Central Nervous System

Lecture 14: Blood Supply of Brain

Dr. Ashraf Ramzy

Professor of Anatomy & Embryology

ash-ramzy@hotmail.com

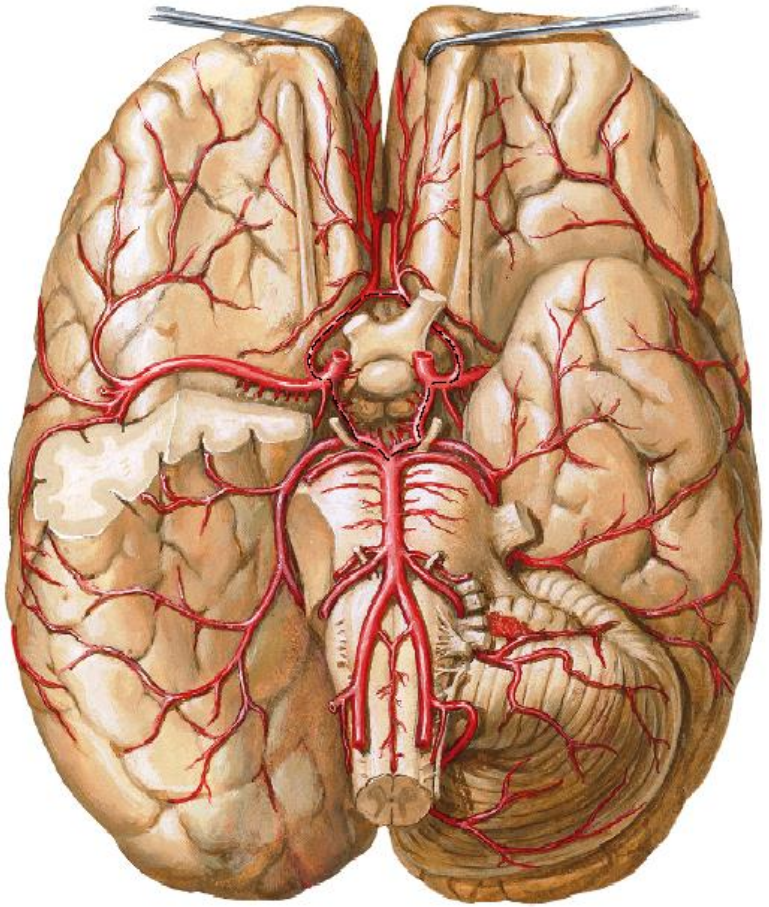
BLOOD SUPPLY OF BRAIN

** The brain is supplied by 2 arterial systems:

A. Carotid (2 internal carotid arteries).

B. Vertebrobasilar (2 vertebral arteries).

* Both anastomose at the circle of Willis.



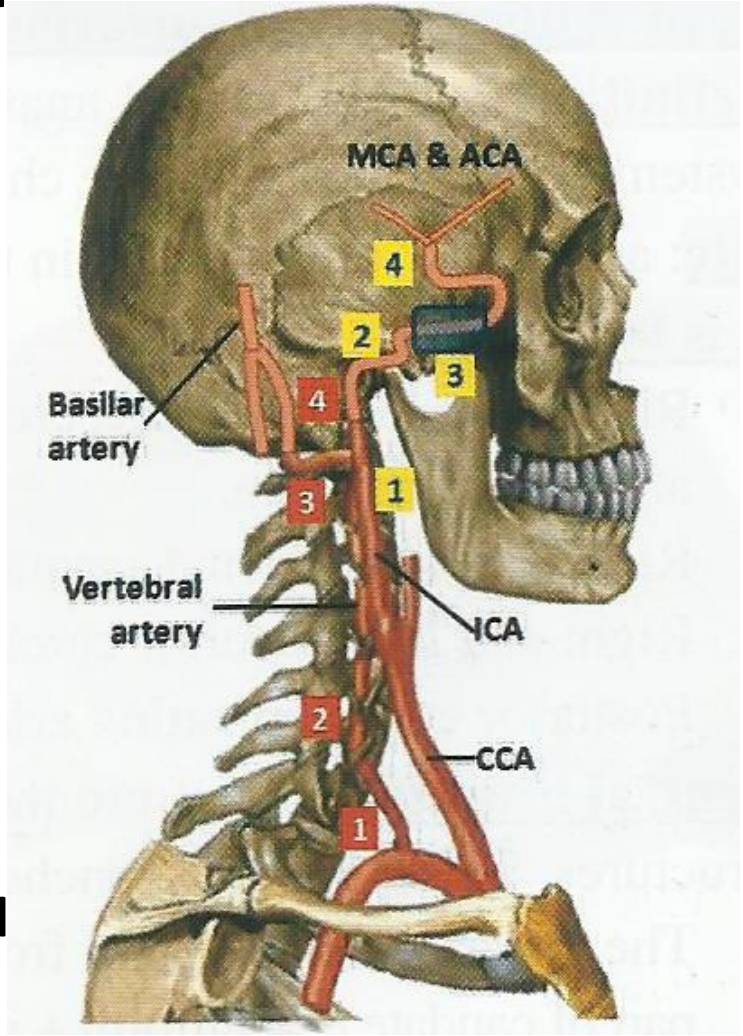
Internal Carotid Artery (ICA)

** **Begins:** at bifurcation of common carotid in neck (at upper border of thyroid cartilage).

** **Its course is divided into 4 parts:**

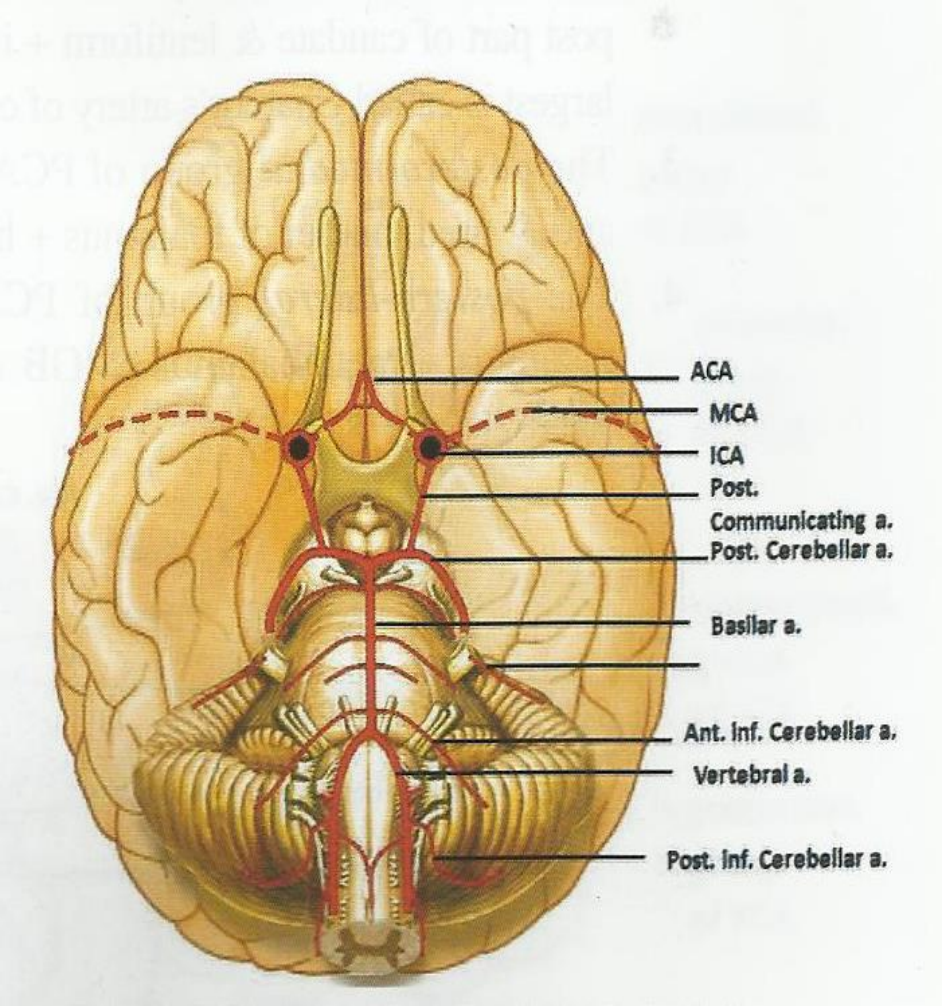
1. The 1st part is the cervical part.
2. The 2nd part (petrous part) passes through carotid canal of skull to enter cranial cavity via foramen lacerum.
3. The 3rd part (cavernous part) runs in cavernous sinus; giving branches to pituitary, trigeminal ganglion & meninges.
4. Its 4th part (cerebral part) emerges through roof of cavernous sinus medial to anterior clinoid process.

** **Terminates:** opposite anterior perforated substance by dividing into anterior and middle cerebral arteries (ACA & MCA).



** Branches of cerebral part of ICA (5):

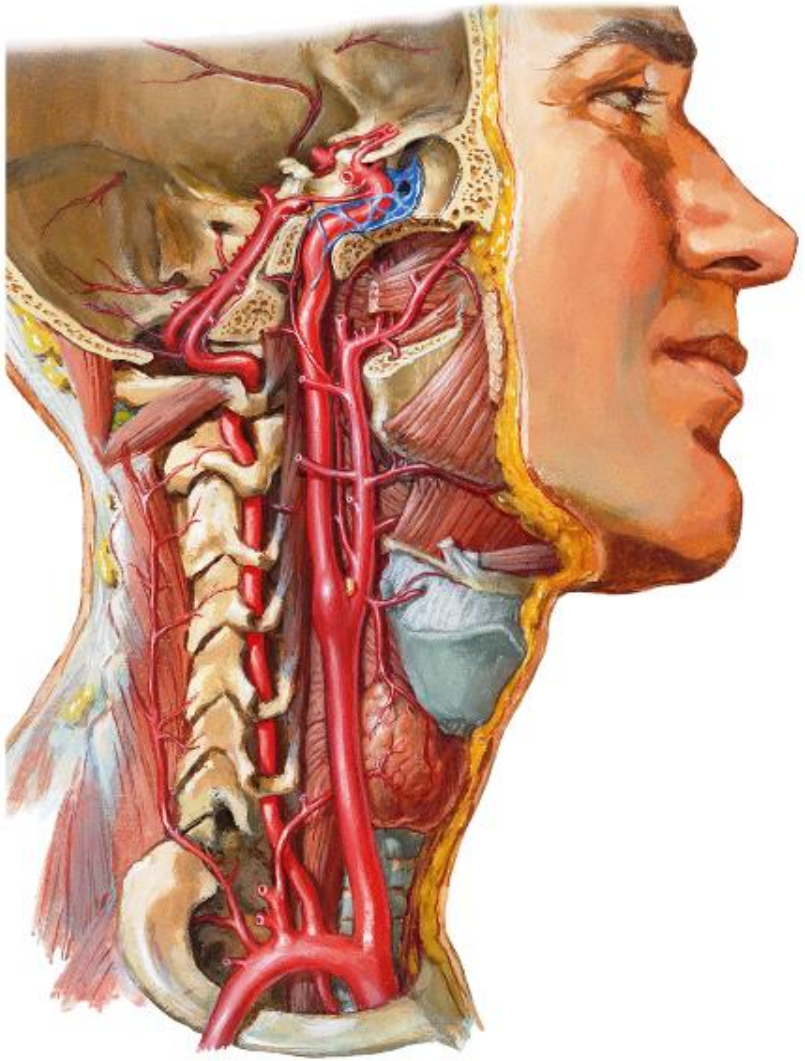
1. Ophthalmic.
2. Anterior cerebral.
3. Middle cerebral.
4. Posterior communicating.
5. Anterior choroidal.



Vertebral artery

* **Begins: as branch of first part of subclavian artery.**
* **Its course is divided into 4 parts:**

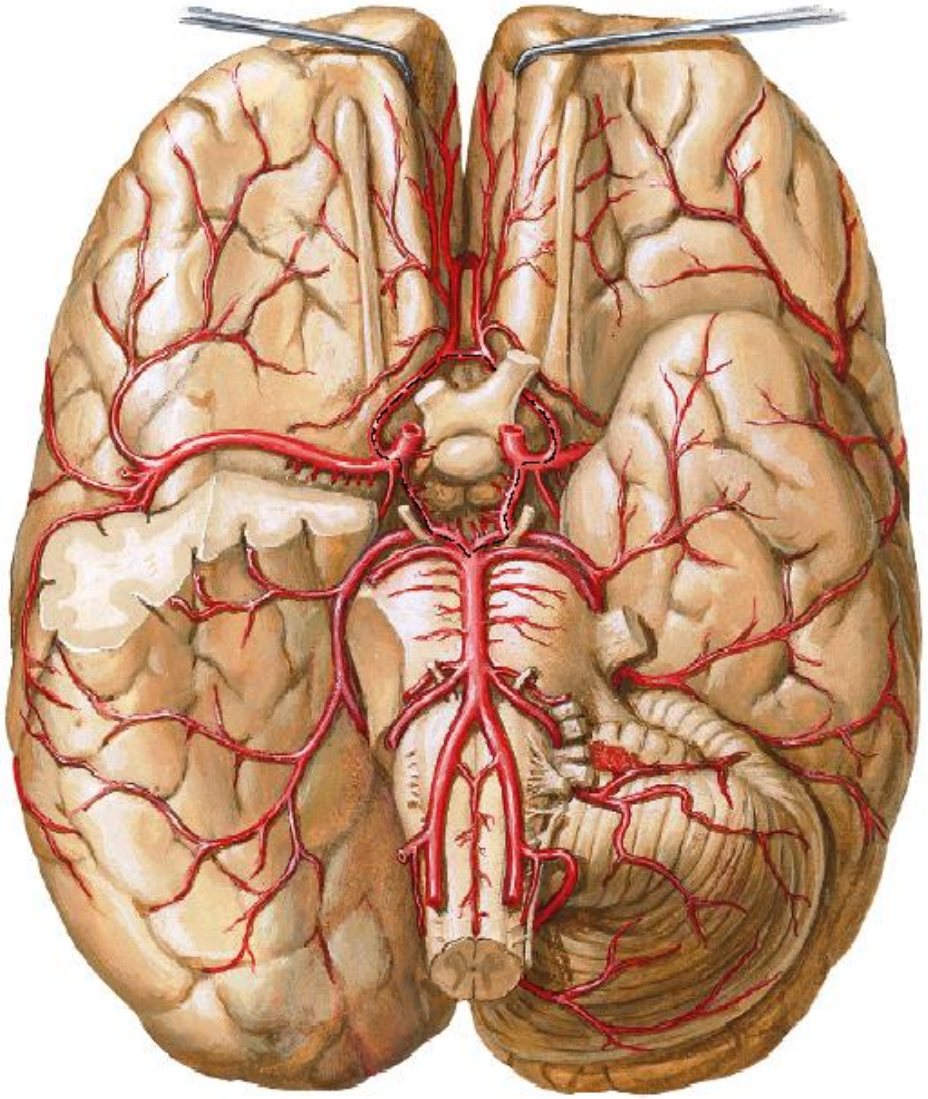
1. **1st part → before the foramen transversarium of C6.**
2. **2nd part → passes through the foramina transversaria of upper six cervical vertebrae.**
3. **3rd part passes in the suboccipital triangle then enters cranial cavity through foramen magnum.**
4. **4th part passes on ventral surface of medulla oblongata.**



* **Ends:** at lower border of pons by joining the other vertebral to form basilar artery.

* **Branches of vertebral artery in cranial cavity:**

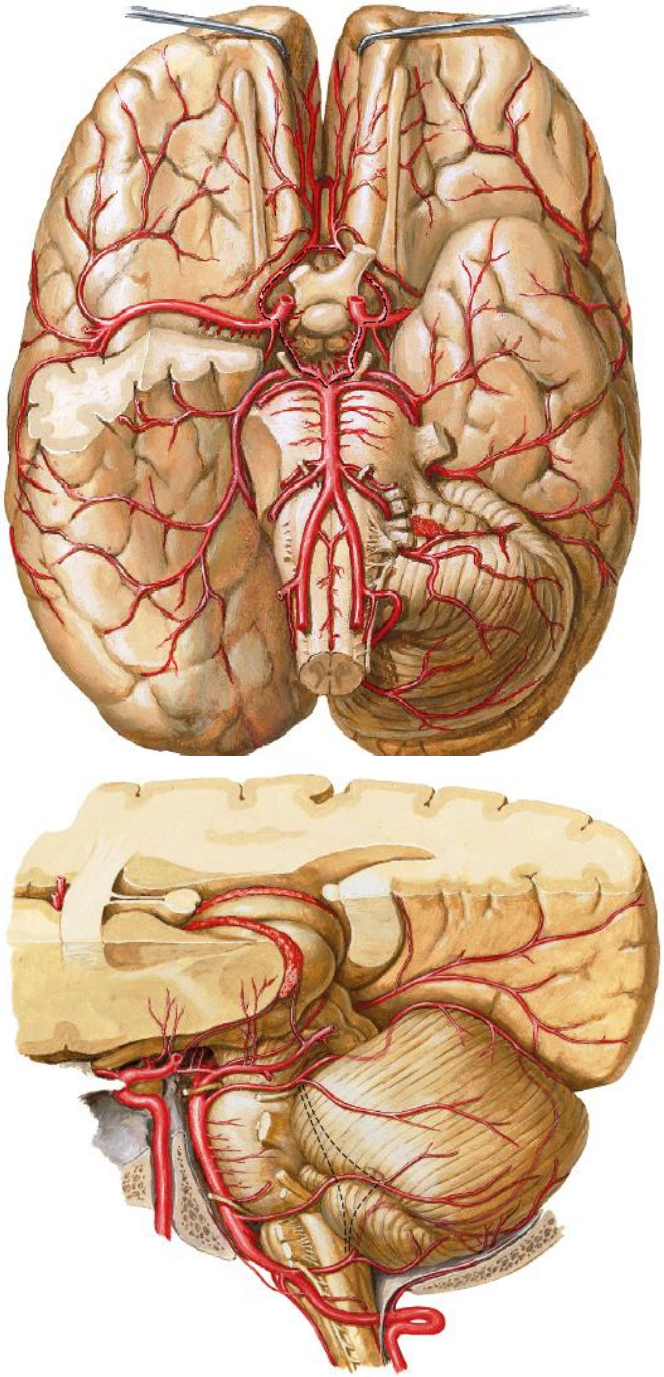
1. Meningeal.
2. Posterior inferior cerebellar.
3. Posterior spinal.
4. Anterior spinal.
5. Medullary branches.



Basilar artery

* **Formed by:** union of right and left vertebral arteries at lower border of pons.
* It runs in a shallow groove along the ventral surface of pons.
* At the upper border of pons, it ends by giving its two terminal branches "right and left posterior cerebral arteries".
* **Branches of Basilar Artery (5):**

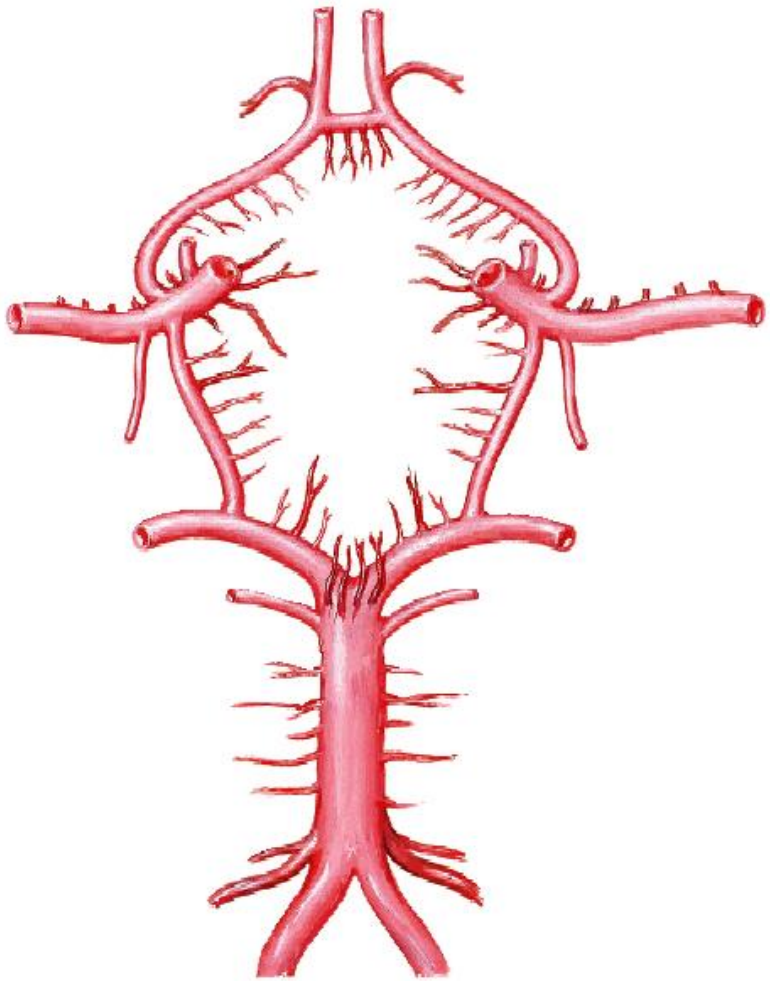
1. Pontine branches.
2. Labyrinthine
3. Anterior inferior cerebellar.
4. Superior cerebellar.
5. Posterior cerebral.



Circle of Willis "Circulus arteriosus"

* **Definition:** a large arterial anastomotic circle between the carotid and vertebrobasilar systems.
* It provides alternate channels if one vessel is occluded.
* **Site:** at the base of the brain, in the interpeduncular cistern.
* **It is formed by:**

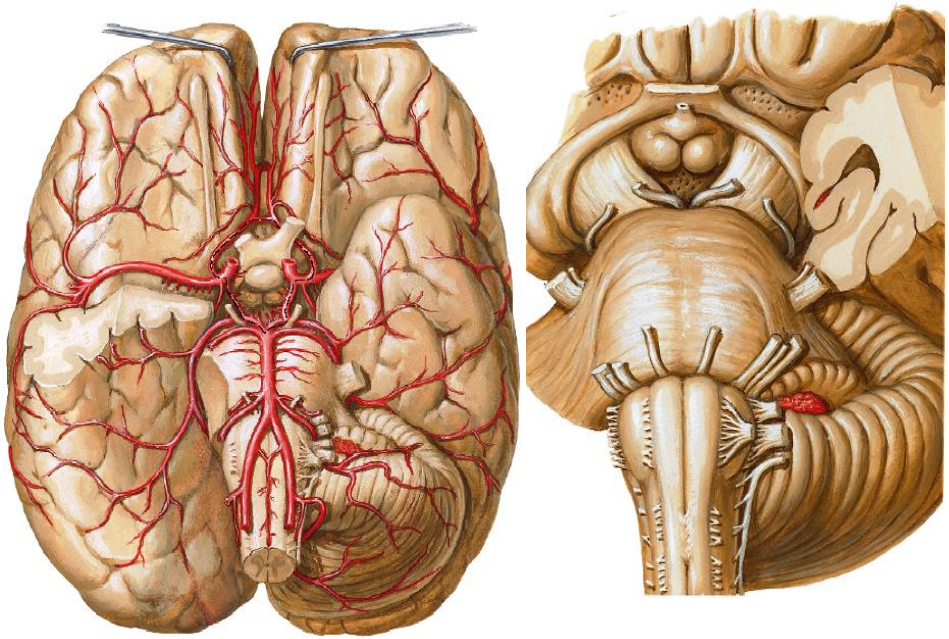
1. Right and left anterior cerebral arteries (ACA), with the anterior communicating artery joining them.
2. Right and left internal carotid arteries (ICA).
3. Right and left posterior cerebral arteries (PCA).
4. Posterior communicating artery joining ICA + PCA.

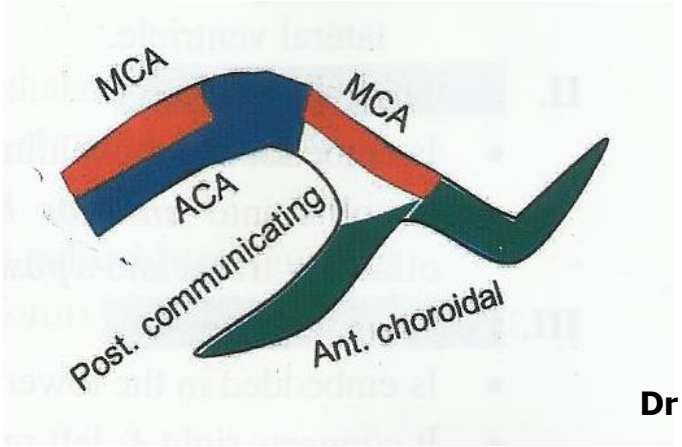


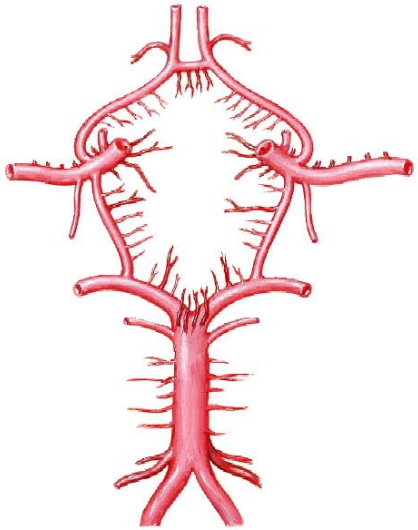
** **Central branches:** arise from the circulus arteriosus or very close to it to supply nearby structures.

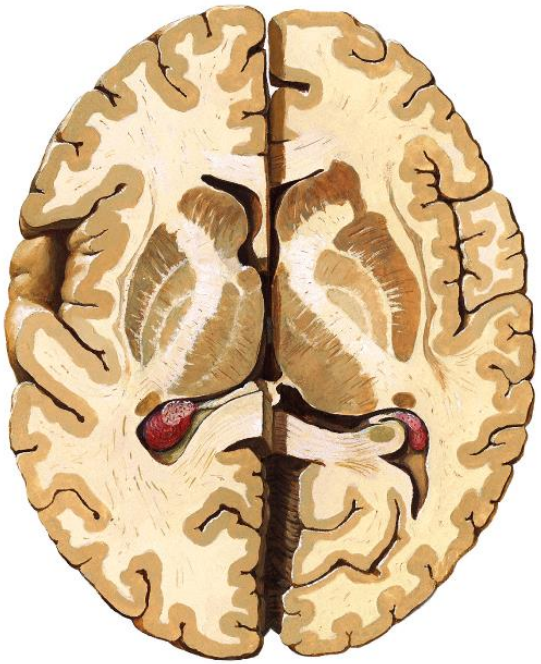
** These central branches are divided into groups (sets):

1. **The antero-medial group from ACA:** Pierce ant. perforated substance to supply ant. part of caudate & lentiform + internal capsule (genu & lower ½ of ant. limb).

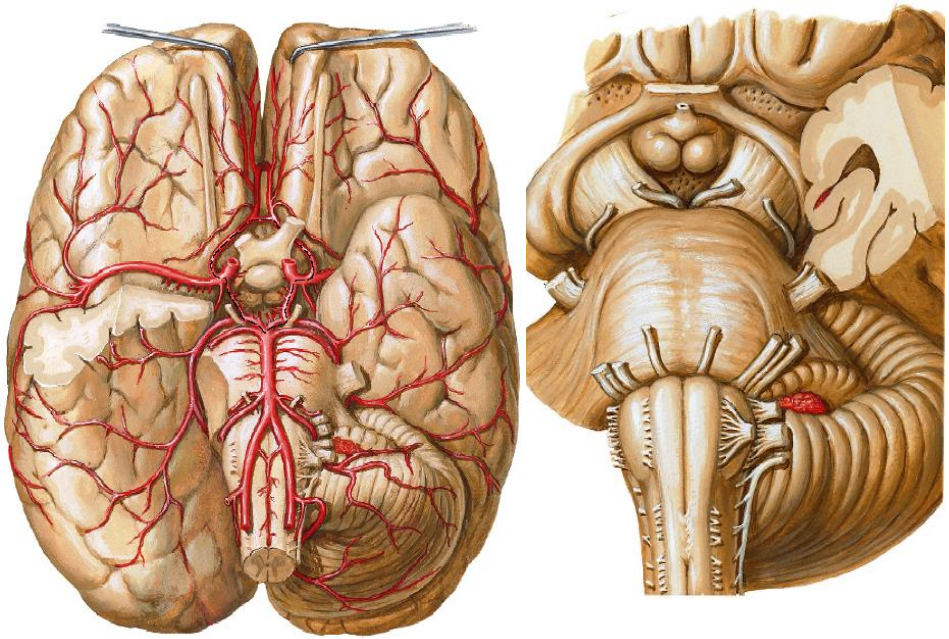


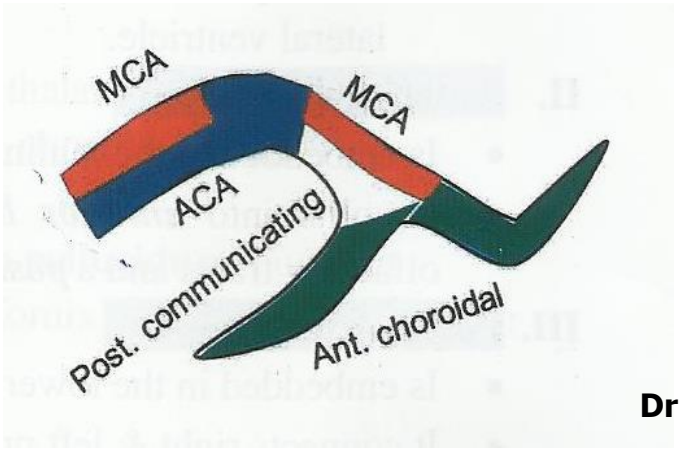


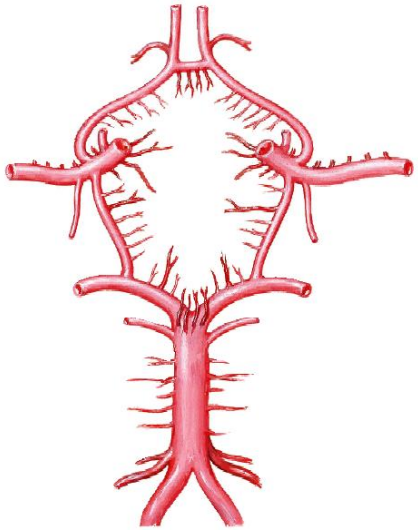


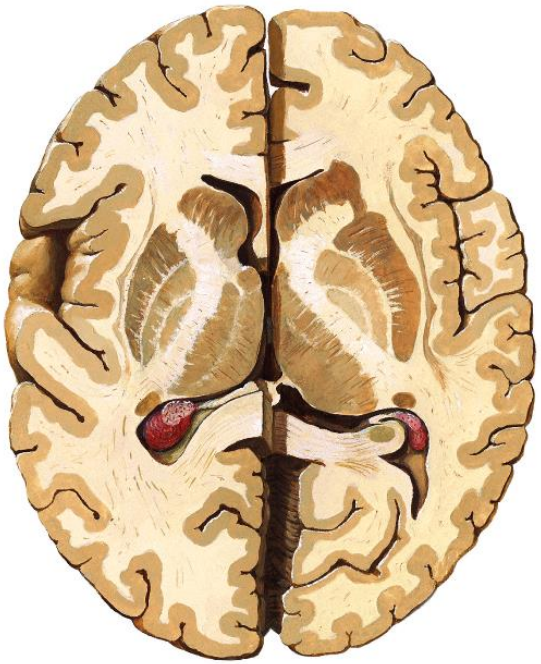


2. The antero-lateral group from MCA: Pierce anterior perforated substance to supply post part of caudate & lentiform + internal capsule (upper ½ of ant. & post. limbs). The largest is called Charcot's artery of cerebral hemorrhage.

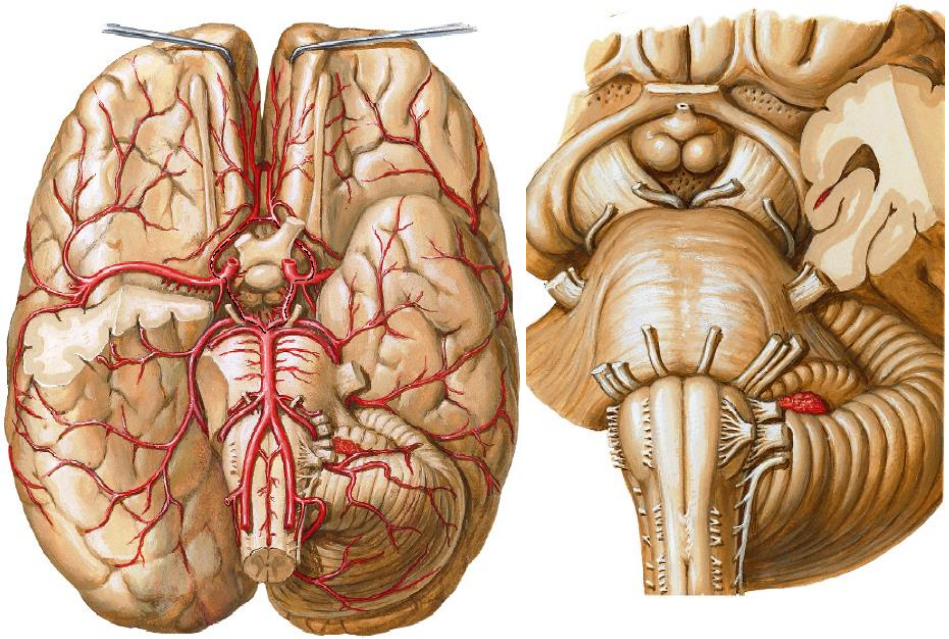


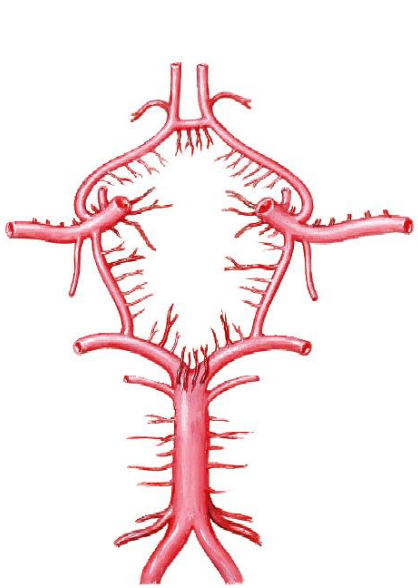


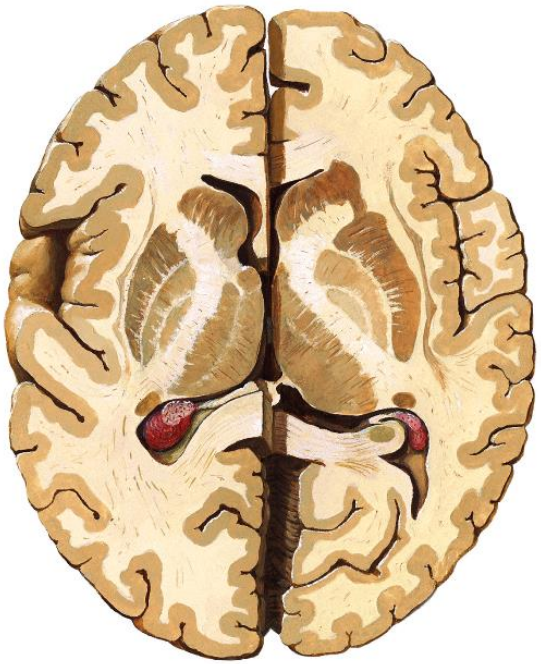




3. **The postero-medial group of PCA:** Pierces posterior perforated substance to supply ant. & med. nuclei of thalamus + hypothalamus.
4. **The postero-lateral group of PCA:** Passes directly to supply lat. & post. parts of thalamus + metathalamus (MGB & LGB). The largest is called thalamogeniculate artery.

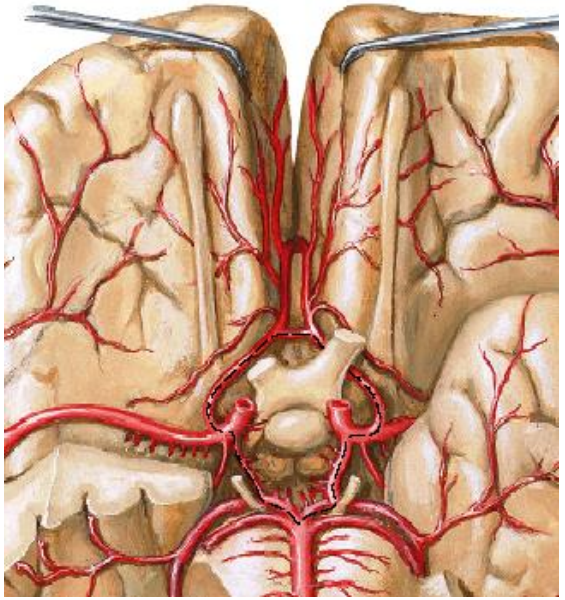


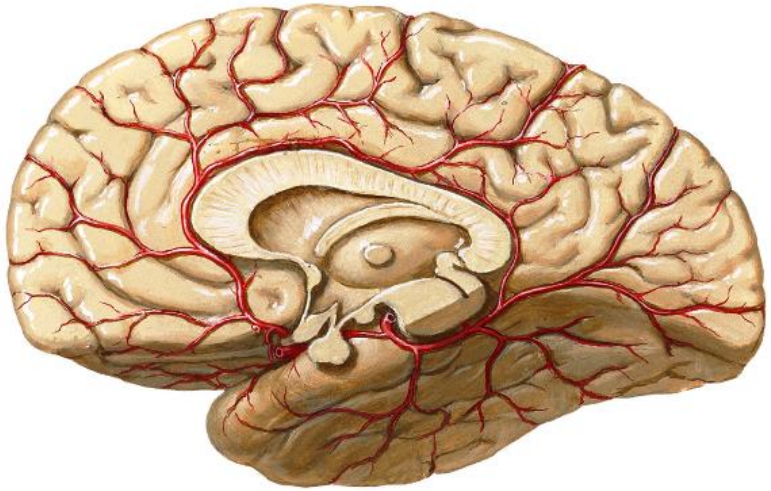




Anterior Cerebral Artery (ACA)

* **Origin: It is a terminal branch of internal carotid artery.**
* **Course: It runs towards the longitudinal fissure where it communicates with the other anterior cerebral artery through the anterior communicating artery. It runs backwards over corpus callosum. It ends at parieto-occipital sulcus (P.O.S.) by anastomosing with the posterior cerebral artery.**

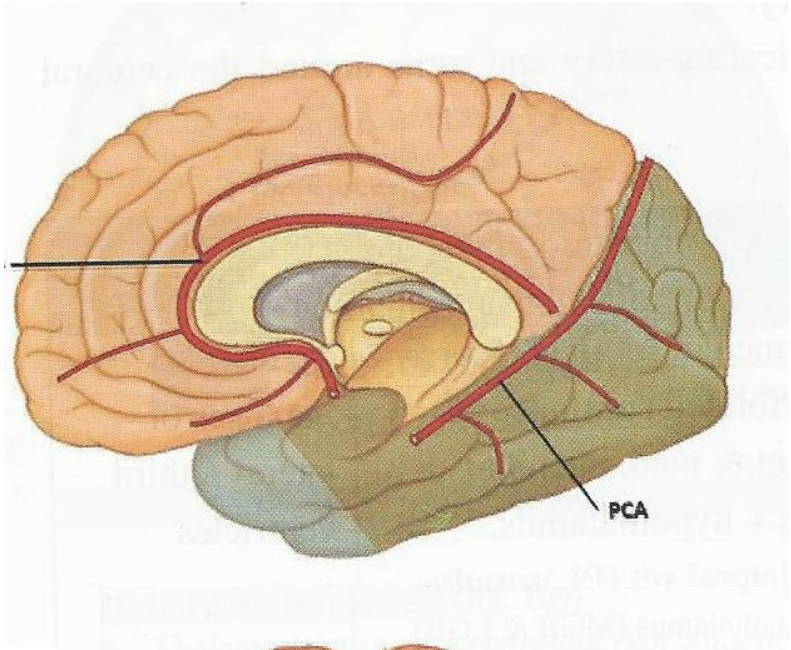


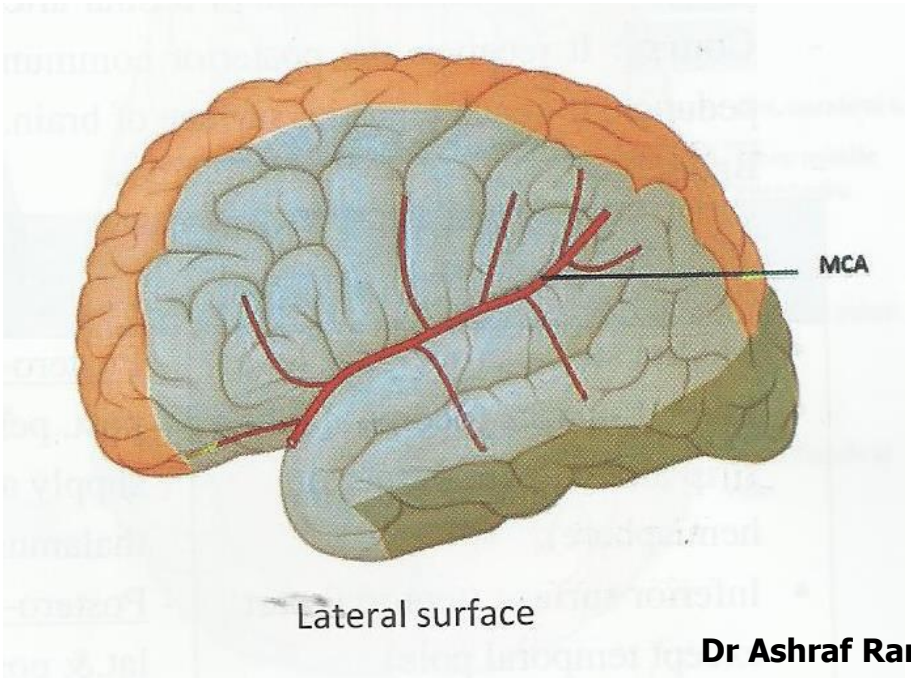


* Branches:

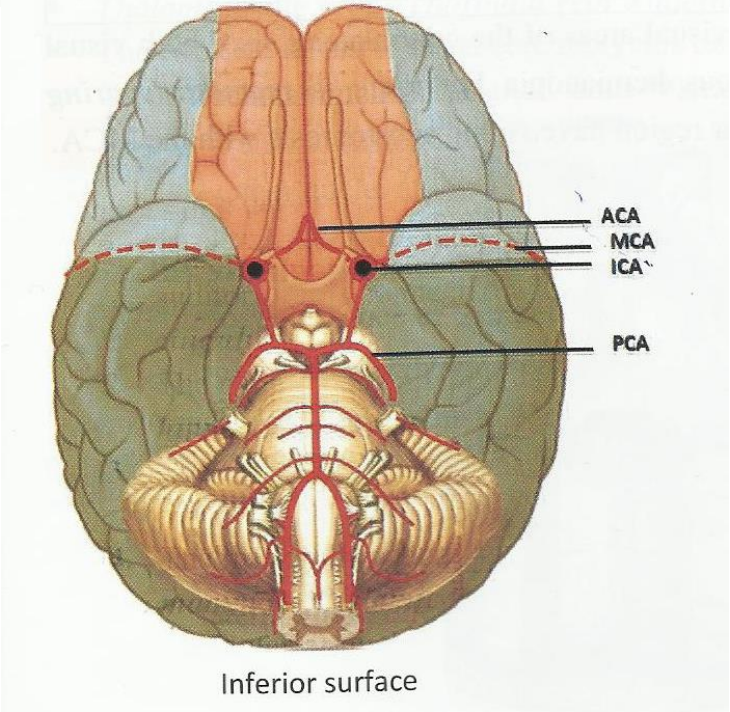
A. Cortical: Supply:

1. Medial surface → All except occipital lobe.
2. Lateral surface → One inch strip superiorly.
3. Inferior surface → medial part of orbital surface.





Lateral surface

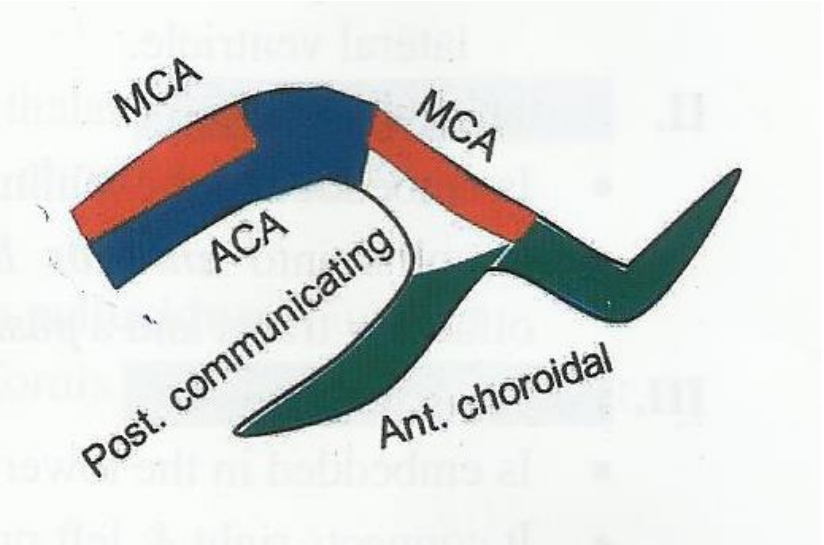


Inferior surface

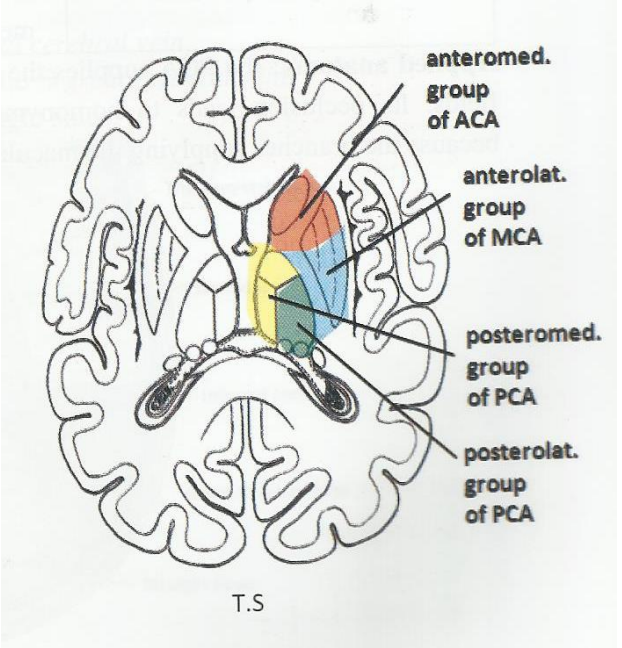
B. Central:

* Antero-medial set (AM):

* Pierce anterior perforated substance to supply: ant. part of caudate, lentiform + internal capsule (genu & lower ½ of ant. limb).

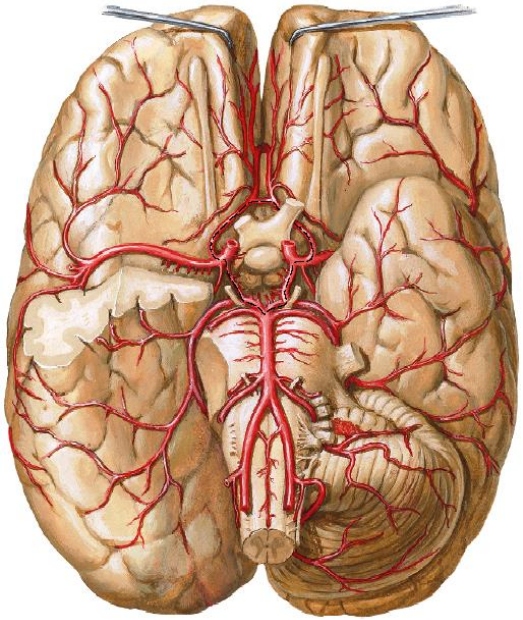


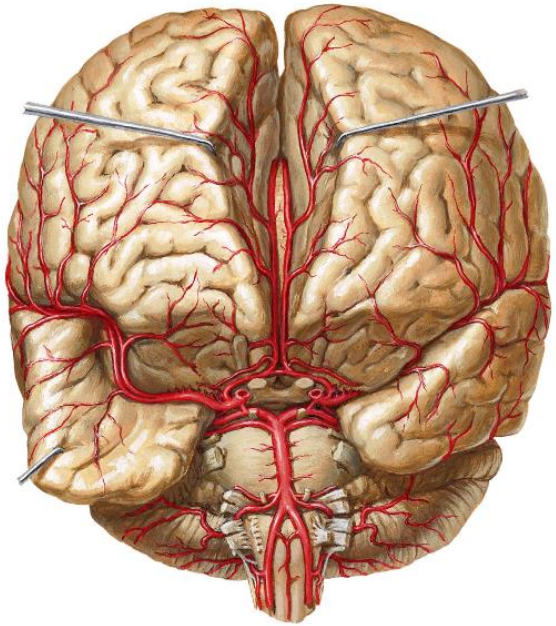
* **Applied anatomy:** the ACA supplies the motor & sensory areas of the contralateral lower limb. Thrombosis of a congenitally unpaired ACA leads to cerebral paraplegia.

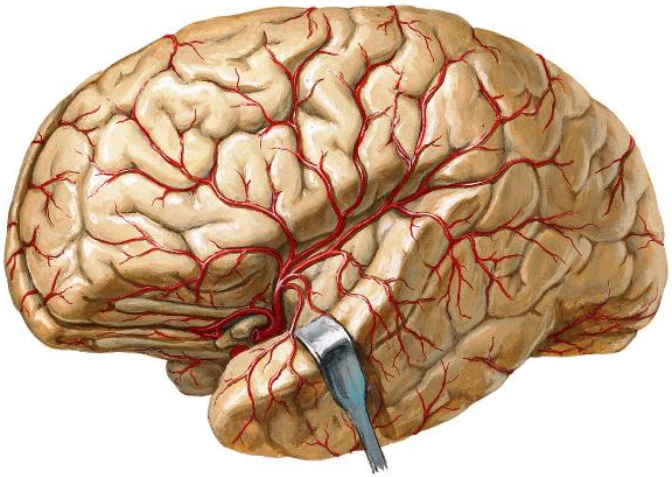


Middle Cerebral Artery (MCA)

* **Origin: It is the larger terminal branch of internal carotid artery.**
* **Course: It runs in the lateral sulcus & insula to reach the superolateral surface.**



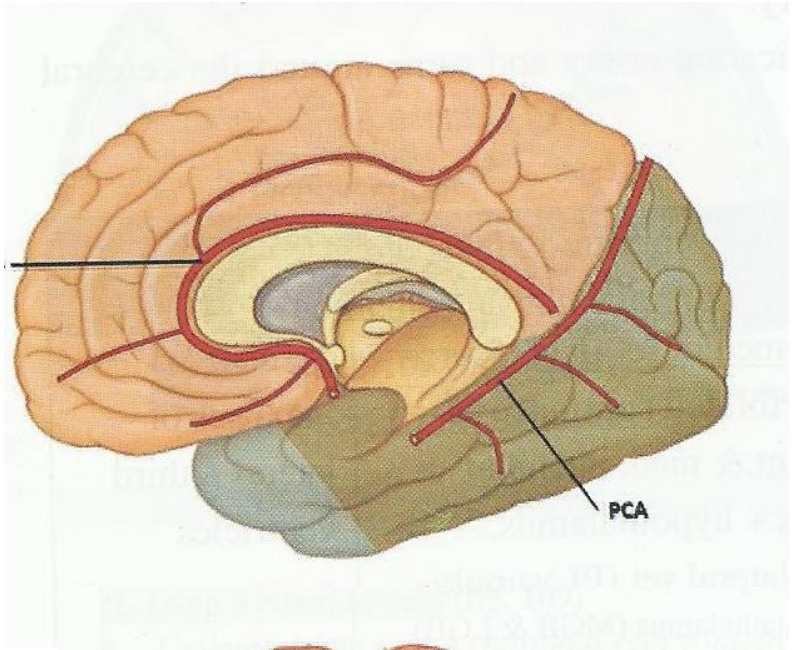


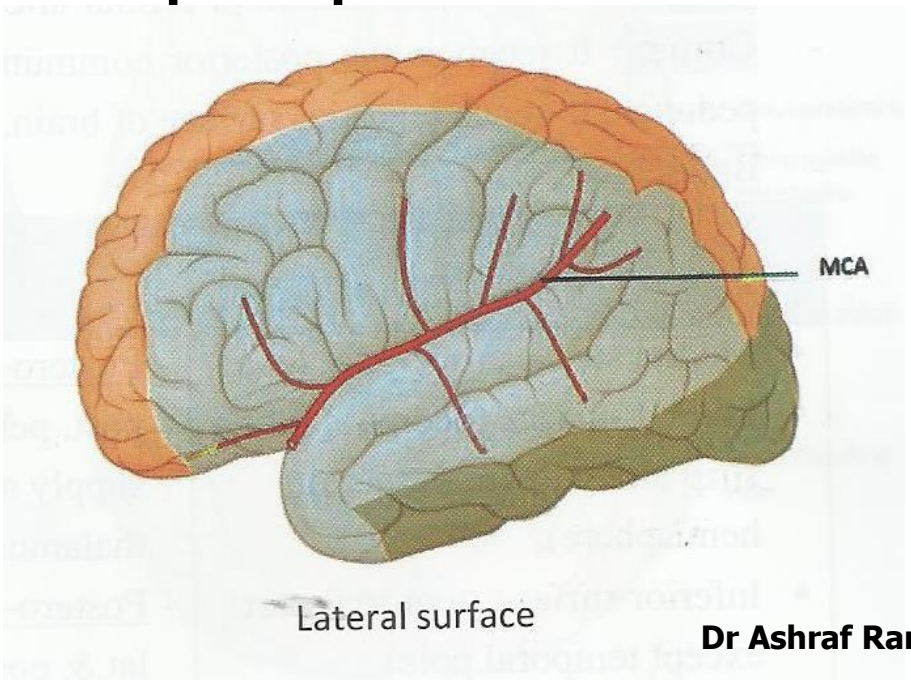


* Branches:

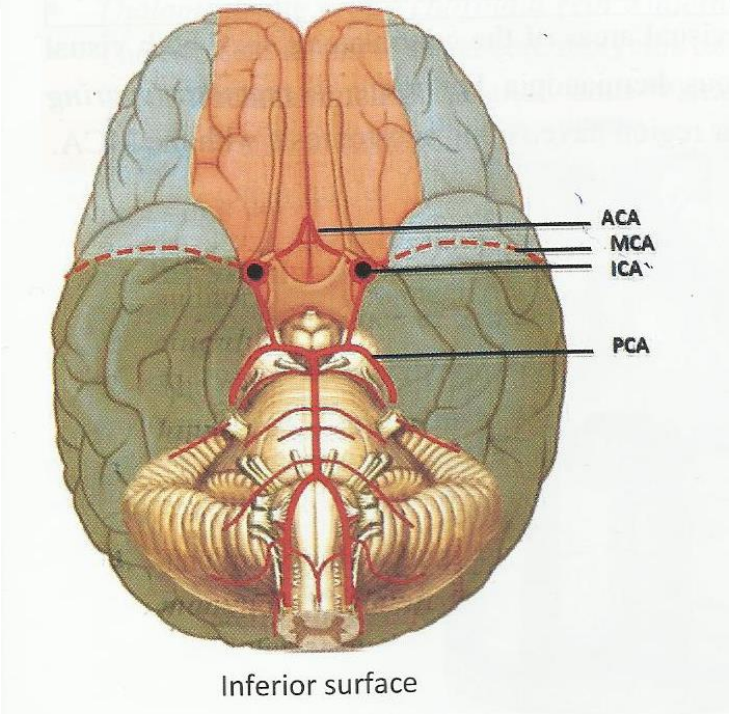
A. Cortical: Supply:

1. Lateral surface →a large area except occipital lobe + a strip along superior border + a strip along inf. border.
2. Inferior surface → lateral part of orbital surface + temporal pole.





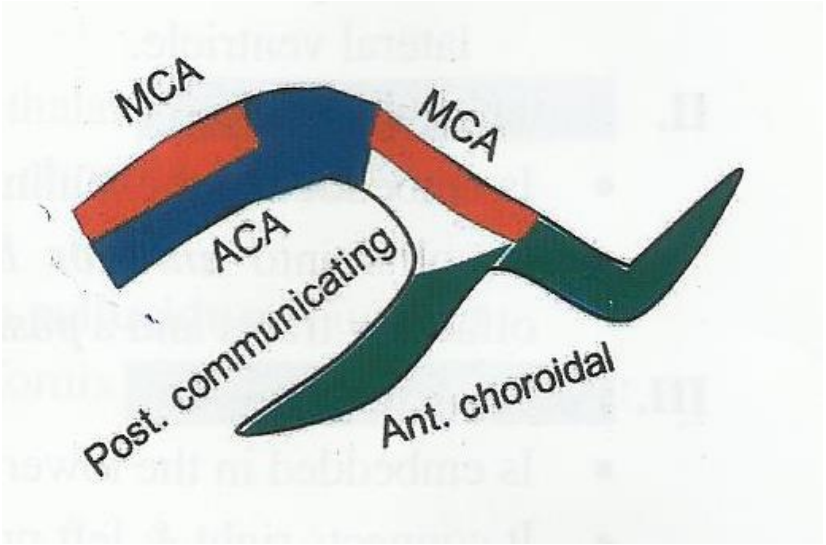
Lateral surface



Inferior surface

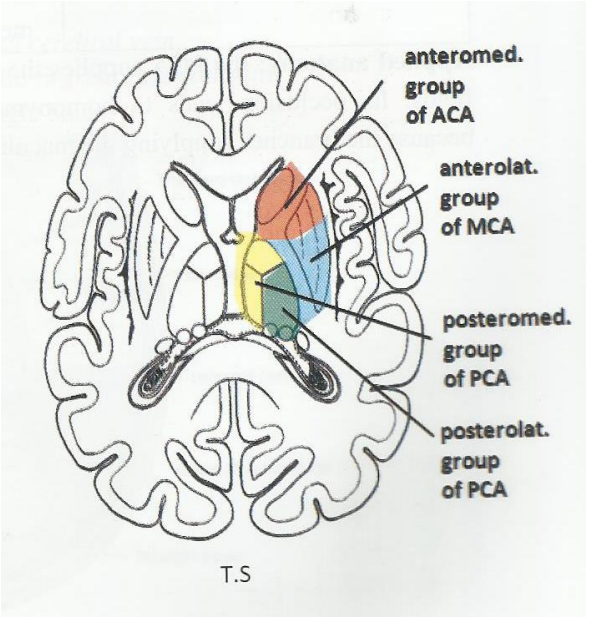
B. Central:

Antero-lateral set (AL): Pierce anterior perforated substance to supply post part of caudate & lentiform + internal capsule (upper ½ of ant.& post. limbs).



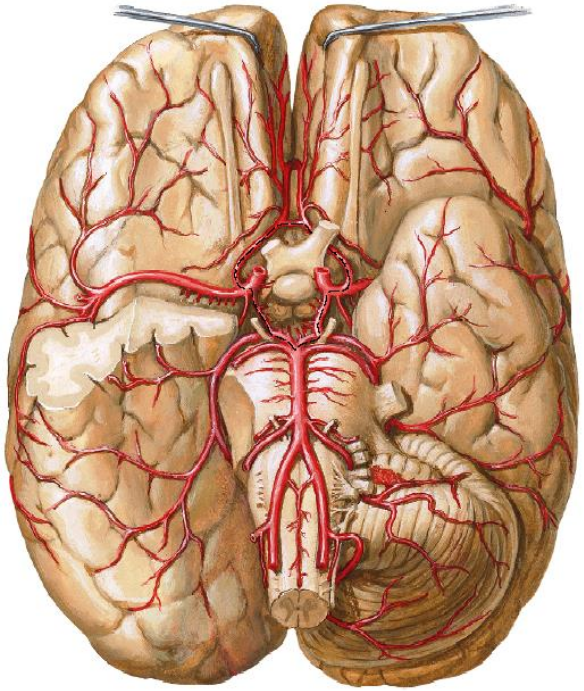
* **Applied anatomy:** The MCA supplies the motor & sensory areas of the contralateral upper limb + speech & auditory areas + frontal eye field.

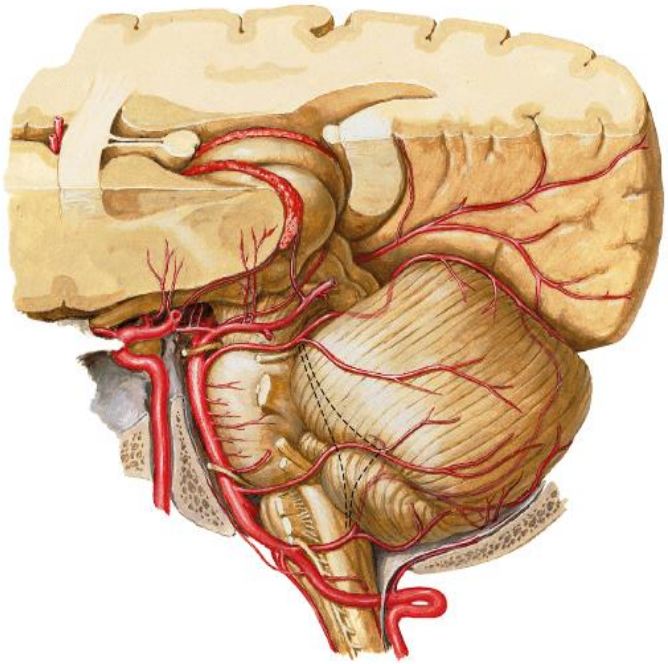
* Its thrombosis is very serious& if occurs on the dominant side → aphasia occurs.



Posterior Cerebral Artery (PCA)

* **Origin: The terminal branch of basilar artery.**
* **Course: It receives the posterior communicating artery and turns around the cerebral peduncle to reach tentorial surface of brain.**

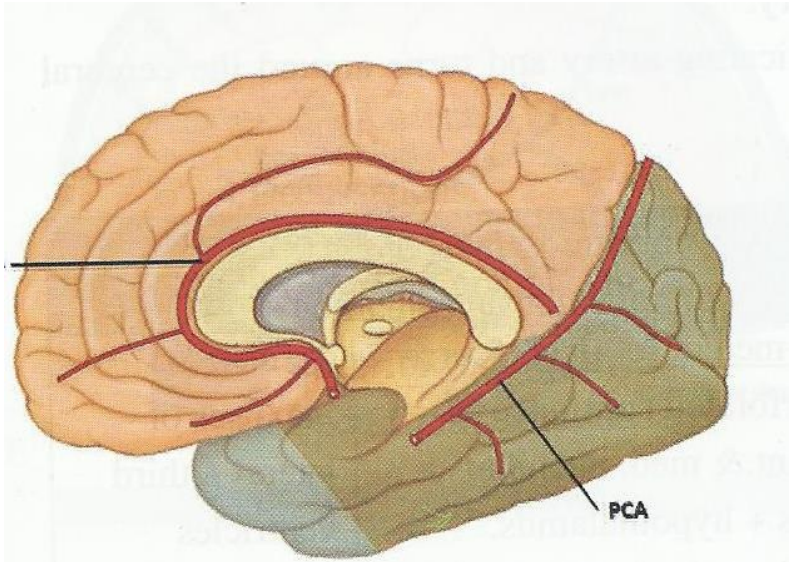


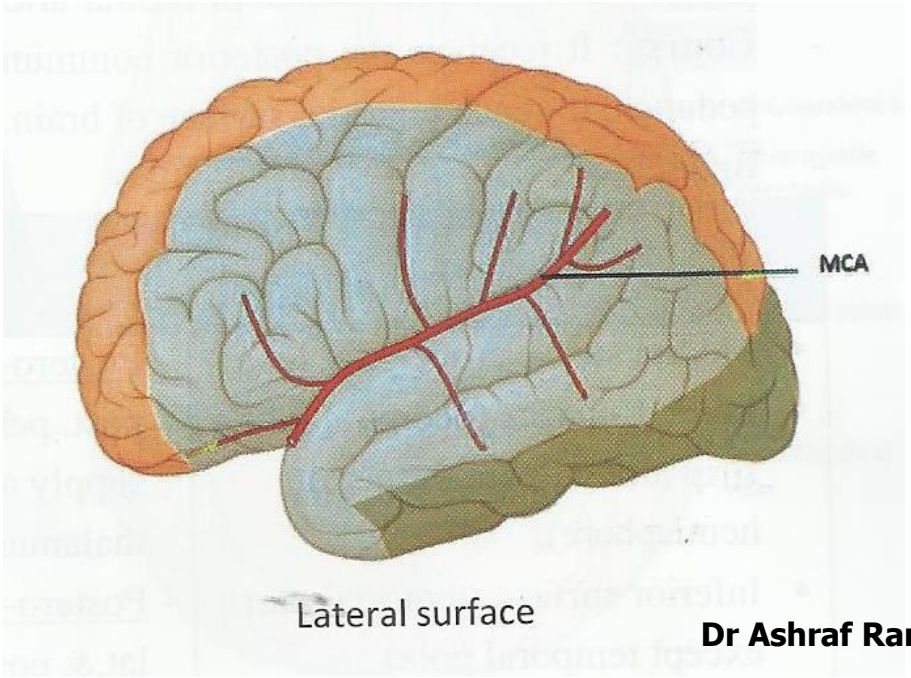


* Branches:

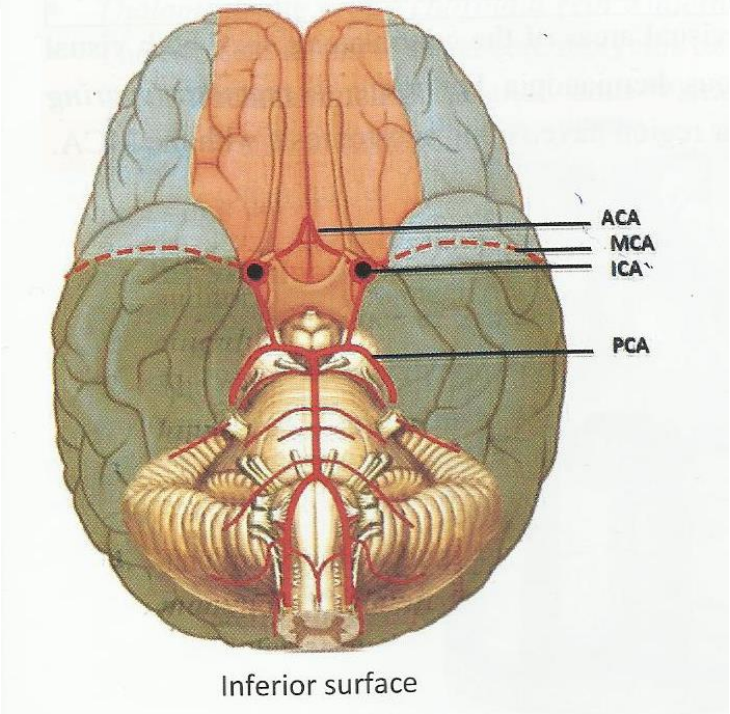
A. Cortical: Supply:

1. Medial surface → occipital lobe.
2. Lateral surface → occipital lobe+ strip along lower border of hemisphere.
3. Inferior surface → tentorial part except temporal pole.





Lateral surface



Inferior surface

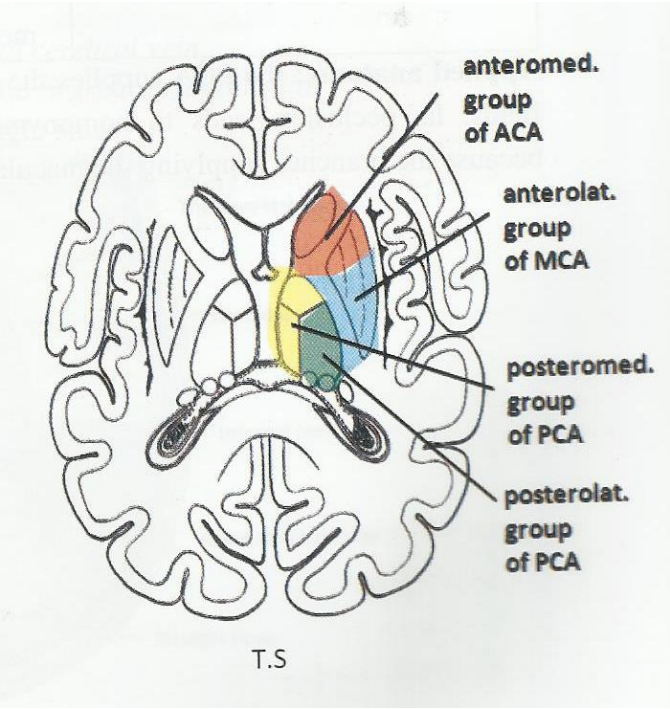
B. Central:

* Postero-medial set (PM):

Pierce post. perforated substance to supply ant.& med. nuclei of thalamus + hypothalamus.

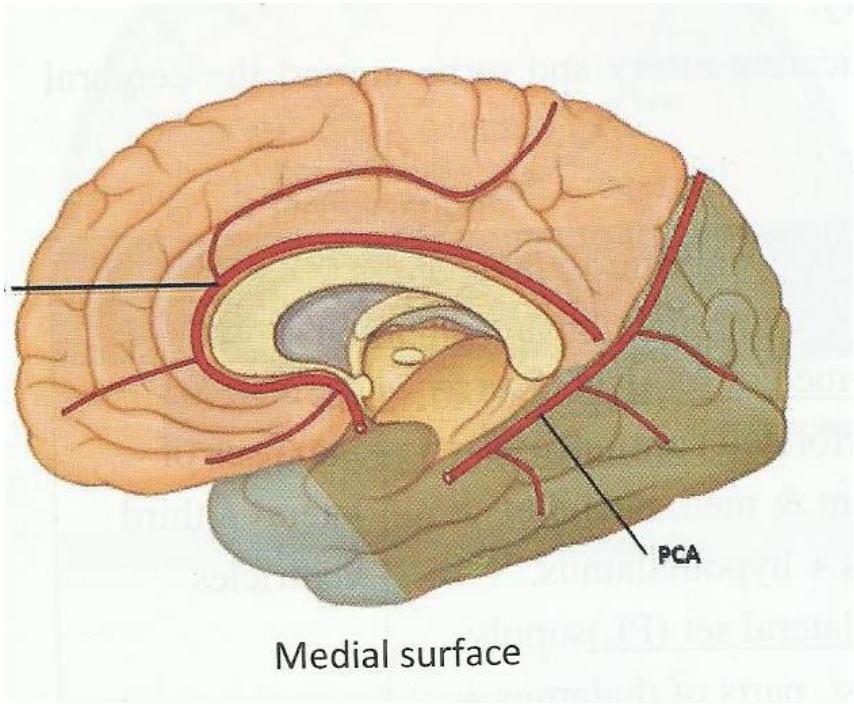
* Postero-lateral set (PL):

supply lat.& post. parts of thalamus + metathalamus (MGB & LGB).



C. Post. Choroidal → to choroid plexuses of lateral & third ventricles.

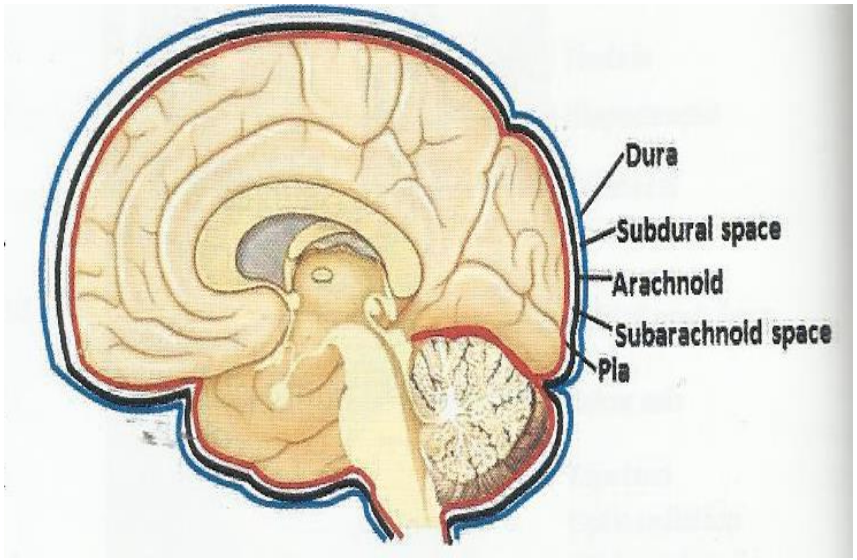
* Applied anatomy: the PCA supplies the visual areas of the contralateral ½ of both visual fields. Its occlusion leads to homonymous hemianopia but there is macular sparing because the branches supplying the macular region have strong anastomosis with the MCA.



Veins of Brain

* Emerge from the brain to the subarachnoid space.
* Then pierce the arachnoid and meningeal layer of dura to drain into cranial venous sinuses.
* <u>Drainage occurs via 2 systems of veins</u>:

1. Superficial System of Veins.
2. Deep System of veins.



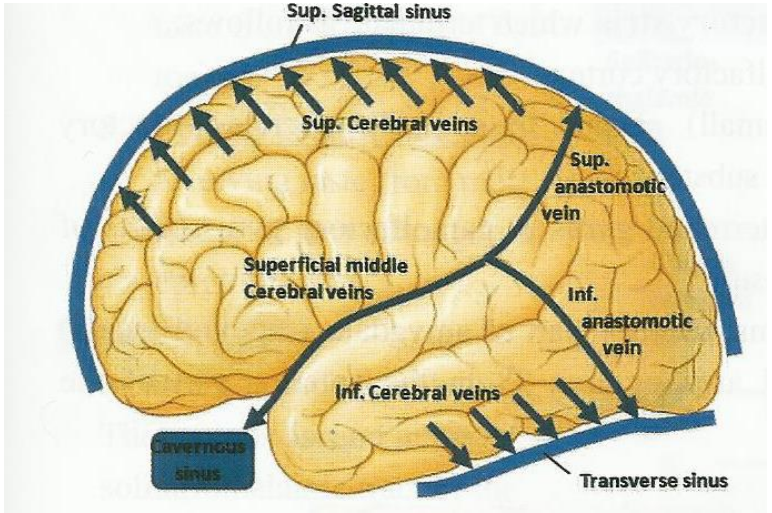
A. Superficial System of Veins

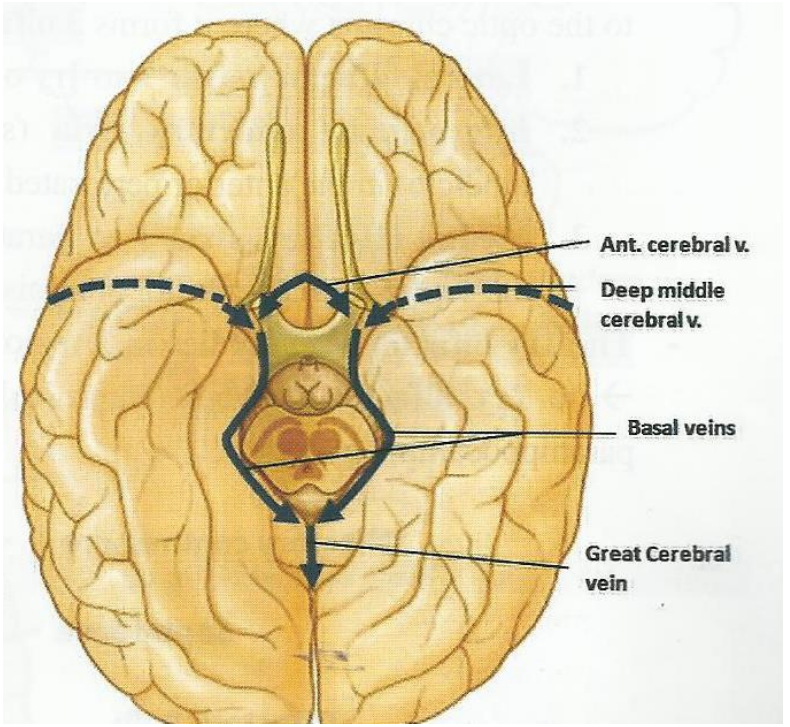
* **Superior cerebral veins** → drain into the superior sagittal sinus.
* **Middle cerebral veins:**

1. **Superficial middle cerebral vein** → drains into the cavernous sinus. It is connected to the superior sagittal sinus by a superior anastomotic vein and to the transverse sinus by an inferior anastomotic vein.

2. **Deep middle cerebral vein** → drains the insula then joins the anterior cerebral vein and the striate veins to form the basal vein which joins the great cerebral vein.

* **Inferior cerebral veins** → drain into the nearby sinuses (especially transverse).

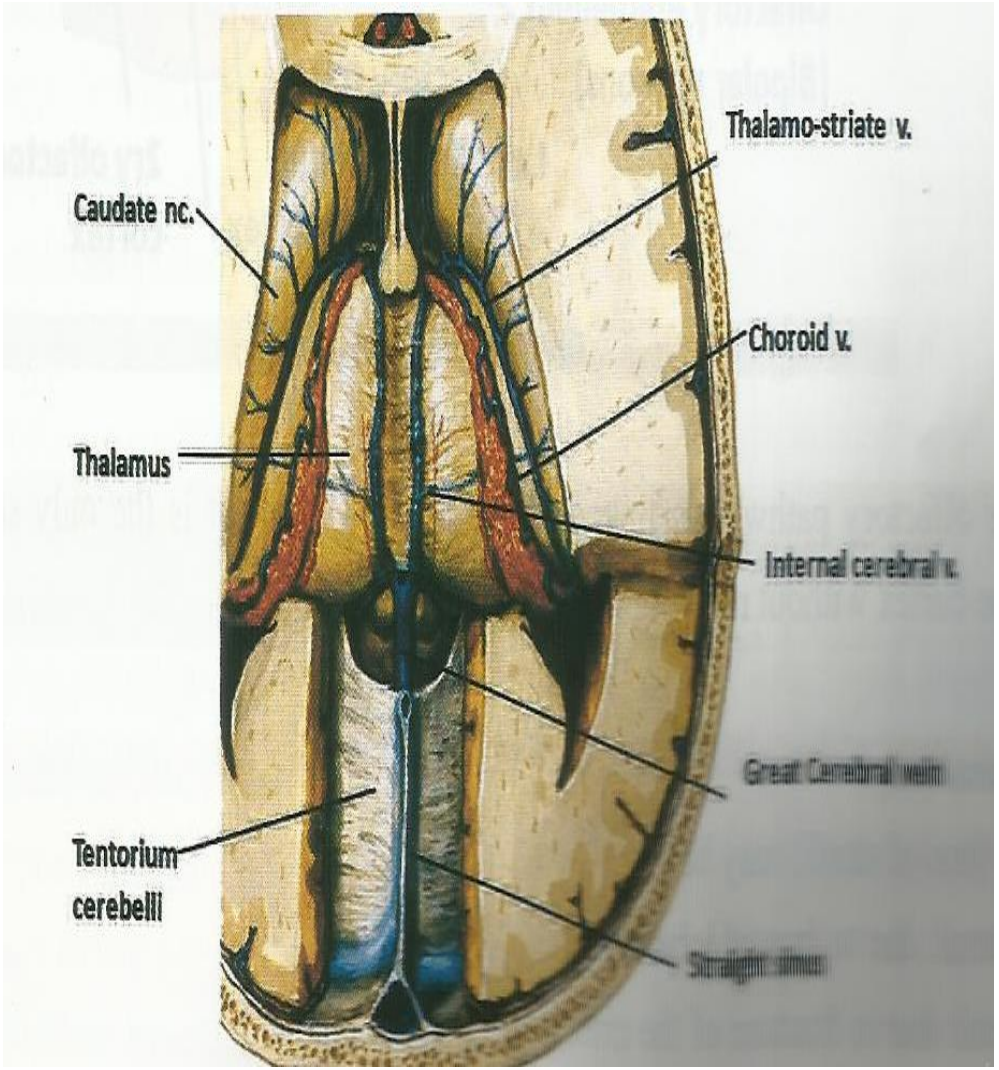




Dr Ashraf Ramzy

B. Deep System of vein

* Thalamostriate vein + choroidal vein → internal cerebral vein.
* The two (Rt. & Lt.) internal cerebral veins unite → great cerebral vein.
* Great cerebral vein + inf. sagittal sinus → straight sinus.



THANK YOU