pathogens as warranted, for example, HSV if vesicular lesions are present [397]. For women diagnosed with HIV during pregnancy, refer to specific testing guidelines. Virologic assays (ie, HIV RNA or HIV DNA NAATs) that directly detect HIV must be used to diagnose HIV in infants and children aged <18 months with perinatal and postnatal HIV exposure. HIV antibody and HIV antigen/antibody tests should not be used [398].

XIII. BONE AND JOINT INFECTIONS

Osteomyelitis may arise from hematogenous seeding of bone from a distant site, extension into bone from a contiguous site, or direct inoculation of microorganisms into bone with surgery or trauma. Infections of native joints may also develop by any of these routes, although most occur by hematogenous seeding. Infections of prosthetic joints are usually acquired from contamination at the time of arthroplasty implantation but may occur due to subsequent hematogenous seeding or extension from adjacent sites.

The potential list of causative agents of bone and joint infections is diverse and largely predicated on the nature and pathogenesis of infection and the host. Although bone and joint infections are usually monomicrobial, some may be polymicrobial.

Key points for the laboratory diagnosis of bone and joint infections

- Swabs are not recommended for specimen collection, with synovial fluid and/or tissue biopsies being recommended.
- Blood cultures are indicated for detection of some agents of osteomyelitis and native joint infection but usually not for periprosthetic joint infection diagnosis.
- Joint fluids should ideally be cultured in aerobic and (specimen volume permitting) anaerobic blood culture bottles.
- For periprosthetic joint infection diagnosis, 3–4 separate tissue samples should be submitted for aerobic and anaerobic culture; sonication of explanted prostheses followed by semi-quantitative aerobic and anaerobic culture of the resultant sonicate fluid may be used to detect pathogens.
- Fungal and mycobacterial stains and cultures should not be routinely performed for the diagnosis of periprosthetic joint infection.
- When anaerobic bacteria are suspected, anaerobic transport containers should be used for transportation of tissues and fluids to the laboratory.
- Some agents of bone and joint infection are nonculturable or poorly culturable and require molecular and/or serologic methods for detection.

Osteomyelitis

Osteomyelitis can occur following hematogenous spread, after a contaminated open fracture, or following direct inoculation of microorganisms into bone with surgery or trauma; those with underlying diabetes mellitus or vascular insufficiency are at particular risk for osteomyelitis. Vertebral osteomyelitis/spondylodiskitis is addressed below. Osteomyelitis is typically suspected on clinical grounds, with confirmation involving imaging, and microbiologic and histopathologic tests. The peripheral white blood cell count may be elevated; erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are often elevated as well. Establishing an etiologic diagnosis, which is important for directing appropriate clinical management since this varies by microorganism-type, and associated antimicrobial susceptibility nearly always requires obtaining bone for microbiologic evaluation (unless blood cultures are positive in the context of convincing radiographic findings). This can be accomplished by imaging-guided or surgical sampling. As much specimen as possible should be submitted to the laboratory; specimens may include pieces of intact bone, shavings, scrapings, and/or excised or aspirated necrotic material (Table 45). Swabs are not recommended. Cultures of sinus tracts are generally not recommended, because recovered organisms, aside from *Staphylococcus aureus*, do not correlate with those found in deep cultures.

Hematogenous osteomyelitis is usually monobacterial, whereas that resulting from contiguous infection is often polymicrobial. Acute hematogenous osteomyelitis of long bones mainly occurs in prepubertal children but may occur in older individuals, persons who inject drugs, and those with indwelling central venous catheters. In prepubertal children, the most common microorganisms involved are *S. aureus* and *Streptococcus pneumoniae*; *Kingella kingae* is common in children under the age of 4 years [399]. Osteomyelitis in neonates, especially in those with indwelling central venous catheters, typically results from hematogenous spread; commonly involved organisms include *Streptococcus agalactiae* and aerobic gram-negative bacteria, especially *Escherichia coli*. *Candida* species and *Pseudomonas aeruginosa*, are more commonly encountered in persons who inject drugs and those with indwelling central venous catheters. In children, diagnosis is often (but not always) made based on clinical and imaging findings in the context of positive blood cultures (https://www.idsociety.org/practice-guideline/bone-and-joint-infections—osteomyelitis/). In adults, imaging-guided aspiration or open biopsy is typically necessary.

In osteomyelitis occurring after a contaminated open fracture, the organisms listed above may be found, with enterococci, fungi, and non-tuberculous mycobacteria alternatively or additionally being involved; microorganisms may derive from patient skin, contaminated soil, and/or the healthcare environment.