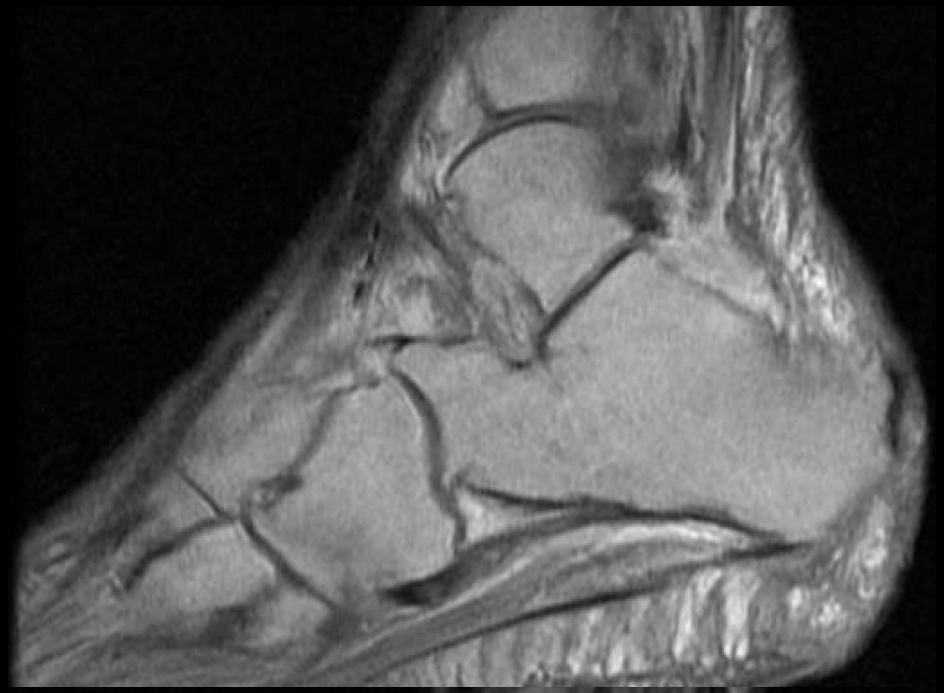
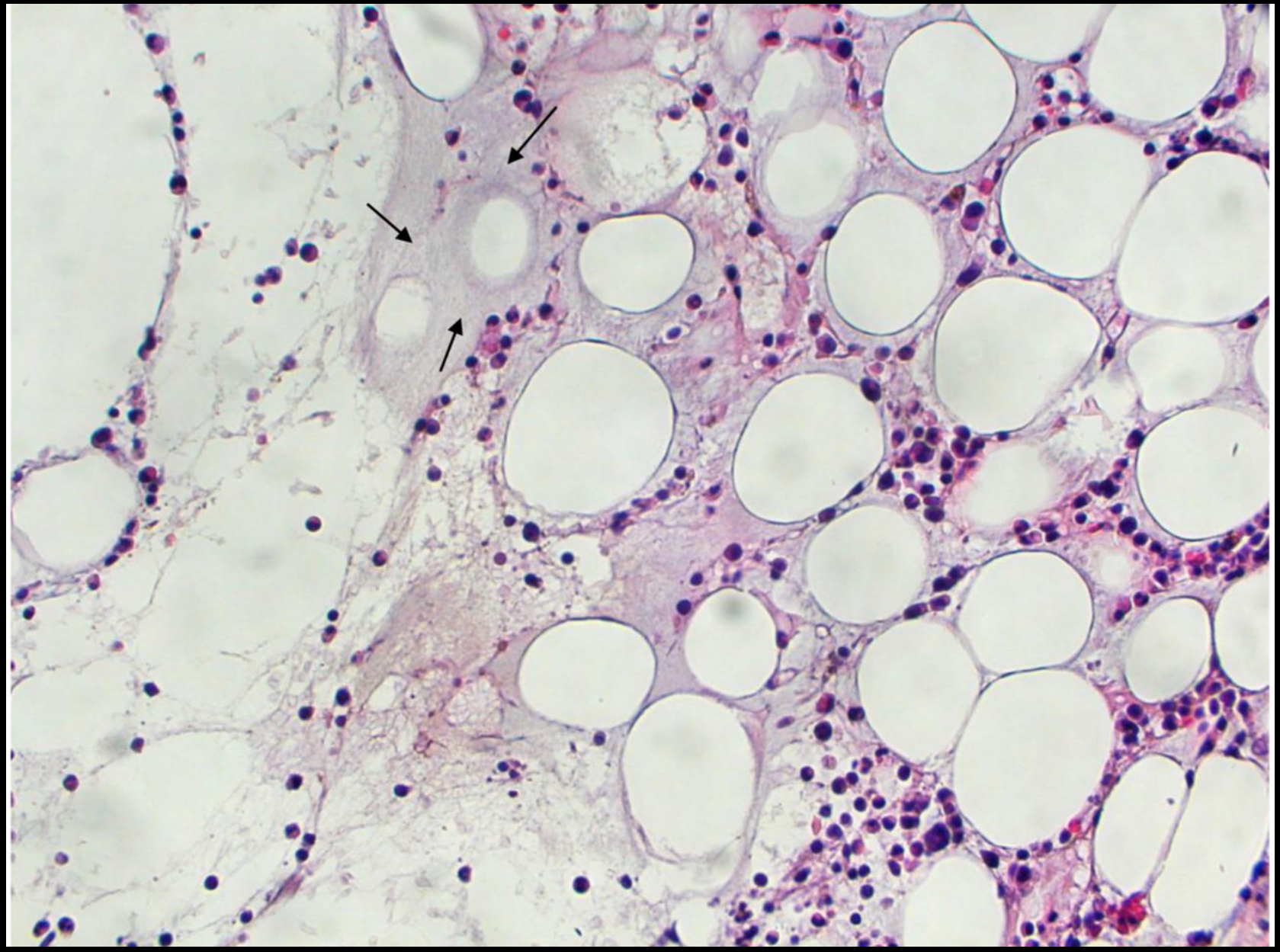
49 yo F with Type I DM. Heel ulcer, concern for osteomyelitis




# Serous Atrophy of Bone Marrow (SABM)

- Gelatinous transformation of bone marrow
- During prolonged neg 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

Eur Radiol (2015) 25:2771–2778
DOI 10.1007/s00330-015-3692-5

MUSCULOSKELETAL

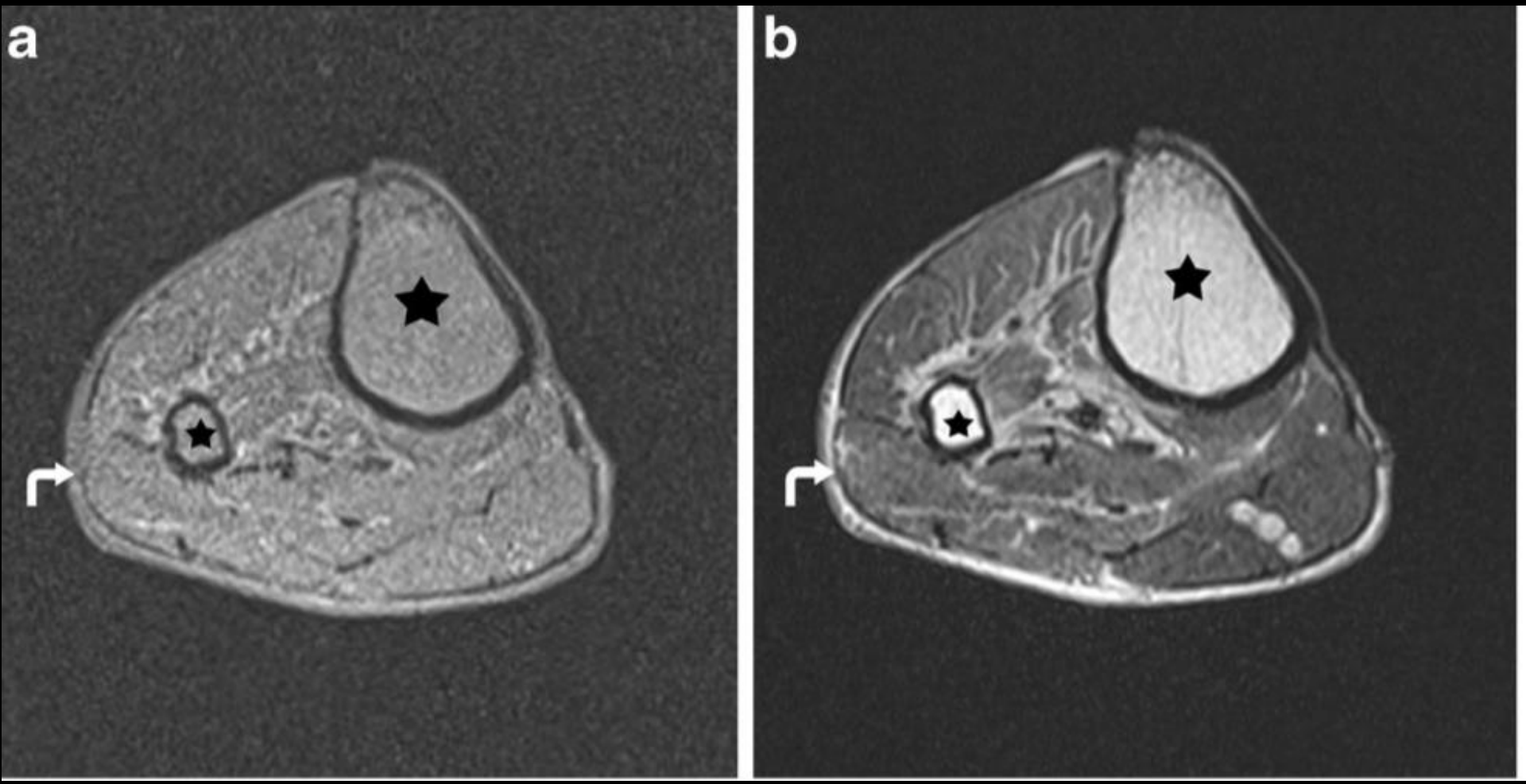
# MRI findings of serous atrophy of bone marrow and associated complications

**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

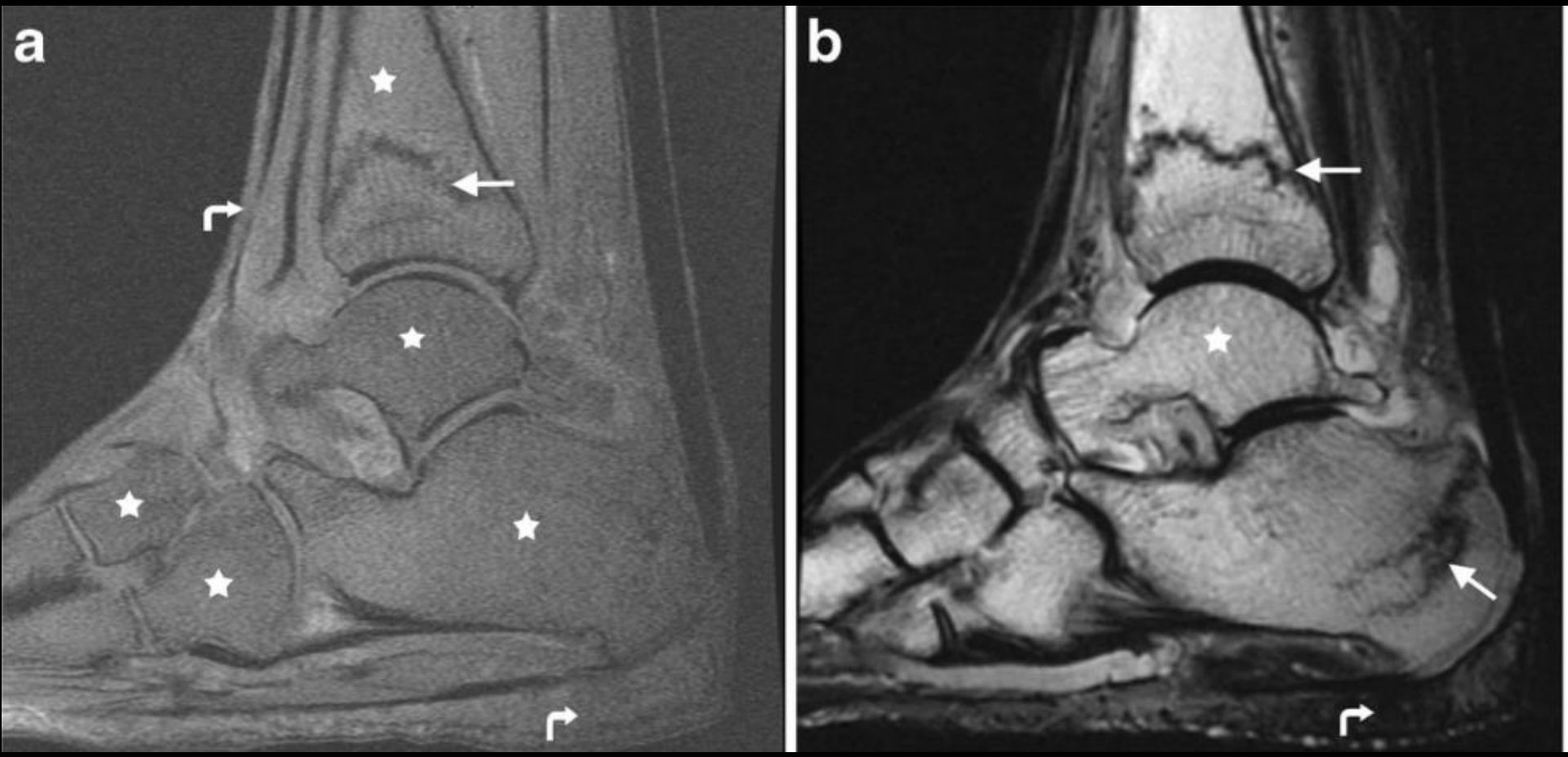
- Associated complications
  - 14 of 30 had lower extremity fractures
    - 4 calcaneus fracture, 1 bilateral Calcaneus fracture
    - 2 femoral neck fx, 1 bilateral femoral neck fx
    - 2 tibia fx
    - 1 intertroch fx
    - 1 sacral insufficiency fx
    - 1 cuboid fx
    - 1 multiple lower extremity fx
  - Infection
    - 1 Discitis/osteomyelitis
    - 1 osteomyelitis- ischium- decub ulcer




Boutin RD, White LM, et al. MRI findings of serous atrophy of bone marrow and associated complications. *European Radiology* 2015 25:2771-2778

# 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

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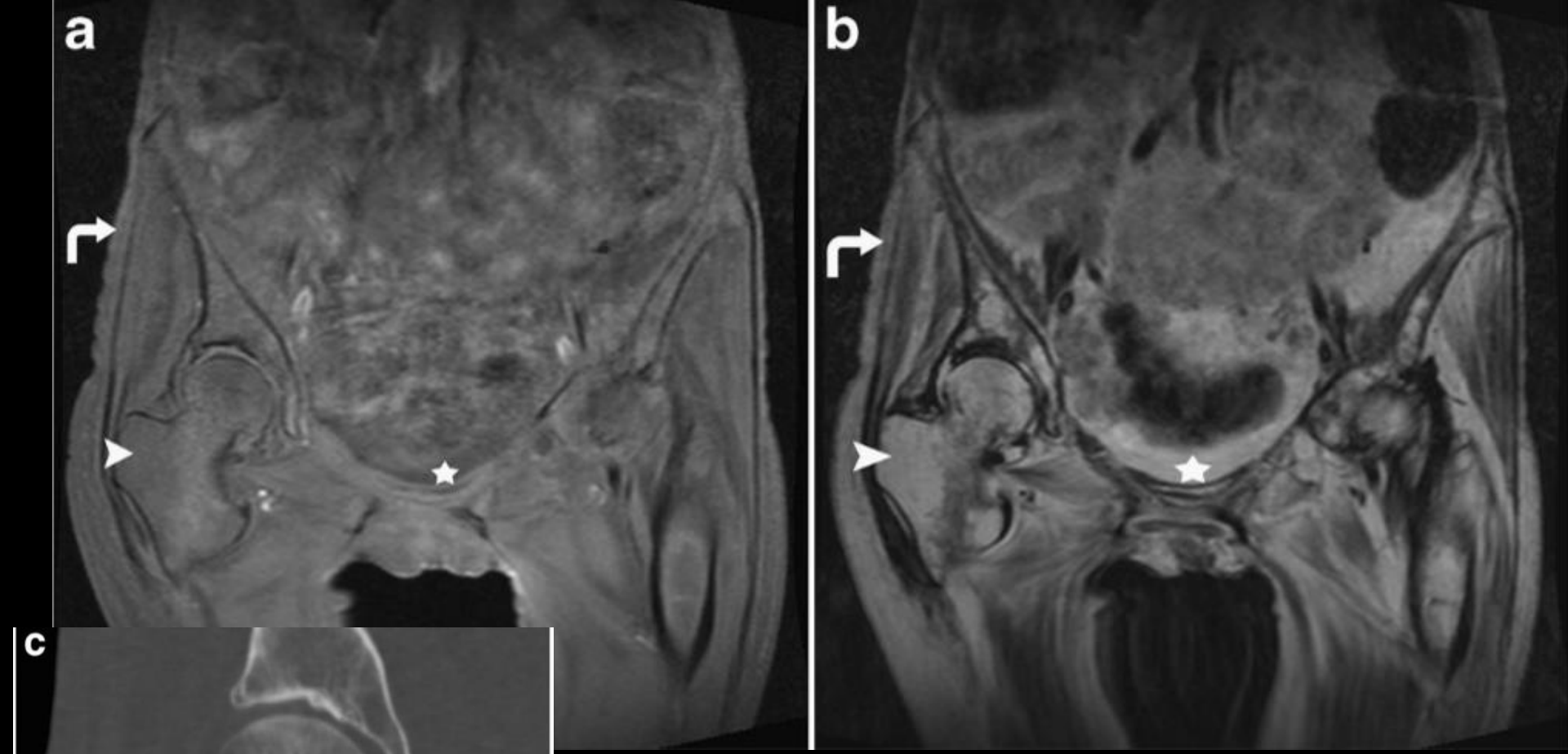



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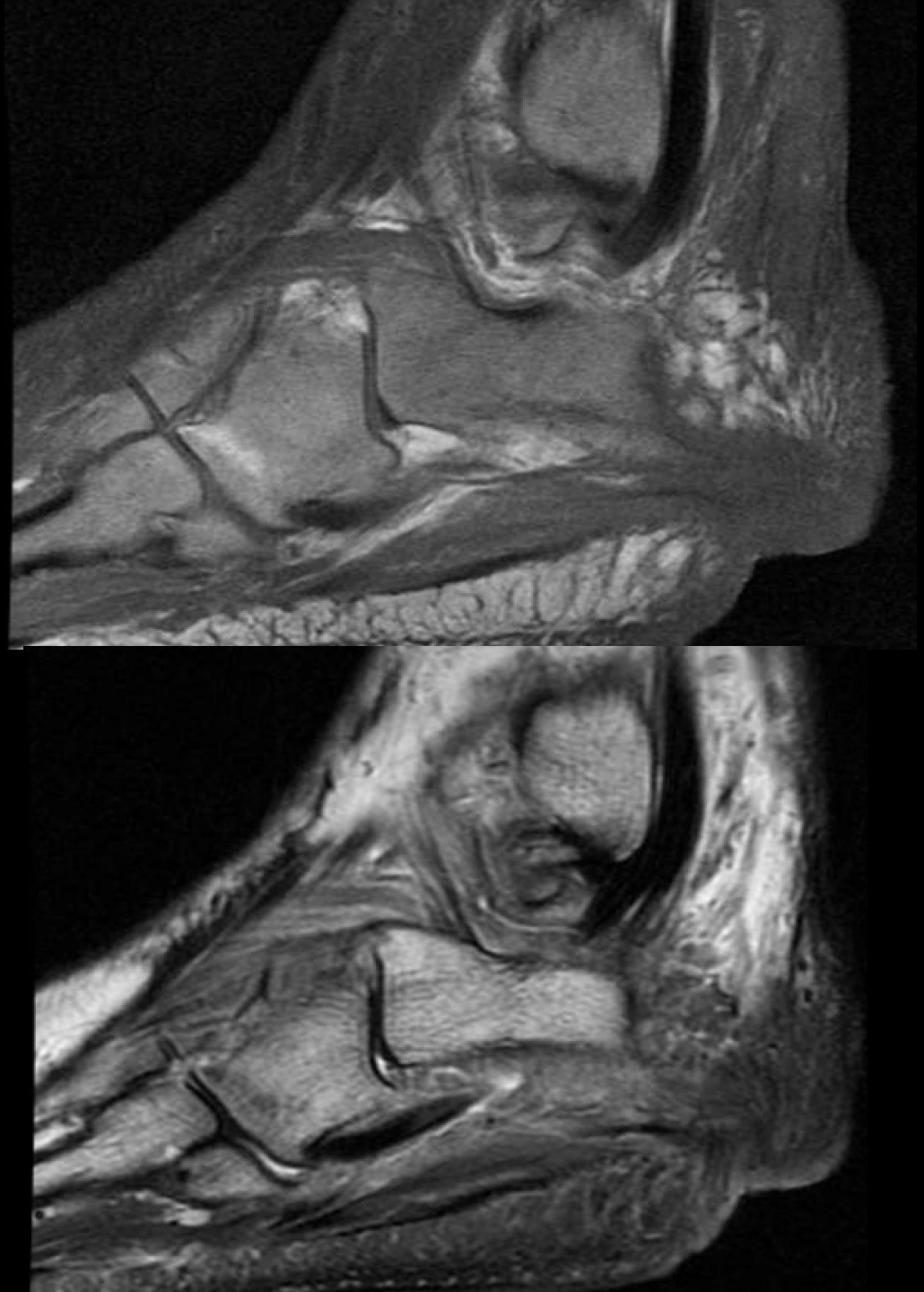

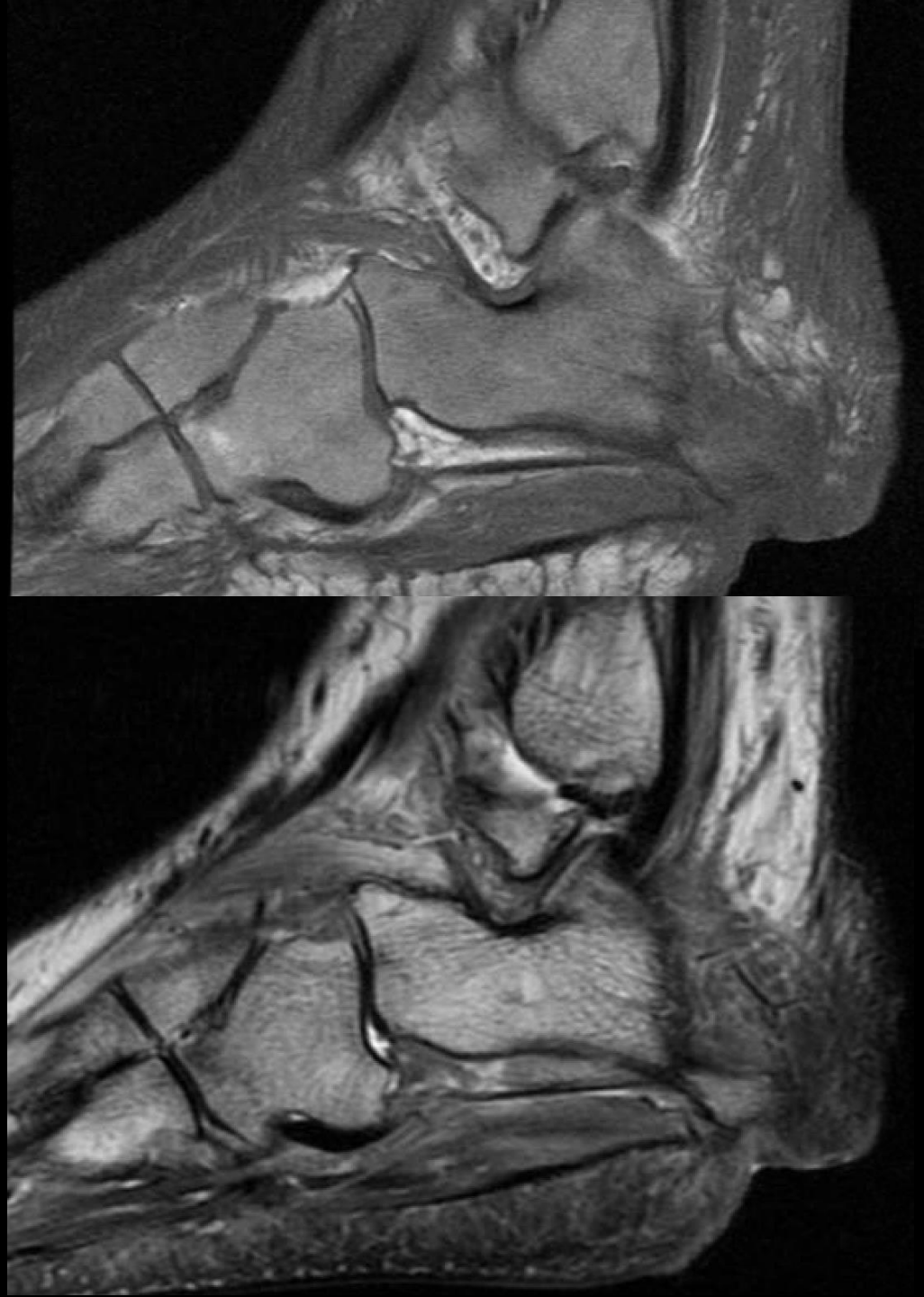

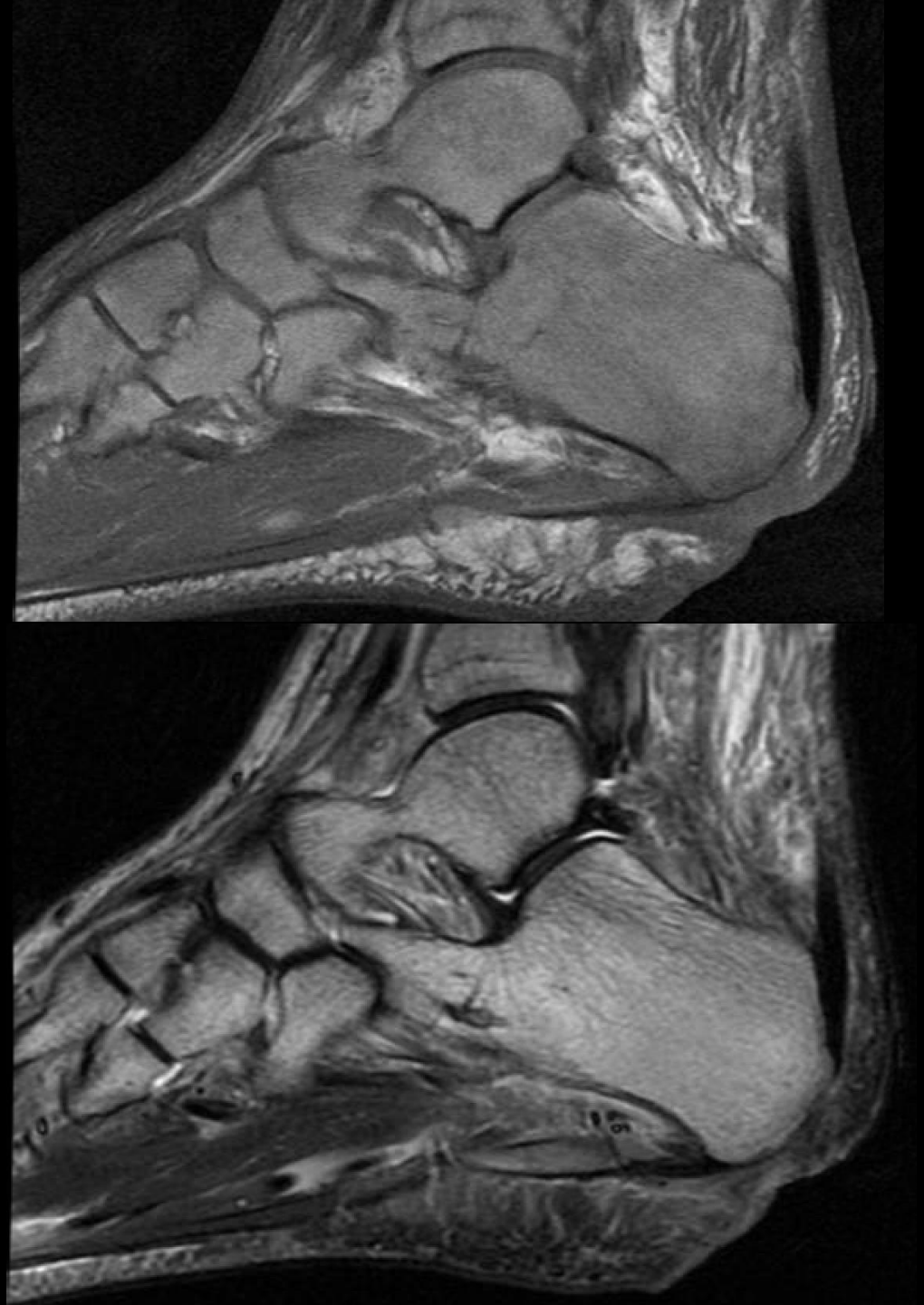

# Take Home Points SABM

- 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


1. Boutin RD, White LM, et al. MRI findings of serous atrophy of bone marrow and associated complications. *European Radiology* 2015 25:2771-2778.
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3. Hanrahan CJ, Shah LM. MRI of Spinal Bone Marrow: Part 2, T1-Weighted Imaging Based Differential Diagnosis. *American J of Roentgenology* 2011; 197:1309-1321