AMSER Case of the Month: May 2020
Right Foot Pain

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Patient Presentation

HPI: 46 y.o. male presented to ED with 3 day history of right foot pain, after "skipping" the last stair while walking down steps, and falling on his inverted foot. Developed immediate pain over right medial midfoot. Weight-bearing was limited by pain. No paresthesias. No prior injuries to right foot.

- PMHx: HTN
- PSx: None
- Meds: Lisinopril
- Social: Drinks alcohol
- V/S: Within normal limits

Physical Exam

Right ankle/foot examination:

- Swelling and ecchymosis over the dorsal foot and digits. No noticeable deformities.
- Significantly tender to palpation over midfoot. Medial and lateral malleolus were nontender to palpation.
- Anterior drawer negative.
- Sensation to light touch intact. Dorsalis pedis pulse 2+.

Left ankle/foot examination:

- Exam within normal limits.

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 4: **Adult or child older than 5 years of age. Acute trauma to the foot. Ottawa rules can be evaluated without exclusionary criteria. Ottawa rules are negative. Suspected pathology in an anatomic area not addressed by Ottawa rules (not involving the midfoot; eg, metatarsal-phalangeal joint, metatarsal, toe, tendon, etc). Initial imaging.**

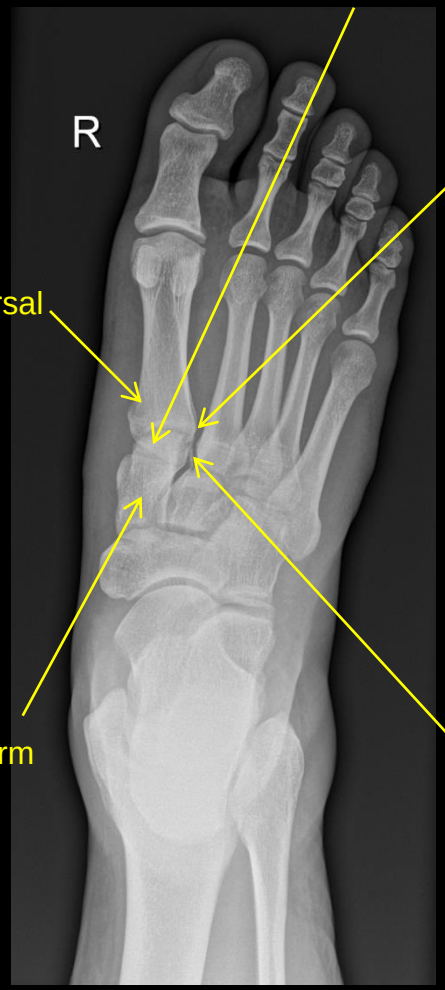
Procedure	Appropriateness Category	Relative Radiation Level
Radiography foot	Usually Appropriate	☢
Radiography foot with weightbearing	Usually Appropriate	☢
CT foot without IV contrast	May Be Appropriate (Disagreement)	☢☢
CT foot with IV contrast	Usually Not Appropriate	☢☢
CT foot without and with IV contrast	Usually Not Appropriate	☢☢
Fluoroscopy foot	Usually Not Appropriate	☢
MRI foot without and with IV contrast	Usually Not Appropriate	O
MRI foot without IV contrast	Usually Not Appropriate	O
US foot	Usually Not Appropriate	O

This imaging modality was ordered by the physician

Findings (unlabeled)

Findings (unlabeled)

Findings (labeled)



Tarsometatarsal joint

Abnormally widened tarsometatarsal joint

First metatarsal

Medial cuneiform

Avulsed cortical fragment

Anterior-Posterior

Soft tissue swelling

Lateral

Accessory ossicle (normal anatomic variant)

Oblique

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Findings (labeled)

These findings are consistent with an injury to the tarsometatarsal (Lisfranc) joint

Avulsed cortical fragment

Abnormally widened tarsometatarsal joint

Magnified view of anterior-posterior radiograph

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Select the applicable ACR Appropriateness Criteria

Variant 5: **Adult or child older than 5 years of age. Acute trauma to the foot. Suspect Lisfranc injury, tendon injury, or occult fracture or dislocation. Radiographs are normal or equivocal. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
CT foot without IV contrast	Usually Appropriate	☢☢
MRI foot without IV contrast	Usually Appropriate	O
US foot	May Be Appropriate	O
CT foot with IV contrast	Usually Not Appropriate	☢☢
CT foot without and with IV contrast	Usually Not Appropriate	☢☢
MRI foot without and with IV contrast	Usually Not Appropriate	O

This imaging modality was ordered by the physician

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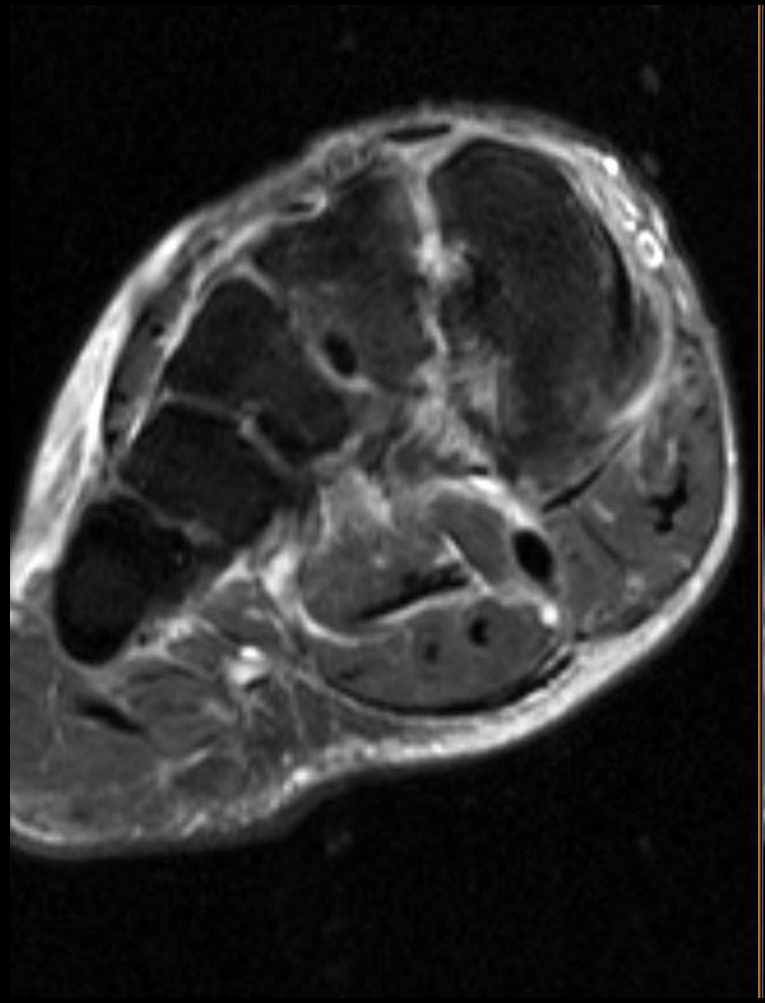
Findings (unlabeled)

Coronal T1-Weighted Image

Anterior-Posterior Radiograph

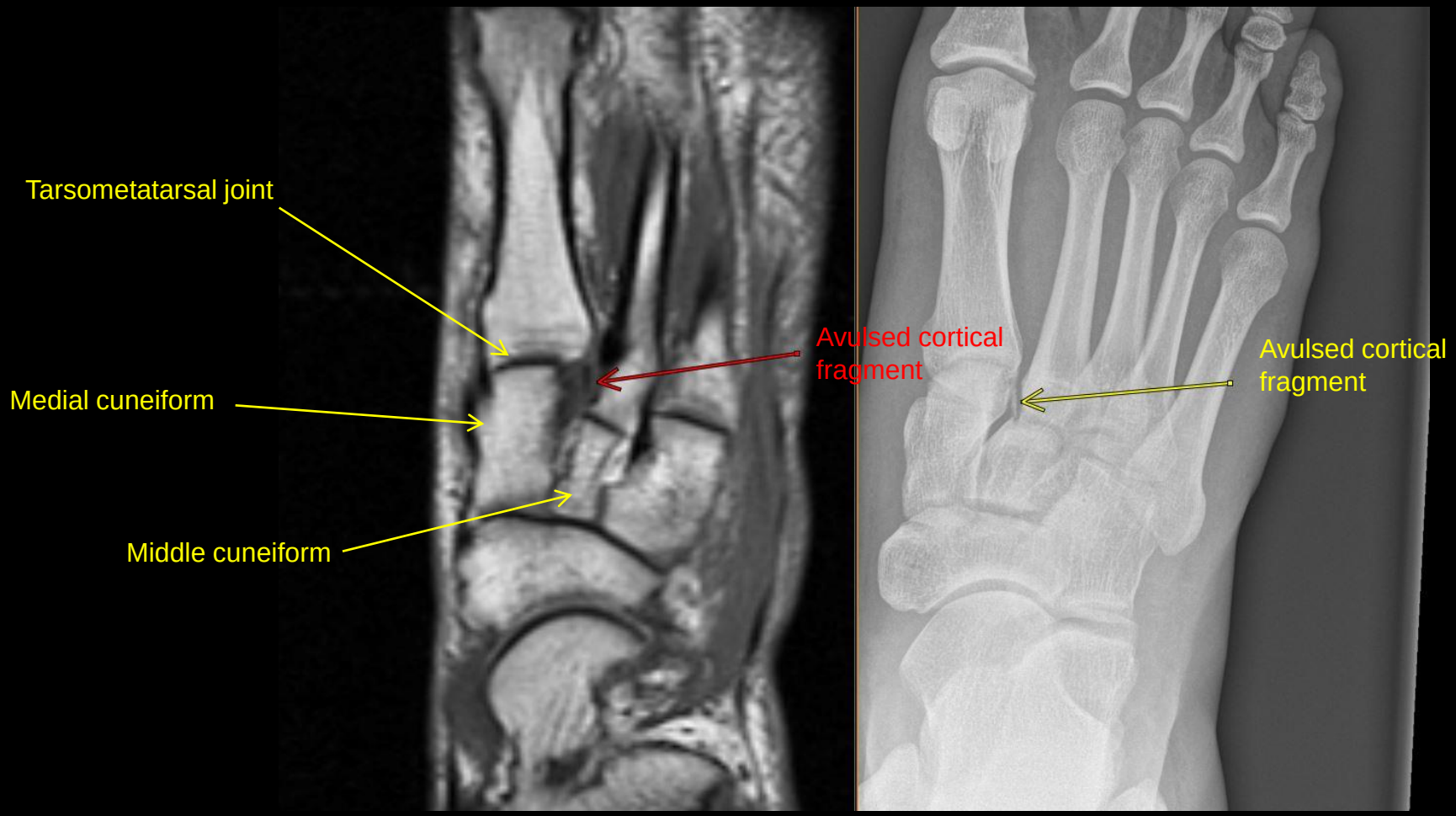
Findings (unlabeled)



Axial T2-Fat Saturated Image

Axial T1-Weighted Image

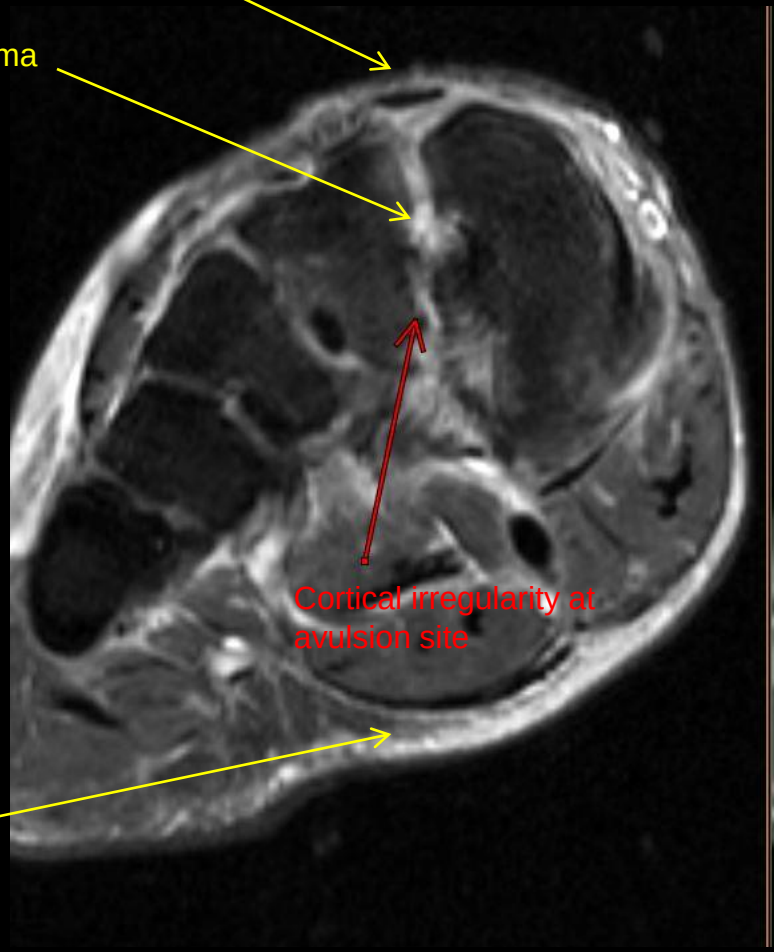
Findings (labeled)



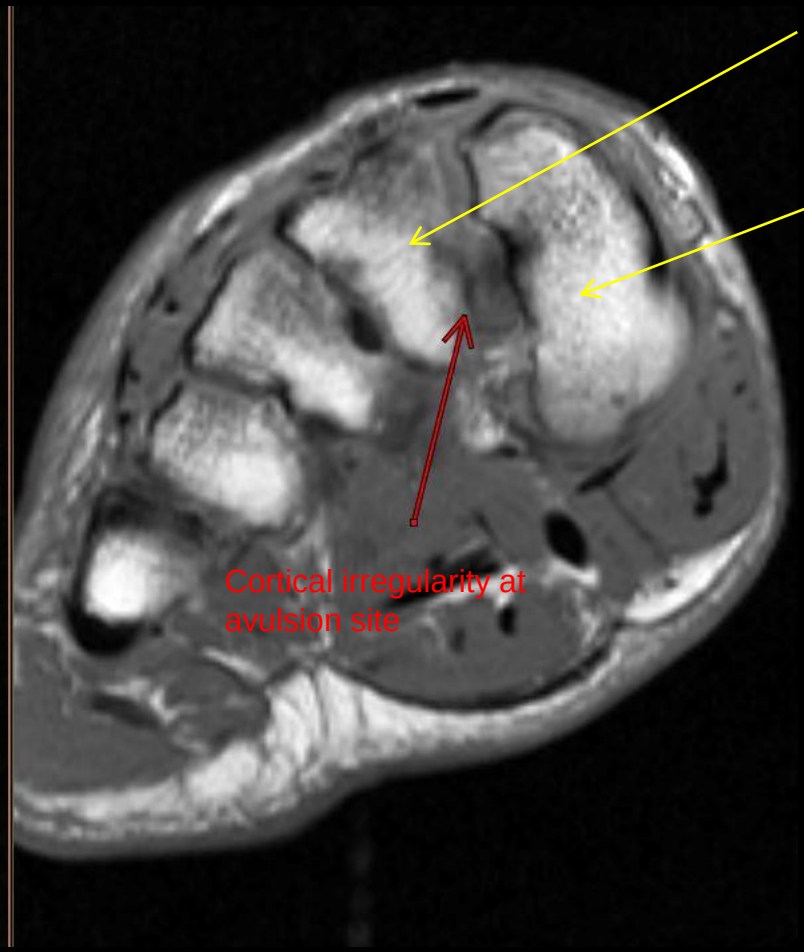
Coronal T1-Weighted Image

AP Radiograph

Findings (labeled)



Axial T2-weighted Fat-Saturated



Axial T1-Weighted

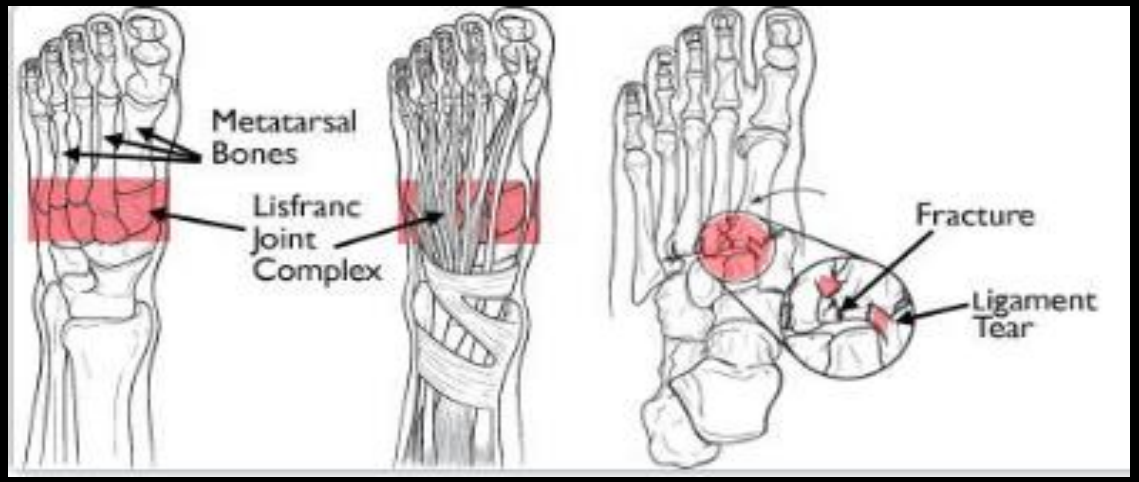
Final diagnosis

- Complete Lisfranc ligament tear with cortical avulsion
- Plan: Patient was fitted with a CAM (controlled ankle movement) boot and is non-weight bearing (non-operative management)

Lisfranc Injury

Anatomy

- Tarsometatarsal (Lisfranc) joint complex includes the bones and ligaments that stabilize the midfoot and forefoot
    - Articulation of 5 metatarsals, three cuneiforms, and the cuboid
- Low-impact injuries may lead to Lisfranc sprains
- High-impact injuries may lead to Lisfranc fracture-displacements



orthoinfo.aaos.org/en/diseases--conditions/lisfranc-midfoot-injury

Case Discussion

Mechanism of Injury

- Twisting
- Axial Loading of a fixed foot
- Crush injury
- Motor vehicle collision

Clinical presentation

- Midfoot pain with difficulty in weight-bearing
- Swelling across the dorsum of the foot
- Deformity is variable
- Treatment
  - Non-operative: Non-weight-bearing cast
  - Operative: Internal fixation

Case Discussion

Diagnostic Challenge

- Relatively uncommon injury, but can result from either high- or low-impact trauma
- Estimated 20% may be initially undiagnosed, particularly in the setting of multiple trauma
- Findings can be difficult to assess on clinical exam due to extensive swelling
- Imaging often plays an essential role to prevent diagnostic delay and associated comorbidities
    - Midfoot instability and pain
    - Planovalgus deformity
    - Post-traumatic osteoarthritis

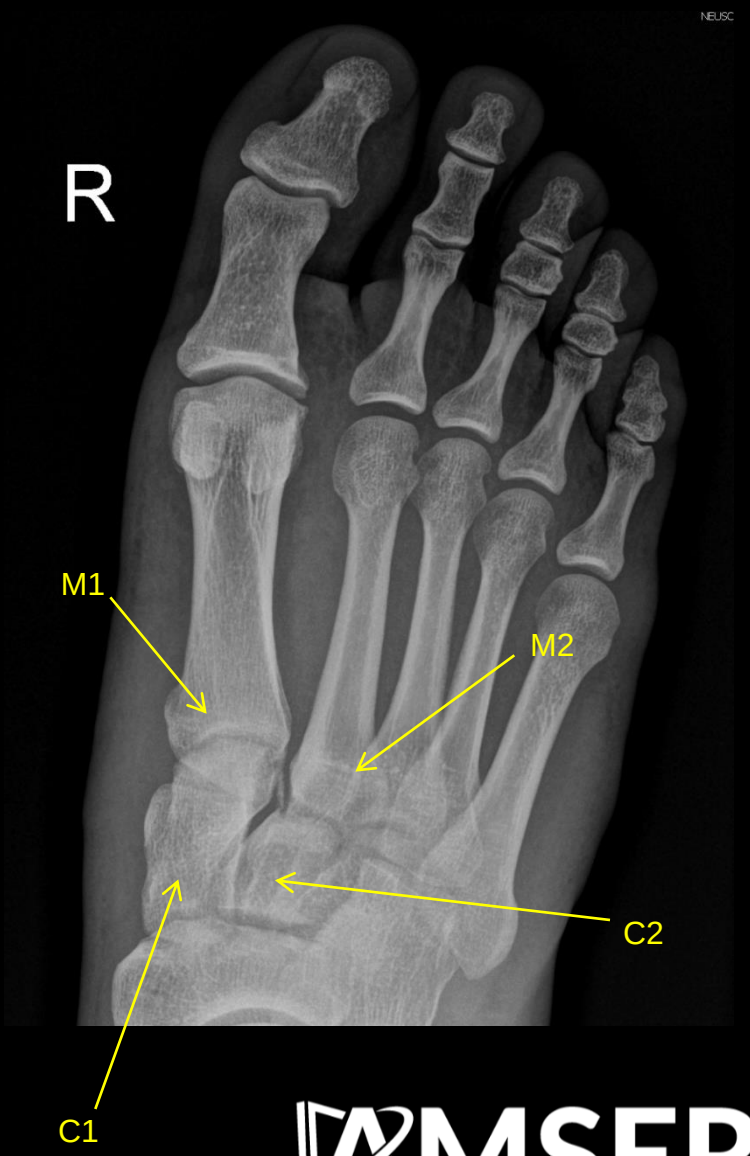
Case Discussion

X-ray

- Small chip fractures arising from the second metatarsal or medial cuneiform (fleck sign) may be the only finding on non-weight-bearing radiographs
- Weight-bearing radiographs can demonstrate more subtle midfoot abnormalities
- Deviation of normal alignment suggests an underlying injury:
    - Lateral border of first metatarsal (M1) should align with the medial cuneiform (C1)
    - Medial border of the second metatarsal (M2) should align with the middle cuneiform (C2)
    - Less than 2 mm should separate the medial cuneiform (C1) and the second metatarsal (M2)

MRI

- Most useful to identify more subtle or partial ligamentous injuries



References:

ACR Appropriateness Criteria: Acute Trauma to the Foot. American College of Radiology. https://acsearch.acr.org/docs/70546/Narrative/. Updated 2019.

Beutler, A. and Cole, T. Tarsometatarsal (Lisfranc) joint complex injuries." https://www.uptodate.com/contents/tarsometatarsal-lisfranc-joint-complex-injuries. Updated April 5, 2018.

Geng, F. and Gaillard, F.. Lisfranc injury. radiopaedia.org/articles/lisfranc-injury?lang=us.

Siddiqui, N.A., Galizia, M.S., Almusa, E., *et al.* Evaluation of the tarsometatarsal joint using conventional radiography, CT, and MR imaging. Radiographics. 2014; 34:514-531

Tejwani, N. and Kirby, D.J. Lisfranc fracture dislocation. emedicine.medscape.com/article/1236228-overview. Updated October 5, 2018

Weatherford, B. Lisfranc (midfoot) injury. orthoinfo.aaos.org/en/diseases--conditions/lisfranc-midfoot-injury/. Updated September 2017

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