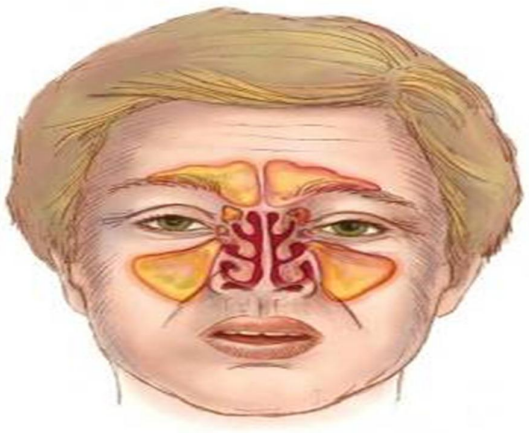
Sinusitis and Its Complications



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- This is dr. Sami's slides . I only listened to the record and put notes on them.
- the objectives are covered but I donôt know whether it's enough to study from or not.
- The blue notes were added from the record.
- The purple ones dr. sami didnôt mention during the lecture.

Good Luck

Maram Alhamad
Asma Almadhi

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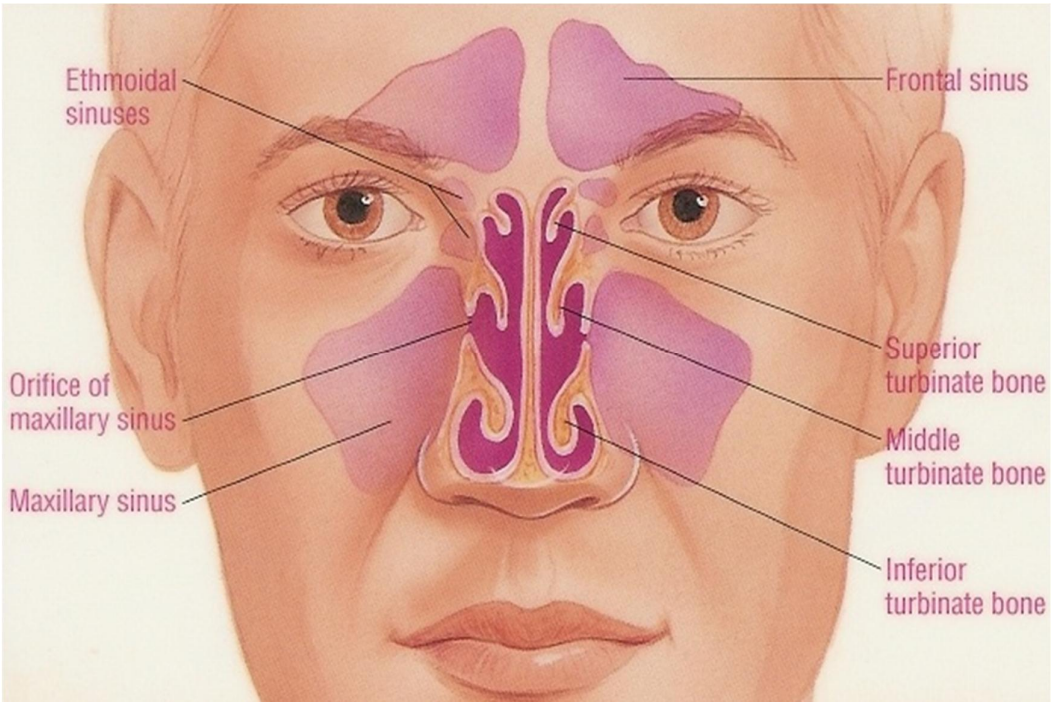


Anatomy

Å Maxillary. Å Anterior ethmoid. Å Frontal.	Open in	Middle meatus (under the middle turbinate).
Å Posterior ethmoid. Å Sphenoid.	Open in	Superior meatus (under the superior turbinate).
Å Lacrimal ducts.	Open in	Inferior meatus (under the superior turbinate).

Development

Å Maxillary and ethmoid sinuses develops during 3rd & 4th gesta□onal month and grow in size until late adolescence (so, at birth only maxillary and ethmoid sinuses are present).

Å Sinusitis in general more common in children and they usually arise from maxillary and ethmoid sinuses .

Å Sphenoid sinus presents by 2 years of age

Å Frontal sinus develops during 5 and 6 yrs.

Definitions

- ***Rhinosinusitis*** - broadly defined as an inflammation and/or infection involving the nasal mucosa and at least one of the adjacent sinus cavities
- ***Acute rhinosinusitis (AS)*** – the persistence and worsening of upper respiratory symptoms for greater than a 7-day course but lasts less than 4 weeks.
- ***Subacute rhinosinusitis (SAS)*** - is defined as nasal symptoms lasting 4 weeks to 12 weeks.
- ***Chronic Rhinosinusitis (CRS***) – persistence mucosal inflammation for > 12 consecu□ve weeks despite medical therapy **or** occurrence of more than four episodes of symptoms a year with persistent radiographic changes.

Rhinosinusitis

Acute

- Less than 3 months
- ***S. Pneumo, H. Flu, M. Catarrhalis***
- More severe symptoms
- General stems from acute viral infection

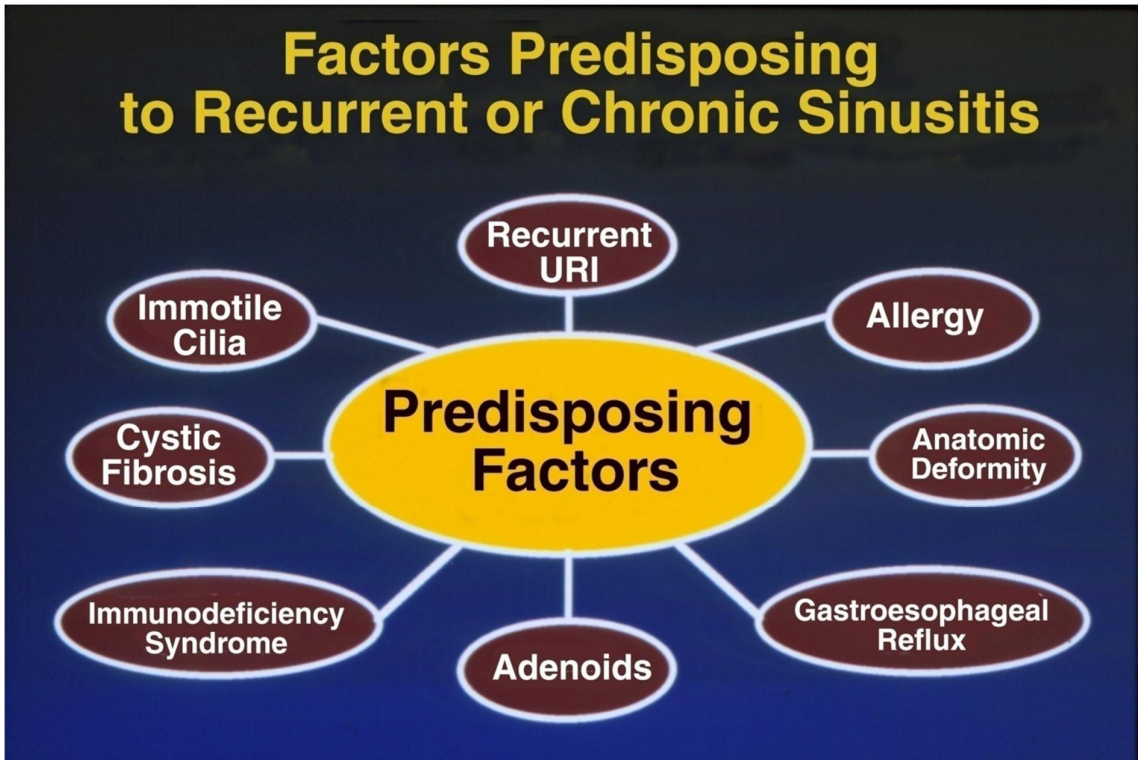
Chronic

- Greater than 3 months
- *S. Aureus,Anerobes , α-hemolytic strep, m. catarrhalis .*
- Milder symptoms
- Additional symptoms present:
  - **chronic cough (continues cough compared to bronchial asthma patient who has cough at night) , bronchitis, fatigue, malaise, and depression**.

Physiology

THREE KEY ELEMENTS

- patency of the ostia
- function of the ciliary apparatus
- quality of secretions



Predisposing factors

- Immotile cilia → the secre□ons will stay in the sinuses.
- Cystic fibrosis → thick secre□ons .
- Immunodeficiency→ more infections
- Adenoids→ mechanical obstruc□on also could be reservoir for the infec□ons.
- GERD → impaired ciliary func□on.
- Anatomical deformities such as choanal atresia, deviated septum → obstruct the sinuses.
- Allergy.
- Recurrent URI –specially children.

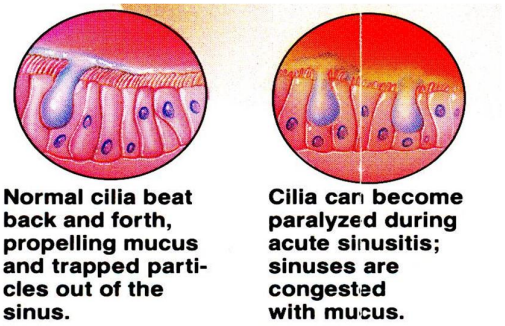
Pathophysiology

- Most important pathologic process in disease is obstruction of natural ostia.
- Obstruction leads to hypo-oxygenation .
- Hypo-oxygenation leads to ciliary dysfunction and poor mucous quality.
- Ciliary dysfunction leads to retention of secretions.

Mucociliary clearance

- Ciliary function very important
- Ostia are small and located in locations not conducive to spontaneous-drainage (ostium of the maxillary sinus and sphenoid also they are not with the gravity which means some mucociliary movement pushing the secretions up then through the ostium).

- Important factors:
  - Number of cilia
  - Structure
  - Activity
  - Coordinated Activity



Normal cilia beat back and forth, propelling mucus and trapped particles out of the sinus.

Cilia can become paralyzed during acute sinusitis; sinuses are congested with mucus.

Decreased MCC

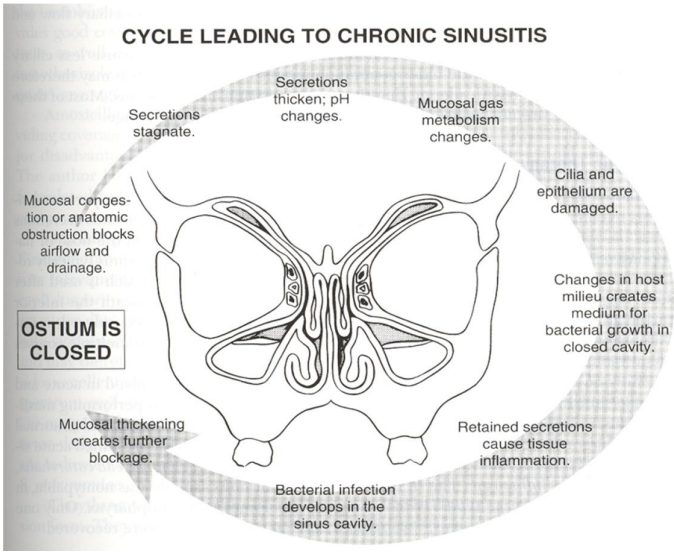
- Kartagener syndrome (Primary ciliary dyskinesia)
- Cystic fibrosis
- Radiotherapy
- GERD
- Rhinosinusitis

Primary ciliary dyskinesia

- Autosomal recessive.
- Dynein arm defects (total, partial, inner, outer or both arms)
- No sex or racial predilection
- Associated with dextrocardia, sinusitis, rhinitis, pneumonia, and otitis media
- Male infertility is common.

Cystic Fibrosis

- Autosomal recessive.
- Decreased chloride secretion with resultant water retention within cell.
- Thicker/stickier mucus adherent to bacteria.
- Leads to infection and inflammation.
- Viscosity leads to dysfunction:
  - Respiratory tract Sweat glands
  - Pancreas Other exocrine glands
  - GI tract



Signs and Symptoms

- Day and night cough
- Purulent nasal discharge (v. imp) (diagnostic) if there is pus coming from the sinus it means sinusitis for sure. We see that then treat it with broad spectrum antibiotic .
- Nasal airway obstruction
- Headache, irritability, or facial pain
- Fever
- Postnasal drip.

Diagnosis- Sinus Aspiration

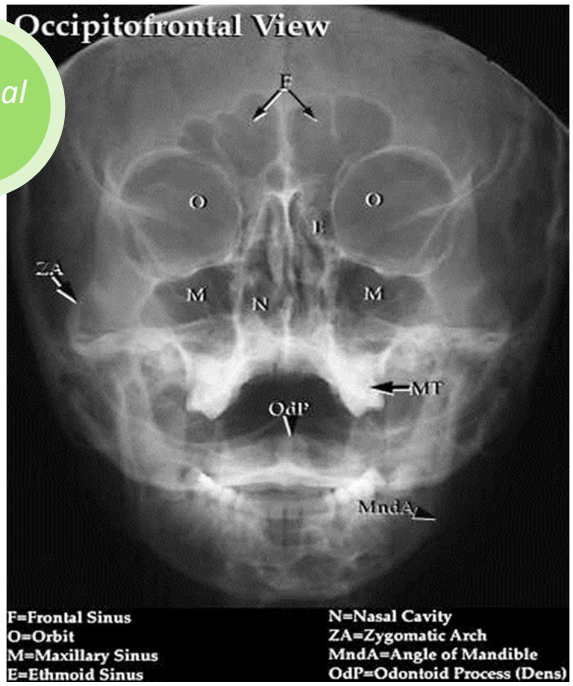
Indications

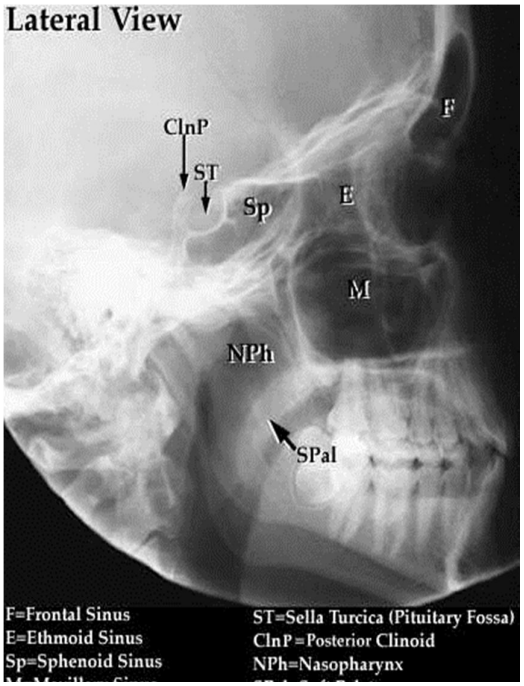
- failure to respond to multiple antibiotics
- severe facial pain
- orbital or intracranial complications
- evaluation of an immunoincompetent host (see which organism causing sinusitis)
- Diagnosis is either clinical or sometimes we need x-ray.

Diagnosis-Imaging

- Standard views
  - Anterioposterior
  - Lateral (we can see adenoid)
  - Occipitomental
- Findings
  - acute-diffuse opacification,mucosal thickening of at least 4 mm, or an air-fluid level

Normal





Diagnosis- CT Scans

- Frequent abnormalities are found in patients with a “fresh common cold”

Indications

- complicated sinus disease(either orbital or CNS complications)
- numerous recurrences
- protracted or nonresponsive symptoms(surgery is being contemplated)
  (the gold standard for investigating chronic sinusitis is CT)

Microbiology

- *Streptococcus pneumoniae* 30-40%
- *Haemophilus influenzae* 20%
- *Moraxella catarrhalis* 20%
- Strep pyogenes 4%
- Respiratory viral isolates 10%
  - adenovirus
  - parainfluenzae
  - influenzae
  - rhinovirus
- Other rarer isolates- group A strep, group C strep, viridians strep, peptostrep, Moraxella species, *Eikenella corrodens*

Treatment-Most Comprehensive Coverage (broad spectrum AB)

- Amoxicillin/potassium clavunate (Augmentin)
- Erythromycin-sulfisoxazole
- Cefuroxime axetil
- Cefpodoxime
- Proxetil
- Azithromycin

Other Medications

- Medications to facilitate drinage:
- Antihistamines if there is allergy
- Decongestants
- Anti-inflammatory agents ex. Steroids which will decrease the edema. So patient who develop sinusitis needs antibiotic + these other medications.

Surgery

- Rarely required
- Consider if orbital or central nervous system complications or
- Failure of maximal medical therapy
- Functional endoscopic sinus surgery (FESS):

- Removal of uncinate process, ethmoid bulla, and variable number of anterior ethmoidal cells, maxillary sinus ostium enlarged and frontal recess diseased tissue is removed if present.

Absolute Indications for Surgery

- Causing brain abscess or meningitis, subperiosteal/orbital abscess, cavernous sinus thrombosis, another contiguous infection, or an impending complication (Pott's tumor)
- Sinus mucocele or pyocele
- Fungal sinusitis
- Nasal polyps (massive)
- Neoplasm or suspected neoplasm

Recurrent Sinusitis

- Most common cause is recurrent viral URIs
  - day care attendance
  - presence of other school age siblings in house
- Other predisposing conditions (we have to rule out these serious conditions):
  - allergic and nonallergic rhinitis
  - CF
  - immunodeficiency disorder
  - ciliary dyskinesia
  - anatomical problem

Acute Fungal Sinusitis

- Uncommon
- Aspergillosis, mucormycosis, candidiasis, histoplasmosis and coccidiomycosis seen
- Aspergillosis most common
- Requires high index of suspscion
- Diagnosed by biopsy and culture

Introduction

- Fungi are ubiquitous (everywhere)
- Immune system keeps organisms suppressed
- Most infections are benign, non-invasive
- Immunocompromised – higher risk of invasive disease

Classification of Infection

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

- Invasive
  - Acute fulminant invasive fungal sinusitis (very bad)
  - Chronic invasive fungal sinusitis (milder than the acute)

*invasive : invading the mucosa & the basement membrane.

- Aspergillosis a common pathogen of soil, fruits, vegetables, grains, birds and mammals
- Suspect if dark, greasy material seen
- Cultures of nose usually not diagnostic
- Antrostomy (get to the maxillary sinus) with biopsy and fungal stain required

Sinus Fungal Ball (Mycetoma)

- Sequestration of fungal elements within a sinus without invasion or granulomatous changes
- Inhaled spores → grow while evading host immune system (no invasion)
- **Aspergillus most common species**
- Maxillary sinus most often involved (70-80% of cases)

Clinically

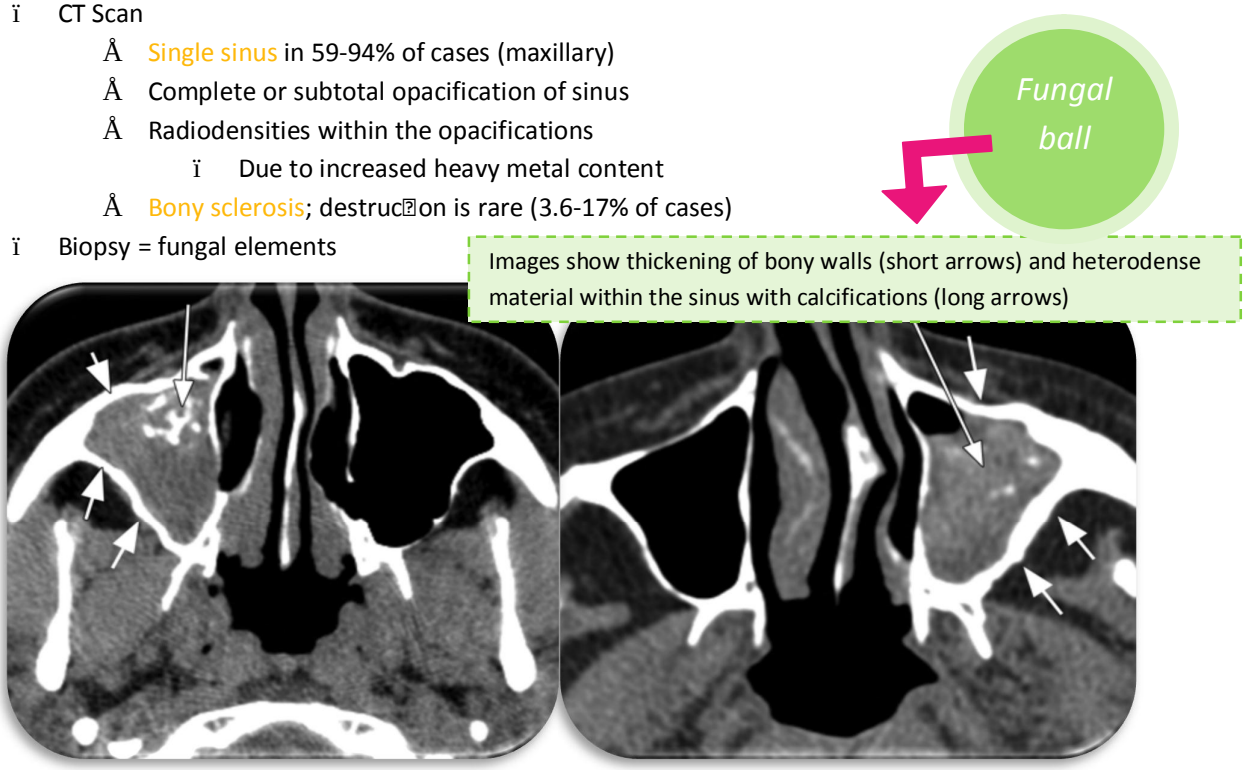
- Symptoms due to mass effect and sinus obstruction
- Presents similar to rhinosinusitis
- Congestion, facial pain, headache, rhinorrhea

Physical examination

- Mild to minimal mucosal inflammation
- Polyps in 10% of cases

Diagnosis

- CT Scan
  - Single sinus in 59-94% of cases (maxillary)
  - Complete or subtotal opacification of sinus
  - Radiodensities within the opacifications
    - Due to increased heavy metal content
  - Bony sclerosis; destruction is rare (3.6-17% of cases)
- Biopsy = fungal elements

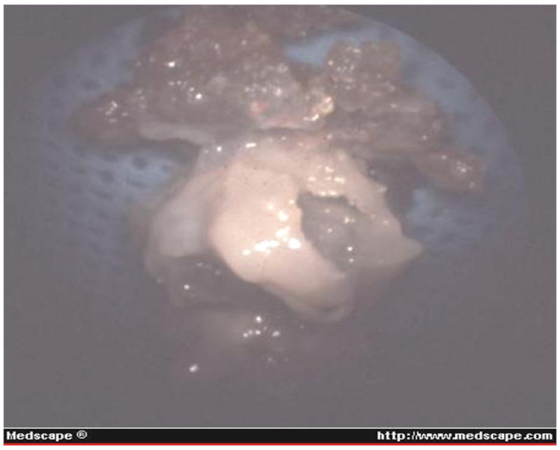


Images show thickening of bony walls (short arrows) and heterodense material within the sinus with calcifications (long arrows)

Treatment

- Complete surgical removal of fungal ball
- Irrigation of involved sinuses
- Antifungal therapy
  - Only if patient is high risk for invasive disease (very rare)
    - Severely immunocompromised
    - Continued recurrence of disease despite proper medical/surgical management
  - Consider topical antifungal irrigation first and then systemic therapy if no improvement

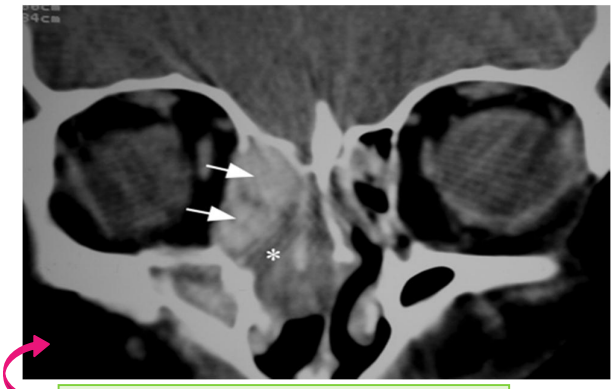
Allergic Fungal Sinusitis



- Fungal colonization resulting in allergic inflammation without invasion
- IgE mediated response to fungal protein
- Symptoms:
  - Nasal obstruction (gradual)
  - Rhinorrhea
  - Facial pressure/pain
  - Sneezing, watery/itchy eyes
  - Periorbital edema

Diagnostic Criteria

1. Eosinophlic mucin
2. Nasal polyposis
3. Radiographic findings (heterogeneity in the sinus)
4. Immunocompetance
5. Allergy to fungi . History of allergy



Double densities (arrows). Expansion of sinus with extension of disease into the nasal cavity (star)

Arrows show double densities. Note sinus expansion but no erosion that's why it is not invasive

Acute Fulminant Invasive Fungal Sinusitis (the worst type)

Patient population

- Most often compromised immune system
  - DM, AIDS, hematologic malignancies, organ transplant, iatrogenic (chemotherapy and steroids).

Most common fungi

- Aspergillus
- Mucormycosis (it is usual here and it is fetal disease)
- Mucor, Rhizopus, Absidia

Less common fungi

- Candida
- Bipolaris
- Fusarium

*not mentioned by the doctor

Pathogenesis

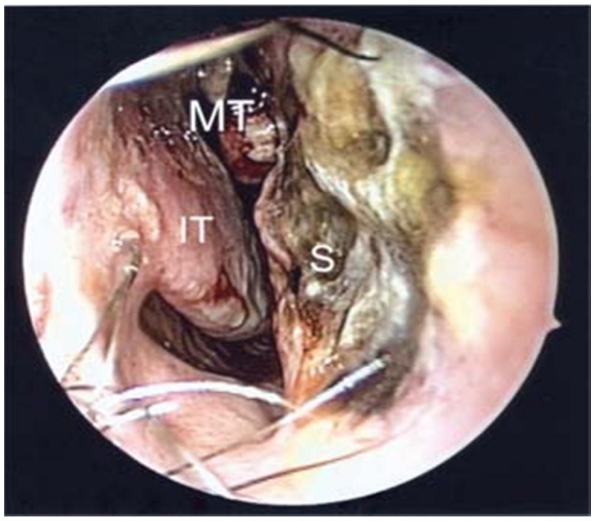
- Spores inhaled → fungus grows in warm, humid sinonasal cavity
- Fungi invade neural and vascular structures with thrombosis of feeding vessels
- Necrosis and loss of sensation → acidic environment → further fungal growth
- **Extrasinus extension occurs via bony destruction, perineural and perivascular invasion**
  - Nasal and palate mucosa destroyed
  - Facial anesthesia
  - Proptosis
  - Cranial nerve deficits
  - Mental status changes

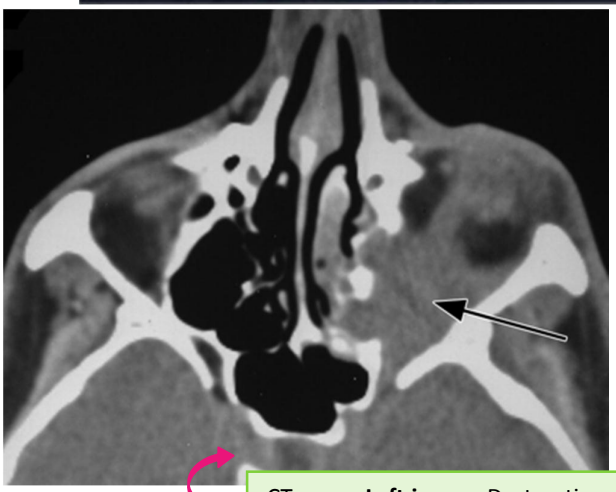
Other signs/symptoms

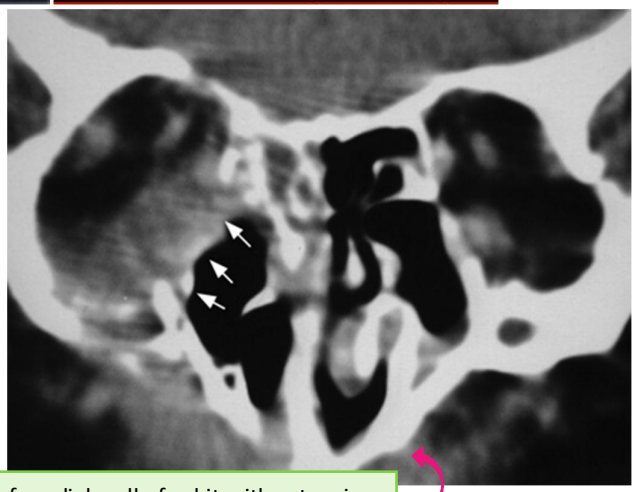
- Fever (most common – 90% of cases)
- **Loss of sensation over face or oral cavity (maxillary nerve)**
- **Ulceration of face and sinonasal/palatal mucosa**
- Rhinorrhea, facial pain/anesthesia, headaches
- Seizures, CN deficits
- Fast progressing symptoms
  - In some cases, hours to days till death!

Endoscopic findings

- Loss of sensation and change in appearance of mucosa (pale or black)
  - Most consistent finding
- Ulcerations and black mucosa are late findings
- Serial examinations are required







CT scans; **Left image**: Destruction of medial wall of orbit with extension of disease into the orbit. **Right image**: Destruction of medial and inferior walls of the orbit with extension of disease into the orbit

Axial CT scans. **Left image:** invasion through lateral wall of the sphenoid sinus and into the cavernous sinus. **Right image:** lack of enhancement of the cavernous sinus due to fungal thrombosis

- Noninvasive Aspergillosis seen as fungal ball, usually in maxillary sinus
- Invasive aspergillosis can invade bone.
- Fulminant aspergillosis occurs in immunocompromised and invades adjacent structures
- Therapy for noninvasive forms is surgical excision followed usually by PO antifungals

- Therapy for invasive forms requires wide local debridement and intravenous ampo 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
- Frequently fatal. 90% mortality in immunocompromised .

- 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
- Treated with radical surgical debridement, amphotericin B and correction of underlying immunosuppression

Chronic Invasive Fungal Sinusitis

- Slower disease process than acute
- Rare
- Biggest difference:
  - Most patients are **immunocompetent**
- Common fungi
  - Aspergillus (most common - >80% of cases)
  - Bipolaris
  - Candida
  - Mucormycosis

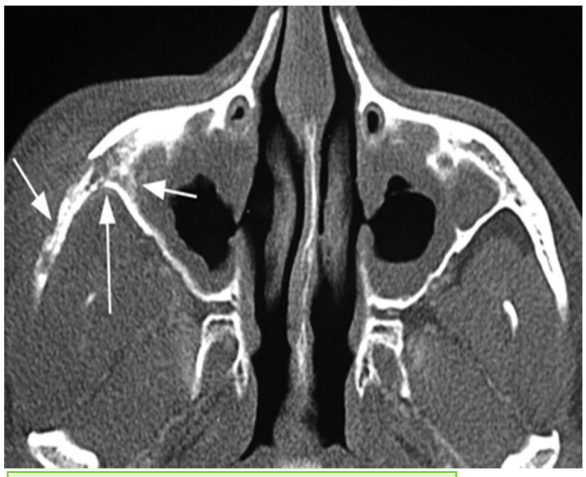
Signs/Symptoms

- Similar to symptoms of chronic rhinosinusitis
  - Nasal congestion, rhinorrhea, facial pressure, headaches, polyposis
- Proptosis, visual changes, anesthesia of skin, epistaxis
  - More concerning
- Does not respond to antibiotics
- Worsens with steroids

→ Which give you a hint that it is fungal not bacterial

Diagnosis

- Full H&N "head and neck "examination with nasal endoscopy
  - Nasal polyps, thick mucus
  - Rarely find ulcerations
  - Biopsy if suspect fungal disease or note any changes
- CT & MRI
  - Similar findings to AFIFS (Acute Fulminant Invasive Fungal Sinusitis)– bony destruction, extrasinus extension, unilateral. But the patient here is imunocompetent.



CT showing destruction of right lateral maxillary sinus and zygomatic arch

CT showing opacification of left maxillary sinus with extrasinus extension of disease into the periantral tissues (arrows)

Complications of Sinusitis

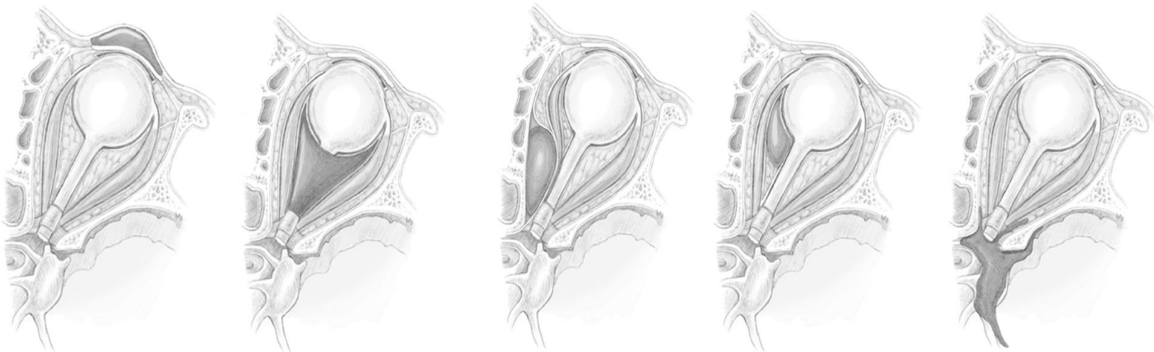
Orbital

- Most commonly involved complication site
  - Proximity to ethmoid sinuses
  - Periorbita/orbital septum is the only soft-tissue barrier
  - Valveless superior and inferior ophthalmic veins
- Children more susceptible
  - < 7 years – isolated orbital (subperiosteal abscess)
  - ≥ 7 years – orbital and intracranial complications why??
  - Remember intracranial complications usually are either from frontal or sephnoidal sinuses which develop a□er 7 years.
  - Where orbital complications alone caused by ethmoid then maxillary which develop early in age.
  - Children get infections more than adults and so orbital complications.

Chandler Criteria

- **FIVE CLASSIFICATIONS**
  - Preseptal cellulitis
  - Orbital cellulitis
  - Subperiosteal abscess
  - Orbital abscess
  - Cavernous sinus thrombosis

In the complications, dr.sami mentioned mainly the treatment of each complication .



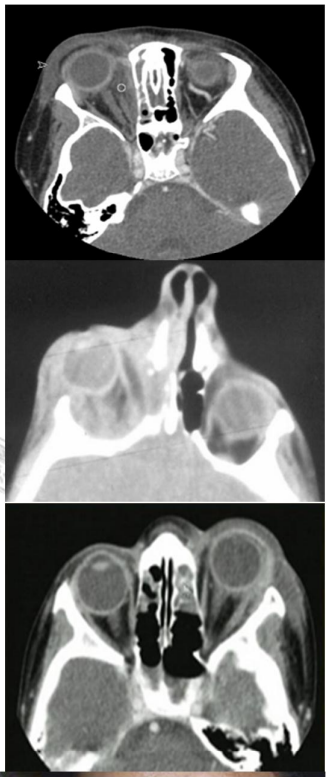
PRESEPTAL CELLULITIS

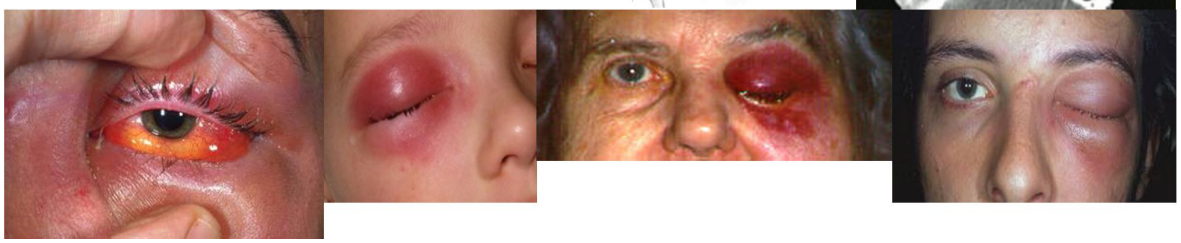
- Medical therapy typically sufficient
  - Intravenous antibiotics
  - Head of bed elevation
  - Warm compresses
- Facilitate sinus drainage
  - Nasal decongestants
  - Mucolytics
  - Saline irrigations



ORBITAL CELLULITIS

- Symptomatology
  - Eyelid edema and erythema
  - Proptosis and chemosis
  - Limited or no extraocular movement limitation
  - No visual impairment
  - No discrete abscess
- Low-attenuation adjacent to lamina papyracea on CT
- Facilitate sinus drainage
  - Nasal decongestants
  - Mucolytics
  - Saline irrigations
- Medical therapy typically sufficient
  - Intravenous antibiotics
  - Head of bed elevation
  - Warm compresses
- May need surgical drainage
  - Visual acuity 20/60 or worse
  - No improvement or progression within 48 hours





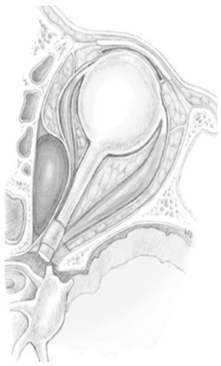
SUBPERIOSTEAL ABSCESS

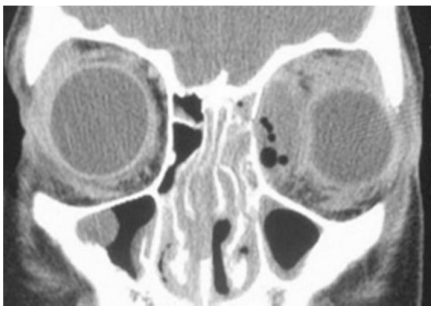
Symptomatology

- Pus formation between periorbita and lamina papyracea
- Displace orbital contents downward and laterally
- Proptosis, chemosis, ophthalmoplegia
- Risk for residual visual sequelae
- May rupture through septum and present in eyelids

- Rim-enhancing hypodensity with mass effect

NOTES: Patients will complain of diplopia, ophthalmoplegia, exophthalmos, or reduced visual acuity. The patient has limited ocular motility or pain on globe movement toward the abscess.; may have normal movement early on. Orbital signs include proptosis, chemosis, and visual impairment.



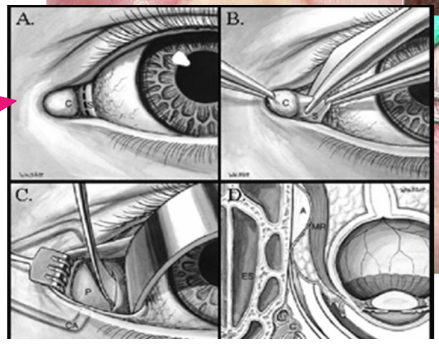


- Surgical drainage
  - Worsening visual acuity or extraocular movement
  - Lack of improvement after 48 hours
- May be treated medically in 50-67%

Approaches

- External ethmoidectomy (Lynch incision) is most preferred
- Endoscopic ideal for medial abscesses
- Transcaruncular approach
- Transconjunctival incision

- Extend medially around lacrimal caruncle



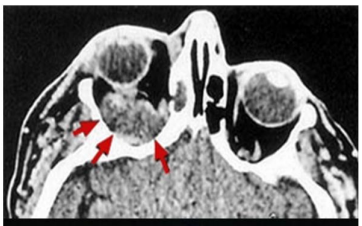
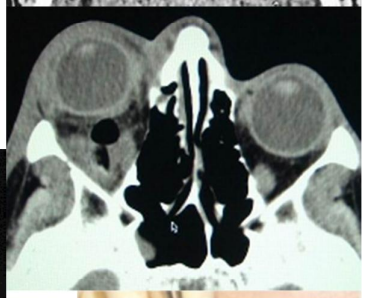
Orbital Abscess

Symptomatology

- Pus formation within orbital tissues
- Severe exophthalmos and chemosis
- Ophthalmoplegia
- Visual impairment
- Risk for irreversible blindness
- Can spontaneously drain through eyelid

- Drain abscess and sinuses

- Similar approaches as with subperiosteal abscess
  - Lynch incision
  - Endoscopic



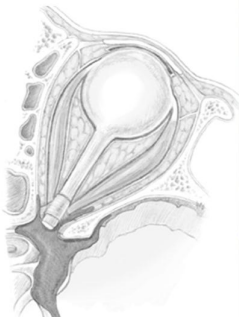
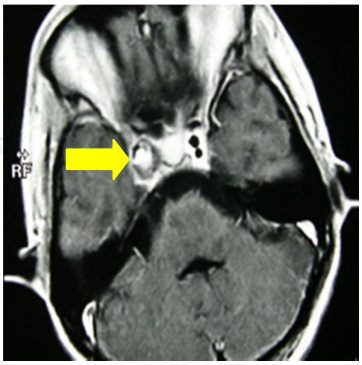
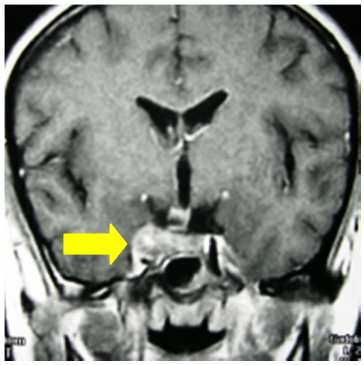

Cavernous Sinus Thrombosis

Symptomatology

- Orbital pain
- Proptosis and chemosis
- Ophthalmoplegia
- **Symptoms in contralateral eye (both eyes will be involved)**
- Associated with sepsis and meningismus

Radiology

Better visualized on MRI

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- Surgical drainage
- Intravenous antibiotics
  - High-dose
  - Cross blood-brain barrier
- Anticoagulant use is controversial

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Intracranial complications of sinusitis

- Male teenagers affected more than children
- Direct extension
  - Sinus wall erosion
  - Traumatic fracture lines
  - Neurovascular foramina (optic and olfactory nerves)
- Hematogenous spread
  - Diploic skull veins
  - Ethmoid bone

Types

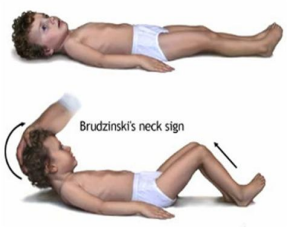
- **FIVE TYPES**
  1. Meningitis (the most imp)
  2. Epidural abscess
  3. Subdural abscess
  4. Intracerebral abscess
  5. Cavernous sinus, venous sinus thrombosis

Common signs and symptoms

- Fever (92%)
- Headache (85%)
- Nausea, vomi□ng (62%)
- Altered consciousness (31%)
- Seizure (31%)
- Hemiparesis (23%)
- Visual disturbance (23%)
- Meningismus (23%)

MENINGITIS

- Most common intracranial complication of sinusitis



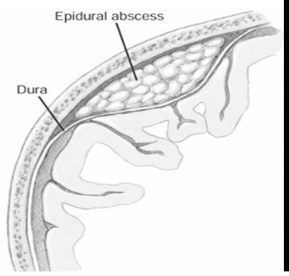
Symptomatology

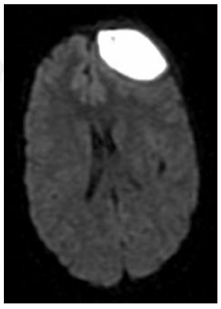
- Headache
- Meningismus
- Fever, septic

- ï Cranial nerve palsies
- Å Usually amenable with medical treatment
- Å Drain sinuses if no improvement a er 48 hours
- Å Hearing loss and seizure sequelae

EPIDURAL ABSCESS

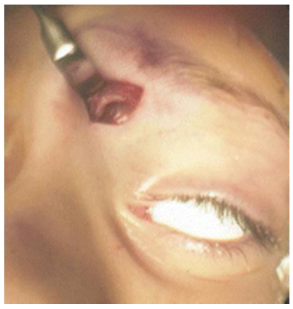
- Å Second-most common intracranial complication
- Å Crescent-shaped hypodensity on CT
- Å Lumbar puncture contraindicated (not to cause herniation)
- Å Antibiotics
  - ï Good intracerebral penetration
  - ï Typically for 4-8 weeks
- Å Drain sinuses and abscess

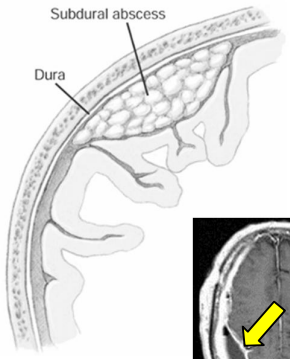


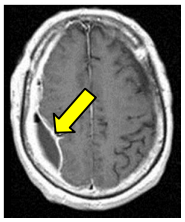


SUBDURAL ABSCESS

- Å Generally from frontal or ethmoid sinusitis
- Å Mortality in 25-35%

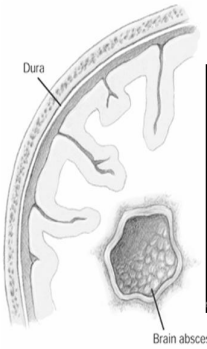


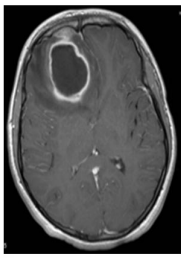




INTRACEREBRAL ABSCESS

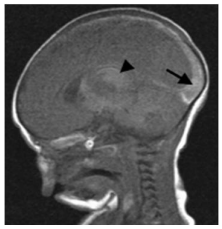
- Å Uncommon, frontal and frontoparietal lobes
- Å Mortality 20-30%

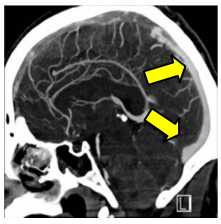




VENOUS SINUS THROMBOSIS

- Å Sagittal sinus most common
- Å Retrograde thrombophlebitis from frontal sinusitis
- Å Extremely ill
- Å High mortality rate





Bony – Complications of sinusitis

- Pott's puffy tumor (osteomyelitis of the frontal bone)
- Frontal sinusitis with acute osteomyelitis
- Subperiosteal pus collection leads to "puffy" fluctuance

Rare complication

- Only 20-25 cases reported in post-antibiotic era (Raja 2007)

Symptomatology

- Headache
- Fever
- Neurologic findings
- Periorbital or frontal swelling
- Nasal congestion, rhinorrhea

- Associated with other abscesses in 60%
- Cooperative effort
  - Otolaryngology
  - Neurosurgery
  - Infectious disease
- Surgical and medical therapy

Conclusions

- Complications are less common with antibiotics
  - Orbital
  - Intracranial
  - Bony
- Can result in fatal sequelae
- Drain abscess and open involved sinuses
- Surgical involvement
  - Ophthalmology
  - Neurosurgery