ORAL SURGERY

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Osteomyelitis

Definition

Osteomyelitis is defined as inflammation of bone; clinically, however, the term is synonymous with an "infection of the bone."

Etiology and pathogenesis

Osteomyelitis will usually originate and spread from the medullary spaces of the jaws. Inoculation of bacteria in the marrow spaces usually causes edema of the marrow, and because this space is confined by the cortical bony walls, the hydrostatic pressure rises, similar to that of an infected dental pulp, and once this pressure is greater than that of the feeding arterial vessels, soft tissue necrosis and pain usually ensue. The failure of the microcirculation of the cancellous bones of the jaws is crucial in the development of osteomyelitis, because oxygen and nutrients required for healing are unable to reach the marrow space. In addition, the body's blood-borne immune system has inhibited transport to the marrow space, resulting in proliferation and spread of the offending organism.

Osteomyelitis is more common in the mandible than the maxilla; this is due to the fact that the blood supply to the maxilla is multifocal and robust, which is in contrast with the mandible that primarily obtains its blood supply from the inferior alveolar artery and periosteum. In contrast, the periosteal blood supply to the maxilla penetrates its cortex to perfuse the underlying porous bone much easier than that of the much thicker cortex of the mandible. Though the marrow of the maxilla and mandible are often exposed to periapical pathogens, osteomyelitis is rare. This is because host defenses usually localize the infection to a periapical abscess and limit the progression. However, in those individuals who are immunocompromised, such as those with human immunodeficiency virus infection, who have poorly controlled diabetes mellitus, or who use chronic corticosteroid regimens, as well as those who are chronic drug abusers, who suffer from chronic malnutrition, or who have an immunosuppressive disease, osteomyelitis may ensue due to the lack of intact host defense mechanisms.

Microbiology

Traditionally Staphylococcus species were the predominant bacteria involved as in the other bones of the body, although it is known now that several other organisms may contribute to the disease process. The microbiologic profile most often present in cases of osteomyelitis of the mandible includes Streptococci spp., as well as anaerobic bacteria, such as Bacteroides or Peptostreptococcus. Less commonly seen organisms include Eikenella, Candida, Staphylococcus, Actinomyces, Bacteroides, Klebsiella, Fusobacterium, Lactobacillus, and Haemophilus spp.

Pharmacology

Ideally, specific (not empiric) antimicrobial therapy, based upon culture and sensitivity testing results, is used to prevent the development of bacterial drug resistance as well as adverse side effects. Osteomyelitis of the jaws is often polymicrobial in nature; therefore, culture and sensitivity testing often fail to identify one or more specific offending organisms. Penicillin remains the empiric antibiotic of choice for orofacial infections, followed by clindamycin and fluoroquinolones; these are used until speciation and sensitivity of cultures are performed. These antibiotics are preferred due to their efficacy and coverage for most of the usual odontogenic microbiota.

Classification

1. Acute Suppurative Osteomyelitis

Acute suppurative osteomyelitis is an infection of the medullary bone that also has associated production of purulence. This entity is often seen in osteoradionecrosis (ORN) or medication-related osteonecrosis of the jaws (MRONJ), where microorganisms colonize areas of necrotic bone. A key point here is that the organisms tend to colonize the surface of the bone initially, before they enter the medullary space, which is likely also necrotic in some instances.

Clinical findings: may include edema, restricted movement of the affected area, erythema, and pain. Most patients do not develop systemic manifestations from this process.

Radiological findings: In the acute phase, no radiographic findings are seen because there is minimal bone loss. When there are radiographic findings, destructive lesions are characterized by radiolucency in the involved areas. There is often a moth-eaten appearance to the bone radiographically, which can be confused with malignancy. Within this radiolucency there may be radiopaque areas of bone that have not yet been resorbed by the usual bone turnover mechanisms. These radiopaque areas are termed sequestra, and the surrounding radiolucent area is termed an involucrum.

Treatment: In the early phases, acute supportive osteomyelitis is managed surgically with aggressive debridement of the affected necrotic bone to expose normal bleeding bone, as well as the use of adjunctive empiric antibiotic therapy. The etiology of the infection must also be addressed, and this often is a carious tooth, a failed root canal treatment, or dental implant, or, in the case of ORN or MRONJ, the precipitating necrotic bone. Often, if the disease process has progressed sufficiently, the mandible may fracture in the area of the necrotic bone (pathologic fracture). When possible, this mandible fracture should be reduced and fixated, but due to the poor healing potential in these cases, additional reconstructive procedures may be required.

2. Chronic Suppurative Osteomyelitis

Long-standing, or chronic suppurative osteomyelitis, is treated in a manner similar to the acute form, with removal of the source of the infection. In addition, if the area of involvement has been treated previously with bone grafting or rigid fixation, all nonviable tissue and hardware should be removed. Standard management of chronic suppurative osteomyelitis should include culture and sensitivity testing of a bone biopsy, aggressive debridement of necrotic bone (may include large segments of the jaws), and high dose intravenous antibiotic treatment. High-dose empiric IV antibiotics should be initiated, with more selective antibiotic administration once speciation and sensitivity has been established. The duration of antibiotic administration (generally a minimum of 6 weeks of outpatient IV antibiotics) is longer than used for common odontogenic infections because bone penetration of the antibiotic and resolution of bony

colonization is more difficult. For more chronic, unresponsive types of osteomyelitis, coverage may require up to 6 months or more of IV antibiotic administration to prevent progression of the disease process.

3. Chronic Sclerosing Osteomyelitis

Microbiology: This rare form of osteomyelitis is an intramedullary bone infection with one of the Actinomyces species as well as Eikenella corrodens as the offending organisms. The combination of these two organisms produces a sclerosis and fibrosis of the medullary space.

Clinical presentation: The pathognomonic clinical sign is intense pain. This pain may fluctuate along with acute exacerbations of mandibular expansion and soft tissue edema. Usually a chronic dull pain is always present. In general, there is no purulence of drainage present. Symptoms may persist for up to 5 years before recognition and establishment of a diagnosis.

Radiographical features: Radiographically an increased trabecular bone density is present in the alveolar and basal bone of the mandible.

Treatment: Although antibiotic therapy, combined with or without hyperbaric oxygen therapy, may mitigate the progression of the disease, surgical resection of the diseased bone is often required.

4. Osteomyelitis with Proliferative Periostitis (Garre Osteomyelitis)

Clinical presentation: usually affects children due to their increased vascularity and regenerative capabilities.Clinically there is expansion of the mandible with pain, but no purulence, drainage, or erythema. Though termed by some as periostitis ossificans, this is not an appropriate term because the periosteum does not become ossified. It is actually the chronic infection that causes an inflammation mediated deposition of new bone lifting the periosteum from the cortex.

Radiographical features: The most notable radiographic finding is paracortical bone formation ("onion-skinning") due to repetitive irritation of the periosteum usually associated with a periapical infection of the mandibular tooth. Radiographically extracortical bone formation in the form of woven bone in layers parallel to the cortex connected by bridges of bone perpendicular to the cortex is seen.

Treatment : Removal of the infectious source is of paramount importance, and biopsy is considered when a source of infection is not identified because malignancy may have similar radiographic findings. Routine treatment includes removal of the offending infectious source and, if needed in the acute phase, a short course of antibiotic therapy (penicillin, tetracycline, or clindamycin) until the bone inflammation resolves spontaneously. Long-term antibiotic therapy is not indicated for osteomyelitis with proliferative periostitis (Garre osteomyelitis).