Anatomy Team
MED 439

Revised & Approved

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MED439
KING SAUD UNIVERSITY

Anatomy of the Meninges, Ventricles & Vertebral Column

CNS Block

Don't forget to check the Editing File

Color index:

Content
Male slides
Female slides
Important
Doctors notes
Extra information, explanation

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Objectives

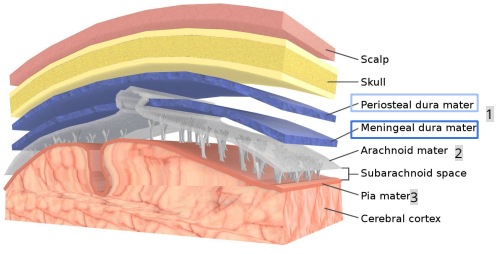
At the end of the lecture, students should be able to:

- Describe the cerebral meninges & list the main dural folds.
- Describe the spinal meninges & locate the level of the termination of each of them.
- Describe the importance of the subarachnoid space.
- List the Ventricular system of the CNS and locate the site of each of them.
- Describe the formation, circulation, drainage, and functions of the CSF.
- Know some clinical point about the CSF.

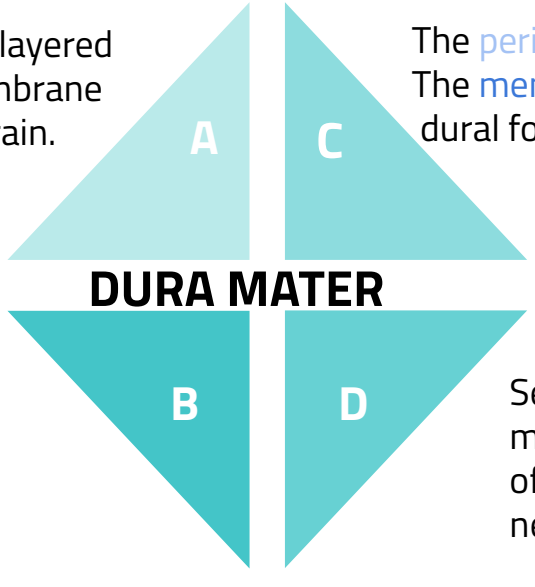
Meninges

The brain and spinal cord are invested by three concentric membranes:

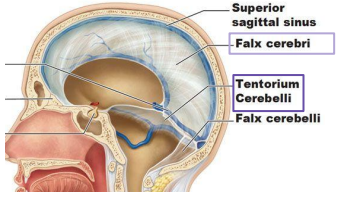
- The outermost Dura matter
- The middle Arachnoid mater
- The innermost Pia mater



The cranial dura is a two layered tough, fibrous thick membrane that surrounds the brain.



The periosteal layer is attached to the skull.
The meningeal layer is folded forming the dural folds : falx cerebri, and tentorium cerebelli.



It is formed of two layers; periosteal and meningeal.

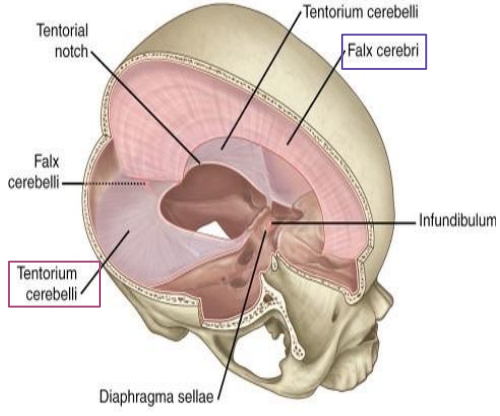
Sensory innervation of the dura is mostly from : meningeal branches of the **trigeminal** and **vagus** nerves & **C1 to C3** (upper cervical Ns.).

DURA MATER Folds

Two large reflection of dura extend into the cranial cavity :

01

The **falx cerebri,** In the midline, It is a vertical sickle-shaped sheet of dura, 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.



02

A horizontal shelf of dura, The **tentorium cerebelli,** It lies between the posterior part of the cerebral hemispheres and the cerebellum.
It has a free border that encircles the midbrain .
In the middle line it is continuous above with the falx cerebri.

Dural nerve supply:

Branches of trigeminal, vagus, and first three cervical nerves and branches from the sympathetic system. The dura is sensitive to stretching (sense of headache)

Very IMPORTANT

Dural Arterial supply:

Branches from internal carotid, mainly maxillary, ascending pharyngeal, occipital, and vertebral arteries. Clinically the most important is the middle meningeal artery (a branch from the maxillary) , which is commonly injured in head injuries.

Arachnoid Mater & Pia Mater

1

The **arachnoid mater** is a soft, translucent membrane loosely envelops the brain. The arachnoid mater is separated
from the dura by a narrow subdural space.

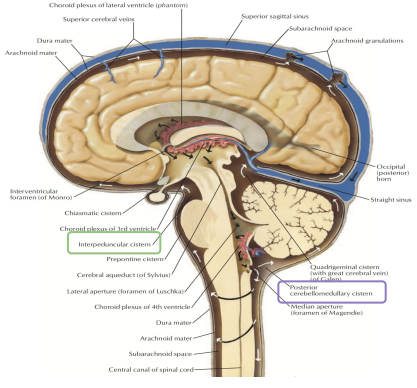
2

The **pia mater** is the innermost, thin, delicate & highly vascular membrane that is closely adherent to the gyri and fitted into the sulci.

3

Between the pia and arachnoid mater lies the **subarachnoid space** which contains; fibrous trabeculae, main blood vessels and CSF.

Subarachnoid Space It is varied in depth forming subarachnoid cisterns:

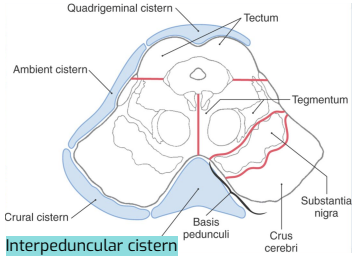


1

The cisterna magna, or **cerebellomedullary cistern** which lies between the inferior surface of the cerebellum and the back of the medulla.
-At this cistern CSF flows out of the 4th ventricle via the 2 lateral apertures and median aperture.

2

The interpeduncular cistern, which is located at the base of the brain, where the arachnoid spans between the two cerebral peduncles of midbrain.
-This cistern contains the optic chiasma & circulus arteriosus of Wills.



Spinal meninges

The spinal cord is invested by three meningeal coverings:

meningeal coverings

dura mater

The outer covering; is a thick, tough fibrous membrane.
-It envelopes the cord loosely.
-It is separated from arachnoid mater by the subdural space, and from the bony wall of the vertebral canal by the epidural space

Between the bone and dura

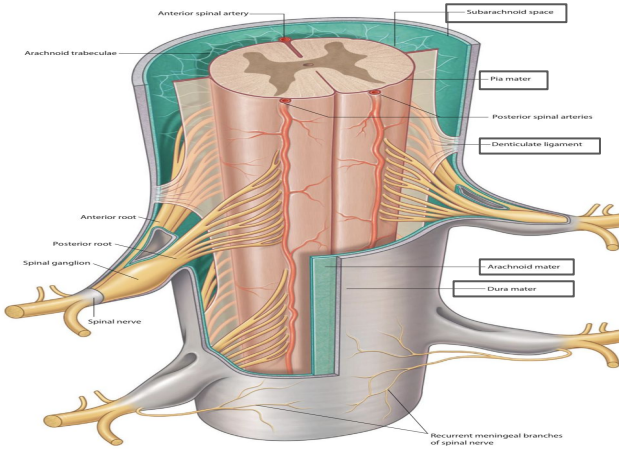
arachnoid

translucent membrane lies between the pia and dura, Between arachnoid and pia lies the subarachnoid space contains CSF.

pia mater

The; The innermost covering, is a delicate fibrous membrane closely envelops the cord and nerve roots. It is attached through the arachnoid to the dura by the denticulate ligament..

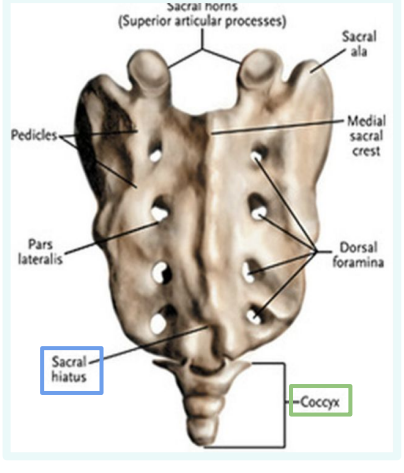
Dr's note:
The difference between meninges of brain and spinal cord ,That the spinal cord have
1- dura matter have only one layer
2–denticulate ligament

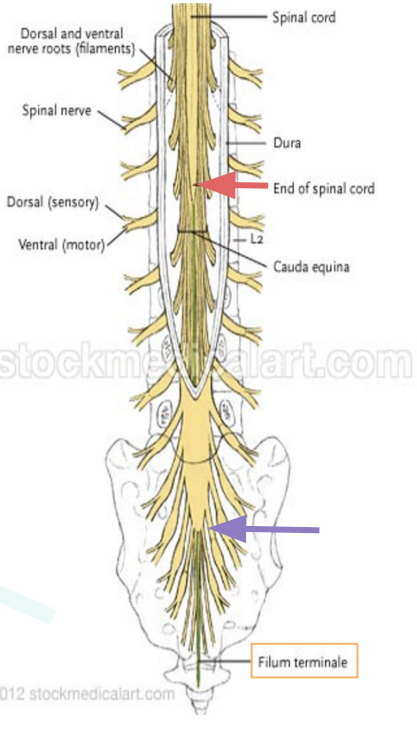


Spinal meninges

- The spinal cord terminates at level L1-L2,
- The dura and arachnoid and, subarachnoid space, continue caudally to S2.
- The pia extends downwards forming the filum terminale which pierces the arachnoid and dural sacs and passes through the sacral hiatus to be attached to the back of the coccyx.

Dr's note:
It's important to memorize the levels where the SC and meninges End





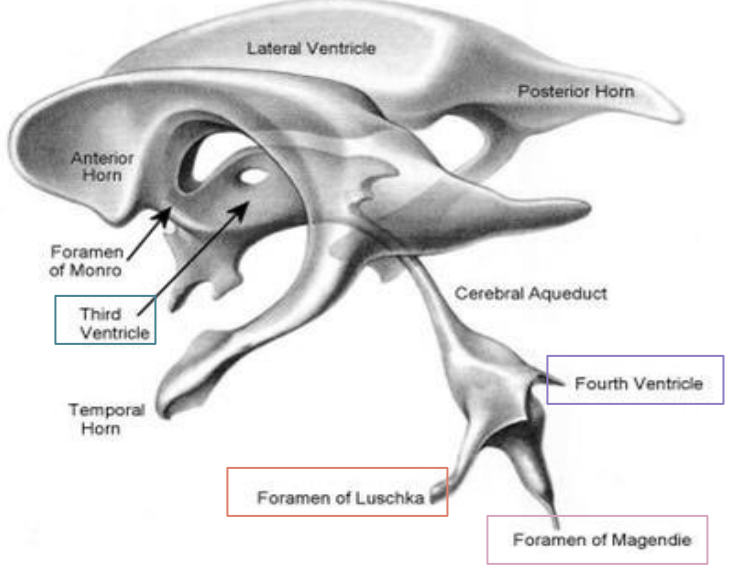
VENTRICULAR SYSTEM

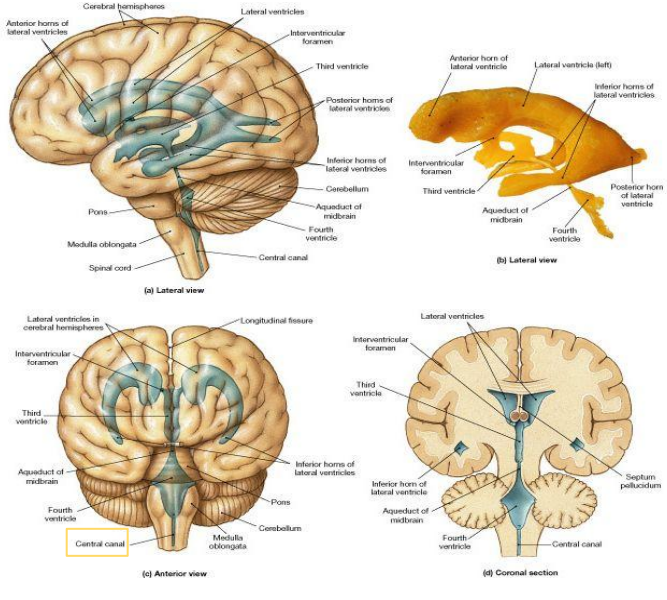
Interconnecting channels within the CNS.

1. In the spinal cord; represented by the central canal. Within the brain; a system of ventricles is found.
2. The central canal of the spinal cord is continuous upwards to the fourth ventricle.
3. 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**)

The **fourth** ventricle is continuous **up** with the cerebral aqueduct → Open → Third ventricular

The **third** ventricle is continuous **with** the lateral ventricle → Through → The interventricular foramen (foramen of Monro).





CEREBROSPINAL FLUID

Present in the **ventricular system,** together with the cranial and spinal subarachnoid spaces.

1. **Colourless clear fluid** containing : little protein and few cells.
2. It is produced by the **choroid plexus**, which is located in the lateral, third & fourth ventricles.
3. It is about **150 ml** and It acts as a **cushion** for the brain from sudden movements of the head

Pathway : From **lateral ventricle** it flows: through the interventricular foramen into the **3rd ventricle** and, by way of the cerebral aqueduct, into the **4th ventricle.**

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

Important

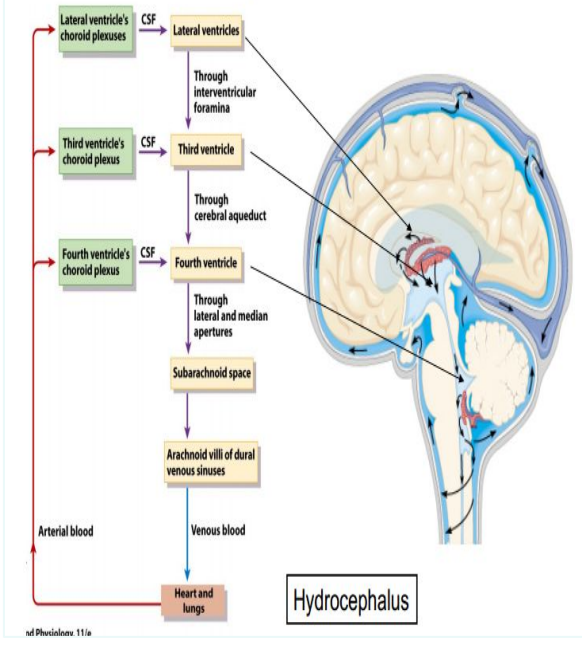
Reabsorbed finally into the **venous system** along arachnoid villi (small microscopic herniation of arachnoid mater), and arachnoid granulation (Macroscopic multilobulated structures) that project into the dural venous sinuses , mainly superior saggital sinus.

Dr's note:

They may ask : where dose the CSf drains finally ?In venous sinus

سألوا عن اي واحد بالضبط يصير

superior saggital sinus.



CEREBROSPINAL FLUID (clinical)

hydrocephalus

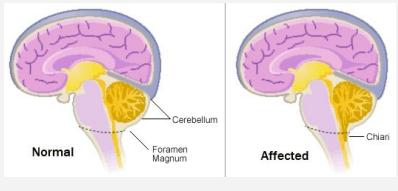
The obstruction of the flow of CSF leads to a rise in fluid pressure causing swelling of the ventricles (hydrocephalus)

Causes of hydrocephalus

Congenital

(Arnold-Chiari malformation).

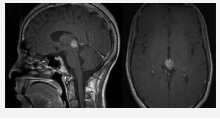
Chiari malformation, previously called an Arnold-Chiari malformation, is where the lower part of the brain pushes down into the spinal canal.



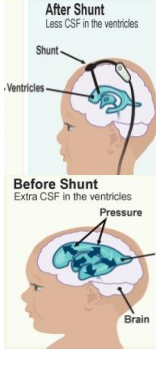
Acquired

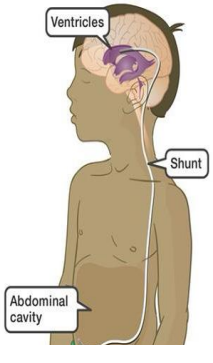
Obstruction of the interventricular foramina secondary to tumors, hemorrhages or infections such as meningitis

Stenosis of the cerebral aqueduct by tumor of pineal region.



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.

MCQ

Q1: dura and arachnoid and, subarachnoid space, continue caudally to:			
A: L2	B: S2	C: S1	D:L1-L2

Q2: Clinically the most important Dural Arterial supply is:			
A: middle meningeal artery	B: middle cerebral artery	C: Anterior cerebral artery	D: vertebral arteries

Q3: horizontal shelf of dura lies between the posterior part of the cerebral hemispheres and the cerebellum.			
A: falx cerebri	B: pia mater	C: subarachnoid space	D: tentorium cerebelli

Q4: The interpeduncular cistern, which is located at the:			
A: Base of brain	B: surface of brain	C: surface of cerebellum	D: none

Q5: spinal cord terminates at level :			
A: S2	B: S1	C: L3	D: L1-L2

Q6: extends downwards forming the filum terminale:			
A: Arachnoid	B: Dura	C: Pia	D: A&B

Answer key:
1 (B) , 2 (A) , 3 (D) , 4 (A) , 5 (D) , 6 (C)

MCQ

Q7: final drainage of CSF into the dural venous sinuses principally :			
A: superior sagittal sinus.	B: subarachnoid space	C: arachnid villi	D: subdural space

Q8: which one of the following will open in the subarachnoid space:			
A: median foramen of Magindi	B: 2 lateral foraminae of Leushka	C: both A& B	D: none

Q9: choroid plexus is located in :			
A: lateral ventricles	B: 3rd ventricle	C: 4th ventricle	D: all

Q10: The interpeduncular cistern contains:			
A: optic chiasma	B: circulus arteriosus of Wills.	C: both A & B	D: none

Q11: highly vascular membrane that is closely adherent to the gyri and fitted into sulci: #438			
A: arachnoid mater	B: pia mater	C: subarachnoid space	D: none

Q12: The CSF flows through foramen of monro (interventricular foramen) from (...) to (...). #438			
A: Cerebral aqueduct , 3rd ventricle	B: 4th ventricle , central canal	C: 3rd ventricle, lateral ventricle	D: Lateral ventricle, 3rd ventricle

Answer key:
7(A) , 8(c) , 9(D) , 10(C) , 11(B) , 12(D)

SAQ

Q1: enumerate Dural nerve supply:

Q2: what are the two reflections of dura extend into the cranial cavity?

Q3: Decompression of the dilated ventricles is achieved by inserting a shunt connect ..... And ... ...?

Q4: describe the pathway of the CSF briefly:

Answers

1 : Branches of trigeminal, vagus, and first three cervical nerves and branches from the sympathetic system. The dura is sensitive to stretching (sense of headache)

2 : falx cerebri and the tentorium cerebelli

3 : ventricles to the jugular vein or the abdominal peritoneum.

4: slide 9

A special thanks to all the members who contributed in the anatomy team CNS block.

We are looking forward to working with you in the future.

We appreciate all the hard work, time & effort you put into making the team successful.

We wish you all the best
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