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(CASE REPORT)

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Odontogenic Maxillary Sinusitis: A clinical case report

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Abstract

Odontogenic maxillary sinusitis (OMS) is a subtype of sinusitis that originates from dental infections and is often underdiagnosed due to its nonspecific clinical presentation, which overlaps with other types of rhinosinusitis. The etiopathogenesis involves a complex interplay of factors including iatrogenic causes, periodontal infections, and traumatic events, leading to a persistent inflammatory response in the maxillary sinus. This report details a clinical case involving a 19-year-old male patient presenting with exacerbated sinusitis symptoms linked to a carious upper right first molar. Clinical manifestations included blurred vision, facial pain, and nasal regurgitation of liquids. Radiographic analysis revealed a radiolucent area indicative of sinus involvement, confirming the diagnosis of OMS.Surgical intervention comprised the extraction of the infected molar and the debridement of the maxillary sinus, followed by the application of Bichat's fat pad to repair the resulting oroantral communication. This technique demonstrated effective closure of the defect, promoting tissue healing and reducing postoperative complications. The postoperative regimen included antibiotics, anti-inflammatories, and antihistamines, which facilitated recovery. This case underscores the necessity of a multidisciplinary approach in the diagnosis and management of OMS, integrating dental and surgical expertise to optimize patient outcomes. Imaging plays a crucial role in the diagnostic process, enabling precise identification of odontogenic lesions and their extent. The successful use of Bichat's fat pad highlights its utility in oral-maxillofacial surgery for managing oroantral fistulas. This report contributes to the growing body of evidence supporting the importance of tailored surgical and medical strategies in managing complex cases of odontogenic maxillary sinusitis.

Keywords: Odontogenic maxillary sinusitis; Dental infection; Oroantral fistula; Bichat's fat pad; Multidisciplinary approach

1. Introduction

The maxillofacial region houses four pairs of bilateral paranasal sinuses: maxillary, ethmoidal, frontal, and sphenoidal. These sinuses are air-filled cavities lined with mucosa that communicate with the nasal cavity through the sinus ostium. [1] The maxillary sinus specifically is a pyramidal-shaped cavity located in the upper maxilla and is the first to develop during fetal ontogenesis, reaching full maturation with the eruption of permanent teeth between the ages of 12 and 14.[2,3] The dimensions of the maxillary sinus in adults show considerable variability among studies, with lengths ranging from 38 to 45 mm, widths from 25 to 35 mm, and heights from 36 to 45 mm. The average volume of the maxillary sinus according to various studies is approximately 150 mm^3, with a range of 100 to 250 mm^3.[4] The roots of the maxillary second molars are anatomically closest to the sinus floor, followed by the roots of the first molar, third molar, second premolar, and first premolar. [2,3]

Maxillary sinusitis is characterized by symptomatic inflammation of the maxillary sinus, generally induced by viral, bacterial, allergic, or fungal rhinitis. According to its duration and frequency, it can be classified as acute and chronic.

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However, any pathology originating in the dental or dentoalveolar structures can compromise the floor of the maxillary sinus, leading to a condition known as maxillary sinusitis of odontogenic origin (SMO). [2,3]SMO was initially described by Bauer in 1943. Since then, the relationship between dental and sinus pathology has been widely recognized in the medical and dental literature. This condition occurs more frequently unilaterally and accounts for between 25% and 40% of all chronic maxillary sinusitis cases. [3,6,7]

1.1. Classification of maxillary sinusitis of odontogenic origin

According to the progression of the disease, SMO is classified into two main categories: acute and chronic. Characteristic symptoms of acute SMO include fever, headache, infraorbital pain, nasal congestion, and rhinorrhea with or without postnasal discharge. If the disease is not controlled in its acute phase, it can progress to a chronic form where fever, headache, and infraorbital pain tend to decrease, but nasal symptoms such as congestion and rhinorrhea persist. Although the symptoms of SMO are similar to those of maxillary sinusitis (MS), they are distinguished by more prominent pain and an unpleasant odor. It is important to note that these symptoms are not always present due to the opening of the maxillary ostium. When the maxillary ostium is open, odontogenic infectious substances can flow through the maxillary sinuses. Dental-originated SMO is classified into four main categories: of pulpal origin, including pulp necrosis, periapical inflammation, root fractures, and other endodontic infections; periodontal origin, referring to periodontal defects with significant alveolar bone loss (more than two-thirds of the root length); pulpal-periodontal origin, involving a tooth affected by a combined periodontal and endodontic infection; and other origins, including oroantral fistulas or accidental introduction of foreign bodies into the sinus during procedures such as dental extraction or oral surgeries. [1]

The etiology of odontogenic maxillary sinusitis can be divided into several distinct categories, including iatrogenic, infectious, implantological, and traumatic.[5] Most scientific literature points to dental extractions as the predominant cause of odontogenic sinusitis, while other potential iatrogenic causes include maxillary sinus elevation and LeFort osteotomies. These procedures can inadvertently establish oroantral communication or other infection foci. [5]Some case series highlight a higher frequency of periodontitis as a trigger in contrast to iatrogeny. Pulp necrosis can rapidly evolve into periapical osteitis, leading to a radiographically visible periapical abscess. This infection can spread directly to the maxillary sinus, causing mucosal thickening around areas adjacent to the affected teeth. [15]

1.2. Diagnostic Criteria for Odontogenic Maxillary Sinusitis (SMO)

The diagnostic criteria for SMO currently vary among different experts. Diagnosis is largely based on imaging, although this should not be the only evidence considered. Normally, maxillary sinuses appear radiographically as translucent, well-defined cavities. In contrast, in pathological states, thickened mucosa, air-fluid levels, or sinus opacification can be observed. A sinus mucosa thickness greater than 2 mm is considered pathologically significant, but this finding alone is not sufficient to diagnose SMO. In some cases, sinus opacification, air-fluid levels, or mucosal thickening may coincide with odontogenic lesions, but this does not constitute a definitive diagnosis of SMO. To establish a conclusive diagnosis of SMO, it is crucial to identify odontogenic lesions and confirm the exact correlation between the maxillary sinus lesion and the corresponding oral lesion.

Maillet proposed that a soft tissue density mass within the sinuses should be considered of odontogenic origin if it meets criteria such as decayed teeth, teeth with defective restorations, or extraction sites with or without radiographically visible periapical lesions, and mucosal thickening limited to the area of the tooth or extraction site. In 2018, Ly presented more detailed criteria suggesting that predominantly unilateral sinus opacification on CT allows the diagnosis of SMO under certain conditions: the presence of an oral lesion associated with the affected sinuses, a history of dental disease or recent dental treatment in the upper dentition on the same side as the maxillary sinus, and radiological evidence of a dental abscess or oroantral communication. Yoshida further simplified these criteria using CT to show apical lesions in maxillary teeth, maxillary sinus opacification, and maxillary bone defects between the sinus floor and dental roots. However, these current criteria only consider pulp infection, neglecting periodontal infection. In response to this problem, some studies are beginning to explore the impact of periodontal infection on SMO. In this context, several authors propose improved diagnostic criteria for SMO based on:

- Patients with clinical symptoms of maxillary sinusitis with or without oral symptoms.
- Presence of diseased teeth in the upper dentition on the same side as the maxillary sinus with periapical lesions or severe alveolar bone loss on CBCT.
- Presence of a foreign body in the maxillary sinus or ipsilateral oroantral fistula.
- CT/CBCT images showing air-fluid levels or maxillary sinus opacification or mucosal thickening (>2 mm) limited to the ipsilateral oral lesion with specific characteristics of the relationship between the maxillary sinus floor and periapical lesions. (1)

These findings are classified into three categories A, B, and C:

- Definitive evidence: Patients meeting criteria 1, 3, or 1, 2, 4a.
- Potential evidence: Patients meeting criteria 1, 2, 4b.
- Questionable evidence: Patients meeting criteria 1, 2, 4c.

Due to the particular etiological and pathological characteristics of SMO, its therapeutic approach requires close collaboration between physicians and dentists. Nasal treatments include both non-surgical therapies and functional endoscopic surgical interventions (FESS) aimed at reducing inflammation, restoring ostium patency of the maxillary sinus, removing irreversible lesions, and improving patient symptoms. Dental treatments mainly include root canal therapy, periodontal treatment, apical surgery, selective tooth extraction, and fistula repair to eliminate the source of odontogenic infection and prevent SMO recurrence. [1]

Non-surgical treatment constitutes the first step and includes antibiotic therapy, nasal corticosteroids, and nasal irrigation, which help improve patient symptoms. Compared to non-odontogenic maxillary sinusitis, SMO often presents significant bacterial infection, making antibiotic therapy an important option. [1]

A microbiological analysis of chronic sinusitis and odontogenic sinusitis samples revealed that only 60% of chronic sinusitis samples showed microbial growth, whereas all odontogenic sinusitis samples showed significant microbial load and led to bacterial development. [1] Unlike common pathogens such as Streptococcus pneumoniae, Moraxella catarrhalis, and Haemophilus influenzae responsible for most non-odontogenic sinusitis cases, various studies on odontogenic sinusitis have revealed an increase in polymicrobial infections.[5] Oral anaerobes such as Peptostreptococcus and Prevotella spp. have been identified, as well as aerobic bacteria like Staphylococcus aureus. Additionally, rare cases of odontogenic sinusitis have identified fungal isolates such as Aspergillus and Candida.

The use of penicillin (amoxicillin) and β-lactamase inhibitors with or without metronidazole can generally combat a wide range of microbial and anaerobic populations. It is crucial for antimicrobial therapy to be guided by the antibiotic resistance pattern. Zirk et al. conducted a study with 121 patients with SMO and found that piperacillin/tazobactam (93.9%), cotrimoxazole (83.3%), ampicillin/sulbactam (80%), cefotaxime (78.1%), cefuroxime (69.4%), ampicillin (68%), and clindamycin (50%) showed the highest sensitivity. For patients with penicillin allergy, fluoroquinolones such as moxifloxacin (86.2%) and ciprofloxacin (62.2%) as well as tetracyclines (62.9%) can be used as alternatives. Saibene et al. demonstrated that among bacterial strains isolated from 28 patients with SMO, 70% were sensitive to amoxicillin, and all isolated strains were sensitive to the combination of levofloxacin, teicoplanin, and vancomycin. However, existing studies have shown that antibiotic therapy alone has difficulties curing SMO. Surgical treatment should be considered if the conservative approach is ineffective.

In the past, the classical Caldwell-Luc procedure was the primary surgical method for treating maxillary sinus diseases but had the disadvantage of causing significant trauma and numerous complications. Currently, functional endoscopic sinus surgery (FESS) is considered the gold standard as an alternative to the Caldwell-Luc approach and has proven highly effective, especially when the maxillary ostium is obstructed. FESS allows for a wide antrostomy in the middle meatus and improves visualization of the entire maxillary sinus through a smaller surgical window. Due to less surgical trauma and optimal exposure, FESS can effectively eliminate maxillary sinus infection by opening the natural ostium and removing sinus lesions, thereby restoring normal drainage and ventilation while preserving healthy mucosa, reducing the risk of complications. FESS is often necessary in cases of SMO, especially when it is difficult to treat with non-surgical methods.

For dental treatment, root canal therapy, apical surgery, and periodontal treatment can be chosen when the focal tooth is evaluated as excellent/good/fair or questionable but with controllable infection, or when patients have a strong desire to preserve the tooth. A recent cohort study showed that 13% (9/68) of patients with SMO improved after receiving conservative dental treatment. The focal tooth can be extracted when evaluated as non-restorable (poor prognosis) or questionable but with difficult-to-control infection. Simuntis et al. published a prospective study with 96 patients with SMO due to apical periodontitis, demonstrating a success rate of 77% with only dental extraction. However, a study with 37 patients with SMO found that even after dental extraction, SMO may not improve, especially in younger patients. Therefore, we propose that the ideal treatment sequence for maxillary sinusitis of odontogenic origin (SMO) should be adapted to individual patient conditions, always considering the most updated diagnostic criteria. [1]

2. Case report

19-year-old male patient with a clinical picture of blurred vision, pain, dyspnea and changes in the voice that persisted for 5 days. In the anamnesis, the patient reported nasal regurgitation of liquids and dysphagia with solid foods. The progression of the symptoms prompted the search for urgent medical attention, going to the emergency service of the Luis F. Martínez Hospital. The patient did not report any type of allergy, systemic diseases, medical treatments, hospitalizations or previous surgical procedures under anesthesia.

On clinical examination, the presence of extensive caries in the first upper right molar is observed, with a possible suspicion of communication with the maxillary sinus, and during palpation he presented pain at the level of the vestibular fundus. A simple computed tomography of the facial complex is performed to observe the extent of the lesion and confirm the communication with the maxillary sinus.

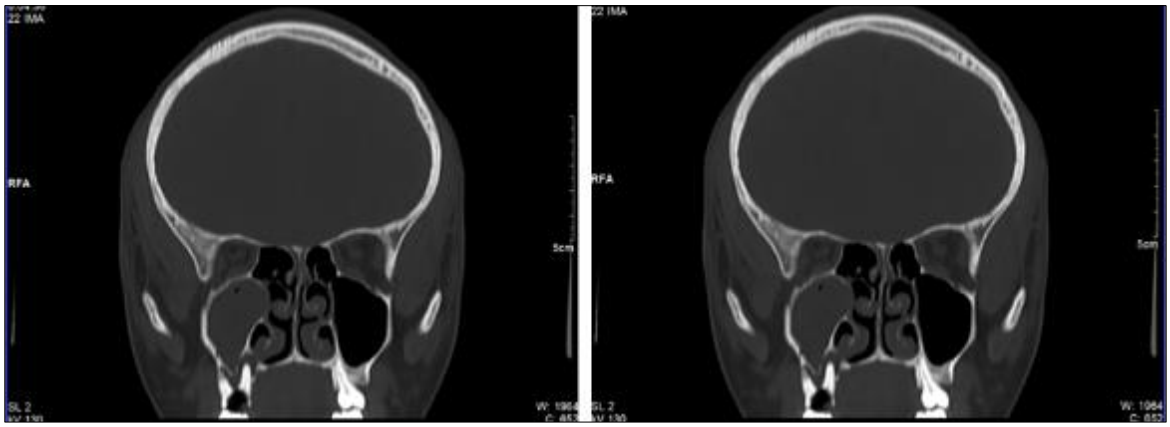

Figure 1 Coronal image from a sinus CT shows a periapical abscess with communication into the maxillary sinus, indicating an oroantral communication

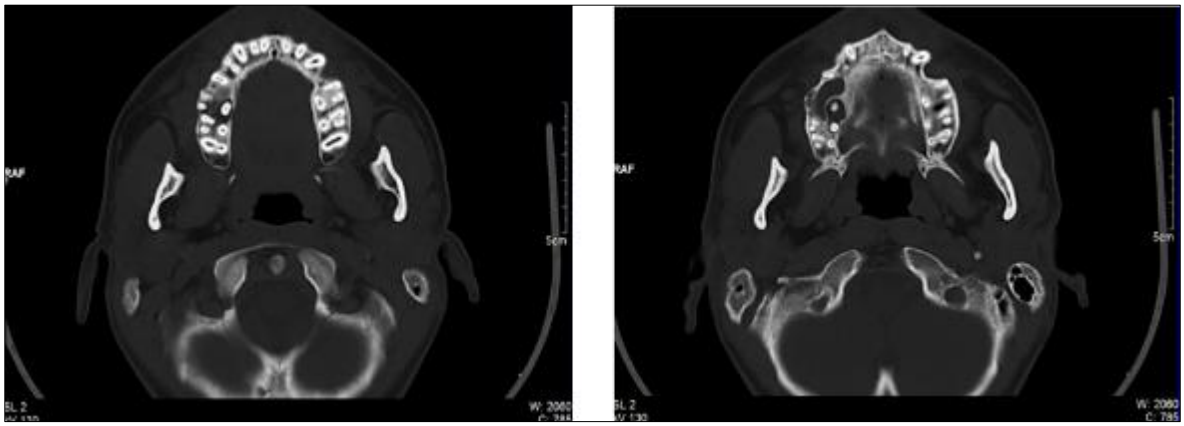

Figure 2 Axial projection of the maxilla shows a periapical abscess

With the images provided by the computed tomography (Figs. 1 to 3), through the different sections, the existence of a radiolucent area at the level of the foramina continuing towards the maxillary sinus is confirmed, confirming the great extension of the lesion caused by the penetrating caries of tooth 16 and the communication with the maxillary sinus at the posterior level, being the cause of origin of the sinusitis that the patient presented.

After confirming the diagnosis of odontogenic sinusitis, the patient was prepared for surgical intervention under general anesthesia. During the procedure, tooth 16 was extracted in order to remove the infectious focus that triggered the sinusitis. Subsequently, the maxillary sinus was cleaned by irrigation with saline solution and surgical aspiration, in order to eliminate the contents present in the maxillary sinus and reduce the bacterial load.

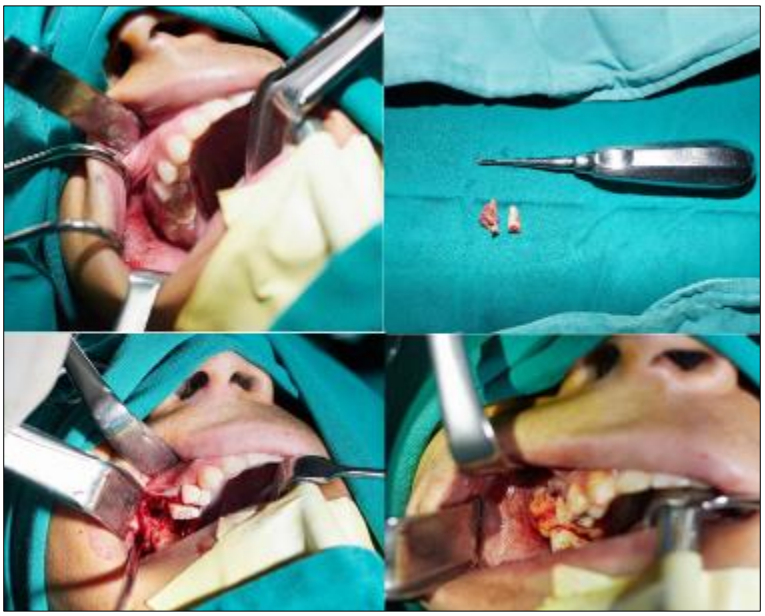

Figure 3 Extraction of the infection-causing tooth.a source tooth of the infection.b Oroantral communication.c Closure of oroantral communication. d,e

With the objective of achieving closure of the oroantral communication, the use of the Bichat's fat pad was chosen. To carry out this procedure, an incision of approximately 10 mm was made on the inner surface of the right cheek, allowing the extraction of the anterior portion of the Bichat's fat pad. Care was taken to perform this manipulation without generating excessive tension. Subsequently, the obtained segment was repositioned at the site of the oroantral communication. Then, suturing was performed with Vicryl 000 in order to prevent the detachment of the fat pad.

After the surgical intervention, the patient was discharged with a pharmacological regimen that included Amoxicillin + clavulanic acid 625 mg, ibuprofen 800 mg, and Cetirizine 10 mg. In addition, he was instructed to rest, maintain a Fowler's position, avoid excessive forces, and follow a liquid and soft diet.

Figure 4 After 11 months of the surgery performed, a follow-up radiograph

After 11 months of the surgery performed, a follow-up radiograph was taken (Figure 4). In this image, the complete closure of the oroantral communication can be observed, along with the formation of bone and the edentulous space corresponding to the loss of tooth 16. This finding is indicative of adequate healing and bone regeneration after the surgical procedure. The radiographic evidence supports the success of the treatment and the restoration of function in the affected area.

3. Discussion

Maillet et al. found that upper molars are 11 times more likely to be associated with odontogenic sinusitis compared to upper premolars, and that the palatal root of the upper first molar is the most predisposed to causing odontogenic sinusitis, more frequent than the maxillary second molar. [9]

Ruiz et al. associated that chronic apical periodontitis along with extensive untreated dental caries leads to the formation of a periapical abscess, and due to its anatomical proximity to the maxillary sinus, especially the first and second molars, can acutely or chronically affect it, resulting in oroantral communication. [10]

Lee et al. identified that the upper second molar was the most frequent cause of sinusitis with 40.8%, followed by the first molar with an incidence of 33.3%, due to their roots being very close to the maxillary sinus floor. [11]

Tuquerres et al. demonstrated that the upper first molar was the tooth most frequently associated with the development of maxillary sinusitis, contrasting with Lee et al.'s study identifying the upper second molar as the most common. Additionally, they found that the most frequent cause of sinusitis was the spread of infection from a tooth, representing 85% of total cases. [12]

Poeschl et al. treated 161 patients with oroantral communication using a pedicled graft of Bichat's buccal fat pad, achieving an overall success rate of 98% in all cases except those with severe tumor-related lesions. This high success rate was attributed to adequate tissue management and the rich blood supply of the fat pad. [13]

Khomutova et al. state that only a multidisciplinary approach, involving collaboration between maxillofacial surgeons, otorhinolaryngologists, and radiologists, along with the use of computed tomography, can ensure appropriate clinical and radiological approaches to determine treatment strategies for patients with sinusitis. This approach is fundamental to reducing relapse incidence and controlling chronic inflammatory processes in the maxillary sinuses. [14]

4. Conclusion

Imaging examinations are an important tool in the detection and diagnosis of odontogenic sinusitis, with computed tomography (CT) being the gold standard for identifying the location and origin of the lesion and determining the cause of the disease with certainty, whether it is a dental problem or some form of iatrogeny. The cause of sinus communication was due to the extent of dental caries, leading to a chronic apical abscess and subsequent communication with the posterior maxillary sinus. Pharmacological therapy for SMO includes the use of antibiotics, NSAIDs, and antihistamines.

The use of Bichat's fat pad as a graft for closing sinus communication resulting from infection progression has shown excellent postoperative results, thanks to its adequate size and manipulability, allowing effective coverage of the anatomical defect. This procedure not only accelerates recovery but also reduces the incidence of postoperative complications associated with more invasive grafts. Thus, the use of Bichat's fat pad represents a significant advancement in facial reconstructive surgery, providing a safe and effective solution to improve the quality of life for patients affected by these conditions.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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