



LECTURE 08

VENTRICULAR SYSTEM (3rd Ventricle)

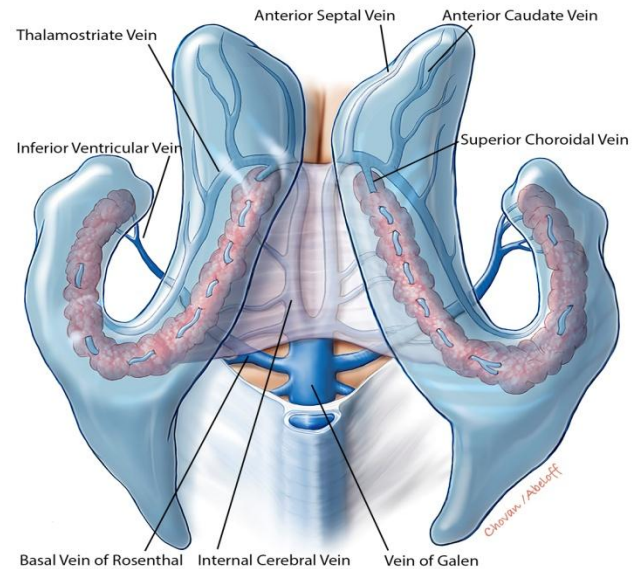
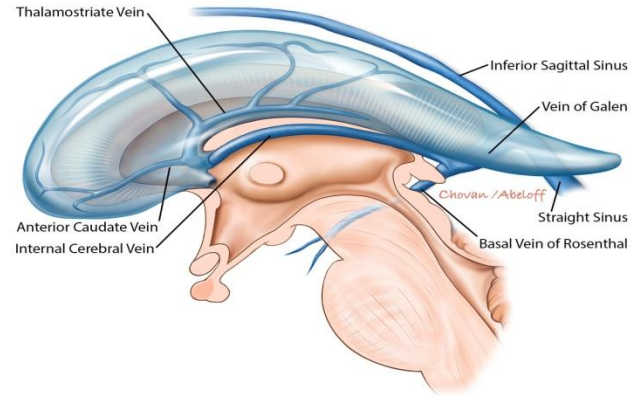
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THE VENTRICULAR SYSTEM

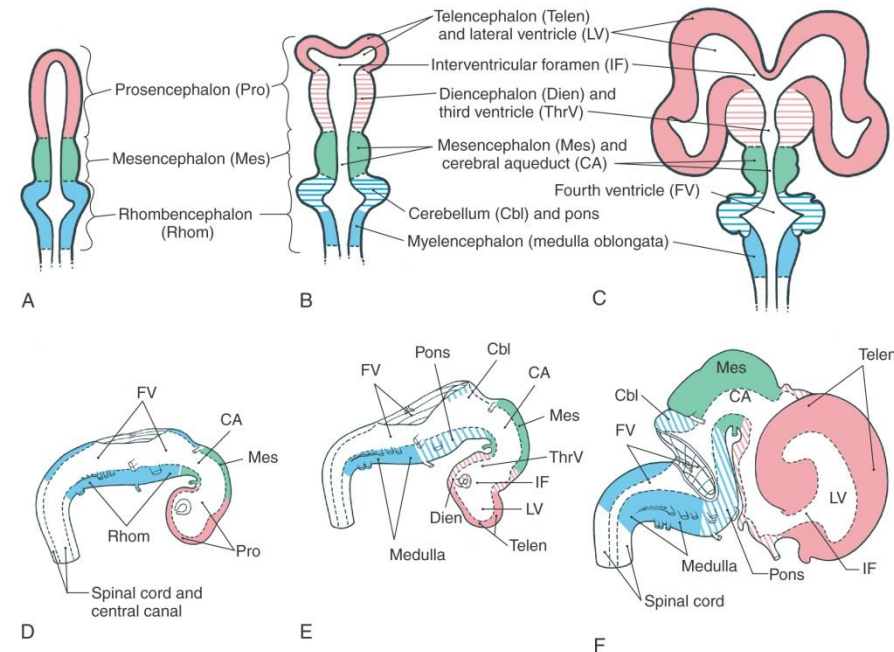
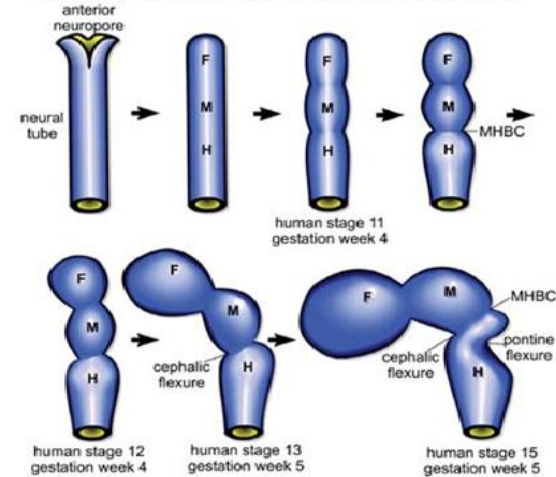
- Comprises of :
- Two lateral ventricle
- Third Ventricle
- Cerebral Aqueduct
- Fourth Ventricle



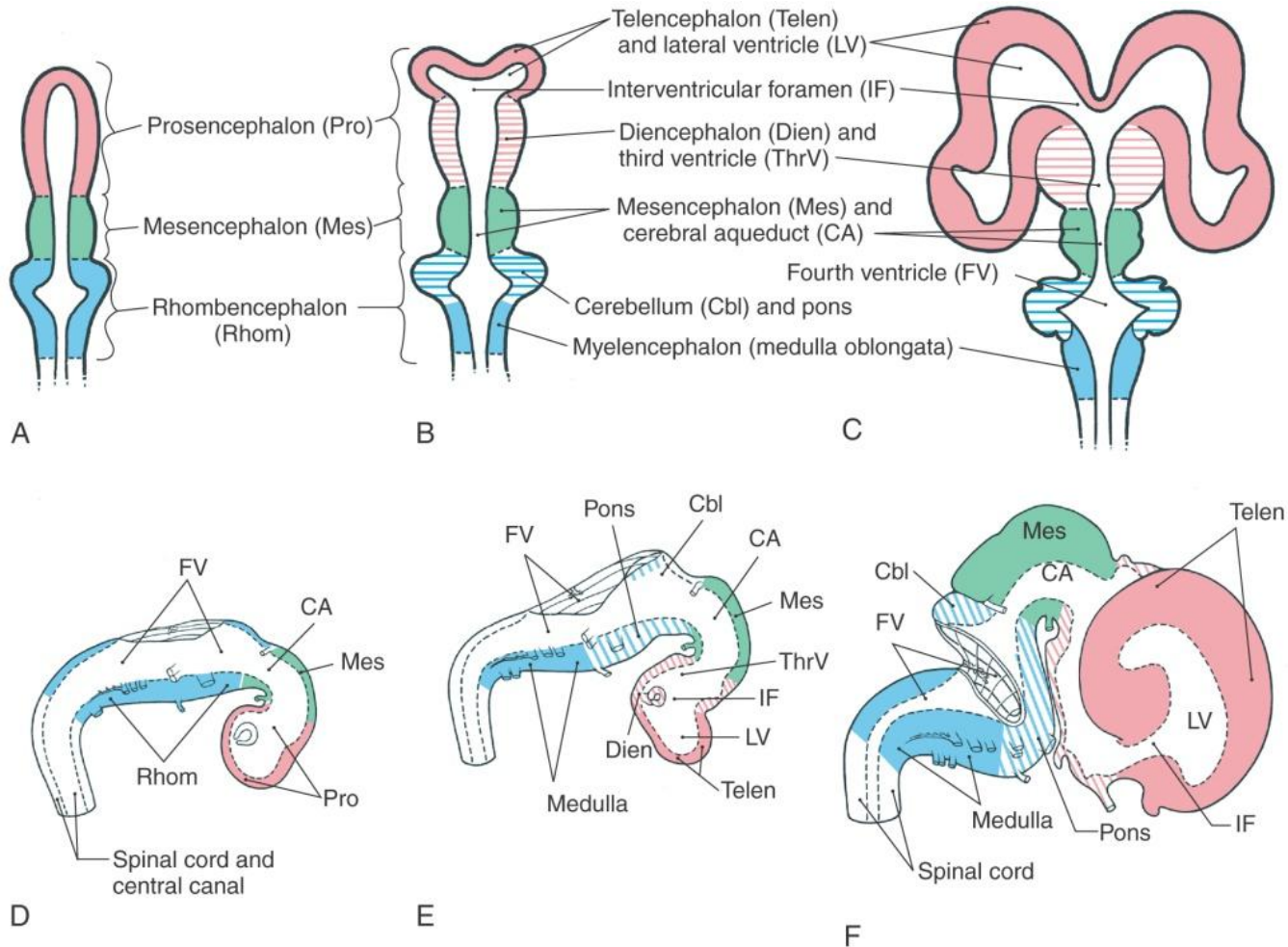
DEVELOPMENT OF THIRD VENTRICLE

- 3rd Ventricle is a part of the ventricular system of the brain.
- Develops from the *neural canal* of the neural tube.
- Specifically, it originates from the most rostral portion of the neural tube which initially expands to become the Prosencephalon.
- The lamina terminalis is the rostral termination of the neural tube.
- After about five weeks, different portions of the prosencephalon begin to take distinct developmental paths from one another – the more rostral portion becomes the telencephalon, while the more caudal portion becomes the diencephalon.

A Steps of Early Embryonic Brain Morphogenesis

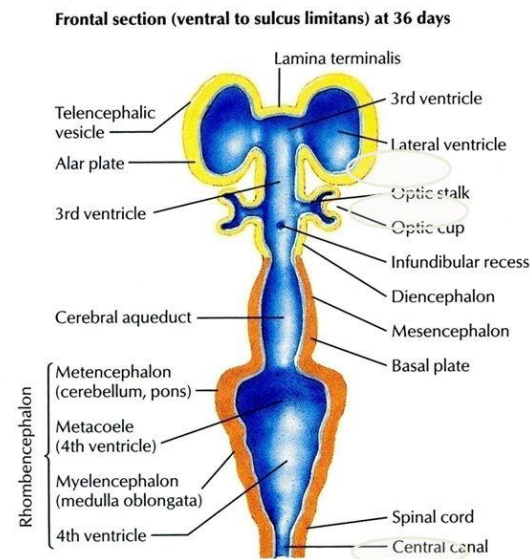


STAGES OF DEVELOPMENT OF BRAIN



DEVELOPMENT OF THIRD VENTRICLE

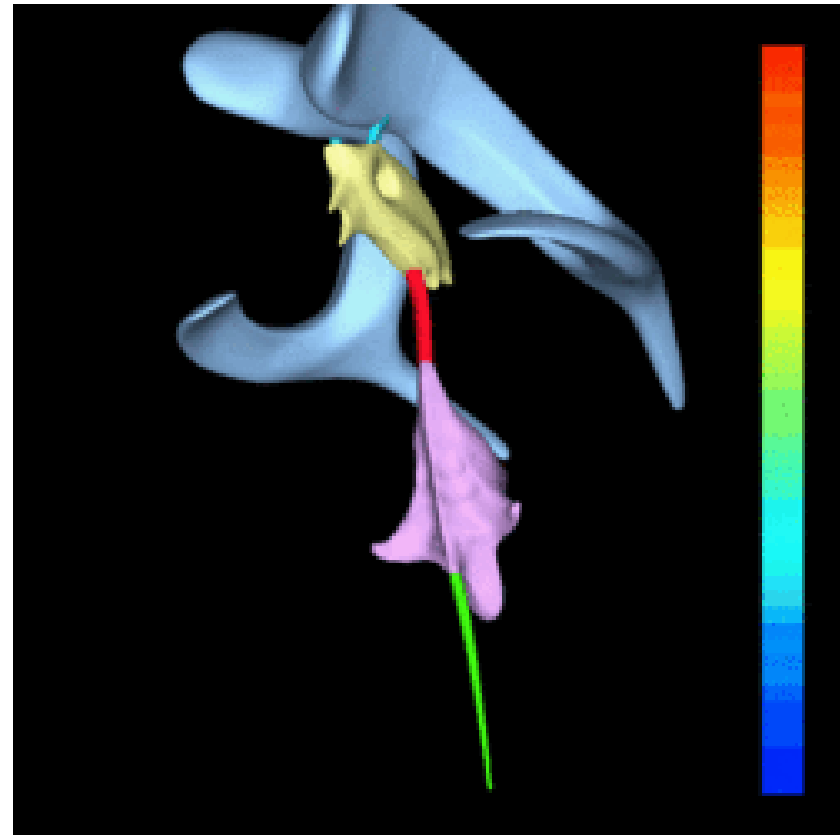
- The Telencephalon gradually expands laterally to a much greater extent than it does dorsally or ventrally.
- Its connection to the remainder of the neural tube reduces to the interventricular foramina.
- The Diencephalon expands more evenly, but caudally of the diencephalon the canal remains narrow.
- The third ventricle is the space formed by the expanding canal of the diencephalon.



The central cavity within the neural tube becomes:
The *ventricles* of the brain & The *central canal* of the spinal cord.

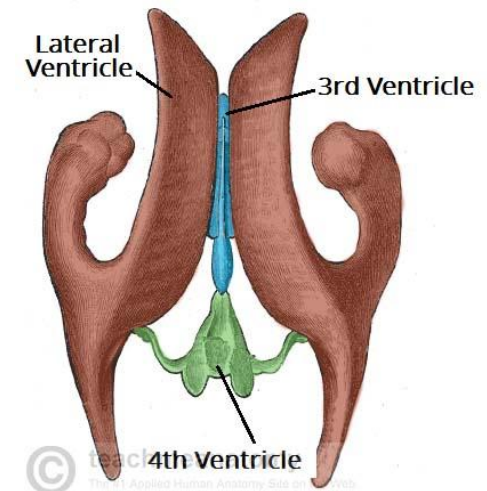
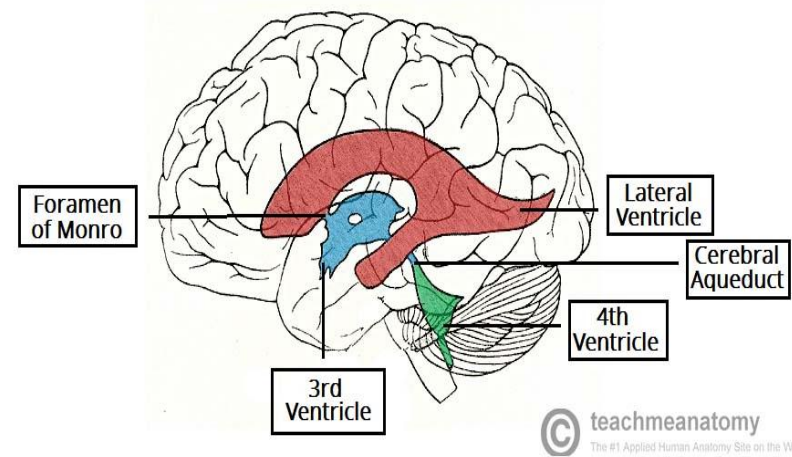
INTRODUCTION TO THIRD VENTRICLE

- The third ventricle is a narrow funnel-shaped cavity of the brain.
- It is located in the midline, comprising the central part of the ventricular system of the brain.
- As such, the third ventricle directly communicates with other ventricles:
- **Foramen of Monro :**
- It communicates with each lateral ventricle.
- **Aqueduct of Sylvius:**
- It communicates with the fourth ventricle.



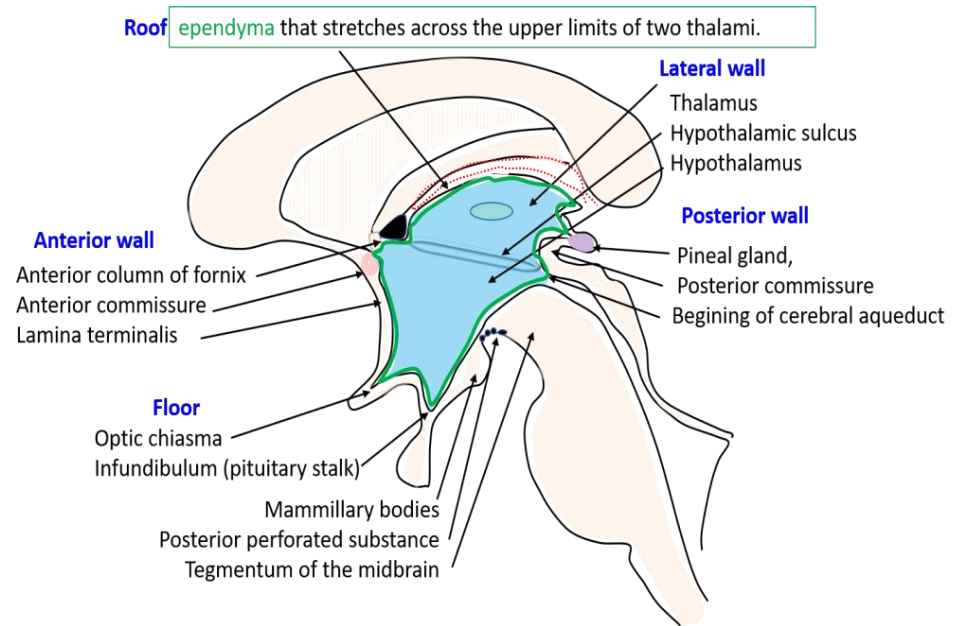
THIRD VENTRICLE

- The third ventricle can be described as a Cuboid's structure that has a:
 - Roof
 - Floor and
 - Four walls (Anterior, Posterior, and Two lateral).
- Similar to the other brain ventricles, the main function of the third ventricle is to produce, secrete and convey cerebrospinal fluid.



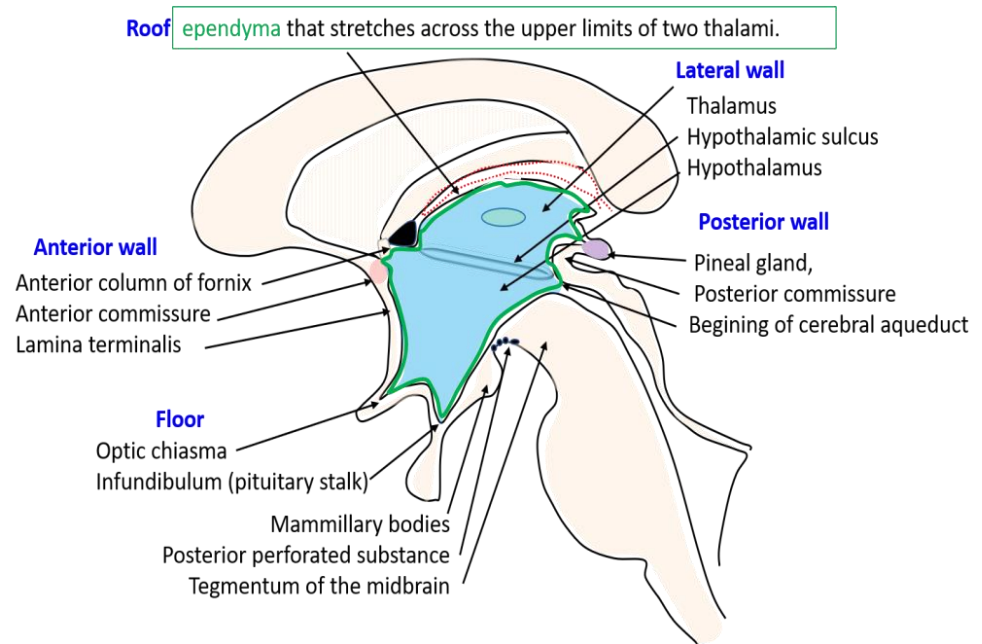
FLOOR OF THIRD VENTRICLE

- The **floor of the third ventricle** extends from the optic chiasma anteriorly to the aqueduct of Sylvius posteriorly.
- The **Anterior portion** of the floor is formed by the hypothalamus, while
- The **Posterior portion** is formed by the midbrain (mesencephalon).



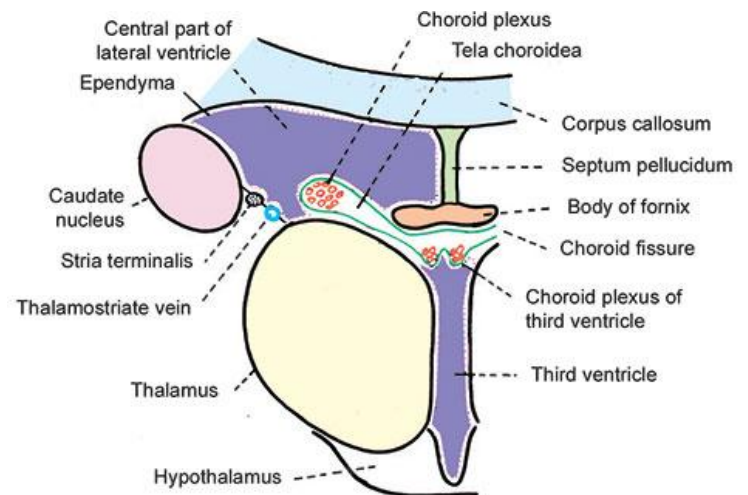
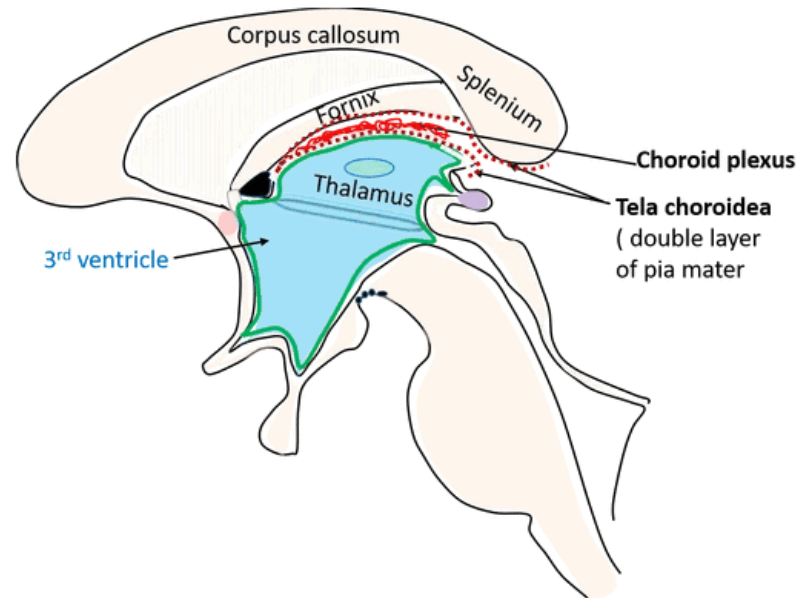
FLOOR OF THIRD VENTRICLE

- Going from the anterior to posterior, the structures that comprise the floor of the third ventricle are the:
 - Optic chiasma
 - Infundibulum of hypothalamus
 - Tuber cinereum
 - Mammillary bodies
 - Posterior perforated substance
 - The anterior part of the tegmentum of the midbrain.



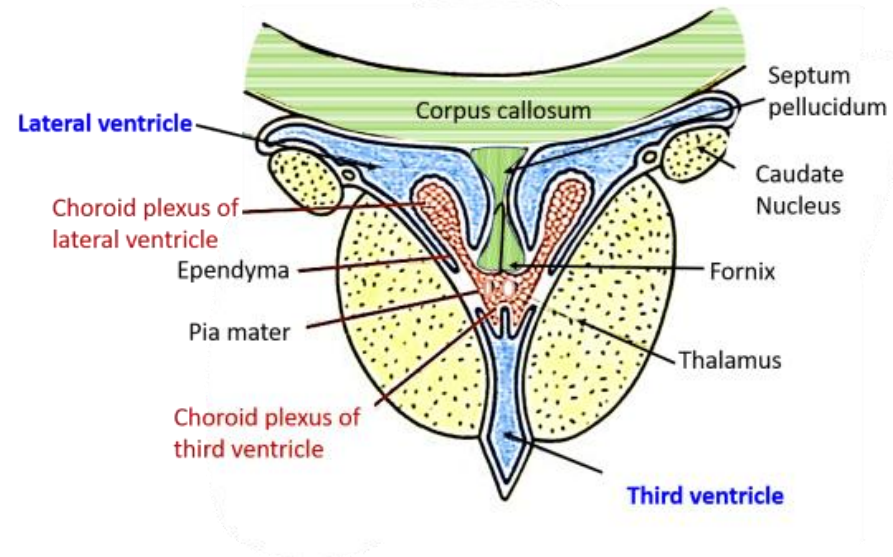
ROOF OF THE THIRD VENTRICLE

- The roof of the third ventricle extends from the foramen of Monro anteriorly to the suprapineal recess posteriorly.
- The roof lies immediately below the body of fornix.
- The roof has four separate layers which include:
 - Neural layer
 - Tela choroidea (two layers)
 - Vascular layer



LAYERS OF THE ROOF OF THIRD VENTRICLE

- The most superficial layer is the neural layer, formed by the body and the crura of the fornix.
- Below this layer, there are two thin membranous layers of tela choroidea.
- The tela choroidea is semi-transparent double-layered structure derived from the pia mater and we'll speak about its function further in the text.
- In between the layers of the tela choroidea, there is a vascular layer that mainly consists of medial posterior choroidal arteries and their branches.

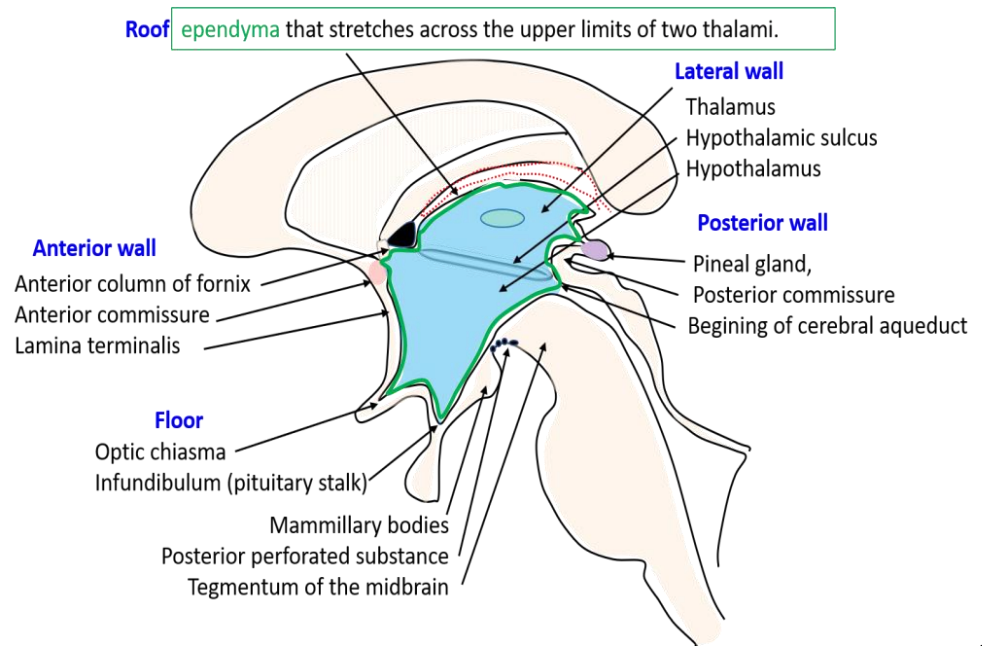


WALLS OF THE THIRD VENTRICLE

- The third ventricle has four walls in total:
- Anterior
- Posterior, and
- Two lateral walls

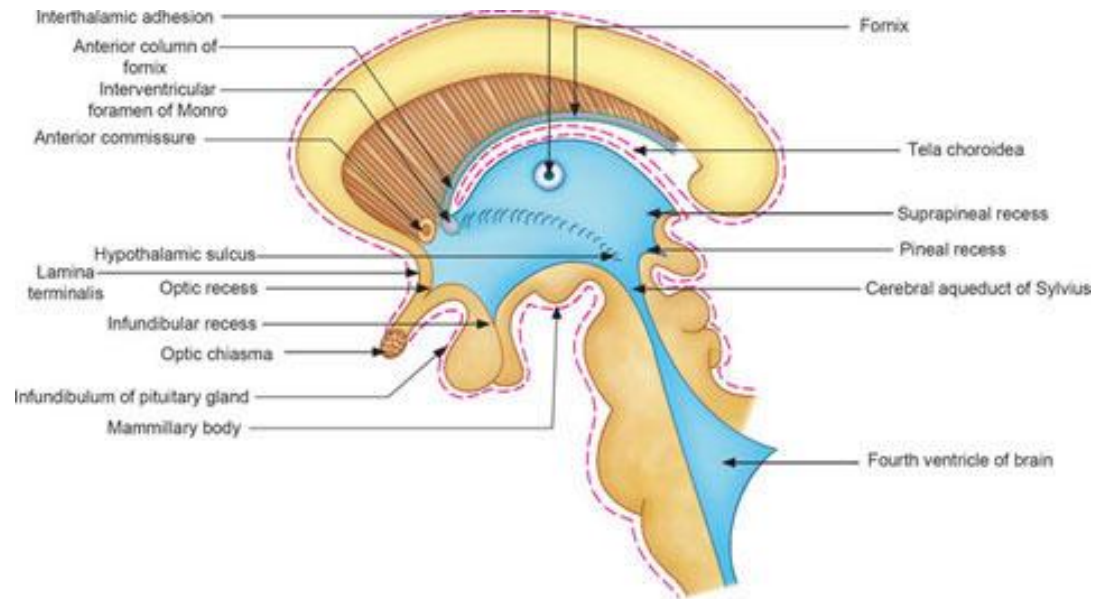
- **ANTERIOR WALL**

- The anterior wall extends from the foramina of Monro superiorly to the optic chiasm inferiorly.
- From superior to inferior, the structures that participate in the formation of the anterior wall are as follows:
- Foramina of Monro
- Columns of fornix
- Anterior commissure
- Lamina terminalis
- Optic recess



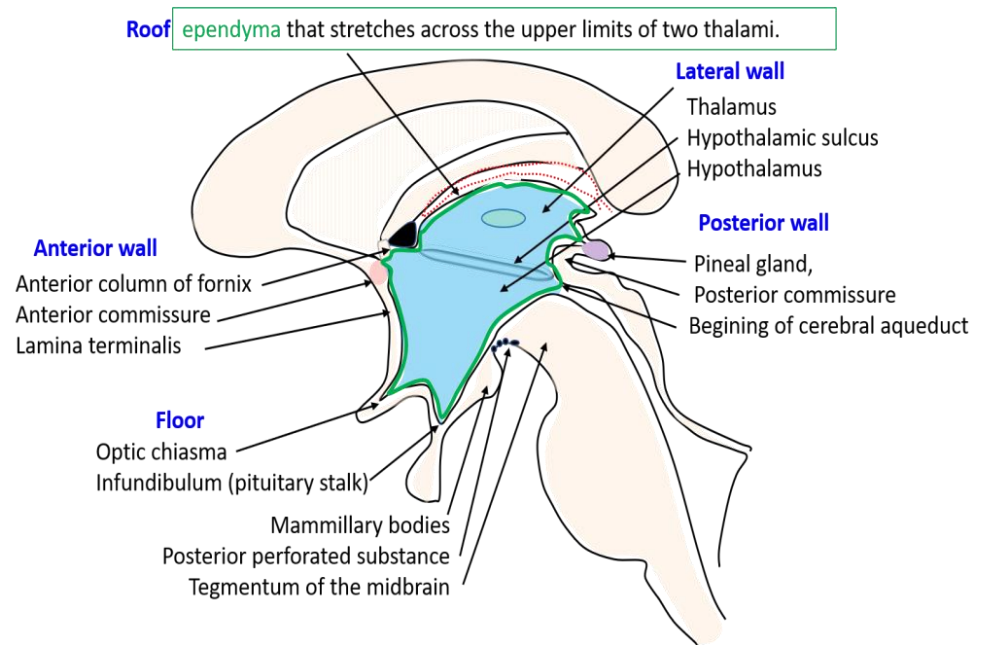
ANTERIOR WALL.....CON'T

- Note that the foramen of Monro is located at the junction between the anterior wall and the roof of the third ventricle.
- When the brain is viewed from the frontal aspect, only the inferior two-thirds of the anterior wall are visible.
- The superiormost portion is covered by the rostrum of the corpus callosum.



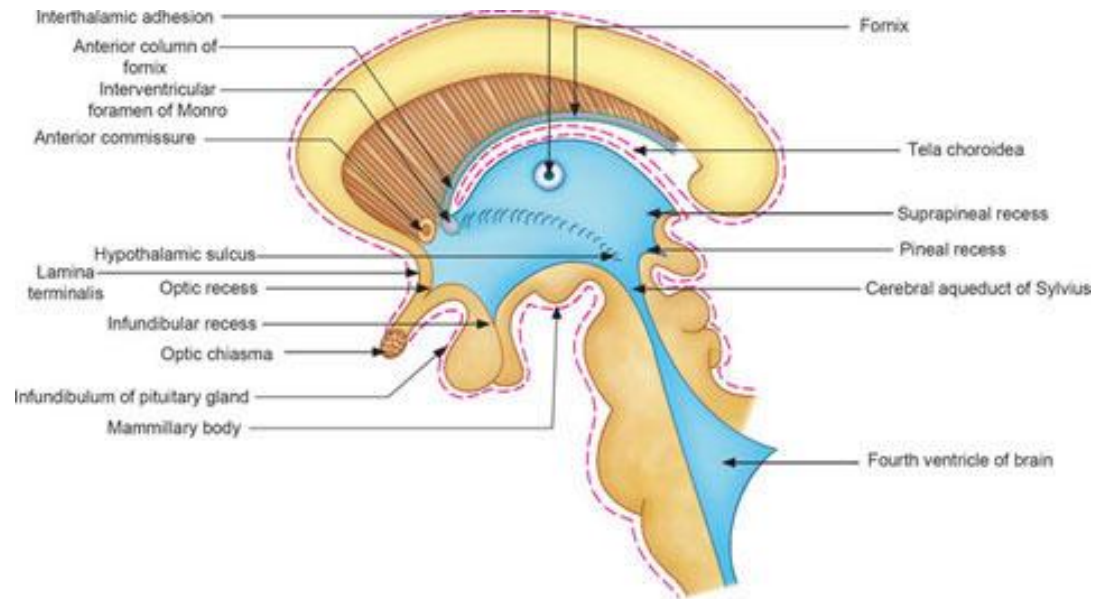
POSTERIOR WALL

- The posterior wall extends:
- Superiorly from the suprapineal recess, to the aqueduct of Sylvius inferiorly.
- When viewed from the anterior perspective, the posterior wall is formed by five structures which are (from superior to inferior):
- Suprapineal recess
- Habenular commissure
- Pineal body and its recess
- Posterior commissure
- Aqueduct of Sylvius



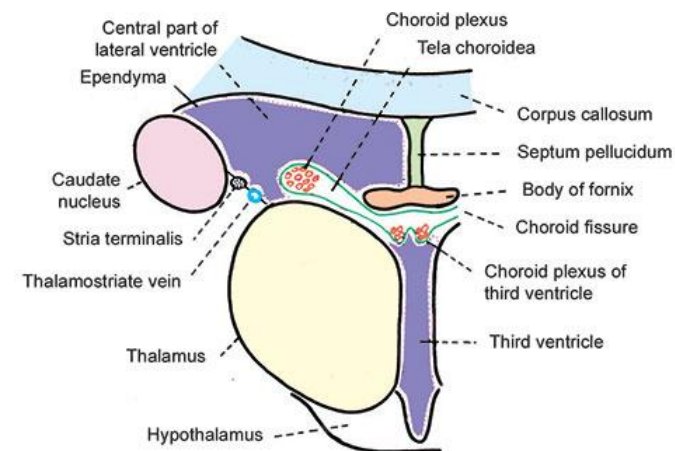
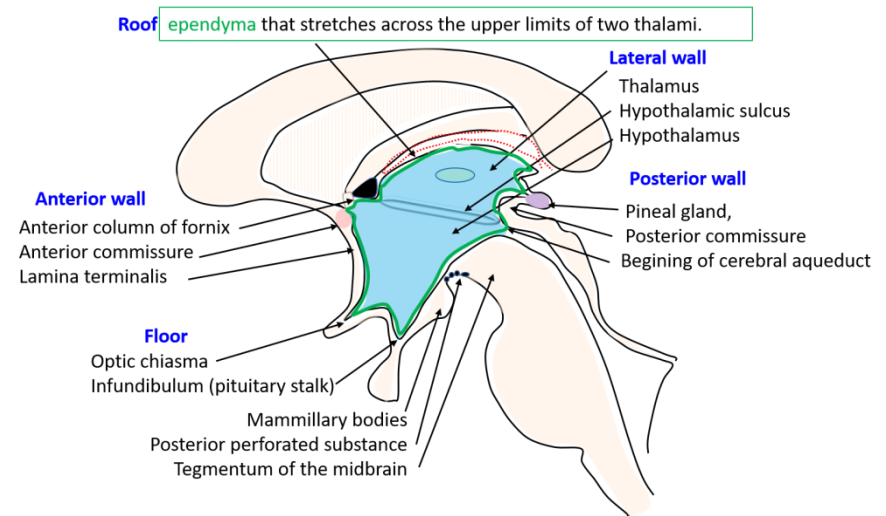
POSTERIOR WALL.....CON'T

- The only structure visible from the posterior aspect of the brain is the pineal gland.
- Inferior to the posterior commissure the ventricle is continuous with the cerebral aqueduct of the midbrain (of Sylvius).



LATERAL WALLS OF THE THIRD VENTRICLE

- The lateral walls of the third ventricle are formed by the medial aspects of the thalamus and hypothalamus, which are separated by the hypothalamic sulcus.
- When viewed from the medial perspective, the outlines of lateral walls can be described as the silhouette of the bird's head with open beaks.
- The majority of the lateral wall (the head of the bird) is formed by the medial aspect of the thalamus.
- The superior beak represents the optic recess, while the inferior beak is formed by the infundibular recess.



CAVITY AND RECESSES OF THIRD VENTRICLE

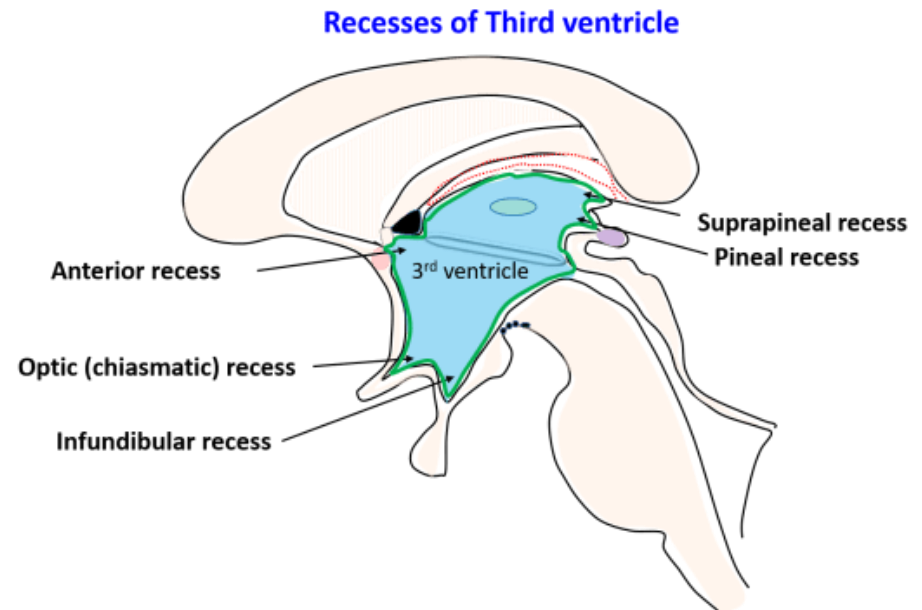
- The cavity of the third ventricle extends into four recesses:

1. Supra-optic recess:

- Located superior to the optic chiasm and inferior to the lamina terminalis.

2. Infundibular recess:

- Found on the floor of the third ventricle, between the optic chiasm and the mamillary bodies.
- It extends inferiorly, into the pituitary stalk.



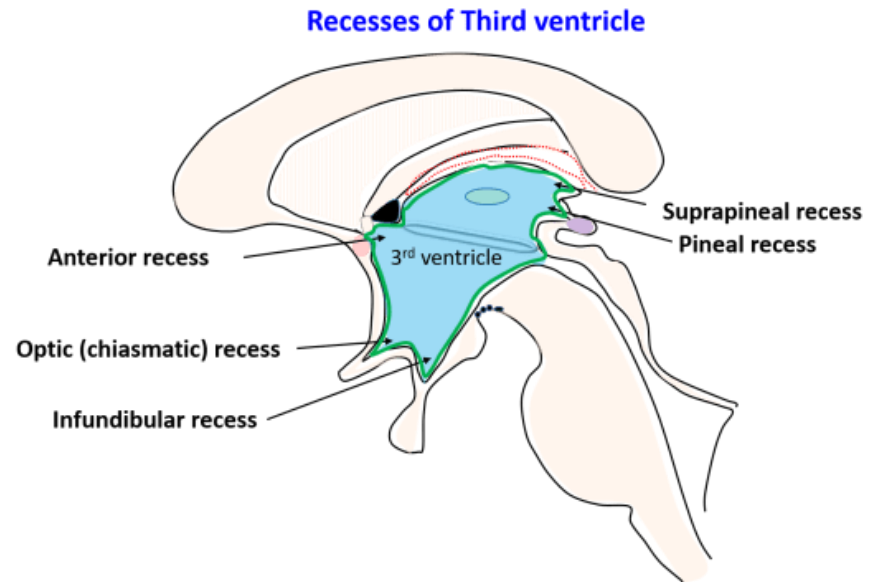
CAVITY AND RECESSES OF THIRD VENTRICLE....CON'T

3. Pineal recess:

- Extends posteriorly.
- More specifically, it projects into the pineal body, between the cranial and caudal lamina of the pineal gland.

4. Suprapineal recess:

- Located between the superior portion of the pineal gland and the inferior aspect of the tela choroidea in the roof of the ventricle.
- It extends posteriorly, behind the posterior wall of the third ventricle.



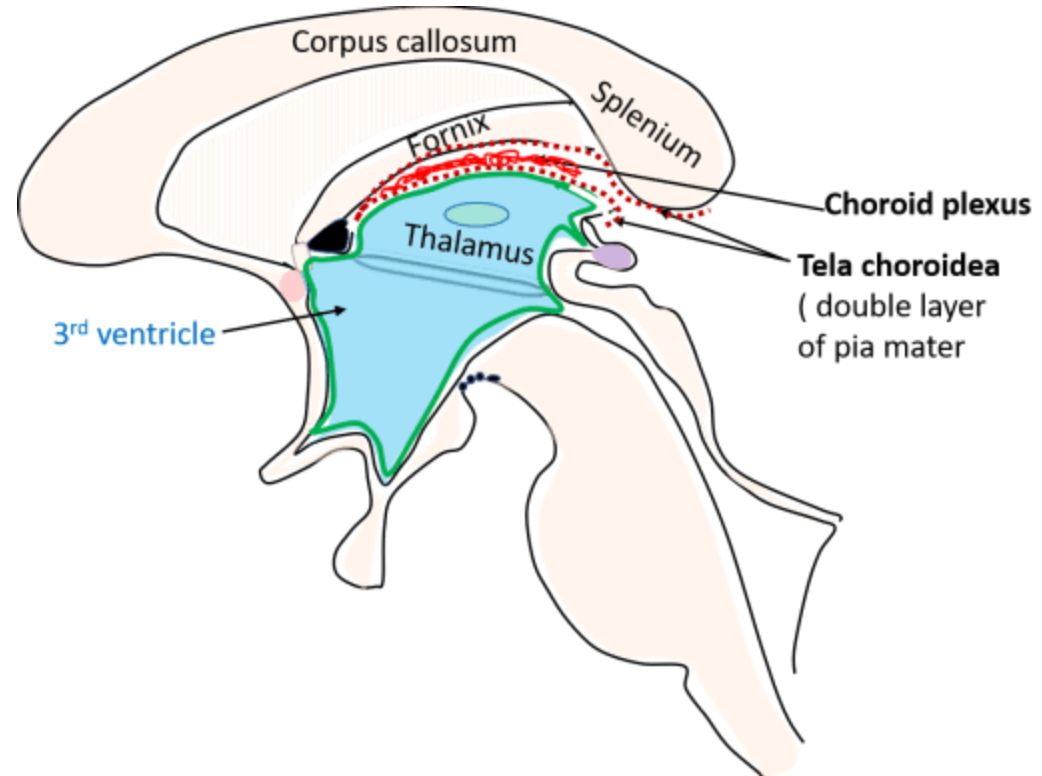
CHOROID PLEXUS AND TELA CHOROIDEA

- **TELA CHOROIDEA:**

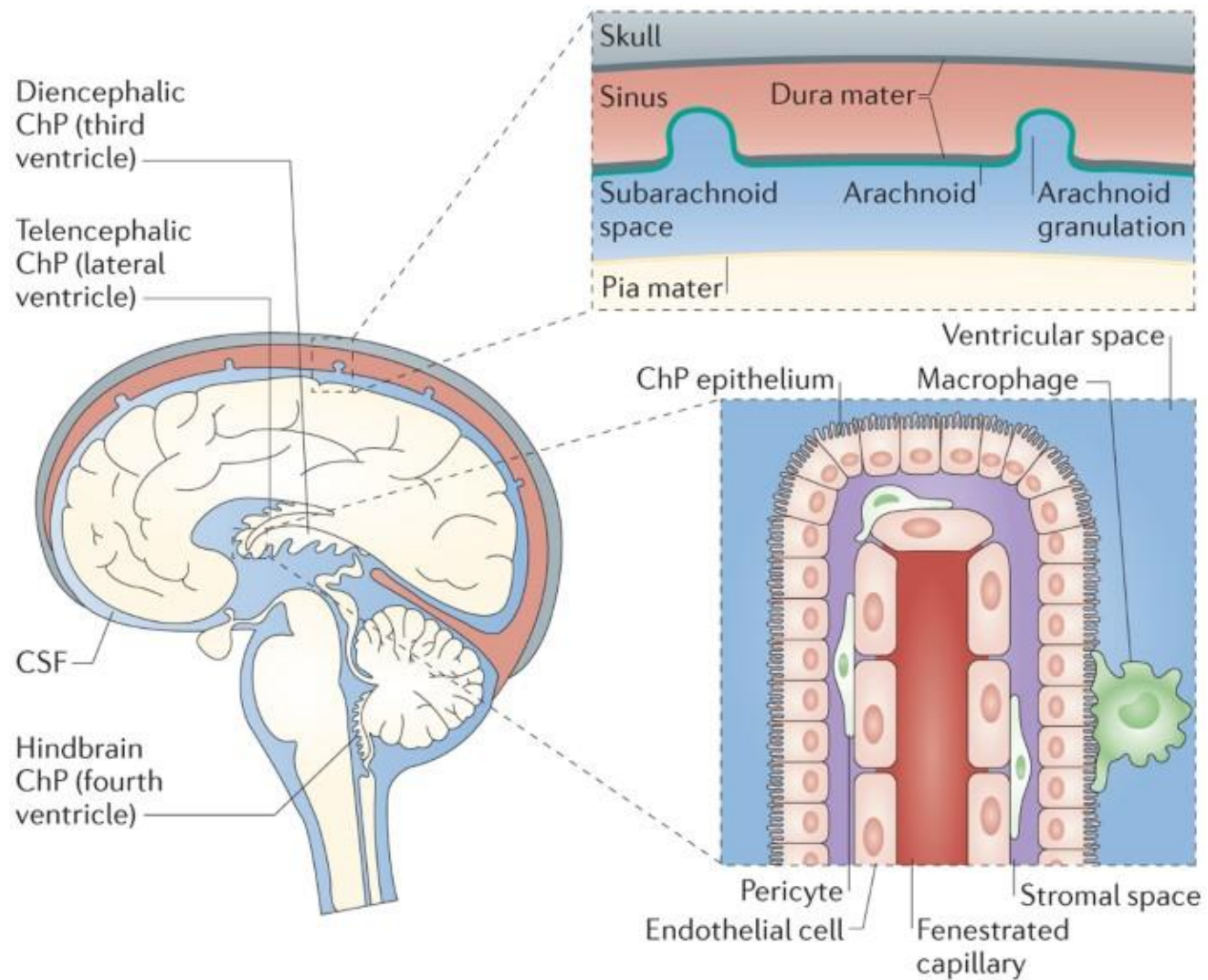
- It is the **Vascular Pia matter** which is closely connected to the ependymal lining of the ventricles.

- In the third ventricle, the tela choroidea is, in fact, embedded in the multi-layered roof of the ventricle.

- The tela choroidea gives rise to the choroid plexus.

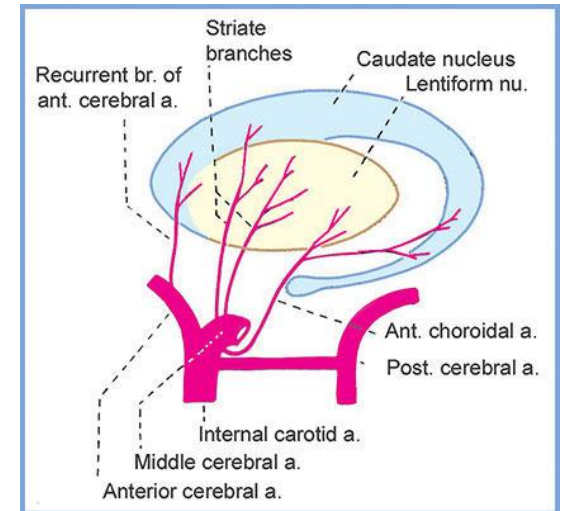
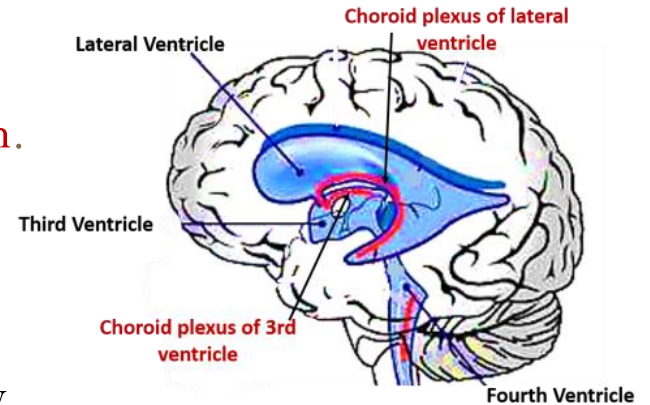


CHOROID PLEXUS AND TELA CHOROIDEA



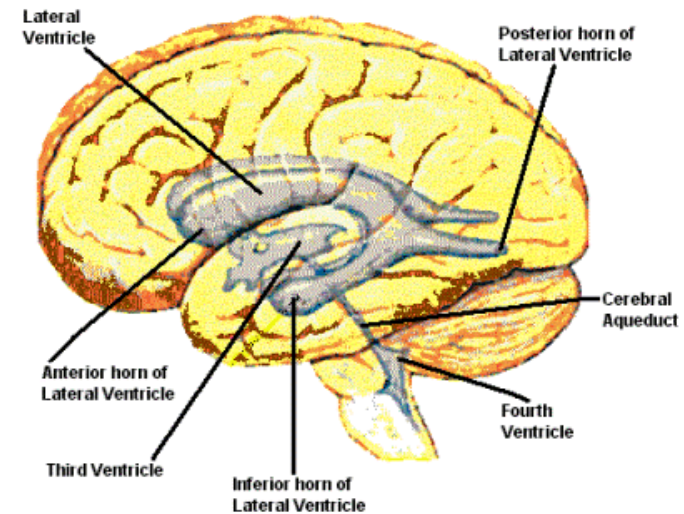
CHOROID PLEXUS

- It is a collection of capillaries that,
 - Produces and
 - Secrete the CSF into the ventricular system of the brain.
- The epithelium of the choroid plexus constitutes the **blood–CSF barrier**.
- The blood for the choroid plexus is mainly **supplied** by the:
 - Anterior choroidal branch of the internal carotid artery and
 - Choroidal branches of the posterior cerebral artery.
- The **Venous blood** is drained by a single choroidal vein.
- When viewed from the sagittal section, the choroid plexuses of the lateral and third ventricles are continuous.



FUNCTION OF THIRD VENTRICLE

- The function of the third ventricle is to:
 - ✓ Produce and
 - ✓ Secrete the CSF
 - ✓ As well as to contribute to the continuous circulation of the CSF through the ventricular system.
- This way, the ventricle participates in
 - ✓ Cushioning and
 - ✓ Protecting the brain from injury
 - ✓ As well as in the transport of nutrients and waste in and out of the neural tissue.
- If the CSF flow through the ventricles is obstructed for any reason (e.g. a tumor that blocks the foramina through which the ventricles communicate), the CSF starts to accumulate and results in hydrocephalus.



CLINICAL CORRELATIONS

VENTRICULOGRAPHY AND HYDROCEPHALUS

- Ventriculo-graphy is a tracing method used to study the ventricular system in living subjects.
- In this procedure, radiographs are taken after injecting a radio-opaque dye into the ventricular system.
- Parts of the ventricles can also be seen using computed tomography (CT) scans and magnetic resonance imaging (MRI).
- Hydrocephalus is one of the well known clinical conditions associated with the ventricular system malformations and can be observed using ventriculography.

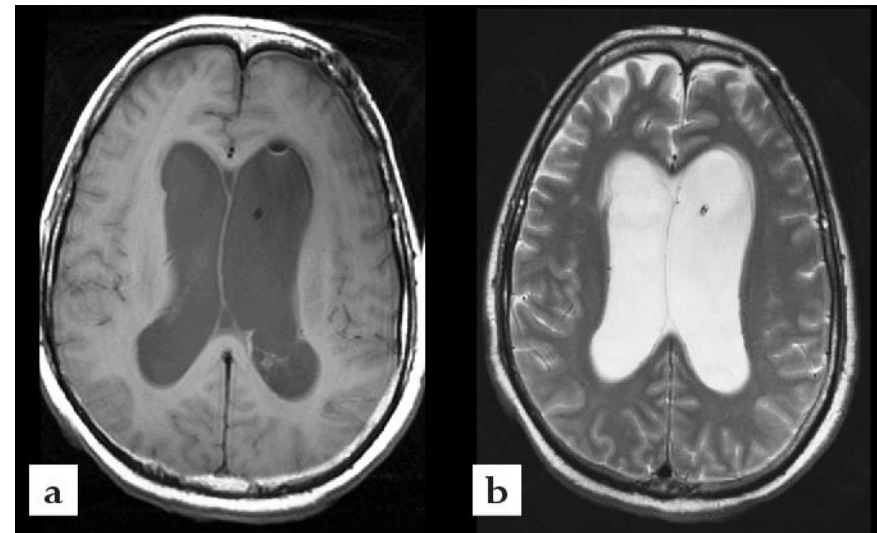
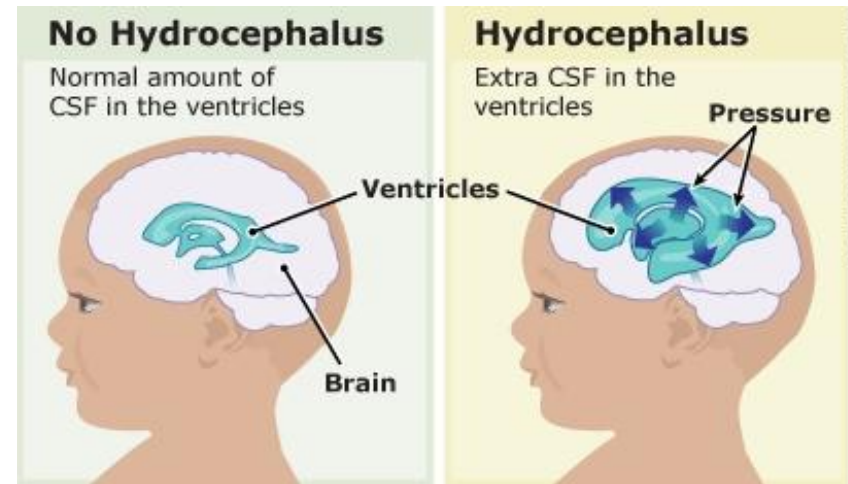


Figure 1: Case #1. (a): Axial T1 weighted magnetic resonance

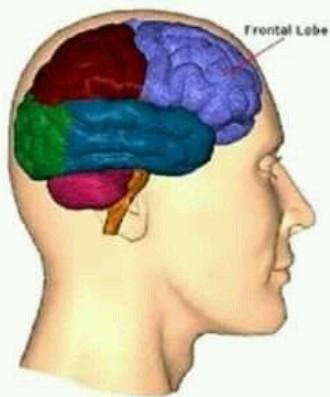
HYDROCEPHALUS

- It is a condition in which there is an abnormal accumulation of CSF in the central nervous system (CNS) due to a disturbance of CSF flow or absorption.
- This leads to an increase in the volume occupied by CSF in the CNS, causing increased intracranial pressure.
- It can also cause progressive enlargement of the head if it occurs in childhood, potentially causing:
 - Convulsion, tunnel vision, slowing of mental capacity,
 - Cognitive deterioration, headaches, neck pain suggesting tonsillar herniation, vomiting,
 - Blurred vision, double vision,
 - Difficulty in walking secondary to spasticity, drowsiness and other forms of mental disabilities, amongst other symptoms.



In the Holy Quran, more than 1400 years ago

Scientific Fact: Center of lying and sin exists in the frontal lobe of the brain



كَلَّا لَئِنْ لَمْ يَنْتَهِ لَنَسْفَعًا بِالنَّاصِيَةِ ﴿١٥﴾ نَاصِيَةٍ كَذِبَةٍ خَاطِئَةٍ ﴿١٦﴾

No! If he does not desist, We will surely drag him by the forelock – A lying, sinning forelock.

(The Clinging substance- 15, 16)



“ كُلُّ مَعْرُوفٍ صَدَقَةٌ ”

EVERY ACT OF GOODNESS IS
(CONSIDERED AS) SADAQAH

Sahih Al-Bukhari

THE MOST BEAUTIFUL ISLAMIC QUOTES ON

KINDNESS

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THANK YOU.....