

Blood Supply of the Brain and Spinal Cord

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Objectives

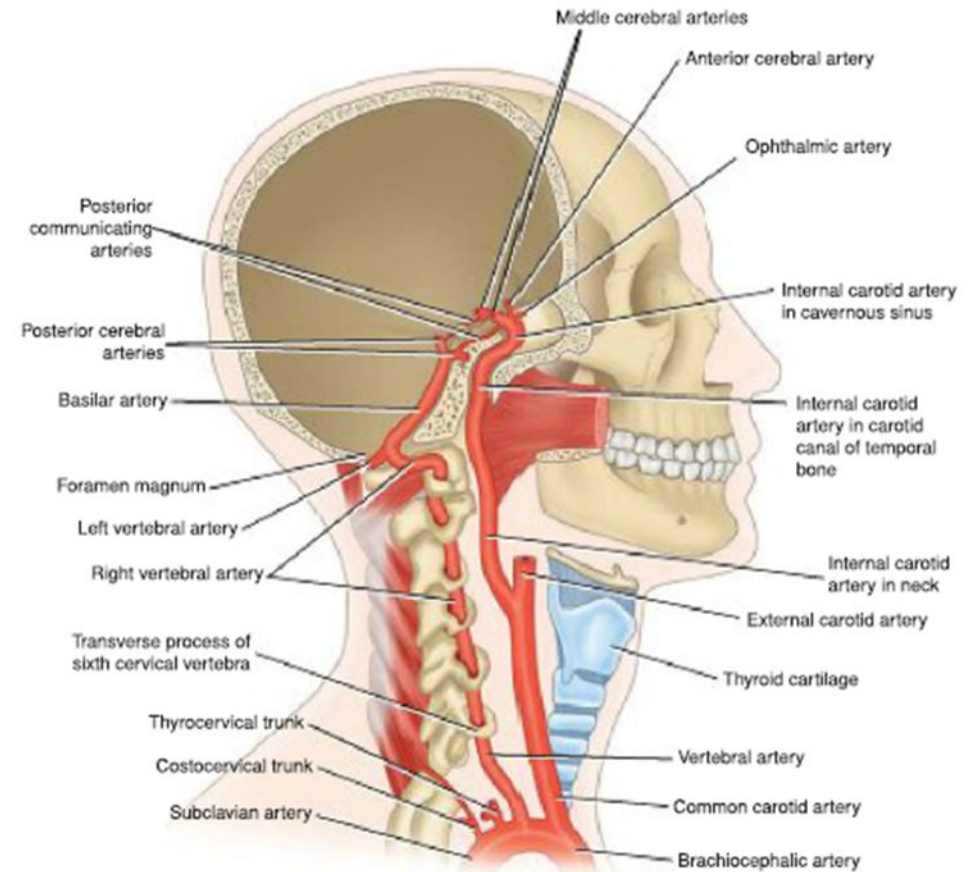
- Main arteries and veins supplying the brain and spinal cord
- Areas of the cerebral cortex and spinal cord supplied
 - Their dysfunction from impaired blood supply
- Circle of Willis
- Blood supply of internal capsule

Arteries of the brain

- Two internal carotid (the major supply)
- Two vertebral arteries
- Their branches anastomose on the Inferior surface of the brain to form the circle of Willis

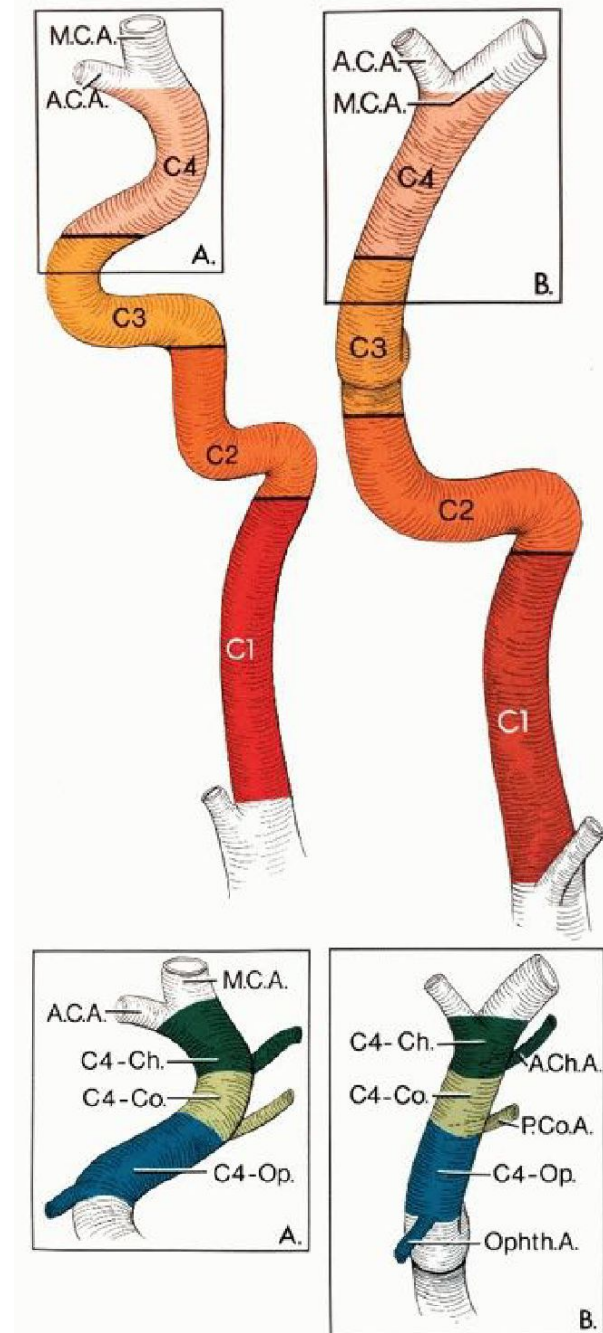
Internal Carotid Artery (ICA)

- Begins at the bifurcation of the common carotid artery (neck)
- Ascends → carotid canal of the temporal bone → cavernous sinus → Enters dura & arachnoid medial to anterior clinoid
- Bifurcates to MCA & ACA at the medial end of sylvian fissure



ICA Segments & Intracranial branches

- Segments
 - Cervical
 - Petrous
 - Cavernous
 - Intracranial (supraclinoid)
 - Ophthalmic (Ophth A)
 - Communicating (PComA)
 - Choroidal (A.Ch.A)
 - A.Ch.A. → inferior horn → choroid plexus → Also crus cerebri, optic tract & internal capsule



ACA & MCA

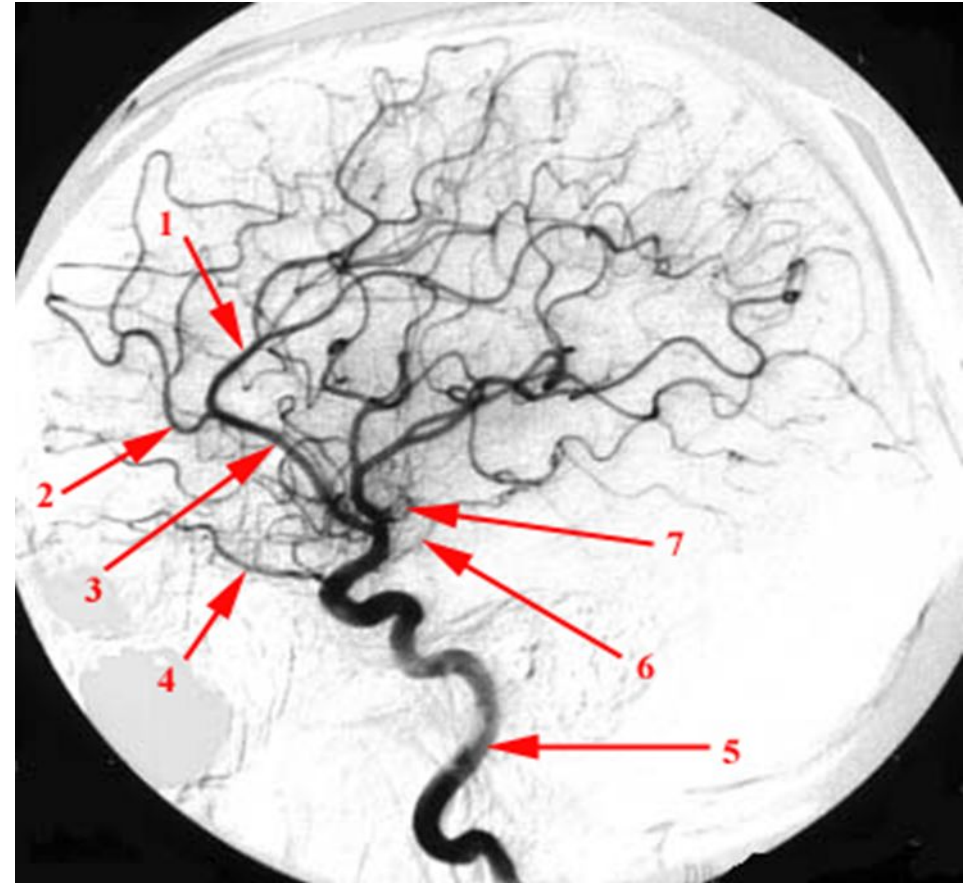
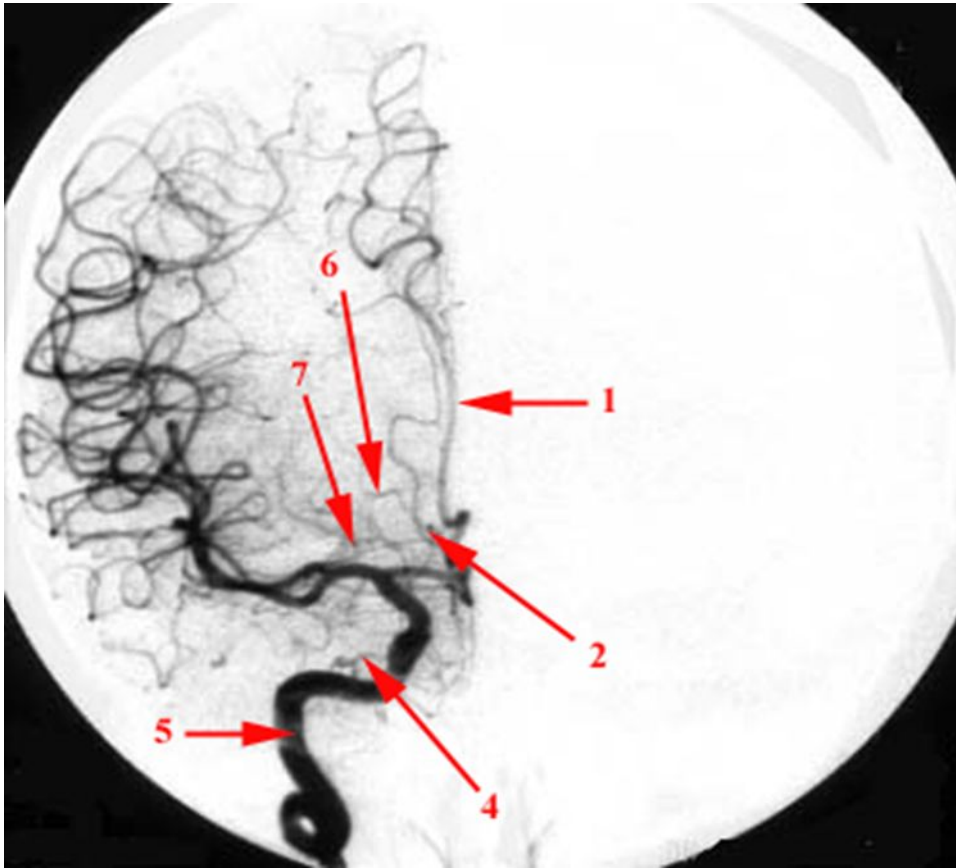
ACA

- Smaller branch
- Direction anterior-medial
- Supplies medial surface (leg)
- AComA join the 2 ACA
- Branches → anterior perforated substance → parts of the lentiform and caudate nuclei and the internal capsule

MCA

- Larger branch (ICA continuation)
- Runs laterally in the lateral cerebral sulcus (sylvian fissure)
- Supplies lateral surface (Face & arm)
- Branches → anterior perforated substance → parts of the lentiform and caudate nuclei and the internal capsule

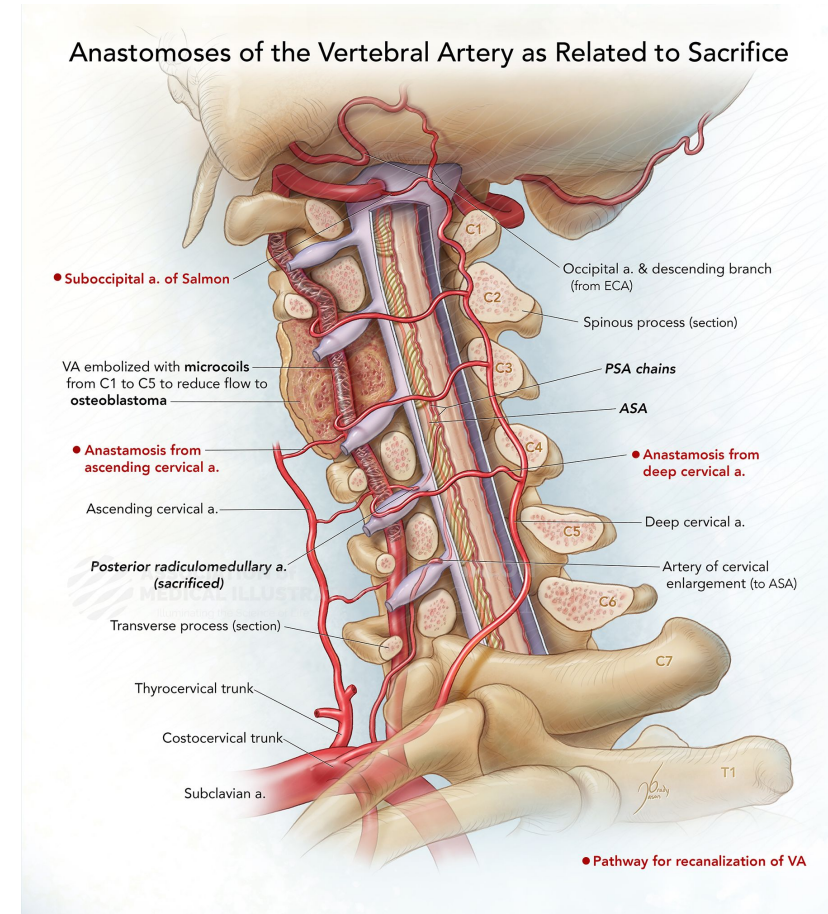
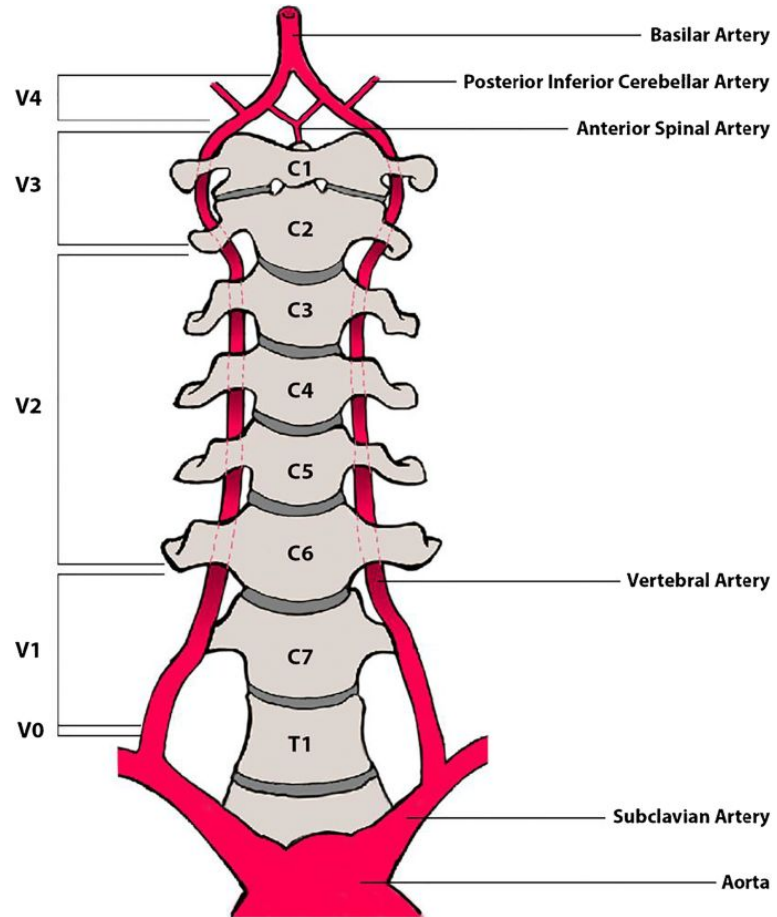
ICA angiogram AP & Lat



Vertebral Artery (VA)

- A branch of the first part of the subclavian artery
- Passing through the foramina in the transverse processes of the upper six cervical vertebrae
- It enters the skull through the foramen magnum and pierces the dura mater and arachnoid
- Passes upward, forward, and medially around the medulla
- At the lower border of the pons, it joins the vessel of the opposite side to form the basilar artery.

Vertebral Artery (VA)



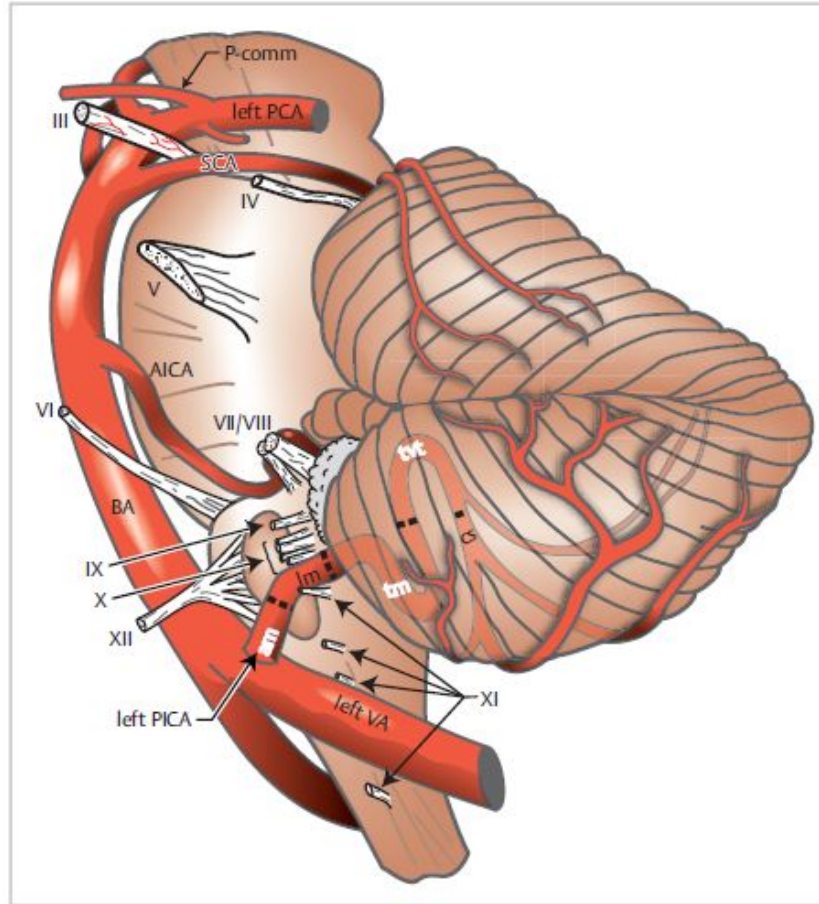
VA branches (intracranial)

- Meningeal branches
- Posterior spinal artery (2)
- Anterior spinal artery (1)
- Posterior inferior cerebellar artery (PICA) → lateral medullary syndrome (or Wallenberg Syndrome):
 - Vertigo, diplopia, dysarthria, ipsilateral Horner's syndrome, numbness (ipsilateral face and contralateral limb)
 - No limb weakness. No LOC
 - ❖ PICA supplies choroid plexus of 4th V
- Medullary branches

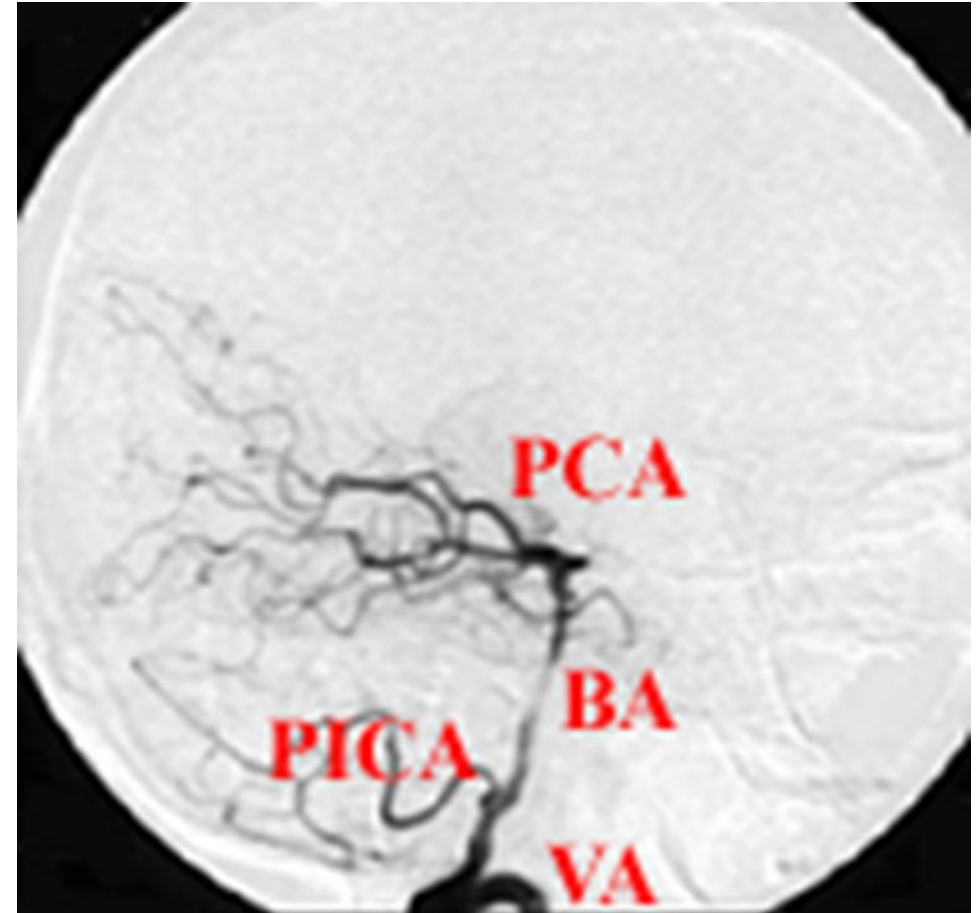
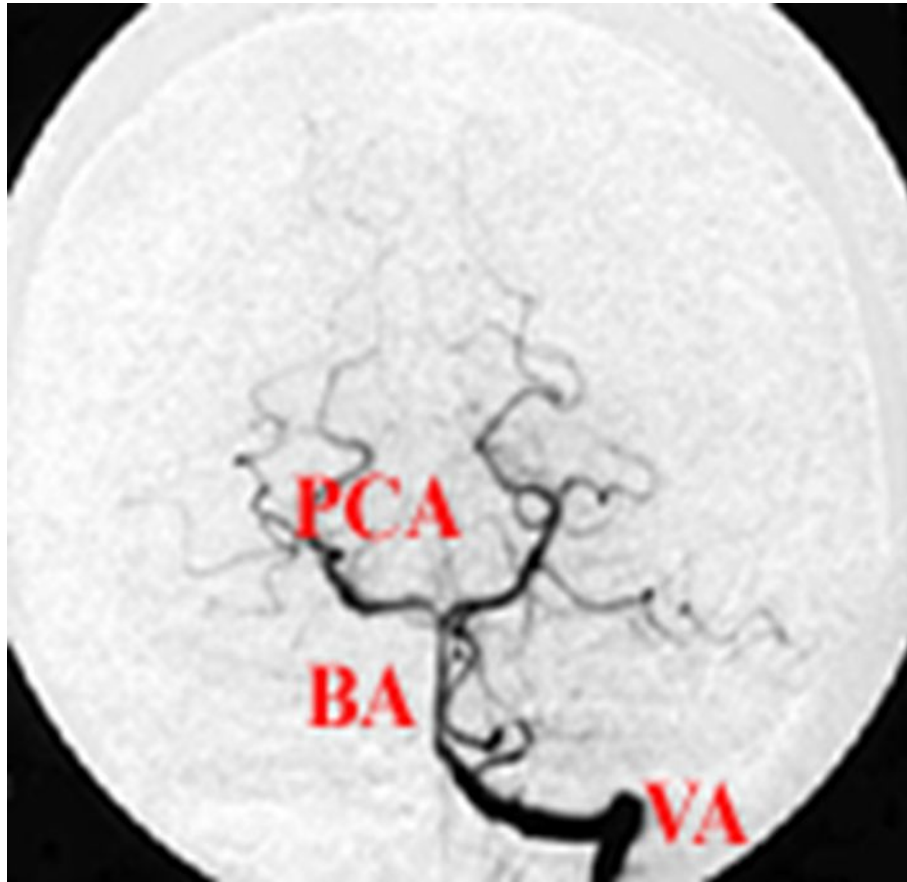
Basilar Artery (BA)

- Formed by the union of the two vertebral arteries
- Ascends in a groove on the anterior surface of the pons
- At the upper border of the pons, it divides into the two posterior cerebral arteries (PCA)
- Branches:
 - Pontine Branches
 - Labyrinthine artery
 - AICA
 - SCA
 - PCA → visual cortex, choroid plexus in inferior horn & 3d V.

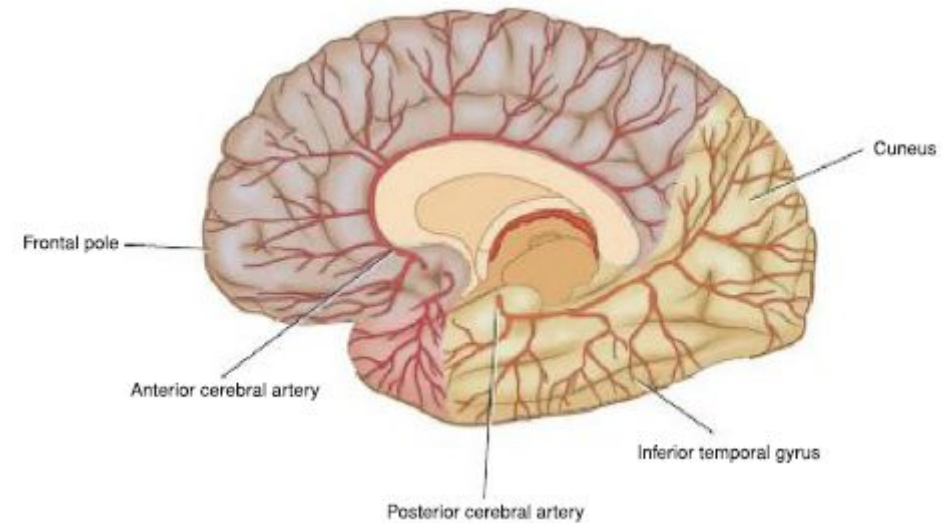
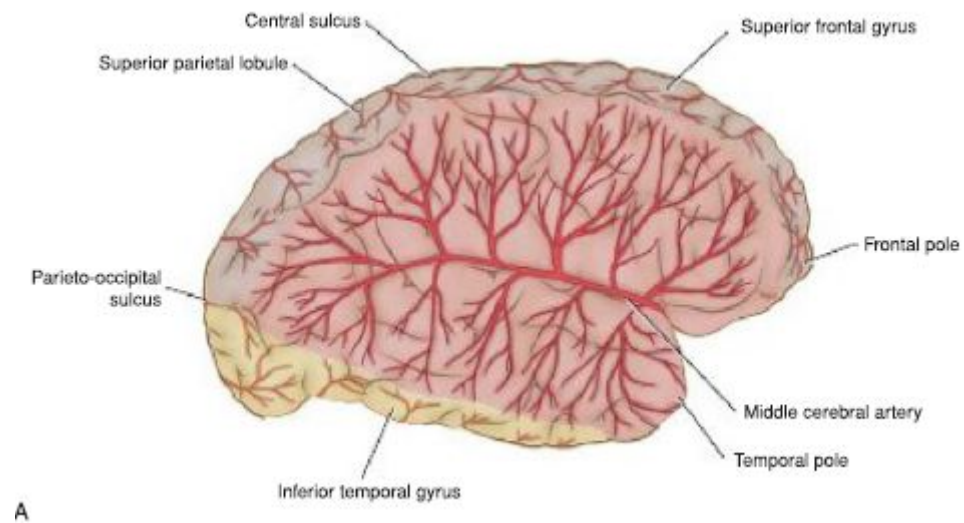
Posterior circulation (VA, BA)



Vertebral angiogram AP & Lat



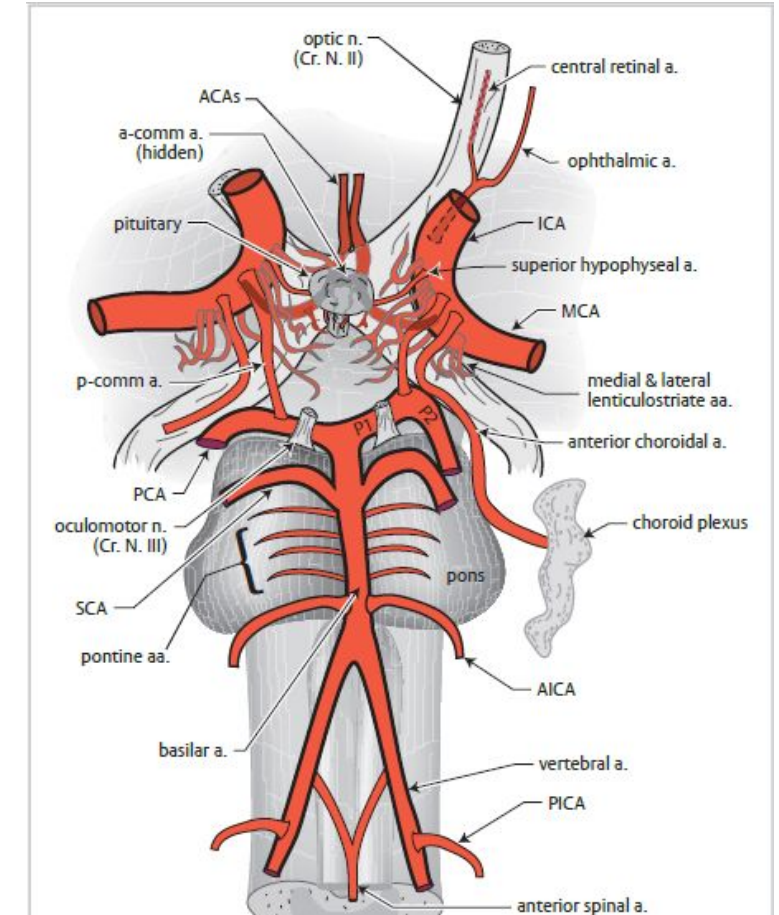
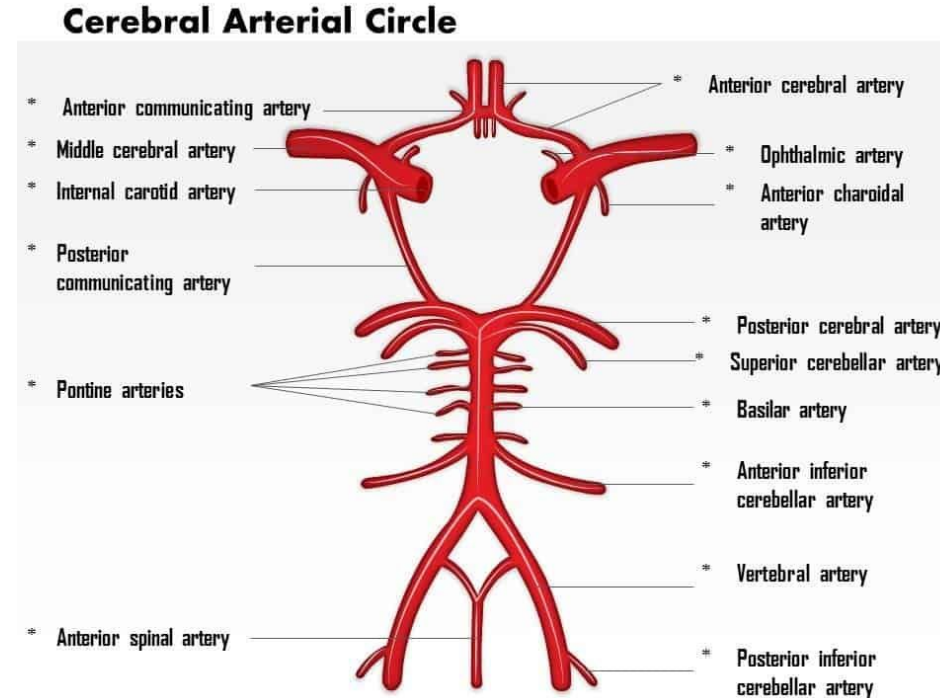
Areas supplied by the cerebral arteries



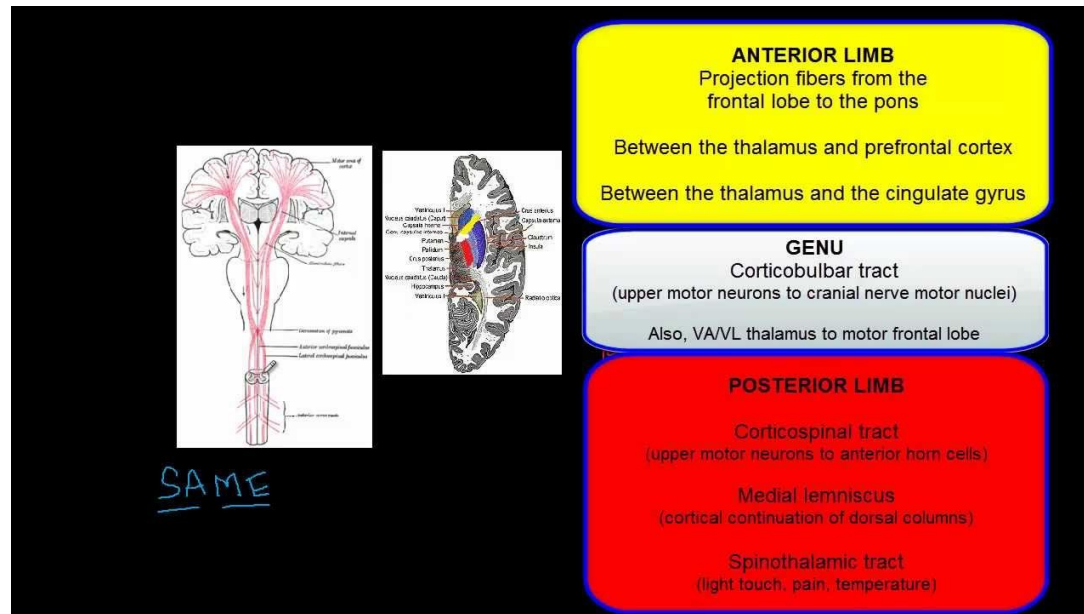
Circle of Willis (10 arteries)

- A Com A
- 2 ACA
- 2 ICA
- 2 P Com A
- 2 PCA
- Basilar

- ❖ Blood distribution
- ❖ Variations



Function & Blood supply of Internal Capsule



BLOOD SUPPLY OF INTERNAL CAPSULE

ANTERIOR LIMB

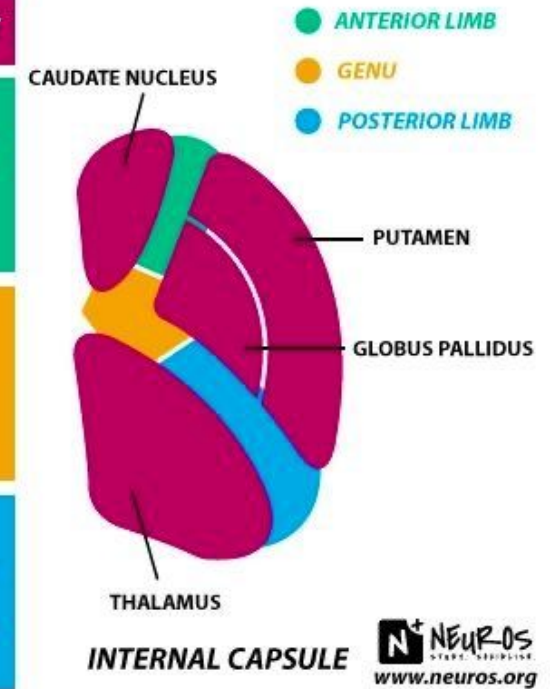
Upper part: lenticulo-striate branches of middle cerebral artery
Lower part: recurrent branch (Heubner artery) of anterior cerebral artery

GENU

Upper part: lenticulo-striate branches of middle cerebral artery
Lower part: direct branches of internal carotid and recurrent branch (Heubner) of anterior cerebral arteries

POSTERIOR LIMB

Upper part: lenticulo-striate branches of middle cerebral artery
Lower part: anterior choroidal artery (branch of internal carotid artery)



Arteries to Specific Brain Areas

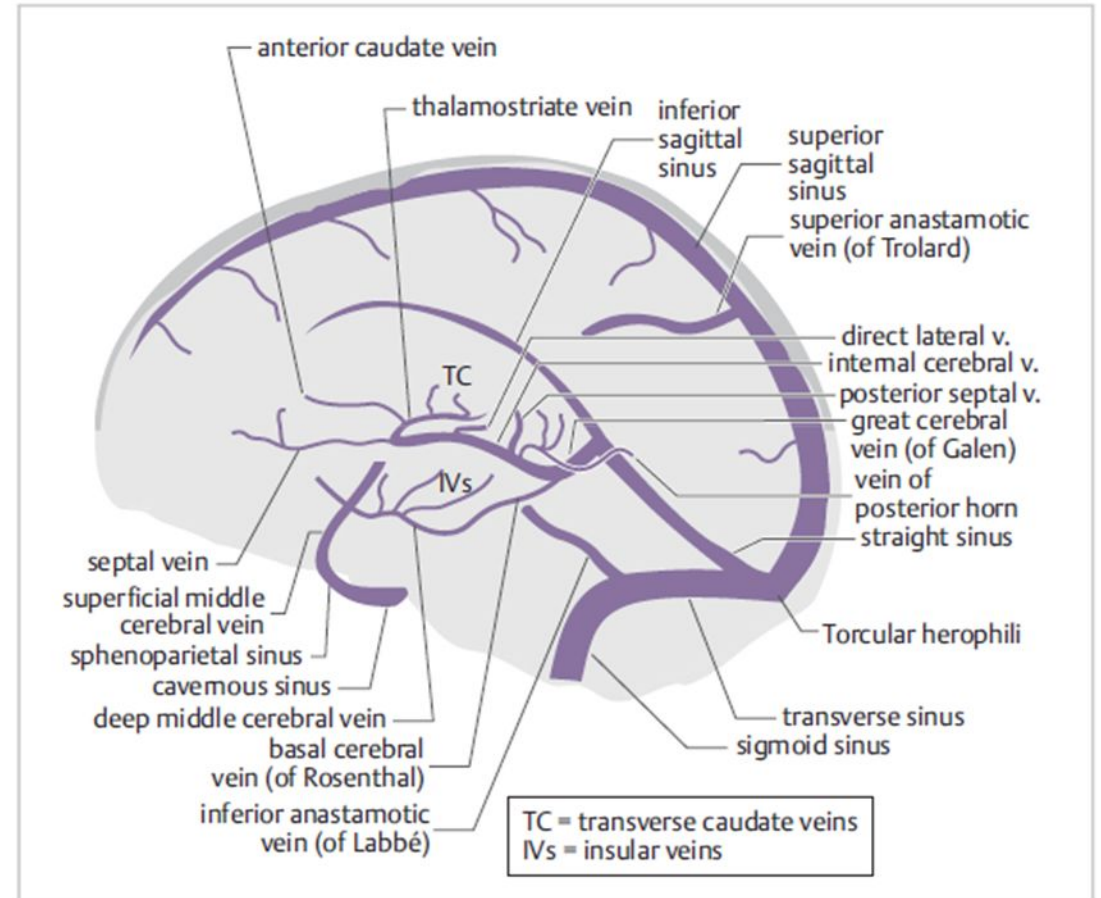
Supply	Area
Mainly by the medial and lateral striate central branches of MCA. <i>ACA</i>	Corpus striatum & internal capsule
P Com A, Basilar, PCA	Thalamus
PCA, Basilar, SCA	Midbrain
Basilar, SCA, AICA	Pons
VA, PICA, Basilar, Anterior & Posterior spinal art.	Medulla oblongata
SCA, AICA, PICA	Cerebellum

Control of cerebral blood flow

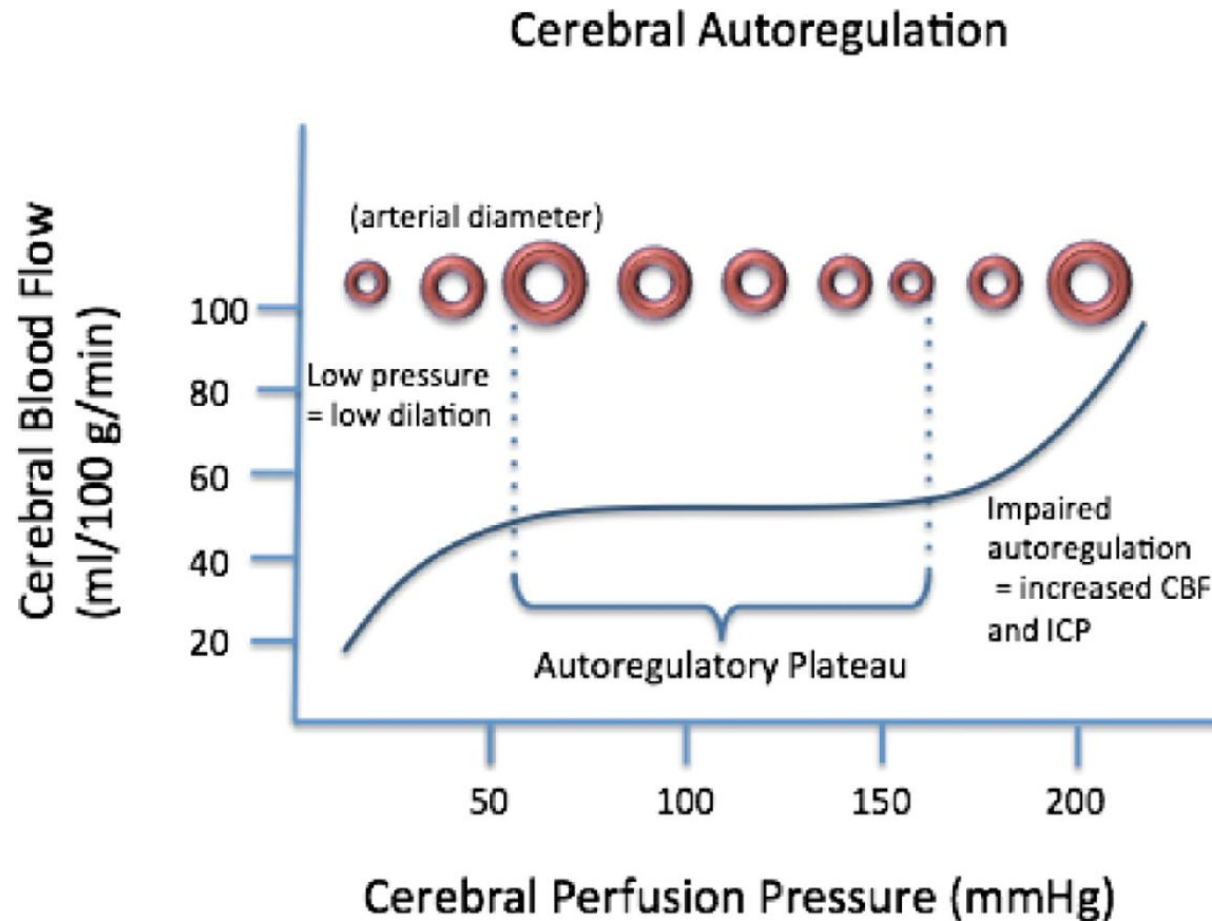
- A rise in CO_2 and H^+ ion concentration & a lowering of the O_2 tension
→ a vasodilatation

Veins of the Brain

- Thin wall (no muscular tissue)
- No valves
- Drain into the cranial venous sinuses



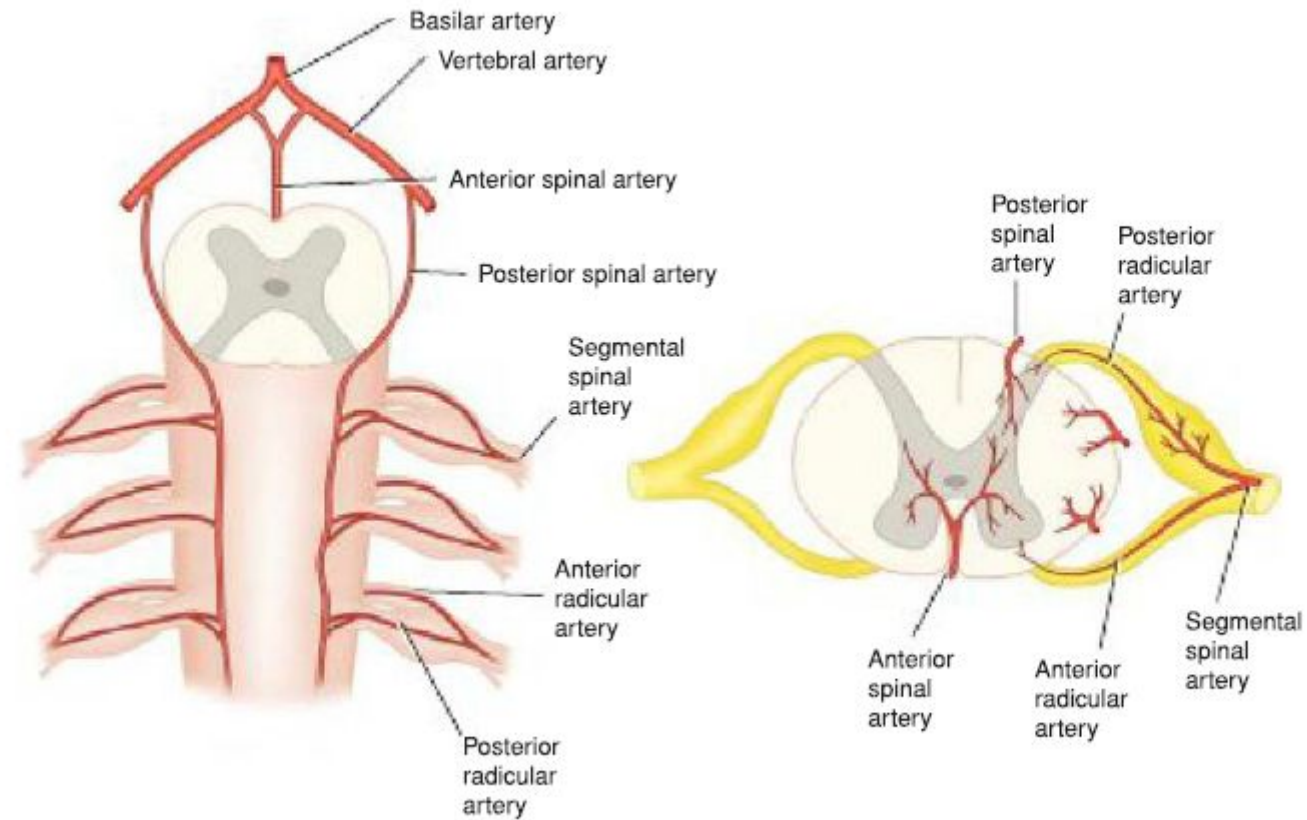
Cerebral Autoregulation



Spinal cord arteries

- Longitudinally running
- Two posterior spinal arteries (supplies posterior 1/3 of the cord)
- One anterior spinal artery (supplies anterior 2/3 of the cord)
- Reinforced by small segmentally arranged arteries:
 - Great anterior medullary [artery of Adamkiewicz](#): from the aorta, in the lower thoracic, unilateral, left side, supplies lower 2/3 of cord.

Spinal cord arteries



Clinical Notes

- Cerebrovascular disease is still responsible for about 50% of all adult neurologic hospital admissions
- If the blood flow to the brain is completely cut (ex. cardiac arrest):
 - 5-10 sec. → LOC
 - 1 min → Neuronal function cease
 - 4 min → Irreversible damage

Arterial occlusion

- ACA occlusion (distal to A com A):
 - Contralateral leg & foot weakness & sensory loss
 - Personality changes
- MCA occlusion:
 - Contralateral hemiparesis and hemisensory loss in the face and arm
 - Aphasia (mostly if Lt side affected)
 - Contralateral homonymous hemianopia (optic radiation)
- PCA occlusion
 - Contralateral homonymous hemianopia with macular sparing (occipital)
 - Impairment of memory (temporal)

Arterial occlusion

- ICA occlusion: Like MCA
- Vertebrobasilar artery occlusion:
 - Pain and temperature sensory loss (ipsilateral face, contralateral body)
 - Hemianopia or complete cortical blindness
 - Ipsilateral loss of the gag reflex, dysphagia, and hoarseness
 - Vertigo, nystagmus, nausea, and vomiting
 - Ipsilateral Horner syndrome
 - Ipsilateral ataxia and other cerebellar signs
 - Unilateral or bilateral hemiparesis
 - Coma

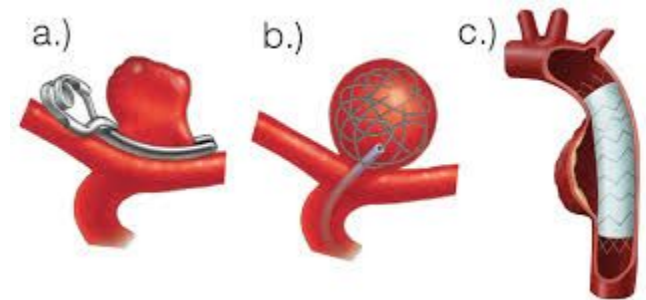
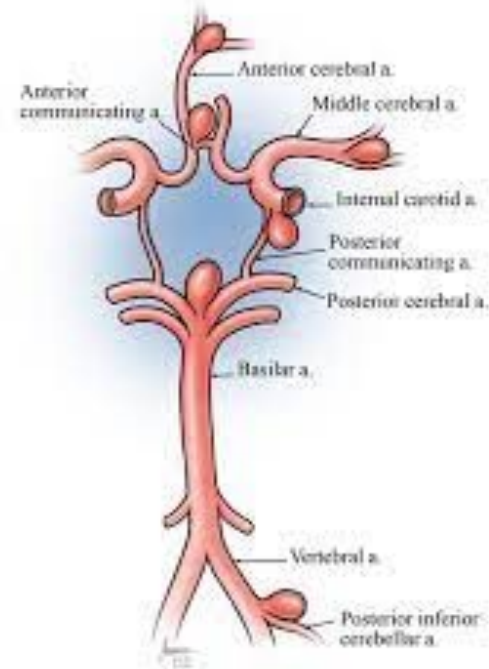
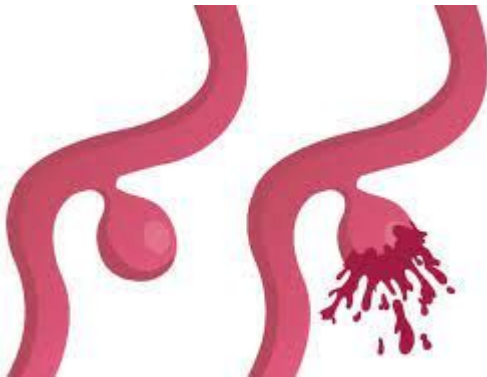
Cerebral Blood Flow Impairment

Main Causes:

- Diseases that produce alteration in blood pressure (Postural hypotension, heart disease,...)
- Diseases of arterial walls (atheroma)
- Diseases that result in blockage of the arterial lumen (thrombus, fat globules)

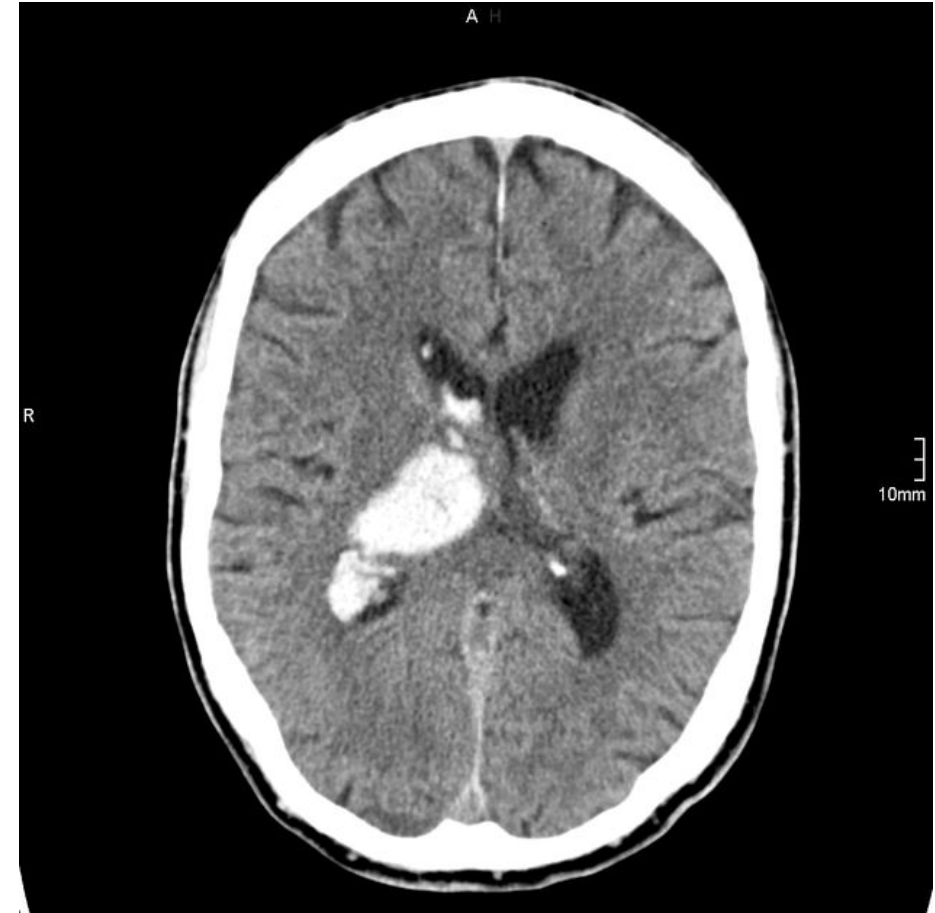
Cerebral Aneurysms

- Dilatation of the arterial wall
- Usually at branching points of major arteries
- Presentation:
 - SAH
 - Pressure symptoms



Cerebral hemorrhage

- HTN
- Rupture of the thin-walled lenticulostriate arteries
- Basal ganglia hemorrhage
- Damage to corticonuclear and corticospinal fibers (IC)
- Coma & Contralateral hemiplegia





For you!