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Cough Committee . AAAAI

**Rhinitis Committee . Mexican College of Pediatricians specialized in
Allergy and Clinical Immunology**

Reviewer.

Revista Alergia Mexico

Expert Reviews of Clinical Immunology

OBJECTIVE

Discuss therapeutic options and their efficacy in the Treatment of chronic rhinosinusitis in children

Evidence – base literature

Expert opinions

Real life

POTENTIAL CONFLICTS = 0

PEDIATRIC CHRONIC RHINOSINUSITIS

HEALTH PROBLEM

DX MORE DIFFICULT TO MAKE

PREVALENCE OF CRS IN PEDIATRIC POPULATION IS INVERSELY RELATED TO THE AGE OF THE PATIENT

YOUNGER AGE GROUPS HAVE HIGHER INCIDENCES OF BOTH VIRAL UPPER RESPIRATORY INFECTIONS AND CRS

SPECTRUM OF DISORDERS WITH SIMILAR PRESENTING SYMPTOMS LIKE THOSE OF

VIRAL UPPER RESP. INFECTIONS OR ALLERGIC RHINITIS 

PEDIATRIC CHRONIC RHINOSINUSITIS

TREATMENT GOAL:

ACHIEVE RESOLUTION OF SYMPTOMS WITH
RETURN OF NORMAL SINUS PHYSIOLOGY AND
MUCOCILIARY CLEARANCE

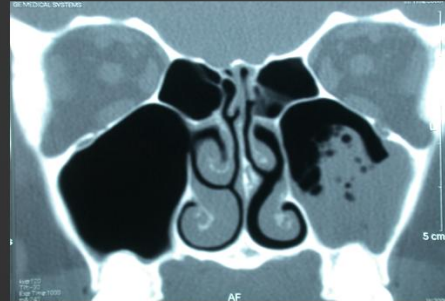
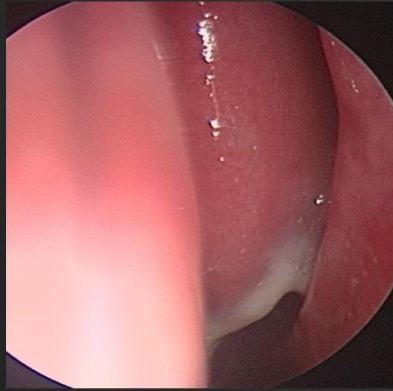
CHRONIC RHINOSINUSITIS IN CHILDREN

*The children should be sick.....
To be healthy*

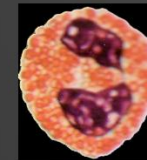
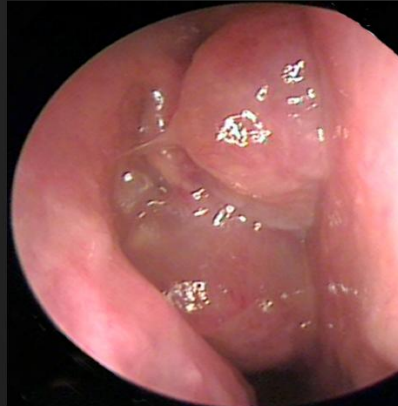
Rhinosinusitis?

Same Process?

ARS
CRSs



CRSw
polyps

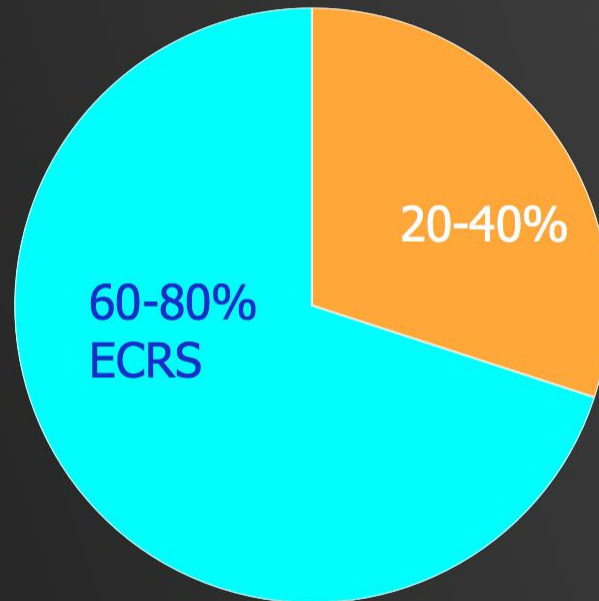


INFLAMMATION

INFECTION

Grouping by Histology

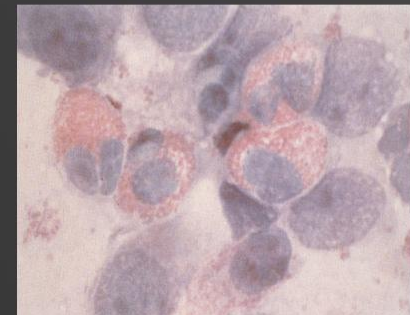
CRS: ECRS/NECRS



ECRS > adults than children

● NECRS
● ECRS

1. Newman JAMA 1994;
2. Hoover JACI 1997;
3. Szucs, AJR 2002;
4. Baroody, Arch Oto 1995;
5. Sobol, Laryngoscope 2003



Consensus Guidelines

- Rhinosinusitis initiative, 2004 (Meltzer, et al)
- Joint Task Force on Practice Parameters, 2005 (Slavin, et al)
- European Position Paper on Rhinosinusitis and Nasal Polyps, 2007 (Fokkens, et al)
- British Society for Allergy and Clinical Immunology, 2008 (Scadding et al)

Desrosiers et al. Allergy, Asthma & Clinical Immunology 2011, 7:2
<http://www.aacjournal.com/content/7/1/2>



ALLERGY, ASTHMA & CLINICAL
IMMUNOLOGY

REVIEW

Open Access

Canadian clinical practice guidelines for acute and chronic rhinosinusitis

EVIDENC BASE OF THE PUBLISHED LITERATURE AND REFLECT VIEWPOINTS OF EXPERTS IN ALLERGY , IMMUNOLOGY, OTOLARYNGOLOGY, RHINOLOGY

CONSENSUS AND DIVERGENT OPINIONS OCCUR BETWEEN GUIDELINES REGARDING CLASSIFICATION, DIAGNOSIS AND MANAGEMENT OF ARS AND CRS and their various subtypes

The diagnostic utility of nasal airway exam is acknowledged by all

Consensus Guidelines

- Rhinosinusitis initiative, 2004 (Meltzer, et al)
- Joint Task Force on Practice Parameters, 2005 (Slavin, et al)
- European Position Paper on Rhinosinusitis and Nasal Polyps, 2007 (Fokkens, et al)
- British Society for Allergy and Clinical Immunology, 2008 (Scadding et al)

EP3OS guidance document:

the most comprehensive treatment recommendations for CRS ,
CRS subtypes and stratified further according to disease severity.

CHRONIC RHINOSINUSITIS IN CHILDREN

MULTIFACTORIAL DISEASE

factors that may contribute to CRS in children

CRS IN CHILDREN

Factors predisposing to Recurrent or Chronic Rhinosinusitis

- Frequent viral upper respiratory tract infections
- Small sinus ostia
- Anatomic abnormalities in the sinuses
- Immaturity of the pediatric immune system
 - Primary
 - Secondary
- Biofilm formation in sinus tissue
- Enlarged adenoids harboring bacteria that cause CRS

Lusk R. Clin Allergy Immunol 2007;20:287-98

Hamilos, D JACI oct 2011 Modified.

Wu, A et al Immunol Allergy Clin N Am 2009 .

CRS IN CHILDREN

Factors predisposing to Recurrent or Chronic Rhinosinusitis

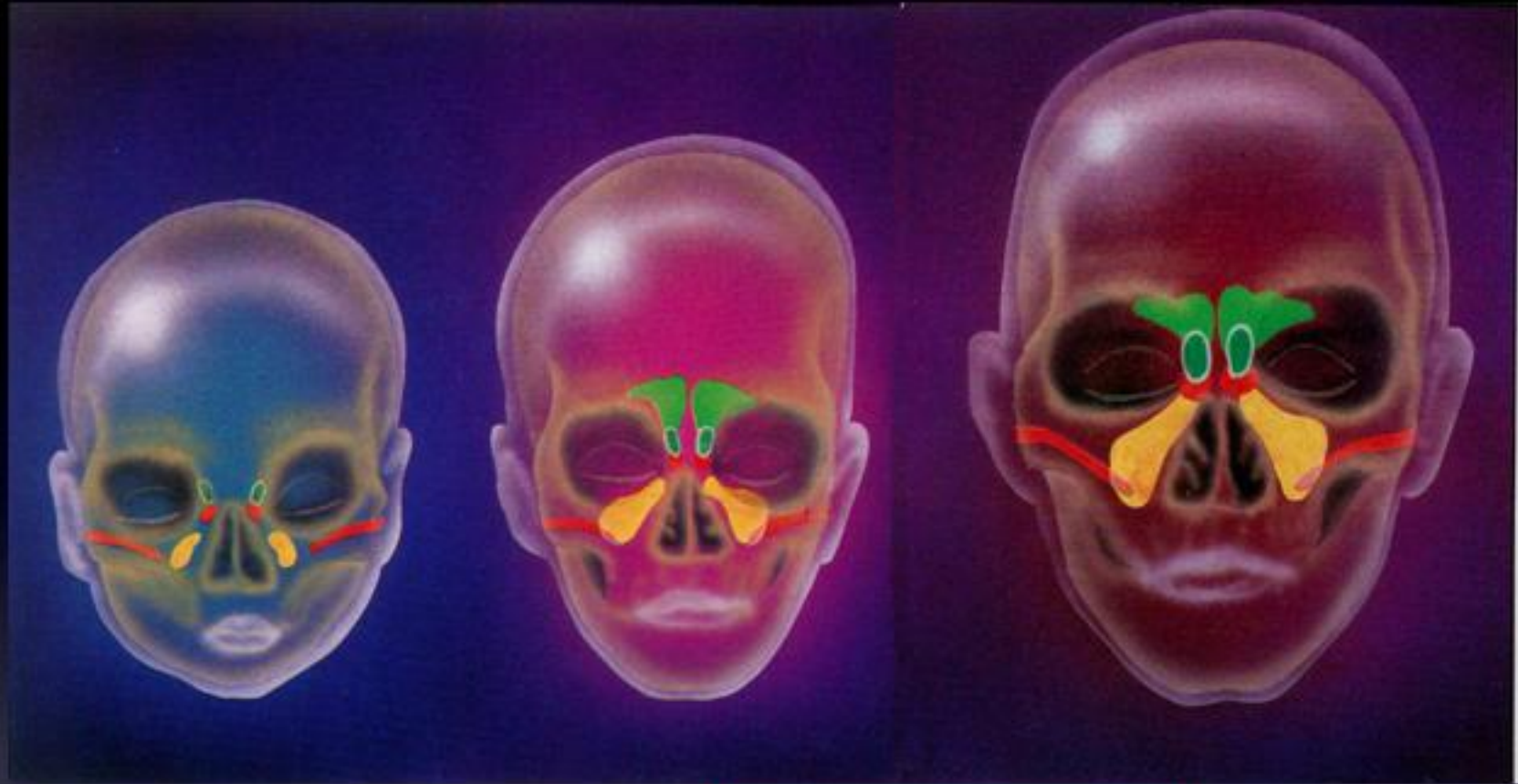
- Allergy
- Tobacco smoke
- Irritants / pollutants
- GERD
- Defects in mucociliary clearance
(primary / secondary)
 - Cystic fibrosis
 - Inmotilia cilia syndrome

Pediatric upper respiratory tract infections (URTIs)

- The incidence of the common cold is much higher in children.
- Rates are highest in children < 5 years. Children attending school or daycare are a large reservoir for URIs to other children and those who care for them.
- Children have 3-8 viral URTIs per year. Adolescents and adults have 2-4 URTIs per year, and people older than 60 years have < than 1 URTIs per year.
- Bacterial rhinosinusitis complicates 2 % of viral URIs.

Emedicine/WebMD, accessed January 19, 2009.

Centers for Disease Control and Prevention. Nonspecific upper respiratory tract Infection.

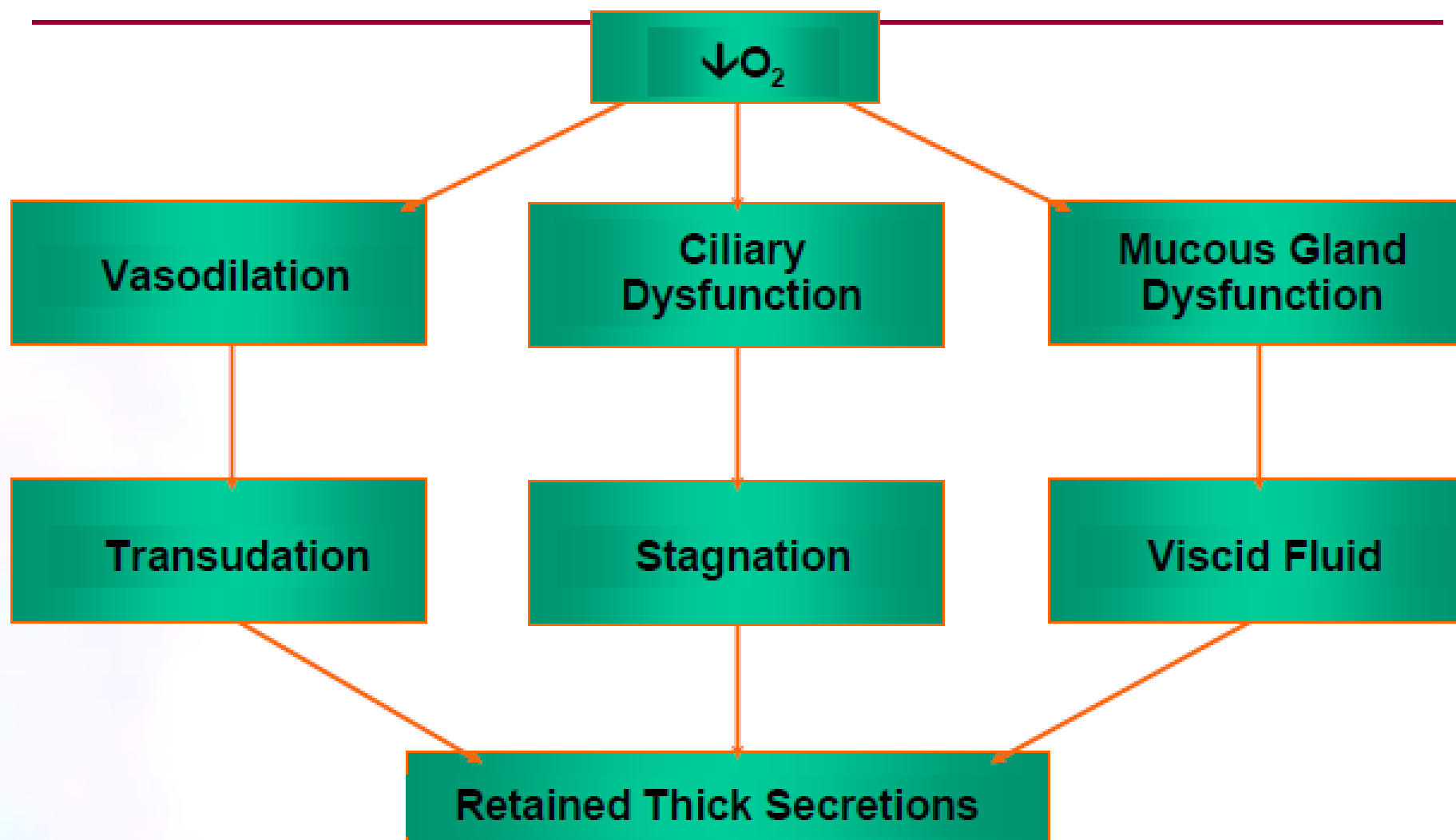


Viral Rhinosinusitis

Clinical and radiographic features of the common cold are similar to bacterial rhinosinusitis:

- a) CT scan within 48-96hrs of a self-diagnosed “cold” (n=31)
- b) 77 % with infundibulum occlusion
- c) 79 % cleared in 2 weeks without antibiotics

Obstruction of the Sinus Ostium Produces Acute Rhinosinusitis



“CRS IN CHILDREN” ??

PITFALLS

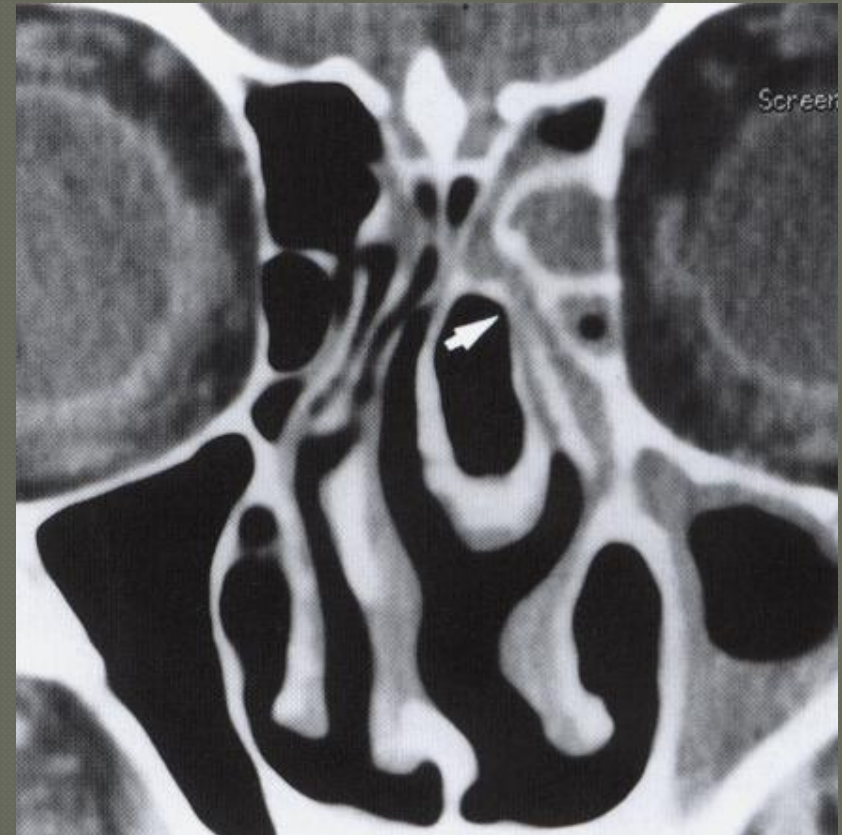
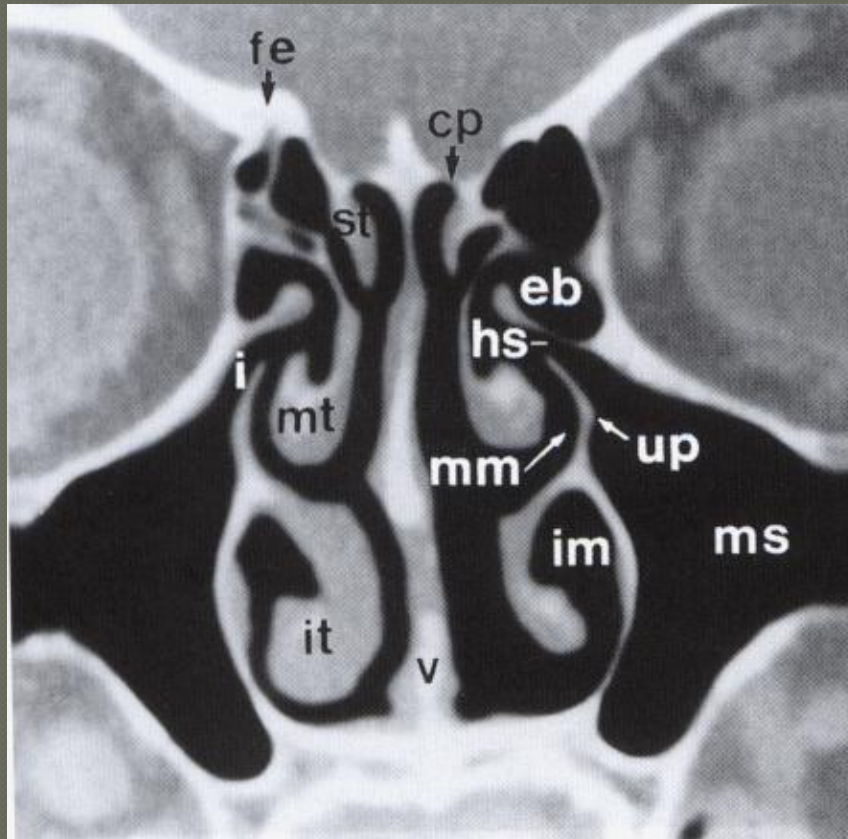
**TREAT THE PATIENT,
NOT THE CT SCAN**

Anatomic abnormalities in pediatric CRS

- It had been postulated that a septal deformity in the region of the OMC would be associated with ostiomeatal narrowing and increased risk of rhinosinusitis.
- Septal deviation is not associated with an increased incidence of rhinosinusitis in adults or children.
- There is a strong correlation between the presence of a concha bullosa and deviation of the septum to the contralateral side.

1. Harar RP, et al. *Rhinology* 2004;42(3):126-30.
2. Hamdan AL, et al. *J Med Liban* 2001;49(1):2-5.
3. Collet S, ET AL. *Acta Otorhinolaryngol Belg* 2001;55(4):299-304.
4. Sivasli E, et al. *Surg Radiol Anat* 2003;24(6):400-5.

ANATOMICAL DEFECTS / VARIANTS AFFECTING OMC CONCHA BULOSA BLOCKING THE INFUNDIBULUM



How common is immune deficiency in pediatric CRS?

- 61 Children with chronic sinusitis were referred for an allergy evaluation; were evaluated for immunologic competence.
- 22 Patients had + prick test; 12 additional patients had highly + intradermal test to common environmental allergens.
- 11 Had low immunoglobulin levels,
 - 6 Had low immunoglobulin levels and vaccine hyporesponsiveness
- 17 Had poor vaccine response only.

- Thus, 34 of 61 patients with refractory sinusitis had abnormal results on immune studies, with depressed IgG3 levels and poor response to pneumococcal antigen 7 being most common.

Bacteriology of pediatric CRS

•Children with radiograph-proven CRS underwent maxillary sinus punctures to obtain pathogens and for analysis of antibiotic resistance.

RESULTS: 295 cultures obtained from 165 children yielded 399 isolates. The common isolates

1. Alpha-hemolytic Streptococcus (20.8 %).
2. Haemophilus influenzae (19.5 %).
3. Streptococcus pneumoniae (14.0 %).
4. Coagulase-negative Staphylococcus (13.0 %).
5. Staphylococcus aureus (9.3 %).
6. Anaerobes in (8.0 %).

•Susceptibility rates of H influenzae for ampicillin and co-trimoxazole were 44.7 % and 42.1 %, respectively, in the first 3 years of the study and 25 % and 40 %, respectively, in the next 3 years.

CRS IN CHILDREN

ANTIBIOTICS 1 a A

Antibiotics in CRS in children – Cochrane meta-analysis of antibiotics for persistent nasal discharge concluded that antibiotics given for 10 days reduced the probability of persistence in the short to medium term .

The benefit were modest and for 8 children treated one additional child would be cured (NNT 8, 95% CI 5 to 29).

No long term benefits were documented.

The only study really treating CRS was negative

Eur Respir J 2011; 38: 9–11
DOI: 10.1183/09031936.00020111
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EDITORIAL

Prescribing and guidelines: both must improve to combat antimicrobial resistance

M. Woodhead

The problem is the development and spread of anti-microbial resistance in common bacterial pathogens. The cause is excessive exposure of these bacteria to antimicrobial agents. The solution is to reduce antimicrobial exposure, the most important element of which is to reduce human use.

Systemic antibiotics for chronic rhinosinusitis without nasal polyps in adults

Authors' conclusions

- There is limited evidence from one small study to support the use of systemic antibiotics for the curative treatment of chronic rhinosinusitis in adults.
- Further good quality trials, with large sample sizes, are needed to evaluate the use of antibiotics in chronic rhinosinusitis.

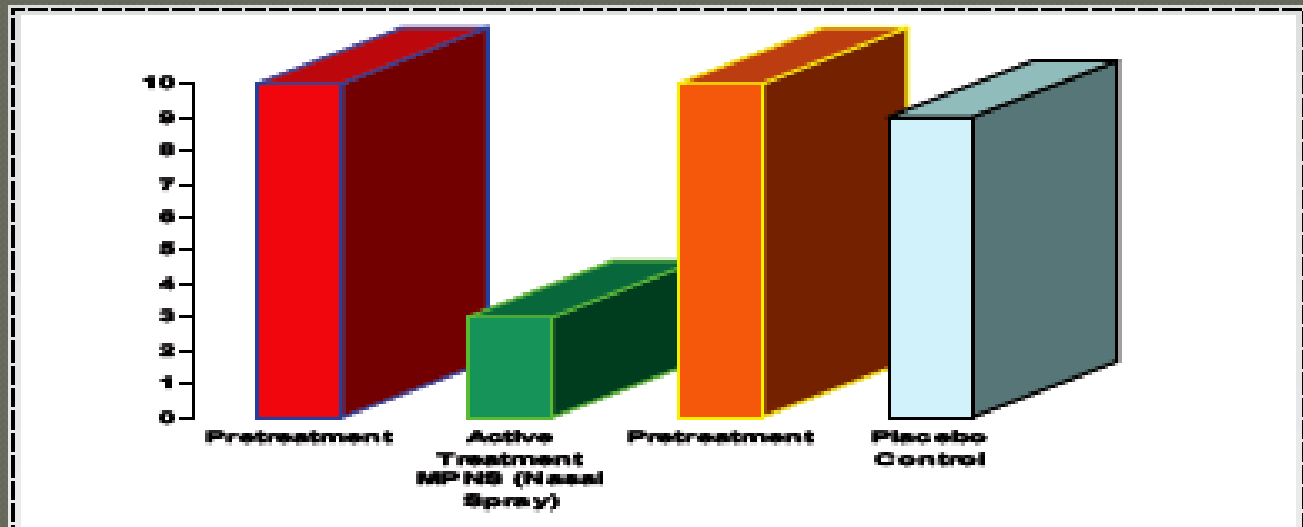
Nasal Topical Antimicrobial Agent, Mupirocin (Bactroban), in the Prophylaxis of Repeated Paranasal Sinusitis: A Double Blind Placebo Control Study

Study Design (Nasal Spray)

- a) 100 patients, (average age 36 y/o)
- b) 38 patients, Bactroban nasal solution: 7 months
- c) 38 patients, Placebo: 7 months
- d) Clinical (> 1 week), CT scan, Fiberoptic Rhinoscopy

Nasal Topical Antimicrobial Agent, Mupirocin (Bactroban), in the Prophylaxis of Repeat Paranasal Sinusitis: A double Blind Placebo Control Study.

Frequency of Paranasal sinusitis episode(s) per 7 months (average)



Conclusion:

Bactroban group frequency of sinusitis decreased 70% versus 10% in the control group. This study suggest evidence in support of Mupirocin nasal sol. As an effective antibacterial agent for the prevention of repeated paranasal sinusitis.

Decreases Nasal Congestion By Killing Staph, Stopping Staph. Allergic Reaction!

Nsouli T. et al. Ann Allergy Asthma Immunol 1996; 76:117 2006-2009 in pred.

Nasal Lavage With Mupirocin for the Treatment of Surgically Recalcitrant Chronic Rhinosinusitis

- **Methods:**

- Patients with surgically recalcitrant CRS who had positive nasendoscopically guided cultures for *Staphylococcus aureus* *were treated with twice daily nasal lavages containing 0.05% Bactroban and lactated ringers salts for 3 wks in this prospective open-label pilot study.
- Patients were assessed before and after treatment in terms of nasendoscopic findings, microbiology results, and SNOT-20 and visual analogue scale questionnaires.

Nasal Lavage With Mupirocin for the Treatment of Surgically Recalcitrant Chronic Rhinosinusitis

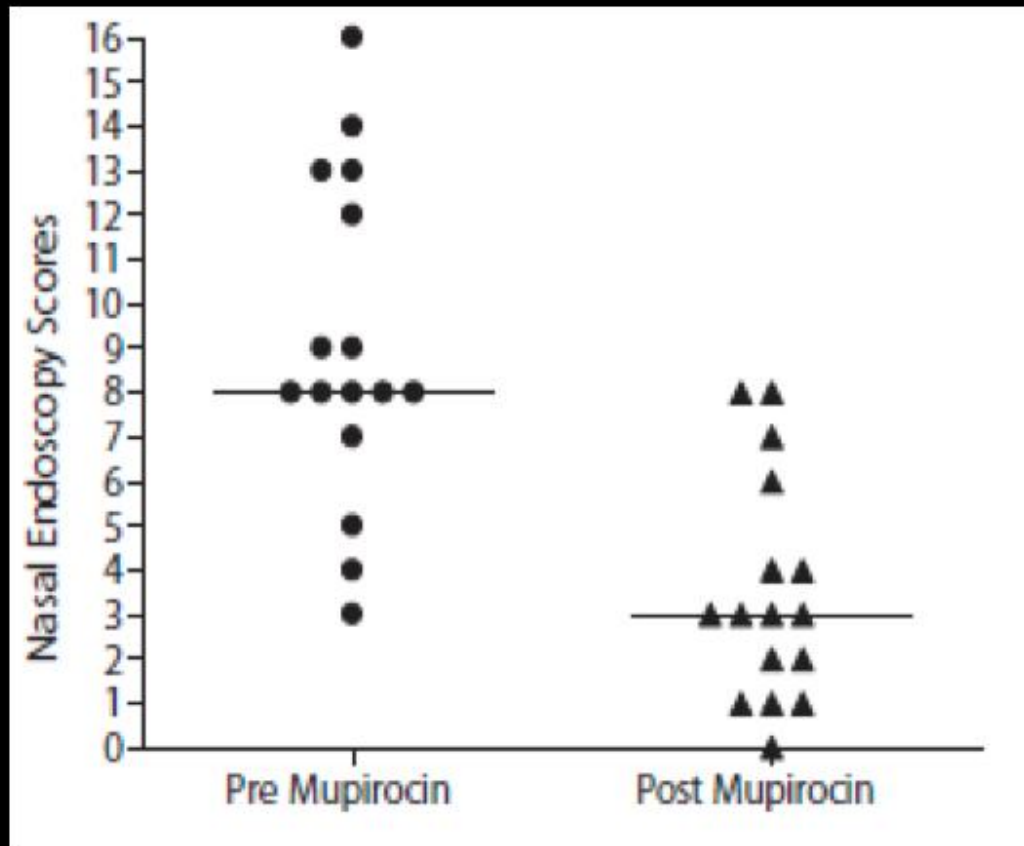
- **Results:**

- Fifteen of 16 patients had improved nasendoscopic findings after treatment. Twelve of 16 patients noted overall symptom improvement.
- Fifteen of 16 patients had negative swab results for *Staphylococcus aureus* after treatment.
- Only minimal adverse effects were experienced.

*specifically discuss concern of biofilm as rationale for nasal lavage

Uren Laryngoscope 2008;118:1677-80

Nasal endoscopy scores pre vs. post Rx



$P=0.001$

Note 15/16 improved
1 subject worsened



Macrolides. Antiinflammatory and immunomodulatory effects. Use in respiratory illnesses

José Antonio Sacre Hazouri*

Table 1. Antiinflammatory effects of macrolides

Nitric oxide	Increases the release of nitric oxide influenced by cNOS Suppression of nitric oxide influenced by iNOS
Respiratory tract mucous Hyperreactivity of the respiratory tract	Reduction of volume and hypersecretion Greater clearance and ciliary movement Reduction of HRB to methacholine Reduction of endothelin-1 protein
Bioactive phospholipids and epithelial damage	Protection of ciliary epithelium of the respiratory tract and of reactive oxidants
Bacterial adherence	Reduction of bacterial adherence to epithelium (<i>Pseudomonas aeruginosa</i>)
Biofilm development	Reduction of biofilm formation Reduction of <i>P. aeruginosa</i> virulence
<i>Pseudomonas aeruginosa</i> virulence factors	

Role of adenoidal biofilm in pediatric CRS

A study of the prevalence and extent of adenoidal biofilm in pediatric CRS versus obstructive sleep apnea (OSA).

CRS (N = 7); OSA (N = 9).

Ultrastructural scanning EM analysis of biofilm.

Group	Pediatric CRS	Pediatric OSA	
Mean biofilm	94.9 %	1.9 %	P < .001

Biofilms in the nasopharynx of children with CRS may act as a chronic reservoir for bacterial pathogens resistant to standard antibiotics.

The role of adenoids in pediatric rhinosinusitis.

To evaluate adenoids' importance in pediatric rhinosinusitis as a cause of mechanical blockage or as a reservoir for pathogenic bacteria.

METHODS:

A retrospective chart review of prospectively collected data was performed, which included 410 children under the age of 14 who underwent adenoidectomy in the study. Adenoid bacteriology was evaluated with adenoid tissue culture, and sinusitis grade and adenoid size were determined using preoperative PNS X-ray. A potential correlation between these factors was then analyzed.

RESULTS:

The overall adenoid bacteria isolation rate was 79.3%. The most common bacteria were Haemophilus influenza (28.5%), Streptococcus pneumonia (21.7%), Streptococcus pyogenes (21.0%), and Staphylococcus aureus (15.6%), and bacterial isolation rate increased significantly according to sinusitis grade ($p=0.000$). This was especially true of Haemophilus influenzae and Streptococcus pneumonia, whose isolation rates increased significantly ($p=0.011$, $p=0.001$ each). There was no statistically significant difference in sinusitis grade or bacterial isolation rate according to adenoid size.

Adenoidectomy as a treatment for pediatrics CRS

- There is a correlation of rhinosinusitis and infected adenoid core pathogens. 1,2
- Adenoidectomy will resolve CRS in roughly 50 % of the children. 3,4
- It is now widely accepted that an adenoidectomy should be performed before intervening with endoscopic sinus surgery. 5,6

1. Lee D, Rosenfeld RM. Otolaryngol HNS 1997;116:301-7.
2. Muntz HR, Lusk RP. Arch OHNS 1991;117:179-81.
3. Ramadan HH. Arch Otolaryngol Head Neck Surg 1999;125(11):1208-11.
4. Vanderberg SJ, Heatley DG. Arch Otolaryngol Head Neck Surg 1997;123(7):675-8.
5. Lieser JD, Derkay CS. Curr Opin Otolaryngol Head Neck Surg 2005;13(1):60-6.
6. Sobol SE, et al. Laryngoscope 2005;115(1):78-80.

Adenoidectomy outcomes in pediatric rhinosinusitis : A meta-analysis

BRIETZKE Scott E. BRIGGER Matthew T. ;

Results: Nine studies met the inclusion criteria. Six were cohort studies (level 2b) and four were case series (level 4). Mean sample size was 46 subjects (range = 10-121) with grand mean age of 5.8 years (range 4.4-6.9 years). All studies showed that sinusitis symptoms or outcomes improved in half or more patients after adenoidectomy. Eight studies were sufficiently similar to undergo meta-analysis. The summary estimate of the proportion of patients who significantly improved after adenoidectomy was 69.3% (95% CI = 56.8-81.7%, $p < 0.001$). The possibility of author bias was explored as one author group contributed a large proportion of patients to the study group.

Conclusion: Adenoidectomy reduces caregiver reported symptoms of chronic rhinosinusitis in a majority of pediatric patients. Given its simplicity, low risk profile, and apparent effectiveness, adenoidectomy should be considered first line therapy for medically refractory, uncomplicated pediatric rhinosinusitis.

FAILURES OF ADENOIDECTOMY FOR CHRONIC RHINOSINUSITIS IN CHILDREN: FOR WHOM AND WHEN DO THEY FAIL ?

- 143 children : adenoidectomy for CRS
- Follow up was available on 121
- 61 failed
- Data on 55 who failed adenoidectomy and had FESS
 - Younger than 7 years of age
 - Asthma
 - Required salvage ESS

Ramadan & Tiu 2007

OUTCOME OF ADENOIDECTOMY VS ADENOIDECTOMY WITH MAX SINUS WASH FOR CHRONIC RHINOSINUSITIS IN CHILDREN

- Children with more severe sinus disease as evidence by a high CT score had a higher success rate if maxillary sinus wash was performed at the time Of adenoidectomy
- Children with a low CT score did not have that benefit

Multipronged approach to treatment of refractory pediatric CRS

OBJECTIVE: To estimate the success of a therapy consisting of culture directed IV antibiotics, adenoidectomy, and sinus aspiration in ameliorating long-term (>12 months) clinical symptoms of CRS in pediatric patients who are resistant to oral antibiotic therapy.

METHODS: retrospective review of 22 pediatric CRS case.

RESULTS: Initial clinical improvement after cessation of IV therapy was achieved in all 22 patients.

- a). Seventeen (77%) demonstrated long-term resolution of clinical symptoms of CRS.
- b). 4 patients were immunocompromised and had poorer outcomes.

Surgical Algorithm

CRS failed Medical Rx

<6 yrs

>6 yrs

Asthma

No Asthma

Asthma

No Asthma

CT ↑

CT ↓

CT ↑

CT ↓

CT ↑

CT ↓

A
wash

A

A
ESS

A
Wash
ESS

A

Risk factors for protracted CRS following FESS

A retrospective chart review of 53 pediatric patients undergoing ESS for CRS between 2002 – 2006. The patients were assigned to the “protracted” group if they demonstrated persistent mucopurulent nasal discharge for > 3 months after ESS, or the “resolved” group.

RESULTS: There were 21 “protracted” patients (39.6%) and 32 “resolved” patients (60.4%).

Risk factors for protracted CRS were:

- a) sinonasal polyposis (80.9% vs. 53.1%, $P = 0.039$).
- b) history of allergic rhinitis (52.4% vs. 12.5%, $P = 0.002$) and
- c) gender (male vs. female = 80.9% vs. 43.7%, $P = 0.007$).

These associations remained significant in a multivariate logistic regression.

Influence of allergy in pediatric CRS

61 Children with chronic sinusitis were referred for an allergy evaluation were evaluated for immunologic competence.

22 Patients had + prick tests;

12 Additional patients had highly + intradermal tests to common environmental allergens.

Thus, roughly 50% of children with refractory sinusitis had relevant allergies

Nasal challenge with allergen leads to maxillary sinus inflammation

Fuad M. Baroody, MD, Samantha M. Mucha, MD, Marcy deTineo, BSN, and Robert M. Naclerio, MD *Chicago, Ill*

DB, crossover, randomized, placebo-controlled study in 20 allergic subjects out of season

- After tx with placebo or loratadine (10 mg PO daily) for 1 week , a catheter was inserted into one maxillary sinus and used to lavage the cavity.
- Nasal challenge with diluent for the allergen extract, followed by 3 concentrations of grass or ragweed
- Nasal and ipsilateral sinus lavages were performed after each challenge and then hourly for 8 hrs.
- Outcomes: symptoms, lavage specimens were evaluated for eosinophils, levels of ECP, albumin and histamine.
- 11 subjects underwent a similar challenge with lactated Ringer's solution

**RESULTS: SIG. INCREASES IN EARLY AND LATE PHASE PARAMETERS
+ maxillary sinus eos and the levels of albumin, ECP, histamine during LPR**

JACI. 2008; 121:1126-32

Nasal challenge with allergen leads to maxillary sinus inflammation

Fuad M. Baroody, MD, Samantha M. Mucha, MD, Marcy deTineo, BSN, and Robert M. Naclerio, MD Chicago, Ill

J ALLERGY CLIN IMMUNOL
MAY 2008

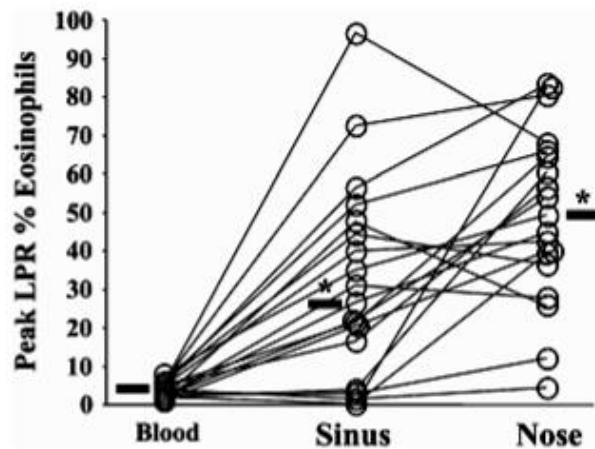


FIG 6. Percentage of eosinophils in blood, the maxillary sinus, and the nasal cavity after allergen challenge depicted as individual values with median bars. The maxillary sinus and nasal cavity data are presented as the median value for the peak LPR percentage of eosinophils for each subject. * $P \leq .01$ versus blood value.

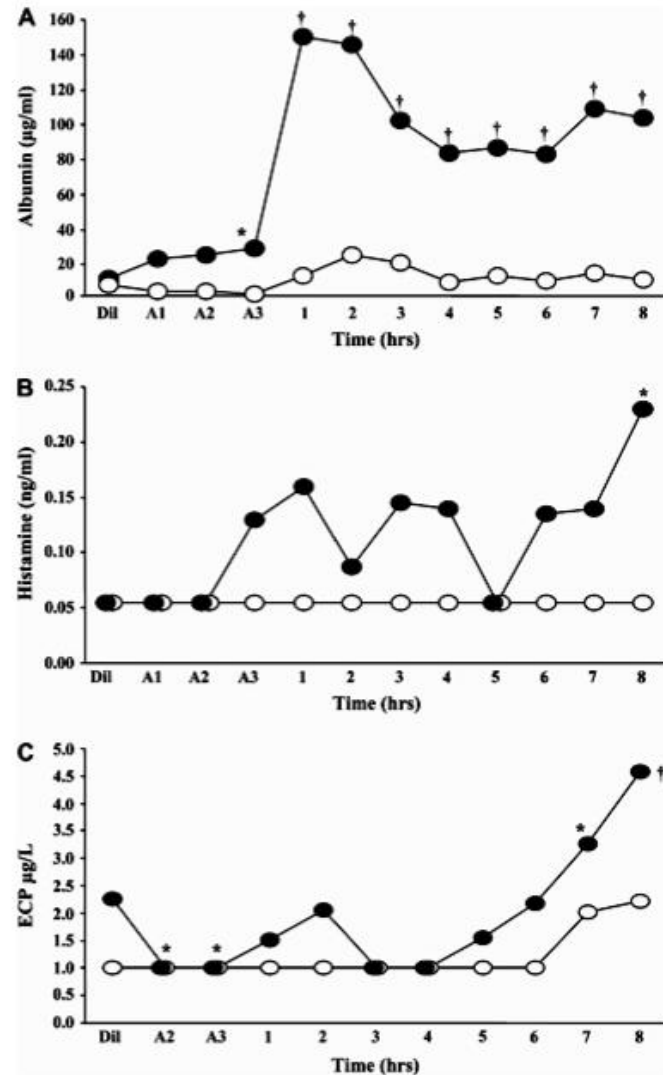
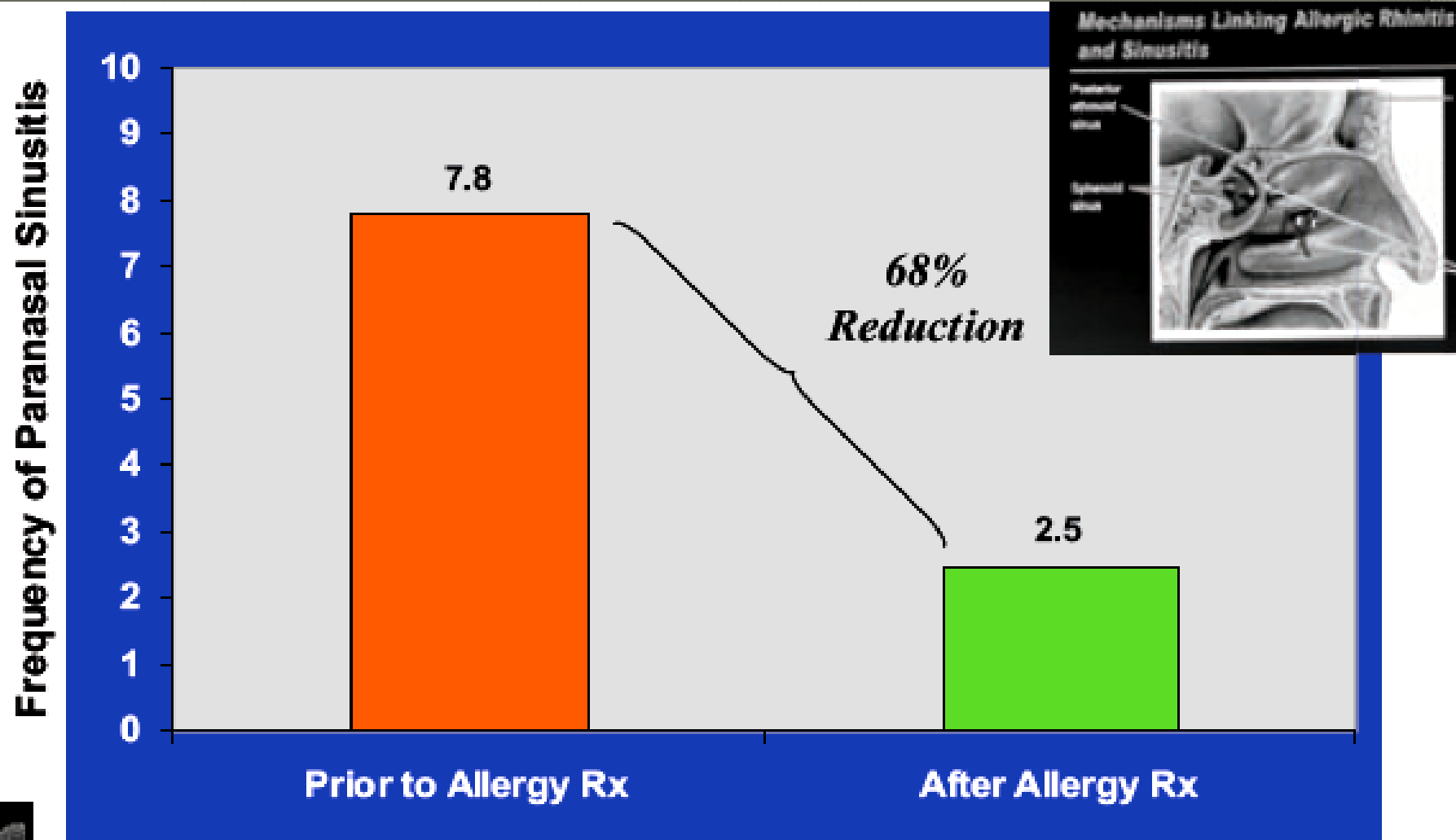


FIG 5. Median levels of mediators in the maxillary sinus after allergen (solid circles, $n = 20$) and control (open circles, $n = 11$) challenges: A, albumin; B, histamine; C, ECP. The protocol is on the x-axis, and the labels are as in Fig 2. * $P \leq .05$ and † $P \leq .01$ versus respective diluent challenges.

The Role of Allergic Rhinitis in Repeated Paranasal Sinusitis



ALLERGY leads to INFECTION ?

- ◉ Mucosal edema
- ◉ Increased ICAM-1
- ◉ Decreased mucociliary clearance
- ◉ Eosinophil damage

Sacre Hazouri. JA

Estudio del niño con obstrucción recurrente de las vías respiratorias superiores

- 117 patients < 12 y old
- Prospective study
- Nasal recurrent obstruction for + 4 days x week , for 3 weeks x month
- Minimum of 3 months

- W /S clinical manifestations of allergy (rhinorrea, sneezing, itching, nasal congestion)
- W /S oral breathing, snoring

- Protocol: H&P , NASAL CYTOGRAM , LATERAL XR , ENDOSCOPY

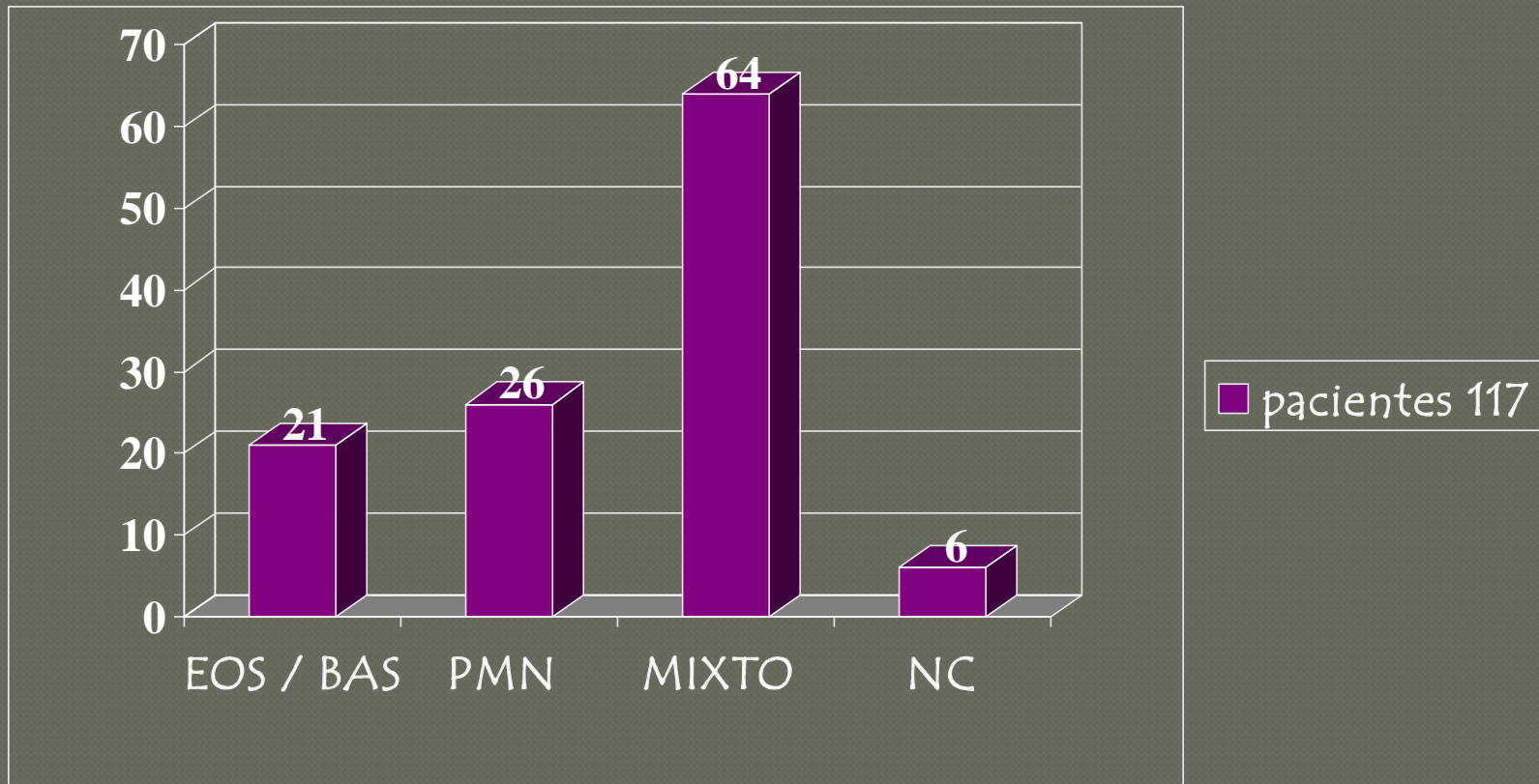
Sacre Hazouri. JA

Estudio del niño con obstrucción recurrente de las vías respiratorias superiores

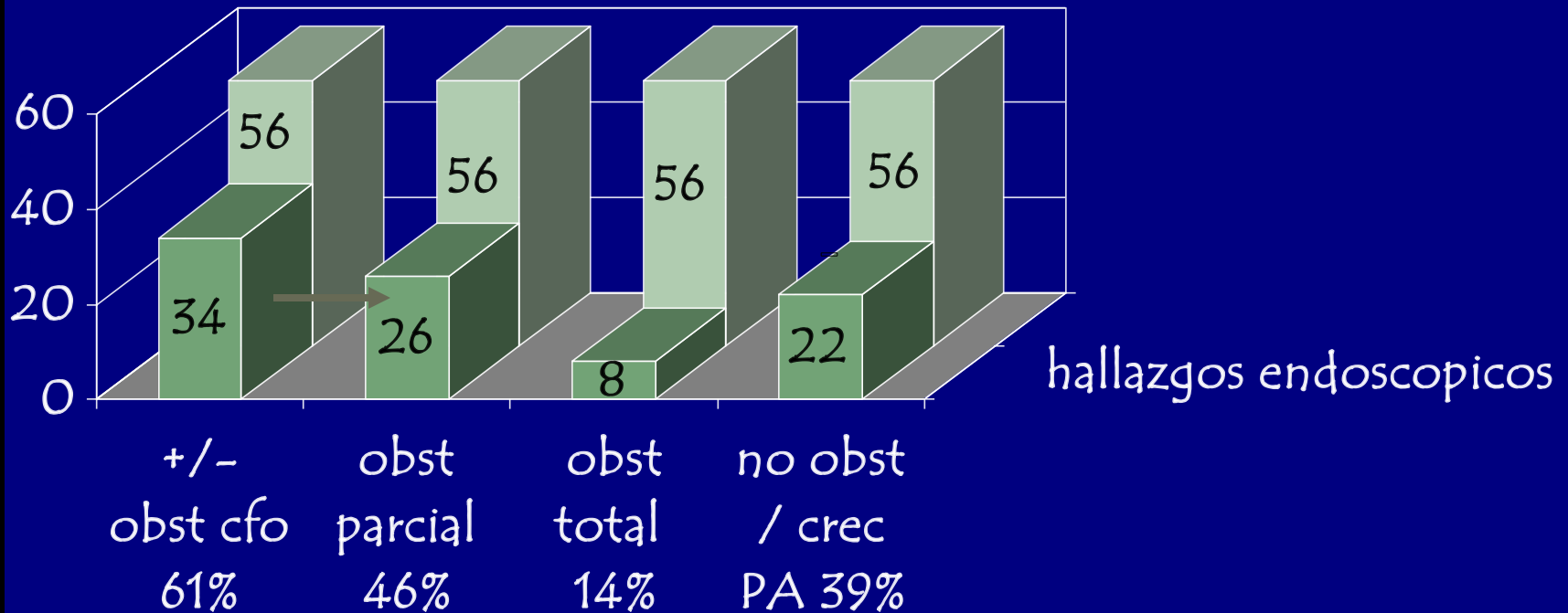
2/3 or these patients had a nasal cytology pattern of nasal allergy (eos / basoph MCC) and neutrophils with IC bacteria at the same time (rhinoprobe – Alfredo Jalowayski MD UCSD)

- Conventional radiology (lateral neck x ray) in the diagnosis of H / H of Adenoids is useful (aprox size in 75 % of the patients)
- If this study shows a decrease in diameter of the airway between the hard palate and the adenoidal shadow of 40% of more, we should proceed with a flexible rhinopharyngoscopy to evaluate not only the real size of the Adenoidal tissue, its mucosal appearance and its potential obstruction of The Eustaquian tube (OPT) “otopharyngeal tube”
- 50 % of the children with abnormal lateral X-ray, have at least some degree OPT obstruction.
- The endoscopic procedure is easy to perform, even in small children

Nasal (Upper Airway) recurrent obstruction in Children (nasal cytogram)



EUSTAQUIAN TUBE OBSTRUCTION related to enlarged adenoids.



■ hallazgos endoscópicos ■ >vol adenoides



**Adenoid Enlargement
Partial obstruction
Reflux to E Tube**



Endoscopy vs XR

Nasal (Upper Airway) recurrent obstruction in Children

- ◎ Endoscopy:

- ◎ Sensitivity 100 %

- ◎ Specificity 91 %

- Positive predictive value: 89 %

- Negative predictive value: 100 %

- Sacre, JA. Alergia México. Vol XLVI, n 6. 1999

Gastroesophageal Reflux Contributing to Chronic Sinus Disease in Children

A Prospective Analysis

David Phipps MD. et al

- Prospective analysis
- Ages 2-18
- 30 patients who failed CRS conservative treatment
- 24 hrs. PH probe was performed
- 63% were found to have pathologic reflux
- 32% had reflux into nasopharynx
- 79% of patients CRS symptoms improved with GERD treatment
- 71% of patients with GERD also had asthma
- Only 44% of patients without asthma had GERD
- Pathophysiological characteristics of GERD in CRS unknown, but there is an association
- Theory-Acid causes inflammatory reaction leading to decreased mucociliary clearance
- Asthmatics use medications that decrease LES tone and cause hypersecretion of gastric acid

Arch Otolaryngol Head Neck Surg. 2000 Jul;126(7):831-6.

- Acid Reflux is common in Pediatric ENT disorders
- Gastric Reflux is common and often benign
- Patients with ENT disorders do not often have Esophagitis

GERD ~~=~~ LPR

REFLUX IN ADENOIDECTOMY

Adenoidectomy

PE Tube

# patients	95	100
Average age	1.46	1.19 y
GERD	42 %	7%

Complex pathophysiology of pediatric CRS

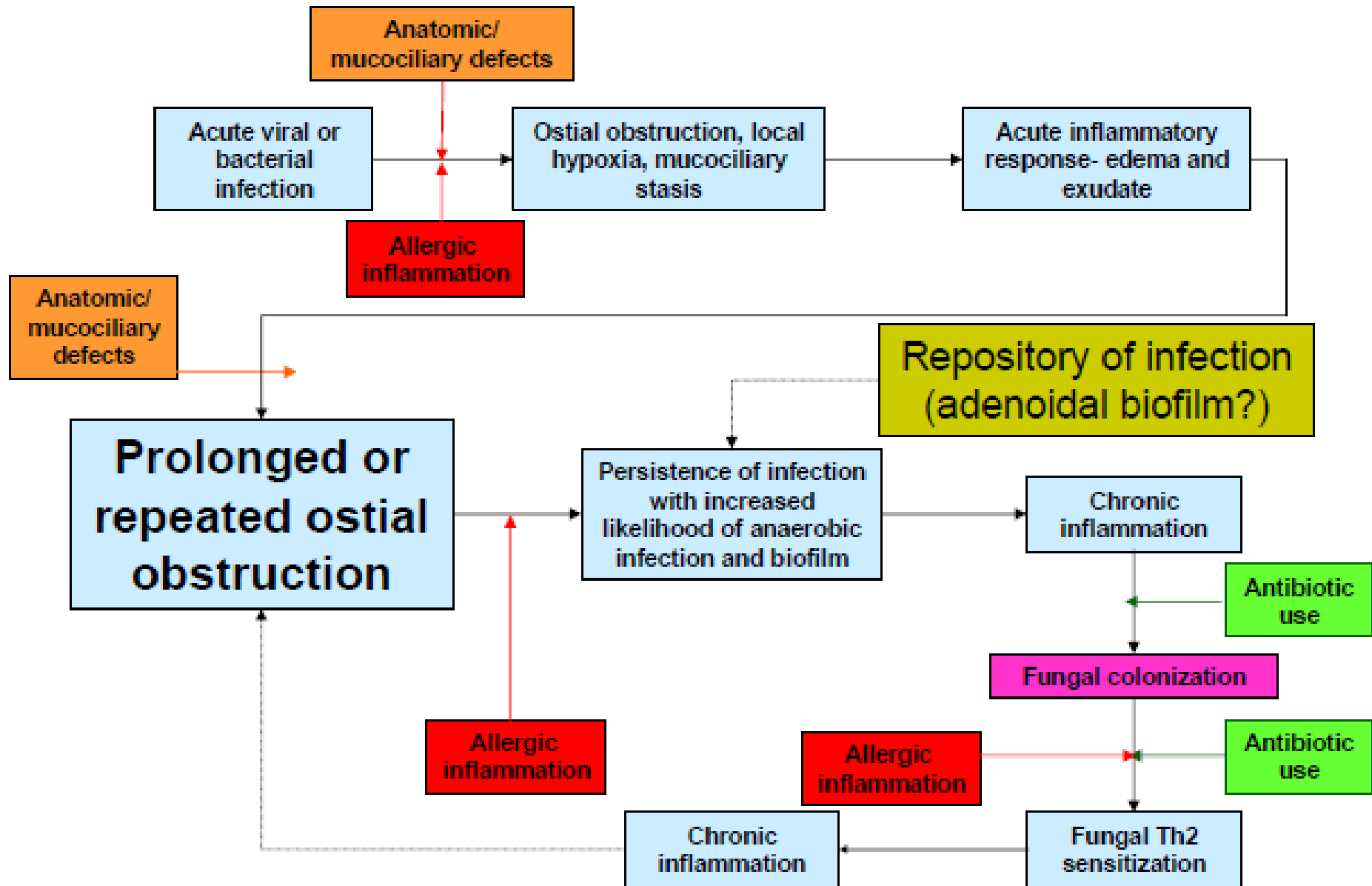
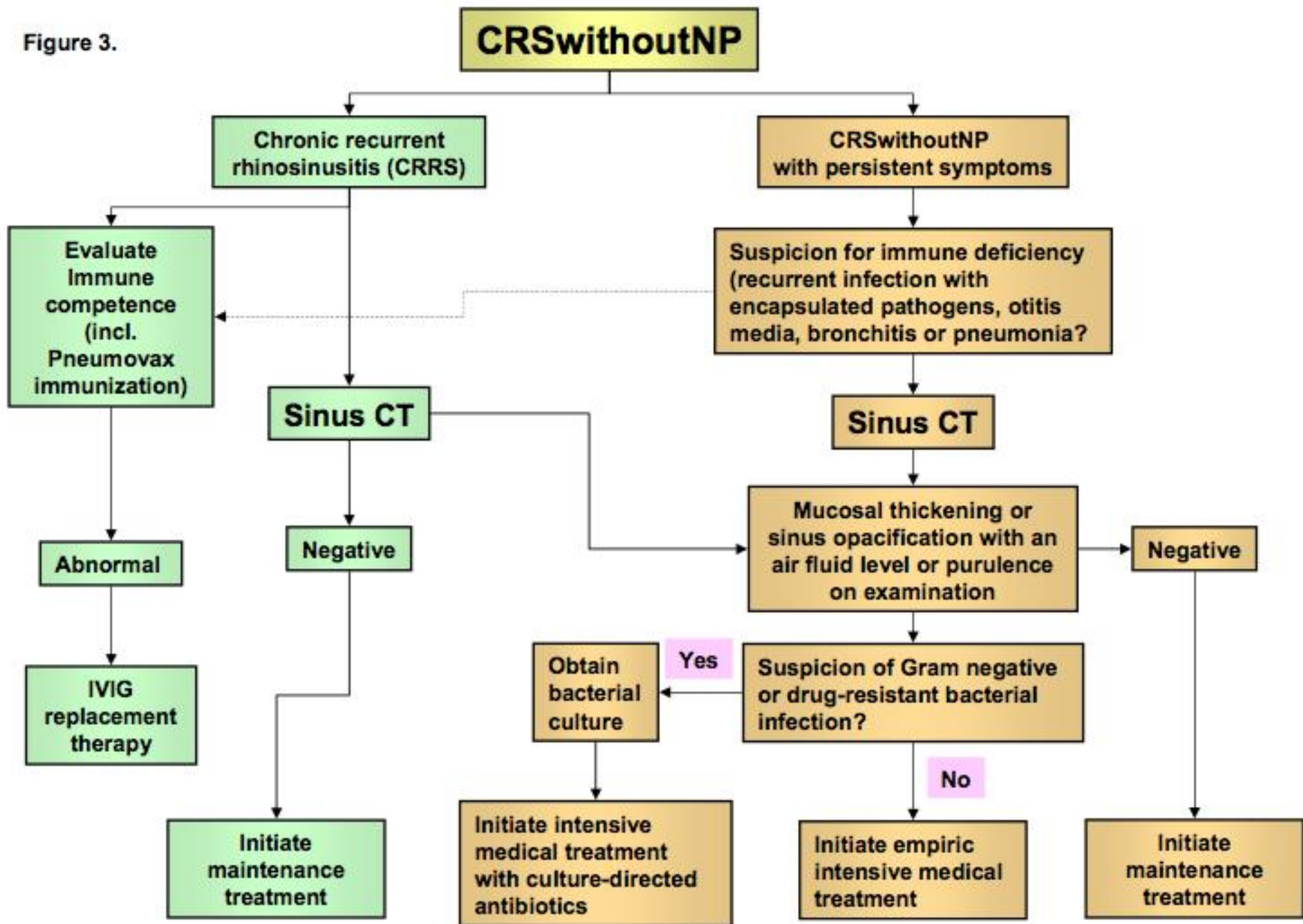


Figure 3.



Advancements in computed tomography management of chronic rhinosinusitis

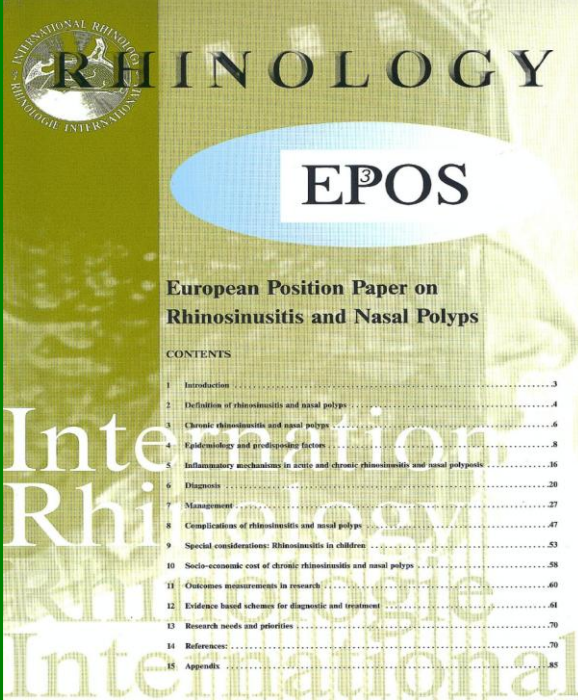
Randy Leung, MD.,¹ Katrina Chaung, M.D.,¹ Jason L. Kelly, M.D.,² and Rakesh K. Chandra, M.D.¹

Table 1 Relative radiation dosage estimates for x-ray and computed tomography (CT) modalities

Imaging Modality	Radiation Dosage (mSv)	Equivalent Radiation Exposure at Sea Level
Chest x-ray	0.1	10 days
Mini-CAT CT Sinus 600 Frame	0.17	20 days
Mammogram	0.7	3 mo
CT sinus	1	4 mo
CT head	2	8 mo
CT chest	8	2 yr
CT pelvis	10-20	3-6 yr

Source: Adapted from Xoran Technologies (www.radsafe.Xorantech.com/).

American J Rhinol & Allergy sept-oct 2011. 25,5.



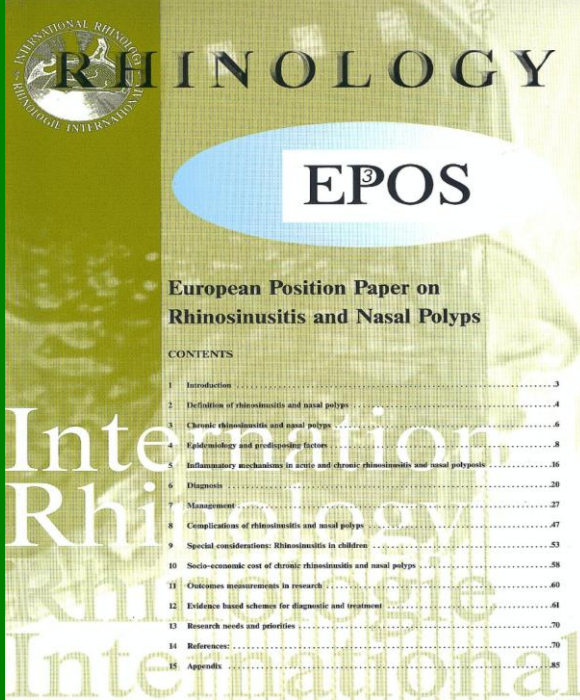
Using ARIA template
 Evidence based review
 Provided definitions

- Clinical
- Epidemiological
- Research

Table 4. Treatment evidence and recommendations for children with acute rhinosinusitis

Therapy	Level	Grade of Recommendation	Relevance
oral antibiotic	Ia	A	yes, after 5 days, or in severe cases
topical corticosteroid	IV	D	yes
topical steroid on top of oral antibiotic	Ib	A	yes
topical decongestant	III (-)	C	no
saline douching	IV	D	yes

III (-): study with a negative outcome



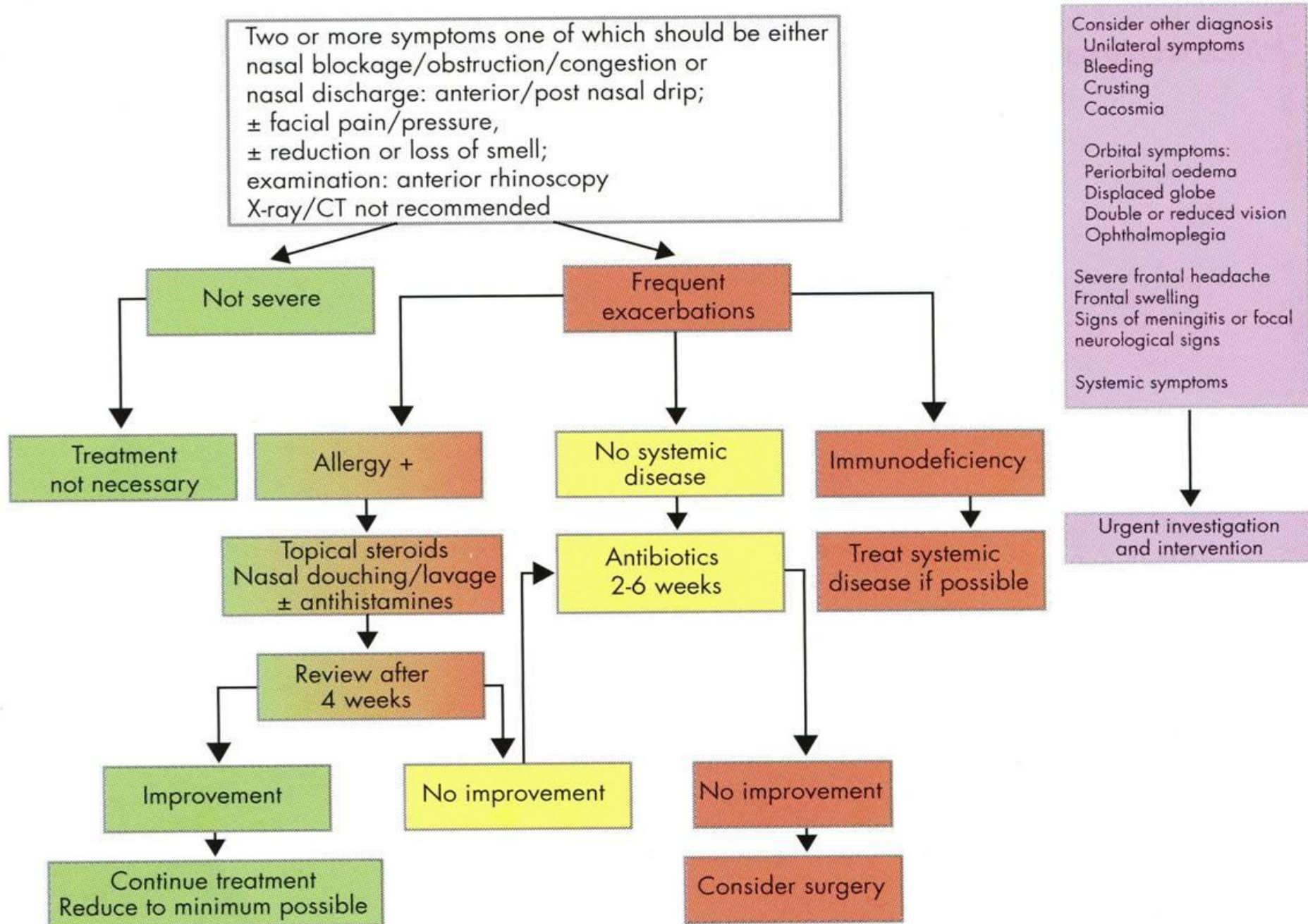
Using ARIA template
 Evidence based review
 Provided definitions

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Table 5. Treatment evidence and recommendations for children with chronic rhinosinusitis

Therapy	Level	Grade of Recommendation	Relevance
oral antibiotic	Ia	A	yes, small effect
topical corticosteroid	IV	D	yes
saline douching	III	C	yes
therapy for gastro-oesophageal reflux	III	C	yes

Figure 7. Chronic rhinosinusitis in children management scheme



Compliance with topical nasal medication An evaluation in children with rhinitis

were collected. Two hundred questionnaires were completed, of which 194 were valid for analysis. The mean age of patients was 7.54 yr; male to female ratio was 1:1.6, and Chinese made up the majority (62.4%). About one quarter (24.7%) of children disliked the use of topical nasal sprays/drops sufficiently to affect compliance with the medication. Furthermore, of those who could indicate their preferred route of drug administration (n = 75), 73% indicated a preference for oral medication, while only 11% preferred the nasal route.

Topical nasal sprays/drops were more acceptable in older children (7–15 yr) compared to the younger ones (1–6 yr) (OR = 2.383, CI

Compliance with topical nasal medication

An evaluation in children with rhinitis

Table 3. Difficulties/unpleasantness experienced during administration*

Pediatr Allergy Immunol 2010; 21: 1146–1150

Difficulties/unpleasantness	Percentage (n = 194)
Complaints of itch/pain/discomfort	31
Medication flowing down throat/nose	23
Struggle away	20
Experiences fear/anxiety/cries	16
Flat refusal	16
Unpleasant aftertaste	15
Only allowing application of 1 nostril	10
Nostril dryness	9
Nosebleed	0

*Difficulties/unpleasantness experienced during administration was obtained from listed options provided in Q12 of questionnaire.

PERO... 55% le dicen sí a las INDICACIONES MEDICAS
30% olvidan tomar sus medicamentos regularmente

Nasal saline irrigations for the symptoms of CRS

Main results

- Eight trials were identified that satisfied the inclusion criteria.
- Three studies compared topical saline against no treatment, one against placebo, one as an adjunct to and one against an intranasal steroid spray.
- Two studies compared different hypertonic solutions against isotonic saline.
- There is evidence that saline is beneficial in the treatment of the symptoms of chronic rhinosinusitis when used as the sole modality of treatment.
- Evidence also exists in favor of saline as a treatment adjunct.
- Saline is not as effective as an intranasal steroid.
- Some evidence suggests that hypertonic solutions improve objective measures but the impact on symptoms is less clear.

Nasal saline irrigations for the symptoms of CRS

Authors' conclusions

- The use of topical saline could be included as a treatment adjunct for the symptoms of chronic rhinosinusitis.

Harvey Cochrane Database of Systematic Reviews 2009

Radiographic Comparison of Three Methods for Nasal Saline Irrigation

David E. L. Olson, MD; Barry M. Rasgon, MD; Raymond L. Hilsinger, Jr., MD

Conclusion: Judged solely on the basis of solution distribution in the nasal sinuses, nasal irrigation is effective when either positive-pressure or negative-pressure irrigation is used but is ineffective when a nebulizer is used.



Fig. 1. (A) Sinus Rinse nasal irrigation applicator (shown by permission of NeilMed Products, Inc.) and (B) RinoFlow nebulizer.

Laryngoscope, 112:1394 –1398, 2002

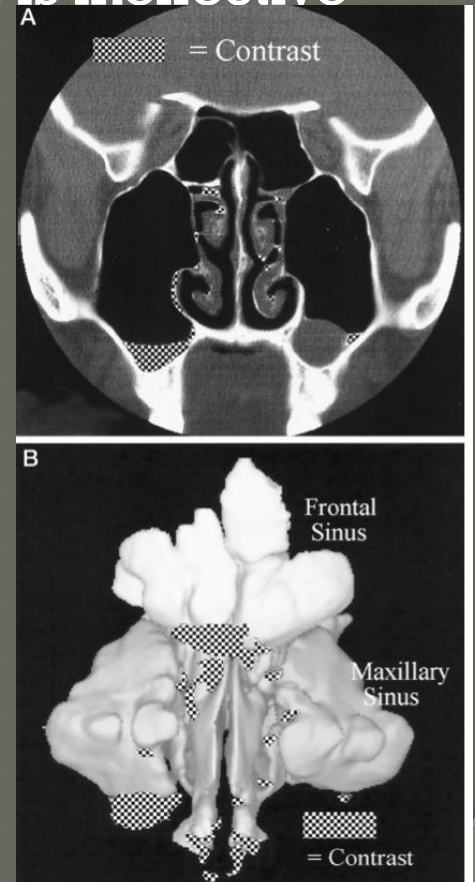
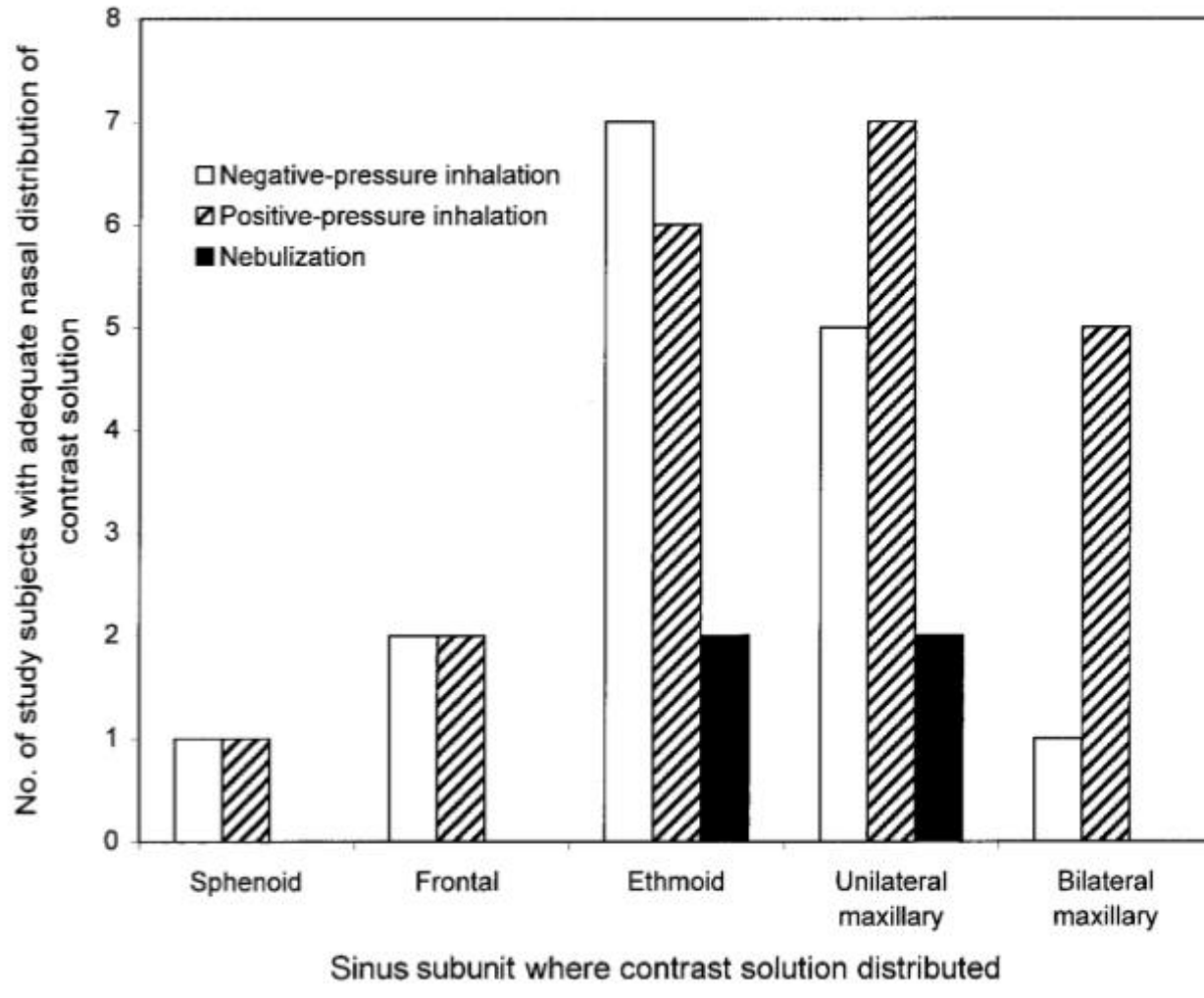


Fig. 2. (A) A computed tomography source image and (B) the image is reconstructed in three dimensions by computer.

Radiographic Comparison of Three Methods for Nasal Saline Irrigation

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A systematic review of the use of intranasal steroids in the treatment of chronic rhinosinusitis

- **REVIEW METHODS:**

- To determine if NCS are useful in the management of chronic rhinosinusitis without polyps and chronic rhinosinusitis with polyps.
- Initial screening of article titles and abstracts obtained from the literature search was performed independently by two based on the research protocol criteria.
- These articles then underwent a second-stage review. Each article was read in detail and discussed by the two reviewers before inclusion in the study.
- The outcome measure used for meta-analysis was change in polyp size from baseline compared between the treatment and control groups.

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A systematic review of the use of intranasal steroids in the treatment of chronic rhinosinusitis

- **RESULTS:**

- The review yielded 13 studies regarding the treatment of sinonasal polyps with intranasal steroids.
- Six of these could be included in the meta-analysis.
- Results from both conservative and optimistic selection of treatment effect are positive, providing significant improvement in polyp size in the treatment group as compared to controls.
- In the conservative estimate, the mean improvement in polyp size score between the treatment and placebo group is 0.43 with a 95% CI of [0.25, 0.61].
- No studies met inclusion criteria without polyps.

(a)

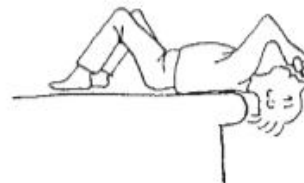
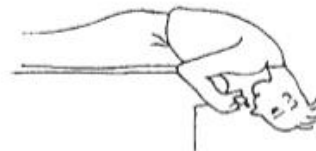
1. Shake bottle well
2. Look down
3. Using Right hand for Left nostril put nozzle just inside nose aiming towards outside wall
4. Squirt once or twice (two different directions ↗ →)
5. Change hands and repeat for other side
6. Do not sniff hard



(b)



Wrong



Choose any position you feel comfortable with

Fig. 1. Chronic rhinosinusitis (non-polypoid). (a) Correct procedure for the application of nasal sprays. (b) Correct procedure for the installation of nasal drops.

Efficacy and tolerability of systemic methylprednisolone in children and adolescents with chronic rhinosinusitis: A double-blind, placebo-controlled randomized trial

Fadil Ozturk, MD,^a Arzu Bakirtas, MD,^b Fikret Ileri, MD,^c and Ipek Turktas, MD^b *Samsun and Ankara, Turkey*

48 children (age, 6-17 y) clinically and rx proved CRS included

Assigned randomly to either oral amox/clav (am-c)and methylprednisolone or am-c and placebo twice daily for 30 days
Oral MP was administered for the first 15 days with a tapering schedule.

Primary parameters were : mean change in symptom and sinus CT scan score after treatment.

Secondary study parameters were: mean changes in individual symptom scores after treatment, relapse rate, and tolerability

Efficacy and tolerability of systemic methylprednisolone in children and adolescents with chronic rhinosinusitis: A double-blind, placebo-controlled randomized trial

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45 patients completed the study (22 am-c and MP and 23 am-c placebo

Both groups demonstrated significant improvements in symptoms and sinus CT scores when compared baseline values with end of treatment values ($p < .001$)

MP as an adjunct was significantly more effective than placebo in reducing CT scores ($p .007$) and cough ($p .009$)

At the end of treatment , 48% of the children in the placebo group still had abnormal findings on CT scans vs 14% in the MP group ($p .013$).

No therapy related adverse events were found between groups

Althouh insignificant , the incidence of clinical relapses was less in the MP group (25%) compared with placebo group (43 % , $p .137$)

Ventilation and drug delivery to the paranasal sinuses: studies in a nasal cast using pulsating airflow*

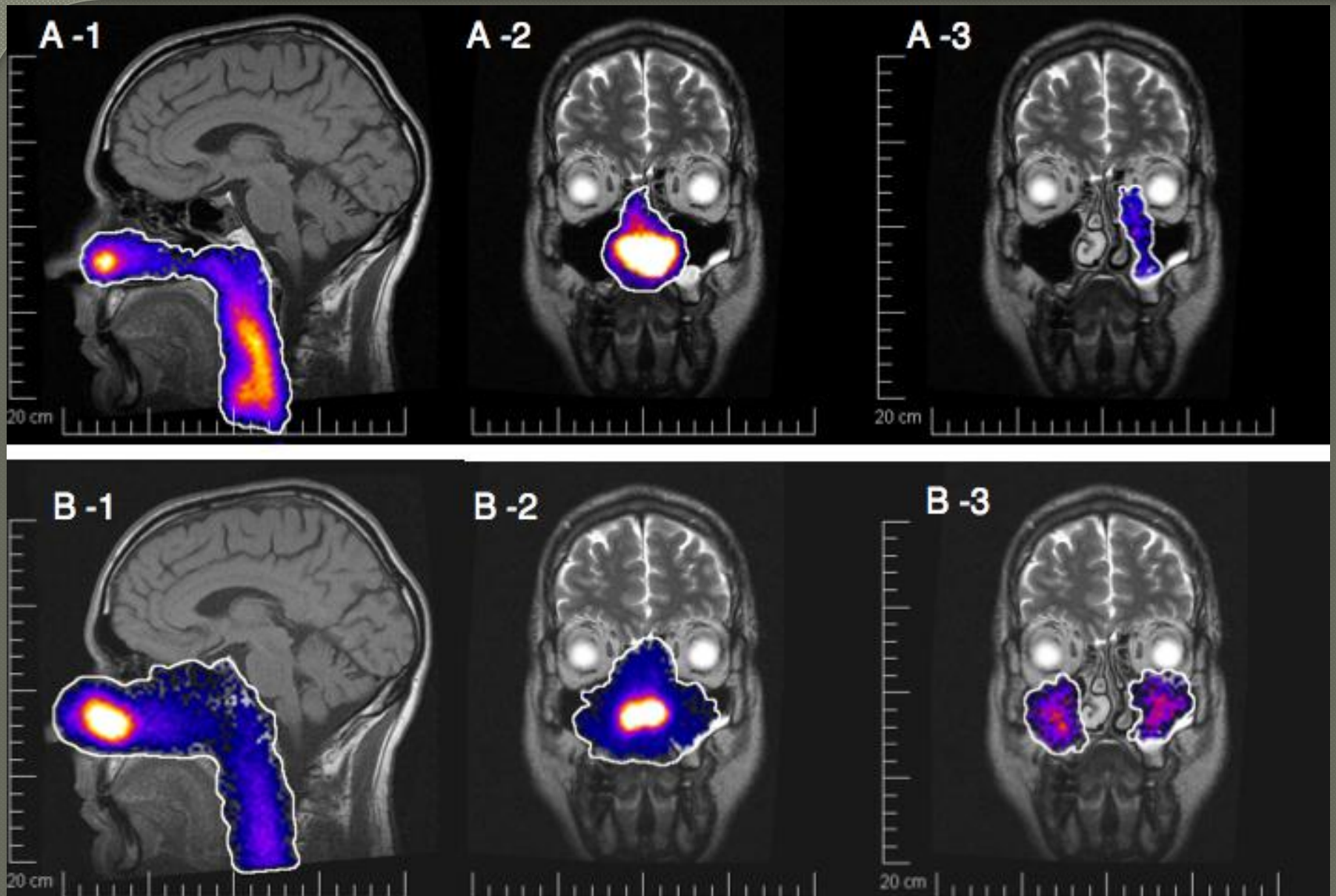
Winfried Möller¹, Uwe Schuschnig², Gabriele Meyer³, Heribert Mentzel², Manfred Keller²

Rhinology, 46, 213-220, 2008

Two physical mechanisms affect the transport of gas and aerosols into non actively ventilated areas: **diffusion and flow induction by pressure difference** .

Flow induction by a pressure gradient has been found to be the most important factor for carrying particles into non-ventilated areas.

Pulsating air flows or **humming** can be used to generate such pressure gradients. In spite of the widespread use of aerosols in respiratory diseases, only a few studies have been performed to assess ventilation and aerosol deposition into the paranasal sinuses .



9mTc-DTPA activity distribution image of a pump spray (A) vs. pulsating aerosol delivery (B) in lateral and anterior view without a nasal shield (Fig. 1, 2) and with a nasal shield

Paranasal aerosol delivery of Budesonide using PARI VibrENT

Uwe Schuschnig, Axel Krüner, Dominik Müller, Martin Luber, Norm Tiffin, Ashley Weigand, Manfred Keller

AAO-HNSF September 21 -24, 2008, Chicago

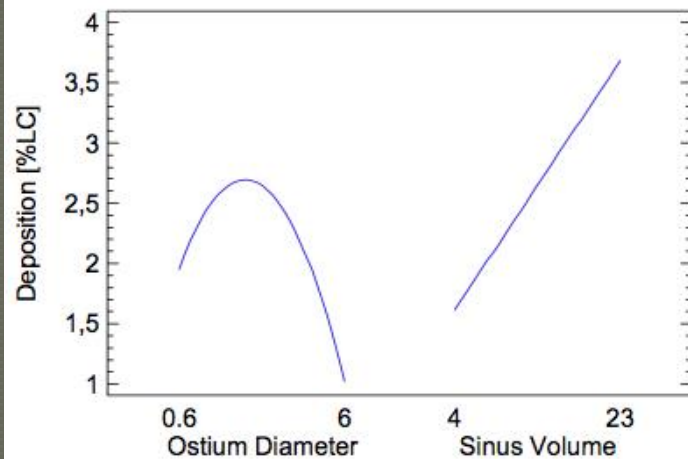


Figure 6:

This plot shows the estimated deposition in a sinus cavity as a function of ostium diameter and sinus volume. In each plot, the factor of interest is varied from its low to its high level, while the other factor is held constant at their central values

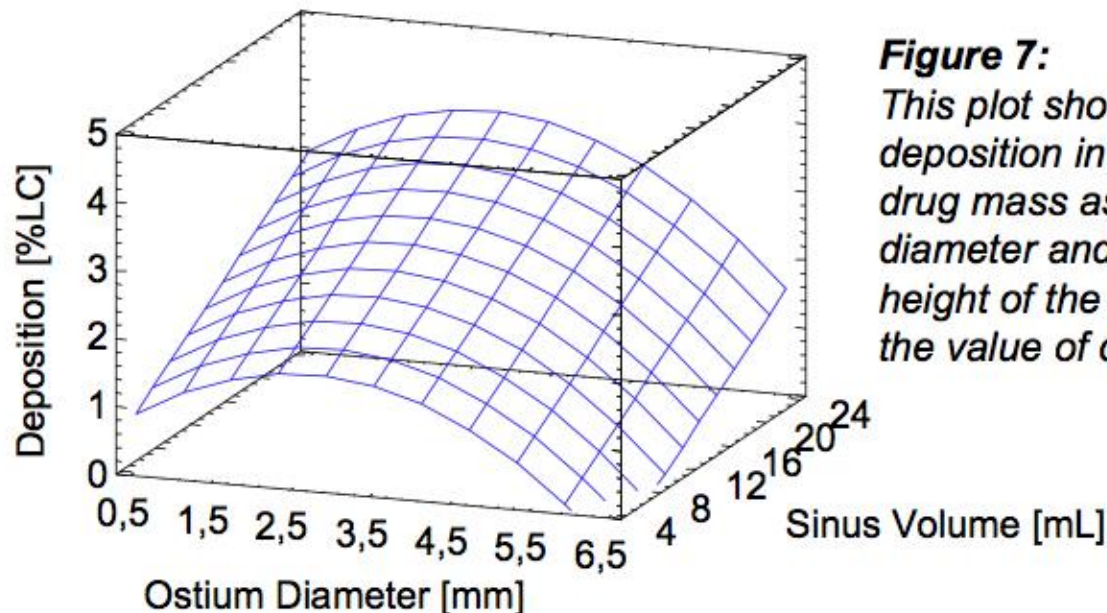


Figure 7:

This plot shows the estimated deposition in % of the charged drug mass as a function of ostium diameter and sinus volume. The height of the surface represents the value of deposition.

Paranasal aerosol delivery of Budesonide using PARI VibrENT

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Results

- ▶ Mean deposition in a single sinus cavity was $2.6\% \pm 0.28\%$ (mean \pm sd, n=50) of the initial charge dose at a sinus volume of 12.5 mL SV and ostia diameter of 2.8 mm.
- ▶ The mean total sinus deposition was 15.9%, 57.7% was measured from the nasal cavity, 15.2% was expelled, and 2.1% remained in the nebulizer.
- ▶ Deposition in the single sinus cavities ranged from 0.1% up to 7% depending on sinus volume ($p < 0.001$) and ostium diameter (OD $p = 0.045$, OD² $p = 0.004$).
- ▶ The deposition increases with increasing sinus volume (Figures 6 & 7).
- ▶ Highest deposition was observed in the range from 1.5 to 3.5 mm OD while deposition efficiency decreases at an OD < 1 mm and at 6 mm (Figures 6 & 7).
- ▶ Mean sinus deposition at 0.6 mm OD was higher than with 6 mm OD ($1.2 \pm 0.3\%$ LC vs. $0.7 \pm 0.6\%$ LC, n=14). The lowest sinus deposition was found for 6 mm OD and 4 mL SV ($0.3 \pm 0.1\%$ LC, n=3).

Figure 7. Chronic rhinosinusitis in children management scheme

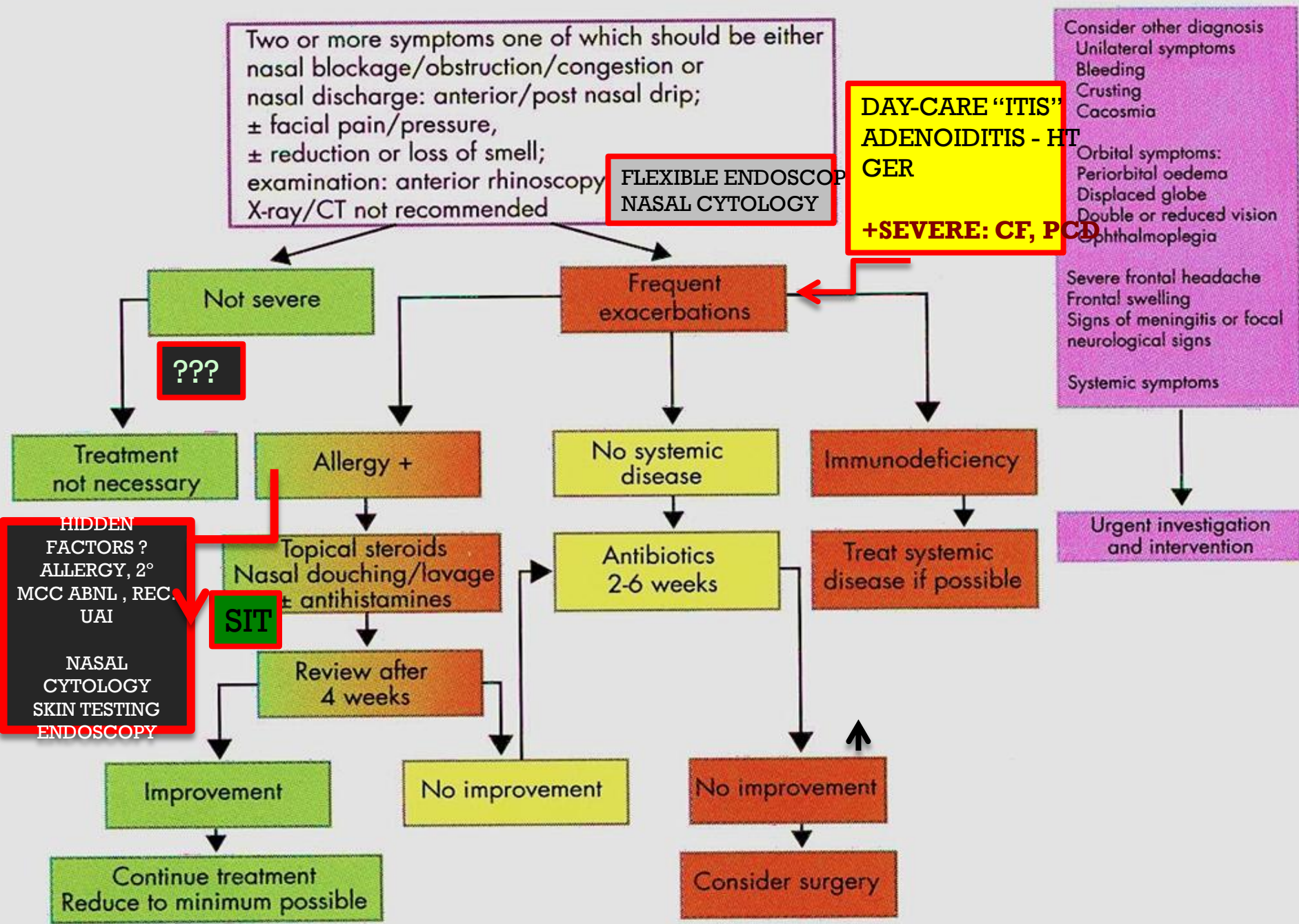


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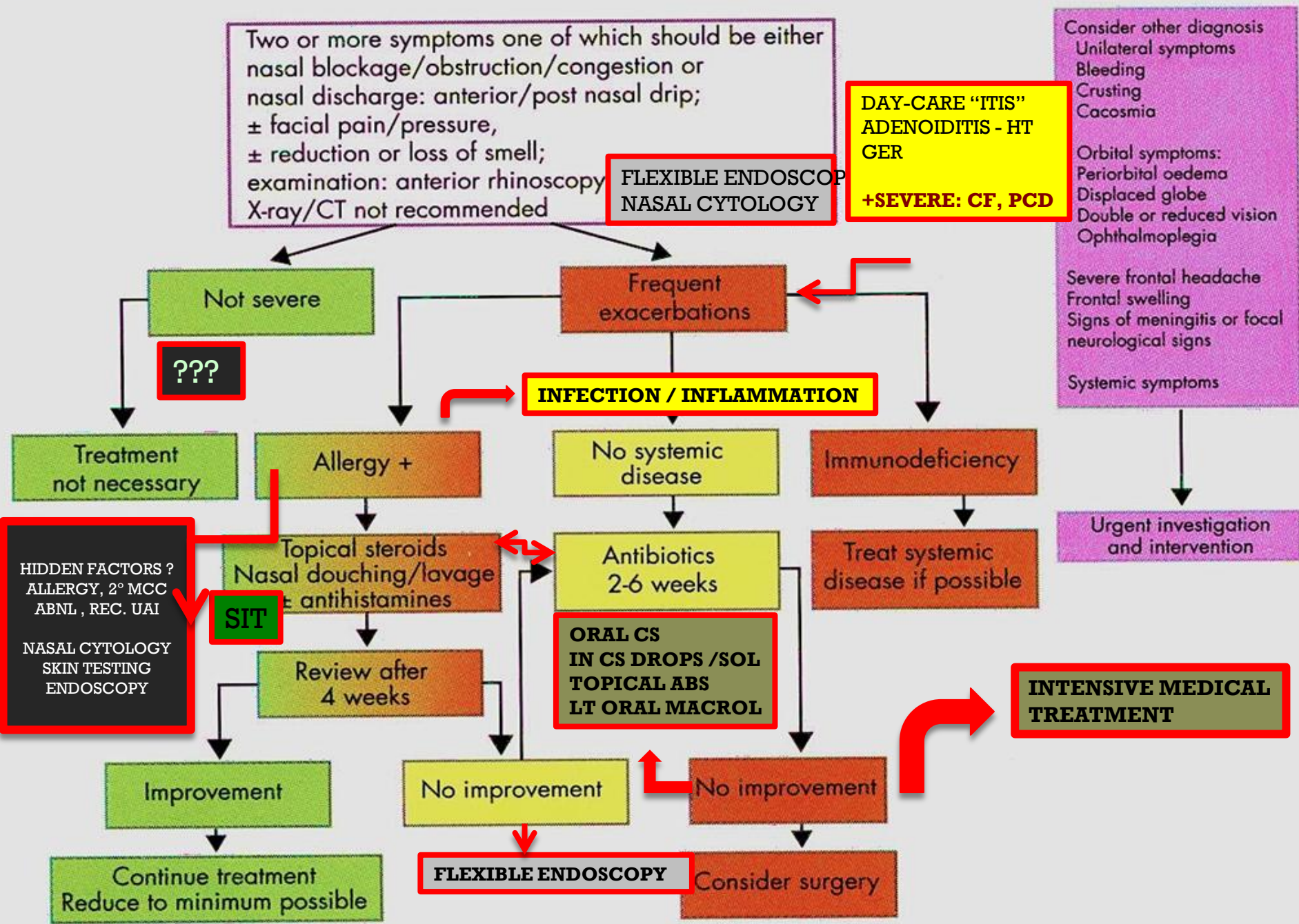
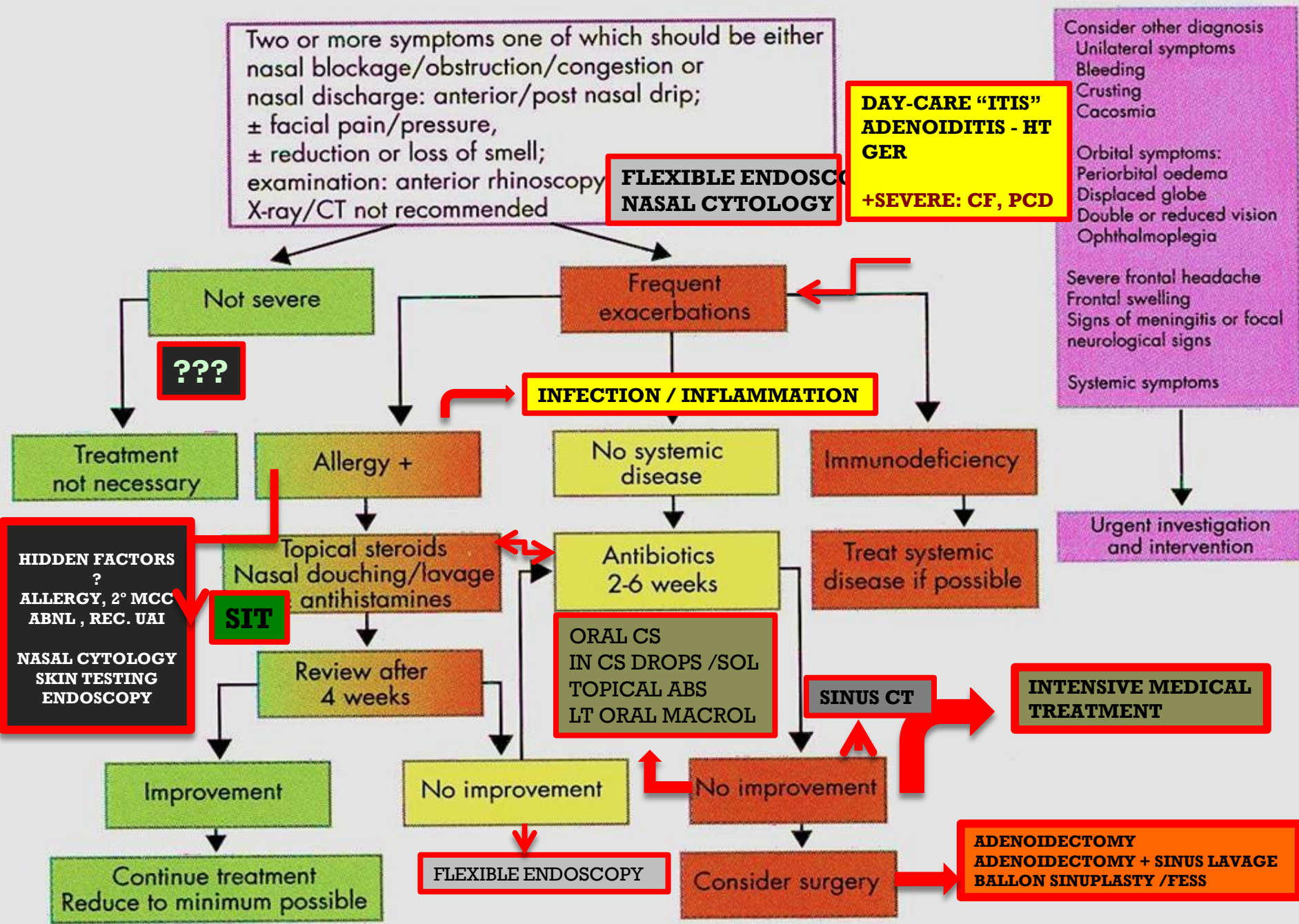


Figure 7. Chronic rhinosinusitis in children management scheme



INTENSIVE MEDICAL TREATMENT

- Brief course of systemic steroids combined with a prolonged course of oral antibiotics and 1 or more adjunctive therapies.
- In children with CRS (retrospective series) , oral glucocorticoids alone, but not antibiotics alone, led to significant radiologic improvement .
- **TYPICAL REGIMEN:** In adults (20 mgs bid x 5 days, 20 mg qd x 5 days.) + 3-4 weeks of oral antibiotic. (can be extended for up to 6 weeks or 7 days after symptoms have cleared
- In addition, topical intranasal steroids and saline lavage are recommended as in EP3OS.
- When possible, the choice of antibiotic tx should be guided by cultures of purulent mucus obtained from middle meatus or another accessible sinus ostium. **Children ??**

In children amoxicillin – clavulanate; clindamicin (patients with penicillin allergy); moxifloxacin (adults).

Alternatively, metronidazole (anaerobes) can be combined with cerufoxime axetil, cefdinir, cefpodoxime proxetil , levofloxacin (adults only), azithromycin, clarithromycin, or trim-sulfa.

INTENSIVE MEDICAL TREATMENT

- Empiric tx is not recommended if the patient has recently experience failure of antibiotic tx with a similar regimen; history of infection with gram neg, or MR Staff species or another highly drug resistant bacteria; there is clinical suspicion that the patient has AFRS; THE PATIENT IS IMMUNOSUPPRESSED or the patient has signs of extrasinus involvement or appears toxic.
- In patients with a partial or unsustained response to intensive medical tx, a second course of empiric tx might be considered, but the likelihood of success after such tx is less than that with the initial course. ----- sinus surgery ? Alternatives ?
- Long term macrolides (EP3OS) recommended.(limited data supporting its efficacy) In children ???
- Patients with persistent symptoms despite use of glucocorticoid nasal sprays, switching to nasal glucocorticoid instillations (solutions) could be considered.

ABSOLUTE INDICATIONS FOR FESS in CHILDREN include the following:

- Complete nasal obstruction in CF caused by massive polyposis or caused by medialization of the lateral nasal wall
- Orbital abscess
- Intracranial complications
- Antrochoanal polyp
- Mucoceles or Mucopyoceles
- Fungal sinusitis

POSSIBLE INDICATIONS FOR FESS in CHILDREN :

- CRS with frequent exacerbations persisting despite optimal medical tx and after exclusion of any systemic disease.

FESS should be followed by medical management to control mucosal inflammation, or symptoms will invariably return.

Gosepath, et al. Acta Otol 2008.

Hamilos, D. JACI .OCT. 2011

NEW INSIGHTS IN THE TREATMENT OF CHRONIC RHINOSINUSITIS IN CHILDREN

CRS in heterogeneous

1. Research on well characterized subgroups needed (phenotypes)
2. Pediatric CRS likely to resolve with growth
3. Inflammation / Infection both relevant
4. Medical treatment is as effective as surgery in adults
5. Surgery rarely needed in children
6. Individualize each treatment



1884- Auguste Renoir

GRACIAS

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