A 10-year clinical study on osteomyelitis of the jaws

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Refractory and atypical cases of osteomyelitis of the jaws are increasing with the emergence of resistant bacteria. Treatment of this condition can be agonizing. Here, we report a study conducted of 109 cases diagnosed with osteomyelitis of the jaws at the First Department of Oral and Maxillofacial Surgery, Osaka Dental University Hospital during the past 10 years. The cases were classified as Type A (acute suppurative osteomyelitis), 5 cases; Type B (chronic suppurative osteomyelitis), 76 cases; and Type C (chronic diffuse sclerosing osteomyelitis), 28 cases. There were 58 males and 51 females, aged 25 to 88 years (median 61 years). The most common site of onset observed (95 cases) was the posterior mandible. In 54 cases, the most common cause was odontogenic infection. Radiographic findings revealed isolated sequestrum in 38 cases. A combination of surgical and conservative treatment with antimicrobial agents was the most common method of treatment. Penicillin was the antimicrobial agent most frequently used. Surgical treatment mainly consisted of sequestrectomy. Most of the cases made good progress and there were few relapses. (J Osaka Dent Univ 2015; 49: 197–204)

Key words: Osteomyelitis; Jaw bones; Surgical treatment

INTRODUCTION

Recently, the incidence of osteomyelitis of the jaws has declined due to the development antibiotics, advances in medical care, and improvements in dentistry. However, the disease has become more complicated due to inappropriate administration of antibiotics and an increase in lifestyle-related diseases. Treatment of this condition can be agonizing. Here, we report a study of 109 cases clinically diagnosed as osteomyelitis of the jaws at the First Department of Oral and Maxillofacial Surgery, Osaka Dental University Hospital, during the past 10 years. The present report also provides an overview of the literature.

MATERIALS AND METHODS

We selected 109 cases that were diagnosed with osteomyelitis in our department in 10 years from January 2001 to December 2010. Cases of radio-osteomyelitis were excluded. This retrospective study was based on patient records, clinical symptoms, and radiographic findings. The clinical classification according to medical history were Type A, acute suppurative osteomyelitis; Type B, chronic suppurative osteomyelitis; and Type C, chronic diffuse sclerosing osteomyelitis. The criteria are for these classifications were as follows. Type A, clinical symptoms of severe pain and anesthesia of the lower lip with no radiographic signs of significant bone resorption. Type B, clinical symptoms of mild swelling and pain, mostly with lower lip anesthesia and continuous pus discharge, with radiographic findings including bone resorption and sequestrum formation surrounded by focal bone sclerosis. Type C, clinical symptoms of repeated pain and swelling, and diffuse bone sclerosis on radiography. Factors evaluated included age, gender, medical history, location of onset, duration from onset until initial visit, treatment before initial visit,
pathogenesis, radiographic findings, type of treatment, antibiotics prescribed by our department, the therapeutic effect of conservative treatment alone, whether surgical treatment was required, the method of operation, the observation period for surgical treatment, and the duration of postoperative healing.

RESULTS

Distribution of cases (Fig. 1)
There were 5 cases of Type A, 76 cases of Type B (including 18 blast crisis cases), and 28 cases of Type C (including 9 blast crisis cases).

Age and gender (Table 1 and Fig. 2)
There were 58 males and 51 females, ranging from 25 to 88 years of age with a median age of 61 years. Type B had the highest average age. The number of males were significantly greater than females only in Type C.

Medical history (Table 2)
Medical history was relevant in 83 of the cases. A systemic disease or therapeutic agent that affected the outcome of dental treatment was considered relevant in the medical history. There were 9 cases of diabetes, 6 of malignant tumors, 5 under bisphosphonate (BP) treatment or corticosteroids, 4 each of liver disease and rheumatoid arthritis (RA), 3 of bronchial asthma, 2 of anemia, and 1 each of renal failure and systemic lupus erythematosus (SLE).

Location of onset (Table 3)
The mandible was affected in 105 of the cases, whereas the maxilla was affected in only 4. In the mandible, there were 95 cases in the molar region, 5 in the region extending from the anterior teeth to the molars, 2 each in the anterior region and the entire mandible, and 1 in the region extending from the molars to mandibular ramus. The maxilla was affected in
2 cases, one in the anterior region and the other in the molar region. The Type A cases were all in the mandibular molars, while 88% of the Type B cases were in the mandibular molars. 13% of the Type B cases included the mandibular anterior teeth. All four cases in the maxilla were Type B, while 96% of the Type C cases were in the mandibular molars.

**Duration from onset until initial visit** (Table 4)
The duration from onset until the initial visit ranged from 1 day to 16 years, the median being 42 days. Treatment was provided at other dental clinics in some of the Type C cases. However, when the symptoms did not improve, the patients consulted our hospital. Most of them had a long duration from onset until the initial visit. As would be expected, the duration from onset until the initial visit was less than one month for all of the Type A cases. For Type B, the duration was 1–6 months for 43% of the cases, and less than one month for 37% of them. For Type C, the duration was less than six months in 61% of the cases, but greater than one year in 36% of them.

**Treatment before initial visit** (Table 5)
Prior to the initial visit to our department, 76 of the cases had been treated at another hospital, 31 had not been treated, and the data for 2 others were unknown. Of these, 51 cases were treated with antibiotics, 10 with tooth extraction, 9 with incision and drainage, 7 with root canal treatment, 6 each with bone curettage and denture adjustment, 3 with sequestrectomy, and 1 each with prescription of analgesics, hemisection of a tooth, implant removal surgery, hyperbaric oxygen therapy and laser therapy. Regarding the antibiotics, 18 were treated with cefem, 5 each with macrolide and new quinolone, 2 each with penicillin and penem, 1 with tetracycline, and 19 had no data (17%). The dosage was large for all classifications.

**Pathogenesis** (Table 6)
The infections were primarily odontogenic and included apical periodontitis and marginal periodontitis in 57 cases, minor surgery including implant removal surgery and tooth extraction in 23, ill-fitting dentures in 4, and infections of unknown origin in 25 cases. The cause was odontogenic infection for almost all of the classifications. When the cause was unknown, an odontogenic infection was assumed.
Radiographic findings (Table 7)
The initial visit revealed 38 cases of sequestration, 28 of osteosclerosis, 22 of bone resorption, 16 of bone resorption with osteosclerosis, and 5 cases with insignificant findings. All of the Type A cases had insignificant findings. Sequestration was the most frequent; 50% of the Type B cases had sequestration. All Type C cases had osteosclerosis.

Treatment (Table 8)
The treatments were classified as conservative treatment (such as prescription of antibiotics, anti-inflammatory analgesics, and irrigation of the area), surgical treatment (such as sequestrectomy with decortication and surgical treatment combined with conservative treatment), and no treatment.

There were 72 cases of combination treatment, 20 of conservative treatment, 11 of surgical treatment, and 6 with no treatment. Conservative treatment was provided mainly in Type A. Combination treatment was provided mainly in Types B and C.

Conservative treatment with antibiotics in our department (Table 9)
Oral antibiotics were administered in 93 cases: penicillin in 60, cefem in 55, macrolide in 5, new quinolone in 4, and penem or tetracycline in 3 cases each. Antibiotics were administered by injection in 14 cases: cefem in 10, penicillin in 2, and carbapenem or fosfomycin in 1 case each. Penicillin and cefem were the common antibiotic for both oral and injection administration. However, macrolide was used in 16% of the Type C cases.

Effectiveness of surgical treatment and method of operation (Table 10)
Surgical treatment was performed in 83 cases: sequestrectomy in 34, bone curettage in 26, sequestrectomy and curettage of bone in 12, and decortication in 11 cases. Sequestrectomy was the primary treatment in Type B cases, and bone curettage and decortication were done in Type C cases.

Prognosis of surgical treatment
The treatment had not been completed in 7 of the Type B cases and 6 of Type C cases. All of the Type A were resolved without symptoms of relapse on the last consultation day at the end of 2010. All but one of the 43 Type B cases were resolved without symptoms of relapse on the last consultation day at the end of 2010. Only one case had a pathological fracture,
which occurred one month after surgical treatment. This was treated with plate reconstruction. Seven cases that were under outpatient observation and were progressing well with no relapse of symptoms. Treatment was interrupted for 2 of the patients who failed to keep follow-up appointments. Fourteen of the patients who completed their final examination, including the two that showed hypoesthesia in Type C, were progressing well without symptoms of relapse on the last consultation day at the end of 2010.

Six cases that were under outpatient observation were progressing well without relapse of symptoms. Of 6 other cases under outpatient observation, 3 relapsed without symptoms, 2 had exacerbation of acute symptoms, and 1 case still had lower lip numbness. Surgery was done 3 times for 1 case. The first two surgeries were decortication incisions from the oral cavity. However, the third surgery was percutaneous decortication because the lesion had expanded. Treatment was interrupted in 2 cases because the patients did not return.

DISCUSSION

The incidence of osteomyelitis of the jaws has recently declined with the development of various antibiotics, advances in medical care, and improvements in oral health. However, little progress has been made in understanding refractory forms of the disease. In addition, treatment has become more difficult with the emergence of antibiotic-resistant bacteria, and increases in the number of compromised hosts as a result of advances in medicine. For these reasons, we performed this clinical study on osteomyelitis of the jaws in 109 cases seen at our department.

Classification

Type A comprised a small number of cases that had received antibiotic treatment at other hospitals. The prevalence of Type A cases has declined compared to previous reports probably due to recent advances in antibiotics. Inflammation may gradually progress as a result of an inappropriate dosage of antibiotics and reach a state resulting in the chronic progression to Type B. Types B and C were most commonly encountered in our study when the inflammation had become chronic by inappropriate administration of antibiotics at the onset of treatment.

Age

Although Type A included patients of a wide age group, the median age was lower than for Types B and C. The onset in the prime of life can be explained by the frequent occurrence of odontogenic infectious diseases such as apical periodontitis from caries. Similar findings were reported by Isogai. Causative chronic periodontal diseases in Types B and C increased with age. An increase in the incidence occurred after 50 years of age with progression of physiological osteosclerosis during middle age because bone trabeculae became inarticulate. The periosteum in young persons exhibits remarkable osteoblastic function.

Gender

Isogai et al. reported the occurrence of this disease in 92 males and 55 females, suggesting a male predilection. However, we observed a prevalence in females, with a male-to-female ratio of 1:2. The results of other studies may be consistent with the findings of Isogai who studied a large sample. The male-to-female ratios observed by Teshima et al. (26:10), Tahara et al. (12:10), and Asada et al. (16:9) showed that Types B and C were more common in men. Males have greater bone density than females and it is difficult for inflammation caused by bone marrow to spread outside the jaw.

Medical history

According to Asada et al., infections of the oral cavity can often be cured when they are relatively localized and there are no complications. In addition, Asagara et al. stated that the spread of disease is not influenced by nutritional status or the presence of underlying disease conditions. In the present study, there were 83 cases with systemic diseases such as diabetes, malignant tumors and liver disease. Osteomyelitis of the jaws was likely to develop in patients with diseases that compromised their host response.
Radiographic findings of Type A cases typically do not change much over time. There were noteworthy findings in all cases of this study. One case was examined by MRI; a low T1 signal was initially shown. A moderate T2 signal was then confirmed. Clinical symptoms provide the main diagnostic evidence. MRI has become indispensable in the diagnosis of osteomyelitis, especially acute cases. Type B cases showed the presence of a sequestrum or evidence of bone resorption. Type C cases were always characterized by increased bone sclerosis.

Treatment and follow-up
Antibiotics were administered in 92 cases as a conservative treatment. Among them, conservative treatment only was performed in 20 cases. The symptoms disappeared in 9 cases with conservative treatment alone. In addition, the remaining 11 cases were only treated conservatively, as the patients did not return to the department for treatment, and the progress of the symptoms could not be confirmed. Many of the patients did not return for review when their inflammatory symptoms had resolved. The antibiotic most frequently administered as conservative treatment was penicillin. Oral infections are often mixed infections of Gram-positive and anaerobic bacteria. Thus, a wide spectrum therapeutic agent with strong antimicrobial activity is the best choice.

Ideally antibiotics should be prescribed after obtaining the results of susceptibility testing. However, we initially used penicillin because closed abscesses were rare, drug sensitivity tests were not often done, and penicillin is conventionally used for pathogenic bacteria. LAPC and BAPC were also often used. They are prodrugs of ABPC with an antibacterial action against both aerobic and anaerobic bacteria. Penicillin is safe for long-term treatment and the dose can be increased. Although Type C cases respond better to macrolides, the administration of penicillin was the first choice in this study, followed by macrolides and then cefem. Antibiotics were administered for an average of 2 weeks. Then, if sequestrum had not separated or inflammatory conditions persisted, the site was treated surgically. Kuroiwa et al. prescribed long-term administration of antibiotics for 4 to 8 weeks in Type C cases, and
performed surgical treatment if the symptoms recurred. In our department, antibiotics were discontinued when clinical improvement was observed in terms of swelling and drainage. If symptoms worsened, such as relapse of inflammation or enlargement even after conservative therapy, we considered the option of surgical treatment. Surgical treatment was performed in 83 cases, mostly of Type B (59 cases). This was probably because it is easy to remove the sequestrum with clear, healthy boundaries and bone lesions as seen with in Type B cases. Because Type C does not easily respond to antibiotics as a result of poor blood flow through bone sclerosis, surgical therapy is generally required. Surgical treatment was performed in 22 cases in this study. In Types B and C, 81 of 103 cases were treated surgically. Ogawa et al. treated 6 cases of Type C and 10 cases of Type B surgically, while Murano treated 9 of 14 cases surgically. Chronic osteomyelitis of the jaws is difficult to manage with only conservative treatment. Although improvements in symptoms are often observed, it is considered necessary to perform surgical treatment.

In our department, we usually perform sequestrectomy, bone curettage and debridement as surgical treatment. Bone curettage and sequestrectomy was done mainly in Type B, and there was no relapse after surgery. This probably brings an end to osteomyelitis sequestrum formation. Even when the disease has spread to the lower border of the mandible and shows loss of mandibular continuity in Type C, segmental resection is not performed because of paresthesia and functional issues. The observation period for surgical treatment was shorter for Type B than for Type C, chronic osteomyelitis of the jaws. Type B is easy to manage by removing the lesion. Type C lesions are difficult to remove adequately since they are likely to relapse; long-term observation for more than one year is considered necessary. Osteomyelitis of the jaws requires early diagnosis, appropriate antibiotics, surgical treatment, and long-term observation.

CONCLUSION

Osteomyelitis of the jaws can be effectively managed with early diagnosis, appropriate antibiotics, surgical treatment and long-term follow-up.

REFERENCES
