

Foot fractures in the Emergency Department

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Learning objectives

- To describe the implications of missed foot fractures in the Emergency Department.
- To understand the diagnostic benefit of further imaging modalities including CT and MRI imaging.
- To understand the confounding factors behind errors in image interpretation.

Background

The interpretation and reporting of acute foot fractures on plain radiographs is a challenging task. Reporting errors can lead to delayed treatment and poorer patient outcomes.



Fig. 1: A transverse dorsal navicular body fracture with subsequent open reduction and internal fixation.

References: 2018 Lineage Medical, Inc. Orthobullets.com

The patient may be a suitable candidate for an open reduction and internal fixation procedure under the orthopaedic surgical team (Fig.1). However, with a missed fracture the bone healing process may be too far along and the patient may no longer be deemed a suitable candidate for surgery. This can effect daily living for the patient and lead to chronic disability. The medico-legal implications from missing foot fractures are also worth considering [1-2].

With this in mind, if there is any ambiguity as to whether or not a fracture is present it is the responsibility of the radiologist or reporting radiographer to suggest an appropriate imaging modality to correlate with the initial plain radiograph. This may include a repeat radiograph after a certain time period, CT or MRI imaging (Fig. 2, Fig.3) [3].

Wei et al. carried out a systematic analysis of missed extremity fractures on initial radiological report over a 6 month period in the Emergency Department. The overall error/miss rate was 3.7%. The highest error rate was in diagnosing foot fractures on plain radiography with a miss rate of 7.6% (Table 1) [4].

Table 1.

Site	Miss rate
Foot	7.6%
Elbow	6%
Hand	5.4%
Wrist	4.1%
Shoulder	1.9%

Images for this section:



Fig. 1: A transverse dorsal navicular body fracture with subsequent open reduction and internal fixation.

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(a)



(b)

Fig. 2: Subtle anterior talar fracture in a 39-year-old man presenting with ankle pain after a fall. (a) AP radiograph shows a subtle oblique radiolucent line through the talus. (b) Sagittal CT reconstruction confirms the presence of an anterior talar fracture with cortical disruption.

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(a)



(b)

Fig. 3: Fatigue fracture of the talus in a 25-year-old male basketball player with right hind foot and ankle pain, without history of trauma, and a normal initial radiograph (a) One-month followup lateral radiograph. (b) Sagittal T1-weighted MRI shows an irregular fracture line within an ill-defined area of hypointensity corresponding to bone marrow oedema.

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Findings and procedure details

Methodology

A retrospective clinical audit was performed analysing initial foot x-ray reports on patients presenting to the Ulster Hospital, Emergency Department. The reports were created using the RIS SPECTRA system by radiologists and reporting radiographers. The reports were analysed from between December 2016 and March 2017.

When analysing the reports we assessed;

1. If a fracture was present on the initial x-ray?
2. If no fracture identified, where there was strong clinical concern, was appropriate follow up imaging recommended?
3. If no fracture identified, was there any fracture identified on follow up imaging?

There was no trust guidelines to set as a clinical standard, however 100% sensitivity was the expected standard in identifying the acute fracture sites.

Results

In total, 734 patients' radiograph reports were analysed. There were 155 diagnosed correctly with a fracture and 573 diagnosed with no fracture, and requiring no follow up imaging.

There were 5 radiographs that were deemed unequivocal, 4 of which were later diagnosed on CT imaging and 1 by a follow up radiograph 3 weeks later.

There was 1 initial radiograph that was deemed as a missed diagnosis and later confirmed on a follow up radiograph. The fracture locations included the anterior aspect of the calcaneus, medial aspect of the talus, and base of the metatarsals. An error rate of 0.1% was calculated.

Conclusion

There are a number of confounding factors responsible for errors in image interpretation. The image quality, number of views available and lack of previous imaging can be important factors. The clinical input is also an important factor in terms of the quantity and quality of clinical information provided [1-4].

Foot fractures are common fractures missed in Emergency Radiology. It is important to accept that film radiography can be equivocal and that further imaging may be required with a relatively low threshold for CT imaging if the patient is non-weightbearing.

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