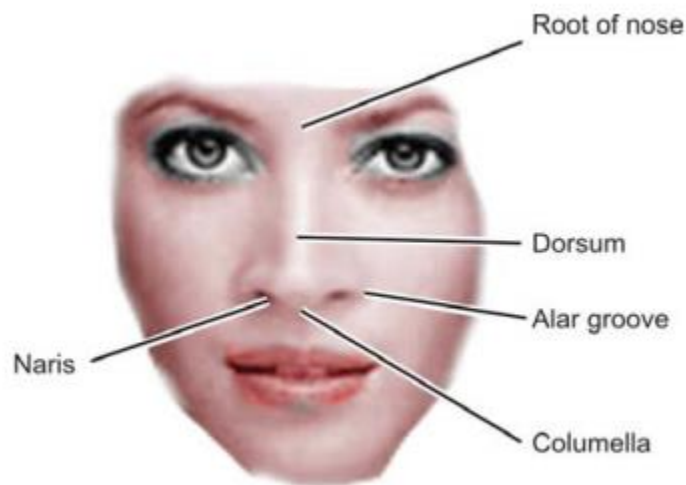


Anatomy of the Nose and Paranasal Sinuses

Anatomy of the nose

1. External nose



Skeleton of the external nose

A. Bony framework

It forms the upper 1/3 and is made up of:

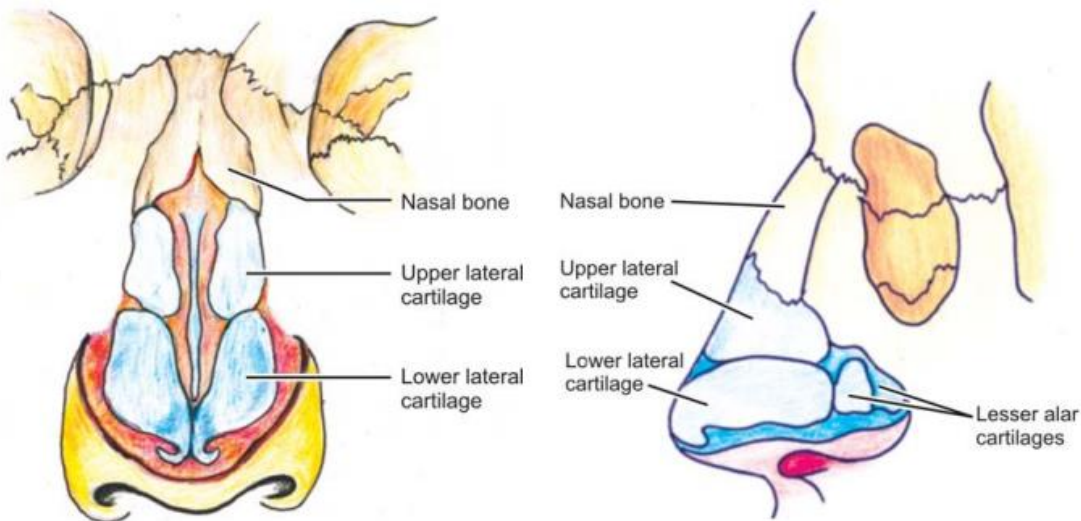
1. Two nasal bones, narrow and thick above; wide and thin below.
2. Nasal process of the frontal bone which articulates superiorly with the nasal bones.
3. Nasal processes of the maxilla articulates laterally with the nasal bones.

B. Cartilagenous framework

It forms the lower 2/3, and is made up of:

1. Upper lateral nasal cartilages above.
2. Lower lateral nasal cartilage below. It has a medial and lateral cms.

3. Alar cartilages that support the nasal alae.
4. Septal quadrangular cartilage.



Interior of the nose (Nasal cavity)

There are two nasal cavities (nasal fossae), that are separated by the nasal septum. They extend from the anterior opening (anterior nares or nostril), to the posterior opening (choana).

- **Nasal valve** : This is the area of greatest narrowing in the nasal cavity at the level of junction between the upper and lower lateral nasal cartilages.

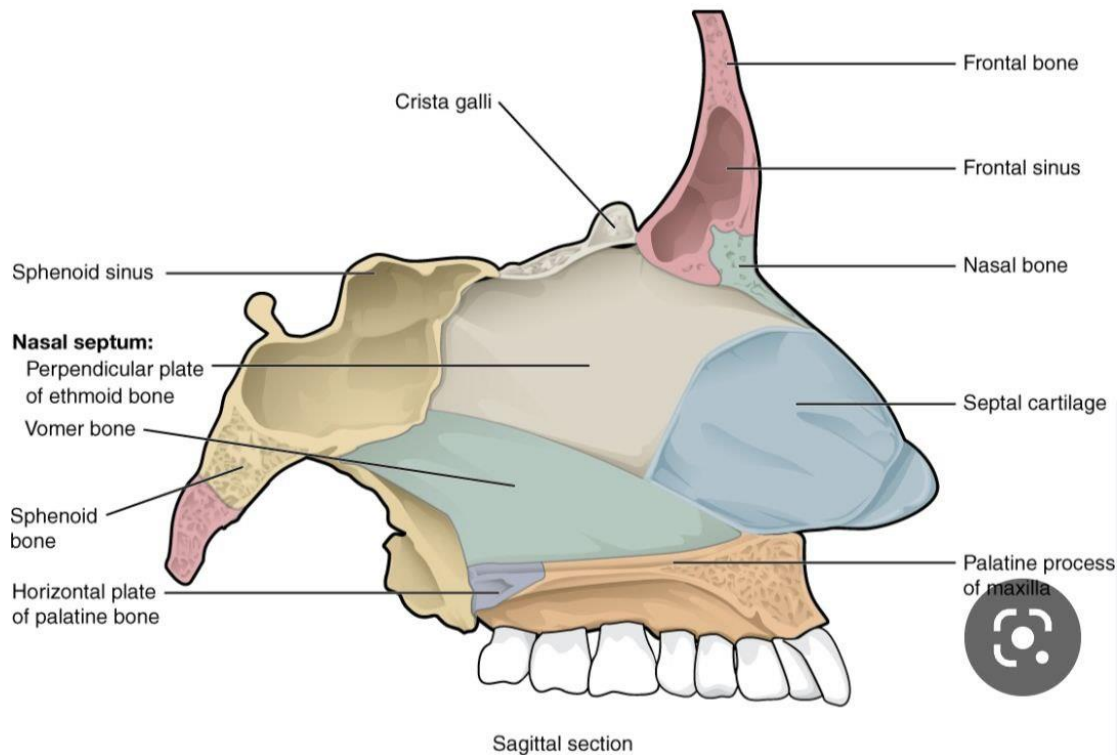
Walls of the nasal cavity

A. **Roof** : Formed by the cribriform plate of the ethmoid bone separating it from the anterior cranial fossa.

B. **Floor** : Formed by the hard palate consisting of the palatine process of the maxilla and the horizontal plate of palatine bone, on both sides.

C. **Medial wall** (Nasal septum); is formed of the following:

1. Perpendicular plate of the ethmoid bone postero superiorly.
2. Vomer bone posteroinferiorly.
3. Rostrum of the sphenoid far posteriorly.
4. Nasal crest of the maxilla inferiorly.
5. Quadrangular septal cartilage, anteriorly.



Nasal septum

D. Lateral wall:

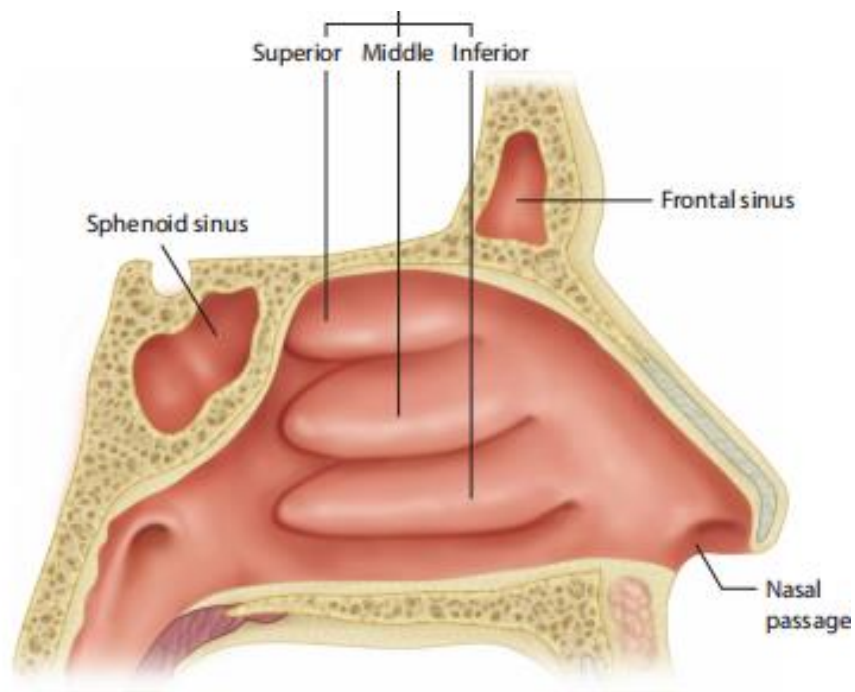
- It is formed by the medial wall of the maxilla, ethmoidal labyrinth and perpendicular plate of the palatine bone. It bounds most of the para nasal sinuses and receives their openings. It shows the following features:

1. Three bony projections : superior, middle and inferior turbinates or conchae.
2. Four spaces in relation to the turbinates: the space below each turbinate is known as the meatus. So, there are superior, middle and inferior meati, and one space above the superior concha called the sphenoidal recess.
 - a. *Inferior meatus* : lies below the inferior turbinate (which is a separate bone and contains dense venous plexus). The naso lacrimal duct opens in the anterior portion of the inferior meatus.
 - b. *Middle meatus* : Lies below the middle turbinate (which is

a part of the ethmoid bone), it shows the following features :

- Bulla ethmoidalis : rounded projection that carries the openings of the anterior ethmoid air cells.
- Hiatus semilunaris : a curved groove in front and below the bulla ethmoidalis.
- Opening of the maxillary sinus : in the postero inferior portion of the hiatus semilunaris.
- Opening of the frontal sinus : in the highest anterior part of the hiatus semilunaris (frontal recess area).
- Uncinate process : a sharp ridge of bone below the hiatus semilunaris.

N.B : *The ethmoid infundibulum* : opens in the hiatus semilunaris. It varies in depth. From 0.5 to 10mm. The anterior ethmoid air cells and the maxillary sinus open in it (as above). Posteriorly, it is continuous with the middle meatus. The medial wall of the infundibulum is the uncinate process and its lateral wall is the lateral wall of the nose.



Lateral nasal wall with the superior, middle and inferior turbinates.

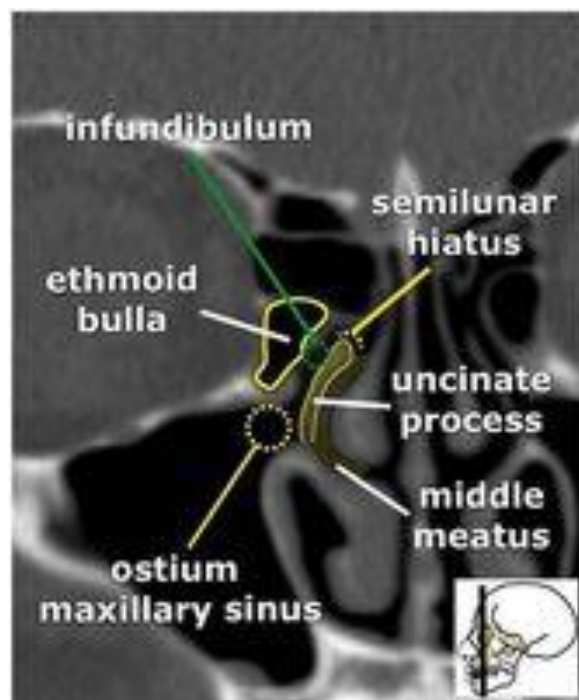
c. *Superior meatus* : lies below the superior turbinate, and the posterior ethmoid air cells open in it.

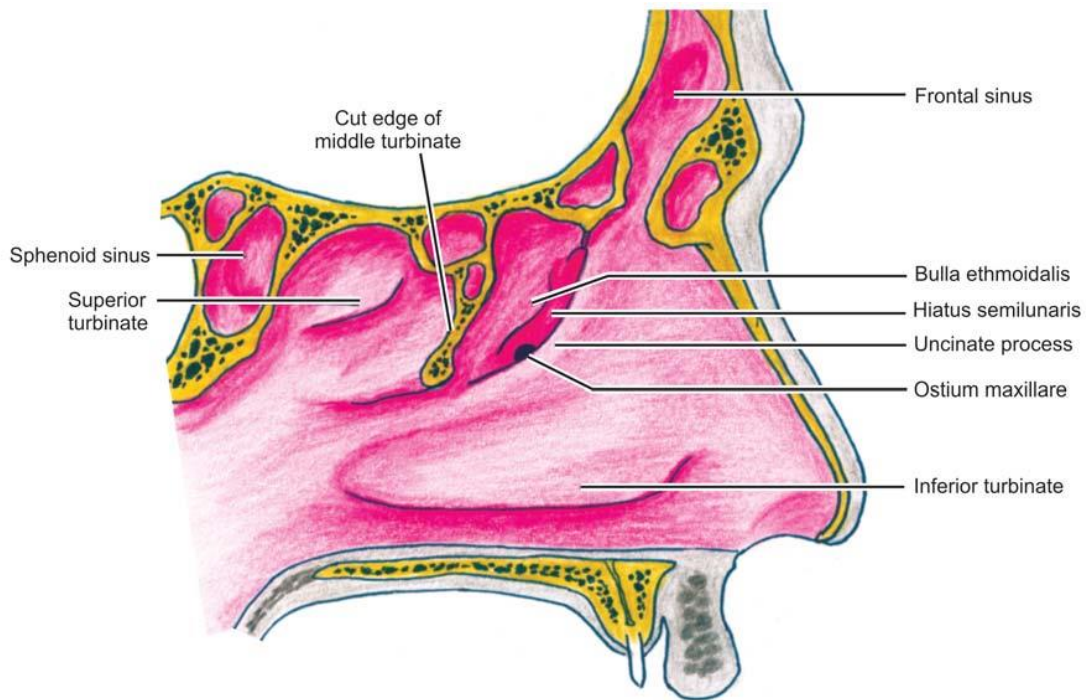
d. *Sphenoethmoidal recess* : lies above the superior turbinate, and carries the opening of the sphenoid sinus

What is the osteomeatal complex ?

The osteomeatal complex is a term used to describe the region of the uncinate process, maxillary ostium, middle turbinate, bulla ethmoidalis and ethmoid infundibulum. It is important because the frontal, maxillary, and ethmoid sinuses all drain in this area which contains a very narrow cleft. Any mucosal thickening or anatomical variation is likely to produce obstruction, stenosis, and recurrent infection of these sinuses. Functional endoscopic sinus surgery is based on the concept that the osteomeatal complex must be cleared to restore and enhance normal sinus drainage.

Middle meatus



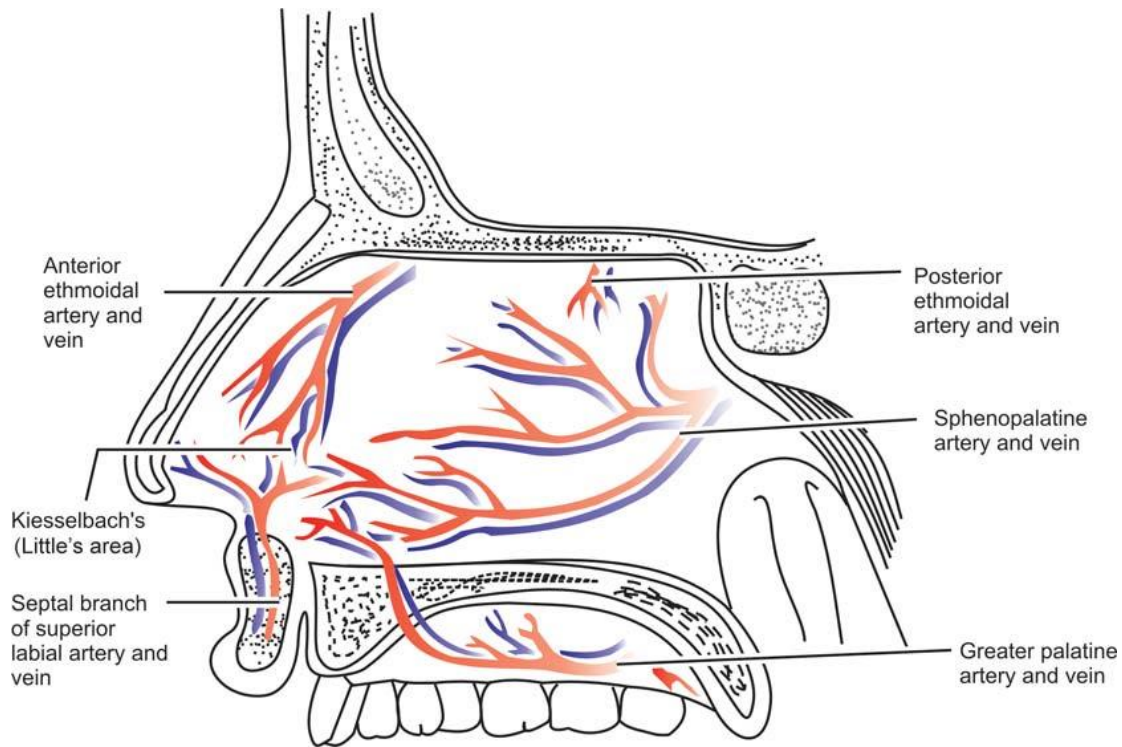


Blood supply

A, Arterial supply

From branches of the internal carotid artery (I.C.A) and external carotid artery (E.C.A.)

The nose has an extremely rich blood supply with contributions from both the internal and external carotid arteries. Vessels from both these sources anastomose extensively within the nasal cavity, including the lateral wall, the septum and also across the midline. The Kiesselbach plexus, or Little's area, is the most frequently associated anastomotic site for epistaxis and is located on the anterior cartilaginous septum. Woodruff's plexus is a confluence of vessels on the lateral wall posterior to the inferior turbinate and is often implicated in 'posterior' bleeds.



Blood supply of the nasal septum

2. The nasal cavity is supplied by the following arteries :

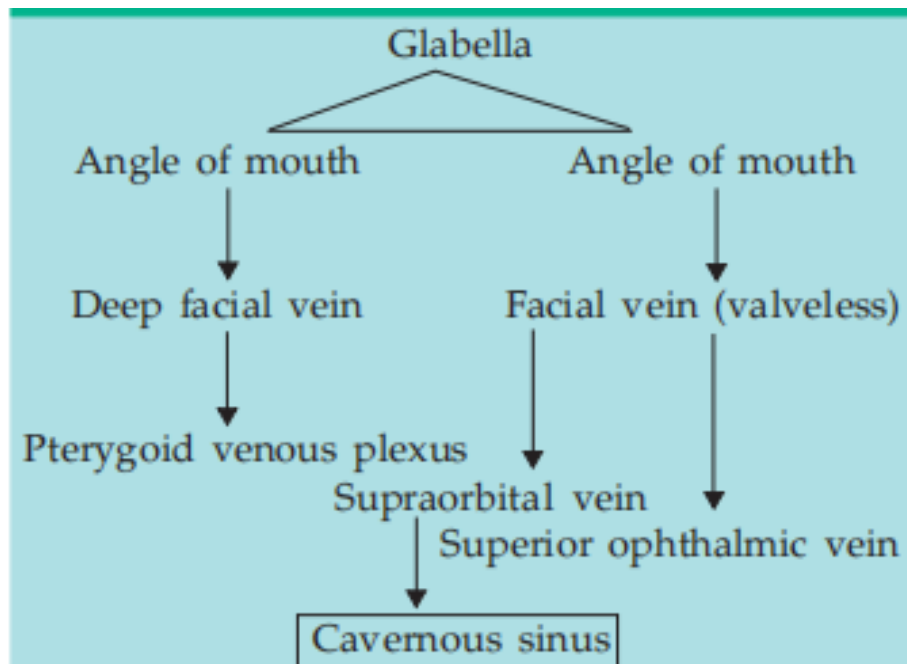
- a. Anterior and posterior ethmoidal arteries from the ophthalmic artery, a branch from the I.C.A. They supply the superior part.
- b. Sphenopalatine artery from the maxillary artery from the E.C.A. It supplies the posterior part.
- c. Greater palatine branch of the maxillary artery.
- d. Superior labial branch of the facial artery. It supplies the anteroinferior part.

B. Venous drainage

1. Sphenopalatine vein.
2. Anterior and posterior ethmoidal veins.
3. Angular vein.

These veins are connected with the cavernous sinus either through the ophthalmic vein or through the pterygoid plexus of veins, so infections of the nose may lead to cavernous sinus thrombosis.

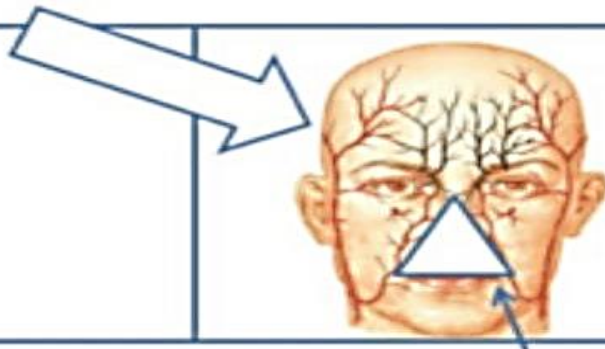
N.B. : The dangerous triangle of the face extends from the root of the nose superiorly (nasion), to the lateral comers of the mouth on each side. Infections in this area might extend to the cavernous sinus.



It is connected to the superior ophthalmic vein directly through the supraorbital vein. By means of the superior ophthalmic vein, the facial vein is connected to

The cavernous sinus

this connection is of a great clinical importance because it provides a pathway for the spread of infection from **DANGEROUS AREA OF THE FACE** (THE LOWER PART OF THE NOSE AND THE UPPER LIP) to the cavernous sinus



Infection from the triangular area can cause Thrombosis of the cavernous sinus

Nerve supply

1. Sensory : 5th (trigeminal nerve) via the anterior and posterioretmoidal branches of the sphenopalatine ganglion (maxillary division of 5th nerve).

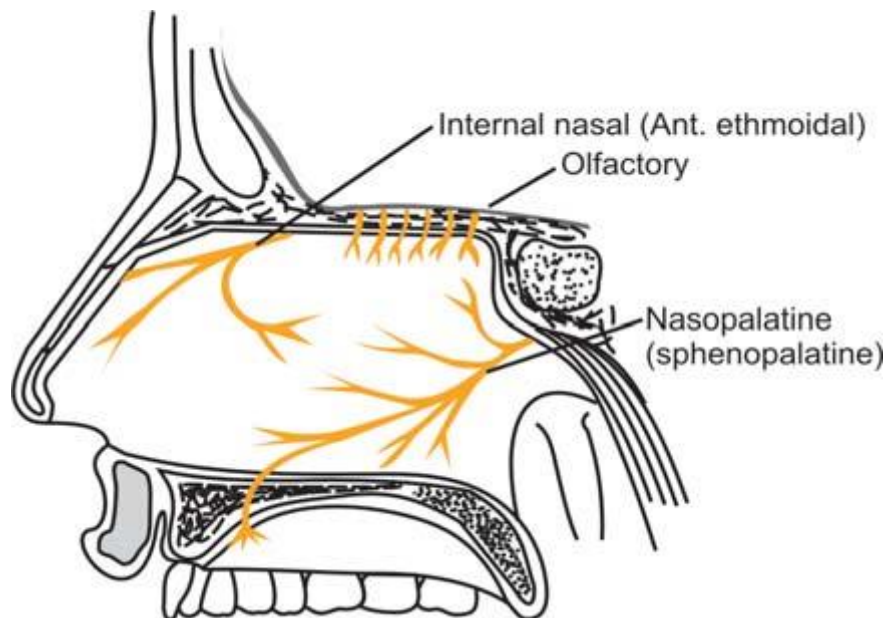
2. Olfaction : 1st cranial nerve (olfactory *n.*)

3. Autonomic supply, (through the sphenopalatine ganglion)

a. Parasympathetic : (Facial nerve) By the greater superficial petrosal nerve which forms the nerve of pterygoid canal (vidian nerve), which relays in the sphenopalatine ganglion and postganglionic fibres carry secretomotor parasympathetic innervation.

b. Sympathetic:

preganglionic fibres from the upper thoracic segment relay in the superior cervical ganglion and postganglionic fibres form a plexus around the ICA from which the deep petrosal nerve arises to form with the greater superficial petrosal nerve the nerve of the pterygoid canal which supplies the nasal blood vessels.



Innervation of nasal septum

Lymphatic drainage

1. Anterior portion : submandibular lymph nodes.
 2. Posterior portion : Retropharyngeal lymph nodes.
- And both finally drain into the upper deep cervical lymph nodes.

Histology

The lining of the nose is divided histologically into three parts :

- 1. The vestibule:** It is lined by stratified squamous epithelium containing stiff hair (vibrissae).
- 2. The respiratory portion :** It is lined by respiratory mucosa (pseudostratified columnar ciliated epithelium with goblet cells and seromucinous glands). It lines the following areas :
 - a. all the nasal cavity except the olfactory portion & vestibule.
 - b. Eustachian tubes.
 - c. Nasopharynx till the level of soft palate.
- 3. The olfactory area :** It is lined by olfactory neuroepithelium cells, which appear yellowish or faint blue. It covers the superior portion of the nasal cavity :
 - a. Superior turbinate.
 - b. Portion of middle turbinate (medial side).
 - c. Lateral surfaces over the ethmoid sinuses.
 - d. Upper portion of the septum.

The nasal cycle :

This feature of normal nasal physiology is a cyclical alteration in nasal resistance between the two nostrils secondary to alteration in vascular activity that regulates the volume of venous sinusoids (capacitance vessels) in the nasal erectile tissue (located primarily in the inferior turbinate and to a lesser extent in the anterior septum). These changes occur between 4 and 12 hours and enhance humidification, warming and mucociliary clearance. The nasal cycle is affected by factors such as allergy, infection, exercise, hormones, pregnancy, emotions, sexual activity and recumbent position.

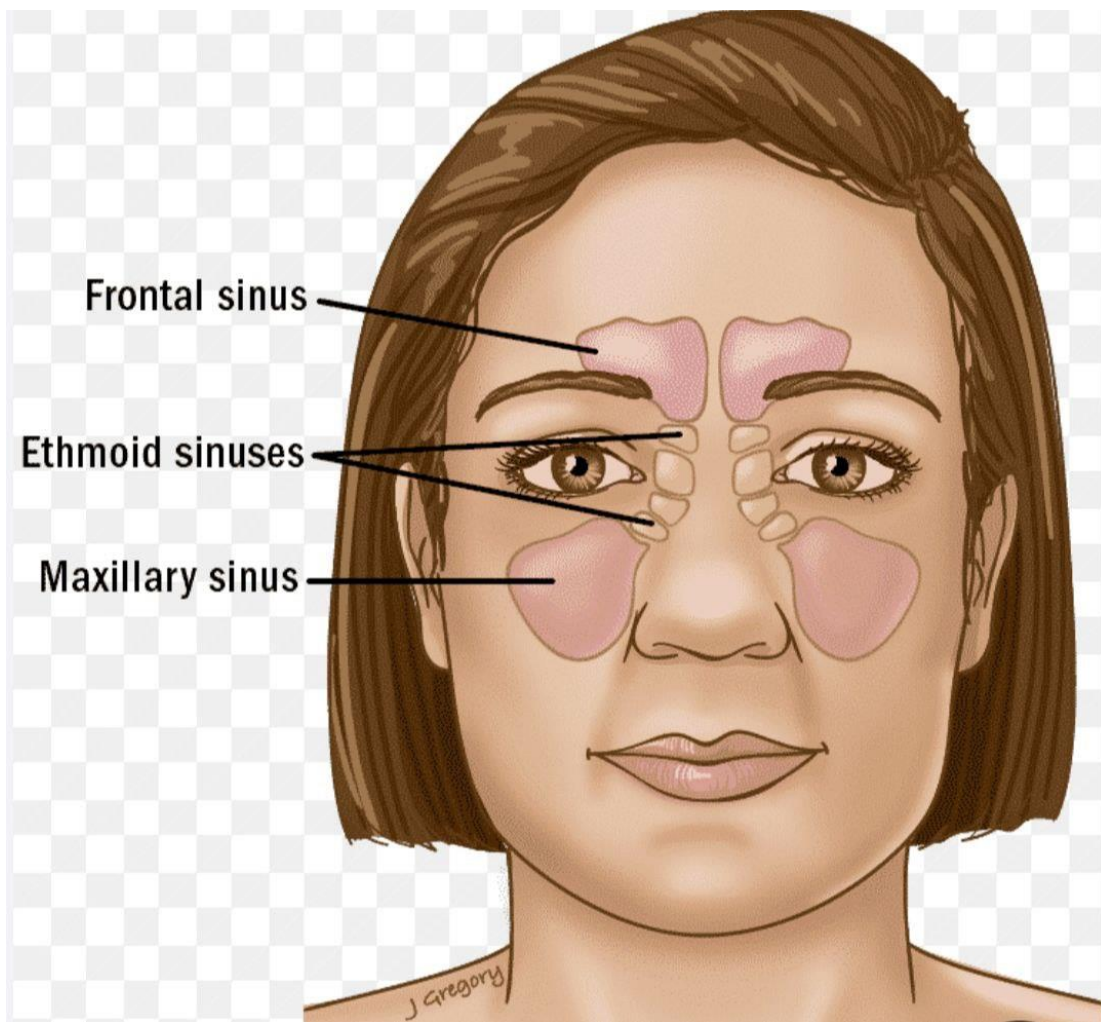
Functions of the nose

1. Respiratory passage.
2. Olfaction.
3. Voice resonator.
4. Protection; through the following mechanisms :
 - a. Humidification and warmth of the inspired air by moisture supplied by the mucous blanket covering the nasal mucosa.
 - b. Vibrissae which filter large particles.
 - c. Ciliae moving the mucous blanket backwards filter small particles.
 - d. Reflex sneezing.
 - e. Lysosomes in the nasal secretion have a bacterolytic effects.

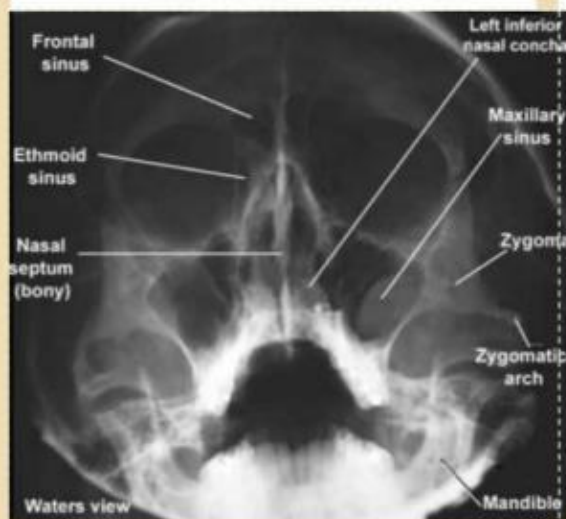
The mucous blanket: The goblet cells and the seromucinous glands of the nose produce mucus that forms a continuous blanket throughout the nose and sinuses. It collects dust, bacteria, viruses and pollens. By the ciliary action .The blanket is carried back to the pharynx and swallowed. Lysosome in the mucus initiates bacterial destruction.

Anatomy of the paranasal sinuses ;

- The paranasal sinuses are air filled spaces present within the skull bones, and lie around the nasal cavity. They open into the lateral nasal wall.
- *Lining* : The paranasal sinuses are lined by mucous membrane similar to, and continuous with that of the nasal cavity.
- *There are four pairs of sinuses* : the frontal, maxillary, ethmoid, and sphenoid sinuses. They vary greatly in size between different individuals.
- Anterior group of sinuses : include the maxillary, frontal, and anterior ethmoid sinuses ,they drain into middle meatus
- Posterior group of sinuses : include the posterior ethmoid and sphenoid sinuses. They drain into superior meatus
- Each sinus communicates with the nasal cavity through an opening known as the ostium.



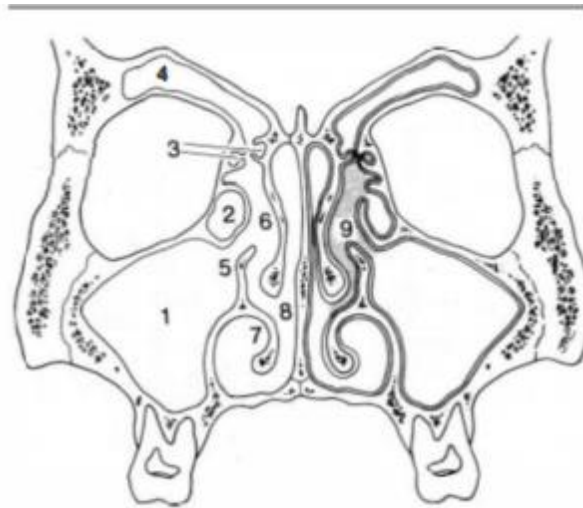
Occipitomental View



Nose Chin Position



- Frontal process of maxilla
- Superior orbital fissure
- Infratemporal fossa
- Sphenoid sinus ?



1. Maxillary sinus
2. Ethmoidal bulla
3. Ethmoidal cells
4. Frontal sinus
5. Uncinate process
6. Middle turbinate
7. Inferior turbinate
8. Nasal septum
9. Osteomeatal complex

Coronal view of the nose and paranasal sinuses

Functions of the paranasal sinuses

1. Lighten the weight of the skull.
2. Humidification and warming of the inspired air.
3. Secretion of mucus to keep the nasal chambers moist.
4. Improving vocal resonance.
5. Absorption of shock to the face or skull.
6. Regulate the intranasal pressure.

KEY POINTS

1. **Dangerous area of nose** is drained by anterior facial vein which communicates with cavernous sinus through ophthalmic vein.
2. **Nasal valve** area is bounded by septum, pyriform aperture and upper lateral nasal cartilage.
3. **Major constituents of the septum** are ethmoid bone (perp. plate), Vomer and the septal cartilage.
Minor contribution is from nasal bones, frontal, sphenoid, maxilla and palatine bones.
4. **Little's area** of nose lies on anteroinferior part of nasal septum. Branches of anterior ethmoidal, sphenopalatine, superior labial and greater palatine vessels anastomose at this area.
5. **Osteomeatal complex** lies in the middle meatus and is important for FESS (functional endoscopic sinus surgery).
6. **Hiatus semilunaris** is a space between uncinat process and bullaethmoidale.