

Pediatric Sinusitis

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Sinus Development

- **Ethmoid and the maxillary sinuses form in the third to fourth gestational month so they are present at birth**
- **Sphenoid sinuses are generally pneumatized by 5 years of age**
- **Frontal sinuses appear at age 7 to 8 years but are not completely developed until late adolescence**

Sinus drainage

- **Maxillary sinus, anterior ethmoids, and frontal sinuses empty via the ostium into the middle meatus of the nasal cavity at a location known as the osteomeatal complex in the middle meatus.**
- **Maxillary sinus ostia (openings) are small, tubular structures with a diameter of only 2.5 mm and a length of 6 mm.**

Cilia

Pathogenesis of sinusitis

The involves 3 key factors:

- **Obstruction of the sinus ostia**
- **dysfunction of the ciliary apparatus**
- **thickening of sinus secretions.**

Definitions-Types of sinusitis

- **Acute bacterial sinusitis: Infection lasting less than 30 days in which symptoms resolve completely.**
- **Subacute bacterial sinusitis: Infection lasting between 30 and 90 days in which symptoms resolve completely.**
- **Recurrent acute bacterial sinusitis: Episodes of infections, each lasting less than 30 days and separated by intervals of at least 10 days during which the patient is asymptomatic. (3 episodes of acute bacterial sinusitis in 6 months or 4 episodes in 12 months)**
- **Chronic sinusitis: Episodes lasting more than 90 days. Patients have persistent residual respiratory symptoms such as cough, rhinorrhea, or nasal obstruction.**
- **Acute bacterial sinusitis superimposed on chronic sinusitis: Patients with residual respiratory symptoms develop new respiratory symptoms. When treated with antimicrobials, these new symptoms resolve, but the underlying residual symptoms do not.**

Diagnosing Sinusitis-

- It may be difficult to distinguish children with uncomplicated viral upper respiratory infections or adenoiditis from those with an episode of acute bacterial sinusitis.
- Most viral infections of the upper respiratory tract involve the nose and the paranasal sinuses(viral rhinosinusitis).
- Bacterial infections of the paranasal sinuses do not usually involve the nose. When the patient with bacterial infection of the paranasal sinuses has purulent (thick, colored, and opaque) nasal drainage, the site of infection is the paranasal sinuses; the nose is simply acting as a conduit for secretions produced in the sinuses.

Diagnosing Sinusitis-common predisposing events

- Acute viral upper respiratory infections accounts for -80% of bacterial sinus infections)
- Allergic inflammation (that predisposes to 20% of bacterial sinus infections).
- Children have 6 to 8 viral upper respiratory infections each year; it is estimated that between 5% to 13% of these infections may be complicated by a secondary bacterial infection of the paranasal sinuses.
- Uncomplicated viral upper respiratory infections generally last 5 to 7 days but may last longer.

Etiology of Sinusitis

- *Streptococcus pneumoniae* recovered from 30% of children
- *H influenzae* recovered 20%.
- *M catarrhalis* recovered 20%.
- Sterile aspirate-30% of children
- Approximately 50% of *H influenzae* and 100% of *M catarrhalis* are likely to be b-lactamase positive nationwide.
- 25% of *S pneumoniae* are not susceptible to penicillin –half are highly resistant to penicillin

Etiology of Sinusitis

- Approximately 80% of children with acute bacterial sinusitis will respond to treatment with amoxicillin.
- Risk factors for the presence of bacterial species resistance to amoxicillin include
 - attendance at day care
 - recent receipt(90 days) of antimicrobial treatment
 - age less than 2 years

Acute Sinusitis

- Physical examination-Similar of uncomplicated viral rhinosinusitis
- Nasal mucosa-mild erythema and swelling of the nasal turbinates with mucopurulent discharge.
- Facial pain- unusual complaint in children.
- Facial tenderness -rare finding in small children and may be unreliable as an indicator in older children and adolescents.

- Observed or reported periorbital swelling is suggestive of ethmoid sinusitis.
- Examination of the tympanic membranes, pharynx, and cervical lymph nodes does not usually contribute to the diagnosis of acute bacterial sinusitis.

The objective of treatment of acute bacterial sinusitis

- To foster rapid recovery
- Prevent suppurative complications
- Minimize exacerbations of asthma (reactive airways diseases)

Treatment

- <2 years of age with uncomplicated acute bacterial mild to moderate in degree of severity, who do not attend day care, and have not recently been treated with an antimicrobial, amoxicillin is recommended at either a usual dose of 45 mg/kg/d in 2 divided doses or a high dose of 90 mg/kg/d in 2 divided doses
- The Food and Drug Administration has not approved azithromycin for use in patients with sinusitis.

Treatment-PCN allergy

- If allergic to amoxicillin, either cefdinir (14 mg/kg/d in 1 or 2 doses), cefuroxime (30 mg/kg/d in 2 divided doses), or cefpodoxime (10 mg/kg/d once daily) can be used (only if the allergic reaction was not a type 1 hypersensitivity reaction).
- In cases of serious allergic reactions, clarithromycin (15 mg/kg/d in 2 divided doses) or azithromycin (10mg/kg/d on day 1, 5 mg/kg/d 3 4 days as a single daily dose) can be used in an effort to select an antimicrobial of an entirely different class.

Treatment

Treatment evaluation and failure

- Within 48–72, If a patient fails to improve, either the antimicrobial is ineffective or the diagnosis of sinusitis is not correct.
- If patients do not improve while receiving the usual dose of amoxicillin (45 mg/kg/d), have recently been treated with an antimicrobial, have an illness that is moderate or more severe, or attend day care, therapy should be initiated with high-dose amoxicillin-clavulanate (80–90 mg/kg/d of amoxicillin component, with 6.4 mg/kg/d of clavulanate in 2 divided doses).
- A single dose of ceftriaxone (at 50 mg/kg/d), given either intravenously or intramuscularly, can be used in children with vomiting that precludes administration of oral antibiotics.

Guidelines 2013

- 2013 Guidelines: Key Action Statement 1
Diagnosis of ABS-Acute Bacterial Sinusitis
- Clinicians should make a presumptive diagnosis when a child with an acute URI presents with the following:
- Persistent illness-nasal discharge (of any quality) or daytime cough or both lasting more than 10 days without improvement

- **OR Worsening course-worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement**
- **OR Severe onset-concurrent fever (temperature $\geq 39^{\circ}\text{C}/102.2^{\circ}\text{F}$) and purulent nasal discharge for at least 3 consecutive days**

2013 Guidelines: Key Action Statement 2 –Imaging for diagnosis

- **2A-Clinicians should not obtain imaging studies (plain films, contrast enhanced computed tomography [CT], MRI, or ultrasonography) to distinguish acute bacterial sinusitis from viral URI**
- **2B Clinicians should obtain a contrast enhanced CT scan of the paranasal sinuses and/or an MRI with contrast whenever a child is suspected of having orbital or central nervous system complications of acute bacterial sinusitis**

2013 Guidelines: Key Action Statement 3-Initial Management of Acute Bacterial Sinusitis

- **3A: “Severe onset and worsening course” -prescribe antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course**
- **3B: “Persistent illness.” -Either prescribe antibiotic therapy OR offer additional outpatient observation for 3 days to children with persistent illness (nasal discharge of any quality or cough or both for at least 10 days without evidence of improvement**
- **In contrast to the 2001 guideline-antibiotic therapy for all children diagnosed with acute bacterial sinusitis, new guideline allows for additional observation of children presenting with persistent illness (nasal discharge of any quality or daytime cough or both for at least 10 days without evidence of improvement).**

2013 Guidelines: Key Action Statement 4

- **Clinicians should prescribe amoxicillin with or without clavulanate as first-line treatment when a decision has been made to initiate antibiotic treatment**

2013 Guidelines: Key Action Statement 5A

- **Reassess initial management if there is either a caregiver report of worsening (progression of initial signs/symptoms or appearance of new signs/symptoms) OR failure to improve (lack of reduction in all presenting signs/symptoms) within 72 hours of initial management**
- **If there are worsening symptoms or failure to improve in 72 hours, may change the antibiotic therapy in those initially managed with antibiotic OR initiate antibiotic treatment in those initially managed with observation**

Complications of acute bacterial sinusitis

- **involve either the orbit**
- **central nervous system**
- **or both**
- **Although rare, complications can result in permanent blindness or death if not treated promptly and appropriately.**

Complications of sinusitis

Guidelines 2013: Recommendation 4

Children with complications or suspected acute bacterial sinusitis should be treated promptly and aggressively. This should include referral to an otolaryngologist usually with the consultation of an infectious disease specialist, ophthalmologist, and neurosurgeon

Orbital complications of ABS

SIGNS

- Proptosis
- Ptosis
- Chemosis
- Lid erythema/edema
- Motility restriction

SYMPTOMS

- Ocular/periorbital pain
- Decreased vision
- Diplopia
- Nasal discharge
- Worsening pain on eye movement
- Nasal tenderness

Orbital Complications of ABS

Chandler Classification

- Preseptal Cellulitis
- Postseptal Cellulitis
- Postseptal subperiosteal abscess
- Intraconal Orbital abscess

Cavernous Sinus Thrombosis

Orbital Complications of ABS

- Antibiotics and nasal decongestants
- IV antibiotics (clinda ceftriaxone) directed towards streptococcus, MRSA
- DECONGEST with oxymetazoline, nasal saline, nasal steroids
- Surgery
- Endoscopic sinus surgery directed at ethmoid sinuses for MEDIAL abscesses

May need orbitotomy for SUPERIOR abscesses

- Intracranial complications of ABS
- Much more serious
- Suspect with patients
- Severe headache
- Photophobia
- Seizures
- Focal neurologic deficits
- Previously healthy Adolescent Males
- Epidural empyema
- Subdural empyema

- Venous thrombosis
- Brain abscess
- Meningitis
- May be associated with intracranial extension into frontal lobe

Chronic Rhinosinusitis in Children

- Presence of symptoms for 90 days
- Similar presenting symptoms like those of viral URI or allergic rhinitis
- Difficult to diagnose in children
- Must differential frequent URIs, allergic rhinitis, and CRS
- At least 12 weeks of symptoms include rhinorrhea, nasal obstruction, cough (younger patients). Older children can describe subjective symptoms such as hyposmia, headache, nasal congestion, otalgia, facial pressure/pain

Chronic Rhinosinusitis in Children

Definition:

- Demonstrate two major symptoms
- Or one major + two minor symptoms
- For at least 12 weeks continuously
- Chronic cough is a very common presenting symptom in children
- Nasal obstruction/discharge

Chronic sinusitis in children- Etiology

- Large adenoids (controversial!)
- Adenoids act as biofilm reservoir
- Atopy
- Allergic fungal sinusitis
- Immune deficiency/dysfunction
- GERD
- Mucociliary dysfunction
- Cystic fibrosis
- Kartageners syndrome (Primary ciliary dyskinesia)
- Inhaled pollutants (tobacco smoke)

Medical Therapy

- Treat both infection and inflammation
- Combo of antibiotic and nasal steroid spray
- Most recommend 3-6 weeks of abx
- Resistance is high
- Start with broad spectrum such as
- Augmentin
- Clinda + bactrim (MRSA)
- CF – fluroquinolone for pseudomonas
- Nasal saline irrigations
- Reflux PPI

Additional studies

- CT maxillofacial without contrast
- Preoperative study
- Endoscopically directed cultures
- Sleep study

Chronic Rhinosinusitis-CT imaging

Surgical Management

- Adenoidectomy
- Inferior turbinate reduction
- Functional endoscopic sinus surgery
- Selected populations:
- Ciliary dyskinesia, CF, AFS, immunocompromised
- Often need revision surgery, diff to treat
- Ciliary biopsy

References

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