Snot Sucks!: Assessing, Managing, and Preventing Pediatric Rhinosinusitis

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No disclosures
• Review guidelines from American Academy of Pediatrics and American Academy of Otolaryngology
• Discuss medical and surgical management strategies
• Review imaging workup
• Discuss questions and potential alternative therapies
• Prevention and referral reasons
Sinus Development

• Maxillary – present at birth, expand up to 4-5 years old
• Ethmoid – present at birth, expand with facial growth
• Sphenoid – develop from 2-12 years old
• Frontal – start developing around 6-8 years old and reach mature development around 14-16 years old
Snot Color Analysis Chart

- Normal Snot Color
- Within Acceptable Range
- Watch for Continuing Changes
- Seek Medical Attention
- Emergency Services Necessary
Snot Color?

• Viruses or Bacteria elicit a white blood cell local mucosa response
• Production of iron laden enzymes which given mucus a green color
• Static mucus thickens and turns yellow or green
• Green snot ≠ Antibiotics
• “It is likely that if antibiotics are prescribed and a patient recovers, the latter had little to do with the former”
Acute vs Chronic Rhinosinusitis

Acute
• Less than 30 days
• 80-90% viral
• Acute edema leading to decreased mucociliary clearance
• Possible fever
• Primary symptoms are drainage congestion, obstruction

Chronic
• More than 90 days
• Allergy, cystic fibrosis, ciliary dyskinesia, GERD, immune dysfunction
## Viral vs Bacterial

<table>
<thead>
<tr>
<th>Viral</th>
<th>Bacterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 7-10 days</td>
<td>• 10-30 days</td>
</tr>
<tr>
<td>• Peaks at 5 days then improves</td>
<td>• Double worsening after 5 days</td>
</tr>
<tr>
<td>• Afebrile or early fever</td>
<td>• Persistent, nonimproving symptoms despite OTC measures</td>
</tr>
<tr>
<td>• Clear to purulent to clear drainage</td>
<td>• Persistent fever possible</td>
</tr>
</tbody>
</table>
Differential Diagnosis of Rhinitis

• Allergic rhinitis
• Adenoiditis
• GERD or laryngopharyngeal reflux (LPR)
• Foreign body
• Choanal atresia
Diagnosis:

- Persistent illness, nasal discharge, daytime cough lasting more than 10 days without improvement
- Worsening course
- Severe onset, concurrent fever and purulent discharge for at least 3 consecutive days
Imaging

• Clinicians should not obtain imaging (plain films, CT, MRI) for acute uncomplicated bacterial sinusitis

• High likelihood of abnormal imaging even in viral URI

• Clinicians should obtain contrast CT and/or MRI if there is suspected orbital or CNS complications
• Prospective study of 70 children with recurrent sinusitis
• Same day Xray and CT
• 75% of plain films did not correlate with CT findings
• 45% had normal plain film with at least one sinus abnormality on CT
• Can be under or overdiagnosed with plain films alone
Initial Management

• Clinician should prescribe antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course OR observe for 3 days, then treat for persistent symptoms

• 82% antibiotic prescription rate for acute sinusitis

• First line antibiotic – amoxicillin with or without clavulanate

• *Streptococcus pneumoniae, Hemophilus influenza, Moraxella catarrhalis*

• *Staph aureus* – more likely to cause orbital or intracranial complications
• 45mg/kg/day divided into 2 doses – increase to 90 mg/kg/day if community with high prevalence of S. pneumoniae

• Cephalosporin for PCN allergic patients

• Reassess after 3 days – alter antibiotic if no improvement

• Amoxcillin → Augmentin

• Augmentin → Clindamycin and cefixime
Adjuvant Therapy
• Intranasal steroids
• Saline irrigations
• Nasal decongestants
• Mucolytics
• Antihistamines

*No strong evidence to suggest role for these in management of acute bacterial sinusitis*
Orbital Complications

Chandler’s classification

I. Inflammatory edema (preseptal)  Lid edema, no limitation in ocular movement or visual change.

II. Orbital cellulitis (postseptal)  Diffuse orbital infection and inflammation without abscess formation.

III. Subperiosteal abscess  Collection of pus between medial periosteum and lamina papyracea, impaired extraocular movement.

IV. Orbital abscess  Discrete pus collection in orbital tissues, proptosis and chemosis with ophthalmoplegia and decreased vision.

V. cavernous sinus thrombosis  Bilateral eye findings and worsening of all other previously described findings.
Preseptal Cellulitis

- Periorbital inflammation
- Globe is spared
- Normal EOM
- PO antibiotics
Postseptal cellulitis

- Typically older than 7
- Globe with chemosis and erythema
- EOM restricted
- IV antibiotics
Subperiosteal Abscess

• Imaging if restriction or pain with eye movement, proptosis
• Less than 9 years old or less than 1 cm width usually get better with IV antibiotics alone
• Low threshold to rescan if not showing clinical improvement
Chronic Rhinosinusitis

• Etiology – inflammatory obstruction of natural sinus ostia secondary to viral or bacterial infection
• Abnormal mucociliary clearance
• Immune deficiencies
• Cystic fibrosis, CF carriers
Clinical Consensus Statement: Pediatric Chronic Rhinosinusitis

Scott E. Brietzke, MD, MPH, Jennifer J. Shin, MD, Sukgi Choi, MD, Jivianne T. Lee, MD, Sanjay R. Parikh, MD, Maria Pena, MD, Jeremy D. Prager, MD, Hassan Ramadan, MD, Maria Veling, MD, Maureen Corrigan, and Richard M. Rosenfeld, MD, MPH

Table 1. Definition and Diagnosis of Pediatric Chronic Rhinosinusitis Statements Reaching Consensus.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Mean</th>
<th>Outliers</th>
<th>Quality Improvement Opportunity</th>
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<tbody>
<tr>
<td>1</td>
<td>Chronic rhinosinusitis (PCRS) is defined as at least 90 continuous days of 2 or more symptoms of purulent rhinorrhea, nasal obstruction, facial pressure/pain, or cough and either endoscopic signs of mucosal edema, purulent drainage, or nasal polyposis and/or CT scan changes showing mucosal changes within the ostiomeatal complex and/or sinuses in a pediatric patient aged 18 years or younger (Adapted from European Position Paper on Rhinosinusitis and Nasal Polyps 2012).</td>
<td>7.56</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>2</td>
<td>Management of children aged 12 years and younger with CRS is distinctly different than management of children aged 13 to 18 years old with CRS.</td>
<td>7</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>3</td>
<td>Nasal endoscopy (flexible or rigid) is appropriate in evaluating a child with CRS to document purulent drainage, mucosal edema, nasal polyps, and/or adenoid pathology (hyperplasia, infection).</td>
<td>7.67</td>
<td>1</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>4</td>
<td>Management of the children with nasal polyps and CRS is distinctly different than management of children with CRS unaccompanied by nasal polyps.</td>
<td>8.22</td>
<td>0</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
<tr>
<td>5</td>
<td>Allergic rhinitis is an important contributing factor to PCRS, especially in older children.</td>
<td>7.56</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>6</td>
<td>Adenoiditis is an important contributing factor to PCRS, especially in younger children.</td>
<td>7.67</td>
<td>1</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>7</td>
<td>The ability of adenoids to serve as a bacterial reservoir for PCRS is independent of adenoid size.</td>
<td>7.67</td>
<td>1</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
<tr>
<td>Number</td>
<td>Statement</td>
<td>Subgroup</td>
<td>Status</td>
<td>Mean</td>
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<tr>
<td>8</td>
<td>Gastroesophageal reflux disease (GERD) can contribute to pediatric chronic rhinosinusitis (PCRS).</td>
<td>Definition and Diagnosis of PCRS</td>
<td>No consensus</td>
<td>6.11</td>
</tr>
<tr>
<td>14</td>
<td>Appropriate antibiotic therapy for PCRS includes a minimum of 10 consecutive days of an antimicrobial medication that is effective against typical rhinosinusitis pathogens.</td>
<td>Medical Management of PCRS</td>
<td>No consensus</td>
<td>6.22</td>
</tr>
<tr>
<td>15</td>
<td>Medical therapy for PCRS should include treatment for GERD when signs or symptoms of GERD are present.</td>
<td>Medical Management of PCRS</td>
<td>No consensus</td>
<td>6.22</td>
</tr>
<tr>
<td>16</td>
<td>Current evidence supports a role for topical antibiotic therapy in managing selected children with CRS.</td>
<td>Medical Management of PCRS</td>
<td>No consensus</td>
<td>4.67</td>
</tr>
<tr>
<td>17</td>
<td>Current evidence supports a role for antral irrigation in managing selected children with CRS.</td>
<td>Medical Management of PCRS</td>
<td>No consensus</td>
<td>4.56</td>
</tr>
<tr>
<td>22</td>
<td>Adenoidectomy is an effective first-line surgical procedure for children aged 13 years and older with CRS.</td>
<td>Adenoidectomy</td>
<td>No consensus</td>
<td>3.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adenoidsitis</td>
<td></td>
<td></td>
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<td>29</td>
<td>Balloon sinuplasty is safe for treating children with PCRS.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>Near consensus</td>
<td>6.56</td>
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<tr>
<td>30</td>
<td>Balloon sinuplasty is effective for treating patients with PCRS.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>No consensus</td>
<td>5.33</td>
</tr>
<tr>
<td>31</td>
<td>Inferior turbinate reduction can benefit children with CRS by reducing nasal congestion and improving penetration of topical medications.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>No consensus</td>
<td>6.22</td>
</tr>
<tr>
<td>32</td>
<td>Inferior turbinate reduction is a safe and minimally invasive adjunctive procedure for treating PCRS.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>No consensus</td>
<td>6.11</td>
</tr>
<tr>
<td>33</td>
<td>Children with swollen, enlarged inferior turbinates on preoperative assessment that have not responded to medical therapy are most likely to benefit from bilateral inferior turbinate reduction.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>No consensus</td>
<td>6.33</td>
</tr>
<tr>
<td>34</td>
<td>Reduction or removal of an obstructive middle turbinate concha bullosa when present is a valuable component of the surgical management of PCRS.</td>
<td>Endoscopic Sinus Surgery/ Turbinoplasty</td>
<td>Near consensus</td>
<td>6.78</td>
</tr>
</tbody>
</table>
Conflicting Opinions/Evidence

• GERD can contribution to pediatric CRS
• Length of antibiotic therapy (at least 10 days?)
• Role of topical antibiotic therapy
• Antral irrigation in selected patients
• Adenoidectomy over age 13
• Balloon sinuplasty – is it safe/effective?
• Role of inferior turbinate reduction
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<tr>
<td>9</td>
<td>Twenty consecutive days of antibiotic therapy may produce a superior clinical response in PCRS patients compared to 10 days of antibiotic therapy.</td>
<td>7.44</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>10</td>
<td>Culture-directed antibiotic therapy may improve outcomes for PCRS patients who have not responded to empiric antibiotic therapy.</td>
<td>8</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>11</td>
<td>Daily, topical nasal steroids are a beneficial adjunctive medical therapy for PCRS.</td>
<td>7.44</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>12</td>
<td>Daily, topical nasal saline irrigations are a beneficial adjunctive medical therapy for PCRS.</td>
<td>7.78</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>13</td>
<td>Empiric treatment for gastroesophageal reflux disease (GERD) is not a beneficial adjunctive medical therapy for PCRS.</td>
<td>7</td>
<td>0</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
</tbody>
</table>
Medical Management

• 20 consecutive days of antibiotics superior to 10 days
• Culture directed antibiotic therapy may improve outcomes in patients who have not responded to empiric therapy
• Daily topical steroids
• Daily nasal saline irrigations
• Empiric therapy for GERD not recommended
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<tbody>
<tr>
<td>18</td>
<td>Adenoidectomy is an effective first line surgical procedure for children up to 6 years of age with chronic rhinosinusitis (CRS).</td>
<td>8.33</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>19</td>
<td>Adenoidectomy is an effective first-line surgical procedure for children aged 6 to 12 years with CRS.</td>
<td>7.11</td>
<td>1</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>20</td>
<td>Adenoidectomy can have a beneficial effect in patients with pediatric CRS that is independent of endoscopic sinus surgery (ESS).</td>
<td>7.33</td>
<td>1</td>
<td>Educating and empowering clinicians and patients</td>
</tr>
<tr>
<td>21</td>
<td>Tonsillectomy (without adenoidectomy) is ineffective treatment for PCRS.</td>
<td>8.56</td>
<td>0</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
</tbody>
</table>
Adenoidectomy

• Effective first line procedure for children up to 6 and between 6-12 with CRS
• Adenoidectomy alone is beneficial without endoscopic sinus surgery
• Tonsillectomy alone is not effective for CRS
Lateral Neck Xray
Table 5. Endoscopic Sinus Surgery/Turbinoplasty Statements Reaching Consensus.

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<tbody>
<tr>
<td>23  Endoscopic sinus surgery (ESS) is an effective procedure for treating pediatric chronic rhinosinusitis (PCRS) that is best performed after medical therapy, adenoidectomy, or both have failed.</td>
<td>7.89</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>24  A CT scan of the paranasal sinuses is indicated prior to ESS to assess structure, development, and extent of disease.</td>
<td>8.56</td>
<td>0</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>25  Image-guided ESS is useful for revision ESS cases and/or for patients with extensive nasal polyposis that can distort anatomical landmarks.</td>
<td>8.22</td>
<td>1</td>
<td>Promoting appropriate care</td>
</tr>
<tr>
<td>26  There is a lack of convincing evidence that ESS causes a clinically significant impairment of facial growth when performed in children with CRS.</td>
<td>7</td>
<td>0</td>
<td>Educating and empowering clinicians and patients</td>
</tr>
<tr>
<td>27  Postoperative debridement after ESS for PCRS is not essential for treatment success.</td>
<td>7</td>
<td>1</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
<tr>
<td>28  The effectiveness of balloon sinuplasty compared to traditional ESS for PCRS cannot be determined based on current evidence</td>
<td>7.89</td>
<td>0</td>
<td>Reducing inappropriate or harmful care</td>
</tr>
</tbody>
</table>
Sinus Surgery

• Effective, best performed after failure of medical therapy and adenoidectomy
• CT scan is indicated prior to surgery
• No evidence to suggest that sinus surgery impairs facial growth and development
• The effectiveness of balloon sinuplasty compared to sinus surgery cannot be determined based on current evidence
Complementary and Alternative Medication

• 70% of patients do not tell their physicians they are taking alternative medication or supplements
• Increased market, availability and interest
• Frequent question, especially from moms
• Very little if any evidence but some reasonably powered studies show promise
Dairy?

• Several studies have failed to show relationship between dairy and mucus production
• Certain cow breeds produce milk with beta-CM-7 which can stimulate mucus glands in genetically susceptible people
• Dairy allergy does not cause nasal symptoms in isolation
• Higher chance of milk allergy in patients with polyps
• Correlation but not causation
Honey?

• Local – does it really help with allergies → no evidence to support this
• 2002 study in Annals of Allergy showed not difference between local honey, commercially processed honey, and honey flavored placebo in controlling allergy symptoms
• Manuka honey
• High sugar concentration dehydrates bacteria
• Slowly releases hydrogen peroxide
• Low pH prevents bacterial growth
• Methylglyoxal (MGO) – natural antibiotic
Papain and Bromelain

- Papaya and Pineapple extract
- Proteolytic enzymes reduce swelling in respiratory mucosa
Prevention and Maintenance Strategy

• Hand hygiene

• Control of allergic inflammation – Allergy referral if failing antihistamine and nasal corticosteroids

• NasalCrom, Sensimist

• Allegra, Zyrtec > Claritin

• Saline mist or irrigation

• NoseFrida
ENT Referral

• Chronic persistent worsening symptoms of 3 months or more
• Failed allergy measures or negative allergy testing
• Recurrent acute infections – 4 or more in a year
• Persistent nasal obstruction, snoring, OSA
• Single sided rhinorrhea that is foul smelling
• Cystic fibrosis
• Immunodeficiency
Questions?