Associated Fractures of the Foot in Ankle Sprain

Paulus Rahardjo

Asian Musculoskeletal Society

University of Airlangga
Introduction

• Most ankle injuries are straightforward ligamentous injuries. **However, the clinical presentation of subtle fractures can be similar to that of ankle sprains**, and these fractures are **frequently missed on initial examination**.

• This presentation features subtle fractures to facilitate timely diagnosis and treatment of these less-common injuries.
Anterior Talar Avulsion Fracture

Talar Dome Fractures

Lateral Talar Process Fractures

Posterior Talar Process Fractures

Fifth Metatarsal Fractures

Anterior Process of Calcaneus Fractures
Lateral View of the Talus and Calcaneus

- Posterior process of talus
- Anterior process of calcaneus
- Cuboid
- Peroneal tubercle
- Lateral process of talus
- Lateral process of calcaneal tuberosity
- Talus
- Navicular
Superior View of the Talus

- Lateral process
- Medial tubercle
- Os trigonum
- Lateral tubercle
- Groove for flexor hallucis longus
- Posterior process
ANTERIOR TALAR AVULSION FRACTURE
Lateral View of the Talus and Calcaneus

- Posterior process of talus
- Talus
- Navicular
- Anterior process of calcaneus
- Cuboid
- Peroneal tubercle
- Lateral process of calcaneal tuberosity
- Lateral process of talus
Talar ridge (*arrow*) is located at mid neck of talus, at site of attachment of anterior tibiotalar joint capsule.
Anterior Talar Avulsion Fracture

- Talar avulsion fractures should be suspected when patients present with a mechanism for ankle sprain in combination with swelling and pain over the dorsum of the foot, even if x-rays are negative.
Anterior Talar Avulsion Fracture
TALAR DOME FRACTURE
Talar dome Fracture

• Fractures of the talar dome may be medial or lateral
• They are usually the result of inversion injuries,
• Medial injuries may be atraumatic (for unclear reasons)
Talar Dome Fracture: Symptoms

- Along with the pain of damaged ligaments, there is **a deep-set pain in the ankle**, which persists for longer, even after the initial intense pain has subsided.
- Return to activity leads to **recurrent pain and swelling**.
- **Stiffness** of the joint (a locking sensation during movement) and **crepitance**
- There may be **weakness and instability** of the joint.
If initial X-rays do not show any evidence of fracture despite the signs and symptoms, a bone scan, CT scan or MRI may be advised.
LATERAL TALAR PROCESS FRACTURES
Lateral Talar Process Fractures

• Lateral talar process fractures are characterized by point tenderness over the lateral process.
Lateral View of the Talus and Calcaneus

- Posterior process of talus
- Anterior process of calcaneus
- Cuboid
- Peroneal tubercle
- Lateral process of calcaneal tuberosity
- Lateral process of talus
Lateral talar process fractures

Fracture of the Lateral Process of Talus
Fracture of the lateral process of the talus (Snowboarder's fracture)

- The lateral process is a broad-based wedge shaped prominence of the lateral talar body
- Articulates with: the fibula and posterior facet of the calcaneus
- Patients with ankle “sprains” should be follow up so that these fractures can subsequently be diagnosed if the “sprain” isn’t healing as expected.

AP ankle joint
Lateral talar process fractures

AP ankle joint

Case 1

Coronal reformat CT

Case 2

Coronal reformat CT
The lateral process normally makes a distinct "V" shape on the lateral radiograph. A fracture of the process disrupts the "V" shape.

Lateral talar process fractures
POSTERIOR TALAR PROCESS FRACTURES
Lateral View of the Talus and Calcaneus

- Posterior process of talus
- Talus
- Navicular
- Anterior process of calcaneus
- Cuboid
- Peroneal tubercle
- Lateral process of calcaneal tuberosity
- Lateral process of talus
The posterior process has a smaller medial and a larger lateral tubercle, separated by the groove of FHL.

The process has a separate ossification centre and may remain a separate bone, the **os trigonum**. (14% of general population)

A fibrous union between the talar body and an ostrigonum may be injured.
• **lateral tubercle**
  – serves as attachment of posterior talo-fibular ligament;

• **medial tubercle**
  – serves as attachment for posterior 1/3 of deltoid ligament;
  – serves as the medial limb of the bifurcate talocalcaneal ligament inferiorly
• Posterior talar process fractures are often associated with tenderness to deep palpation anterior to the Achilles tendon over the posterolateral talus, and plantar flexion may exacerbate the pain.
Post Process of Talus

• Mechanism of the injury
• This fracture is often confused with an ankle sprain. The mechanism of this injury is an axial load. Diagnosis is often very difficult.
• Lateral x-ray of the ankle showing a fresh fracture of the lateral tubercle of the posterior process of the talus.
• Oblique view of the ankle mortise demonstrating fracture of the entire posterior process of the talus.

• (Courtesy of Robert R. Foster, MD)
Avulsion fracture of the medial tubercle fracture of the posterior process of the talus
Anteroposterior and lateral radiographs of an acute fracture of the medial tubercle of the posterior process of the talus. The arrows identify the fracture line.
Posterior Talar Process Fractures

- A plain x-ray may be diagnostic, but CT scans are often necessary for a complete definition of the injury.
Avulsion Fracture Posterior Process of Talus
Os trigonum

- The presence of an os trigonum which is a developmental failure of the fusion of the posterior tubercle of the talus with its body may be very confusing in making a diagnosis.
Fractures of Posterior Process of Talus

• Radiographs: lateral x-ray:

• postero-lateral tubercle is seen in profile;

• Os trigonum may be seen just posterior to lateral tubercle of posterior process (bilateral in 60%)
Fracture vs os trigonum

The aspect of the os trigonum facing the rest of the talus is corticated whereas a fresh fracture is not. If there is any doubt, a bone scan or an MRI would be definitive.
Os trigonum

- Edges appear smooth, with dense cortical bone;
Os Trigonum Syndrome
Os Trigonum Syndrome

- The additional inflammatory changes in the adjacent soft tissues can also be demonstrated on MRI, including edema or enhancement of posterior soft tissue, indicating posterior tibiotalar joint synovitis caused by the repetitive compression and posterior-capsular thickening. There can be fluid around the flexor hallucis longus (FHL) tendon or synovial enhancement, which is caused by tenosynovitis of the FHL and high signal changes and/or enhancement within the musculotendinous junction of FHL muscle belly due to impingement.
Os Trigonum Syndrome

The sagittal T2-weighted fat-saturation image demonstrates mild edema along the synchondrosis (small arrow) of an os trigonum and the talus, and fluid projecting cephalad within the posterior subtalar recess (long arrow).
FIFTH METATARSAL FRACTURES
Fifth Metatarsal Fractures

1. Zone of tuberosity fracture
2. Zone of Jones fracture
3. Zone of diaphyseal stress fracture
Fifth metatarsal fractures

• These fractures involve one of the following: an avulsion fracture, caused by the pull of the plantar aponeurosis and the peroneus brevis tendon at the tuberosity of the bone, a Jones fracture, at the base of the fourth and fifth metatarsal, and a shaft fracture, distal to the fifth metatarsal joint in the proximal diaphysis.
Plantar Fascia attachment to the base of 5th MT
• Tuberosity avulsion fracture. Note that the fracture line is perpendicular to the long axis of the fifth metatarsal.

• Tuberosity avulsion fracture with intra-articular involvement greater than 30 percent of the cubo-metatarsal articulation with displacement.

• Indications for surgical consultation.
Fracture vs. Apophysis
Fracture vs. Apophysis
Jones fx

- Head fractures
- Shaft fractures
- Stress fractures
- "True Jones" fractures
- Tuberosity fractures
Stress Fx

- Head fractures
- Shaft fractures
- Stress fractures
- "True Jones" fractures
- Tuberosity fractures
FRACTURES OF THE ANTERIOR PROCESS OF CALCANEUS
Fracture line of anterior process of calcaneus (fine arrow) with attached bifurcate ligament (heavy arrow).
Ant eater-nose sign

Normal Anterior Process of Calcaneus

• 11-year-old boy presented with an inversion injury and ankle/midfoot pain. This is a commonly missed fracture. It is an avulsion fracture at the attachment of the interosseous ligament to the cuboid and bifurcate ligament to both the cuboid and the navicular.
Fractures of the anterior process of calcaneus

• Fractures of the anterior process of calcaneus account for approximately 15 percent of all calcaneal fractures
Fractures of the anterior process of calcaneus
Look into the Oblique projection
CT scan can always reveal the fracture and secondary pathology.