

What is osteomyelitis of the jaw bones? Its history and classification

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I. General Information

Osteomyelitis; It is a progressive disease that occurs as a result of a microorganism causing damage to the bone tissue through infectious and inflammatory processes. Only a part of the bone may be involved, and all of the medullary canal, periosteum, cortex and surrounding soft tissues may be included in this picture. The success of treatment in bone and joint infections is low compared to the successes in the treatment of infections in other parts of the body due to some anatomical and pathophysiological features. Most of the patients are patients who have been operated many times, have been treated with different antibiotics for a long time, but the infection still continues. This chronic state of osteomyelitis is a condition that limits the patient both physically and can leave psychiatric sequelae [1].

It is most common between the ages of 1-20. This disease is 2.5 times more common in boys than girls. Local causes of bone tissue (trauma) and low systemic defense of the patient (immunodeficiency syndromes, diabetes, malnutrition, chronic diseases, etc.) play a role in the formation of infection [2].

As can be understood from the roots of the word, "osteon" means the smallest unit that makes up the bone, "myelo" means bone marrow and "itis" means inflammation. Osteomyelitis can occur in a variety of ways, such as by dissemination by bacteremia from a focus of infection elsewhere in the body, by infection of adjacent soft tissue or joints, or by direct contamination of the microorganism after a penetrating trauma or surgery [1]

Infection may be limited to only one area of the bone; It can spread to the bone marrow, cortex, periosteum, and even to the surrounding soft tissues, and if not treated, it can drain into the skin as fistulized [2]

It is known that approximately 20% of patients with chronic osteomyelitis died until the beginning of the 19th century, and significant disabilities remained in survivors [2]

Bone and joint infections, an infection that is relatively common despite the increase in antibiotic types and efficacy, and the improvement of operating room conditions with surgical techniques. It is one of the diseases [1]

7 It is known that the effective treatment of chronic osteomyelitis is still very difficult, and early diagnosis and appropriate surgical and antimicrobial therapy are required for successful treatment [2]

With the term osteomyelitis, it is mostly acute or chronic, depending on the onset of infection and the duration of symptoms; Hematogenous or exogenous, depending on the mode of transmission of the causative agent; Depending on the immune system's response, the terms pyogenic or granulomatous are used [1]

The definitive diagnosis of osteomyelitis is made by bone biopsy. The material should be obtained percutaneously with a biopsy needle or during surgical debridement. The sample taken must be examined both microbiologically and pathologically [2]

Basically, a successful treatment of osteomyelitis; After diagnosis by bone biopsy, radical removal of dead tissue and long-term effective antibiotic therapy [2]

II. History

Osteomyelitis is an insidious and stubborn disease that has existed since the beginning of human history. 4000-year-old chronic osteomyelitis (COM) lesions have been found in Egyptian mummies. The earliest records of osteomyelitis in history are found in Hindu inscriptions around 2500 BC. B.C. In 500-400 BC, Hippocrates revealed the obvious relationship between bone infection and trauma; defined the surgical intervention that enables the removal of the infected sequestrant formed in the body and the acceleration of this process. He also established the connection between non-healing sinus discharge and dead bone tissue. M.S. In the 1st century, Celsus made the first attempt to understand the pathology of disease. Celsus describes the four main signs of inflammation; defined as redness, swelling, warmth and pain. He tried to explain the bone pathology with decay, ulceration, blackness, fistulas and gangrene. In 1830, Brodie published his series of nine cases of chronic bone abscess and described the type of osteomyelitis that occurs with low virulence microorganisms [1].

Use of sulfonamides in osteomyelitis Michtell in 1938; The use of penicillin was reported by Trueta in 1941. In this way, the mortality rate decreased from 20% to 3.5% with the introduction of chemotherapeutics in this previously life-threatening disease. Although mortality was almost eliminated with the discovery of various antibiotics, advances in surgical techniques and a better understanding of the pathogenesis of osteomyelitis; osteomyelitis may still be unresponsive to treatment from time to time. In 1962, Willenegger introduced a continuous irrigation and drainage system for the treatment of osteomyelitis. Upon understanding that implants increase the risk of orthopedic infection; In 1969, antibiotic bone cement was started to be used by Bucholz during the revision of infected total hip prostheses. In 1972, Klemm developed gentamicin-impregnated cemented beads and chains in Darmsadt, Germany [1].

Despite this increase in recovery rates, osteomyelitis still remains a problem for orthopedists, pediatricians and infectious diseases specialists. Considering that there are cases of osteomyelitis that flared up again 40 years after the treatment, it will be understood how difficult it is to talk about the cure of this disease [2].

In summary, acute osteomyelitis can be successfully treated in developed countries. Along with the improvement in quality of life, hygiene and nutrition, the incidence of acute hematogenous osteomyelitis has decreased. However, the disease still maintains its severity in developing countries. Although there are certain basic rules in the treatment of chronic osteomyelitis, complications and difficulties can be encountered everywhere [2].

III. Osteomyelitis in Oral and Maxillofacial Surgery

As in some other diseases, osteomyelitis ⁸ has become a very rare disease with the intensive use of antibiotics and attention to general body health and oral health. Today, it is seen in infants in underdeveloped countries or in those with impaired body resistance due to diabetes mellitus, chronic kidney failure, drug addiction and alcoholism [3].

The disease is seen at all ages and mostly in men. Although it is more common in the maxilla during infancy, the mandible is more affected in later ages. This ratio is approximately 6:1 [3].

Microorganisms causing pyogenic osteomyelitis are mostly *Staphylococcus aureus*; but it also occurs with *Staphylococcus albus*, streptococci, pneumococci, typhoid bacillus. There are also specific osteomyelitis caused by *Actinomyces Israeli*, Koch bacillus, *Treponema pallidum* and fungi [3]. *Hemophilus influenzae* can be effective in children aged 1-4 years, and group B streptococcus and *Escherichia coli* can be effective in children of other ages. Fungal infection and associated osteomyelitis may develop in people receiving long-term intravenous therapy. *Staphylococcus epidermidis* may be responsible for osteomyelitis due to prostheses used in the body [4]. Microorganisms causing

osteomyelitis are listed in Table 1 according to their frequency percentages. Accordingly, Staphylococcus aureus is the most common causative agent [5].

Table-1 Causes of osteomyelitis

| Subject | Percentage(%) |
|--|----------------|
| <i>S. aureus</i> | 60 |
| <i>Enterobakteriasea</i> <i>Proteus spesies(Spp)</i> <i>Escherichia koli(E. koli)</i> <i>Klebsiella spp.</i> <i>Enterobacter spp.</i> <i>Salmonella spp</i> | 20-30 |
| <i>Streptokokus spp</i> | 10 |
| <i>Pseudomonas spp</i> | 5 |
| <i>Others</i> | 5 |

Chronic infected teeth with caries, infection in neighboring anatomical structures and its spread, septic thrombosis spreading from metastatic septic focus, advanced chronic periodontitis and factors that reduce body resistance (nutrition disorder, radiation therapy, neoplasia, drug treatments, blood diseases, diabetes, tuberculosis, osteopetrosis) such as bone diseases) are among the causes of osteomyelitis [3]. The most important reasons for the onset of osteomyelitis are trauma and odontogenic infections. Bone infection occurs when the bone is affected by any of the factors listed above and is invaded by bacteria. In osteomyelitis that develops due to osteoradionecrosis, however, the bone is primarily damaged due to radiation and bacteria are involved secondarily [4]. Table 2 shows the relationship between the type of causative microorganism and the underlying diseases in osteomyelitis [5].

Table 2: Type of Microorganism and Underlying Diseases in Osteomyelitis

| Factor | Cause of osteomyelitis | |
|---------------------------|------------------------|---|
| | Predominant | Others |
| Sickle cell anemia | <i>Salmonella spp.</i> | <i>S. aureus</i> <i>H. influenza</i> <i>S. pnomonie</i> |
| Heroin habit | <i>S. aureus</i> | <i>Pseudomonas spp.</i> <i>Gram negatif basil</i> |

| | | |
|---------------------|------------------------|---|
| Hemodialysis | <i>S. aureus</i> | <i>S. epidermidis</i> <i>Mikobakterium tuberculosis</i> (<i>M. tuberculosis</i>) |
| Pulmoner tbc | <i>M. tuberculosis</i> | |
| Bruselloz | <i>Brusella spp</i> | |

Osteomyelitis of the jaws is of hematogenous and non-hematogenous origin. Nonhematogenous infection occurs as bacteria enter through an open wound or spread of infection from adjacent anatomical regions. Hematogenous infections are more common in children and the elderly. It can originate from an angina, peritonsillar abscess, frunkel, or any primary infection. The location of the entry cannot always be determined exactly. Microorganisms can enter the bone from the primary infection site via blood. Hematogenous osteomyelitis may also develop during an infectious disease. Approximately 85% of osteomyelitis of the long bones in children younger than 16 years of age is of hematogenous origin. Types of osteomyelitis of the jaw that occur with hematogenous infection are very rare [3]

The diagnosis of osteomyelitis is made by isolating the causative agent and imaging the bone, as well as anamnesis and physical examination findings. Early diagnosis and treatment of osteomyelitis is extremely important for the course of the disease. Therefore, in the presence of findings such as bone pain, soft tissue swelling, and limitation of extremity movements, patients should be investigated in detail for osteomyelitis [1]

While sinus drainage culture was used previously, studies have shown that bone biopsy culture is superior in terms of both specificity and sensitivity. Bone biopsy culture should not be neglected in order to produce gram-positive cocci other than *S. aureus*, especially gram-negative bacteria and enterococci [1]

Proving the presence of the causative pathogen histologically or by culture makes the definitive diagnosis of osteomyelitis, but it is difficult to isolate the causative microorganism. For this reason, [5] is an accepted approach to diagnose and start treatment based on clinical and radiological findings. The diagnosis of osteomyelitis can be made in the presence of two of the following criteria. These:

- Aspirating pus from the bone,
- Reproduction in bone or blood culture,
- Clinical findings such as pain, swelling, temperature increase, joint movement limitation,
- Radiological findings [1]

The main conditions in which the causative agent may be anaerobic in osteomyelitis are as follows:

- Osteomyelitis caused by abdominal sepsis
- Osteomyelitis caused by decubitus ulcer
- Skull and facial bone osteomyelitis
- Osteomyelitis caused by chronic foot ulcers
- Presence of foul-smelling exudate
- Presence of bacteria in smear, no growth in culture [5]

Table 3 shows the differences in predisposing factors, involved bones and causative microorganisms in osteomyelitis that develops according to the mechanism of formation. The factors of osteomyelitis differ according to age [5]

Tablo 3: Factor, Predisposing Factor and Affected Bones in Osteomyelitis According to Formation Mechanism

| | Hematogenous osteomyelitis | Osteomyelitis due to close infection focus | Osteomyelitis due to vascular insufficiency |
|-----------------------------|---|--|--|
| Factor | ⁶ <i>S. aureus</i> <i>H. influenza</i> Gram negative bacilli (<i>E.coli</i> , <i>klebsiella</i> , <i>salmonella</i> , <i>proteus</i> , <i>pseudomonas</i>) | (usually mixed) <i>S. aureus</i> Gram negative bacilli Anaerobic bacteria | (Can be mixed) <i>S. aureus</i> <i>S.epidermitis</i> Enterococci Streptococci Gram negative bacilli Anaerobic bacteria |
| Predisposing factors | bacteremia Trauma | Operation Open fracture reduction Soft tissue infection (Decubitus ulcer) | Diabetes mellitus Peripheral vascular diseases |
| Retained bones | long bones (in child), Vertebra (adult) | Femur, tibia, skull, mandible | foot bones |

IV. Classification

Osteomyelitis classification; It varies according to the duration of the disease, the age of the patient, the presence of the ¹⁰ underlying predisposing factor, the host factors, the causative microorganism, the mechanism of infection, and the host's response to the infection [1].

¹ The classification made by Schelhorn P and Zenk W in 1989 according to the clinical picture;

I. Acute osteomyelitis

Secondary chronic osteomyelitis

III.Primary chronic osteomyelitis

IV.Special forms

- Osteomyelitis sicca

- It is in the form of chronic sclerosing osteomyelitis (Garre) [6].

The classification made by Topazian RG in 1994 according to clinical picture, radiological findings and ¹ ology;

I. Suppurative osteomyelitis

1) Acute suppurative osteomyelitis

- 2) Chronic suppurative osteomyelitis
 - Primary chronic suppurative osteomyelitis
 - Secondary chronic suppurative osteomyelitis
- 3) Infantile osteomyelitis
- II. Nonsuppurative osteomyelitis
 - 1) Chronic sclerosing osteomyelitis
 - Focal sclerosing osteomyelitis
 - Diffuse sclerosing osteomyelitis
 - 2) Garre's sclerosing osteomyelitis
 - 3) Actinomycotic osteomyelitis
 - 4) Radiation osteomyelitis and necrosis [6].

Classification made by Bernier S, Clermont S, Maranda G, Turcotte JY in 1995 according to clinical picture and radiological findings;

- I. Suppurative osteomyelitis
 - 1) Acute suppurative osteomyelitis
 - 2) Chronic suppurative osteomyelitis
- II. Nonsuppurative osteomyelitis
 - 1) Chronic focal sclerosing osteomyelitis
 - 2) Chronic diffuse sclerosing osteomyelitis
 - 3) Garre's chronic sclerosing osteomyelitis (proliferative osteomyelitis)
- III. It is in the form of osteoradionecrosis [6].

Wassmund M's classification according to clinical picture and radiological findings in 1935;

- I. Exudative osteitis
- II. Resorptive osteitis
- III. Productive osteitis
- IV. Acute necrotizing osteitis (osteomyelitis)
- V. Chronic osteomyelitis
 - 1) Chronic course of acute osteomyelitis
 - 2) Occult osteomyelitis
 - 3) Chronic necrotizing osteomyelitis with hypertrophy
 - 4) Chronic exudative osteomyelitis
 - 5) It is in the form of productive osteomyelitis [6].

Osteomyelitis in the jaw bones;

- 1) Acute suppurative osteomyelitis
- 2) Chronic suppurative osteomyelitis
- 3) Focal chronic sclerosing osteomyelitis (Condensing osteitis)
- 4) Diffuse chronic sclerosing osteomyelitis
- 5) Chronic osteomyelitis with proliferative periostitis (Garre's osteomyelitis)
- 6) Childhood osteomyelitis
- 7) Osteomyelitis due to osteoradionecrosis
- 8) Actinomycosis osteomyelitis
- 9) Tuberculous osteomyelitis
- 10) Syphilis osteomyelitis

- 11) Coccidioidmycosis osteomyelitis
- 12) Herpes zoster osteomyelitis
- 13) Neoplastic osteomyelitis
- 14) It can be classified as idiopathic osteomyelitis [3,4].

V. Conclusion

Osteomyelitis is still an important disease. Although rare, it may occur. should be well known by dentists.

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