

## *Case 2*

### **History**

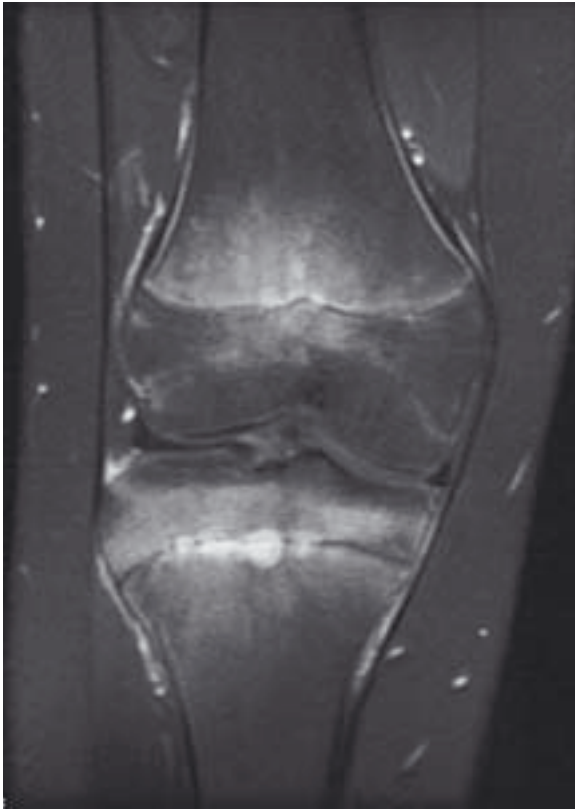
This is a 13-year-old girl with chronic right knee pain. She is otherwise well, without fever or systemic symptoms. CBC and ESR were normal.



**Figure 2A.** Coronal T1 of the right knee.



**Figure 2B.** Sagittal STIR.



**Figure 2C.** Coronal T1 post-Gd FS.



**Figure 2D.** Lateral plain radiograph.

**Figures 2A, 2B, 2C.** Focal ill-defined T1 hypointensity, STIR hyperintensity, and enhancement are present, centered at the physes of the distal femur and proximal tibia. There is minimal juxta-cortical edema in Hoffa's fat pad. There is also mild periosteal enhancement along the distal femoral and proximal tibial metaphyses. No intraosseous fluid collections or soft tissue abscess are seen.

**Figure 2D.** Osteolysis with marginal sclerosis involves the anterior aspects of the physeal margins of the metaphyses of the distal femur and proximal tibia (**arrows**), corresponding to the signal abnormality on MRI.

## Diagnosis

### Chronic recurrent multifocal osteomyelitis (CRMO)

### Questions

1. What MRI features are seen with pyogenic osteomyelitis and not CRMO?
2. What is the most common location for CRMO?

### Discussion

Chronic recurrent multifocal osteomyelitis (CRMO) and pyogenic osteomyelitis share many features. Both may have osseous and adjacent soft tissue inflammation and they are typically located near the physis. Additional shared osseous findings include transphyseal spread, osteolysis or sclerosis, and varying degrees of periosteal reaction (1, 2). Pyogenic osteomyelitis is occasionally multifocal (Figures 2E, 2F), but unlike CRMO, there may be intraosseous and soft tissue abscesses, sequestra, and fistulous tracts (Answer to Question 1) (2). In the absence of these findings, CRMO and multifocal pyogenic osteomyelitis may be indistinguishable based on MRI features at individual sites.

CRMO is a diagnosis of exclusion after pyogenic osteomyelitis has been ruled out. By definition, an organism is not isolated by blood culture or biopsy. The term CRMO is a misnomer since it represents a non-pyogenic inflammatory disorder and is technically not considered osteomyelitis. CRMO is viewed as a seronegative arthropathy-like condition that occurs in children (3). Additional clinical features associated with CRMO include psoriasis, inflammatory bowel disease, recurrent arthritis, spondyloarthropathy, or sacroiliitis. CRMO is generally a self-limited disease and the majority of cases have no disability beyond childhood (4). SAPHO (synovitis, acne, pustulosis, hyperostosis, and osteitis) is considered the adult equivalent of CRMO.

CRMO has been observed most commonly in the tubular bones of the lower extremity (Answer to Question 2). The clavicles are next most common (see Case 11) (3). When the changes are restricted to the thorax and shoulder girdle, the term sternocostoclavicular hyperostosis is generally employed. Rarer locations include the spinal column and pelvic girdle (1, 5).

The principal differential diagnosis for CRMO is multifocal pyogenic osteomyelitis, and bone biopsy and culture are generally required for diagnosis. Less likely differential considerations include Langerhans cell histiocytosis, small round blue cell tumors, and trauma/stress reaction.

In this patient, the diagnosis of CRMO was invoked because of the multifocality and the absence of clinical or laboratory findings to suggest pyogenic osteomyelitis. A total body MRI showed no additional lesions. A biopsy showed changes of chronic osteomyelitis without bacterial organisms, and culture of the biopsy material showed no growth. Symptoms resolved with naproxen. She was not given antibiotics.

### Orthopedic Perspective

Although patients with CRMO are usually not acutely ill, they may have erythema, low-grade fever, and abnormal laboratory values. The clinician relies on imaging to define the full extent of the process and identify a suitable site for open or percutaneous biopsy. Unlike pyogenic osteomyelitis, discrete fluid collections are not typical features of CRMO. Biopsy should target areas of granulation tissue and bone destruction, rather than bony sclerosis or nonspecific reactive edema to increase the diagnos-

tic yield. Patients are typically treated with anti-inflammatory medications and followed by a rheumatologist.

### **What the Clinician Needs to Know**

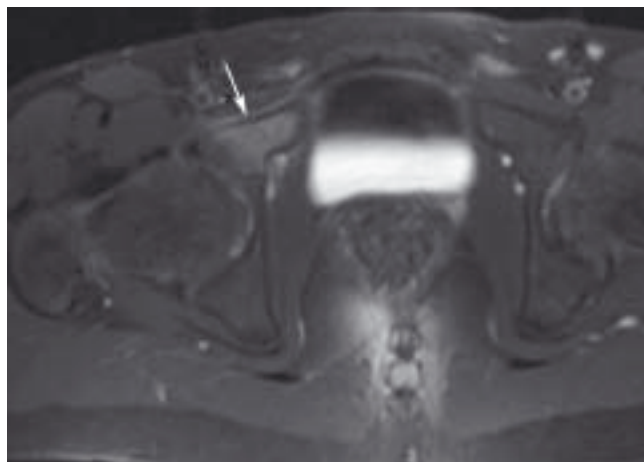
1. Is the lesion pyogenic osteomyelitis, CRMO, or tumor?
2. Are there other lesions?
3. Which lesion is best suited for percutaneous biopsy?
4. Is the process subsiding on follow-up studies? Active lesions demonstrate juxtacortical soft tissue edema, whereas the SI within inactive lesions is confined to bone (2).

### **Answers**

1. Intraosseous or soft tissue abscesses, sequestra, and fistulous tracts.
2. Lower extremity tubular bones.

## Additional Example

### Multifocal *Staphylococcus aureus* Osteomyelitis



**Figure 2E.** Axial T1 post-Gd FS of the pelvis.



**Figure 2F.** Coronal T1 post-Gd FS of the left knee.

## Findings

This is a 14-year-old boy with diffuse lower extremity pain and non-weight bearing. He had a severe upper respiratory tract infection 2 weeks prior to presentation. At the time of admission, he had a high fever and blood cultures were positive for *Staphylococcus aureus*.

**Figures 2E, 2F.** Two foci of abnormal enhancement are located in the right pubic ramus (**arrow**) and the left distal femoral metaphysis (\*) and epiphysis (**arrowhead**). Without the clinical history or positive blood cultures, the imaging findings do not allow differentiation of pyogenic osteomyelitis from CRMO, Langerhans cell histiocytosis, metastases, or stress reaction.

## Pitfalls and Pearls

1. CRMO is a misnomer because it is not a bacterial infection of bone. CRMO represents a non-pyogenic inflammatory disorder that primarily affects bone.
2. The imaging features of pyogenic osteomyelitis and CRMO are similar in the majority of cases. Therefore, the diagnosis of CRMO should be made only if pyogenic osteomyelitis has been completely excluded.

3. If CRMO is a consideration, a bone scan is indicated to assess for other lesions, and to identify the optimal biopsy site.

## References

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Pediatric and Adolescent Musculoskeletal MRI

A Case-Based Approach

Kan, J.H.; Kleinman, P.K.

2007, XII, 754 p. 980 illus., Hardcover

ISBN: 978-0-387-33686-2