



Cerebral circulation

Brain is only 2% of body weight but it receives about 15% of total cardiac output and that because brain cells have no ability to store oxygen and nutrients so they need a continuous blood supply. (to supply O₂ and nutrients and removes metabolites and wastes). Some cells in the body can resist *ischemia* (restriction in blood supply to tissues with decrease O₂ level) for up to half an hour but the brain cells cannot resist ischemia more than 2 minutes. Brain cells consume 20% of O₂ delivered by the cardiovascular system because they are highly active cells. Any disruption of the blood supply of the brain may result in: Loss of consciousness within seconds or Irreversible neuronal damage and neurological deficits within minutes.

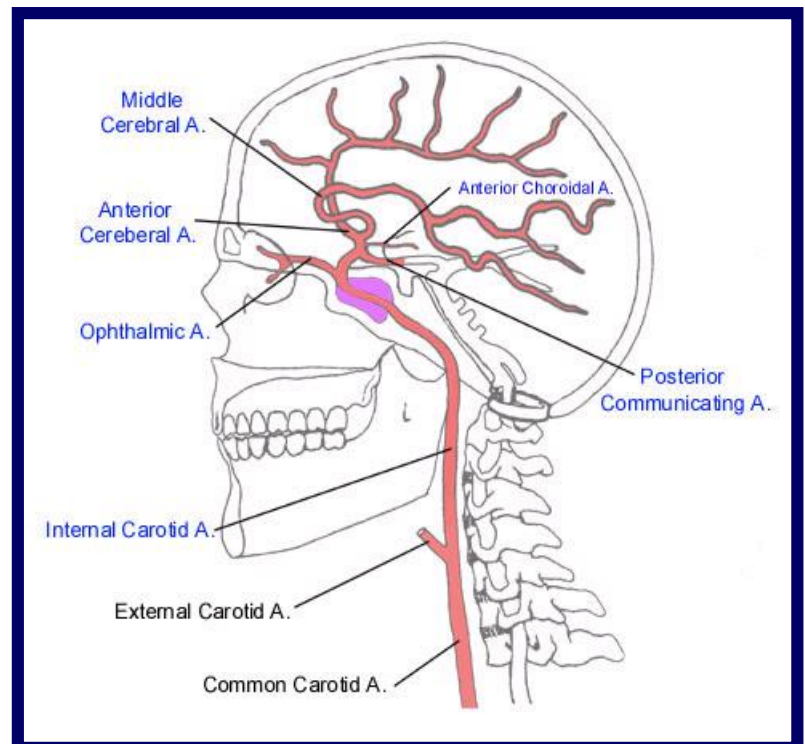
To understand the symptomology, diagnosis and management of stroke, it is essential to have knowledge of the Cerebral Vascular Anatomy.

Blood Supply of the Brain

1. The internal carotid arteries >> the anterior circulation to the brain
2. The vertebral arteries >> the posterior circulation to the brain

1.The Internal Carotid Artery

Branch of the common carotid artery which will divide at the upper part of the neck into *external carotid* which will supply structures outside the skull in the head and neck. And the *internal carotid* which will not give any branches outside the skull. It enters the skull through carotid canal to supply the anterior half of the brain.





2. The vertebral artery

The **subclavian artery** passes below the clavicle to supply the upper limbs. It gives one important branch which is the vertebral arteries. It ascends the neck by passing through the transverse foramina of the upper 6 cervical vertebrae and enters the skull through **foramen magnum**. It does not pass through C7 because it arises at the same level of C7 so to go through the transverse foramen it has to go down and then upward. Once they enter the foramen magnum they join together to form **basilar artery** at the lower border of the pons. And the basilar artery divides into **Posterior cerebral artery** right and left. The **Posterior cerebral artery** supplies the posterior and inferior surfaces of the cerebral hemispheres. In the posterior area we have the region responsible for vision so any block to the post. cerebral artery will affect the vision.

The vertebral artery gives branches in the neck (cervical branches).

- Spinal branches to supply spinal cord
- Muscular to supply muscles of the neck

And branches inside the skull (cranial branches) to supply:

- the meninges
- spinal cord (through **ant. & post. Spinal arteries**)
- branch to cerebellum (**Posterior inferior cerebellar artery**)>1
- branch to medulla oblongata (**medullary artery**)

Branches of basilar artery:

- **pontine artery** (to the pons)
- **labyrinthine artery** (to the inner ear)
- **Anterior inferior cerebellar**>2
- **Superior cerebellar**>3
- **Posterior cerebral arteries**

1,2&3 supply the cerebellum



The internal carotid arteries

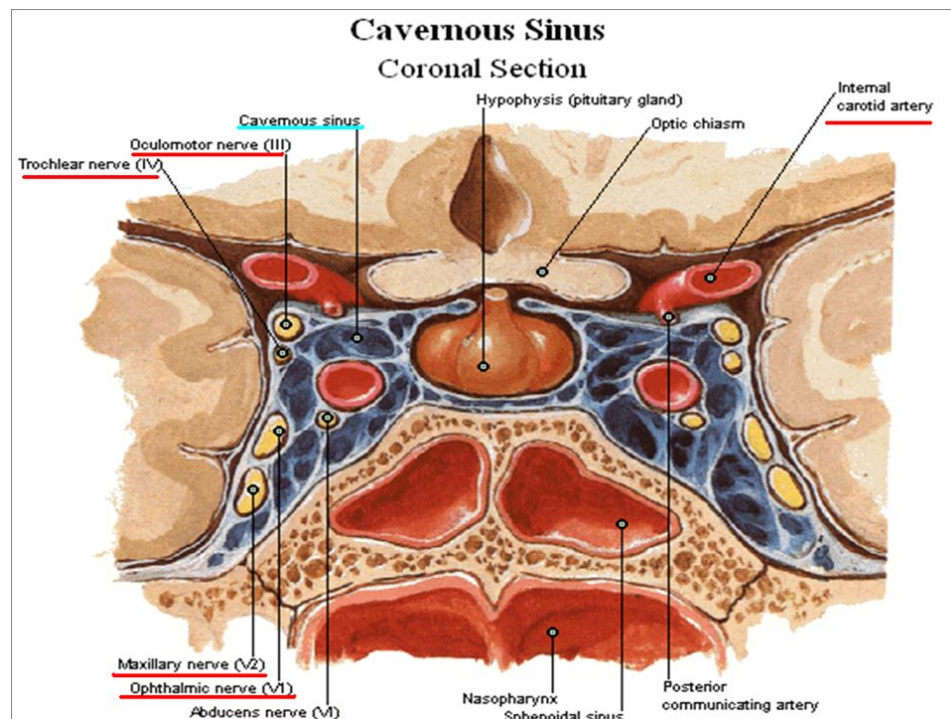
Branch of CCA is divided into extracranial and intracranial portions. The extracranial portion have no branch at all. it enters the cranial cavity through **carotid canal** and then it Pierces Dura mater to pass through the **cavernous venous sinus**.

in the wall of the cavernous sinus we have the following structures:

ICA

CNs:

- Trochlear (IV)
- Oculomotor (III)
- Abducent (VI)
- Ophthalmic (V1)
- Maxillary (V2)



Branches of ICA:

- **Ophthalmic artery** (inters the orbit through optic canal) >> supplies structures within the orbit , forehead, scalp and nasal cavity.
- **Anterior choroidal artery** >> supplies choroid plexus of the epithalamus
- **Posterior communicating artery** >> connect ICA to posterior cerebral artery
- **Anterior cerebral artery** >> supplies the medial surface of the cerebral hemispheres and the upper 1 inch of the lateral surface of cerebral hemispheres
- **Middle cerebral artery** >> supplies most of the lateral surface

The anterior and middle cerebral arteries are the terminal branches of the ICA

Remember that cerebral hemispheres have lateral, medial and inferior surfaces.



If we have block to anterior cerebral artery or damage >> the lower limb is affected because it supply the Anterior cerebral artery (depending on the branches the motor or sensory functions would be affected)

block to Middle cerebral artery >> *Hemiplegia* (paralysis of one side of the body).

If the patient is right handed and he lost the ability to move his left hand and also the speech is affected this is Left Middle cerebral artery damage. If the speech is affected that's mean the dominant cerebral hemisphere is affected (because the motor speech area is located in the dominant hemisphere).

If just left handed weakness and the left of the body is affected and the speech is fine this is Right Middle cerebral artery damage.



Middle cerebral artery

Most commonly affected by stroke. Second and largest terminal branch of the internal carotid artery. Runs laterally in the lateral sulcus

Branches:

- Deep (central)
- Superficial (Cortical)

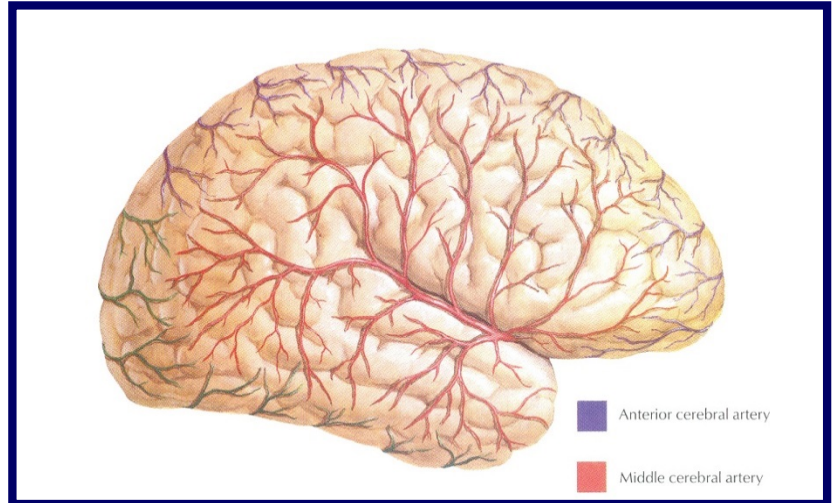


Figure 1 Middle cerebral artery passes over the insula

Cerebral arteries:

- Anterior Cerebral artery >> branch of ICA
- Middle Cerebral artery >> branch of ICA
- Posterior Cerebral artery >> branch of basilar which is branch of vertebral artery.

Cerebellar arteries:

- Anterior inferior cerebellar >> branch of basilar which is branch of vertebral artery
- Superior cerebellar >> branch of basilar which is branch of vertebral artery
- Posterior inferior cerebellar artery >> one of the cranial branches of the vertebral artery.



The Circle of Willis

found Surrounding the pituitary gland and closely relate to optic chiasma.

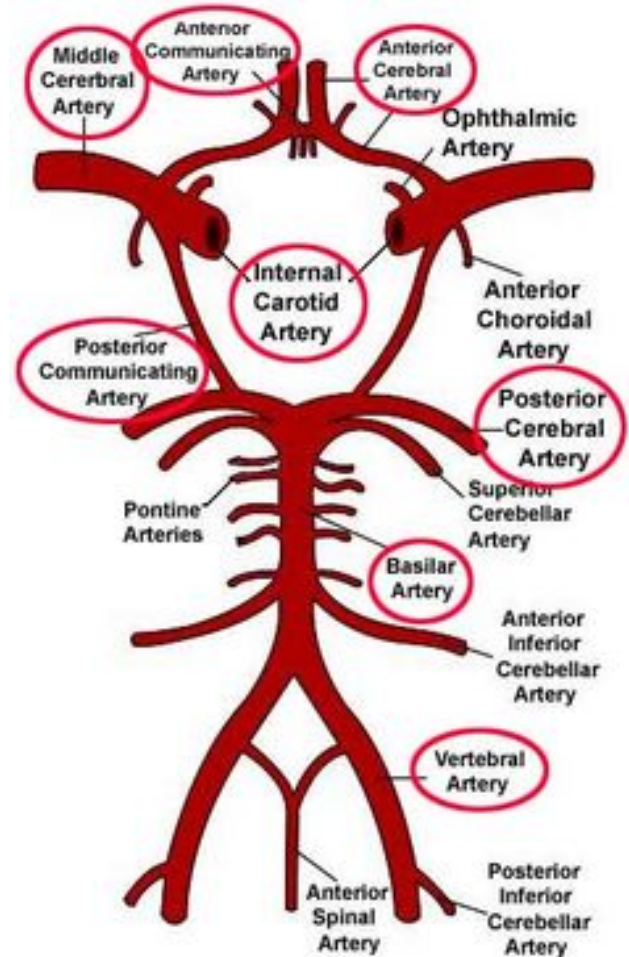
Consist of the following arteries:

- Anterior cerebral artery
- Middle cerebral artery
- Posterior cerebral artery
- Posterior communicating artery
- Anterior communicating artery >> connect the 2 anterior cerebral arteries

It is very important because it provide alternative pathway for blood to pass if there is any block (so it provided *collateral circulation*).

The circle of willis is common site for cerebral *Aneurysm* (the walls of artery become weak and thin and start to bulge). So if there is any increase in blood pressure may rupture the Aneurysm and then we will have a *stroke\ cerebrovascular accident (CVA)* (if the artery is blocked or ruptured) And that will result in **sudden death**. The second problem of Aneurysm is clot formation or *Thromboembolism*. If the clot is attached to the B.V wall we call it *Thrombus* if the clot moving we call it *embolism*.

Note: In the body wherever we have fluid not moving E.G urine, blood...etc. we will have problems like infection or clotting if it blood.



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