Solitary Lytic Bone Lesion

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Case Presentation

A 66-year old woman presented with a four-year history of left lower extremity pain that began after she had been diagnosed with a left lower-extremity venous stasis ulcer. The ulcer had healed but the pain had acutely worsened over the previous three months. Pertinent medical history included stroke, antiphospholipid antibody syndrome, and end-stage renal disease on hemodialysis. Her physical examination was unremarkable other than pain with weight bearing. The patient had previously undergone two CT-guided biopsies at outside hospitals, both of which were nondiagnostic.

FIGURE 1. Initial presentation frontal radiograph of the lower leg demonstrating a mottled appearance of the midfibular diaphysis without pathologic fracture (arrows).

FIGURE 2. Concurrent axial CT image in bone window (A) and soft-tissue window (B) shows cortical scalloping of the midfibular diaphysis (A, arrows) with mild inflammatory change in the superficial tissues (B, asterisk) and within deep fascial planes, but without discrete soft-tissue mass.

FIGURE 3. Repeat frontal radiograph three months later of the lower leg demonstrates progressive permeative destruction of the midfibular diaphysis (arrows).
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FIGURE 4. Noncontrast T1-weighted image demonstrates destructive and permeative lesion at the midfibular diaphysis (arrows). Axial (B) and sagittal (C) STIR-weighted images demonstrate soft-tissue and muscle edema (arrows) adjacent to the midfibular diaphyseal lesion without discrete soft-tissue mass. Contrast was not administered secondary to patient’s decreased renal function.

Key Imaging Finding(s)
Lytic, destructive lesion of the fibula

Differential diagnoses
Infection (osteomyelitis)
Metastatic disease
Brown tumor
Gorham’s disease
Peripheral vascular malformation

Discussion
Infection (Osteomyelitis)
In adults, osteomyelitis typically occurs via hematogenous spread or direct extension from an overlying ulcer or trauma. As the vascular supply to bone changes with age, so does the typical location of osteomyelitis. Osteomyelitis tends to affect the metaphyses in children and the epiphyses in adults. The most common pathogen in osteomyelitis is Staphylococcus aureus, even in patients with sickle cell anemia who are at increased risk for salmonella osteomyelitis. Bacterial infection results in a local inflammatory response in and around the affected bone.

On initial radiographs, there may be no findings in the initial 10-14 days in adults. Once present, radiographic findings of osteomyelitis include regional osteopenia, cortical bone loss, periosteal thickening, and eventual peripheral sclerosis as the infected bone begins to heal. MRI is the most sensitive modality for detecting osteomyelitis and is more specific than bone scintigraphy. Findings include low T1 and high T2/STIR signal of the affected bone and postcontrast enhancement of the bone, periosteum, and surrounding soft-tissue collections.

Metastatic Disease
Metastatic lesions to bone are far more common than primary malignant bone lesions, often arising from malignancies of the lung, breast, kidney, and prostate. Myelomatous lesions should also be considered in patients over age 40 and typically present as punched out lytic lesions. The most common route of spread of metastatic disease is hematogenous, and common locations include ribs, vertebrae, the pelvis, and ends of long bones. Symptomatic lesions can present with pain and pathologic fracture. Usually, the primary malignancy is known at the time of diagnosis of osseous metastatic disease, but bone biopsy can be performed to provide definitive diagnosis.

The radiographic appearance of skeletal metastases can vary. Lesions may be lytic, sclerotic, or mixed lytic and sclerotic. It is important to note that radiographs are insensitive for the detection of asymptomatic osseous metastatic disease. Bone scintigraphy can also be used to detect skeletal metastases, can conveniently evaluate the entire skeleton at one time, and is very sensitive for the detection of osseous metastases. Usually, there is increased radiotracer uptake by the metastatic lesion. An exception is when a lesion is purely lytic, which will produce a photopenic defect on the bone scan. It is helpful to correlate scintigraphic findings with findings on other imaging modalities to exclude benign causes.

CT provides detailed information about cortical and trabecular bone involvement. MRI is highly sensitive and specific for detecting metastatic lesions to the bone marrow (90% and 95%, respectively) before cortical destruction occurs, and can evaluate extent of surrounding soft-tissue involvement. Additionally, PET/CT imaging can be performed to evaluate for metastatic disease that is F-18 fluorodeoxyglucose (FDG) avid.

Brown Tumor
Chronic renal disease causes excessive urinary excretion of calcium, thereby lowering serum calcium levels. To maintain normal serum calcium levels, parathyroid hormone levels increase and cause calcium resorption...
from bone. Brown tumor forms when granulation tissue with active, vascular proliferative fibrous tissue replaces the bone marrow.5

Radiographic findings include a well-circumscribed lucent lesion, sometimes with cortical thinning and expansion but no cortical break. MRI appearance can vary depending on tumor components, which can be entirely solid, entirely cystic, or mixed cystic and solid. Cystic components will be T2 hyperintense, and solid components will be T1 and T2 hypointense. Solid components can show postcontrast enhancement.6

**Gorham’s Disease**

A rare skeletal disease of unknown cause, Gorham’s disease is also called Gorham-Stout syndrome, progressive massive osteolysis, or vanishing bone disease. Disease manifests with progressive osteolysis and proliferation of thin-walled vascular and lymphatic channels. The process typically begins in one bone and can spread to adjacent bones and soft tissues. Diagnosis is made by exclusion of more aggressive osseous lesions, exclusion of underlying infection and the presence of angiomatous tissue on biopsy.7,8

Radiographic appearance is a lytic lesion with progressive, often circumferential osteolysis secondary to osteoclastic hyperactivity with resorption of the affected bone. The vascular and lymphatic channels often result in a permeative appearance of the bone. There is no osteoblastic activity in this process, so there is no periosteal reaction. This process typically plateaus and stabilizes over time.7,8

**Vascular Malformations**

Vascular malformations develop from dysplastic vascular channels and do not involute over time. They are classified based on the predominant vessel type and subcategorized as high- or low-flow lesions. Radiographic findings of erosive changes, periosteal reaction, cortical scalloping, or pathologic fracture could indicate bony involvement.9 Venous malformations account for two-thirds of all vascular malformations and 40% of venous malformations occur in the extremities.10 MRI combined with MR angiography is best for evaluating vascular malformations to determine the extent of the lesion as well as involvement of adjacent structures. MRI appearance varies depending on the characteristics of the vascular malformation. Venous and lymphatic malformations are usually septated, lobular T1 hypointense and T2 hyperintense masses with fluid-fluid levels and no flow voids. Arteriovenous malformations demonstrate no well-defined mass but instead demonstrate enlarged feeding arteries and draining veins with flow voids.10

**Diagnosis**

Gorham’s disease. A biopsy was performed under CT with samples sent for culture and surgical pathology. Histologic evaluation demonstrated skeletal muscle and tissue fragments composed of well-formed capillary and venous spaces with rare multinucleated giant cells but no evidence of malignancy or infection. Over the subsequent three months, the pain in the patient’s lower leg began to subside.

**Conclusion**

The broad differential for solitary lytic bone lesions can be narrowed based on patient age and lesion location. Radiographic appearance can also help narrow the differential by noting the presence of cortical thinning, cortical breakthrough, sclerosis, and periosteal reaction. MRI with and without contrast may also further narrow the differential; however, biopsy is important to exclude osteomyelitis and malignancy.

**References**