

EAR, NOSE AND THROAT

(13) Nose III

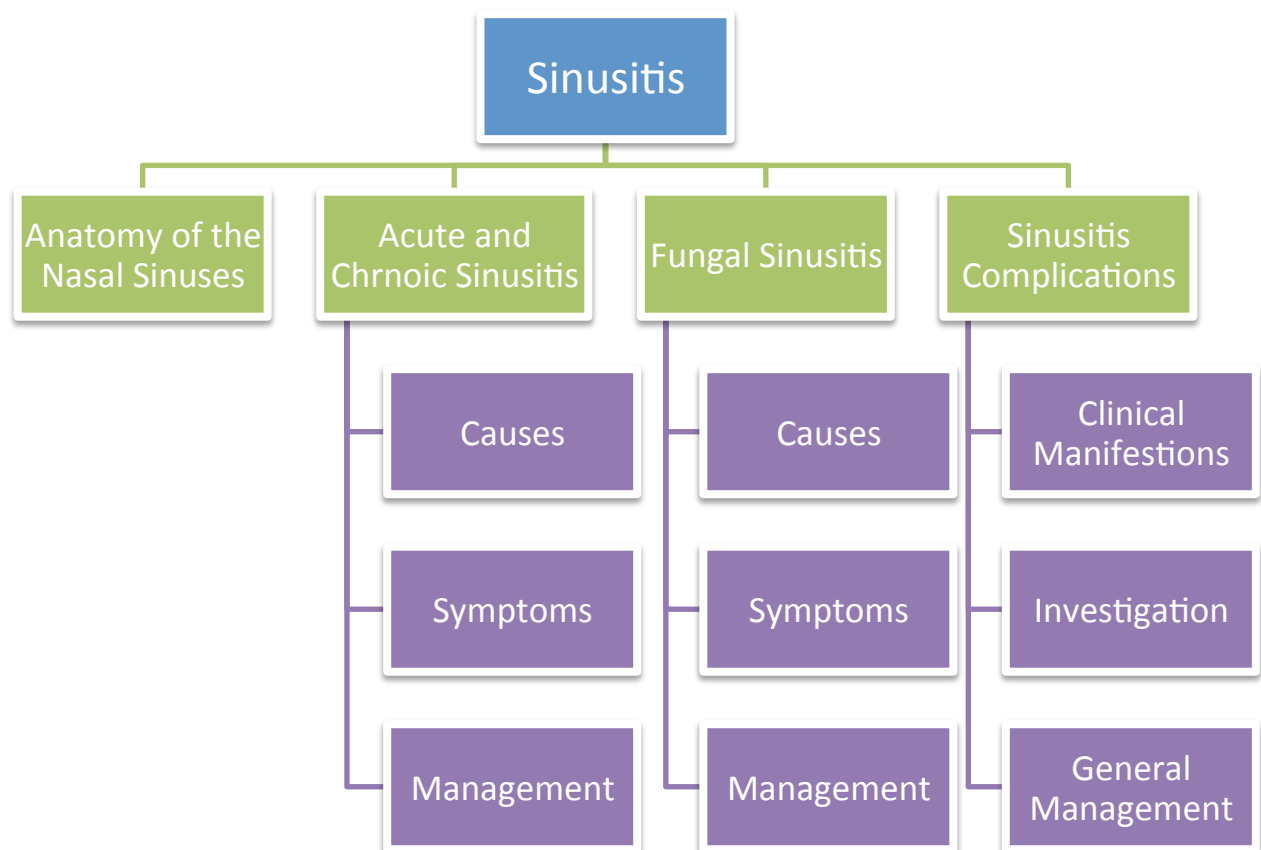
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Objectives:

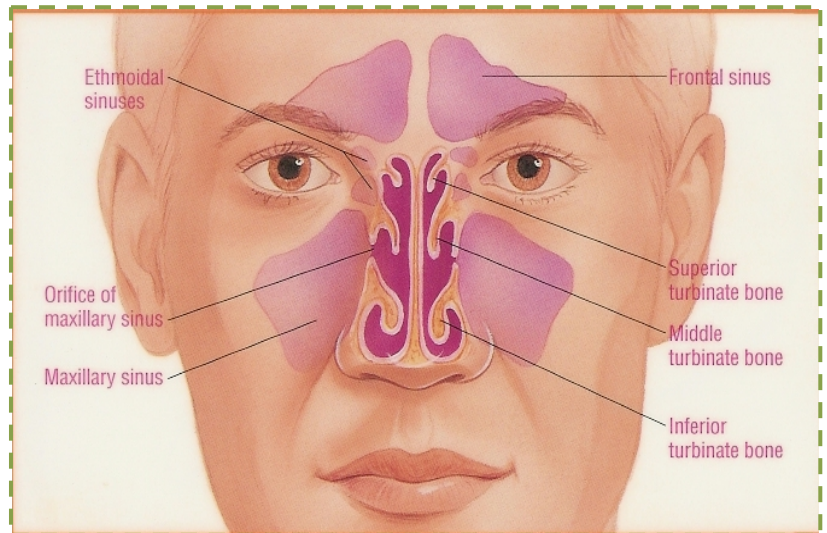
1. Know the causes, clinical manifestations and management of acute and chronic sinusitis.
2. Know about fungal sinusitis in brief.
3. Know the classification and management of sinusitis complications, in addition to the investigation and general management of orbital complications.
4. Be familiar with the role of radiology in sinusitis.



Anatomy of the Nasal Sinuses

The Paranasal Sinuses ⁽¹⁾:

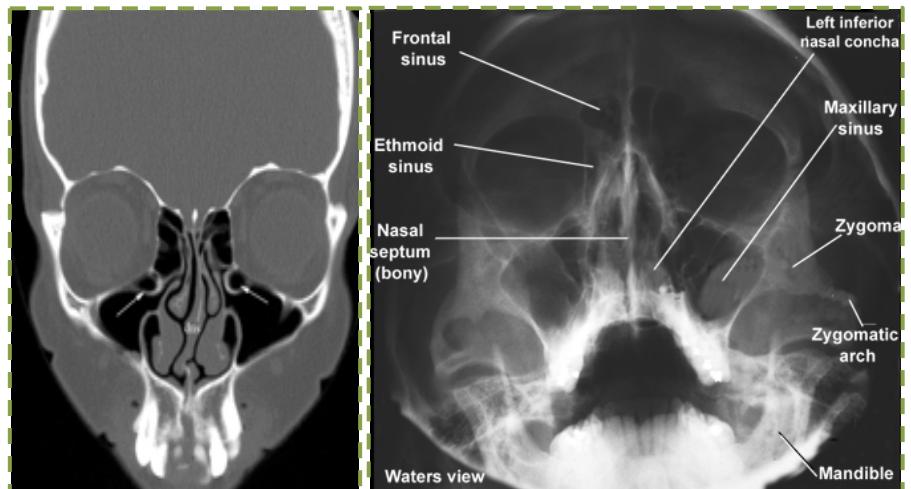
The paranasal sinuses are cavities found in the interior of the maxilla, sphenoid, and ethmoid bones. They are lined with mucoperiosteum and filled with air; they communicate with the nasal cavity through relatively small apertures. **The maxillary and sphenoid sinuses are present in a rudimentary form at birth; they enlarge appreciably after the 8th year and become fully formed during adolescence.**



Maxillary Sinus ⁽¹⁾:

The largest and the first sinus to develop. The maxillary sinus is pyramidal in shape and located within **the body of maxilla behind the skin of the cheek**. The roof is formed by the floor of the orbit, and the floor is related to **the roots of the premolars and the molar teeth**.

First and second molar roots dehiscent in 2%.
The maxillary sinus opens into the **middle meatus of the nose** through the hiatus semilunaris.



The anterior wall forms the facial surface of the maxilla, the posterior wall borders the infratemporal fossa, the medial wall constitutes the lateral wall of the nasal cavity, the floor of the sinus is the alveolar process, and the superior wall serves as the orbital floor.

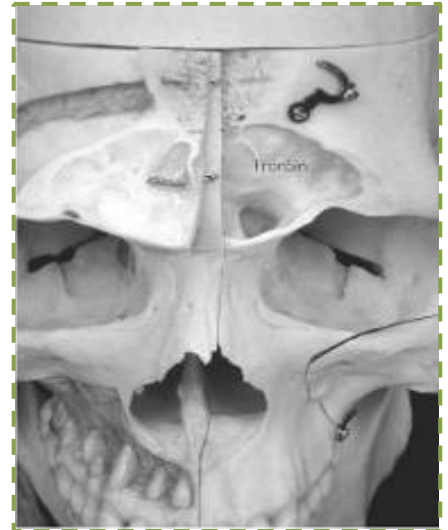
Frontal Sinuses ⁽¹⁾:

The two frontal sinuses are contained within the frontal bone. They are separated from each other by a bony septum. Each sinus is roughly triangular, extending upward above the medial end of the eyebrow and backward into the medial part of the roof of the orbit. **Each frontal sinus opens into the middle meatus** of the nose through the infundibulum.

- Not present at birth, starts developing at four years.
- Development not complete until 12-20 years.

The anterior table of the frontal sinus is twice as thick as the posterior table, which separates the sinus from the anterior cranial fossa. The floor of the sinus also functions as the supraorbital roof, and the drainage ostium is located in the posteromedial portion of the sinus floor.

A markedly pneumatized agger nasi cell or ethmoidal bulla can obstruct frontal sinus drainage by narrowing the frontal recess. Drainage of the frontal sinus also depends on the attachment of the superior portion of the uncinate process.



Sphenoidal Sinuses ⁽¹⁾:

The two Sphenoidal sinuses lie within the body of the sphenoid bone. **Each sinus opens into the sphenoidal recess above the superior concha.**

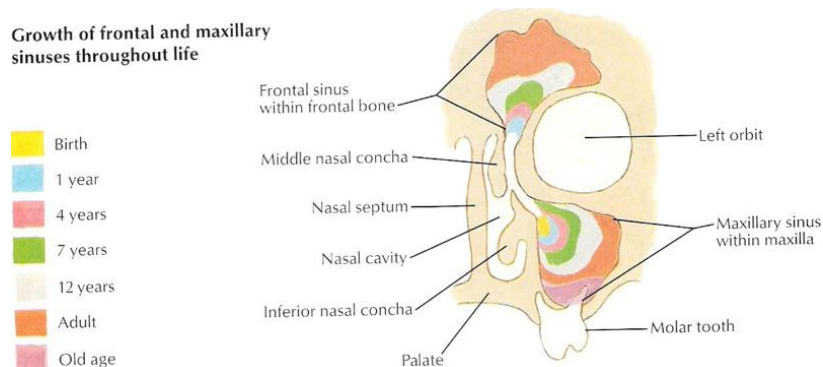
- Pneumatization begins in middle childhood.
- Reaches adult size by 12-18 years.

Approximately 25% of bony capsules separating the internal carotid artery from the sphenoid sinus are partially dehiscent. An optic nerve prominence is present in 40% of individuals with dehiscence in 6%.

In most cases, the posteroinferior end of the superior turbinate was located in the same horizontal plane as the floor of the sphenoid sinus. The ostium was located medial to the superior turbinate in 83% of cases and lateral to it in 17%.

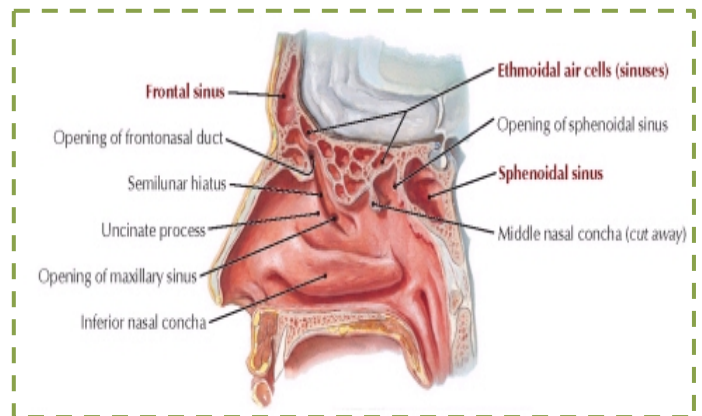


Growth of frontal and maxillary sinuses throughout life



Ethmoid Sinuses ⁽¹⁾:

First seen at 5 months gestation. Adult size by 12-15 years has between 10-15 cells. The ethmoidal sinuses are anterior and posterior, and are contained within the ethmoid bone, between the nose and the orbit. They are separated from the latter by a thin plate of bone that infection can readily spread from the sinuses to the orbit. **The anterior sinuses open into the infundibulum “middle meatus”, and the posterior sinuses open into the superior meatus.**



The lateral portions form the medial walls of the orbits, the sphenoid establishes the posterior face, the superior surface is formed by the skull base of the anterior cranial fossa, and many of the key structures of the lateral nasal wall, derived from basal lamellas, extend posteroinferiorly from the skull base. The lateral wall of the ethmoid sinus, or lamina papyracea, forms the paper-thin medial wall of the orbit. The midline vertical plate of the ethmoid bone is composed of a superior portion in the anterior cranial fossa called the crista galli and an inferior portion in the nasal cavity called the perpendicular plate of the ethmoid bone that contributes to the nasal septum. The anterior cranial fossa is separated from the ethmoid air cells superiorly by the horizontal plate of the ethmoid bone, which is composed of the thin medial cribriform plate and the thicker, more lateral ethmoid roof. The ethmoid roof articulates with the cribriform plate at the lateral lamella of the cribriform plate, which is the thinnest bone in the entire skull base.

The ethmoid sinuses are separated by a series of recesses demarcated by five bony partitions or lamellae. These lamellae are named from the most anterior to posterior: first (uncinate process), second (bullae ethmoidalis), third (ground or basal lamella), fourth (superior turbinate), and fifth (supreme turbinate).

In summary:

- The superior meatus receives the opening of posterior ethmoid sinus.
- The middle meatus receives the opening of frontal, maxillary and anterior ethmoidal sinuses.
- The inferior meatus receives the opening of nasolacrimal duct.
- The Sphenoidal sinuses open into the sphenoethmoidal recess above the superior meatus.
- Daily mucus production in the sinuses is about 1-1.5 L.

Acute and Chronic Sinusitis

- **Acute** – the persistence of upper respiratory symptoms for greater **than a 7-day course but lasts less than 4 weeks**.
- **Subacute** - nasal symptoms lasting 4 weeks to 12 weeks.
- **Chronic**– **persistence mucosal inflammation for > 12 consecutive weeks** despite medical therapy or occurrence of more than 4 episodes a year.

Causes of Acute Rhinosinusitis:

Streptococcus pneumonia, Haemophilus influenza, and Moraxella catarrhalis.

Infection lasting less than three months with more severe symptoms. The most common cause of acute sinusitis is a **viral infection associated with the common cold**. Bacterial sinusitis occurs much less commonly, in only 0.5 to 2 percent of cases, usually as a complication of viral sinusitis ⁽²⁾.

Nasal sinuses become infected whenever there is a blocked drainage introduced by allergy, infection, immunosuppression, or ciliary dysfunction.

Clinical Manifestations of Acute Rhinosinusitis ⁽³⁾:

- Nasal congestion and obstruction
- Purulent nasal discharge
- Maxillary tooth discomfort
- Facial pain or pressure that is worse when bending forward.
- Other signs and symptoms include fever, fatigue, cough “day and night”, hyposmia or anosmia, ear pressure or fullness, headache, and halitosis.

Causes of Chronic Rhinosinusitis:

Staphylococcus aureus, Anaerobes, Alpha-hemolytic Streptococcus, and Moraxella catarrhalis.

Infection for more than three months with milder symptoms. Additional symptoms are present like: **chronic cough, bronchitis, fatigue, malaise, and depression**.

Clinical Manifestations of Chronic Rhinosinusitis “CRS” ⁽⁴⁾:

The first manifestation of CRS may be a relatively acute presentation with severe headaches or facial pain or visual changes (such as diplopia).

There are four cardinal signs/symptoms of CRS in adults:

- Anterior and/or posterior nasal mucopurulent drainage
- Nasal obstruction/nasal blockage/congestion
- Facial pain, pressure, and/or fullness
- Reduction or loss of sense of smell

Pathophysiology:

Systemic:

- Viral infections
- Allergy
- Immotile cilia
- Cystic fibrosis
- Immune disorder

Chronic sinusitis may be noninfectious and related to allergy, cystic fibrosis, gastroesophageal reflux, or exposure to environmental pollutants ⁽⁵⁾.

Local:

- Trauma
- Swimming/diving
- Rhinitis medicamentosa

Swimming or diving could apply pressure over the sinuses or introduce foreign bodies.

Mechanical:

- Choanal atresia
- Deviated septum
- Polyps/foreign bodies
- Turbinate/adenoid hypertrophy

Mucociliary Clearance:

Ostia are small and located in locations not conducive to spontaneous drainage

Cilia work best at a temperature of 37°C and humidity near 100%. Respiratory epithelium is **pseudostratified ciliated columnar epithelium with goblet cells.**

Reduced mucociliary clearance can be seen in cases of: **Kartagener's syndrome** "**primary ciliary dyskinesia**", **cystic fibrosis**, **radiotherapy**, **GRED**, or **rhinosinusitis.**

Kartagener's Syndrome:

It is an autosomal recessive disease characterized with the presence of immotile cilia and immotile spermatozoa due to **dynein arm defects**, resulting in **reduced mucociliary clearance of the respiratory tract** "therefore chronic URTIs and LRTIs" **and male infertility.** It is also associated with **dextrocardia, sinusitis, rhinitis, pneumonia, and otitis media.**

Cystic Fibrosis:

It is an autosomal recessive disease characterized by **decreased chloride secretion due to protein transmembrane conductance regulator (CFTR) mutation**, results in **thicker/sticker mucus adherent to bacteria.** The viscosity leads to multi-organ

systems dysfunction including GIT, pancreas, respiratory tract, sweat glands, and other exocrine glands.

Treatment of Acute Rhinosinusitis ⁽²⁾:

The initial treatment aims to relieve the symptoms, since almost everyone **will improve within 7-10 days**. At this stage, **antibiotics can only be used if there is clear evidence of severe bacterial infection**.

So as an initial treatment, we can give acetaminophen or ibuprofen for the pain, **flushing the nose and sinuses** with a saline solution to decrease pain associated with nasal congestion, and **nasal decongestants** to temporarily treat congestion.

Second-line treatment includes **nasal steroids to reduce swelling inside the nose**, **amoxicillin** can be prescribed if bothersome symptoms of sinusitis persist for more than 10 days, or improve and worse again within the same period.

Treatment of Chronic Rhinosinusitis ⁽⁵⁾:

The symptoms of chronic rhinosinusitis may be relieved with **topical decongestants, topical steroids, antibiotics, nasal saline, topical cromolyn, or mucolytics**.

Steam inhalation and nasal saline irrigation may help by **moistening dry secretions, reducing mucosal edema and mucus viscosity**.

Steroids may help decreasing polyps size and improving olfaction.

Oral antibiotics regimens generally used to treat chronic rhinosinusitis. Initial choice of the appropriate antimicrobial(s) is usually empiric. Therapeutic regimens include **the combination of a penicillin (e.g., amoxicillin) plus a beta-lactamase inhibitor (e.g., clavulanic acid), a combination of metronidazole plus a macrolide or a second- or third-generation cephalosporin, and the newer quinolones (e.g., moxifloxacin)**.

Surgical Treatment:

Conservative FESS “Functional endoscopic sinus surgery”.

- We start with the medial management “steroids nasal sprays and nasal wash”, then we go to the surgical.
- Go for surgical management if there are complications or no response to medical therapy.

Sinusitis Complications

Three main categories:

- ✓ **Orbital** (60-75%)
- ✓ **Intracranial** (15-20%)
- ✓ **Bony** (5-10%)

Radiography:

- Computed tomography (CT) best for orbit.
- Magnetic resonance imaging (MRI) best for intracranium.

Orbital Complications: “Chandler Criteria”

Five classifications:

- Preseptal cellulitis
- Orbital cellulitis
- Subperiosteal abscess
- Orbital abscess
- Cavernous sinus thrombosis

Table 2 – Chandler's classification of orbital infection deriving from sinusitis

Group 1	Preseptal cellulitis	Inflammatory edema primarily limited to eyelid due to restricted venous drainage
Group 2	Orbital/postseptal cellulitis	Progressive inflammatory edema involving globe marked by chemosis
Group 3	Subperiosteal abscess	Collection of purulence between bone and periosteum with development of proptosis
Group 4	Orbital abscess	Collection of pus in orbital contents with onset of ophthalmoplegia
Group 5	Cavernous sinus thrombosis	Progression of inflammation intracranially with onset of fever, headache, and cranial nerve palsy

From Chandler JR, et al. *Laryngoscope*. 1970.¹³

1. Preseptal Cellulitis "managed by antibiotics"



2. Orbital Cellulitis



Patients may complain of pain and diplopia and a history of recent orbital trauma or dental surgery.

Diagnosis of sinusitis complications: based on the symptoms and the CT scan or MRI findings.

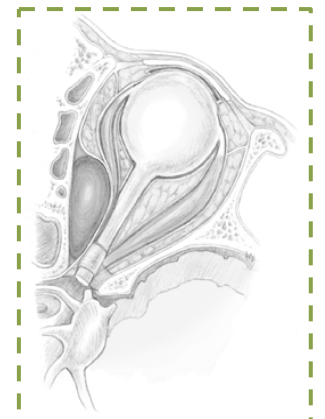


3. Subperiosteal Abscess



Surgical drainage is indicated if there is worsening of visual acuity or extraocular movement, or in case of lack of improvement after 48 hours. "Antibiotics then drainage"

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



4. Orbital Abscess



Similar approaches as with subperiosteal abscess:

- Lynch incision
- Endoscopic



5. Cavernous Sinus Thrombosis

Symptomatology:

- Orbital pain
- Proptosis and chemosis
- Ophthalmoplegia
- Symptoms in contralateral eye
- Associated with sepsis and meningitis

Radiology:

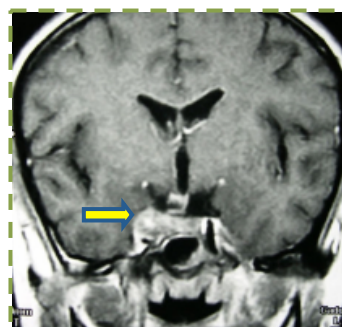
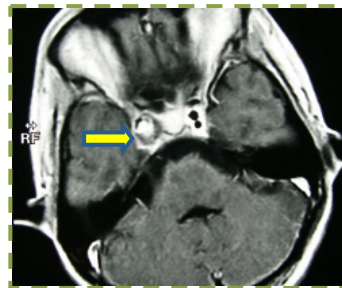
- Better visualized on MRI

Mortality rate up to 30%. Needs surgical drainage and intravenous antibiotics.

Transcaruncular approach allegedly does not utilize a facial incision.



- Contralateral involvement is distinguishing feature of cavernous sinus thrombosis
- MRI findings of heterogeneity and increased size suggest the diagnosis.
- MRI better especially if suspecting intracranial involvement, too.



Intracranial Complications:

Five types:

- ✓ **Meningitis “the most common”**
- ✓ Epidural abscess
- ✓ Subdural abscess
- ✓ Intracerebral abscess
- ✓ Cavernous sinus, venous sinus thrombosis

Teenagers affected more because of developed frontal and sphenoid sinuses, and because they are more prone to URI's than adults. Thrombophlebitis originating in the mucosal veins progressively involves the emissary veins of the skull, the dural venous sinuses, the subdural veins, and, finally, the cerebral veins. By this mode, the subdural space may be selectively infected without contamination of the intermediary structure; a subdural empyema can exist without evidence of extradural infection or osteomyelitis.

Bony Complications:

Pott's puffy tumor

- Frontal sinusitis with acute osteomyelitis.
- **Subperiosteal pus collection leads to “puffy” fluctuance.**
- Rare complication

Sir Percivall Pott described Pott's Puffy tumor in 1768 as a local subperiosteal abscess due to frontal bone suppuration resulting from trauma. Pott reported another case due to frontal sinusitis.



Fungal Sinusitis (6)(7)

Fungal rhinosinusitis is a fungal infection of the paranasal sinuses. Fungal colonization of the upper and lower airways is a common condition, since fungal spores are constantly inhaled into the sinuses and lungs.

Allergic fungal rhinosinusitis involves a hypersensitivity response to colonizing fungi.

Invasive fungal sinusitis can be acute or chronic. Acute invasive fungal sinusitis is usually seen in immunocompromised patients and has a time course of days to few weeks, whereas chronic fungal sinusitis is usually seen in patients who are less immunocompromised with a time course greater than 12 weeks.

So the patients in general are immunocompromised, usually due to diabetes, cancer, HIV, organ transplantation or using systemic or intranasal glucocorticoids.

Patients with acute invasive fungal sinusitis are usually hospitalized and are very sick with fever, cough, nasal discharge, headache, and mental status changes. Signs and symptoms include **dark ulcers on the septum, turbinates, or palate**. In the late stages, signs and symptoms of cavernous sinus thrombosis are present.

Patients with chronic invasive fungal sinusitis present with symptoms of long-standing sinusitis. Symptoms are usually not acute, and fever and mental status changes are absent.

Orbital apex syndrome, which is characterized by a decrease in vision and ocular immobility due to a mass in the superior portion of the orbit, is usually associated with this condition.

Diagnosis: early nasal endoscopy with biopsies of affected tissues. Cultures of the affected biopsy specimen are usually positive. Assessing the extent of infection should be done using CT scan or MRI.

Treatment of acute invasive fungal sinusitis: Initial systemic antifungal treatment after surgical debridement. High doses of **amphotericin B** (1-1.5 mg/kg/d) are recommended followed by oral itraconazole.

Treatment of chronic invasive fungal sinusitis: **Surgical treatment** is mandatory. Initiate medical treatment with systemic antifungals once invasion is diagnosed.

Amphotericin B (2 g/d) is recommended; this can be replaced by **ketoconazole** or **itraconazole** once the disease is under control.

Summary

Rhinosinusitis

Acute: the persistence of upper respiratory symptoms for greater than a 7-day course but lasts less than 4 weeks.

Subacute: nasal symptoms lasting 4 weeks to 12 weeks.

Chronic: persistence mucosal inflammation for > 12 consecutive weeks despite medical therapy or occurrence of more than 4 episodes a year.

Causes of Acute Rhinosinusitis: Streptococcus pneumonia, Haemophilus influenza, and Moraxella catarrhalis.

Causes of Chronic Rhinosinusitis: Staphylococcus aureus, Anaerobes, Alpha-hemolytic Streptococcus, and Moraxella catarrhalis.

Treatment:

The initial treatment aims to relieve the symptoms. Antibiotics are only for bacterial clearance. Medications: NSAID and flushing the nose and sinuses you can give steroids nasal spray (second-line treatment). Surgical (FESS) treatment if there are complications or medication doesn't work.

Complications of Sinusitis

Orbital

- Preseptal cellulitis
- Orbital cellulitis
- Subperiosteal abscess
- Orbital abscess
- Cavernous sinus thrombosis

Intracranial Complications

- Meningitis
- Epidural abscess
- Subdural abscess
- Intracerebral abscess
- Cavernous sinus, venous sinus thrombosis

Bony

- Pott's puffy tumor

References

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5. Chronic Sinusitis: <http://emedicine.medscape.com/article/232791-overview>
6. Fungal Rhinosinusitis: <http://www.uptodate.com/contents/fungal-rhinosinusitis>
7. Fungal Sinusitis: <http://emedicine.medscape.com/article/863062-overview#a5>

MCQ's:

A 30-year-old woman complaining of headache increases on leaning forward during praying and mucopurulent postnasal discharge. On examination there was nasal discharge in both nasal cavities.

What is the investigation required to reach the diagnosis?

- A. CT sinuses
- B. Plain x ray to the nasal bone
- C. Skin allergy test

What is the best imaging modality for the orbit?

- A) MRI
- B) CT
- C) US
- D) X-ray

Answers: A, B

For mistakes or feedback

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