

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 4 vessels

2 carotid
2 vertebral

anterior circulation

- Two internal carotid (the major supply)

- Two vertebral arteries post. circulation

in Base of

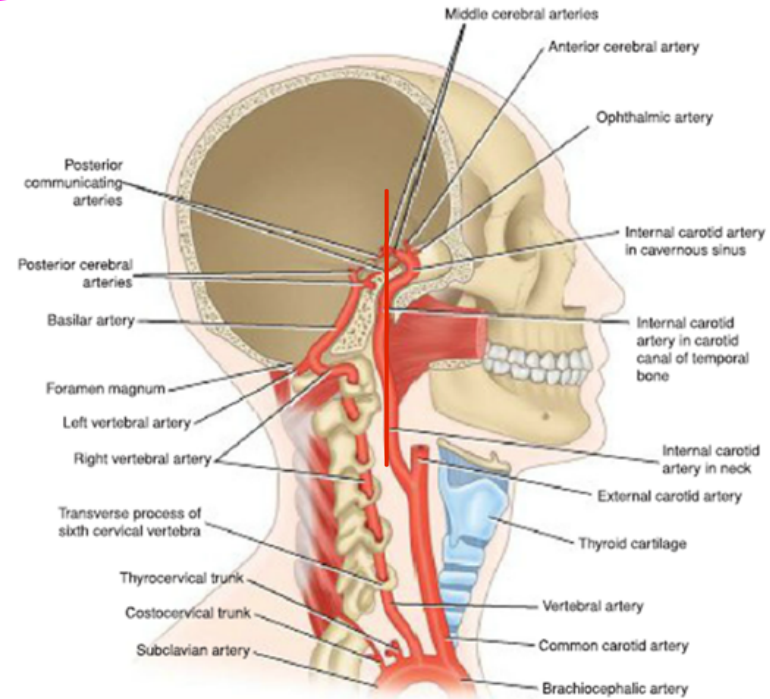
- Their branches anastomose on the Inferior surface of the brain to form the circle of Willis

دائرة د قاع الدماغ
من فروع الشرايين
A و B

Internal Carotid Artery (ICA)

1-6 vertebra

- 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



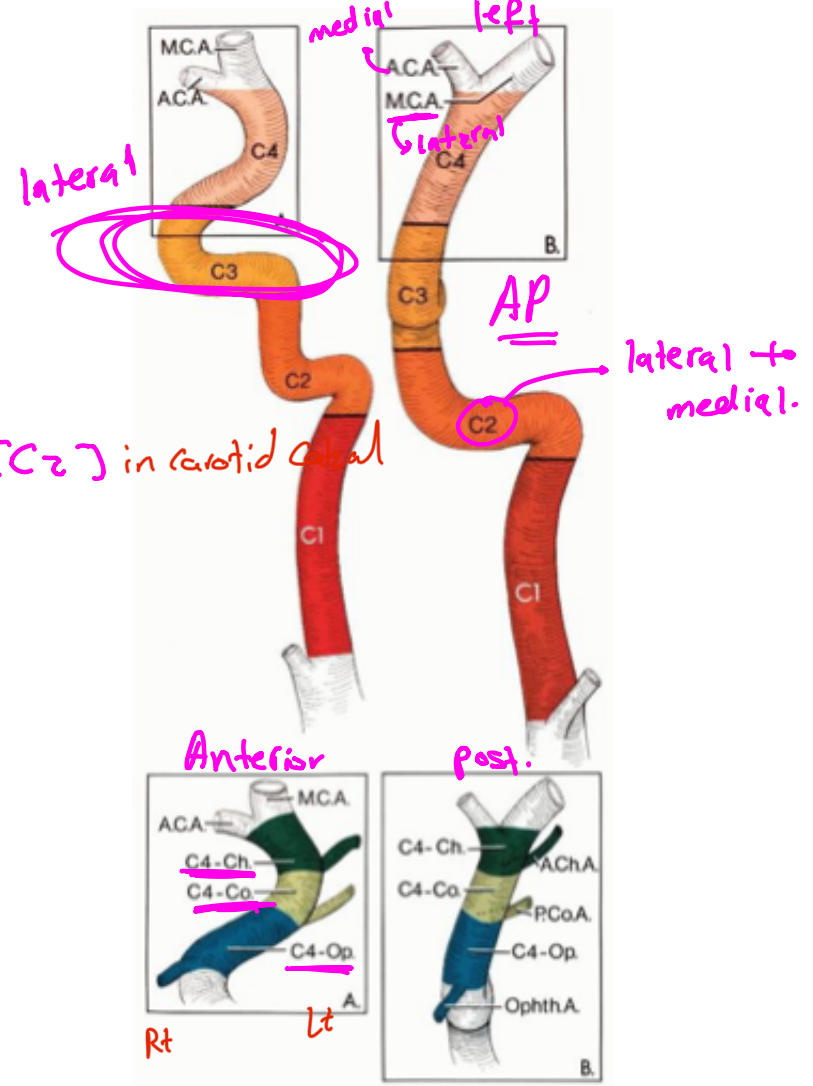
ICA Segments & Intracranial branches

• Segments (4)

- Cervical C1
- Petrous horizontal in temporal bone. [C2] in carotid canal
- Cavernous [C3] around sella turcica
- Intracranial (supraclinoid) [C4]

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

بتهری جوا
dura



cerebral

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

medial Art.

basal ganglia
and medial
capsule

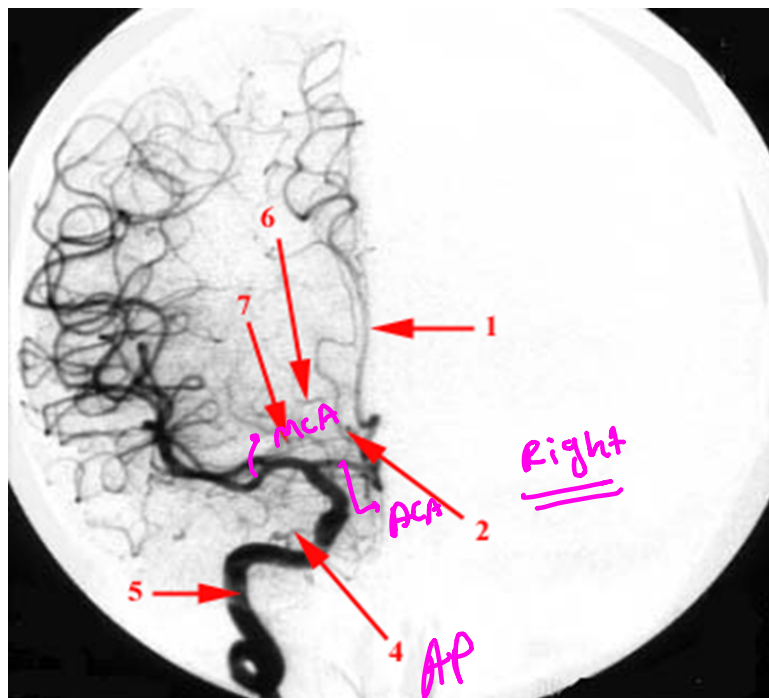
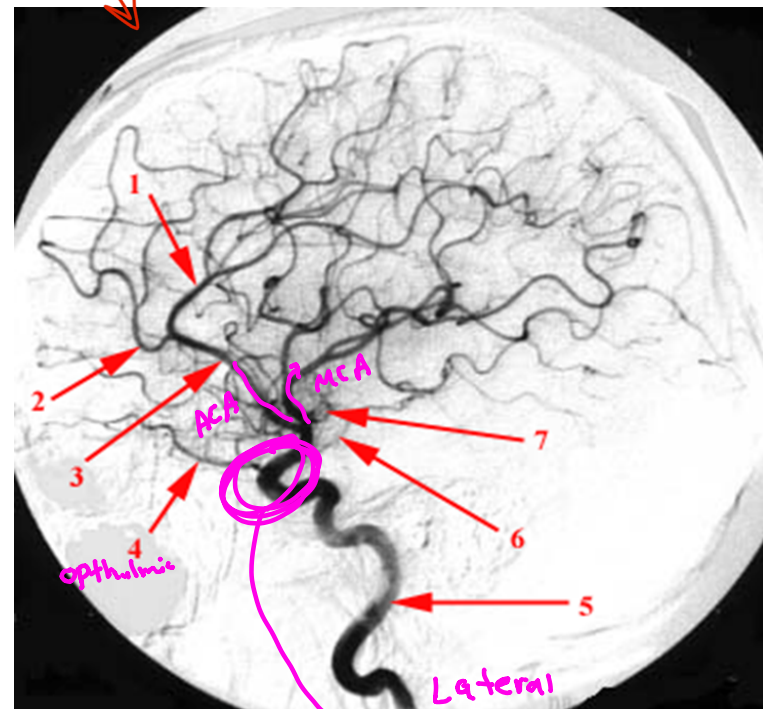
MCA

- 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

AP → posterior in Anterior circulation

venogram
└ Arteriogram

ICA angiogram AP & Lat



[Arteriogram]

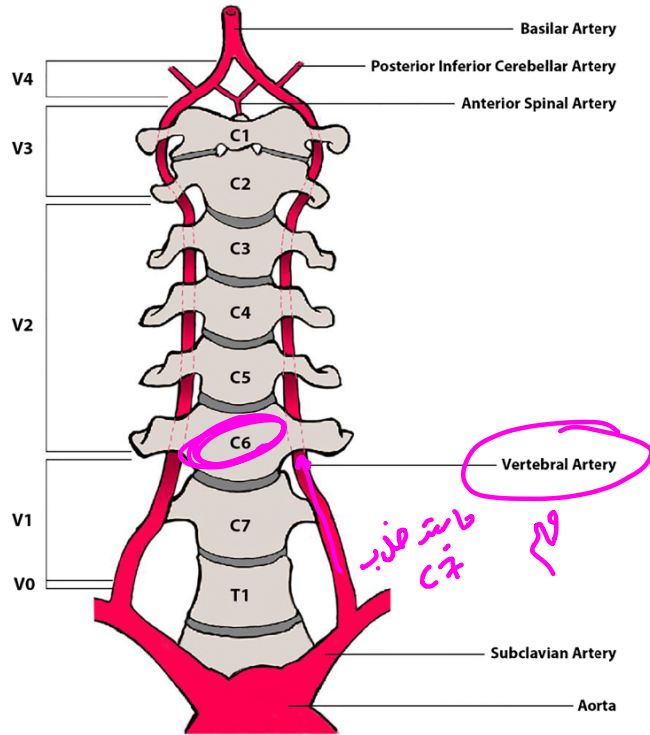
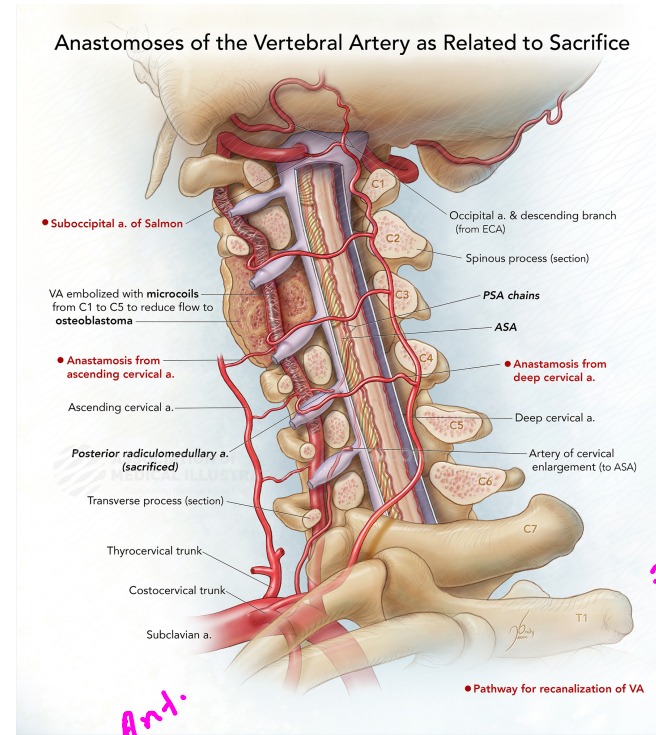
Vertebral Artery (VA)

- 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.

بشلف anterior ، medial حوض medulla

تنتفرع فوق tentorium الى
posterior cerebral artery

Vertebral Artery (VA)



VA branches (intracranial)

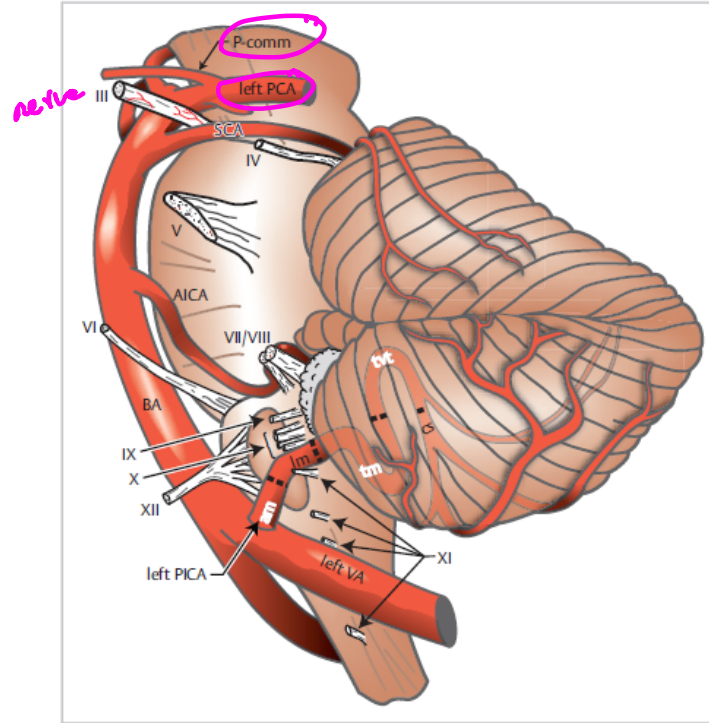
- Meningeal branches *small vessels.*
- Posterior spinal artery (2)
- Anterior spinal artery (1) *from vertebral and basilar.*
- Posterior inferior cerebellar artery (PICA) → lateral medullary syndrome (or Wallenberg Syndrome):
 - Vertigo, diplopia, dysarthria, ipsilateral Horner's syndrome, numbness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

Basilar Artery (BA)

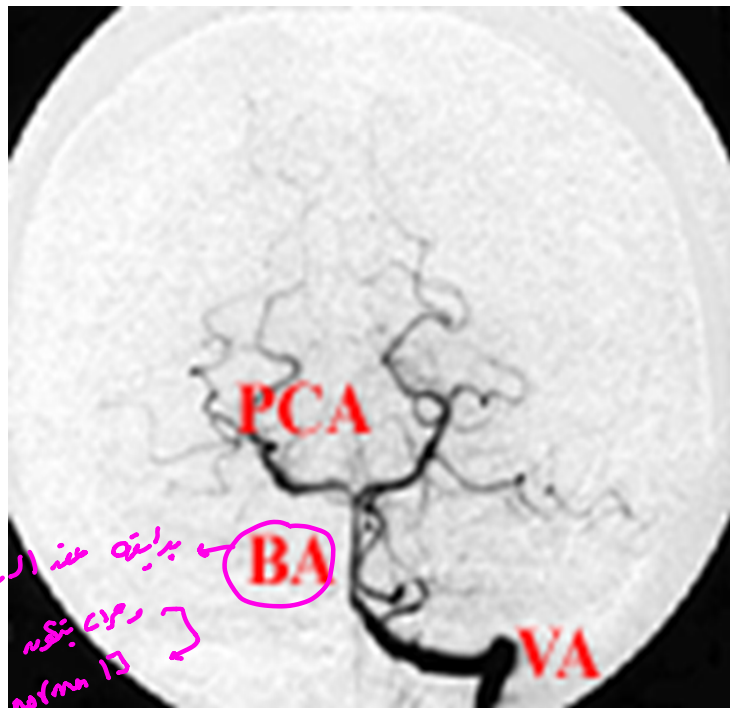
- Formed by the union of the two vertebral arteries
- Ascends in a groove on the anterior surface of the pons
- At the upper border of the pons, it divides into the two posterior cerebral arteries (PCA) *contin. A.*
- Branches:
 - Pontine Branches → *subbly pontine*
 - Labyrinthine artery
 - AICA
 -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

Contralateral hemianopia

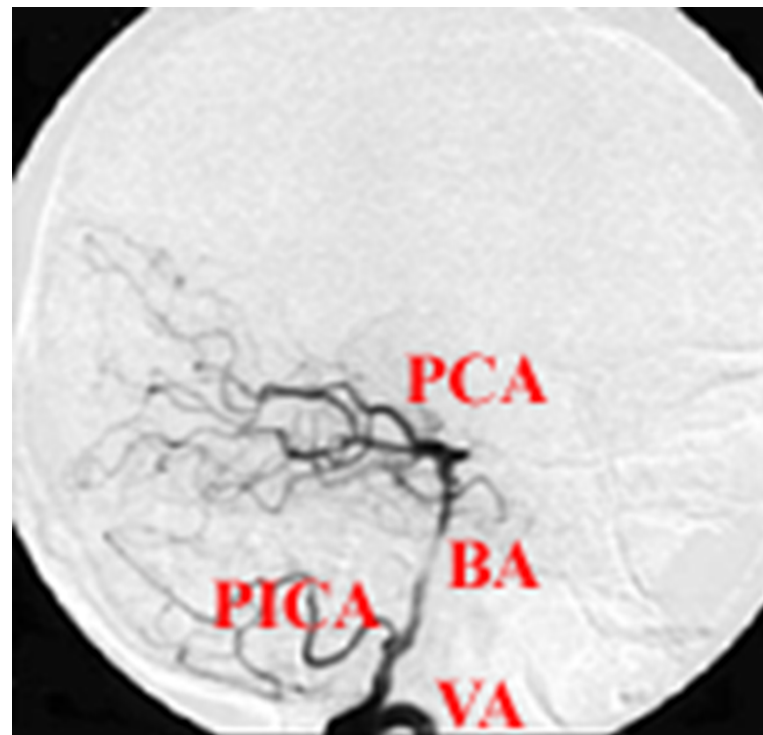
Posterior circulation (VA, BA)



Vertebral angiogram AP & Lat



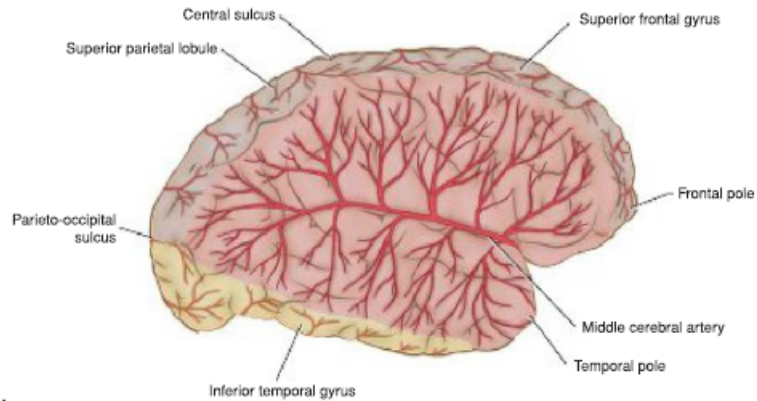
AP



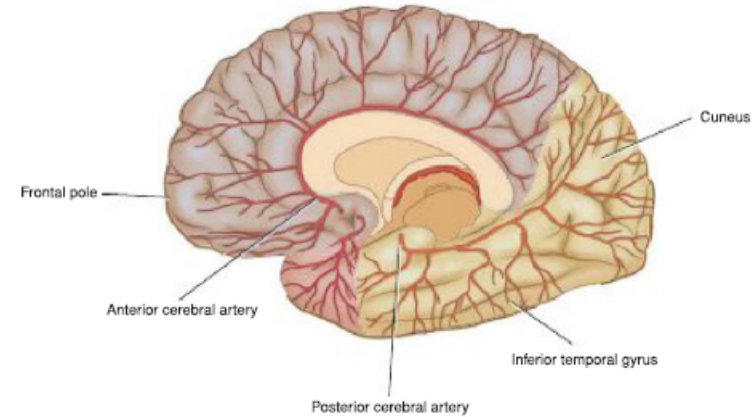
lateral

Areas supplied by the cerebral arteries

Lateral → MCA
medial → ACA
PCA



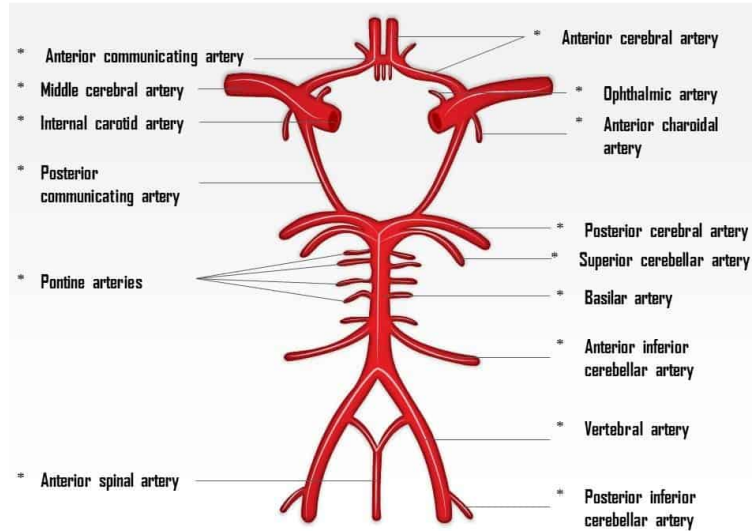
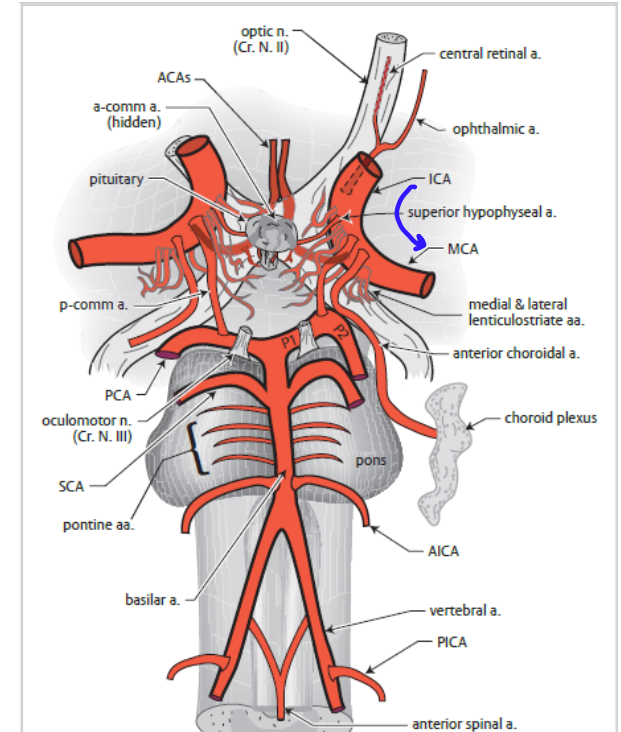
A



Circle of Willis (10 arteries)

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

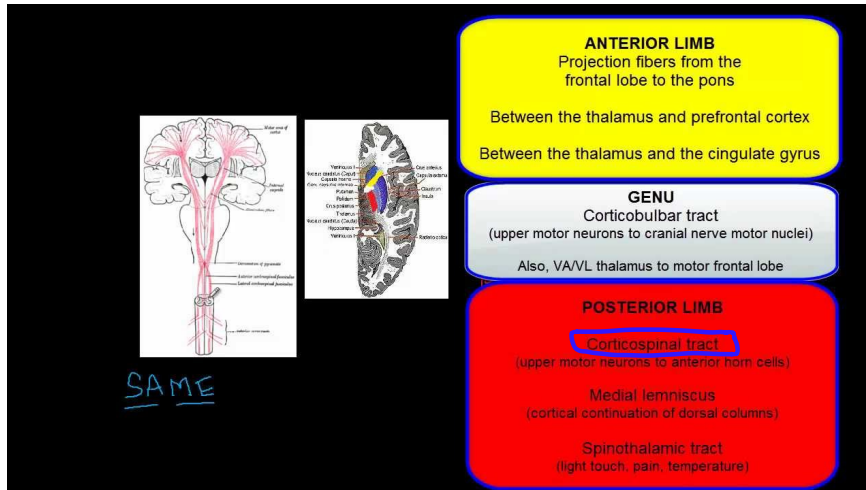
Cerebral Arterial Circle



- Blood distribution → function 11
- Variations

Function & Blood supply of Internal Capsule

اینجا
in the Basal ganglia level



hemi plegia

BLOOD SUPPLY OF INTERNAL CAPSULE

ANTERIOR LIMB MCA

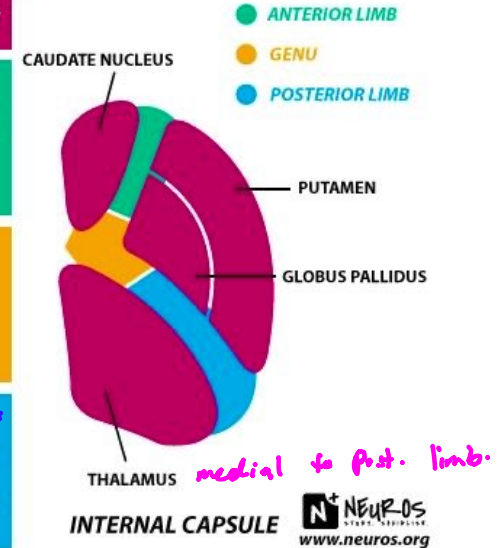
Upper part: lenticulo-striate branches of middle cerebral artery
Lower part: recurrent branch (Heubner artery) of anterior cerebral artery

GENU ACA

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 A carotid A

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. ACA	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

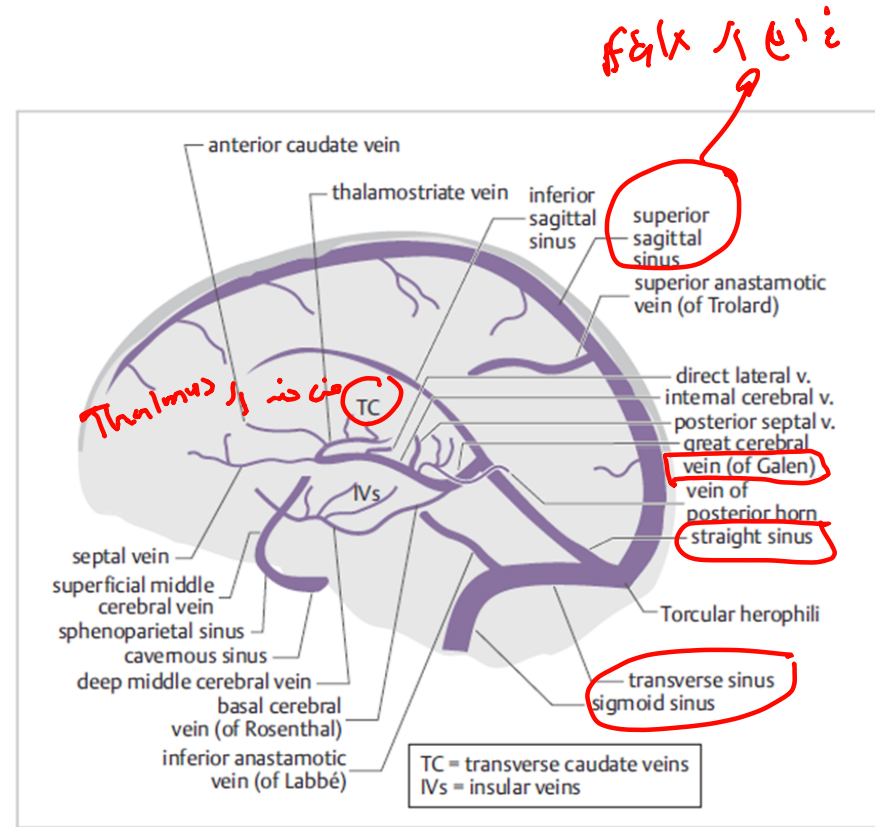
Brain is supplied by multiple Arteries also ~ 15% of
 the total blood flow (CBF)

Control of cerebral blood flow

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

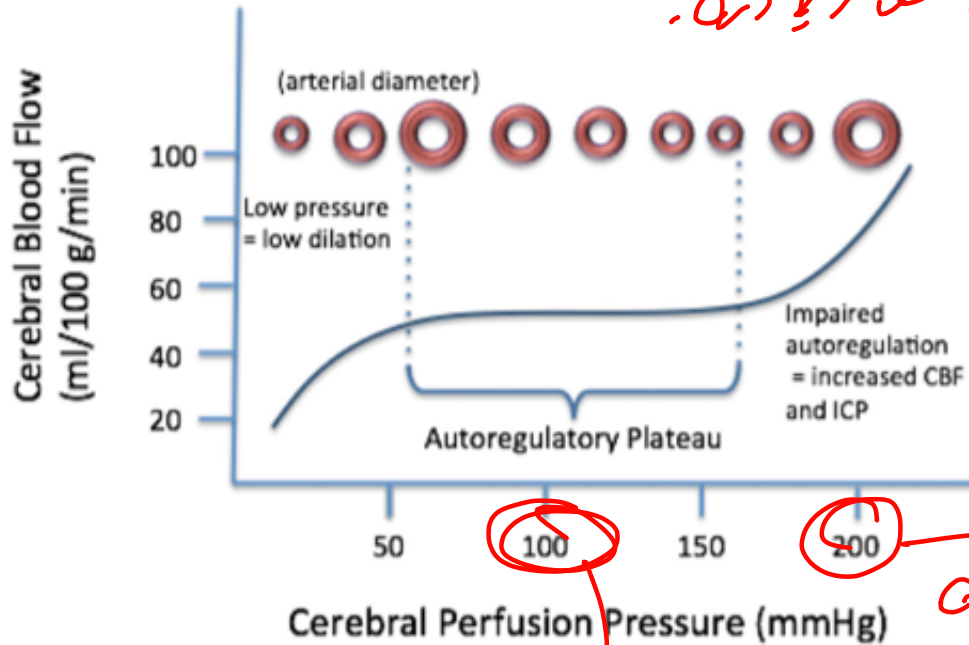
Veins of the Brain

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



Cerebral Autoregulation

كل ما زاد الضغط يقل diameter vessel (تضيق) [vasoconstriction] العكس صحيح.
 نقصان الضغط + زيادة في diameter vessel (توسع).
 Cerebral Autoregulation



مما كثر في 2002
 في عين بالعدالة
 in head trauma
 20

Spinal cord arteries

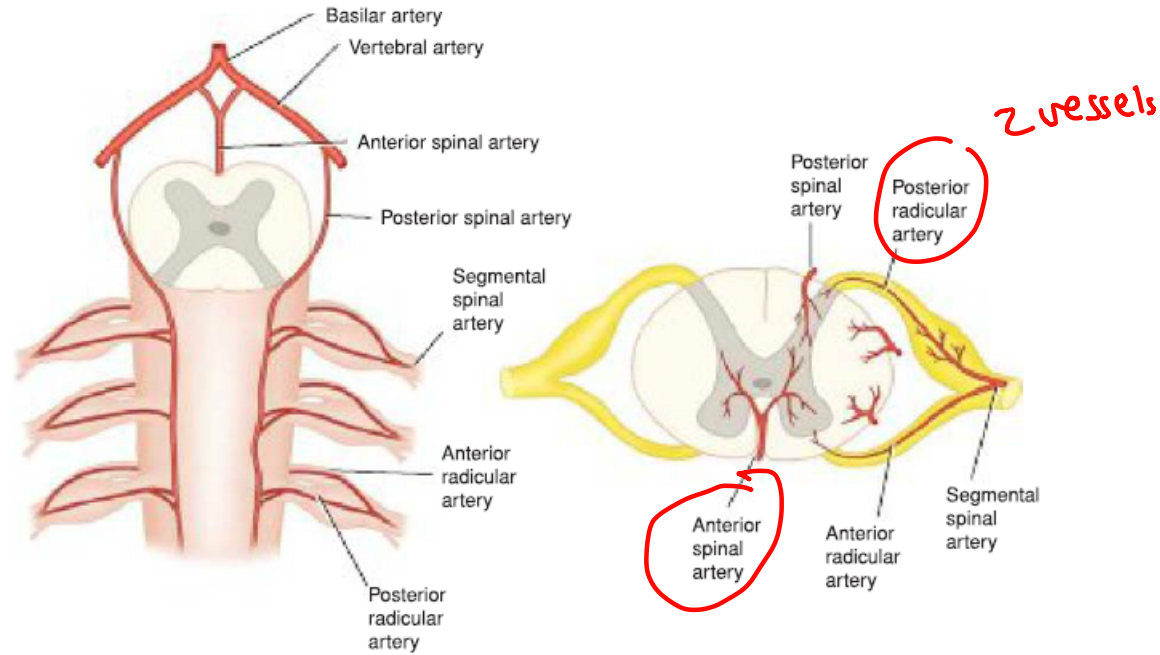
- Longitudinally running
- Two posterior spinal arteries (1/3) → small in upper thoracic
- One anterior spinal artery (2/3) → small in upper & lower thoracic
- Reinforced by small segmentally arranged arteries:
 - Great anterior medullary artery of Adamkiewicz: from the aorta, in the lower thoracic,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

T10 - L2
[Thoraco lumbal]

segmental Arteries

پارالیزیا - منیای فلج - نوروپاتی
paralysis, neuropathy, neuritis
نوروپاتی، پارالیزیا، نوروپاتی

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

در وقت نصف، ایستادن
بغیر حیات

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) *dysphasia*
- 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

قد يكون في الوجه العاكسة في نفس الوجه

دنيا كنعان

Cerebral Blood Flow Impairment

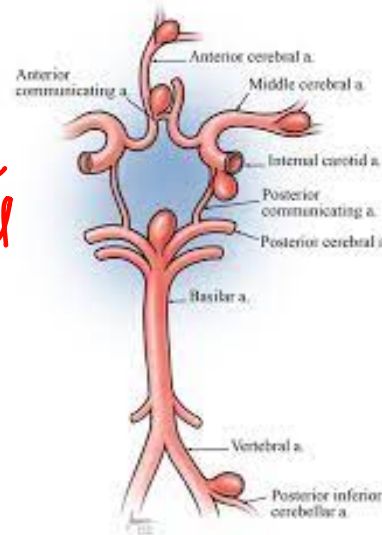
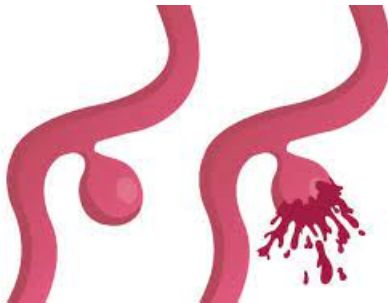
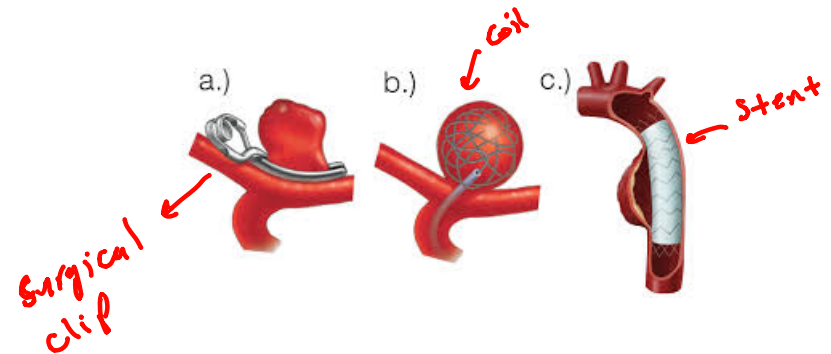
Main Causes:

- 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 *sub arachnoid hemorrhage*
 - Pressure symptoms

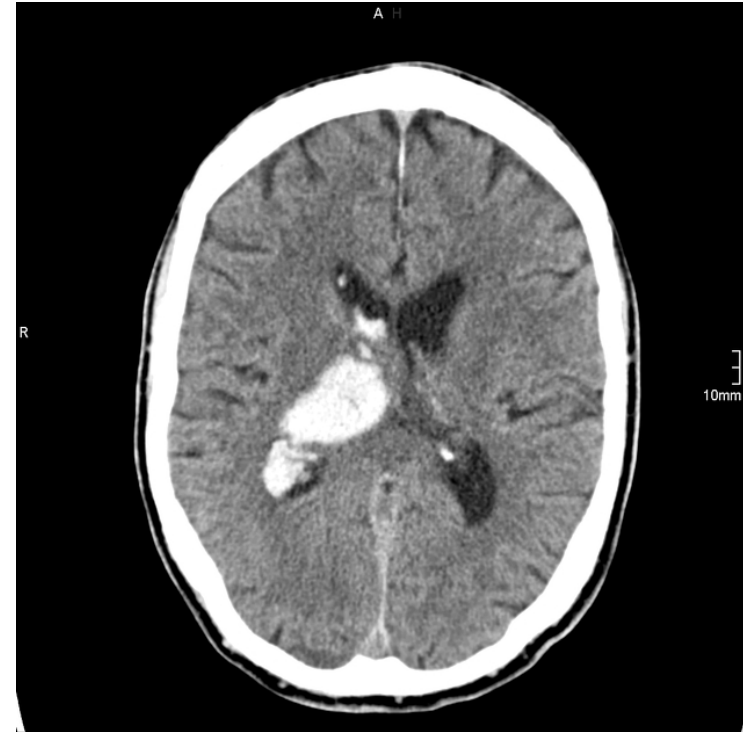
and may be ruptured



CVA → cerebral vascular Accident.

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!

Done