Sinus Disease in 2015

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DISCLOSURES

- No financial relationships or gift-in-kind with industry that is relevant to the subject matter of the presentation of any sort.
Paranasal Sinuses

- Frontal sinus
- Ethmoid sinus
- Nasal cavity
- Maxillary sinus
- Sphenoid sinus
- Pharynx (throat)
The nasal cavity is a hollow space behind the nose that air flows through.

The septum is a thin "wall" made of cartilage and bone. It divides the inside of the nose into two chambers.

The turbinates on each side of the nose are curved, bony ridges lined with mucous membrane. They warm and moisten the air you breathe in.

The mucous membrane is thin tissue that lines the nose, sinuses, and throat. It warms and moistens the air you breathe in. It also makes the sticky mucus that helps clean that air of dust and other small particles.

Nasal bone
Frontal sinus
Cribriform plate of ethmoid bone
Sphenoid sinus
Pharyngeal tonsil
Perpendicular plate of ethmoid
Septal cartilage
Vomer
Palatine cartilage
Vomeronasal cartilage
FUNCTIONs OF The PARASINUSES

- Humidifying and warming inspired air
- Regulation of intranasal pressure
- Increasing surface area for olfaction
- Lightening the skull
- Resonance
- Absorbing shock
- Contribute to facial growth
Physiology

- The mucosa secretes a mucous which traps bacteria
- The mucous is naturally extruded through sinus ostia to be expectorated or swallowed
- The drainage of the maxillary and frontal sinuses follows a circular pattern through the natural ostia – MUCOCILIARY CLEARANCE
Anatomy / physiology of Sinuses

- Lined by respiratory epithelium
- Mucous blanket is in two layers: a superficial viscous layer and an underlying serous layer.
- Cilia beat in the serous layer, moving the blanket towards the natural ostia
- Normal function depends on patent ostia, ciliary function and quality of mucous
Pathophysiology of sinusitis

- Most important pathologic process in disease is obstruction of natural ostia
- This obstruction leads to ciliary dysfunction and poor mucous quality
- Ciliary dysfunction leads to stasis -> Infection
Pathophysiology of Sinusitis (continue)

- Local factors can impair ciliary function.
- Cold air “stuns” the epithelium, resulting in retained secretions.
- Dry air desiccates the blanket.
- Anatomical factors - polyps, tumors, foreign bodies and rhinitis, can block the ostia
- Kartagener’s Syndrome (immotile cilia syndrome)
SINUSITIS DISEASE PROGRESSION

Bone and tissue structure enables natural sinus clearance

Multiple factors can impair mucociliary clearance, hindering or stopping normal drainage of the sinuses

Acute sinusitis can progress to a recurrent or chronic disease state

Although medical management is adequate for ~80% of patients; recalcitrant disease may require surgical treatment
Acute sinusitis

- **Major symptoms**
  - Facial pain/pressure
  - Facial congestion/fullness
  - Nasal obstruction
  - Nasal discharge/purulence

- **Minor symptoms**
  - Headache
  - Fever (non-ARS)
  - Halitosis
  - Fatigue
  - Hyposmia / anosmia
  - Purulence on exam
  - Fever (ARS only)
  - Dental pain
  - Cough
  - Ear pain / pressure

- Diagnosis with two major or one major and two minor factors
Acute Bacterial Sinusitis

- Acute sinusitis can be thought of as an abscess or empyema
- Cornerstone is drainage and antibiotics
- Drainage is usually medical with topical and oral decongestants, mucolytics, sinus lavage
- In rare cases where medical treatment fails, surgical drainage may be required
Acute Bacterial Sinusitis (continued)

- S. pneumo, H. flu and *Moraxella catarrhalis*
- Amoxicillin is the first line antibiotic
- Failure to respond to amoxicillin necessitates broad coverage with clavulonic acid and culture directed Abx treatment
- Surgical drainage is required for medical failures
ACUTE sinusitis
**SINUSITIS DISEASE PROGRESSION**

**Increasing symptom duration & frequency**

**Acute**
- Up to 4 weeks in duration
- Purulent nasal discharge and/or
  - Nasal obstruction
  - Facial pain-pressure-fullness

**Subacute**
- 4-12 Weeks in duration
- Symptoms as in acute disease

**Recurrent**
- 4+ episodes/yr, 10+ days in duration or worsening symptoms within 10 days of onset
- Symptoms as in acute disease

**Chronic**
- 12+ weeks in duration
- 2+ symptoms
  - Mucopurulent drainage
  - Nasal Obstruction
  - Facial Pain-pressure-fullness
  - Decreased sense of smell
- Pathology evident on endoscopic or CT examination

Surgical intervention may be considered in cases of severe sinusitis

“Clinical practice guideline: Adult sinusitis”
Rosenfeld et al., Otolaryngology–Head and Neck Surgery (2007) 137, S1-S31
CHRONIC SINUSITIS

- Symptoms present for $\geq 12$ consecutive weeks
- “Subacute” for symptoms between 4-12 weeks

- Chronic inflammation
  - Bacterial, fungal, and viral
  - Allergic and immunologic
  - Anatomic
  - Genetic predisposition
Chronic sinusitis - Treatment

- Treatments:
  - Longer term antibiotics, typically 3 week course
  - Nebulized antibiotics
  - Sinus irrigations
  - Allergy management
  - Sinus surgery
BIOFILMS: BACKGROUND

- A structured community of microorganisms encapsulated within a self-developed polymeric matrix
- Characterized by:
  - Surface attachment
  - Structural heterogeneity
  - Genetic diversity
  - Complex community interactions
  - Extracellular matrix of polymeric substances
- Phenotypically different from planktonic mode
- Observed and implicated in CRS

Prince et al., The University of Pennsylvania School of Medicine
BIOFILMS ARE ASSOCIATED WITH SEVERE CRS

- There is a high percentage of CRS patients (28.6%) whose sinonasal mucopurulence has biofilm-forming capacity. Postsurgical patients had a high prevalence of biofilm-forming bacteria, a possible reflection of the severe nature of their disease.

- Data are mounting supporting the contributory role of biofilms in poor disease progression.

- The mucosal epithelial function must be preserved, because adequate mucociliary clearance remains the best treatment to prevent CRS.

“Prevalence of biofilm-forming bacteria in chronic rhinosinusitis.”
Prince et al., The University of Pennsylvania School of Medicine

“Biofilms in chronic rhinosinusitis: A review”
Cohen et al. [Emphasis added]
CONTRIBUTING FACTORS CHRONIC SINUSITIS

- Biofilms are implicated in Chronic Rhinosinusitis (CRS)
  - Natural mucociliary clearance inhibits biofilm formation and CRS progression
  - FESS with current techniques and instrumentation is vastly less traumatic than historical approaches, but we still are very cognizant to minimize disruption to the natural sinus environment
TREATING Biofilms

- Nasal irrigation with saline is the cornerstone – with or without irrigant additives such as:
  - Antibiotics
  - Antifungals
  - Steroids
  - Baby shampoo (surfactant)
  - Xylitol
What is xylitol

- Xylitol is a naturally occurring food substance. It is found in many fruits and vegetables; a plum has about half of a gram.
- In the US, it is primarily made from corn husks and birch.
- It is made in the human body. An average sized person makes about 10 grams of xylitol every day.
- When used in the nose it blocks the ability of bacteria and fungi to bind on to the surfaces in our mucosa.
- It also encourages our mucosa to be stimulated and cleansed thereby disrupting the biofilm.
When to refer

1. Chronic, recurrent, or persistent sinusitis that may need surgical management
2. An anatomical abnormality preventing adequate sinusitis treatment
3. A sinusitis complication
FUNGAL Sinus Infections

- Non-invasive
  - Saprophytic fungal infestation
  - Sinus fungal ball (mycetoma)
  - Allergic fungal sinusitis

- Invasive
  - Acute fulminant invasive fungal sinusitis
  - Chronic invasive fungal sinusitis
  - Granulomatous invasive fungal sinusitis
- Therapy for invasive forms requires wide local debridement and intravenous ampho B
- Mucormycosis is encountered in dust and soil and enters through the respiratory tract
- The fungus invades vascular channels and causes hemorrhagic ischemia and necrosis
- 90% mortality in immunocompromised
Fungal Sinusitis

- Ketoacidosis predisposes to mucormycosis, as the fungus thrives in acidic environments.
- Initially seen as engorgement of turbinates, followed by ischemia and necrosis of the turbinates and adjacent nose.
Allergic Fungal Sinusitis (AFS)

• AFS is a colonization resulting in allergic inflammation without invasion
• AFS produces the characteristic Eosinophilic (or Allergic Mucin) which appears as a thick peanut buttery type of debris
• Most patients with AFS will have allergy to fungus with IgE levels > 1000 IU/mL
Allergic Fungal Sinusitis (AFS)

“Double Densities” - classic radiographic presentation
Mycetoma Video (India)

Nasal Polyps

- Nasal polyps
  - Semitranslucent masses in the nasal cavity and sinuses.
  - Large inferior turbinates (bottom right) are often confused for a polyp (bottom left).
  - Mostly originating from the mucosal linings of the sinuses and prolapsing into the nasal cavities.
Nasal Polyps

- Nasal polyposis
  - Characterized by eosinophil inflammation,
  - Accompanied by acetylsalicylic intolerance in up to 25% of cases
- 40% of cases of nasal polyposis are associated with intrinsic asthma
- Samter’s triad (nasal polyps, ASA sensitivity, and asthma)
- Churg-Strauss syndrome (a form of eosinophilic immunovasculitis) and eosinophilic nasal polyposis
Treatment of Nasal Polyps

- Mainstay of treatment
  - Oral steroids
  - Nasal steroids
  - Allergy management
  - Surgery
Mucoceles

- Mucoceles are chronic, cystic lesions of the sinuses lined by pseudostratified epithelium.
- They are NOT mucous retention cysts (bottom right)
- Expand slowly and are destructive
- Etiology is debated. Likely due to obstruction of ostia
Complications: Mucoceles (Continued)

- Sphenoidal and ethmoidal mucoceles are less common
- Seen with vertex headaches and deep nasal pain
- Treatment is wide drainage
Complications: Orbital

- Five classifications of orbital complications:
  1. Inflammatory edema: lid edema
  2. Orbital cellulitis: diffuse edema
  3. Subperiosteal abscess: usually seen near lamina papyracea
  4. Orbital abscess: collection within orbit
  5. Cavernous sinus thrombosis: bilateral
- Must have CT and Surgical Consult
Complications: Pott’s Puffy Tumor

- Non-neoplastic complication of acute sinusitis
- Subperiosteal abscess associated with osteomyelitis, usually related to the frontal sinus
- Treatment is surgical with drainage of the abscess and IV antibiotics (6 to 8 weeks)
CURRENT PRACTICE—FUNCTIONAL ENDOSCOPIC SURGERY

1. Trans-nasal approach
2. More precise instrumentation
3. Image-guided navigation

1. Nasal approach reduces structural trauma
2. Microdebriders enable a more targeted dissection/resection process
3. Image guidance reduces uncertainty during approach to treatment site

FESS significantly reduced the invasiveness of sinus surgery, and it continues to evolve today.
3D Image guided surgery
Balloon Sinus Surgery Equipment

XprESS LoProfile Multi-Sinus Dilation Tool with PathAssist LED Light Fiber

XprESS Multi-Sinus Dilation Tool
MANAGEMENT GOALS IN SEVERE SINUSITIS

1. Resolve Infection/Allergic Response
2. Restore Mucociliary Clearance
3. Ensure Patency of Outflow Tracts

“The natural drainage and ventilation paths should be restored, the anatomy changed as little as possible, and the mucosa preserved to the greatest extent.”
-H. Stammberger, 2003

"FESS - Endoscopic diagnosis and surgery of the paranasal sinuses and anterior skull base.”
H. Stammberger
Thank you

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