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MatNO: 17/MHS01/066

COURSE TITLE: Gross Anatomy of the Head and Neck

COURSE CODE: ANA 301

## Assignment

1. Write an essay on the cavernous sinus.
2. Discuss the walls of the nose.

### ANSWER 1 THE CAVERNOUS SINUS

#### INTRODUCTION

The cavernous sinus (also called the parastella sinus) is one of the dura venous sinuses, responsible for venous drainage of the brain.

Dura sinuses are intracranial venous channels in the periosteal and meningeal layers of the dura mater. They are incompressible and are responsible for the drainage of venous blood from the brain and its meninges to the internal jugular vein.

Dura venous sinuses are valveless which allows for the bi-directional flow of blood (depending on venous blood pressure). There are 6 paired and 4 unpaired venous sinus.

#### FUNCTION

Like other dura sinuses, the function of the cavernous sinus is to drain blood and cerebrospinal fluid (CSF) from the brain and its meninges to the internal jugular vein.

#### LOCATION

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). It extends from the superior orbital fissure to the apex of the petrous temporal bone. The cavernous sinuses 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 OF THE CAVERNOUS SINUS**

The following vessels pass through the cavernous sinus;

- The oculomotor nerve (CN<sub>3</sub>)
- The trochlear nerve (CN<sub>4</sub>)
- The trigeminal nerve (ophthalmic and maxillary division)
- The abducens nerve (CN<sub>6</sub>)
- The internal carotid artery

### **The internal carotid artery**

The internal carotid artery (a branch of the common carotid artery) – along with its postganglionic sympathetic plexus from the superior cervical ganglion – gains access to the cavernous sinus posteriorly.

As the petrous part of the internal carotid artery leaves the carotid canal, it curves vertically and superiorly above foramen lacerum to enter the cavernous sinus. Here the artery is also referred to as the cavernous part.

Within the sinus, the internal carotid artery travels anteriorly, in a horizontal manner until it reaches the anterior limit of the sinus. Here it curves vertically and superiorly to exit the sinus through its roof and become the cerebral part of the internal carotid artery. It is noteworthy that the cavernous part of the internal carotid artery is the only arterial vessel that is completely surrounded by venous networks.

## **VENOUS COMMUNICATIONS OF CAVERNOUS SINUS**

- Superior ophthalmic vein
- Inferior ophthalmic vein
- Superficial middle cerebral vein
- Middle meningeal vein
- Hypophyseal vein

### **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.

## **THE INTERCARVENOUS SINUS**

The cavernous sinus is only one of the paired venous sinus which communicates with each other via the anterior and posterior intercarvenous sinus. The intercarvenous sinuses travel around the infundibulum of the pituitary gland, deep to the diaphragm, between the layers of the dura mater.

## **DRAINAGE OF THE CARVENOUS SINUS**

The cavernous sinus 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.

## **APPLIED ANATOMY**

### **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).

## **ANSWER 2**

### **THE WALLS OF THE NOSE**

#### **INTRODUCTION**

The nose comprises of a lateral and medial wall

#### **MEDIAL WALL OF THE NASAL CAVITY**

The medial wall of the nasal cavity comprises the nasal septum, the septal cartilage and various bones of the skull

#### **Nasal skeleton**

The nasal septum is a structure consisting of both bony and cartilaginous components. The bony components are the:

perpendicular plate of the ethmoid superiorly

the vomer posteriorly

the crests of the maxillary bone anteriorly

the crest of the palatine bone inferior to the vomer

#### **Nasal cartilage and associated structures**

The septal cartilage is approximately 3-4mm thick. It divides the nasal cavity into two halves. The anterior part of the cartilage has an expansion known as the 'footplate' which is 4-8mm wide. This foot plate lies in free contact with the membranous septum. The cartilage is expanded in other regions, namely the junction with the lateral nasal cartilage termed the posterior process. The cartilage is firmly adhered to the nasal bone by taut collagen fibres

The cartilage of the septum is also termed the 'quadrangular cartilage' due to its shape. The posterior nasal spine is a sharp pointed projection of the posterior border of the palatine bone. The musculus uvula gains its attachment here

The pharyngeal tonsil is also known as the adenoid. It is a mass of lymphatic tissue located in the roof of the nasopharynx. The structure degrades with age and is almost entirely absent at puberty. The torus tubarius is also known as the tubar tonsil. It resides at the base of the cartilaginous section of the Eustachian tube

The choana is an opening at the back of the nasal passage that empties into the nasopharynx, close to where the adenoids are. The passage way forms an outflow from the nasopharynx into the mouth and throat.

## **FLOOR OF THE NASAL CAVITY**

### **Hard palate**

The pharyngeal opening of the auditory tube can be described as a triangular opening surrounded by a raised, firm prominence known as the 'torus'. The most medial end of the cartilage causes the elevation of the mucous membrane. The hard palate is a horizontal plate of bone formed by both the palatine process of the maxilla, which forms 75% of the hard palate, and the horizontal plate of the palatine bone, which forms the remaining 25%.

This bony structure has numerous perforations to allow for the passage of nutrient vessels. Its function is to form a separation between the nasopharynx and oropharynx. Insufficiency in this structure can cause difficulty with swallowing.

### **Soft palate**

The soft palate is also referred to as the 'velum'. This is a continuation of the hard palate posteriorly but has no bony structure. This structure is constituted of five muscles crucial for swallowing. These are the:

tensor veli palatini (innervated by the mandibular branch of the trigeminal nerve)

palatoglossus

the palatopharyngeus which has a crucial role in breathing

the levator veli palatini which elevates the soft palate to encompass the bolus of food

the musculus uvulae which move the uvula

The uvula has an essential role in human speech and works with the posterior part of the tongue to create 'guttural' sounds.

## **THE LATERAL WALL OF THE NASAL CAVITY**

The lateral wall of the nasal cavity is a region of the nasopharynx essential for humidifying and filtering the air we breathe in nasally

The lateral wall of the nasal cavity consist of the nasal septum and nasal conchae

### **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.

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**

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 sphenoidal recess. Similar to the middle nasal concha the superior concha is itself part of the ethmoid bone.