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Head and Neck

1.

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. It consists of venous plexuses of extremely thin-walled veins that extend from the superior orbital fissure anteriorly to the apex of the petrous body of the temporal bone posteriorly.

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

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 mater 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.

The artery carrying warm blood from the body's core transverses the sinus filled with cooler blood returning from the capillaries of the body's periphery, allowing for heat exchange to conserve energy or cool the arterial blood. This isn't as important in humans as it is in running animals (Cheetahs and horses) in which the carotid artery runs a longer more tortuous course through the cavernous sinuses, allowing cooling of blood before it enters the brain.

Pulsations of the artery within the cavernous sinus are said to promote propulsion of venous blood from the sinus, as does gravity.

Relations

There are numerous structures surrounding the cavernous sinus. Medially, the sinus is adjacent to the lateral walls of the pituitary fossa with the pituitary gland, the sphenoid bone and its air sinus. The cerebral part of the internal carotid artery courses superiorly. Laterally, the medial aspect of the temporal lobe of each hemisphere lies adjacent to the sinus. And 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, 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: 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

Anterior intercavernous sinus (Sinus intercavernosus anterior)

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.

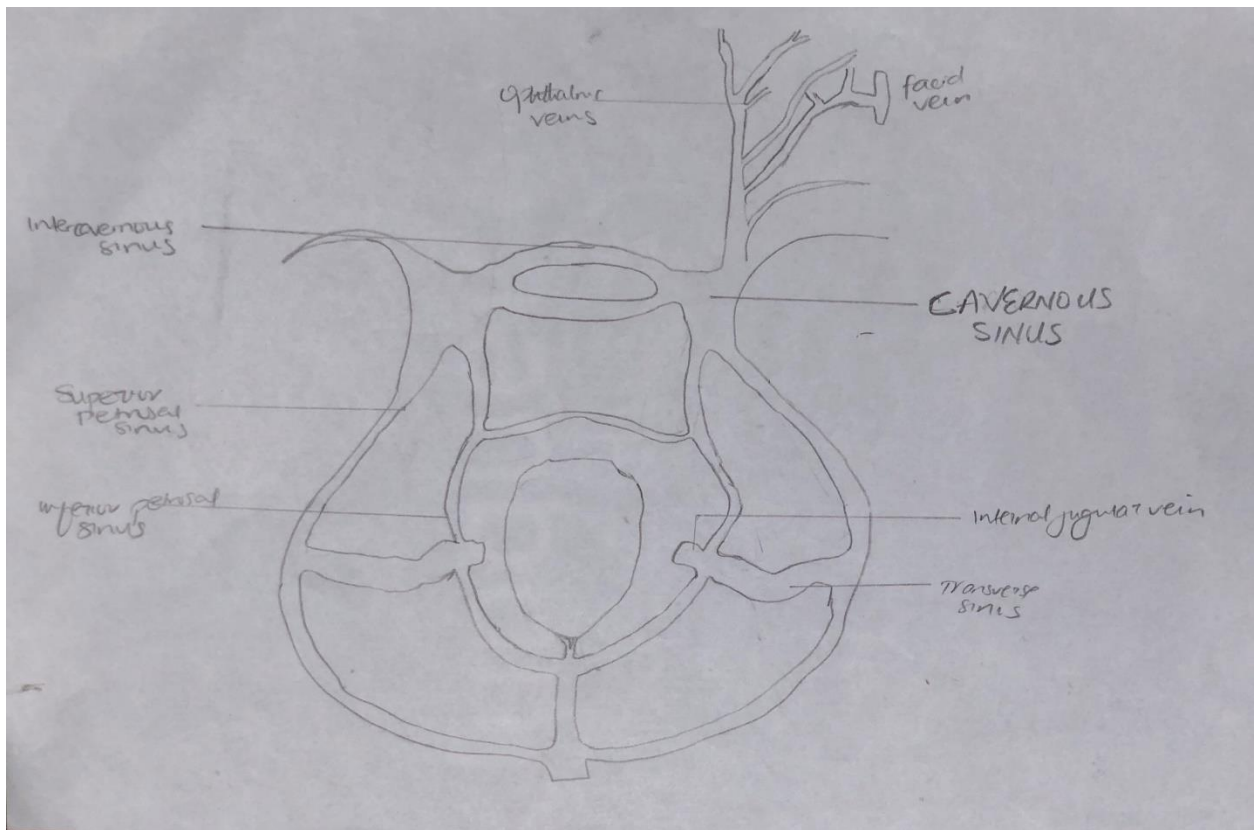
Clinical significance

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

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).



2.

Walls of the Nose

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

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.

Boundaries

Besides the anterior and posterior apertures, each nasal cavity has a roof, floor, and lateral and medial walls. There are 12 cranial bones in total that contribute to the nasal cavity structure, which include the paired nasal, maxilla, palatine and lacrimal bones, as well as the unpaired ethmoid, sphenoid, frontal and vomer bones. Among all of them, the ethmoid bone is the most important element, for two reasons: first, it makes the greatest portion of the nasal skeletal framework by forming the roof and walls of the nasal cavities; and second, it contains ethmoidal cells which, as a group, are one of the four paranasal sinuses

- **The roof:** is curved and narrow except at its posterior end where the hollow body of the sphenoid forms the roof. It is divided into frontonasal, sphenoidal and ethmoidal.
- **The floor:** is wider than the roof and is formed by the palatine processes of the maxillae and horizontal plates of the palatine bone.
- **The medial wall:** is formed by the nasal septum(this is what divides the chamber of the nose to nasal cavities. It has a bony and soft mobile cartilaginous part).
- **The lateral walls:** are irregular owing to bony plates, the nasal conchae, which project inferiorly somewhat like louvers.

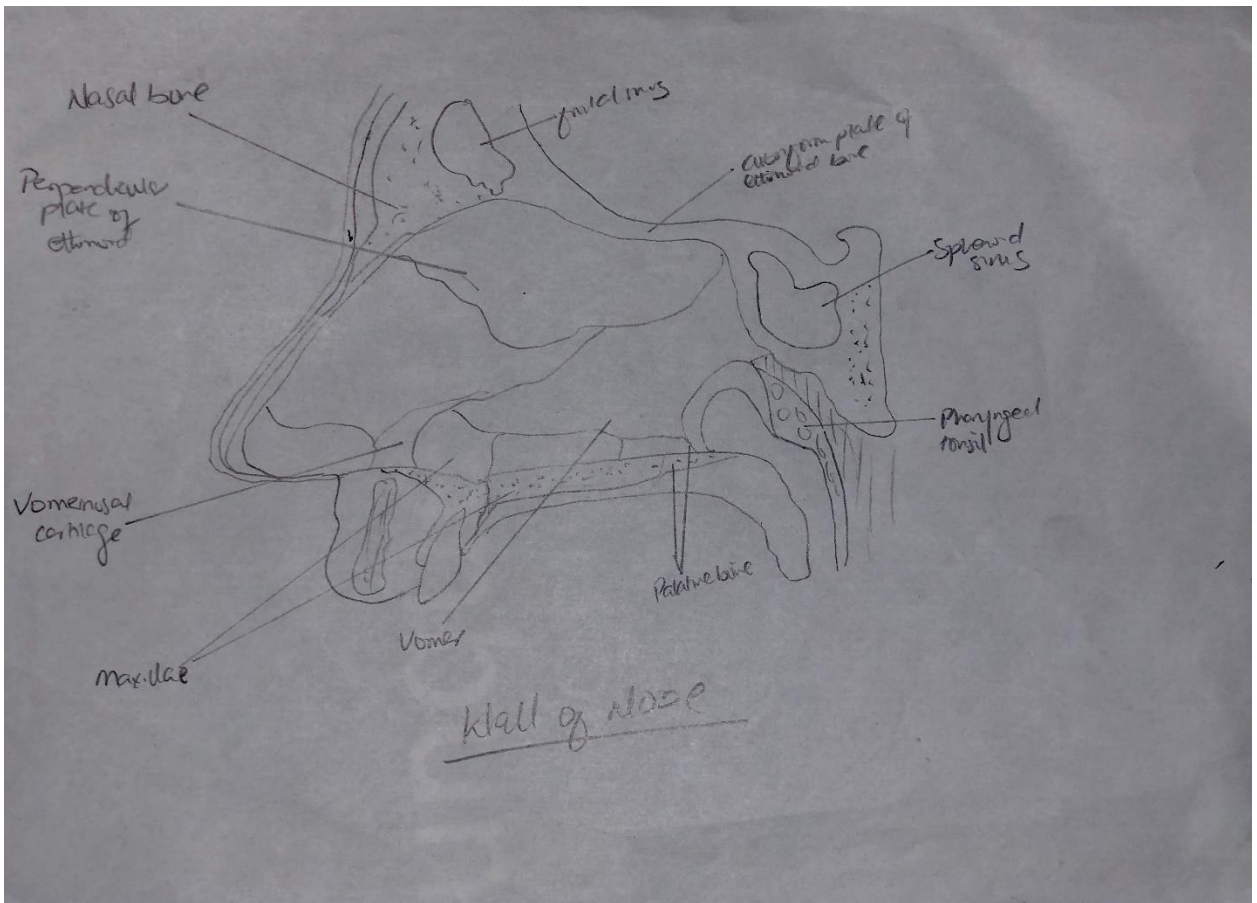
Three bony shelves called the inferior, middle and superior nasal conchae are attached to the lateral walls and by projecting into the cavities.

Inferior conchae; is the broadest and longest of the conchae and is formed by an independent bone. It is covered by a mucous membrane that contains large vascular spaces that can enlarge thus affecting caliber of the nasal cavity. The middle and superior are medial processes of the ethmoid bone. When infected or irritated the mucosa swells rapidly, blocking the nasal passage on that side.

These nasal conchae divide both nasal cavities into five air channels:

- Inferior nasal meatus; is a horizontal passage between the floor and inferior concha. The nasolacrimal duct drains tears from the lacrimal sac, opens into the anterior part of this meatus.
- Middle nasal meatus; between the inferior and middle concha. It is longer and deeper than the superior one. The anterosuperior part leads to a funnel shaped opening known as the ethmoidal infundibulum.
- Superior nasal meatus; between the middle and superior concha into which the posterior ethmoidal sinuses open by one or more orifices.
- Sphenoethmoidal recess; between the superior concha and the nasal cavity roof. It receives the opening of the sphenoidal sinus.
- Common nasal meatus; between the conchae and nasal septum. It is the medial part of the nasal cavity into which the lateral recess and meatus open.

The two nasal cavities communicate with four bony recesses called the paranasal sinuses. They are named according to the bones they are placed within, as the: sphenoidal, maxillary, and frontal sinuses, and the ethmoidal cells. All of the sinuses are covered by respiratory mucosa and innervated by the trigeminal nerve (CN V).



Nasal cavity