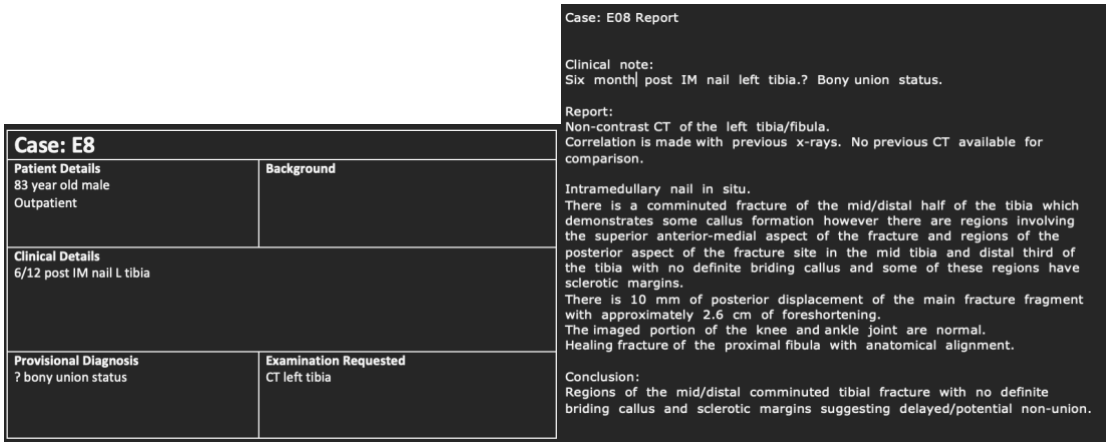

Case: E8

Patient Details	Background
83 year old male Outpatient	
Clinical Details 6/12 post IM nail L tibia	
Provisional Diagnosis ? bony union status	**Examination Requested** CT left tibia

Case: E08 Report

Clinical note:
Six month post IM nail left tibia.? Bony union status.

Report:
Non-contrast CT of the left tibia/fibula.
Correlation is made with previous x-rays. No previous CT available for comparison.

Intramedullary nail in situ.
There is a comminuted fracture of the mid/distal half of the tibia which demonstrates some callus formation however there are regions involving the superior anterior-medial aspect of the fracture and regions of the posterior aspect of the fracture site in the mid tibia and distal third of the tibia with no definite briding callus and some of these regions have sclerotic margins.
There is 10 mm of posterior displacement of the main fracture fragment with approximately 2.6 cm of foreshortening.
The imaged portion of the knee and ankle joint are normal.
Healing fracture of the proximal fibula with anatomical alignment.

Conclusion:
Regions of the mid/distal comminuted tibial fracture with no definite briding callus and sclerotic margins suggesting delayed/potential non-union.

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1. Methods for the image acquisition based upon the request form.

This is a simple scan of the 83-year-old man's lower leg to see whether there has been any callus formation that may suggest healing of the fracture. The man had an intramedullary nail inserted six months ago across the fractured bones to aid as a solid metal support for the bone fragments to stay in proximity and fuse (Xiong et al. 2018). To begin with, the man should be asked to change into a gown and lie feet first, on his back. We can then position the red laser above the man's knee to ensure we can visualise both the knee and ankle joints in full. Therefore, we can collimate to just below the ankle joint to ensure we can visualise the full length of the tibia, fibula, and any effects on the joints. No contrast will be needed as there is inherent high contrast between bone and soft tissue. AEC should be used to modulate mAs and kVp should be around 120.

2. Provide a written description of the **typical CT appearances** of the **disease process** under investigation

Callus formation appears hyperdense and usually starts forming around the fractured bone to bridge the gap between fracture fragments. Intramedullary nails are forced into the medullary canal to immobilise the structures. They are made of metal and therefore appear as bright attenuating structures on CT. Comminated fractures broken in two or more locations follow a similar healing pattern to simple fractures, however, they take much longer to heal and can turn into a deformity (Bigham-Sadegh et al. 2015). Some parts of the bone appeared to have sclerotic margins which appear as an increased density of bone. According to Islam et al. (2000), marginal sclerosis is a sign indicating normal bone healing. Bones may also appear foreshortened due to an overlap between proximal and distal fracture fragments or if bone fragments are driven into each other resulting in an overall shortening.

3. Explain the **importance** of **CT imaging** in the **disease process** under investigation

Grigoryan et al. (2003) compares the use of CT and X-ray techniques in the assessment of fracture healing. Callus formation is detected earlier using CT as opposed to x-rays. CT imaging is more useful than diagnostic X-rays as it is not limited by the superimposition of the cast and fixation hardware. CT images provide better details of the degree of comminution and more accurate measurements of parameters (Patel et al. 2023). It is also a superior imaging modality when it comes to preoperative planning compared to postoperative imaging. Although it is known universally that CT is a better diagnostic tool compared to X-

ray, it is often not preferred due to the higher cost and radiation exposure. In this case, the patient is in his 80s and the risk of radiation might be outweighed by the importance of assessing this complex fracture. Perhaps more detail is needed to see the minor fractures and details of the bone.

4. Review fine slice image data on the Siemens Syngo.Via Workstation.

The rod is highly attenuating and causes an artefact that reduces the clarity of the image. I constructed 1/1mm reconstructions, but I think 0.5/0.5 would have provided better resolution that is necessary to see the small fractures and subtle changes in bone.

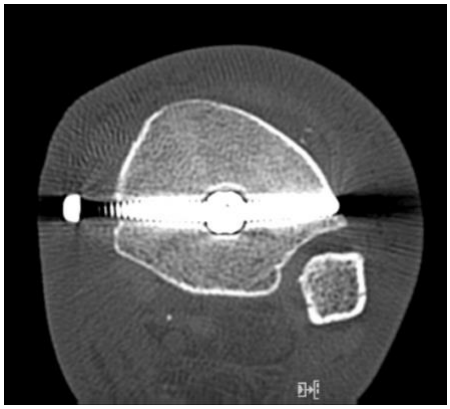

Figure 1. Metal artefact seen on Axial Bone MPR slice.

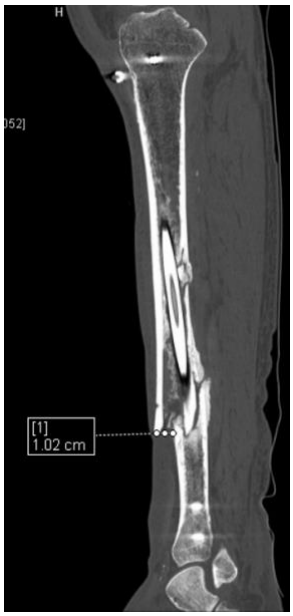

Figure 2. The Sagittal Bone MPR slice shows the main fracture fragments in the tibia.

The images from the Sagittal Bone MPR show the comminuted fracture. In Figure 2. we can also see the posterior displacement of the main fragment which has been displaced approximately 10mm.

Figure 3. Demonstrates an example of what callus formation should look like on CT. Extracted from Bickle I. (2020).

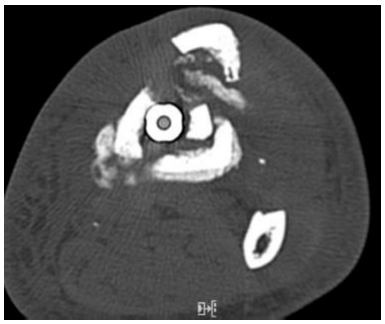

Figure 4. This Axial Bone MPR slice shows minor callus formations between fractured bone fragments.

A healing callus formation should look like the appearance in Figure 3. This is visible in Figure 4. but is not a widespread occurrence. A healing fracture should have a larger amount of callus formation after the 6-month mark compared to the limited callus formation that we see in this case study. Therefore there is delayed union of the fracture fragments which may take time or further intervention.

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