Chronic Rhinosinusitis in Children

Hassan H. Ramadan, M.D., MSc., FACS
West Virginia University, Morgantown, WV.

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

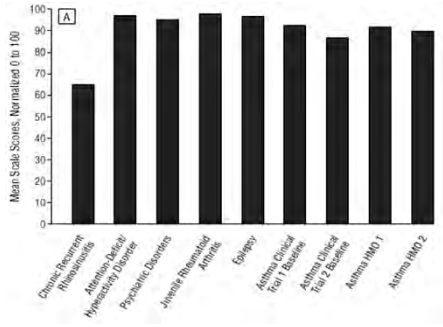
- Inflammation of the nose and paranasal sinuses characterized by 2 or more symptoms one of which should be either nasal blockage/ obstruction/congestion or nasal discharge (anterior/posterior nasal drip):
  - ± cough
  - ± facial pain/pressure
- and either:
  - Endoscopic signs of disease and/or relevant 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 sxs between Sept-Dec 1999 in Finland.
- Average age= 5.7 yrs (range= 4-7 yrs).
- Underwent an MRI and symptoms were recorded.

Kristo A et al. *Pediatrics* 2003;111:e586–e589.

Rhinosinusitis and the Common Cold
MRI Study

Normal

Minor Abnormality

Major Abnormality

Rhinosinusitis and the Common Cold
MRI Study

N=60	MRI Findings*		
	Normal	Minor Abnormality	Major Abnormality
	n (%)	*n* (%)	*n* (%)
Maxillary sinuses	15 (25)	9 (15)	36 (60)
Ethmoidal sinuses	10 (17)	13 (22)	37 (62)
Frontal sinuses†	16 (27)	6 (10)	11 (18)
Sphenoidal sinuses‡	31 (55)	6 (10)	20 (35)
All sinuses	7 (12)	12 (20)	41 (68)

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

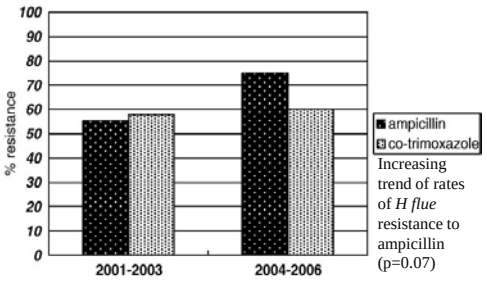
- No good studies in pediatrics
- No studies comparing anatomic abnormalities in children with CRS to control children
- One study showed no correlation between anatomic abnormalities and extent of sinus disease in CT scans of 65 children with CRS (Al Qudah 2008).

Bacteriologic Findings of Pediatric CRS (maxillary sinus punctures)

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

Hsin CH, et al. Am J Otolaryngol Head Neck Med Surg 2010;31:145-9.

Resistance Rates for *H flu*



Increasing trend of rates of *H flue* resistance to ampicillin (p=0.07)

Hsin CH, et al. Am J Otolaryngol Head Neck Med Surg 2010;31:145-9.

Role of Adenoids

Adenoiditis vs CRS

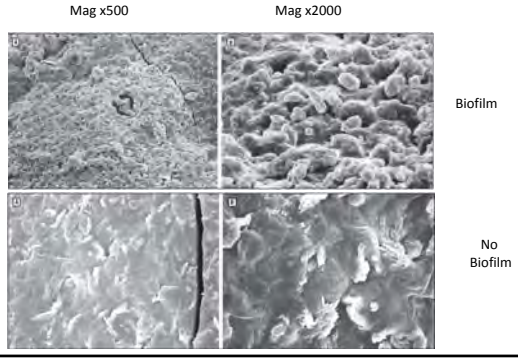
- Difficult to distinguish between chronic adenoiditis and CRS.
- Clinical symptoms and exam findings are identical.
- CT scan will allow us to differentiate between the 2 entities.
- Bhattacharyya 2004:
  - CT score >5 suggestive of CRS
  - Score <5 adenoiditis

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.

Coticchia J et al. *Arch Otolaryngol Head Neck Surg* 2007;133:110-14.

Adenoid Biofilm in Pediatric CRS



Adenoid Biofilm in Pediatric CRS

Table. Patient Demographics and Diagnoses and Percentage of Biofilm Surface Area of Samples Imaged Using Scanning Electron Microscopy

Patient No./Sex/Age	Diagnosis	Biofilm Surface Area, %
1/M/2 y	CRS	96.5
2/M/2 y	CRS	98.2
3/M/2 y	CRS	99.2
4/M/6 y	CRS	96.1
5/F/3 y	CRS	97.8
6/F/3 y	CRS	88.0
7/M/10 y	CRS	88.5
8/M/9 mo	OSA	0.0
9/M/12 mo	OSA	0.0
10/M/16 mo	OSA	8.5
11/M/5 y	OSA	2.5
12/F/3 y	OSA	0.0
13/M/4 y	OSA	0.0
14/F/3 y	OSA	3.9
15/M/5 y	OSA	4.3
16/M/1 mo	OSA	0.0

Coticchia J et al. *Arch Otolaryngol Head Neck Surg* 2007;133:110-14.

Chronic Inflammation

CRS in Young Children

- 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.

Chan KH, et al. *J Pediatr* 2004;144:206-12.

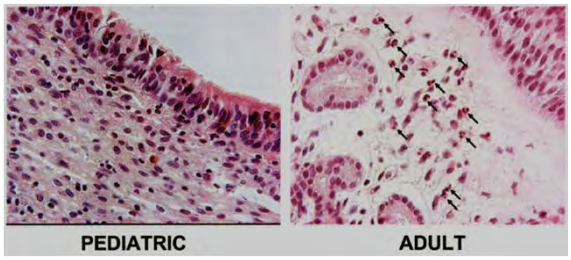
CRS in Young Children

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

Inflammatory cells	Pediatric CRS (N = 19)	Adult CRS (N = 5)	P value*
Neutrophils	37 (2–128)†	12 (3–46)	.14
Lymphocytes	469 (181–1880)	294 (228–328)	.02
Eosinophils	13 (0–56)	82 (29–256)	.01
Plasma cells	88 (8–366)	58 (25–121)	.52
TOTAL	678 (206–2280)	510 (295–677)	.14
MBP+ cells‡	15 (0–51)	47 (33–212)	.01

Chan KH, et al. *J Pediatr* 2004;144:206-12.

CRS in Young Children



Less eosinophilic, more lymphocytic inflammation in children

Chan KH, et al. *J Pediatr* 2004;144:206-12.

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

Rhinosinusitis-Associated Conditions

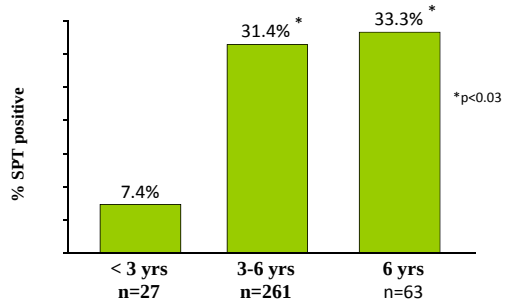
- Allergic rhinitis
- Asthma
- Nasal polyps
- Aspirin hypersensitivity
- Cystic fibrosis
- Immune deficiencies
- Gastroesophageal reflux disease
- Primary Ciliary Dysmotility

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 ags: pollens, dustmites, molds and animal dander.
- General prevalence of allergy in children in Italy= 31.8%

Leo G et al. *Ped Allergy Immunol* 2007;18:19-21.

CRS and Allergy in Children



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

Rachelefsky et al. *Pediatrics* 1984;73:526-9.

Sinusitis and Asthma

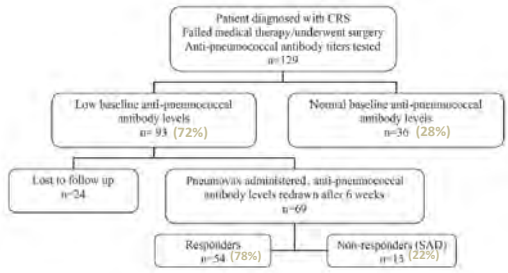
- 18 children (5- 12 yrs) with moderate asthma (poorly controlled by ICS) and CRS.
- Treated with Amox/Clav, systemic steroids and INS x 2 weeks
- All improved their asthma control
  - 8/18 becoming intermittent asthma
  - 10/18 becoming mild asthma
- Nasal inflammatory markers:
  - Inflammatory cells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

Tosca MA et al. *Ann Allergy Asthma Immunol* 2003;91(1):71-8.

Specific Antibody Deficiency (SAD)

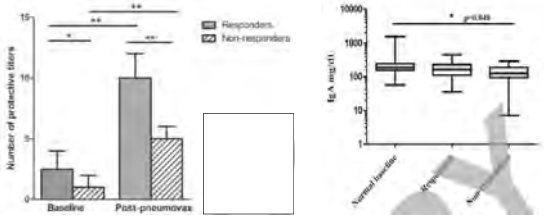
- Impaired response to immunization with polysaccharide antigens in the presence of normal quantitative immunoglobulin levels.
- Sinopulmonary infections with *S. pneumo*, *M. cat*, *H. influenzae*, and *S. aureus* most common manifestations.
- SAD recognized in 5-20% of children >2yrs old who suffer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

SAD in Adults with CRS



Carr TF, et al. Am J Rhinol Allergy 2011;25:241-44.

SAD in Adults with CRS



Carr TF, et al. Am J Rhinol Allergy 2011;25:241-44.

Immunodeficiency and CRS

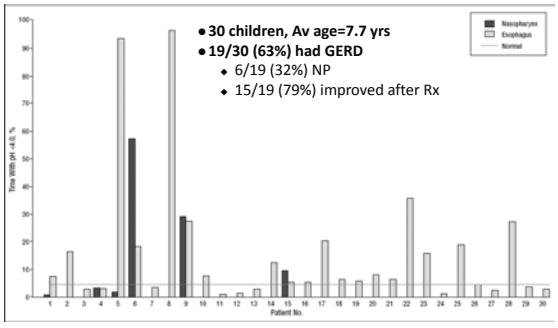
- Evaluate the following:
  - IgE, G, M, A , and IgG subclasses
  - Antibody levels before and after vaccination with *H flue* and *Strep pneumo*
- If abnormalities detected, immunize and repeat titers, refer to allergist/immunologist
- Consider IVIG or SCIG

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 sxs
  - 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.

Sinusitis: GERD



- **30 children, Av age=7.7 yrs**
- **19/30 (63%) had GERD**
  - 6/19 (32%) NP
  - 15/19 (79%) improved after Rx

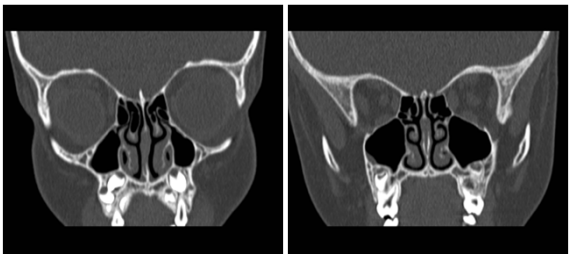
Primary Ciliary Dysmotility

- 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

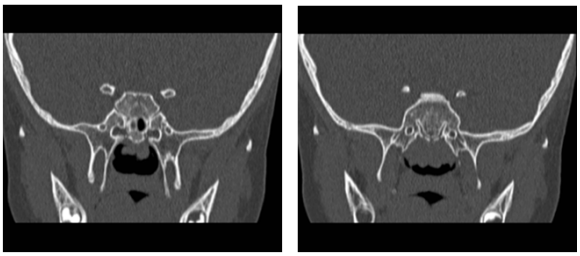
Computed Tomography

5 y.o with chronic cough and nasal drainage



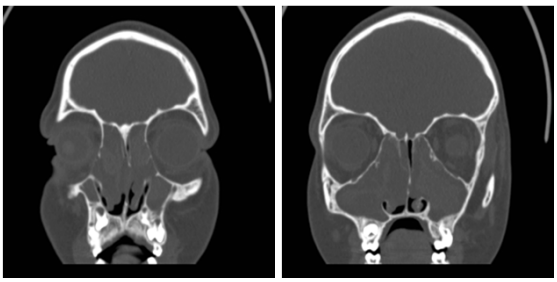
Computed Tomography

Adenoid views

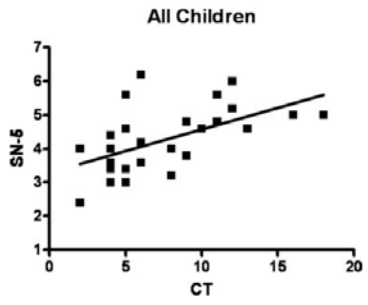


Computed Tomography

Cystic fibrosis



Sxs and CT Scans in Pediatric CRS



r_s= 0.67
p<0.0001

Useful tool for clinical follow up

Terrell/Ramadan, et al. *Laryngoscope* 2009;119:1394-98

Treatment

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

Author	Intervention	Age Range	Outcome	Category of Evidence
Ozturk 2011	Amoxicillin/Clavulanate PO x 30 days and methyl-prednisolone or placebo PO x 15 days	6-17 years	CT scan and symptom scores improved in all with superiority of the combination treatment	Ib
Adappa 2006	Intravenous antibiotics (5 weeks)+maxillary irrigation and adenoidectomy	1-14 years	89% long term improvement in CRS symptoms (>12 months after therapy)	III
Don 2001	Intravenous antibiotics+maxillary irrigation and adenoidectomy	10 mon-15 years	89% complete resolution of symptoms	III
Otten 1994	Tap and washout followed by randomization to cefaclor or placebo PO for 1 week	2-12 years	No difference in resolution rate at 6 weeks	Ib(-)*
Otten 1988	saline nose drops (placebo), xylometazoline 0.5%-nose drops with amoxicillin 250 mg PO TID, drainage of the maxillary sinus under anesthesia and irrigation, and a combination of drainage and irrigation with xylometazoline and amoxicillin for 10 days	3-10 years	No difference in cure rate between groups at 6 or 26 weeks	Ib(-)**

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 sxs & inflammation:
  - Improved mucus clearance
  - Enhanced ciliary beat activity
  - Clearance of allergen/biofilm/mediators

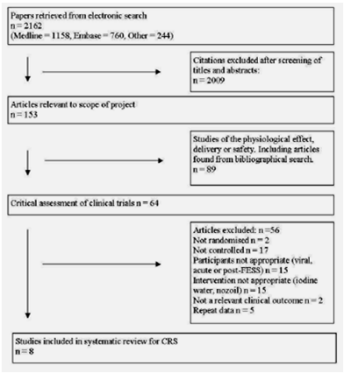
Harvey R, et al. *Cochrane Database* 2009

Nasal Saline Irrigation

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

Harvey R, et al. *Cochrane Database* 2009

Nasal Saline Irrigation



- Wide range of delivery techniques
- Duration: 7 ds-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

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

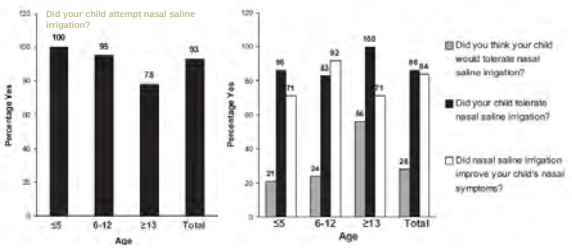
- Retrospective study.
- Children with nasal congestion and rhinorrhea (sinusitis, allergic rhinitis, chronic rhinitis).
- Therapeutic course of isotonic nasal saline (100 ml/nostril) recommended and questionnaire administered 2-4 months later.

Table 1
Patient demographics.

Parameter	Value
n	61
Median age, years (range)	8 (2–16)
Age, *n* (%)	
≤5 years	14 (23)
6–12 years	38 (62)
≥13 years	9 (15)
Male, *n* (%)	41 (67)

Jeffe JS, et al. IJPO 2012; 76:409-13.

Compliance with Saline Irrigation



Jeffe JS, et al. IJPO 2012; 76:409-13.

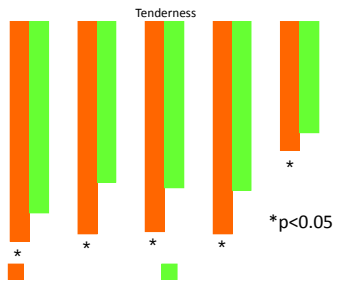
Intranasal Steroids

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

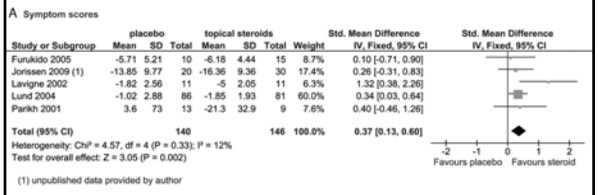
Meltzer et al *J. Allergy Clin Immunol* 2000;105:S208.

Individual Sinusitis Symptoms
Clinician-Rated Symptoms at Endpoint



Meltzer et al *J. Allergy Clin Immunol* 2000;105:S208.

Effect of Intranasal Steroids on CRSsNP in Adults



EPOS 2012, Rhinology, 2012

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

Ozturk F, et al. J Allergy Clin Immunol 2011;128:348-52.

Steroids and Antibiotics in Pediatric CRS

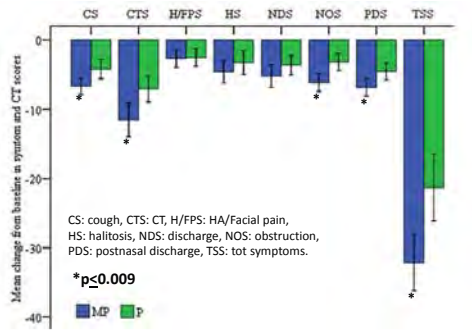
TABLE I. Baseline characteristics of patients

	MP group (n = 22)	Placebo group (n = 23)	*P* value
Age (y [SD])	8.5 (2.9)	8.0 (2.3)	NS
Male/female ratio	14/8	15/8	NS
Weight (kg [SD])	28.4 (11.7)	26.3 (7.7)	NS
Duration of symptoms (mo [SD])	16.8 (17.1)	20.5 (13.5)	NS
Smoking in household, no. (%)	6 (27)	7 (30)	NS
Atopy, no. (%)	8 (36)	10 (43)	NS
Blood eosinophil count (SD)	274 (183)	322 (247)	NS
Total symptom score (SD) (Max=60)	35.1 (8.2)	36.5 (6.5)	NS
Total CT scan score (SD) (Max=24)	12.8 (5.3)	11.2 (4.5)	NS

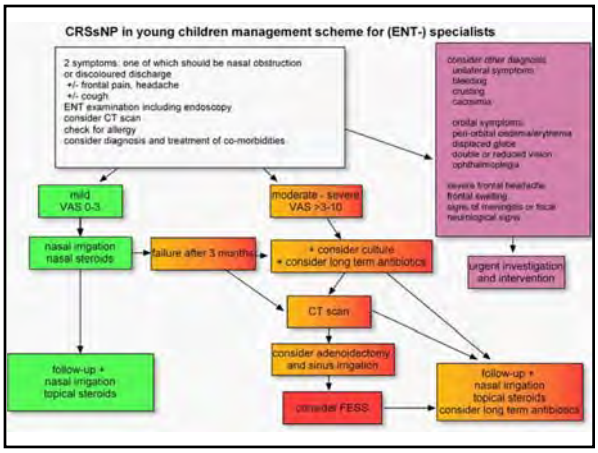
All parameters were insignificant between the groups.
MP, Methylprednisolone; *NS*, not significant.

Ozturk F, et al. J Allergy Clin Immunol 2011;128:348-52.

Steroids and Antibiotics in Pediatric CRS



Ozturk F, et al. J Allergy Clin Immunol 2011;128:348-52.



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

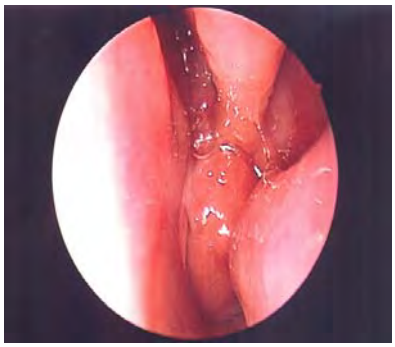
- *Orbital complications*
- *CNS complications*
- *Severe polyposis (CF)*
- *Immune-deficiency disorders*
- *Fungal rhinosinusitis*

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*



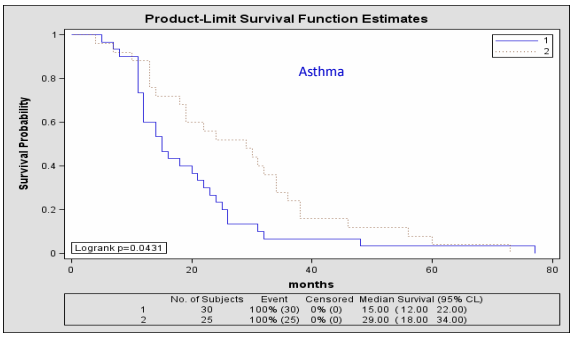
Adenoidectomy

- *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*

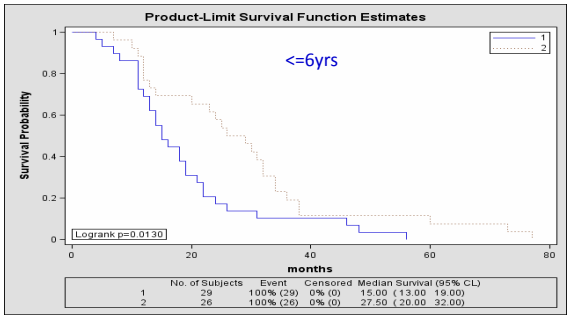
Adenoidectomy

- *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

Variable	Number (%)
Patients	233
Male sex	142 (61)
Mean age	5.5
Allergy	92 (47.7)
Asthma	85 (39.9)
Mean Ct score	6.4

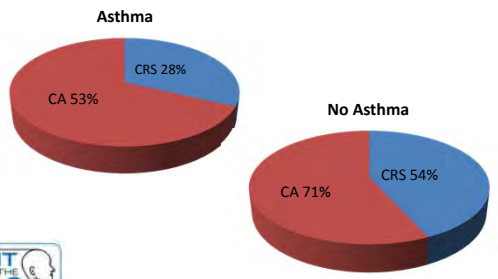
CRS vs CA

Makary C, Ramadan H- AJR 2014

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

CRS vs CA

Makary C, Ramadan H- AJR 2014



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*

Adenoidectomy with Wash

- *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 with Wash

- *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*

Adenoidectomy with Wash

- *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	# of patients (%)
>=-1.5	12 (50%)
<-1.5>=-1.0	7 (29%)
<-1.0>=-0.5	2 (8%)
Success total	21 (87%)
<-0.5 =0	1 (4%)
>0	2 (8%)
Failure total	3 (12%)

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*

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

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

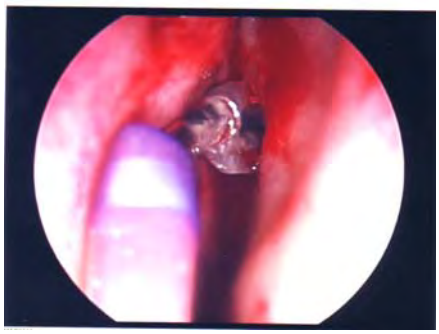
SN-5 Change	Balloon	Adenoidectomy
Marked improvement (>= -1.5)	43.3	36.8
Moderate improvement (-1 to -1.4)	20	10.5
Mild improvement (-0.5to -0.9)	16.7	5.3
Total success	80	52.6
Same (0 to -0.4)	16.7	36.8
Worse (>= +0.1)	3.3	10.5
Total failure	20	47.4

Results: *Multivariate analysis of all covariables with surgery as outcome.*

Variable	P-value
Surgery	0.038
Age	0.1
CT score	0.7
Prior adenoidectomy	0.18
Asthma	0.92
Allergy	0.19
Gender	0.08

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

Surgical Treatment

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

ESS

- *ESS has gained over the years acceptance as 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

- *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*

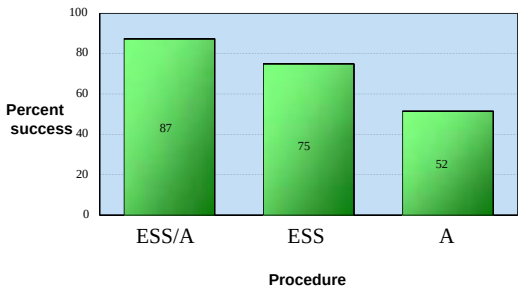
Surgical Treatment

- *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*

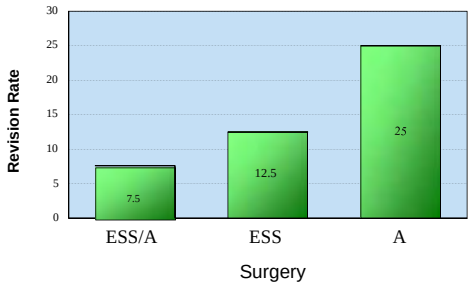
Results

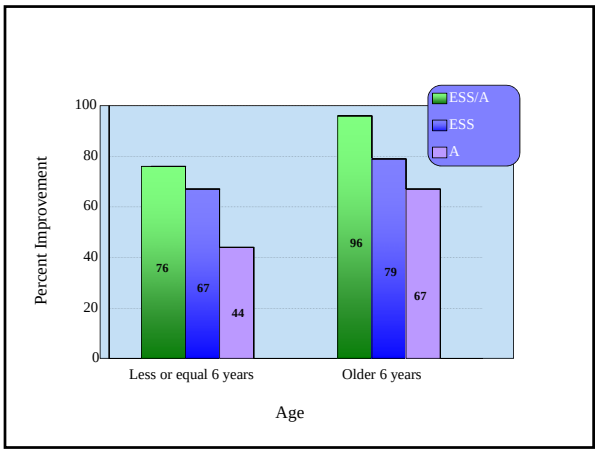
- *1850 patients were evaluated for surgery and included in the study*
- *202 (11%) children were considered as surgical candidates*
- *18 (9%) were lost to follow up or refused surgery*
- *183 patients were available for analysis*

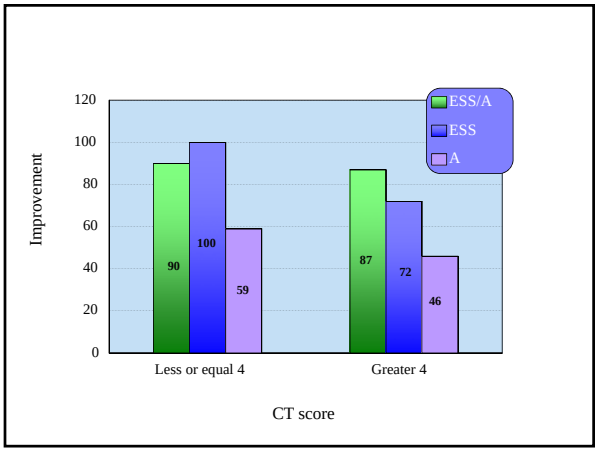
Results

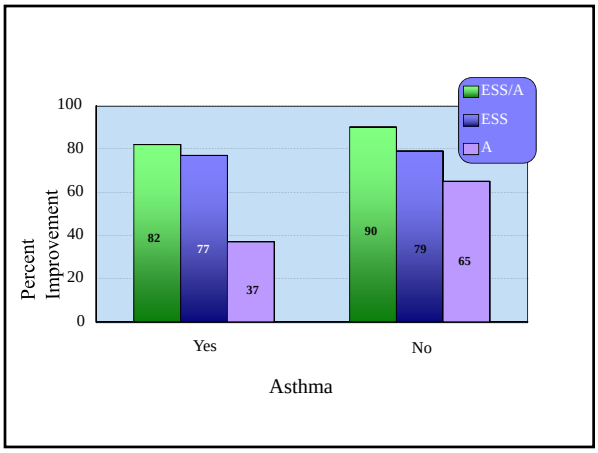


Results




ESS/A
ESS
A
Percent Improvement
100
80
60
40
20
0
76
67
44
96
79
67
Less or equal 6 years
Older 6 years
Age


ESS/A
ESS
A
Improvement
120
100
80
60
40
20
0
90
100
59
87
72
46
Less or equal 4
Greater 4
CT score


ESS/A
ESS
A
Percent Improvement
100
80
60
40
20
0
82
77
37
90
79
65
Yes
No
Asthma

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 hi CT score (younger children)*
- *ESS/hybrid helpful at time of adenoidectomy (88%) for older children with asthma and a hi CT score*

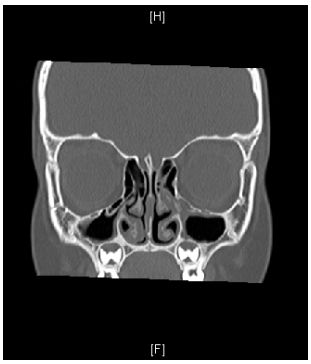
Case Presentation

- *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*

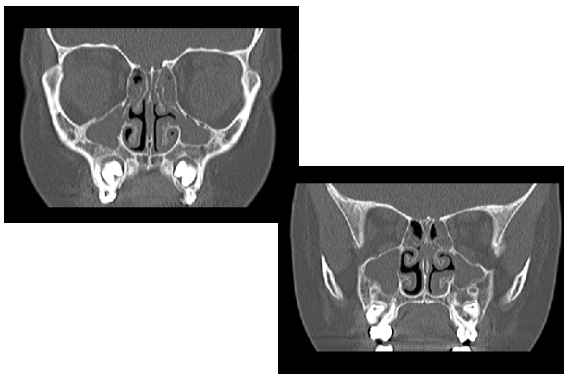
Diagnosis

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

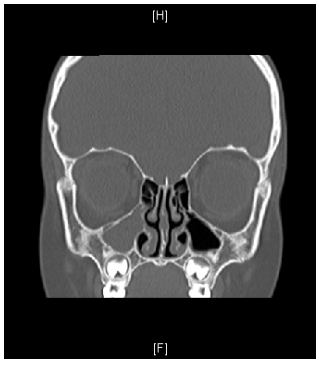
Case 1

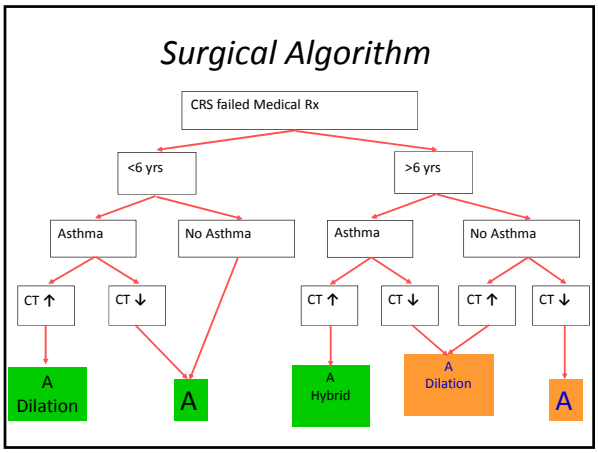


Case 2



Case 3




Surgical Algorithm
CRS failed Medical Rx
<6 yrs
>6 yrs
Asthma
No Asthma
Asthma
No Asthma
CT ↑
CT ↓
CT ↑
CT ↓
CT ↑
CT ↓
A
Dilation
A
A
Hybrid
A
Dilation
A