



## Management of acute sinusitis secondary to minor maxillary sinus exposures

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### Introduction

Perforation of the maxillary sinus, or antrum of Highmore, can occur during surgical procedures of the posterior maxillary teeth including extraction, root-end surgery, or periodontal procedures. Proper management of the perforation is essential to prevent infection, chronic sinusitis, or oroantral fistula formation. The purpose of this *Clinical Update* is to describe the anatomy of the maxillary sinus, discuss prevention and management of minor sinus perforations, delineate acute and chronic sinusitis, and describe when to refer to the oral and maxillofacial surgeon (OS) or otolaryngologist (ENT).

### Anatomy

The maxillary sinus is located in the body of the maxilla and has the shape of a quadrilateral pyramid whose base forms the medial wall toward the nasal cavity and whose rounded tip rests within the zygomatic bone.<sup>1</sup> The sinus is relatively small at birth, but continues to grow in size until the permanent teeth have developed. The natural drain for the sinus is an opening called the ostium which is variable in size and positioned on the highest part of the medial wall of the antrum.<sup>2</sup> This positioning is somewhat unfavorable because it impedes the outflow of secretions from the maxillary sinus when a person is standing upright. The antrum is lined by the Schneiderian membrane, which consists of mucosal glands and goblet cells interspersed in a single layer of ciliated pseudo-stratified columnar epithelium cells. The mucus secretions and beating cilia act to clear the sinus of bacteria and small debris by sweeping them toward the ostium to be drained away to the middle meatus of the nasal cavity through a tube called the infundibulum.<sup>1</sup>

The maxillary first molar is the closest of the teeth to the sinus, with the average distance from the apex of its mesio-buccal root being less than 2mm.<sup>3</sup> If the sinus is pneumatized, it is even possible for the roots of posterior teeth to extend well into it.<sup>2</sup>

### An ounce of prevention

A radiographic survey of the teeth in question prior to any surgical procedure of the posterior maxilla is necessary to provide an appropriate informed consent to the patient concerning the risk of oroantral communication. Periapical radiographs are necessary to determine basic tooth morphology, while vertical bitewings are useful for morphometric analysis. Computerized Tomography is one method of truly visualizing and measuring the relationship of the teeth and sinus in 3 dimensions.<sup>3</sup>

Proper flap design can ensure that sutures will be placed over healthy bone and not over a potential sinus perforation area. For extractions, surgical sectioning in addition to judicious apical force may prevent the fracture of alveolar bone or exposure of the sinus. Diagnosis of sinus perforations after extractions can be aid-

ed by ample light, irrigation, suctioning, and having the patient gently blow while holding their nose.<sup>2</sup>

### Management of minor sinus perforations

Minor sinus perforations can be defined as those less than 4 mm. If a patient has a healthy sinus, an oroantral communication less than 4-5 mm will most likely heal without surgery.<sup>4</sup> Standard precautions for the patient include sneezing with the mouth open, and refraining from blowing the nose, sucking through a straw, or smoking.<sup>2</sup> Prescribing an antibiotic and both systemic and topical decongestants are important at the time of the acute injury. The medicinal objectives are prevention of infection by opportunistic organisms, increasing drainage by maintaining patency of the ostium, and reducing the secretions of the membrane.

Antibiotic coverage to prevent infection is the most important medication after acute sinus injury.<sup>2</sup> It is generally accepted that the three most common isolates in acute sinusitis are *Streptococcus pneumoniae*, *Haemophilus influenzae* and, in children, *Branhamella catarrhalis*.<sup>5</sup> Aminopenicillins, such as amoxicillin and ampicillin, are bactericidal against these organisms. They bind to proteins in the cell wall and inhibit its synthesis, leading to rupture of the bacteria. Some of these bacteria have developed a resistance-factor enzyme to the aminopenicillin antibiotics called  $\beta$ -lactamase. This enzyme works by disrupting a structural component of the penicillin molecule called the  $\beta$ -lactam ring. To counteract this, clavulanate has been added to these drugs to make them more effective. It binds irreversibly with some  $\beta$ -lactamase enzymes and prevents the breakdown of amoxicillin.<sup>6</sup> Augmentin® is an example of this combination, and is the drug of choice for oral use to cover sinus perforations.<sup>2</sup> In patients allergic to penicillin, trimethoprim-sulfamethoxazole (Bactrim® and Septra®) and cefaclor (Ceclor®) are just as effective.<sup>7</sup> The timing of antibiotic coverage is somewhat controversial, but most clinicians recommend a 10-14 day course for acute sinus perforations.<sup>2</sup>

Systemic antihistamines (AHs) are prescribed to decrease edema of the sinus membrane and thus help maintain patency of the ostium by preventing its occlusion by edematous tissues. Long-acting tricyclic AHs such as loratidine (Claritin®) have selective peripheral H1 receptor antagonistic activity that causes increased capillary permeability and decreases edema.<sup>6</sup> Tricyclic AHs are favored because they cause less drowsiness than some other AHs. Side effects include xerostomia, gastric upset, and CNS suppression. For a complete list of contraindications, side-effects, and interactions, clinicians should consult a drug reference manual for any drugs they prescribe.

Topical spray decongestants (TSDs) such as oxymetazoline hydrochloride (Afrin®) work by causing local vasoconstriction of arterioles through  $\alpha$ -1 receptors to reduce blood flow and nasal congestion.<sup>6</sup> This subsequently allows the sinus to drain more adequately by reducing the edema around the ostium. A notable side-effect of these TSDs is a rebound congestion known as *rhinitis medicamentosa* (RM) when they are abruptly discontinued after having been used for greater than 3 days. RM is a downward spiral of TSD-induced down-regulation of the  $\alpha$ -1 receptors, requiring a higher dose of TSD to prevent the con-

gestion, leading to further down-regulation and worsening of the condition. Table 1 lists a sample medical regime for a healthy patient with a sinus perforation that should be in most formularies.

Acute sinusitis can be moderately to severely painful and appropriate pain control with oral, schedule-3 narcotics is indicated. Acetaminophen with codeine, hydrocodone or propoxyphene is reasonably effective. Adjunctive treatments include steam treatment (shower, vaporizer, or sauna) and/or hydration (6-8 glasses of water per day).<sup>8</sup>

Typical prescription regimen for the healthy patient		
Drug/mg	Disp:	Sig
Augmentin ® 500	20 tabs	Take 1 q12hrs for 10 days
Claritin®	10 tabs	Take 1 q24hrs for 10 days
Afrin ®	1 Vial	2-3 sprays into each nostril twice daily for no longer than 3 days

**Table 1: Medical regime for a healthy patient with sinus perforation.**

### Chronic vs. acute sinusitis

Acute sinusitis is an inflammation of the sinus that is usually caused by an upper respiratory tract infection leading to rhinitis.<sup>2</sup> Other causes include allergic rhinitis, odontogenic infection, and sinus membrane damage secondary to trauma or dental surgical procedures. This damage results in disruption of both the membrane's ability to clear debris via muco-ciliary action, and the ostium's ability to adequately drain the antrum. Table 2 lists the signs and symptoms of acute maxillary sinusitis modified from Hupp:<sup>2</sup>

Acute sinusitis signs	Symptoms
1. Pain on pressure above the canine fossa	1. Cheek pain with referral to the frontal region
2. Mucopurulent drainage from the nose	2. Increased pain on bending or going up stairs
3. Fever	3. Nasal Congestion or Pressure Sensation
4. Malaise	5. Hyposmia: reduced ability to smell and detect odor

**Table 2: Signs and symptoms of acute maxillary sinusitis.**

The treatment of *acute* sinusitis is targeted to prevent the onset of *chronic* sinusitis. While treatment and diagnosis of chronic sinusitis are beyond the scope of this *Clinical Update*, it is important to be able to recognize its presence to appropriately refer the patient. Table 3 shows the definition of chronic sinusitis that Melen created to delineate the two entities.<sup>9</sup>

Chronic sinusitis
Facial pain, nasal congestion, or abnormal secretions remain or reappear during a period of a least 3 months
Sinus radiography reveals persistent localized or generalized mucosal swelling with or without secretion
Does not heal after conservative treatment consisting of one or more courses of antibiotics of 10 days duration, nose drops or oral decongestants, and antral lavage
Chronic maxillary sinusitis of <i>dental origin</i> exists prior to oral antral fistula, or radiographs or examination show an indistinct border or close connection between the diseased maxillary sinus mucosa and the apex of nonvital teeth, an inflammatory periodontal periapical lesion, or the follicle of an impacted tooth in connection with a periodontal or periapical lesion

**Table 3: Definition of chronic sinusitis according to Melen, et al. 1986.**

### When to refer to OS or ENT:

- The perforation is greater than 4mm in diameter
- The patient has signs/symptoms of chronic sinusitis prior to the perforation, even if it is less than 4mm
- Evidence of sinusitis does not improve with the above regimen of medications in 48-72 hours (4)
- There is evidence of worsening or spread of the infection such as progressing signs and symptoms
- There is a foreign body in the sinus such as a root tip, restorative material, or root canal filling material

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