

Infections Involving Bones and Joints



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DEFINITION

The term *osteomyelitis* refers to infection of any component of the bony skeleton, whereas *septic arthritis* refers to infection of native or prosthetic joints. Associated structures such as tendons, ligaments, and bursae can also become infected, especially if they involve prosthetic or biografted material. Osteomyelitis and septic arthritis can each occur as a result of seeding during an episode of bacteremia, as a consequence of vascular insufficiency, as a complication of trauma, or by extension from a contiguous focus of infection in an adjacent tissue or structure.

In the case of hematogenous infection, the bacteremia itself may be relatively transient and of little clinical consequence. Hematogenous osteomyelitis is common in children but accounts for only about 20% of osteomyelitis in adults. The vertebrae and pelvis are the most commonly involved sites.

Peripheral vascular disease leading to tissue hypoxia, often related to diabetes, hypertension, hyperlipidemia, or smoking, is the biggest risk factor for the development of osteomyelitis in adults older than 50 years of age. There is often antecedent soft tissue infection or destruction as a result of vascular insufficiency and neuropathy. It is most common in the lower extremities, particularly in the feet, and often occurs in diabetics.

Trauma, especially when it involves open fracture, with its attendant disruption of the bony architecture and vascular supply, is a major risk factor for development of osteomyelitis and septic arthritis. This is particularly true when an open fracture (such as from a fall or a motor vehicle accident), is heavily contaminated with soil or other environmental materials. Such fractures often require internal fixation (i.e., placement of rods, screws, or other metal devices) to stabilize the bone. The presence of such internal fixation devices provides a nidus for bacteria and other microorganisms, including fungi, to elude the immune system and incubate. Chronic osteomyelitis is a possible complication of such injuries and is often a result of multiple or unusual organisms. It may occur despite aggressive débridement and prophylactic antibiotic treatment at the time of injury and can arise months or even years afterward. Individuals who experience prolonged periods of immobility (e.g., paraplegia) are also at risk for osteomyelitis. Infection typically involves the pelvis, sacrum, and lower spine, corresponding to areas of unrelieved pressure and resulting pressure sores.

Osteomyelitis may be thought of as being acute or chronic. The former is typically hematogenous and associated with signs of inflammation in the overlying soft tissue, with onset occurring over the course of days to 1 week. Radiographs are usually normal

at presentation. Chronic osteomyelitis is typically more indolent, with onset over the course of months. It is more likely to show bony destruction on plain radiographs at the time of presentation and is often associated with a draining sinus tract. Sequestra (areas of dead bone) and involucra (new bone formed around sequestra) may also be seen on radiographs. Whereas with acute osteomyelitis, a 6-week course of antibiotics may effect a cure, chronic osteomyelitis more typically requires surgical intervention and a prolonged (≥ 3 months) course of antibiotic therapy.

PATHOPHYSIOLOGY

Characteristics of the vascular supply of the bone and properties of the most common pathogen, *Staphylococcus aureus*, may combine to lead to infection. Although bone is generally resistant to infection, the vasculature of the metaphysis contains capillary loops composed of a single layer of discontinuous endothelial cells, which may allow bacteria to enter the extracellular matrix. Additionally, these capillary beds appear to lack functionally active phagocytes. *S. aureus* is able to elaborate proteins expressed on its surface that promote adherence to tissues of the extracellular matrix. When engulfed by osteoblasts, *S. aureus* can survive for prolonged periods in an almost sporelike state, leading to potential recurrences of infection. Finally, many bacteria can elaborate biofilms that allow them to elude clearance by the immune system. Prosthetic material, such as that used in joint replacements and other grafts, can serve as a platform for the formation of such biofilms.

In the case of septic arthritis, there is usually some underlying joint abnormality (e.g., rheumatoid arthritis), although this abnormality may be as mundane as osteoarthritis. It is hypothesized that relatively trivial injuries, which may even go unnoticed or unremembered by the patient, can cause minor bleeding into the joint, providing a hospitable environment for bacteria to incubate.

CLINICAL PRESENTATION AND DIAGNOSIS

Patients with osteomyelitis often have pain at the site of infection. The overlying soft tissue may have signs of inflammation or tissue destruction; the latter is often seen in diabetics with soft tissue ulceration. Historically, the diagnosis of osteomyelitis relied on the presence of lucency on plain radiographs of the affected area. The diagnosis could be confirmed histologically by bone biopsy with culture to identify the pathogenic organism. Currently, the diagnosis is typically based on magnetic resonance imaging (MRI) with gadolinium, which demonstrates marrow edema with or without bony destruction. Alternatively, the diagnosis