

GROSS ANATOMY ASSIGNMENT

NAME: OLORUNFEMI PEACE TOLUWALASE

MATRIC NO: 17/MHS01/257

DEPT: MBBS

COURSE: GROSS ANATOMY OF HEAD AND NECK

QUESTION 1

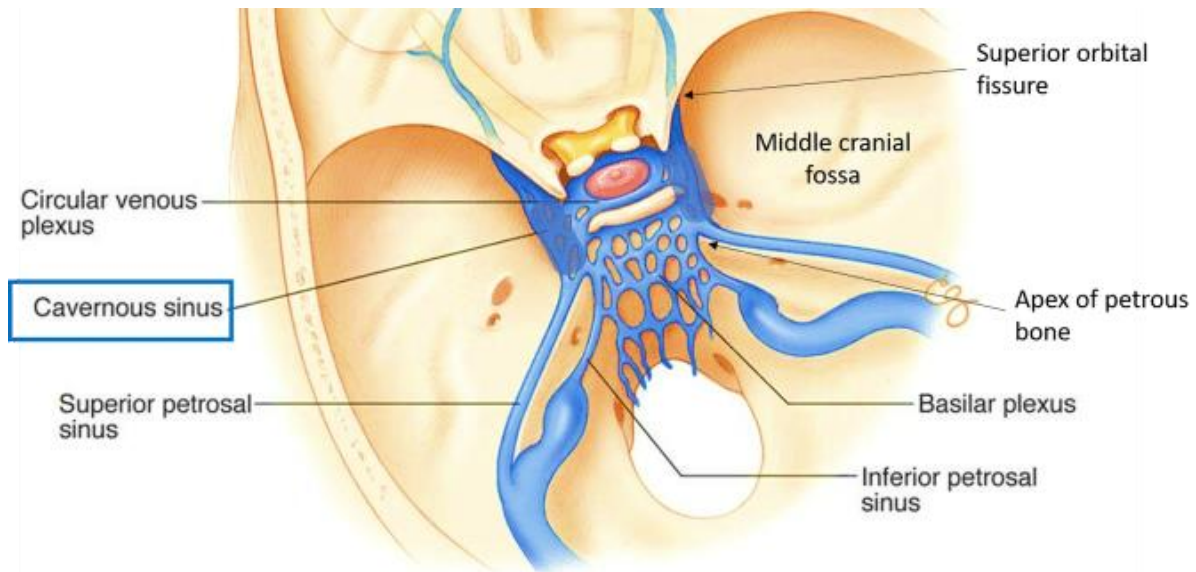
Write an essay on the cavernous sinus.

The **cavernous sinuses** are one of several drainage pathways for the brain that sits in the middle. In addition to receiving venous drainage from the brain, it also receives tributaries from parts of the face.

STRUCTURE

- The cavernous sinuses are 1 cm wide cavities that extend a distance of 2 cm from the most posterior aspect of the **orbit** to the **petrous part of the temporal bone**.
- They are bilaterally paired collections of venous plexuses that sit on either side of the sphenoid bone.
- Although they are not truly trabeculated cavities like the corpora cavernosa of the penis, the numerous plexuses, however, give the cavities their characteristic sponge-like appearance.
- The cavernous sinus is **roofed** by an inner layer of dura matter that continues with the diaphragma sellae that covers the superior part of the pituitary gland. The roof of the sinus also has several other attachments.
- Anteriorly, it attaches to the anterior and middle **clinoid processes**, posteriorly it attaches to the **tentorium** (at its attachment to the posterior clinoid process). Part of the periosteum of the greater wing of the sphenoid bone forms the floor of the sinus.

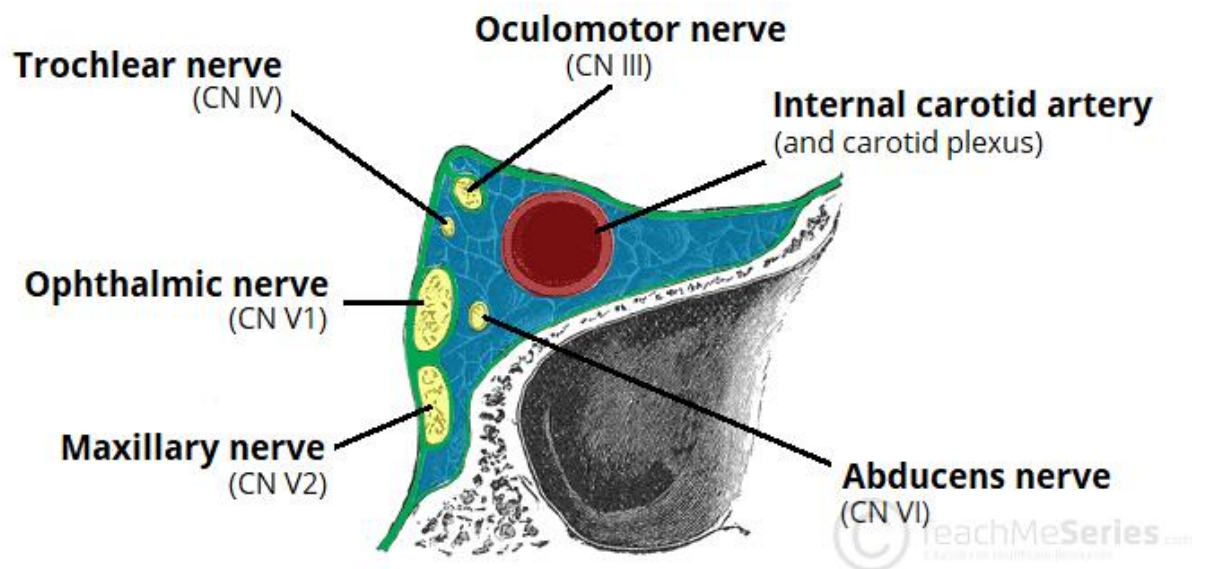
- The body of the sphenoid acts as the medial wall of the sinus while the lateral wall is formed from the visceral part of the dura mater.

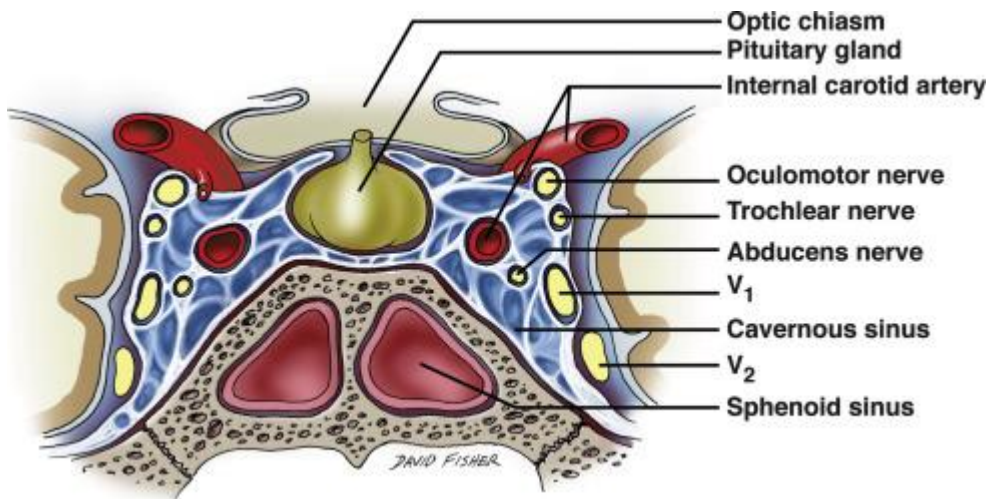


CONTENTS

The cavernous sinus contains the internal carotid artery and several cranial nerves. Abducens nerve (CN VI) traverses the sinus lateral to the internal carotid artery. The remainder of the cranial nerves pass through the lateral wall of the carotid sinus, and from superior to inferior they are:

- Oculomotor nerve (CN III)
- Trochlear nerve (CN IV)
- Trigeminal nerve (CN V) - ophthalmic and maxillary divisions.
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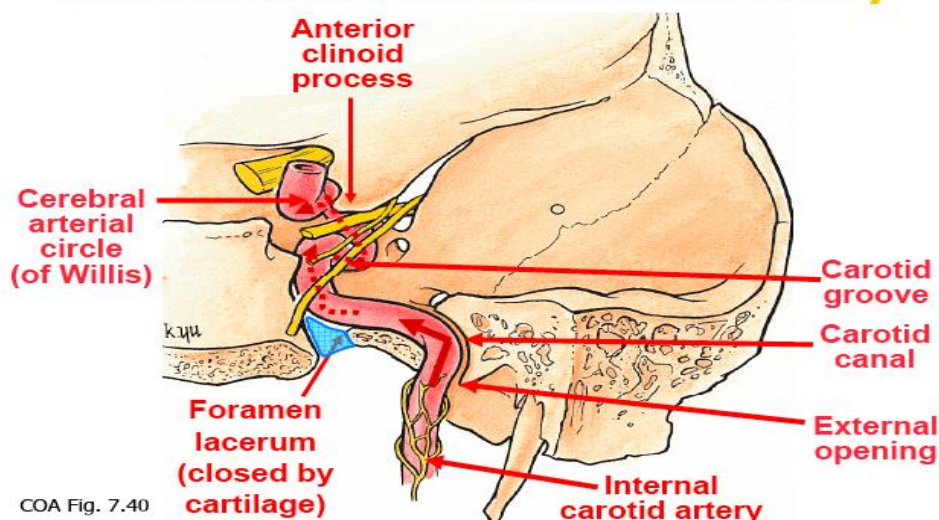




a) Internal Carotid Artery:

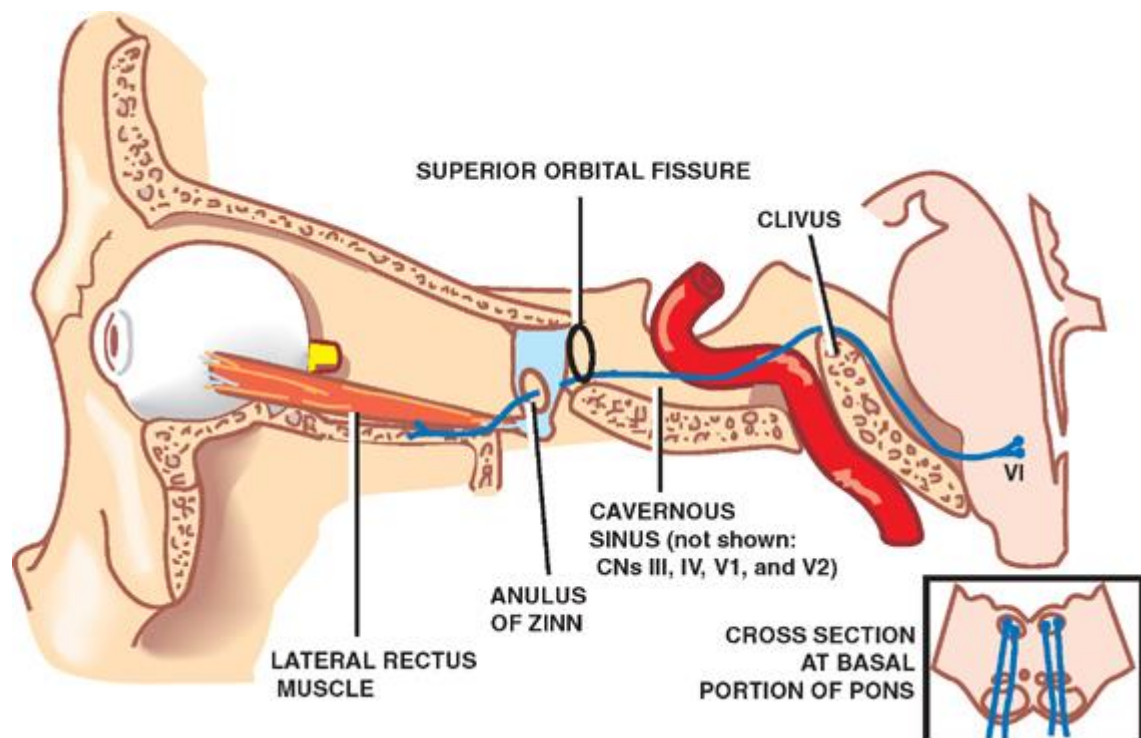
- The internal carotid artery (a branch of the common carotid artery) – along with its postganglionic **sympathetic plexus** from the superior cervical ganglion – gains access to the cavernous sinus posteriorly.
- As the ***petrous part*** of the internal carotid artery leaves the ***carotid canal***, it curves vertically and superiorly above ***foramen lacerum*** to enter the cavernous sinus. Here the artery is also referred to as the cavernous part.
- Within the sinus, the internal carotid artery travels anteriorly, in a horizontal manner until it reaches the anterior limit of the sinus. Here it curves vertically and superiorly to exit the sinus through its roof and become the ***cerebral part*** of the internal carotid artery.
- **It is noteworthy that the cavernous part of the internal carotid artery is the only arterial vessel that is completely surrounded by venous networks.** This fact is of great clinical significance.

Path of the Internal Carotid Artery



b) Abducent nerve:

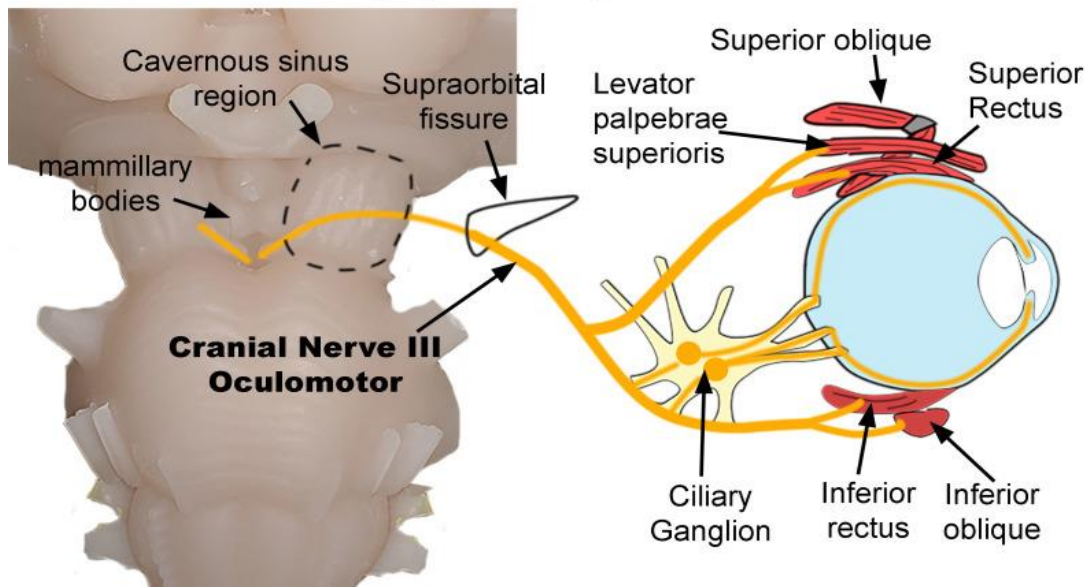
- This motor nerve leaves the **pons** and gains access through the posterior part of the sinus after passing of the apical portion of the petrous temporal bone.
- It has also been known to access the cavernous sinus by way of the **petrosal sinus**, adjacent to **the clivus**.
- Within the cavernous sinus, it takes an inferolateral course, relative to the internal carotid artery.
- It exits the sinus by way of the **superior orbital fissure** to gain access to the orbit, where it innervates the **lateral rectus muscle** of the eyeball.



c) Oculomotor nerve:

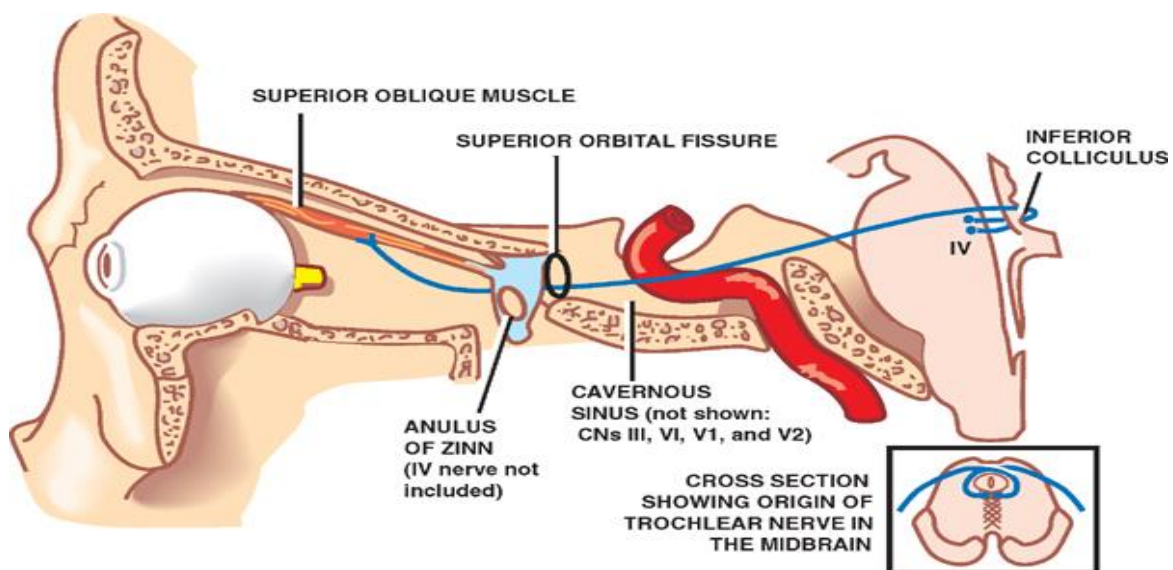
- This is the most superior of the four nerves in the lateral wall. At the posterior aspect of the roof of the cavernous sinus, the free and attached edges of tentorium cerebelli forms a space through which CN III (oculomotor nerve) enters the lateral wall of the sinus.
- It takes an anterior, inferomedial course (relative to the other nerves in the lateral wall) towards the anterior extremity of the sinus.
- Here it bifurcates into its **superior and inferior rami** that pass through the **superior orbital fissure**. Along with **sympathetic fibers** from the internal carotid plexus, CN III provides motor supply to **inferior oblique**, **levator palpebrae superioris**, and the **inferior, medial and superior recti muscles**.

Oculomotor Nerve (III) Pathway



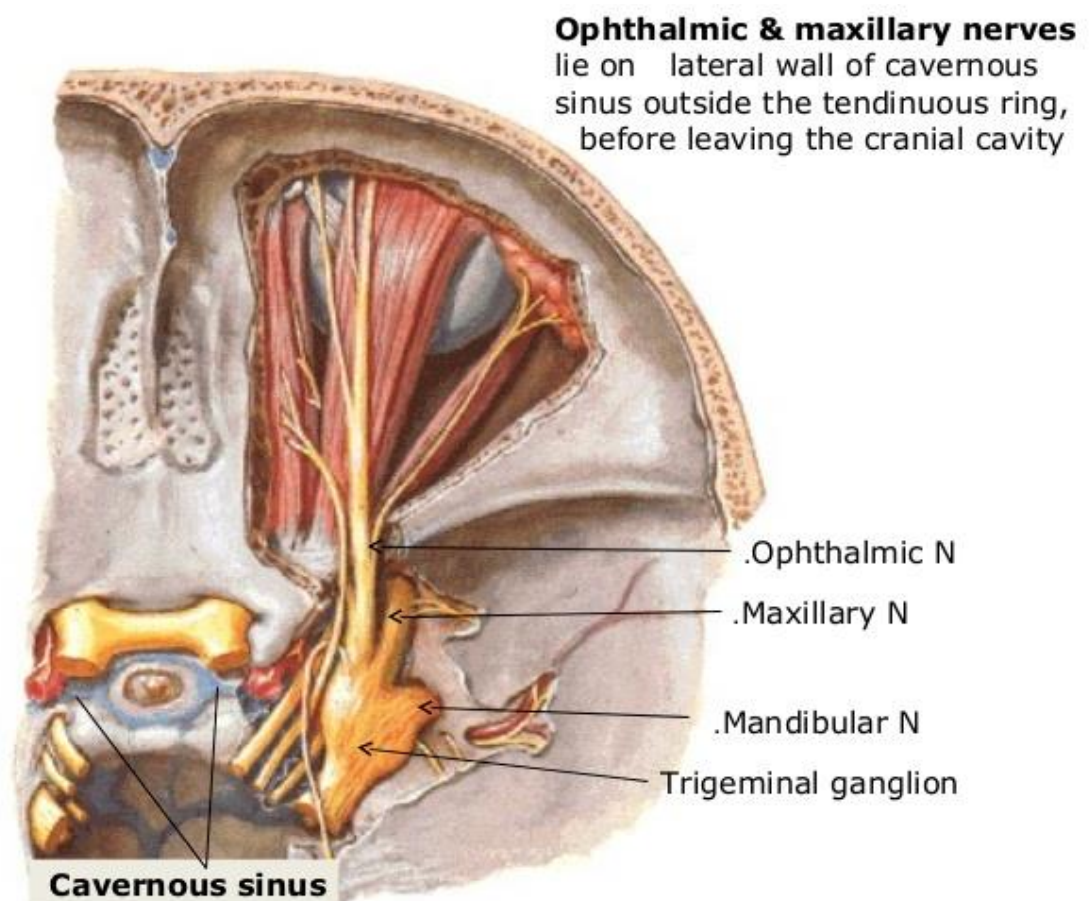
d) Trochlear nerve:

- The smallest of the cranial nerves, the trochlear nerve, enters the posterior aspect of the cavernous sinus after leaving the posterior part of the **brainstem** and **decussating with** the same nerve from the opposite side.
- It continues anteriorly in the lateral wall of the cavernous sinus, inferior to CN III and passes through the **superior orbital fissure** at the anterior aspect of the sinus.
- Once in the orbit, CN IV has the responsibility of innervating the **superior oblique muscles of the eyeball**.



e) Trigeminal nerve:

- Finally, two of the three branches of the trigeminal nerve pass through the cavernous sinus. Prior to entering the cavernous sinus, the proximal portion of the nerve lies in **Meckel's cave**, where it forms the **trigeminal ganglion**.
- After leaving the cave, the **mandibular division (CN V3)** courses inferiorly to pass through **foramen ovale** (without entering the cavernous sinus).
- The other two branch **ophthalmic** and **maxillary (CN V1 and CN V2, respectively)**, travel through the lateral wall of the sinus. Both take courses inferior to CN III and CN IV, however, CN V2 is the most inferior of them all.
- Both CN V branches in the sinus travels horizontally. CN V2 leaves the sinus via **foramen rotundum**, while the three branches of CN V1 exit the cranial fossa via the **superior orbital fissure**. CN V1 and CN V2 are purely sensory and supply specific regions of the face.



Exit from the skull of trigeminal branches

N.B. trigeminal ganglion

lies at the apex of
petrous temporal
bone

The 3 divisions leave
the cranial cavity

: through

: **Ophthalmic branch. 1**

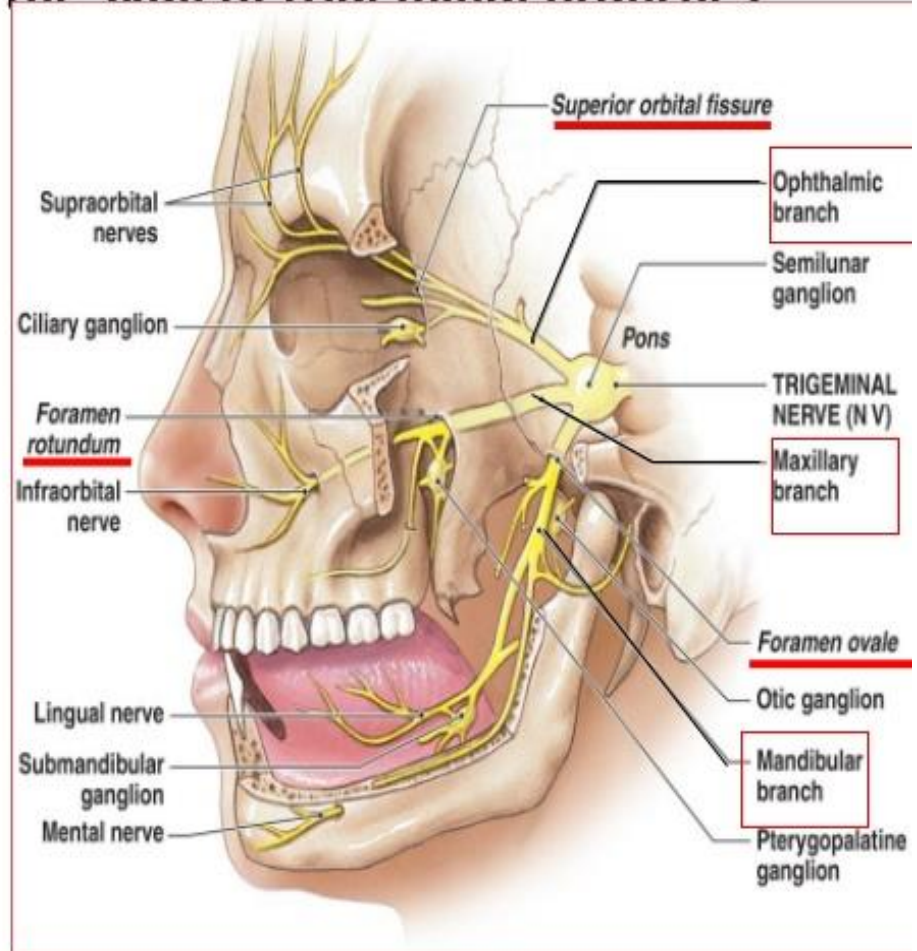
superior orbital
fissure

: **Maxillary branch. 2**

foramen rotundum

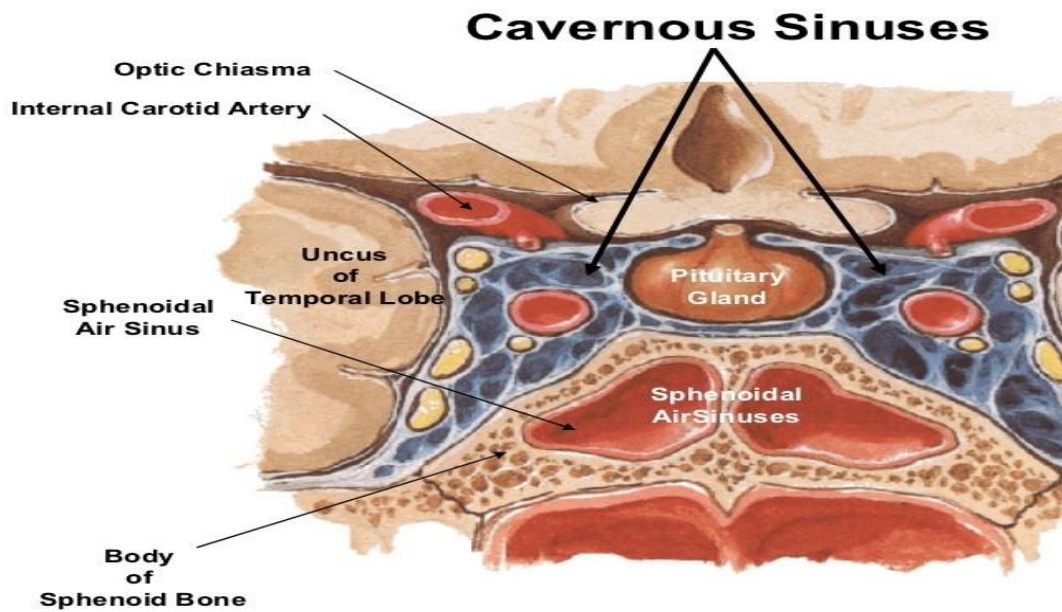
: **Mandibular branch. 3**

. foramen ovale



RELATIONS OF THE CAVERNOUS SINUS: There are numerous structures surrounding the cavernous sinus that are noteworthy.

- **Medially**, the sinus is adjacent to the lateral walls of the **pituitary fossa** with the pituitary gland, the **sphenoid bone** and its **air sinus**.
- **Superiorly**: The cerebral part of the **internal carotid artery**.
- **Laterally**: the medial aspect of the **temporal lobe** of each **cerebral hemisphere** lies adjacent to the sinus.
- **Posteriosuperiorly**: the **uncus** of the temporal lobe has a relation to the sinus.



COMMUNICATIONS:

The cavernous sinus is an unconventional venous system in the sense that it does not have a unidirectional flow of blood. Owing to the fact that there are no valves in the sinus and its connected veins, the direction of blood flow is dependent on venous pressure. The veins that communicate with the cavernous sinus are:

- Superior ophthalmic vein
- Inferior ophthalmic vein
- Superficial middle cerebral vein
- Middle meningeal vein
- Hypophyseal veins

Superior ophthalmic vein

The cavernous sinus generally has five venous tributaries. The **superior ophthalmic vein** receives blood from the ethmoidal, nasofrontal, vorticoses (drains the ocular choroid), and central retinal veins. It drains into the anterior part of the sinus via the superior orbital fissure.

Inferior ophthalmic vein

The **inferior ophthalmic vein** collects blood from the eyelids, lacrimal sac, and some vorticoses contributions, as well as the anterior floor and medial wall of the

orbit. In addition to draining to the cavernous sinus, it also drains to the pterygoid plexus.

Superficial middle cerebral vein

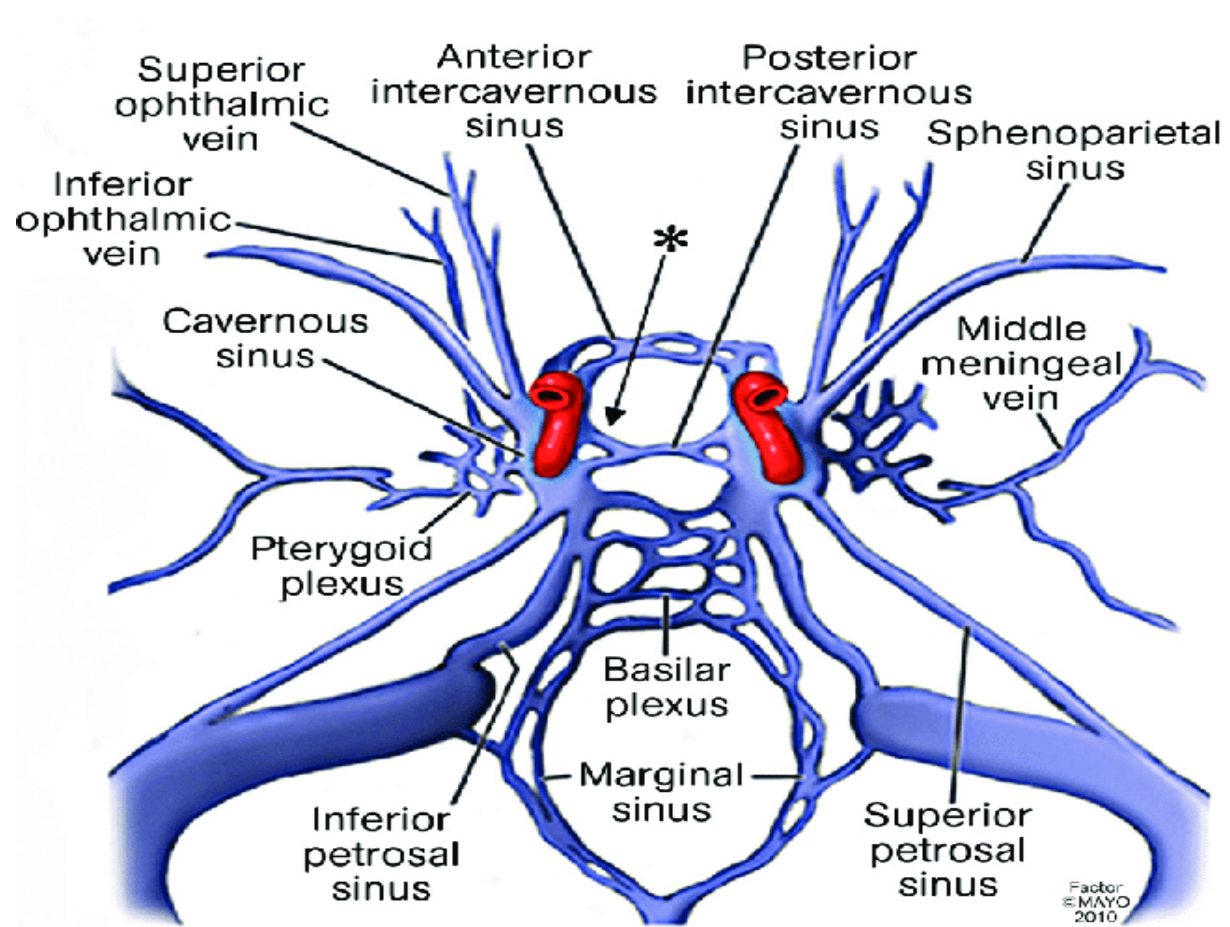
At the point where the internal carotid artery emerges, the **superficial middle cerebral vein** pierces the roof of the sinus. Here, it drains blood from the cortices that are adjacent to it as it courses through the lateral sulcus.

Middle meningeal vein

Finally, branches of the **middle meningeal vein** may join the **sphenoparietal sinus** on its way to the cavernous sinus. Before piercing the roof of the sinus, it travels along the edge of the lesser wing of the sphenoid between the layers of dura mater.

Hypophyseal veins

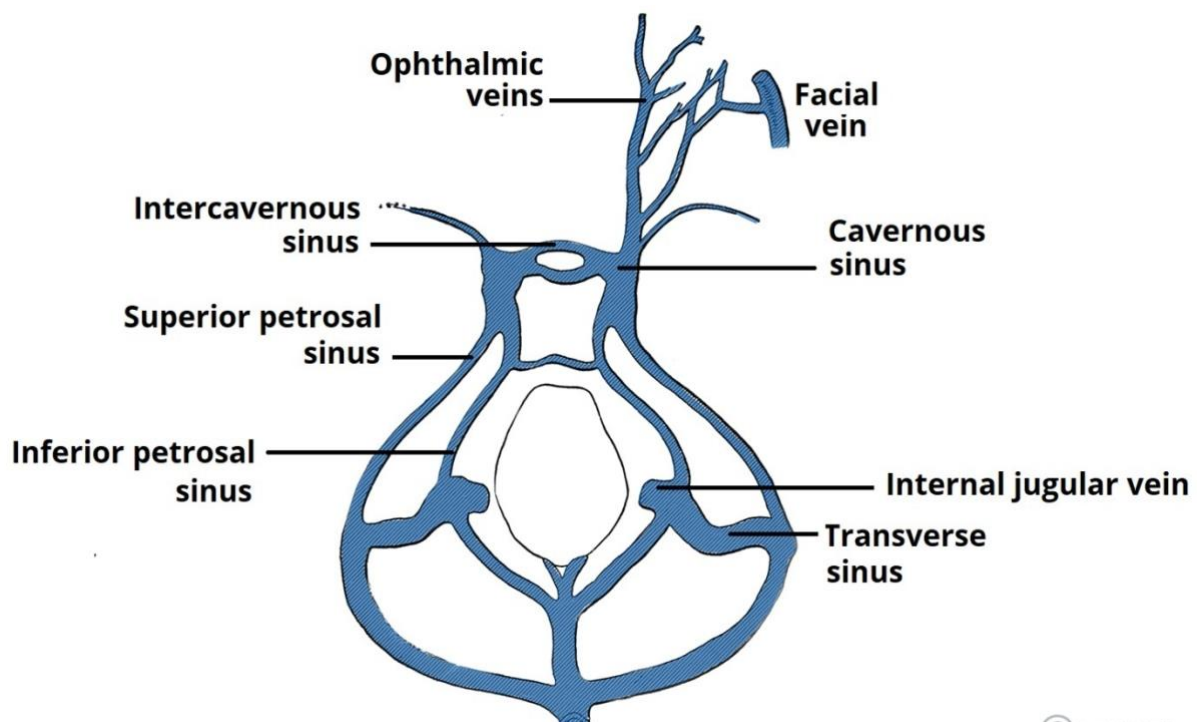
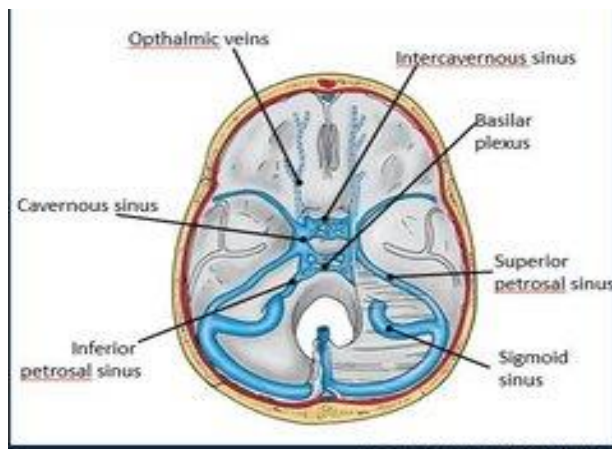
Additionally, **efferent hypophyseal veins** of both the adenohypophysis and neurohypophysis drain to the cavernous sinus.



Intercavernous sinuses and drainage

The left and right cavernous sinuses communicate by way of the **anterior and posterior intercavernous sinuses**. These vessels travel anteriorly and posteriorly (respectively) around the infundibulum of the pituitary gland, deep to the diaphragma sellae, between the layers of dura mater.

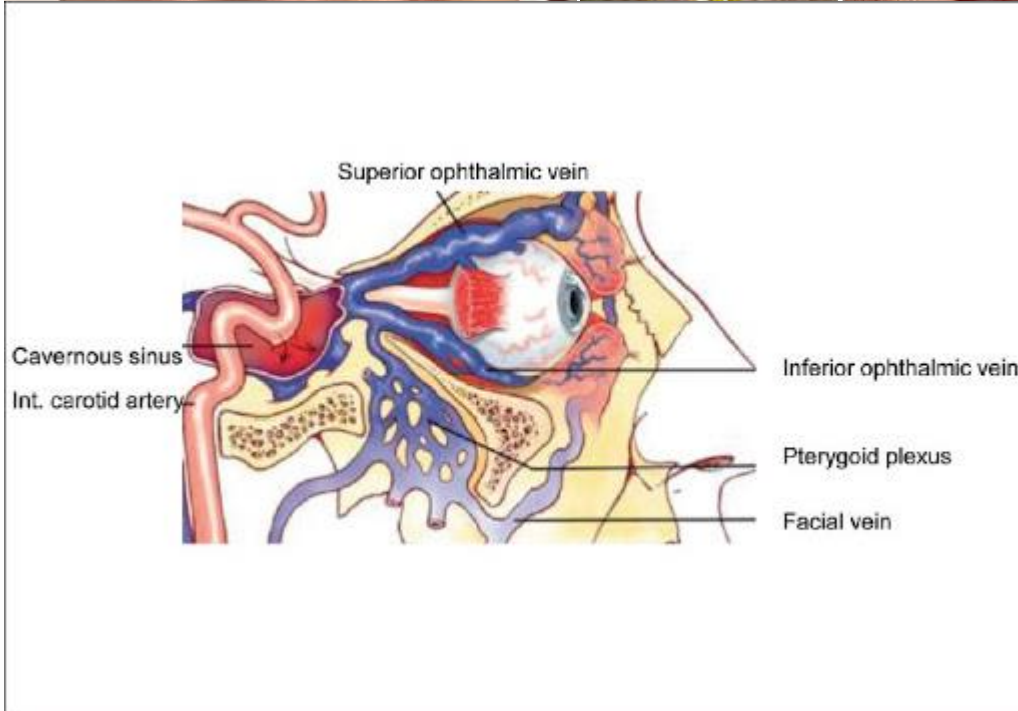
The cavernous sinus in turn drains to the **superior and inferior petrosal sinuses**. Both sinuses join the **sigmoid sinus**, which then becomes **the internal jugular vein**. The internal jugular vein meets with the **subclavian vein** to become the left (or right) **brachiocephalic vein**.



CLINICAL ANATOMY

- **Carotid-cavernous fistula**

Head trauma resulting in rupture of the cavernous part of the **internal carotid artery** can produce what is known as a carotid-cavernous fistula. A pulsating exophthalmos can result as the venous pressure in the sinus would increase and reverse the flow of blood in the ophthalmic veins.



- **Cavernous sinus thrombosis**

Particularly in the '**danger area**' (at the nasolabial crease and at the crease between the ala of the nose and the cheek), an infection can spread to the cavernous sinus, which can result in a cavernous sinus thrombosis. This condition can result in **internal strabismus** (crossed [eyes](#)) if the CN VI is damaged, **doubled vision** while looking downward if CN IV was damaged, or **ophthalmoplegia** (paralysis or weakness in muscles of movement of the eye).

Cavernous sinus thrombosis



Dr.GPK, OMFS

24

Thrombosis of the Cavernous Sinus

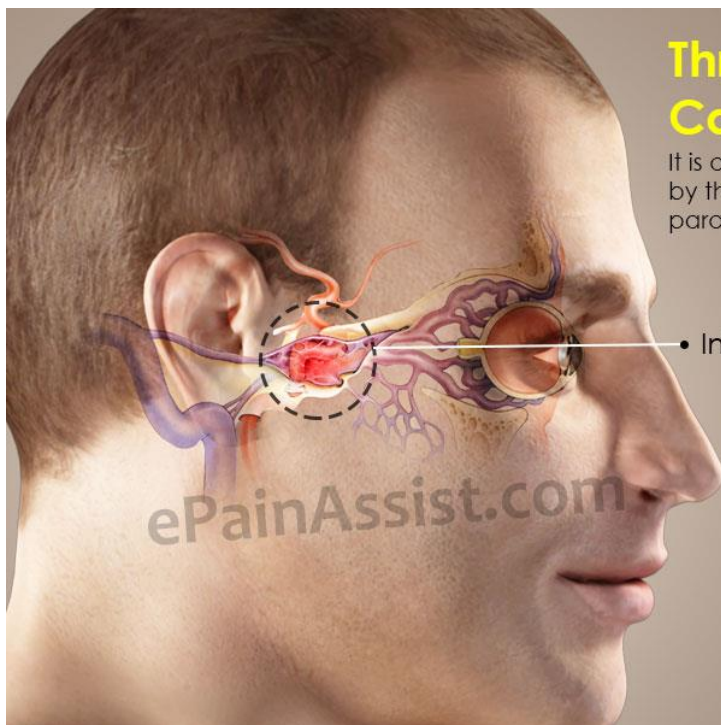
It is an infection leading to blood clot caused by the complication of an infection in the paranasal or central face sinuses.

• Inflamed Cavernous sinus

Signs and Symptoms of Thrombosis of Cavernous Sinus

- 1 Fatigue
- 2 Seizures
- 3 Vomiting
- 4 Impaired vision
- 5 Boil on the face
- 6 Drooping eyelids
- 7 High temperature
- 8 Sinusitis- an infection in the skull
- 9 Severe pain or numbness in the face
- 10 Infection in eyes- redness, swelling or irritation around the eyes

ePainAssist.com



ePainAssist.com

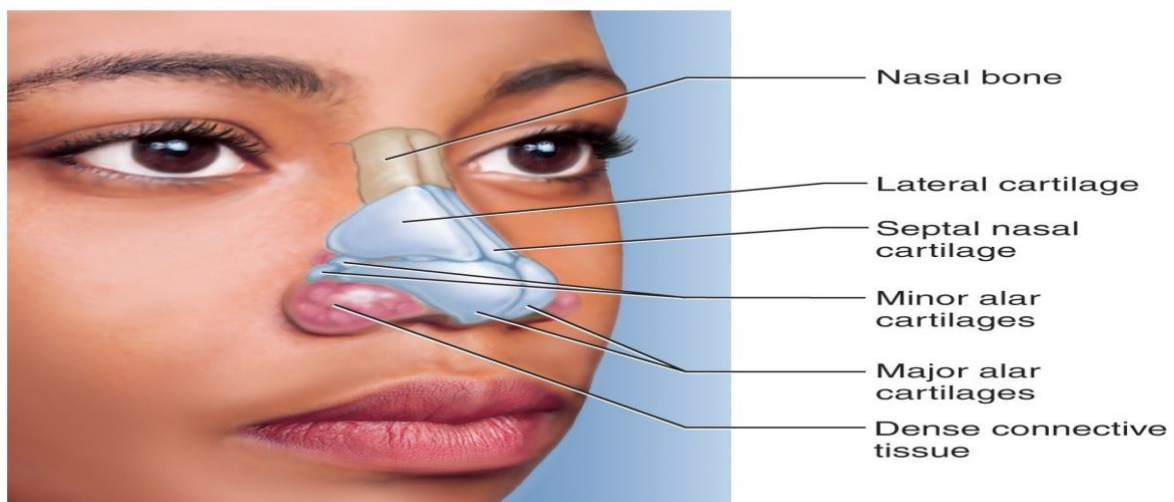
QUESTION 2

Discuss the walls of the nose.

The nose is the most prominent part of the human face. It has internal and external parts. The external nose functions to protect the inner nose and allows the entry of air.. It is involved in respiration, olfaction, speech and taste. The external nose is comprised of both bony and cartilaginous components. The bony part shapes the nose root, formed by the **nasal, maxillae** and **frontal** bones. The cartilaginous part is located inferiorly and is comprised of several alar, two lateral, and one septal cartilage:

- **Alar cartilages**; major alar cartilage forms the apex of the nose, minor alar cartilages support the ala nasi
- **Lateral processes** of the alar cartilage; form the dorsum of the nose
- **Septal cartilage**; bounds the nares medially

Note that the septal cartilage is attached to both the bony nasal septum (which is actually the perpendicular plate of the ethmoid bone) and the vomer bone. Both nasal septum and vomer are bony parts of the internal nose.



(b)

a-b: ©McGraw-Hill Education/Joe DeGrandis

The internal part of the nose is termed the **nasal cavity**. The two nasal cavities sit within the external nose and the adjacent skull. The cavities open anteriorly to the face through the two nares. Posteriorly the cavities communicate with the nasopharynx by two apertures called **choanae**.

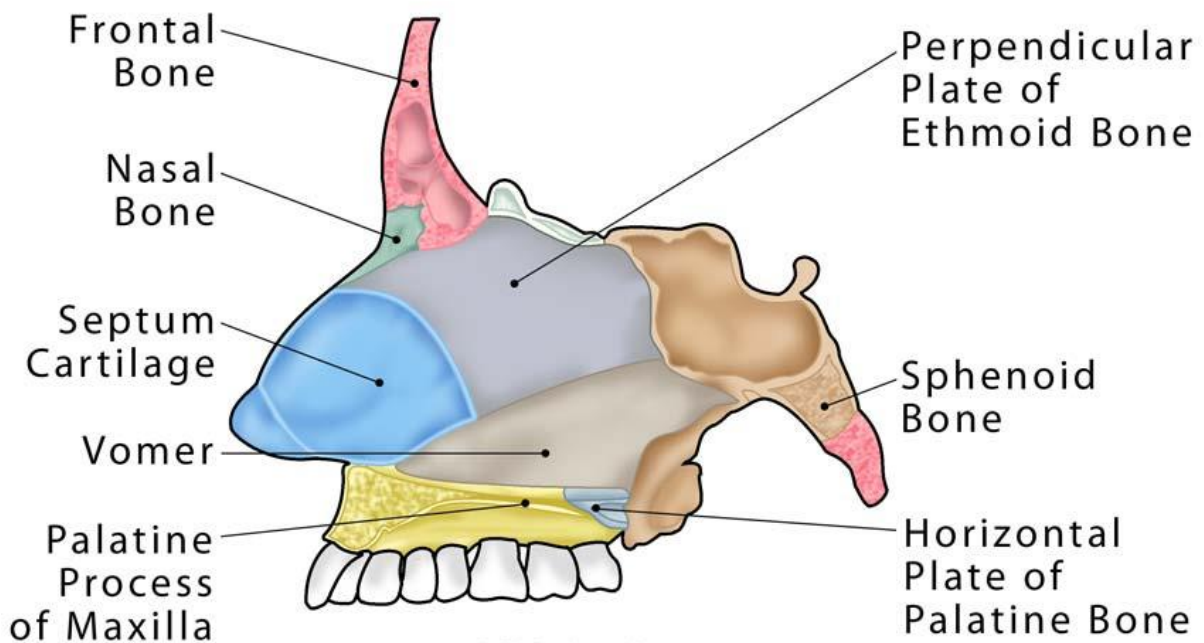
Besides the anterior and posterior apertures, each nasal cavity has a:

- Roof
- Floor
- Lateral walls
- medial walls

NOTE: There are 12 cranial bones in total that contribute to the nasal cavity structure, which include:

- The **paired:**
 - Nasal
 - Maxilla
 - Palatine
 - Lacrimal
- The **unpaired:**
 - Ethmoids
 - Sphenoid
 - Frontal
 - Vomer

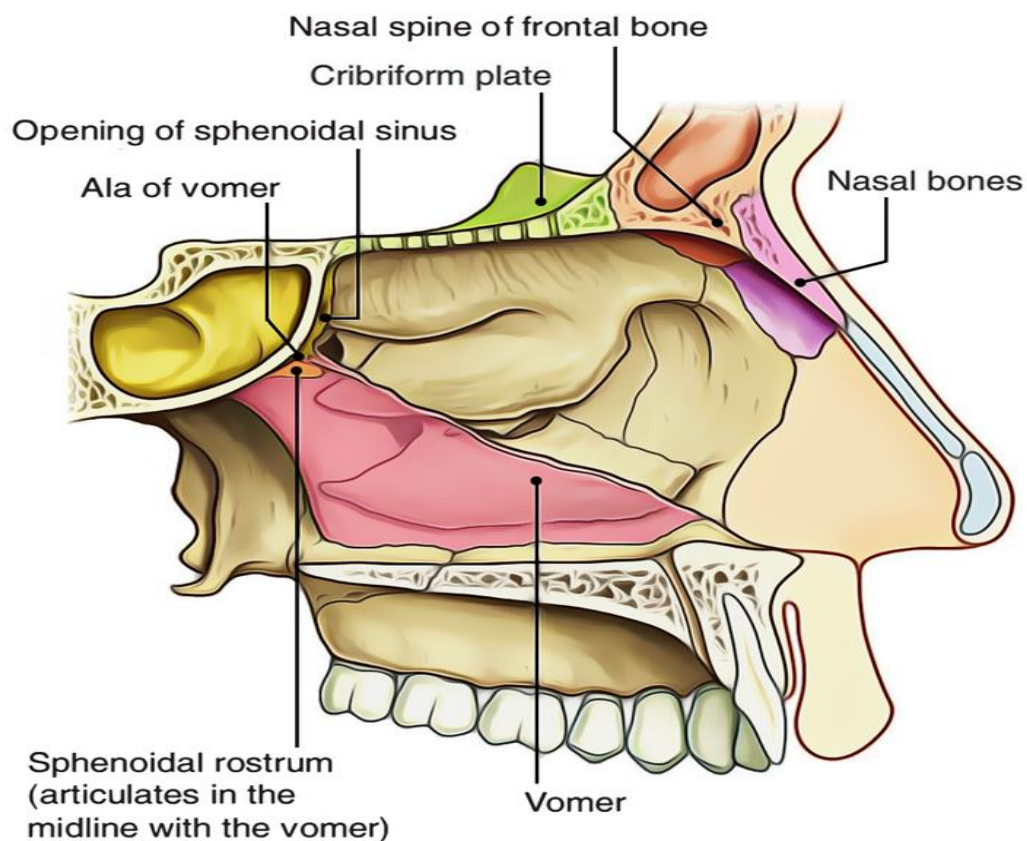
Bones Forming the Walls of Nasal Cavity



Among all of them, the **ethmoid** bone is the most important element, for two reasons:

- ✓ It makes the greatest portion of the nasal skeletal framework by forming the roof and walls of the nasal cavities.
- ✓ It contains **ethmoidal cells** which, as a group, are one of the four paranasal sinuses.

ROOF OF THE NASAL CAVITY: The roof of the nasal cavity is formed by **nasal** cartilages and several bones, chiefly the **nasal** and **frontal bones**, the **cribriform plate of the ethmoid**.



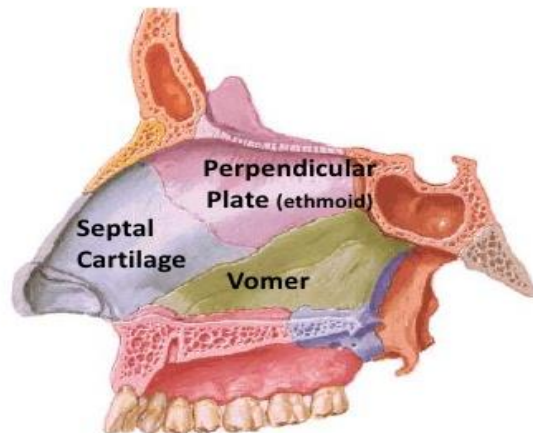
MEDIAL WALL: The medial wall of the nasal cavity comprises the **nasal septum**, the **septal cartilage** and various **bones** of the skull.

- 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
- 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.

The Medial Wall of Nasal Cavity

- The Nasal Septum
- Divides the nasal cavity into right and left halves
- It has osseous and cartilaginous parts
- Nasal septum consists of the **perpendicular plate of the ethmoid bone** (superior), the **vomer** (inferior) and **septal cartilage** (anterior)

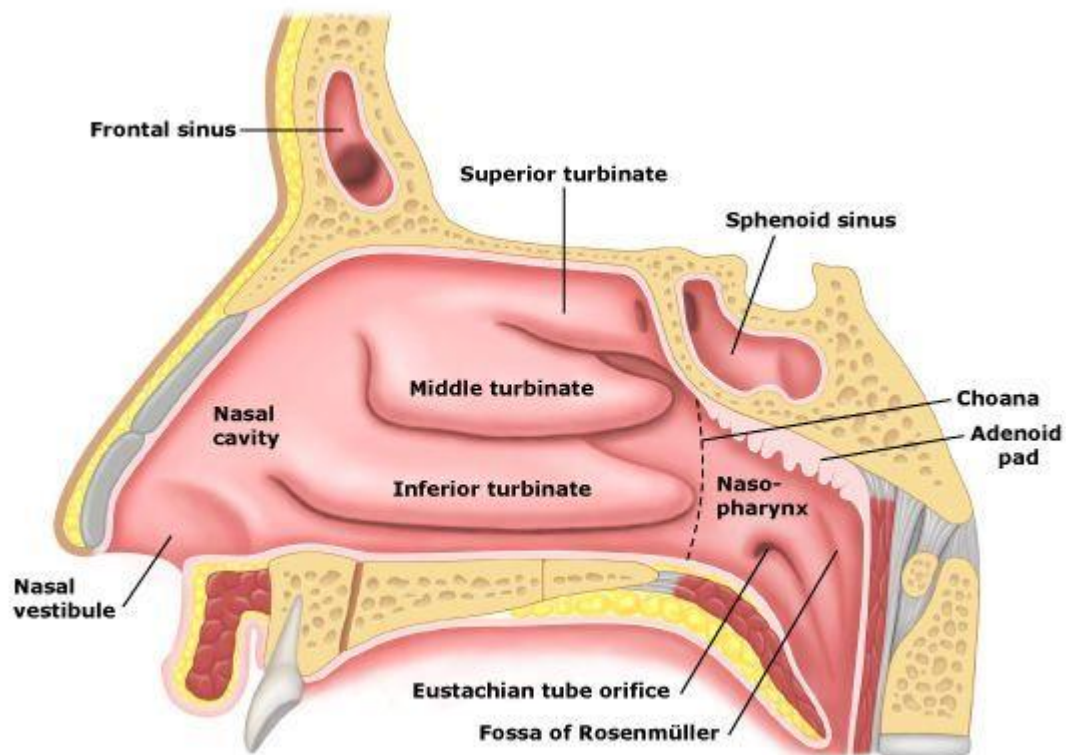


LATERAL WALLS: The lateral wall of the nasal cavity is a region of the nasopharynx essential for humidifying and filtering the air we breathe in nasally. Three bony shelves called the inferior, middle and superior **nasal conchae/ turbinate** are attached to the lateral walls:

- **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).

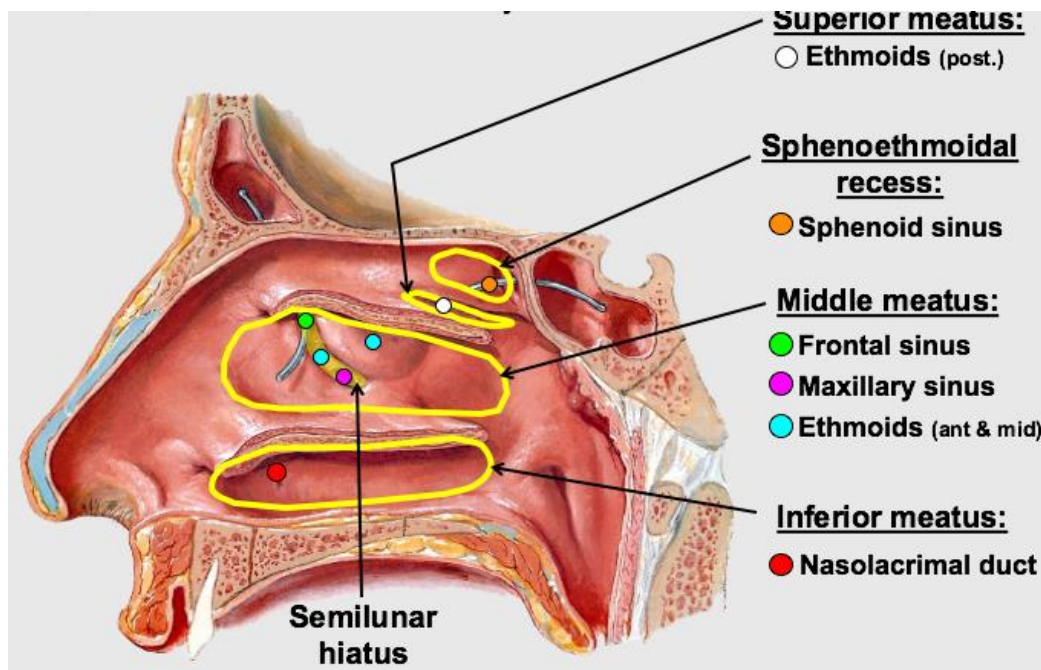
The concha is covered by a mucous membrane that contains large vascular spaces and is one of the three that work to both humidify and clear the air that passes into the nasopharynx.

- **Middle nasal conchae:** arise from the perpendicular plate of the ethmoid bone. 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.



By projecting into the cavities, the **nasal conchae** divide both nasal cavities into four air channels:

- **Inferior nasal meatus;** between the floor and inferior concha
- **Middle nasal meatus;** between the inferior and middle concha
- **Superior nasal meatus;** between the middle and superior concha
- **Sphenoethmoidal recess;** between the superior concha and the nasal cavity roof



FLOOR OF NASAL CAVITY:

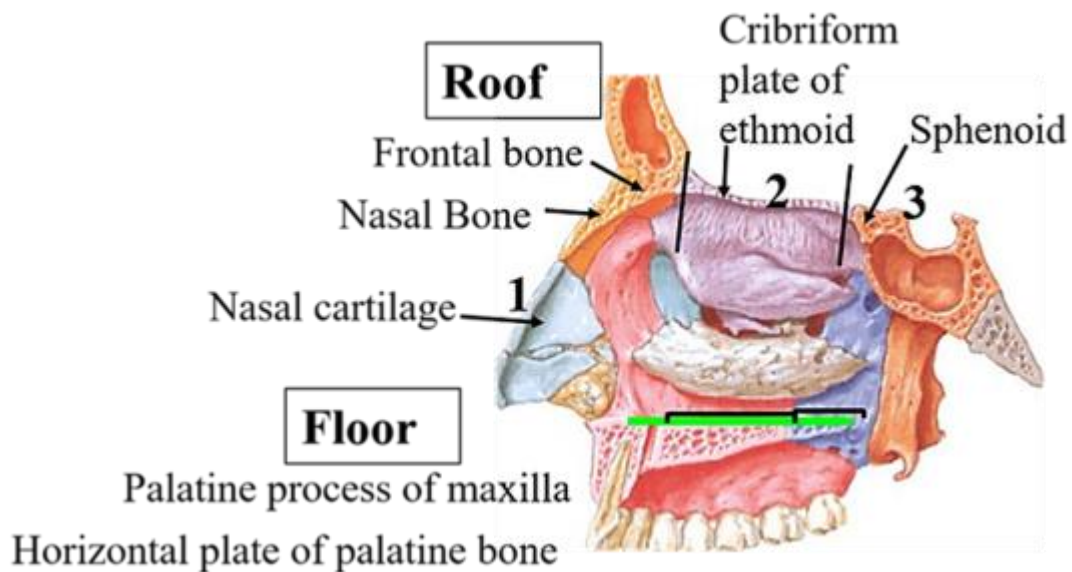
➤ Hard palate

. The **hard palate** is a horizontal plate of bone formed by both the **palatine process** of the maxilla, which forms 75% of the hard palate, and the **horizontal plate** of the palatine bone. This bony structure has numerous perforations to allow for the passage of nutrient vessels. Its function is to form a separation between the nasopharynx and oropharynx. Insufficiency in this structure can cause difficulty with swallowing.

➤ Soft palate

The **soft palate** is also referred to as the 'velum'. This is a continuation of the hard palate posteriorly but has no bony structure. This structure is constituted of five muscles crucial for swallowing. These are the:

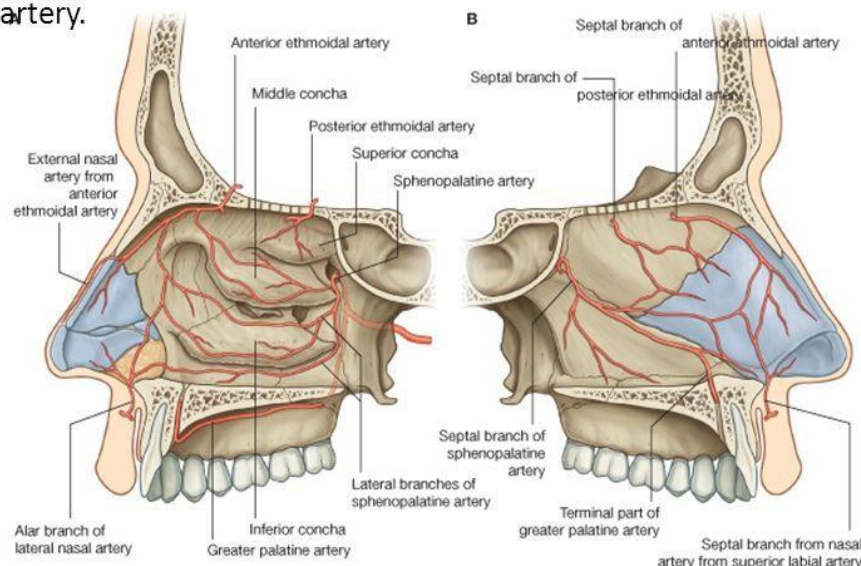
- **tensor veli palatini** (innervated by the mandibular branch of the trigeminal nerve)
- **palatoglossus**
- the **palatopharyngeus** which has a crucial role in breathing
- the **levator veli palatini** which elevates the soft palate to encompass the bolus of food
- the **musculus uvulae** which move the uvula



Blood Supply to the Nasal Cavity

Arterial supply is from branches of maxillary & facial arteries (ECA). The most important branch is sphenopalatine artery from maxillary artery that anastomoses with septal branch of superior labial branch of facial artery in the vestibule (little's area) which is the area most commonly bleed (epistaxis)

Internal Carotid artery (ICA) also supplies nasal cavity through ethmoidal branches of ophthalmic artery.



The nose is supplied by branches of both the external and internal carotid arteries.

- The **external carotid artery** sends the sphenopalatine, greater palatine, superior labial and lateral nasal arteries which mostly supply the

vestibule and respiratory portions of the nasal cavity, as well as the surrounding parts of the external nose (apex and dorsum).

- The **internal carotid artery** gives off the anterior and posterior ethmoidal arteries which mostly supply the apex of the nasal cavity and the surrounding part of the external nose. Many of the external and internal carotid arterial branches anastomose at the anterior part of the medial wall. This particular spot is the place from where the most **nosebleeds** occur.

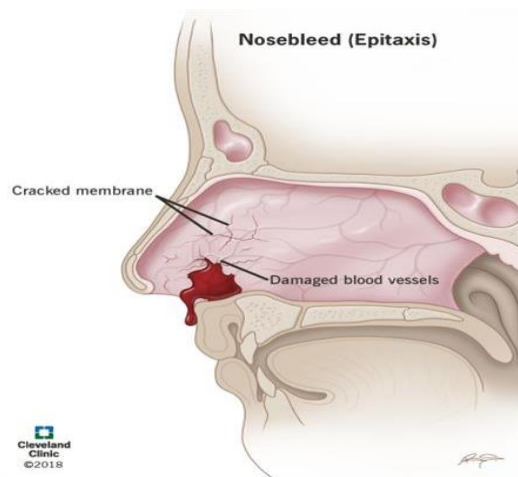
CLINICAL ANATOMY

➤ Epistaxis

Epistaxis, which is the clinical term for a nosebleed, is usually caused by:

- a trauma
- sinus infection
- rhinitis
- an arid environment
- hypertension
- hematologic disorders
- neoplasms

The most common form is **anterior epistaxis** which occurs along the septum and arises from Kiesselbach's plexus. **Posterior epistaxis** is usually due to the maxillary artery. Depending on the area of the bleed, various treatments are available since the blood will either run out of the nose in an anterior case or down the throat in a posterior case.



➤ Deviated septum

A deviated septum means that the **bony midline** of the nasal cavity is off centre, either due to a trauma or birth defects and this results in partial or total occlusion of one side of the cavity. The treatment is surgical and a septoplasty is usually performed.

