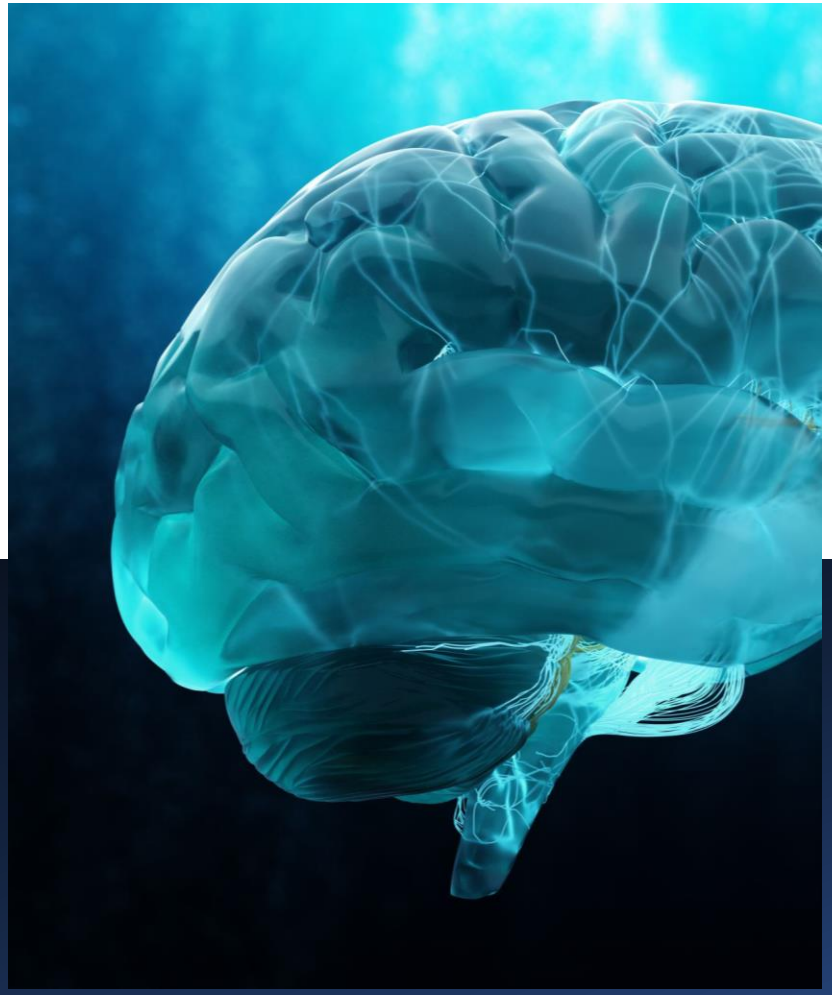
Gross Anatomy I (final part)

DTIP 203 & DTAN 211

Mahidol University
Faculty of Dentistry

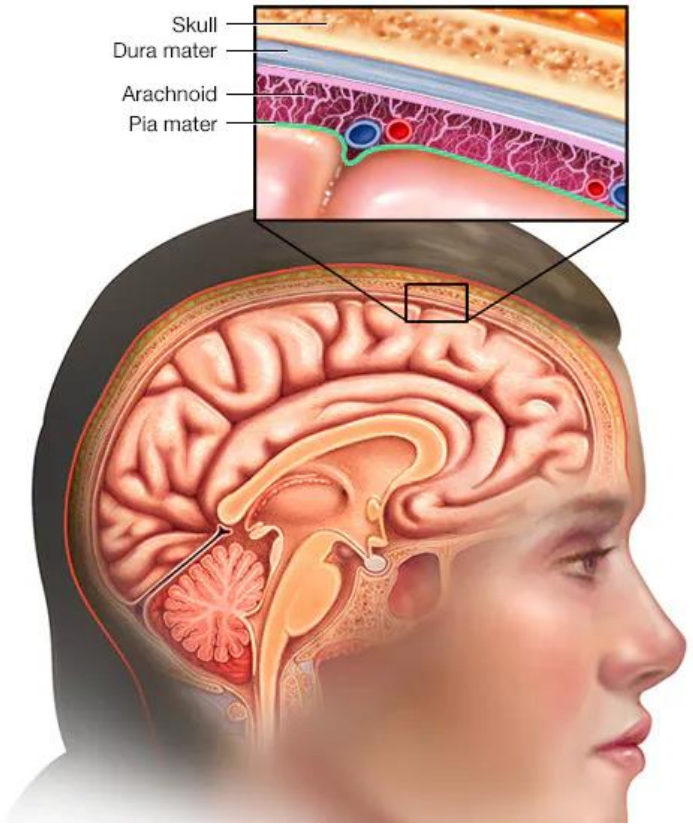
Dura mater of brain and dural venous sinus

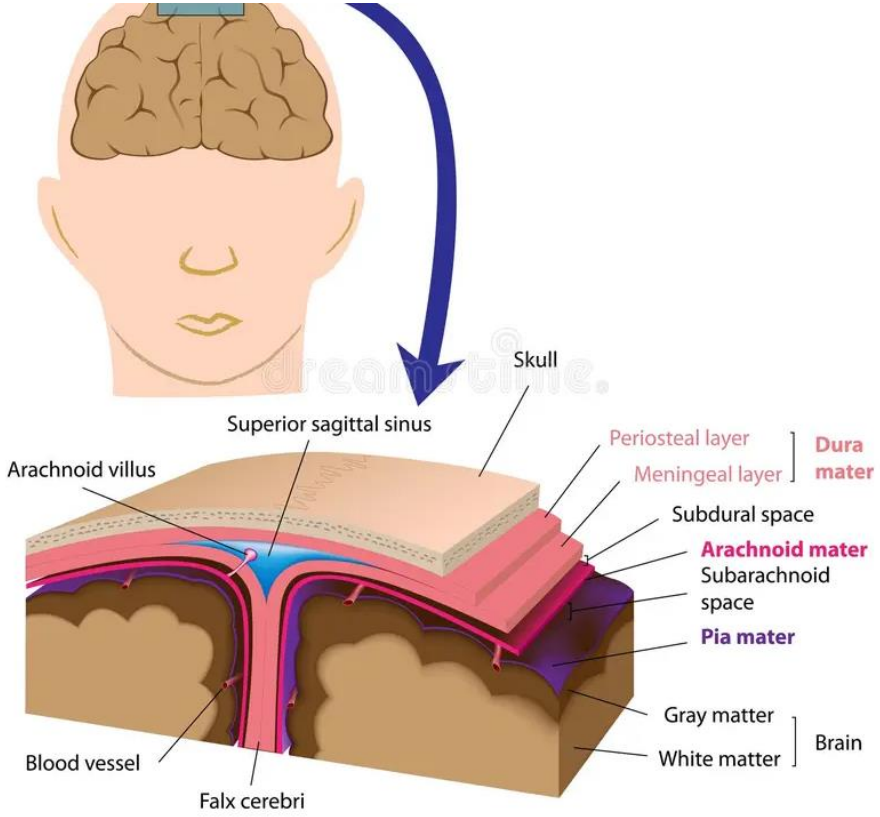


Dr. Jirattikarn Kaewmuangmoon
Department of Anatomy, Faculty of Dentistry, Mahidol University.

Outlines

- Dura mater of brain
- Dural venous sinus

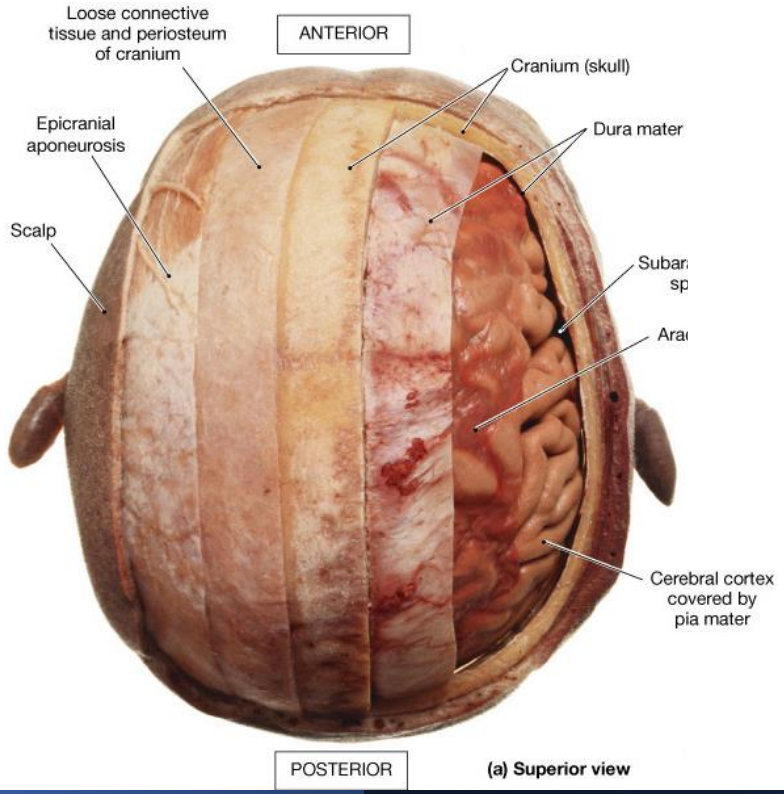


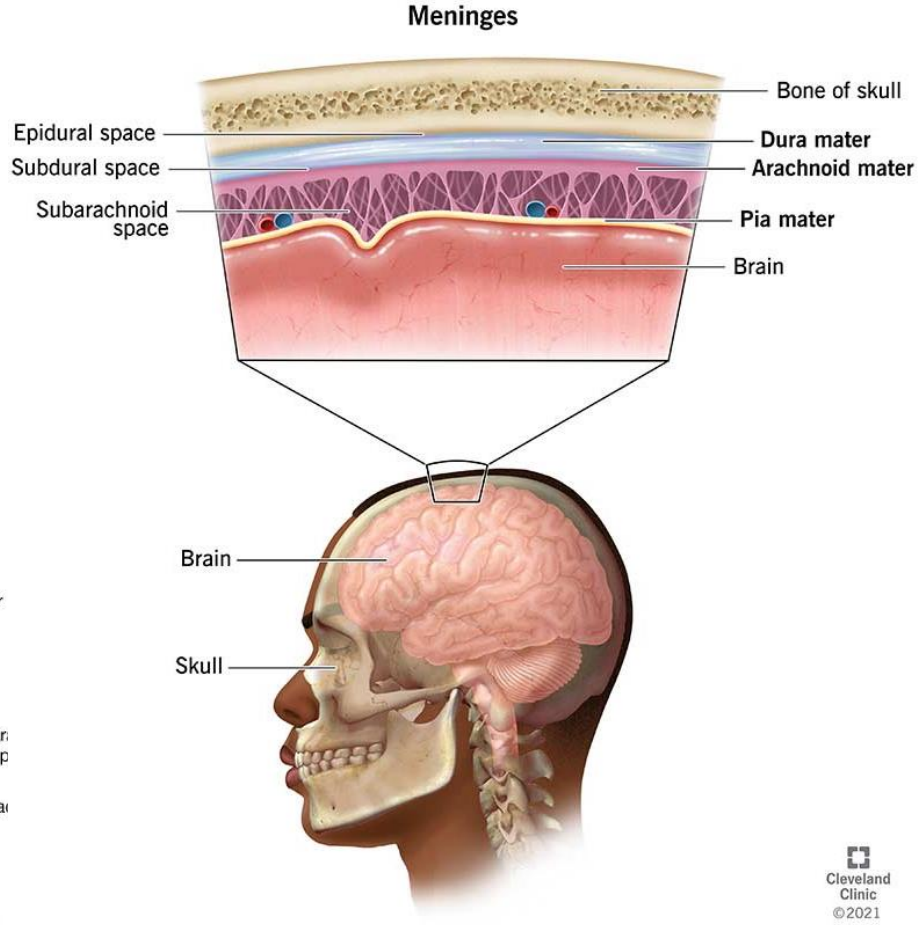


Development of the dural venous sinuses is mainly related to the development of the meningeal layers of the brain, specifically the dura mater.

Meninges of Brain

- Dura mater
- Arachnoid
- Pia mater

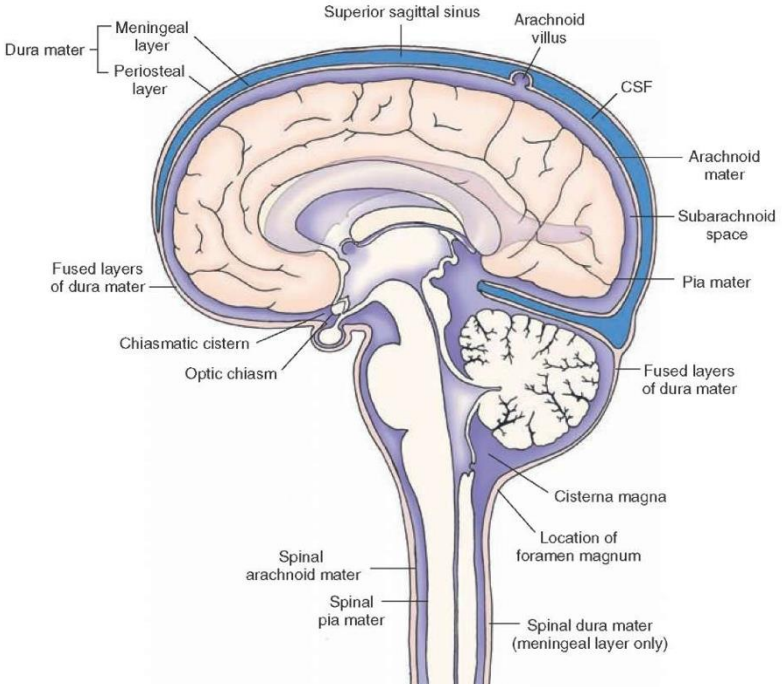


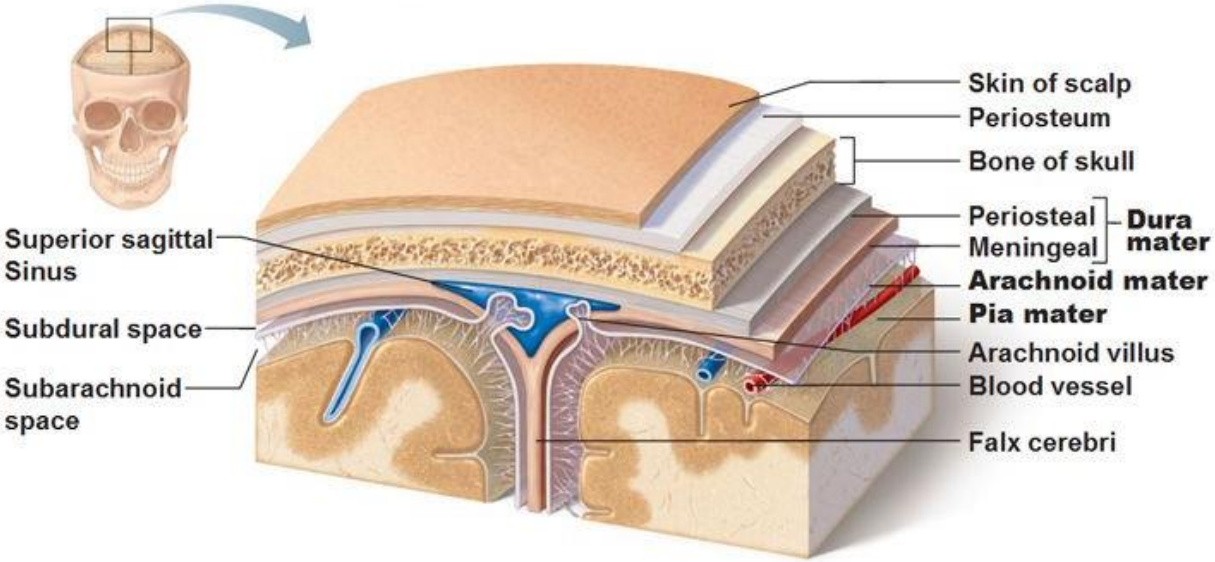


- Epidural space
- Subdural space
- Subarachnoid space

Dura mater of Brain

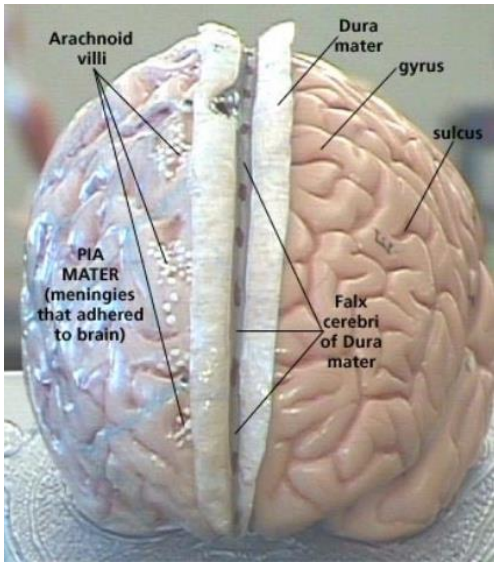
- **External (Periosteal layer/endosteal layer)**
  - Attach to inner aspect of cranial bone.
  - Serves as the skull's inner periosteum, called the endosteal layer.
- **Internal (Meningeal layer)**
  - Continuous inferiorly with the Duramater of the spinal cord.

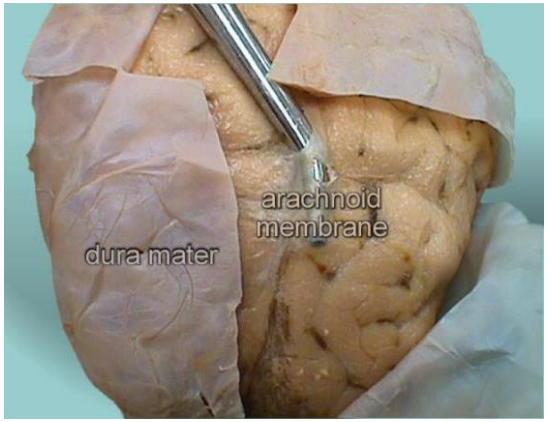




Arachnoid mater

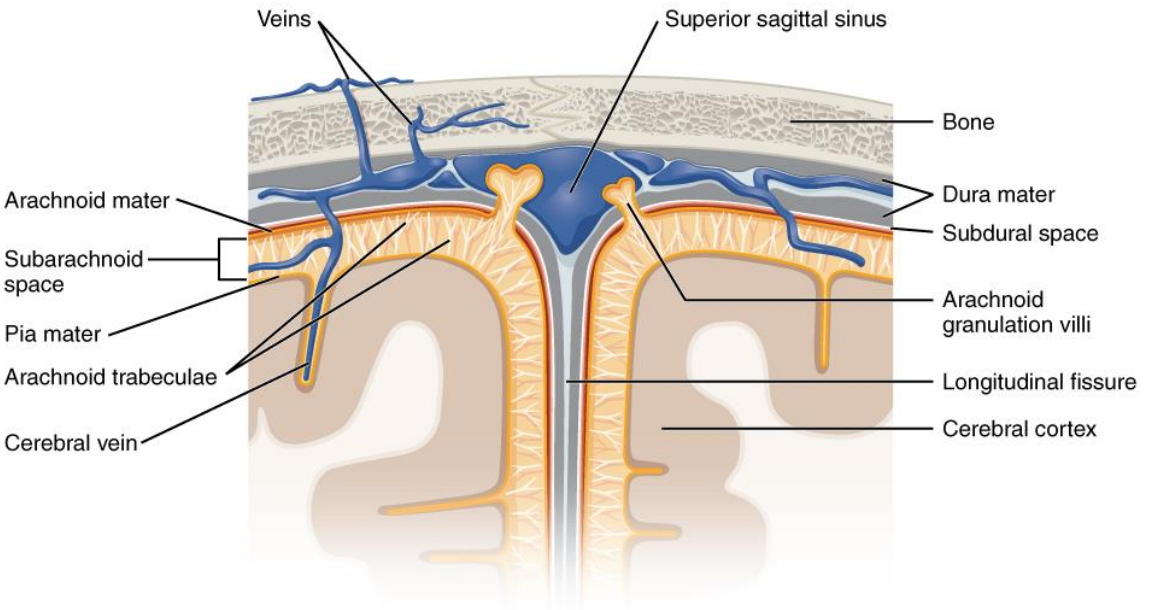
- Thin, Lies immediately deep to dura mater.
- Thin process or trabeculae extend downward, cross the subarachnoid space and continuous with pia mater below.





Pia mater

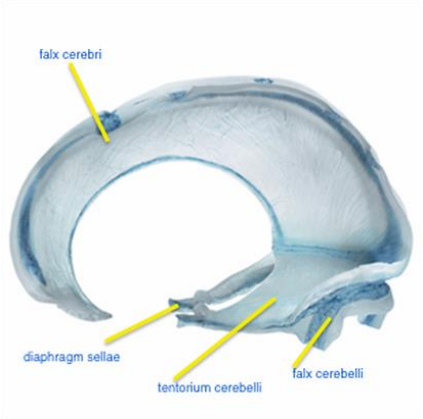
- Thin, delicate innermost layer that intimately adheres to the surface of brain.

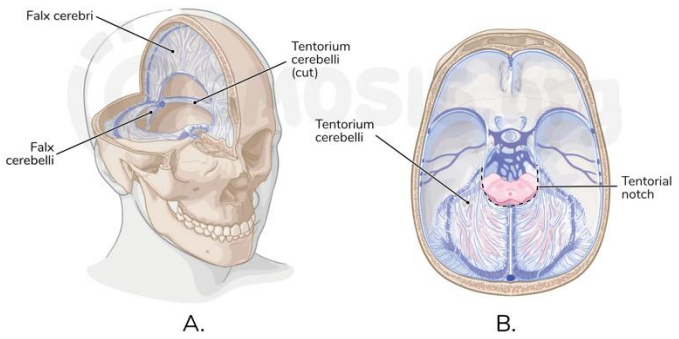


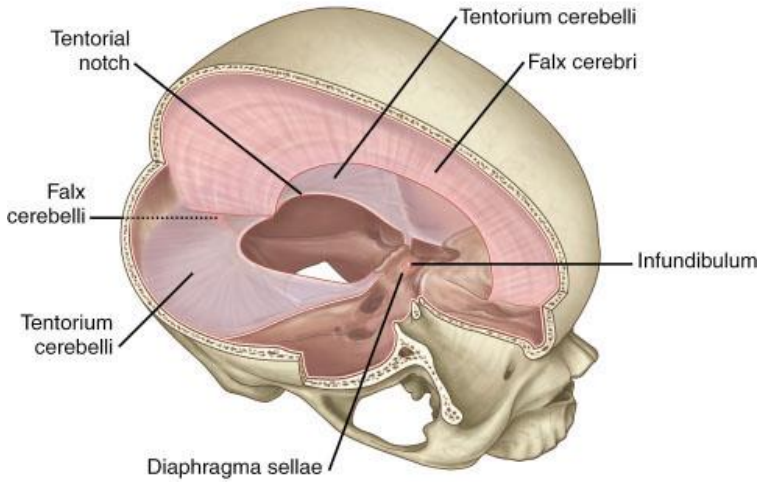
Dural folds

- Falx cerebri
- Falx cerebelli
- Tentorium cerebelli
- Diaphragma sellae

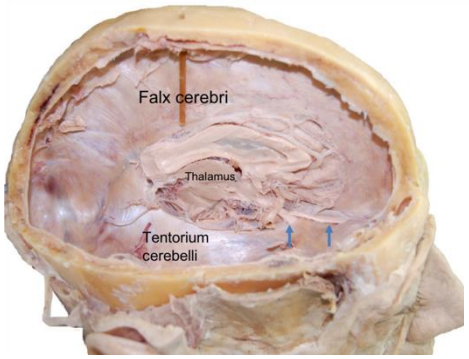
The meningeal layer of the dura mater creates several dural folds that divide the cranial cavity into freely communicating spaces. The function of the dural folds is to restrict the rotational movement of the brain.



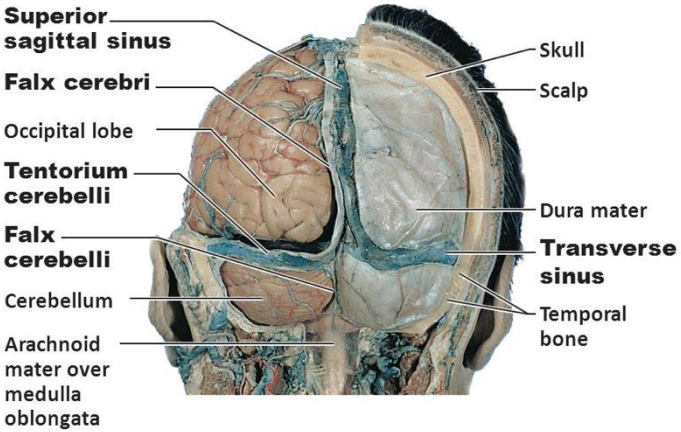


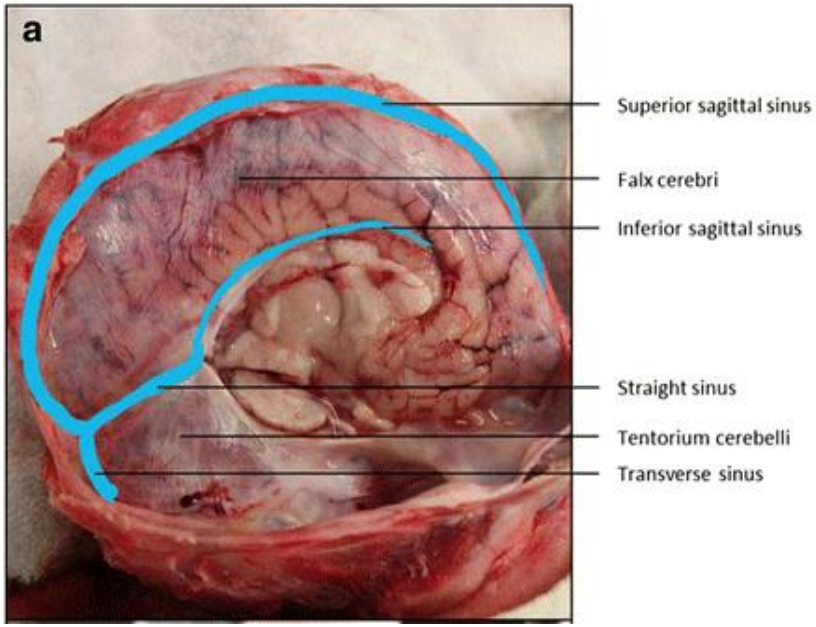


Falx cerebri



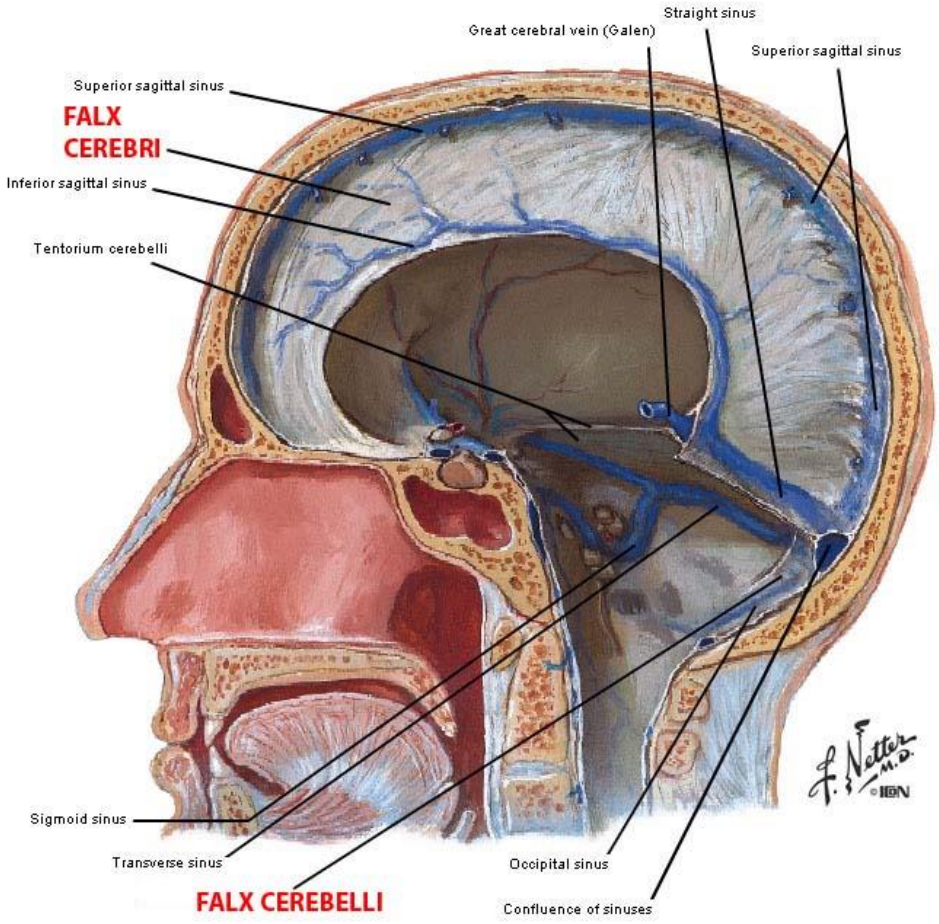
- Sickle – shape
- Located in longitudinal fissure between cerebral hemisphere.
- **Anterior**: attach at crista galli of ethmoid bone.
- **Posterior**: fuse to tentorium cerebelli & contain **straight sinus**.
- **Upper border**: convex, contain **superior sagittal sinus**, atttach inner aspect of skull at median plane.
- **Lower border**: concave, contain **inferior sagittal sinus**.

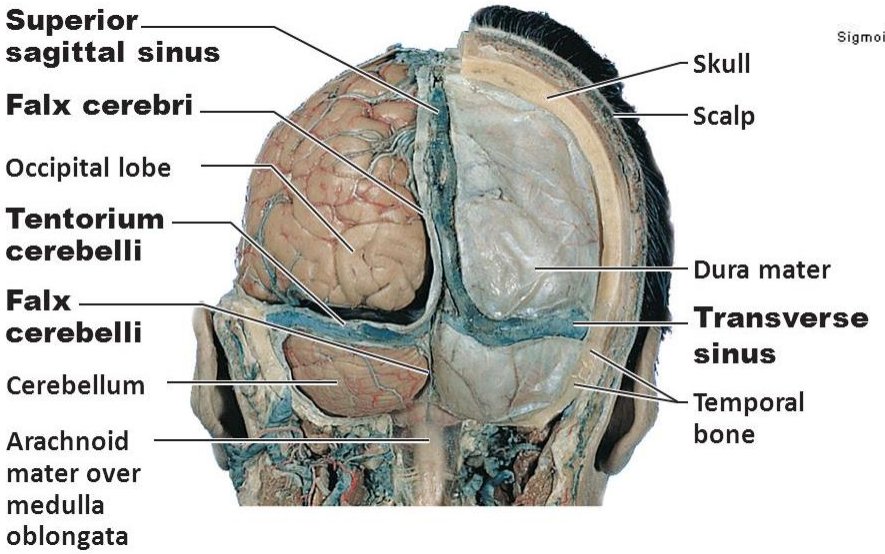


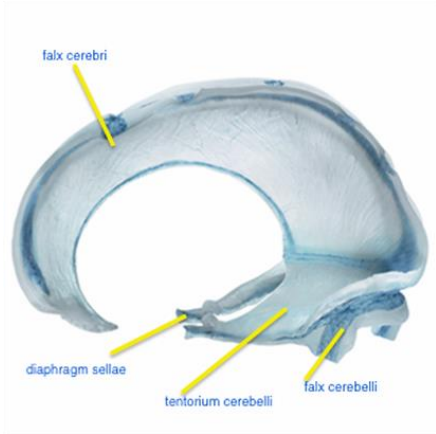


Falx cerebelli

- Sickle-shaped
- Located between cerebellum.
- **Anterior**: free, between cerebellar hemisphere.
- **Posterior**: contain **occipital sinus**, attach with occipital bone.
- **Upper border**: attach lower aspect of tentorium cerebelli.







Tentorium cerebelli

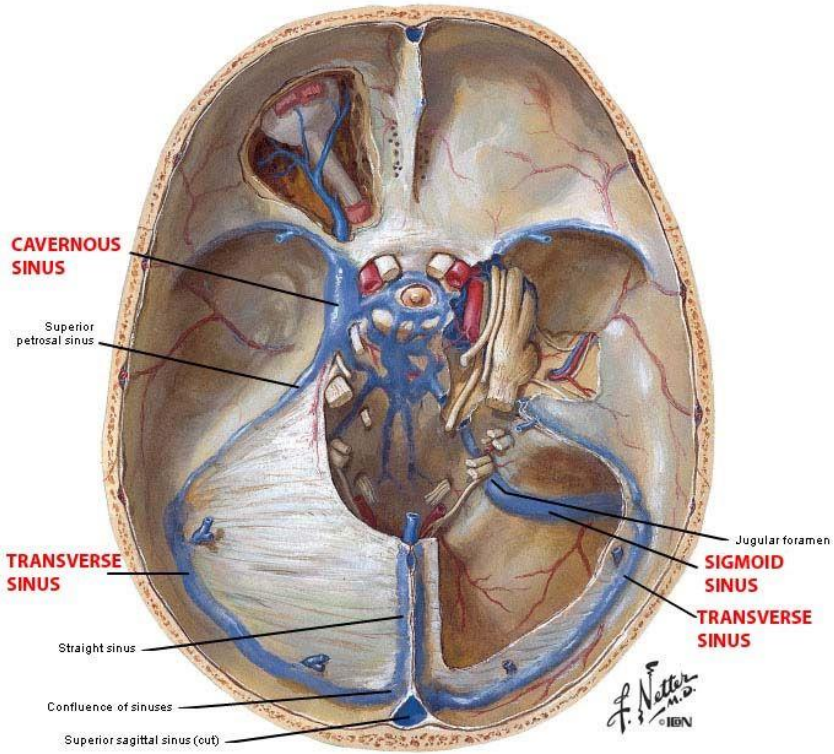
- Cresent shape
- Support occipital lobe of cerebral hemisphere
- Form the roof of <u>cerebellum</u>

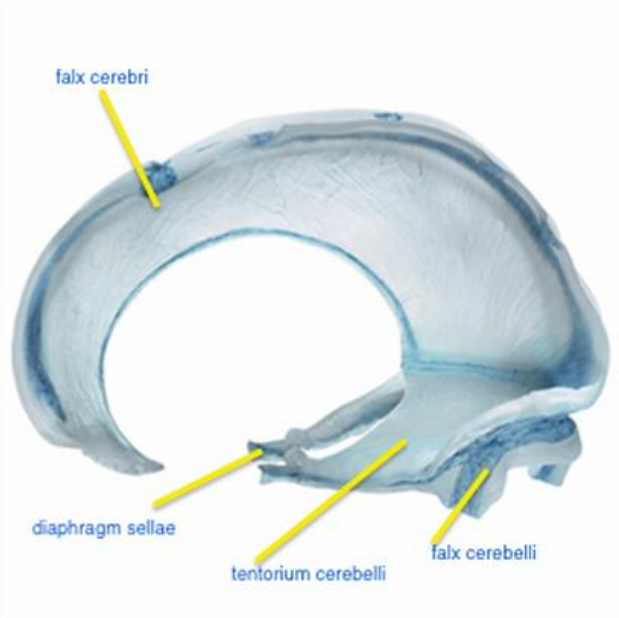
Internal border: concave and free

➢ Found the tentorial notch for the midbrain

External border: convex

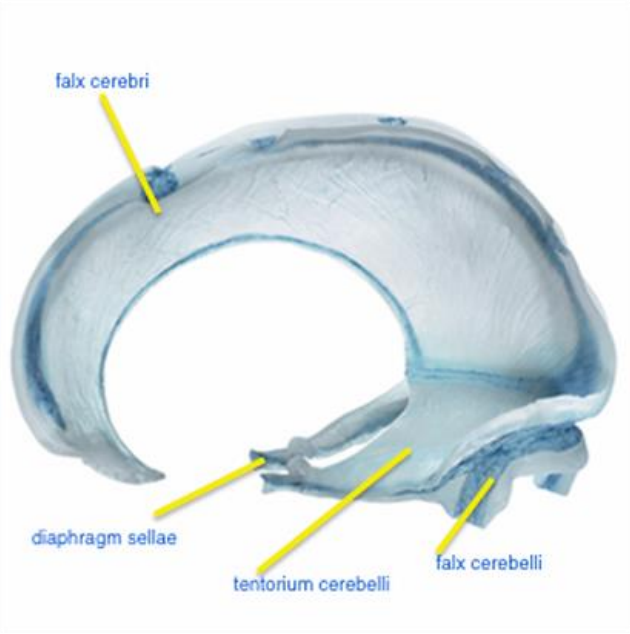
- **Anterior:** cover **superior petrosal sinus**
  - Attach: the upper border of petrous temporal bone and the posterior clinoid process.
- **Posterior:** contain **transverse sinus**
  - Attach: the inner aspect of occipital and parietal bones.

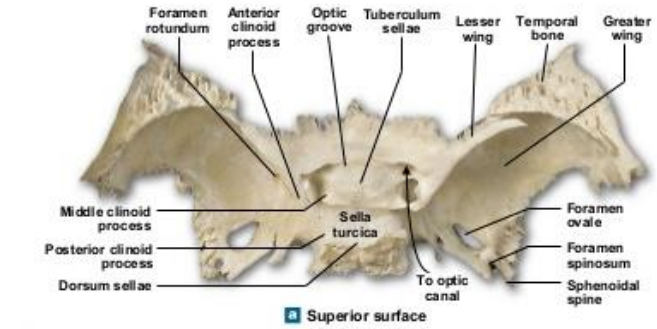




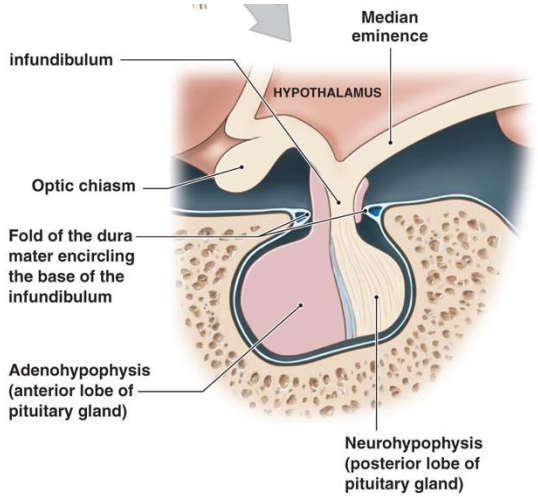
Diaphragma sellae

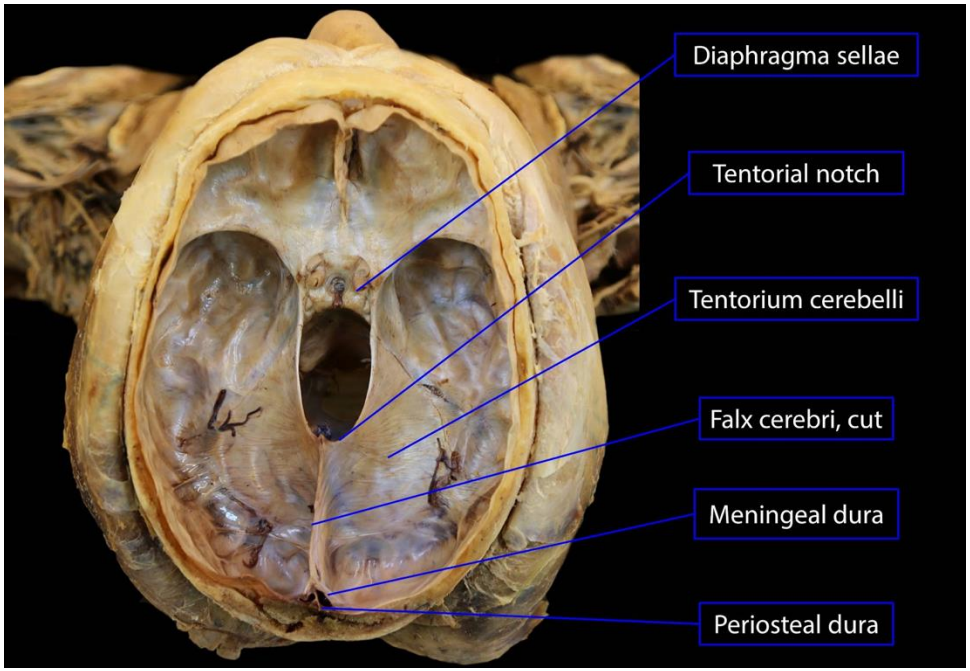
- Circular, horizontal. Form dural roof of sella turcica
- Cover hypophysis (pituitary gland), has aperture for infundibulum
- Is covered by part of optic chiasma





ation, Inc.

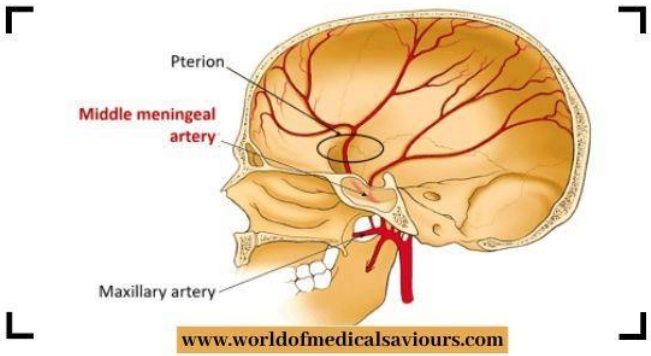


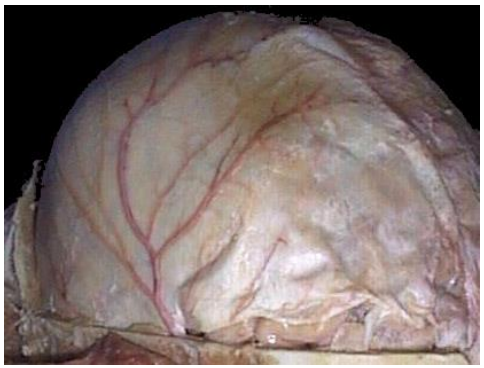


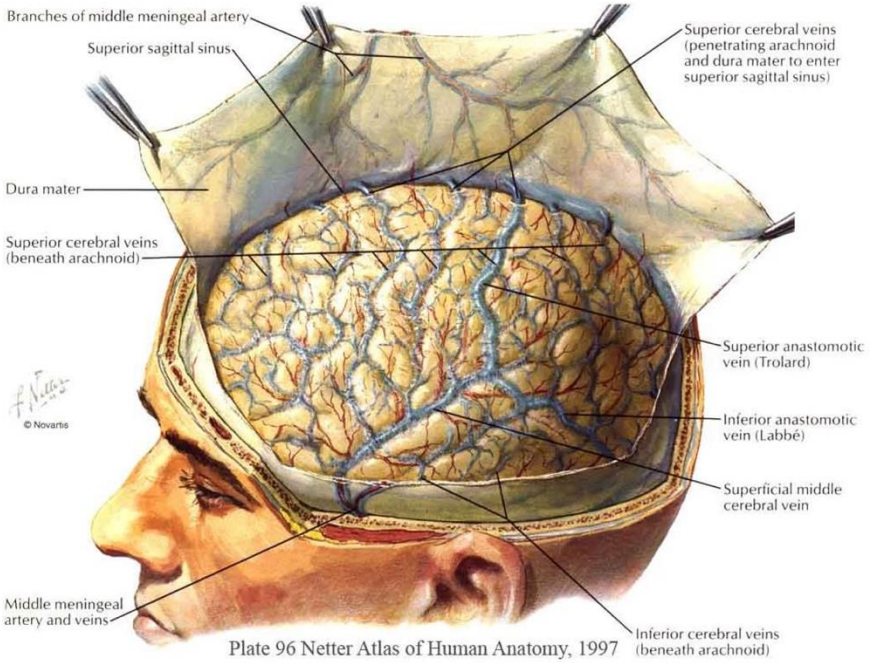
Vasculature of Dura mater

Arterial supply

- Middle meningeal artery.
- Anterior and posterior meningeal branch
  (ex. Branch of ethmoidal artery and vertebral artery)







Venous drainage

- The middle meningeal vein (follows the branches of the middle meningeal artery)
- Drains into the venous sinus.

Innervation of Dura mater

Anterior cranial fossa:

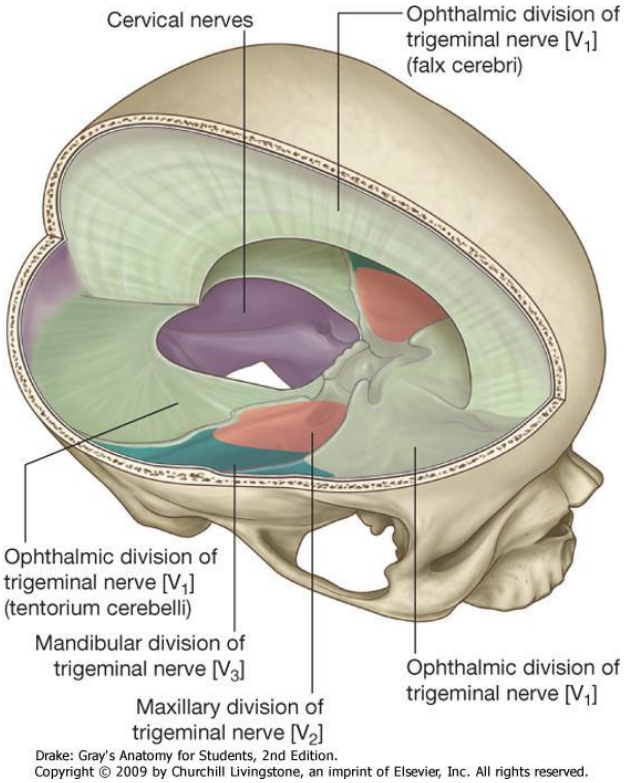
- Ophthalmic nerve (V1) (via anterior and posterior ethmoidal nerve).

Middle cranial fossa:

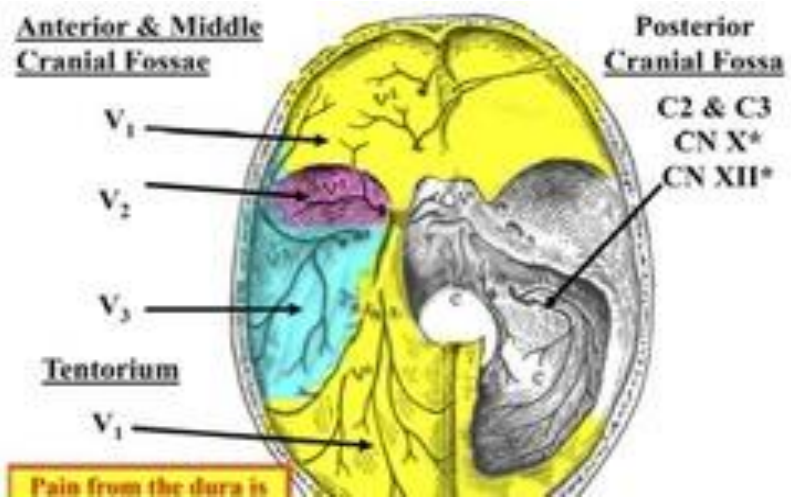
- Meningeal branch of maxillary and mandibular nerve (V2 & V3)

Posterior cranial fossa:

- Meningeal branch of vagus neve (CN X) and hypoglossal nerve (CN XII)
- Meningeal branch of cervical nerve (C1, 2, 3)



Drake: Gray's Anatomy for Students, 2nd Edition.
Copyright © 2009 by Churchill Livingstone, an imprint of Elsevier, Inc. All rights reserved.



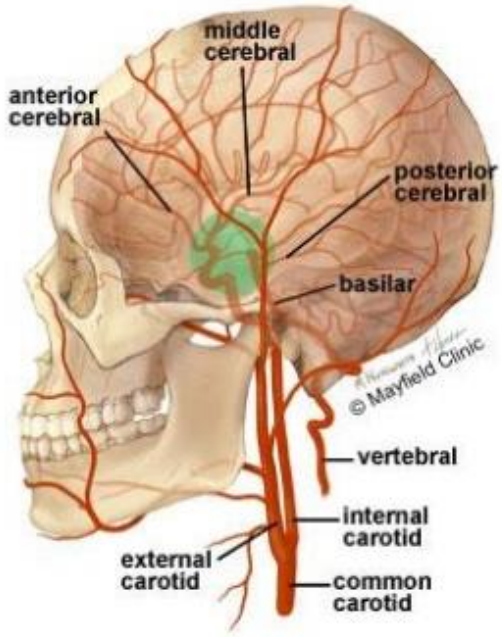
- **Tentorium cerebelli** was supply by tentorial branch of V1 (also supply falx cerebri)

Headache: cause by vascular (intra-cranial or extra-cranial)

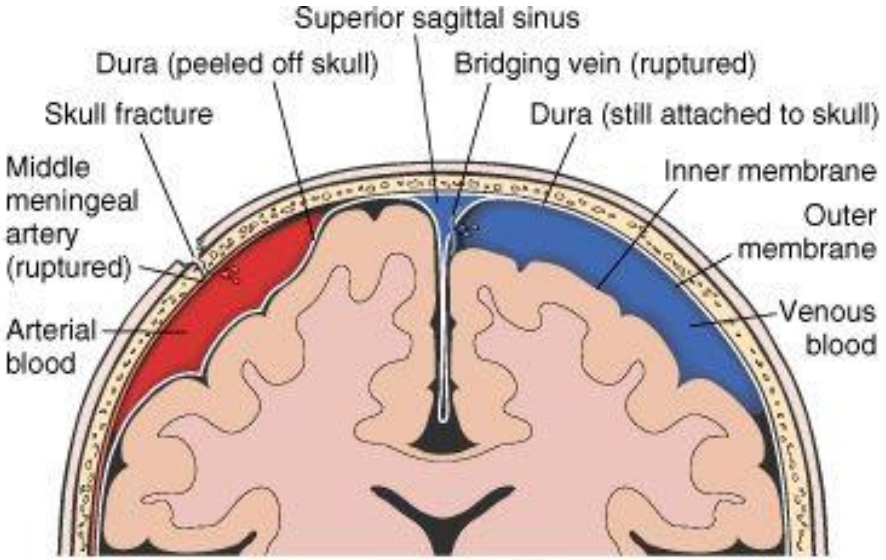
Epidural and Subdural Hematoma

Clinical:

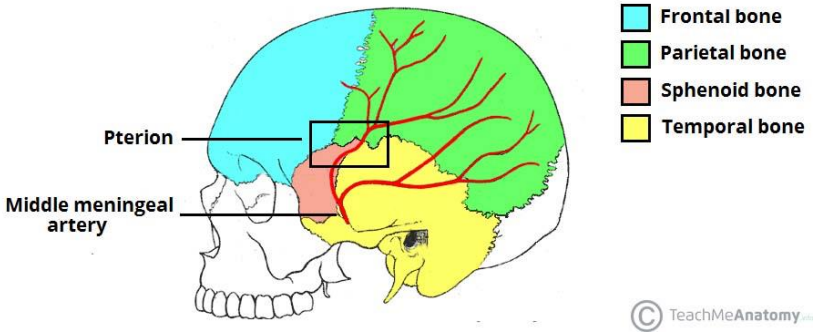
- **Epidural hematoma (EDH)**
  - Middle meningeal artery



- **Subdural hematoma**
  - Cerebral vein



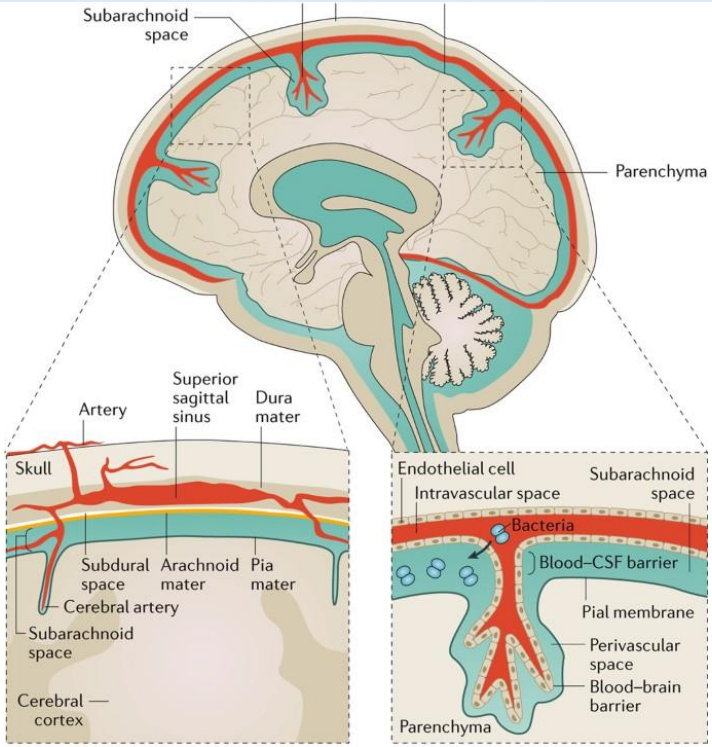
© Elsevier Ltd. Kumar et al: Basic Pathology 7E www.studentconsult.com



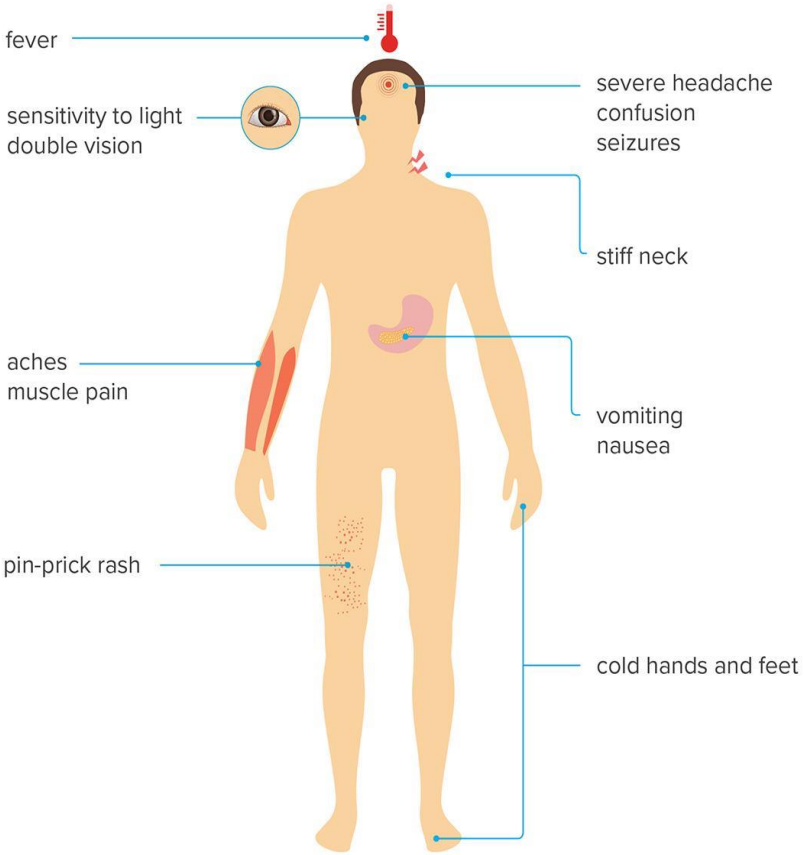
Meningitis



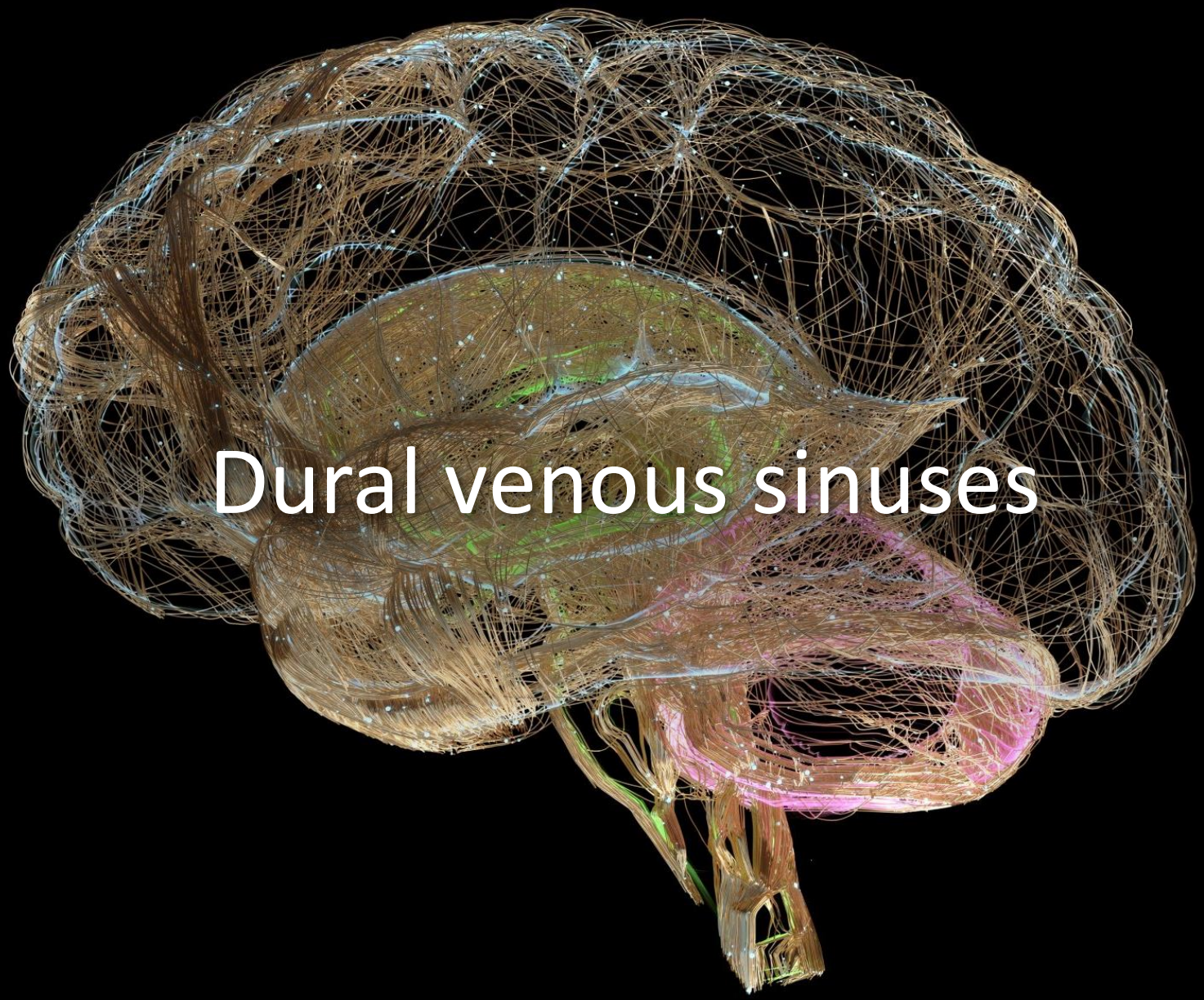
- Is an inflammation of the meninges covering the brain and spinal cord
- **Cause**: Bacterial, viral, fungal infections of the pia-arachnoid and CSF of the **subarachnoid space**.



Nature Reviews | Disease Primers



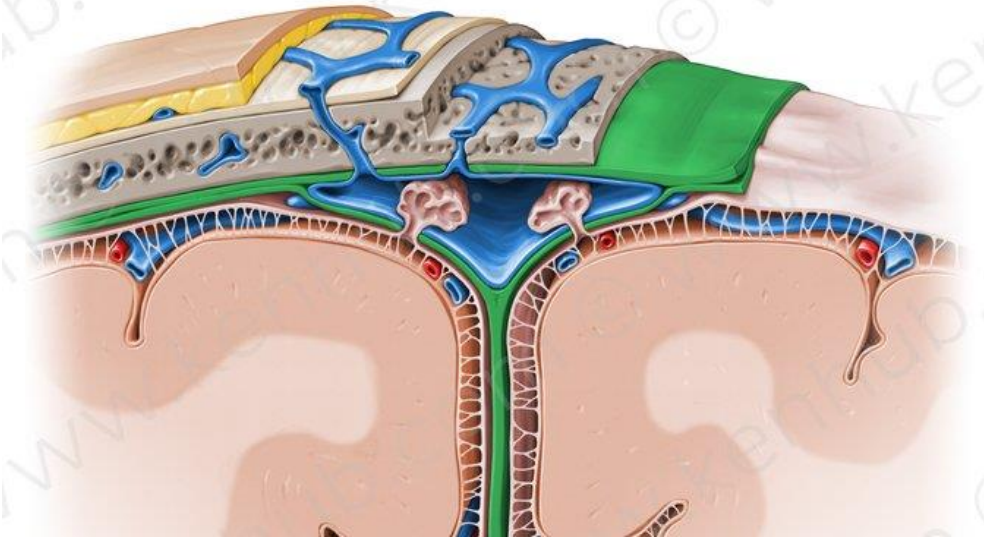
Gross Anatomy I (final part)

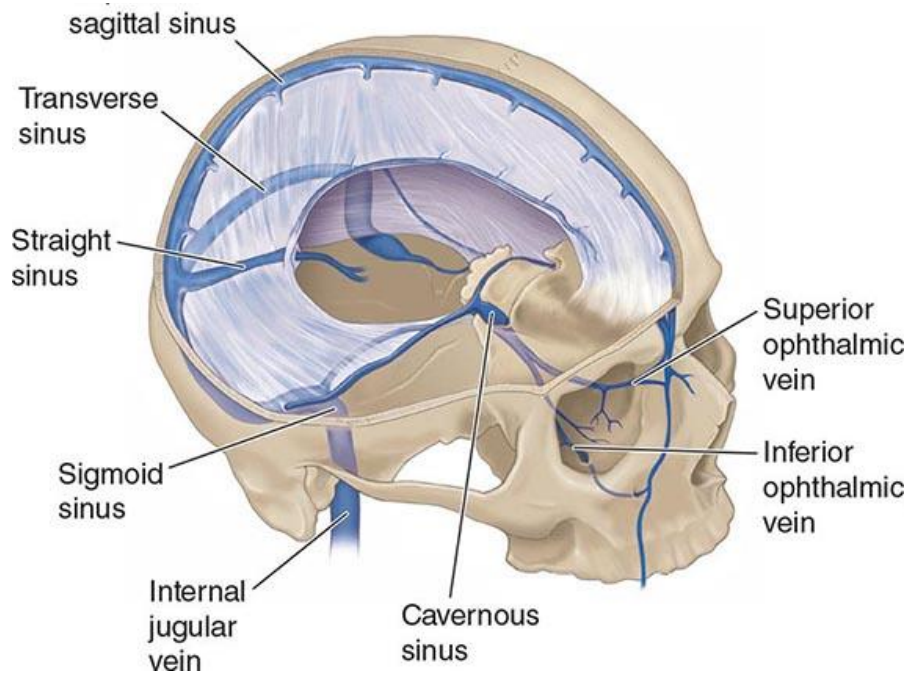


Dural venous sinuses

Venous sinuses of Dura mater

- Space between **periosteal layer (endosteal layer)** and **meningeal layer** of dura mater
- Thin wall, no muscular tissue
- No valves
- Drains blood from brain & bones of the cranium





12 Venous Sinuses

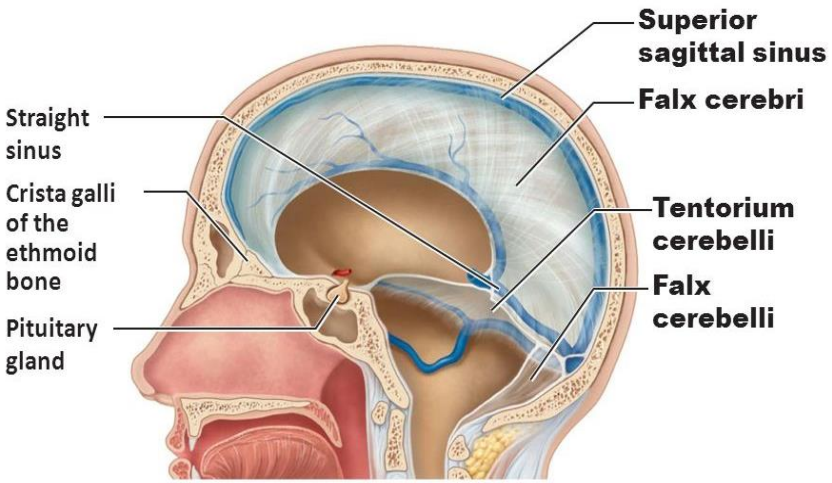
Single sinus

- Superior sagittal sinus
- Inferior sagittal sinus
- Confluence of the sinus
- Straight sinus
- Occipital sinus

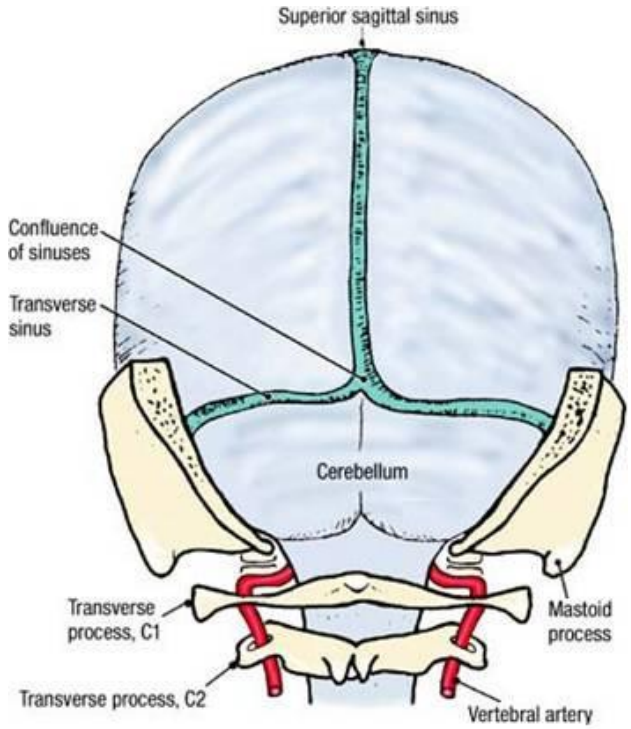
Paired sinus

- Transverse sinuses
- Sigmoid sinuses
- Cavernous sinuses
- Sphenoparietal sinuses
- Superior petrosal sinuses
- Inferior petrosal sinuses
- Intercavernous sinuses

Superior sagittal sinus



- In the convex entire border of falx cerebri
- Anterior: crista galli
- Posterior: internal occipital protuberance
- Drain into the confluence of sinus



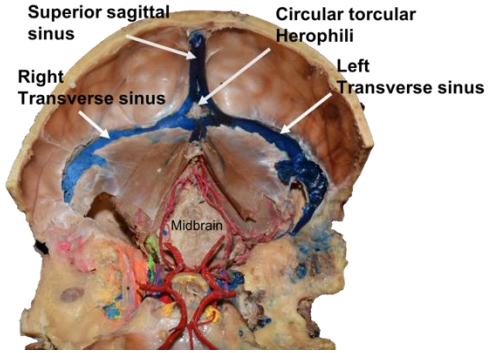
A Cadaveric Case of a Circular Torcular Herophili

Sasha Lake, Juan J. Altafulla, Joe Iwanaga, Rod J. Oskouian, Marios Loukas, R. Shane Tubbs

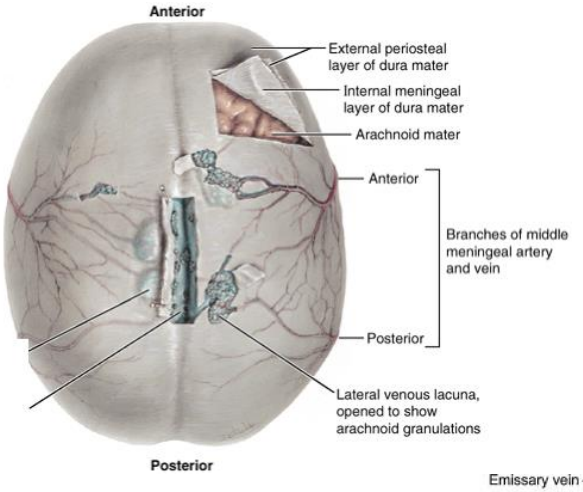
Published: August 04, 2018 (see history)
DOI: 10.7759/cureus.3099
Cite this article as: Lake S, Altafulla J J, Iwanaga J, et al. (August 04, 2018) A Cadaveric Case of a Circular Torcular Herophili. Cureus 10(8): e3099. doi:10.7759/cureus.3099

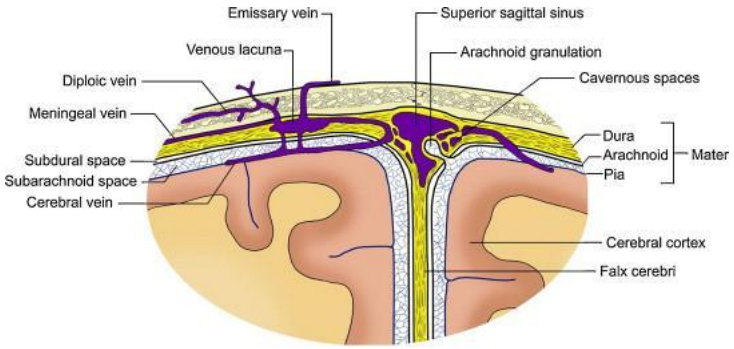
Abstract

The torcular Herophili is formed by the joining of the straight sinus, superior sagittal sinus, and transverse sinus. The anatomic configuration of the torcular Herophili is highly variable. In the current literature, classification systems define up to nine subtypes of the torcular Herophili. The frequency of prevalence of these anatomical variants is also variable. Herein is a case report of a circularly-shaped torcular Herophili found during cadaveric dissection.

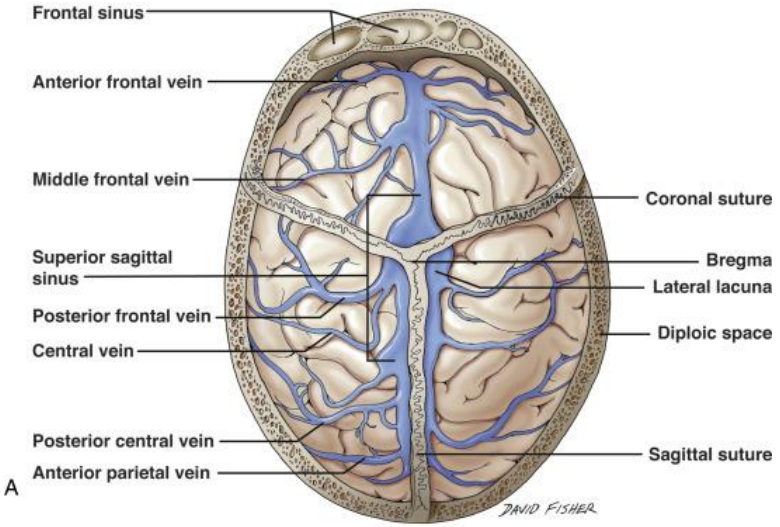


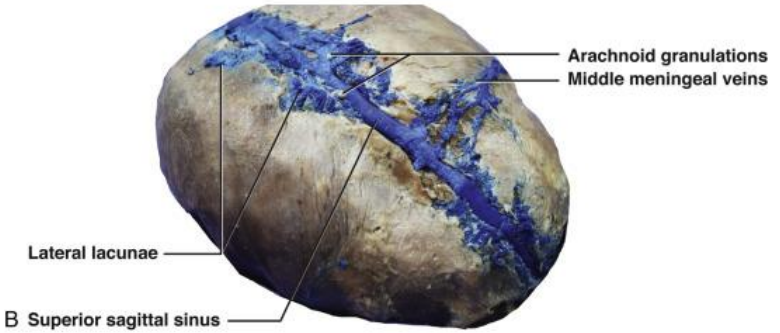
They reported that venous flow from the superior sagittal sinus to the transverse sinus could be either symmetric or asymmetric







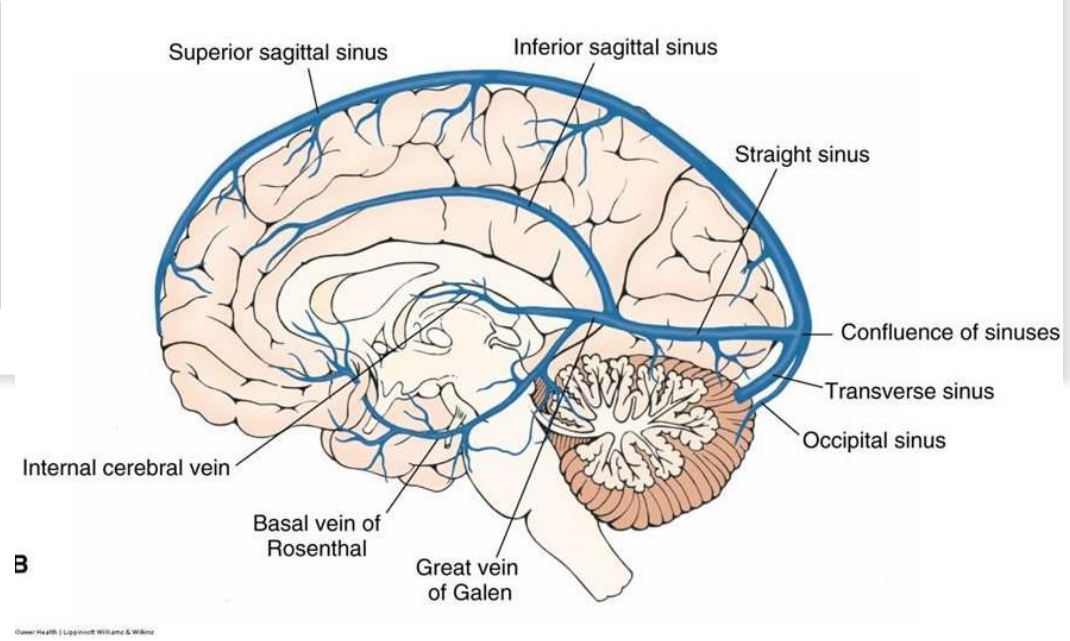


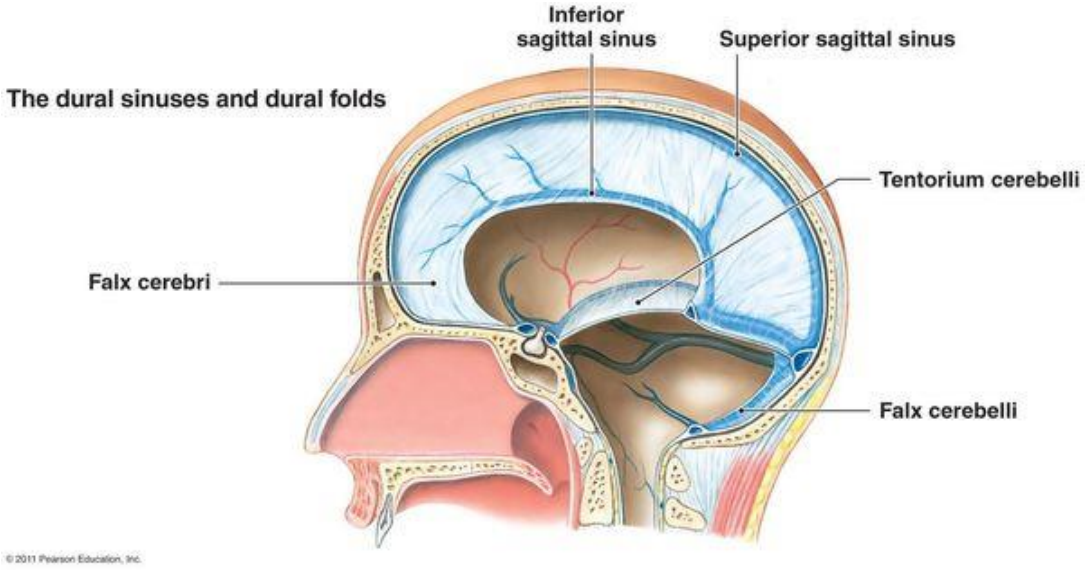


- Superior sagittal sinus receive blood from a **superior cerebral vein.**
- Communicate with **lateral lacunae** (receive blood from meningeal vein, diploic vein, and emissary vein).
- Arachnoid granulation bulges into it, presenting **Foveolar granulares.**

Inferior sagittal sinus

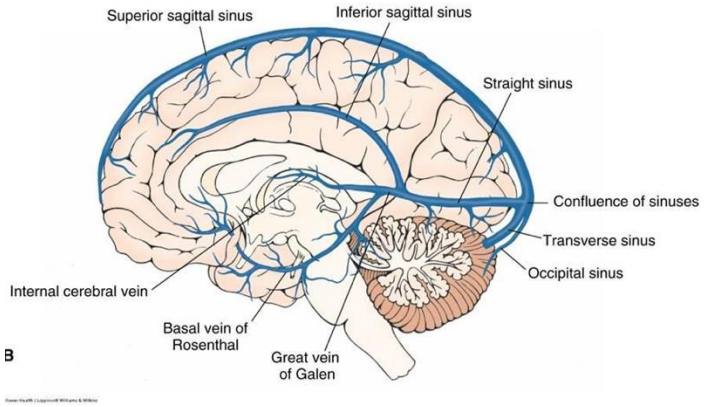
- **Location:** in the concave border of posterior 2/3 of free margin of falx cerebri
- Join with the great cerebral vein (of galen).
- Drain into straight sinus.

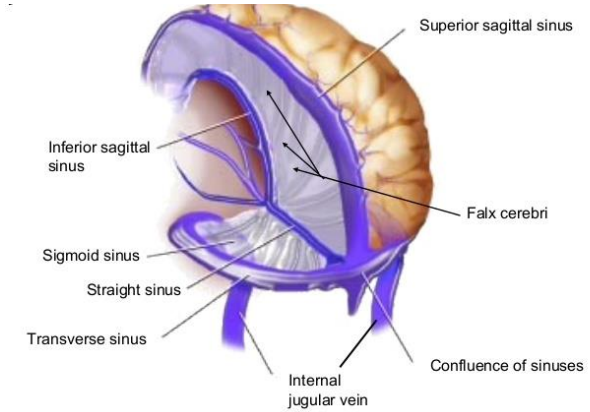


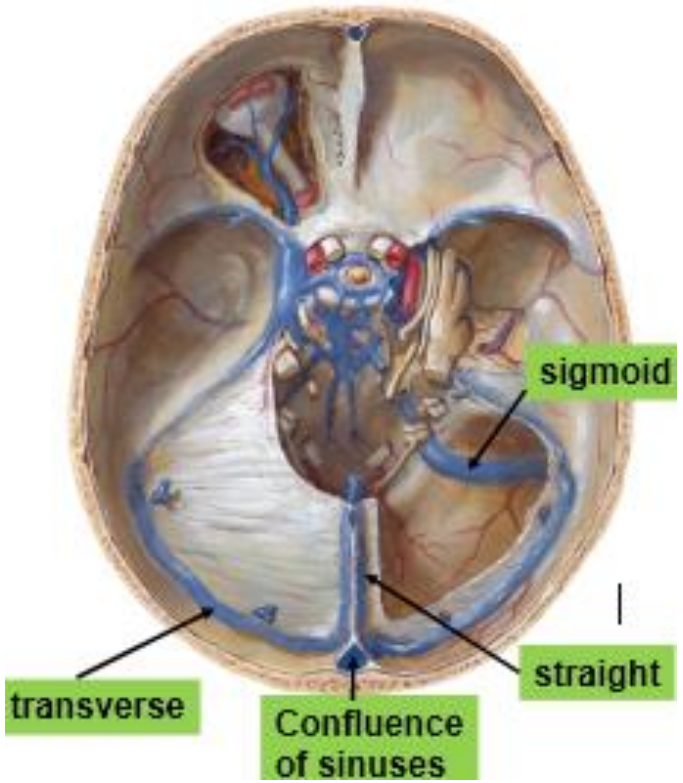


Straight sinus

- **Location**: in the junction between the tentorium cerebelli and the falx cerebri Join with the great cerebral vein (of galen).
- Received blood from great cerebral vein, inferior sagittal sinus and some cerebellar vein.
- Lie backward and downward and drains to confluence of the sinus.

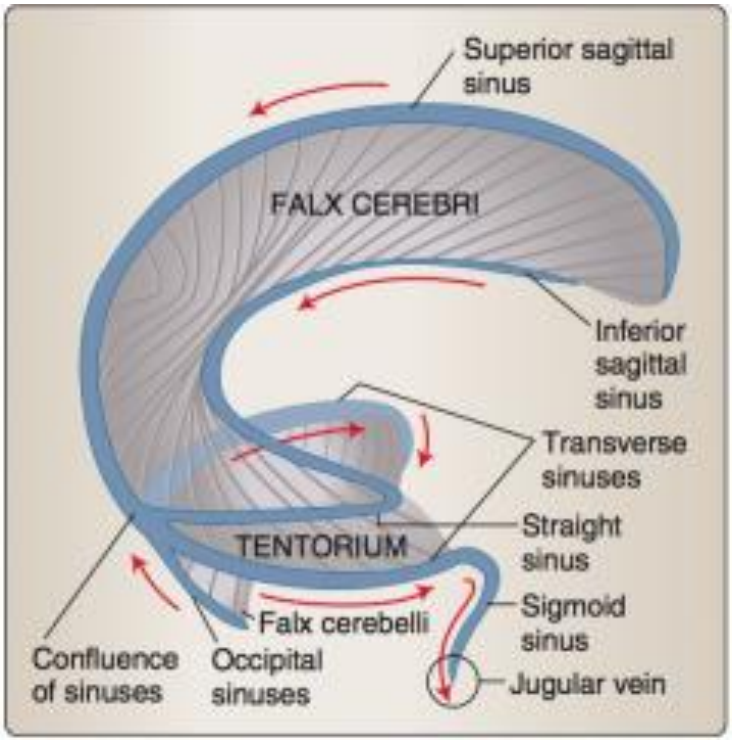


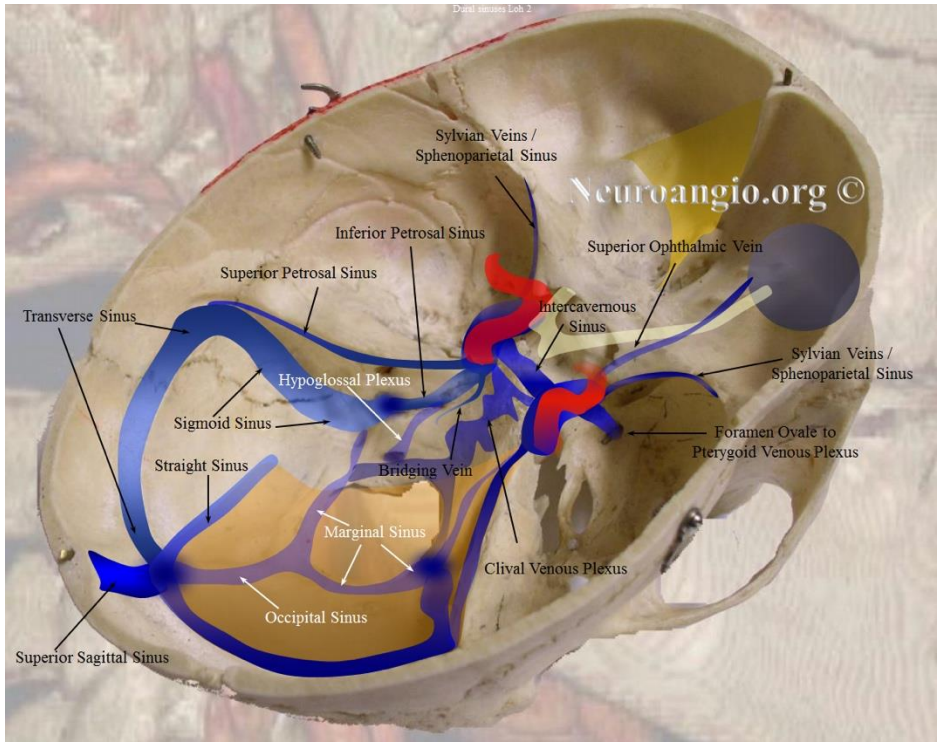




Occipital sinus

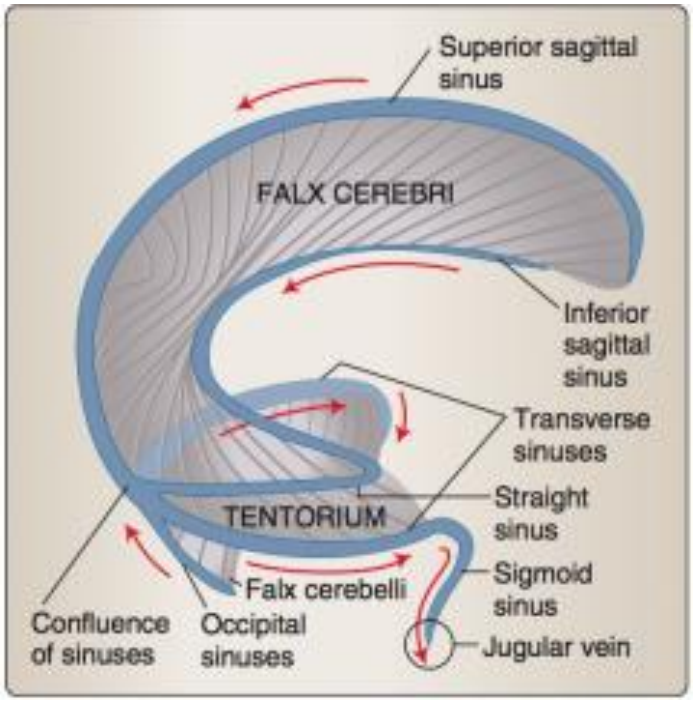
- It is smallest cranial sinus is in the attached margin of falx cerebelli.
- Begins near the margin of foramen magnum.
- Receives blood from cerebellar veins, drains to confluence of the sinus.

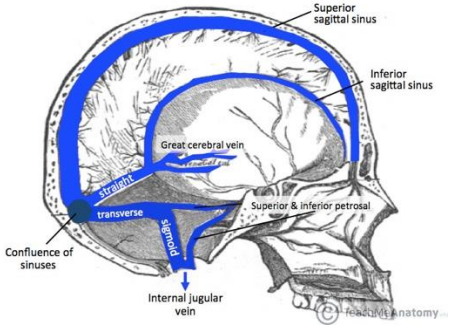


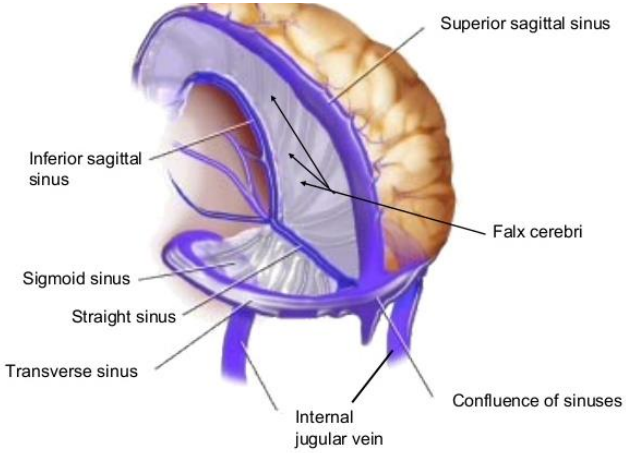


Confluence of the sinus

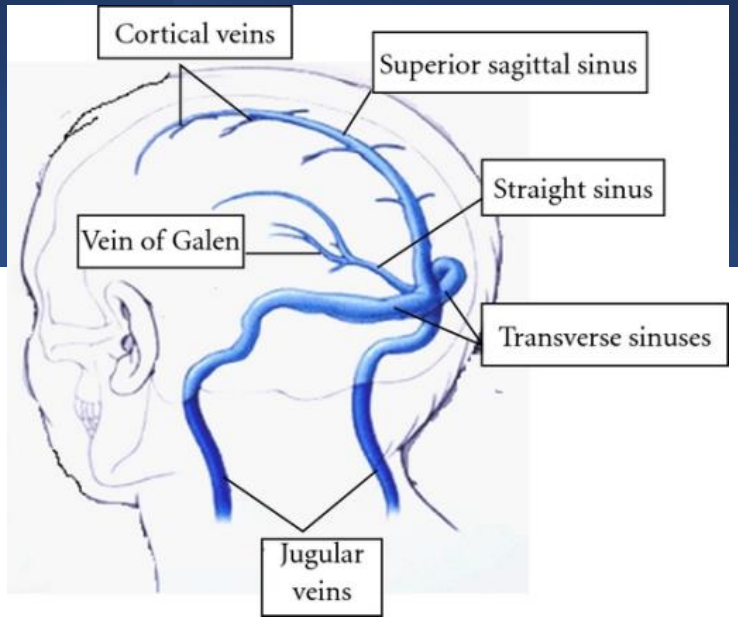
- **Location**: near internal occipital protruberance
- Receive blood from superior sagittal sinus, straight sinus and occipital sinus.
- The area for the beginning to form left and right transverse sinus



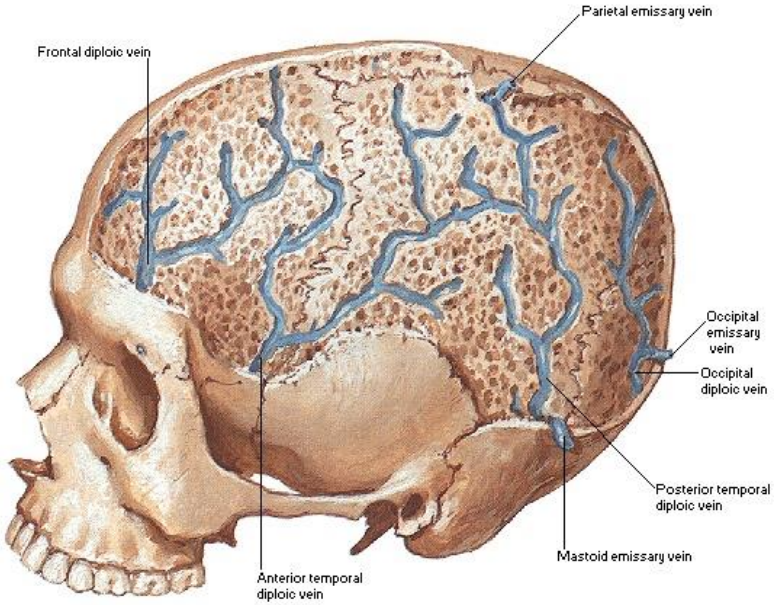


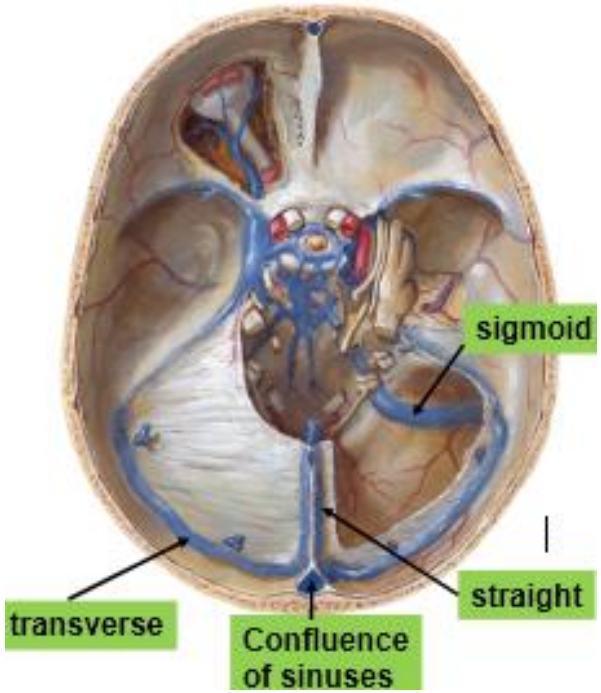


Transverse sinus

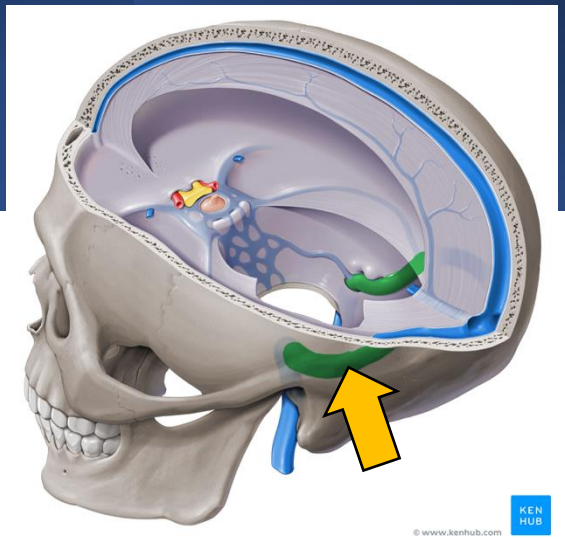


- Continue from confluence of sinus
- Extend lateral & forward in convex border of tentorium cerebelli to petrous temporal bone.
- Received blood from confluence of sinus, superior sagittal sinus, inferior cerebral vein, inferior cerebellar vein and diploic vein.

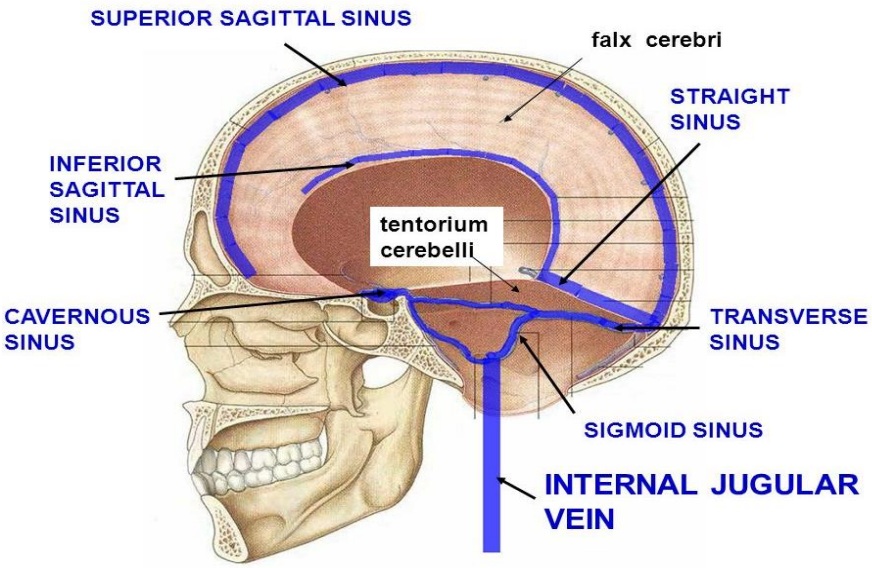


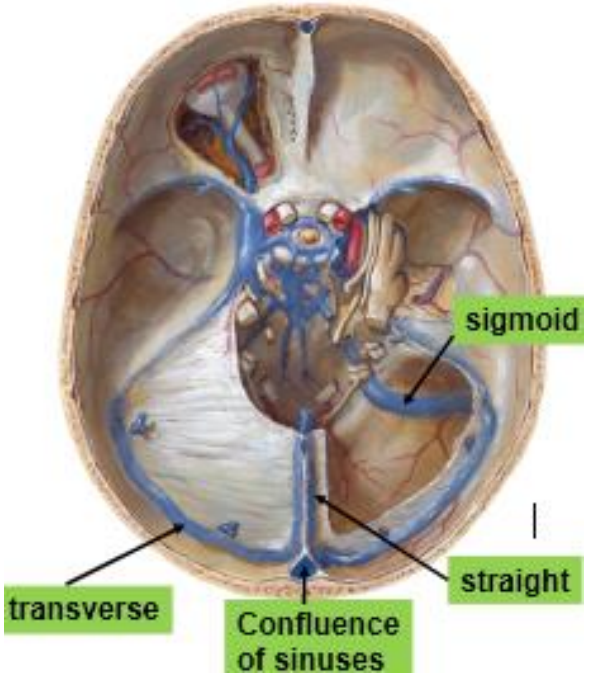


Sigmoid sinus

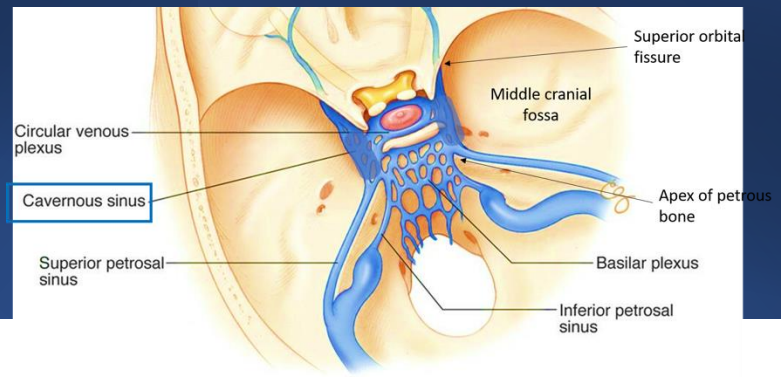


- Continue with transverse sinus
- Extend downward & medially to deep groove on mastoid part of temporal bone.
- Receives blood from transverse sinuses.
- In jugular foramen, it continue with superior bulb of internal jugular vein.

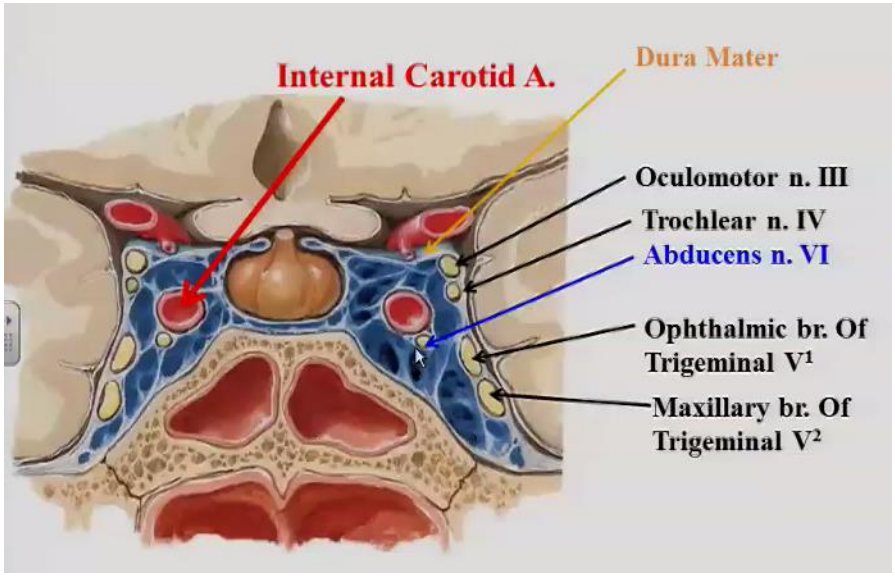


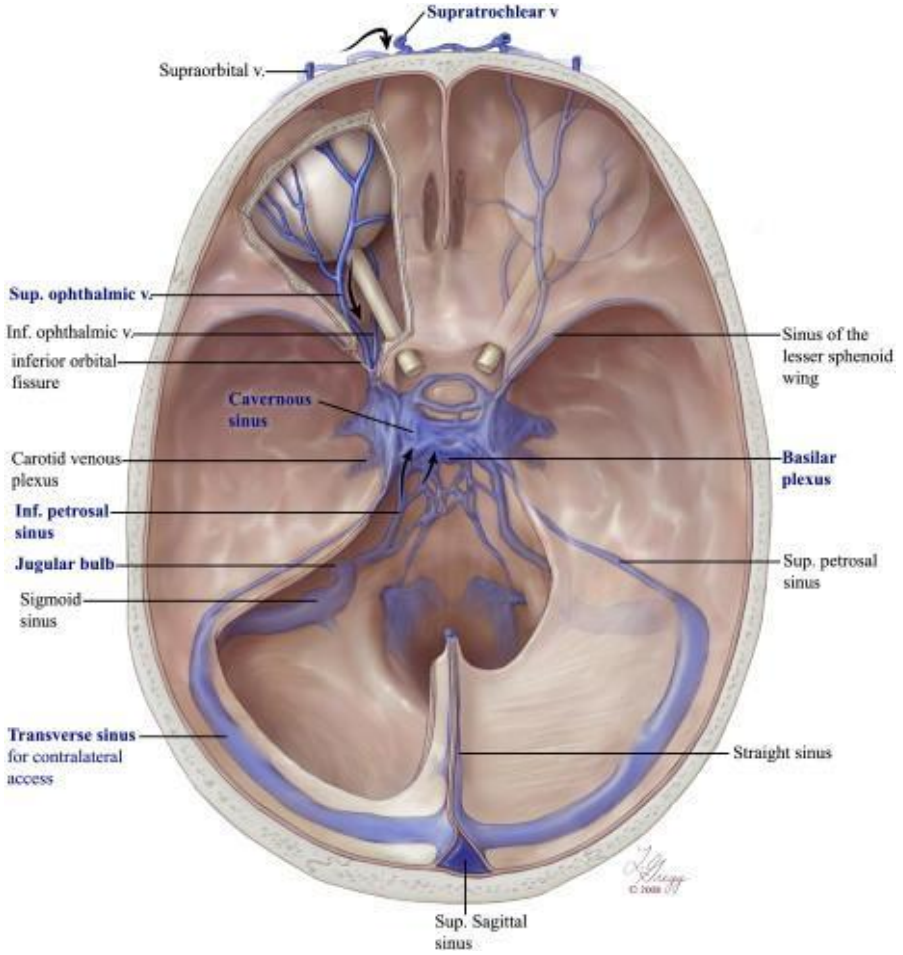


Cavernous sinus



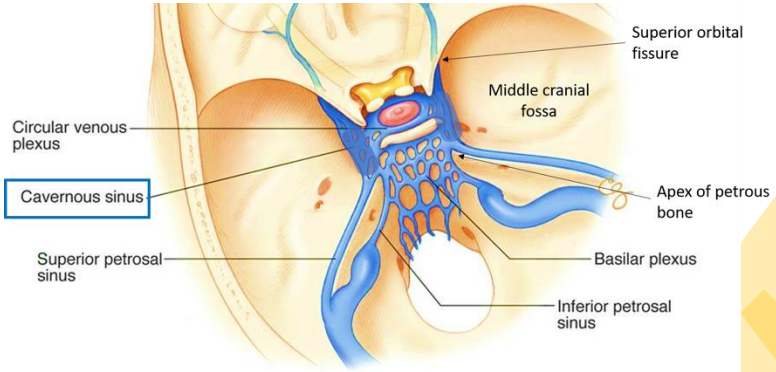
- Extend from superior orbital fissure to apex of petrous temporal bone
- Osseodural compartment (is covered with body of sphenoid bone and tentorium cerebelli)
  - Found 1 main venous channel or more.
  - Found internal carotid artery, sympathetic plexus, abducens nerve in this compartment.

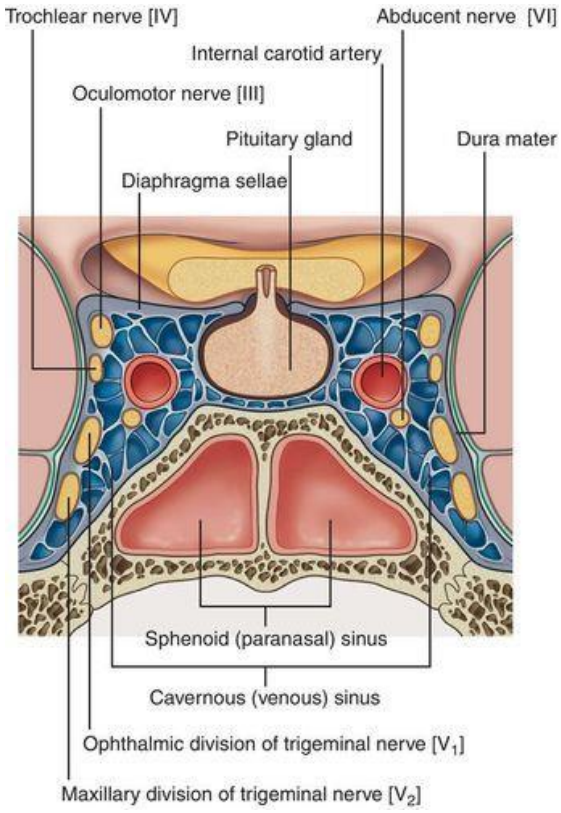


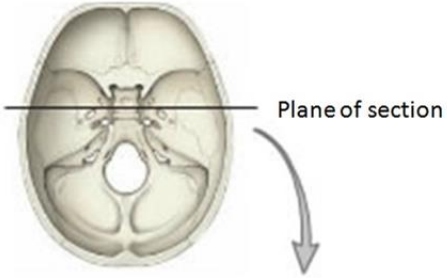


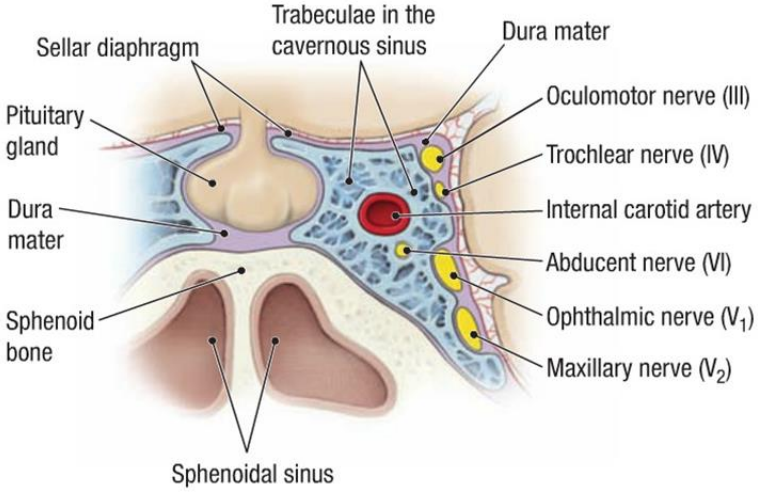
Wall of cavernous sinus

- **Lateral wall:** oculomotor nerve, trochlear nerve, ophthalmic nerve, maxillary nerve.
- **Medial wall:** sphenoidal air sinus, & hypophysis cerebri









Communication of cavernous sinus

Transverse sinus

- by Superior petrosal sinus

Internal jugular vein

- by Inferior petrosal sinus

Facial vein

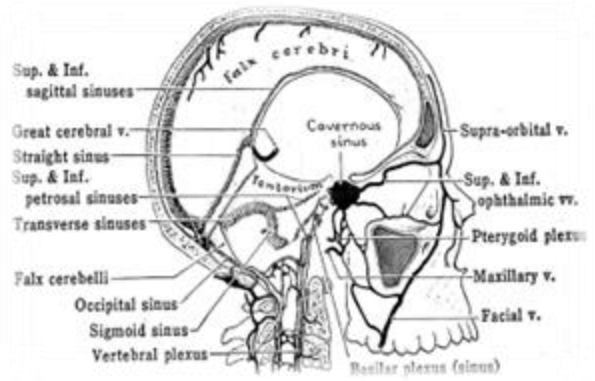
- by Superior ophthalmic vein

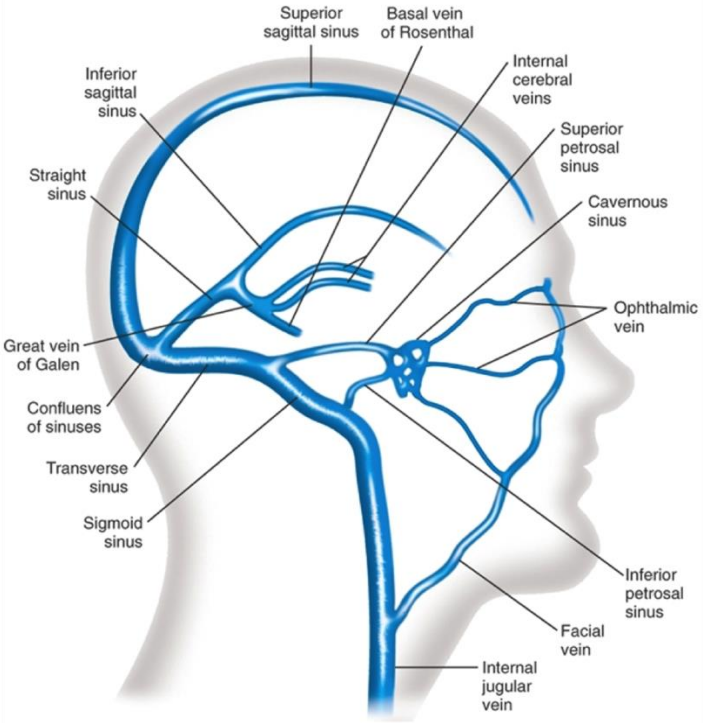
Pterygoid venous plexus

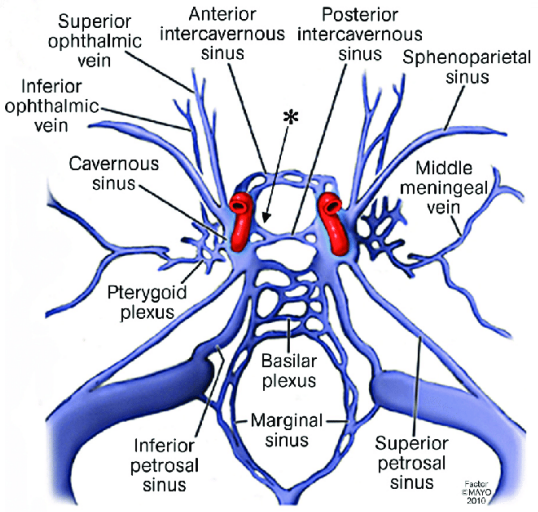
- by Emissary vein

Cavernous sinus (opposite)

- by Intercavernous sinuses

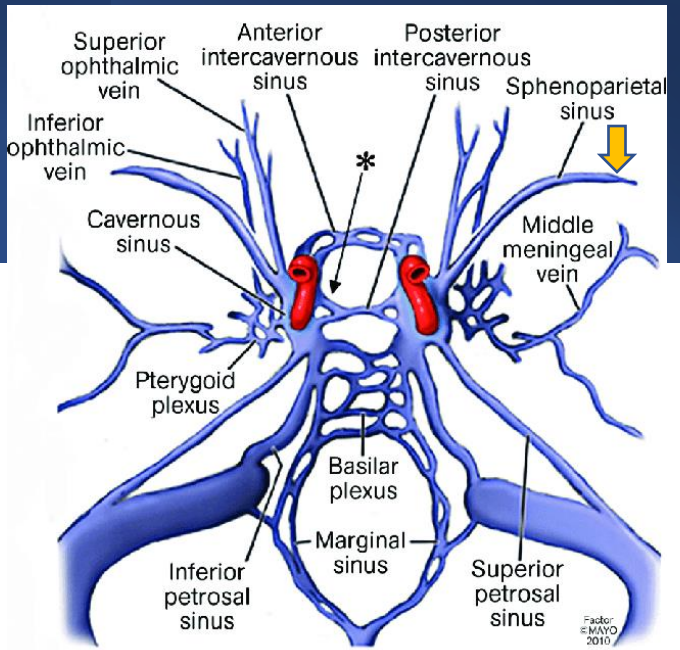


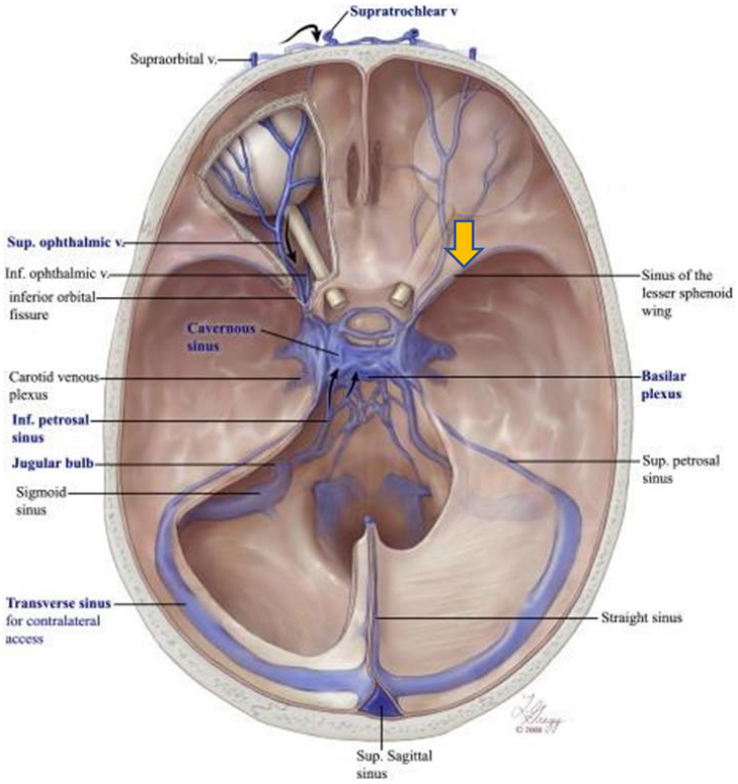


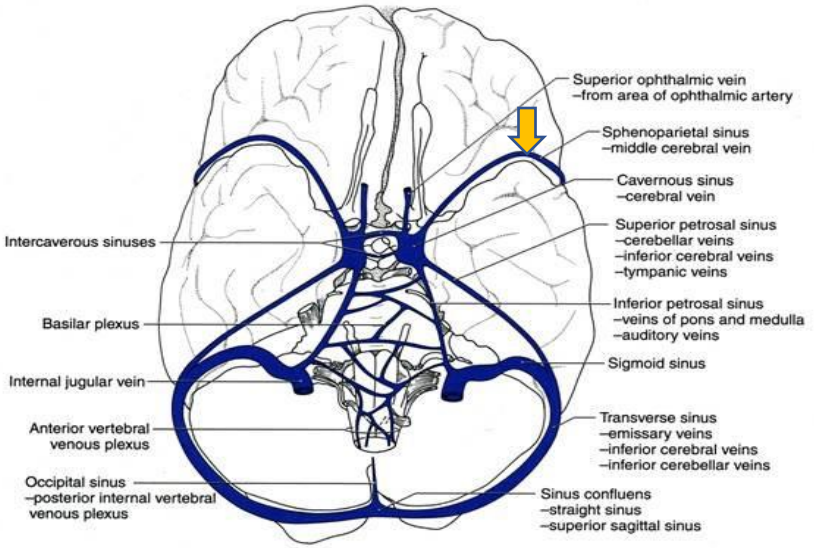


Sphenoparietal sinus

- Location: beneath lesser wing of sphenoid bone.
- Received blood from dura mater at neighbouring area.
- Drains to anterior part of **carvernous sinus.**

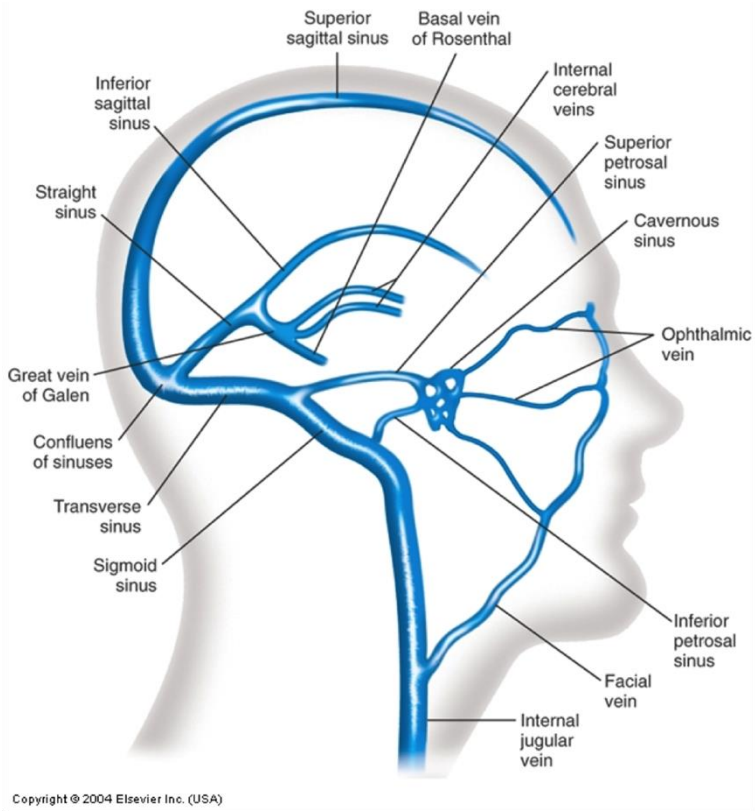






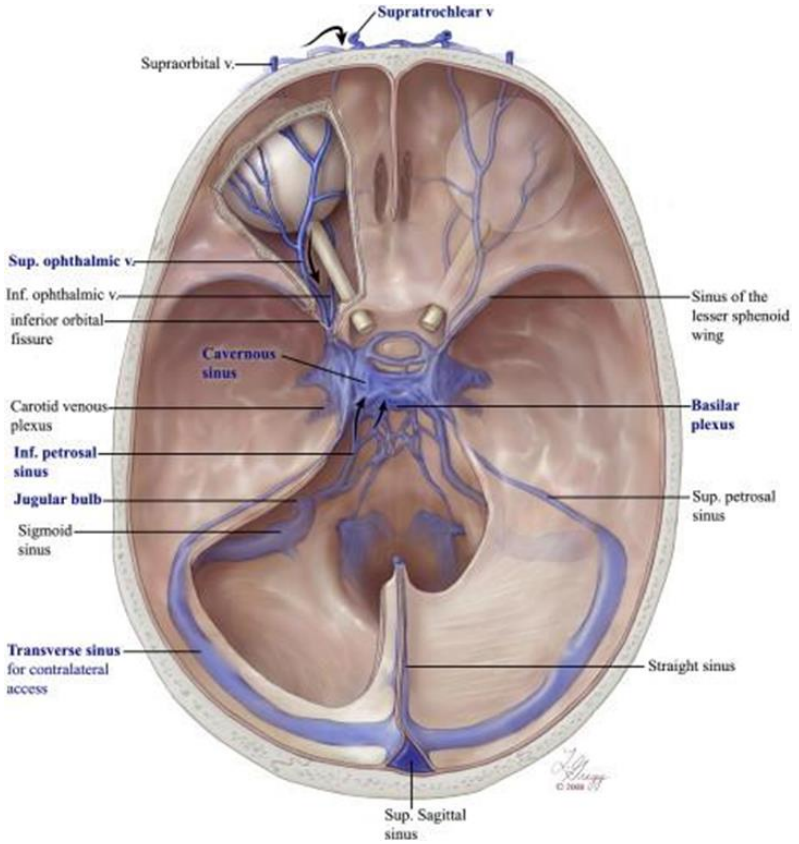
Superior petrosal sinus

- Is located in the attach margin of tentorium cerebelli at groove on superior border of petrous part of temporal bone.
- Drain blood from **cavernous sinus** to **transverse sinus.**

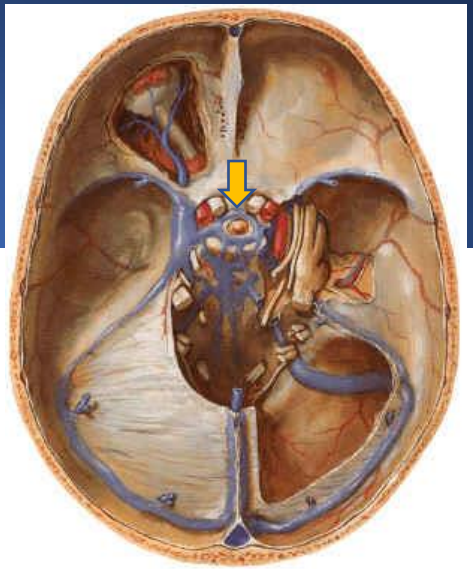


Inferior petrosal sinus

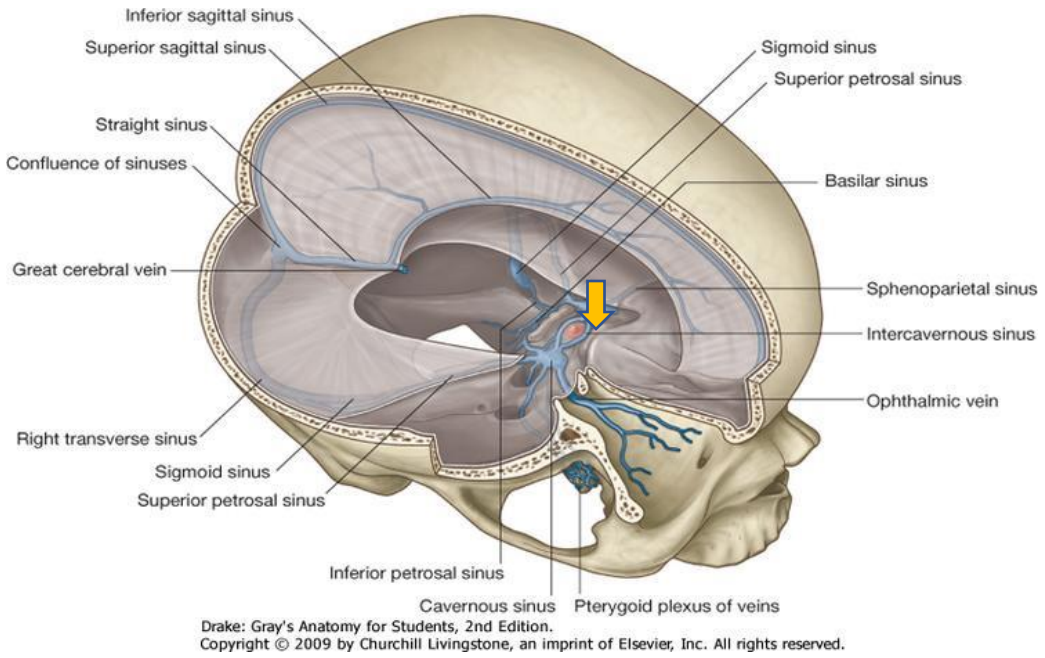
- Is located in the groove between petrous part of temporal bone and basilar part of occipital bone.
- Drain blood from **cavernous sinus** to superior bulb of **internal jugular vein**



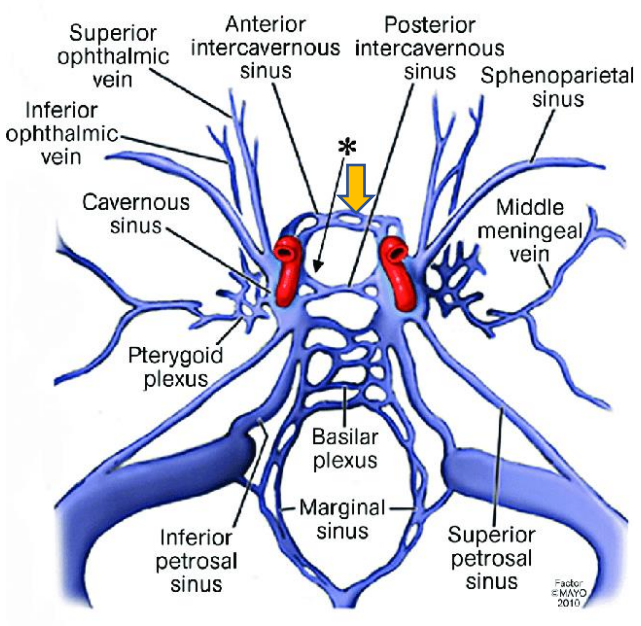
Intercavernous sinus



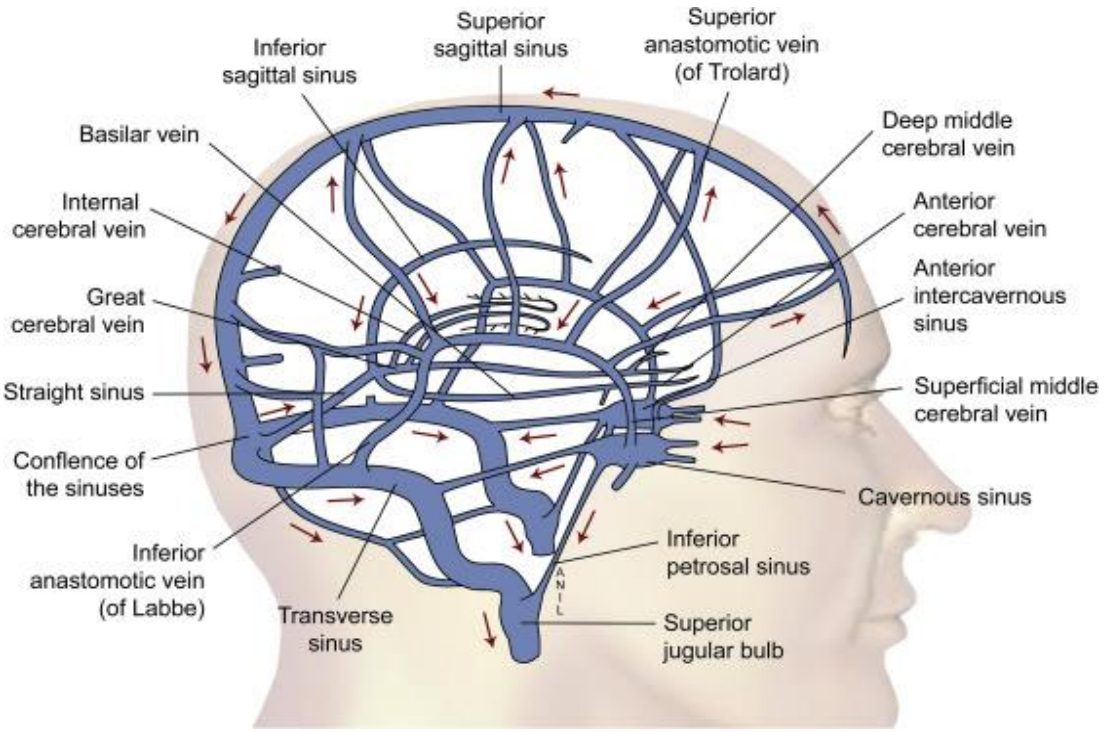
- Connect 2 sides of cavernous sinus.
- Devided into **anterior intercavernous** sinus and **posterior intercavernous sinus**.
- Is located in anterior and posterior borders of diaphragma sellae, around hypophysis cerebri.

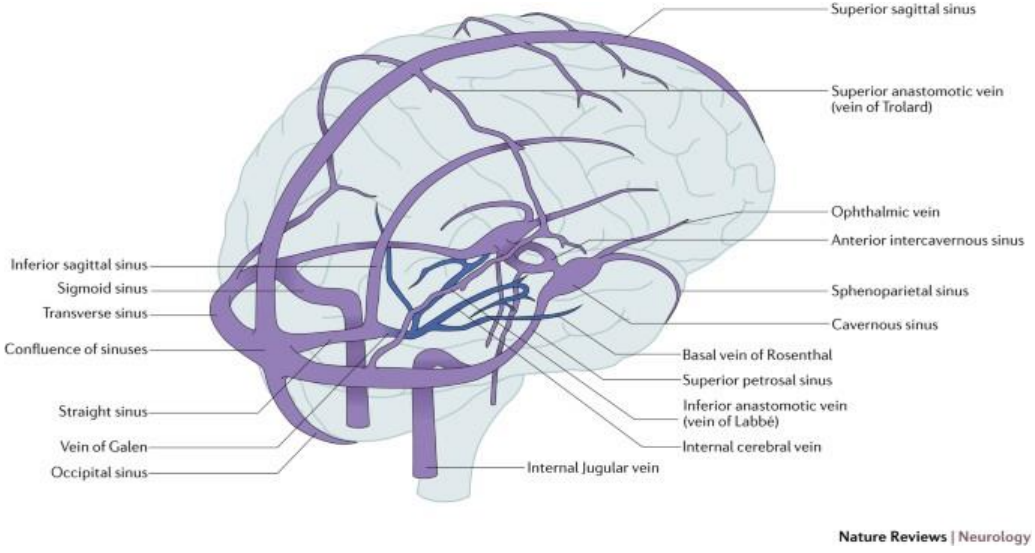


Drake: Gray's Anatomy for Students, 2nd Edition.
Copyright © 2009 by Churchill Livingstone, an imprint of Elsevier, Inc. All rights reserved.

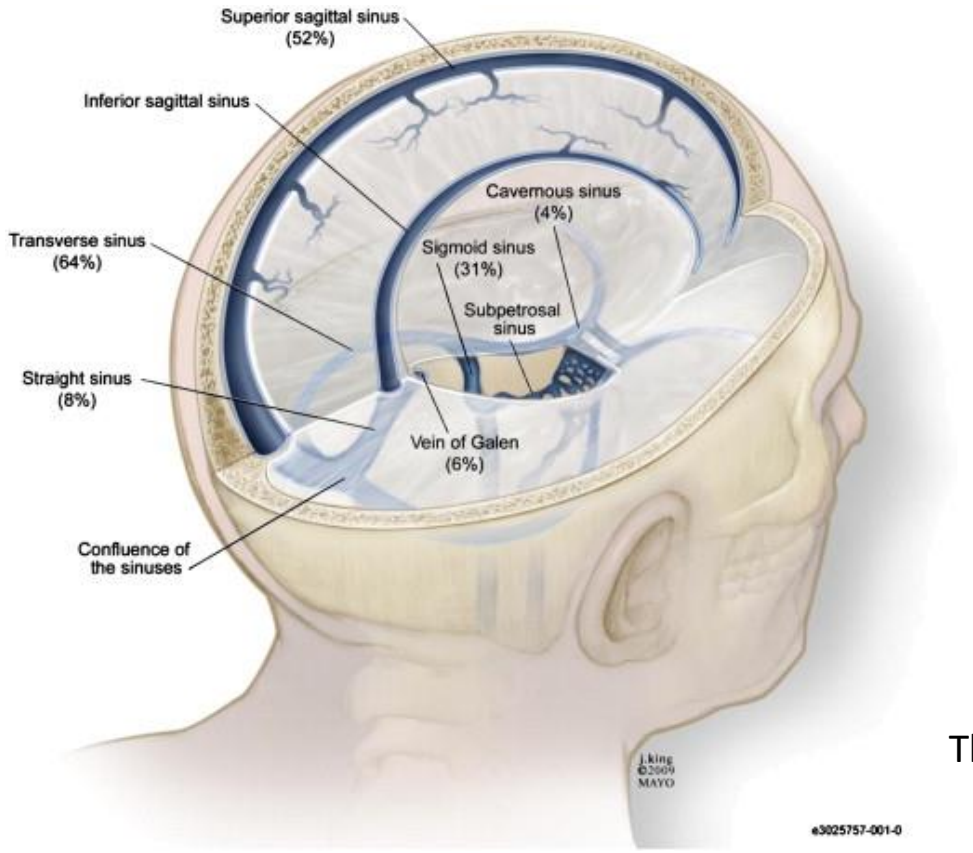


Venous sinus drainage





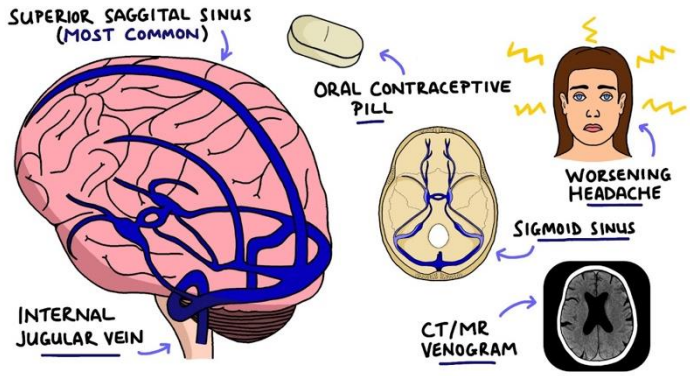
Cerebral venous sinus Thrombosis





Important risk factors for CVT (most likely first) are:

- estrogen-containing oral contraceptives
- pregnancy and the puerperium
- infections
- malignancy (cancer)
- head injury
- inflammatory diseases

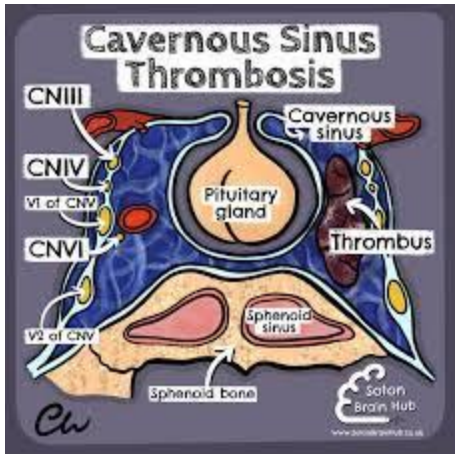


These are the physical symptoms that may occur:

- Headache.
- Blurred vision.
- Fainting or loss of consciousness.
- Loss of control over movement in part of the body.
- Seizures.
- Coma.

Cavernous Sinus Thrombosis (C/F)

- Pupil may be dilated and sluggishly reactive.
- Infection can spread to contralateral cavernous sinus within 24–48 hr of initial presentation.
- Cranial nerve most commonly affected is Abducens (VI)
- Classic presentations are abrupt onset of
  - unilateral periorbital edema,
  - headache,
  - photophobia,
  - Proptosis





SPREAD OF INFECTION TO CAVERNOUS SINUS

SUMMARY

2 layers of Dura mater

- Periosteal layer (endosteal layer)
- Meningeal layer

Dural folds

- Vertical folds: Falx cerebli and falx cerebelli
- Horizontal folds: Tentorium cerebelli and diaphragm sellae

Artery supply of Dura mater

- Ant. & Post. Meningeal branch (ex. Internal cartotid artery & vertebral artery)
- Middle meningeal artery (branch of maxillary artery)

Innervation of Dura mater

- Anterior part: V1
- Middle part: V2 & V3
- Posterior part: C1,2,3 and meningeal branch of vagus and hypoglossal nerve.

Single sinus

- Superior & inferior sagittal sinus
- Confluence of the sinus
- Straight sinus
- Occipital sinus

Paired sinus

- Transverse sinuses
- Sigmoid sinuses
- **Cavernous sinuses**
- Sphenoparietal sinuses
- Superior & inferior petrosal sinuses
- Intercavernous sinuses

Jirattikarn.kae@mahidol.edu