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**Matric No.:** 17/MHS01/018.

**Department:** MBBS.

**Level:** 300.

**Course Title:** Gross Anatomy of Head and Neck.

**Course Code:** ANA 301.

**Question:**

1. Write an essay on the cavernous sinus.

2. Discuss the walls of the nose.

**Question 1:**

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](https://www.kenhub.com/en/library/anatomy/the-human-face). The cavernous sinus is a paired dural venous sinus located within the cranial cavity. The paired cavernous sinuses are against the lateral aspect of the body of the sphenoid bone on either side of the sella turcica. They are enclosed by the endosteal and meningeal layers of the dura mater.

**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.

**Structure of each Cavernous Sinus:**

The cavernous sinuses are **1 cm wide** cavities that extend a distance of 2 cm from the most posterior aspect of the [orbit](https://www.kenhub.com/en/library/anatomy/bones-of-the-orbit) to the petrous part of the [temporal bone](https://www.kenhub.com/en/library/anatomy/the-temporal-bone). They are bilaterally paired collections of venous plexuses that sit on either side of the [sphenoid bone](https://www.kenhub.com/en/library/anatomy/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 mater**](https://www.kenhub.com/en/library/anatomy/meninges-of-the-brain-and-spinal-cord) that continues with the diaphragm sellae that covers the superior part of the [pituitary gland](https://www.kenhub.com/en/library/anatomy/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 of the Cavernous Sinuses:**

Several important structures pass through the cavernous sinus to enter the orbit. The can be sub-classified by whether they travel through the sinus itself, or through its lateral wall:

|  |  |
| --- | --- |
| **Travels through Cavernous Sinus** | **Travels through Lateral Wall of Cavernous Sinus** |
| Internal carotid artery | Oculomotor nerve (CN III) |
| Abducens nerve (CN VI) | Trochlear nerve (CN IV) |
|  | Ophthalmic division of Trigeminal nerve (CN V1) |
|  | Maxillary division of Trigeminal nerve (CN V2) |

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

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** - The superior ophthalmic vein receives blood from the ethmoidal, nasofrontal, vorticose (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 vorticose 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** - 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 diaphragm 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](https://www.kenhub.com/en/library/anatomy/brachiocephalic-veins).

**Applied Anatomy:**

* **Cavernous Sinus Thrombosis (CST):** Cavernous sinus thrombosis (CST) refers to the formation of a clot within the cavernous sinus. The most common cause of CST is infection; which typically spreads from an extracranial location such as the orbit, paranasal sinuses, or the ‘danger zone’ of the face. Infection is able to spread in this manner due to the anastomosis between the facial vein and superior ophthalmic veins.
* **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.

**Question 2:**

The walls of the nose (nasal cavity) are: the **medial wall** and the **lateral wall**.

* **The medial wall:** is formed by the nasal septum
* **The lateral walls:** are irregular owing to three bony plates, the nasal conchae, which project inferiorly, somewhat like louvers

**Features on the lateral wall of the nasal cavity**

There is the presence of nasal conchae (singular: concha) which curve inferomedially. The nasal conchae include:

* Superior nasal concha
* Middle nasal concha
* Inferior nasal concha

The conchae or turbinates of many mammals (especially running mammals and those existing in extreme environments) are highly convoluted, scroll-like structures that offer a vast surface area for heat exchange. Underneath each concha in both humans with simple nasal conchae and animals with complex turbinates is a recess or meatus {passage(s) in the nasal cavity}

The nasal cavity is thus divided into 5 passages:

1. A posterosuperiorly placed sphenoethmoidal recess

**3 laterally located nasal meatus:**

1. Superior
2. Middle
3. Inferior

**And:**

1. A medially placed common nasal meatus into which the four lateral passages open

**Arterial supply:**

The arterial supply of the medial and lateral walls of the nasal cavity is from five sources:

* Anterior ethmoidal artery (from the ophthalmic artery)
* Posterior ethmoidal artery (from the ophthalmic artery)
* Sphenopalatine artery (from the maxillary artery)
* Greater palatine artery (from the maxillary artery)
* Septal branch of the superior labial artery (from the facial artery)

**Venous drainage:**

A rich submucosal venous plexus deep to the nasal mucosa drains into the sphenopalatine, facial, and ophthalmic veins.

**Innervation:**

* olfactory nerve
* branches of the ophthalmic [V1] which include the anterior and posterior ethmoidal nerves
* maxillary [V2] nerves which include;
* posterior superior lateral nasal nerves
* posterior superior medial nasal nerves
* nasopalatine nerve
* posterior inferior nasal nerves

**Clinical Anatomy:**

1. **Epistaxis:** Epistaxis (nosebleed) is relatively common because of the rich blood supply to the nasal mucosa. In most cases, the cause is trauma and the bleeding is from an area in the anterior third of the nose (Kiesselbach area). Epistaxis is also associated with infections and hypertension. Spurting of blood from the nose results from the rupture of arteries. Mild epistaxis may also result from nose picking, which tears veins in the vestibule of the nose.
2. **Rhinitis:** The nasal mucosa becomes swollen and inflamed (rhinitis) during severe upper respiratory infections and allergic reactions (e.g.: hayfever). Swelling of the mucosa occurs readily because of its vascularity.

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