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COURSE TITLE: GROSS ANATOMY OF HEAD AND NECK

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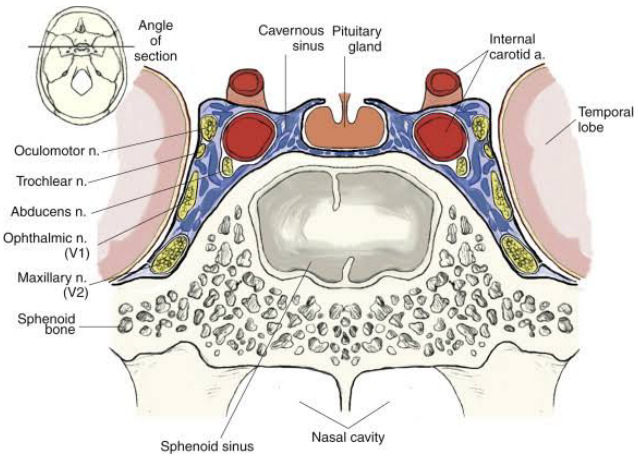
Question

1) Write an essay on the carvenous sinus

THE CARVENOUS SINUS



The dural venous sinuses are channels between the two layers of dura mater which

are responsible for the venous drainage of the brain, skull, orbit and internal ear.

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:

-Abducens nerve (CN VI)

-Carotid plexus (post-ganglionic sympathetic nerve fibres)

-Internal carotid artery (cavernous portion)

Travels through lateral wall of cavernous sinus:

-Oculomotor nerve (CN III)

-Trochlear nerve (CN IV)

-Ophthalmic (V1) and maxillary (V2) branches of the trigeminal nerve

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.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. 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.

-**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. 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.

-**Pterygoid plexus** – located within the infratemporal fossa.

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

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.

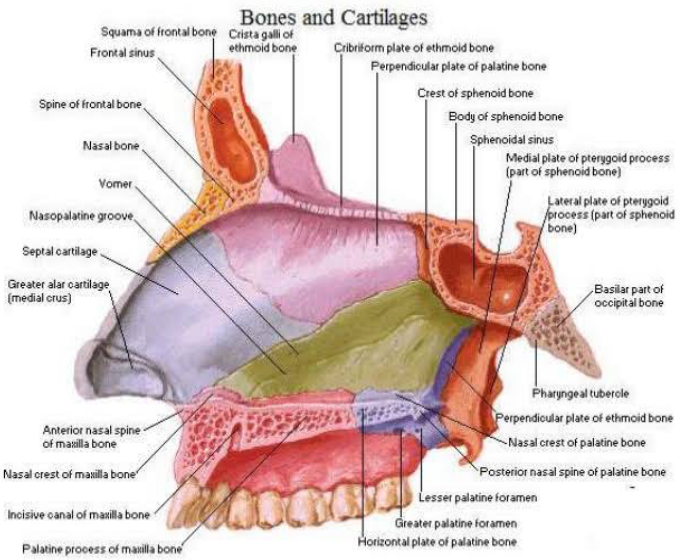
CLINICAL CORRELATES

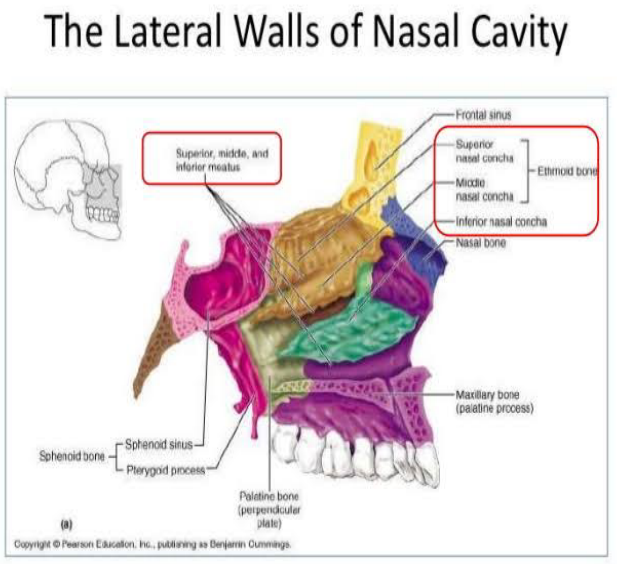
Carotid-cavernous fistula: Head trauma resulting in rupture of the cavernous part of the internal carotid artery can produce what is known as a carotid-cavernous fistula. A pulsating exophthalmos can result as the venous pressure in the sinus would increase and reverse the flow of blood in the ophthalmic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

WALLS OF THE NOSE





The nose is an olfactory and respiratory organ. It consists of nasal skeleton, which houses the nasal cavity. The nasal cavity has four functions:

-Warms and humidifies the inspired air.

-Removes and traps pathogens and particulate matter from the inspired air.

-Responsible for sense of smell.

-Drains and clears the paranasal sinuses and lacrimal ducts.

The nasal cavity is the most superior part of the respiratory tract. It extends from the vestibule of the nose to the nasopharynx, and has three divisions:

-Vestibule – the area surrounding the anterior external opening to the nasal cavity.

-Respiratory region – lined by a ciliated psudeostratified epithelium, interspersed with mucus-secreting goblet cells.

-Olfactory region – located at the apex of the nasal cavity. It is lined by olfactory cells with olfactory receptors.

Nasal septum

Bones and cartilages

The anterior nasal aperture is simply the area where the anterior bony aspects of both the maxilla and the nasal bone terminate and form an opening into the cartilaginous nasal vestibule. The structure is also referred to as the piriform aperture.

Bones

The bony structure of the nose is provided by the maxilla, frontal bone, and a number of smaller bones.

The topmost bony part of the nose is formed by the nasal part of the frontal bone, which lies between the brow ridges, and ends in a serrated nasal notch. A left and a right nasal bone join with the nasal part of the frontal bone at either side; and these at the side with the small lacrimal bones and the frontal process of each maxilla. The

internal roof of the nasal cavity is composed of the horizontal, perforated cribriform plate of the ethmoid bone through which pass sensory fibres of the olfactory nerve. Below and behind the cribriform plate, sloping down at an angle, is the face of the sphenoid bone.

The wall separating the two cavities of the nose, the nasal septum, is made up of bone inside and cartilage closer to the tip of the nose. The bony part is formed by the perpendicular plate of the ethmoid bone at the top, and the vomer bone below. The floor of the nose is made up of the incisive bone and the horizontal plates of the palatine bones, and this makes up the hard palate of the roof of the mouth. The two horizontal plates join together at the midline and form the posterior nasal spine that gives attachment to the musculus uvulae in the uvula.

The two maxilla bones join at the base of the nose at the lower nasal midline between the nostrils, and at the top of the philtrum to form the anterior nasal spine. This thin projection of bone holds the cartilaginous center of the nose. It is also an important cephalometric landmark.

Three cartilages contribute to the nasal septum:

-lesser alar cartilages are paired cartilages suspended in the fibro-fatty tissue that forms the lateral aspect of the nostril. The structures lie free from the other cartilages and provide the nostril with stability and form.

-greater alar cartilages are paired cartilages that form part of the antero-superior nostril as well as the nasal tip. The structures give the tip of the nose stability and flexibility and are a crucial element of the cartilaginous apparatus of the nose.

-lateral nasal cartilages are structures that articulate inferiorly with the greater alar cartilages and superiorly with the anterior nasal aperture formed by both the nasal bone superiorly and for a short part of its border with the perpendicular plate of the ethmoid bone. These structures form the cartilaginous part of the bridge of the nose and form in conjunction with the greater alar cartilages, the major structural appearance of the nose.

Nasal conchae

Projecting out of the lateral walls of the nasal cavity are curved shelves of bone. They are called conchae (or turbinates).We can find 3 types of nasal conchae in the nasal cavity. Those are:

-**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.

Vasculature

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

Internal carotid branches:

-Anterior ethmoidal artery

-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:

-Sphenopalatine artery

-Greater palatine artery

-Superior labial artery

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 .

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

The innervation of the nose can be functionally divided into special and general innervation.

Special sensory innervation refers to the ability of the nose to smell. This is carried out by the olfactory nerves. The olfactory bulb, part of the brain, lies on the superior surface of the cribriform plate, above the nasal cavity. Branches of the olfactory nerve run through the cribriform plate to provide special sensory innervation to the nose.

General sensory innervation to the septum and lateral walls is delivered by the nasopalatine nerve (branch of maxillary nerve) and the nasociliary nerve (branch of the ophthalmic nerve). Innervation to the external skin of the nose is supplied by the trigeminal nerve.

CLINICAL CORRELATES

-**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).

-Epistaxis: Epistaxis is the medical term for a nosebleed. Due to the rich blood supply of the nose, this is a common occurrence. It is most likely to occur in the anterior third of the nasal cavity – this area is known as the Kiesselbach area. The cause can be local (such as trauma), or systemic (such as hypertension).