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Chapter 50

Rhinosinusitis

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Key Points

- Rhinosinusitis remains a clinical diagnosis.
- When used appropriately, antibiotics can reduce the number of symptom days.
- Any abnormal neurologic finding in a child with rhinosinusitis warrants a brain imaging study.

Introduction and Background

Sinusitis is the inflammation of one or more of the paranasal sinuses, which include the ethmoid, maxillary, sphenoid, and frontal sinuses. This inflammation can be due to infection, allergy, or anatomic obstruction. The obstruction of the sinus ostia, whether due to infection, allergy, or anatomic malformations (Fig. 50–1), is the common pathway leading to the symptoms and pathology of sinusitis.[1,2] The term *rhinosinusitis* is considered by many experts to be a more accurate term since the nasal mucosa is almost always involved in sinus infections.[3] Rhinosinusitis, based on the duration of symptoms, is further subdivided into acute rhinosinusitis, chronic rhinosinusitis, and recurrent rhinosinusitis.[1,2] It has been estimated that between 5% and 10% of children with an upper respiratory infection will go on to develop rhinosinusitis.[2,4]

The etiology of rhinosinusitis can be divided into the following categories: infectious and allergic. Among infectious etiologies, viral causes of rhinosinusitis include rhinovirus, influenza virus, and coronavirus.[3] Viral infections cause local inflammation and blockage of the sinus ostia. Additionally, they can disrupt the ciliary function of the sinuses, leading to stasis and subsequent bacterial colonization. Cultures obtained from individuals presenting to an outpatient clinic with signs and symptoms consistent with acute bacterial rhinosinusitis revealed a number of organisms, as reported by the Respiratory Surveillance Program.[4] The most common bacterial organisms causing rhinosinusitis are listed in Table 50–1.

There is a strong association between rhinosinusitis and allergy. Children with a family history of allergy are at a higher risk of developing rhinosinusitis.[1] Some authors have considered whether rhinosinusitis and asthma are variations of the same disease.[5] When an allergen is identified and exposure to that allergen reduced or eliminated, there is a marked decrease in rhinosinusitis symptoms.[5,6]

Recognition and Approach

The maxillary and ethmoid sinuses form in utero and are present at birth. The sphenoid sinus forms at approximately 5 years of age and the frontal sinuses at 7 to 8 years. This timeline becomes important when considering the clinical symptoms and complications that accompany rhinosinusitis at various ages. Maxillary sinusitis, for example, is more common in younger children than sphenoid or frontal sinusitis.

Clinical Presentation

Acute Bacterial Rhinosinusitis

According to the American Academy of Pediatrics clinical practice guideline on sinusitis, acute bacterial sinusitis is defined as a bacterial infection of the paranasal sinuses that persists less than 30 days.[1] Goldsmith and Rosenfeld defined acute rhinosinusitis as an upper respiratory infection that persists beyond 10 days.[3] Ueda and Yoto used the same definition for rhinosinusitis in his study group and was able to demonstrate radiographic proof of sinusitis in 92.5% of patients.[7] Acute bacterial sinusitis can also be further divided by the severity of the presenting symptoms. Severe symptoms include illness duration of more than 10 to 14 days, fever ≥ 102° F, and purulent nasal discharge in an ill-appearing child.[1]

The symptoms of an acute rhinosinusitis include nasal discharge, cough, fever, and halitosis. Nasal discharge can be clear or mucopurulent and does not correlate with the severity of disease. Cough is the most common complaint and is classically worse at night. The cough is described as persistent and may be dry or accompanied by copious nasal secretions. Fever is more indicative of a bacterial rhinosinusitis infection, especially when it lasts longer than 3 days and accompanies the rhinitis.[3] Children with maxillary sinusitis can present with pain to the upper posterior teeth. Rhinosinusitis can be differentiated from an upper respiratory tract infection (URI) by the worsening of symptoms

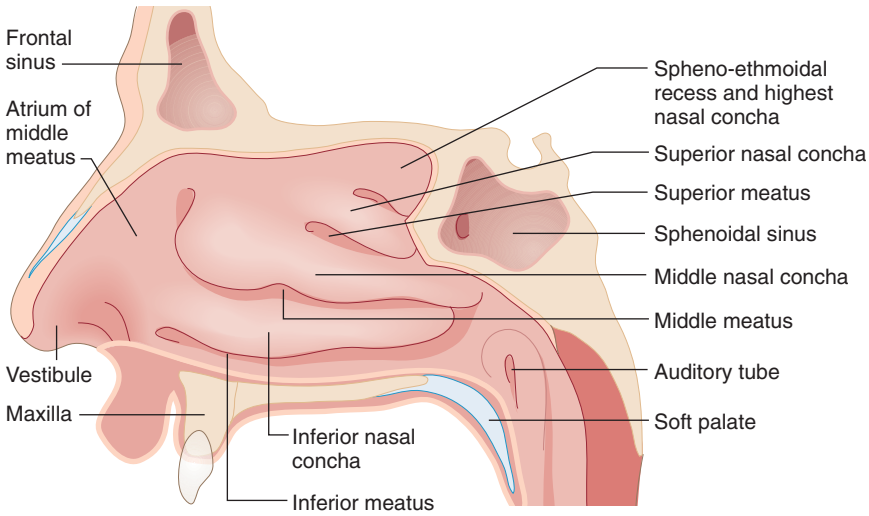

FIGURE 50–1. Lateral view of the nasal passages. (From Williams PL, Warwick R: Gray's Anatomy, 36th ed. London: Churchill Livingstone, 1980.)

Table 50–1 Frequency of Organisms in Acute Pediatric Sinusitis

	Frequency (%)
*Streptococcus pneumoniae**	30–66
Haemophilus influenzae non–type b	20–30
Moraxella catarrhalis	12–28
Staphylococcus aureus	<10

*Seventy percent penicillin resistance.
From Anon JB: Acute bacterial rhinosinusitis in pediatric medicine: current issues in diagnosis and management. Paediatric Drugs 5(Suppl):25–33, 2003.

over time. URI symptoms will usually improve after a week. Most viral URIs have a fever that peaks early in the disease.[1,3,8]

The physical examination often is of limited value because the clinical findings mimic those of a viral URI. The use of an otoscope to examine the nose is recommended.[3] The nasal mucosa should be examined for edematous turbinates, polyps, and foreign bodies. Reproducible facial tenderness on percussion or pressure over the sinuses may be indicative of sinusitis, although complaints of facial pain are not consistent in children.[1]

Chronic Bacterial Rhinosinusitis

Chronic bacterial rhinosinusitis is described as an infection of the sinuses that lasts more than 90 days. Symptoms include persistent nasal congestion, cough, nasal discharge, and halitosis. Headache is a more common symptom in chronic rhinosinusitis, and a history of behavioral changes may also be present.[3]

Important Clinical Features and Considerations

Children with asthma who continue to have persistent symptoms of cough and rhinorrhea despite appropriate asthma therapy may benefit from antibiotic treatment for rhinosinusitis. Resolution of rhinosinusitis in these patients may decrease the number of asthma exacerbations.[5,6]

Intubated patients or patients with a recent history of intubation are at a higher risk of developing rhinosinusitis. Antimicrobial therapy should be aimed at treating *Pseudomonas aeruginosa*, Acinetobacter species, Escherichia species, Enterobacter species, Streptococcus species, and *Staphylococcus aureus*.[9]

Differential Diagnosis

The differential diagnosis for rhinosinusitis includes URI, allergic rhinitis, pneumonia, asthma, nasal foreign bodies and tumors, and immune deficiency (common with human immunodeficiency virus).

Complications

- Frontal sinusitis can result in several complications, including osteomyelitis, intracranial abscesses, meningitis, orbital complications, and dural sinus thrombophlebitis.[10]
- Maxillary sinusitis complications include intracranial abscesses, meningitis, and oral abscesses.
- Sphenoid sinusitis may cause complications as a result of compression or bacterial infiltration and involve the internal carotid artery, cavernous sinus, cranial nerve palsy, ocular disease, intracranial abscess, and meningitis.[11]
- Ethmoid sinusitis has been reported to cause intracranial abscesses, orbital cellulitis, and osteomyelitis.

Imaging Studies

Although rare, children with severe acute and chronic rhinosinusitis are at risk for intracranial pathology. Any child presenting with an abnormal neurologic examination should undergo brain imaging with computed tomography (CT) or magnetic resonance imaging (MRI).[10-12]

Plain Radiography/Sinus Series

These studies have a poor correlation with CT scanning; as many as 75% of them either underestimate or overestimate

disease. Plain radiography is a fairly inaccurate screening method for maxillary sinus disease. Inaccuracies are compounded by mucosal tears, asymmetric facial or sinus development, overlying soft tissue, multiple septal walls, sinus overlap, improper exposure, and head rotation.

Computed Tomography

Thin-cut axial and coronal images of the paranasal sinuses are optimal. A limited number of coronal images alone are used by some as a screening method. Contrast is not necessary for routine sinus evaluation, but it is necessary when a complication such as orbital or intracranial abscess is suspected. The best images for chronic sinusitis are taken at the point of maximal wellness, usually during the last week of a 4-week course of maximal medical therapy. Maximal medical therapy includes appropriate antibiotics and possibly nasal saline irrigations, topical nasal steroids, or decongestants.

A 45% occurrence of incidental sinusitis/opacification has been found on pediatric facial CT scans taken for other reasons. In an asymptomatic patient, no treatment or further workup is necessary. In children younger than 12 years, mucosal thickening or sinus opacification is associated with only a 50% chance of actual sinusitis. During an acute viral URI, the sinuses are routinely opacified on CT scan. In the early stages, URIs do not require treatment with antibiotics.

Anatomic abnormalities, hypoplastic maxillary sinuses, concha bullosa, and changes consistent with cystic fibrosis (e.g., medial displacement of the lateral nasal wall) should be noted on review of CT scans. A thinning of the surrounding bone with wispy areas of calcium density may be observed in patients with allergic fungal sinusitis.

Management

Antimicrobial therapy continues to be the mainstay of the treatment of rhinosinusitis. Because of increasing resistance of bacteria to antibiotics, it is important that treating physicians understand the local resistance patterns in their communities. When used judiciously, antibiotics can decrease the number of symptom days in rhinosinusitis.[13] First-line drugs for acute bacterial rhinosinusitis are listed in Table 50–2. The duration of treatment is from 10 to 14 days or for 7 days after symptoms resolve.[1,3,13]

Adjunctive therapy, such as antihistamines, decongestants, and steroids, is controversial, and there are no definitive data concerning their use. Saline drops may help clear the nasal passages and give some comfort to the patient but do not hasten clinical cure.

Overall, imaging has no role in the diagnosis of uncomplicated acute bacterial rhinosinusitis. It may be useful in cases of chronic rhinosinusitis and in those patients who failed medical therapy and for whom surgery is a possibility (Figs. 50–2 and 50–3). Proper positioning of children for radiographs is difficult, and some children may require sedation for CT or MRI.

All patients require re-evaluation after 72 hours to ensure that the antimicrobial therapy is adequate, and that there is no worsening in the patient's condition. Any deterioration in the patient's condition may necessitate a change in the antibiotic regimen.

Table 50–2 First-Line Drugs for Acute Bacterial Rhinosinusitis

Mild to Moderate Rhinosinusitis	Severe Rhinosinusitis or Nonresponder to Initial Antibiotic Treatment
First Line	
Amoxicillin 45 mg/kg *or* Amoxicillin 90 mg/kg divided bid	Amoxicillin/clavulanate 90 mg/kg (amoxicillin component) divided bid
Amoxicillin Allergy	
Cefdinir 7 mg/kg q12h or 14 mg/kg daily Cefuroxime 30 mg/kg divided bid Cefpodoxime 5 mg/kg q12h	Consider ceftriaxone for those patients unable to tolerate drug by mouth.
Severe Amoxicillin Allergy	
Azithromycin Clarithromycin Clindomycin	If hospitalized, the patient should have a computed tomography scan of the sinuses. Obtain otorhinolaryngology consult and consider starting the patient on vancomycin.

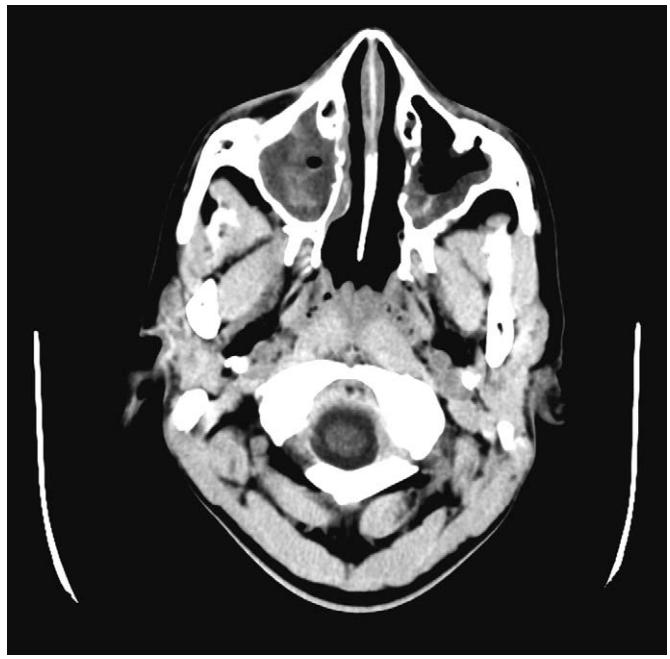

FIGURE 50–2. Computed tomography scan demonstrating maxillary sinusitis (opacified right maxillary sinus).

Summary

Rhinosinusitis affects a large number of children every year. As a result, it is important that clinical criteria be used to decide who has the disease and when to treat. This will decrease the unnecessary use of radiographs and CT scans and allow the appropriate use of antibiotics.

FIGURE 50–3. Computed tomography scan of a child with frontal sinusitis (opacified frontal sinus).

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