Pediatric Endoscopic Sinus Surgery

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Background

- Importance
  - Children average 6-8 URIs per year
  - 5%-13% of URIs are complicated by secondary bacterial infection of paranasal sinuses

- History
  - Pediatric FESS reported to have success over 80% in late 1980s and early 1990s
  - Initial surgical indications were broad but published studies were often retrospective
  - Paradigm shifted when prospective studies showed that medical options were effective in treatment of pediatric sinus diseases and possible effect that surgery had on facial skeletal development
  - In late 1990s to the present, evidence-based approaches to pediatric sinus disease include FESS as an option
Indications for Pediatric FESS

Clement, 1998

- Management of rhinosinusitis in children: consensus meeting

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<table>
<thead>
<tr>
<th>Box 1. Consensus panel guidelines for endoscopic surgery in children [1]</th>
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</thead>
<tbody>
<tr>
<td><strong>Indications</strong></td>
</tr>
<tr>
<td>1. Complete nasal obstruction in cystic fibrosis caused by massive polyposis or closure of the nose by medialization of the lateral nasal wall</td>
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<td>2. Antro-choanal polyp</td>
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<td>3. Intracranial complications</td>
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<td>4. Mucoceles and mucopyoceles</td>
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<td>5. Orbital abscess</td>
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<td>6. Traumatic injury to the optic canal</td>
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<td>7. Dacryocystorhinitis secondary to sinusitis</td>
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<td>8. Fungal sinusitis</td>
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<td>9. Some meningo-encephaloceles</td>
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<td><strong>Possible indication</strong></td>
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<td>Chronic sinusitis that failed medical management</td>
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Indications for Pediatric FESS

- Complicated ABS with orbital or CNS involvement
- Sinonasal polyposis refractory to steroids
- Allergic fungal sinusitis
- Anterior skull base tumors: JNA
- Failure of medical management of CRS
  - Multifactorial cause
    - Recurrent URI
      - Daycare
    - Allergic rhinitis, Atopy, Asthma
    - Adenoid hypertrophy
    - Structural abnormalities
    - GERD
    - Immune deficiency
    - Ciliary dyskinesia
    - Smoking
Allergic Rhinitis

- AR is reported to be present in up to 40% at some point in childhood
- AR is associated with up to 80% of cases of CRS
- Family history of allergy
- Serologic or skin testing should be considered in all children with sinusitis
Structural Abnormalities

- Severely deviated septum
- Large agger nasi air cells
- Hypoplastic maxillary sinuses
- Bony remodeling or erosion
- Choanal abnormality
- CT of sinuses
GERD

- GERD was documented in 19 of 30 pediatric patients with chronic sinusitis tested by pH probe
  - 79% of these patients showed improvement after medical and behavioral therapy for reflux
- 25 of 28 children who were candidates for FESS due to sinusitis were able to avoid surgery with a regimen of PPI and behavior modification
- Empiric therapy with PPI with or without a prokinetic agent and behavioral modification is an acceptable approach
**Immune Deficiency, Cystic Fibrosis, and Ciliary Dyskinesia**

- Recurrent and chronic infections that respond poorly to medical therapy
  - Quantitative and qualitative immunologic testing
    - Antibody titers
    - T-cell function

- Recurrent upper and lower respiratory tract infections should lead to further testing
  - Sweat choride: CF
  - Ciliary biopsy: dyskinesia
Allergic Fungal Sinusitis

- AFS is caused by hypersensitivity response to fungi in the paranasal sinuses
  - Aspergilles
  - Alternaria
  - Bipolaris
  - Culvularia
  - Drechslera

- Kuhn and Swain, 2003
  - Major criteria
    - Type I IgE-mediated hypersensitivity
    - Nasal polyps
    - Characteristic CT findings
    - Allergic mucin
    - Positive fungal smear
  - Minor criteria
    - Asthma
    - Unilateral predominance
    - Bone erosion on CT
    - Fungal culture
    - Charcot-Leyden crystals
    - Serum eosinophils
Allergic Fungal Sinusitis

• McClay, 2002
  • Differences in children
    • Greater incidence of facial abnormalities
      • Proptosis
    • Greater incidence of unilateral and asymmetric disease
  • Same fungal species as adults
Allergic Fungal Sinusitis
Allergic Fungal Sinusitis

Figure 2. Large Charcot-Leyden crystal (arrow) surrounded by numerous eosinophils in a background of allergic mucin (hematoxylin-eosin, original magnification ×40).

Figure 3. Silver stain highlighting several fungal hyphae (arrow) and yeast forms (original magnification ×20).
Clinical Practice Guideline: Management of Sinusitis

- *Pediatrics* 2001
- Acute bacterial sinusitis: bacterial infection of the paranasal sinuses lasting less than 30 days in which symptoms resolve completely
- Subacute bacterial sinusitis: bacterial infection of paranasal sinuses lasting between 30-90 days in which symptoms resolve completely
- Recurrent acute bacterial sinusitis: episodes of bacterial infection of the paranasal sinuses, each lasting less than 30 days and separated by intervals of at least 10 days during which the patient is asymptomatic
- Chronic sinusitis: episodes of inflammation of the paranasal sinuses lasting more than 90 days. Residual respiratory symptoms persist such as rhinorrhea, nasal obstruction, or cough
- Acute bacterial sinusitis superimposed on chronic sinusitis: patients with residual respiratory symptoms develop new respiratory symptoms. When treated with antimicrobials, the new symptoms resolve, but underlying residual symptoms persist
Clinical Practice Guideline: Management of Sinusitis

- **Recommendations**
  - Antibiotics are recommended for management of ABS to achieve more rapid clinical cure
  - Children with uncomplicated ABS with mild to moderate severity not attending daycare are recommended to be treated with either amoxicillin 45 mg/kg/d in 2 divided doses or 90 mg/kg/d in 2 divided doses
  - For PCN allergic patients: cefdinir (14 mg/kg/d in 1-2 doses), cefuroxime (30 mg/kg/d in 2 doses), cefpodoxime (10 mg/kg/d 1 dose), clarithromycin (15 mg/kg/d 2 doses), azithromycin (10 mg/kg/d on day 1, and 5 mg/kg/d for 4 days)
  - If symptoms are severe, or refractory usual amoxicillin or other antimicrobial, or daycare is attended high-dose amoxicillin-clavulinate (80-90 mg/kg/d in 2 doses) or IM ceftriaxone (50 mg/kg single dose) followed by oral therapy is recommended
  - Duration of therapy may be 10, 14, 21, or 28 days but alternative suggestion is 7 days of therapy beyond resolution of symptoms
Clinical Practice Guideline: Management of Sinusitis

Recommendations

- After failure with oral antibiotics IV cefotaxime or ceftriaxone are recommended
  - Maxillary sinus aspiration
- Children with complicated or suspected complications of ABS should be treated promptly and aggressively and have appropriate consultations with an otolaryngologist, infectious disease specialist, ophthalmologist, and neurosurgeon
  - Maxillary sinus aspiration
  - IV ceftriaxone (100 mg/kg/d in 2 doses) or ampicillin-sulbactam (200 mg/kg/d in 4 doses)
    - Vancomycin (60 mg/kg/d in 4 doses)
  - CT scan
    - Orbital or CNS involvement
- Inadequate data for recommendations for nasal steroids and decongestants
The Role of IV Abx in CRS

- **Don, 2001 (CHOP)**
  - Efficacy of a stepwise protocol that includes intravenous antibiotic therapy for the management of chronic sinusitis in children and adolescents
  - Retrospective study of 70 patients with CRS
    - 10 months to 15 years old
    - 12 week history of symptoms
    - Persistent sinus disease on CT after 3-4 wk course of oral Abx
  - All patients underwent maxillary sinus aspiration and irrigation with selective adenoidectomy depending on intraoperative or CT findings followed by 1-4 week course of culture directed IV Abx

- **Cultures**
  - 73% had at least one organism (H. influenzae was most common)
  - 43% had multiple organisms
Treatment

- Abx
  - Cefuroxime (43%)
  - Ampicillin with sulbactam (31%)
  - Ticarcillin with clavulanate (21%)
  - Ceftriaxone (3%)
  - Vancomycin (1%)

- 2/3 of patients also had course of oral Abx after completion of IV therapy

- 10% had relatively minor complications
Results

- 89% had initial improvement after IV therapy
- 74% had long term follow up (mean 25 mo, range 6-62 mo)
  - 88% of those with long term f/u were reported to be improved by parents
  - 12% were not improved but did not require FESS
  - 23% had no further episodes of sinusitis
  - 77% had episodes of sinusitis which resolved completely with oral Abx

- No difference in improvement in IV Abx only group versus concomitant selected adenoidectomy group

- 11% had no response to IV therapy and required FESS

- 88% had long term f/u
  - 43% had improvement
Don, 2001

Chronic sinusitis >12 wk Duration
Failure of 3-4 wk PO Abx Course

Allergy Eval
Immune Workup

Medical Therapy

+ 

Improvement

No Improvement

Positive Without Anatomic Abnormality

Positive With Anatomic Abnormality

B Maxillary Sinus Lavage with Cx-Directed IV Abx and Selective Adenoidectomy

FESS

Prophylactic or PRN PO Abx

Improvement

No Improvement
Don, 2001

- No stratification for severity of symptoms
  - No validated questionnaire for symptom assessment
  - No standardized analysis of CT findings
- Unable to assess the role of adenoidectomy
- Unable to assess role of topical steroids and antihistamines for long term management
What is the role Adenoidectomy?

- Adenoid tissue has been found to be a reservoir for pathogenic bacteria.
- Hypertrophic adenoids obstruct the nasopharynx leading to stasis of secretions and bacterial overgrowth.
- Overall success rate for adenoidectomy in the treatment of chronic sinusitis is 50%.
What is the role Adenoidectomy vs FESS?

- Ramadan, 2004
  - Surgical management of chronic sinusitis in children
  - Prospective nonrandomized study over 10 years
  - 202 children (2 – 13 y) enrolled and 18 lost to follow up
    - Documented sinusitis on H&P and CT
    - No response to at least 26 weeks of treatment with an antibiotic as decongestant or 6 or more episodes of sinusitis
    - Allergy evaluation and management
  - Three groups
    - Group 1: Adenoidectomy and FESS
    - Group 2: FESS alone
    - Group 3: Adenoidectomy alone
  - 12 month follow up assessment
Results

- Group 1 (FESS+A)
  - 87.3% symptom improvement
  - 7.6% revision rate

- Group 2 (FESS only)
  - 75% symptom improvement
  - 12.5% revision rate

- Group 3 (A only)
  - 51.6% symptom improvement
  - 25% revision rate
Fig. 3. Success of three surgical groups controlling for age. ESS/A = endoscopic sinus surgery with adenoidectomy; ESS = endoscopic sinus surgery alone; A = adenoidectomy.
Fig. 5. Success of three surgical groups controlling for cigarette smoke exposure. ESS/A = endoscopic sinus surgery with adenoidectomy; ESS = endoscopic sinus surgery alone; A = adenoidectomy.
Fig. 4. Success of three surgical groups controlling for asthma. ESS/A = endoscopic sinus surgery with adenoidectomy; ESS = endoscopic sinus surgery alone; A = adenoidectomy.
Fig. 6. Success of three surgical groups controlling for computed tomography (CT) score. ESS/A = endoscopic sinus surgery with adenoidectomy; ESS = endoscopic sinus surgery alone; A = adenoidectomy.
Fig. 7. Success of three surgical groups controlling for allergy. ESS/A = endoscopic sinus surgery with adenoidectomy; ESS = endoscopic sinus surgery alone; A = adenoidectomy.
Conclusion

- When a surgical intervention is required for pediatric CRS cases, adenoidectomy with or without FESS is appropriate
  - If previous adenoidectomy has already been done, FESS may be performed
- Which children will benefit from adenoidectomy alone and which need additional FESS?
  - Children with asthma exposed to smoking environment had least benefit from adenoidectomy alone, but this improved with FESS and adenoidectomy
  - Children over 6 y with CT score greater than 4 had better outcome with adenoidectomy and FESS
  - For children 6 y and under with a low CT score without asthma adenoidectomy as the initial procedure was appropriate
Quality of Life After Surgery for Sinus Disease

Rudnick, 2006

- Improvements in quality of life in children after surgical therapy for sinonasal disease
- Prospective, nonrandomized QOL study
  - 22 children (1.4-15.9 y)
  - Adenoidectomy (59%) vs. FESS (41%)
    - 32% with previous adenoidectomy
- Caregivers completed preop SN-5 QOL survey and 2nd survey within 6 months following surgery
<table>
<thead>
<tr>
<th>Domain</th>
<th>Symptoms included</th>
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<tbody>
<tr>
<td>Sinus infection</td>
<td>Nasal discharge, bad breath, daytime cough, postnasal drip, headache, facial pain, head-banging</td>
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<tr>
<td>Nasal obstruction</td>
<td>Stuffy, blocked, or congested nose, reduced sense of smell, trouble breathing with mouth closed</td>
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<tr>
<td>Allergy symptoms</td>
<td>Sneezing, need to rub nose or eyes, watery eyes</td>
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<tr>
<td>Emotional distress</td>
<td>Irritable, frustrated, sad, restless, unable to sleep</td>
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<tr>
<td>Activity limitations</td>
<td>Misses school or day care, loses time with family or friends, unable to complete projects</td>
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<td>Domains and items</td>
<td>Preoperative mean score</td>
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<td>---------------------------</td>
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<tr>
<td>SN-5 total score</td>
<td>25.8</td>
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<tr>
<td>Sinus infection</td>
<td>5.9</td>
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<tr>
<td>Nasal obstruction</td>
<td>5.6</td>
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<tr>
<td>Allergy symptoms</td>
<td>4.5</td>
</tr>
<tr>
<td>Emotional distress</td>
<td>5.5</td>
</tr>
<tr>
<td>Activity limitation</td>
<td>4.4</td>
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</tbody>
</table>
All children had significant improvement after surgical intervention.

No difference in QOL scores between children undergoing adenoidectomy vs. FESS.
How accurate is CT study for evaluation of pediatric sinusitis?
CT Findings

- Bhattacharyya, 2004 (CHB)
  - The diagnostic accuracy of computed tomography in pediatric chronic rhinosinusitis
  - Prospective study of two cohorts of children: one group undergoing preop CT for planning FESS (66, diseased) and other group undergoing CT for non-sinusitis reasons (192, control)
  - Lund-McKay score (max 24)
    - Individual paranasal sinuses
      - 0 = no opacification
      - 1 = partial opacification
      - 2 = complete opacification
    - Individual OMC
      - 0 = not occluded
      - 2 = occluded
Figure 1. Staging distribution of children with chronic rhinosinusitis. See “Methods” section for explanation of Lund-Mackay scoring system.

Figure 2. Staging distribution of children without chronic rhinosinusitis. See “Methods” section for explanation of Lund-Mackay scoring system.
CT may detect incidental mucosal thickening that does not truly represent symptomatic sinus disease.

Lund score ≥ 5 would exhibit sensitivity and specificity of 85% and 86%, respectively, indicating presence of disease.
Age and Sinus Surgery

- What is the effect of age on surgical outcome for CRS?
Age and Sinus Surgery

Ramadan, 2003

- Relation of age to outcome after endoscopic sinus surgery in children
- Cohort study 99 children (age 2-13 y) who underwent FESS and selective adenoidectomy for CRS
- 12 month follow up
- Questionnaire sent to caregivers for assessment of symptoms
Ramadan, 2003

Results

- Mean Lund-MacKay score 11.1
- Overall success of FESS 82%
  - Children age 6 y and older 89%
  - Under 6 y 73%
- 11% required revision surgery
  - 9% were under 6 y
- Age stratification
  - Under 4 y (11/99) 35% success
  - 4-8 y (60/99) 88% success
  - Over 8 y (24/99) 86% success
- Children under 3 y had highest failure rate with 75% requiring revision surgery (3/4)
Ramadan, 2003

- Questionnaire-based assessment of improvement of sinus symptoms without exam
- Role of nasal steroids
- Small patient population in younger age group
What is the impact of sinus surgery on growth of the facial skeleton?
FESS and Facial Growth

- Verwoerd, 1979
  - The effects of septal surgery on the growth of the nose and maxilla
  - Site-specific injury to developing septal cartilage in rabbits had a detrimental effect to nasal and maxillary growth

- Mair, 1995
  - Sinus and facial growth after pediatric endoscopic sinus surgery
  - Unilateral sinus surgery on piglets with evaluation of development by CT
  - On the operated side, maxillary and ethmoid sinuses reached only 57% and 65%, respectively, of size of non-operated side
FESS and Facial Growth

- Bernstein, 1968
  - The effect of timing of cleft palate operations on subsequent growth of the maxilla
  - Greater incidence of midface maldevelopment after cleft palate repair
- McGuirt and Salisbury, 1987
  - Mandibular fractures: their effect on growth and dentition
  - Significant incidence of facial asymmetry after repair of mandibular fractures in children
- Kosko, 1996
  - Acquired maxillary sinus hypoplasia: a consequence of endoscopic sinus surgery?
  - CT confirmation of maxillary sinus hypoplasia after endoscopic sinus surgery without apparent clinical facial asymmetry
FESS and Facial Growth

- Wolf, 1995
- The endoscopic endonasal surgical technique in the treatment of chronic recurring sinusitis in children
- 124 post FESS children evaluated by questionnaire
- No clinically significant disturbance in facial bone development
- Mean age 12 y
- 4% of patients were <5 y
  - Most rapid period of growth of sinuses is between 1-4 y
- No major complications
FESS and Facial Growth

- Senior, 2000 (Detroit)
  - Quantitative impact of pediatric sinus surgery on facial growth
  - 8 pediatric patients treated with unilateral sinus surgery for periorbital or orbital cellulitis
  - Control group of 9 normal adults without CT evidence of sinusitis and 10 adults with CT findings of sinusitis and history of childhood sinus-related symptoms
  - Mean follow-up 6.9 years
  - CT volumetrics used to calculate volumes of sinus and orbits in normal, sinusitis without surgery, and surgical groups
  - No significant difference in sinus volumes among normal patients, patients with sinusitis, and patients who had sinus surgery
FESS and Facial Growth

- Bothwell, 2002 (Wash. U)
  - Long–term outcome of facial growth after functional endoscopic sinus surgery
  - Retrospective review of quantitative anthropometric analysis using 12 parameters and qualitative analysis of 67 children diagnosed with CRS with age-matched controls
  - 46 patients underwent FESS
  - 21 patients did not undergo FESS
  - 10 year follow up
FESS and Facial Growth

- Bothwell, 2002 (Wash. U)
  - Caucasian population (normal data available)
  - Sinus CT reviewed and scored by Pediatric Rhinosinusitis CT Scoring System
    - 0 = no disease
    - 1 = <50% disease
    - 2 = >50% disease
    - 3 = complete opacification
Bothwell, 2002 (Wash. U)

- Quantitative anthropometric analysis
  - Single reviewer
- Qualitative assessment of facial growth
  - Single reviewer, blinded

Results:

- No statistically significant difference for anthropometric measurements for (CRS) with FESS, (CRS) without FESS, and normal control groups
- On qualitative evaluation, the overall score for the non-surgical group was worse than the score for the FESS group
FESS and Facial Growth

- Peteghem, 2006 (Belgium)
- Influence of extensive FESS on facial growth in children with CF. Comparison of 10 cephalometric parameters of the midface for three study groups.
  - Prospective study, 23 patients, f/u at least 10 years
    - 9 patients underwent FESS before 2\textsuperscript{nd} growth spurt (mean age 11, range 9 – 14)
      - Cephalometric measurement at mean age 22 (range 18 – 31)
    - 9 patients with CF without FESS were in the control group
      - Cephalometric measurement at mean age 25 (range 18 – 37)
    - 5 patients underwent FESS after 2\textsuperscript{nd} growth spurt (mean age 22, range 16 – 28)
      - Cephalometric measurement at mean age 26 (range 19 – 38)
FESS and Facial Growth

- Peteghem, 2006 (Belgium)

<table>
<thead>
<tr>
<th>Cephalometric measurements</th>
<th>FESS before second growth spurt, n = 9</th>
<th>No FESS, n = 9</th>
<th>FESS after second growth spurt, n = 5</th>
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<tbody>
<tr>
<td>1</td>
<td>9.38</td>
<td>9.44</td>
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<td>2</td>
<td>96.4</td>
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<tr>
<td>9</td>
<td>18.9</td>
<td>18.8</td>
<td>18.7</td>
<td>0.99</td>
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<tr>
<td>10</td>
<td>24.7</td>
<td>24.1</td>
<td>26.1</td>
<td>0.48</td>
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FESS, functional endoscopic sinus surgery; angular measurements, in degrees: (1) sella-nasion/palatal plane, angle expressing the inferior inclination of the maxilla; (2) palatal plane/nasion-anterior nasal spine. Linear measurements, in millimeters (3) posterior nasal spine-anterior nasal spine, expressing the anterior-posterior length of the maxilla to the palatum durum; (4) posterior nasal spine-supradentale, expressing the anterior-posterior length of the most anterior-inferior point till the most postero-inferior point of the pterygomaxillary fissure; (5) pterygo-maxillary fissure, inferior-anterior nasal spine; (6) anterior nasal spine perpendicular to PM vertical (PM vertical: Pterygo-Maxillary Fissure, Inferior-Ethmoid Registration Point); (7) Ethmoid Registration Point-Posterior Nasal Spine; (8) Anterior Nasal Spine-Nasion; (9) Anterior Nasal Spine-Supradentale; (10) Sella-Ethmoid Registration Point.

a Age in years.
FESS and Facial Growth

- Peteghem, 2006 (Belgium)

**Fig. 6** Angular measurements (degrees) for parameters 1 and 2.

**Fig. 7** Linear measurements (millimeter) for parameters 3–10.
FESS and Facial Growth

- Peteghem, 2006 (Belgium)
  - No statistically significant difference in cephalometric parameters
  - No difference in the experimental groups compared to normal age-matched adults
Pediatric FESS

- How safe and effective is FESS in the pediatric population?
Pediatric FESS Safety and Efficacy

Hebert, 1998

- Meta-analysis of outcomes of pediatric functional endoscopic sinus surgery
- 8 articles with 832 patients, 50 unpublished patients
- Positive outcome with FESS: 88.7%
- Mean follow up 3.7 years
- Major complication rate 0.6%
  - 6 of 8 articles reported complications
  - 2 blood loss requiring transfusion
  - 2 meningitis
Pediatric FESS

- When is image guided surgery recommended for pediatric FESS?
Box 2. American Academy of Otolaryngology Head and Neck Surgery indications for computer-assisted endoscopic sinus surgery

1. Revision sinus surgery
2. Distorted sinus anatomy of development, postoperative, or traumatic origin
3. Extensive sino-nasal polyposis
4. Pathology involving the frontal, posterior ethmoid, and sphenoid sinuses
5. Disease abutting the skull base, orbit, optic nerve, or carotid artery
6. Cerebrospinal fluid rhinorrhea or conditions where there is a skull-base defect
7. Benign and malignant sino-nasal neoplasms
8. Choanal atresia
Image Guidance

- Lusk, 2005
  - Computer-assisted functional endoscopic sinus surgery in children
  - Revision or initial surgery with distorted anatomy and polyposis especially in children with CF
  - Choanal atresia
  - Lamina papyracea and skull base identification
  - AFS
Fig. 1. Child with choanal atresia with the straight probe placed through the atretic plate.
Image Guidance

Fig. 2. Child with Wegener’s disease and thin diseased bone over the roof of the ethmoid sinus.
Fig. 4. Child with sphenoid sinusitis and the probe placed at the face of the sphenoid sinus.
Image Guidance

Fig. 5. Probe placed into the sphenoid sinus through the enlarged patent window.
What Would I Do?

Chronic sinusitis >12 wk Duration
Failure of 3-4 wk PO Abx Course

Allergy Evaluation
Immune Workup

Medical Therapy

Improvement
No Improvement

Positive Without Anatomic Abnormality
B Maxillary Sinus Lavage with Cx-Directed IV Abx and Selective Adenoidectomy

Positive With Anatomic Abnormality
FESS/Adenoidectomy

Prophylactic or PRN PO Abx

Improvement
No Improvement
What Would I Do?

- Allergy/Immunology assessment
- Sweat chloride for children with sinonasal polyps
- Consultations
  - Pulmonologist
  - Allergy/Immunologist
  - Infectious Disease
  - *Ophthalmology/Neurosurgery
- Medical Therapy
  - Nasal steroids
  - Antihistamines
  - Saline irrigations
- CT Sinus with fine cuts, axial and coronal
  - Adenoid pad assessment
  - Anatomic abnormalities
  - Lund-MacKay score
What Would I Do?

- Maxillary sinus aspiration/irrigation/culture and possible adenoidectomy with IV Abx
  - Younger children (under 4 years)
  - Empiric Abx: Unasyn, Cefuroxime, Clindamycin
  - Culture directed IV Abx for 7-21 days (ID recommendations)

- FESS (with possible adenoidectomy)
  - Anatomic abnormalities, polyps, JNA
  - Older children
  - Limited approach
    - MMA, anterior ethmoidectomy
  - Sinus irrigations
What Would I Do?

- **Maintenance**
  - Limit Smoke exposure
  - Remove from daycare
  - Nasal steroids
  - Saline irrigations
  - Endoscopic evaluation for synechiae, polyps

- **Persistent or Recurrent Symptoms after FESS**
  - CT sinus


