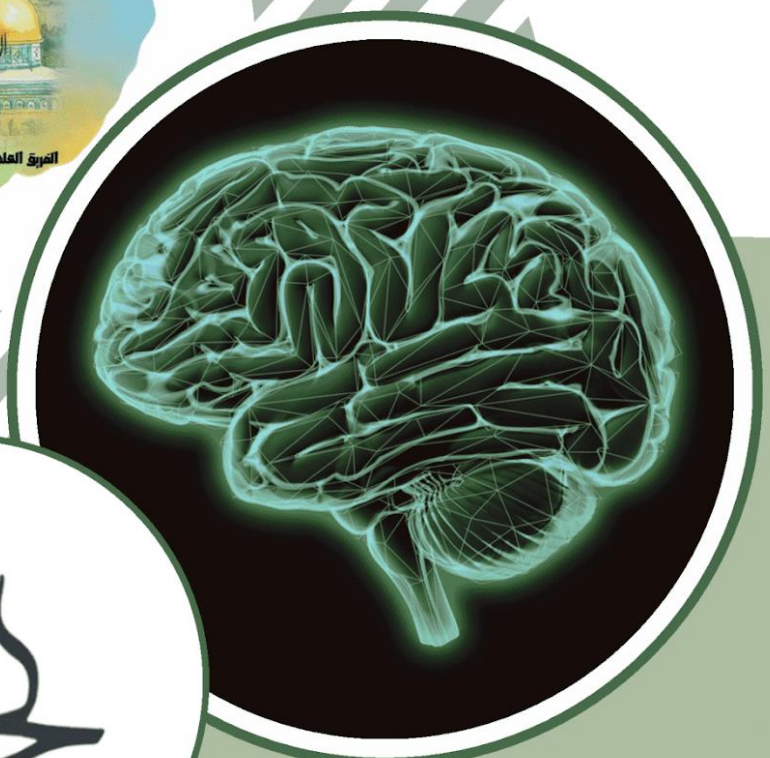
CNS ANATOMY

DOCTOR NOTES



LECTURE NO. 5

WRITTEN BY: Layan Abu Arja & Alaa Khader

REVIEWED BY: Ismail Alardah

5.1 Horizontal section of Lateral ventricle:

This is a horizontal section of the brain, similar to a CT scan. **The anteroposterior section** extends from the genu of the corpus callosum to the splenium of the corpus callosum. The labeled components are as follows:

A. **Anterior horn of the lateral ventricle**

B. **Head of the caudate nucleus** (the body of the caudate is associated with the body of the lateral ventricle, while the tail of the caudate is related to the inferior hom)

C. **White matter known as the external capsule or the extreme capsule**

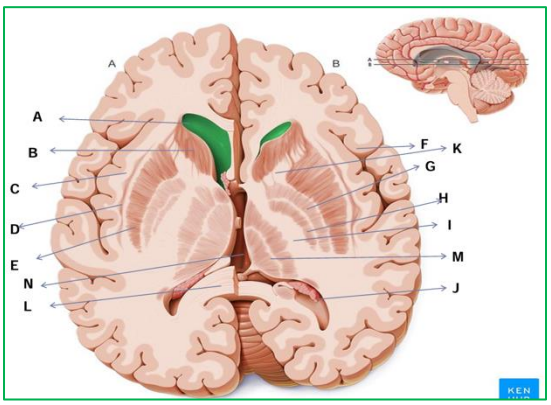


Figure (1)

D. **Gray matter known as the claustrum** (part of the basal nuclei)

E. **Putamen**

F. **Insula**

G. **globus pallidus externa**

H. **globus pallidus interna**

I. **Internal capsule** (divided into the anterior limb, genu, posterior limb, lentiform part, and retroform part)

M. **Thalamus**

N. **3rd ventricle**

L. Spelnium of corpus callosum and forceps major

J. Posterior hom of lateral ventricle

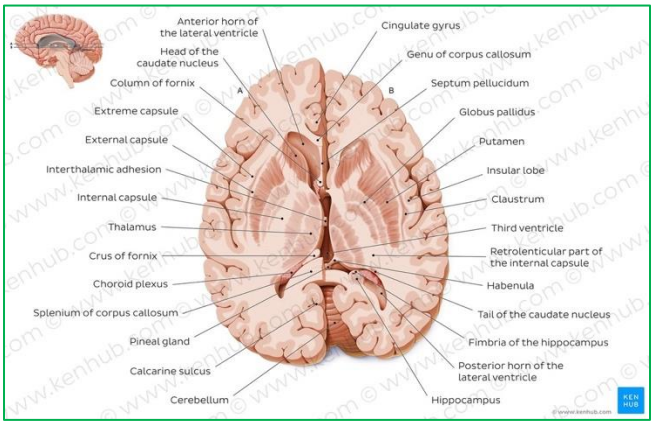


Figure (2)

Additionally, you can see the lateral fissure clearly in this section. Extra point: this is forceps minor that give rise to genu of corpus callosum

5.2 The 3rd Ventricle:

The relations of the third ventricle can be observed from a sagittal section. The outline of the third ventricle is highlighted in blue.

Roof: The roof contains the choroid fissure, which houses the choroid plexus. The choroid fissure is positioned between two structures: the fornix above and the thalamus below. The fornix begins at point 2 (the anterior column of the fornix) and arches downward, continuing with the hippocampus. It's important to note that point 2 is not related to the roof of the third ventricle.

In addition to the choroid plexus, the roof includes **the body of the fornix**, the **septum pellucidum** (which closes off the cavity of the lateral ventricle), and **the corpus callosum.**

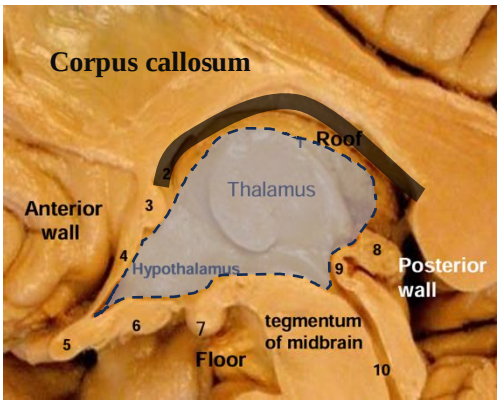


Figure (3)

Anterior Wall: The anterior wall begins at the anterior column of the fornix (point 2). Behind this region is the interventricular foramen (IVF) which connects the lateral and third ventricles.
In front of the anterior fornix is the anterior commissure (AC)(point 3, indicated by a black dot). The anterior column of the fornix is located between IVF and AC.
Additionally, the lamina terminalis (point 4) contains the nuclei of the hypothalamus.
The components of the anterior wall **are the anterior column of the fornix**, the **anterior commissure**, and the **lamina terminalis.**

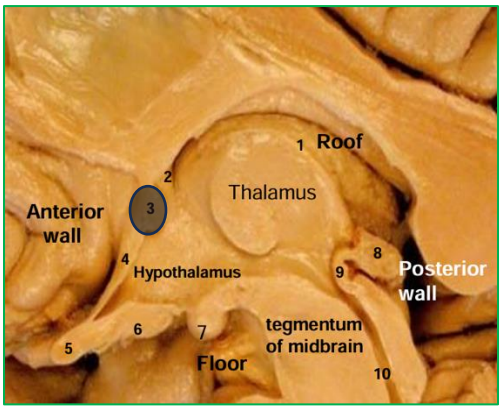
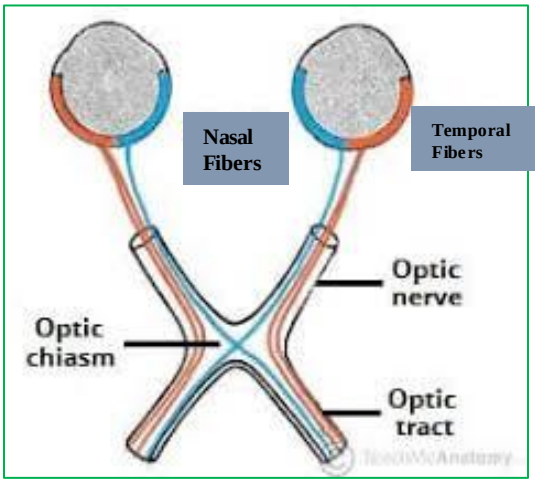


Figure (4)

Floor: Optic chiasm, tuber cinereum, mammillary body, and tegmentum of midbrain.

Figure (5)



Optic chiasm (5), which is the part of the brain where the optic nerves decussate. The optic nerve contains temporal and nasal fibers. In the optic chiasm, the nasal fibers cross to the other side while temporal fibers remain uncrossed. These fibers, after exiting the optic chiasm, contain nasal fibers of the opposite side and the temporal side of the same side. They move through the optic tract to the lateral geniculate body of the metathalamus ,then from **LGB** there is fibers called optic radiation reach to the occipital lobe, and this is the pathway of vision.

The tuber cinereum (6) is a gray matter structure of the hypothalamus located between the mammillary bodies and the optic chiasm. it connects to the infundibulum, which is the stalk of the pituitary gland. infundibulum play role in the hormonal regulation of the body by the hypothalamic-hypophyseal portal circulation.

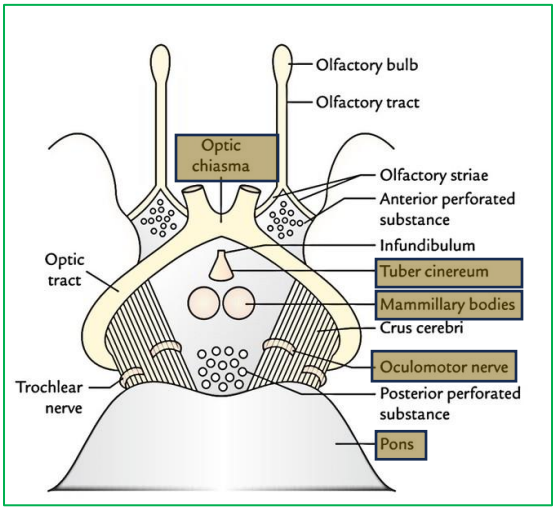


Figure (6)

The mammillary bodies (7) are paired structures in that are located anterior to the posterior perforated substance, in the interpeduncular fossa. **The interpeduncular fossa** is situated at the base of the brain, and around this fossa lies the **circle of Willis**; an arterial anastomosis junction between the internal carotid system and the vertebrobasilar system.

The boundaries of the **interpeduncular fossa**, in the anterior is the optic chiasm, and from the posterior, back of the pons. The oculomotor nerve rises from this fossa, and the mammillary bodies are found there.

The **tegmentum of the midbrain** is the anterior part of the midbrain. The midbrain is divided into tegmentum and tectum (which has two superior and inferior colliculi). Between them lies a canal called the cerebral aqueduct, and this is the only connection between the third ventricle and the fourth ventricle.

Posterior wall:

closing 3rd ventricle from behind
part cerebral aqueduct (of sylvius (10)), posterior commissure (9), and pineal body (8) and habenular commissure (11).

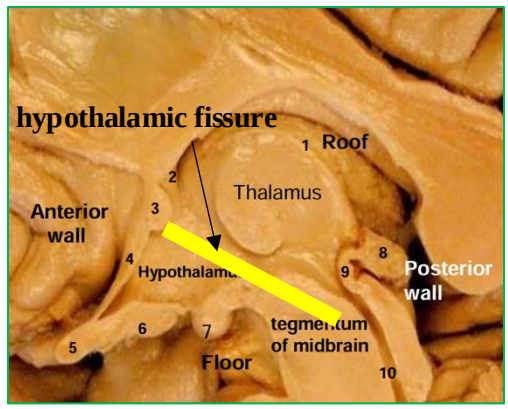


Figure (7)

The hypothalamic fissure connects the interventional ventricular foramen (IVF) to the cerebral aqueduct of Sylvius (10). Above the fissure lies the thalamus, while below it is the hypothalamus. Consequently, the nuclei associated with the lamina terminalis, which are part of the anterior wall and floor of the third ventricle, are situated below the hypothalamic fissure.

Connections : It is connected with the lateral ventricle through interventricular foramen & with the 4th ventricle through cerebral aqueduct.

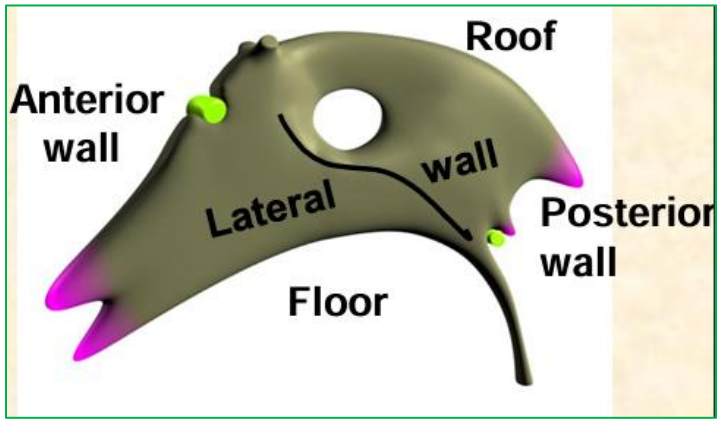


Figure (8)

5.3 The 3rd Ventricle / Choroid plexus :

Formed of tela choroidea above the roof of the ventricle. While in the lateral ventricle is situated in the inferior part of temporal hom mainly and trigone also.

As you recall, the blood supply of the lateral ventricle was 2 blood vessels anterior choroidal artery and the posterior choroidal artery while the Blood supply of the choroid plexus of the third ventricle is derived from choroidal branch of posterior cerebral artery

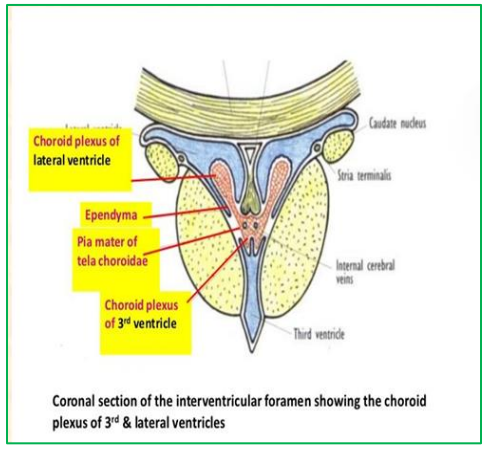


Figure (9)

5.4 The 4th Ventricle:

How to separate between cerebellum and the brain stem in order to see the back of the pons and the open medulla (floor)?
By cutting the three connections there, which are:

Cerebellar peduncles, rhomboid or diamond in shape, they cover the center of the 4th ventricle, so in order to see its floor you have to cut all these 3 connections:

A. **Superior cerebellar peduncle**, it connects between the midbrain and the cerebellum
B. **Inferior cerebellar peduncle**, it connects between the medulla and the cerebellum, so it comes from the medulla inferiorly up to the cerebellum
C. **Middle cerebellum peduncle**, between pons and cerebellum.

As shown here in figure (10) the cut edges of these 3 connections. The left side shows the other half of the cerebellum connected to the brain stem.
We can see the **angles** of this diamond: One superior, one inferior and 2 lateral (lateral recesses).
The **superior angle** connects between the 4th and 3rd ventricles by the superior aqueduct. The **inferior angle** connects between the 4th ventricle and the spinal canal of the spinal cord. The last **2 lateral angles** connect between the 4th ventricle and the cerebellum, they have 2 foramina inside:
A. Luschka (Laterally) **B. Magendie** (Medially).
Through these foramina, the CSF runs from the ventricular system to the subarachnoid space, in which it stays there around the brain and the spinal cord to be absorbed and secreted daily.

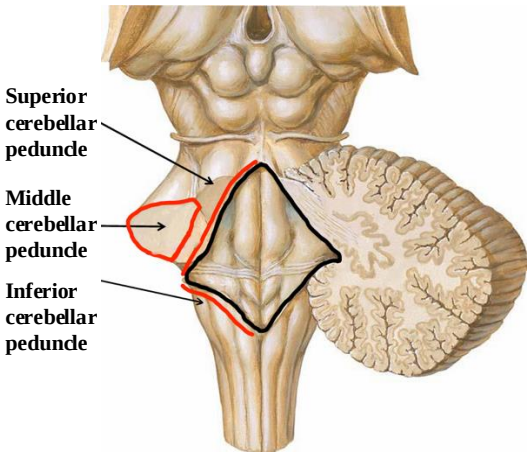


Figure (10): Floor of the 4th ventricle

Superior medullary vellum: Connects between the 2 superior cerebellum peduncles under the cover of the cerebellum. (The cerebellum covers all the structure in figure (11))
Inferior medullary vellum: Connects between the 2 inferior cerebellum peduncles under the cover of the cerebellum.

So in conclusion, to see the 4th ventricle, you have to remove the cerebellum first, then the superior medullary vellum and the inferior medullary vellum.

In blue we can see the Luschka foramen, and the red "T" structure represents the choroid plexus that comes out from foramen of magendie, then each side goes to one of the lateral angles to pass through Luschka foramen.

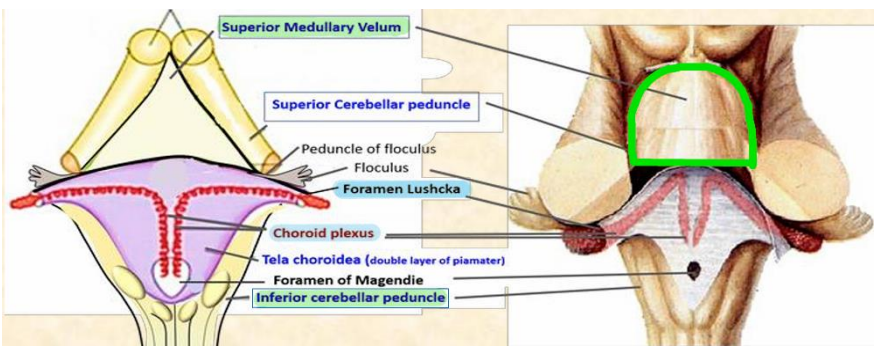


Figure (11)

Note that the 4th ventricle choroid plexus locates on the lower half of the inferior surface of its roof (foramen of magendie).
Posterior inferior cerebellar artery supplies the cerebellum, lateral part of the medulla oblongata. Occlusion of this vessel is associated with the **lateral medullary syndrome**.

5.5 The 4th Ventricle\ Sagittal Section:

We can see the **cerebellum** and the **vermis** posteriorly. Anteriorly there is the **back of the midbrain**, (**pons** and **open medulla**)(floor of the 4th ventricle in yellow).
In red we can see the **foramen of magendie** where the **choroid plexus** rises from.
Superior and inferior cerebellar peduncles (look at the black arrows).
Lateral angles can't be seen here, they can be seen from the roof.
So only half of the diamond shape can be seen in this section.

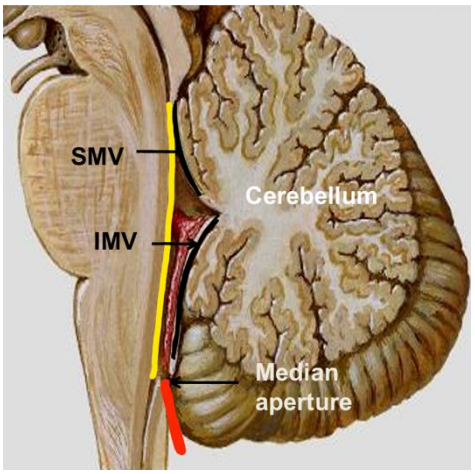


Figure (12)

5.6 Communications between the whole ventricular system:

1. Anterior horn of lateral ventricle
2. Trigon of lateral ventricle
3. Posterior horn of lateral ventricle
4. Temporal or inferior horn
5. Third ventricle
6. Fourth ventricle
7. Interventricular foramen between 3rd and lateral ventricle

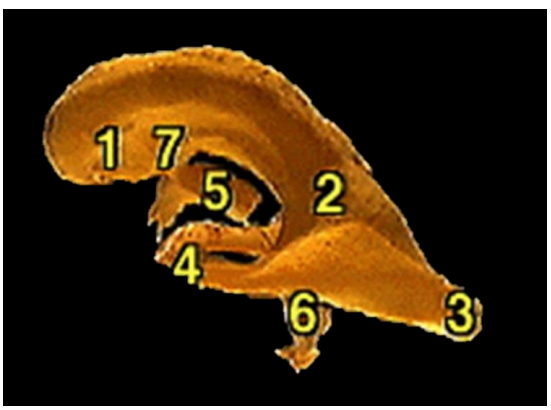


Figure (13)

5.7 Subarachnoid Cisterns:

As we mentioned before, the CSF is circulated in ventricles, and also circulated in the subarachnoid space by the foramina.
Some subarachnoid space are filled with CSF, so large bulges appear on their surfaces. The point of having these large quantities of CSF refers to its ability of protecting the internal structures like blood vessels or nerves.

These bulges are known as subarachnoid cisterns, and there are **6** of them:

1.Cerebello-Medullary cisterna (Cisterna Magna): locates between the medulla and the 4th ventricle. **Function:** protects the roof of the 4th ventricle.

2.Pontine cisterna (Ponto-Medullary): **locates** anterior to pons. **Function:** protects the basilar artery that gives 2 posterior cerebral arteries which give blood supply to the posterior surface of the occipital lobe.

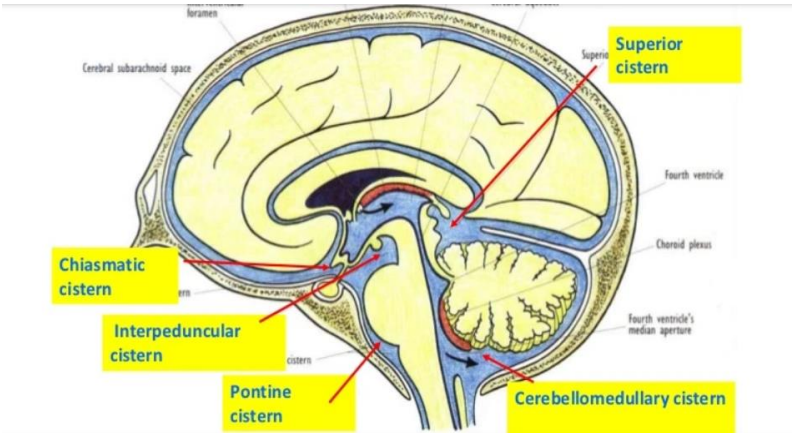


Figure (14)

3. Interpeduncular cisterna: **locates** on the interpeduncular fossa, contains circle of willis (connects between the internal carotid system anteriorly and the vertebrobasilar system posteriorly).
Function: protects circle of wills.
4. Cisterna of lateral fissure: Function: protects the middle cerebral artery that runs on the lateral fissure.
5. Callosal cisterna: locates above the corpus collosum that can be seen on the medial surface. **Function:** protects the anterior cerebral artery that runs on the callosal sulcus.
6. Chiasmatic cisterna: locates around the optic chiasma that is important for vision.
Function: protects the optic chiasma

5.8 Clinical View:

Choroid plexus secretes the CSF, over secretion without reabsorption there will cause a problem known as **Hydrocephalus:** when the excess fluid causes lateral ventricle to widen, which puts harmful press on the tissues of the brain.

Treated by reabsorption of **arachnoid villi** (in green), which are projections that expands away till the superior sagittal sinus (in blue), the largest dural venous sinus, it runs in a sagittal plane in the superior aspect of the falx cerebri.

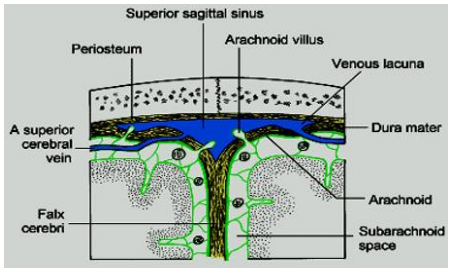


Figure (15)

The CSF pores inside the venous circulation, then goes to the svc then to the right atrium, so it doesn't mix with the oxygenated blood on the left side

Lumber Puncture: at the lower border of L2 at the end of the spinal cord.

Papilledema: rising of CSF pressure compressing retinal veins, compression of the optic nerve and in the subarachnoid space around.

Figure (16): Sunset eyes.

V2
Page 5
Posterior inferior cerebellar artery supplies the cerebellum

V3
Page 2
There is no choroid plexus in posterior horn of lateral ventricle