Doctor.021

no.

RS

ANATOMY

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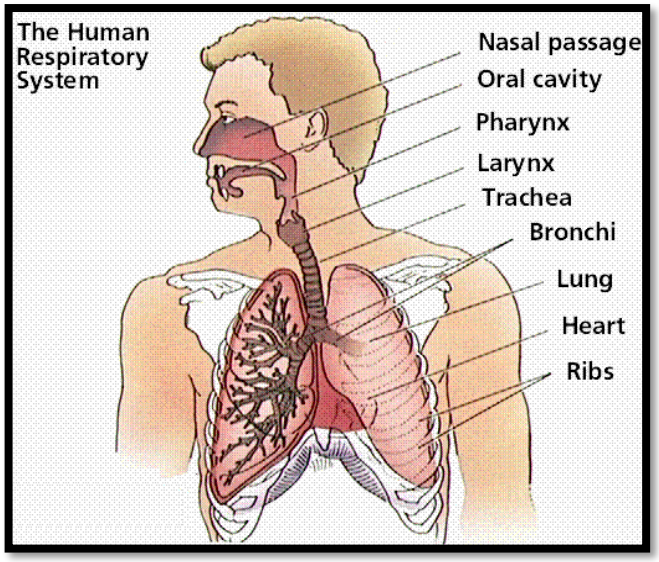
Respiratory system organs

The organs of respiratory system open ultimately into the respiratory tract (there is no associated organs like Digestive systems) these organs are:

1- **Nasal cavity**: first part of the respiratory tract
2- **Pharynx**: for passage of air
3- Larynx (second lecture)
4- Trachea
5- **Bronchi**: in each lung, there is 10 bronchopulmonary segments and it contains cartilage.
6- Bronchioles
7- Alveoli



- Bronchioles (no cartilage) end in **alveoli** (a cluster of air sacs) which are the main building unit that performs the lung function.

- we have billions of them in the lungs, they're responsible for gas exchange, they are surrounded by a very large network of blood capillaries (the **largest** capillaries in the body) to give a large surface area for gas exchange.

- The **lungs** are surrounded by pleura and they are two types:

A) Parietal pleura: lines the thoracic cage -to be specific walls of the pleural cavity.
B) Visceral pleura that adheres to the lungs.

- Note that some histological details are mentioned by the doctor will be covered the histology lecture.

Functions of respiratory system

1- Provides for **gas exchange**.
2- **Regulates blood PH:** depends on oxygen and carbon dioxide levels.
3- **Filters of inspired air**: lining epithelium of the respiratory tract is pseudostratified **ciliated** columnar epithelium; filtration is done by the cilia.
4- Contains receptors for smell by the olfactory nerve, and produces vocal sounds (**phonation**)
5- **Excrete** small amounts of **water and heat**.

The nose

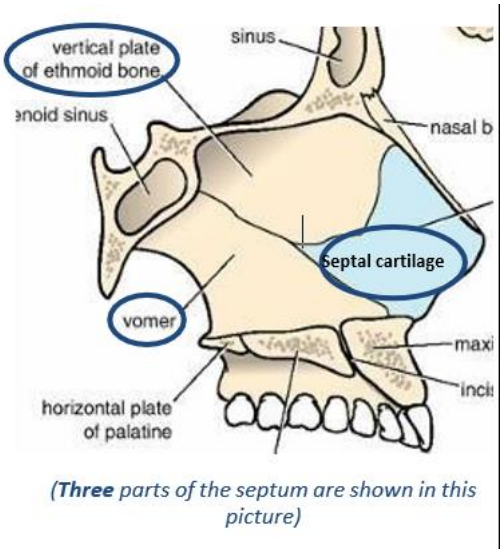
The nose is divided into: 1) external nose 2) Nasal cavity.

1) External nose: it is a cartilaginous framework which is two cavities separated by septum the septum (which is the medial wall of the nasal cavity) is divided into three parts:

A. cartilaginous framework.

1- septal cartilage (anteriorly)
2- Lateral nasal cartilage
3- Alar cartilage: contains two types of muscles: constrictor muscles and dilator muscles. In situations where more oxygen is needed, dilator muscles help facilitate increased oxygen intake. This can be observed in children who have adenoid issues. (located in the roof of nasopharynx)

- **All are Plates of hyaline cartilage.**



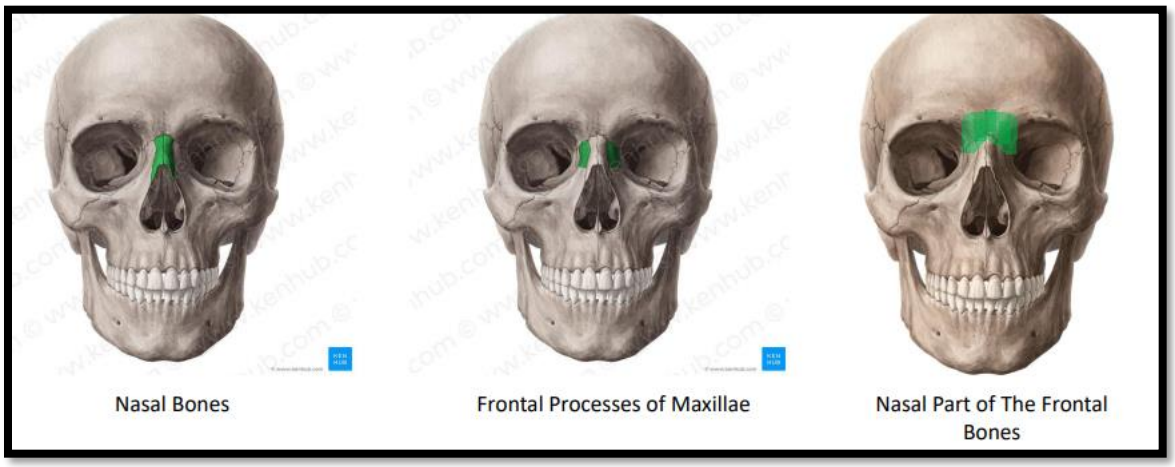
*(**Three** parts of the septum are shown in this picture)*

B. perpendicular plate of ethmoid bone (above)

C. the vomer (posterior).

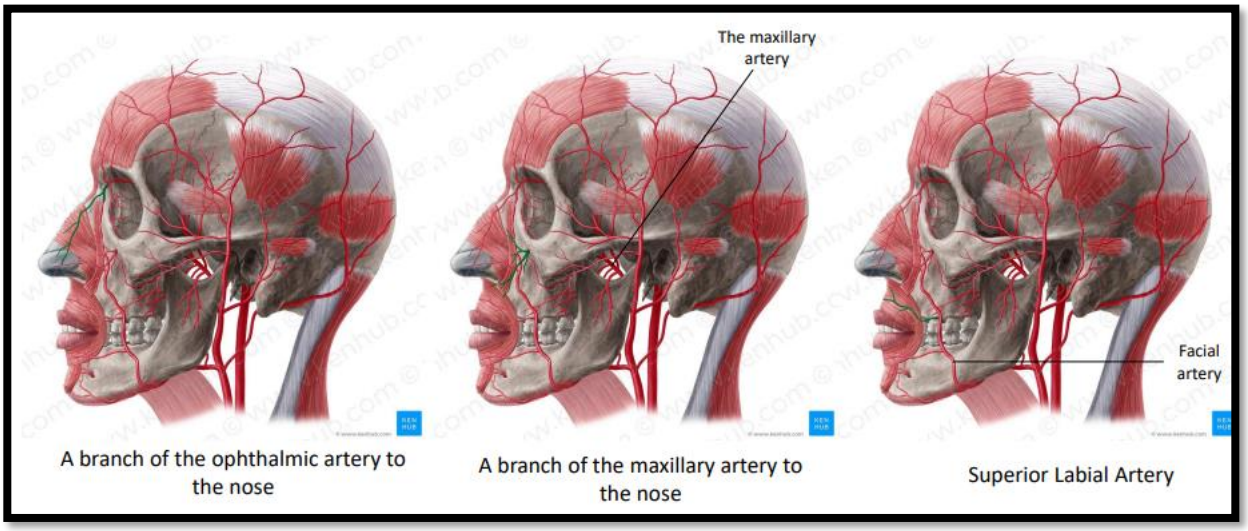
- **Bony framework of the external nose.**

1- Nasal bone (base of the nose)
2- Frontal process of the maxilla.
3- Nasal part of the frontal bone



Blood supply of the external nose

- The ophthalmic artery: a branch from the internal carotid artery.
- The maxillary artery: a branch from the external carotid artery.
- Facial artery: supply lower part of the septum and ala.

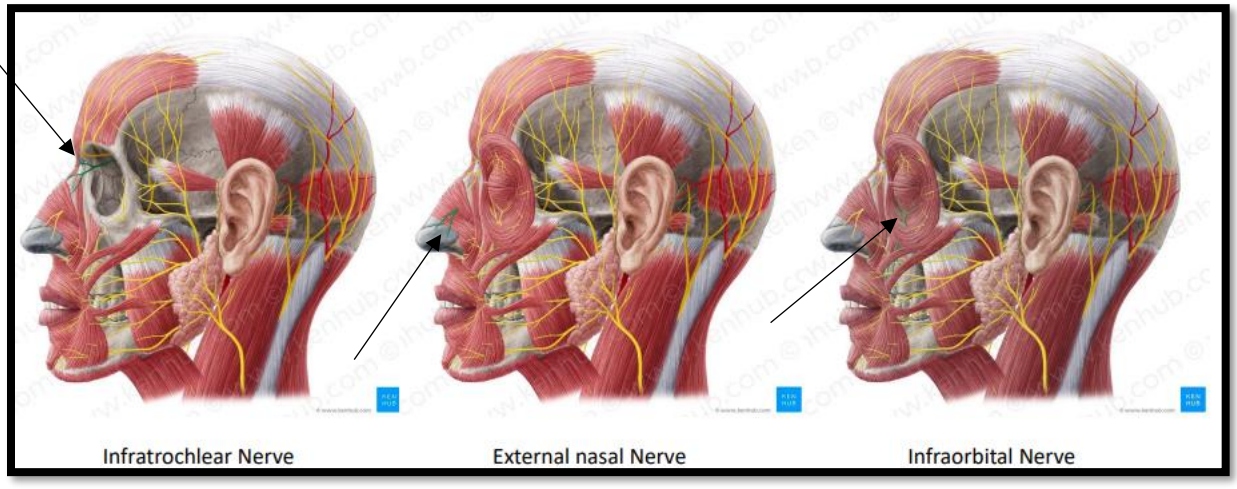


- Note that the blood supply of the external nose is from external and internal carotid arteries. **(important)**

Nerve supply of the external nose

- Branches of the **ophthalmic nerve**
  A) Infratrochlear nerve
  B) External nasal nerve

- Branch from maxillary nerve which is **infraorbital nerve.**



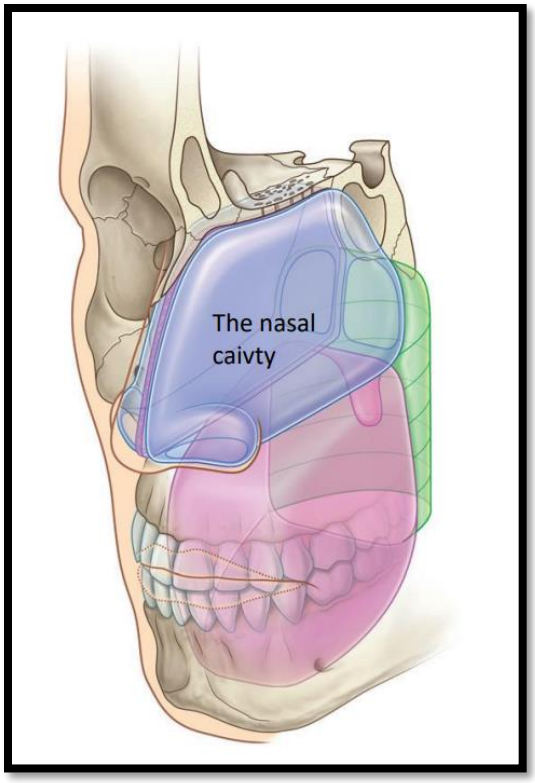
Nasal cavity.

- The nasal cavity extends from the nostrils (anterior nasal opening) to the posterior nasal apertures (**choana**) where it opens into the nasopharynx.

- Nasal cavity Opens into the nasopharynx.
- Vestibule is the area of the nasal cavity lying just inside the nostril.

- Divided into right and left halves by the nasal septum.

- Septum is made up of the septal cartilage, the vertical plate of the ethmoid, and the vomer.



Parts of nasal cavity

- Nostril: (Nares): The anterior openings of the nasal cavities, held open by the surrounding alar cartilages and septal cartilage, and it is **continuously open.** Can be widened further by the action of the related muscles of facial expression.
- Vestibule: is the area of the nasal cavity lying just inside the nostril, Divided into right and left halves by the medial nasal septum. Septum is made up of the septal cartilage, the vertical plate of the ethmoid, and the vomer. (so, septum is made up by cartilaginous and bony parts).
- Vestibule contains thick and short hair
- **Important**: the vestibule's mucosa is modified skin: stratified squamous keratinized with thick hair follicles. (Not the common respiratory lining epithelium).

- Choana: it is an Openings between the nasal cavities and the nasopharynx, these openings are Rigid completely surrounded by bone

Boundaries of choana

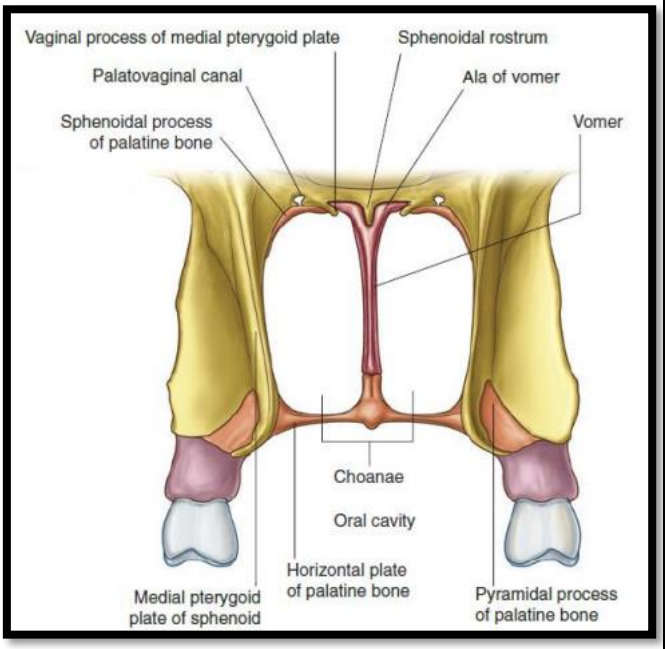
Medially: the vomer and its superior process which is ala of vomer (remember that vomer is the posterior part of nasal septum)

Laterally: Medial pterygoid plate

Floor: Horizontal plate of palatine bone

Roof

1- palatovaginal canal which leads to the nasopharynx.
2- Vaginal process of medial pterygoid plate.
3- Sphenoidal process of palatine bone.



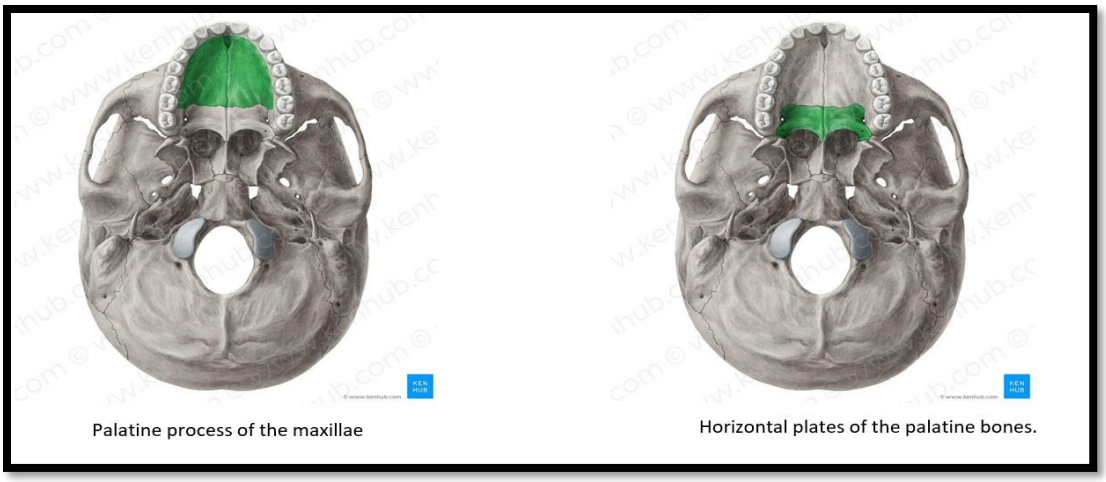
Functions of nasal cavity

1- Respiratory: gas exchange and passage of air
2- Olfactory: because it contains smell sensation.
3- Resonance of voice because it contains paranasal sinuses
4- Drains of lacrimal fluids: on the medial angel of the eye there is a lacrimal sac for the collection of tears, these tears reach **the inferior meatus** through the nasolacrimal duct.
- Some children have blocked nasolacrimal duct, as a result the tears will flow from the eye to the skin continuously and causes inflammation as well as irritation. Open the nasolacrimal duct to treat this problem
5- Protective: sneezing, filtration, proteolytic enzymes. Warming and moistening the air

Boundaries of nasal cavity

Floor: the upper surface of the hard palate which consist of two bones:

1- Palatine process of the maxilla (anteriorly).
2- Horizontal plate of palatine bone (posteriorly)



Roof:

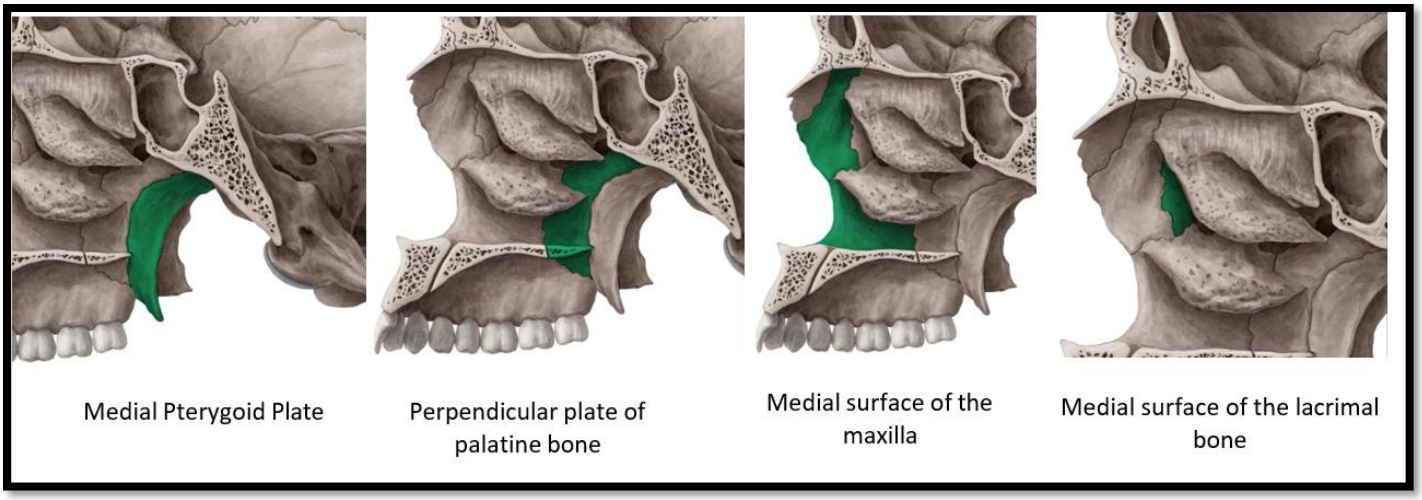
1- **Sloping anterior part**: nasal spine of the frontal bone **and** the nasal bone**.**
2- **Horizontal middle part:** the cribriform plate of the ethmoid bone. Cribriform plate for the passage of olfactory nerve. (cribriform means غربال)
3- **Sloping posterior part**: anterior surface of the sphenoid bone(body), and Ala of the vomer. Also, the vaginal process of the palatine bone.

Medial wall

1- **Septal nasal cartilage** anteriorly (remember that the septum divided into three parts)
2- Posterior vomer and the perpendicular plate of the ethmoid bone.

Lateral wall: complex and formed by bone, cartilage, and soft tissues.

- There are three conchae (superior, middle and inferior)
- There are three meatuses under each concha
- One recess (sphenoethmoidal recess).
- **Superior and middle** conchae are made by **ethmoid bone**
- **Inferior concha** is made by **maxilla**.



Medial Pterygoid Plate | Perpendicular plate of palatine bone | Medial surface of the maxilla | Medial surface of the lacrimal bone

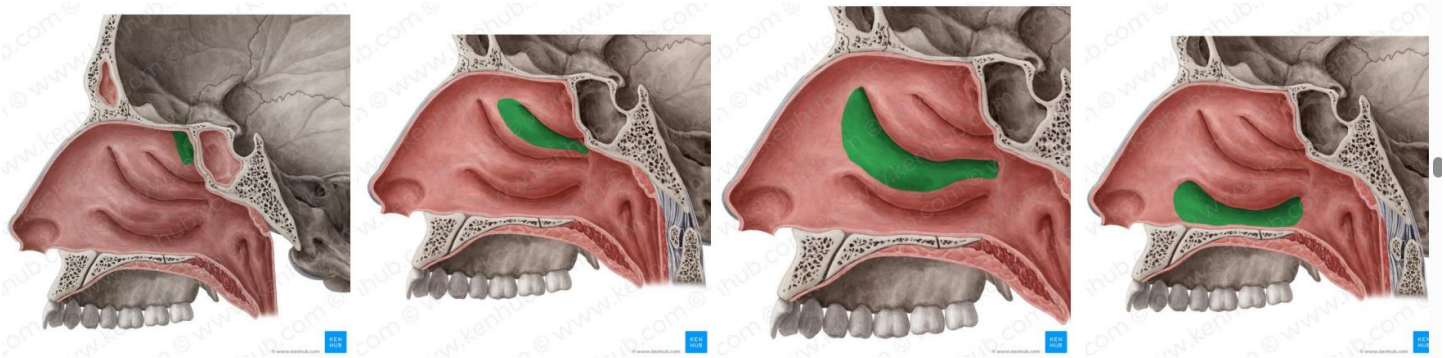
Parts of the lateral wall of nasal cavity.

A- **Vestibule**: is the area of the nasal cavity lying just inside the nostril. It is covered with skin and contains **thick hairs that filtrate hair** (vibrissae). Ant the type of epithelium is modified skin. Which contains glans and hair follicles.

B- **Antrum (atrium)**: Located above the vestibule at the same level of **middle meatus.**

C- **Posterior part** contains 3 conchae and 3 meatuses and 1 recess (spheno-ethmoidal recess). (Important)

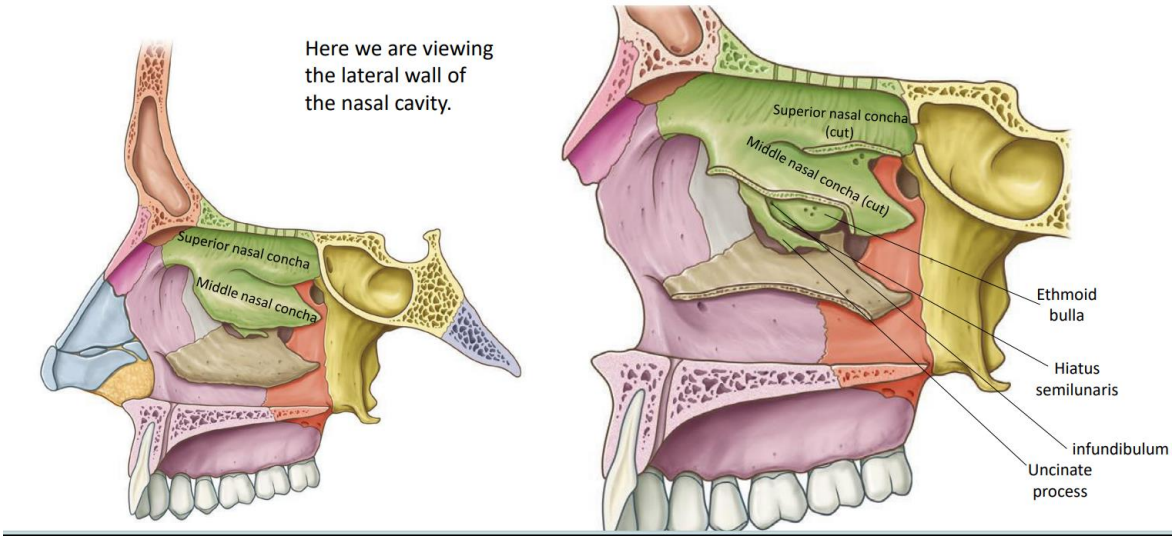
- **The concha: it is a bulge of bone which covered by thick mucosa and it increase the surface area of the nose** (important)



Sphenoethmoidal Recess | Superior Nasal Meatus | Middle Nasal Meatus | Inferior nasal meatus

Bony Support of the lateral wall

- Ethmoidal labyrinth and uncinate process
- Perpendicular plate of the palatine bone
- Medial plate of the pterygoid process
- Medial surfaces of the lacrimal bones and maxillae
- Inferior concha from maxilla.



Mucosa.

- lined with respiratory mucous membrane.

There are two exceptions:

1- The **vestibule** is lined **with modified skin and has coarse hairs**.

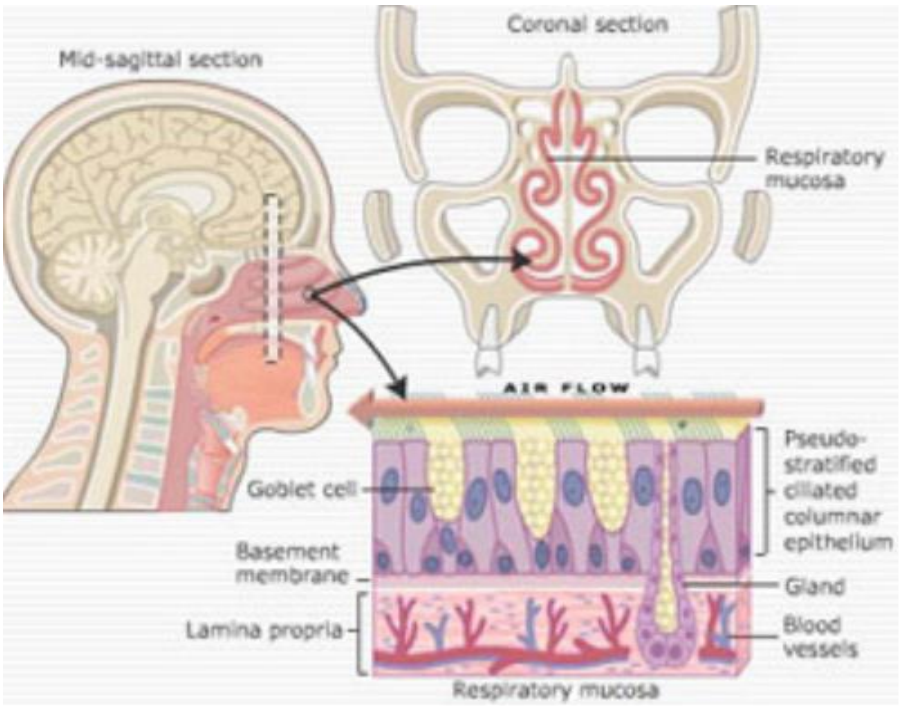
2- Above the superior concha is lined with **olfactory mucous membrane** and contains nerve endings**.**

Functions of mucus membrane

- Large plexus of veins in the **submucous** connective tissue is present in the respiratory region.

  1- Warm blood in the venous plexuses serves to **heat up the inspired air** as it enters the respiratory system
  2- Mucous traps foreign particles organisms in the inspired air.

- Patient who has rhinitis will suffer from congestion because of the increase in venous blood, which leads to increase the **thickening** of mucosa and submucosa, so **the nasal cavity is blocked**.
- Treatment: Anti congestion.
- Cold air could damage the brain cells so that warming is important.



Conchae (detailed).

There are three conchae, three hiatus and one recess

- All Choncae extend medially across the nasal cavity, separating it into four air channels
- There are superior, middle and inferior conchae.
- Inferior, Middle, and Superior meatus, and a **Spheno-ethmoidal recess.**
- Anterior end of each concha curves inferiorly to form a lip that overlies the end of the related meatus.
- Lateral wall of the middle meatus elevates to form the dome shaped ethmoidal bulla(bulla ethmoidalis)
- Ethmoidal bulla is formed by the underlying middle ethmoidal cells, which expand the medial wall of the ethmoidal labyrinth.
- Inferior to the ethmoidal bulla is a curved gutter or groove (the **Hiatus semilunaris**).
- **Hiatus semilunaris** is formed by the mucosa covering the lateral wall.
- Defect in the bony wall between the ethmoidal bulla above and the uncinate process below is a type of ethmoidal sinus disease that can cause chronic sinusitis (here the underlying sentence is extra info)
- Anterior end of the **hiatus semilunaris** forms a channel (the Ethmoidal infundibulum).
- **Ethmoidal infundibulum** curves upwards and continues as the Frontonasal duct through the anterior part of the ethmoidal labyrinth to open into the frontal sinus. (Important).

Paranasal sinuses (Important)

- The nasolacrimal duct and most of the paranasal sinuses open onto the **lateral wall** of the nasal cavity except the Sphenoidal sinuses (Important)

1- Maxillary sinus: opens into middle meatus through hiatus semilunaris
2- Frontal sinuses: open into middle meatus via **infundibulum** and **frontonasal duct**.

3- Sphenoidal sinuses: open into sphenoethmoidal recess (note that it does not open into lateral wall).
4- Ethmoidal sinuses
   A- Anterior Group opens into anterior part of hiatus semilunaris of **middle meatus**
   B- Middle Group opens into middle meatus or above **bulla ethmoidalis**
   C- Posterior Group opens into **superior meatus**.

- Nasolacrimal duct opens onto the lateral wall of the **inferior nasal meatus.**

Blood supply of the nasal cavity.

- Divided into blood supply of the septum and lateral wall.

1- Sphenopalatine artery.

- Largest vessel supplying the nasal cavity
- Terminal branch of the maxillary artery in **the pterygopalatine fossa**

External carotid artery → Maxillary artery → Sphenopalatine artery.

- Sphenopalatine artery Enters the nasal cavity by passing medially through the **sphenopalatine foramen**

■ **Branches of the sphenopalatine artery: these branches supply the septal and the lateral wall**

- **Short** sphenopalatine artery supplies the **lateral wall** (posterior superior quadrant)
- **Long** sphenopalatine artery (nasopalatine) supplies the medial wall (the **septum**), and passes over the roof of the cavity and onto the nasal septum.

2- **Palatine artery**: a branch from maxillary artery, further divided into greater and lesser palatine arteries.

- **Greater** palatine artery supplies the **nose**, arises in the pterygopalatine fossa as a branch of the maxillary artery
- **Greater** palatine artery enters the nasal cavity by passing up through the incisive canal
- **Lesser** palatine artery supplies the **soft** palate.

3- **Anterior and posterior ethmoidal arteries:** originate in the orbit from the ophthalmic artery. (and ophthalmic from internal carotid artery)

- **Anterior ethmoidal artery:** accompanies the anterior ethmoidal nerve, descending through a slit like foramen lateral to crista galli. Anterior ethmoidal nerve supplies the **medial(septal)** and the lateral wall of the nasal cavity (anterior superior quadrant)

- **Posterior ethmoidal artery:** descends into the nasal cavity through the cribriform plate and has branches to the upper parts of the medial and lateral walls.

4- Superior labial and lateral nasal arteries Originate from the facial artery on the front of the face

- **Superior labial artery** gives an **alar branch** supplies the region around the naris and a **septal branch** supplies anterior regions of the **nasal septum**.
- **Internal nasal arteries** supply the blood of the external nose.
- **Note that** Alar branches pass around the lateral margin of the naris and supply the nasal vestibule

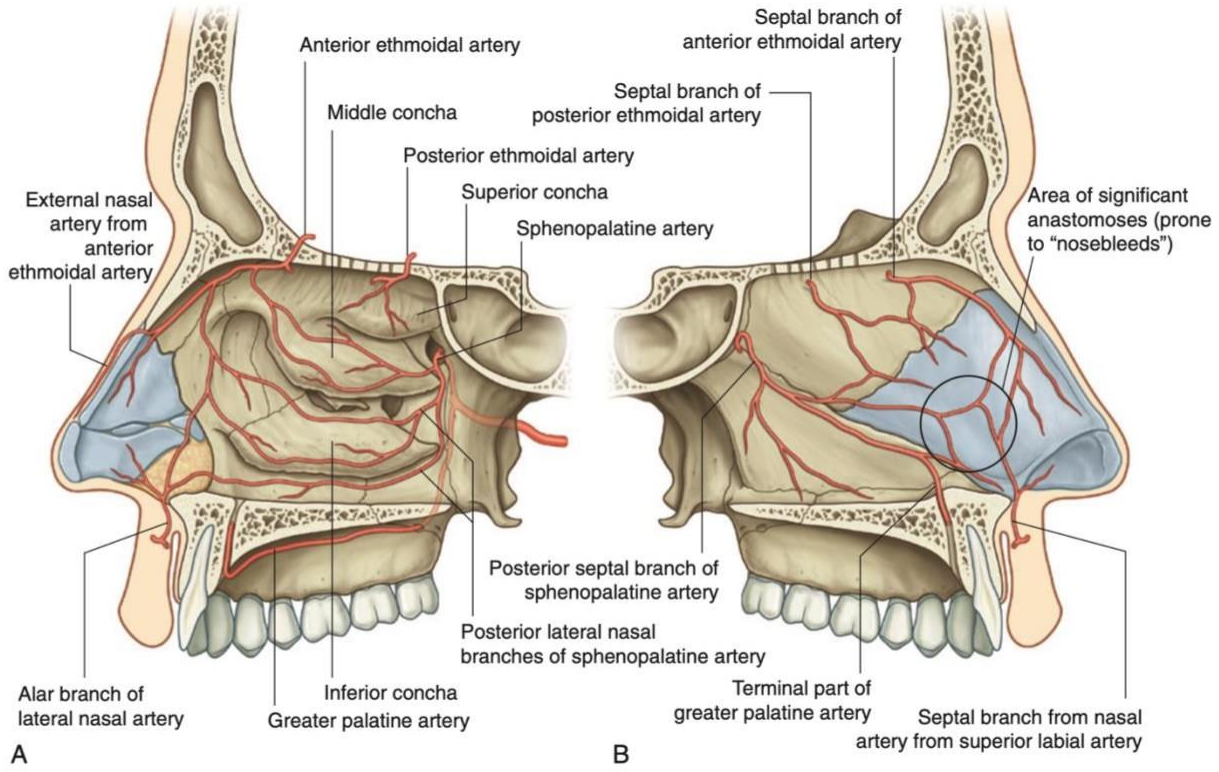


Fig. 8.243 Arterial supply of the nasal cavities. **A.** Lateral wall of the right nasal cavity. **B.** Septum (medial wall of right nasal cavity).

Epistaxis: It is the medical term for a nose bleeding, vessels that supply the nasal cavities form extensive anastomoses with each other.

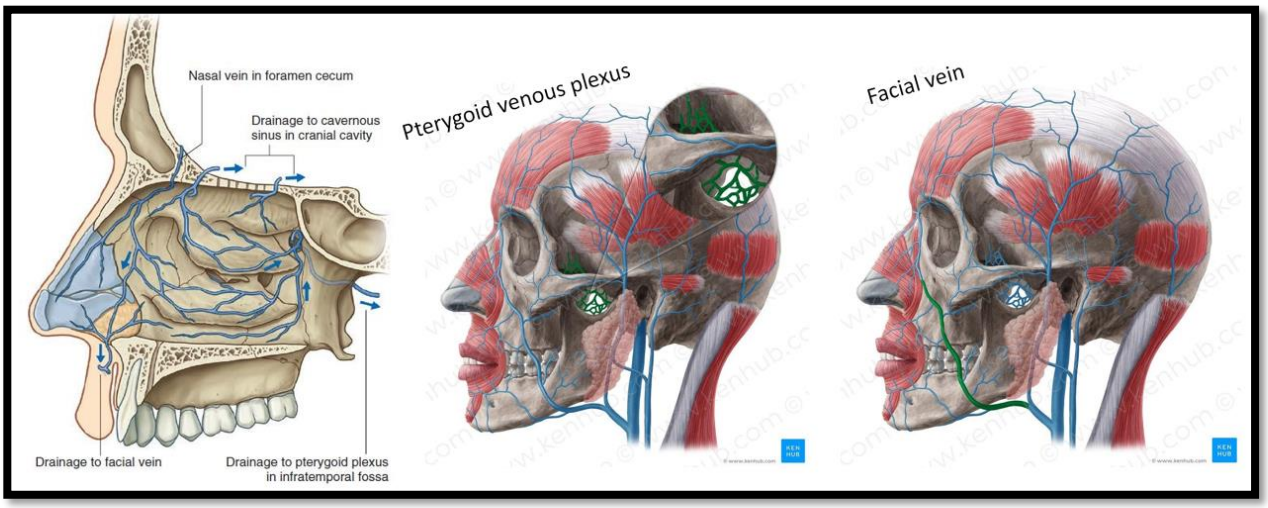
- In the anterior region of the medial wall there are anastomoses relatively close to the surface (**Kiesselbach's area**).
- This area is the major site of nose bleeds or epistaxis.
- The main arteries that involved when epistaxis occur are **nasopalatine artery** and **superior labia artery** (there is anastomosis).
- Treatment: apply pressure, or silver nitrate

Venous drainage of the nasal cavity

- Vains draining the nasal cavities generally follow the arteries
- veins that pass with branches originate from the **maxillary artery** (posterior regions) drain into **the pterygoid plexus,** which located around the lateral pterygoid muscle.

Pterygoid plexus ⟶ Maxillary veins + superficial temporal ⟶ retromandibular vein

- veins from **anterior regions** of the nasal cavities join the **facial vein.**



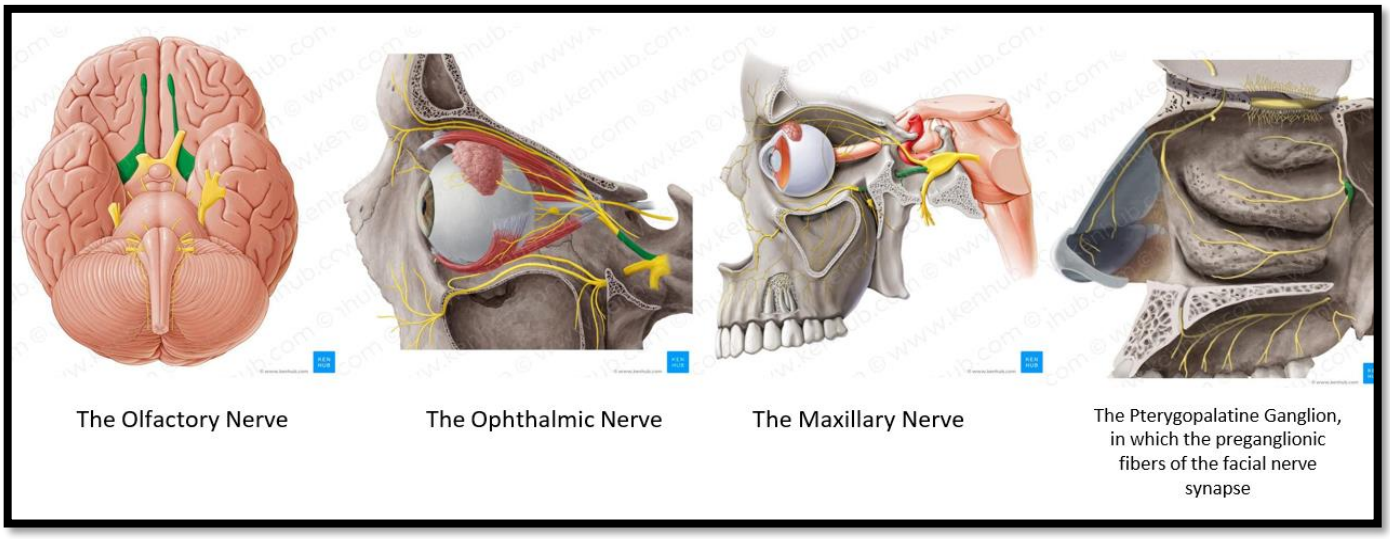
Lymphatic drainage of the nasal cavity.

- Lymph from anterior regions drains onto the face by passing around the margins of the nares
- These lymphatics connect with the submandibular nodes
- Then drains into the deep cervical lymph nodes

Innervation.

1- Smell sensation through **the olfactory nerve**, begins as bipolar cells in the roof of the nose ⟶ filaments of olfactory ⟶ olfactory bulb ⟶ olfactory tract and finally to the **central of smells**. Which located in the temporal lobe of the brain.(storage for smell information)

2- **Branches from ophthalmic nerve**: ethmoidal anterior and ethmoidal posterior.
3- **Branches from maxillary nerve**: long and short sphenopalatine nerves, greater and lesser palatine nerves also branch from maxillary nerve. (notice it is the same branches of arteries)
4- Parasympathetic fibers from the **facial nerve** (greater petrosal nerve), secretomotor innervations of mucus gland.



Details about innervation (from slides).

Olfactory nerve.

- Composed of axons from receptors in the olfactory epithelium at the top of each nasal cavity
- Pass superiorly through the cribriform plate to synapse with the olfactory bulb of the brain.

Branches that innervate the nasal cavity:

1- **Anterior and posterior ethmoidal nerves:** branch from nasociliary nerve in the orbit.

A- **Anterior ethmoidal nerve:** travels with the anterior ethmoidal artery

- It has branches to the medial and lateral wall of the nasal cavity and continues forward on the undersurface of the nasal bone
- onto the external surface of the **nose** by traveling between the nasal bone and lateral nasal cartilage, terminates as the **external nasal nerve**

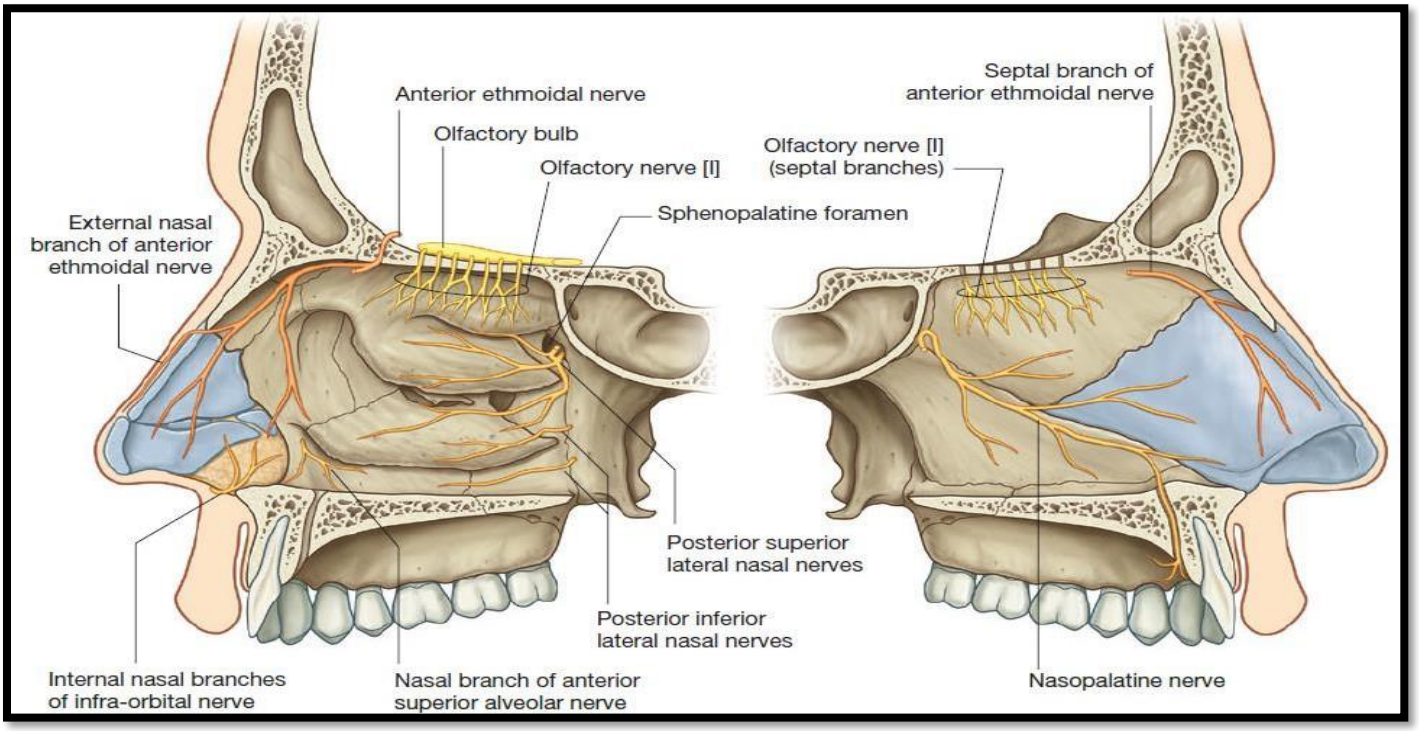
B- **Posterior ethmoidal nerve:** leaves the orbit through a similar canal in the medial wall of the orbit

- Terminates by supplying the mucosa of the **ethmoidal cells and sphenoidal sinus**
- Normally **does not** extend into the nasal cavity itself.

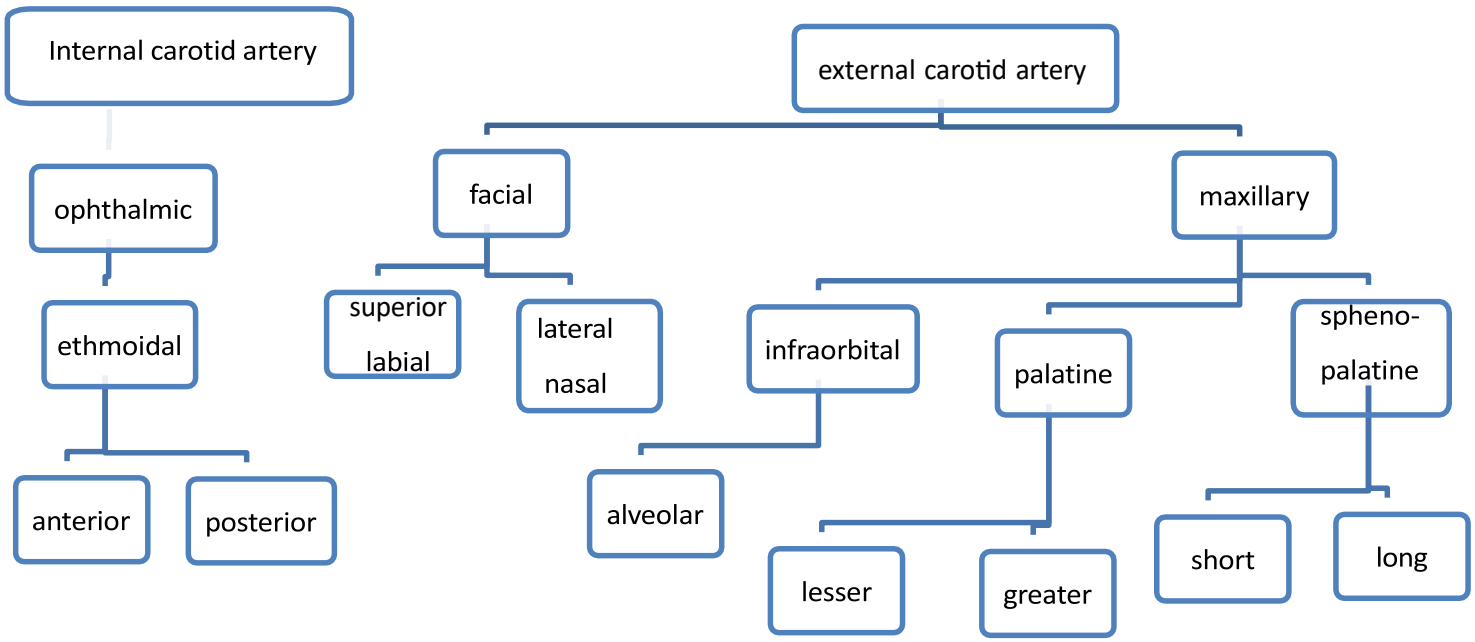
Branches from the maxillary nerve(V2).

- originate in the pterygopalatine fossa just lateral to the lateral wall of the nasal cavity
- leave the fossa to enter the nasal cavity by passing medially through the **sphenopalatine foramen**

1- Posterior superior lateral nasal nerves pass forward on and supply the lateral wall of the nasal cavity.
2- Posterior inferior nasal nerves originate from the greater palatine nerve, innervate the lateral wall of the nasal cavity.
3- Anterior superior alveolar branch of the infra-orbital nerve supplies the lateral wall near the anterior end of the inferior concha.
4- Largest of these nerves is the **nasopalatine nerve**, pass through the incisive canal onto the roof of the oral cavity, and terminates by supplying the oral mucosa posterior to the incisor teeth
5- . Posterior superior medial nasal nerves cross the roof to the nasal septum and supply both these regions.



Summary of the blood supply and innervation (From Dr.02)

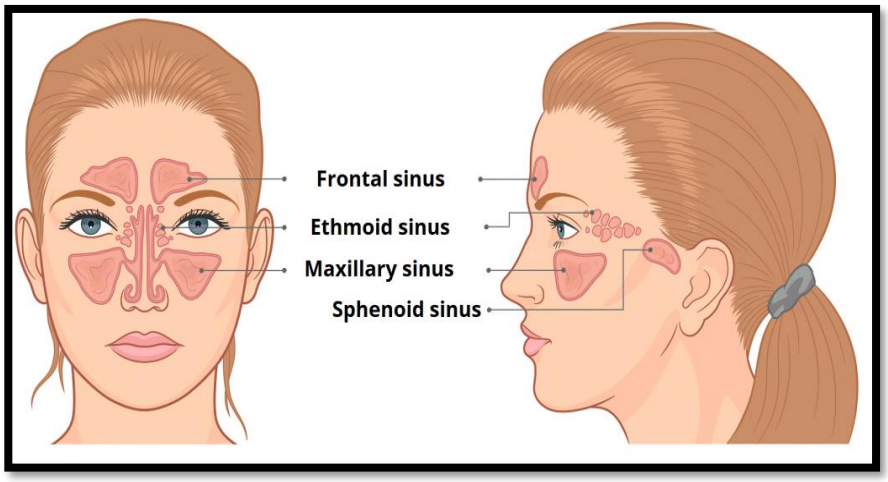


Summary for blood supply and innervations:

Postero-superior quadrant:	Posterior-superior lateral nerve and vessels (**short spheno palatine**)
Postero-inferior quadrant:	**Greater palatine** nerve and vessels
Antero-superior quadrant:	**Ant. Ethmoidal** nerve (internal and external nerve) and artery
Antero-inferior quadrant:	**Ant. Superior alveolar** nerve and branches from the **facial** and **greater palatine** artery
Nasal septum:	Lower posterior part by the **long sphenopalatine nerve** Upper anterior part by the septal branch of the **anterior ethmoidal nerve**.

Superior meatus	**Middle meatus**	**Inferior meatus**	**Sphenoethmoidal recess**
Posterior ethmoidal sinus	Anterior ethmoidal sinus Middle ethmoidal sinus Maxillary air sinus Frontal air sinus	Nasolacrimal duct	Sphenoidal air sinus

Paranasal sinuses



spaces inside some of the skull bones. They're all lined with respiratory mucosa which is **pseudostratified ciliated columnar epithelium,** but the mucosa here is thin.

There are four paranasal air sinuses-the ethmoidal cells, and the sphenoidal, maxillary, and frontal sinuses

- All are: lined by respiratory mucosa, which is ciliated and mucus secreting and open into the nasal cavities; they innervated by branches of the **trigeminal nerve [V].**
- **All sinuses** open by ducts into the lateral wall of the nose.

- All sinuses are small in size at birth and increase in size as the individual reaches adulthood.

Functions of paranasal sinuses

1. Resonance of the voice. (that's why each one of us has a special voice)
2. Decrease the weight of the skull.
3. Protection. (by moisturizing and modifying of the temperature and reduction of intracranial pressure)

Frontal sinuses

- One on each side, separated by a septum
- **Triangular in shape** and is in the part of the frontal bone under the forehead
- Drains onto the lateral wall of the middle meatus via the frontonasal duct, which continues as the **ethmoidal infundibulum.**
- Innervated by branches of the **supra-orbital nerve** from the ophthalmic nerve.

Ethmoidal sinuses

- They are 6 in number
- Each cluster of cells is separated from the orbit by the thin orbital plate of the ethmoidal labyrinth.
- Divided into anterior, middle, and posterior ethmoidal cells
- **The anterior ethmoidal** cells open into anterior part of hiatus semilunaris of **middle meatus.**
- **The middle ethmoidal** cells open onto the **ethmoidal bulla**
- **The posterior ethmoidal** cells open onto the lateral wall of the **superior nasal meatus**.
- Innervated by the **anterior** and **posterior ethmoidal** branches of **the nasociliary nerve** from the ophthalmic nerve.
-

Maxillary sinuses (Important)

- The largest of the paranasal sinuses and completely fill the bodies of the maxillae
- **Pyramidal** in shape.
- Apex directed **laterally.**
- Base deep to the **lateral wall** of the adjacent nasal cavity

- Innervated **by infra-orbital** and **alveolar** branches of the maxillary nerve
- Drains in Middle meatus through hiatus semilunaris **(Pad drainage) important**
- The drainage is bad because the opening is upward, if there is abscess it could result is **fistula** and then the bus reaches the oral cavity.

Clinical note: Extraction of upper teeth might lead to fistula formation and sinusitis

Relations of the maxillary sinus

- Related above to the **orbit**
- Related below to the roots of the upper molar and premolar teeth.
- Related behind to the infratemporal fossa
- Related medially to the lower part of the nasal cavity.
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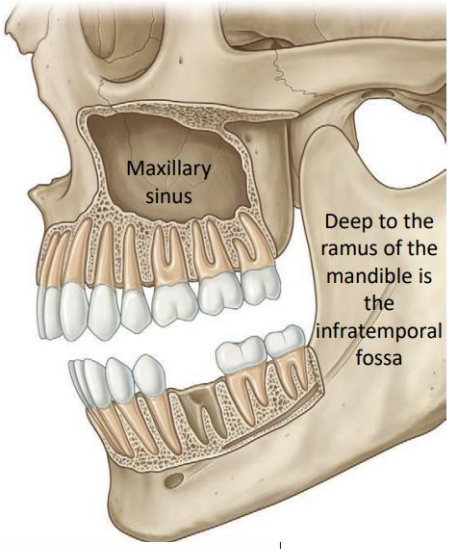
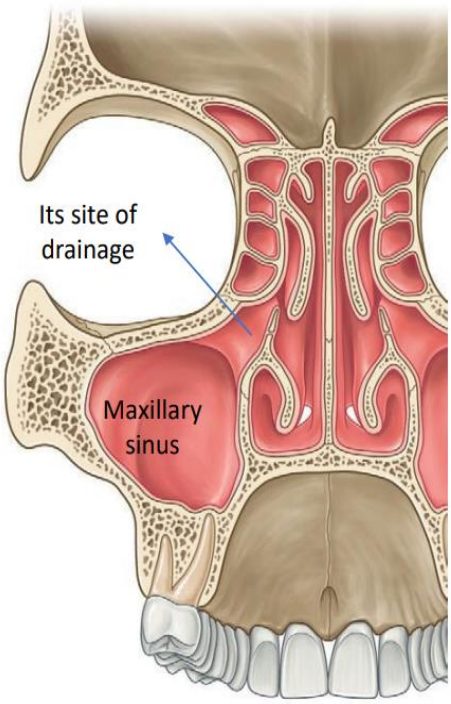
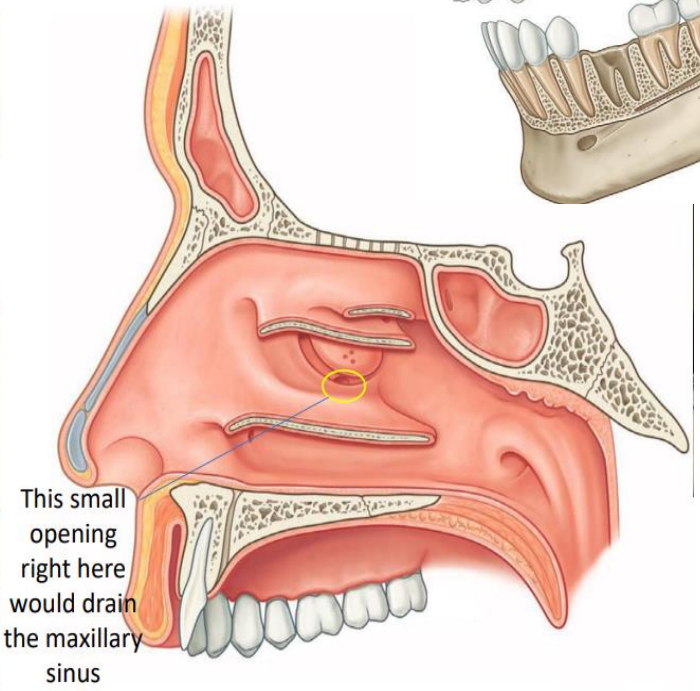






Sphenoidal sinuses

- There are two sphenoidal sinuses.
- Within the body of the sphenoid
- Open into the roof of the nasal cavity on the wall of the spheno-ethmoidal recess

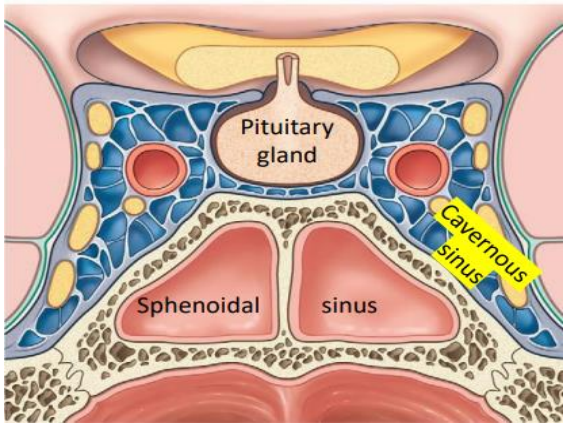
Innervation

- the posterior ethmoidal branch of the ophthalmic nerve [V1]
- the maxillary nerve [V2] via orbital branches

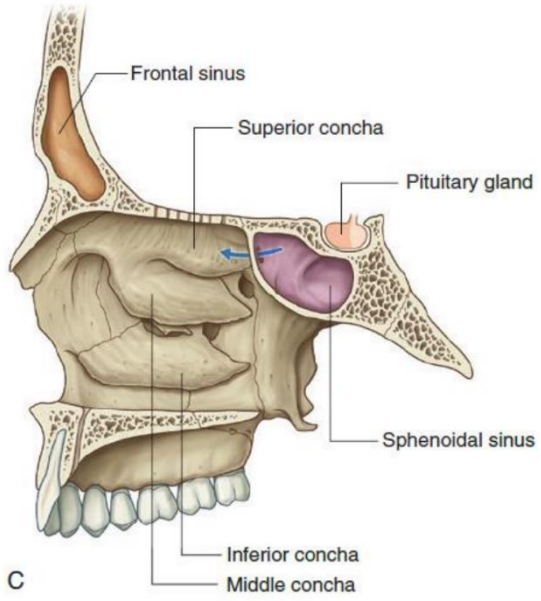
Relations

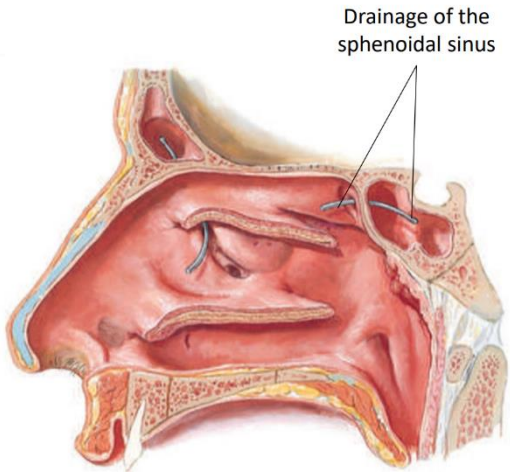
- **Above** to the pituitary gland and to the optic chiasm (the pituitary gland can be surgically approached)
- **Laterally** to the cavernous sinuses
- **Below and in front**, to the nasal cavities.

Note: If there is an invasive tumor in the pituitary gland, it causes changes in the underlying bone and compresses the sphenoidal sinus



Look to the relation between cavernous sinus and sphenoidal sinuses





You can study this sheet by using my Notion in Ju medicine

لا اله الا انت سبحانك اني كنت من الظالمين ... يا رب انصر اهلنا في غزة والسودان وسوريا واليمن وفي كل مكان يذكر فيه اسمك يا الله