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REVIEW ARTICLE

MAXILLARY SINUSITIS OF ODONTOGENIC ORIGIN: A REVIEW

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Abstract

Odontogenic infections are one of the contributing factors of maxillary sinusitis. The association between maxillary sinus and odontogenic infections may be because of close approximation of sinus and maxillary teeth. The teeth predominantly affect the sinuses are the maxillary molars, with the first molar tooth being the most frequent. The odontogenic maxillary sinusitis differs in its pathophysiology, microbiology, diagnosis and management from sinusitis of other causes, therefore, failure to accurately identify a dental cause may lead to recurrence of symptoms of sinusitis. Therefore management of maxillary sinusitis of odontogenic origin often requires treatment of the sinusitis as well as the odontogenic source. The aim of this article is to review the different types of odontogenic etiology of maxillary sinusitis.

INTRODUCTION

The maxillary sinuses, anatomically lying in an intermediate position between the nasal and oral cavities and are therefore most susceptible for the invasion by pathogenic bacteria through the nasal ostium or the oral cavity. The maxillary sinuses are most commonly affected with acute and chronic sinusitis. Maxillary sinusitis is a multifactorial disease characterized by the inflammation of maxillary sinus mucosa that may be due to viral, bacterial or fungal infections of upper respiratory tract.[1] Odontogenic infections are one of the common cause of maxillary sinusitis. Odontogenic sinusitis accounts for approximately 10% to 12% of maxillary sinusitis cases.[2] However, a recent publication reported that up to 30-40% of chronic maxillary sinusitis cases contribute to dental cause.[3] However the incidence of sinusitis associated with odontogenic infections is low despite the high frequency of dental infections.[4]
Normally the roots of the maxillary premolar and molar are separated from the maxillary sinus by a dense cortical bone of variable thickness. But sometimes only mucoperiosteum separate sinus from teeth therefore sinuses are in close approximation to teeth. Clearly, this close relationship can explain and responsible for development of sinusitis.[5] Common odontogenic etiology of sinusitis are dental abscess, periodontal diseases, periapical lesions, post dental extraction, oroantral fistula, and impacted teeth.[6]
Majority of the patients of maxillary sinusitis consult and treated by otorhinolaryngologists. Many otorhinolaryngologists fail to find the exact etiology of sinusitis especially in the cases of odontogenic origin. Because of failure to detect, there are non removal of the etiology that leads to recurrence of the sinusitis. Therefore opinion from Dentist before planning treatment helps to rule out odontogenic etiology and this helps to choose the medical and surgical methods for treatment of sinusitis.

ANATOMY OF MAXILLARY SINUS & ITS DENTAL RELATIONS

From an anatomic perspective, maxillary sinuses are largest paranasal air-filled cavities. The shape of the sinus is a pyramid. Maxillary sinus are situated laterally to the nasal fossae and communicate with them through an ostium of approximately 4 millimeters in diameter and vulnerable to occlusion during mucosal inflammation.[6] The maxillary

sinus have its relationships including a medial wall that separates the maxillary sinus from the nasal cavity, a posterior wall facing the maxillary tuberosity, an upper wall separates the orbit floor, and a lower wall toward the alveolar process that is the bottom of the maxillary sinus.[7] The maxillary sinus anatomical relates inferiorly with the roots of maxillary teeth that explain the easy extension of the infections from maxillary teeth to the maxillary sinus.[8]

ETIOLOGY OF ODONTOGENIC MAXILLARY SINUITIS

Maxillary sinuitis are mostly due to viral, bacterial or fungal infections. Sinuitis may also be allergic. Inflammation of sinus cause oedema of the nasal mucosa and obstruct the drainage of the sinuses. Odontogenic etiology of maxillary sinusitis includes periodontal diseases,[9] periapical lesions, odontogenic cysts, peri-implantitis, Post extraction of teeth, oro-antral fistulae,[10] and impacted teeth especially upper first ,second molars & first premolars region. Odontogenic reasons such as periodontal disease and periapical lesions are reported to cause 58% to 78% of maxillary sinus mucosal thickening.[11]

Periodontal disease-

Abrahams et al.[9] have observed that sinusitis incidence in patients with periodontal disease is two times than that in patients without periodontal disease and suggested a causal relationship. Falk *et al.* in a study reported that patients who undergo successful treatment of periodontal disease have a significant decrease in the incidence of maxillary sinusitis.[12]

Odntogenic cyst-

Calcifying Odntogenic cyst involving the maxillary sinus has rarely been reported.[13,14] One of the reports was on a recurrent case of sinusitis.[14] Another report has been a calcifying Odntogenic cyst with malignant transformation.[15]
Dentigerous cyst is the second most common odontogenic cyst, next to radicular cyst. The teeth most involved are the third molars, the canines, and the second premolars.[16]
There is low incidence of sinusitis because of cysts, and is mainly due to the fact that during their development, they push the sinus structures causing no damage to sinus unless the presence of infection.

Periapical lesion-

As a result of the close relationship, periapical infections might cause mucosal irritation and thickening within the maxillary sinus.[17] In a prospective study of Melen et al[5]. and Lindahl et al.[18] most cases of maxillary sinusitis were secondary to a dental infection such as marginal periodontitis and periapical lesion.

Teeth extraction and oroantral fistula-

The maxillary sinus may be accidentally opened during the traumatic tooth extraction due to close relation and cause maxillary sinus perforation, creating oroantral fistula and it may be a cause of maxillary sinusitis.
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.[19]

Implant-

Lee & Lee conducted a retrospective study of 27 patients with maxillary sinusitis and concluded that implant related causes were most common which accounted for 37% of cases.[20] To prevent sinus involvement during implant surgery maxillary sinus floor elevation should be performed before implant placement. Maxillary sinus floor elevation was initially described by Tatum[21] at an Alabama implant conference in 1976 and subsequently published by Boyne in 1980.[22] Other alternative to prevent sinus involvement is the use of reduced-length implants with roughened surfaces or tilted implants inserted in a variety of ways.

Foreign body-

Although rare, but sometimes the foreign body inserted in the sinus through trauma or accident.[23] Foreign bodies inducing the maxillary sinusitis, may be exogenous or endogenous foreign bodies. The most frequent types of exogenous foreign bodies are endodontic material used in dental obturation.[8] The foreign bodies can trigger inflammatory response and an alteration of the ciliary function.[5,24] Lopatin et al, reported that an exogenous foreign body found in 10 cases (14%), of which 7 dental amalgam fillings and 3 dental packings, and an endogenous foreign body (i.e. a tooth root) in 11 cases.[25]

Impacted teeth-

Impacted or embedded maxillary teeth in the vicinity of sinus exert pressure on sinus, causing maxillary sinus disease. Wizimirska J et al. presented a case of odontogenic maxillary sinusitis caused by a retained maxillary third molar tooth.[26]

CLINICAL FEATURES OF ODNTOGENIC MAXILLARY SINSITIS-

Most of the patients of sinusitis presents to Otorhinolaryngologist, only about 10% patients present to Dental surgeon. Odontogenic sinusitis may be acute or chronic. Acute sinusitis presents as nasal obstruction, nasal discharge, and pain over the maxillary sinus area, fever, malaise, headache, and occationally dental pain or any other dental problem on same side.[27]

Chronic odontogenic maxillary sinusitis presents with chronic nasal obstruction unilateral or bilateral, purulent nasal discharge decreased smelling sensation, foul smelling nasal discharge, post nasal drip, sometimes dental pain, or other dental problem on same side.[28]

DIAGNOSIS ODONTOGENIC MAXILLARY SINUITIS-

Diagnostic procedure for sinusitis include the extra- and intraoral clinical examination, the endoscopy and advanced imaging techniques (ultrasound, radiograph diagnosis, 3-D imaging).

Extra- and intraoral clinical examination-

Patients of sinusitis examined extra-orally for tenderness over sinus area, existing cheek swelling, redness and local heat generation. Intraoral examination include tooth related disease like periodontal diseases, periapical lesions, odontogenic cysts, periimplantitis, nonhealing of extraction site, oro-antral fistulae, and impacted teeth

Radiological imaging-

X RAY: Radiological imaging is an important tool for establishing the diagnosis of sinus diseases.[29]

Waters view: Routinely Waters view is done for maxillary sinusitis. It shows partial or complete haziness or mucosal thickening. Mucosal thickening in the floor of maxillary sinus raise the suspicion of Maxillary Sinuitis. This view also reveals dental fillings and implants in approximation to the sinus.

IOPA X RAY: Intraoral periapical X ray reveal teeth proximity to sinus, periapical lesions, periodontitis, any other pathology related to teeth particularly in maxillary teeth region.

Orthopantomogram (OPG): This view evaluates the relationship of the maxillary dentition to the sinus, pneumatization, and pseudocysts.(Fig 1) The overlaping of the hard palate limits the usefulness of this x ray for thorough evaluation. An OPG is more useful for identifying displaced roots, teeth, or foreign bodies in the sinus, odontogenic cyst size. It is less accurate than Water‘s view in identifying maxillary sinusitis, but gives more detailed informaion about dental etiology.

Fig 1- Orthopantomograph showing maxillary teeth and sinus relationship.

Computed Tomography (CT scan)-
CT scan is the gold standard in the diagnosis of maxillary sinus disease because of its high resolution and its ability to discern bone and soft tissue. CT should be preferred when clinical findings strongly suggest sinusitis but direct X-rays fails to detect sinusitis.[30] CT is helpful for evaluating the relationship of the maxillary teeth roots with the maxillary sinus. (Fig 2) Recently, cone beam computed tomography (CBCT) has been new tool for dental and maxillofacial imaging, which has several advantages over traditional CT, including lower radiation dose and chairside process.[11]

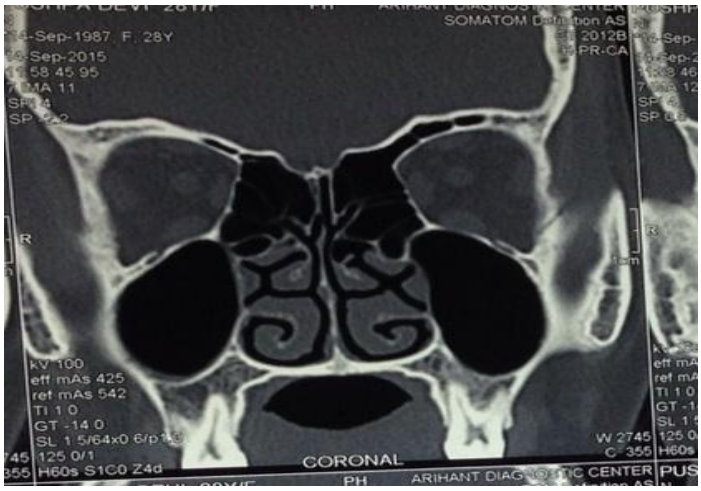

Fig 2- CT scan showing maxillary sinusitis and periapical lesion in molar tooth.

Endoscopy-
Endoscopy allows direct inspection of maxillary sinus and the nasal cavity. The Endoscopy of sinus (sinuscopy) is used as a diagnostic measure in unclear radiological findings, inflammation, suspected tumors, and for follow-up after surgery.

TREATMENT OF ODONTOGENIC MAXILLARY SINUSITIS
Odontogenic maxillary sinusitis should be treated by both medical and surgical approach along with the removal of odontogenic etiology.
The first step consists of addressing the dental pathology. Etiology removal procedures include dental extraction, drainage of periodontal abscess, periodontal surgery, and treatment of periapical lesions.[24] Elimination of the source of the infection is necessary to prevent recurrence of the sinusitis. Sinus floor elevation procedure should be performed before implant placement whenever needed.
As with odontogenic infections, odontogenic maxillary sinusitis is polymicrobial and mixed aerobic/anaerobic infectious disease. Acute odontogenic maxillary sinusitis due to bacterial cause medical treatment is instituted to cover the aerobic organisms as they predominate in acute phase. In chronic phase mixed organisms aerobic and anaerobic organisms dominate, hence antibiotics selected with bacterial cultures to cover both should be given. Other medical treatment is decongestants and anti-inflammatory drugs.
If sinusitis persist Functional endoscopic sinus surgery (FESS) should be performed, to widen the natural maxillary sinus ostium and clear diseased muscosa from maxillary and other sinuses if they are also involved. Minimal invasive endoscopic sinus surgery is safer, quicker, has less impact on the sinus mucus clearance, provokes less bleeding, and allows for a shorter hospitalization time.[24]

CONCLUSION-
The close proximity of the maxillary sinus to the upper teeth makes it a common clinical concern for both Otolaryngologist and Dentist. For this reason, both Otolaryngologist and dentists should be familiar with odontogenic etiology and the anatomy, physiology and pathology of the sinus region. Concomitant management of the odontogenic etiological factor and the associated sinusitis ensure complete resolution of the sinus infection and may prevent recurrence and complications of the sinus disease.

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