

Meninges ventricles

&

CSF

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OBJECTIVES

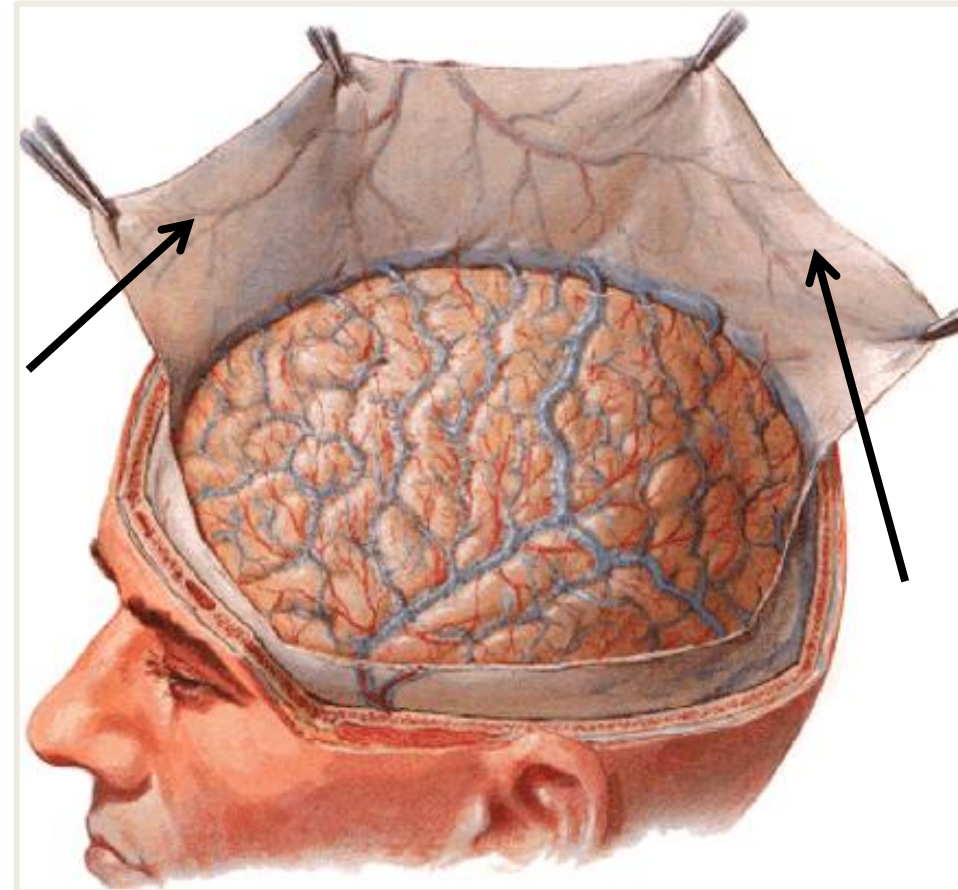
- **By the end of the lecture the student should be able to:**
- Explain, the cerebral meninges & compare between the main dural folds.
- Identify the spinal meninges & locate the level of the termination of each of them.
- Describe the importance of the subarachnoid space.
- Explain the Ventricular system of the CNS and locate the site of each of them.
- Analyze the formation, circulation, drainage, and functions of the CSF.
- Justify the clinical point related to the CSF

MENINGES

- The brain and spinal cord are invested by three concentric membranes ;
- The outermost layer is the dural matter.
- The middle layer is the archnoid matter.
- The innermost layer is the pia matter.

DURA MATER

- The cranial dura is a two layered tough, fibrous membrane that surrounds the brain.
- It is formed of two layers; **periosteal** and **meningeal**.
- The periosteal layer is attached to the skull.
- The meningeal layer is folded forming the **dural folds**; **falx cerebri**, and **tentorium cerebelli**
- Sensory innervation of the dura is mostly from the three branches of the trigeminal and vagus nerves & C1 to C3.



DURA MATER

❑ Two large reflections of dura extend into the cranial cavity;

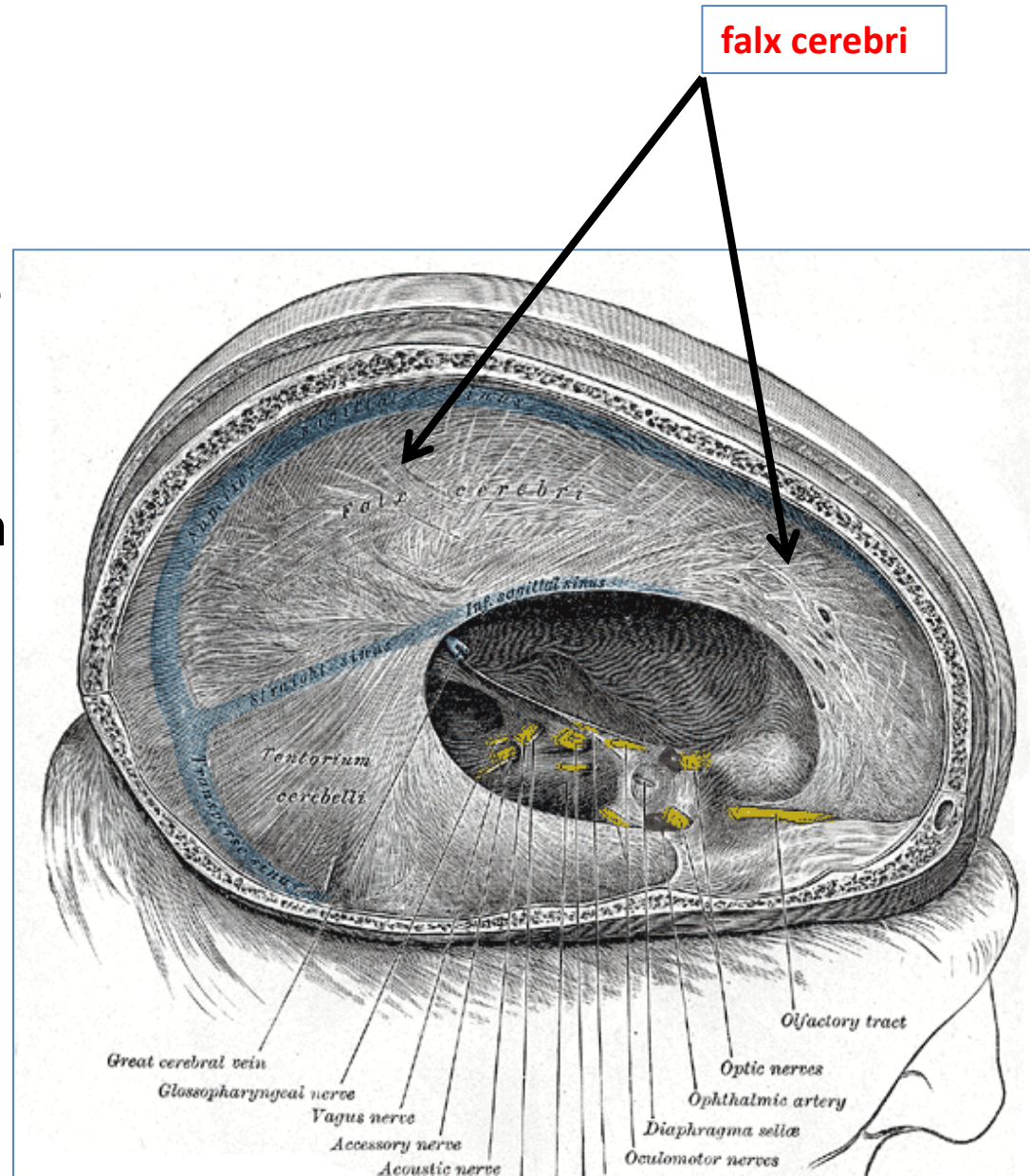
▪ Falx cerebri;

▪ It is a vertical sickle shaped sheet of dura, in the midline

▪ Extends from the cranial roof into the great longitudinal fissure between the two cerebral hemispheres.

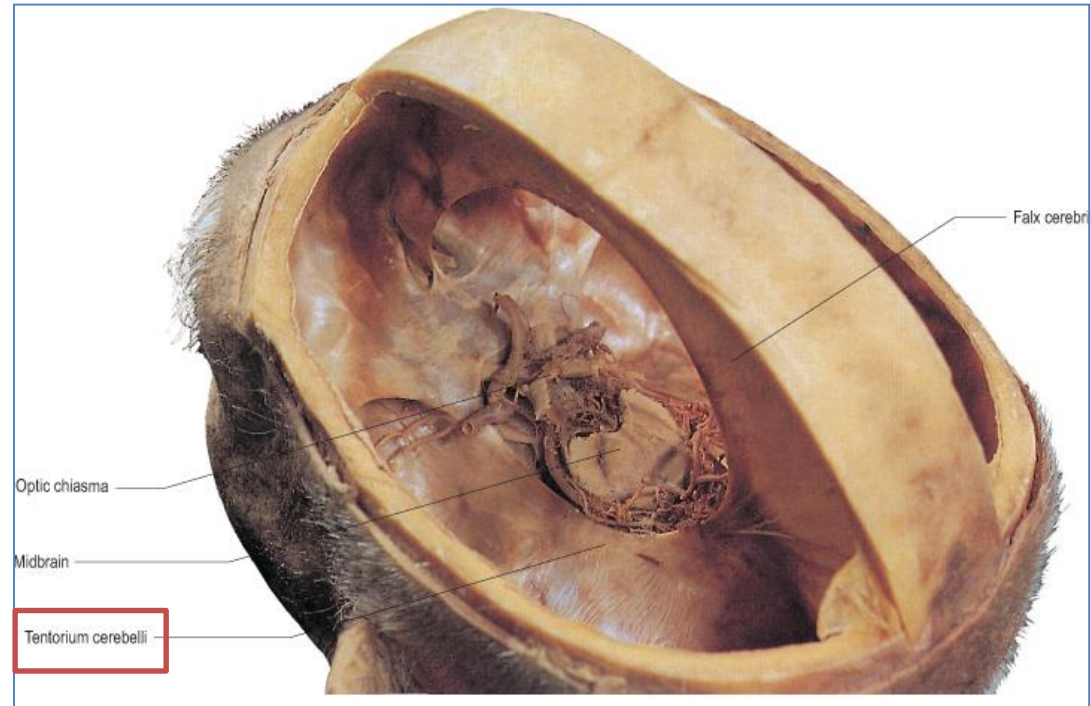
▪ It has an attached border adherent to the skull.

▪ And a free border lies above the corpus callosum.



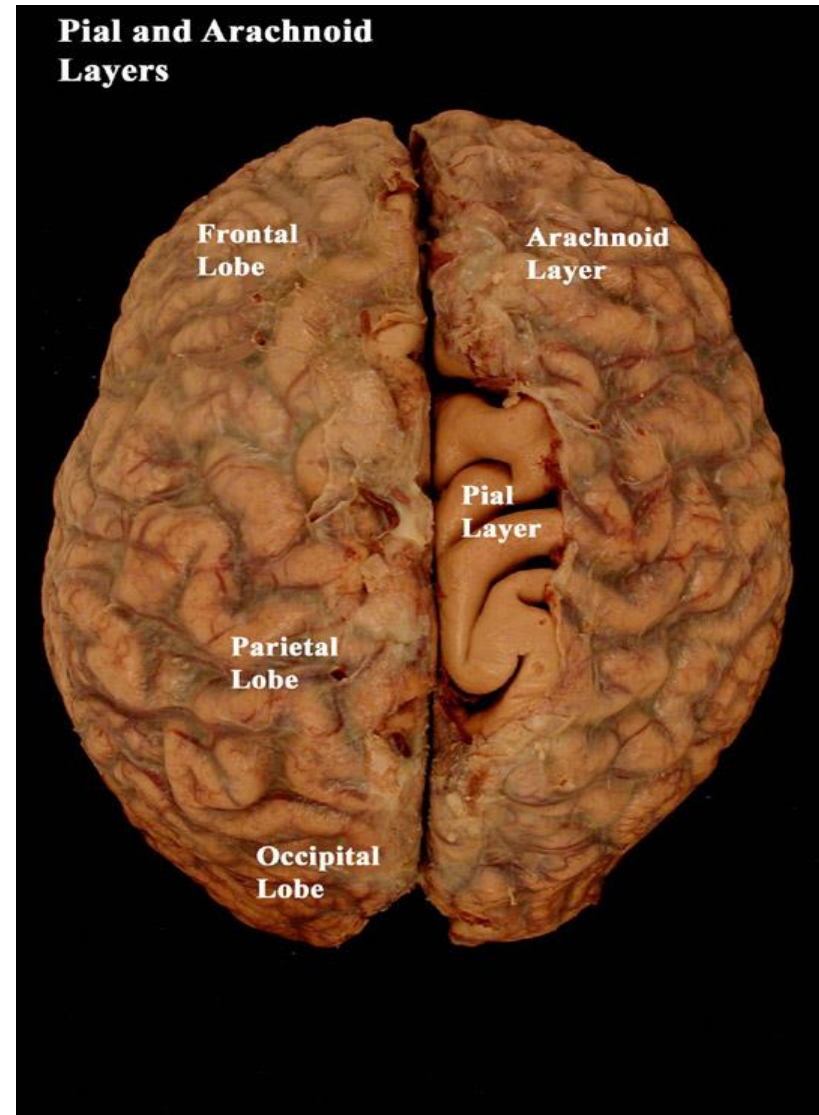
DURA MATER

- **Tentorium cerebelli;**
- A horizontal shelf of dura, lies between the posterior part of the cerebral hemispheres and the cerebellum.
- It has a free border that encircles the midbrain.
- Its superior surface in the middle line it is continuous with the falx cerebri, separated by the straight sinus



Arachnoid Mater & Pia Mater

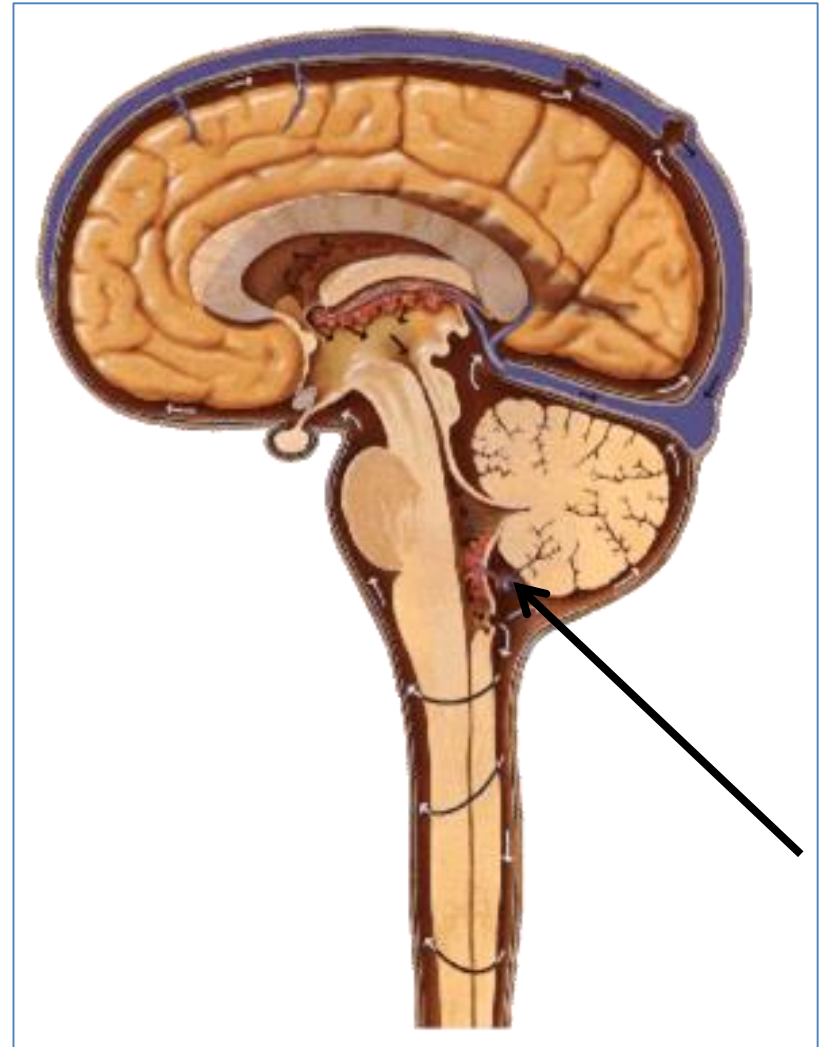
- **Arachnoid mater**; is a soft, translucent membrane loosely envelops the brain.
- It is separated from the dura by a narrow **subdural** space.
- **Pia mater**; is a thin, delicate & highly vascular membrane that is closely adherent to the gyri and fitted into the sulci.
- Between the pia and arachnoid mater lies the **subarachnoid space** which contains; fibrous trabeculae, main blood vessels and CSF.



■ The subarachnoid space is varied in depth forming; **subarachnoid cisterns.**

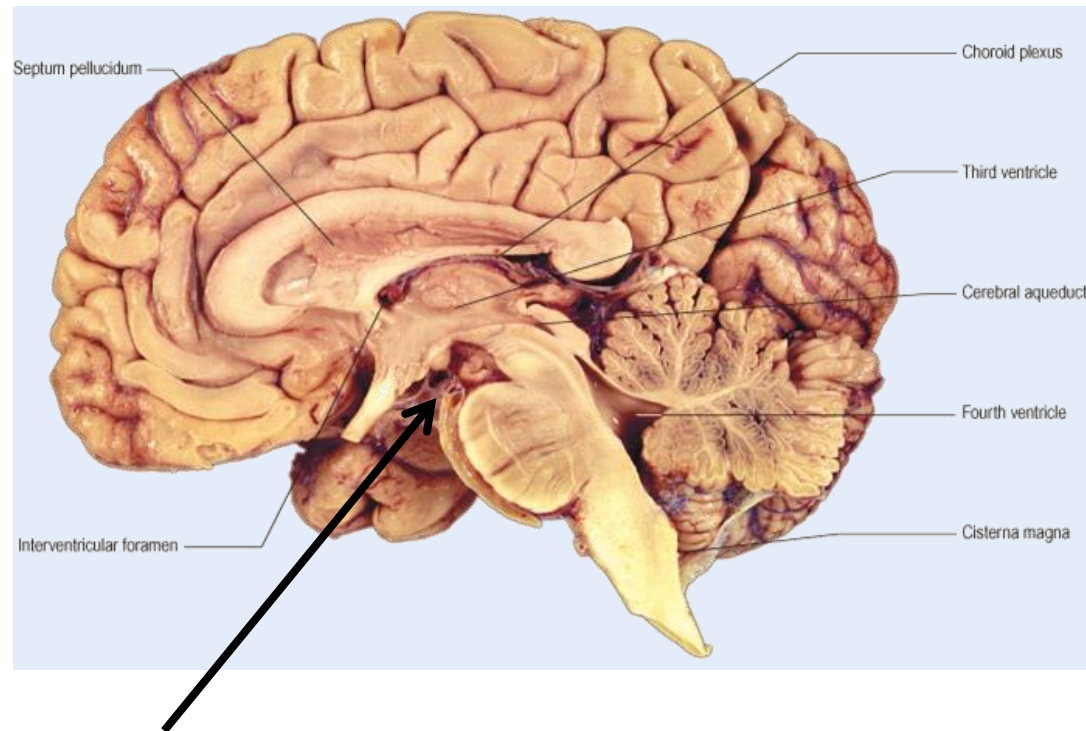
- The **cisterna magna**, or cerebellomedullary cistern which lies between the inferior surface of the cerebellum and the back of the medulla.
- from this cistern CSF flows out of the fourth ventricle.

Subarachnoid Space



- **Interpeduncular cistern;**
- Is located at the base of the brain, where the arachnoid spans the space between the two cerebral peduncles.
- It contains the optic chiasma & circulus arteriosus of Wills.

Subarachnoid Space



Spinal meninges

□ The spinal cord, is invested by **three meningeal coverings: the pia mater, arachnoid mater and dura mater.**

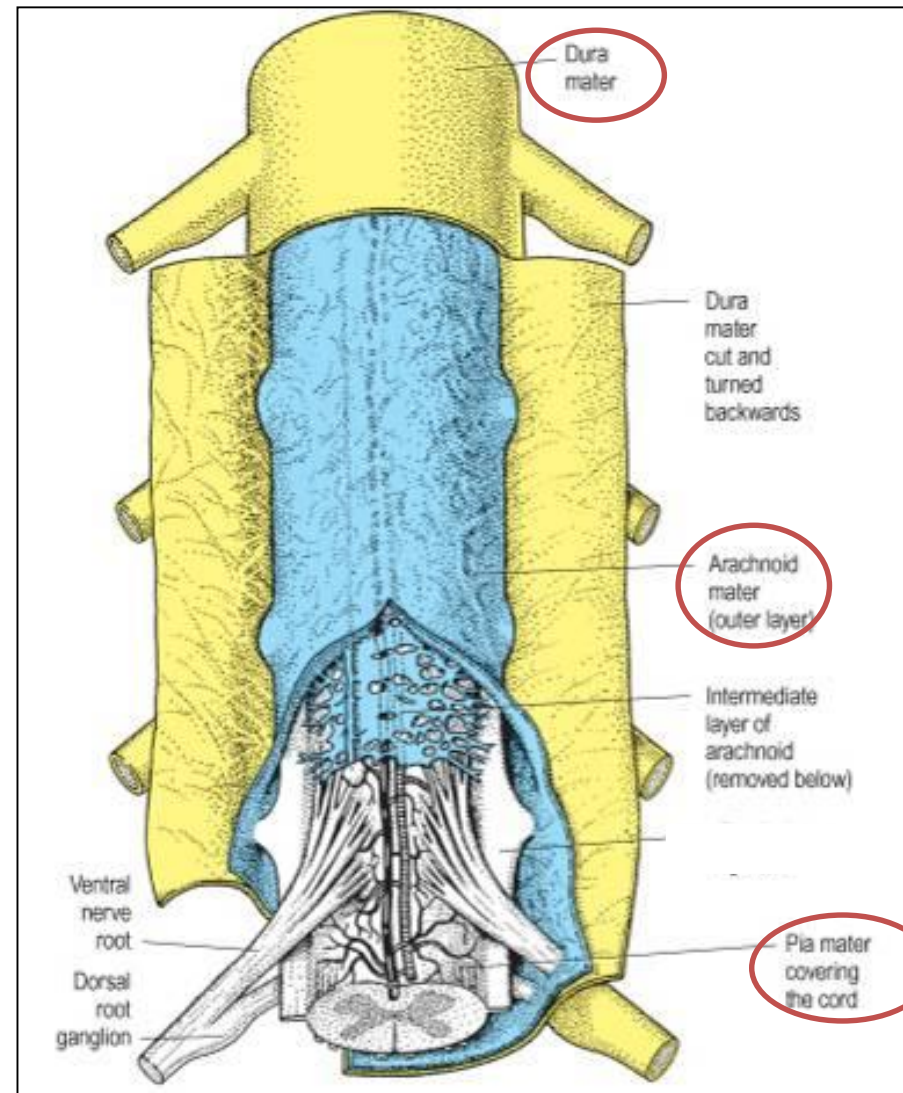
□ **Dura mater;** the outer covering, is a single, tough fibrous membrane.

- It envelops the cord loosely

- It is separated from arachnoid matter by the **subdural space**, and from the bony wall of the vertebral canal by the **epidural space.**

□ **Arachnoid matter;** is a translucent membrane, lies between the pia and dura,

- Between it and pia lies the subarachnoid space contains CSF.



□ **Pia mater,** is a delicate membrane closely envelops the cord and nerve roots.

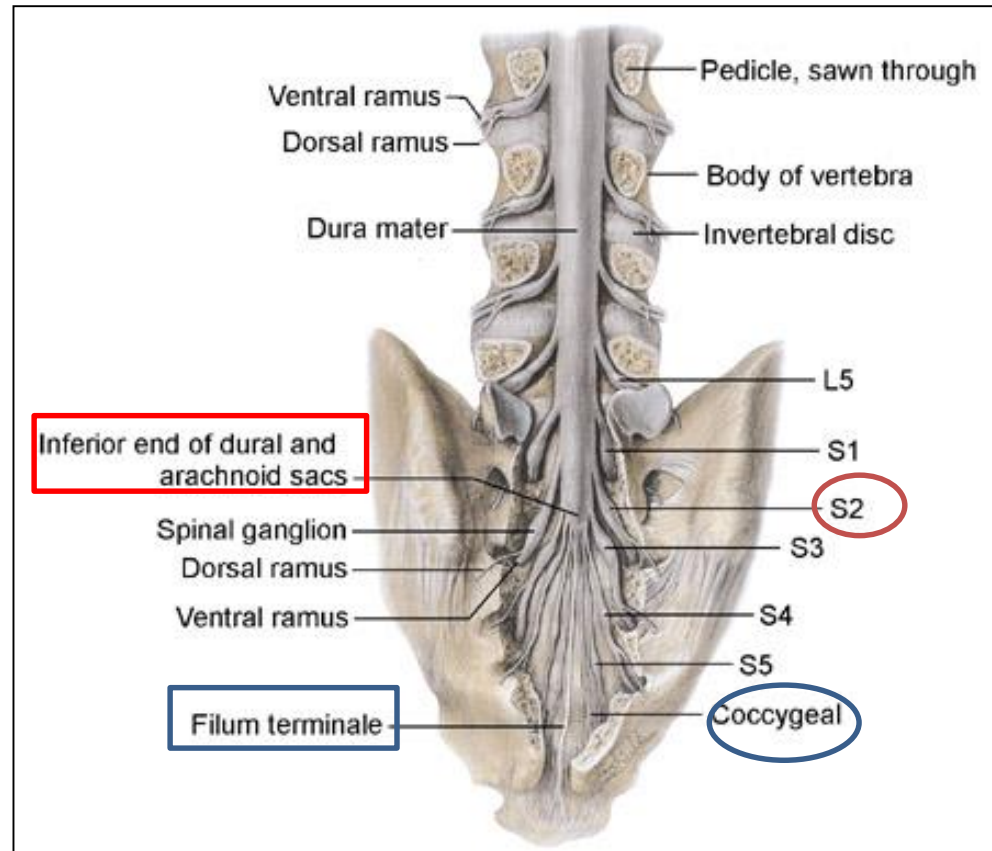
- It is attached through the arachnoid to the dura by the **denticulate ligament.**

❑ **Spinal cord** terminates at level L1-L2, while

❑ **Arachnoid and dural** and, subarachnoid space, continue caudally to S2.

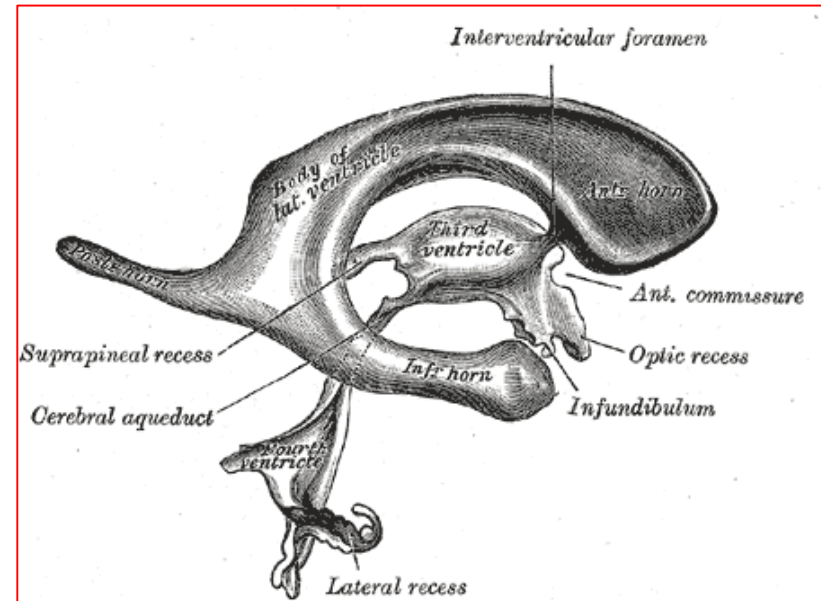
❑ **Pia** extends downwards forming the **filum terminalis** which pierces the arachnoid and dural sacs and passes through the sacral hiatus to be attached to the back of the coccyx.

Spinal meninges



VENTRICULAR SYSTEM

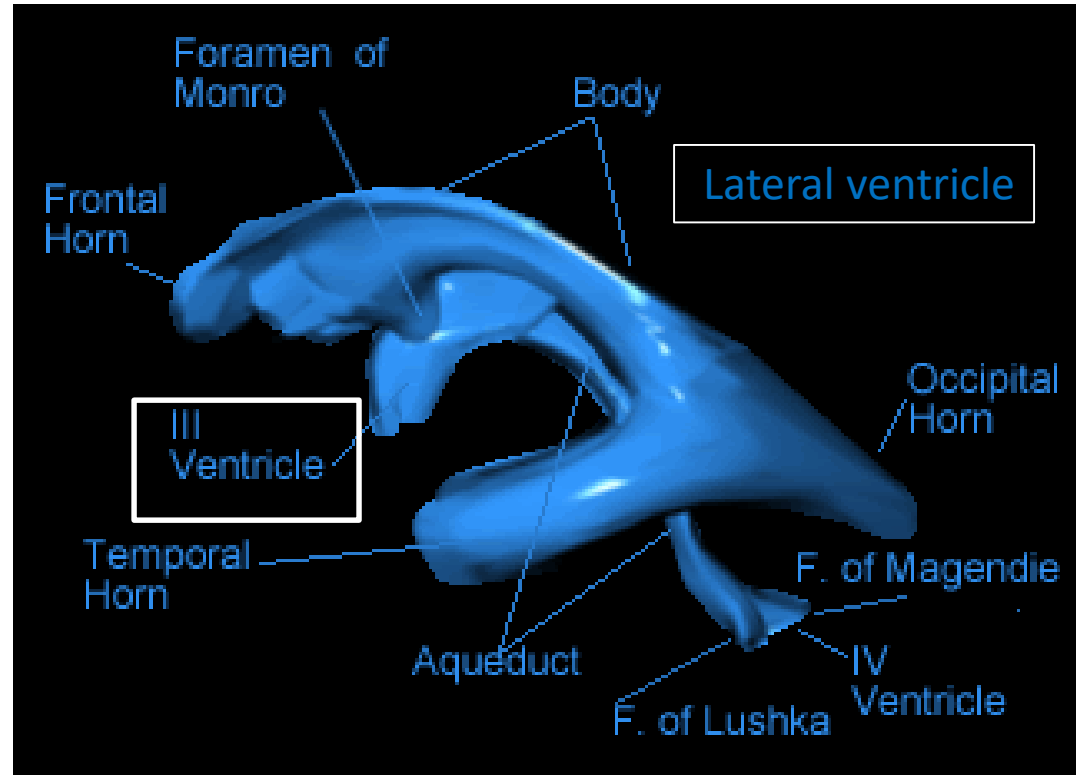
- ❑ Interconnecting channels within the CNS.
- ❑ In the spinal cord; represented by the central canal.
- ❑ Within the brain; a system of ventricles is found.
- ❑ The central canal of the spinal cord is continuous upwards to the fourth ventricle.
- ❑ On each side of the fourth ventricle laterally, lateral recess extend to open into lateral aperture (foramen of Luschka), central defect in its roof (foramen of Magendie)



VENTRICULAR SYSTEM

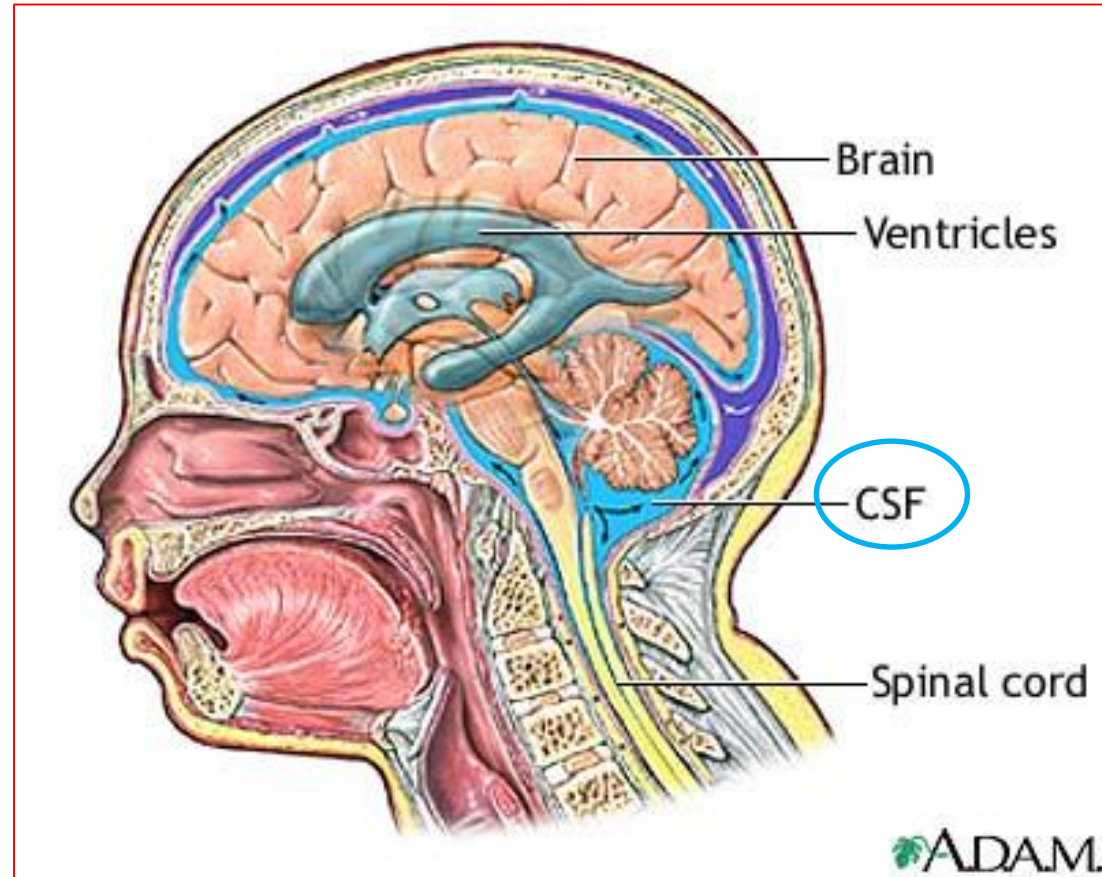
❑ The **fourth ventricle** is continuous with the cerebral aqueduct, that opens in the **third ventricle**.

❑ The third ventricle is continuous with the **lateral ventricle** through the interventricular foramen.



CEREBROSPINAL FLUID

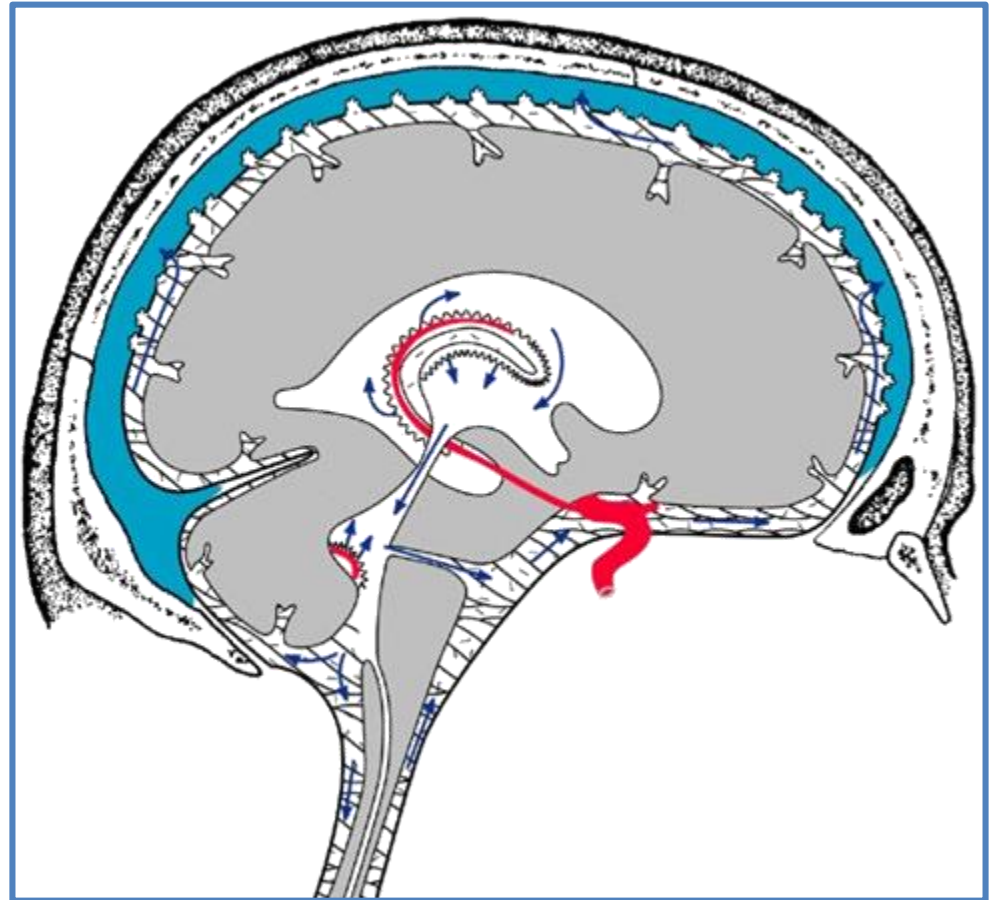
- ❑ Present in the **ventricular system**, together with the cranial and spinal **subarachnoid spaces**.
- ❑ It is **colourless** fluid containing little protein and few cells.
- ❑ It is about **150 ml**.
- ❑ It serves to **cushion** the brain from sudden movements of the head



❑ It is **produced by** the **choroid plexus**, which is located in the lateral, third & fourth ventricles.

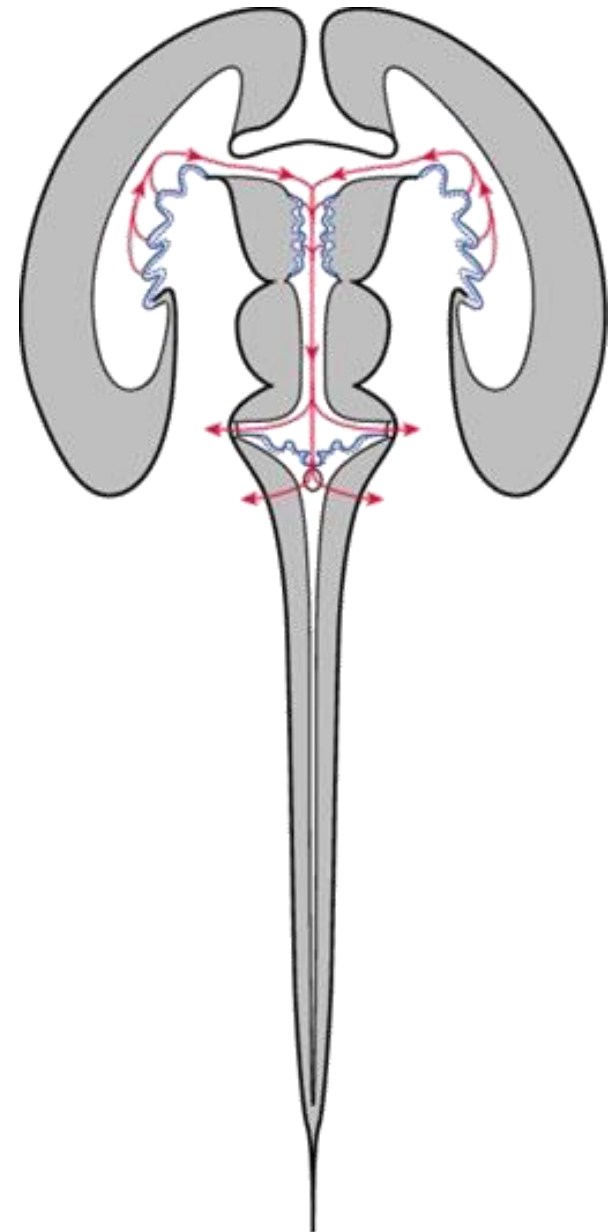
❑ From there **it flows:** through the **interventricular foramen** to the **third ventricle** and, by way of the **cerebral aqueduct**, to the **fourth ventricle**.

CEREBROSPINAL FLUID



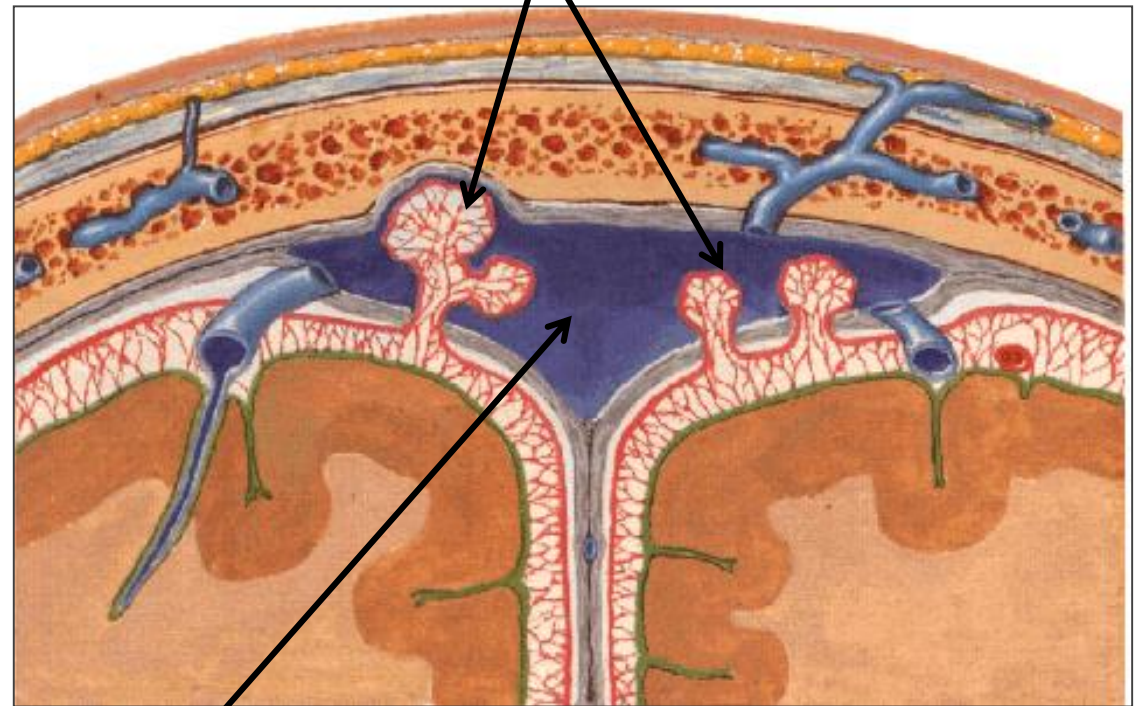
- It leaves the ventricular system through the three apertures of the 4th ventricle ;
 - (median foramen of Magindi &
 - 2 lateral foramina of Leushka), to enter the **subarachnoid space.**

CEREBROSPINAL FLUID



CEREBROSPINAL FLUID

- Reabsorbed into the venous system along;
 - **arachnoid villi,** and
 - **arachnoid granulation**
 - that project into the dural venous sinuses, mainly superior sagittal sinus.



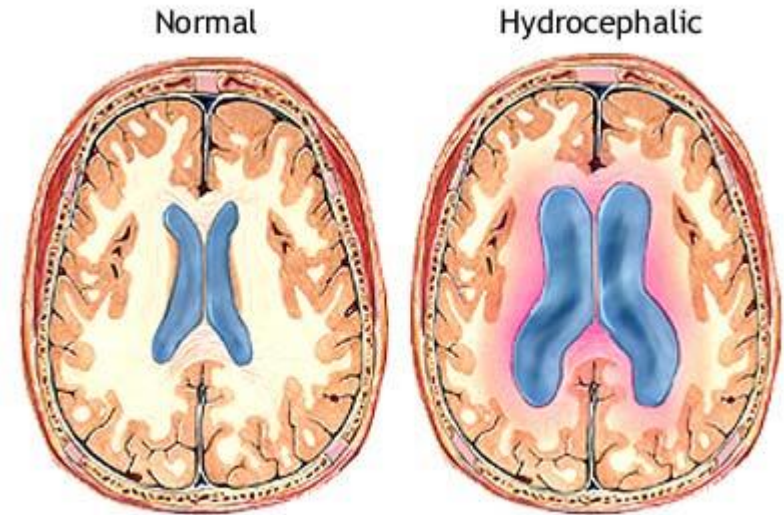
arachnoid villi

dural venous sinuses.

CEREBROSPINAL FLUID

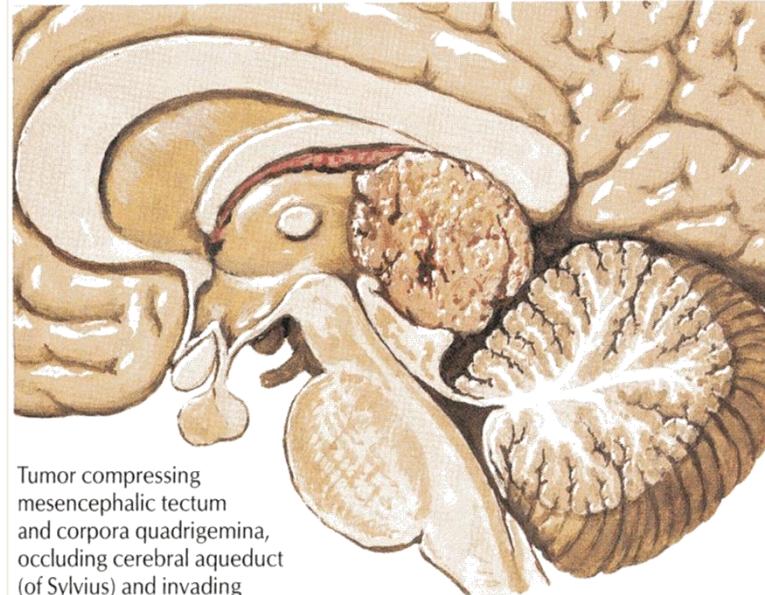
clinical point

❑ **Obstruction** of the flow of CSF leads to a rise in fluid pressure causing swelling of the ventricles (hydrocephalus).

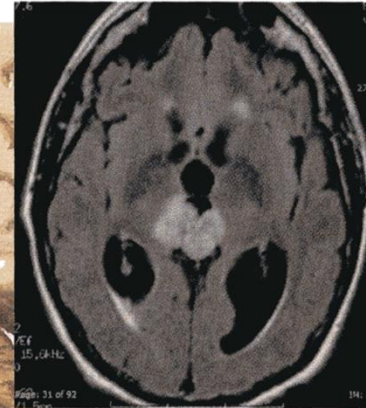


ADAM.

Tumors of Pineal Region



Tumor compressing mesencephalic tectum and corpora quadrigemina, occluding cerebral aqueduct (of Sylvius) and invading 3rd ventricle

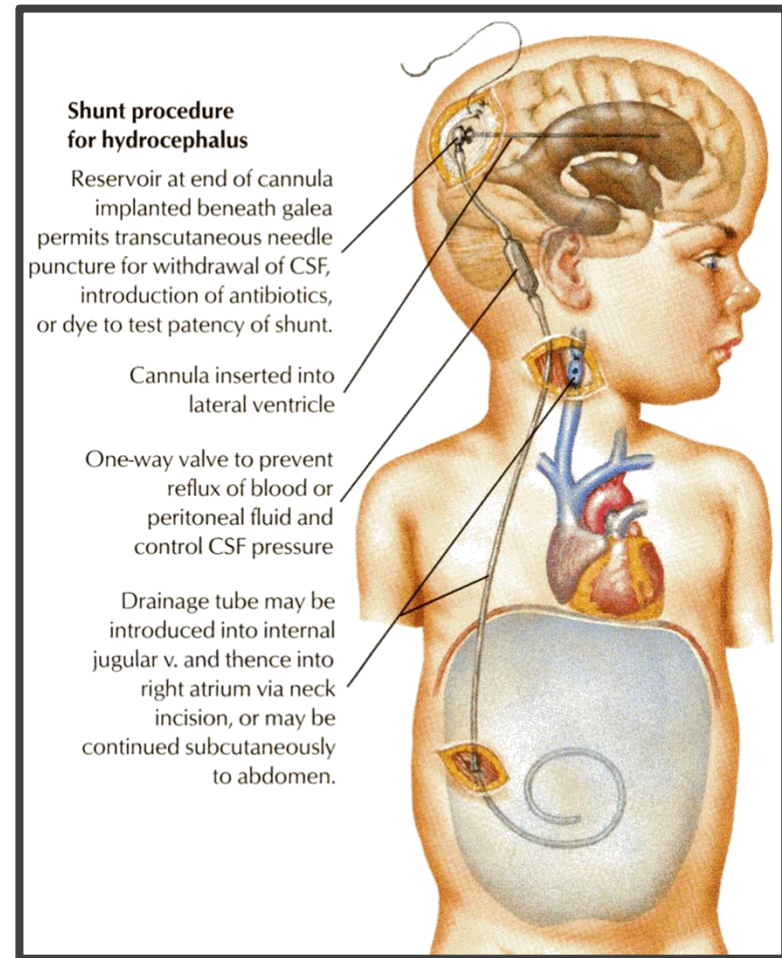


MR scan showing tumor of pineal region, with hydrocephalus

CEREBROSPINAL FLUID

clinical point

❑ **Decompression** of the dilated ventricles is achieved by inserting a shunt connecting the ventricles to the jugular vein or the abdominal peritoneum.



Summary

- **The brain & spinal cord are covered by 3 layers of meninges** : dura, arachnoid & pia mater.
- **The important dural folds** inside the brain are the falx cerebri & tentorium cerebelli.
- **CSF is produced by** the choroid plexuses of the ventricles of the brain ;lateral ,3rd & 4th ventricles.
- **CSF circulates** in the subarachnoid space.
- **CSF is drained into** the dural venous sinuses principally superior sagittal sinus.
- **The subarachnoid space in the spinal cord terminates** at the 2nd sacral vertebra.
- Obstruction of the flow of CSF as in tumors of the brain leads to **hydrocephalus**.

THANK YOU
&
GOOD LUCK