CEREBRAL BLOOD CIRCULATION

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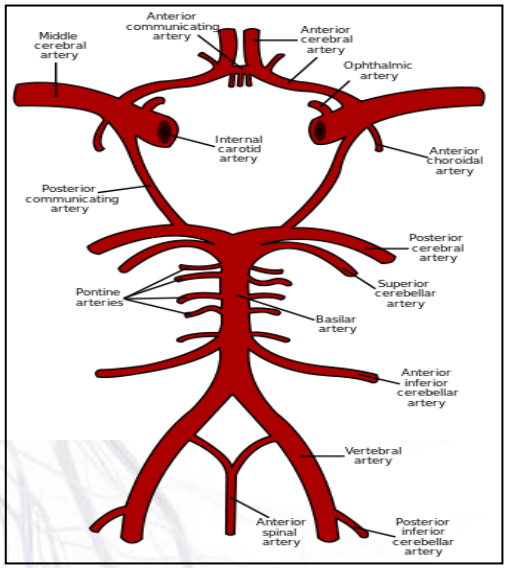
OBJECTIVES

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

- ✓ List the cerebral arteries.
- ✓ Describe the cerebral arterial supply regarding the origin, distribution and branches.
- ✓ Describe the arterial Circle of Willis .
- ✓ Describe the cerebral venous drainage and its termination.
- ✓ Describe arterial & venous vascular disorders and their clinical manifestations.

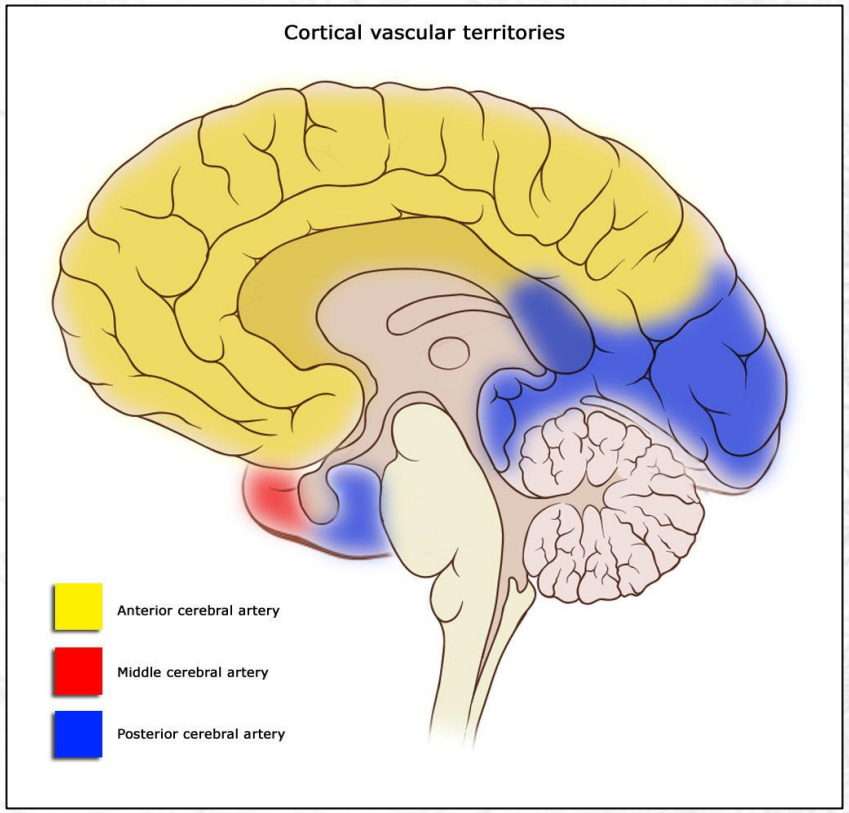
OVERVIEW

- **CEREBRAL BLOOD CIRCULATION**
  - **Arterial supply**
    - **Carotid system**
      - **Internal carotid artery**
        - **Anterior cerebral A.**
        - **Medial cerebral A.**
    - **Vertebrobasilar ststem**
      - **Basilar artery**
        - **Posterior cerebral A.**
  - **Venous drainge**
    - **deep**
      - **Into Dural Venous Sinuses**
    - **superficial**
      - **Superior cerebral V.**
      - **Medial cerebral V.**
      - **Inferior cerebral V.**

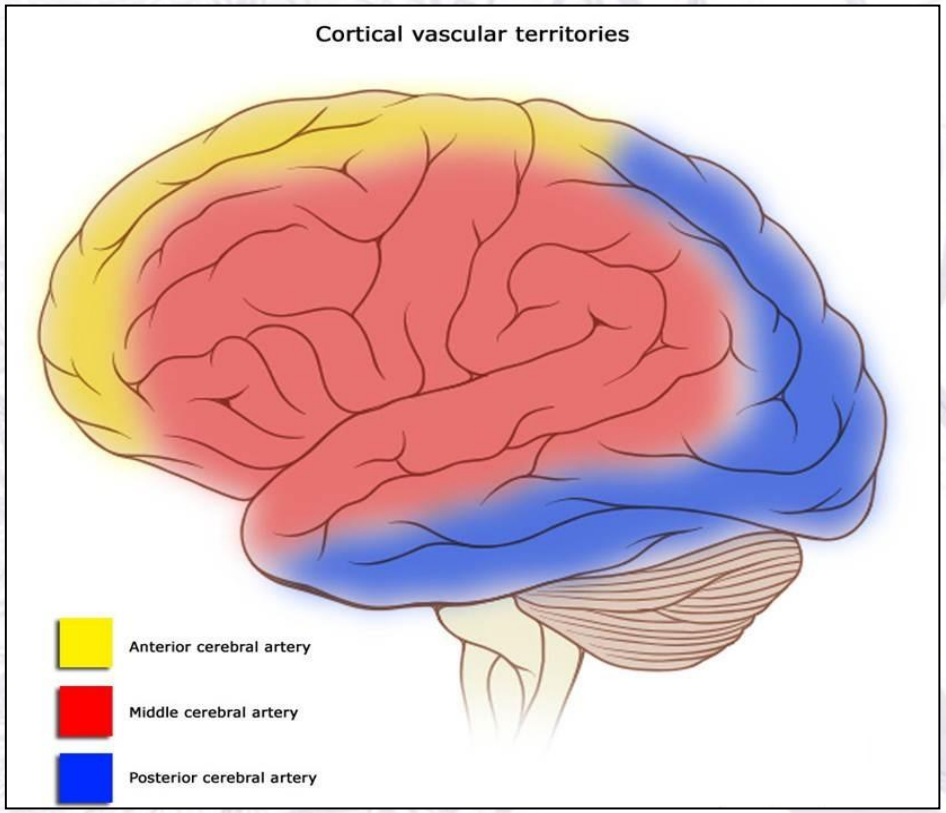


Distribution of the cerebral arteries on :

Medial surface



Superolateral surface



Arterial supply :

Anterior cerebral A.	Middle cerebral A.	Posterior cerebral A.
Supplies : • orbital and medial surfaces of the **frontal** and **parietal** lobes. • A narrow part on the superolateral surface.	**Supplies:** entire superolateral surface: • ***Somatosensory Cortex*** • ***Motor Cortex*** • ***Language areas:*** • ***Broca's Area*** • ***Wernicke's Area)*** • ***Auditory areas:*** • ***Primary auditory area*** • ***Auditory association (Heschl's Gyrus***	**Supplies:** • Anterior and inferior parts of temporal lobe. • Uncus • Inferior temporal gyrus. • Inferior and Medial parts of Occipital lobe (visual areas)

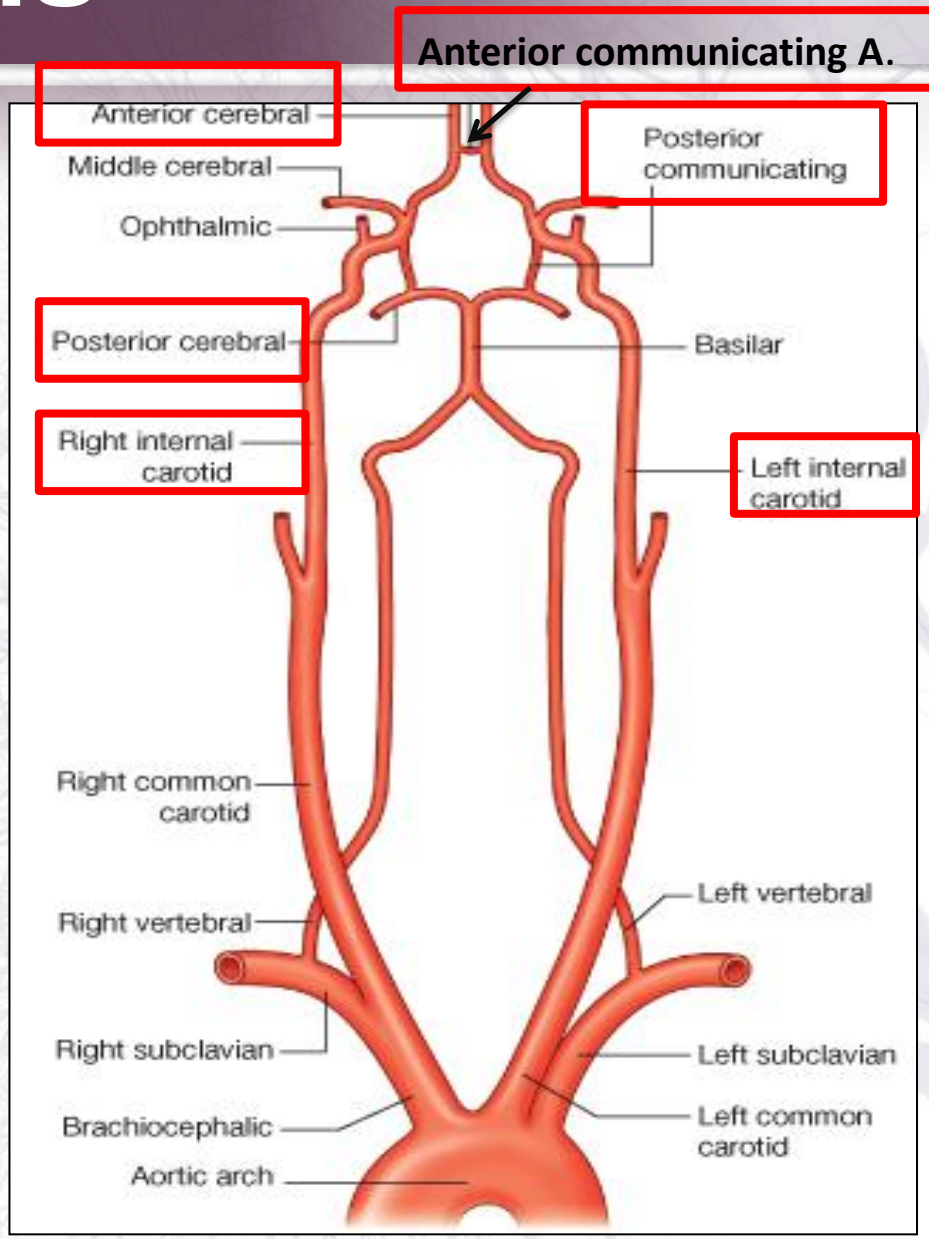
Circulus of Willis

- **Connect the carotid system with vertebrobasilar system.**
- **Located on the base of the brain .**

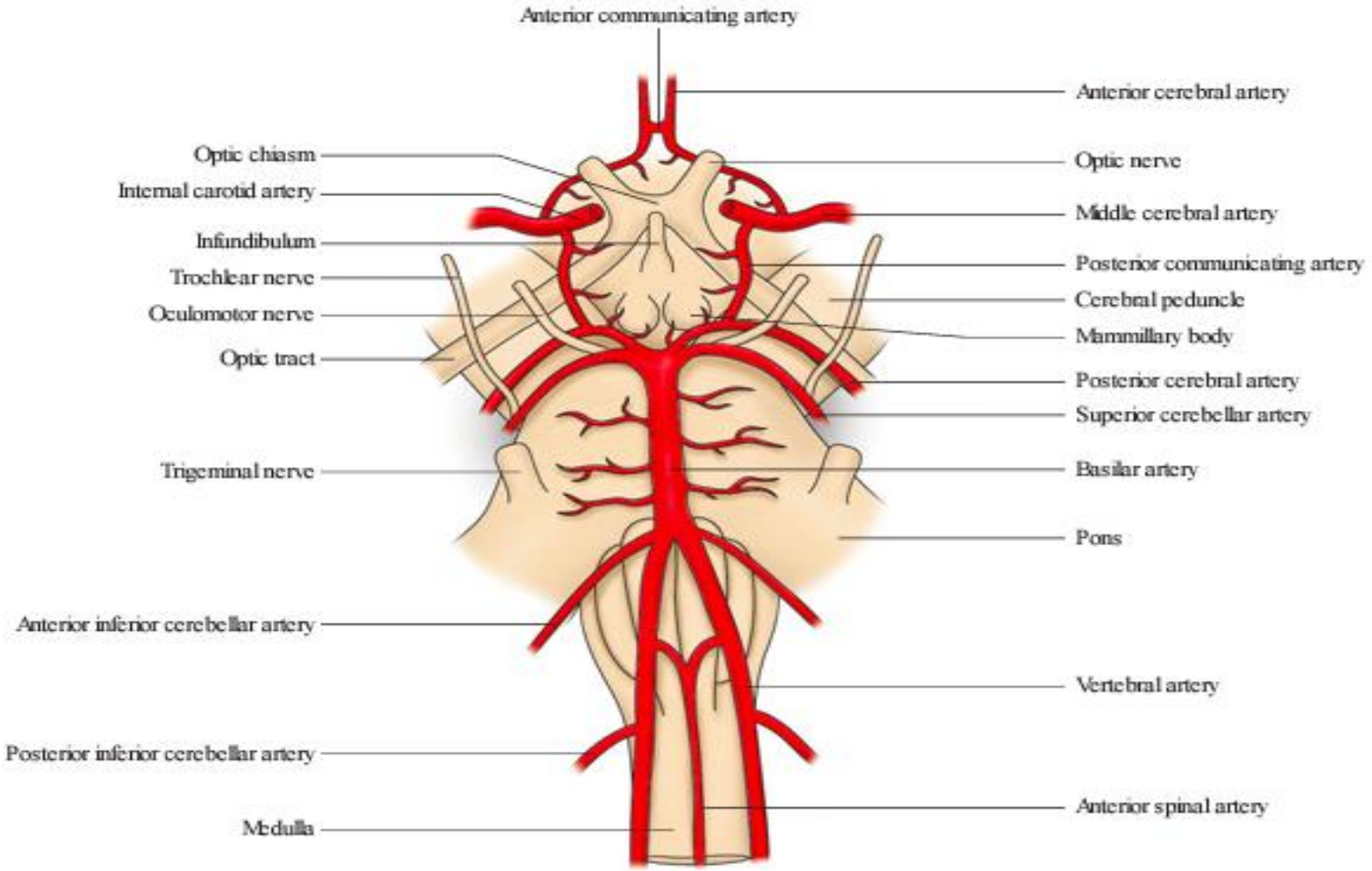
- **Encircles :** See next pic
  - ❑ Optic Chiasma
  - ❑ Hypothalamus
  - ❑ Pituitary gland
  - ❑ Midbrain.

- **Composed of**
- **Paired of each of:**
  - Anterior cerebral arteries
  - Internal carotid arteries
  - Posterior cerebral arteries
  - Posterior communicating arteries
- **Except anterior communicating (just 1)**

- **NOTE: middle CA isn't a component of circle of willis**



circle of willis


Anterior communicating artery
Anterior cerebral artery
Optic chiasm
Optic nerve
Internal carotid artery
Middle cerebral artery
Infundibulum
Posterior communicating artery
Trochlear nerve
Cerebral peduncle
Oculomotor nerve
Mammillary body
Optic tract
Posterior cerebral artery
Superior cerebellar artery
Trigeminal nerve
Basilar artery
Pons
Anterior inferior cerebellar artery
Vertebral artery
Posterior inferior cerebellar artery
Anterior spinal artery
Medulla

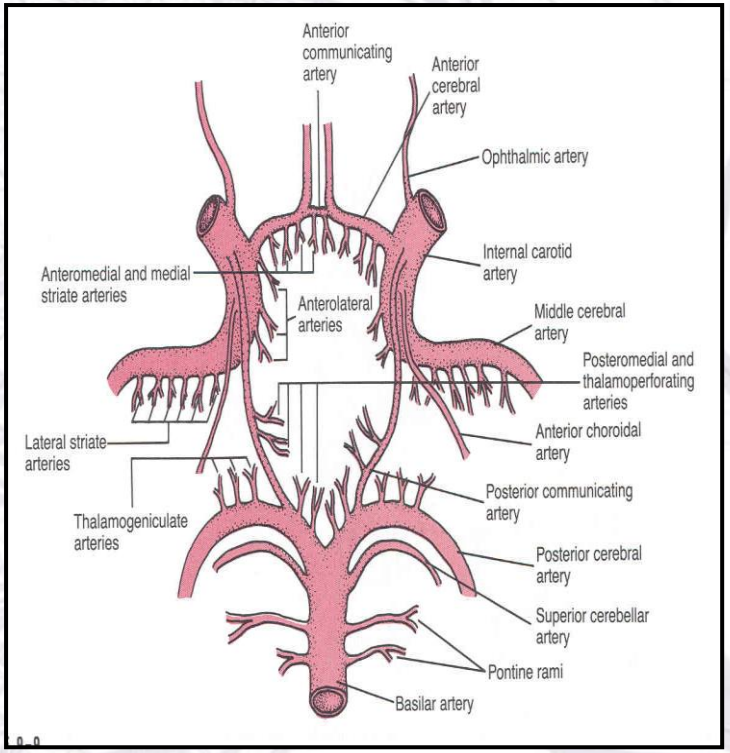
Branch of Circulus of Willis

1. Anterior perforating artery (APA) :

- Supplies : ***I HOB " I HOPE"***
  - I : Internal capsule
  - H : Hypothalamus
  - O : Optic chiasms
  - B :Basal ganglia " part of it "

2. Posterior perforating artery (PPA) :

- Supplies : سهم
  - parts of Subthalamus
  - Hypothalamus
  - Ventral portion of Midbrain



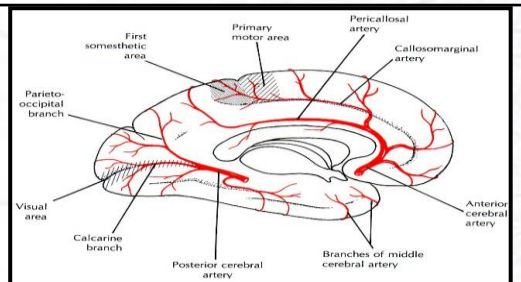
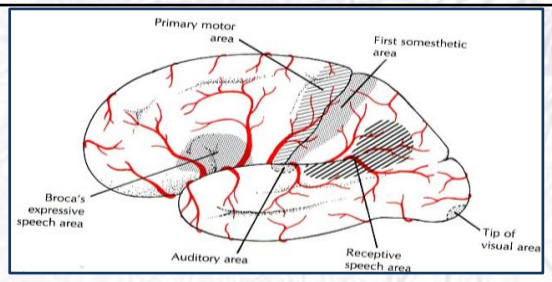
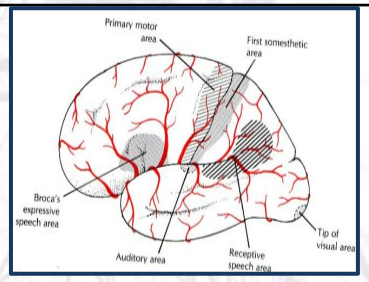
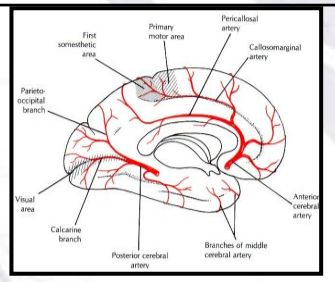
Arterial disorders

A. Stroke
(Sudden occlusion of the blood supply):
1. Hemorrhagic 2. Ischemic

B. Aneurysm
Balloon-like bulge in the wall of a blood vessel.

C. Angioma
Tumor of the artery

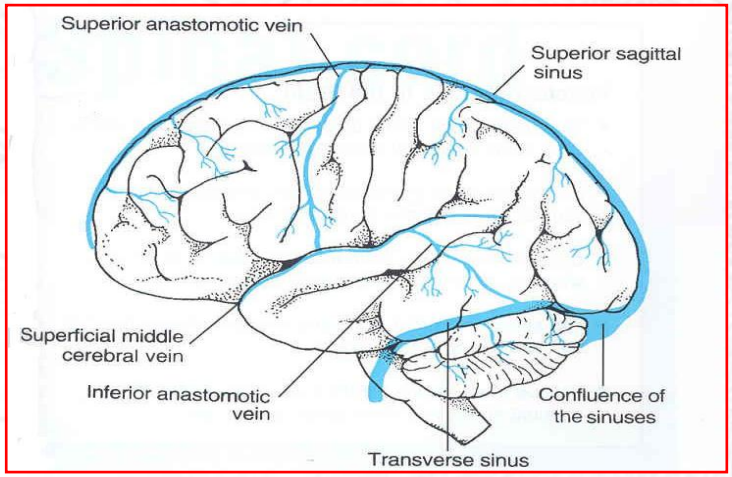
Effect of occlusion of cerebral arteries

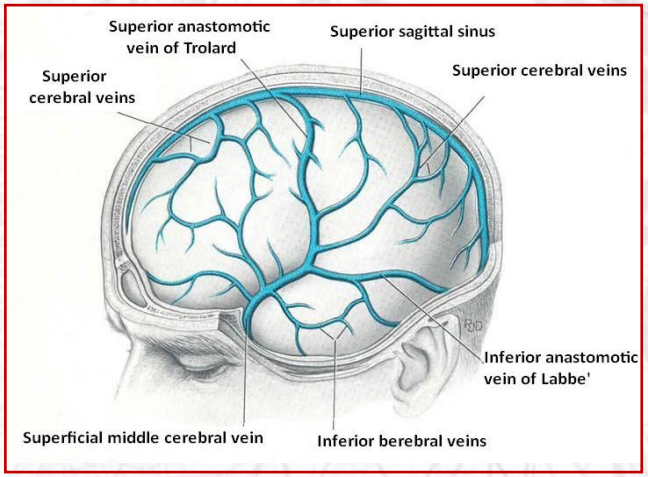
ACA	MCA	PCA
1. Motor and sensory disturbances " in the contralateral distal leg " **2. Difficulty in the Prefrontal lobe functions:** ◆ Cognitive thinking and Judgment ◆ Motor initiation and ◆ Self monitoring	**1. Contralateral weakness of:** ◆ Face, Arm & Hand (more than leg) **2.Contralateral sensory loss of:** ◆ Face, Arm & Hand (more than leg) **3. Visual field cut** ◆ (damage to optic radiation) **4. Aphasia** ◆ (language disturbances)	1. **Visual disturbances** ◆ Contralateral homonymous hemianopsia ◆ In Bilateral lesions: Cortical Blindness patients unaware they cannot see (Anton's syndrome) **2. Memory impairment** ◆ If the temporal lobe is affected
		 

Venous drainage

Superficial found in the Subarchnoid space and divided into:

	Superior	Inferior	Superficial middle*
Drain	Lateral surface "above lateral sulcus"	Lateral surface of temporal lobe "below lateral sulcus"	Runs along the lateral sulcus
Main terminate	Superior sagittal sinus	Superficial middle cerebral vein	Cavernous sinus
Other termination	Superficial middle cerebral vein	Transverse sinus	-





*It is connected posteriorly through **Superior & Inferior anastomotic veins** to **Superior Sagittal & Transverse** sinuses.

Deep veins

- Drain the internal structure (Basal ganglia, internal capsule and thalamus)
- These veins are **thin** walled and **devoid of valves.**
- They ultimately drain into the **Dural Venous Sinuses**
- They merge to form two ***Internal Cerebral Veins*.**
- The two veins unite in the midline to form the **Great Cerebral vein.**
- This short vessel is continuous with the **Straight Sinus**

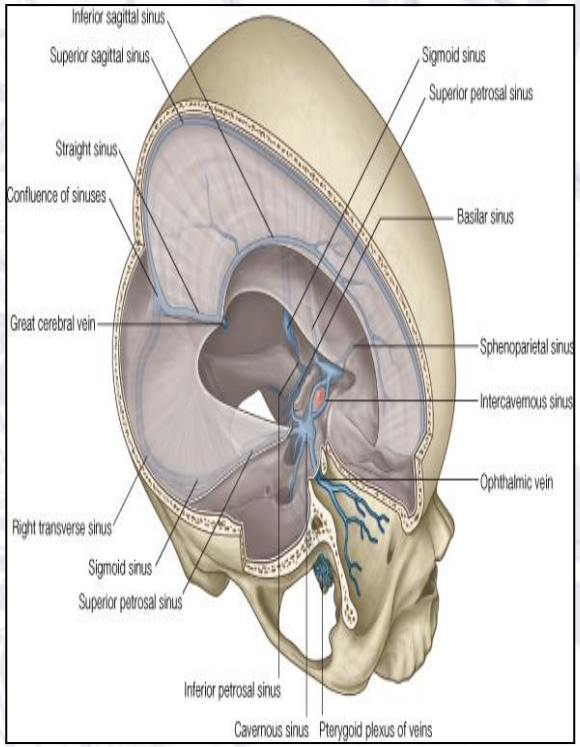
Dural Venous Sinuses :

1- paired

- **Transverse.**
- **Sigmoid.**
- **Cavernous.**
- **Petrosal**

2- single

- **Superior sagittal**
- **Inferior sagittal**
- **Straight**
- **Occipital**



Blood flows from **transverse &sigmoid sinuses into IJV**

Venous disorders

infection in the dangerous area of the face

- Sinus thrombosis
- Cavernous S thrombosis
- Infraction
- **VENOUS DISORDERS**
- Obstruction of venous drainge
  - ➔**Cerebral edema** and ↑**ICP**
- SSS thrombosis
  - **ear infection**

Pic shows
cavernous S thrombosis

*SSS thrombosis > Superior sagittal sinus thrombosis.

MCQs

1- Which one of the following areas is affected in case of middle cerebral A. lesion :

A. Motor area 4
B. Broca's area
C. Primary Somatosensory area

2- Posterior perforating A. supplies :

A. Optic chiasma
B. Internal capsule
C. Ventral portion of midbrain

3- Superior cerebral veins terminate mainly in :

A. Superior Sagittal sinus
B. Transverse sinus
C. Superficial middle cerebral vein

4- which one of the following disorders can result from infection in the dangerous area of the face :

A. Obstruction of venous drainage
B. Stroke
C. Cavernous S thrombosis

1.B 2.C 3.A 4.C