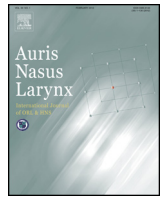




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## Association between odontogenic infections and unilateral sinus opacification

Yuma Matsumoto, Tetsuya Ikeda, Hidenori Yokoi\*, Naoyuki Kohno

Department of Otorhinolaryngology, Oral Surgery, Kyorin University School of Medicine, Tokyo, Japan

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### ABSTRACT

*Objectives:* Consideration of the causes of unilateral paranasal sinusitis, which frequently occurs in routine medical care and is often associated with odontogenic infection.

*Study Design:* Retrospective data analysis.

*Methods:* A review of the charts of all 190 patients treated for unilateral paranasal sinusitis at our department between 2005 and 2012 was carried out. All patients were diagnosed based on clinical signs, symptoms, and imaging findings, including computed tomography (CT), orthopantomography (OP), and other modalities. Patients were classified in three groups: patients with odontogenic infection involvement (Group A); patients without odontogenic infection involvement (Group B); and patients with inconclusive odontogenic infection involvement (Group C).

*Results:* The most common cause of unilateral paranasal sinusitis was odontogenic infection, as seen in 138 cases (72.6%), followed by chronic inflammation in 43 cases (22.6%). Among patients diagnosed with odontogenic infection, one patient was also diagnosed with coexistent polyps and mycosis. Based on CT, OP, EPT, and oral examination, final distribution was 138 patients (72.6%) in Group A, 32 (16.8%) in Group B, and 20 (10.5%) in Group C.

*Conclusions:* Odontogenic infection involvement was implicated in approximately 70% cases of unilateral paranasal sinusitis. Odontogenic maxillary sinusitis can be difficult to diagnose, and consideration of imaging performed under various conditions is recommended. In order to determine the most appropriate treatment for unilateral paranasal sinusitis, whether such treatment will be surgery, dental treatment, conservative therapy, or other treatments, collaboration between concerned doctors is essential.

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### 1. Introduction

Unilateral paranasal sinusitis is characterized by obvious primarily single-sided sinus lesions on imaging and chronic or recurrent symptoms of nasal congestion, buccal pain, and ipsilateral postnasal drip. This condition as well as odontogenic maxillary sinusitis, paranasal sinus mycosis, allergic fungal sinusitis, and nasal and sinonasal papilloma, etc. are commonly encountered in clinical practice. In particular, institutions often may face difficulty collaborating with a dentist to diagnose odontogenic sinusitis. As a result, treatment sometimes may become difficult, despite the reportedly high prevalence of 10–40% [1–3] of maxillary sinusitis. Potential causes of the condition include dental caries, periodontal disease, and dental trauma; though it is rare for the causative tooth

to remain untreated, insufficient treatment is becoming more commonly reported as an etiology. Most dentists face difficulty evaluating odontogenic infection involvement in sinusitis. Our hospital includes an oral surgery department as the dentist, which enables daily collaboration; odontogenic maxillary sinusitis can be treated cooperatively by both dental and otorhinolaryngological specialist.

In the current study, we have described our diagnostic and therapeutic protocols, emphasizing odontogenic maxillary sinusitis as one manifestation of unilateral paranasal sinusitis. In addition, we reviewed pertinent recent literature and included discussions on the findings from these literatures.

### 2. Patients and methods

A total of 190 patients were examined at the Department of Oral Surgery and Otorhinolaryngology between 2005 and 2012 and diagnosed with unilateral paranasal sinusitis based on clinical signs, symptoms, and imaging findings, including computed tomography (CT), orthopantomography (OP), or other modalities.

\* Corresponding author at: Department of Otorhinolaryngology-Head and Neck Surgery, Kyorin University School of Medicine, 6-20-2 Shinkawa, Mitaka, Tokyo 181-8611, Japan. Tel.: +81 422 42 5968; fax: +81 422 42 5968.  
E-mail address: [h-yokoi@ks.kyorin-u.ac.jp](mailto:h-yokoi@ks.kyorin-u.ac.jp) (H. Yokoi).

In this study, unilateral paranasal sinusitis was defined as meeting both of the following conditions: (1) shadows on CT predominantly in the sinus on one side, and always including the maxillary sinus and (2) Lund–Mackey score [4] <2 in the contralateral sinus, with cystic disorders and tumors excluded. CT and OP were the primary diagnostic modalities, but electric pulp testing (EPT) and oral examination were also used in diagnosis. Imaging signs were classified as follows: (1) in cases of pericementitis, periodontal space enlargement; (2) in cases of periodontitis, evidence of bone resorption; (3) in cases of an apical cyst, periodontal space enlargement and the presence of a cystic lesion; (4) in cases of tooth fracture, visible root fracture; (5) in cases of caries, coronal radiolucency; and (6) in cases of osteomyelitis, evidence of maxillary necrosis with maxillary sinusitis secondary to bacterial infection (Fig. 1).

EPT was used as an auxiliary tool to assess the pulp response; the device was pressed against the crown and the pulp reaction to an electrical stimulus was compared between abnormal and healthy teeth. Other conditions associated with oral hygiene, such as caries and gingivitis, were also evaluated. Patients diagnosed with unilateral maxillary sinusitis were categorized into three groups: patients with dental infection involvement (Group A); those without dental infection involvement (Group B); and those for whom dental infection involvement was inconclusive (Group C). The 23 patients in Group C underwent additional 1-mm slice CT after providing informed consent.

### 3. Results

#### 3.1. Sex, age and laterality distributions

In total, 190 patients were evaluated, with a mean age of 47.6 years in the range 4–93 years. There were more men than women examined (109 versus 81 patients, respectively). The mean

(range) ages were 47.6 years (9–85 years) in men and 48.9 years (4–93 years) in women. The age distribution peaked at 40–49 years in both men and women (Fig. 2).

The left sinus was affected in 105 patients and the right in 85, but this difference was not statistically significant.

#### 3.2. Pathologic classification

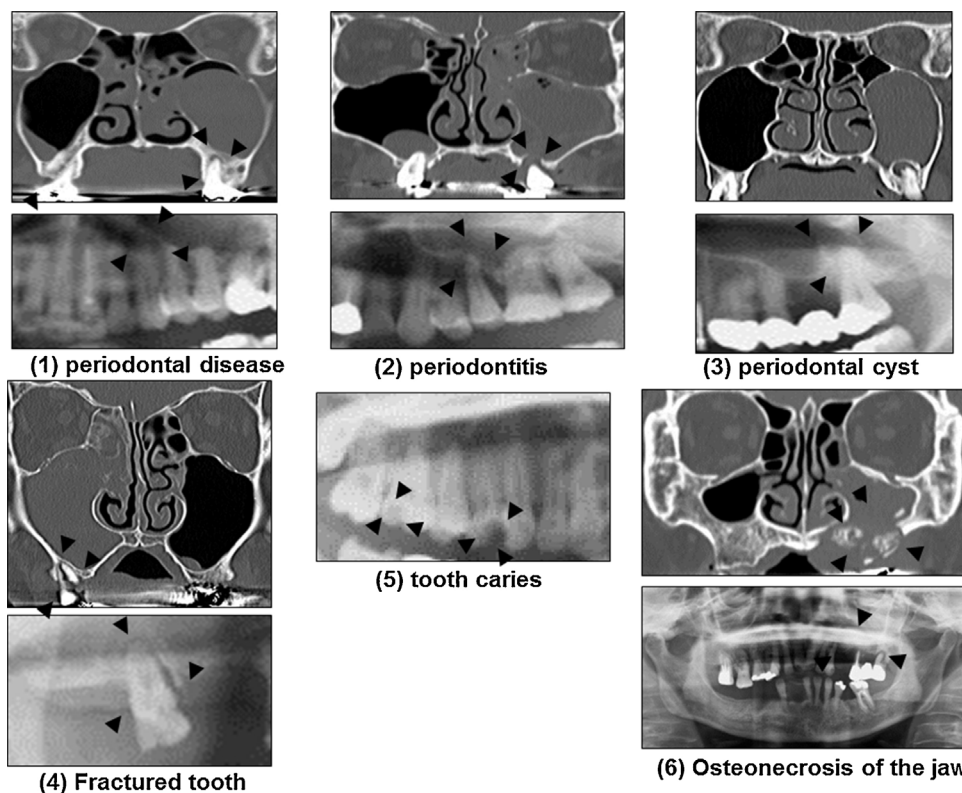
The most common cause of unilateral paranasal sinusitis was odontogenic infection in 138 cases (72.6%), followed by chronic inflammation in 43 (22.6%), mycosis in 21 (11.1%), polyp in 15 (7.9%), and foreign body in 4 (2.1%) (Fig. 3). In patients diagnosed with odontogenic infection, the most common comorbidity was mycosis in 15 cases, followed by polyp in 13 and foreign body in 3 (Fig. 4).

#### 3.3. Causative tooth in odontogenic maxillary sinusitis

The first molar was the most frequent odontogenic infectious origin in 74 cases, followed by the second molar (66), second premolar (24), third molar (7), first premolar (5), canines (2), and the central incisor (1) (Fig. 5). Widespread unilateral maxillary necrosis was present in 2 patients. Multiple causative teeth were present in 36 patients. The most common combinations were the first and second molars (18), second premolar and first molar (6), second premolar and second molar (4), and the first and second premolars (2). A range of 2–5 causative teeth was implicated in these cases (Fig. 6).

#### 3.4. Imaging conditions and diagnostic findings

Based on the initial imaging, EPT, and oral examination, 125 patients were categorized into Group A, 26 in Group B, and 39 in Group C. High-resolution CT was performed in the 23 Group C



**Fig. 1.** CT and OP in odontogenic maxillary sinusitis. (1) Periodontal disease: Expansion of the periodontal ligament space; (2) Periodontitis: Bone resorption of alveolar bone; (3) Periodontal cyst: Cystic; (4) Fractured tooth; (5) Dental caries: resorption image in the crown of tooth; (6) Maxillary osteomyelitis: osteonecrosis of the jaw and maxillary sinusitis.

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