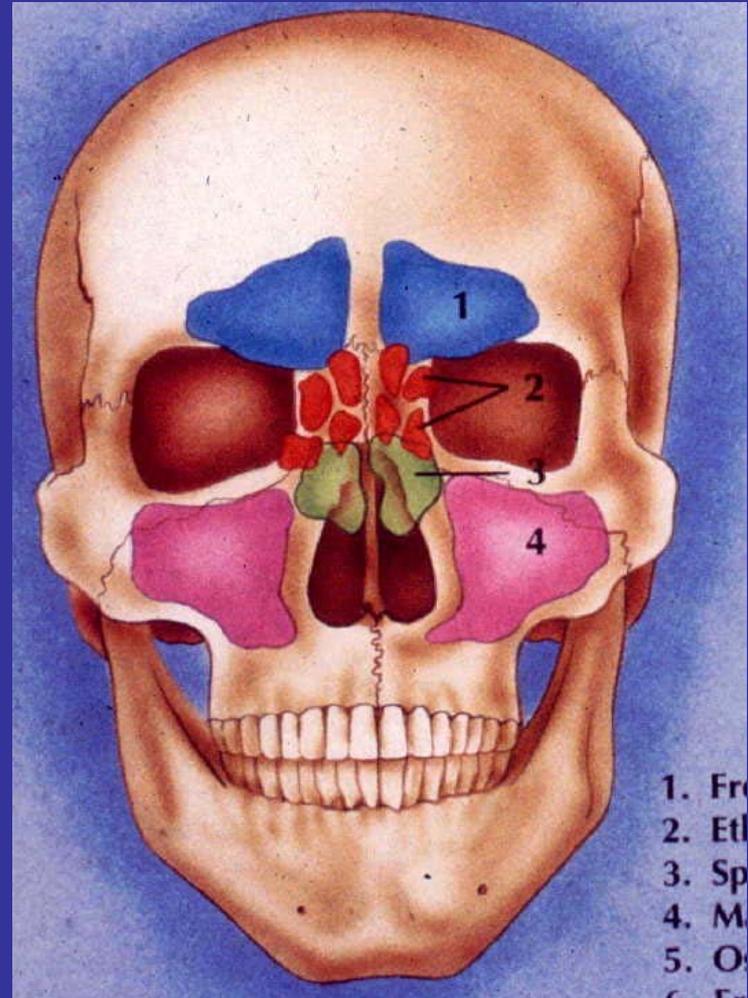


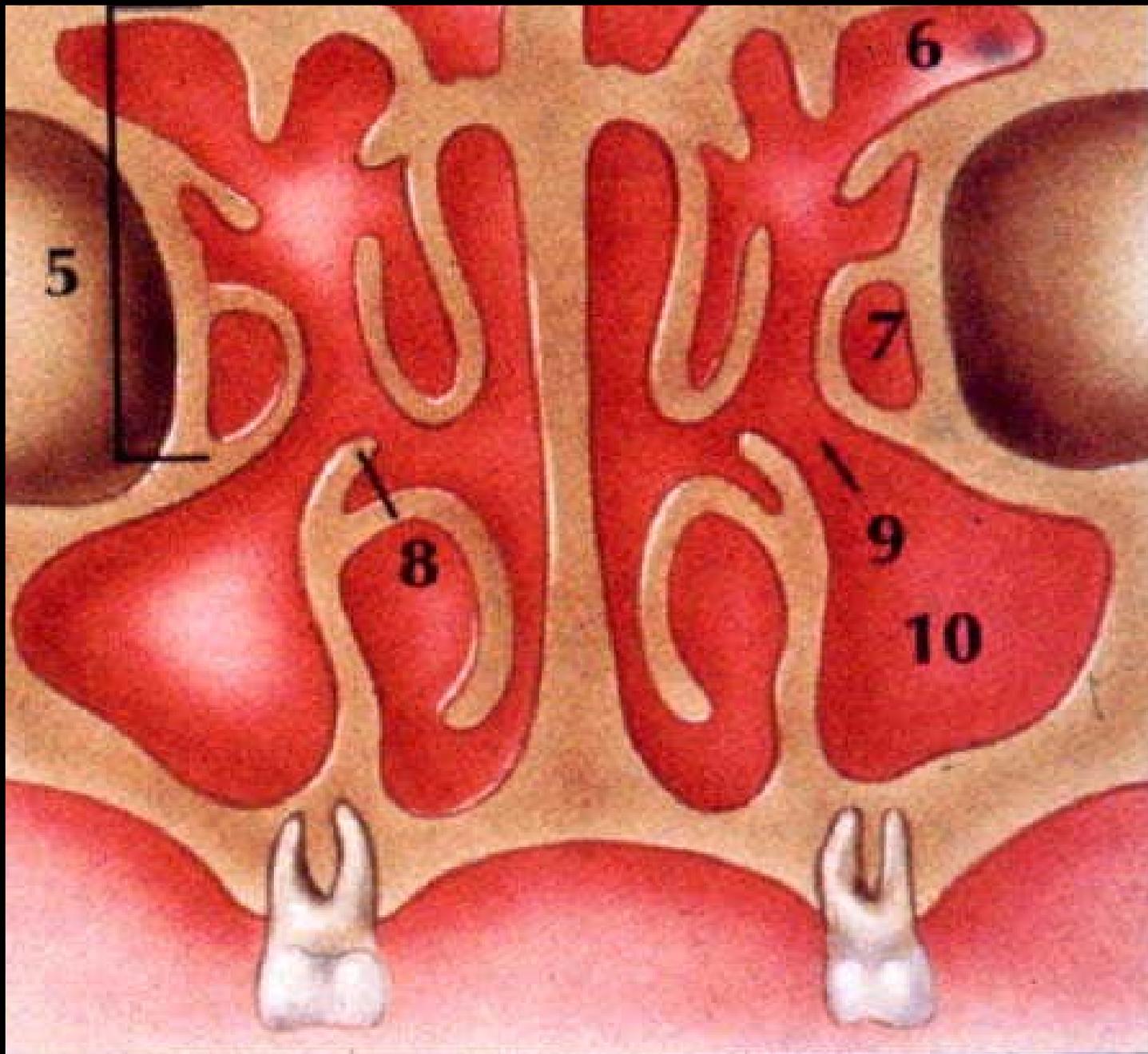
Chronic sinusitis

A group of disorders characterized by inflammation of the mucosa of the nose and paranasal sinuses of at least 12 weeks duration.

Why do we have sinuses?

- Reduce weight
- Insulation for skull
- Resonance for voice





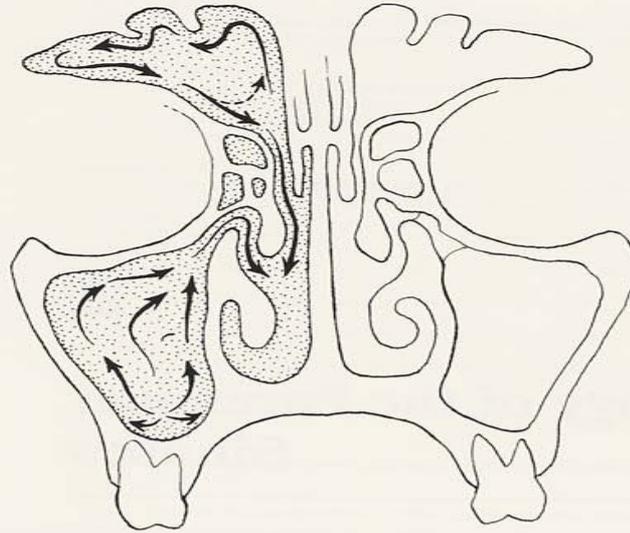


Figure 2.1A. Coronal diagram showing direction of flow of mucous blanket in frontal and ethmoid sinuses.

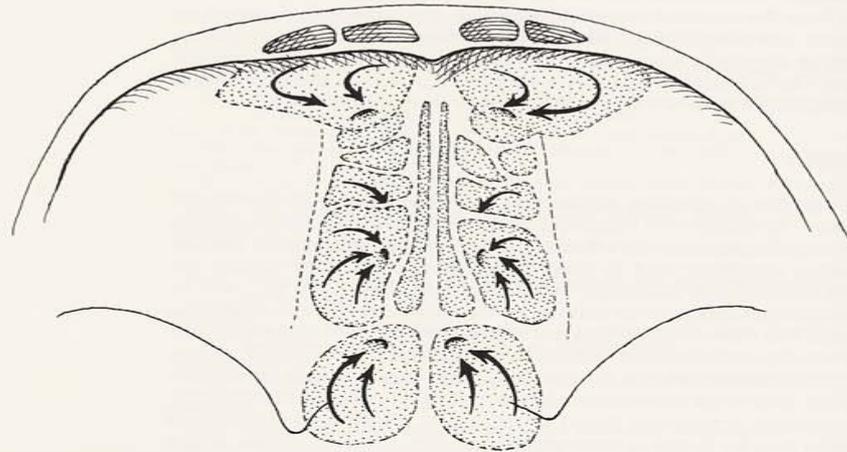
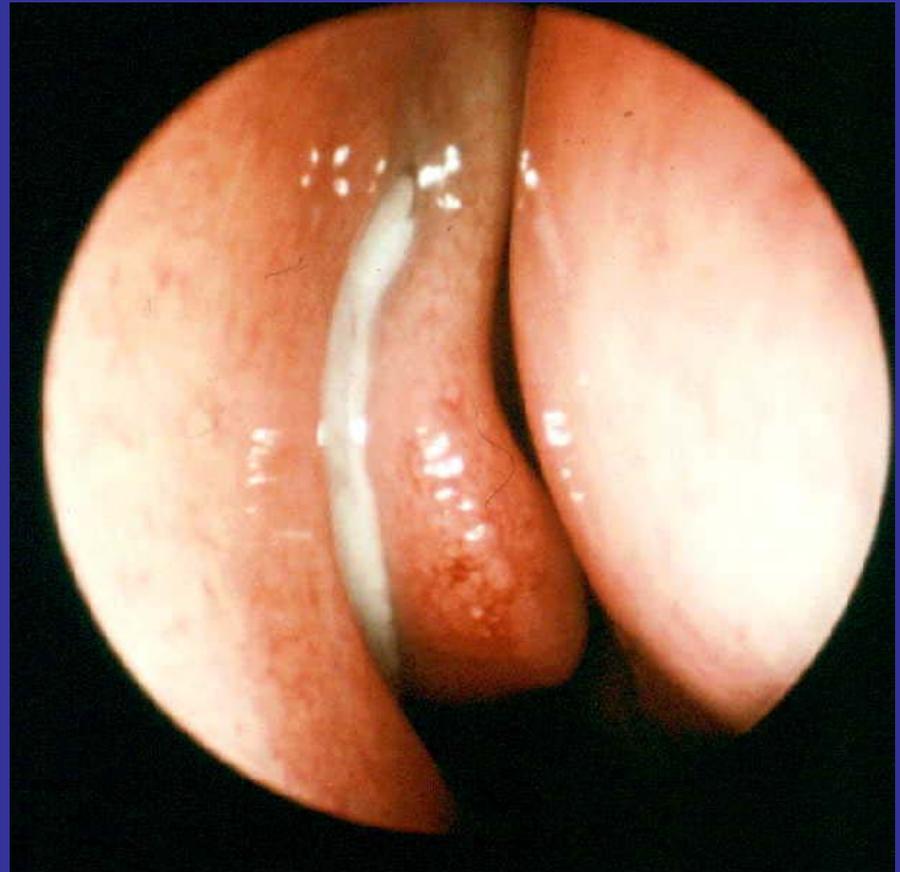


Figure 2.1B. Axial diagram showing direction of mucus flow in frontal, ethmoid and sphenoid sinuses.

Forms of Sinusitis – What is in a name?

- Acute
- Recurrent Acute
- Chronic

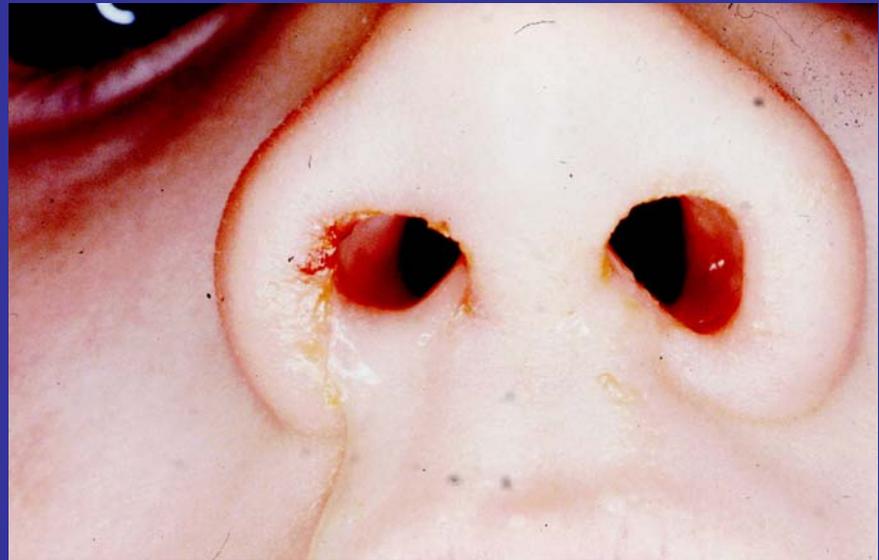


Who Gets Sinusitis?

- 15% of population
- US 9 million annual 1989
- 35 million annual 2001
- 0.5-2% of people with colds develop true sinusitis

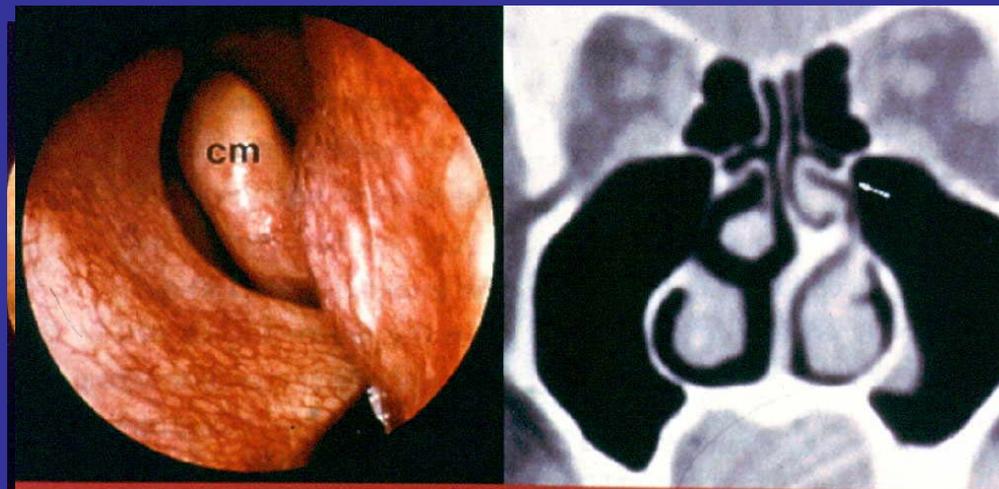
What Are The Symptoms Of Acute Sinusitis?

- Pain
- Discharge
- Nasal blockage
- Upper dental tenderness
- Systemic



Conditions Leading to Chronic or Recurrent Sinusitis

- Untreated acute sinusitis
- Medical conditions that cause chronic thickened stagnant mucus
- Structural abnormalities



Allergic Rhinitis

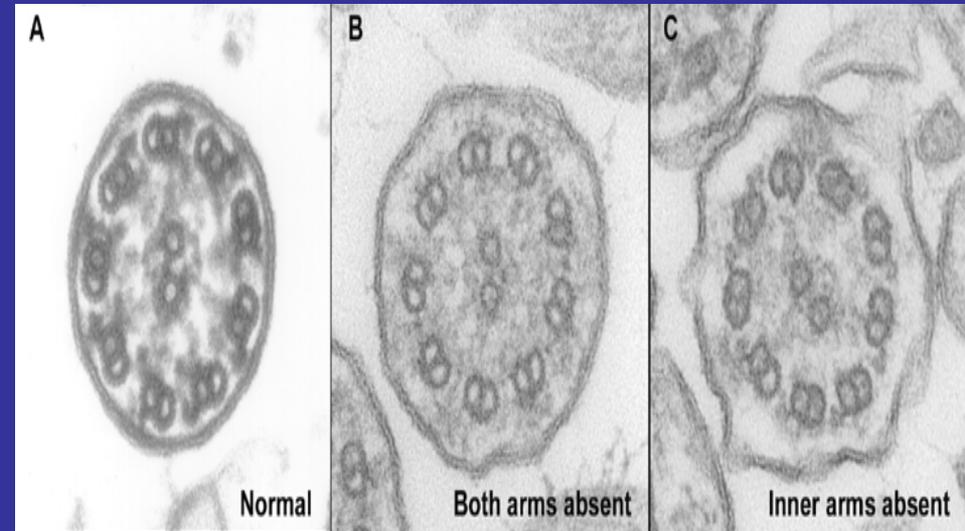
Up to 84% of patients with chronic sinusitis suffer from allergic rhinitis.

Conjunctivitis

Asthma

Etiology of rhinosinusitis

- Systemic diseases
 - Cystic fibrosis
 - Immotile cilia syndrome
 - Immune deficiencies
 - Selective IgA deficiency
 - IgG deficiencies
 - Acquired (HIV, transplant, chemotherapy)
 - Autoimmune diseases
 - Sarcoidosis
 - WG



Primary Ciliary Dyskinesia

- 1/16,000 live births
- 1/2 will have Kartegener's syndrome – situs inversus/ciliary dyskinesia
- Normal cilia have a 9*2+2 structure with A and B subunits with two dynein arms on the A and Nexin links linking the subunits
- Abnormal cilia
 - Absence of dynein arms
 - Basal feet disorientation
 - Axoneme angle > 25 degrees

Primary Ciliary dyskinesia

- Clinical
 - Purulent rhinorrhea- absent frontal sinus/polyps in 30%
 - Otitis
 - Chronic bronchiectasis
 - Male infertility
- Diagnosis
 - Onset of symptoms shortly after birth
 - EM. Use brushings of MT
- DDX CF
 - Hypogamaglobulinemia
 - Young's syndrome: ciliary dysfunction and obstructive azoospermia

Cystic Fibrosis

- Carrier rate 1/20
- 1/2000 live births
- Deficiency in transmembrane transport of Cl⁻
- Q31 region of chromosome 7
- Creates extracellular fluid dehydration and thick exocrine secretions
- Viscous mucous plugging of ostia, ciliary injury-mucosal edema –bacteria
 - Pseudomonas
 - Staph aureus, H flu

Cystic fibrosis

- Polyps lack submucosal hyalinization
- Lack eosinophils
- Lots of acid mucin.

Cystic fibrosis

- CT findings
 - Frontal sinus agenesis
 - Pansinus opacification
 - Medial bulging of lateral nasal wall

Cystic fibrosis

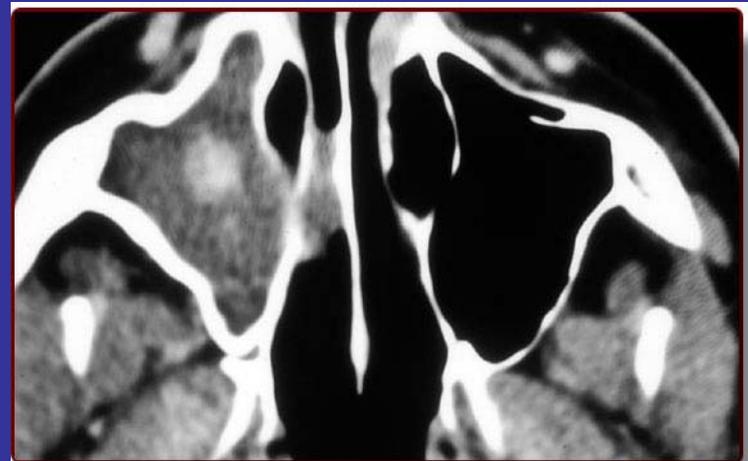
- Indications for FESS
 - Persistent nasal obstruction or medial bulging of nasal wall
 - Medialization of lateral nasal wall
 - Pulmonary exacerbations
 - Facial pain/headaches

What Are The Symptoms Of Chronic Sinusitis?

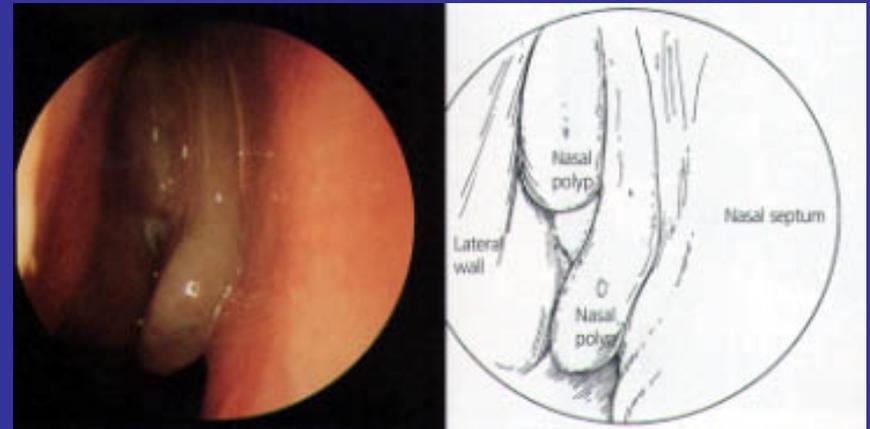
- More vague and generalized
- Longer than 12 weeks
 - Nasal congestion
 - Yellowish discharge
 - Chronic cough
 - Postnasal drip
 - Facial pain/pressure

Chronic sinusitis

- Fungal sinusitis
- Diagnostic criteria
 - Allergic mucus with necrotic inflammatory cells, eosinophils
 - Charcot Leyden crystals; byproduct of eosinophil degradation.
 - Fungal elements
 - History of atopy, asthma, nasal polyps
 - CT focal hyperdense lesion with surrounded by more hypodense material
 - Path: no vessel penetration



- Nasal polyposis
- Less than 1/2 of polyp patients have positive allergy testing
- Associated with chronic low grade Staph infection.



Diagnosing Sinusitis: The Problem

- Diagnostic accuracy
presence of rhinosinusitis must be inferred largely from multiple nonspecific symptoms
- Inability to distinguish viral from bacterial sinusitis

Diagnostic factors...

- At least two major diagnostic factors or one major and two minor factors used to diagnose sinusitis.
- The more factors present the higher the chance of a correct diagnosis.

Task Force on Rhinosinusitis of the American Academy of Otolaryngology-Head & Neck Surgery

Diagnostic Factors Predictive of Sinusitis

- Major Factors
 - Facial pain or pressure
 - Facial congestion or fullness
 - Nasal obstruction
 - Nasal purulence or discoloured post nasal discharge
 - Hyposmia or anosmia
 - Fever
- Minor Factors
 - Headache
 - Halitosis
 - Fatigue
 - Dental pain
 - Cough
 - Ear pain or pressure

Microbiology

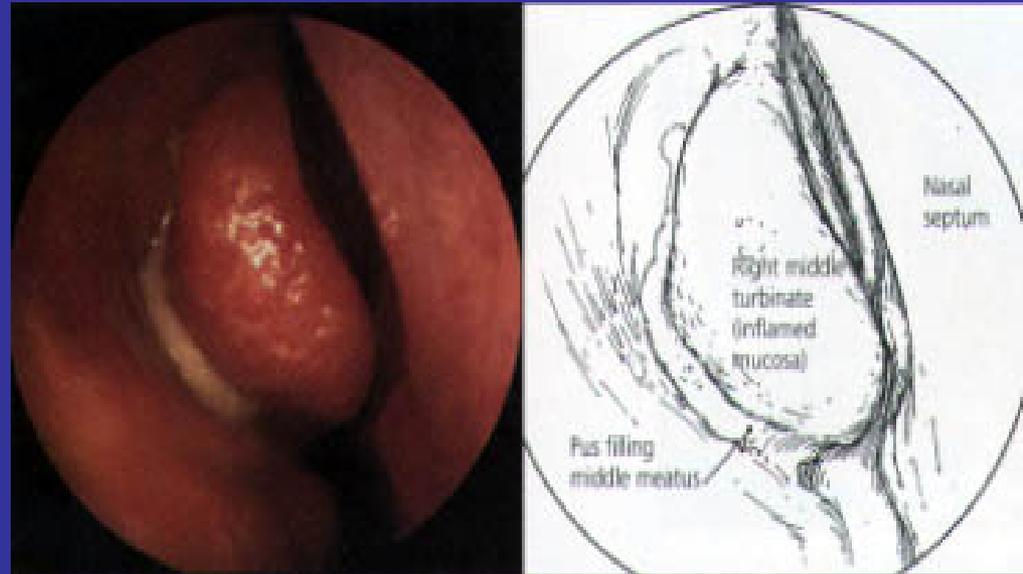
- Acute Sinusitis
- Viral
- Bacterial
 - S. Pneumonia
 - H. Influenza
 - M. Catarrhalis
- Chronic Sinusitis
- Anaerobes
- Strep, Staph Aureus, Pseudomonas
- Fungal

Bacteria associated with CRS

Isolates	% Isolates	% Patients
Coag neg Staph	33	60
S. Aureus	18	13
GNRs	20	34
P. Aeruginosa	9	11
Strep species	7	12
S. Pneumoniae	1	2

Do cultures influence therapy?

- Culture results changed course of treatment in 40% of patients who were cultured (Coffey et al, AJR 2006)
- Based on sensitivities and organism identification



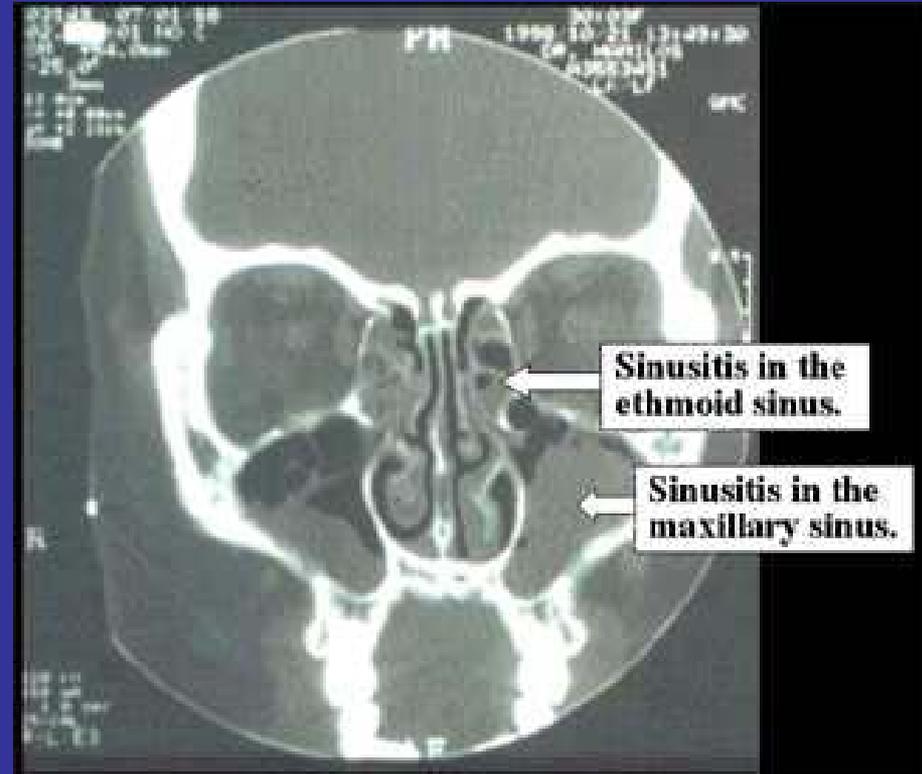
Imaging

- Imaging is not cost effective in the initial assessment of patients in the primary care setting.
- No role for CT in the setting of acute sinusitis unless complications suspected. Useful for chronic disease.

Imaging

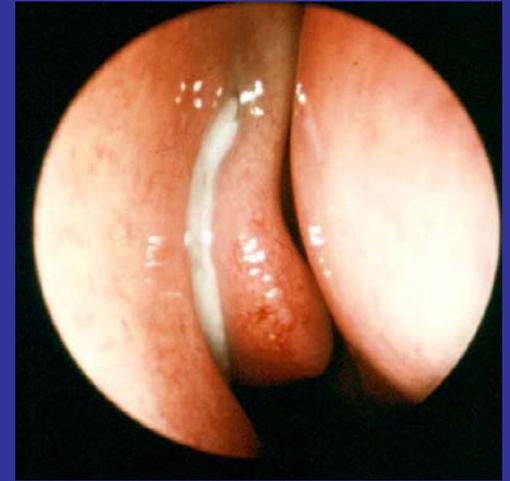
Gwaltney et al found 87% of adults with acute onset URI symptoms demonstrated inflammation within the nose and viscous secretions with air bubbles in the sinuses on CT.

This was resolved in 79% on repeat CT scan



How is Acute Sinusitis Treated?

- Primary Objectives
 - Reduce swelling
 - Drainage of sinuses
 - Eradication of infection



- Hydration – fluids, steam
- Saline nasal rinses
- Topical nasal steroids
- Decongestants
 - Topical
 - Oral
- Expectorants
- Medications for pain/fever reduction
- Antibiotics

Management: Nasal Irrigation

- Numerous commercial products
 - Hydrasense
 - Salinex
- Benefit is from rinsing away mucosal irritants.



What are some of the problems in treating acute sinusitis?

- Diagnosis is difficult; Rx empiric
- Most are viral; Bacteria uncommon <7 days
- 60 - 70% of patients resolve without antibiotics after 14 days
- Lots of guidelines
- Most antibiotic studies are equivalence studies
- Have patients recently received an antibiotic?

Do antibiotics help patients with acute bacterial sinusitis?

- 2 meta-analyses (5 studies): antibiotics more efficacious than placebo in reducing or eliminating symptoms at 10 to 14 days
- Cost-effectiveness analysis favors antibiotic treatment for pts with moderate to severe symptoms based on clinical criteria; symptomatic treatment only for pts with mild symptoms

Agency for Health Care Policy & Research, 1999

Clinical Trials : Antibiotics vs. Placebo

- At 10 - 14 days:
 - Cure - 47% vs 32%
 - Cure and/or improvement - 81% vs 66%
- Treatment effect diluted by cases that do not truly have a bacterial infection

Hickner et al. Ann Intern Med 134; 2001

Many guidelines for acute bacterial sinusitis: What do you follow?

- Low DE, et al. 1997. CMAJ 156 (Suppl 6)
- Noyek A, et al. 1998. Can J Infect Dis 9 (Suppl B)
- Hickner JM, et al. 2001. Ann Intern Med 134
- Canadian Anti-infective Guidelines for Community-acquired Infections. 2001 Ed.
- Sinus & Allergy Health Partnership. Otolaryngology Head & Neck Surg. 2000;123
- Gilbert DN, et al. 2002. Sanford Guide to Antimicrobial Therapy
- Desrosier M et al. 2003
- Anti-Infective Guidelines 2005

Anti-Infective Guidelines for Community Acquired Infections (2005)

- Peer-reviewed
- Evidenced-based
- User-friendly

First Line

- Amoxicillin 500 mg TID \$0.60

Second Line

- Pivampicillin 500 mg BID \$1.32
- Amox/Clav 500 mg TID/875 mg BID \$2.52-\$2.80
- Cefuroxime 250-500 mg BID \$2.03-\$4.01
- Cefprozil 250-500 mg BID \$3.06-\$6.00
- Cefixime 400 mg OD \$3.09
- Doxycycline 100 mg BID then OD \$0.59
- Clarithromycin 500 mg BID/1000 mg XL OD \$5.92/\$5.03
- Azithromycin 500 mg day 1, 250 mg x 4/7 \$5.92
- TMP/SMX 2 tabs BID/1 DS BID \$0.19-\$0.24

Third Line

- Gatifloxacin¹ 400 mg OD
\$5.01
- Levofloxacin¹ 500 mg OD
\$5.01
- Moxifloxacin¹ 400 mg OD
\$5.01
- Telithromycin² 800 mg OD x 5 days \$6.21

¹ “Due to the importance of these quinolones for other indications and concern of developing resistance with overuse, these agents need to be held in reserve for severe situations”

² “Telithromycin may have a role in individuals with treatment failures or where drug-resistant pneumococci (pen or macrolide) are a problem or are suspected and should be held in reserve for these situations”

Antibiotic Compliance in Pneumonia

Antibiotic Schedule

Compliance Failure

OD	4.4
BID	23.8
TID	24.7
QID	41.6

“... when there is no therapeutic difference between two treatments, the least complex should always be prescribed.”

Cockburn et al, BMJ 1987;395

Cycling Antibiotics – Is it clinically
important?

Individual use and resistance

- Antibiotic use in last 1-6 months is associated with increased risk of antibiotic resistance
 - Penicillin, cephalosporins, macrolides, TMP-SMX
 - Fluoroquinolones
 - For both colonization and infection
- Antibiotic use increases chances of seeing resistance in normal flora weeks later (RCTs)

*Anti-Inflammatory Medications
Intranasal Corticosteroids in Acute
Rhinosinusitis ?*

- By interrupting the inflammatory process, the net result is a lower level of inflammatory cells (e.g. eosinophils)

Topical Nasal Steroids As Adjunctive Therapy

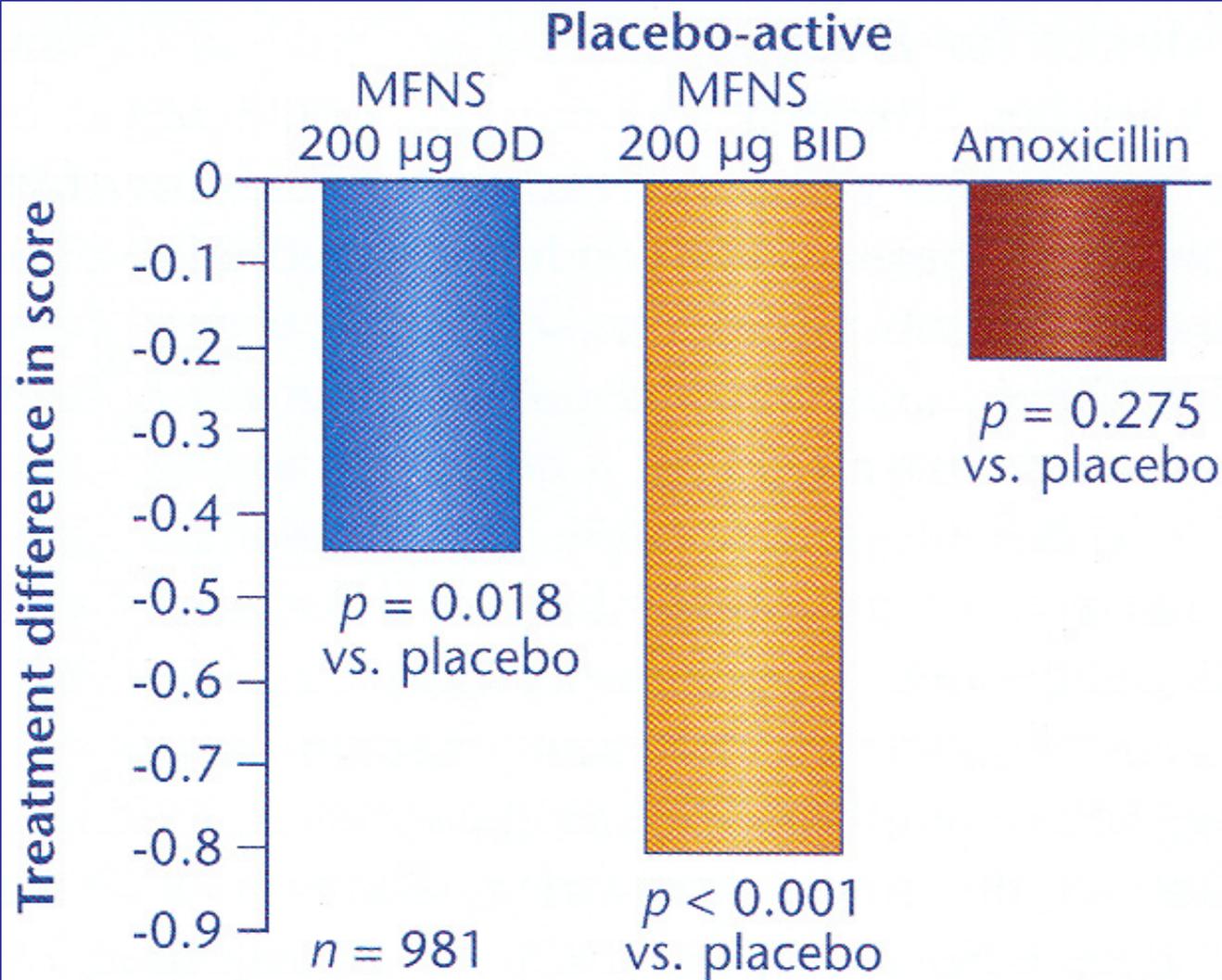
- Five Studies
 - Added benefit of a topical nasal steroid with antimicrobial therapy
1. Barlan et al. Intranasal budesonide spray as an adjunct to oral antibiotic therapy for acute sinusitis in children. *Ann Allergy Asthma Immunol* 1997;78:598-601
 2. Yilmaz et al. Intranasal budesonide spray as an adjunct to oral antibiotic therapy for acute sinusitis in children. *Eur Arch Otorhinolaryngol* 2000;257:256-9.
 3. Meltzer et al. Added relief in the treatment of acute recurrent sinusitis with adjunctive mometasone furoate nasal spray. The Nasonex Sinusitis Group. *J Allergy Clin Immunol* 2000;106:630-7.
 4. Nayak et al. Effective dose range of mometasone furoate nasal spray in the treatment of acute rhinosinusitis. *Ann Allergy Asthma Immunol* 2002;89:271-8
 5. Dolor et al. Correlation of cefuroxime with or without intranasal fluticasone for the treatment of rhinosinusitis. The CAFFS Trial. *JAMA* 2001;286:3097-105

- Budesonide studies
 - improvements in nasal discharge and cough
 - significantly higher rate of recovery in children compared with antimicrobial therapy alone
- Mometasone studies
 - Significant improvement in total symptom score and individual symptoms (headache, facial pain, congestion, purulent rhinorrhea, and PND)

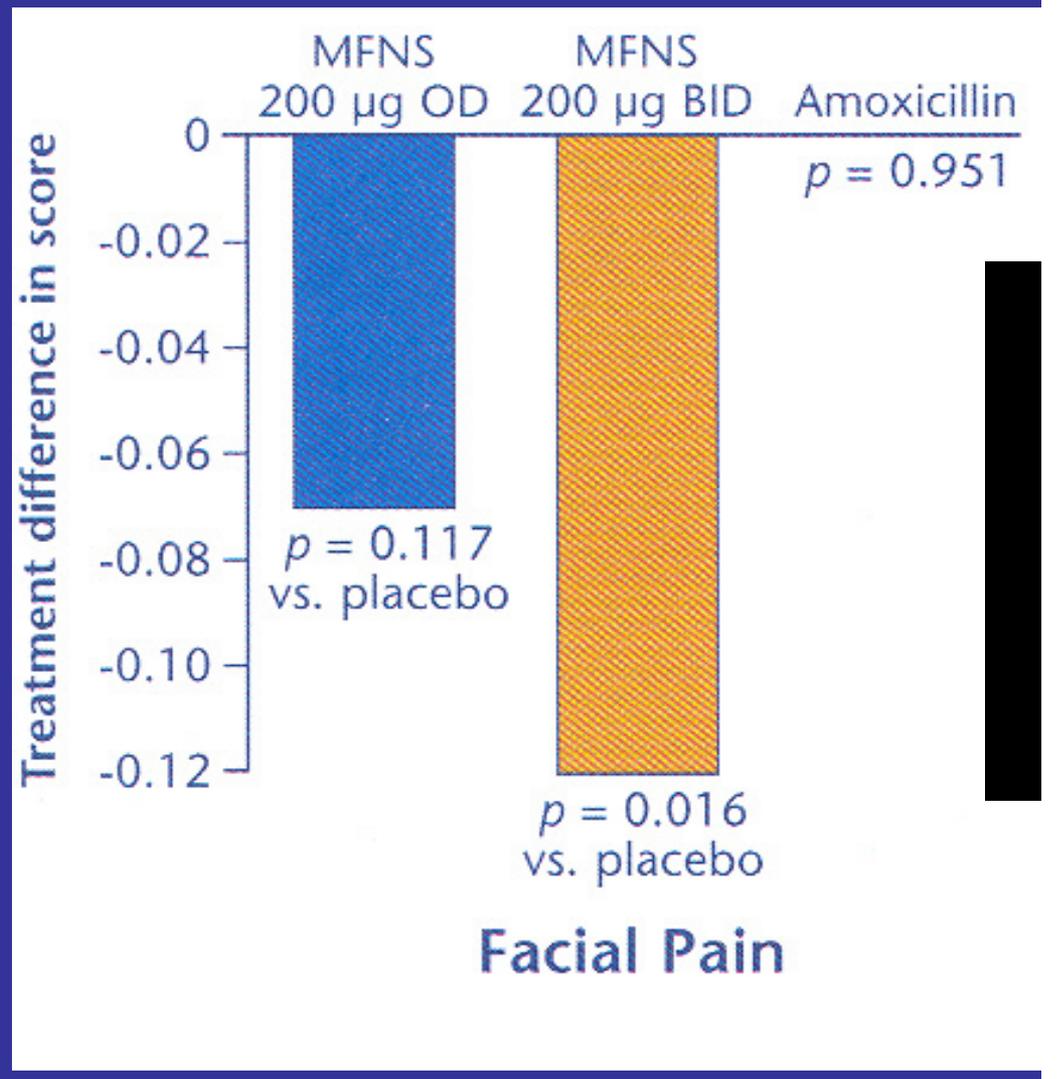
Topical Nasal Steroids as Monotherapy for Acute Sinusitis?

- N = 981
- Age > 12 years
- Symptoms > 7 days, < 28 days
- Major Symptom Score (MSS) = 5-12
 - 5 symptoms scored 0 to 3
 - Facial pain, rhinorrhea, PND, headache, nasal congestion

Changes in Mean Symptom Score from Baseline



Change in Facial Pain Score From Baseline



Morbidity of Canine Fossa Puncture

- Facial pain
- Gingival pain
- Cheek parasthesia and numbness
- Dental devitalisation
- Facial swelling

- Principal nerve injured is the Anterior Superior Alveolar nerve.

- 37 CFP in 21 patients
- Mean F/U 11 months
- 76% experienced adverse effect
- 16% persistent side effect after 6 months

Robinson S, Wormald PJ. 2005 Am J Rhinol

Complications of Sinusitis

- Anosmia
- Spread of infection locally, or systemically
- Secondary pneumonia
- Exacerbation of asthma
- Chronic cough

Orbital complications of Sinusitis

- Chandler's classification.
 - Preseptal (inflammatory edema)
 - Orbital Cellulitis
 - Subperiosteal Abscess
 - Orbital Abscess
 - Cavernous sinus thrombosis



Subperiosteal abscess

- Between orbital periosteum, and orbital wall. Usually medial
- Decreased EOM
- Severe proptosis
- May have decreased VA, eye usually displaced inferolaterally



Orbital abscess

- Abscess in orbital contents
- Severe proptosis, ophthalmoplegia, chemosis
- Visual loss



Cavernous sinus thrombosis

- Bilateral symptoms
- Severe proptosis, ophthalmoplegia
- Spiking fevers.
- Will have irreversible damage to eye if blood flow interrupted for more than 90 minutes

Treatment

- Antibiotics
- Indications for Surgery
 - Subperiosteal abscess
 - Endoscopic or open.
 - Anterior ethmoid artery is 24mm posterior to lacrimal crest
 - Posterior ethmoid is 12mm posterior to this, and optic nerve is 6mm posterior to the post ethmoid artery.
 - Orbital abscess
 - Must also incise and drain periobital tissue in addition to above
 - Failure of medical therapy, progression of symptoms, progression to contralateral eye.

Surgical options:

Cavernous sinus thrombosis

- Bilateral orbital involvement, with severe retroorbital pain, proptosis, chemosis, fever, papilloedema, nuchal rigidity, lethargy to coma
- Usually *S. Aureus*
- Spread of infection
 - Direct venous channels
 - Ophthalmic vein
 - Infra orbital vein

Subperiosteal frontal abscess

- Pott's puffy tumor
- Osteomyelitis of anterior table of frontal bone
- Localized swelling of the forehead
- Erythema, edema
tenderness, fever
- Staph aureus, strep pneumo,
morazella, anaerobes



Subperiosteal frontal abscess

- Pott's puffy tumor
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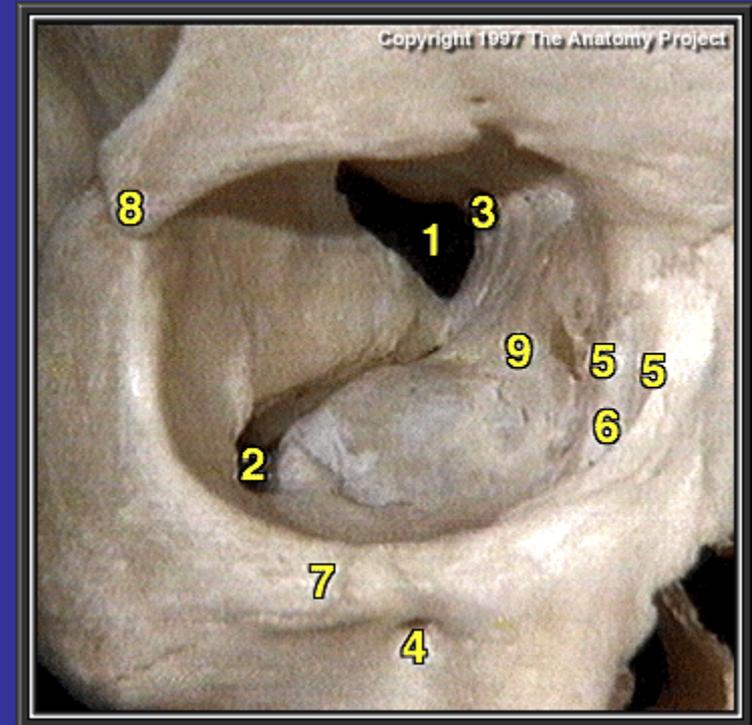
Intracranial complications

- Subdural abscess
- Etiology
 - Direct extension through posterior wall of frontal sinus
 - Retrograde thrombophlebitis of valveless ophthalmic veins



Right frontal view of Orbit

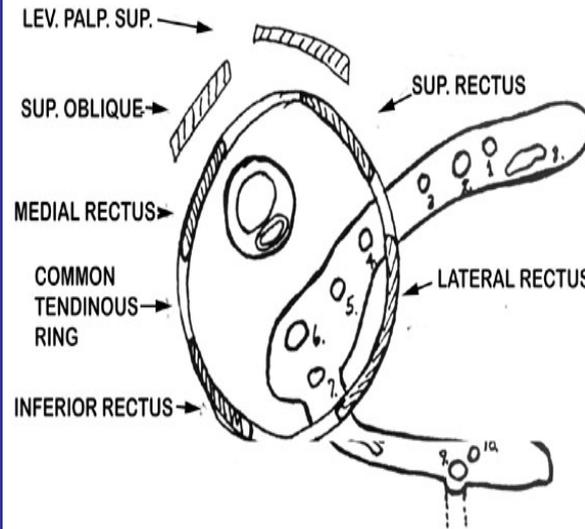
- 1. Superior orbital fissure
- 2. Inferior orbital fissure
- 3. Optic Canal
- 4. Infraorbital foramen
- 5. Lacrimal crest
- 6. Lacrimal groove
- 7. Zygomaticomaxillary suture
- 8. Zygomaticofrontal suture
- 9. Orbital plate of ethmoid bone.



Superior orbital fissure

- Contains
- Oculomotor nerve
- Trochlear nerve
- Lacrimal, frontal and nasociliary branches of V1
- Abducens nerve
- Superior ophthalmic vein
- Sympathetic fibres from cavernous plexus.

MAIN STRUCTURES ENTERING ORBIT (LEFT SIDE) and MUSCLE ORIGINS



THROUGH OPTIC FORAMEN:
OPTIC NERVE
OPHTHALMIC ARTERY
THROUGH SUPERIOR ORBITAL FISSURE:

1. LACRIMAL NERVE V'
2. FRONTAL NERVE V'
3. TROCHLEAR NERVE IV
4. SUPERIOR DIV., OCULOMOTOR N.
5. NASOCILIARY NERVE V'
6. INFERIOR DIV., OCULOMOTOR N.
7. ABDUCIENS NERVE VI

8. OPTALAMIC VEINS, BRANCHES
LEAVE IN SUPERIOR AND INFERIOR ORB. FISS.

THROUGH INFERIOR ORBITAL FISSURE:
9. INFRA ORBITAL NERVE V²
10. ZYGOMATIC NERVE V²

NOTE:
INFERIOR OBLIQUE ORIGINATES FROM
ANTERIOR PART OF FLOOR OF ORBIT

Superior orbital fissure

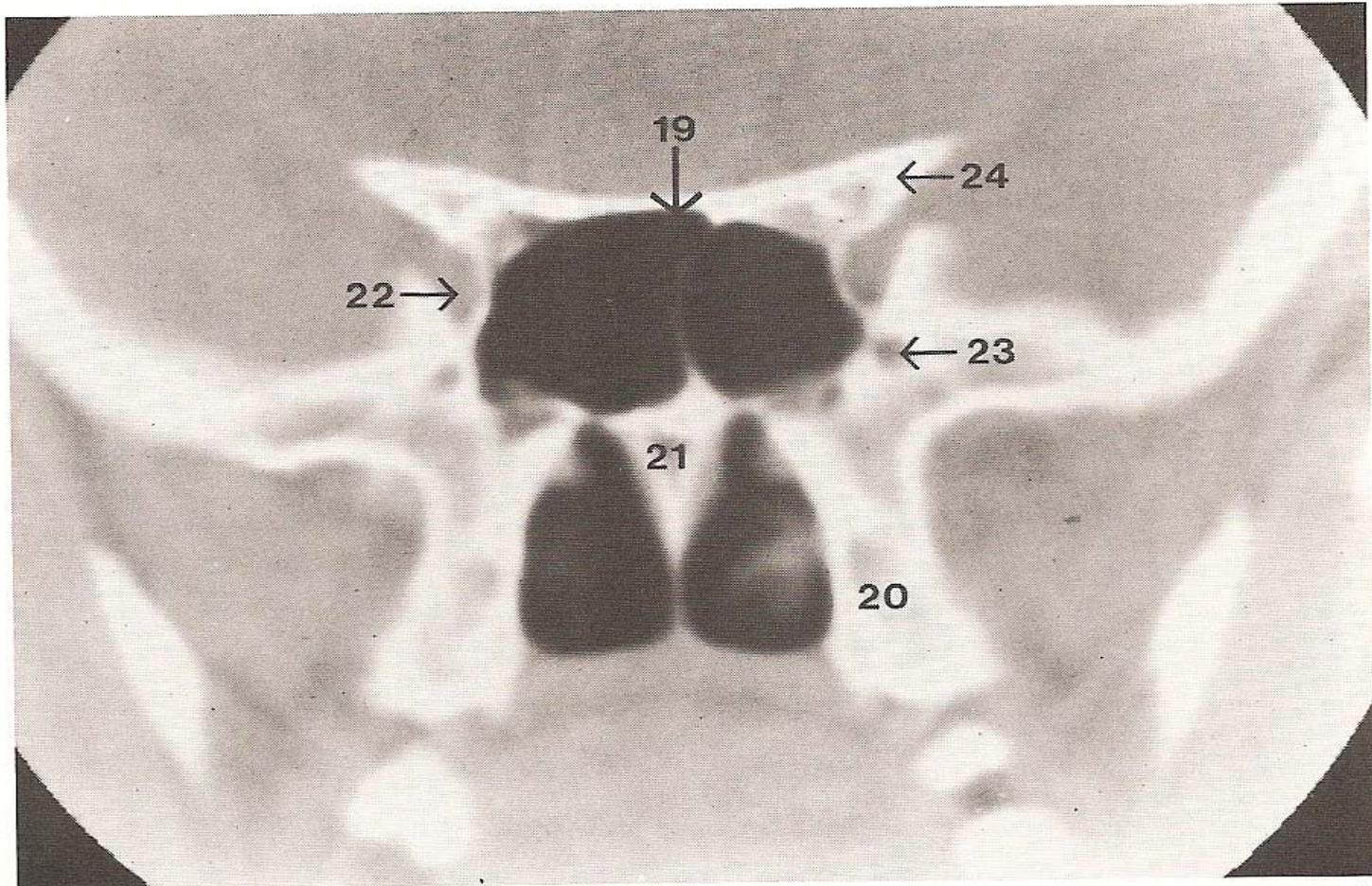


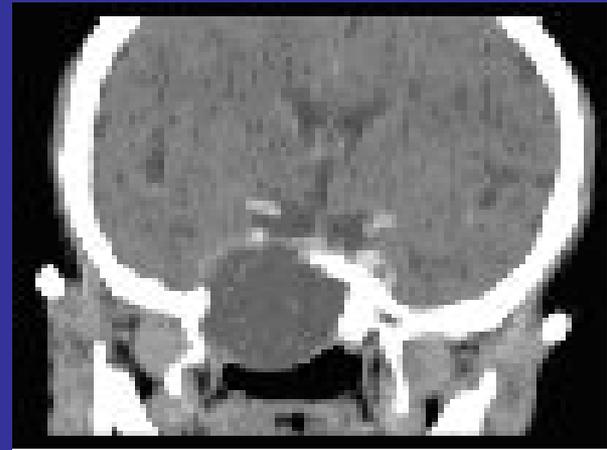
Figure 3.4E. The sphenoid sinus (19) is well aerated. The septum as shown here is usually asymmetrical. Also visualized are the pterygoid plates (20), sphenoidal keel (21), superior orbital fissure (22), foramen rotundum (23), and anterior clinoid process (24).

Superior orbital fissure syndrome

- CN 3,4, and 6
- Immobile globe
- Dilated pupil
- Ptosis
- Hyposthesia CN V ophthalmic branch involvement

Orbital Apex syndrome

- Similar to orbital fissure syndrome plus
 - Neuritis
 - Papilledema
 - Decreasing visual acuity
- Both apex, and fissure syndrome caused by
 - Mucoceles, orbital abscesses, periobital abscess, cavernous sinus thrombosis.



Sinus surgery

- Opening up the natural sinus ostia via endoscopic or open approach
- Many different acromyms out there
- MESS, FESS etc...
- Perfection is not necessary

Landmarks

- Insertion of middle turbinate
 - Maxillary sinus ostia
 - Arch of choanae
 - Nasal floor anteriorly
 - Nasal septum
 - Lamina papyraceae
 - Nasal floor
-
- May, Shaikin and Kay: Laryngoscope 104: June 1994

Contraindications

- Untrained or unskilled surgeon
- Anticoagulants
- Uncontrolled hypertension
- Bleeding disorders
- Lack of knowledge of anatomic variants, or of normal anatomy of the sinuses.

General tips

- If you can't see , don't go there
- Stop and control bleeding as needed
- Always start with the zero degree scope to avoid initial disorientation.
- Review CT immediately before and during case as needed.

High risk areas

- Lamina papyracea
- Roof of the ethmoid near the anterior ethmoidal artery
- The lateral lamella of the cribriform plate
- Roof of the ethmoid near the posterior ethmoid artery
- The area between the posterior ethmoid, and sphenoid sinuses.

Orbit

- Palpate for the maxillary sinus ostia just above the bony insertion of the inferior turbinate
- If you go too high, you will breach the lamina papyracea
- Repeatedly ballot the eye to look for orbital fat.
- If in doubt, ballot the eye.
- Orbit is more at risk with a hypoplastic maxillary sinus, narrow infundibulum.

Complications of sinus surgery

lots of ways to classify these

Intraoperative

Early post operative

Late post operative

Major

- carotid bleed

- blindness

- CSF leak

- intraorbital bleeding.

Minor

Complications of sinus surgery

CNS complications

Orbital

Vascular

Nasolacrimal system

Soft tissue injury

Septal trauma

CSF leak: classification

- Accidental trauma
- Surgical trauma
- Tumors
- Congenital
- Spontaneous: BIH, middle age obese females
 - Papilledema, visual changes, pulsatile tinnitus, headaches.

CSF leak

- CSF leak
- Make about 350-500cc per day
- Most commonly at the lateral lamella of the of the cribriform plate
- Posterior ethmoid just anterior to sphenoid
- Posterior sphenoid

CNS

- CSF leak
 - Repair immediately if noted intra operatively. Various techniques
 - If delayed, and pt has limited symptoms, bed rest and elevate head of bed to 30 degrees
 - stool softeners.
 - Avoid straining
 - Acetazolamide (Diamox) reduces CSF production up to 48%
 - No prophylactic antibiotics
 - packing, pain meds.
 - Lumbar drain?
- Brain injury
 - Neurosurgical consultation
 - CT head

CSF leak

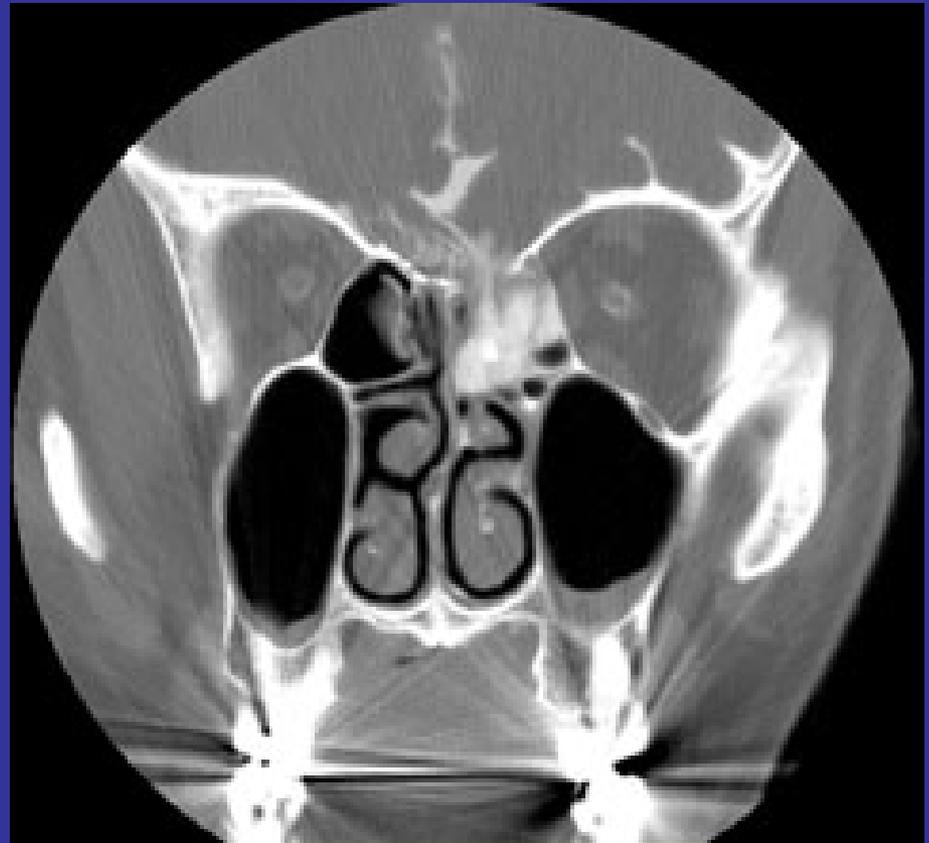
- If patient has secondary infection, or not responding to conservative treatment repair leak
 - If greater than one week
 - Meningitis
 - Large defect
 - Bony spicule
 - Brain herniation

CSF leak

- Diagnosis
 - Beta 2 transferrin: in CSF, perilymph and aqueous humor
 - Send to Toronto St. Josephs lab
 - Tea pot sign
 - Halo sign. CSF travels faster than blood
 - Headache
 - Clear nasal discharge
 - Glucose will be > 30 mg/ml

localization

- Intrathecal Fluorescein
- Radioactive cisternograms.
- CT sinuses with or without cisternogram.
- MRI and MR cisternography



Options to repair

- Endoscopic
 - 90 % success rate vs 70-80% for intracranial repair, with less morbidity.
- Intracranial
 - Intradural
 - extradural

Orbital

- Orbital fat exposure
- Orbital hemorrhage
- Orbital Muscle injury or exposure
- Optic nerve injury

Orbital

- Orbital fat exposure
 - Usually in anterior ethmoid region
 - Important to ballot eye during case to identify dehiscent lamina papriciae
 - Avoid further manipulation of the area.
 - Avoid nose blowing post op for 4-5 days
 - Consider oral or IV steroids
 - If significant obtain Ophthalmological consult

Orbital Hemorrhage

- If minor, observation is indicated
- No nose blowing, lifting for 10 days
- If severe perform lateral canthotomy while awaiting ophthalmologic consult
- Medial canthotomy may be necessary

Orbital muscle injury

- Usually at posterior ethmoid, or in the sphenoid sinus to the medial rectus
 - Don't dissect in lateral sphenoid
 - Ballot eye during surgery to avoid this injury
 - Ophthalmologic consult.

Optic nerve injury

- Occurs in the superior posterior ethmoid, or sphenoid
 - If recognized, stop dissection
 - Large doses of IV steroids
 - Ophthalmologic consult
 - Consider decompression.

Nasolacrimal system

- Occurs if too anterior enlarging the maxillary sinus ostia.
- Duct is 0.5-1.0cm anterior to the natural ostia
- It is usually surrounded by thicker bone.
- Correct with dacrocystorhinostomy if obstruction occurs, and does not spontaneously fistulize in the nasal cavity

Hemorrhage

- Mucosal,
- Septal vessels,
- Sphenopalatine artery. Inferior to sphenoid sinus, posterior to maxillary sinus ostia.
- Anterior ethmoid artery (frontal recess dissection)
 - may be up to 5mm below dome of ethmoid.
- Posterior ethmoid artery
 - Superior to anterior face of sphenoid.
- Carotid artery bleeding (lateral sphenoid wall)

Soft tissue

- Synechia
- Lateralization of middle turbinate
- Missed disease
- Septal perforation
- Retained packing
- Dislodged stents

What to do when sinus surgery does not work?

- Wait
- Try nasal rinses
- Add pulmicort to rinses
- Topical antibiotics via rinse or
- MAST tube injection
- Long course of antibiotics : four weeks
- Oral steroids.