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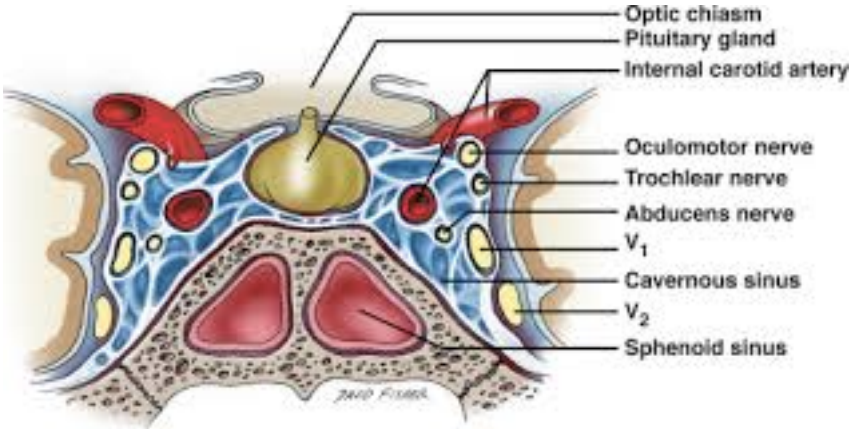
MATRIC NUMBER: 17/MHS01/258
COURSE: GROSS ANATOMY OF THE HEAD AND NECK(ANA 301)

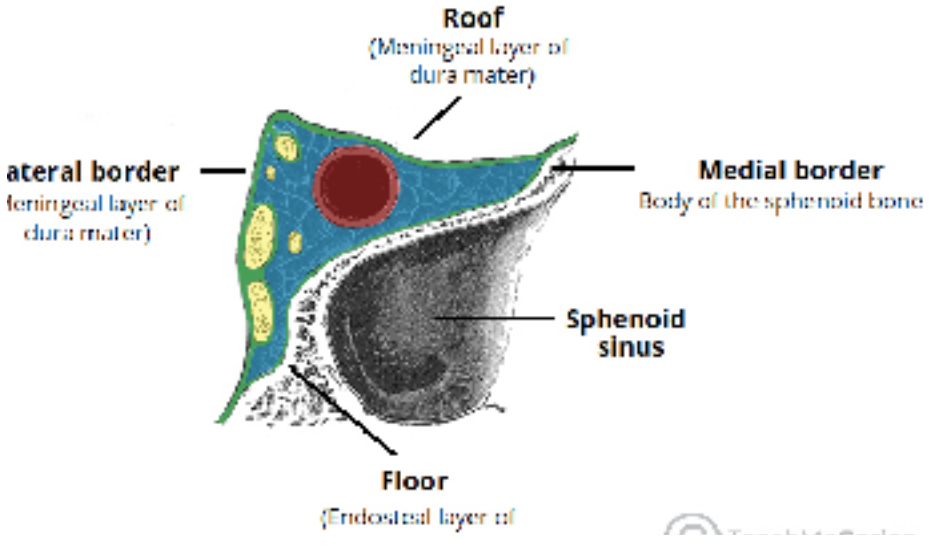
QUESTION
1) Write an essay on the cavernous sinus
2) Discuss the walls of the nose

ANSWERS
1) CAVERNOUS SINUS



The cavernous sinus is a paired dural venous sinus located within the cranial cavity. It is divided by septa into small 'caves' from which it gets its name.The dural venous sinuses are channels between the two layers of dura mater which are responsible for the venous drainage of the brain, skull, orbit and internal ear. The cavernous sinus has been described as an anatomical jewel box owing to its complexity.

SITE OF THE CAVERNOUS SINUS:The cavernous sinuses are located within the middle cranial fossa, on either side of the sella turcica of the sphenoid bone (which contains the pituitary gland). They are enclosed by the endosteal and meningeal layers of the dura mater. Each sinus extends from the superior orbital fissure to the apex of the temporal bone posteriorly.



BORDERS OF THE CAVERNOUS SINUS

The borders of the cavernous sinus are as follows:

- Anterior – superior orbital fissure.
- Posterior – petrous part of the temporal bone.
- Medial – body of the sphenoid bone.
- Lateral – meningeal layer of the dura mater running from the roof to the floor of the middle cranial fossa.
- Roof – meningeal layer of the dura mater that attaches to the anterior and middle clinoid processes of the sphenoid bone.
- Floor – endosteal layer of dura mater that overlies the base of the greater wing of the sphenoid bone.

A number of important structures pass through the cavernous sinus to enter the orbit. Some pass through the cavernous sinus itself while others pass through the lateral wall of the cavernous sinus.

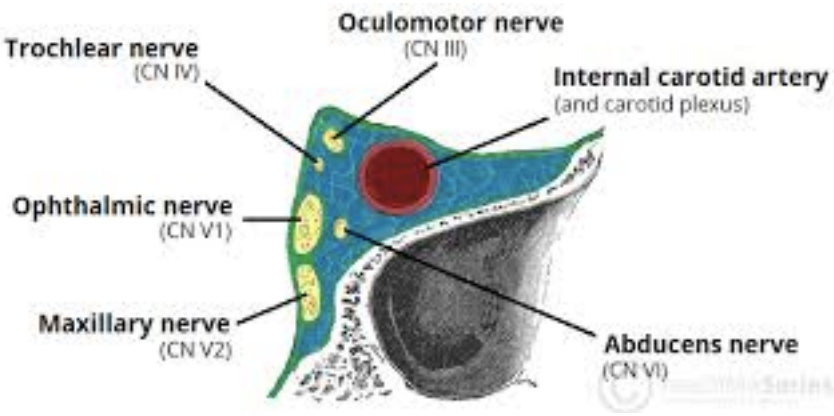
STRUCTURES PASSING THROUGH CAVERNOUS SINUS:

- Abducens nerve(CN VI)
- Carotid plexus(post ganglionic sympathetic nerve fibre)
- Internal carotid artery(cavernous portion)

STRUCTURES PASSING THROUGH LATERAL WALL OF THE CAVERNOUS SINUS

- Oculomotor nerve (CN III)
- Trochlear nerve (CN IV)
- Ophthalmic (VI) and maxillary (V2) branches of the trigeminial nerve

NOTE: The cavernous sinus is the only site in the body where an artery(internal carotid) passes through a vents structure. This is thought to allow for heat exchanger between the warm arterial blood and cooler venous circulation.



The cavernous sinus receives venous drawing from:

A. *Ophthalmic veins (superior and inferior):* These enter the cavernous sinus via the superior orbital fissure.

Superior ophthalmic vein forms anastomosis with the facial vein. Therefore, the ophthalmic veins represent a potential route by which infection can spread from an extra cranial to an intracranial site.

B. *Central vein of the retina*: It drains into the superior ophthalmic vein, or directly into the cavernous sinus.
C. *Sphenoparietal sinus*: empties into the anterior aspect of the cavernous sinus.
D. *Superficial middle cerebral vein*: contributes to the venous drainage of the cerebrum
E. *Pterygoid plexus:* it is located within the infra temporal fossa

The cavernous sinus empties into:

I. Superior and inferior petrosal sinuses and ultimately into the internal jugular vein

The left and right cavernous sinuses are connected in the midline by the anterior and posterior inter cavernous sinuses. They travel through the sella turcica of the sphenoid bone.

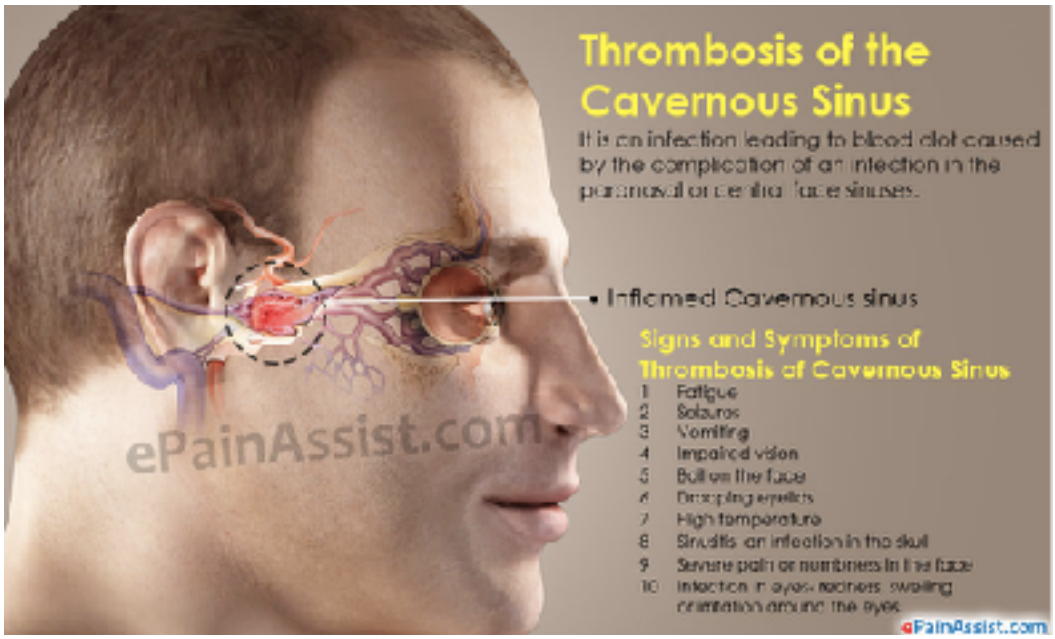
NOTE: Cavernous sinus is of great clinical importance because of the connection and structures that pass through it.

CLINICAL ANATOMY

- Ophthalmic veins represent a potential route by which infection can spread from extra cranial site to an intracranial site.
- Structures that pass through the cavernous sinuses and are located in the walls of these sinuses they are vulnerable to injury due to inflammation.
- ***Cavernous Sinus Thrombosis***: It refers to the formation of a clot within the cavernous sinus.the most common cause is infection. Infection is able to spread in this Manner due to the anastomosis between the facial vein and superior ophthalmic veins.

Symptoms include: headaches, unilateral periorbital oedema, proptosis(eye bulging), photophobia and canal nerves palsies. The abducens nerve is most commonly affected.

Treatment is typically with antibiotics therapy. Where the cause is infection, thrombosis of the cavernous sinus can rapidly progress to meningitis.



2) WALLS OF THE NOSE

The nose is an olfactory and respiratory organ. It consists of nasal skeleton, which houses the nasal cavity.

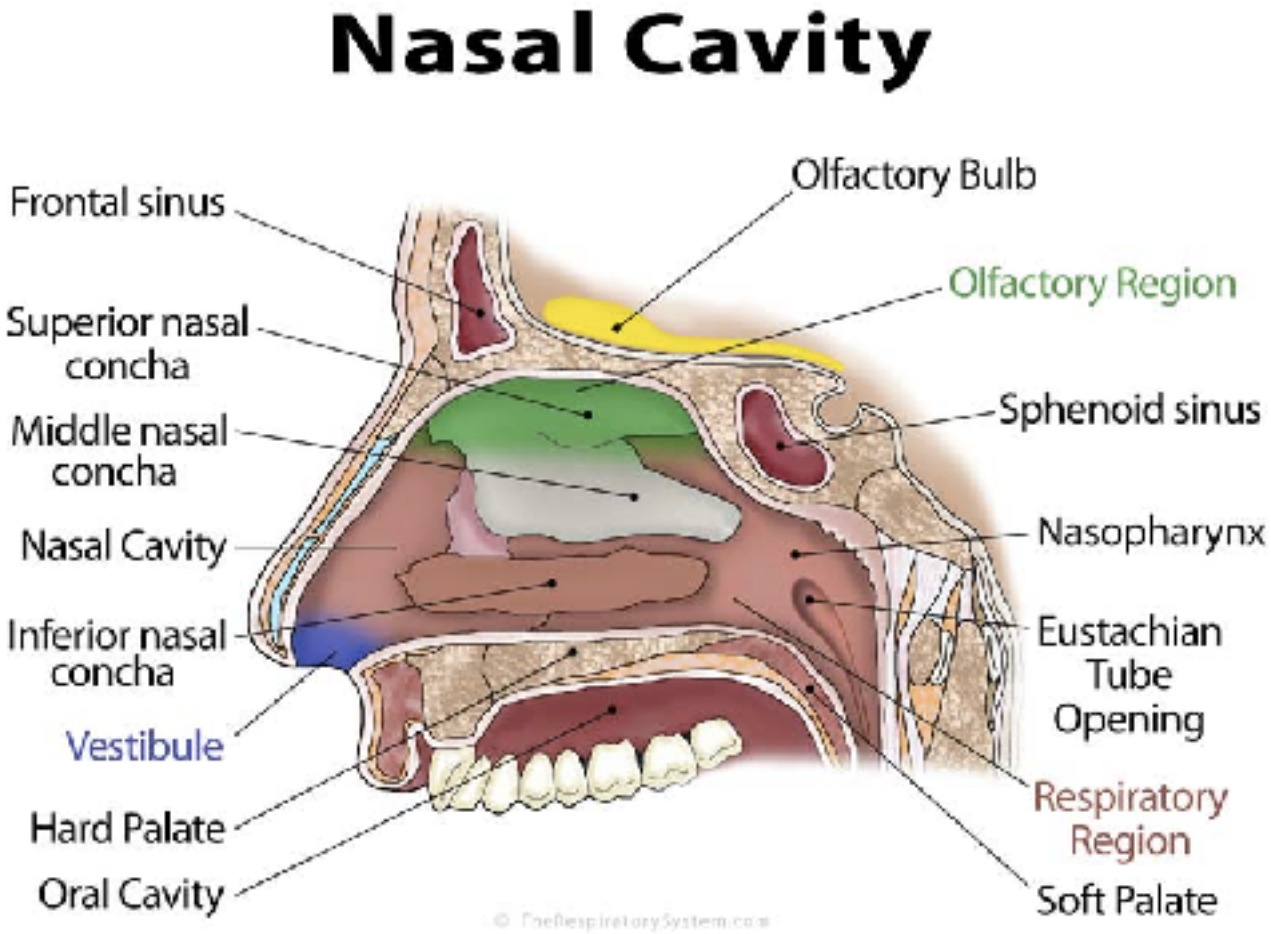
The walls of the nose includes:

- Medial wall
- Lateral wall

A. MEDIAL WALL

The medial wall of the nasal cavity comprises the nasal septum, the septal cartilage and various bones of the skull.

I. NASAL SEPTUM

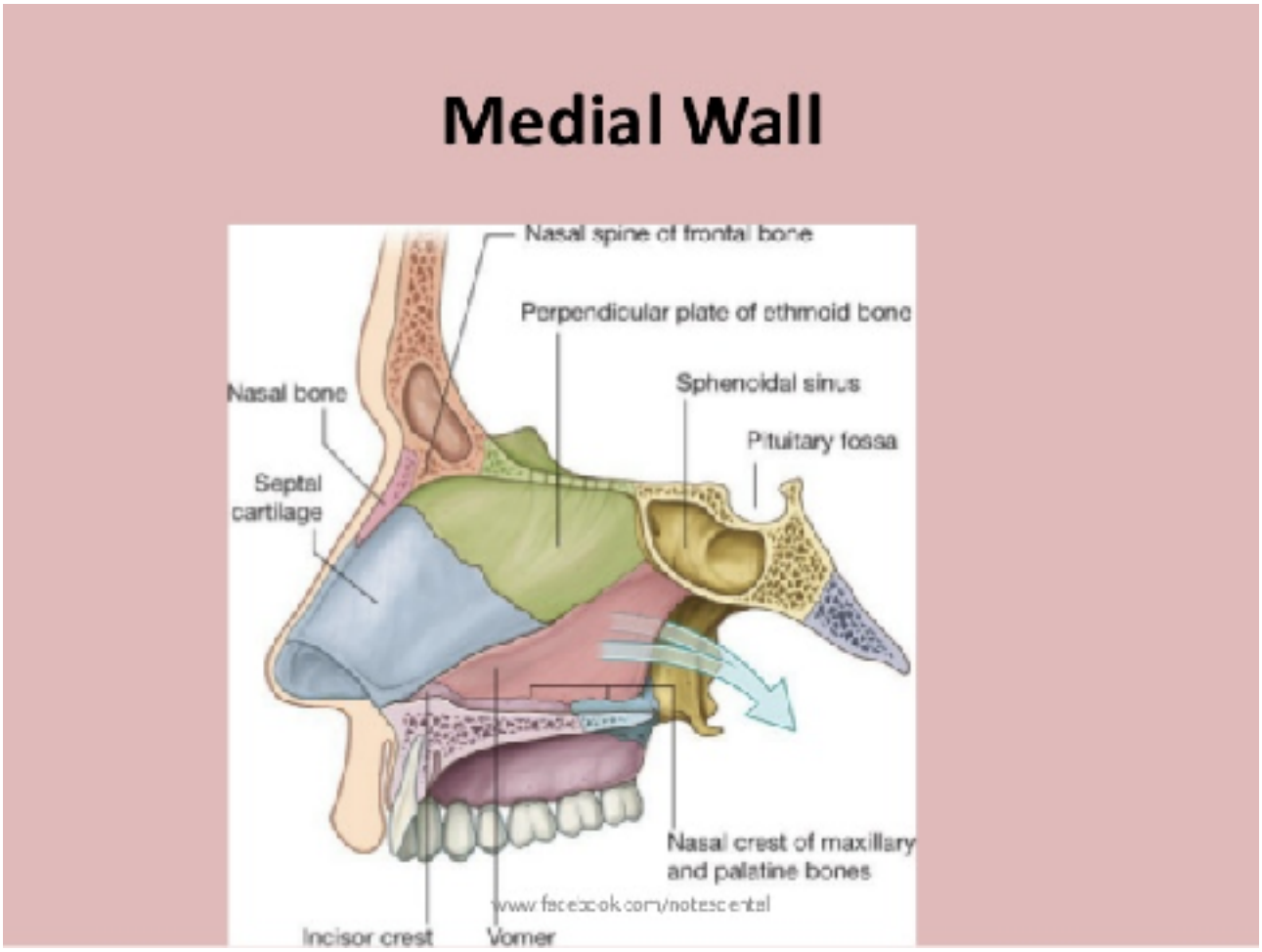


The nasal septum is a structure consisting of both bony and cartilaginous components. The bony components are the:

- perpendicular plate of the ethmoid superoinferiorly
- the vomer posteroinferiorly
- the crests of the maxillary bone anteroinferiorly
- the crest of the palatine bone inferior to the vomer

II. <u>THE SEPTAL CARTILAGE</u>

The septal cartilage is approximately 3-4mm thick. It divides the nasal cavity into two halves. The anteroinferior part of the cartilage has an expansion known as the ‘footplate’ which is 4-8mm wide. This foot plate lies in free contact with the membranous septum. The cartilage is expanded in other regions, namely the junction with the lateral nasal cartilage termed the posterior process. The cartilage is firmly adhered to the nasal bone by taut collagen fibres
The cartilage of the septum is also termed the ‘quadrangular cartilage’ due to its shape. The posterior nasal spine is a sharp pointed projection of the posterior border of the palatine bone. The musculus uvula gains its attachment here.



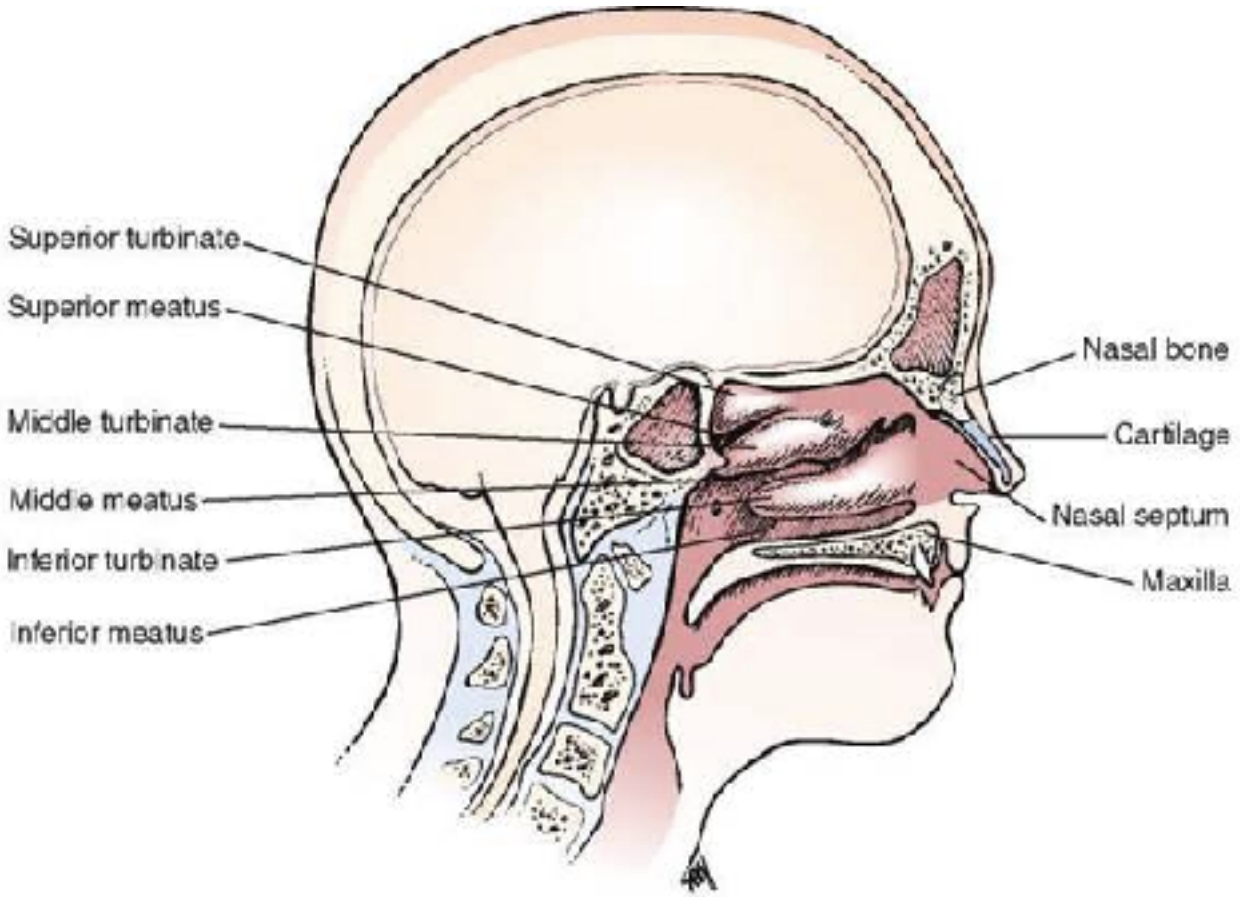
B) **<u>LATERAL WALL</u>**:

They are irregular owing to the three bony plates, the nasal conchae, which project inferiorly, somewhat like louvers. It is a region of the nasopharynx essential for humidifying and filtering the air we breathe in nasally It includes:

- The presence of nasal conchae and they curve inferomedially. The nasal conchae includes: superior nasal conchae, middle nasal conchae and inferior nasal conchae.
- Underneath, each concha in both humans and animals with complex turbinates is a recess or meatus

<u>NASAL CONCHAE</u>: The concha is covered by a mucous membrane that contains large vascular spaces and is one of the three that work to both humidify and clear the air that passes into the nasopharynx.

They project into the nasal cavity, creating four pathways for the air to flow. These pathways are called meatuses:



- **Inferior meatus** – between the inferior concha and floor of the nasal cavity. It is a horizontal passage.
- **Middle meatus** – between the inferior and middle concha. It is longer and deeper than the superior one.
- **Superior meatus** – between the middle and superior concha.
- **Spheno-ethmoidal recess** – superiorly and posteriorly to the superior concha.
- Common nasal meatus: it is the medial part of the nasal cavity between the conchae and the nasal septum, into which the lateral recesses and meatus open.

The function of the conchae is to increase the **surface area** of the nasal cavity – this increases the amount of inspired air that can come into contact with the cavity walls. They also disrupt the fast, laminar flow of the air, making it slow and turbulent. The air spends longer in the nasal cavity, so that it can be humidified.

- Here we can find a structure called agger nasi. The agger nasi is also referred to as the ‘nasoturbinal concha’ or ‘nasal ridge.’ It can be described as a small mound or ridge found in the lateral side of the nasal cavity. The structure is located midway along the anterior aspect of the middle nasal concha. An abnormally enlarged form may restrict the drainage of the frontal sinus by

obstructing the frontal recess area.

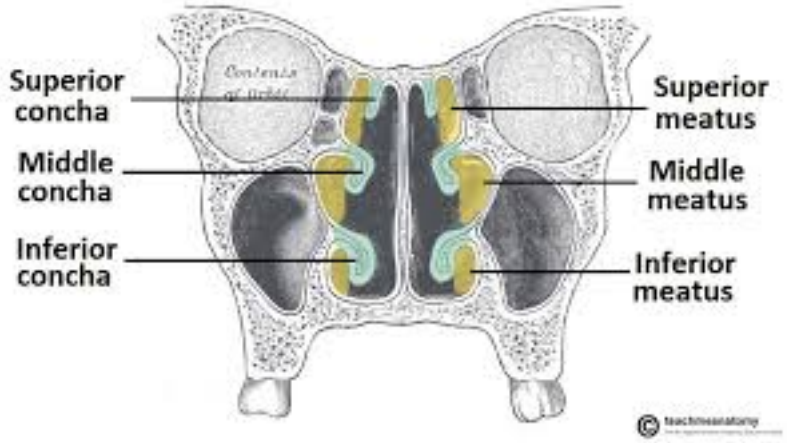
TYPES OF NASAL CONCHAE

- *Inferior nasal concha*. It is the longest and broadest of the conchae and is formed by an independent bone (of the same name, inferior concha). The concha is covered by a mucous membrane that contains large vascular spaces and is one of the three that work to both humidify and clear the air that passes into the nasopharynx. When infected or irritated, the mucosa may swell rapidly, blocking the nasal passage on that side.

- *The middle nasal concha:* is found in between the superior and inferior nasal concha and plays a role in humidifying and clearing inspired air of micro-particles such as dirt.

- *The superior nasal concha* is a bony shelf located above the middle nasal concha and below the sphenoethmoidal recess. Similar to the middle nasal concha the superior concha is itself part of the ethmoid bone.

NOTE: Superior and middle nasal conchae arise from the perpendicular plate of the ethmoid bone



VASCULATURE OF THE WALLS OF THE NOSE

ARTERIAL SUPPLY

The nose has a very rich vascular supply, this allows it to effectively change humidity and temperature of inspired air. The nose receives blood from both the internal and external carotid arteries:

INTERNAL CAROTID BRANCHES:

-)Anterior ethmoidal artery

-) Posterior ethmoidal artery

The ethmoidal arteries are branch of the ophthalmic artery. They descend into the nasal cavity through the cribriform plate

EXTERNAL CAROTID BRANCHES:

-) Sphenopalatine artery
-) Greater palatine artery
-) Superior labial artery
-) Lateral nasal arteries

In addition to the rich blood supply, these arteries form anastomoses with each other. This is particularly prevalent in the anterior portion of the nose .

VENOUS SUPPLY

The veins of the nose tend to follow the arteries. They drain into the pterygoid plexus, facial vein or cavernous sinus, sphenopalatine and ophthalmic veins. In some individuals, a few nasal veins join with the sagittal sinus (a dural venous sinus). This represents a potential pathway by which infection can spread from the nose into the cranial cavity.

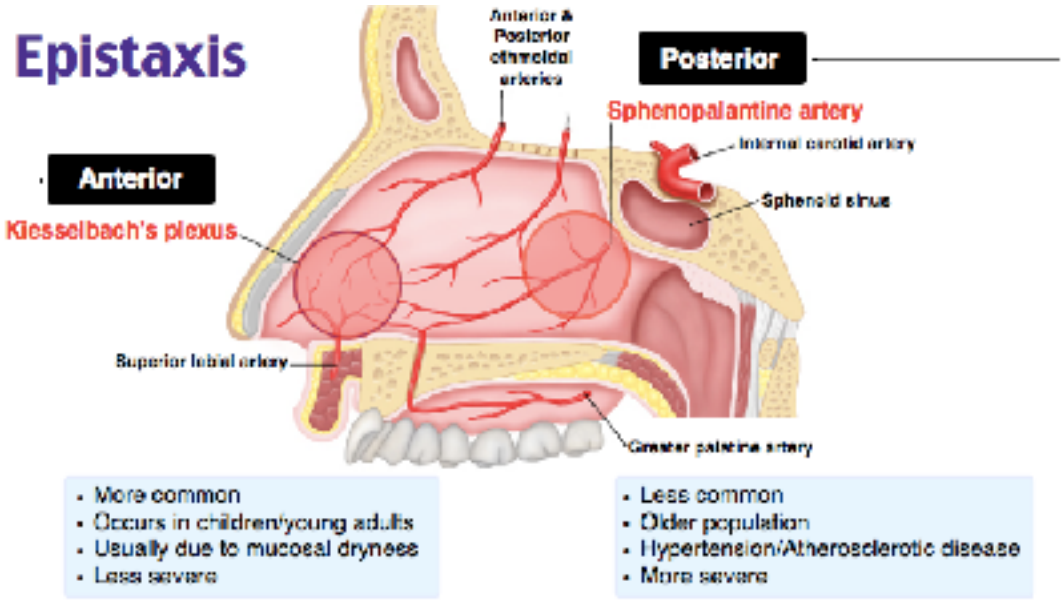
INNERVATION

It is innervated by:

-) olfactory nerve
-) branches of the ophthalmic (V1) which include the anterior and posterior ethmoidal nerves.
-) maxillary (V2) nerves which includes:
    *) posterior superior lateral nasal nerves
    *) posterior superior medial nasal nerves
    *) nasopalatine nerve
    *) posterior inferior nasal nerves

CLINICAL ANATOMY

I. EPISTAXIS: Epistaxis is the medical term for a nosebleed. Due to the rich blood supply of the nose, this is a common occurrence. It is most likely to occur in the anterior third of the nasal cavity, this area is known as the Kiesselbach area. The cause can be local (such as trauma), or systemic (such as hypertension). It is also associated with infections and hypertensions. Mild epistaxis can be caused from nose picking.



II. RHINITIS: The nasal mucosa becomes swollen and inflamed (rhinitis) during severe upper respiratory infections and allergic reactions(eg hay fever). Swelling of the mucosa occurs readily because of its vascularity.
III. DEFLECTED NASAL SEPTUM
IV. IMPACTION OF FOREIGN BODY

NOTE: Infections of the nasal cavities may spread to the:

- Anterior cranial fossa through the cribriform plate
- Nasopharynx and retropharyngeal soft tissues
- Middle ear through the pharyngotympanic tube (auditory tube), which connects the tympanic cavity and nasopharynx
- Paranasal sinuses
- Lacrimal apparatus and conjunctiva