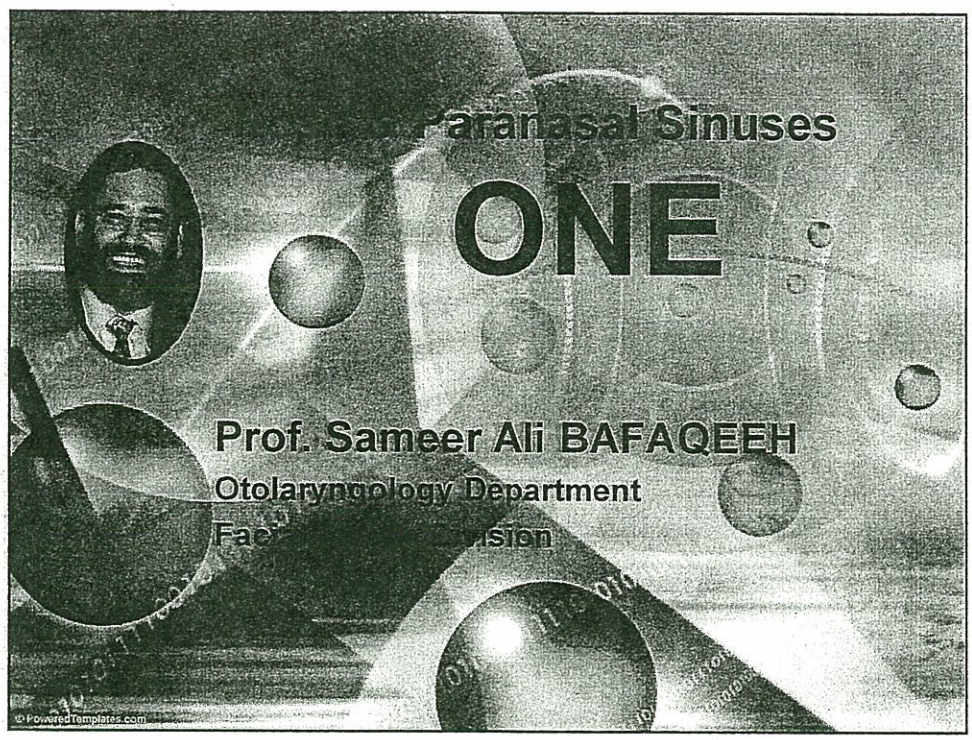
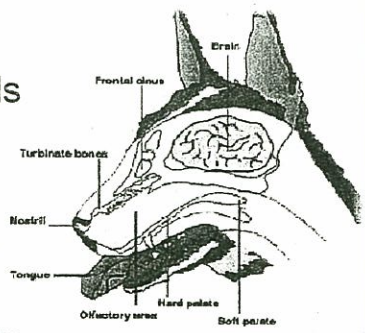


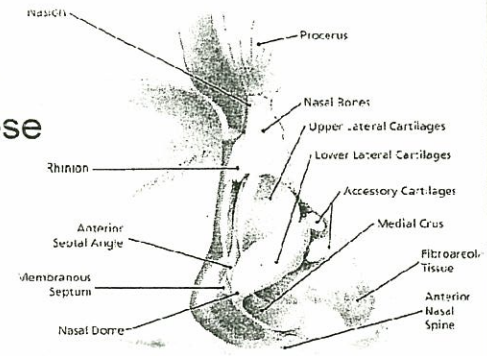
Anatomy & Physiology of The NOSE

- The major function was Olfaction
- Still remains in lower Mammals
- Modification of the internal nasal anatomy
- Olfaction is now sited in small area
- The Turbinate shrunken in size



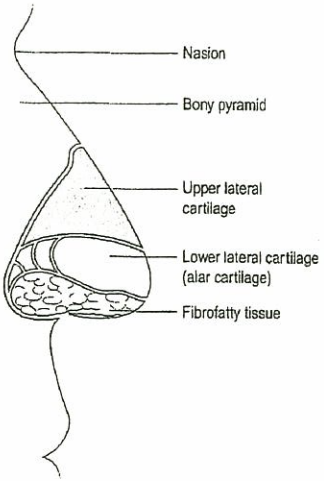
The Anatomy of the Nose

- It is useful to consider the anatomy of the Nose by dividing it into:
- The external Nose
- The nasal cavity including the nasal septum



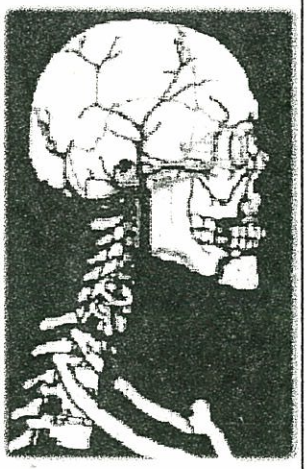
External Nose

- 30%The upper 1/3 : Nasal Bone (frontal & maxilla)
- Fractured nasal bone may be deviated or depressed
- 70%The inferior 2/3 : ULC & LLC
- Tip laterally →fibrocartilage
- Nasal shape Maintenance (minor trauma)
- Skin-closely adherent
- Multiple sebaceous glands (Rhinophyma)



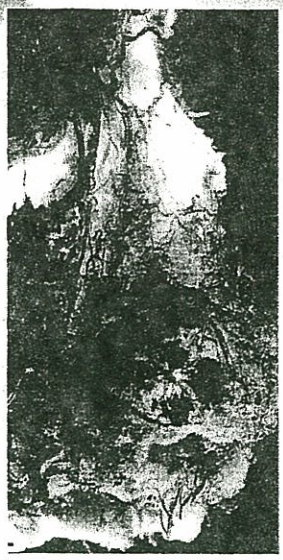
External Nose

- The external nose arterial supply comes from branches of Facial & Ophthalmic arteries
- Bleeding after facial trauma
- Angular vein lies at the medial canthus
- Face infection can spread to the cavernous sinus



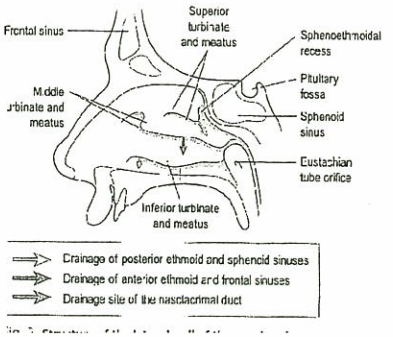
External Nose

- Angular vein lies at the medial canthus
- Bruising (Black eyes) during Rhinoplasty
- Lymphatic vessels drain to UDC chain



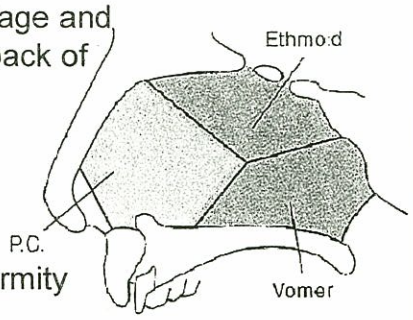
Nasal Cavity

- Vestibular anteriorly - Nasopharynx posteriorly
- Osteocartilaginous septum
- Furuncle arise in the vestibular skin
- Nasal valve demarcates vestibule from nasal cavity
- Turbinate : lined by CCE & contain erectile tissue
- PNS : drain around the middle Turbinate



Nasal Septum

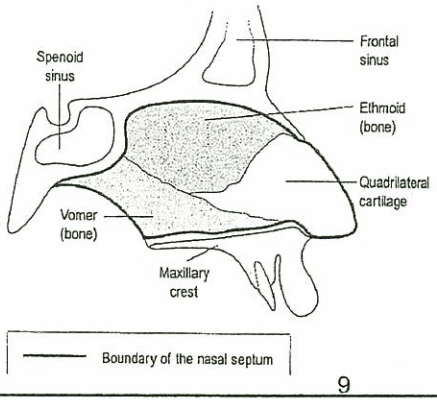
- The nasal septum is a wall in the middle of your nose that divides the nose in two. It is composed of bone and cartilage and reaches from the nostrils to the back of the throat.
- Mucoperichondrium &mucoperiosteum
- Rarely straight
- Airway blockage &cosmetic deformity (Marked Displacement)



Nasal anatomy - the septum

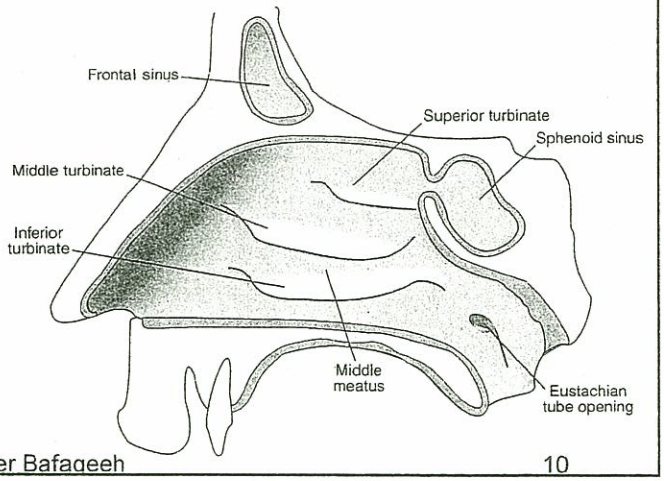
- ***There are three main functions of the septum:***

1. Structural support for the nasal dorsum
2. Regulation of air flow in the nasal passages
3. Support for the mucous membranes of the nose



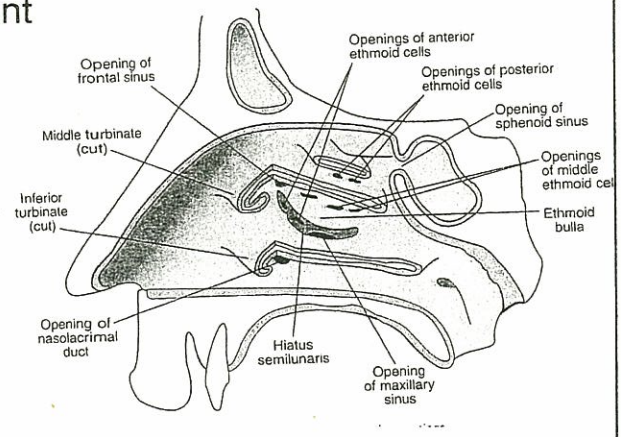
The lateral nasal wall

- 3Turbinate or conchae projecting shelves of bone
- Increase surface area of nasal cavity

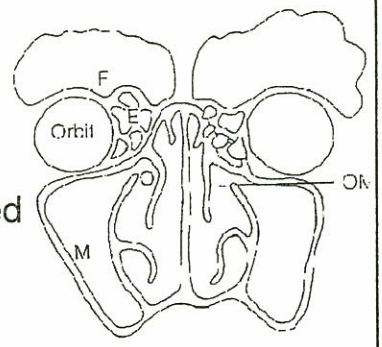


The lateral nasal wall

- Middle meatus is the most important functional area (ostio-meatal complex)
- Sphenoid& Post. ethmoidal cells



Ostio-meatal Complex

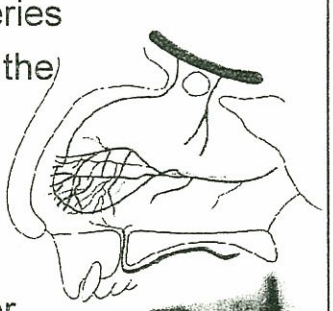


- The openings of the sinus ostia into the middle meatus are closed together
- OMC is a Key area
- Pathology in OMC interfere with :

Ventilation & Mucociliary clearance

Vascular & Nerve Supply

- Terminal branches of carotid arteries
- Anterior &posterior ethmoidal for the region above the root of middle turbinate
- Sphenopalatine ,palatine & labial arteries
- Anastomoses at the anteroinferior region of the septum :'Little's area' or 'Kiesselbach's plexus'



Vascular & Nerve Supply

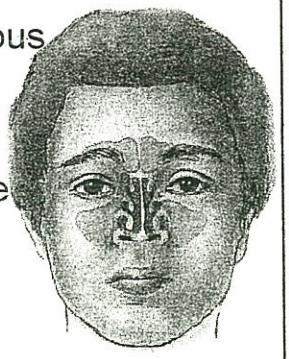
- External nose venous drainage drain via the facial& ophthalmic veins to the cavernous sinus
- Superficial infection of the nasal lining may involve the cavernous sinus

Vascular & Nerve Supply

- Sensory is via maxillary division of trigeminal nerve
- Secretory glands :autonomic nervous system in the vidian nerve
- Nasal vascular supply:-

  - Constricted by sympathetic nerve stimulation

  -Dilated by parasympathetic



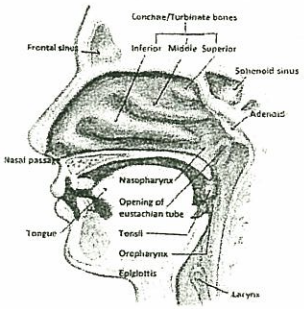
Nasal Anatomy
The nose and sinuses

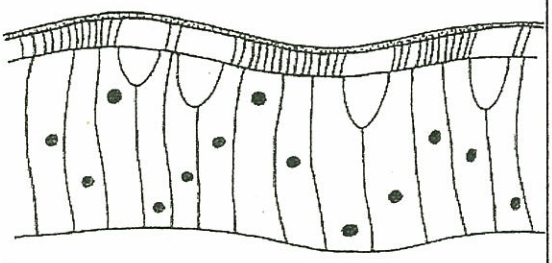
Amazingly sensitive and complex, your nose has two main functions:

1. It serves as the organ of smell and is directly related to the sense of taste
2. It is the primary passage for air into and out of your lungs

Physiology

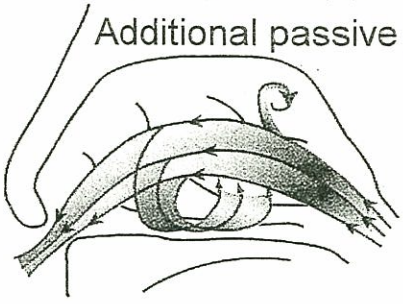
- **Filtration & protection**
- Particulate matter is trapped by Vibrissae
- Mucus Blanket provides a tacky surface to which SS Material (pollen) adherence occurs.

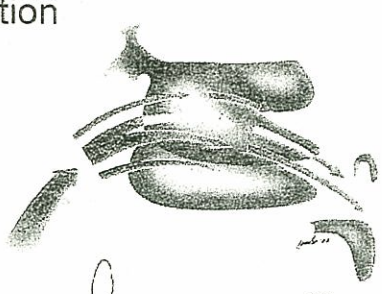




Physiology

- Nasal cilia beating action (5-6mm/min)
- 300-500 ml is swallowed daily
- Glycoprotein's ,enzymes :
  Lysozyme + (IgA & IgG) →
  Additional passive protection





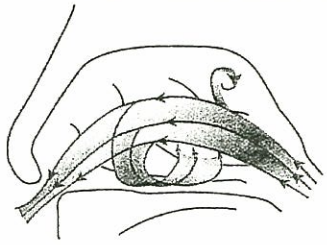
Kartagener's Syndrome

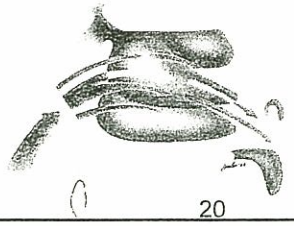
Nasal ciliary action defect

- Rhinorrhoea
- Chronic Secretory Otitis Media
- Chronic Sinusitis
- Bronchiectasis
- dextrocardia

H[illegible]cation & Warming

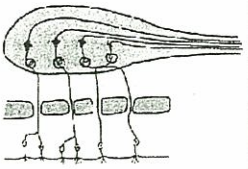
- ↑ drying & ◆ of temperature → ✖ normal ciliary action
- Inspired air 30 C - 95%
- Profuse vascular supply & secretory glands → optimal parameters





Olfaction

- Olfactory mucosa is located high in the nasal vault
- Sniff is required & air must be moist
- Physical Obstruction :
  (DNS or Infl. Swelling)



- Viral damage the Olfactory nerve endings
- Sever Trauma can transect nerve fibres
- All special senses ,acuity diminishes with age

Vocal resonance

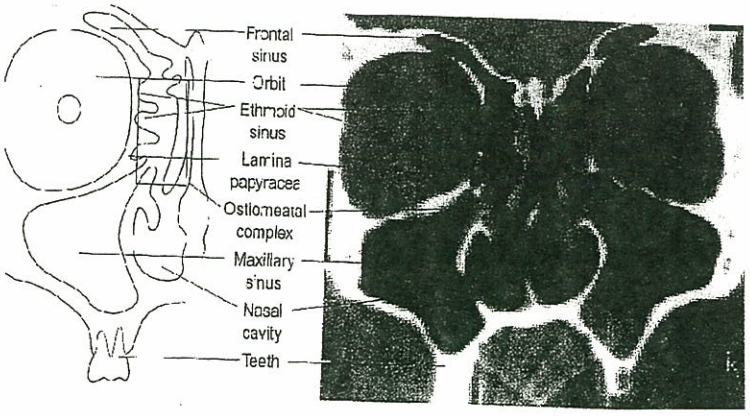
- Quality of voice is imparted by the size & form of the nasal cavity
- Vocal quality is impaired by nasal blockage → serious handicap to professional voice users
- Nasal operations alter vocal resonance & hence voice quality

THE PARANASAL SINUSES

ANATOMY & PHYSIOLOGY

PNS Anatomy

- PNS are extensions of the nasal cavity (Air-filled spaces into the skull bones)



N[illegible]omy
The nose and sinuses

- Adjacent to the nose, there are hollow, air-filled cavities in the bones of the face and skull, about the size of a walnut. These are called the paranasal sinuses, which are connected to the nose by a small opening (an ostium).

Th[illegible]and sinuses

- **There are four paired paranasal sinuses, the maxillary, ethmoid, frontal and sphenoid sinuses**
- ***"Anterior" and "posterior" sinuses***

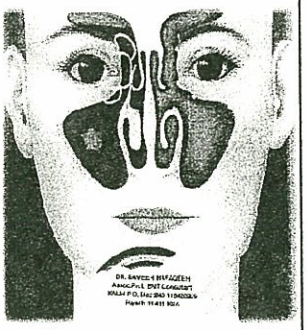
- Frontal – located in the forehead region
- Maxillary – in the cheek area
- Ethmoid – between the eyes
- Sphenoid – deep in the center of the skull

PNS Anatomy

- *"Anterior" and "posterior" sinuses*
- The frontal , anterior ethmoidal & maxillary sinuses

(anterior group)

Drain into the middle meatus (ostiomeatalcomplex)



PNS Anatomy

- Posterior ethmoidal & sphenoid ***(posterior group)***

Drain into the superior meatus & sphenoethmoidal recess

- Nasolacrimal duct into inf. meatus

Lining of the sinuses is pseudostratified, columnar epithelium

(respiratory epithelium)

which is continuous with the nasal epithelium

Nasal Anatomy
The nose and sinuses

- Both the nose and the sinuses produce a special mucus that:

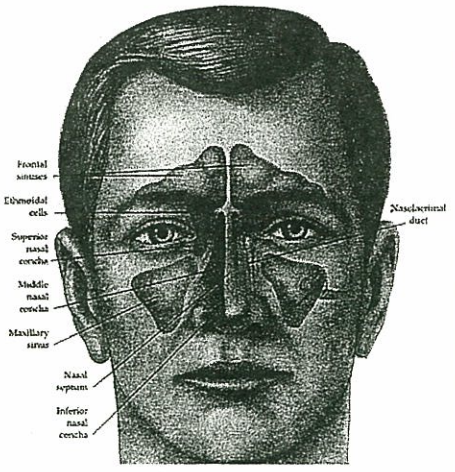
  keeps the inside of the nose moist and protects it from dust, dirt, pollutants and traps bacteria.
- ***Each person produces about one quart or one liter of mucus per day!***

ANATOMY (continued)

- 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***

Frontal Sinus

- Not present at birth; usually not visible until age 2
- Extensively pneumatized when fully develoed
- Great variability in size; congenitally absent in 5%

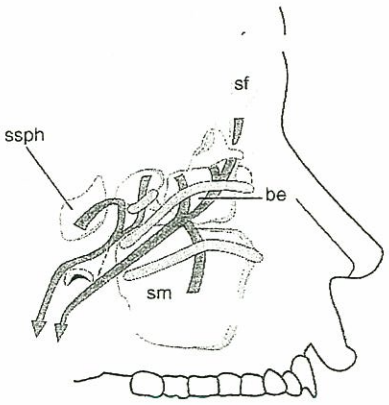


Frontal Sinus

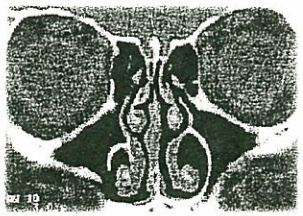
- Begins as evagination of the anterior nasal capsule around the fourth month of development
- ***Orbit & anterior cranial fossa***
- **Blood supply from the *supraorbital* and *supratrochlear* arteries, innervation from nerves of the same name**

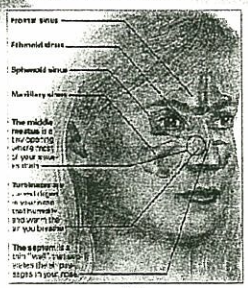
Frontal Sinus

- Drains into the frontal recess in the middle meatus near the upper portion of the infundibulum (***Ethmoidal ostiomeatal complex)***
- **Like the maxillary sinuses have circurlar mucociliary clearance**



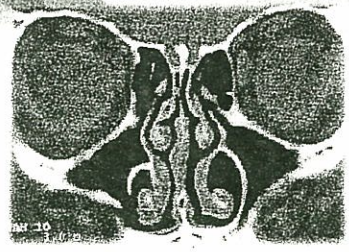
The Maxillary Sinus





- Present at birth & largest sinus
- Continues to grow until the 3rd decade
- ***Anatomical Landmarks :***
  (Orbit , Teeth , Nasal cavity & Cheek)

The Maxillary Sinuses



- Pyramidal shaped with apex near zygomatic arch
- **In child, inferior border near nasal floor. In adult, 1 cm below nasal floor**
- Floor over maxillary dentition, which is often thin and dehiscent over tooth roots

Maxillary Sinuses

- ***The infraorbital nerve runs along roof, and is often dehiscent. At risk during antral procedures***
- **Sinus ostia loacated anteriorly in the middle meatus**
- ***Accessory ostia*** are usually more posterior and are **a sign of chronic disease**

Maxillary Sinus

- Blood supply is from divisions of the ***maxillary artery***
- Innervation is via ***V2***
- Postganglionic sympathetic fibers are from ***VII*** via the ***sphenopalatine ganglion*** and the **greater superficial petrosal nerve**

Ethmoid Sinus

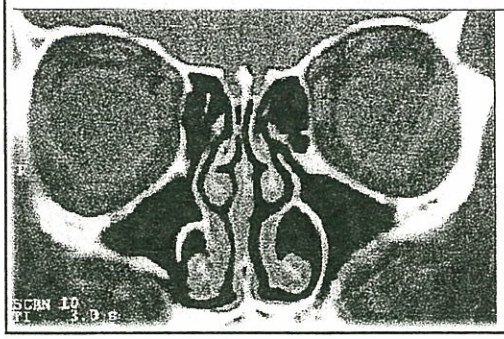
- Labyrinth of air-filled cavities
- Appear as evaginations of the lateral nasal wall around the third month of fetal gestation
- ***Are present at birth, adult size by age 12***
- Honeycomb in the sup. & lat. Part

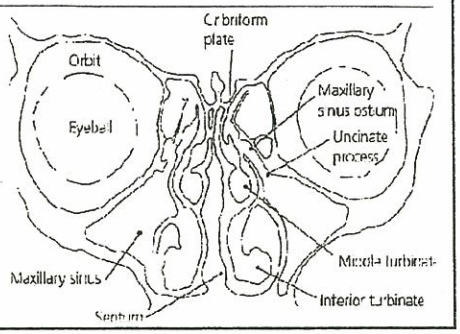
The Ethmoid Sinus

- Very thin walls
- Easy spread of infection & tumour
- The Orbit ***(Lamina Papyracea)***
- The anterior cranial fossa ***(cribriform plate)***
- Are separated by the ground (basal) lamella into the anterior and posterior ethmoids, which drain into the middle and superior meatus.

Computerized Tomography (CT)

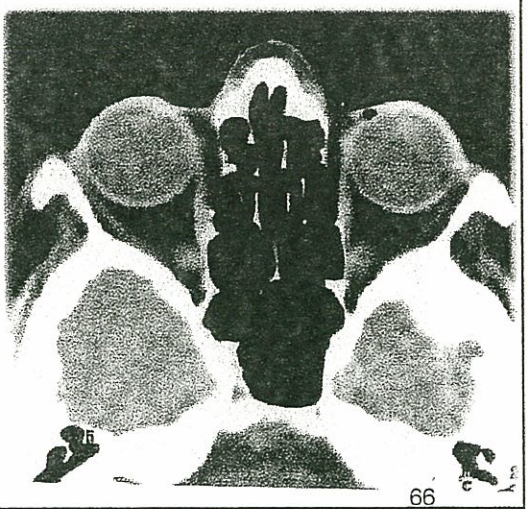
- CT bony structures well
- High-density change between air & bone
- Coronal plane (5-mm slices)





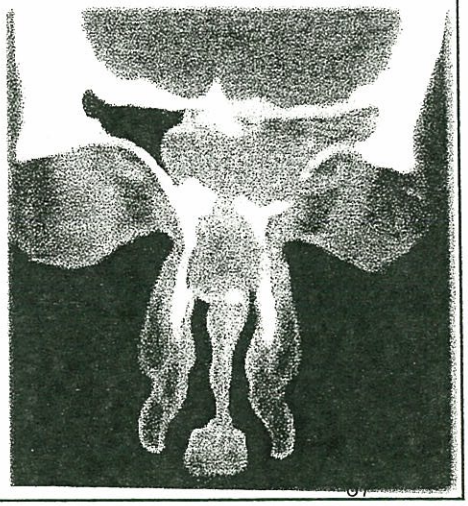
Computerized Tomography (CT)

- CT coronal plane reduces radiation dose to the eye
- Axial scans at the level of the optic nerve are recommended if coronal CT shows pathology in the posterior ethmoid cells



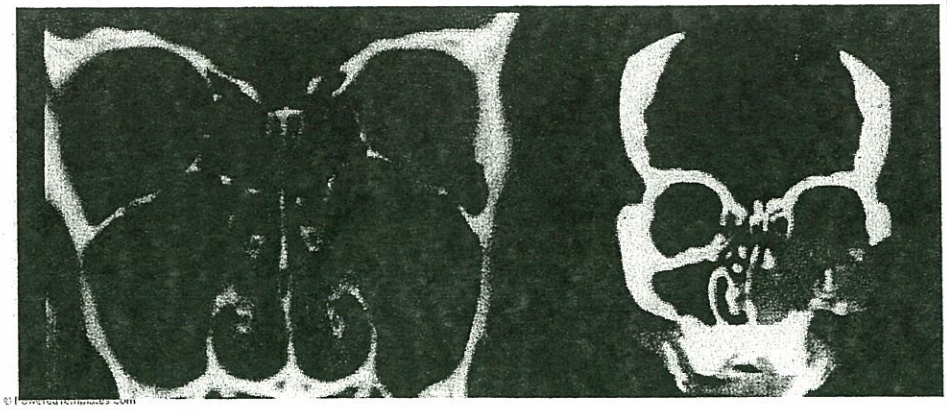
Computerized Tomography (CT)

- CT demonstrate normal & pathological changes
- CT delineates nasal & sinus pathology
- CT is a route map for FESS



C[illegible] of the PNS

Shows bony relationships as well as Tumors & Foreign bodies



The Ethmoid Sinus

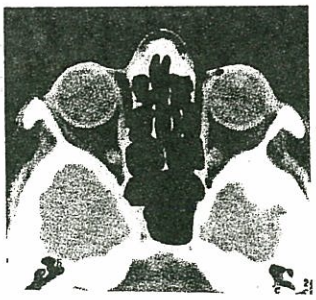
- Consist of ***vertical*** and ***horizontal*** plates
- The ***vertical plate*** is divided into two portions, the perpendicular plate of the ethmoids and the crista galli
- The ***horizontal plate*** is known laterally as the fovea ethmoidalis and medially as the cribriform plate
- Medially is the lamina papyracea

The Ethmoid Sinus

- Blood supply is from both the external and internal branches of the carotid, through the sphenopalatine and the anterior and posterior ethmoidal arteries
- Innervation is from V2 and V3

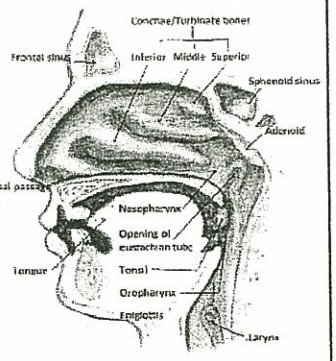
Sphenoid Sinuses

- Began as outpuchings of the superior nasal vault around the fourth month of gestation
- Rarely present at birth, usually seen around age 4
- Development at puberty
- Drain into the superior meatus in the sphenoethmoidal recess
- Ostia of variable size



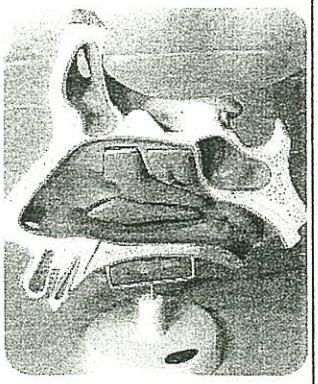
Sphenoid Sinus

- Adjacent important structures:
  (Internal carotid artery , Optic nerve & Cavernous Sinus)
- ***Cavernous Sinus :***
  (oculomotor, trochlear &abducent nerves , 1st & 2nd divisions of the Trigeminal)
- **Pituitary Fossa lies posteriorly**



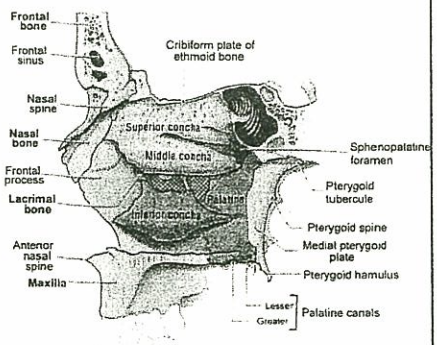
Sphenoid Sinuses

- The optic nerve lies superiorly
- The pons lies posteriorly
- The cavernous sinus is lateral, along with CN III, IV and VI and the carotid artery
- The carotid artery is dehiscent in 50% of specimens



Sphenoid Sinuses

- Blood supply from both the internal and external carotid arteries via the sphenopalatine (floor) and the posterior ethmoidal arteries (roof)
- Innervation from V2 and V3



PNS Physiology

- ***No specific function***

- The following have been considered:

-1- An aid to Vocal Resonance

-2-Reduction of skull weight

-3-Protection of the Eye from Trauma

-4- Protection of vital intracranial strucures

Anatomy & Physiology Note

- Nose is structurally composed of bone & cartilage.
- Both the external & internal carotid arteries provide the rich vascular supply of the nasal mucosa.
- The nose has an important protective role in filtering, humidifying & warming inspired air.
- The nose , as part of the respiratory tract, is prone to acute infection & allergic phenomena.
- Since the PNS drain via the nose ,sinus disease is frequently due to primary problems in the nose.

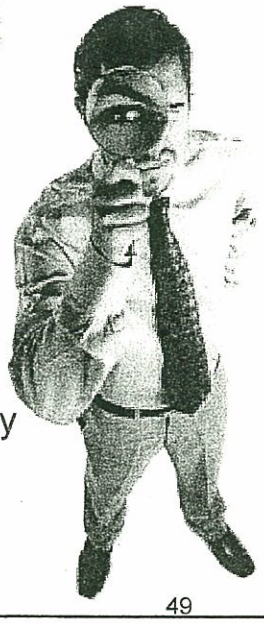
External Examination of Nose

- ***Inspect nose***

  look for swelling, trauma, congenital anomalies, deviation, hematoma, saddle-nose deforming

- ***palpate sinuses***

  tenderness over frontal and maxillary sinuses may indicate sinusitis



Internal Examination of Nose

- ***inspect with nasal speculum***
- **position of septum**
- ***colour of nasal mucosa :***

  normally pink and moist with a smooth clean surface, blue/grey secondary to allergies , and red secondary to inflammation

- size, colour, and mucosa of inferior and middle turbinates

possible abnormal findings

- septal deviation or perforation
- exudate, swelling, epistaxis
- nasal polyps

Choanal atresia

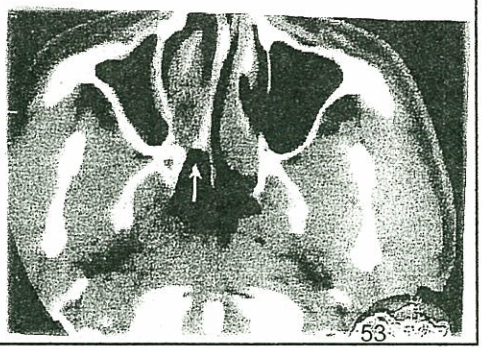
- Rare congenital abnormality
- Failure of canalization of the bucconasal membrane
- The Choana: natural communication between the nose & pharynx
- Unilaterally or bilaterally
- Bony (90%) or membranous (10%)
- Neonates are obligate nasal breathers (not aquired adult habit of mouth breathing)

Choanal atresia

- Bilateral cases present at birth with sever respiratory difficulties is a fatal condition
- Cyclic cyanosis : blue relieved by cries
- Diagnosis :soft catheter , CT scanning ,endoscopy in adult

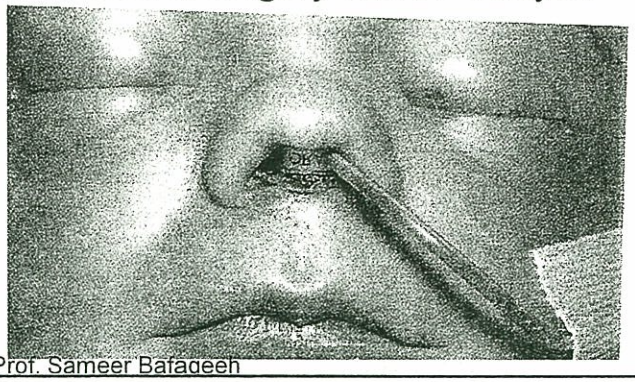
Choanal atresia (management)

- Bilateral atresia is a neonatal emergency
- Oral airway is inserted &fixed in position
- Pernasal or transpalatal surgical approaches, depending on the precise nature of the atresia



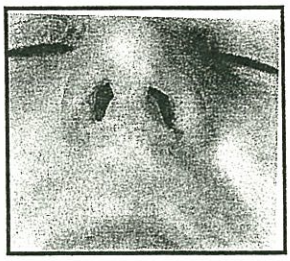
Choanal atresia (management)

- Indwelling tubes to prevent reclosure
- Regular bouginage after surgery
- Unilateral cases, surgery can be delayed



Nasal Vestibulitis

- Excoriation of the skin due to local & general conditions
- Nose picking , a dislocated columella & rhinorrhoea from allergy
- Herpes simplex & zoster vesicles



vestibulitis

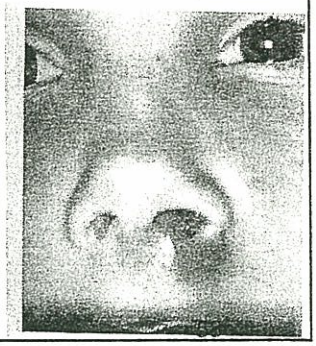
- Foreign body Purulent nasal discharge
- Generalized eczema
- ***Staphylococci are the commonest***
- Commensal in the anterior nares

Treatment of Vestibulitis

- Topical & occasionally systemic antibiotics
- Steroid base ointment in eczematous cases
- ***Persistent vestibulitis with ulceration associated with neoplastic process such as basal or squamous cell carcinoma***

Nasal furunculosis

- ***Staphylococcus aureus***
- Hair follicle infection in the vestibule
- Chronic asymptomatic nasal carriers of this bacterium
- Nose picking is a frequent initiator
- The nose is tender & red



Nasal furunculosis

- Swab should be taken
- Systemic & topical antibiotics
- ***Patient should not to squeeze out pus***
- **Potential risk of spreading infection to the cavernous sinus via the facial veins**
- ***Diabetes mellitus should be excluded in cases of recurrent nasal furunculosis***

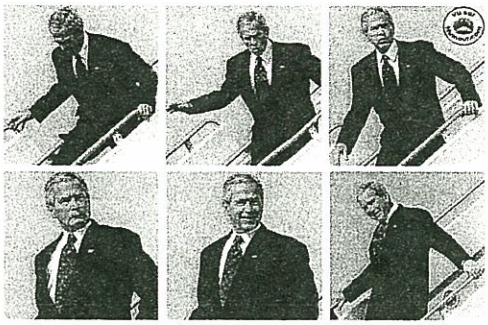
Specific Nasal Dermatitides

- Specific dermatitides are rare in the nasal vestibule
- ***Part of generalized skin condition:***

  Psoriasis , seborrhoeic dermatitis & Rosacea
- The area kept clean
- Steroid antibiotic ointment
- Barrier cream

Lupus Vulgaris

- ***Mycobacterium Tuberculosis***
- Indolent ulcer of the nasal vestibule & septum



Lupus pernio

Skin involved in Sarcoidosis

(Boeck's disease)

Erythema nodosum –(lupus pernio)

Bluish-red nodules

Sarcoidoses is a systemic disease affected other tissues:

Chest, eyes , lacrimal & salivary glands

Systemic steroids is mainstay of treatment

N Syphilis

Cogenital :

Persistent nasal discharge & fissuring of the anterior nares "Snuffles"

Acquired Syphilis:

Nasal gummatous lesions

Destruction of septal structures in the tertiary stage

Radiology

PNS are complex air-containing cavities within the skull

Sharp contrast between air & bone

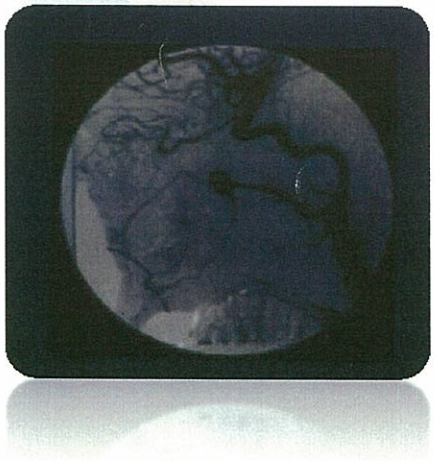
- ***Computerized Tomography (CT)***
- ***Magnetic Resonance Imaging (MRI)***
- ***Plain Radiographs***
- ***angiography***

angiography

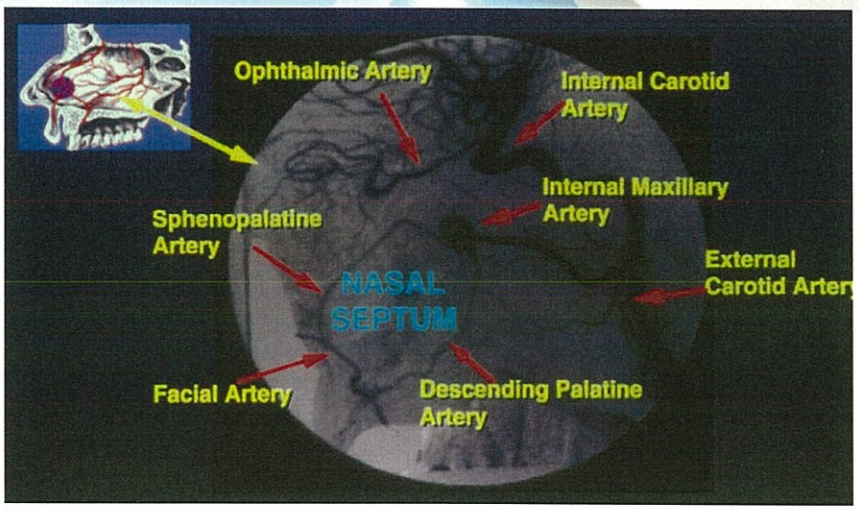
- Demonstrate blood supply of vascular tumors (Angiofibromas)
- Relative importance of each feeding vessel can be demonstrated
- Embolization performed to reduce tumor vascularity
- Digital subtraction venous angiography allows non-invasive imaging of blood vessels

ANGIOGRAPHY

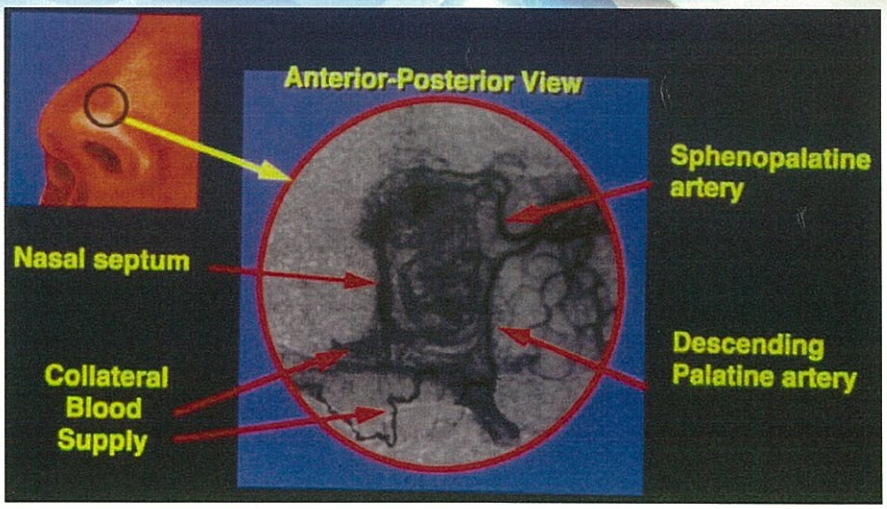
- Recurrent, refractory epistaxis
- ***Shows vessel anatomy***
  - **.Anomalies**
  - **.Collaterals**
- Can embolize
- Pre and postoperative evaluation



NORMAL ARTERIOGRAM OF THE NOSE



COLLATERAL BLOOD SUPPLY TO THE NASAL SEPTUM



Key Points in Radiology

1. CT is required before endoscopic sinus surgery
2. CT identifid anatomical landmarks & variants & delineates pathology
3. MRI is particularly useful for soft tissue masses (eg, tumors)
4. Mucosal thickening or fluid levels are not synonymous with infection
5. Plane X rays are rarely useful & are not recommended

Advanced Anatomy of The nose and sinuses

- The nose and sinuses are composed of many anatomical features; however, the ones most often implicated in nasal obstruction problems are the turbinates, septum, and sinuses. This anatomy varies somewhat from person to person, and sometimes these anatomical differences can cause breathing problems or nasal blockage.

Nasal anatomy - the turbinates

- The turbinates are small, rounded, bony projections inside the breathing passage on each side of your nose. There are three turbinates on each side: inferior, middle, and superior. The inferior turbinate is the largest of the three; the superior turbinate is the smallest. In very rare cases, a fourth pair of small "supreme" turbinates may be present.

the turbinates

- The turbinates are very important because they prepare the air you breathe before it enters your lungs and help you feel or perceive the level of airflow through your nose.

the turbinates

- Each turbinate is covered by a soft mucous membrane called mucosa - a lining that contains mucus-secreting glands and is rich with tiny blood vessels, which helps warm and humidify the air you breathe.

the Turbinates

- Understanding the function of healthy turbinates helps you realize how nose and sinus problems can affect your lungs. ***When you breathe through your nose, healthy turbinates:***
- **Clean and filter the air**. The turbinates trap dirt, dust, and particulates as small as a grain of pollen, so that these irritants do not enter your lungs.

the Turbinates

- **Disrupt and humidify the air**. Within the small space of your nasal passages, the turbinates actually create barely perceptible air turbulence. This may sound strange, but this is what creates the sensation of airflow in your nose. The turbulence also adds humidity (moisture) to the air to help prevent dryness of the lungs and bronchial tubes.
- **Warm the cold air**. The turbinates' rich network of blood vessels warms the inspired air to your own body temperature, which helps your lungs operate more effectively.

Why do we have sinuses?

The main purpose of the sinuses is not fully understood. Some experts maintain that they exist to lighten the weight of the skull, while others note that the sinuses improve the resonance of your voice.

Another theory claims the sinuses are there to ensure that, in the event of severe trauma, the facial skeleton will crumple and collapse in order to absorb most of the force of the trauma and protect the brain from injury.

Why do we need our sense of smell?

- Though it is not fully understood, the sense of smell is more important than you may think. It is directly related to the sensation of taste, because the brain requires both smell and taste to be able to distinguish most flavors.

  Olfactory nerve cells (smell receptor cells) are located in the upper nasal cavity and connect directly to the brain. These nerve cells have tiny cilia (like tiny little hairs) that are stimulated by different chemicals in the odors around us. When stimulated, the cilia send nerve impulses to the brain, and the brain perceives the smell.

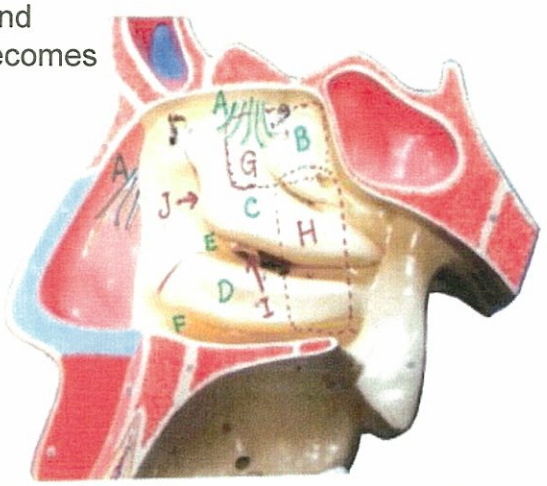
sense of smell

- Research indicates that people who have a diminished or lost sense of smell experience a reduced appetite and food "just doesn't taste right." This can affect our enjoyment of eating, socializing and quality of life.

  Our sense of smell also alerts us to potential harm, such as a fire, hazardous chemicals or gases, and spoiled food. For these reasons, a sense of smell and taste is especially important for people who work in certain fields, such as cooking or fire protection.

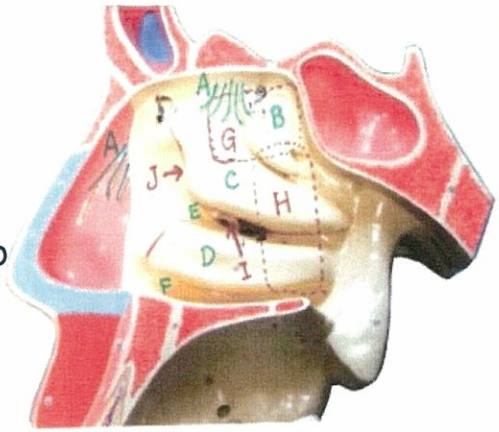
Area of Inflammation

- The inflamed membranes of areas **C** and **D thicken** and harden so much that it becomes an obstacle to the gauze insertion for treatment.
  A: Olfactory Nerves
  B: Superior Turbinate
  C: Middle Turbinate
  D: Inferior Turbinate
- **E: Middle Meatus**
  F: Inferior Meatus



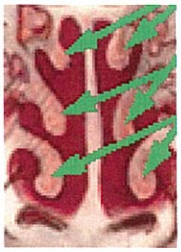
Area of Inflammation

- ***Area G:*** Inflammation here causes headaches.
- ***Area H:*** Inflammation in this area causes postnasal drips.
- ***Area I:*** The opening of the paranasal sinus is up here
- ***Crevice J:*** In advanced cases blood and pus accumulates up here.



Function of the sinus cavity

- The nasal cavity is made up of superior turbinate, superior meatus, middle turbinate, middle meatus, inferior turbinate, inferior and superior meatus, and paranasal cavity. It is a complex structure lined with erectile soft nasal tissues.



- The nasal membrane tissues create a cavernous body which is malleable and able to expand or contract.
- The sinus cavity has a function like a radiator by expanding and contracting to adjust the temperature of the air coming into the cavity.

- When the infected mucous tissues are inflamed, they swell or thicken and expand its size like a balloon. If you have a cold, for instance, your nasal mucous tissues enlarge and narrow the airways. This is called nasal obstruction and can block the whole cavity.

- Using **nasal spray** at this stage will contract the mucous tissues and the nasal blocking will be improved only slightly and **temporarily**. The use of a nasal spray cannot be continued or encouraged after a certain short period of time. After such period of time, however, the infected area cannot be left untreated. The urgency to treat it properly should not be forgotten.

- The mucous tissues in the nasal cavity have an important role to protect the tissues from contamination by bacteria or disease germs. The surface of the mucous tissues is covered by cilia, which has the excretory function to send off drips, foreign matters and germs toward the gular region (throat).

- When one has cold or flu, however, the nasal epidermis (surface membrane) is damaged with numerous wounds.

  From the wounds, pyogenic (pus-producing) bacteria such as **staphylococcus aureus** and hemolytic streptococci enter (bacterial infection) and cause inflammation. This is what's happening to the person who just had cold or flu.

Function of the sinus cavity

- The nasal cavity is the black part.
  (Upward from the entrance of the nasal cavity (bottom part of the cavity),
  Interior Meatus, Middle Meatus, and Superior Meatus).
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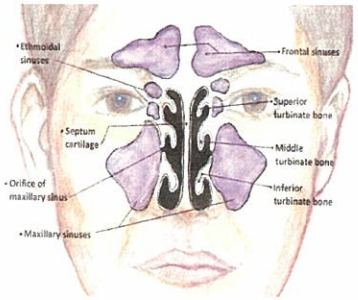

Function of the sinus cavity

- Each meatus is covered by the **turbinates**
  (also called conchae)
- Which consist of bony shelves surrounded by erectile soft tissue.

- The three meati can be reached by the gauze for treatment.

What is the purpose of sinuses?

- The reason is unknown but there are a number of theories as to why the sinuses developed:
- Humidification and filtration of inhaled air
- Lightens the weight of the skull
- Affect vocal resonance/enhance voice
- Absorb energy of an impact therefore helping to prevent brain injury (much like the body of a car does in a crash)

What are cilia?

- The sinuses in their normal state are empty since mucous is constantly swept out by cilia. The cilia work in unison to sweep the mucous through the ostia. The mucous is swept into the nasal cavity where it then drains out of the nose (runny nose) or into the back of the throat (post nasal drip). When cilia do not function properly either due to an inborn problem (rare), infection or smoking, mucous is not properly cleared. This becomes self-perpetuating process where the infected mucous interferes with the normal sweeping process of the cilia and this in turn prevents proper clearance of the mucous.