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**DEPARTMENT: MEDICINE AND SURGERY**

**COURSE CODE: ANA 301**

**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](https://www.kenhub.com/en/library/anatomy/the-human-face).

The left and right cavernous sinuses communicate by through the anterior and posterior intercavernous sinuses. The cavernous sinus drains to the superior and inferior petrosal sinuses, which then join the sigmoid sinus.

**Anatomical location and borders 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). The are enclosed by the endosteal and meningeal layers of the dura mater.

The borders 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.

**Content of the cavernous sinus**

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** |
| * Abducens nerve (CN VI)
 | * Oculomotor nerve (CN III)
 |
| * Carotid plexus (post-ganglionic sympathetic nerve fibres)
 | * Trochlear nerve (CN IV)
 |
| * Internal carotid artery (cavernous portion)
 | * Ophthalmic (V1) and maxillary (V2) branches of the trigeminal nerve
 |

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.

**Dural Venous Sinus System**

Each cavernous sinus receives venous drainage from:

* **Ophthalmic veins (superior and inferior)** – these enter the cavernous sinus via the superior orbital fissure.
* **Central vein of the retina** – drains into the superior ophthalmic vein, or directly into the cavernous sinus.
* **Sphenoparietal sinus** – empties into the anterior aspect of the cavernous sinus.
* **Superficial middle cerebral vein** – contributes to the venous drainage of the cerebrum
* **Pterygoid plexus** – located within the infratemporal fossa.

**NOTE: The superior ophthalmic vein forms an anastomosis with the facial vein. Therefore, the ophthalmic veins represent a potential route by which infection can spread from an extracranial to an intracranial site.**

The cavernous sinuses empty into the **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 **intercavernous sinuses**. They travel through the sella turcica of the sphenoid bone.

**Clinical significance**

• **Cavernous sinus thrombosis**

The sinus also has communicating branches from the sin of the face. 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).

• **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: Discuss the walls of the nose**

The nasal cavity has a roof, floor, medial wall and lateral wall.

**The roof**: is curved and narrow, except at its posterior end and it is divided into 3 parts. They are named from the bones forming each part.

**• frontonasal**

**• ethmoidal**

**• sphenoidal .**

**The floor:** is wider than the roof and is formed by the palatine processes of the maxilla and the horizontal plates of the palatine bone.

**The medial wall:** formed by **the nasal septum**

**The lateral walls:** are irregular owing to three bony plates, **the nasal conchae**, which project inferiorly, somewhat like louvers

**The Medial Wall/ Nasal Septum**

It divides the chamber of the nose into two nasal cavities. It has a bony part and a soft mobile cartilaginous part. The components of the nasal septum are:

• perpendicular plate of the ethmoid bone

• Vomer bone

• septal cartilage

• nasal crest of the maxillary bone

• nasal crest of palatine bone

The perpendicular plate of ethmoid, vomer, nasal crests of maxillary and palatine bones form the bony part of nasal septum while the septal cartilage forms the cartilagenous part.

1. **The perpendicular plate of the ethmoid bone:** forming the superior part of the nasal septum descends from the cribriform plate and is continued superior to this plate as the crista galli which is seen in the anterior cranial fossa.
2. **The Vomer:** a thin flat bone, forms the posteroinferior part of the nasal septum, with some contribution from the nasal crests of the maxillary and palatine bones.
3. The **septal cartilage** has a tongue-and-groove articulation with the edges of the bony septum.

**Lateral wall**

We can find 3 types of nasal conchae in the nasal cavity. Those are: inferior nasal conchae, superior and middle nasal conchae.

1. **Inferior nasal conchae**: 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.
2. **Superior and 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.

These nasal conchae 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.
* **Middle meatus** – between the inferior and middle concha.
* **Superior meatus** – between the middle and superior concha.
* **Spheno-ethmoidal recess** – superiorly and posteriorly to the superior concha.

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.

**Vasculature**

The nose receives blood from both the **internal** and **external carotid arteries**:

**Internal carotid branches**

1. Anterior ethmoidal artery
2. 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**

1. Sphenopalatine artery
2. Greater palatine artery
3. Superior labial artery
4. 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 drainage**

The veins of the nose tend to follow the arteries. They drain into the pterygoid plexus, facial vein or cavernous sinus.

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**

• 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 significance**

1. **Cribriform Plate Fracture**

A fracture of the cribriform plate can occur as a result of nose trauma. It is either fractured directly by the trauma, or by fragments of the ethmoid bone.

A fractured cribriform plate can penetrate the meningeal linings of the brain, causing leakage of cerebro-spinal fluid. Exposing the brain to the outside environment like this increases the risks of meningitis, encephalitis and cerebral abscesses.

The olfactory bulb lies on the cribriform plate and can be damaged irreversibly by the fracture. In this case, the patient may present with anosmia (loss of smell).

1. **Sinusitis**

Sinusitis is an inflammation of the different sinuses found in the head. That type of inflammation may result in different symptoms including:

• plugged nose;

• nasal mucus;

• pain in the facial region.

The frontal bone overlies the frontal lobe of the brain and lies anteriorly forming the brow, forehead and one third of the anterior scalp. The bone contains the frontal sinus, which in sinusitis and nasal infections can become filled with fluid.

1. **Rhinitis**

The nasal mucosa becomes swollen and inflamed (rhinitis) during severe upper respiratory infections and allergic reactions (e.g., hay fever). Swelling of the mucosa occurs readily because of its vascularity.