49 yo F with Type I DM. Heel ulcer, concern for osteomyelitis
Serous Atrophy of Bone Marrow (SABM)

- Gelatinous transformation of bone marrow
- During prolonged negative energy balance (Phase II of starvation), SQ and visceral fat is mobilized, but paradoxical increase in marrow fat
  - Adipose in BM is resistant to lipolysis until other fat deposits exhausted
- Late phase III starvation - fat stores in BM are mobilized. Extracellular space of cancellous bone filled with gelatinous material made of hyaluronic acid rich mucopolysaccaride
  - Dx on histopathology - deposition of extracellular gelatinous (‘serous’) material - not present in normal BM. And decrease in size and # of haematopoietic and fat cells
- Some have used term ‘Starvation marrow’
Osgood E, Muddasier S, et al. Starvation marrow- gelatinous transformation of bone Marrow. *J of Community Hospital Internal Medicine Perspectives* 2014; 4(4)
SABM

• Associated with
  – malnutrition (esp anorexia)
  – malabsorption,
  – chronic infx (AIDS, TB)
  – malignant tumors (cachexia)
  – CHF
  – CKD
  – alcoholism and
  – cytotoxic drugs
SABM

• Can affect haematopoiesis
  – Leukopenia ➔ increased susceptibility to infx
  – Anemia

• Increased fracture risk- due to underlying condition (such as anorexia) and b/c BM composition decreased mechanical strength of bone ➔ insufficiency/stress fracture
MRI findings of serous atrophy of bone marrow and associated complications

Robert D. Boutin · Lawrence M. White · Tal Laor · Damon J. Spitz · Robert R. Lopez-Ben · Kathryn J. Stevens · Miriam A. Bredella
• Identified 30 patients (15 male, 15 female) with MRI findings of SABM

• Underlying conditions
  – Anorexia nervosa (10)
  – Cachexia from malignancy (5)
  – Cachexia non malignancy (7)
  – Massive weight los after bariatric surgery (1)
  – Biliary atresia (1)
  – AIDS (3)
  – Endocrine disorders (2)
  – Scurvy (1)

• Mean BMI 15
• MRI findings
  – 29 of 30 had diffuse T1 mildly hypointense marrow signal compared to muscle. Diffuse hyperintense marrow signal on fat suppressed fluid sensitive sequences. 1 of 30 had more focal
  – No cortical erosion or associated soft tissue mass (excludes osteomyelitis and marrow replacing malignant processes)
  – 29/30 Abnormal signal of SQ soft tissues- low on T1, high on fluid sensitive FS
  – Diagnosis was delayed in 7/30 patients (23 %) due to misinterpretation of the initial MRI, which required repeat MRI as the initial study was thought to be abnormal due to technical errors, such as failed fat suppression
• Associated complications
  – 14 of 30 had lower extremity fractures
    • 4 calcaneus fracture, 1 bilateral Calcaneus fracture
    • 2 femoral neck fx, 1 bilateral femoral neck fx
    • 2 tibia fx
    • 1 intertroch fx
    • 1 sacral insufficiency fx
    • 1 cuboid fx
    • 1 multiple lower extremity fx
  – Infection
    • 1 Discitis/osteomyelitis
    • 1 osteomyelitis-ischium- decub ulcer
Pattern of SABM

• Marrow reconversion and other replacement processes typically at sites of most recently pre-existing red marrow—i.e. axial skeleton.

• Opposite in SABM which starts in fatty marrow→ peripheral skeleton
Take Home Points SABM

• Diffusely hypointense T1, hyperintense fluid sensitive BM signal and SQ soft tissues
  – Don’t write it off as fat sat failure- check STIR- shouldn’t have inhomogeneities that FS sequences do.
  – Different pattern than most marrow replacing processes- starts peripheral, less axial

• History important- anorexia, cachexia, severe malnutrition, etc

• Complications
  – Hypervigilant for fractures- at increased risk and tough to see with underlying diffuse BM signal abnormality
  – Infection
References


2. Osgood E, Muddasier S, et al. Starvation marrow- gelatinous transformation of bone Marrow. *J of Community Hospital Internal Medicine Perspectives* 2014; 4(4)