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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.

Each cavernous sinus has a close anatomical relationship with several**key structures** in the head, and is arguably the most clinically important venous sinus.

## Anatomical Location and Borders

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.

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.

## Contents

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) * Carotid plexus (post-ganglionic sympathetic nerve fibres) * Internal carotid artery (cavernous portion) | * Oculomotor nerve (CN III) * Trochlear nerve (CN IV) * 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.

It is important to note that 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

Cavernous sinus thrombosis (CST) refers to the formation of a **clot** within the cavernous sinus.

This 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.

Common clinical features include headache, unilateral periorbital oedema, proptosis (eye bulging), photophobia and cranial nerve palsies. The **abducens nerve** (CN VI) is most commonly affected.

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

2. WALLS OF THE NASAL CAVITY

The **nasal cavity** is a large, air-filled space above and behind the nose in the middle of the face. The nasal septum divides the cavity into two cavities, also known as **fossae**. Each cavity is the continuation of one of the two nostrils. The nasal cavity is the uppermost part of the respiratory system and provides the **nasal passage** for inhaled air from the nostrils to the nasopharynx and rest of the respiratory tract.

The nasal cavity has boundaries such as:

Roof

Floor

Medial Wall

Lateral Wall

The walls of nasal cavity comprises of the medial wall and the lateral wall

Medial wall: the medial wall mainly formed by the nasal septum

Lateral wall: are irregular owing to three bony plates, the nasal conchae, which project inferiorly. It is the region of the nasopharynx essential for humidifying and filtering the air we breathe in nasally. The lateral wall of the nasal cavity is made up of nasal conchae

Superior nasal conchae

Middle nasal conchae

Inferior 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.
* **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.

The nasal cavity is divided into 5 passages

* 1. Sphenoethmoidal recess
  2. Superior nasal meatus
  3. Middle nasal meatus
  4. Inferior nasal meatus
  5. Common nasal meatus

Sphenoethmoidal recess

It is lying superoposterior to the superior conchae. It receives the opening of the sphenoidal sinus, an air filled cavity in the body of the sphenoid

Superior nasal meatus

It is a narrow passage between the superior and the middle nasal conchae. The posterior ethmoidal sinuses open into this superior nasal meatus through one or more orifices.

Middle nasal meatus

It is longer and deeper than the superior one. The anterosuperior part of this passage leads into a funnel shaped opening, the ethmoidal infundibulum through which it communicates with the frontal sinus through a passage known as the frontonasal duct. The anterior ethmoidal cells opens directly or indirectly on the ethmoidal infundibulum.

Inferior nasal meatus

It is a horizontal passage inferolateral tonthe inferior nasal conchae. The nasolacrimal duct, which drains tears from the lacrimal sac, opens into the anterior part of the meatus.

Common nasal meatus is the medial part of the nasal cavity between the conchae and nasal septum, into which the lateral recesses and meatus open.

Arterial supply; the medial and lateral walls of the nasal cavity

Anterior ethmoidal artery from the ophthalmic artery

Posterior ethmoidal artery from the ophthalmic artery

Sphenopalantine artery from the maxillary artery

Greater palantine 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 sphenopalantine, facial, and ophthalmic veins.

Innervation

Olfactory nerve

Branches of the ophthalmic which include the anterior and posterior ethmoidal nerves

Maxillary nerves which include;

Posterior superior lateral nasal nerves

Posterior superior medial nasal nerves

Nasopalantine nerve

Posterior inferior nasal nerves

Clinical Significance

Epitaxis

Also known as nosebleed is relatively common because of the rich blood supply to the nasal mucosa. In most cases, the cause is trauma and bleeding is from an area in the anterior third of the nose.( Kisselbach area). It is also associated with infections and hypertension. Spurting of blood from the nose results from rupture of arteries. Mild epitaxis may also result from nose picking, which tears veins in the vestibule of the nose.

Rhinitis

The nasal mucosa becomes swollen and inflamed during severe upper respiratory infections and allergic infection (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 cribiform 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 conjuctiva.