Blood Vessels to Brain

Neural Science

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Applied Computing Lab

Course: Master Ph.D Integrated
Presenter: Jongmin Yu

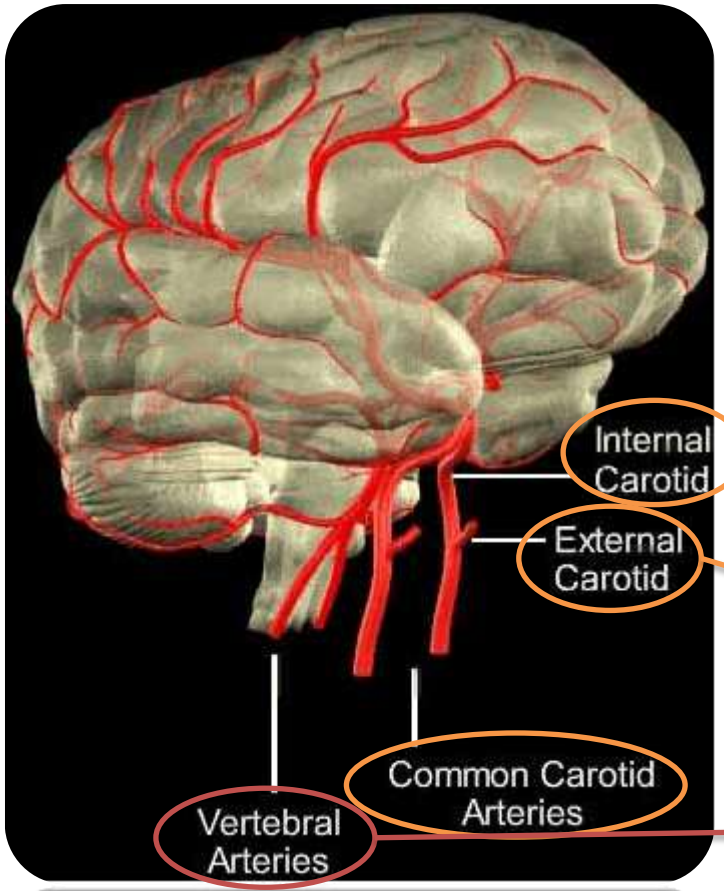
Contents

Blood vessels to brain

- Major blood vessels
- Circle of Willis
- Anterior cerebral artery
- Middle cerebral artery
- Posterior cerebral artery
- Lenticulostriate arteries

Blood vessels to brain

Brain blood vessels system



- Blood vessels that carry blood to the brain from the heart
- Carries the Oxygen and nutrients
- With each heartbeat, arteries carry about 20 to 25 percent of your blood to your brain.
- Common carotid arteries have two division.

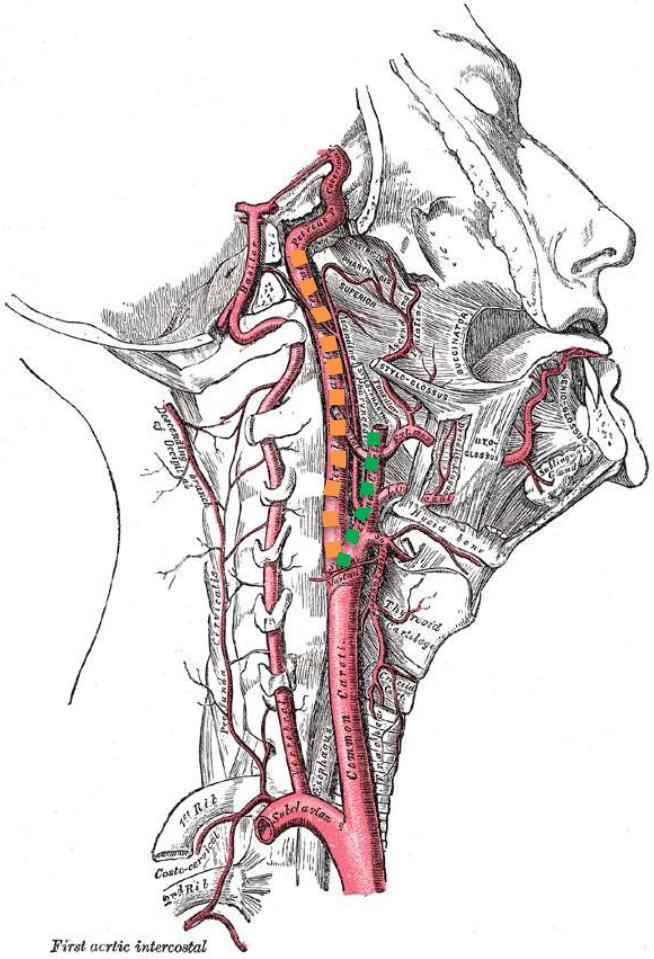
Blood supply to the anterior **three-fifths of cerebrum**, except for parts of the temporal and occipital lobes.

Blood supply to **Face** and **Scalp**

Blood supply the posterior **two-fifths of the cerebrum**, part of the cerebellum, and the **brain stem**.

Blood vessels to brain

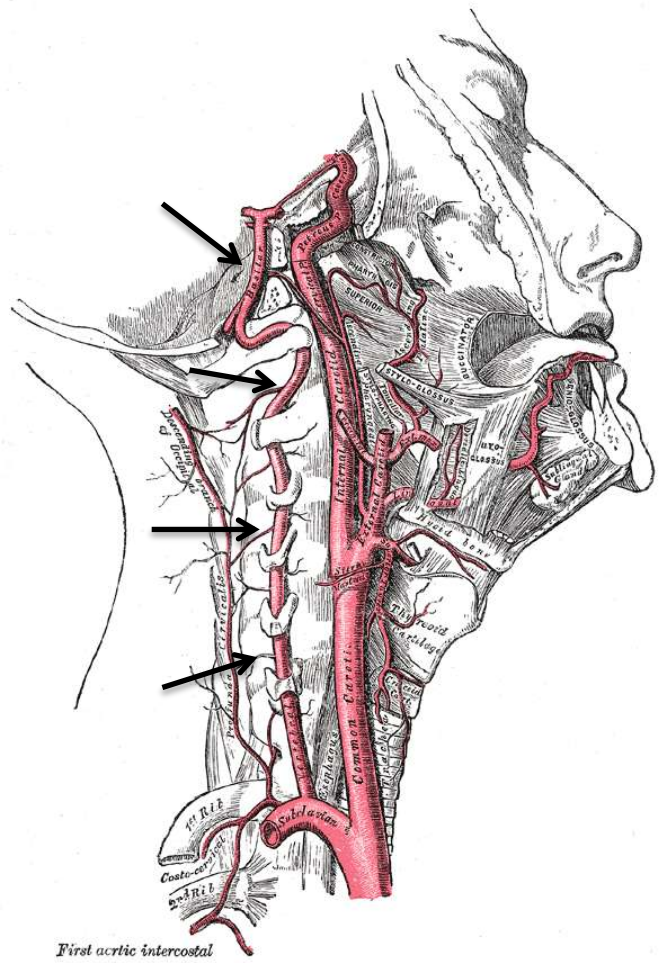
Common carotid arteries



- Supply the head and neck with Oxygenated Blood
- paired structure
- Divided by
  - Internal Carotid
    - the internal carotid artery supplies the brain.
  - External Carotid
    - nourishes other portions of the head(face, scalp, skull, and meninges)
- Decrease of blood supply is brings about some impairment in the function of the frontal lobes
  - numbness, weakness, or paralysis on the side of the body opposite to the obstruction of the artery.

Blood vessels to brain

Vertebro-basilar(Vertebral) Arteries

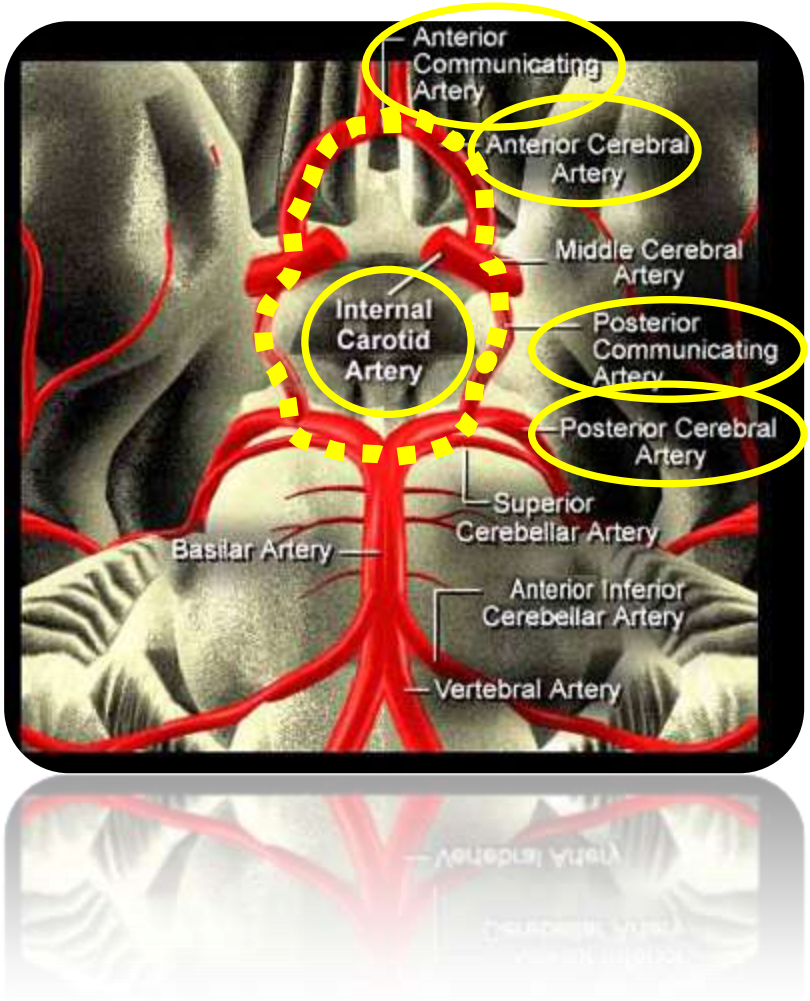


- Vertebral artery (VA)
  - major arteries of the neck.
  - branch from the subclavian arteries
  - supplies blood to the posterior part of the **circle of Willis**
- Basilar artery(BA)
  - one of the arteries that supplies the brain(Brainstem) with oxygen-rich blood.
  - supplies blood to the posterior part of the **circle of Willis**
- VA(2) + BA(1) =

  Vertebro-basilar system

Circle of Willis

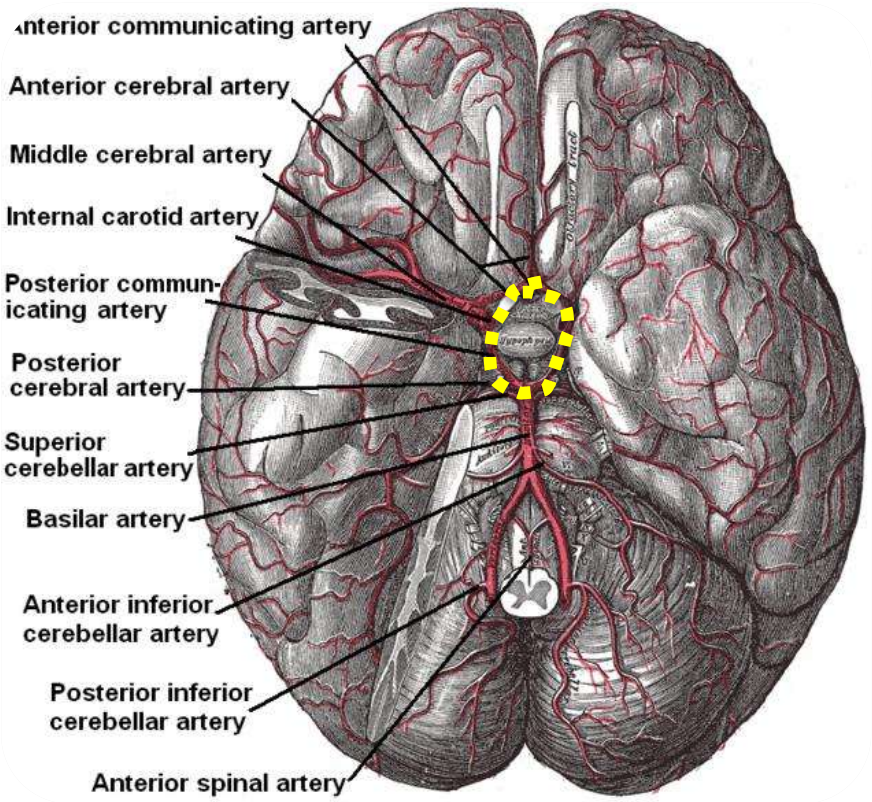
Component & Physiologic significance



- **Carotid** and **vertebro-basilar** arteries form a circle of communicating arteries Basilar artery(BA)
- Blood vessels alternative rule at occlusion
  - Creates redundancies or collaterals in the cerebral circulation.
  - **Collateral circulation**
- Other arteries arise and travel to all parts of the brain.(**Origin of arteries**)
  - The anterior cerebral artery (ACA)
  - The middle cerebral artery (MCA)
  - The posterior cerebral artery (PCA)

Circle of Willis

Origin of arteries



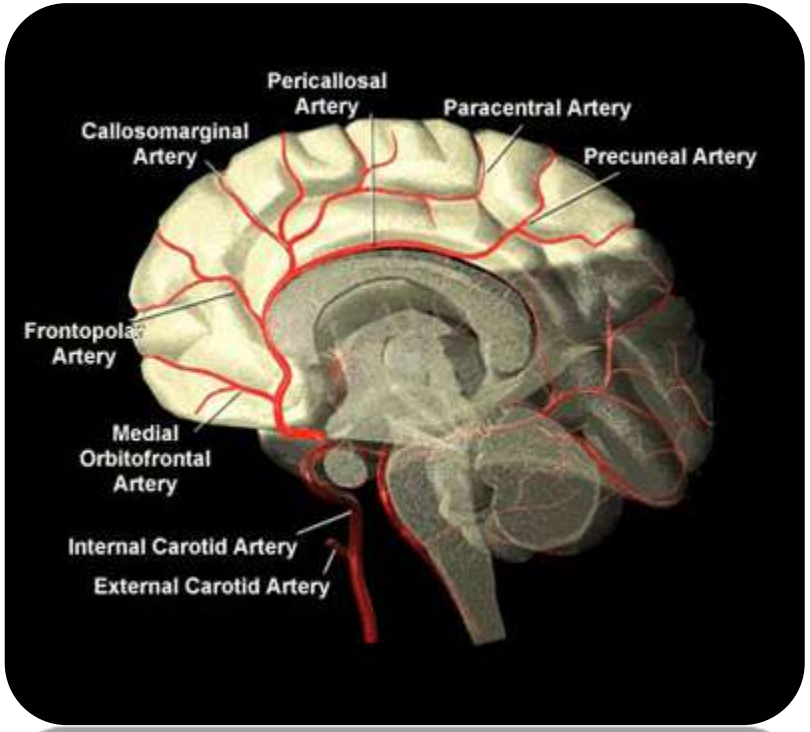
- Other arteries arise and travel to all parts of the brain.(**Origin of arteries**)
  - The anterior cerebral artery (ACA)
  - The middle cerebral artery (MCA)
  - The posterior cerebral artery (PCA)

- Common carotid arteries -> Internal carotid arteries
- Posterior communicating artery -> Internal carotid artery
- Posterior cerebral arteries -> Basilar artery
- Anterior communicating artery -> Anterior cerebral arteries

- **Collateral circulation**
  - If one part of the circle becomes blocked or narrowed (stenosed) or one of the arteries supplying the circle is blocked or narrowed

Anterior Cerebral Artery

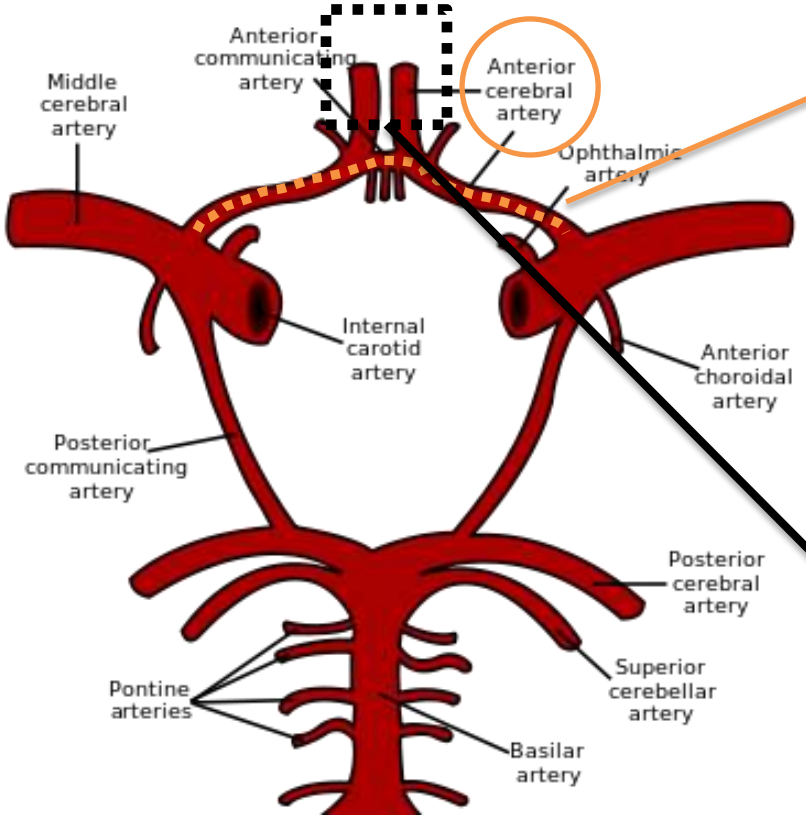
Anterior Cerebral Artery (ACA)



- Extends upward and forward from the internal carotid artery.
- ACA arise from the internal carotid artery and are part of the Circle of Willis.
- Areas supplied
  - The medial surface of the **frontal lobe** by the medial orbito-frontal artery, and parietal lobes
    - Control logical thought, personality and voluntary movement(leg)
    - both anterior cerebral territories are affected, profound mental symptoms (*Akinetic mutism*)
  - The anterior four- fifths of the corpus callosum

Anterior Cerebral Artery

Occlusion in ACA

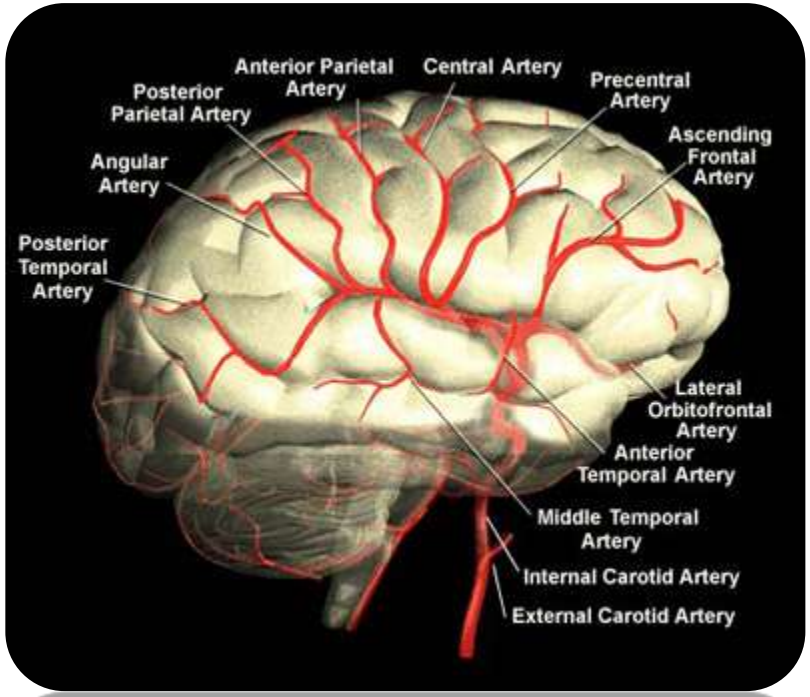


- If stroke occurs prior to the anterior communicating artery it is usually well tolerated secondary to collateral circulation.

- Occlusion of A2 segment
  - Paralysis or weakness of the contralateral foot and leg
  - Cortical Sensory loss in the contralateral foot and leg
  - Gait apraxia Impairment of gait and stance
  - Abulia akinetic mutism, slowness and lack of spontaneity
  - Urinary incontinence which usually occurs with bilateral damage in the acute phase
  - Frontal Cortical release reflexes: Contralateral grasp reflex, sucking reflex, gegenhalten(paratonic rigidity)

Middle Cerebral Artery

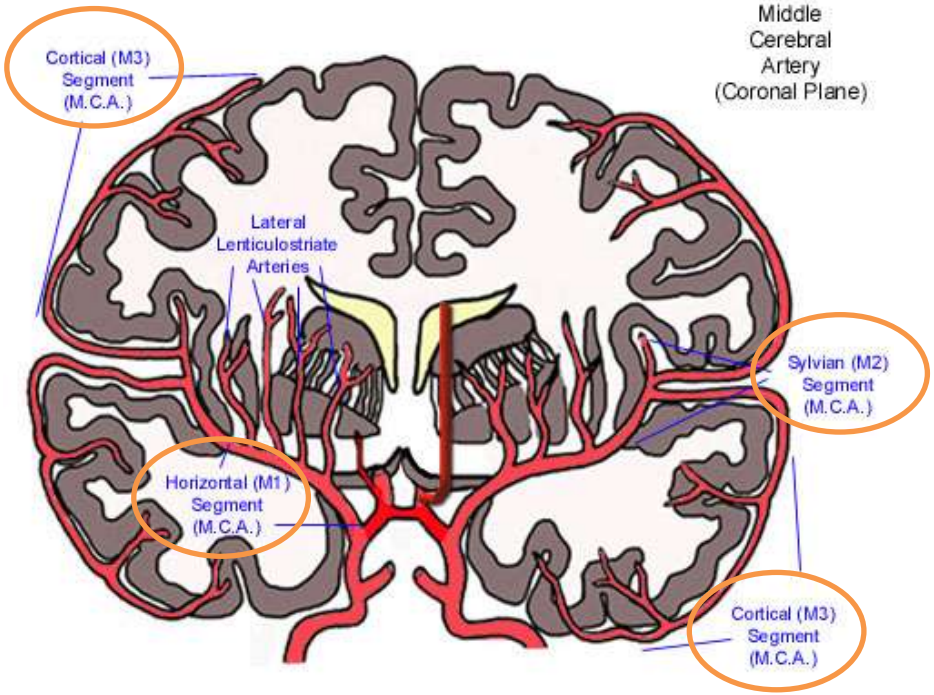
Middle Cerebral Artery (MCA)



- The largest branch of the internal carotid artery
- The middle cerebral artery is the artery most often occluded in stroke.
- Areas supplied
  - The bulk of the lateral surface of the hemisphere; except for the superior inch of the frontal and parietal lobe (anterior cerebral artery), and the inferior part of the temporal lobe.
  - Superior division supplies lateroinferior frontal lobe
  - Inferior division supplies lateral temporal lobe
  - Deep branches supply the basal ganglia as well as the internal capsule

Middle Cerebral Artery

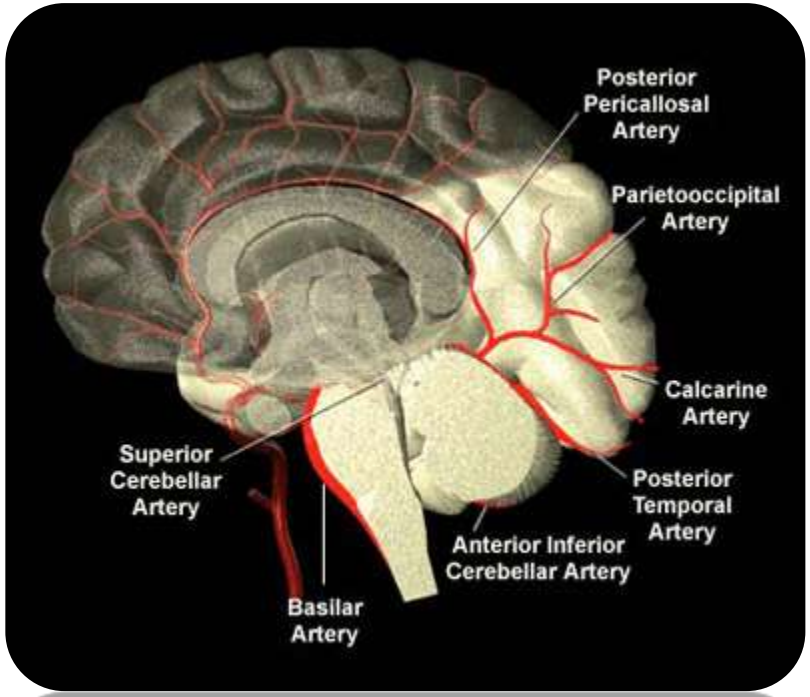
Occlusion in MCA



- Areas supplied
  - **Frontal lobes**, lateral surface of the **temporal** and **parietal lobes**
    - Paralysis or weakness of the contralateral face and arm.
    - Sensory loss of the contralateral face and arm.
    - Damage to the dominant hemisphere (usually the left hemisphere)results in aphasia
    - Damage to the non-dominant hemisphere (usually the right hemisphere) results in contralateral neglect syndrome

Posterior Cerebral Artery

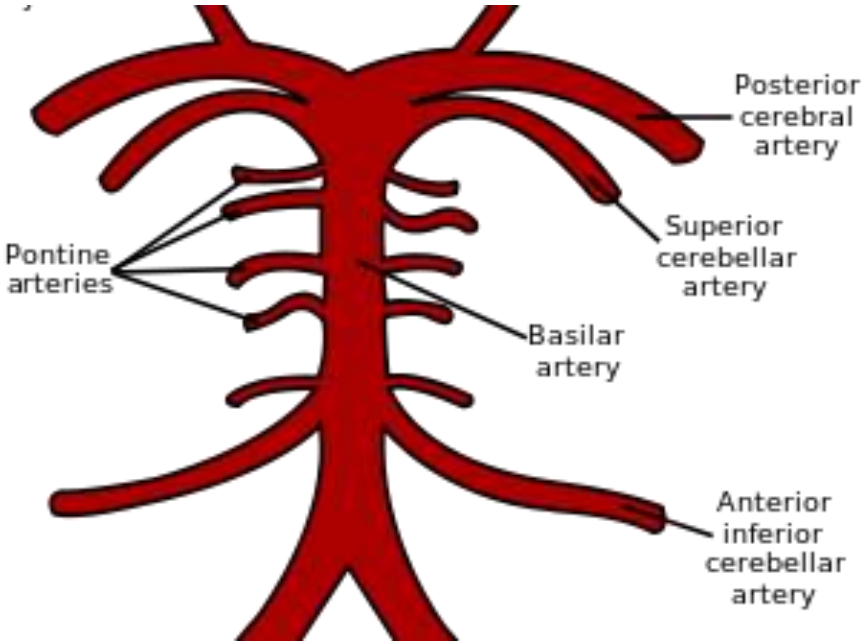
Posterior Cerebral Artery (PCA)



- One of a pair of blood vessels that supply oxygenated blood to the posterior aspect of the brain
- Near the intersection of the posterior communicating artery and the basilar artery
- Most individuals from the basilar artery.
- Areas supplied
  - The Temporal and occipital lobes of the left cerebral hemisphere and the right hemisphere.

Posterior Cerebral Artery

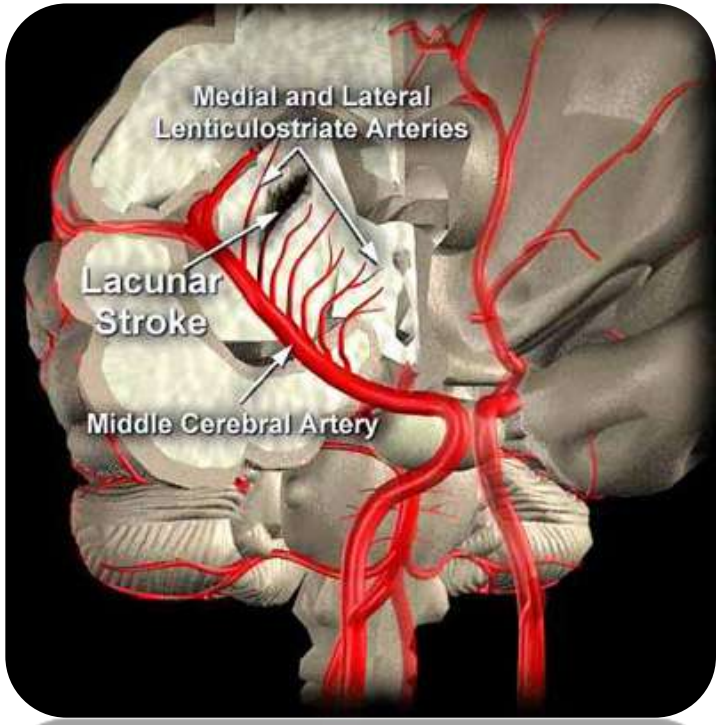
Occlusion in PCA



- Areas supplied
  - The Temporal and occipital lobes of the left cerebral hemisphere and the right hemisphere. Then if occur Occlusion.
    - Contralateral loss of pain and temperature sensations.
    - Visual field defects
    - Prosopagnosia with bilateral obstruction of the lingual and fusiform gyri.
    - Superior Alternating
    - Contralateral deficits of facial nerve, vagus nerve and hypoglossal nerve
    - Ipsilateral deficit of oculomotor nerve
    - Horner's Syndrome

Lenticulostriate Arteries

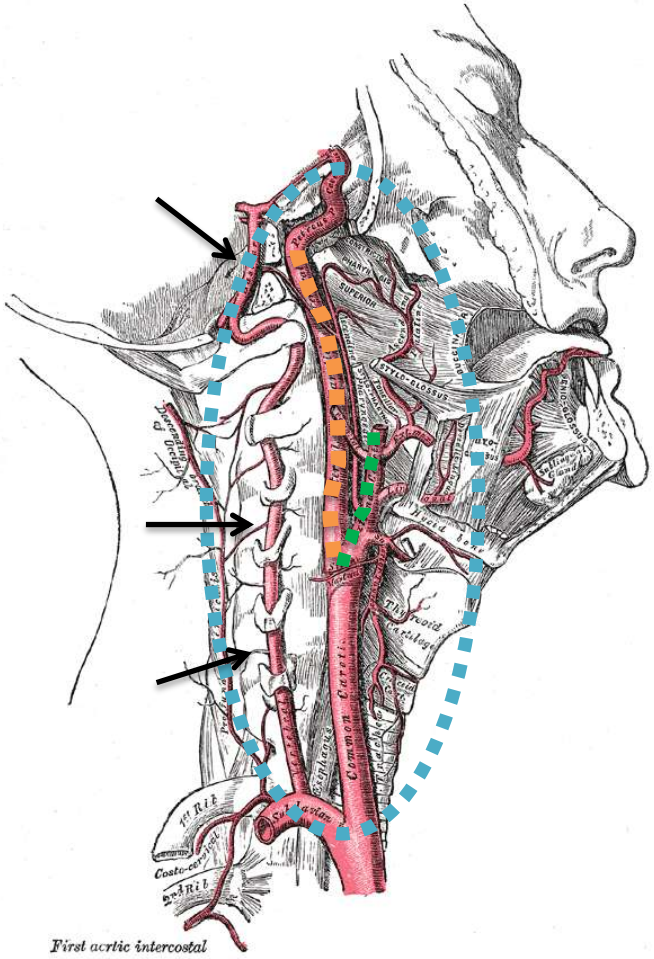
Lenticulostriate Arteries



- Small, deep penetrating arteries
  - provides blood to the brain's deep structures.
- Branch from the middle cerebral artery
- Refer to as lacunar strokes
  - high incidence in patients with chronic hypertension. (20% of all stroke)

Summary

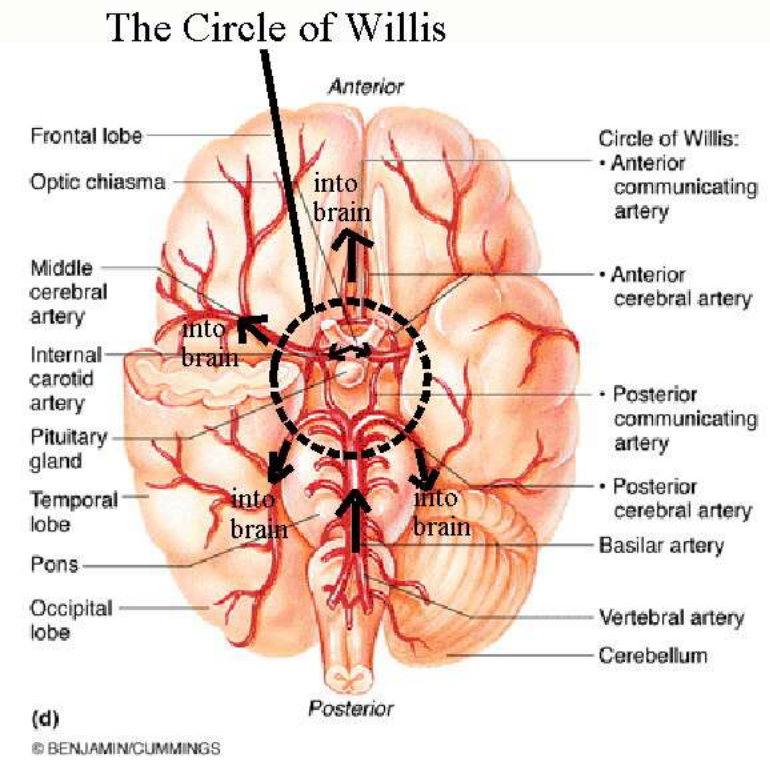
Common carotid arteries
Vertebro-basilar(Vertebral) Arteries



- Common carotid arteries
  - Supply the head and neck with Oxygenated Blood
  - paired structure
  - Divided by
    - Internal Carotid
    - External Carotid
- Vertebro-basilar arteries
  - Vertebral artery (VA)
    - major arteries of the neck.
  - Basilar artery(BA)
    - one of the arteries that supplies the brain(Brainstem) with oxygen-rich blood.

Summary

Circle of Willis



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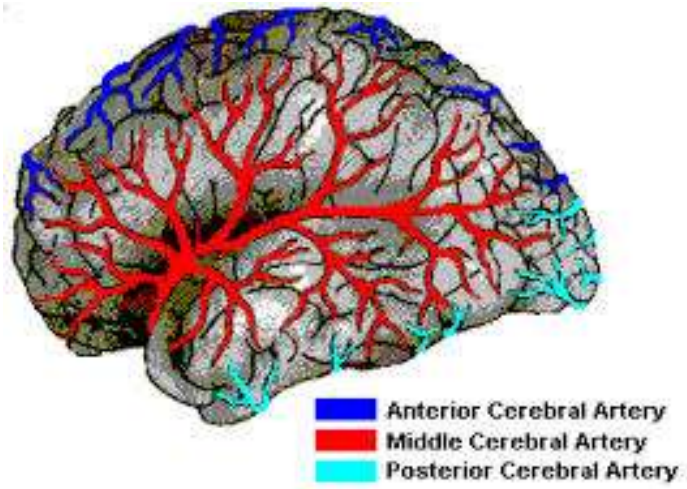
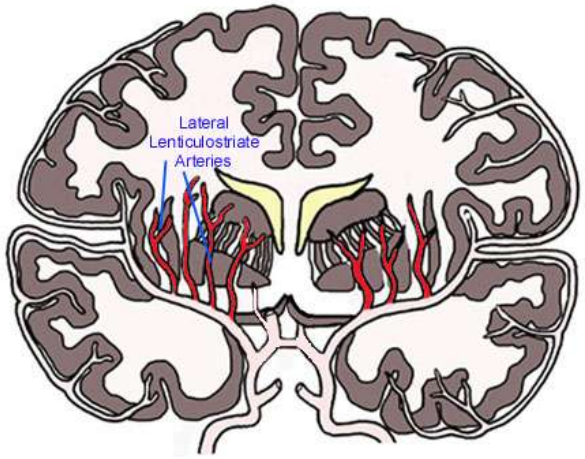
Summary

ACA & MCA & PCA





- **Anterior Cerebral Artery**
  - Extends upward and forward from the internal carotid artery.
  - Supplied medial surface of the **frontal lobe** and **parietal lobes**
- **Middle Cerebral Artery**
  - The largest branch of the internal carotid artery
  - **Frontal lobes**, lateral surface of the **temporal** and **parietal lobes**
  - the artery most often occluded in stroke.
- **Posterior Cerebral Artery**
  - a pair of blood vessels that supply oxygenated blood to the posterior aspect
  - Supplied the Temporal and occipital lobes
- **Lenticulostriate Arteries**
  - Small, deep penetrating arteries
    - provides blood to the brain's deep structures.

Reference

Reference of this presentation

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- **Lenticulostriate Arteries**
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Thank you for watching