

Objective: At the end of this lecture you should be able to :

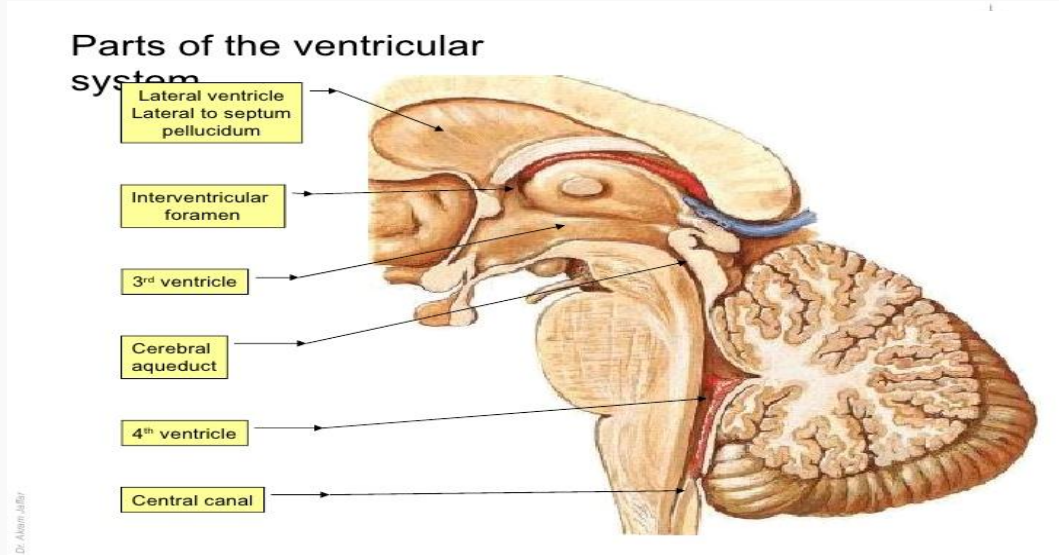
- ☒ Define ventricular system of the brain .
- ☒ Describe location and the boundaries of the four ventricles of the brain.
- ☒ Define the choroid plexus and CSF and their functions
- ☒ Know the pathway of CSF circulation
- ☒ Clinical notes

Definition:

The ventricles of the brain are a communicating network of cavities filled with cerebrospinal fluid (CSF) and located within the brain parenchyma.

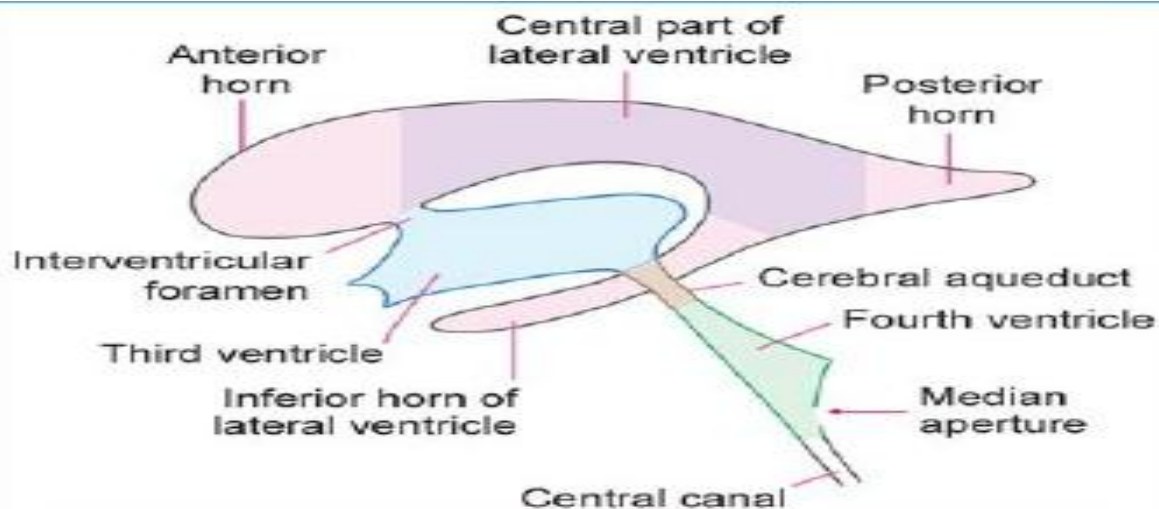
The ventricular system is lined by an epithelial covering called the **ependyma**, which is functionally important in the production of CSF, and the maintenance of the blood-CSF barrier.

There are four shallow spaces in the brain that house cerebrospinal fluid (CSF): two lateral ventricles, third ventricle and fourth ventricle.



Lateral Ventricles

Are two large cavities of the ventricular system. Each lateral ventricle is divided into a central portion and 3 lateral extensions or horns of the ventricles.



1. Anterior horn : Located in In the frontal lobe ,has :

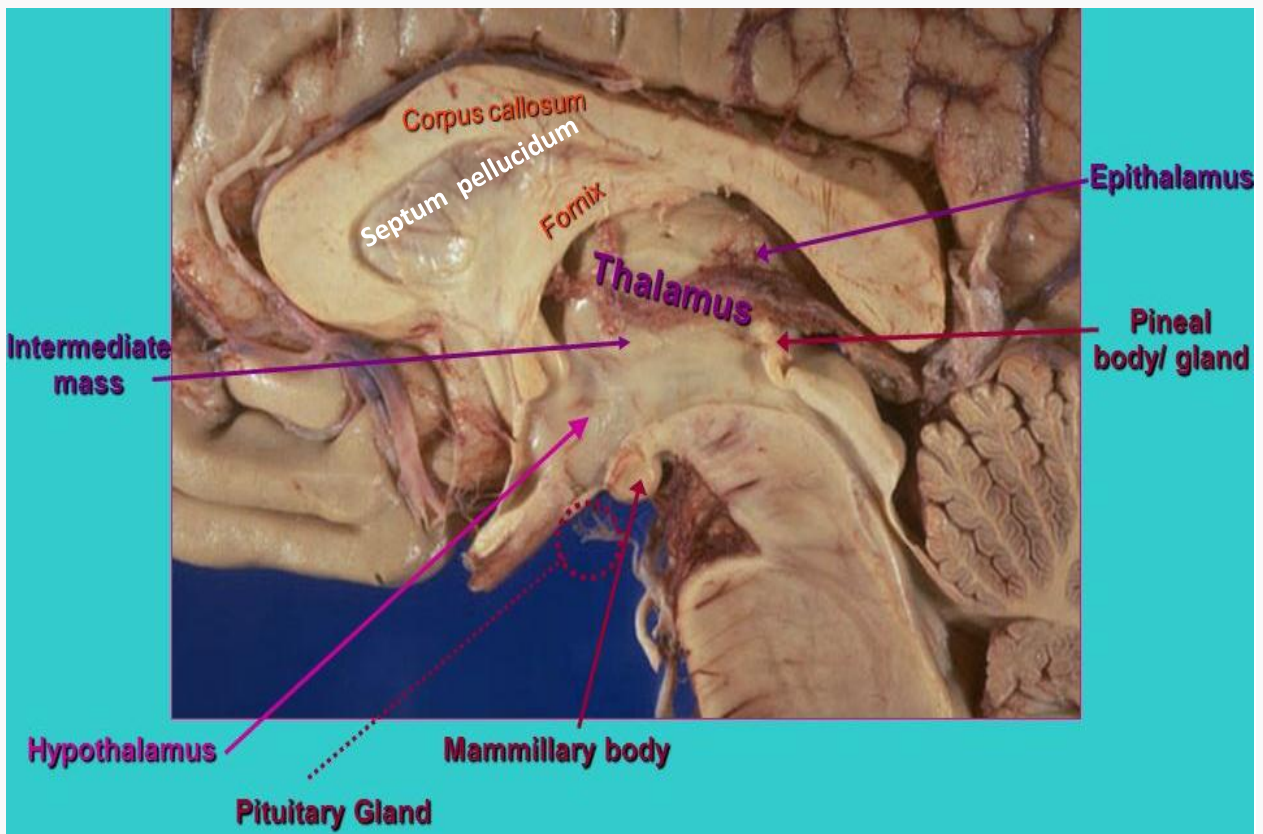
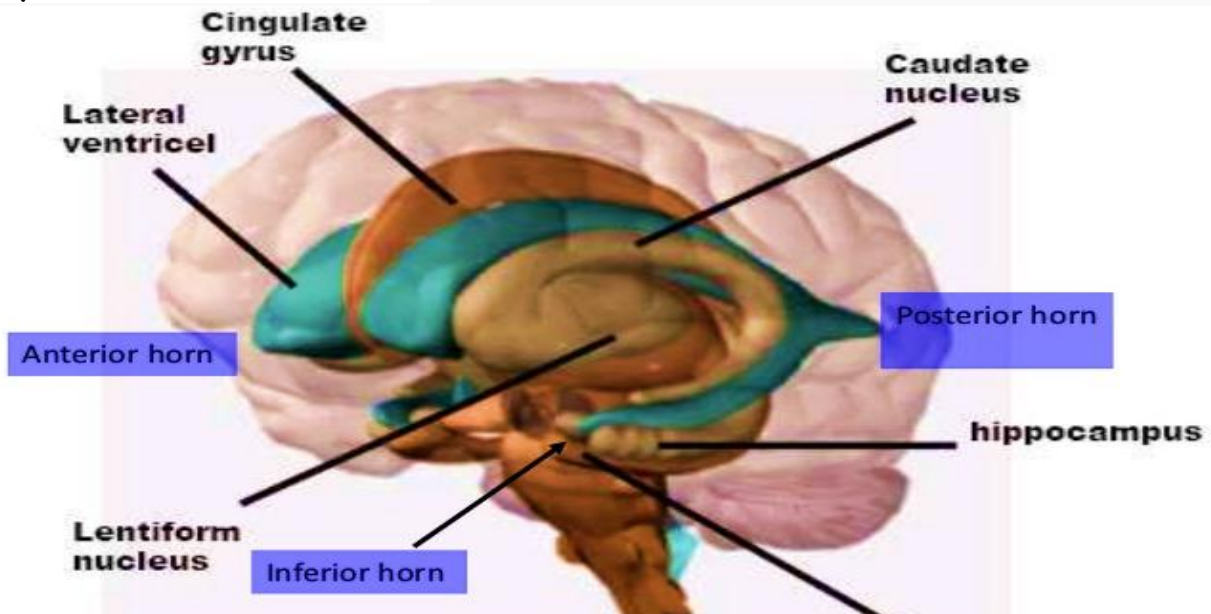
Roof ,:formed by Corpus callosum

Floor: formed by Corpus callosum

Anterior: formed by Corpus callosum

Medially: formed by Septum pellucidum.

Laterally: Head of Caudate nucleus.

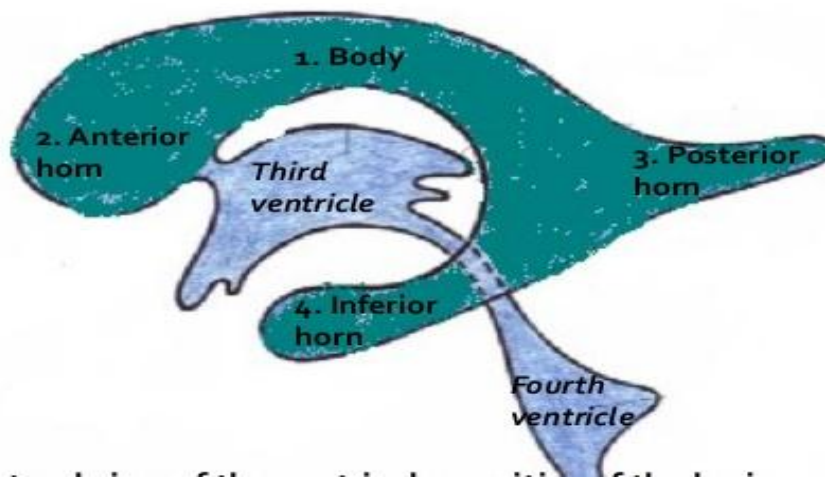


2. Body of the lateral ventricle: Lies in the parietal lobe.

1. Roof: formed by Corpus callosum
2. Floor: formed by Caudate nucleus, thalamus, choroid plexus and fornix,
3. Medial wall: formed by Septum pellucidum.
4. Lateral wall: meeting of roof & floor.

Lateral ventricle

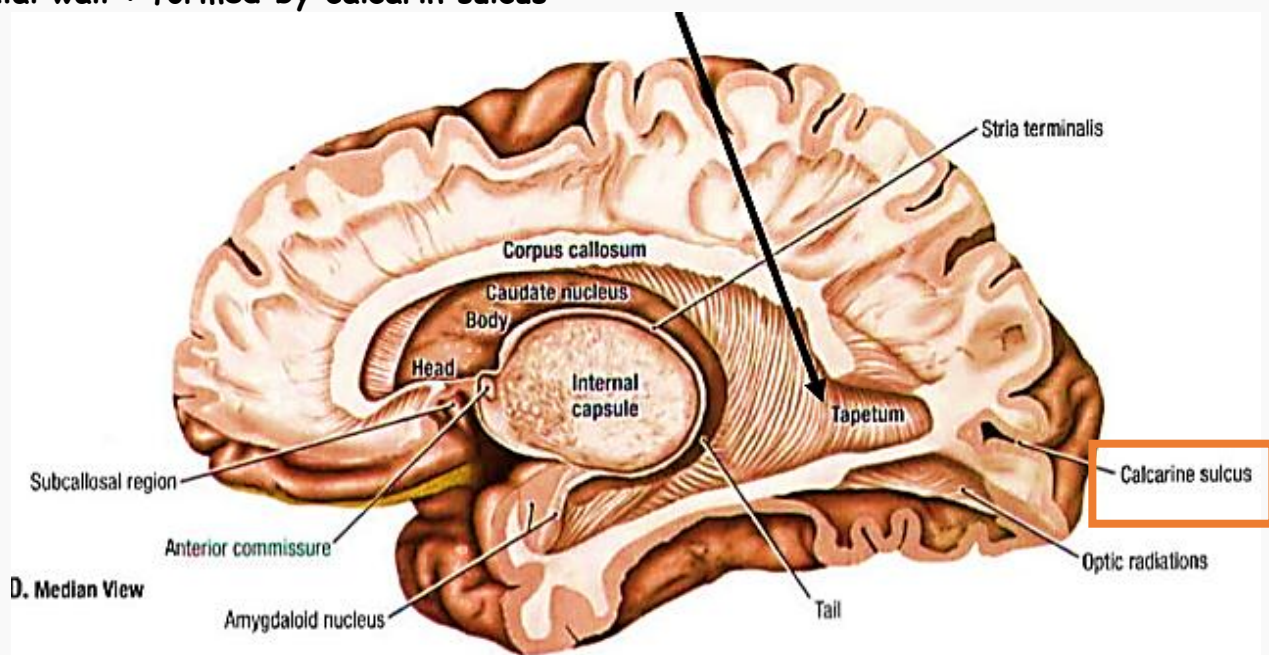
□ C-shaped cavity & may be divided into :



3. Posterior horn: Lies the occipital lobe.

Roof, lateral wall, and floor: Are formed by the corpus callosum.

Medial wall : formed by calcarine sulcus

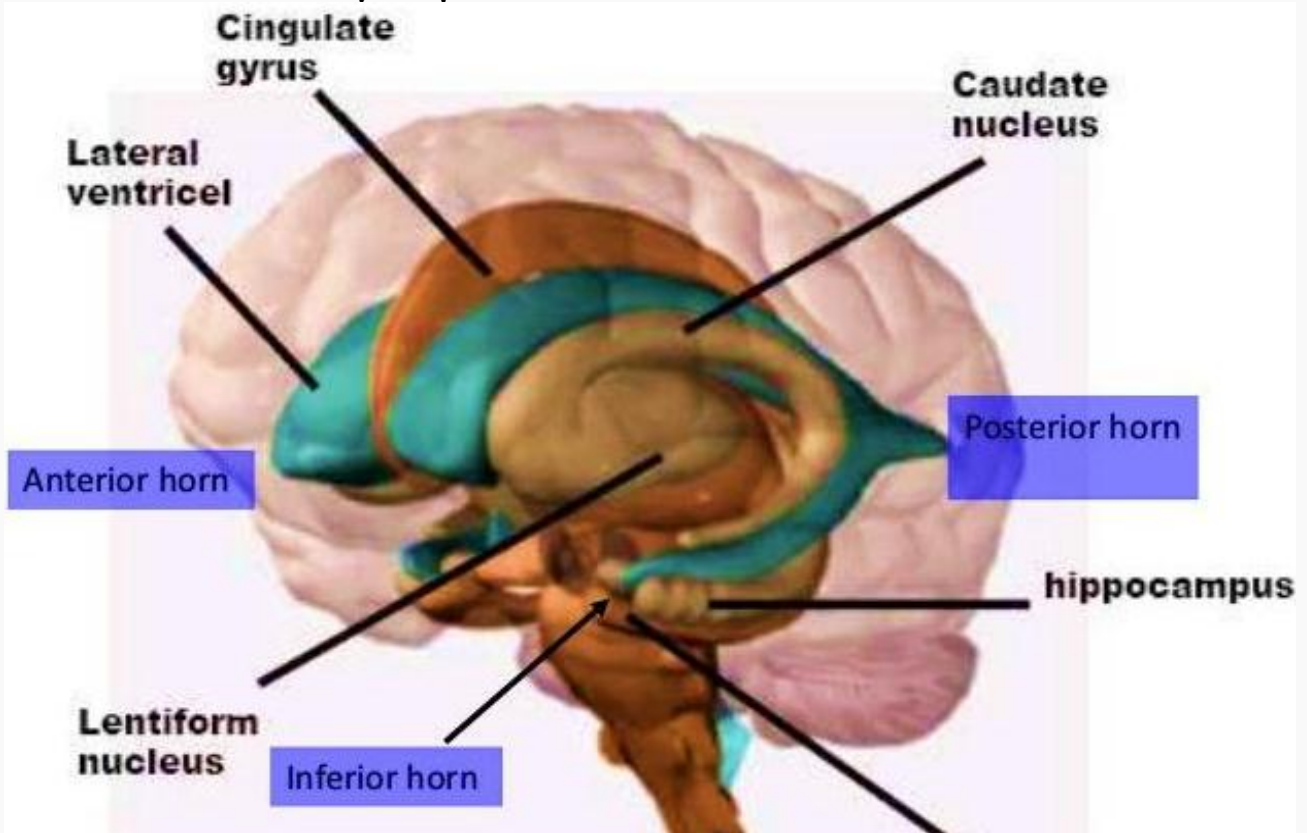


4. Inferior horn : Temporal horn

Floor : is formed by Hippocampus Choroid plexus and Collateral sulcus

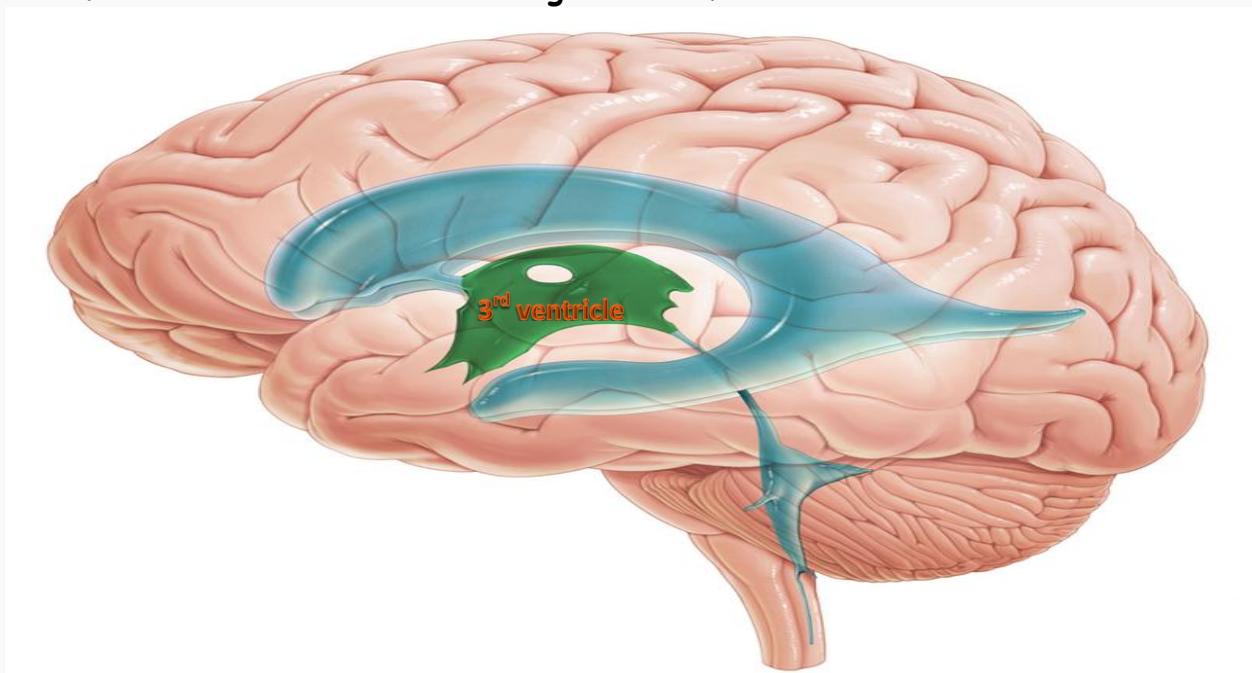
Roof : is formed by caudate nucleus tail

Lateral wall : is formed by Corpus callosum

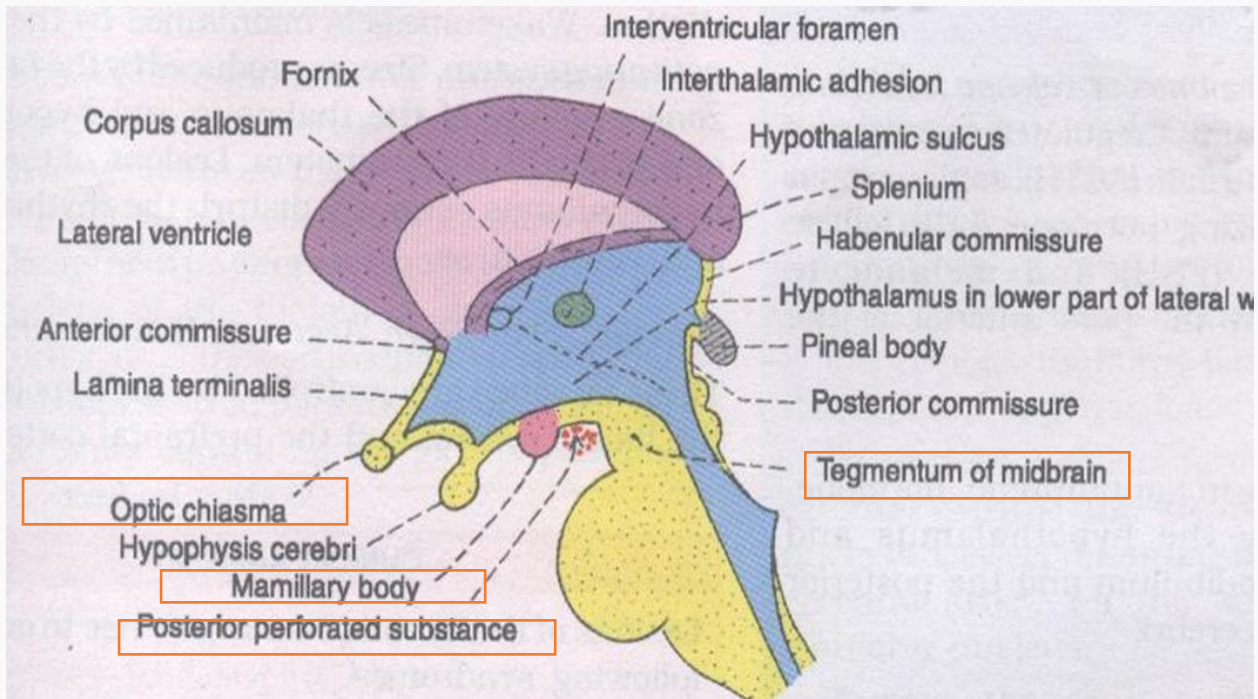


Third Ventricle:

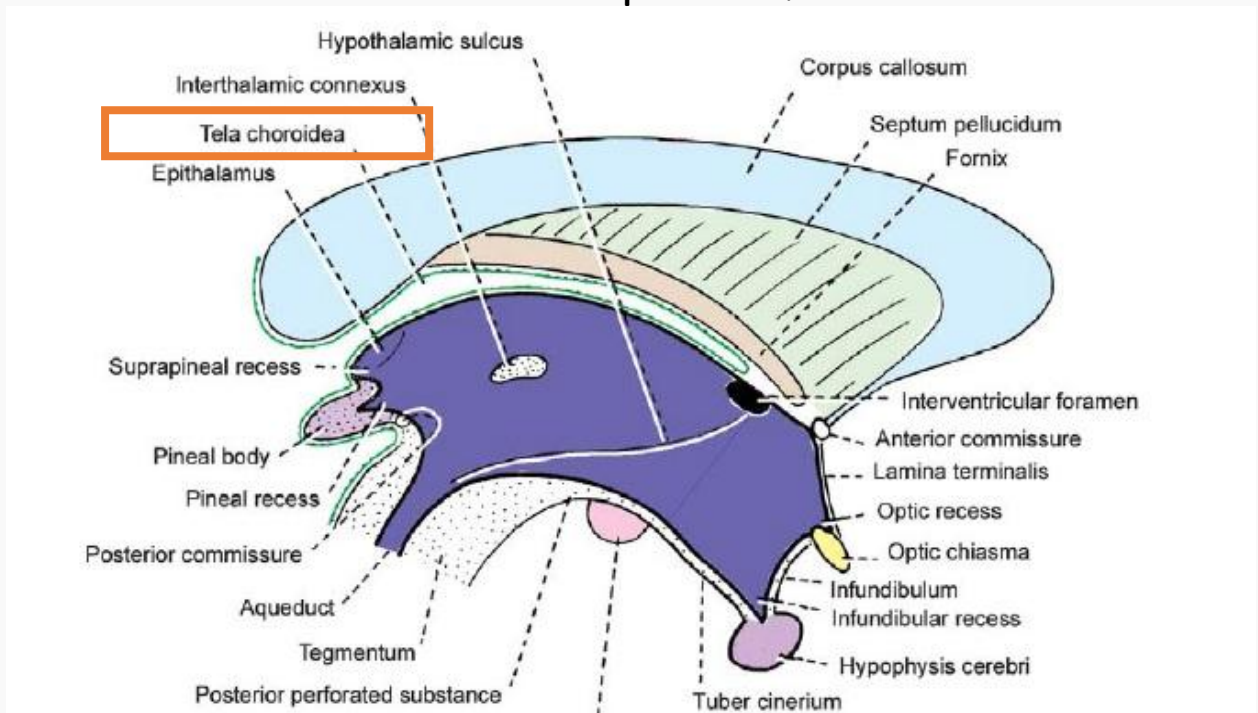
Located in the diencephalon and is referred to as the cavity of the diencephalon. It is a median fossa situated between the right and left thalami.



The Floor : is formed by
Optic chiasma, mamillary body ,tegmentum of mid brain and posterior perforated substance.



The Roof : is formed by :
Ependyma that stretches across the two thalami and lines the ventricular surface.
*Above ependyma, there is a tela choroidea
*Within the tela choroidea are two choroid plexuses of blood.



Lateral Walls:

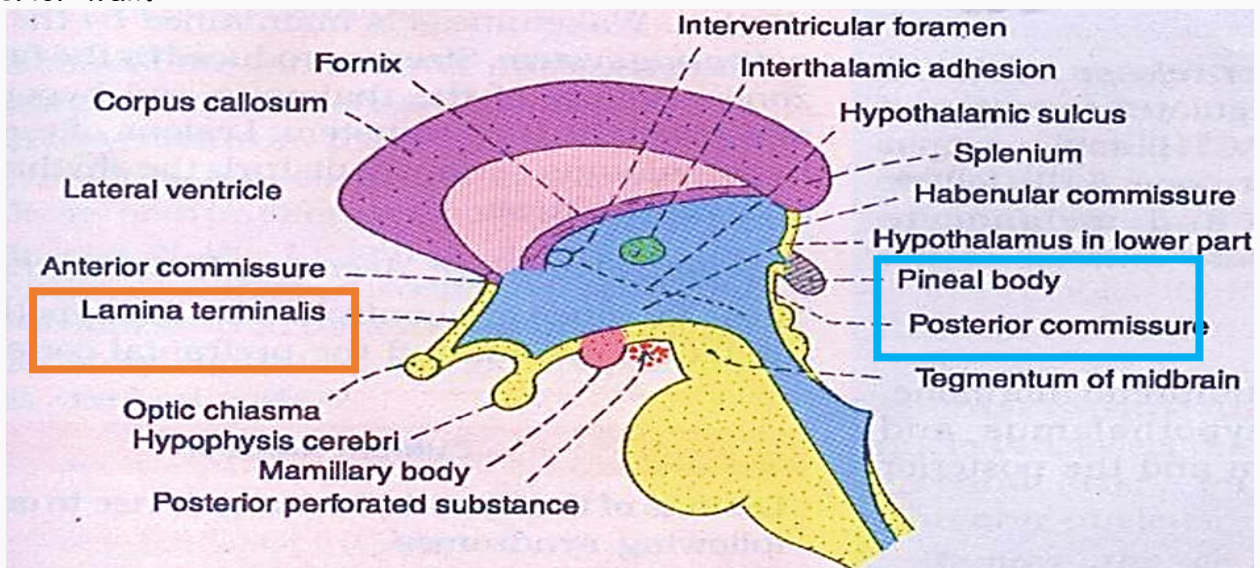
The left and right thalami are also major structures forming the lateral walls of the third ventricle.

Anterior wall :

Is formed by the lamina terminalis, which bridges between the optic chiasm and the rostrum of the corpus callosum.

Posterior wall:

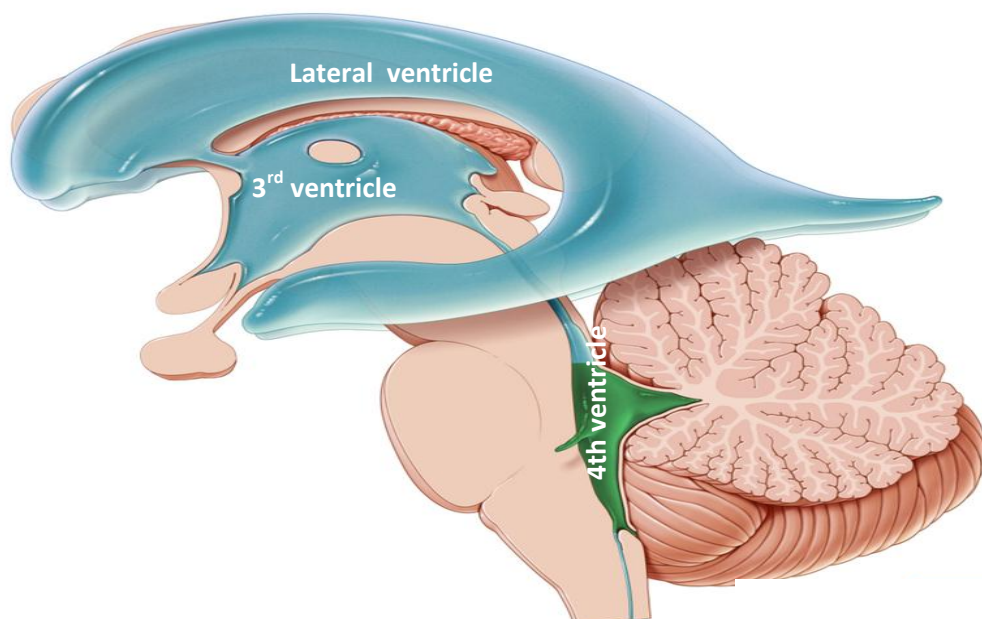
The pineal body and the posterior commissure lie posterior to the ventricle forming its posterior wall.



Fourth Ventricle:

Lies dorsal to the pons and medulla (of the brainstem) & ventral to the cerebellum.

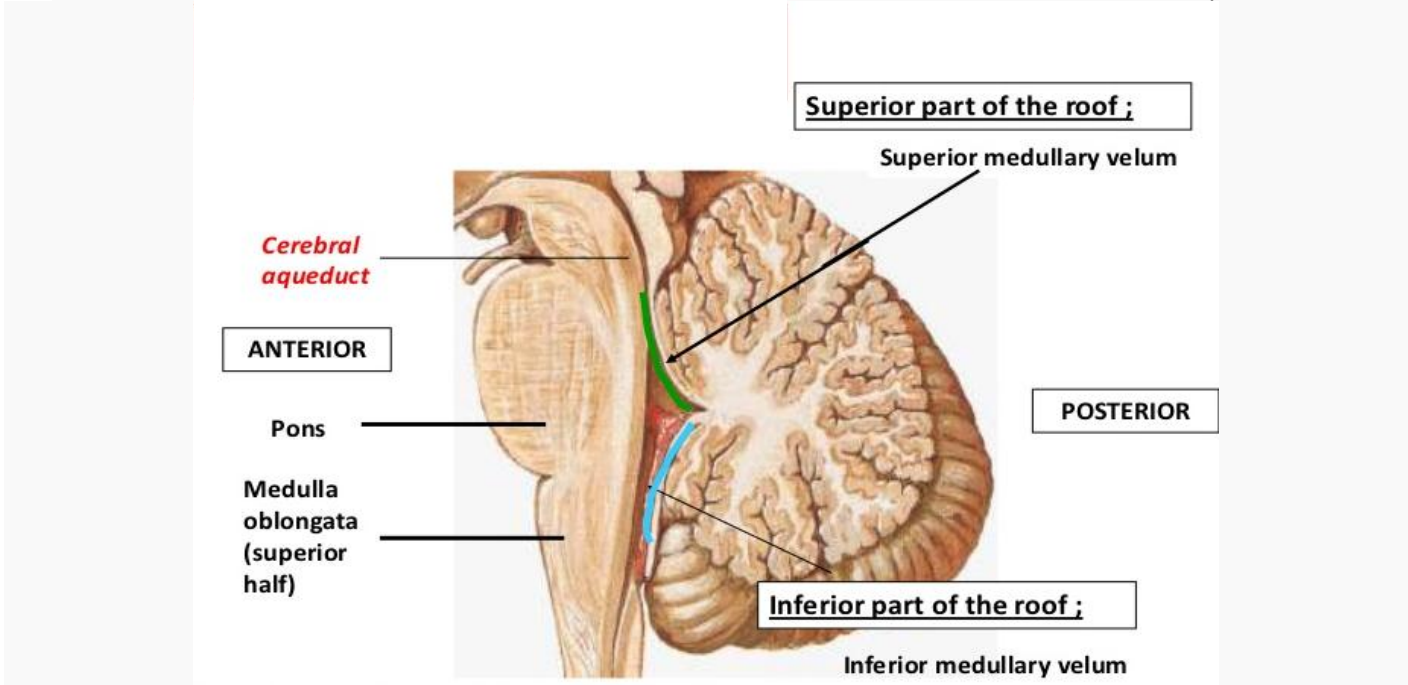
- ✖ Extends from cerebral aqueduct (aqueduct of Sylvius) to the obex.
- ✖ communicating freely with the central canal of the spinal cord inferiorly and the third ventricle superiorly.



The Roof :

Roof of the fourth ventricle is tent-shaped and is divided into 2 parts.

- ✘ The upper part is formed by superior cerebellar peduncles & superior medullary velum (thin sheet of white matter).
- ✘ The inferior part is made of non-nervous tissue, the inferior medullary velum.

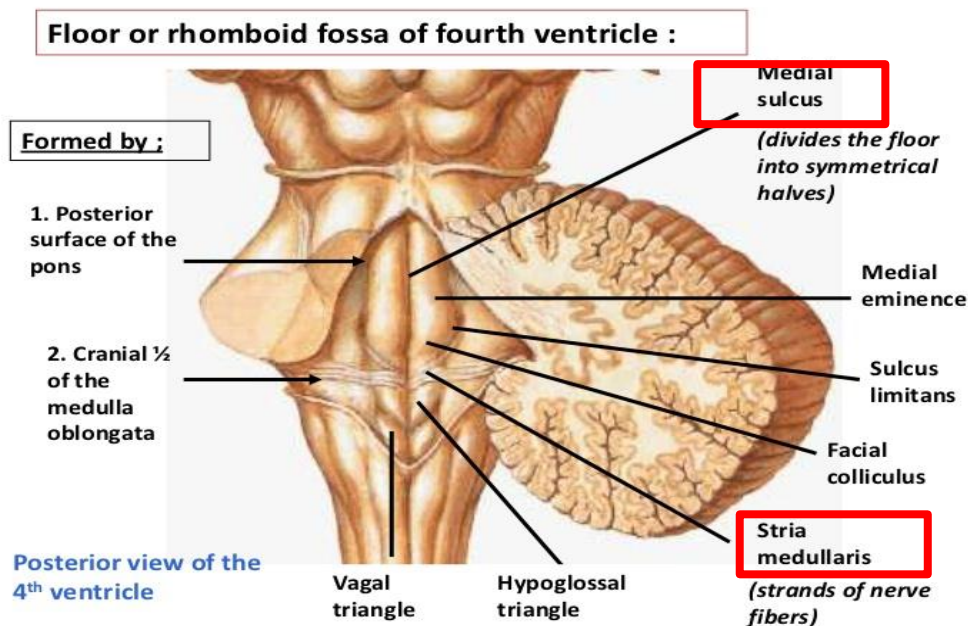


The floor: Rhomboid fossa

It is divided into a right and left half by the median sulcus and a superior and inferior triangle by the striae medullares.

*The upper triangular part is formed by the posterior surface of the pons.

*The lower triangular part is formed by upper part of the posterior surface of the medulla oblongata



Lateral wall:

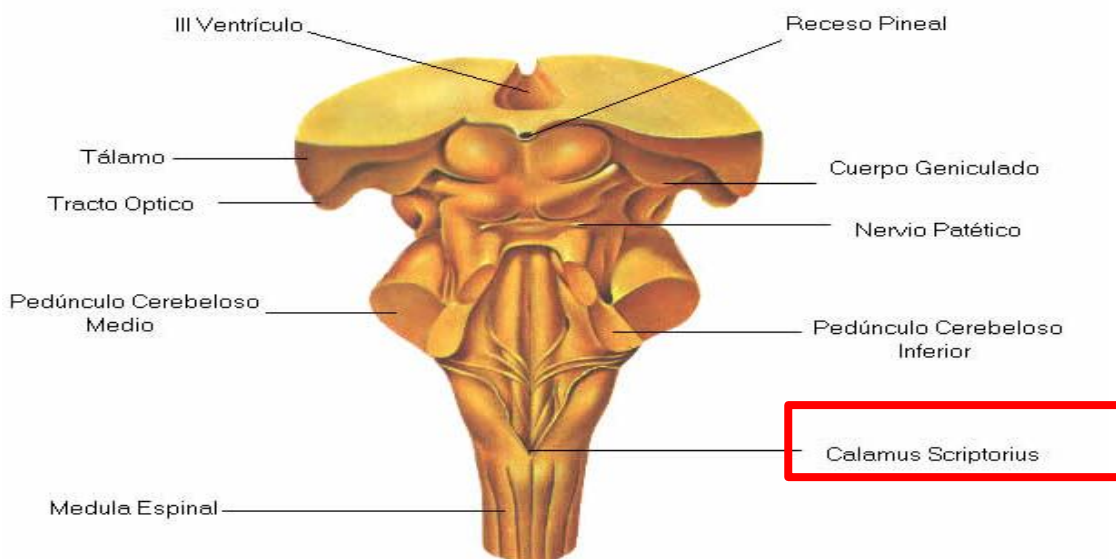
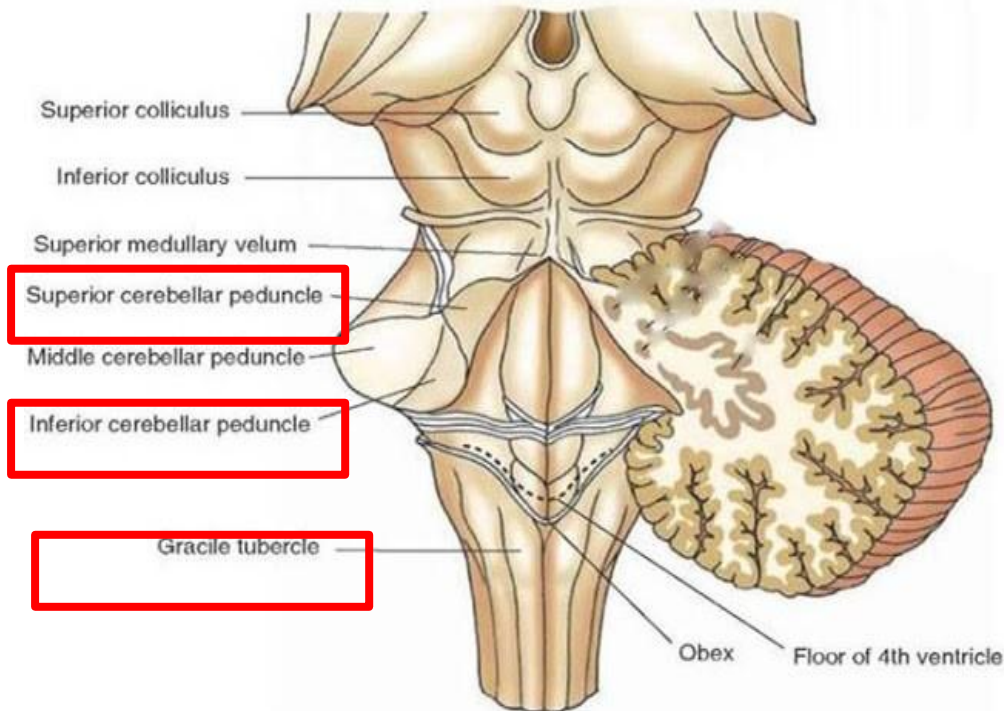
The lateral walls are formed by the cerebellar peduncles.

* superior part of these walls is formed by the superior cerebellar peduncle.

* inferior part is formed by the inferior cerebellar peduncle and by the gracile and cuneate tubercles of the brainstem.

* intermediate part marked by the presence the striae medullares.

* lowest part of the floor is referred to as the calamus scriptorius.



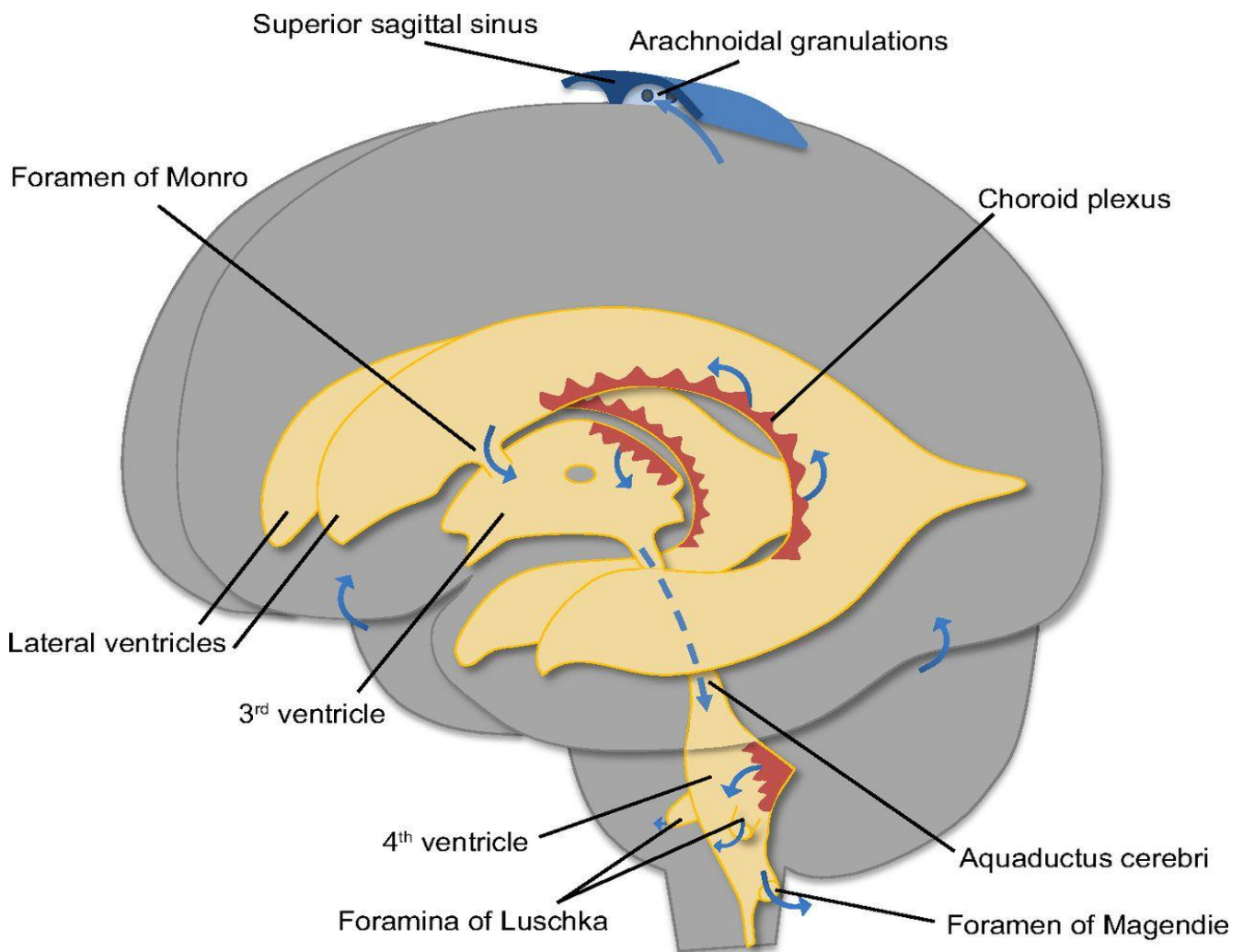
Choroid Plexus:

The choroid plexuses are a network of capillaries and specialized ependymal cells that is located in the ventricular system .

The choroid plexus serves two important functions :

*produces cerebrospinal fluid , which fills the ventricles & subarachnoid space, following a cycle of constant production and reabsorption.

*helps to provide a barrier, which protects the brain and other central nervous system tissue from toxins.



☠️ Cerebrospinal fluid

Cerebrospinal fluid (CSF) is a clear, colorless body fluid .It is presented within the subarachnoid space, which covers the brain, spinal cord, and stretches below the end of the spinal cord to the sacrum . It is produced in the choroid plexuses of the ventricles of the brain and absorbed in the arachnoid granulations. There is about 125 -150 mL of CSF at any one time, and about 500mL is generated every day.

CSF acts as:

- * a cushion or buffer for the brain
- * providing basic mechanical and immunological protection to the brain inside the skull.
- * serves a vital function in cerebral autoregulation of cerebral blood flow.

☠CSF Circulation

The majority of CSF is produced from within the two lateral ventricles.

CSF passes through the interventricular foramina of Monro to the 3rd ventricle, then via cerebral aqueduct of Sylvius to the 4th ventricle. From the 4th ventricle, the fluid passes into the subarachnoid space through four openings :

- * central canal of the spinal cord
- * median aperture
- * two lateral apertures

. The level at which the CSF enters the subarachnoid space is called the cerebellomedullary cistern. The fluid then flows through the subarachnoid space surrounding the brain and spinal cord. It finally leaves the subarachnoid space and CNS by entering the venous sinuses (superior sagittal sinus) through the arachnoid villi. The arachnoid villi provide a valvular mechanism for flow of CSF into the bloodstream without permitting backflow of blood into the CSF.

☠Clinical Notes:

Hydrocephalus

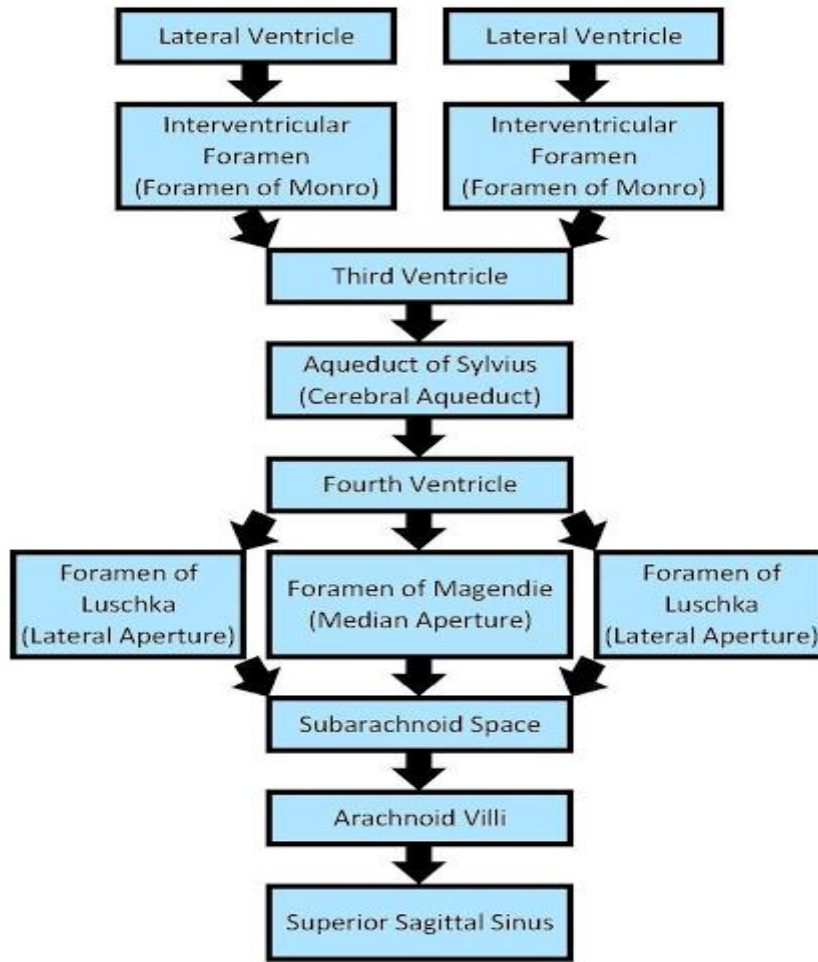
Hydrocephalus is an abnormal enlargement of the head in children due to an abnormal increase in the amount of CSF. It may be caused by excessive production of CSF, obstruction of its flow, or by impaired absorption through the arachnoid villi.

Obstructions are most likely to occur at narrow passages such as the interventricular foramen, the cerebral aqueduct, the median aperture, and lateral apertures of the fourth ventricle.

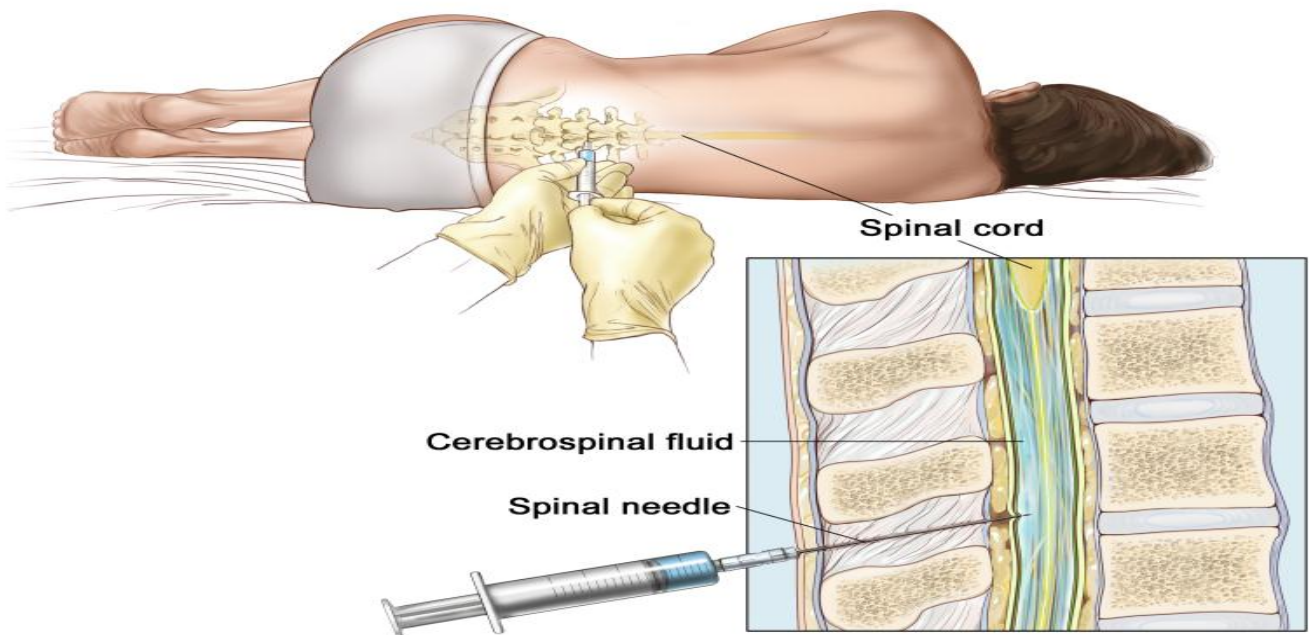
Lumbar Puncture

Lumbar punctures are a common procedure for assessing diseases and disorders relating to the CSF and meninges in both adults and infants. The procedure is performed with the patient in their maximal lumbar flexion. Marks are made between the top of the iliac crests to provide the indication of the join between L3 and L4, palpation is made to ensure correct placement of the needle. Extracted CSF undergoes clinical tests, including visual and technical analysis.

Circulation of Cerebrospinal Fluid (CSF)



Lumbar Puncture



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