Chronic Rhinosinusitis in Children

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Disclosures
• None

Learning Objectives
• Differentiate between sinusitis in children and common cold or allergy
• Develop an appropriate plan of medical management of a child with sinusitis.
• Recognize when referral for surgery may be necessary and what the surgical options are for children.
Chronic Rhinosinusitis: Clinical Definition

- Inflammation of the nose and paranasal sinuses characterized by 2 or more symptoms one of which should be either nasal blockage/obstruction/congestion or nasal discharge (anterior/posterior nasal drip):
  - + cough
  - + facial pain/pressure
- and either:
  - Endoscopic signs of disease and/or relevant CT changes
- Duration: > 12 weeks without resolution

Health Impact of Chronic Recurrent Rhinosinusitis in Children

CHQ-PF50 results for Role/Social-Physical

Rhinosinusitis group had lower scores than all other diseases (p<0.05)

Cunningham MJ, AOHNS 2000

Rhinosinusitis and the Common Cold MRI Study

- Sixty (60) children recruited within 96 hrs of onset of URI sx between Sept-Dec 1999 in Finland.
- Average age = 5.7 yrs (range = 4-7 yrs).
- Underwent an MRI and symptoms were recorded.

26 of the children with major abnormalities had a repeat MRI after 2 weeks with a significant improvement in MRI findings although 2/3rds still had abnormalities.

Anatomical Factors

- No good studies in pediatrics
- No studies comparing anatomic abnormalities in children with CRS to control children
- One study showed no correlation between anatomic abnormalities and extent of sinus disease in CT scans of 65 children with CRS (Al Qudah 2008).
Bacteriologic Findings of Pediatric CRS (maxillary sinus punctures)

<table>
<thead>
<tr>
<th>Species</th>
<th>No. cultured</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Hemolytic Streptococcus</td>
<td>83 (20.8%)</td>
</tr>
<tr>
<td><em>H influenzae</em></td>
<td>78 (19.5%)</td>
</tr>
<tr>
<td><em>S pneumoniae</em></td>
<td>56 (14.0%)</td>
</tr>
<tr>
<td>Coagulase-negative Staph</td>
<td>52 (13.0%)</td>
</tr>
<tr>
<td><em>S aureus</em></td>
<td>37 (9.3%)</td>
</tr>
<tr>
<td>Anaerobes</td>
<td>32 (8.0%)</td>
</tr>
<tr>
<td><em>M catarrhalis</em></td>
<td>21 (5.3%)</td>
</tr>
<tr>
<td>Corynebacterium species</td>
<td>16 (4.0%)</td>
</tr>
<tr>
<td>Neisseria species</td>
<td>6 (1.5%)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>18 (4.5%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>399</strong></td>
</tr>
</tbody>
</table>


Resistance Rates for *H flu*

- Amplification
- Eto-tomarocile
- Increasing trend of rates of *H flu*
- Resistance to ampicillin (p=0.07)


Role of Adenoids
Adenoiditis vs CRS

- Difficult to distinguish between chronic adenoiditis and CRS.
- Clinical symptoms and exam findings are identical.
- CT scan will allow us to differentiate between the 2 entities.
- Bhattacharyya 2004:
  - CT score >5 suggestive of CRS
  - Score <5 adenoiditis

Adenoid Biofilm in Pediatric CRS

- 16 adenoid samples collected from 4 girls and 12 boys:
  - Age 3 mos to 10 yrs.
  - 7 with CRS failed maximal Rx
  - 9 with OSA
- SEM imaging of the adenoid surface to determine percent surface area covered by biofilm.

Adenoid Biofilm in Pediatric CRS


Chronic Inflammation

• Maxillary sinus biopsies from children with CRS.
• Median age: 3.9 yrs, Range: 1.4-8.2 yrs
• Compared to archival tissue from maxillary sinuses of adults with CRSsNP.

CRS in Young Children

Table I. Inflammatory cell profiles in the sinus submucosa of children with CRS and adult CRS controls

<table>
<thead>
<tr>
<th>Inflammatory cells</th>
<th>Pediatric CRS (N = 19)</th>
<th>Adult CRS (N = 5)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutrophils</td>
<td>37 (2-138)</td>
<td>12 (3-46)</td>
<td>.14</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>469 (181-1880)</td>
<td>294 (228-328)</td>
<td>.02</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>13 (6-56)</td>
<td>82 (29-256)</td>
<td>.01</td>
</tr>
<tr>
<td>Plasma cells</td>
<td>88 (8-366)</td>
<td>58 (25-121)</td>
<td>.52</td>
</tr>
<tr>
<td>TOTAL</td>
<td>678 (204-2280)</td>
<td>510 (295-677)</td>
<td>.14</td>
</tr>
<tr>
<td>MBP+ cells</td>
<td>15 (0-51)</td>
<td>47 (33-212)</td>
<td>.01</td>
</tr>
</tbody>
</table>

Less eosinophilic, more lymphocytic inflammation in children

CRS in Young Children

Workup
Diagnostic tests

- Appropriate History
- Nasal endoscopy
- Middle meatal cultures
- CT scans
- Miscellaneous testing:
  - Allergy testing (RAST, skin test)
  - Immunoglobulin quantitation
  - Sweat chloride
  - Biopsy for evaluation of cilia

Rhinovirus-Associated Conditions

- Allergic rhinitis
- Asthma
- Nasal polyps
- Aspirin hypersensitivity
- Cystic fibrosis
- Immune deficiencies
- Gastroesophageal reflux disease
- Primary Ciliary Dysmotility

CRS and Allergy in Children

- 2200 children referred for chronic respiratory symptoms
- 351 fulfilled criteria for CRS (sxs >12 weeks)
- Underwent SPT and serum IgE
- Positive SPT to at least 1 allergen/hi IgE: 29.9%
- Most frequent pos as: pollens, dustmites, molds and animal dander.
- General prevalence of allergy in children in Italy = 31.8%

Sinusitis and Asthma

• 48, nonrandomized children (mean age=8.2 yrs)
  – moderate to severe asthma
  – Almost daily wheezing for 7 months
• Pharmacologic or surgical intervention for associated sinusitis:
  – 80% able to discontinue asthma medications
  – 80% had normal findings on x-ray films
• Asthma recurred when sinusitis subsequently developed


Sinusitis and Asthma

• 18 children (5-12 yrs) with moderate asthma (poorly controlled by ICS) and CRS.
• Treated with Amox/Clav, systemic steroids and INS x 2 weeks
• All improved their asthma control
  – 8/18 becoming intermittent asthma
  – 10/18 becoming mild asthma
• Nasal inflammatory markers:
  – Inflammatory cells decreased
  – IL-4 (TH2) decreased
  – IFN-γ (TH1) increased

Specific Antibody Deficiency (SAD)

- Impaired response to immunization with polysaccharide antigens in the presence of normal quantitative immunoglobulin levels.
- Sinopulmonary infections with *S. pneumoniae*, *M. catarrhalis*, *H. influenzae*, and *S. aureus* most common manifestations.
- SAD recognized in 5-20% of children >2yrs old who suffer from recurrent or severe infections.

SAD in Adults with CRS

![Diagram](Carr TF, et al. Am J Rhinol Allergy 2011;25:241-44.)
Immunodeficiency and CRS

- Evaluate the following:
  - IgE, G, M, A, and IgG subclasses
  - Antibody levels before and after vaccination with H. influenzae and Strep pneumoniae
- If abnormalities detected, immunize and repeat titers, refer to allergist/immunologist
- Consider IVIG or SCIG

Sinusitis: GERD

- Children aged 2-18 yrs referred for evaluation of chronic sinus disease from Dec 1996 through April 1998.
- Criteria for participation in the study:
  - >3 months of multiple clinical sinus sx
  - Failure of maximal medical management
  - Evidence of disease on CT scan after Rx
- Underwent evaluation by dual pH probes: esophageal and nasopharyngeal
- Symptom questionnaires were also obtained

Phipps CD et al. AOHNS 2000;126:831-36.
Primary Ciliary Dysmotility

- Primary or with Situs Inversus (Kartagener's syndrome).
- Suspected if child has recurrent infections at multiple sites: otitis, sinusitis, pneumonias.
- Ciliary biopsy is best diagnostic test.
- Site of biopsy best from non-infected location (carina).
- Test directly by light microscopy or later by electron microscopy.
- Reliability of test variable at different centers.

Radiologic Testing

Computed Tomography

5 y.o. with chronic cough and nasal drainage
Computed Tomography

Adenoid views

Computed Tomography

Cystic fibrosis

SxS and CT Scans in Pediatric CRS

$r_s = 0.67$
$p < 0.0001$

Useful tool for clinical follow up

Treatment of Chronic Rhinosinusitis

- Chronic inflammatory disease
- Doubtful contribution of bacteria
- Shift in strategy to favor anti-inflammatory Rx vs anti-bacterial
- Reduce usage of antibiotics

Antibiotics

<table>
<thead>
<tr>
<th>Author</th>
<th>Intervention</th>
<th>Age Range</th>
<th>Outcome</th>
<th>Category of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams 2006</td>
<td>Azithromycin (5 days) and clarithromycin</td>
<td>5-19 years</td>
<td>100% response rate in the first week</td>
<td>B</td>
</tr>
<tr>
<td>Lin 2011</td>
<td>Azithromycin (5 days) and clarithromycin</td>
<td>5-19 years</td>
<td>80% resolution of sinusitis</td>
<td>B</td>
</tr>
<tr>
<td>Cole 1999</td>
<td>Azithromycin (5 days) and clarithromycin</td>
<td>2-&lt;15 years</td>
<td>No difference in resolution rate</td>
<td>C</td>
</tr>
<tr>
<td>Abelson 1994</td>
<td>Azithromycin (5 days) and clarithromycin</td>
<td>5-19 years</td>
<td>No difference in resolution rate</td>
<td>C</td>
</tr>
</tbody>
</table>

Available data does not justify the use of short-term oral antibiotics for the treatment of CRS in children (Strength of recommendation: B).
Available data does not justify the use of intravenous antibiotics alone for the treatment of CRS in children (Strength of recommendation: C).
Antibiotic Choices for Children

• Initial choices:
  – Amoxicillin/clavulanate (Augmentin®)
  – Cefdinir (Omnicef®)
  – Cefpodoxime proxetil (Vantin®)
  – Cefuroxime axetil (Ceftin®)
  – Amox/clav (Augmentin ES 600®)

• For patients with β-lactam allergies:
  – TMP/SMX, azithromycin, clarithromycin or erythromycin
  – Limited effectiveness with bacteriologic failure rates of 20-25%
  – Clindamycin
  – Consider quinolones

• Switch therapy includes interchanging the above, re-evaluating the pt and combination Rx

Adjunctive Therapy

• Saline irrigation
• Intranasal steroids
• Systemic steroids
• Systemic decongestants
• Topical decongestants
• Antihistamines
• Mucus thinners

Nasal Saline Irrigation

• Increasing perception that nasal saline contributes to resolution of sx & inflammation:
  – Improved mucus clearance
  – Enhanced ciliary beat activity
  – Clearance of allergen/biofilm/mediators

Harvey R, et al. Cochrane Database 2009
Nasal Saline Irrigation

- Adults and children with sx of CRS (sx of persistent sino-nasal disease).
  - Rhinitis with seasonal exacerbations
  - Perennial rhinitis
  - Recurrent acute sinusitis with ongoing sx
  - Chronic rhinosinusits
- CT documentation not required
- Saline administered as douche, irrigation, pulsed, spray, or nebulizer
- Outcome measures: QOL and sx

Harvey R, et al. Cochrane Database 2009

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Nasal Saline Irrigation

- Wide range of delivery techniques
- Duration: 7 do-6 mos
- Comparators:
  - Saline vs no saline
  - Saline vs Placebo (refloxology)
  - Standard Rx + saline
  - Saline alone vs active agent
  - Hypertonic vs isotonic saline
  - 7/8 hypertonic saline
  - 2/8 children

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Nasal Saline Irrigation

Conclusions

- Beneficial effects of saline appear to outweigh the drawbacks for the majority of patients with chronic sinonasal symptoms.
- No evidence that saline is more effective than active agents.

Harvey R, et al. Cochrane Database 2009
Compliance with Saline Irrigation

- Retrospective study.
- Children with nasal congestion and rhinorrhea (sinusitis, allergic rhinitis, chronic rhinitis).
- Therapeutic course of isotonic nasal saline (100 ml/nostril) recommended and questionnaire administered 2-4 months later.

Table 1: Patient demographics.

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 years</td>
<td>8 (12.5%)</td>
</tr>
<tr>
<td>3-6 years</td>
<td>14 (20%)</td>
</tr>
<tr>
<td>6-12 years</td>
<td>19 (27%)</td>
</tr>
<tr>
<td>12 years and older</td>
<td>45 (67%)</td>
</tr>
</tbody>
</table>


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Compliance with Saline Irrigation


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Intranasal Steroids
Fluticasone Propionate as Adjunctive Therapy in Acute Rhinosinusitis

- Double-blind, randomized, parallel-group, multi-centered, placebo-controlled.
- Allergic or nonallergic, age ≥12 years.
- Received either FP200 mcg QD or placebo for 49 ds. All patients received cefuroxime axetil 250 mg BID for the first 21 ds of the treatment period.
- Patients were required to have from 7 through 28 days of symptoms prior to Visit 1.


Individual Sinusitis Symptoms
Clinician-Rated Symptoms at Endpoint


Effect of Intranasal Steroids on CRSsNP in Adults


Intranasal Steroids

Nasal corticosteroid treatment is a first line treatment in CRS with and without nasal polyps in children (Strength of recommendation: D).

EPOS2012

Systemic Steroids

• Commonly used to treat inflammatory disorders of the sinuses unresponsive to intranasal steroids (polyps, severe congestion)
• Evidence suggests efficacy in improving the sense of smell and nasal airway resistance in patients with nasal polyposis
• Recent trial in the pediatric age group

Steroids and Antibiotics in Pediatric CRS

• Randomized, placebo-controlled, double blind trial
• Children with CRS with S/S>3mos with CT abnormalities
• All received PO Amox/Clav (45/6.4 mg/kg/d) for 30 ds
• Randomized to receive methylprednisolone or placebo PO for first 15 days:
  – 1mg/kg/d (max 40 mg) for 10 ds
  – 0.75 mg/kg/d for 2 ds
  – 0.5 mg/kg/d for 2 days
  – 0.25 mg/kg/d for 1 day

Steroids and Antibiotics in Pediatric CRS

**Table I. Baseline characteristics of patients**

<table>
<thead>
<tr>
<th></th>
<th>MP group</th>
<th>Placebo group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y ± SD)</td>
<td>8.5 (2.9)</td>
<td>8.0 (2.3)</td>
<td>NS</td>
</tr>
<tr>
<td>Male/Female</td>
<td>148</td>
<td>159</td>
<td></td>
</tr>
<tr>
<td>Weight (kg ± SD)</td>
<td>28.4 (11.7)</td>
<td>26.3 (7.7)</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of symptoms (mo ± SD)</td>
<td>16.8 (17.1)</td>
<td>20.5 (13.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Smoking in household, no. (%)</td>
<td>6 (27)</td>
<td>7 (30)</td>
<td>NS</td>
</tr>
<tr>
<td>Anorexia, no. (%)</td>
<td>8 (36)</td>
<td>10 (43)</td>
<td>NS</td>
</tr>
<tr>
<td>Blood eosinophil count (SD)</td>
<td>274 (183)</td>
<td>322 (247)</td>
<td>NS</td>
</tr>
<tr>
<td>Total symptom score (SD)</td>
<td>35.1 (8.2)</td>
<td>36.5 (6.3)</td>
<td>NS</td>
</tr>
</tbody>
</table>

*All parameters were insignificant between the groups. MP, Methylprednisolone; NS, not significant.


**Figure**

Bar chart showing changes in symptoms and CT scores.


**Diagram**

CRS/NP in young children management scheme for (ENT) specialists.

20
Surgical Treatment

- Significant differences of opinion
- No uniformity in the studies available
- Diagnosis: some based on CT scan, some based on clinical impression
- No validated instruments were used to measure outcome: phone interviews, medical record reviews etc…
- Duration of follow up: 6 months - 24 months

Surgical Treatment

- Surgery for chronic rhinosinusitis should only be considered after medical treatment failure
- Which surgical procedure to perform

Surgical treatment:
Indications

- Orbital complications
- CNS complications
- Severe polyposis (CF)
- Immune-deficiency disorders
- Fungal rhinosinusitis
Adenoiditis and Rhinosinusitis

- 2000 - Bernstein found that bacteria from adenoids correlated with lateral wall cultures in 89% of the cases
- 2007 - Coticchia et al 95% of adenoids in CRS had biofilm compared to 2% in controls
- 2008 – Shin et al 79% correlation between bacteriology of adenoids and stage of CRS in children

Surgical Treatment

- Adenoidectomy
- Balloon dilation with a wash
- ESS
Adenoidectomy

- Takahashi 1989; 25/45 (56%) success with adenoidectomy
- Vandenberg 1997; 25/43 (58%) success with adenoidectomy for symptoms of CRS in 43 children
- Ramadan 2004; 33/64 (52%) success in 30 children with documented CRS

Adenoidectomy

- Which children were the failures of adenoidectomy for CRS
- Ramadan, Tiu 2007; 55 patients who failed adenoidectomy and required ESS
- Variables evaluated included age, gender, CT score, asthma and allergy
Asthma

Age

Asthma & Rhinosinusitis

- Marseglia et al 2010; Int J Immunopathol
- CRS & Asthma are not simply localized disease processes
- Systemic inflammatory disease
- There is strong correlation between severity of asthma and imaging features of CRS
- In moderate to severe asthmatics, the sinuses should always be investigated regardless of presence or absence of nasal symptoms
### CRS vs CA
Makary C, Ramadan H - AJR 2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>233</td>
</tr>
<tr>
<td>Male sex</td>
<td>142 (61%)</td>
</tr>
<tr>
<td>Mean age</td>
<td>5.5</td>
</tr>
<tr>
<td>Allergy</td>
<td>92 (47.7%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>85 (39.9%)</td>
</tr>
<tr>
<td>Mean Ct score</td>
<td>6.4</td>
</tr>
</tbody>
</table>

### CRS vs CA
Makary C, Ramadan H - AJR 2014

<table>
<thead>
<tr>
<th>Variable</th>
<th>CRS</th>
<th>CA</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>127 (57%)</td>
<td>97 (43%)</td>
<td>0.52</td>
</tr>
<tr>
<td>Male sex</td>
<td>80 (63%)</td>
<td>57 (59%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Mean age</td>
<td>5</td>
<td>6.4</td>
<td>0.0001</td>
</tr>
<tr>
<td>Allergy</td>
<td>56 (48%)</td>
<td>45 (51%)</td>
<td>0.68</td>
</tr>
<tr>
<td>Asthma</td>
<td>53 (43%)</td>
<td>39 (42%)</td>
<td>0.77</td>
</tr>
<tr>
<td>Mean Ct score</td>
<td>9.7</td>
<td>2.6</td>
<td>0.0001</td>
</tr>
<tr>
<td>Success</td>
<td>54 (43%)</td>
<td>54 (65%)</td>
<td>0.0017</td>
</tr>
</tbody>
</table>

### CRS vs CA
Makary C, Ramadan H - AJR 2014

- **Asthma**
  - CRS 28%
  - CA 53%
- **No Asthma**
  - CRS 56%
  - CA 71%
Surgical Treatment

- Adenoidectomy
- Balloon dilation with a wash
- ESS

Adenoidectomy with wash + IV A/biotics

- Buchman et al 1999; 27 patients had sinus wash and culture via the inferior meatus
- 89% had resolution of sxs on IV antibiotics
- ? Adenoidectomy, wash or IV a/biotics

Adenoidectomy + Wash & Rhinosinusitis

- 2006 – Adappa & Coticchia 22 children with CRS had sinus wash with adenoidectomy and IV antibiotics
- 89% were doing well after long-term follow-up
Ramadan 2007; 60 children had adenoidectomy for CRS
32 had also sinus wash and culture via the middle meatus
All had post-op oral a/biotics for 2 weeks

Adenoidectomy group had 60% success at 12 months follow up
Adenoidectomy-sinus wash group had 88% success rate at 12 months follow up
Those with a high (>6) CT score & Asthmatics had better success than adenoidectomy alone

Criddle 2008; 23 children had adenoidectomy with a sinus wash for CRS
Only 7 had CT scan
All had 2 post-op oral a/biotics for 2 weeks
86% had long term resolution rate
Intact Study
Ramadan HH et al. American J of Rhinology & Allergy; 24(1):54-56

• Establish safety & outcome of balloon sinus dilation for children with CRS refractory to medical treatment

Materials & Methods

• Multicenter, 6 investigators prospective evaluation of children who had balloon sinuplasty over 14 months period
• All children age 2-11 years included in the study failed medical treatment with oral and/or IV antibiotics and had a positive CT scan of sinuses

Materials & Methods

• Outcome was assessed comparing SN-5 questionnaire at 52 weeks post-op and at baseline
• Endoscopic exam difficult in children
• Use of CT scan just for follow-up unjustified
Results

- 52 week follow up was available on 24/32 (75%) children
- Mean SN-5 at 52 weeks was 2.95 compared to 4.9 at baseline ($P<0.0001$

### SN-5 Change

<table>
<thead>
<tr>
<th>SN-5 Change</th>
<th># of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&gt;=-1.5$</td>
<td>12 (50%)</td>
</tr>
<tr>
<td>$&lt;-1.5$</td>
<td>7 (29%)</td>
</tr>
<tr>
<td>$&lt;-1.0$</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Success total</td>
<td>21 (87%)</td>
</tr>
<tr>
<td>$&lt;-0.5$</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>$&gt;0$</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>Failure total</td>
<td>3 (12%)</td>
</tr>
</tbody>
</table>

Balloon Sinuplasty vs adenoidectomy
Ramadan HH, Terrell A. Ann Otol Rhinol laryng 2010

- A non-randomized prospective evaluation
- Inclusion criteria: age >2 and <12, failed maximal medical therapy, confirmed diagnosis of CRS by CT and SN-5, and planned surgical intervention
- Outcomes based on 12 month SN-5 scores
Results: Patient characteristics by surgery group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Balloon</th>
<th>Adenoidectomy</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>30 (61%)</td>
<td>19 (39%)</td>
<td></td>
</tr>
<tr>
<td>Male sex</td>
<td>16 (53%)</td>
<td>11 (58%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Age</td>
<td>7.7</td>
<td>4.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Allergy</td>
<td>11 (38%)</td>
<td>5 (28%)</td>
<td>0.48</td>
</tr>
<tr>
<td>Asthma</td>
<td>10 (33%)</td>
<td>9 (47%)</td>
<td>0.33</td>
</tr>
<tr>
<td>Mean CT score</td>
<td>7.5</td>
<td>6.9</td>
<td>0.68</td>
</tr>
<tr>
<td>Mean SN-5 score</td>
<td>4.2</td>
<td>3.8</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Results: Percentage of children according to their SN-5 score change

<table>
<thead>
<tr>
<th>SN-5 Change</th>
<th>Balloon</th>
<th>Adenoidectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marked improvement (&gt;= -1.5)</td>
<td>43.3</td>
<td>36.8</td>
</tr>
<tr>
<td>Moderate improvement (-1 to -1.4)</td>
<td>20</td>
<td>10.5</td>
</tr>
<tr>
<td>Mild improvement (0.5 to -0.9)</td>
<td>16.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Total success</td>
<td>80</td>
<td>52.6</td>
</tr>
<tr>
<td>Same (0 to -0.4)</td>
<td>16.7</td>
<td>36.8</td>
</tr>
<tr>
<td>Worse (&gt;= +0.1)</td>
<td>3.3</td>
<td>10.5</td>
</tr>
<tr>
<td>Total failure</td>
<td>20</td>
<td>47.4</td>
</tr>
</tbody>
</table>

Results: Multivariate analysis of all covariables with surgery as outcome

<table>
<thead>
<tr>
<th>Variable</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>0.083</td>
</tr>
<tr>
<td>Age</td>
<td>0.1</td>
</tr>
<tr>
<td>CT score</td>
<td>0.7</td>
</tr>
<tr>
<td>Prior adenoidectomy</td>
<td>0.18</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.92</td>
</tr>
<tr>
<td>Allergy</td>
<td>0.19</td>
</tr>
<tr>
<td>Gender</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Balloon Sinuplasty after adenoidectomy failure
Ramadan HH, Bueller H, Terrell A

- A retrospective review of 26 children who failed adenoidectomy at a mean of 18 months
- Age range 2-12, mean 7.7 years
- Balloon sinuplasty of maxillary sinuses
- Outcomes assessed at 12 month SN-5 scores
- 21/26, 81% had improvement in their scores
**Procedure**

- Adenoidectomy ~ 50%
- Balloon dilation with a wash ~ 88%
- ESS

**Surgical Treatment**

- ESS has gained over the years acceptance as a surgical option for CRS in children
- Fear of complications and potential of facial growth retardation
- Studies over the years reassured surgeons of small percentage of complications
- Bothwell et al showed facial growth retardation have been shown to be minimal.

**ESS**
ESS

• Numerous studies dating back to 1991 have shown a success rate ranging between 78%-88%
• Meta-analysis by Bent JP 1997; showed a success rate of 88% for ESS
• Success rate similar to adults with much lower complication rate

ESS/A

• Most surgeons perform ESS after an adenoidectomy has been performed
• Ramadan 2004; reviewed 200 patients over a 10 year period
• Children had A, ESS, or ESS/A

Surgical Treatment

• Prospective collection of surgical data over a 10 years period
• Children were referred for surgical opinion
• All failed medical Rx with antibiotics, nasal/systemic steroids, allergy Rx, and also reflux Rx for at least 6 months
Results

- 1850 patients were evaluated for surgery and included in the study
- 202 (11%) children were considered as surgical candidates
- 18 (9%) were lost to follow up or refused surgery
- 183 patients were available for analysis
Surgery for CRS in Children

- Adenoidectomy has a 50% success rate and is helpful for children who are young, have no asthma and a low CT score
- Adenoidectomy with sinus wash will have 88% success rate for children with asthma and high CT score (younger children)
- ESS/hybrid helpful at time of adenoidectomy (88%) for older children with asthma and a high CT score

Case Presentation

- 6 years old with CRS for more than a year
- He has been on antibiotics & sprays regularly
- Continued symptoms
- History of ear tubes at age of 2 years
- No ear problems currently
- No other surgeries

Diagnosis

- Exam findings (endoscopy)
  - Congestion/edema
  - Colored discharge
  - polyps
  - adenoids
Surgical Algorithm

CRS failed Medical Rx

<6 yrs

Asthma

No Asthma

CT ↑

A Dilatation

A

CT ↓

>6 yrs

Asthma

No Asthma

CT ↑

CT ↓

CT ↑

CT ↓

CT ↑

CT ↓

CT ↑

CT ↓