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REVIEW ARTICLE

OSTEOMYELITIS IN AN OTHERWISE HEALTHY PATIENT- A UNIQUE CASE REPORT WITH REVIEW

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ABSTRACT

Osteomyelitis of the craniofacial skeleton must be uniquely managed and is more difficult to treat than osteomyelitis of other bones of the body, owing to the complex craniofacial skeletal anatomy and associated aesthetic concerns. Though these days, occurrence of osteomyelitis has become less common due to the advent of antibiotics and also the progressively higher standards of oral and dental health, we encountered a case in an otherwise young healthy patient. This articles aims is to present with a case report, and brief and inclusive overview of osteomyelitis, its clinical features, and diagnosis, classification, and treatment modalities.

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INTRODUCTION

"Osteomyelitis" is a Greek word meaning, bone (osteon) and marrow (muelinos). The osteomyelitis is a condition where there is inflammation of the bone, which generally begins as an infection of the medullary cavity and spreads rapidly to involve the Haversian canals, and eventually extends to the periosteum (Marc Baltensperger, 2008). These days, this condition is less common, but in the past, osteomyelitis was more prevailing and characterized by a prolonged course, uncertainty of treatment response, and disfigurement occasionally (due to loss of bone and teeth and resulting facial scars). The decline in prevalence can be due to the increased usage of antibiotics and also the progressively higher standards of oral and dental health (Barry, 2007). Nonetheless, osteomyelitis still remains a challenge for both clinicians and patients.

Classification

Osteomyelitis can be classified based on duration as acute or chronic, pathogenesis as trauma, contiguous spread, hematogenous, or surgical), site, extent, or type of patient. Although several classifications of osteomyelitis have been described, the most widely used in the medical literature and in clinical practice are the classification systems by Waldvogel et al. (Waldvogel, 1970) and Cierny et al (Cierny, 2003). Under the Waldvogel system, osteomyelitis is described primarily according to duration (acute or chronic). Further, the disease is classified according to source of infection, as hematogenous when it is derived from a bacteremia or as contiguous focus when it derived from an infection in a nearby tissue. The last catergory of the classification is vascular insufficiency. One of the limitations of the Waldvogel classification system is that the infection originating from direct penetration of microorganisms into the bone, as may occur after trauma or surgery is not consider. Also, it is an etiologic classification system and does not readily lend itself to guiding surgical or antibiotic therapy. The second system is known as the Cierny-Mader classification. Being a clinical classification, the Cierny-Mader classification is based on anatomic, clinical, and radiologic features. It categorizes osteomyelitis as being in one of four anatomic stages. In stage 1- medullary, osteomyelitis is confined to the medullary portion of the bone. Stage 2- superficial, involves only the cortical bone and often originates from a contiguous focus infection or direct inoculation. Stage 3- localized, involves both cortical and medullary bone.

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The bone remains stable in this stage, and the inflammatory process does not involve the entire bone diameter. Stage 4-diffuse, the entire thickness of the bone is involved, with loss of stability. This system includes a second dimension, categorizing the host as either A, B, or C. Category A, hosts without any systemic or local compromising factors. Category B, hosts are affected by one or more compromising factors. Category C, hosts are so severely compromised that the radical treatment necessary would have an unacceptable risk-benefit ratio. One of the drawbacks of this system is that by definition, the C host category is based on subjective evaluation. Also not taken into account are other properties including the duration of time that an infection has been able to persist, presence of medical devices in the infected area, and whether it is a pediatric or teen/adult patient.

Epidemiology

It is a well- established fact that maxilla is less frequently affected by osteomyelitis than mandible. This is due to the significant collateral blood flow in the midface & the porous nature of maxillary bone and thin cortices (Osteomyelitis of Jaws, 1993; Barry, 2003; Koorbusch, 1992 and Wannfors, 1991). The overall incidence of pyogenic osteomyelitis of mandible is up to 3 to 19 times greater than maxillary case (Koorbusch, 1992). The most common sites of the osteomyelitis in the mandible, are the body followed by the symphysis, angle, ascending ramus and condyle (Zurich, 2003). Predisposing factors include uncontrolled diabetes immunocompromised patients, and patients on immunosuppressive therapy and radiotherapy (Osteomyelitis of Jaws, 1993 and Aitasalo, 1998). It is seen predominantly amongst the age group of fifties to the sixties with male predilection. Chronic osteomyelitis cases are more frequent after the second decade of life peaking and this may correlate with changes of the immune and vascular health of the adult and aging patient (Uche, 2009). Chronic osteomyelitis in children is uncommon (Auh JS BHKB, 2004). In children, chronic osteomyelitis is seen after traumatic injuries or as a complication of surgical procedures.

Etiology

The medications linked to osteomyelitis are steroids, chemotherapeutic agents, bisphosphonates and other toxic therapeutic agents (IR, 2009). Local conditions that adversely affect the blood supply or lead to tissue necrosis can also predispose the host to a bone infection or localized osteomyelitis (Yavuz, 2008). Osteomyelitis can be diagnosed on the basis of patient's history, clinical and radiological examinations, and also surgical findings. Histopathologic examinations can be consistent with the diagnosis and the microbiologic tests can be helpful.

Microbiology

The bacteria associated with infected dentition, such us periodontal pathogens including Staphylococcus aureus, Staphylococcus epidermidis, Actinomyces, Prevotella species and Eikenella species have been noted to be present in most chronic cases (Uche, 2009). Last two groups of bacteria become more prevalent in refractory forms of osteomyelitis of the jaws. While osteomyelitis in mandible is considered a polymicrobial disease, in long bones it is attributed to Staphylococcus Aureus. Candida infections were also noted in some of the cases of osteomyelitis (Uche, 2009).

Pathophysiology

The pathophysiology involves the accumulation of an inflammatory exudate in the bony medullary cavity and beneath the periosteum, causing compression of the central and peripheral blood supply to the bone. So there is a reduced supply of nutrients and oxygen because the osseous bloody supply is compromised. This condition results in the formation of necrotic bone. Bacterial proliferation is promoted by the necrotic tissue, which, without an appropriate intervention, will result in incomplete healing and progression of the osteomyelitis. Also antibiotic cannot penetrate in this area, so a surgical intervention is necessary (Uche, 2009). The aetiology can include bacterial infection (dental or bacteraemia from distant foci), vascular deficiency (localized endarteritis), autoimmune disease or trauma.

Clinical Features

Clinical manifestations of Osteomyelitis vary depending on the virulence of the infecting organisms, host resistance, and the reaction of the periosteum to inflammation (Jones, 2005). In most cases, the primary complaints are swelling, pain, or draining fistula. Other initial signs include local erythema, tenderness over the involved bone, pathologic fracture, malocclusion, sequestra and exposed bone, fever, and trismus. Chronic osteomyelitis is generally seen secondary to open fractures, bacteremia, or contiguous soft issue infection. The incidence of significant infection within three months after an open fracture has been reported to be as high as 27 percent (Pollak, 2010). The incidence appears to be independent of the length of time from the injury to surgery.

Lab Investigations

Though helpful, laboratory investigations lack specificity in case osteomyelitis. There may be increased ESR and C-reactive protein levels, leucocytosis. These inflammatory markers are especially likely to be elevated in children with acute osteomyelitis. A persistently normal ESR and C-reactive protein level virtually rules out the condition. The C-reactive protein level correlates with clinical response to therapy and may be used to monitor treatment (Saavedra-Lozano, 2008). Microbial cultures are play an important role in the diagnosis and treatment of osteomyelitis. When supported with substantial clinical or radiographic evidence, Positive blood cultures may eliminate the need for a bone biopsy. The organisms identified by superficial wound cultures may correspond with bone biopsy culture results in only about one-third of cases, thus they do not contribute significantly to the diagnosis of osteomyelitis;. Chronic infections are more likely to have polymicrobial involvement, including anaerobic, mycobacterial, and fungal organisms. Specific cultures or microbiologic testing may be required for suspected pathogens (Gross, 2002). Bone biopsy showing positive culture with consistent necrosis is the preferred diagnostic criteria for osteomyelitis.

Imaging

Plain radiography, technetium-99 bone scintigraphy, and magnetic resonance imaging (MRI) are the most useful modalities (Pineda, 2009). Plain radiography usually does not show changes caused by osteomyelitis until about two weeks after the initial infection, when nearly 50 percent of the bone mineral content has been lost (20). Typical findings include

osteolysis with non-specific periosteal reaction. Plain radiography is a useful first step that may reveal other diagnoses, such as metastases or osteoporotic fractures. It generally complements information provided by other modalities and should not be omitted, even if more advanced imaging is planned (Schweitzer, 2008). The role of computed tomography (CT) in the diagnosis of osteomyelitis is limited. Although computed tomography is superior to MRI in detecting necrotic fragments of bone, its overall value is generally less than that of other imaging modalities. CT should be used only to determine the extent of bony destruction such as in case of the spine involvement, to guide biopsies, or in patients with contraindications to MRI (Pineda, 2006). MRI gives better information for early detection of osteomyelitis than the other imaging modalities. MRI can detect osteomyelitis within 3-5 days of disease onset (Pineda, 2009). The sensitivity and specificity of MRI in the diagnosis of osteomyelitis may be as high as 90 percent (Termaat, 2005). MRI is superior to bone scintigraphy in diagnosing and characterizing osteomyelitis as it can also detect necrotic bone, sinus tracts, or abscesses. Its use can be limited, however, if surgical hardware is present. Nuclear imaging can be helpful in diagnosing osteomyelitis.Technetium-99 bone scintigraphy and leukocyte scintigraphy are usually positive within a few days of the onset of symptoms. The sensitivity of bone scintigraphy is comparable to MRI, but the specificity is poor. Specificity of leukocyte scintigraphy is also poor, but when combined with three-phase bone scintigraphy, sensitivity and specificity are improved (Termaat, 2005). Bone and leukocyte scintigraphy can provide valuable information if MRI is contraindicated or unavailable. Other imaging modalities seem promising for the diagnosis of osteomyelitis, but they are not routinely used. Positron emission tomography (PET) has the highest sensitivity and specificity—more than 90 percent—but it is expensive and not as widely available as other modalities (23). The role of musculoskeletal ultrasonography in the diagnosis of osteomyelitis is evolving. Some studies suggest that in some patients, such as those with sickle cell disease, detection of sub-periosteal fluid collections can be useful or even diagnostic; however, reliable estimates of sensitivity and specificity are lacking (22).

TREAMENT

Treatment of osteomyelitis of the jaws includes elimination of the cause, incision and drainage, sequestrectomy, saucerization, decortication, resection of the jaw, antibiotics and hyperbaric oxygen (Barry, 2007). The main treatment of localized osteomyelitis in a patient without any systemic conditions is to remove the etiology of the disease as well as antibiotic therapy to prevent post-surgical infection(Kushner, 2003) Empirical antibiotic therapy should be instituted at the earliest moment and can be changed according to the results of antibiogram. Treatment of osteomyelitis may often require surgical removal of infected and necrotic tissue. Choice of antibiotic therapy should be determined by culture and susceptibility results, if possible. Patients in whom antibiotic therapy is already initiated, false-negatives biopsy reports and cultures is possible. If clinically possible, delaying antibiotics is recommended until microbial culture and sensitivity results are available. Indications for surgery include antibiotic failure, infected surgical hardware, and chronic osteomyelitis with necrotic bone and soft tissue. The optimal duration of antibiotic treatment and route of delivery are unclear. Intravenous antibiotic therapy for two to six weeks, with a transition to oral antibiotics for a total treatment period of four to eight weeks is generally recommended, for chronic cases. Long-term parenteral therapy is likely as effective as transitioning to oral medications, but has similar recurrence rates with increased adverse effects. Surgical intervention is necessary in some cases to preserve viable tissue and prevent recurrent systemic infection. Antibiotic regimens for the empiric treatment of acute osteomyelitis, should include an agent directed against S. aureus. Betalactam antibiotics are first-line of drugs unless methicillin resistance strains are suspected (greater than 10%), in which case, MRSA should be considered in initial antibiotic coverage. In such cases, intravenous vancomycin is the first-line choice. Incision and drainage relieves the pressure and pain caused by the accumulation of pus. It helps in localization by reducing absorption of toxic products and preventing further spread of infection in the bone. Incision of abscesses should be carried out intraorally or extra-orally depending upon the location. The pus can be sent for culture. The consistency, color and odour of the pus also provide important clues to the diagnosis and initial treatment. Patients with compromised systemic conditions or toxemia, surgical interference may be postponed for 2 to 3 days.

Removal of all necrotic soft and hard tissue as well as all granulation tissue must be achieved. The extent of the surgery is dictated by the extent of the lesion. Tissue excision and bone curettage should be extended to tissue with sufficient perfusion, e.g., bleeding tissue. Surgical debridement includes removal of loosened teeth in the infected area, as well as removal of foreign bodies/implants and sequestrum. Surgical procedures are extended simultaneously, in cases of more extensive infection. Local curettage, saucerization of the infected bone, decortication, and possibly resection followed by reconstruction may be necessary. Sequestra are confined to the cortical bone but may also be cancellous or cortical−cancellous and may persist for several months in untreated cases before being resorbed or spontaneously expelled through the oral mucosa or the facial skin. Once completely formed, the sequestrum may be removed with minimal surgical trauma. This minimally invasive procedure reduces subsequent bone and tooth loss. While this approach may be applicable in cases of localized osteomyelitis with superficial sequester formation, it is contraindicated in advanced cases with protracted spreading of the infection and sequester formation in more profound regions of the bone

Saucerisation is the surgical procedure of de-roofing the jaw bone to expose the medullary cavity for subsequent thorough debridement. The margins of necrotic bone overlying the focus of osteomyelitis are excised to create direct visualization of the infected medullary cavity and access to formed and forming sequestra, granulation tissue, and affected bone. In advance cases, waiting for sequester formation and reducing surgery to sequestrectomy, is not feasible as there is risk for further spread, abscess formation, and cellulitis. The affected cortical bone is avascular and harbors microorganisms. Parenteral or per oral administered antibiotics cannot reach the affected region as the medullary cavity is destructed and largely replaced by granulation tissue and pus. In such cases, Decortication promotes resolution by allowing well-perfused tissue into contact with bone, thereby promoting further healing. HBOT can be used as an adjunct early in the management. The goal of HBOT is to improve oxygen tension in hypoxic wounds, which in turn enhances vascular

proliferation and fibroblastic activity and stimulates osteoclastic activity. Higher tissue oxygen tensions improves the ability of leukocytes to kill bacteria. In general, the benefits of HBOT validate its use as an adjunct to surgical and antimicrobial therapy in the management of refractory, chronic sclerosing and chronic suppurative osteomyelitis.

Case Report

A 30 year old male patient reported to the Department of Oral and Maxillofacial Surgery, Dayananda Sagar College of Dental Sciences, Bangalore with a chief complaint of pain and swelling in relation to the lower right side of face with a one week duration. Patient gave history of an uneventful extraction of a root canal treated lower right back tooth, 10 days back, following which he developed pain and swelling with respect to the lower right side of cheek and also reported pus discharge in relation to the extracted tooth region. The patient also complained of paresthesia over the right side of the lower lip and chin region since 4 days. The swelling seemed to gradually increase and patient had severe deep aching type of pain with respect to the same region along with the lower right back tooth region. Preoperative routine investigations were performed and values were found to be within normal limits. A Pus sample was obtained via a culture swab and sent for culture and sensitivity testing. The pus culture showed 'Staphylococci' in numerous number and antibiotic sensitivity showed sensitivity to Amikacin and Cefoperazone. A panoramic radiograph and CBCT were subsequently done, which revealed bi-focal radiolucent areas extending between left mandibular first premolar and third molar suggestive of lytic changes. Hence, based on clinical and radiographic presentation, a diagnosis of chronic suppurative osteomyelitis was arrived at.

The treatment plan consisted of Extraction of offending teeth, Tooth 44 and 45, Decortication, Sequestrectomy, Saucerization and Debridement with respect to the 44, 45 and 46 region and Excision of the Sinus tract and Curettage of the area. Under local anesthesia, a Trapezoidal incision was placed and mucoperiosteal flap was raised in relation to the 44, 45, 46 region. Saucerization or unroofing of the bone was done to expose the nonviable nonvascular necrotic bone. Bony fragments were removed using a bone rongeur. The granulation tissue and loose bony fragments were removed using a bone curette. The lateral cortex was also removed using a bone rongeur until viable fresh bleeding bone bed was encountered. The Sinus tract was excised and curetted as well. The surgical site was thoroughly irrigated with saline. Platelet Rich Fibrin immersed in 1ml of Amikacin (125mg) was placed into the surgical site to achieve local drug delivery and also enhance healing. The wound was closed and elimination of dead space was done using pressure bandages for 48 hours to maintain close contact with vascular soft tissue and bone bed. The Specimen obtained was sent for histopathological examination.

Post-operative care included, Antibiotic therapy (Iv- Amikacin 100mg, twice daily for 10 days and Orally- Cefoperazone 1g + Sulbactum 0.5g twice daily for five days, adequate hydration and rest. The wound healed uneventfully without any postoperative complications. Panoramic radiographs were taken at 2-month intervals. Panoramic radiograph 6 months postoperatively showed considerable resolution. Paresthesia of the left side of lower lip resolved completely by 6 months postoperatively. Absence of any clinical signs of infection and sequential postoperative radiographs at different intervals demonstrated clinical success, showing resolution of pathology by decreased radiolucency indicating osteogenesis.

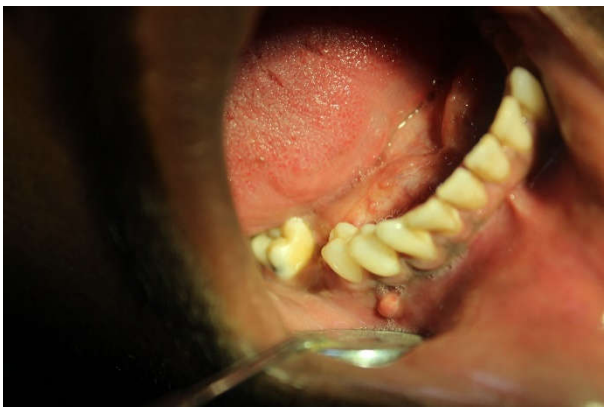

Figure 1. Pre op- intra oral

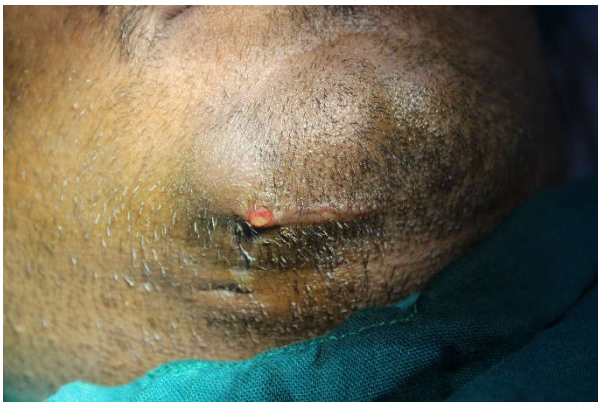

Figure 2. Pre op extra- oral sinus opening

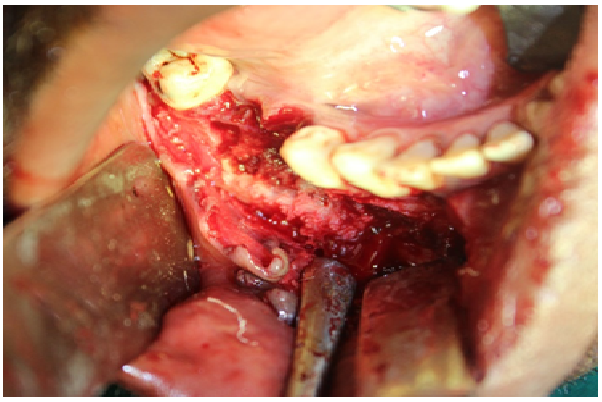

Figure 3. Intraoperative site- necrotic bone

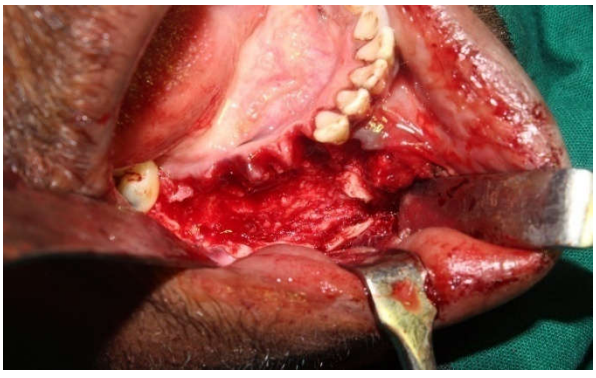

Figure 4. Decortication

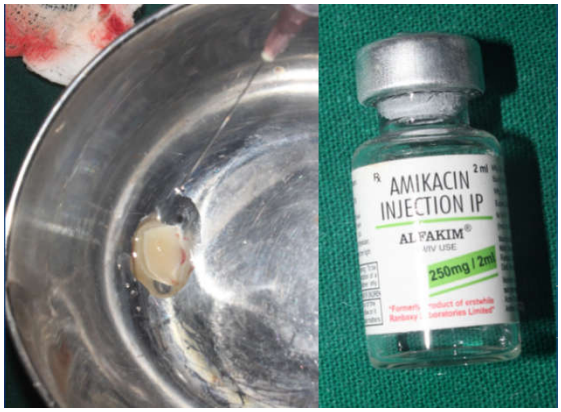

Figure 5. Amikacin impregnated PRF

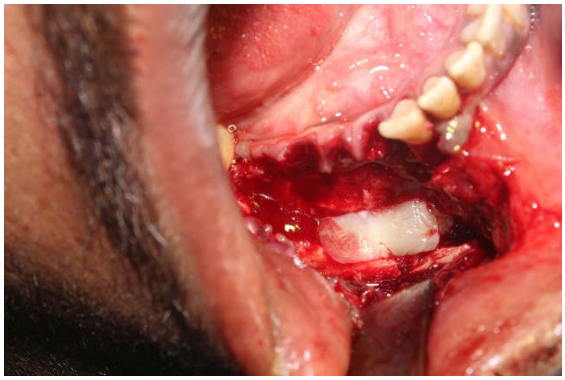

Figure 6. Local drug delivery using amikacin impregnated PRF

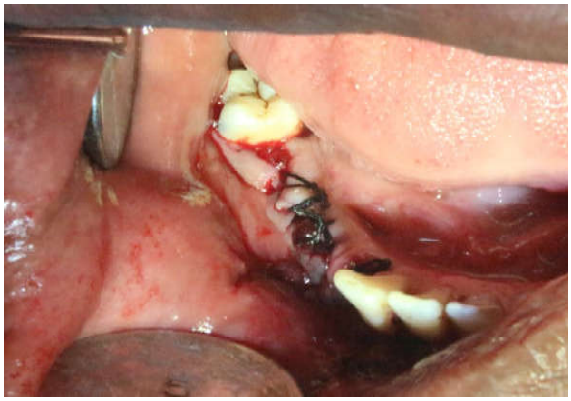

Figure 7. Site sutured

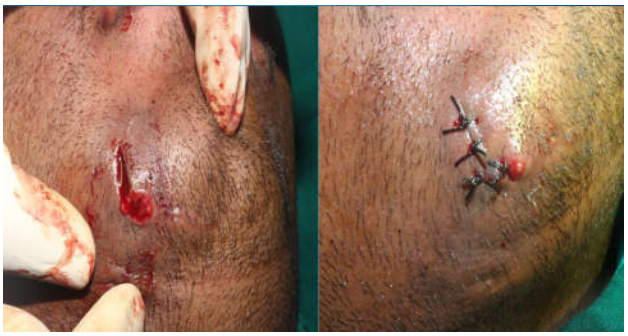

Figure 8. Sinus track debrided and sutured

Conclusion

Though many studies suggest that osteomyelitis has become a rare entity because of advances in medical therapy and higher standards in oral and dental health, our experience suggest a contrary review. However, a correct diagnosis will allow adequate management and improve patients' prognosis.

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