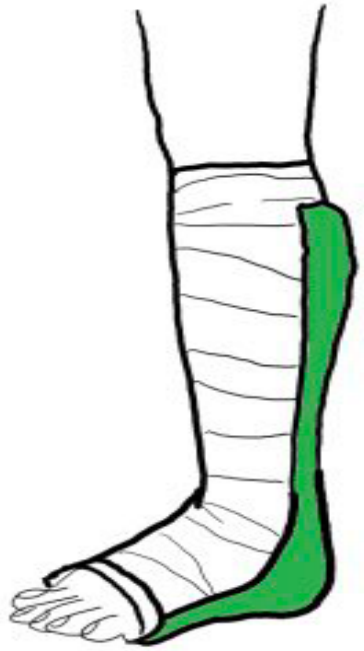
O'Neil, J (2019), He et al (2020), Deitrech et al (2020), Millen et al (2011)

An example of syndesmosis repair and stabilization

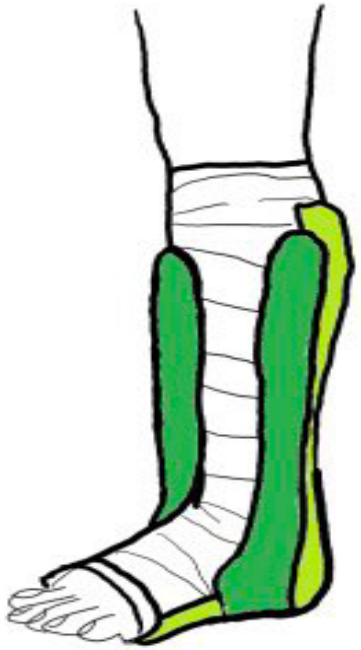


Example of a controlled ankle movement (CAM) boot

Splinting an ankle fracture with stabilization of fibula



Posterior Ankle Splint



Sugar-Tong Splint
(U–splint)

Case Study #1 conclusion

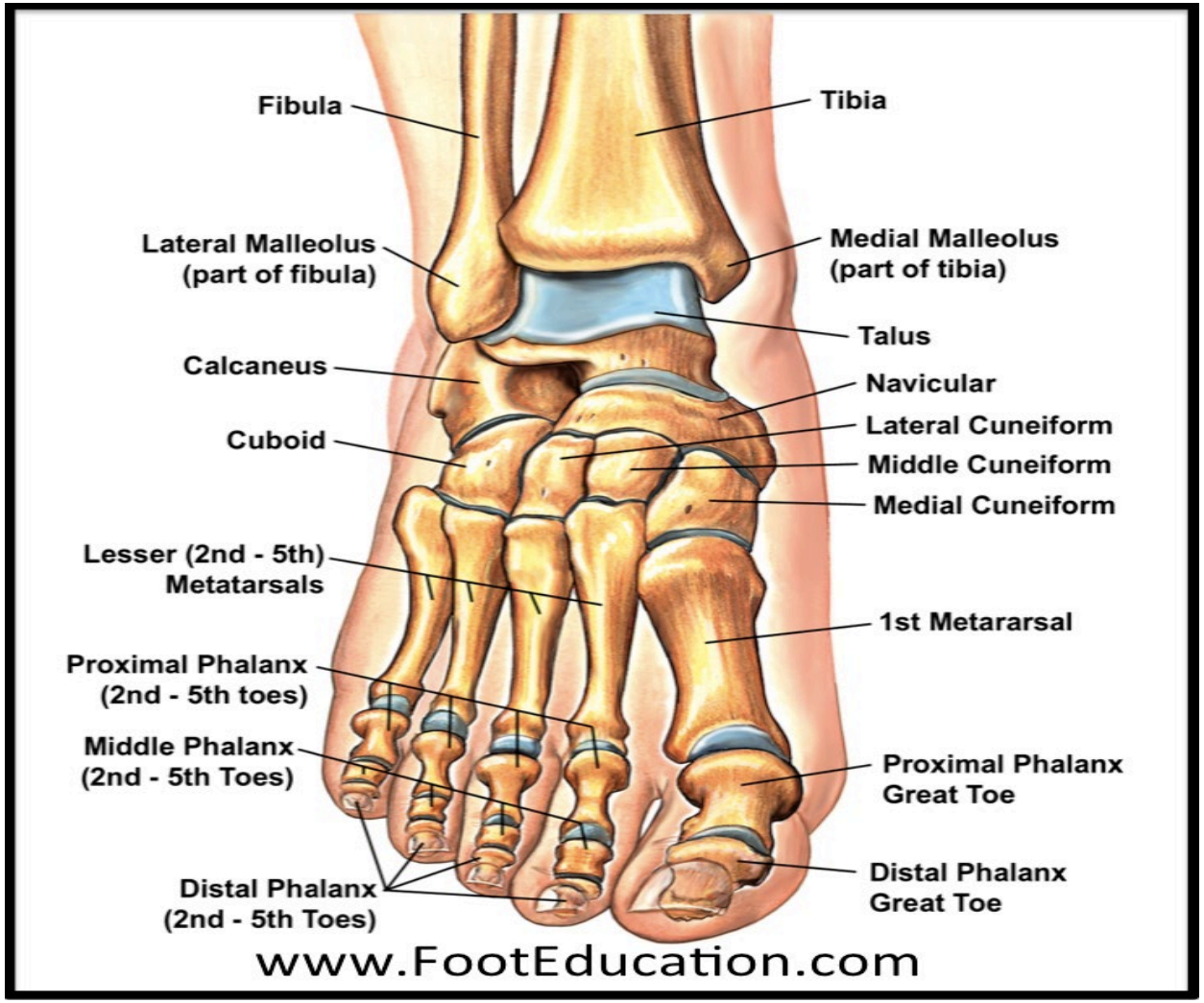
Plain Xrays of the ankle and tibia-fibula area showed a proximal fibula fracture and a 5th metatarsal fracture. Stress Xrays did not show any widening of the ankle mortise, however through CT the orthopedist felt that there was some syndesmotic injury and decided that he would treat it as a Maisonneuve type injury/fracture.

Since there was no major ligament tear and the fact that this patient was an insulin dependent diabetic, the ED placed a short leg splint and did crutches training. She only wanted Tylenol or Nsaids for pain. She was to follow up with the orthopedist the following week.

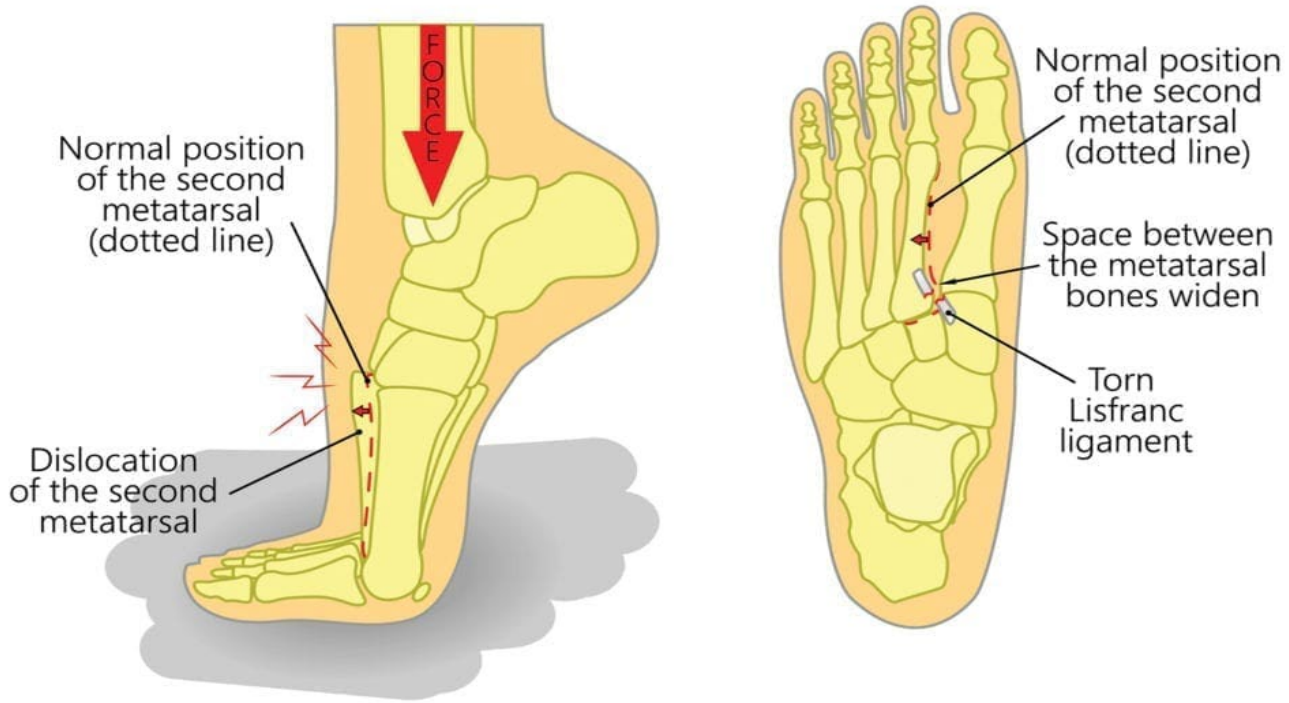
Case Study #2

- *26 yo female presented to urgent care because of left mid-foot pain, swelling and inability to bear weight. She was carrying scuba equipment on a boat and didn't see that someone had left the hatch open. She fell down the hatch landing on both feet before falling over. Her right foot was fine but her left foot was in extreme pain. Plain non-weight bearing Xrays were done and did not show any ankle or foot fractures. The patient was sent home with an ace wrap and some crutches and to take Nsaids for pain. She called her parents a week later because her midfoot pain was excruciating and she sustained some plantar bruising. She also had limited ability to flex her foot. She was taken to a local podiatrist for consultation.*

Bones of the foot



Mechanism of Injury for Lisfranc
https://upswinghealth.com/conditions/lisfranc-injury/



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Bruising on plantar side of foot

Foot Injury - Lisfranc

- First described by a Dr. Lisfranc, a French surgeon.
- The Lisfranc ligament is responsible for the stability of the first and second metatarsals. The first metatarsal is important for “en pointe” type flexion and the second metatarsal is important to maintain the midfoot arch
- A Lisfranc injury usually involves one or more metatarsals that are displaced from the tarsus
- The usual finding of a Lisfranc injury is midfoot between the first and second metatarsal joint.
- These injuries can be purely ligamentous or also involve a fracture of the metatarsal or the surrounding structures
- A Lisfranc injury with a fracture account for about 0.2% of all fractures, however, even without a fracture, a ligament tear that goes unnoticed can cause future foot pain and disability

Clare, M (2017)

Assessing for Lisfranc Injury

- Any neurovascular issues are emergent and ortho needs to called immediately

- Thoroughly assess the mechanism of injury

  Direct injury – ex. Crushing
  Indirect injury – ex. Fall that lead to pronation or hyperflexion of the foot

- Besides pain, look for any deformity, swelling, bruising of the foot (especially the plantar area) and/or the inability to flex or bear weight on the foot

- Plain non-weight bearing Xrays which have an AP, oblique and lateral view may be enough to demonstrate a more obvious Lisfranc injury especially where there is a separation between the 1st and 2nd metatarsal

- Weight bearing Xrays showing both the normal and injured foot can provide a comparison, as well as show a more subtle Lisfranc injury

- If the injury is still not obvious, or the patient can't tolerate a weight bearing Xray, then a CT of the foot can pick up more subtle fractures and subluxations and/or and MRI can show soft tissue and ligamentous injury

Clare, M (2017), Welck et al (2015)

Normal foot
Xray

Lisfranc Injury on Xray

Normal left foot vs Lisfranc injury right foot Xray

Grading Lisfranc Injuries

Homolateral – all 5 metatarsals are displaced in the same direction

Divergent – lateral displacement of the 2nd to 5th metatarsals with a medial dislocation of the 1st metatarsal

Isolated - one or two metatarsals are displaced from the others

Management of a Lisfranc Injury in the Emergency Department

- Missed Lisfranc injuries can lead to increased foot deformity, post-traumatic arthritic changes and foot instability.

- If after testing, the Lisfranc injury is found to be stable, then a non-surgical approach can be taken with foot stabilization in a non-weight bearing cast or CAM boot for 6 weeks, followed by physical therapy and an orthotic shoe for the following 4 weeks.

- If after testing, the Lisfranc injury is found to be unstable or the ligament and surrounding structures are displaced, then surgical intervention is needed

Clare, M (2017), Welck et al. (2015)

An example of a Lisfranc repair

Case Study #2 conclusion

This patient was seen by the podiatrist and was subjected to weight bearing Xrays and a foot CT. It was concluded that she did suffer a stable Lisfranc injury between her 1st and 2nd metatarsals without fractures. She was put in CAM boot and given crutches. She was advised to continue non-weight bearing for the next 4 weeks. She was able to come out of the CAM boot for showers and sleep. Eventually after approximately 4-6 weeks, she was able to start walking without the CAM boot and had minimal pain. This patient states that every now and then her mid-foot still hurts, but a year after her injury, she ran and finished the Honolulu Marathon!

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