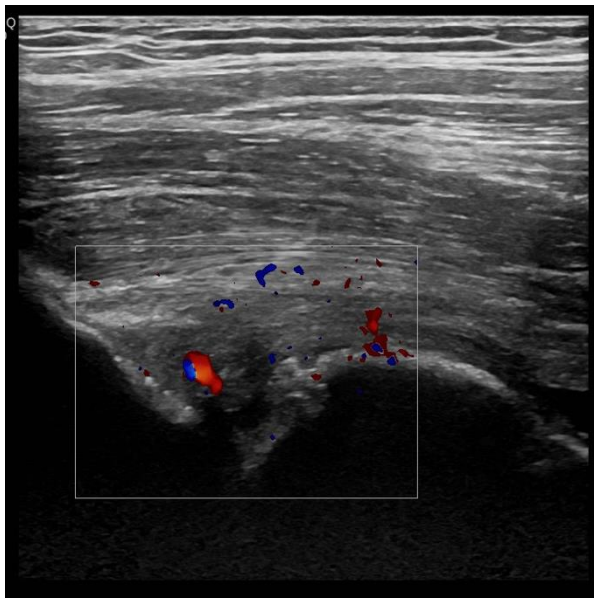
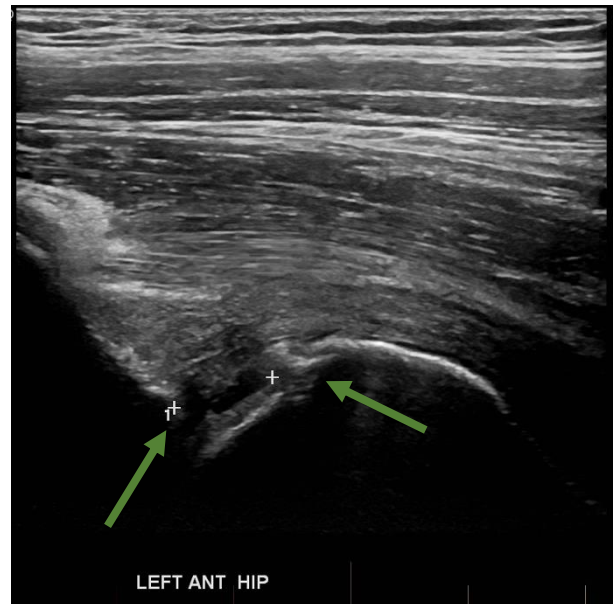


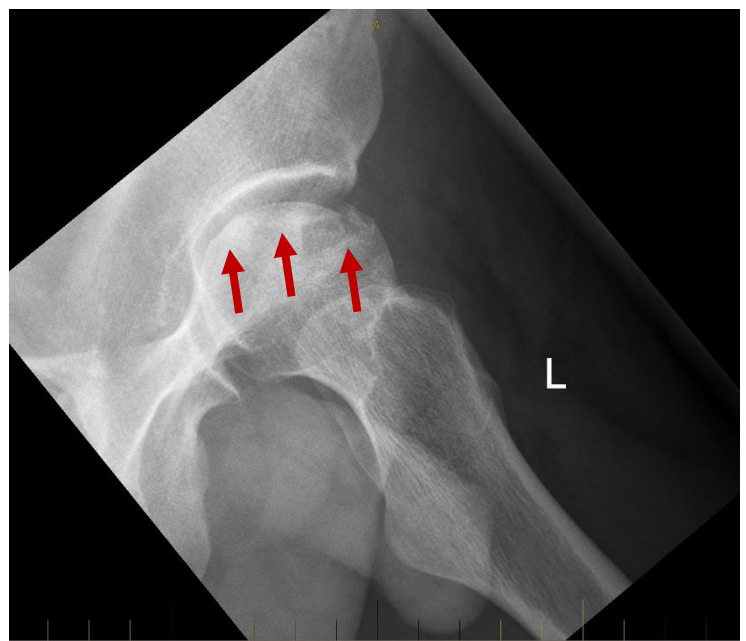
48 year old man presents with slowly increasing hip pain for ultrasound assessment

Ultrasound findings:

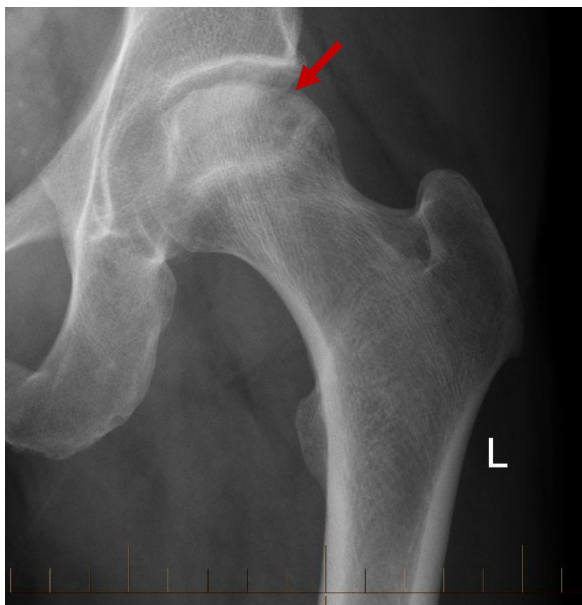
- Hip capsule thickening and hyperaemia
- Irregular appearance of the femoral head
- Disrupted articular margin of the femoral head with step deformity



ULTRASOUND HIP: Discontinuity of the normal smooth articular margin of the femoral head (blue arrows), with a well defined step deformity (green arrows). The overlying hip capsule is thickened and hyperaemic, but the patient had minimal probe tenderness in this region (image on the left). The unusual appearance of the femoral head on ultrasound prompted an X-ray:



X-RAY HIP: The radiograph better shows the stigmata of established osteonecrosis of the femoral head: a sclerotic, fragmented and depressed articular margin. The step deformity indicated with the red arrow is the same area of articular disruption seen on the ultrasound image above marked with a blue arrow.



Discussion

- True pathogenesis poorly understood, believed to be caused by disrupted blood supply to a region of bone – bone covered by cartilage (i.e. femoral head) tends to have more tenuous blood supply
- Interestingly, the articular margin collapse is the result not of the bone infarct of the osteonecrosis, but is result of bone marrow healing (healing bone resorbs dead bone → weight-bearing along the comparatively softer reactive zone of bone healing leads to subchondral injury/fracture).
- Key risk factors: Prolonged corticosteroid use, alcoholism, haemoglobinopathies, post-traumatic, vasculitis

➤ X-Ray / CT

- Key point – Xrays are of low sensitivity for identification of AVN. A normal X-ray does not exclude AVN.
- Patchy sclerosis of femoral head, represents new bone being laid down within/along necrotic trabecula
- Classic subchondral crescentic lucency – herald of impending articular surface collapse

➤ Ultrasound

- Usually not involved in assessment of AVN – in our case, the disrupted articular surface of a relatively young patient prompted further investigation

➤ MRI

- Most sensitive and specific
- Can assess chondral irregularity
- Initial – nonspecific bone marrow oedema. Be concerned about bone marrow oedema which crosses physis
- Classic – “double line sign” – crescentic low signal under the articular margin (infarcted tissue), with bright inner line (reactive bone marrow oedema/repair)

➤ Nuclear medicine

- More sensitive than radiography, but significantly less so than MR
- Starts as femoral head photopaenia → progresses to increased tracer uptake from revascularisation/repair

Differential diagnosis:

- Transient osteoporosis of the hip (bone marrow oedema syndrome)
 - Osteopaenic hip on Xray, marked marrow replacement on T1
- Subchondral insufficiency fracture
 - Patients usually elderly and osteoporotic, lack the risk factors seen for osteonecrosis. Can seem almost identical, but lack the ‘double line’ sign of MRI



Further Reading:

Murphey et al, From the radiologic pathology archives – imaging of osteonecrosis: radiologic-pathologic correlation, Radiographics, 2014, 34: 1003-1028

Berg et al, MR imaging of avascular necrosis and transient marrow oedema of the femoral head, Radiographics, 1993, 13:501-520

Mitchell et al, Femoral head avascular necrosis: correlation of MR imaging, radiographic staging, radionuclide imaging, and clinical findings, Radiology, 1987, 162: 709-715

Petersilge CA and Manaster BJ, Osteonecrosis of Hip, STATdx, Accessed 10.04.2019, DOI: <https://my.statdx.com/document/osteonecrosis-of-hip/32e9afe2-e6e6-445b-97fa-273d614efc98?searchTerm=OSTEONECROSIS%20FEMORAL%20HEAD>