

Emergency Imaging

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Figure 1



Figure 2

A 25-year-old man presents to the emergency department with right foot pain, swelling, and inability to bear weight after stepping on a rock the prior day. AP (Figure 1) and lateral (Figure 2) radiographs are obtained.

What is the diagnosis?

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ANSWER



Figure 3



Figure 4

The AP radiograph of the right foot (Figure 3) reveals malalignment of the base of the second metatarsal (white arrow) and the middle cuneiform (black arrow). Lateral subluxation of the first metatarsal (white asterisk, Figure 3) relative to the medial cuneiform (black asterisk, Figure 3) is also seen. On close examination, there is a tiny cortical fracture fragment adjacent to the lateral border of the medial cuneiform (red arrow, Figure 3). These findings indicate the presence of a Lisfranc joint fracture-dislocation.

The Lisfranc joint is the articulation of the three cuneiforms and the cuboid with the first through fifth metatarsals. This joint, also referred to as the tarsometatarsal joint, separates the midfoot from the forefoot. The joint is named for Jacques Lisfranc de St. Martin, who as a surgeon in Napoleon's army described amputations without osteotomies at the tarsometatarsal joint for soldiers suffering from gangrene.

Injuries to the Lisfranc joint are uncommon, representing 0.2% of all orthopedic injuries.¹ These injuries may be classified based on the mechanism of injury as

high-velocity or low-velocity. High-velocity injuries typically occur due to falls from height or in motor vehicle accidents (with the foot planted on the brake or floor at impact), and are typically easy to diagnose. Low-velocity injuries occur from what often seem like trivial traumatic events, such as tripping while stepping off a curb. The clinical presentation of low-velocity injuries may be similar to that of sprains, and these injuries may be missed on initial work-up in up to 50% of cases, making both low- and high-velocity Lisfranc injuries among the most commonly missed emergency department diagnoses. While outcomes for patients with these injuries are good if treatment is undertaken early (within 4–6 weeks), failure to treat results in progressive midfoot instability, foot deformity, and a rapidly progressing osteoarthritis.²

Radiographs are typically the initial diagnostic imaging test for evaluation of foot injury. On an AP view of the foot, the cortices of the second metatarsal (white arrow, Figure 4) and the middle cuneiform (black arrow) should exactly align. An oblique view of the foot may be

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XARELTO® (rivaroxaban) tablets

Rivaroxaban crosses the placenta in animals. Animal reproduction studies have shown pronounced maternal hemorrhagic complications in rats and an increased incidence of post-implantation pregnancy loss in rabbits. Rivaroxaban increased fetal toxicity (increased resorptions, decreased number of live fetuses, and decreased fetal body weight) when pregnant rabbits were given oral doses of ≥ 10 mg/kg rivaroxaban during the period of organogenesis. This dose corresponds to about 4 times the human exposure of unbound drug, based on AUC comparisons at the highest recommended human dose of 20 mg/day. Fetal body weights decreased when pregnant rats were given oral doses of 120 mg/kg. This dose corresponds to about 14 times the human exposure of unbound drug.

Labor and Delivery: Safety and effectiveness of XARELTO during labor and delivery have not been studied in clinical trials. However, in animal studies maternal bleeding and maternal and fetal death occurred at the rivaroxaban dose of 40 mg/kg (about 6 times maximum human exposure of the unbound drug at the human dose of 20 mg/day).

Nursing Mothers: It is not known if rivaroxaban is excreted in human milk. Rivaroxaban and/or its metabolites were excreted into the milk of rats. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants from rivaroxaban, a decision should be made whether to discontinue nursing or discontinue XARELTO, taking into account the importance of the drug to the mother.

Pediatric Use: Safety and effectiveness in pediatric patients have not been established.

Geriatric Use: Of the total number of patients in the RECORD 1-3 clinical studies evaluating XARELTO, about 54% were 65 years and over, while about 15% were >75 years. In ROCKET AF, approximately 77% were 65 years and over and about 38% were >75 years. In the EINSTEIN DVT, PE and Extension clinical studies approximately 37% were 65 years and over and about 16% were >75 years. In clinical trials the efficacy of XARELTO in the elderly (65 years or older) was similar to that seen in patients younger than 65 years. Both thrombotic and bleeding event rates were higher in these older patients, but the risk-benefit profile was favorable in all age groups [see *Clinical Pharmacology (12.3)* and *Clinical Studies (14)* in full Prescribing Information].

Females of Reproductive Potential: Females of reproductive potential requiring anticoagulation should discuss pregnancy planning with their physician.

Renal Impairment: In a pharmacokinetic study, compared to healthy subjects with normal creatinine clearance, rivaroxaban exposure increased by approximately 44 to 64% in subjects with renal impairment. Increases in pharmacodynamic effects were also observed [see *Clinical Pharmacology (12.3)* in full Prescribing Information].

Treatment of DVT and/or PE, and Reduction in the Risk of Recurrence of DVT and of PE: In the EINSTEIN trials, patients with CrCl values <30 mL/min at screening were excluded from the studies. Avoid the use of XARELTO in patients with CrCl <30 mL/min.

Hepatic Impairment: In a pharmacokinetic study, compared to healthy subjects with normal liver function, AUC increases of 127% were observed in subjects with moderate hepatic impairment (Child-Pugh B).

The safety or PK of XARELTO in patients with severe hepatic impairment (Child-Pugh C) has not been evaluated [see *Clinical Pharmacology (12.3)* in full Prescribing Information].

Avoid the use of XARELTO in patients with moderate (Child-Pugh B) and severe (Child-Pugh C) hepatic impairment or with any hepatic disease associated with coagulopathy.

OVERDOSAGE:

Overdose of XARELTO may lead to hemorrhage. Discontinue XARELTO and initiate appropriate therapy if bleeding complications associated with overdose occur. A specific antidote for rivaroxaban is not available. Rivaroxaban systemic exposure is not further increased at single doses >50 mg due to limited absorption. The use of activated charcoal to reduce absorption in case of XARELTO overdose may be considered. Due to the high plasma protein binding, rivaroxaban is not expected to be dialyzable [see *Warnings and Precautions and Clinical Pharmacology (12.3)* in full Prescribing Information].

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used to evaluate for alignments of the medial cortex of the third metatarsal with the lateral cuneiform, and the fourth metatarsal with the cuboid; obtaining this view may increase the sensitivity of radiography. Abnormal alignment and the presence of cortical avulsion fragments, referred to as the *fleck sign*, are diagnostic of instability and indicate the need for surgical stabilization.³

CT with multiplanar reformats is more sensitive than radiography for detection of Lisfranc injuries. CT is also useful in documenting the full extent of these complex injuries, allowing optimized presurgical planning. MRI is also useful in cases of Lisfranc injury because it is able to directly visualize the ligaments and injuries to them.

The Lisfranc joint should be carefully evaluated on all foot radiographs, as failure to detect these injuries may result in significant morbidity. In cases that are equivocal or have normal radiographs with a high suspicion of injury to the Lisfranc joint, additional imaging should be performed with CT or MRI. For the patient presented, prompt diagnosis of the Lisfranc injury leading to surgical intervention resulted in a return to normal function.

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References

1. Sands AK, Grose A. Lisfranc Injuries. *Injury*. 2004;35 Suppl 2:SB71-76.
2. Mayich DJ, Mayich MS, Daniels TR. Effective detection and management of low-velocity Lisfranc injuries in the emergency setting: Principles for a subtle and commonly missed entity. *Can Fam Physician*. 2012;58(11):1199-1204.
3. Kalia V, Fishman EK, Carrino JA, Fayad LM. Epidemiology, imaging, and treatment of Lisfranc fracture-dislocations revisited. *Skeletal Radiol*. 2012;41(2):129-136.