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Odontogenic maxillary sinusitis: A review

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SUMMARY

Maxillary sinusitis of odontogenic origin is a well-known condition in both the dental and otolaryngology communities. It occurs when the Schneiderian membrane is violated by conditions arising from dentoalveolar unit. This type of sinusitis differs in its pathophysiology, microbiology, diagnostics and management from sinusitis of other causes, therefore, failure to accurately identify a dental cause in these patients usually lead to persistent symptomatology and failure of medical and surgical therapies directed toward sinusitis. Unilateral recalcitrant disease associated with foul smelling drainage is a most common feature of odontogenic sinusitis. Also, high-resolution CT scans and cone-beam volumetric computed tomography can assist in identifying dental disease. Sometimes dental treatment alone is adequate to resolve the odontogenic sinusitis and sometimes concomitant or subsequent functional endoscopic sinus surgery or Caldwell-Luc operation is required.

The aim of this article is to give a review of the most common causes, symptoms, diagnostic and treatment methods of odontogenic maxillary sinusitis. Search on Cochrane Library, PubMed and Science Direct data bases by key words resulted in 35 articles which met our criteria. It can be concluded that the incidence of odontogenic sinusitis is likely underreported in the available literature.

Key words: odontogenic maxillary sinusitis; functional endoscopic sinus surgery, cone-beam volumetric computed tomography.

INTRODUCTION

Historically, 10-12% of maxillary sinusitis (MS) cases have been attributed to odontogenic infections (1-4). However, in recent publications, up to 30-40% of chronic maxillary sinusitis cases contributes to dental cause (5). It occurs when sinus membrane is violated by conditions such as infections of the maxillary posterior teeth, pathologic lesions of the jaws and teeth, maxillary (dental) trauma, or by iatrogenic causes such as dental and implant surgery complications and maxillofacial surgery procedures (1, 2). Intimate anatomical relation of the upper teeth to the maxillary sinus promotes the development of periapical or periodontal odontogenic infection into MS. The bony wall, separating maxillary sinus from teeth roots varies from full absence, when teeth roots are covered only by mucous membrane, to the wall of 12 mm (35). MS can also develop because of the maxillary osteomyelitis, radicular cysts, after mechanical injury of sinus mucosa during root canal treatment, overfilling of root canals with endodontic material, which protrudes into maxillary sinus, incorrectly positioned implants, improperly performed sinus augmentation and oroantral fistulas (OAF) after tooth extraction (32-34).

This disease differs in its pathophysiology, microbiology, diagnostics and management from sinusitis of other causes, although clinical symptoms are not conspicious. Therefore, incorrectly diagnosed, it leads to failure of medical and surgical treatment directed toward sinusitis. 2D radiographs are usually used in diagnostics of odontogenic MS (OMS), but it is often difficult because of many structures superimposing in this area (5, 8).

The aim of this article is to give a review of the most common causes, symptoms, diagnostic and treatment methods of odontogenic maxillary sinusitis. Search on Cochrane Library, PubMed and Science Direct data bases by keywords: od-

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ontogenic maxillary sinusitis, sinusitis of dental origin symptoms, diagnostics, treatment, oroantral fistula, Caldwell-Luc, FESS, resulted in 35 articles which met our criteria. 7 of them were reviews, 5 were related to radiological findings in OMS, 12 articles were about surgical treatment, 10 related to oroantral fistulas and one with sinus augmentation after radical surgery.

ETIOLOGY

In meta-analysis made by Arias-Irimia (3) the most common cause of OMS was iatrogenia (55.97%). Other possible etiologies were periodontitis (40.38%) and the odontogenic cysts (6.66%). Oroantral fistulas and the remaining roots, taken together as iatrogenia after tooth extraction, accounted for 47.56% within iatrogenic causes. The dressings to close these oroantral fistulas and non-specific foreign bodies for the 19.72%, extrusion of endodontic obturation materials into the maxillary sinus represented the 22.27%, amalgam remains after apicoectomies the 5.33%, the maxillary sinus lift preimplantology surgery 4.17%, and poorly positioned dental implants or those migrated to the maxillary sinus the 0.92% of all cases included under a iatrogenic source. On the other hand, Lee & Lee made a retrospective chart analysis of 27 patients with OMS and found that implant related causes were most common which accounted for 37% of cases. Dental extraction-related complications were the second most common cause, found in 29.6% of cases. A dentigenous cyst was seen in 11.1%, a radicular cyst, dental caries, and a supernumenary tooth were each found in 7.4% of cases (5).

About the main tooth involved, the molar region standed out with a maxillary sinusitis frequency of 47,68%. The first molar tooth was the most frequently affected with an incidence of 22.51%, followed by the third molar tooth (17.21%) and the second molar tooth (3.97%). Regarding the premolar region, it was only affected in 5.96% of the cases, being the second premolar tooth the most frequently involved (1.98%). The canine only participated in 0.66% of the cases of maxillary sinusitis (3).

CLINICAL FEATURES

Classic symptoms suggestive of an odontogenic source can include sinonasal symptoms such as unilateral nasal obstruction, rhinorrhea, and/or foul odor and taste (5). Brook (2) adds such symptoms as headaches, unilateral anterior maxillary tenderness and postnasal drip. Dental symptoms, such as pain and dental hypersensitivity, do not reliably predict an odontogenic cause. The infrequency of dental complaints may be due to preserved patency of the osteomeatal complex of the maxillary sinus, which allows egress of pressure from within the sinus (3). In a case series of 21 patients with odontogenic sinusitis, dental pain was present in only 29% of the patients (6). These findings highlight the importance of maintaining a high level of suspicion for an odontogenic source of infection even in the absence of dental pain. Upper dental pain may also reflect primary sinusitis with referred pain to the teeth (5).

Sinonasal symptoms predominate in patients with odontogenic sinusitis; however, these symptoms do not distinguish odontogenic sinusitis from other causes of sinusitis. Furthermore, no single symptom from the various sinonasal complaints associated with sinusitis has been shown to predominate in odontogenic sinusitis. In a retrospective chart review of 27 patients diagnosed with odontogenic sinusitis, Lee and Lee reported that unilateral purulent rhinorrhea was most common and found in 66.7% of their patients with OMS, followed by ipsilateral cheek pain in one-third of the patients, whereas 26% reported a foul smell or taste (4). The case series by Longhini reports unilateral nasal obstruction as the most common and bothersome symptom followed by facial pressure/pain. This case series reported foul smell or rotten taste in 48% and tooth pain in 29% of patients (6) Therefore, unilateral sinus disease associated with a rotten or foul taste appears to be the only clinical finding most likely to differentiate between nonodontogenic sinusitis and odontogenic sinusitis (5).

DIAGNOSTICS

The accurate diagnosis of odontogenic maxillary sinusitis (OMS) is particularly important, because its pathophysiology (7), microbiology (2) and treatment differ from those of other forms of maxillary sinusitis. Recognition of OMS is important because failure to address the dental pathology will result in failure of medical and surgical therapies and persistence of symptoms (6, 9). Radiologic imaging can provide useful adjunct information in the diagnosis of sinusitis and particularly whether an odontogenic source may be responsible for the infection. The panoramic radiograph is a standard radiograph used in dental offices. This view is useful for evaluating the relationship of the maxillary dentition to the sinus, pneumatization, and pseudocysts. The overlap of the hard palate limits the usefulness of this examination for thorough

evaluation (5, 8). A panoramic radiograph is more useful for identifying displaced roots, teeth, or foreign bodies in the sinus. It is less accurate than Water's view in identifying MS, but gives more detailed informaion about lower part of the sinus (29). Dental examinations also include plain radiographs to evaluate for dental and/or periodontal disease. However, these dental radiographs have been shown to have estimated sensitivity of 60% for caries and approximately 85% for periodontal disease, leaving a high false negative rate (8). According to Longhini & Ferguson (6), 86% of the dental evaluations on patients subsequently diagnosed with odontogenic sinusitis failed to identify the dental disease. Therefore, specific attention should be directed toward careful review of imaging studies in cases in which odontogenic sinusitis is suspected. Furthermore, negative dental evaluations do not definitively rule out a dental cause of sinusitis, particularly in the patient with recalcitrant chronic rhinosinusitis (CRS). CT is the gold standard in the diagnosis of maxillary sinus disease due to its high resolution and ability to discern bone and soft tissue. Case series by Patel (5) revealed that all patients with odontogenic sinusitis showed signs of dental disease on CT scan, with 95% of patients showing periapical abscesses on CT. Cone beam CT is a relatively new tool which utilizes approximately 10% of the radiation dose of conventional thin-slice CT, and is able to image bony detail exquisitely, although soft tissue detail is reduced. Radiation dosage for cone beam volumetric CT (CBCT) is approximately 10-fold higher than for a panoramic dental radiograph. [30] The technique is gaining popularity among dentists, particularly in the field of implant dentistry, as there is frequently a need to assess the thickness of the floor of the maxillary sinus and rule out the presence of concurrent sinus disease prior to implantation. It has a higher resolution than conventional CT which is a good advantage, especially in challenging cases of OMS (10).

MANAGEMENT

Concomitant management of the dental origin and the associated sinusitis will ensure complete resolution of the infection and may prevent recurrence and complications. Elimination of the source of the infection (eg, removal of an external dental root from the sinus cavity, extraction, or root canal therapy of causative tooth) is necessary to prevent recurrence of the sinusitis (1, 2, 4, 5). Despite development of functional endoscopic treatment for chronic rhinosinusitis, external approach and extensive exploration of the diseased sinus is often used in the treatment of chronic maxillary sinusitis of dental origin (CMSDO). These methods are traumatic and carry a greater risk of postoperative complications compared with endoscopic sinus surgery (12). Another important consideration regards future bone reconstruction of the maxillary sinus, considering the fact that CMSDO is more often present in the elderly population, who may require prosthetic rehabilitation once CMSDO is resolved (3). In a classical Caldwell-Luc, where the antral lining is completely removed, mucocilliary lining is replaced by nonfunctional mucosa which is detrimental to sinus physiology. Moreover, this procedure has a high rate intraoperative (bleeding, infraorbital nerve damage) (20), immediate postoperative (facial swelling, cheek discomfort, pain, significant hemorrhage and temperature elevation) (21, 22) and long term (facial asymmetry, facial and teeth numbness or paresthesia, oroantral fistulas, gingivolabial wound dehiscences, dacryocystitis, facial pain, teeth devitalization, recurrent sinusitis, recurrent polyposis, antral wall sclerosis) complications (21, 23). With these postoperative changes in maxillary sinus it becomes very difficult to make future bone reconstructon for prosthetic rehabilitation (31).

The functional endoscopic sinus surgery (FESS) entails middle antrostomy and removal of only irreversibly diseased tissue, polyps, and foreign bodies through the middle antrostomy window thus preserving sinus mucosa and function. It can replace Caldwell Luc procedure in several cases (11, 12, 24).

Oroantral communication (OAC) is a relatively common complication of dental surgery.The extraction of maxillary posterior tooth is most common cause and accounts for more than 80% of all OAC cases (27). Successful management depends largely on primary closure of the defect and adequate medical management (15). Once a sinus communication has been diagnosed following dental surgery such as extraction, the size of the defect must be assessed. Defects of 5 mm or less generally close spontaneously in compliant patients. The use of a resorbable barrier, such as absorbable gelatin sponge (Gelfoam, Ferrosan Inc., Soeborg, Denmark) and suturing is advantageous. If the size of the defect is greater than 5 mm, primary closure is indicated and can generally be accomplished with standard surgical techniques such as buccal advancement flaps, palatal island flaps, full- or split-thickness palatal pedicle flaps, gold foils, or buccal fat pad pedicle flaps (15, 16). For predictable results, it is

paramount to perform any reconstructive effort in a disease-free sinus environment. Performing surgery at the oroantral communication site in the presence of acute infection in the sinus itself will most likely result in failure of the surgery (25, 26).

An oroantral fistula (OAF) is an unnatural communication between the mouth and the maxillary sinus which is covered with epithelia and can be filled with granulation tissue or polyposis of the sinal mucous membrane (13, 14). It most frequently occurs because of improperly treated diatrogenic oroantral communication (13). In such cases communication between the oral cavity and the maxillary sinus occurs as a result of extraction of upper lateral teeth, which do not heal by means of a blood clot but inside which granulation tissue forms, and on the edges narrowing of its vestibule occurs by migration of the epithelia cells of the gingival proprie, which cover the edges of the vestibule and partially grow into the canal. During expiry the air current which passes from the sinus through the alveoli into the oral cavity facilitates the formation of a fistular canal, which connects the sinus with the oral cavity. With the presence of a fistula the sinus is permanently open, which enables the passage of microflora from the oral cavity into the maxillary sinus the inflammation occurs with all possible consequences (17).

The symptoms during the occurrence of an oroantral fistula are similar to the symptoms of oroantral communication. A purulent discharge may drip through the fistula, which cannot always be seen. Also, when the patient drinks he feels as though part of the liquid enters the nose from that side of the jaw and occasionally runs out of the nostril on the same side. When the nostrils are closed with the fingers and the patient is asked to blow through the nose, air may hisse from the fistula into the mouth. Moreover, the test with a blunt probe will confirm the existence of a fistular canal (17, 21). The fistula must be quickly closed as its persistence intensifies the possibility of inflammation of the sinus by infection from the oral cavity. In the cases of unsuccesful closure by multiple surgical interventions or long time OAF, hyperplasia of MS mucous membrane occurs, which should be solved surgically by Caldwell Luc procedure (17). Recent literature suggests endoscopic surgery for this purpose (18, 19).

CONCLUSIONS

The incidence of odontogenic sinusitis is likely underreported in the available literature. More recent studies suggest an incidence that is much higher than previously reported and closer to 30-40% of all cases of chronic maxillary sinusitis. The most common causes are iatrogenia and marginal/apical periodontitis. Symptoms and exam findings in odontogenic and nonodontogenic sinusitis are similar, only with a small portion of patients with positive dental findings. In addition, dental evaluations with only panoramic or dental radiographs frequently fail to diagnose a dental disease in patients with OMS, therefore, evaluation of a patient with recalcitrant CRS, particularly if unilateral or associated with foul smell or taste, should prompt strong consideration of a sinus CT or CBVCT with thorough inspection for evidence of periapical abscesses. The treatment of OMS has variuos options. Because of less traumatic approach, lower rate of complications and better preservation of antral lining, FESS has gained popularity for last decades against Caldwell Luc procedure in treatment of CMSDO. However, some situations still requires this external approach.

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