



Virtua Health College
of Medicine & Life Sciences
of Rowan University



AMSER Case of the Month

August 2023

A 15-year-old female presents to the emergency department with fever, unilateral ankle swelling, and difficulty with ambulation.

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Patient Presentation

HPI: 15-year-old female who has a history of recent prior sports related injury, presents to the emergency room with several day history of progressive pain, swelling, difficulty with ambulation and maximum temperature of 102°F.

PMH: asthma, atlantoaxial dislocation of cervical spine at the age of 3 (MVC)

Medications: ibuprofen, acetaminophen

Allergies: NKDA

Vitals: BP: 100/70 mmHg, Pulse: 72, SpO2%: 98%, Respirations: 16

Physical Exam: diffuse right ankle edema and tenderness, limited range of motion, increased temperature, and brisk capillary refill

Patient Presentation

Pertinent Laboratory Findings:

Glucose, sodium, potassium, and chloride are within the normal range.

↑ WBC count (11,100 mg/uL)	↓ RBC count (3.78 million/mm ³)
↑ Platelet count (421,000 mg/uL)	↓ Hemoglobin (11.2 g/dL)
↑ CRP (9.98 mg/dL)	↓ RDW (11.6%)
↑ ESR (62 mm/h)	↓ Hematocrit (33.9%)

What Imaging Should We Order?

ACR Appropriateness Criteria

Variant 1: Suspected osteomyelitis or septic arthritis or soft tissue infection (excluding spine and diabetic foot). Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography area of interest	Usually Appropriate	Varies
US area of interest	Usually Not Appropriate	○
MRI area of interest without and with IV contrast	Usually Not Appropriate	○
MRI area of interest without IV contrast	Usually Not Appropriate	○
3-phase bone scan area of interest	Usually Not Appropriate	☢☢☢
CT area of interest with IV contrast	Usually Not Appropriate	Varies
CT area of interest without and with IV contrast	Usually Not Appropriate	Varies
CT area of interest without IV contrast	Usually Not Appropriate	Varies

This imaging modality was ordered by the ER physician

Findings (unlabeled)

PORTABLE R



AP radiograph of the left ankle

Findings (labeled)

PORTABLE R



Radiolucent lesion surrounded by a rim of reactive sclerosis located in the distal tibia affecting the metaphysis, physis, and epiphysis.

AP radiograph of the left ankle

What Imaging Should We Order NEXT For A
Definitive Diagnosis?

ACR Appropriateness Criteria

Variant 3: Suspected osteomyelitis. Initial radiographs normal or with findings suggestive of osteomyelitis. Next imaging study.

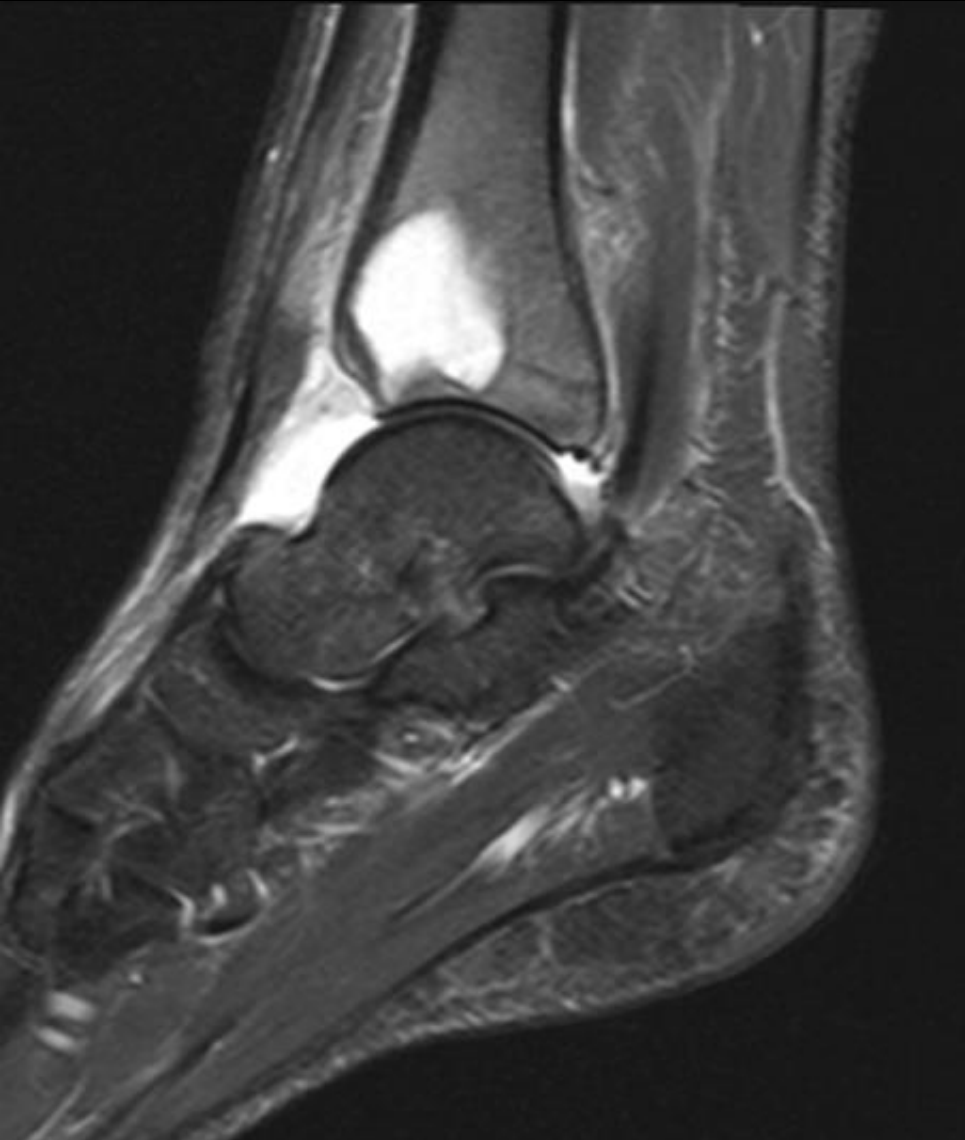
Procedure	Appropriateness Category	Relative Radiation Level
MRI area of interest without and with IV contrast	Usually Appropriate	○
MRI area of interest without IV contrast	Usually Appropriate	○
3-phase bone scan area of interest	May Be Appropriate	⊗⊗⊗
3-phase bone scan and WBC scan and sulfur colloid scan area of interest	May Be Appropriate	⊗⊗⊗⊗
3-phase bone scan and WBC scan area of interest	May Be Appropriate	⊗⊗⊗⊗
FDG-PET/CT area of interest	May Be Appropriate	⊗⊗⊗⊗
WBC scan and sulfur colloid scan area of interest	May Be Appropriate	⊗⊗⊗⊗
CT area of interest with IV contrast	May Be Appropriate	Varies
CT area of interest without IV contrast	May Be Appropriate	Varies
US area of interest	Usually Not Appropriate	○
WBC scan area of interest	Usually Not Appropriate	⊗⊗⊗⊗
CT area of interest without and with IV contrast	Usually Not Appropriate	Varies

This imaging modality was ordered

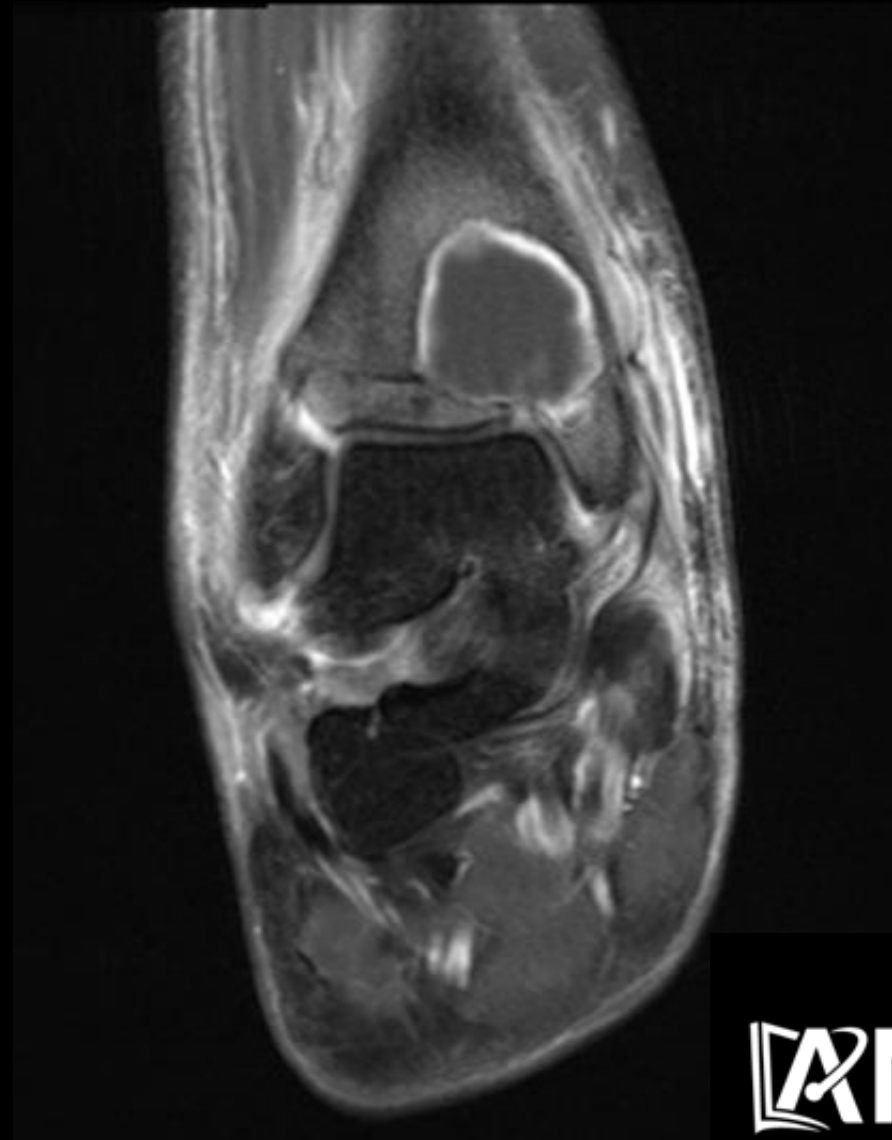


Findings (unlabeled)

Sagittal STIR MRI left ankle



Coronal fat saturated T1-weighted post contrast MRI left ankle



Findings (labeled)

Sagittal STIR MRI left ankle



Well-defined hyperintense lesion of the tibia with a surrounding rim of hypointensity

Coronal fat saturated T1-weighted post contrast MRI left ankle



Well-defined hypointense lesion surrounded by a rim of hyperintensity ("penumbra sign")

Differential diagnosis

1. Acute osteomyelitis
2. Bone cyst (e.g., aneurysmal, unicameral)
3. Brodie's abscess
4. Ewing's sarcoma
5. Langerhans cell histiocytosis/eosinophilic granuloma
6. Non-Hodgkin's lymphoma of the bone/reticulosarcoma
7. Osteoid osteoma
8. Sarcoma (e.g., chondrosarcoma, osteosarcoma)
9. Tuberculosis

Final diagnosis: Brodie's abscess

Brodie's Abscess

First described in the medical literature by Sir Benjamin Collins Brodie in 1832, a Brodie's abscess is a subacute form of osteomyelitis characterized by a localized intraosseous purulent collection [1, 2, 3, 4]. On average, patients experience 12 weeks of symptoms before a diagnosis is established [1].

Clinical Presentation: Brodie's abscess most commonly has an insidious onset of atraumatic limb pain and localized swelling [1, 2]. It is often mistaken for a bone tumor. It has a predilection for the tibia and femur, which account for 49% and 31% of cases, respectively [1, 2]. Naald et al. published a systematic review examining 407 cases, and found that 84% of patients were afebrile and less than 50% had elevated levels of serum inflammatory markers (e.g., ESR, WBC, CRP).

Brodie's Abscess

Epidemiology: Brodie's abscess more commonly affects young male patients, with a 2:1.1 male-to-female ratio and a median age of 17 [1]. Most reported cases come from developed countries, where osteomyelitis rarely occurs. However, it has the highest incidence in developing countries, and these cases are largely unrepresented in the literature [1].

Pathophysiology: The lesion is caused by hematogenous spread of bacteria from a distant, often unidentified, site of infection. It is thought that bone bruising caused by minor trauma increases the susceptibility of the bone to infection. Systemic symptoms are limited because the abscess is walled-off to host defenses [1, 3].

Brodie's Abscess

Microbiology: *Staphylococcus aureus* is the most commonly identified pathogen (65% of cases); however, the causative agent could not be cultured in approximately 25% of cases [1, 2]. More rare etiologies include MRSA, *Salmonella*, *Kingella kingae*, and *Pseudomonas* [1].

Diagnostic Imaging: The “penumbra sign” on MR images has greater than 90% specificity for Brodie's abscess, however it is not pathognomonic [3]. It represents a wall of vascularized granulation surrounding the abscess cavity [3].

Treatment: Surgical debridement with antibiotics is the mainstay treatment, and outcomes are often good. Approximately 15% of patients experience recurrence [1].

References

1. van der Naald N, Smeeing DPJ, Houwert RM, Hietbrink F, Govaert GAM, van der Velde D. Brodie's abscess: A systematic review of reported cases. *J Bone Joint Infect.* 2019;4(1):33–39.
2. Salik M, Mir MH, Philip D, Verma S. Brodie's abscess: A diagnostic conundrum. *Cureus.* 2021;13(7):e16426.
3. A F, Gh Y, Uh U, Ms A, Z M, A A. The “penumbra sign” on magnetic resonance images of brodie's abscess: A case report and literature review. *AJMCR.* 2017;5(8):199–201
4. Hammad A, Leute PJF, Hoffmann I, Hoppe S, Lakemeier S, Klinger H-M. Acute leg pain with suspected beginning leg compartment syndrome and deep vein thrombosis as differential diagnoses in an unusual presentation of Brodie's abscess: a case report. *J Med Case Reports.* 2015;9(1):292.