5th stage

Oral and maxillofacial surgery

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Sinus disease

The maxillary sinuses are air-containing spaces that occupy the maxillary bone bilaterally. After birth the maxillary sinus expands by pneumatization into the developing alveolar process and closely matching the growth rate of the maxilla and the development of the dentition. By the time a child reaches age 12 or 13, the sinus will have expanded to the point at which its floor will be on the same horizontal level as the floor of the nasal cavity. In adults the apices of the teeth may extend into the sinus cavity. Expansion of the sinus normally ceases after the eruption of the permanent teeth, but on occasion the sinus will pneumatize further, after the removal of one or more posterior maxillary teeth, to occupy the residual alveolar process. The maxillary sinus is significantly larger in adult patients who are edentulous in the posterior maxilla compared with patients with complete posterior dentition. The maxillary sinus is the largest of the paranasal sinuses. Antrum is derived from the Greek word meaning cave. The maxillary sinus is described as a four-sided pyramid, with the base lying vertically on the medial surface and forming the lateral nasal wall. The apex extends laterally into the zygomatic process of the maxilla. The upper wall, or roof, of the sinus is also the floor of the orbit. The posterior wall extends into the maxillary tuberosity. Anteriorly and laterally the sinus extends to the region of the first bicuspid or cuspid teeth. The floor of the sinus forms the base of the alveolar process. The adult maxillary sinus averages 34 mm in anteroposterior direction, 33 mm in height, and 23 mm in width. The volume of the sinus is approximately 15 to 20 mL. The sinuses are primarily lined by respiratory epithelium, a mucus-secreting, pseudostratified, ciliated, columnar epithelium. The cilia and mucus are necessary for the drainage of the sinus because the sinus opening, or ostium, is not in a dependent (inferior) position but lies two thirds the distance up the medial wall and drains into the nasal cavity. The maxillary sinus opens into the semilunar hiatus, which lies in the middle meatus of the nasal cavity, between the inferior and middle nasal conchae. The cilia beat at a rate of up to 1000 strokes per minute and can move mucus a distance of 6 mm per minute.
Clinical evaluation of a patient with suspected maxillary sinusitis should begin with:

1. Careful visual examination (inspection) of the patient's face and intraoral vestibule for swelling or redness.
2. Nasal discharge may be evident during the initial evaluation.
3. Palpation intraorally on the lateral surface of the maxilla between the canine fossa and the zygomatic buttress.
4. Tapping of the lateral walls of the sinus externally over the prominence of the cheek bones may be very tender to gentle tapping or palpation.
5. Tenderness to percussion of several maxillary posterior teeth is often indicative of an acute sinus infection.
6. Transillumination of the maxillary sinuses. Transillumination of the maxillary sinus is done by placing a bright fiberoptic light against the mucosa on the palatal or facial surfaces of the sinus and observing the transmission of light through the sinus in a darkened room. In unilateral disease, one sinus may be compared with the sinus on the opposite side.

Radiographic Examination of the Maxillary Sinus
A wide variety of exposures are available that may include:

1. **Periapical X-Ray**. A periapical radiograph is limited in that only a small portion of the inferior aspect of the sinus can be visualized. In some cases, the apices of the roots of the posterior maxillary teeth may be seen to project into the sinus floor.

2. **Occlusal.**

3. **Panoramic views (OPG)** may provide a "screening" view of the maxillary sinuses. This projection is the best radiograph available in most dental offices to provide a view of both maxillary sinuses for comparison. They are of value in locating and retrieving foreign bodies within the sinus—particularly teeth, root tips, or osseous fragments. in implant and sinus lift procedures

4. **Waters’ views** frequently useful view is taken with the head tipped 37 degrees to the central beam. This projection places the maxillary sinus area above the petrous portion of the temporal bones, allowing for a clearer view of the sinuses than a standard posterior-anterior view of the skull.
5- *The lateral view* can be obtained in a standard cephalometric machine with the patient's head tipped slightly toward the cassette. Tipping of the patient's head avoids superimposition of the walls of the sinus.

6- *Computed tomography (CT)* is a useful technique for imaging of the maxillary sinuses and other facial bony structures. Its ability to produce clear images has made computed tomography CT increasingly popular for evaluating all types of facial bone pathologic conditions including abnormalities of the maxillary sinus.
Interpretation of radiographs of the maxillary sinus is not difficult. The body of the sinus should appear radiolucent and should be outlined by a well-demarcated layer of cortical bone. Comparison of one side with the other is helpful. One should not see evidence of thickened mucosa on the bony walls, air-fluid levels (caused by accumulation of mucus, pus, or blood), or foreign bodies lying free.

**Radiographic changes are to be expected with acute maxillary sinusitis.**
1. Mucosal thickening caused by infections may obstruct the ostium of the sinus and allow accumulation of mucus, which will become infected and produce pus.
2. The characteristic radiographic changes may include an air-fluid level in the sinus.

**The radiographic changes indicative of chronic maxillary sinusitis include**
1. Mucosal thickening.
2. Sinus opacification.
3. Nasal or antral polyps.
4. Air-fluid levels in the sinuses are more characteristic of acute sinus disease but may be seen in chronic sinusitis in periods of acute exacerbation.

*Disruption of the cortical outline may be a result of trauma, tumor formation, an infectious process with abscess and fistula formation, or a surgical procedure that violates the sinus walls.*
**Dental pathologic:**
Dental pathology such as cysts or granulomas may produce radiolucent lesions that extend into the sinus cavity.
These conditions may be distinguished from normal sinus anatomy by
1- Association with the tooth apex.
2- The presence of a cortical osseous margin on the radiograph.
3- The clinical correlation with the dental examination.
Those point usually enough to separates the area in question from the sinus itself.

**Non-odontogenic lesions involving maxillary sinus**
The dynamic nature of the sinus with active epithelium and a constant moving mucus layer prevents any significant colonization. The mucosa of the sinus is susceptible to
1- Inflammatory disease including infection and allergic reactions that can cause hyperplasia and hypertrophy of the mucosa and may cause obstruction of the ostium. If the ostium becomes obstructed, the mucus produced by the secretory cells lining the sinus is collected over long periods. Bacterial overgrowth may then produce an infection resulting in the signs and symptoms of sinusitis, as well as the radiographic changes seen with these conditions.
2- Neoplasm; the mucosa of the sinus is susceptible also to neoplastic diseases.

When inflammation develops in any of the paranasal sinuses, whether caused by infection or allergy, the condition is described as sinusitis.
Inflammation of most or all of the paranasal sinuses simultaneously is known as pansinusitis and is usually caused by infection.
Similar conditions of individual sinuses are known, for example, as maxillary sinusitis or frontal sinusitis.

**Acute maxillary sinusitis**
1- May occur at any age.
2- Rapid onset of developing sense of pressure, pain, and/or fullness in the vicinity of the affected sinus.
3- The discomfort rapidly increases in intensity.
4- May be accompanied by facial swelling and erythema, malaise, fever,
5- Drainage of foul smelling mucopurulent material into the nasal cavity and nasopharynx.

**Chronic maxillary sinusitis**
1- Usually a result of bacterial or fungal infections that are low grade and recurrent or allergy.
2- Chronic maxillary sinusitis is characterized by episodes of sinus disease that respond initially to treatment, only to return, or that remain symptomatic in spite of treatment.

Aerobic, anaerobic, or mixed bacteria of nonodontogenic origin may cause infections of the maxillary sinuses.
Mucostasis that occurs within the sinus allows for colonization of these organisms.
ODONTOGENIC INFECTIONS OF THE MAXILLARY SINUS
Maxillary sinusitis is occasionally a result of odontogenic sources because of the anatomic juxtaposition of the teeth and the maxillary sinus. Odontogenic sources account for approximately 10% to 12% of all maxillary sinusitis. If left untreated or inadequately treated the following squeal will occur:
1- This condition may readily spread to involve the other paranasal sinuses.
2- In rare cases, these infections become life threatening and can include orbital cellulitis, cavernous sinus thrombosis, meningitis, osteomyelitis, intracranial abscess, and death.

TREATMENT OF MAXILLARY SINUSITIS
Early treatment of maxillary sinusitis
1- Humidification of inspired air to loosen and aid in the removal of dried secretions from the nasal passage and the sinus ostium.
2- Systemically administered decongestants such as pseudoephedrine (Sudafed) and nasal spray containing vasoconstrictors, such as 2% ephedrine or 0.25% phenylephrine, decrease nasal and sinus congestion and help facilitate normal drainage.
3- Patients with sinus infections often experience moderate to severe pain, and prescribing a nonsteroidal or narcotic analgesic may be appropriate.
4- When sinusitis is a result of an infectious process, the use of antibiotics is indicated. Antibiotic choices for treatment of maxillary sinusitis include amoxicillin, azithromycin, and cefuroxime. It is important to obtain purulent material for culture and sensitivity testing whenever possible.
If the patient fails to respond to this initial treatment regimen within 72 hours, it is necessary to reassess the treatment and the antibiotic. If the organism or organisms causing the infection are B-lactamase producers, another antibiotic, such as the combination agent trimethoprim-sulfamethoxazole (Bactrim, Septra), may be effective. A combination of amoxicillin and clavulanate potassium (Augmentin) has also been shown to be effective.
Acute maxillary sinusitis is a painful, potentially serious condition.

Diagnosis and treatment of chronic maxillary sinusitis is difficult and may include allergy testing, nasal or septal surgery; and surgical debridement of the sinuses. The goal of sinus surgery is to remove abnormal tissue from within the sinus cavity and restore normal drainage through the ostium using different technique.
A- Caldwell-Luc procedure
Is the traditional technique in which the anterior wall of the sinus is accessed in the area of the canine fossa through a vestibular approach. The sinus is opened, and abnormal tissue or foreign bodies can be removed.
B- Antrostomy approaches
   1- Traditional technique in which the ostiomeatal area can be evaluated and opened, the opening for more dependent drainage into the nose (termed an antrostomy) can be created near the floor of the sinus.
   2- Endoscopic approaches is a less invasive newer techniques allow exploration and surgical treatment of the sinus with endoscope.

COMPLICATIONS OF ORAL SURGERY INVOLVING THE MAXILLARY SINUS
The most common dental complications of oral surgical procedures that subsequently involve the maxillary sinus include
   1- Displacement of teeth, roots, or instrument fragments into the sinus
   2- Creation of a communication between the oral cavity and the sinus during surgery that occur due to
      A- During extraction in the posterior partially edentulous maxilla in which pneumatization of the sinus in to edentulous alveolar process been establishes .
      B- Abnormally long roots that perforate the floor of the sinus.
      C- Destruction of a portion of the sinus floor by periapical lesions or large cystic.
      D- Perforation of the floor and sinus membrane with injudicious use of instruments, forcing a root or tooth into the sinus during attempted removal.

Removal of the roots & broken instrument
The roots and broken instrument that dislodge to sinus may be found either below the sinus membrane directly “between the membrane and bony wall of the sinus OR within the sinus membrane this can felt by during movement of the head or be serial X-ray. Removing the displaced object must can be managed as following
   1- Extreme care during exploration so that not force or push the object within the sinus if fell that it is located just below the sinus. In many cases the opening created during initial displacement can be enlarged slightly, and the tooth or other object can be visualized and retrieved with small forceps or with the use of suction. Irrigating the sinus followed by suction can often accomplish retrieval of the object.
2- The sinus needs to be opened through a Caldwell-Luc approach and the object retrieved.

**Oroantral Communications: Immediate Treatment**

1- The best treatment of a potential sinus exposure is avoiding the problem through careful observation and treatment planning. Evaluation of high-quality radiographs before surgery usually reveals the presence or absence of an excessively pneumatized sinus or widely divergent or dilacerated roots, which have the potential of having a communication with the sinus or causing fractures in the bony floor of the antrum during removal. If this observation is made, surgery may be altered to section the tooth and remove it one root at a time.

2- When exposure and perforation of the sinus result, the least invasive therapy is indicated initially. If the opening to the sinus is small and the sinus is disease free, efforts should be made to establish a blood clot in the extraction site and preserve it in place. Sutures are placed to reposition the soft tissues, and a gauze pack is placed over the surgical site for 1 to 2 hours. The patient is instructed to use nasal precautions for 10 to 14 days. These include:

   A- Opening the mouth while sneezing.
   B- Not sucking on a straw or cigarettes.
   C- Avoiding nose blowing and any other situation that may produce pressure changes between the nasal passages and oral cavity.
   D- The patient is placed on an antibiotic, usually a penicillin for 7 to 10 days to prevent infection.
   E- Antihistamine; and a systemic decongestant for 7 to 10 days to shrink mucous membranes, and to lessen nasal and sinus secretions.
   F- The patient is seen postoperatively at 48- to 72-hour intervals and is instructed to return if an oroantral communication becomes evident by leakage of air into the mouth or fluid into the nose or if symptoms of maxillary sinusitis appear. The majority of patients treated in this manner heal uneventfully if there is no evidence of preexisting sinus disease.

3- If larger perforations occur, it may be necessary to cover the extraction site with some type of flap to provide primary closure in an attempt to cover the sinus opening. The most commonly used flap:

   A- Buccal flap, elevating buccal mucosperiosteal flap. Broad based flap with adequate width to cover the communication with margins of the flap positioned over bone rather than directly over the defect of area of communication. The flap must be free of any tension. To accomplish this, the periosteum usually must be incised and released at the height of the dissection.
**Oroantral Fistulae: Delayed Treatment**

Successful treatment and closure of the oroantral fistula requires more extensive medical and surgical treatment.

Steps that should be followed for accurate management do Oroantral fistula:

1. Before the procedure for closure of an oroantral fistula, it is imperative to eliminate any acute or chronic infection within the sinus. This may require frequent irrigation of the fistula and sinus combined with the use of antibiotics and decongestants.

2. It may also be helpful to construct a temporary appliance to cover the fistula to prevent food and other oral contaminants from getting into the sinus.

3. If sinus disease persists, it may be necessary to remove diseased tissues from the sinus using a Caldwell-Luc procedure through the lateral maxillary wall above the apices of the remaining teeth.

4. Careful evaluation of adjacent teeth. If the fistula has developed in approximation to the root of an adjacent tooth, closure is further complicated; and to be successful, removal of the tooth may be necessary.

5. Surgical steps for closing oroantral fistulae include
   - **A**- Fistulous tract will be lined with epithelium that must be excised or elevated from the bony walls of the fistula, sutured together if possible, and inverted into the sinus cavity. This should be accomplished before elevating the flap so that the actual size of the bony defect can be inspected and the size of the flap designed appropriately to allow the flap to cover the entire defect with the margins lying over bone.
   - **B**- Using one or both of the following flaps
     1. **Buccal advancement flap**, as previously described, one must remember that the osseous defect surrounding the fistula is always much larger than the clinically apparent soft tissue deformity.
2- *Rotation of a palatal flap* is often used to close an Oroantral fistula. The advantages of using a full-thickness palatal flap are that a large amount of tissue can be elevated with good blood supply from palatal vessels and the thickness and keratinized nature of palatal tissue more closely resemble crestal ridge tissue than thinner, less keratinized tissue in the buccal vestibule. The disadvantage of this flap is the large area of exposed bone that results from elevation of the flap. The palatal defect will eventually heal with granulation and secondary epithelialization. In some cases the defect can be covered with a temporary obturator with some type of soft tissue conditioning liner; however, it is important that no pressure be applied over the flap area because this may decrease blood supply and cause tissue necrosis.
3- *Elevation of flap from both buccal and palatal flaps (advancement)*

4- Larger defects, particularly those resulting from surgical removal of pathologic lesions, may require larger flaps to accomplish closure and may include the use of pedicle flaps from the *tongue or temporalis muscle*.

*Sinus lift procedures:*  
Is the procedures that done primarily to improve the posterior maxillary alveolar base for secondary or simultaneous endosseous implant placement.  
In most cases, careful elevation of the schneiderian (i.e., sinus) membrane creates a space into which particulate grafts of autologous bone, allogeneic bone, alloplastic materials, or combinations of these can be placed. If the procedure is done carefully, complications resulting from sinus lift operations are rare.