CRANIAL CAVITY

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The cranial cavity is the space within the skull that houses the brain.

The skull (excluding the mandible) is called the cranium.

The cavity is formed by 8 cranial bones known as the neurocranium that in humans includes the skull cap and forms the protective case around the brain.

Meninges are protective membranes that surround the brain to reduce the damage to the brain when there is head trauma.

Meningitis is a condition that is causing inflammation of meninges by bacterial or viral infections.
The floor of the cranial cavity is divided into three distinct depressions known as the anterior, middle and posterior cranial fossae.

Each fossa accommodates a different part of the brain.

The **anterior cranial fossa** lies superiorly over the nasal and orbital cavities.

The fossa accommodates the anteroinferior portions of the frontal lobes of the brain.

The **middle cranial fossa** is located centrally in the cranial floor.

It is said to be butterfly shaped, with a middle part accommodating the pituitary gland and two lateral parts accommodating the temporal lobes of the brain.

The **posterior cranial fossa** is the most posterior and deep of the three cranial fossae.

It accommodates the brainstem and cerebellum.
Meninges
INTRODUCTION

- Meninges are three membranous envelopes that surround the brain and spinal cord.
  - Dura mater
  - Arachnoid
  - Pia mater
- Cerebrospinal fluid fills the ventricles of the brain and the space between the pia mater and the arachnoid.
- The primary function of the meninges and the cerebrospinal fluid is to protect the central nervous system.
- The pia mater is the meningeal envelope that firmly adheres to the surface of the brain and spinal cord.
- It is a very thin membrane composed of fibrous tissue covered on its outer surface by a sheet of flat cells thought to be impermeable to fluid.
- The pia mater is pierced by blood vessels that travel to the brain and spinal cord.
DURA MATTER

- The outermost of the three meninges located directly underneath the bones of the skull and vertebral column.
- It is thick, tough, and dense membrane.
- It consists of two layered sheets of connective tissue:
  - **Periosteal layer** lines the inner surface of the bones of the cranium.
  - **Meningeal layer** located deep to the periosteal layer. It is continuous with the dura mater of the spinal cord.
- The dural venous sinuses are located between the two layers of dura mater.
- They are responsible for the venous drainage of the cranium and empty into the internal jugular veins.
- The dura mater receives its own vascular supply primarily from the middle meningeal artery and vein.
- It is innervated by all branches of trigeminal nerve.
The meningeal layer of dura mater folds inwards upon itself to form four dural reflections.

These reflections project into the cranial cavity, dividing it into several compartments, each of which houses a subdivision of the brain.

The four dural reflections are:

- **Falx cerebri** which projects downwards to separate the right and left cerebral hemispheres.
- **Tentorium cerebelli** which separates the occipital lobes from the cerebellum. It contains a space anteromedially for passage of the midbrain – the tentorial notch.
- **Falx cerebelli** which separates the right and left cerebellar hemispheres.
- **Diaphragma sellae** which covers the hypophysial fossa of the sphenoid bone. It contains a small opening for passage of the stalk of the pituitary gland.
The arachnoid mater is the middle layer of the meninges, lying directly underneath the dura mater.

It consists of layers of connective tissue, which is avascular, and does not receive any innervation.

Underneath the arachnoid is a space known as the sub-arachnoid space.

It contains cerebrospinal fluid, which acts to cushion the brain.

Small projections of arachnoid mater into the dura (known as arachnoid granulations) allow CSF to re-enter the circulation via the dural venous sinuses.
The pia mater is located underneath the sub-arachnoid space. It is very thin, and tightly adhered to the surface of the brain and spinal cord.

It is the only covering to follow the contours of the brain (the gyri and fissures).

Like the dura mater, it is highly vascularised, with blood vessels perforating through the membrane to supply the underlying neural tissue.
The blood supply of the meninges generally concerns the blood supply of the outer layer of dura mater rather than the inner layer of dura mater, arachnoid or pia mater since they do not require a large blood supply.

There are several arteries that supply the dura in the anterior, middle, and posterior cranial fossae:

**Anterior cranial fossa**
- Meningeal branches of anterior and posterior ethmoidal arteries.
- Ophthalmic artery.

**Middle cranial fossa**
- Frontal and parietal branches of the middle meningeal artery.
- Accessory meningeal artery.
- Ascending pharyngeal artery.
- Branches directly from the internal carotid artery.

**Posterior cranial fossa**
- Vertebral arteries.
- Occipital arteries.
- Ascending pharyngeal arteries.
MENINGITIS

- Meningitis refers to inflammation of the meninges.
- It is usually caused by pathogens, but can be drug induced.
- Bacteria are the most common infective cause.
- The immune response to the infection causes cerebral oedema, consequently raising intra-cranial pressure.
- This has two main effects:
  - Part of the brain can be forced out of the cranial cavity – this is known as cranial herniation.
  - In combination with systemic hypotension, raised intracranial pressure reduces cerebral perfusion.
- Both complications can rapidly result in death.
Dural Venous Sinuses
INTRODUCTION

- The dural venous sinuses lie between the periosteal and meningeal layers of the dura mater to drain the central nervous system, the face, and the scalp.
- All the dural venous sinuses eventually drain into the internal jugular vein.
- Unlike most veins of the body, the dural venous sinuses do not have valves.
There are eleven venous sinuses in total, some paired and some unpaired.

The *straight*, *superior*, and *inferior sagittal sinuses* are found in the falx cerebri of the dura mater and they converge at the confluence of sinuses.

The *straight sinus* is a continuation of the great cerebral vein and the inferior sagittal sinus.

From the confluence, the *transverse sinus* continues bilaterally and curves into the *sigmoid sinus* to meet the opening of the *internal jugular* vein.

The *cavernous sinus* drains the ophthalmic veins and can be found on either side of the sella turcica.

From here, the blood returns to the *internal jugular* vein via the superior or inferior petrosal sinuses.
LISTS OF VENOUS SINUSES

- **The Superior Sagittal Sinus**
  - Lies along the superior border of the falx cerebri and empties into the confluence of sinuses.

- **The Inferior Sagittal Sinus**
  - Lies in the inferior border of the falx cerebri.
  - The great cerebral vein of Galen joins the inferior sagittal sinus to form the straight sinus.

- **The Transverse Sinuses**
  - Originate on each side of the confluence of sinuses.
  - Each transverse sinus travels laterally, and curves downward to form the sigmoid sinus that empties into the internal jugular vein on the same side.

- **The Confluence of Sinuses**
  - At the confluence of sinuses, the superior sagittal, straight, transverse, and occipital sinuses join.
LISTS OF VENOUS SINUSES

- **The Cavernous Sinuses**
  - Located on each side of the sphenoid bone.
  - Ophthalmic and superficial middle cerebral veins drain into these sinuses.

- **The Sphenoparietal Sinuses**
  - Located below the sphenoid bone and drain into the cavernous sinus.

- **The Sigmoid Sinuses**
  - Receive blood from posterior dural venous sinus veins.
Cerebral venous sinus thrombosis is the presence of a thrombus within one of the dural venous sinuses.

The thrombus block venous return through sinuses and causes accumulation of deoxygenated blood within the brain.

This may lead to venous infarction (tissue death, necrosis) that is caused by a local lack of oxygen.

The situation is complicated by the accumulation of cerebrospinal fluid, which can no longer drain through the venous sinus with thrombosis.

Common clinical symptoms include headache, nausea, vomiting, and neurological defects.

The diagnosis can be made by CT or MRI scan with contrast.

Treatment by anticoagulation.
The diploic veins are large, thin-walled valveless veins that channel in the diploë between the inner and outer layers of the cortical bone in the skull.

They are lined by a single layer of endothelium supported by elastic tissue.

The diploic veins drain this area into the dural venous sinuses.

There are four main groups of diploic veins: frontal, anterior temporal, posterior temporal and occipital diploic veins.

Their function is to drain the venous blood from the cranial bones to the dural venous sinuses and other intracranial and extracranial veins.

Diploic veins drain the diploic venous system into emissary veins, which subsequently empty into the dural venous sinuses and meningeal veins.
Emissary veins play a vital role in facilitating venous communication between the pterygoid venous plexus within the infratemporal fossa and the cavernous sinus within the middle cranial fossa.

The pterygoid venous plexus is a rich venous network, directing blood flow to the maxillary vein and the retromandibular vein posteriorly and into the ophthalmic veins and the anterior facial vein anteriorly.

Emissary veins are valveless venous structures that connect the extracranial vessels of the scalp to the intracranial dural venous sinuses and diploic veins.

The distribution of the emissary veins vary from person to person, and allows the equalization of intracranial pressures and applies cooling of the brain.
QUESTIONS?

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