Osteomyelitis

Osteomyelitis is inflammation and destruction of bone caused by bacteria, mycobacteria, or fungi. Common symptoms are localized bone pain and tenderness with constitutional symptoms (in acute osteomyelitis) or without constitutional symptoms (in chronic osteomyelitis). Diagnosis is by imaging studies and cultures. Treatment is with antibiotics and sometimes surgery.

Etiology

Osteomyelitis is caused by

- Contiguous spread (from infected tissue or an infected prosthetic joint)
- Bloodborne organisms (hematogenous osteomyelitis)
- Open wounds (from contaminated open fractures or bone surgery)

Trauma, ischemia, and foreign bodies predispose to osteomyelitis. Osteomyelitis may form under deep decubitus ulcers.

About 80% of osteomyelitis results from contiguous spread or from open wounds; it is often polymicrobial. *Staphylococcus aureus* (including both methicillin-sensitive and methicillin-resistant strains) is present in ≥ 50%; other common bacteria include streptococci, gram-negative enteric organisms, and anaerobic bacteria. Osteomyelitis that results from contiguous spread is common in the feet (in patients with diabetes or peripheral vascular disease), at sites of bone penetrated by trauma or surgery, sites damaged by radiation therapy, and in bones contiguous to decubitus ulcers, such as the hips and sacrum. A sinus, gum, or tooth infection may spread to the skull.

Hematogenously spread osteomyelitis usually results from a single organism. In children, gram-positive bacteria are most common, usually affecting the metaphyses of the tibia, femur, or humerus. Hematogenously spread osteomyelitis in adults usually affects the vertebrae. Risk factors in adults are older age, debilitation, hemodialysis, sickle cell disease, and IV drug use. Common infecting organisms include *S. aureus* (methicillin-resistant *S. aureus* [MRSA] is common) and enteric gram-negative bacteria (in adults who are older, debilitated, or receiving hemodialysis); *S. aureus*, *Pseudomonas*
aeruginosa, and Serratia sp (in IV drug users); and Salmonella sp (in patients with sickle cell disease). Fungi and mycobacteria can cause hematogenous osteomyelitis, usually in immunocompromised patients or in areas of endemic infection with histoplasmosis, blastomycosis, or coccidioidomycosis. The vertebrae are often involved.

**Pathophysiology**

Osteomyelitis tends to occlude local blood vessels, which causes bone necrosis and local spread of infection. Infection may expand through the bone cortex and spread under the periosteum, with formation of subcutaneous abscesses that may drain spontaneously through the skin. In vertebral osteomyelitis, paravertebral or epidural abscess can develop.

If treatment of acute osteomyelitis is only partially successful, low-grade chronic osteomyelitis develops.

**Symptoms and Signs**

Patients with acute osteomyelitis of peripheral bones usually experience weight loss, fatigue, fever, and localized warmth, swelling, erythema, and tenderness.

Vertebral osteomyelitis causes localized back pain and tenderness with paravertebral muscle spasm that is unresponsive to conservative treatment. Patients are usually afebrile.

Chronic osteomyelitis causes intermittent (months to many years) bone pain, tenderness, and draining sinuses.

**Diagnosis**

- ESR or C-reactive protein
- X-rays, MRI, or radioisotopic bone scanning
- Culture of bone, abscess, or both

Acute osteomyelitis is suspected in patients with localized peripheral bone pain, fever, and malaise or with localized refractory vertebral pain, particularly in patients with recent risk factors for bacteremia. Chronic osteomyelitis is suspected in patients with persistent localized bone pain, particularly if they have risk factors.

If osteomyelitis is suspected, CBC and ESR or C-reactive protein, as well as plain x-rays of the affected bone, are obtained. The WBC count may not be elevated, but the ESR and C-reactive protein usually are. X-rays become abnormal after 2 to 4 wk, showing periosteal elevation, bone destruction, soft-tissue swelling, and, in the vertebrae, loss of vertebral body height or narrowing of the adjacent infected intervertebral disk space and destruction of the end plates above and below the disk.

If x-rays are equivocal or symptoms are acute, CT and MRI are the current imaging techniques of choice to define abnormalities and reveal abscesses (eg, paravertebral or epidural abscesses). Alternatively, a radioisotope bone scan with technetium-99m can be done. The bone scan shows abnormalities earlier than plain x-rays but does not distinguish among infection, fractures, and tumors. A white blood cell scan using indium-111–labeled cells may help to better identify areas of infection seen on bone scan. Bacteriologic diagnosis is necessary for optimal therapy of osteomyelitis; bone biopsy with a needle or surgical excision and aspiration or debridement of abscesses provides tissue for culture and antibiotic sensitivity testing. Culture of sinus drainage does not necessarily reveal the bone pathogen. Biopsy and culture should precede antibiotic
therapy unless the patient is in shock or has neurologic dysfunction.

Treatment

- Antibiotics
- Surgery if abscess, constitutional symptoms, potential spinal instability, or much necrotic bone

Antibiotics are selected to cover both gram-positive and gram-negative organisms until culture results and sensitivities are available. Initial antibiotic treatment for acute hematogenous osteomyelitis should include a penicillinase-resistant semisynthetic penicillin (eg, nafcillin or oxacillin 2 g IV q 4 h) or vancomycin 1 g IV q 12 h (when MRSA is prevalent in a community) and a 3rd- or 4th-generation cephalosporin (such as ceftazidime 2 g IV q 8 h or cefepime 2 g IV q 12 h). Empiric treatment of chronic osteomyelitis arising from a contiguous soft-tissue focus, particularly in diabetic patients, must cover anaerobic organisms in addition to gram-positive and gram-negative aerobes. Ampicillin/sulbactam 3 g IV q 6 h or piperacillin/tazobactam 3.375 g IV q 6 h is commonly used; vancomycin 1 g IV q 12 h is added when infection is severe or MRSA is prevalent. Antibiotics must be given parenterally for 4 to 8 wk and tailored to results of appropriate cultures. If any constitutional findings (eg, fever, malaise, weight loss) persist or if large areas of bone are destroyed, necrotic tissue is debrided surgically. Surgery may also be needed to drain coexisting paravertebral or epidural abscesses or to stabilize the spine to prevent injury. Skin or pedicle grafts may be needed to close large surgical defects. Broad-spectrum antibiotics should be continued for > 3 wk after surgery. In chronic osteomyelitis, long-term antibiotic therapy may be needed.

Last full review/revision February 2008 by Steven Schmitt, MD
Content last modified February 2008