


Pediatric Sinusitis

Medical and Surgical Management

Elisabeth Ferenc, MDMPH

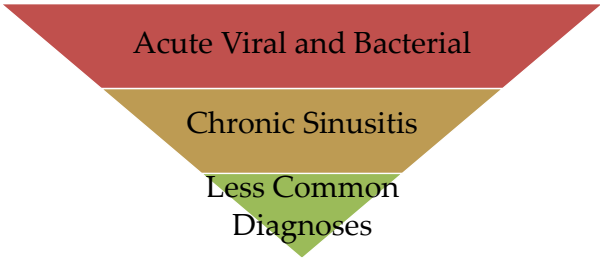


Disclosures


- Partnership for Health Analytic Research (PHAR), LLC
- Novartis
 - No direct interests with any treatment or product in this talk



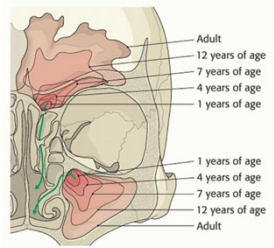

Outline



- Acute Viral and Bacterial
- Chronic Sinusitis
- Less Common Diagnoses




Sinus Development





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Acute Rhinosinusitis

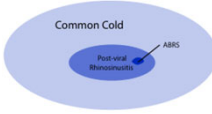
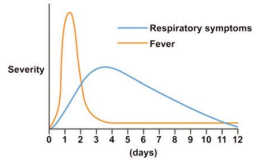



- Child with an URI with
 - Persistent illness (nasal discharge of any quality or cough or both) for 10 days without improvement
 - Worsening course (worsening or new onset nasal discharge, daytime cough or fever after initial improvement)
 - Severe onset (concurrent fever >102.2 and purulent nasal discharge for at least 3 consecutive days)



AAP 2013

Viral URI

EPOS 2012 & AAP 2013

Viral URI



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Acute Bacterial Sinusitis

Strep pneumoniae

Non-typeable H. Influenzae

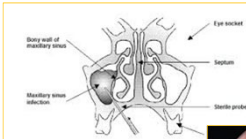
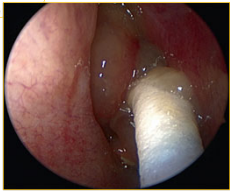
Moraxella catarrhalis

- Staph Aureus and anaerobes are rare in acute sinusitis
 - But S. Aureus significant pathogen in complications
 - Anaerobes more common if dental origin
- Determined 30 years ago, so not take into account new vaccines
 - Decrease in S. Pneumonia, increase non-typeable H. influenzae

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Cultures

- No response to empiric therapy within 2-3 days
- Severe illness or complications
- Immunocompromised

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Hsin C-H, Tsao C-H, Su M-C, Chou M-C, Liu C-M. Comparison of maxillary sinus puncture with endoscopic middle meatal culture in pediatric rhinosinusitis. Am J Rhinol. 2008;22(3):280-4.

Treatment: Antibiotics

Professional Organization	Antibiotic Choice	Duration
IDSA	<ul style="list-style-type: none"> First line: Amoxicillin/clavulanate Non type 1 hypersensitivity to penicillin, Cephalosporin and Clindamycin Type 1 hypersensitivity to penicillin: Levofloxacin 	10-14 days
EPOS 2012	<ul style="list-style-type: none"> First line: Amoxicillin, Amoxicillin/clavulanate, or Cephalosporin If penicillin allergy: Azithromycin, Clarithromycin, or Trimethoprim/sulfamethoxazole. Anaerobes: Clindamycin 	Duration of therapy not specified
AAP	<ul style="list-style-type: none"> First line: Amoxicillin, Amoxicillin/clavulanate for patients younger than 2 years old, with severe symptoms, or recent antibiotics Non type 1 hypersensitivity to penicillin: Third generation cephalosporin (cefdinir or Cefuroxime) Type 1 hypersensitivity to penicillin: Levofloxacin or Cefixime with Clindamycin or Linezolid 	7 days following complete clinical improvement with a minimum of 10 days duration

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Adjuvant Work-up and Treatment

- No imaging studies unless concern for complications

Table 8.21 Treatment evidence and recommendations for children with acute rhinosinusitis.

Therapy	Level	Grade of recommendation	Relevance
antibiotic	Ia	A	yes in AERG
topical steroid	Ia	A	yes mainly in post oral ABS studies only done in children 12 years and older
addition of topical steroid to antibiotic	Ia	A	yes in AERG
mucolytics (acetylcysteine)	1b (*)	A-C*	no
saline irrigation	IV	D	yes
oral antihistamine	IV	D	no
decongestion	IV	D	no

(*) 1b (*) 1b study with negative outcome

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EPOS 2012

Topical Steroids and Growth

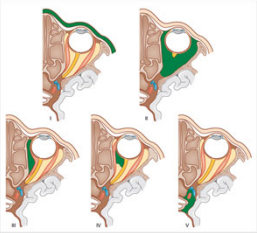
- Associated with small but statistically significant decrease in growth velocity compared to placebo in some studies (Skoner)
 - Unknown if possibility of catch-up growth after stopping
 - No documentation of intranasal corticosteroids causing decrease in adult height (Hoover)
- Lowest effective dose with low systemic absorption ratio should be used
- Risk balanced with the potential benefit of reducing nasal symptoms

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Skoner DP et al. "Intranasal triamcinolone and growth velocity." Pediatrics 2015; 135:e348.
Hoover et al. "Effect of inhaled corticosteroids on long-term growth in pediatric patients with asthma and allergic rhinitis. Ann Pharmacother. 2013; 47(9):1175-81

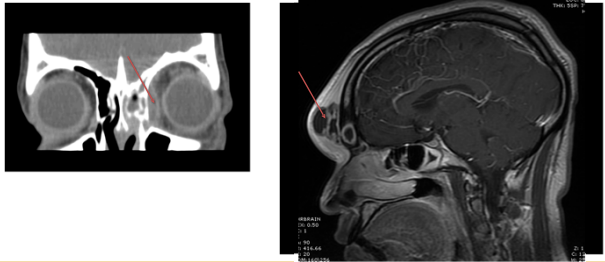
Acute Bacterial Sinusitis Complications

- Orbital (Chandler Classification)**
 - Preseptal inflammation
 - Orbital Cellulitis
 - Subperiosteal abscess
 - Orbital abscess
 - Cavernous Sinus Thrombosis
- Intracranial**
 - Epidural or subdural abscess
 - Brain abscess
 - Venous thrombosis
 - Meningitis
- Frontal osteomyelitis (Pott's Puffy Tumor)**



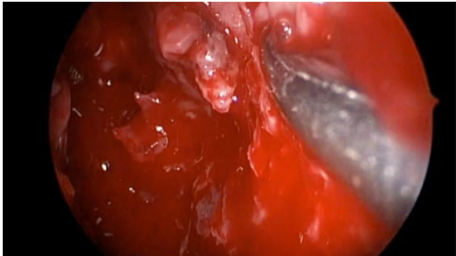
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Acute Sinusitis Complications



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Acute Sinusitis Complications



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Chronic Sinusitis

- At least 3 months of:**
 - 2 or more symptoms of nasal drainage, nasal obstruction, facial pressure/pain or cough
 - And either endoscopic evidence of inflammation/purulent drainage or CT scan showing edema
- Contributing factors:**
 - Allergies
 - Adenoiditis
 - Infection
 - Environmental: smoke, pollution, daycare
 - Medical conditions: immunodeficiency, cystic fibrosis, primary ciliary dyskinesia, asthma, gastroesophageal reflux disease (?)

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Treatment

**Alpha-hemolytic streptococci including *S. pneumoniae*
Staph aureus
followed by *H. influenzae*, *M. catarrhalis* and anaerobes**

- May be role for longer term antibiotics
- Antibiotics:
 - Amoxicillin with or without clavulanate
 - Penicillin allergic: cephalosporin or macrolide
 - MRSA: Clindamycin or Bactrim

Keck Medicine of USC Hsin CH, Su MC, Tsao CH, Chuang CY, Liu CM. Bacteriology and antimicrobial susceptibility of pediatric chronic rhinosinusitis: a 6-year result of maxillary sinus punctures. Am J Otolaryngol - Head Neck Med Surg. 2010;31(3):145-9.

Adjunct Treatment

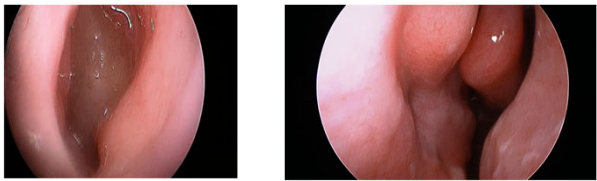
Table 8.7. Treatment evidence and recommendations for children with chronic rhinosinusitis.

Therapy	Level	Grade of recommendation	Relevance
nasal saline irrigation	Ia	A	yes
therapy for gastro-oesophageal reflux	III	C	no
topical corticosteroid	IV	D	yes
oral antibiotic long-term	no data	D	unclear
oral antibiotic short term <4 weeks	B(-)*	A(-)*	no
intravenous antibiotics	III(-)**	C(-)**	no

* Ib (-) Ib study with a negative outcome
 *A(-) grade A recommendation not to use
 **III(-) level III study with a negative outcome
 **C(-) grade C recommendation not to use

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When to consider other medical conditions:



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Workup

- CT scan reserved for surgical planning or concern for complications or atypical presentations (unilateral disease)
 - CT abnormalities in 18-45% of healthy kids (EPOS 2012)
- Allergy Testing
- Immunodeficiency workup
- Cystic fibrosis testing (especially if polyps on exam)
- Ciliary biopsy for primary ciliary dyskinesia
- Testing for auto-immune disease such as granulomatosis with polyangiitis

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Primary Immunodeficiency and Antibody deficiency

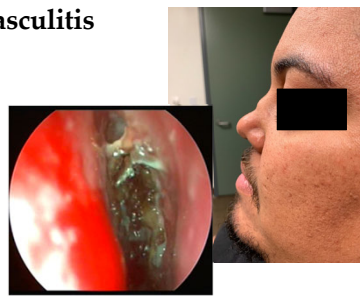
- Average child has 3 to 8 upper respiratory infections per year
- Pathological susceptibility to infection can be a sign of primary immunodeficiency
 - IgA deficiency, IgG subclass deficiency, hypogammaglobulinemia, Common Variable Immunodeficiency (CVID)
- Diagnostic delay: period 4.7-15 years can pass between first manifestation and final diagnosis (Stenner)
 - 50% of patients with refractory sinusitis referred to tertiary academic center for allergy eval had low immunoglobulin levels or poor response to pneumococcal vaccine (Shapiro)
- Consider CBC with differential, serum immunoglobulins (IgG, IgM, and IgA), response to pneumococcal vaccine, B- and T-cell subsets, HIV testing

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Shapiro GG, Vitant FS, Furukawa CT, et al. "Immunologic defects in patients with refractory sinusitis." *Pediatrics*. 1991 Mar; 87(3):311-6.
Stenner M, and Rudack C. "Disease of the nose and paranasal sinuses in child." *GME Current Topics in Otorhinolaryngology*. 2014, 13: Doc 10.

Systemic Disease: Vasculitis

- Sedimentation rate (ESR)
- C-reactive protein (CRP)
- Antineutrophil cytoplasmic antibodies (ANCA)
- Rheumatoid factor
- Biopsy of sinus and nasal structures
 - Absence of granulomas does not rule out the disease

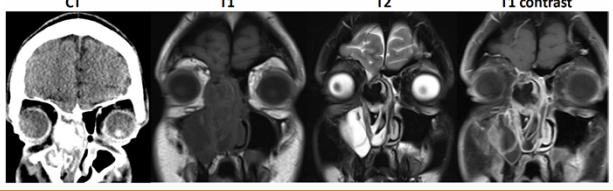


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Sachse, Florian and Wolfgang Stoll. "Nasal surgery in patients with systemic disorders" *GMS current topics in otorhinolaryngology, head and neck surgery*.vol. 9 (2011): Doc02.

Allergic Fungal Sinusitis

- Allergic reaction to environmental fungi (Type 1 IgE Mediated)
- Nasal polyps, Eosinophilic Mucin (peanut butter), Fungus on pathology without invasion (Bent Kuhn Criteria)

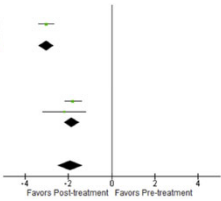


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Image Courtesy of Dr. Edward Kuan

Surgical Options

Study	Year	n	ESR	CRP	ANCA	RF	Biopsy	ESR	CRP	ANCA	RF	Biopsy
4.3.2 Adenotomy												
Battadani 2017	2017	155	1.06	60	4.59	0.98	60	11.8%	-3.04	[-3.41, -2.67]		
Ramadan 2010a	2010	29	0	19	3.8	0	19					Not estimable
Subtotal (95% CI)		79		79		79	11.8%		-3.04	[-3.41, -2.67]		
Heterogeneity: Not applicable Test for overall effect: Z = 16.31 (P < 0.00001)												
4.3.4 Endoscopic Sinus Surgery												
Sethi 2016	2016	22	0.85	35	3.98	0.79	35	11.7%	-1.78	[-2.16, -1.40]		
Taylor 2014	2014	2.82	1.29	9	5	0.79	9	9.2%	-2.19	[-3.17, -1.19]		
Subtotal (95% CI)		44		44		44	20.9%		-1.83	[-2.19, -1.47]		
Heterogeneity: Tau ² = 0.00; Chi ² = 0.55, df = 1 (P = 0.46); I ² = 0% Test for overall effect: Z = 10.02 (P < 0.00001)												
Total (95% CI)		342		342		342	100.0%		-1.91	[-2.50, -1.32]		
Heterogeneity: Tau ² = 0.74; Chi ² = 107.12, df = 8 (P < 0.00001); I ² = 93% Test for overall effect: Z = 6.32 (P < 0.00001) Test for subgroup differences: Chi ² = 25.94, df = 3 (P < 0.0001), I ² = 88.0%												



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Ni JS, Kompelli AR, Nguyen SA, Schlosser RJ, Clemmens C, Soler ZM. "The Sinus and Nasal Quality of Life Survey (SN-5) in the Management of Pediatric Chronic Rhinosinusitis: A Systemic review and meta-analysis." *Int Journal of Pediatric Otorhinolaryngology*. 2016; 111: 160-9.

Balloon Catheter Dilation

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Soler ZM, Rosenbloom JS, Skarada D, Gutman M, Hoy MJ, Nguyen SA. Prospective, multicenter evaluation of balloon sinus dilation treatment of pediatric chronic rhinosinusitis. *Int Forum Allergy Rhinol* [Internet]. 2017 Mar 1 [cited 2019 Feb 9];7(3):221-9.

Gerber ME, Kennedy AA. Adenotomomy With Balloon Catheter Sinuplasty: A Randomized Trial for Pediatric Rhinosinusitis. *Laryngoscope* [Internet]. 2018 Sep 8.

Facial Growth

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Van Peltghem A, Clement PAR. Influence of extensive functional endoscopic sinus surgery (FESS) on facial growth in children with cystic fibrosis. *International Journal of Pediatric Otorhinolaryngology* 2006.

Bothwell MR, Piccirillo JJ, Luok RJ, Radenour BD. Long-term outcome of facial growth after functional endoscopic sinus surgery. *Otolaryngology - Head and Neck Surgery*

Septoplasty

Type of Surgery	Patients	Mean (SD) Nasolabial Angle	95% CI	Range	Mann-Whitney Test	t-Test
Male patients						
Extracorporeal septoplasty	13	91.8 (11.7)	84.7-98.8	74.0-107.0	<i>p</i> = 0.05	<i>p</i> = 0.002
Conservative septoplasty	12	99.8 (10.5)	93.1-106.4	86.7-115.3		<i>p</i> = 0.17
Female patients						
Extracorporeal septoplasty	9	89.1 (10.1)	81.3-96.9	73.4-101.0	<i>p</i> = 0.002	<i>p</i> = 0.002
Conservative septoplasty	10	105.6 (9.0)	99.1-112.1	89.0-119.0		<i>p</i> = 0.63

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Tasca I, Compradretti GC. "Nasal growth after pediatric septoplasty at long term follow up." *Am J Rhinol Allergy*. 2011; 25: E7-12.

Second Look

	Complete Resolution or Improvement in Symptoms		No Change in Symptoms	
	n	%	n	%
Group A* (n = 50)	45	90	5	10
Group B† (n = 50)	42	84	8	16
Total (n = 100)	87	87	13	13

	Complete Resolution or Improvement in Symptoms (n, % Symptoms)		No Change in Symptoms (n, % Symptoms)	
	Group A*	Group B†	Group A*	Group B†
Persistent cough	94	94	6	8
Nasal obstruction	90	76	10	24
Nasal drainage	90	84	14	14
Total	90	84	10	18

*Underwent FESS without a second look procedure.
†Underwent FESS with a second look procedure.
FESS = functional endoscopic sinus surgery.

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Mitchell, SS, Frenkel, KP. Minors and children: functional endoscopic sinus surgery: is a second look necessary? *Laryngoscope*. 1997;107:1267-1269.

Walner, DL, Falciglia M, Willging P, Meyer CM. "The role of second-look nasal endoscopy after functional endoscopic sinus surgery." *Arch Otolaryngol Head Neck Surg*. 1998; 124, 425.

Less Common:


- Anatomic
- Foreign bodies
- Systemic Disease
- Trauma
- Masses malignant and benign

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Foreign bodies


- Unilateral nasal purulence
- Endoscopy either in clinic or in the OR versus imaging



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Long Term Trauma Sequelae



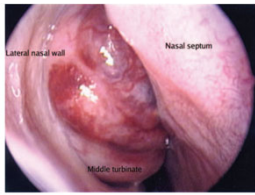
- Cerebrospinal fluid leak
 - Clear, watery rhinorrhea
 - Salty or metallic taste
 - Drips like a sink faucet when leaning forward or straining
- Encephalocele

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Tumors

Malignant:

- Rhabdomyosarcoma (28%)
- Esthesioneuroblastoma (23%)
- Nonrhabdomyosarcoma sarcoma, Leukemia/lymphoma, Squamous cell, adenocarcinoma, Small cell neuroendocrine carcinoma, Yolk Sac Tumor

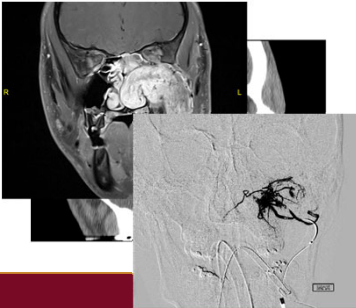


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Benoit MM, Bhattacharyya N, Faquin W, Cunningham M. "Cancer of the Nasal Cavity in the Pediatric Population." *Pediatrics*. January 2008; 121(1): e141.


Juvenile Nasal Angiofibroma

- Benign but locally aggressive
- Males
- Epistaxis, eustachian tube obstruction
- Biopsy of mass in office can be fatal
- Surgical resection treatment of choice



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Bony Lesions




- Benign lesions can increase in size and cause obstruction, impingement, or cosmetic deformity
- Osteogenic: osteoma, osteoblastoma
- Chondrogenic: chondroma, osteochondroma
- Fibrogenic: Fibrous dysplasia, juvenile ossifying fibroma
- Recommend observation unless symptomatic

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Bony Lesions

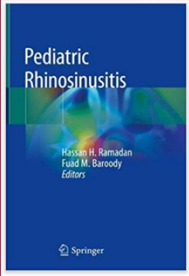
Pediatric Osteoma with Orbital Mass Effect
 Elisabeth H. Ference, MD MPH, David Hsu, MD,
 and Jeffrey D. Suh, MD

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Evidence Based Guidelines

- American Academy of Pediatrics Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 years (2013)
- EPOS 2012: European position paper on rhinosinusitis and nasal polyps
- International Forum of Allergy and Rhinology International Consensus on Rhinosinusitis (2016)
- American Academy of Otolaryngology Head and Neck Surgery Clinical Consensus Statement: Pediatric Chronic Rhinosinusitis (2014)
- Infectious Disease Society of America Clinical Practice Guidelines for Acute Bacterial Rhinosinusitis in Children and Adults (2012)



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