Foot XRs in the Emergency Department

Foot Radiographs are often requested in the emergency department. Indicated in cases of trauma, infection, or pain for instance, it is essential to have an efficient and structured approach to reading these studies.

Using a consistent approach to any radiograph is key to overcoming common pitfalls and blind spots in imaging. This resident clinical pearl will provide a systematic approach that can be molded into personal preferences (1).

1. Adequacy (2)

A standard foot radiograph includes an AP or anteroposterior view (also called DP view or dorsoplantar), a lateral view and an oblique view.

- **AP view**: all metatarsal bones should be appropriately visible.
- **Oblique view**: taken with a 30-40 degree medial angulation of the foot.
- **Lateral view**: includes a projection of the ankle. Here, the base of the 1st, 2nd and 3rd metatarsal should align with the three cuneiforms.
Figure 1: Foot series

Figure 2: Foot Anatomy
2. Soft Tissue

Assess for soft tissue swelling and/or effusion; these findings can guide you to an underlying pathology (i.e.: fracture).

3. Bone (1)

Outline the cortex of each bone to assess for fractures.
- Beware that subtle and frequently missed fractures usually occur at the base of the metatarsal bones.
- An unattached bone may represent a bone fragment, an avulsion fracture, or an accessory ossicle in which case, could be normal variant anatomy.

4. Cartilage and Joints (2)

Always look out for a Lisfranc injury located at the Lisfranc joint complex which is best seen on the AP and oblique views. The Lisfranc ligament stabilizes the foot therefore, a missed injury can lead to great damage to the foot cartilage. Arthritis and collapse of the arch are complications of a missed Lisfranc injury.
- The Lisfranc ligament complex consists of a dorsal, interosseous, and plantar ligament (see Figure 3).
- The medial borders of the 2nd metatarsal and 2nd cuneiform, also named intermediate cuneiform, should be aligned on the AP view. The medial border of the 3rd metatarsal and 3rd cuneiform should align on the oblique view.
- If there is any disruption or widening of the 1st-2nd metatarsal space, a Lisfranc injury should be suspected.
- This injury typically results from an axial load to a plantarflexed foot or a crush injury.
Examine the **midtarsal joints** for good alignment to assess for appropriate integrity of the corresponding ligaments.
5. Additional View Needed?

- Weight bearing foot AP or lateral view if a Lisfranc injury is suspected. Some institutions will acquire a foot CT instead as it is more sensitive for this type of injury and could also unveil subtle findings that would be missed on a plain radiograph.
- Os calcis view if there is suspicion for a calcaneal fracture.
  - Around 60% of tarsal bone fractures are associated with the calcaneus.

The **Bohler’s angle** is used on plain radiographs to assess the presence and severity of these fractures. This angle is measured on the lateral view and results from an initial line drawn from the highest point of the anterior process of the calcaneus and the posterior articular facet (line 1) followed by a line joining the highest point of the posterior articular facet with the calcaneal tuberosity as shown in figure 5. A normal Bohler’s angle ranges between 20 and 40 degrees, any value below should raise suspicion for a calcaneal fracture.

![Bohler's Angle](image)

*Figure 5: Bohler’s angle (6)*
Pitfall

Apophysis of the proximal 5th metatarsal: Appears from age 10 and 12 in girls and boys, respectively and generally fuses within 2-4 years. This apophysis is located laterally and oriented parallel to the shaft as seen in Figure 6. Do not mistake this with an avulsion fracture or an os peroneum (accessory bone) which are often oriented transversally.

Figure 6: Apophysis of the proximal 5th metatarsal
Figure 7: Avulsion fracture of the 5th metatarsal
Bottom Line

Foot radiographs are often utilized in clinical practice and especially in the emergency department. Research shows that having a systematic approach improves the diagnosis accuracy and therefore can reduce the incidence of inappropriate management of foot injuries (8).

References

1. https://radiopaedia.org/articles/foot-radiograph-an-approach
7. https://radiologyassistant.nl/musculoskeletal/wrist/foot-1#foot-case-1-distortion
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1964112/