Mahidol University
Faculty of Medicine Siriraj Hospital

Neurovascular Anatomy (1):
Anterior Circulation Anatomy

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December 14th, 2017

STROKE CORE LECTURE

Contents:

Neurovascular Anatomy

- Arterial supply of the brain
  - Anterior circulation
  - Posterior circulation
- Arterial supply of the spinal cord
- Venous system of the brain

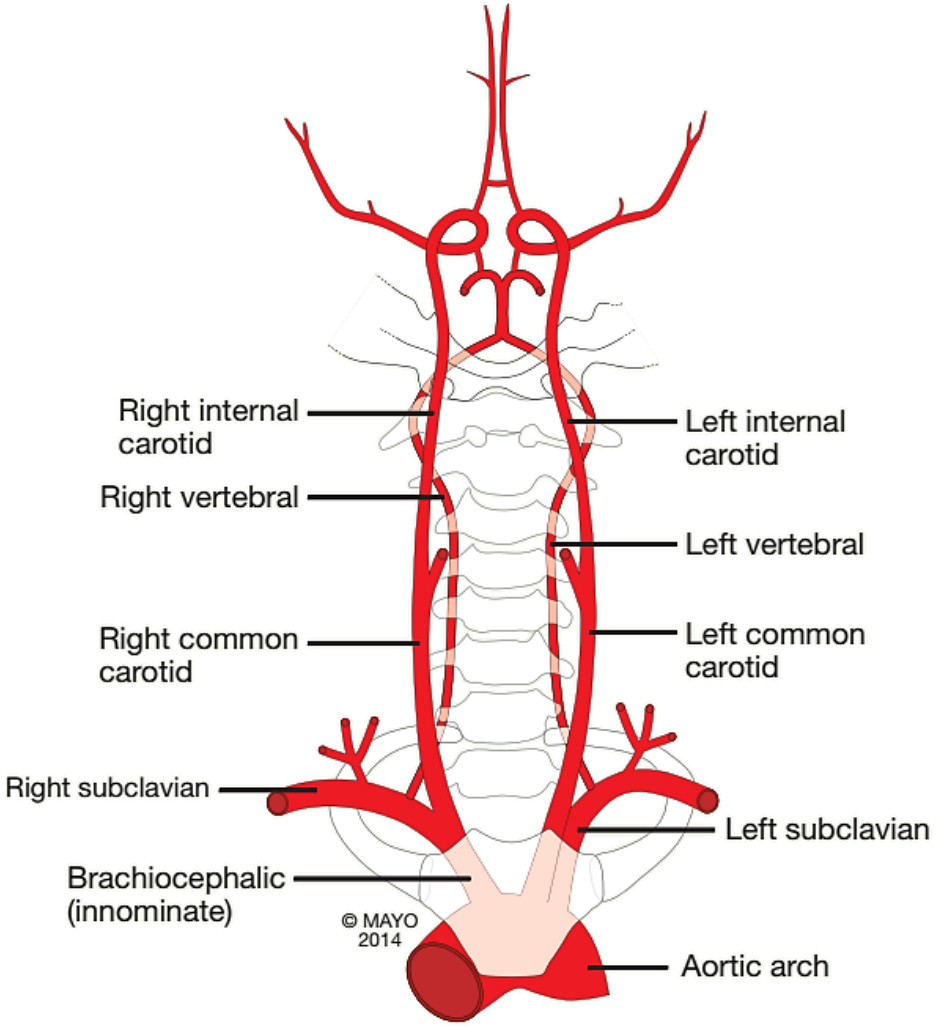
Neurovascular Anatomy (1):
Anatomy of the Anterior Circulation

- Carotid artery system
- Ophthalmic artery
- Arterial circle of Willis
- Arterial territories of the cerebrum

Cerebral Vasculature

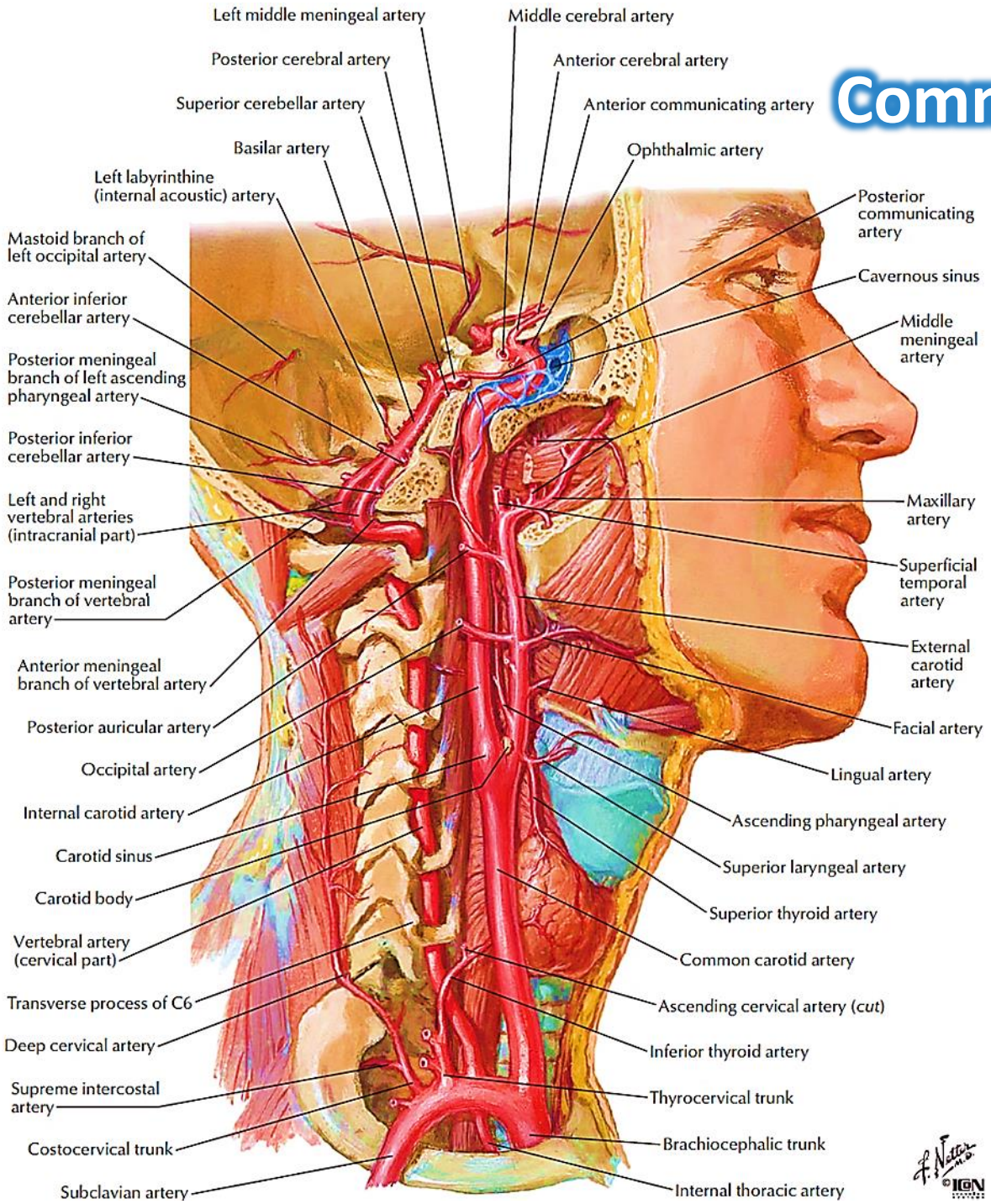
- **Anterior circulation:**
  Internal carotid artery
- **Posterior circulation:**
  Vertebrobasilar system

- **All originates at the arch of aorta**



Flemming KD, Jones LK. Mayo Clinic neurology board review: Basic science and psychiatry for initial certification. 2015

Common Carotid Artery



- **Carotid bifurcation at the level of C3-4 vertebra or superior border of thyroid cartilage**

External carotid artery

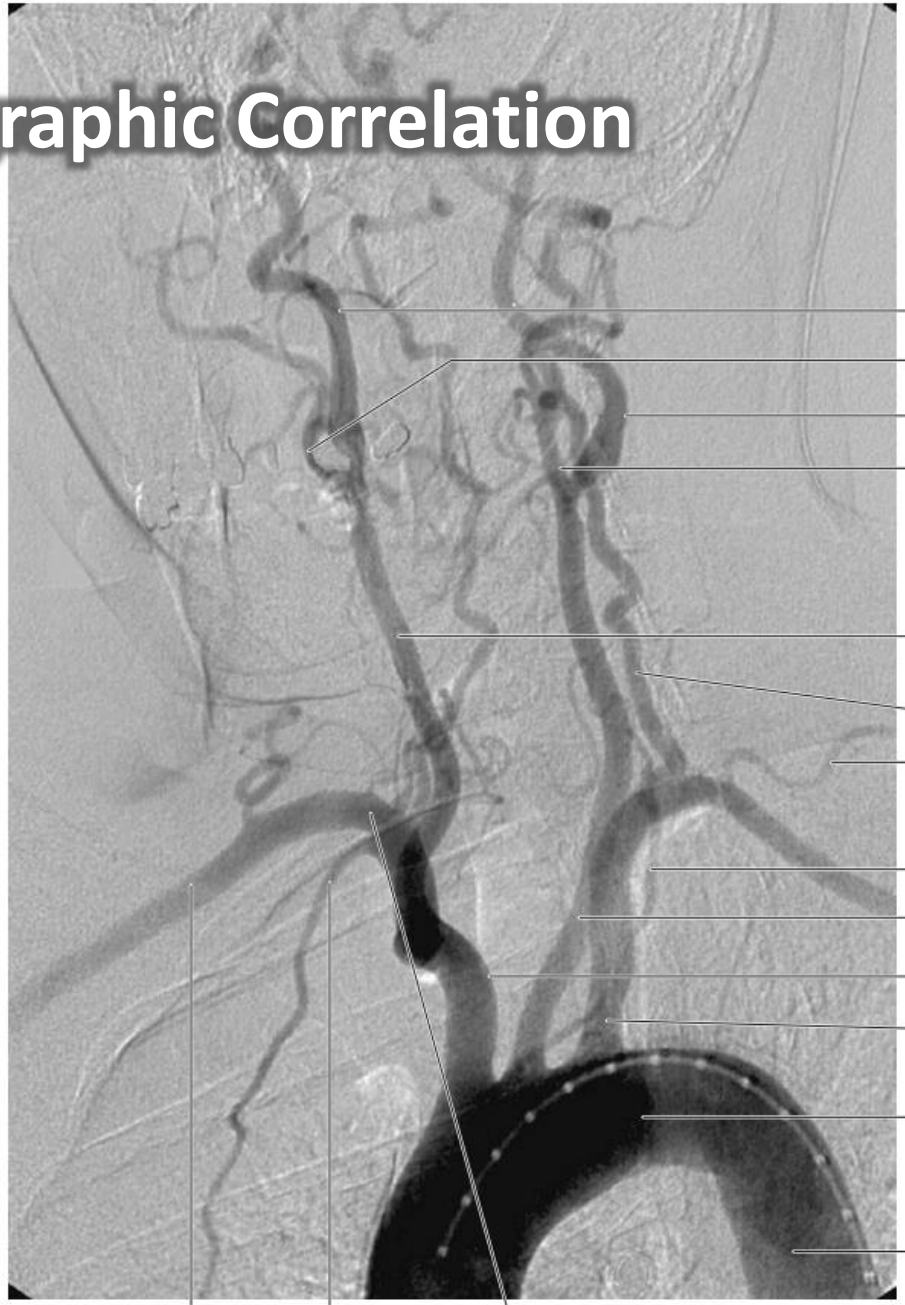
Supply the head & neck, except for the brain the eyes

Internal carotid artery

- **Supply the brain the eyes**
- **Enter the skull via the carotid canal**

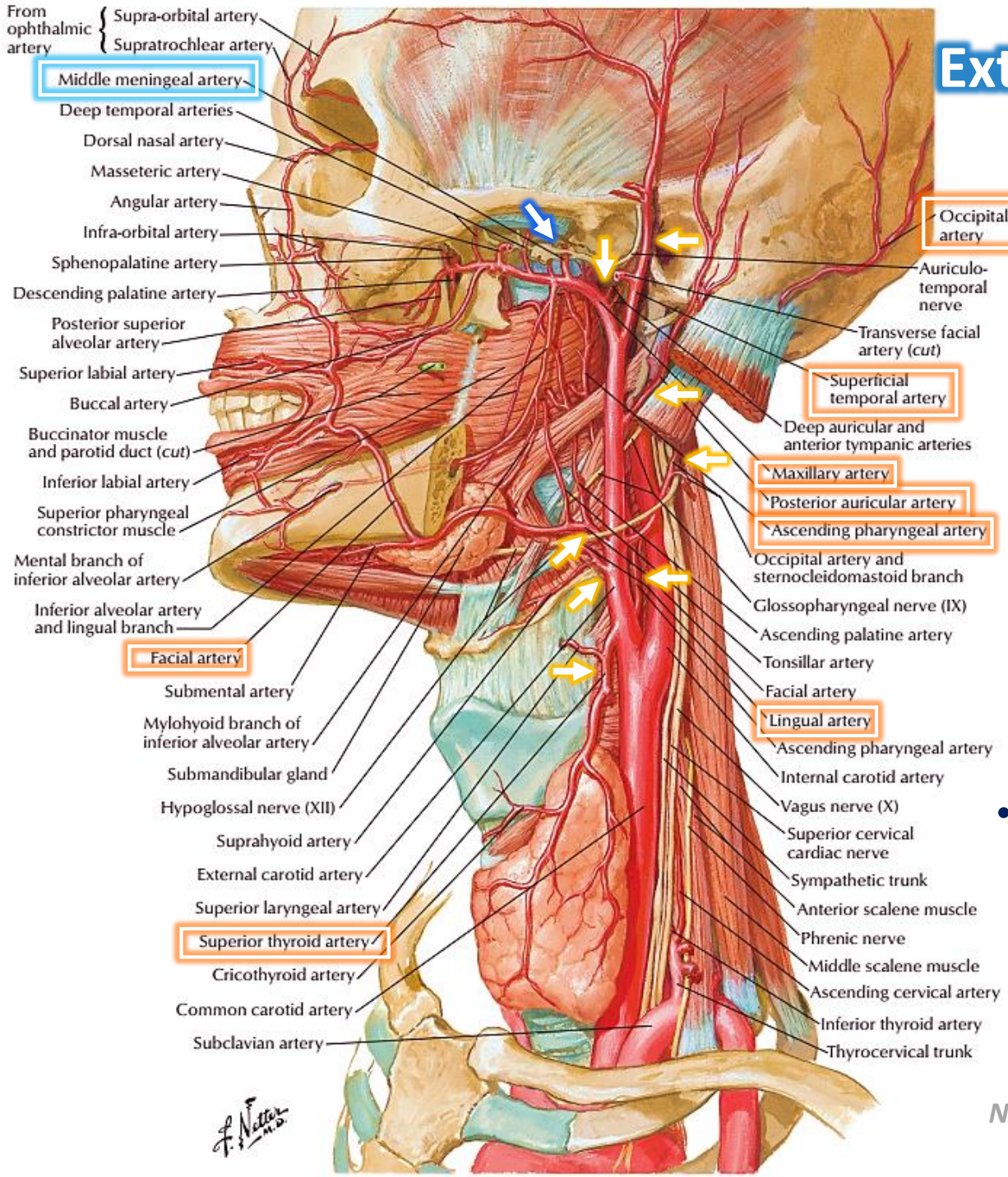
Netter FH. Atlas of human anatomy, 6th ed. 2014

Angiographic Correlation



Uflacker R. Atlas of vascular anatomy: an angiographic approach, 2007

External Carotid Artery



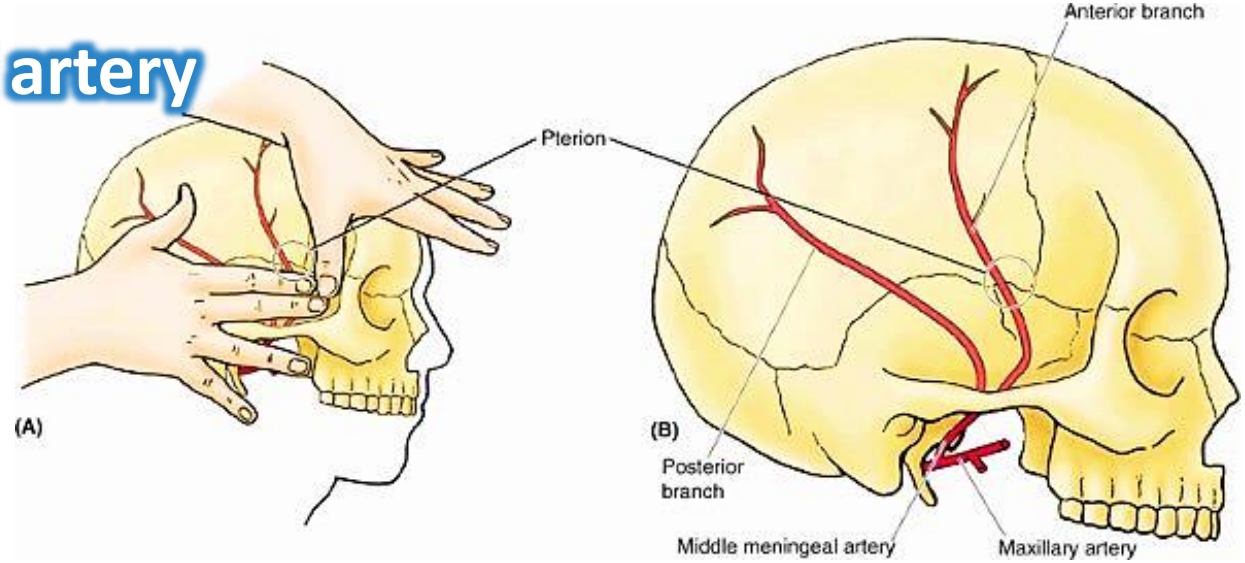
External carotid artery

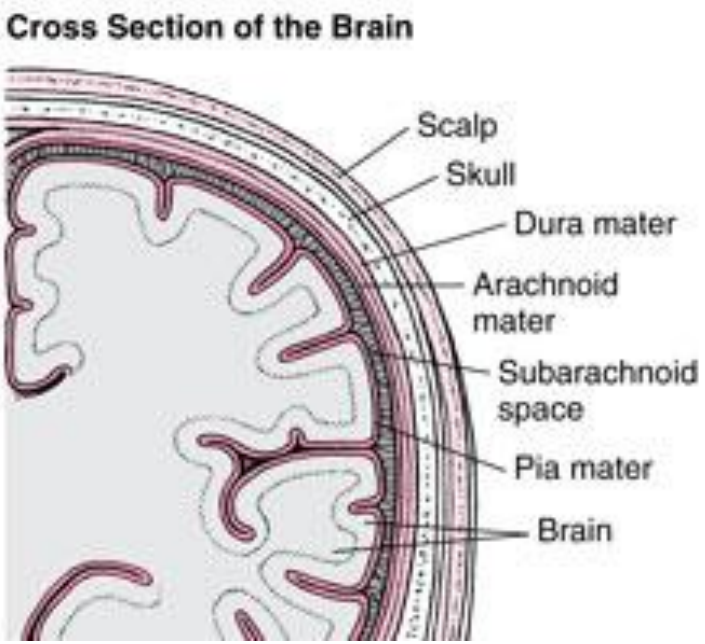
- Superior thyroid artery
- Lingual artery
- Facial artery
- Ascending pharyngeal artery
- Posterior auricular artery
- Occipital artery
- Maxillary artery
- Superficial temporal artery

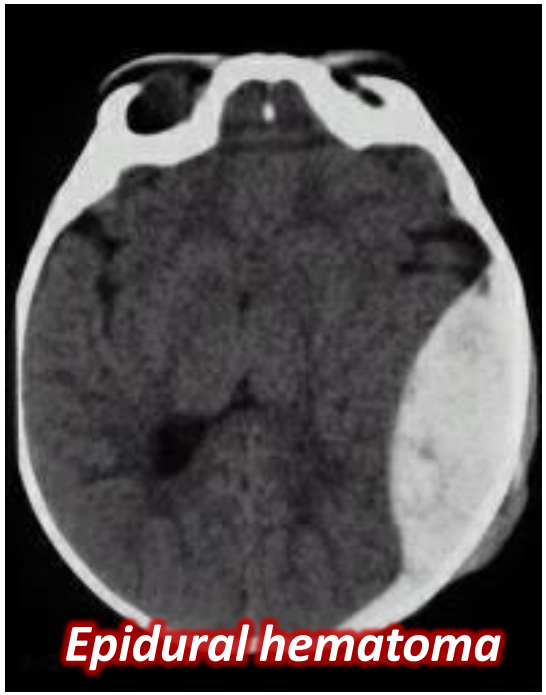
- **Middle meningeal artery – epidural hemorrhage**

Netter FH. Atlas of human anatomy, 6th ed. 2014

Middle meningeal artery

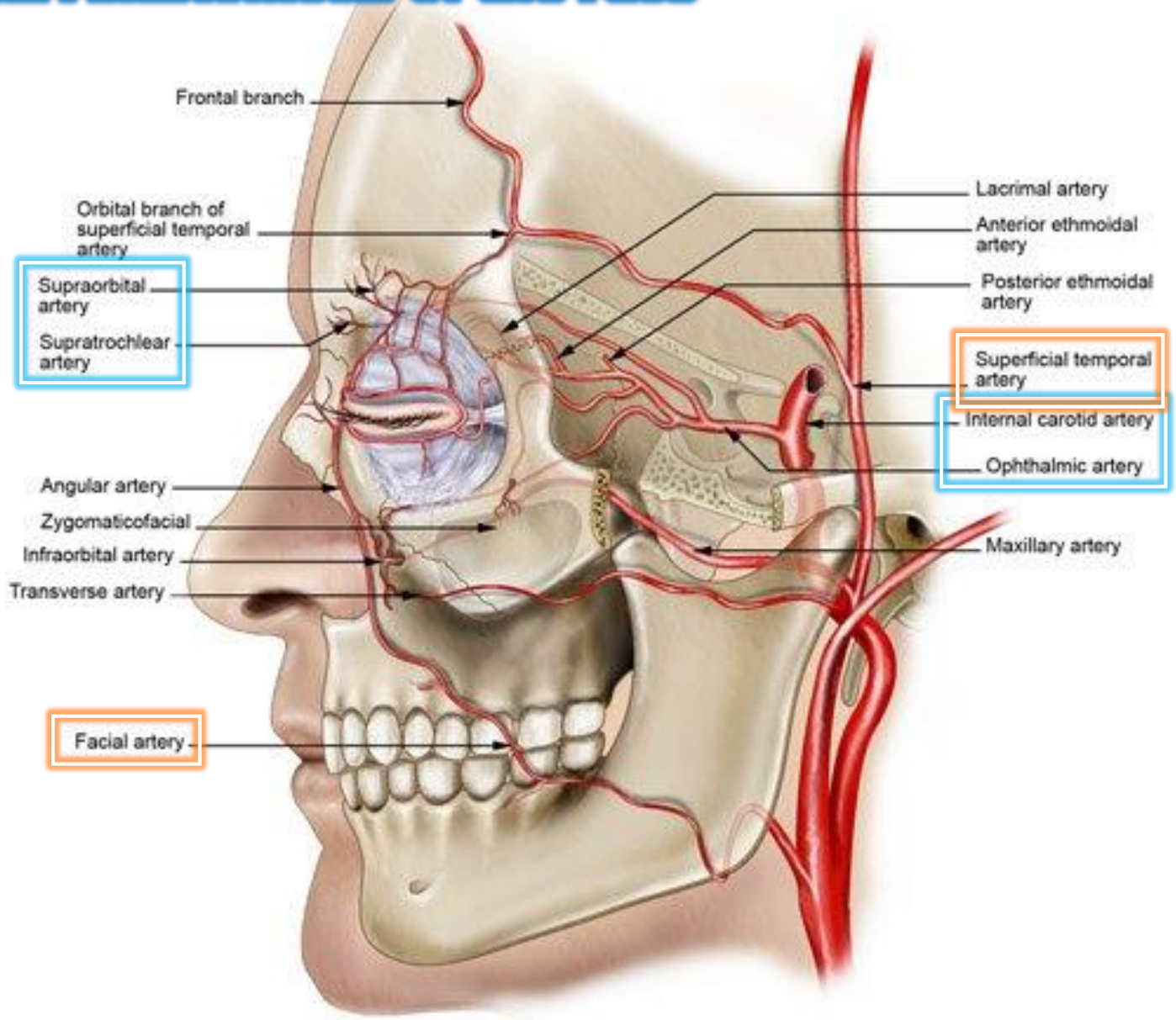






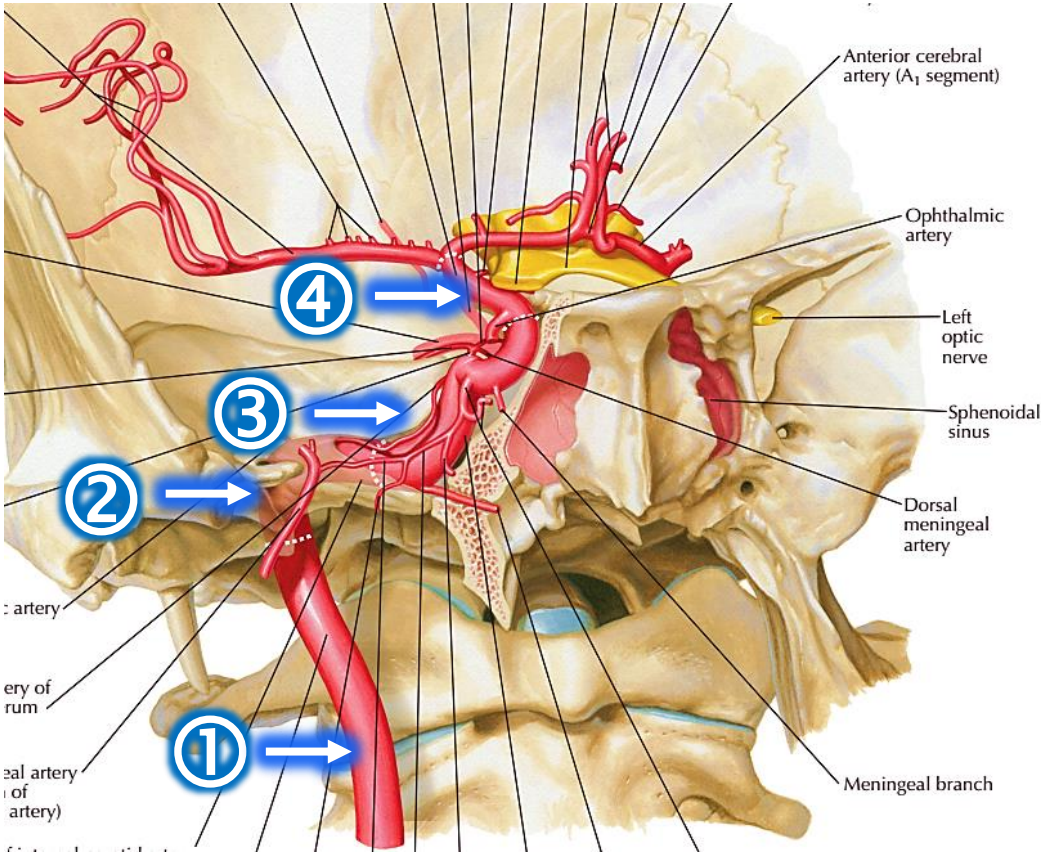
http://www.jrlawfirm.com/library/subdural-epidural-hematoma
https://twitter.com/medicinedoctors/status/796351913948086272

Arterial Anastomosis of the Face



http://medicalart-work.co.uk/wordpress/?page_id=8

Internal Carotid Artery

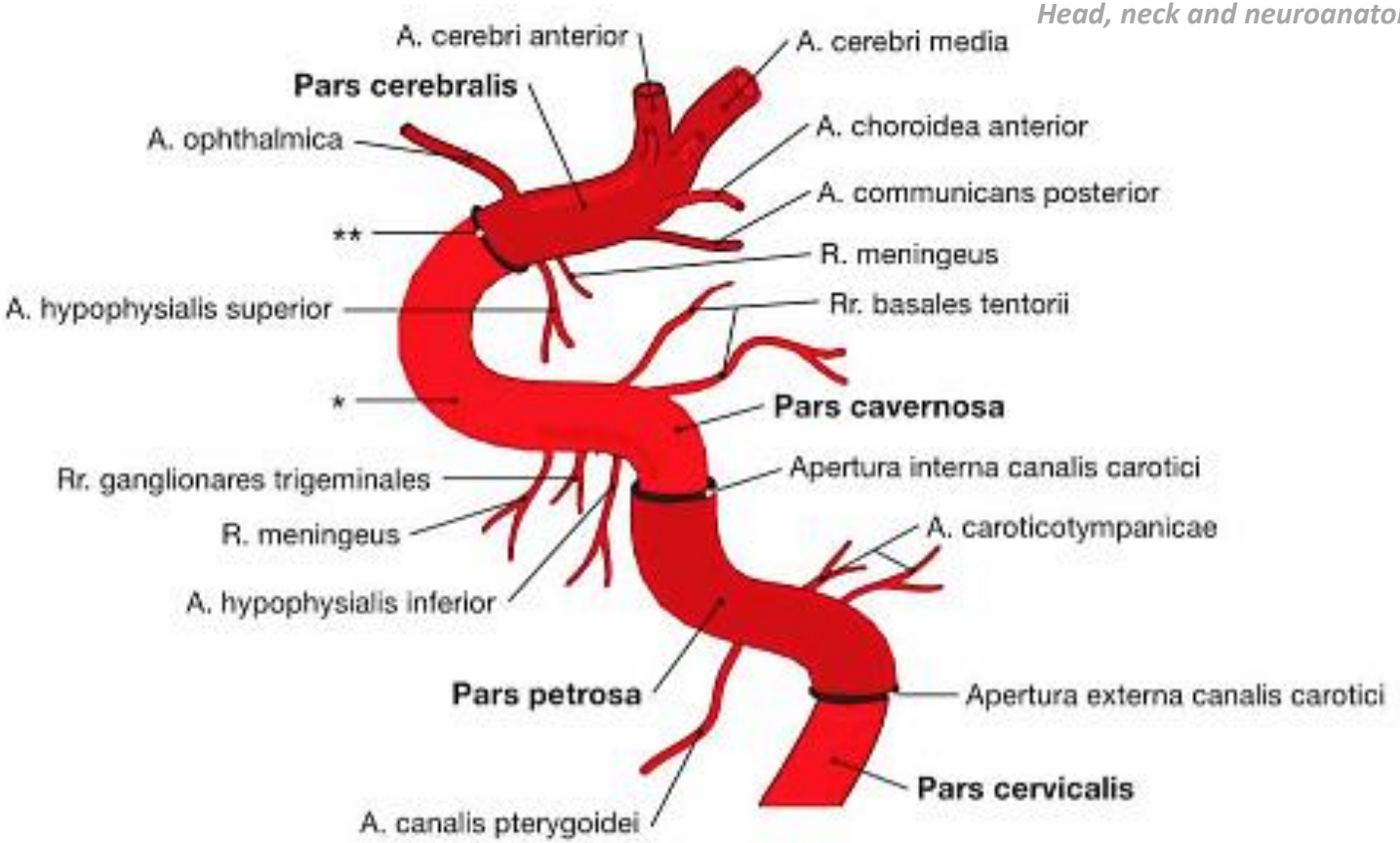


4 parts:

- **Cervical part**
- **Petrous part**
- **Cavernous part**
- **Cerebral part (supraclinoid)**

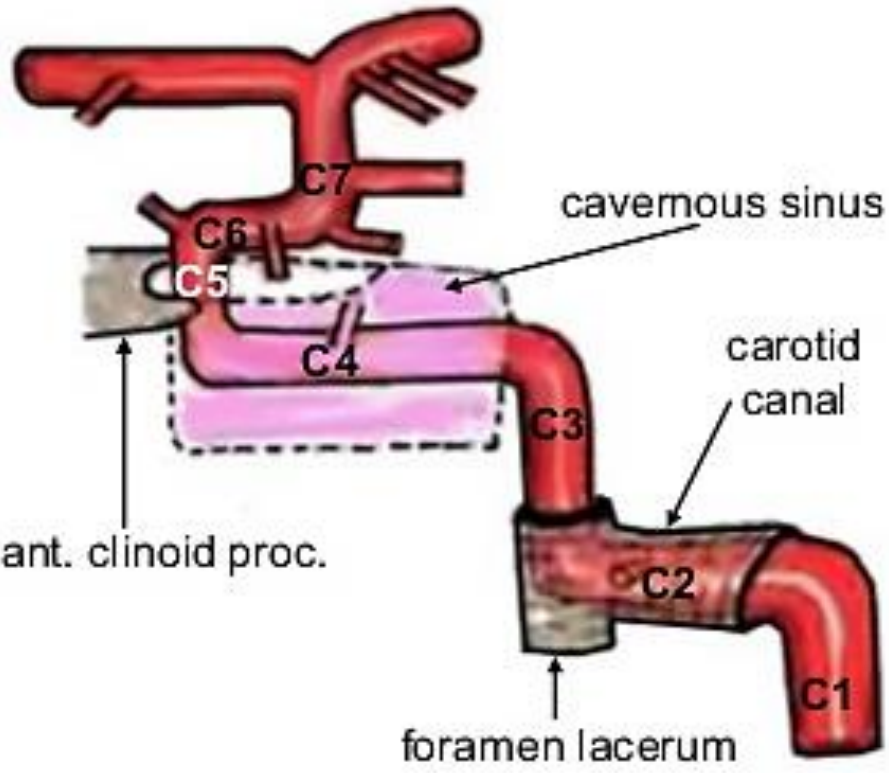
Netter FH. Atlas of human anatomy, 6th ed. 2014

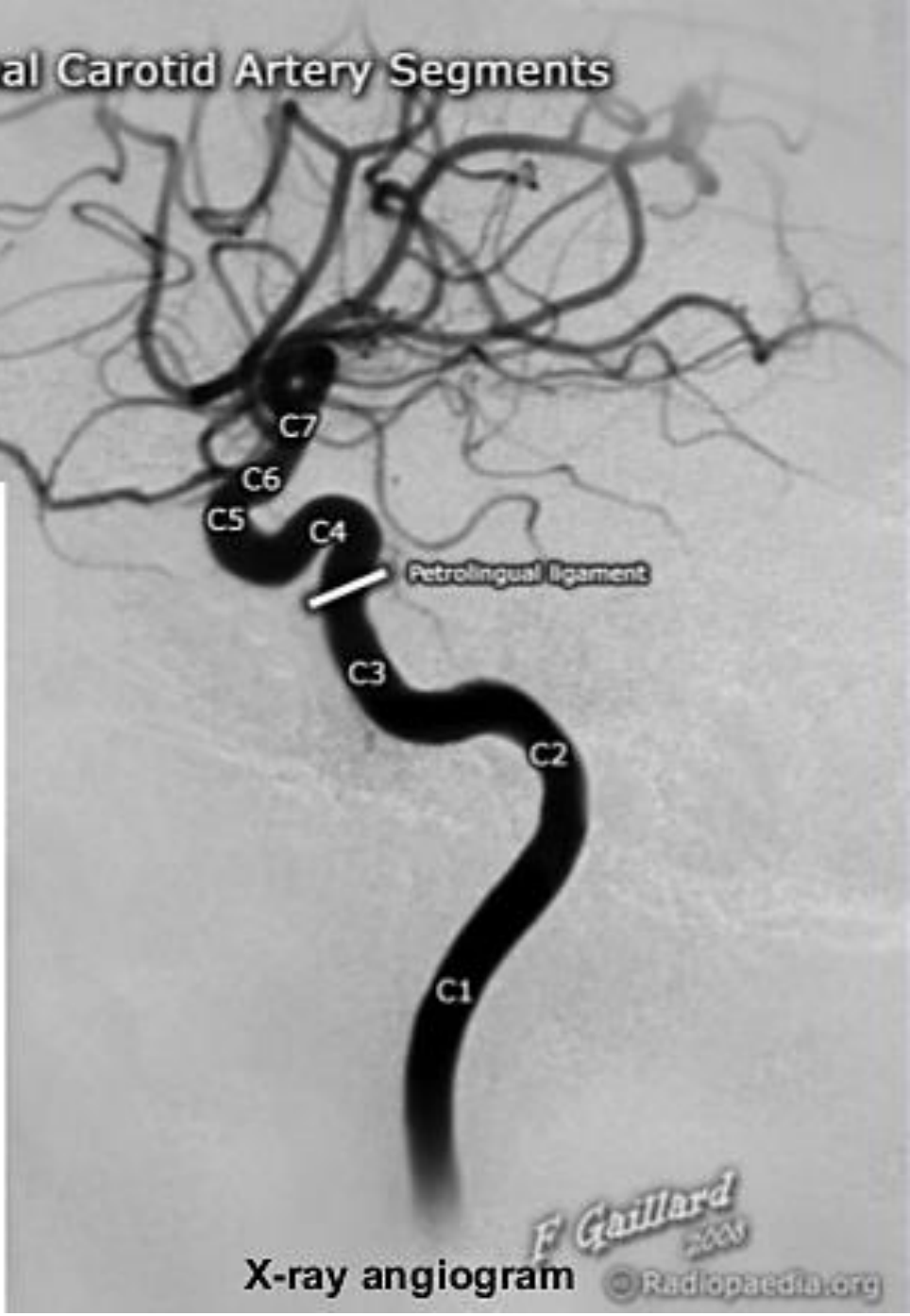
Pauslsen F, Washchke J. Sobotta atlas of human anatomy: Head, neck and neuroanatomy, 15th ed, 2011



Segments	Branches
Cervical	No branch
Petrous	Artery of pterygoid canal (vidian a.), caroticotympanic artery
Cavernous	Meningohypophyseal trunk, inferolaterl trunk, capsular artery
Supraclinoid	• Ophthalmic part – ophthalmic artery, superior hypophyseal artery • Communicating part – posterior communicating & anterior choroidal arteries • Terminal branches – anterior & middle cerebral arteries (ACA, MCA)

C1 - cervical
C2 - petrous
C3 - lacerum
C4 - cavernous
C5 - clinoid
C6 - ophthalmic
C7 - communicating





https://image.slidesharecdn.com/brainvascularsupply-140701071122-phpapp01/95/brain-vascular-supply-8-638.jpg?cb=1404217076

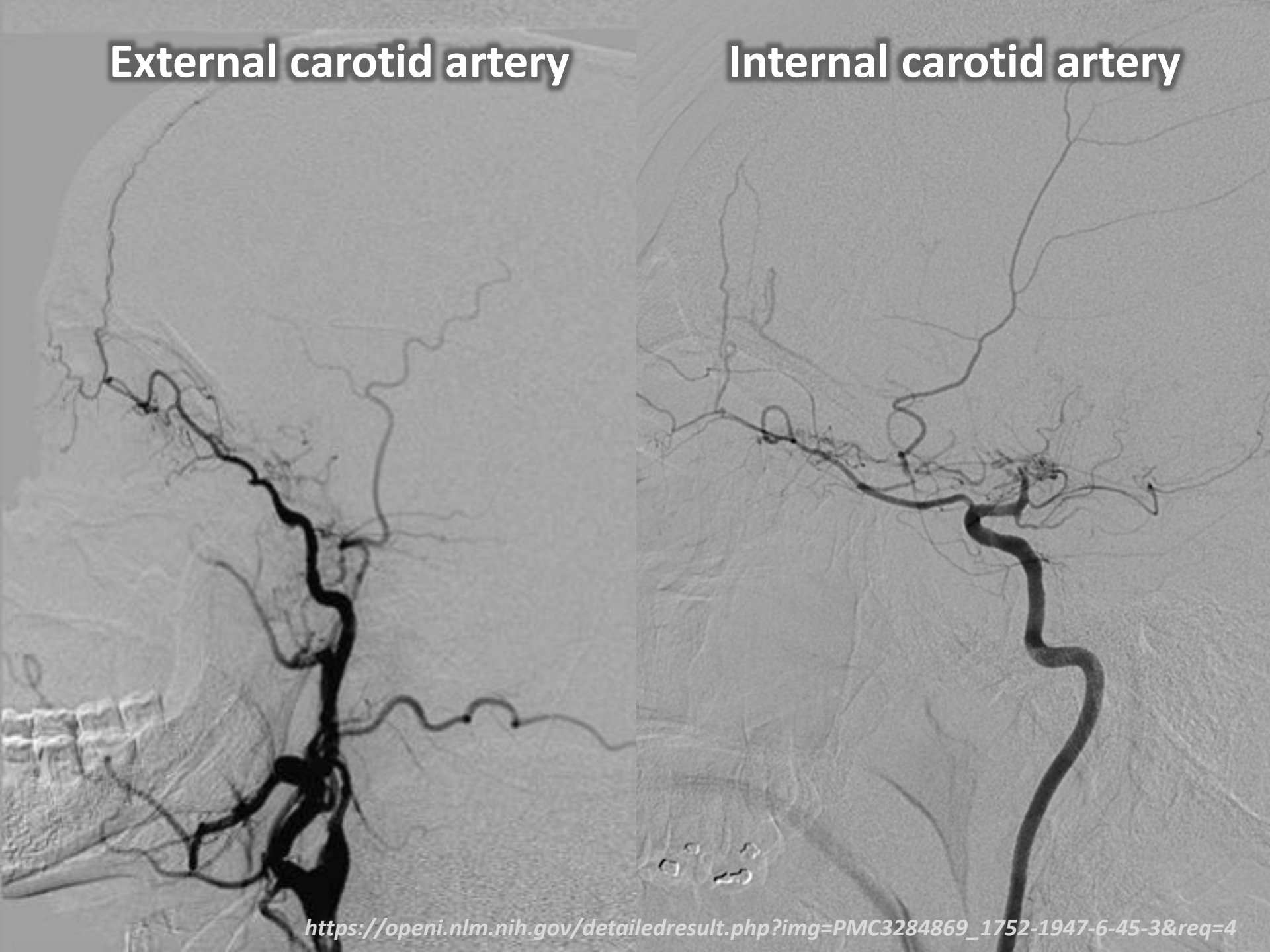

External carotid artery
Internal carotid artery
https://openi.nlm.nih.gov/detailedresult.php?img=PMC3284869_1752-1947-6-45-3&req=4

Fig. 5.2 Lateral view following common carotid artery injection. Non-filling of the middle cerebral artery from atherosclerotic occlusion allows unobtrusive view of the anterior cerebral artery territory.

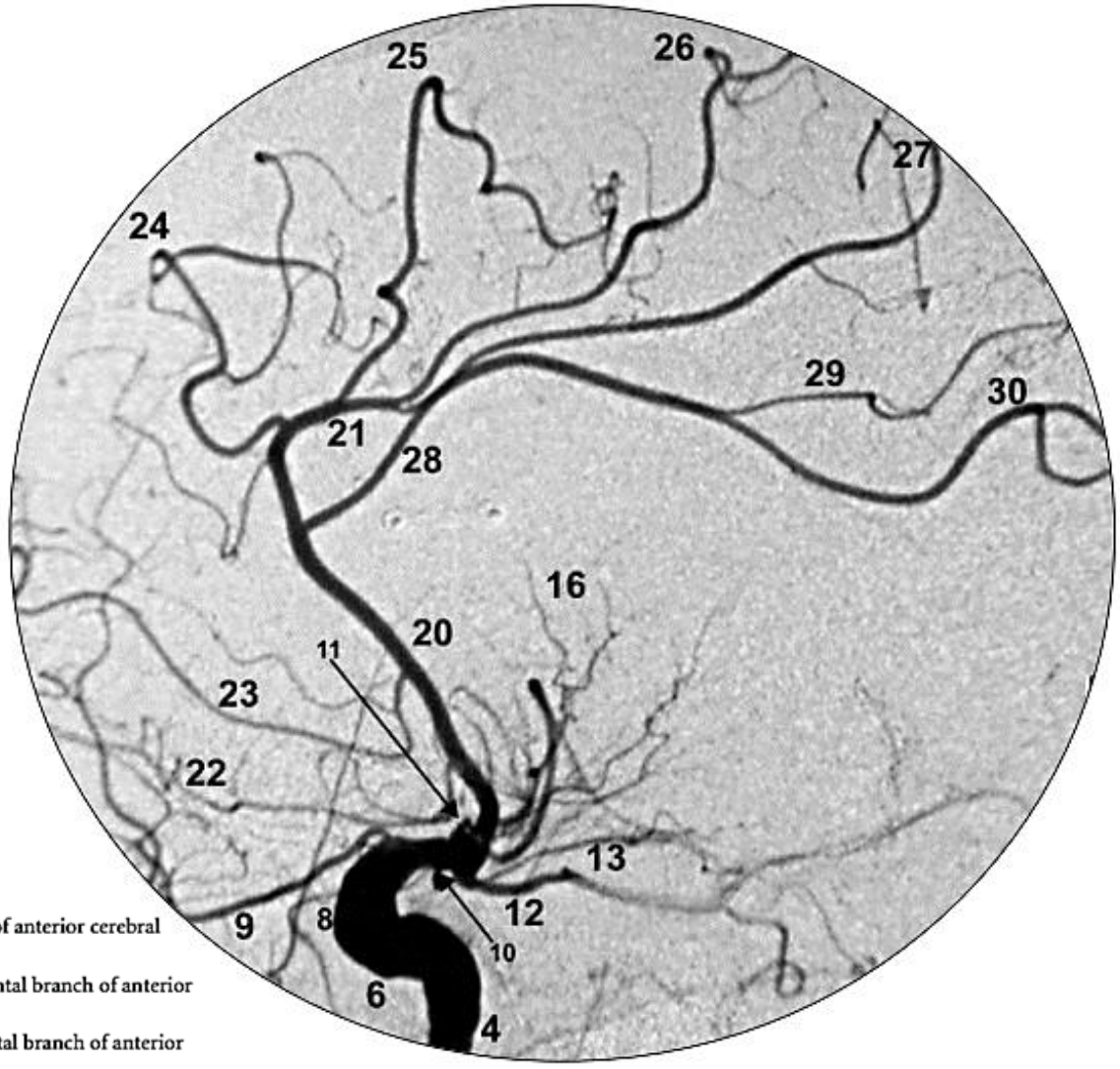


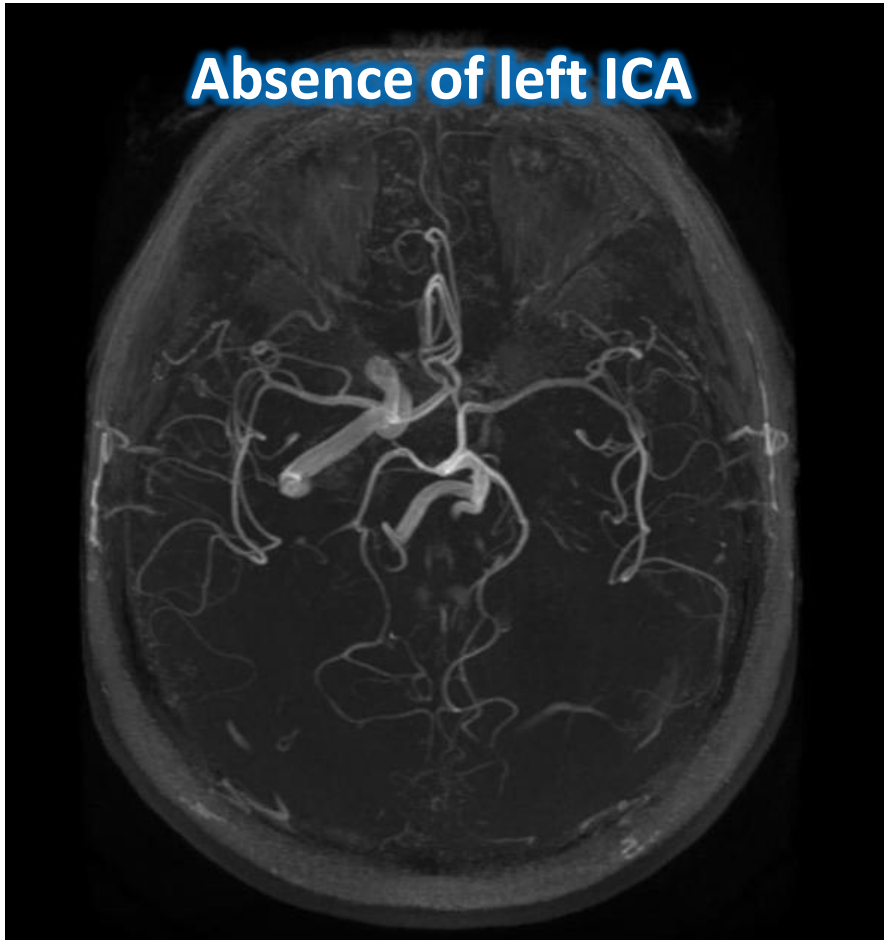
FIGURE KEY

4 presellar (Fischer C5) segment internal carotid artery
6 horizontal (Fischer C4) intracavernous internal carotid artery
8 anterior genu (Fischer C3) intracavernous internal carotid artery
9 ophthalmic artery
10 & 11 proximal and distal supraclinoid segment internal carotid artery
12 posterior communicating artery
13 anterior choroidal artery
16 medial lenticulostriate arteries
21 callosomarginal branch of anterior cerebral artery
22 orbitofrontal branch of anterior cerebral artery
23 frontopolar branch of anterior cerebral artery
24 anterior internal frontal branch of anterior cerebral artery
25 middle internal frontal branch of anterior cerebral artery
26 posterior internal frontal branch of anterior cerebral artery
27 paracentral lobule artery branch of anterior cerebral artery
28 pericallosal branch of anterior cerebral artery
29 superior internal parietal branch of anterior cerebral artery
30 inferior internal parietal branch of anterior cerebral artery

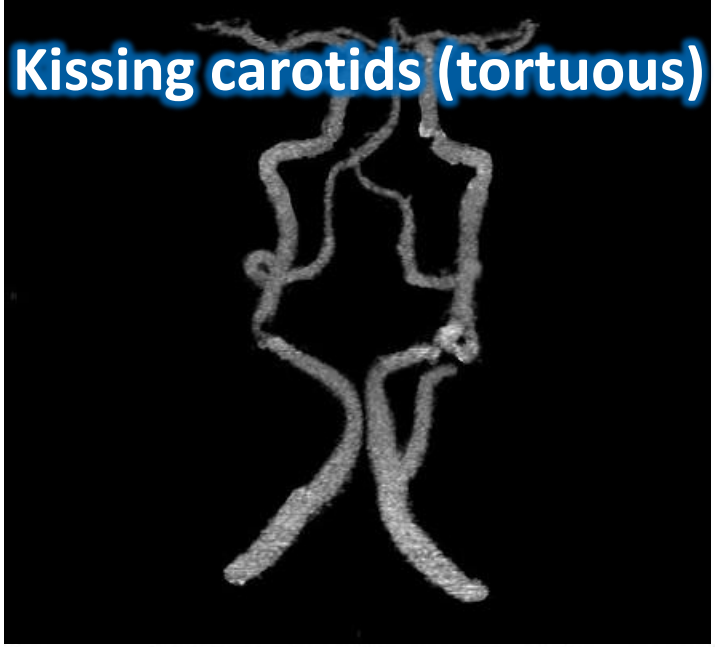
Borden NM. 3D angiographic atlas of neurovascular anatomy and pathology, 2007

Variation of ICA

- Mostly arise between C3-C5 level
  - C3/4 34.2%, C4/5 48.1%
- Asymmetry of bifurcation
  - Left higher 50%, right higher 22%, same level 28%
- Variations
  - Aberrant ICA
  - Congenital absence of ICA
  - Retropharyngeal ICA (rare)
  - Kissing carotids
  - Persistent carotid-vertebrobasilar anastomoses
  - Lateralised ICA



Kissing carotids (tortuous)



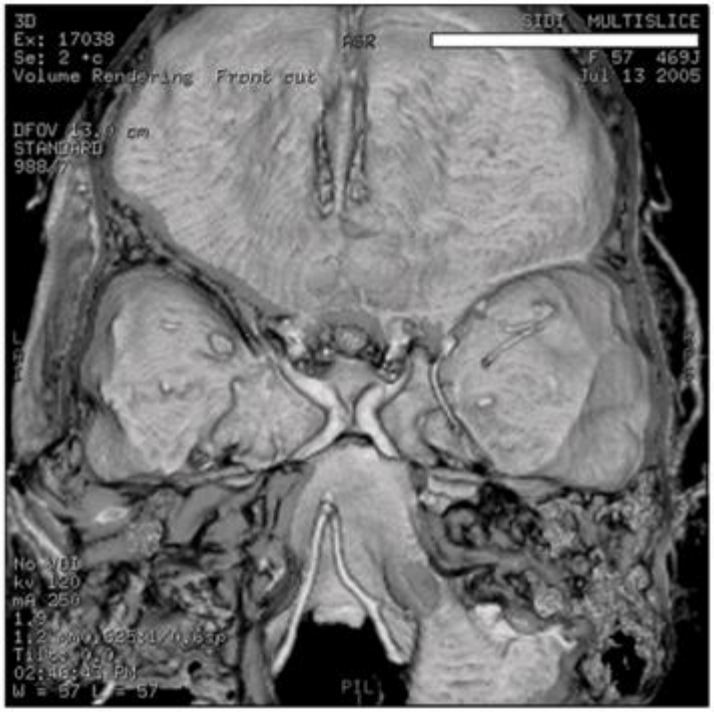
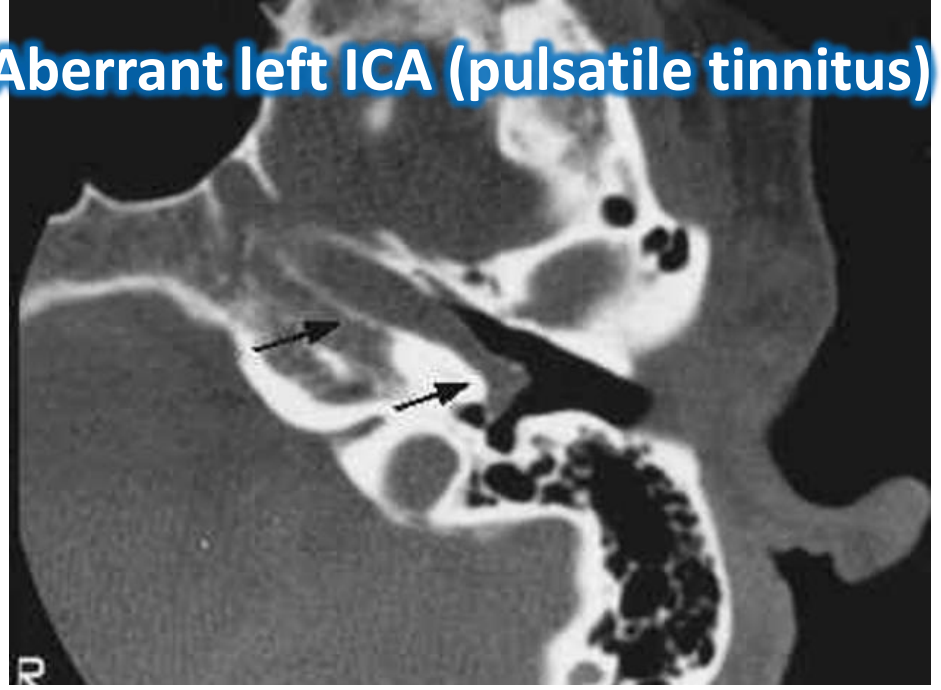


Fig 3. CTA – 3D Reconstruction (Axial View): Intracranial intrasel - lar kissing carotid arteries.

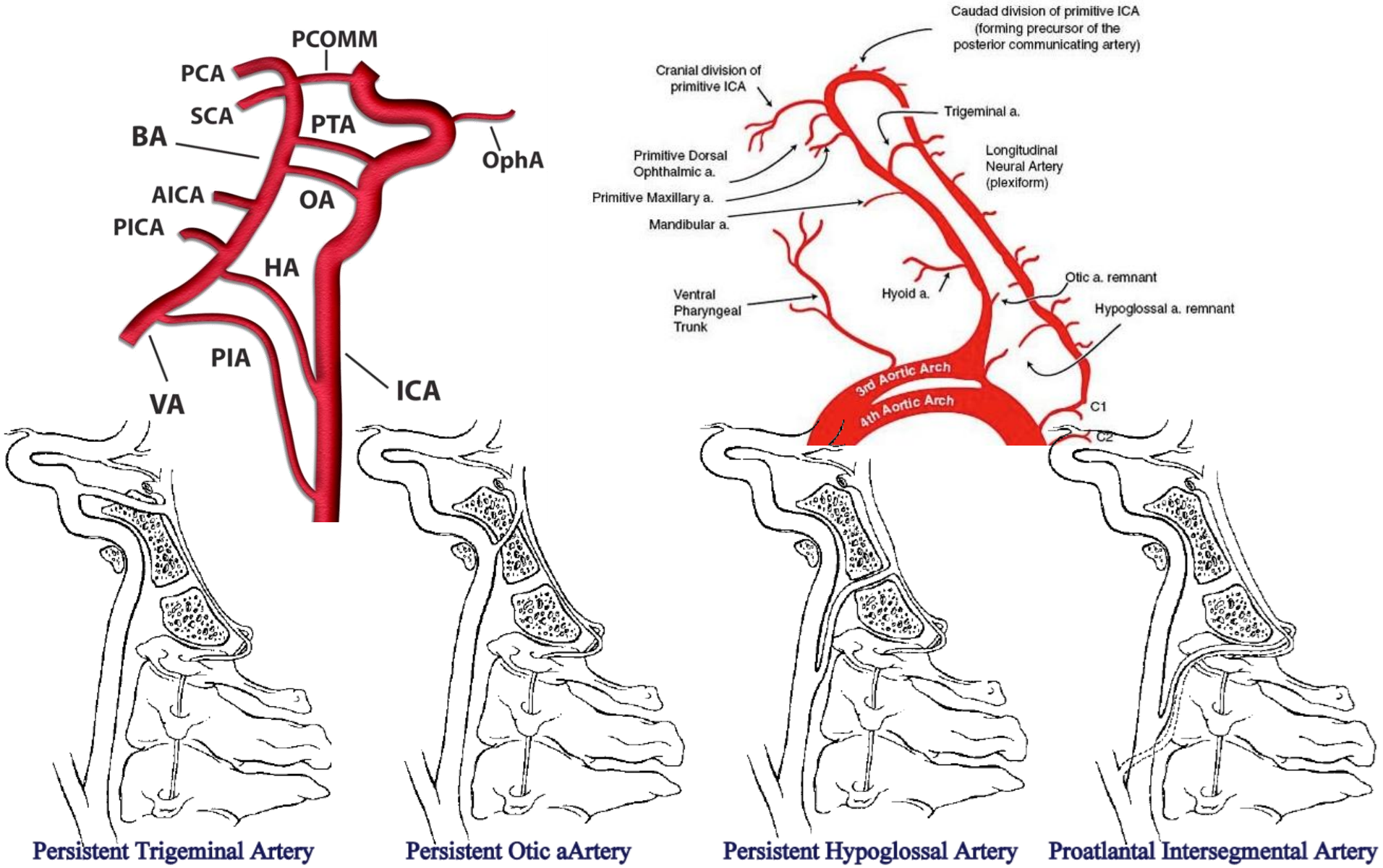
Aberrant left ICA (pulsatile tinnitus)



Persistent carotid-vertebrobasilar anastomoses

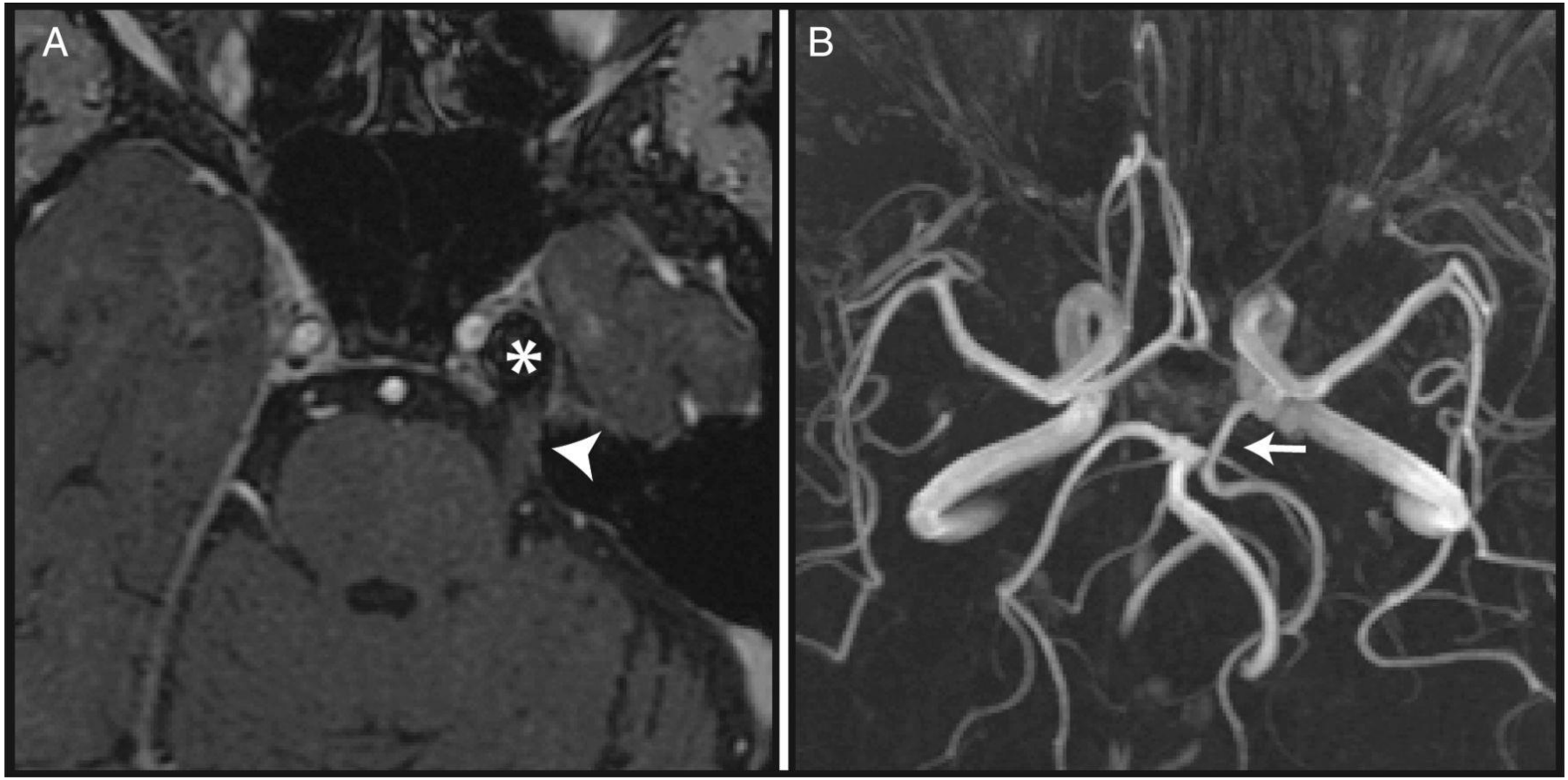
https://radiopaedia.org
http://dx.doi.org/10.1590/S0004-282X2007000200034

Persistent Carotid-Vertebrobasilar Anastomoses

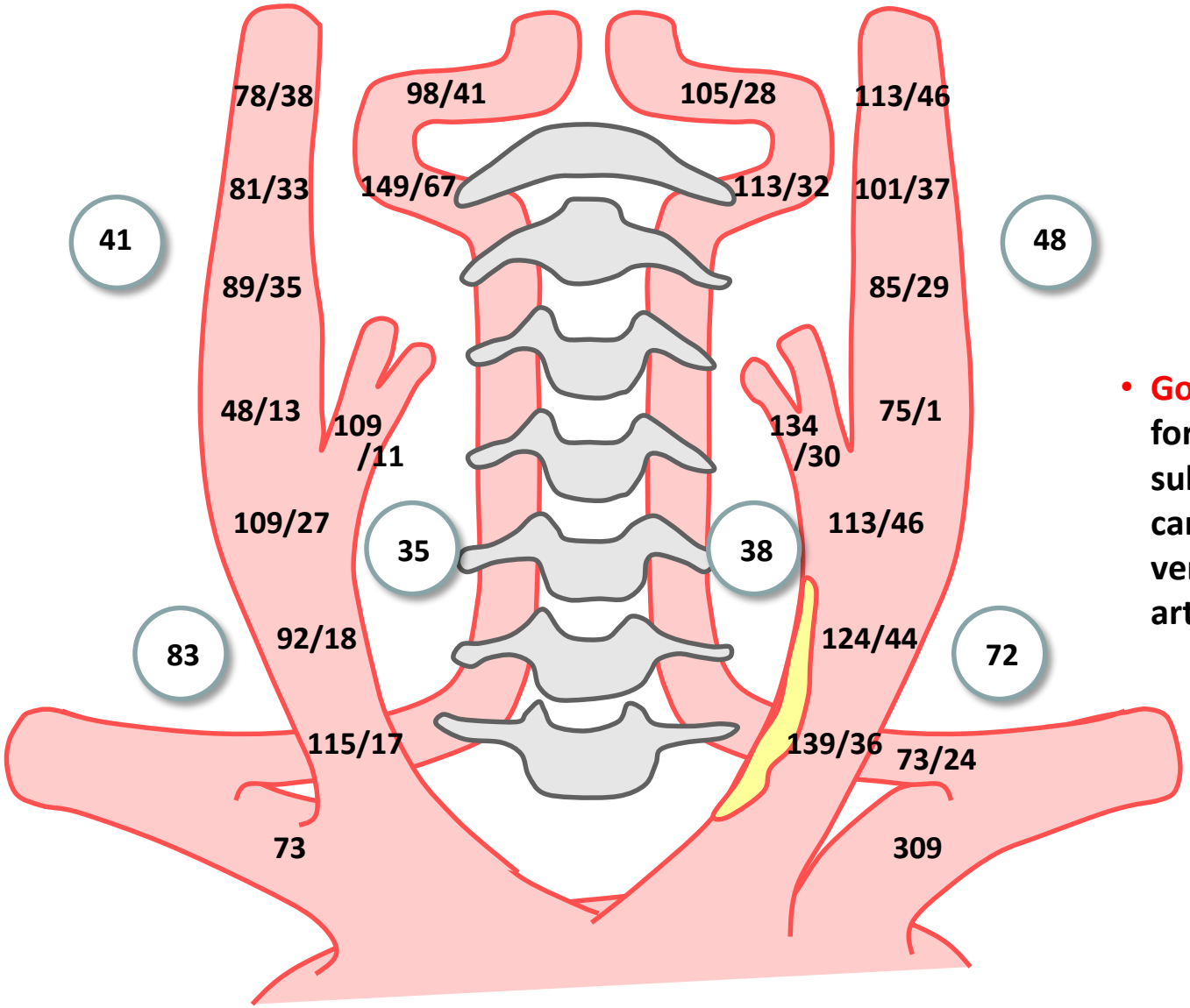


http://www.neuroradiologycases.com/2012/03/carotid-vertebrobasilar-anastomoses.html
http://dx.doi.org/10.1136/neurintsurg-2013-010703.rep

Persistent Trigeminal Artery



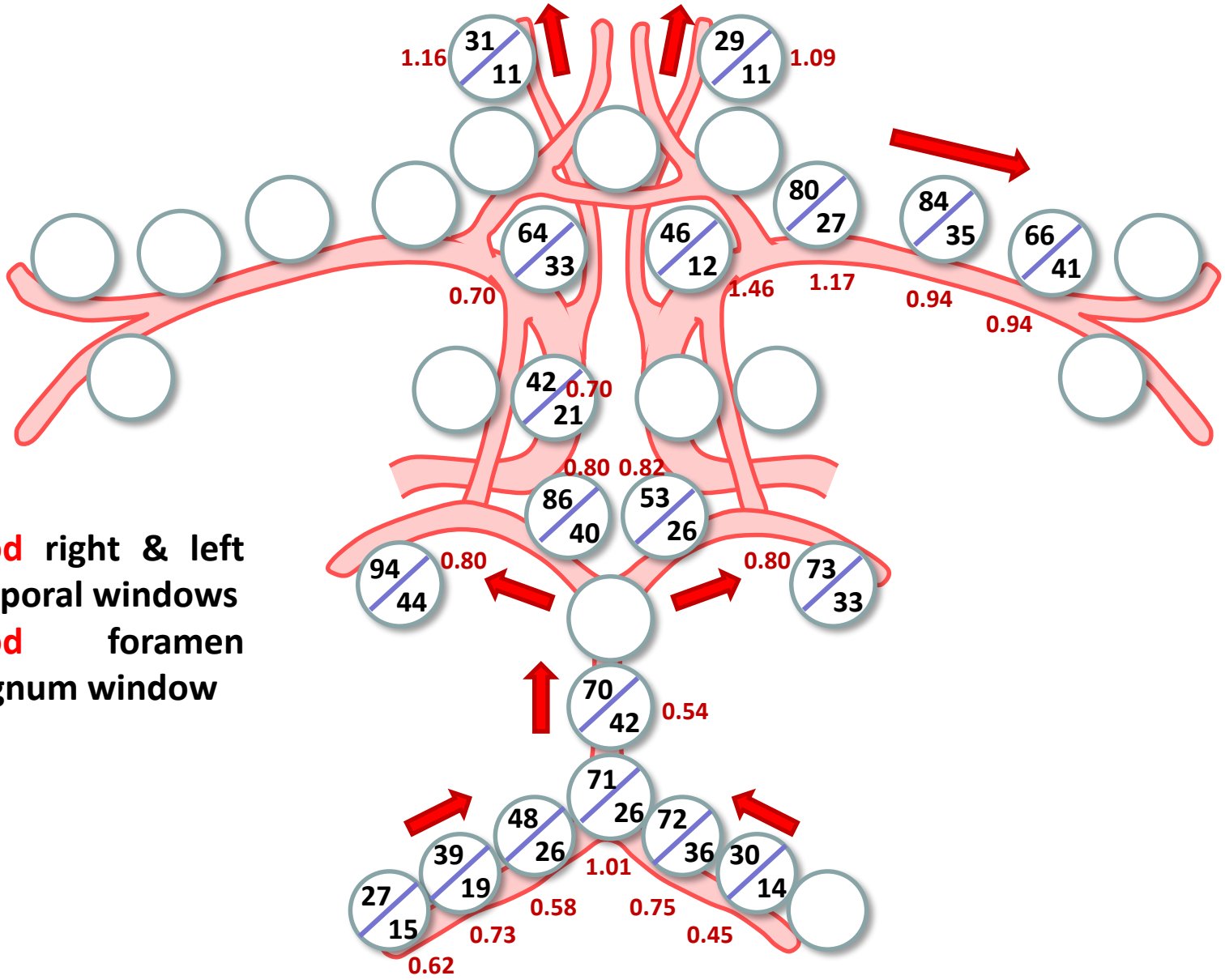
CDUS



- **Good** windows for right & left subclavian, carotid and vertebral artery system

No hemodynamically significant stenosis in right and left carotid arteries and right and left extracranial vertebral arteries

TCCD



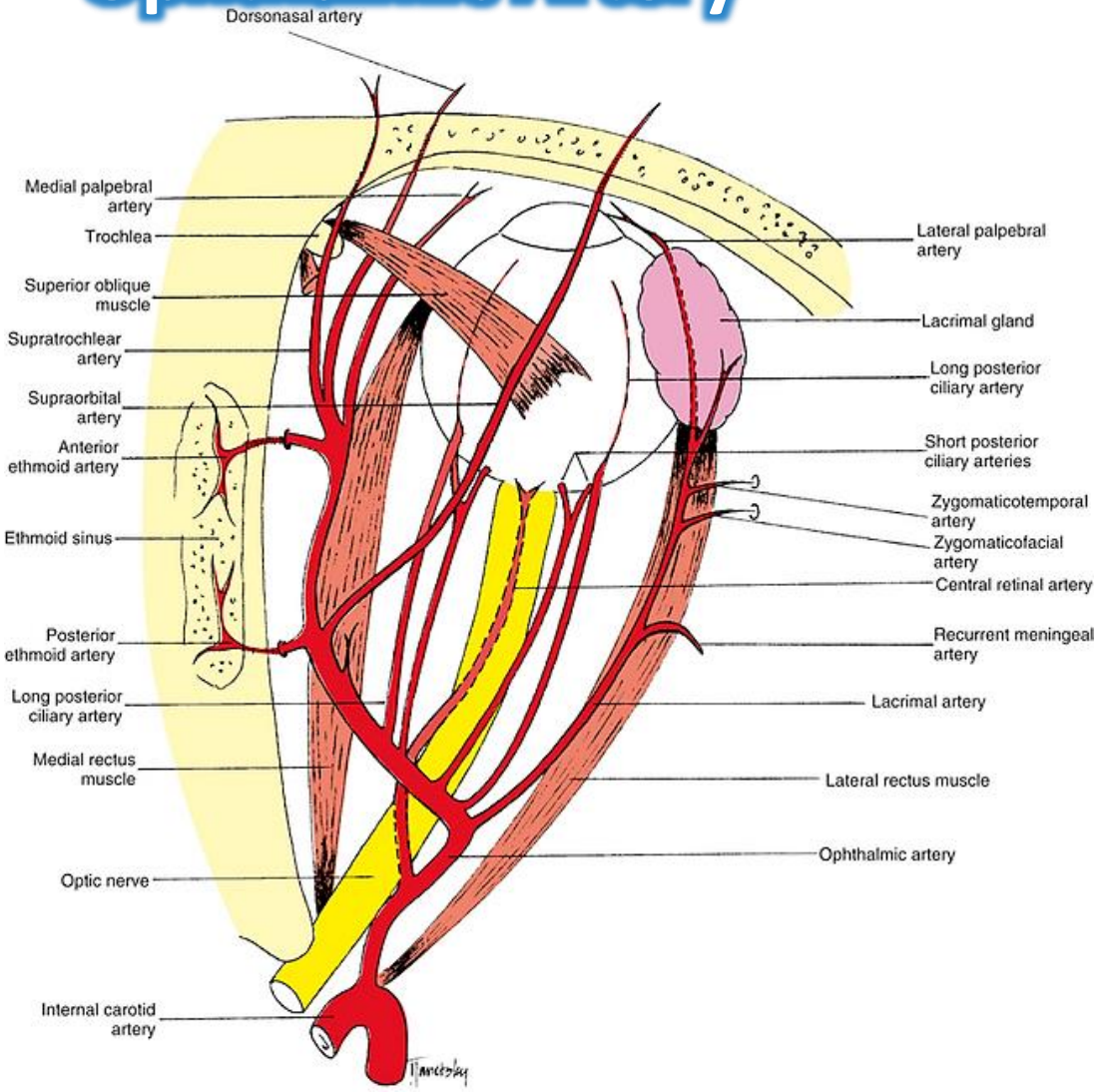
- **Good** right & left temporal windows
- **Good** foramen magnum window

No hemodynamically significant stenosis in terminal right & left ICA, left MCA, right & left PCA, right V4 & left V4 and BA. The near occlusion of total occlusion of right MCA should be considered.

Neurovascular Anatomy (1):
Anatomy of the Anterior Circulation

- Carotid artery system
- **Ophthalmic artery**
- Arterial circle of Willis
- Arterial territories of the cerebrum

Ophthalmic Artery



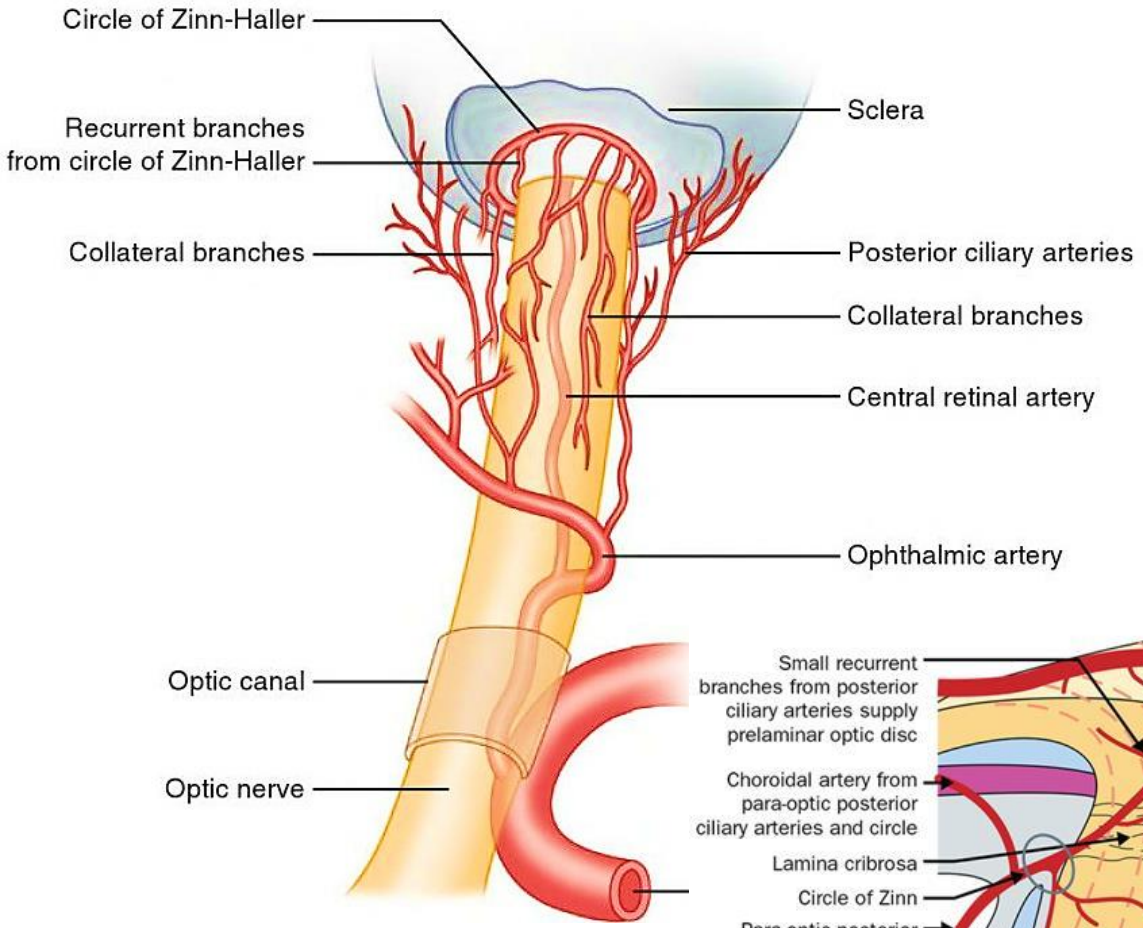
Branches of ophthalmic artery

- Central retinal artery**
- Long & short posterior ciliary arteries**
- Supratrochlear artery**
- Supraorbital artery**
- Lacrimal artery
- Anterior & posterior ethmoidal arteries
- Etc.

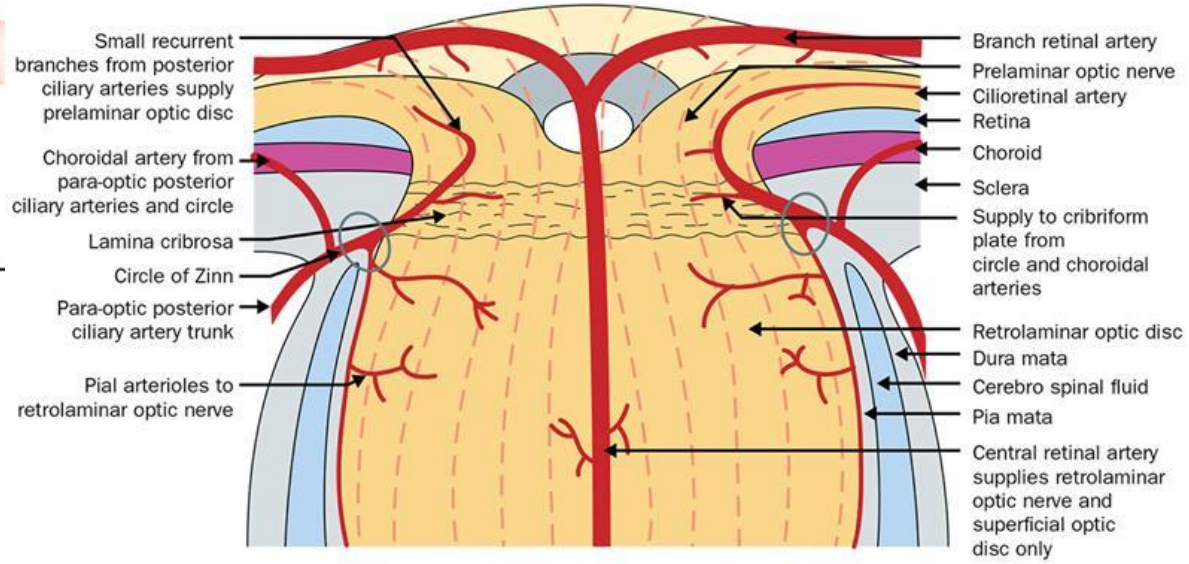
http://anesthesiology.pubs.asahq.org/article.aspx?articleid=2566231

https://www.opticianonline.net/cet-archive/150
https://www.pinterest.com/pin/488922103268831757/?lp=true

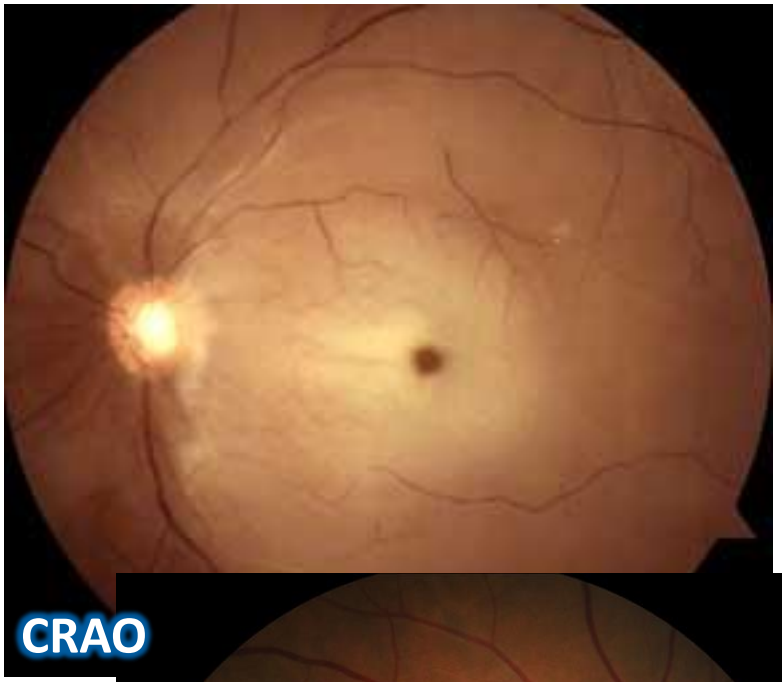
Ophthalmic Artery



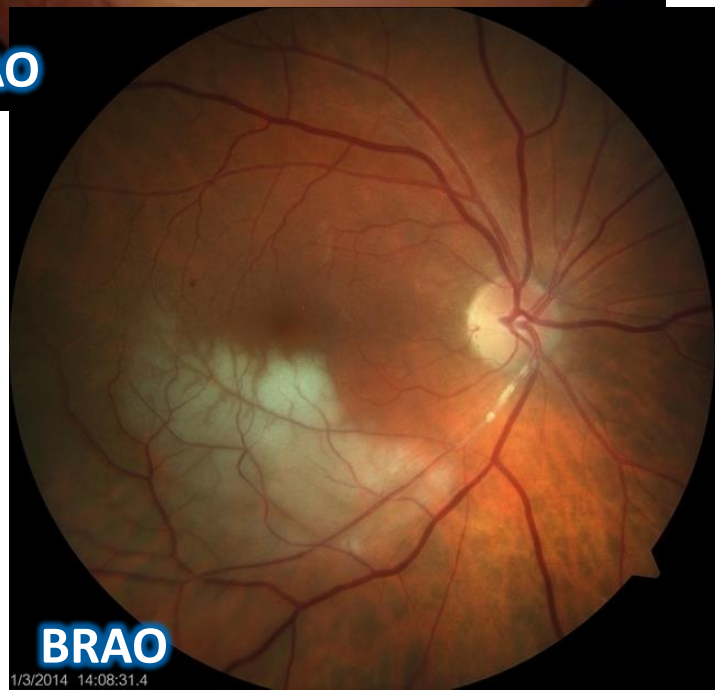
- **Central retinal artery – supply most part of the retina**
- **Posterior ciliary artery – supply choroid plexus and macula lutea (forming circle of Zinn-Haller)**



Retinal artery occlusion



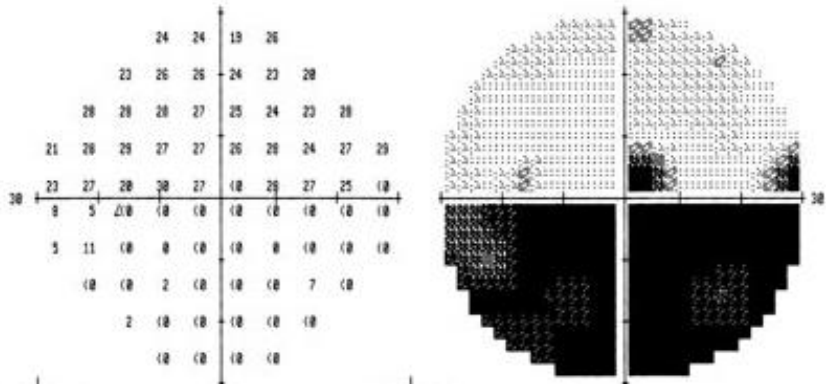
CRAO



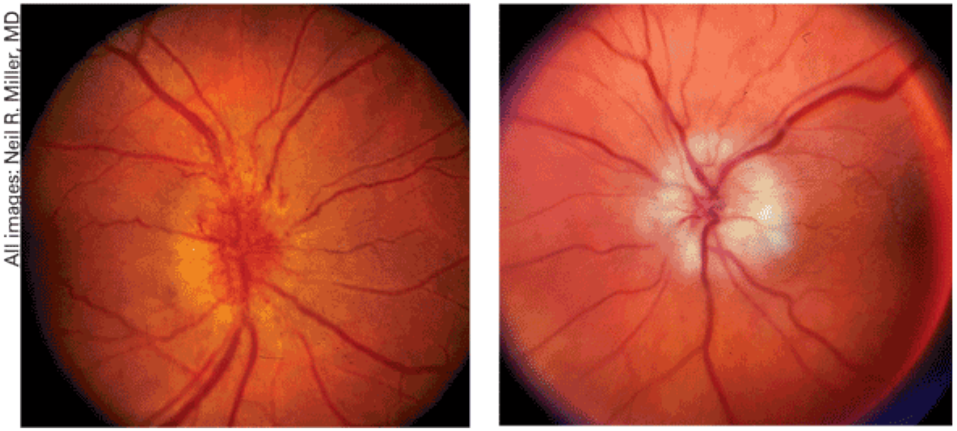
BRAO

1/3/2014 14:08:31.4

Altitudinal visual field defect



All images: Neil R. Miller, MD



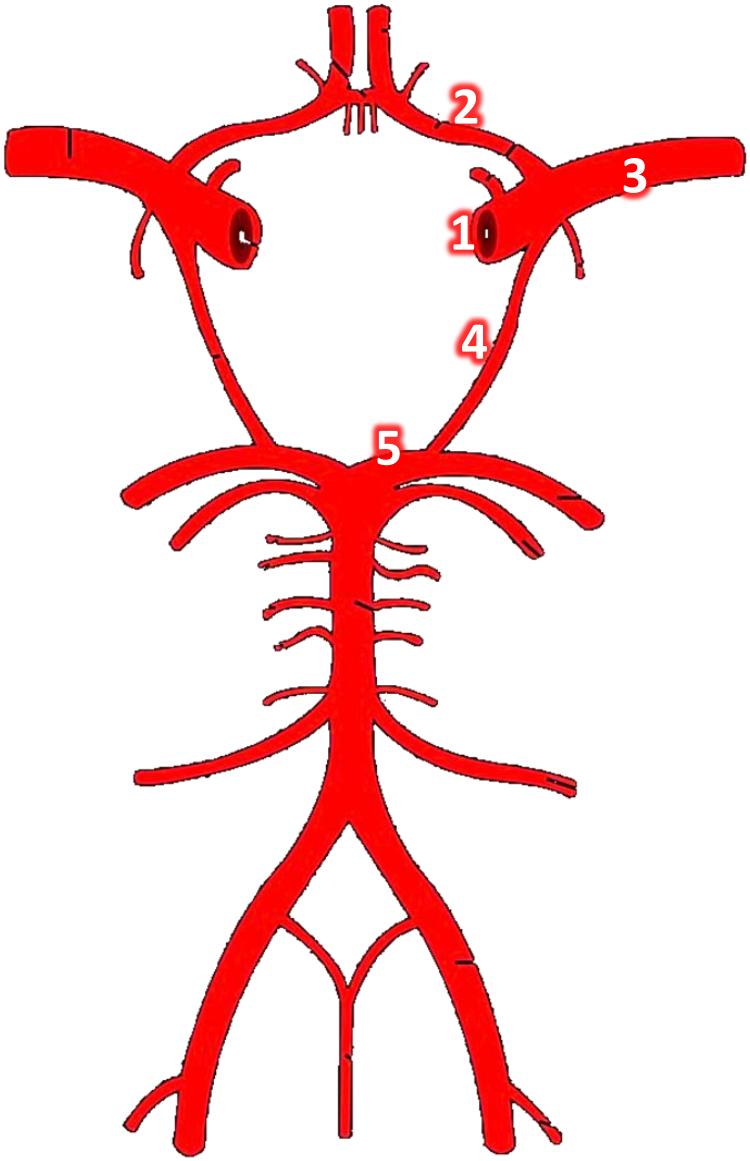
Left: Nonarteritic anterior ischemic optic neuropathy. Note the hyperemic swelling of the optic disc associated with the flame-shaped peripapillary hemorrhage. Right: Arteritic anterior ischemic optic neuropathy. Note the pallid swelling of the optic disc and a peripapillary cotton-wool spot.

https://www.reviewofophthalmology.com/article/diagnosing-and-managing-ischemic-optic-neuropathy

Neurovascular Anatomy (1):
Anatomy of the Anterior Circulation

- Carotid artery system
- Ophthalmic artery
- **Arterial circle of Willis**
- Arterial territories of the cerebrum

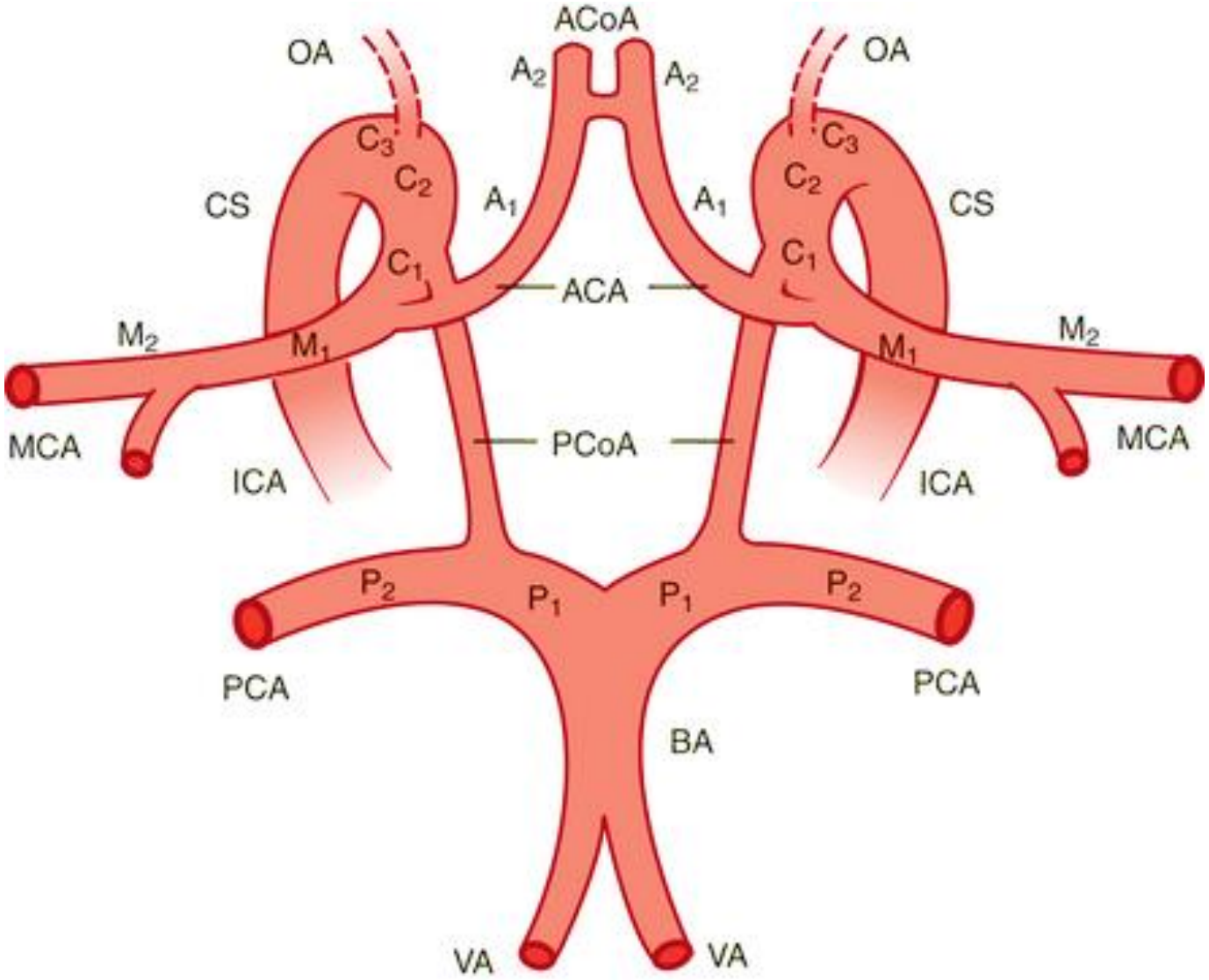
Arterial Circle of Willis



Item	
1	Internal carotid artery (supraclinoid part)
2	Anterior cerebral artery
3	Middle cerebral artery
4	Posterior communicating artery
5	Posterior cerebral artery

Segments of the Arterial Circle

Carotid siphon



https://radiologykey.com/ultrasound-assessment-of-the-intracranial-arteries/
https://www.rainwaterharvesting.co.uk/accessories/overflow-siphon-22

Variations of Arterial Circle of Willis

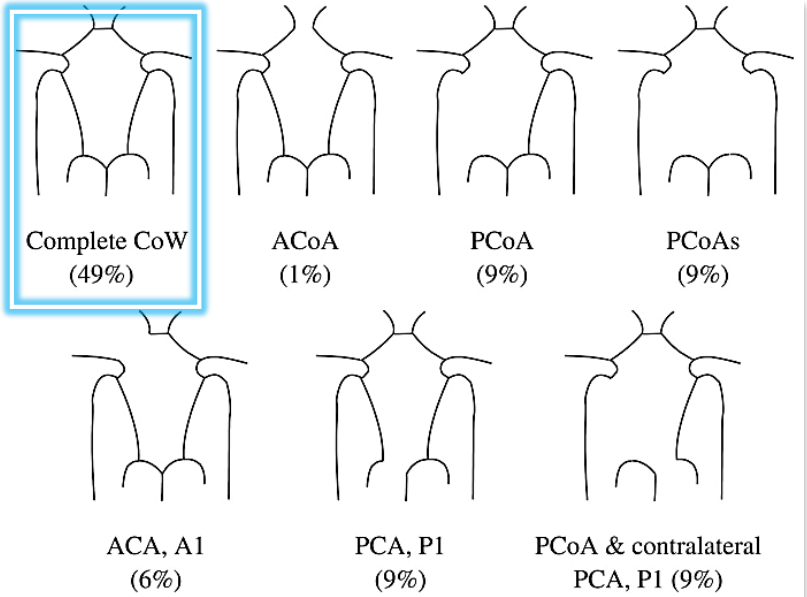


Figure 1 Some common variations of the Circle of Willis [48].

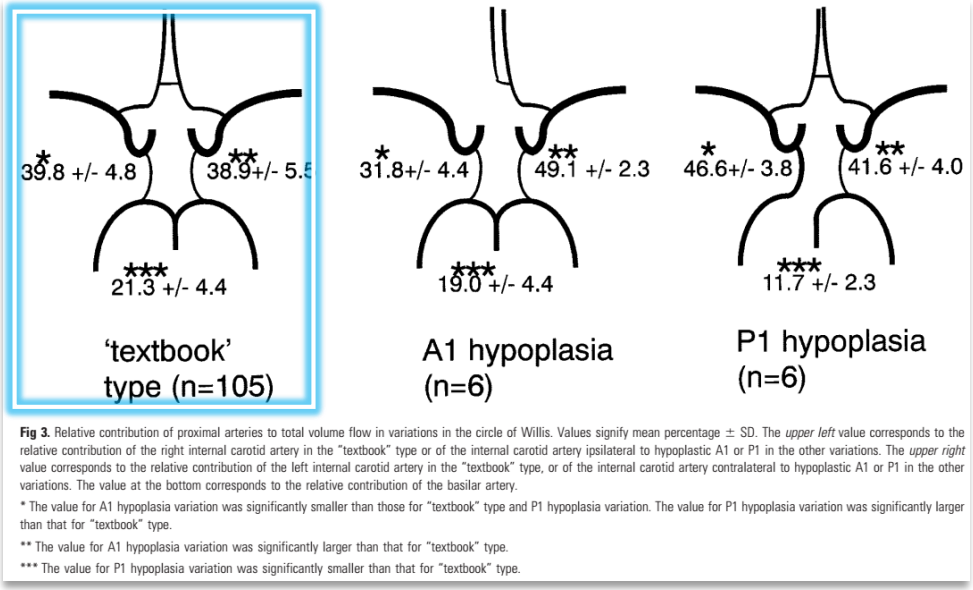


Fig 3. Relative contribution of proximal arteries to total volume flow in variations in the circle of Willis. Values signify mean percentage ± SD. The *upper left* value corresponds to the relative contribution of the right internal carotid artery in the "textbook" type or of the internal carotid artery ipsilateral to hypoplastic A1 or P1 in the other variations. The *upper right* value corresponds to the relative contribution of the left internal carotid artery in the "textbook" type, or of the internal carotid artery contralateral to hypoplastic A1 or P1 in the other variations. The value at the bottom corresponds to the relative contribution of the basilar artery.

* The value for A1 hypoplasia variation was significantly smaller than those for "textbook" type and P1 hypoplasia variation. The value for P1 hypoplasia variation was significantly larger than that for "textbook" type.

** The value for A1 hypoplasia variation was significantly larger than that for "textbook" type.

*** The value for P1 hypoplasia variation was significantly smaller than that for "textbook" type.

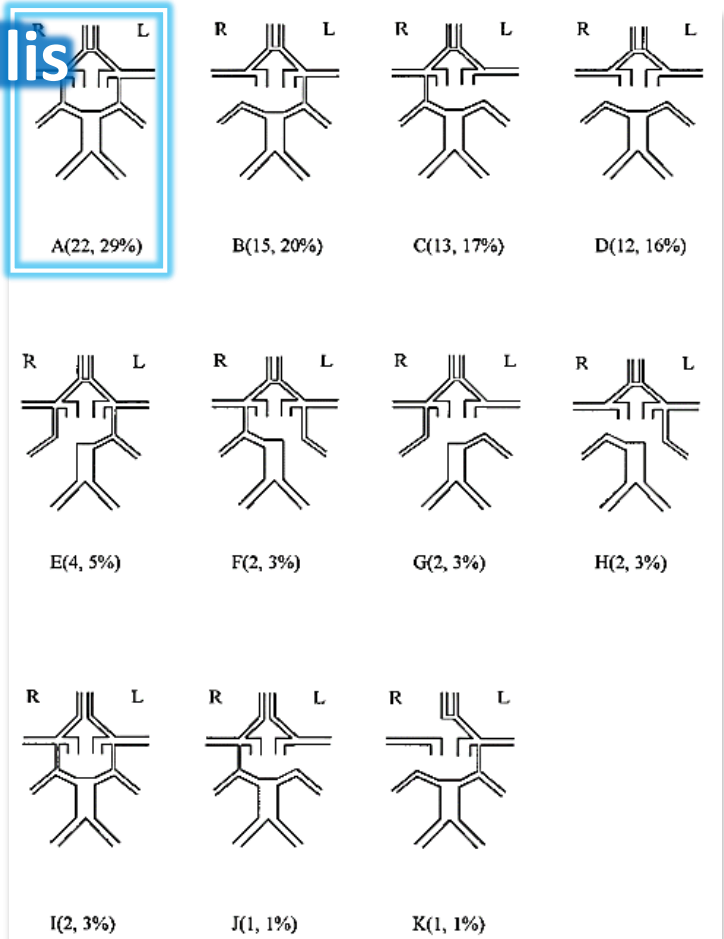


Figure 3. Schematic drawings of the collateral variations found in the circle of Willis in the present study. Numbers and percentages of patients are shown in parentheses for the following conditions: A, complete circle; B, hypofunctional right PcoA; C, hypofunctional left PcoA; D, bilateral hypofunctional PcoAs; E, fetal right posterior cerebral artery; F, fetal left posterior cerebral artery; G, hypofunctional left PcoA and fetal right posterior cerebral artery; H, hypofunctional right PcoA and fetal left posterior cerebral artery; I, hypofunctional AcoA; J, hypofunctional AcoA and hypofunctional left PcoA; and K, hypoplasia right A1 and hypofunctional right PcoA. R indicates right; L, left.

J Biomech 2007; 40: 1794-805
Am J Neuroradiol 2006; 27: 1770-5
Stroke 2000; 31: 1656-60

Arterial Circle of Willis

Cortical branches

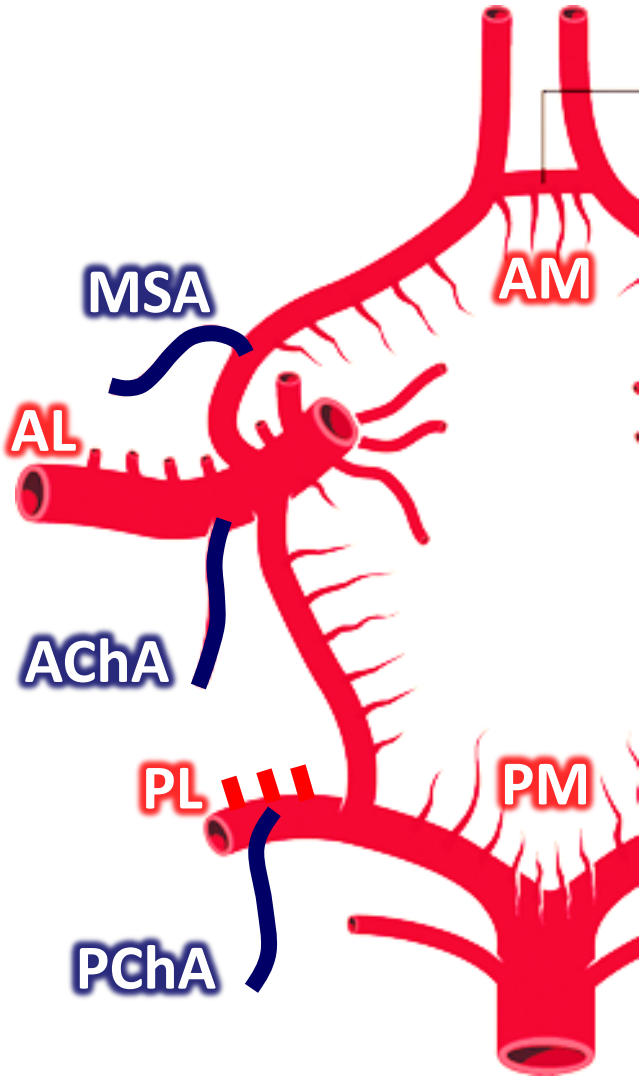
- Anterior cerebral artery (ACA)
- Middle cerebral artery (MCA)
- Posterior cerebral artery (PCA)

Circumferential branches

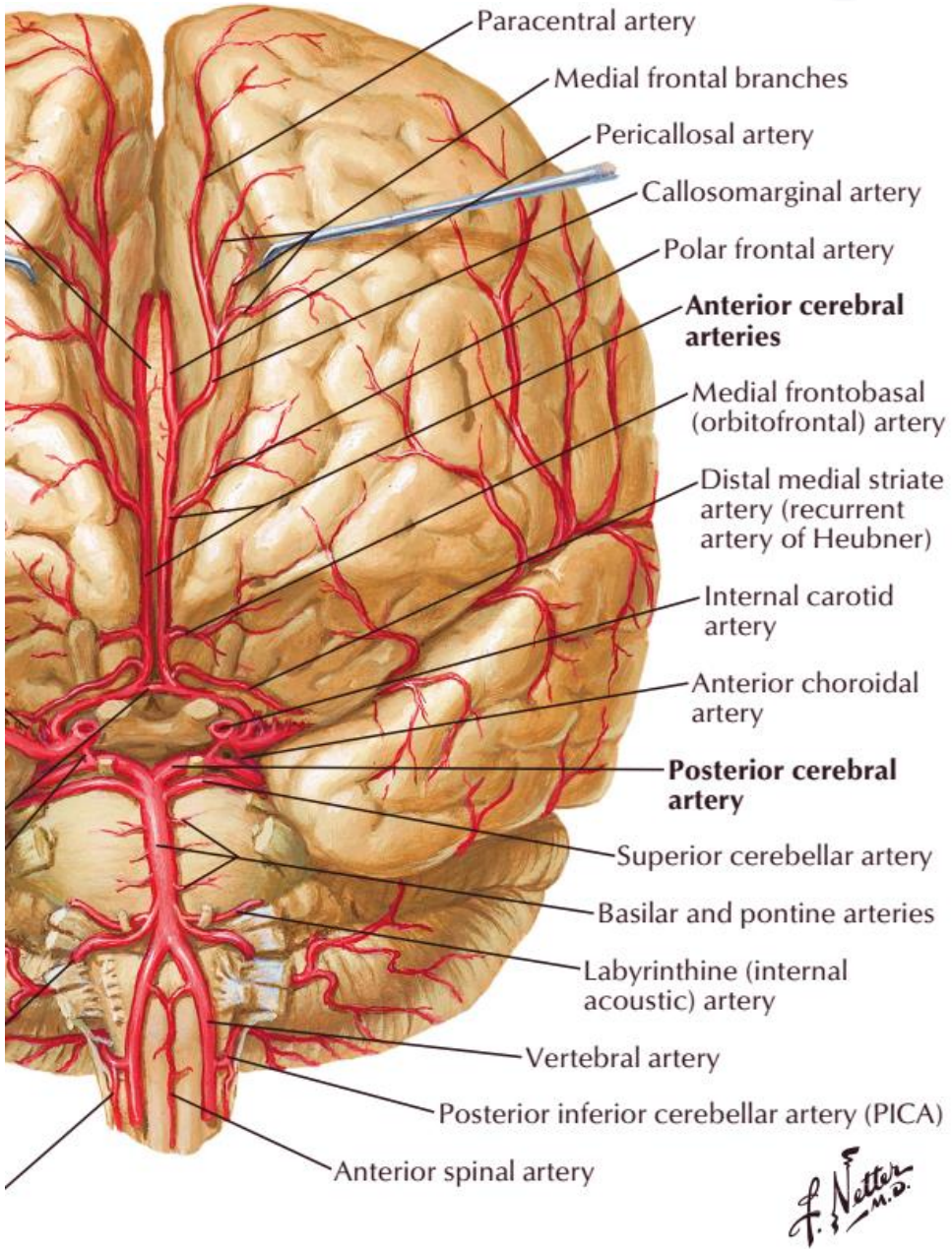
- Medial striate artery (recurrent artery of Heubner's)
- Anterior choroidal artery (AChA)
- Posterior choroidal artery (PChA)

Central branches

- Anteromedial artery
- Posteromedial artery
- Anterolateral artery (lentriculostriate artery)
- Posterolateral artery



Anterior Cerebral Artery



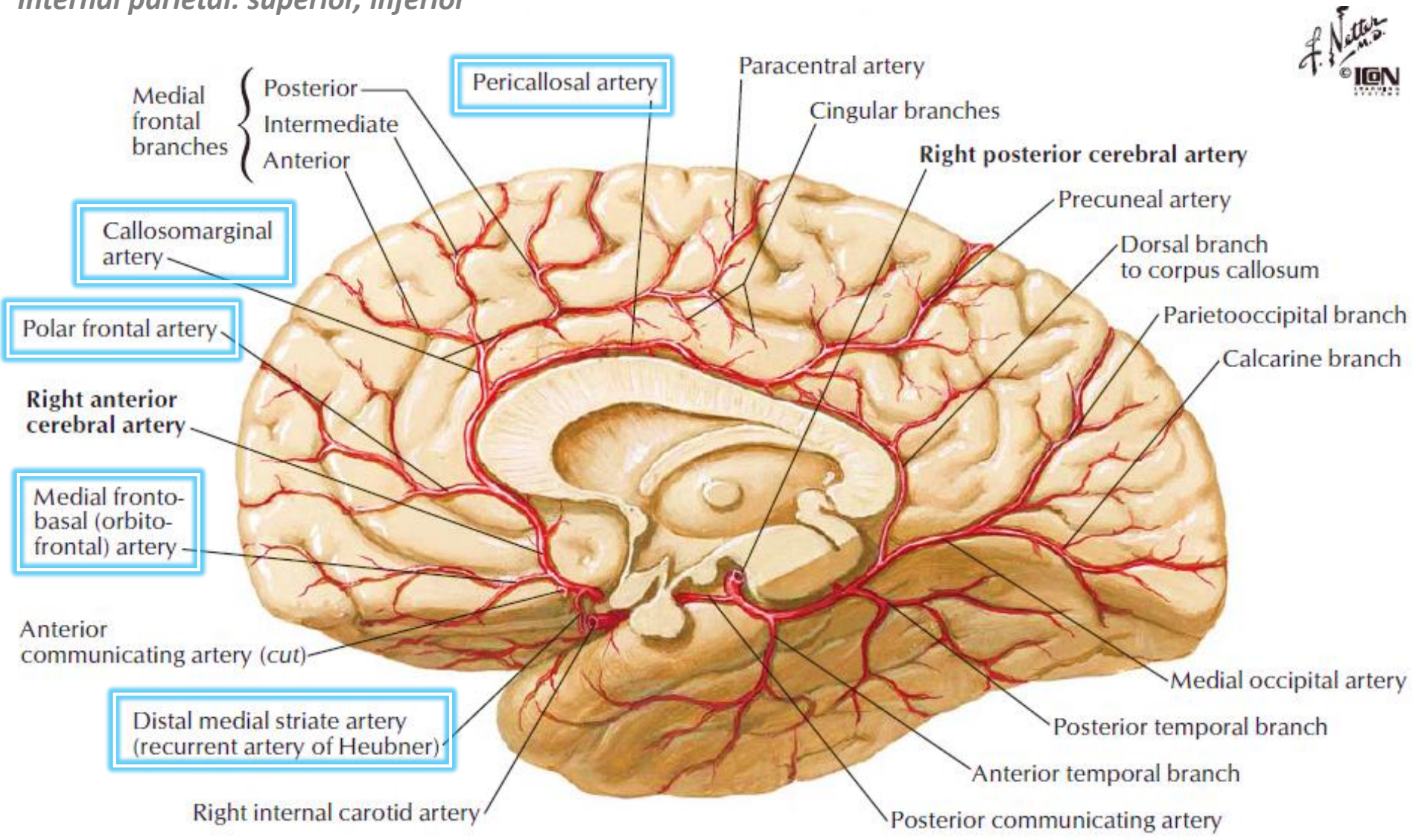
- **Arise just below the anterior perforated substance**
- **Run anteromedially to the interhemispheric fissure**

Branches of ACA

- **Medial striate artery**
- **Orbitofrontal artery**
- **Frontopolar artery**
- **Callosomarginal artery**
- **Pericallosal artery**

Netter FH. Atlas of human anatomy, 6th ed. 2014

Internal frontal: anterior, intermediate, posterior
Internal parietal: superior, inferior

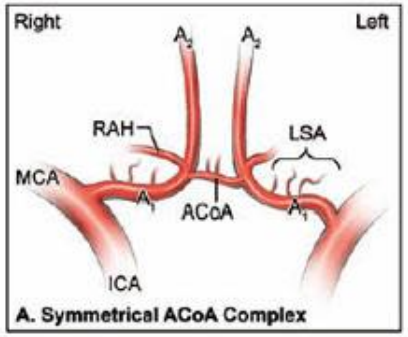


Note: Anterior parietal (postcentral sulcal) artery also occurs as separate anterior parietal and postcentral sulcal arteries

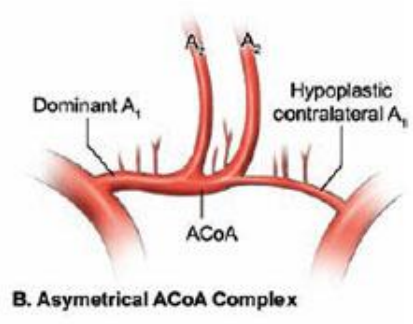
Netter FH. Atlas of human anatomy, 6th ed. 2014

https://neupsykey.com/anterior-communicating-artery-aneurysms-2/
http://dx.doi.org/10.4067/S0717-95022017000300049

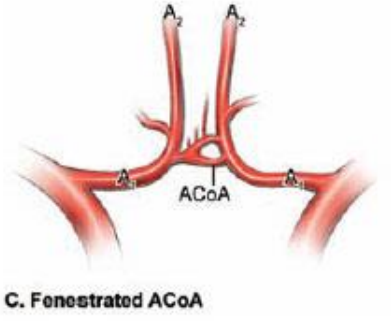
Variation of ACA



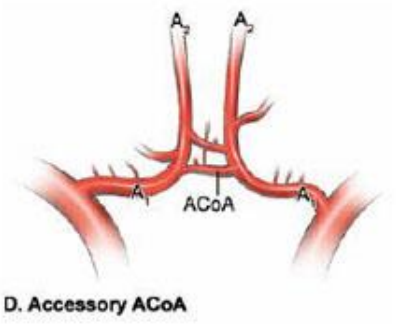
A. Symmetrical ACoA Complex



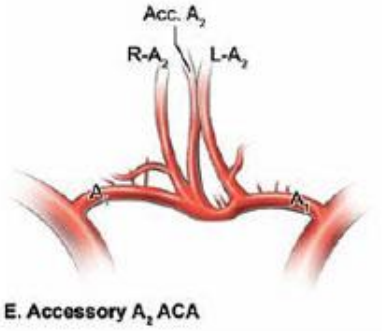
B. Asymetrical ACoA Complex



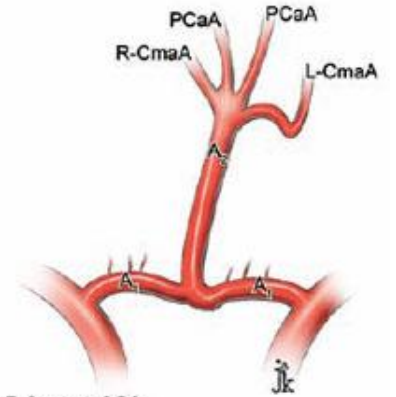
C. Fenestrated ACoA



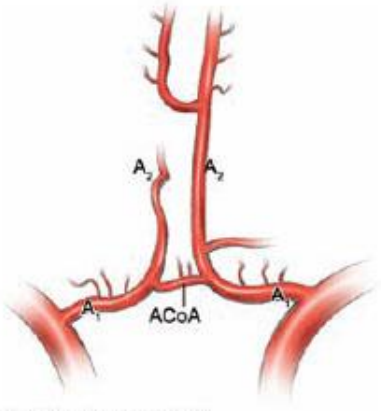
D. Accessory ACoA



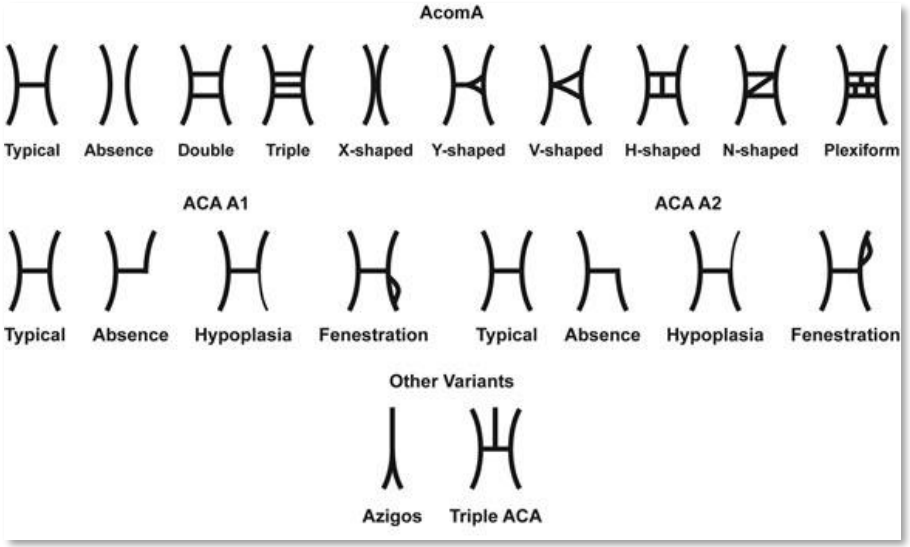
E. Accessory A_2 ACA



F. Azygos ACA



G. Bihemispheric ACA

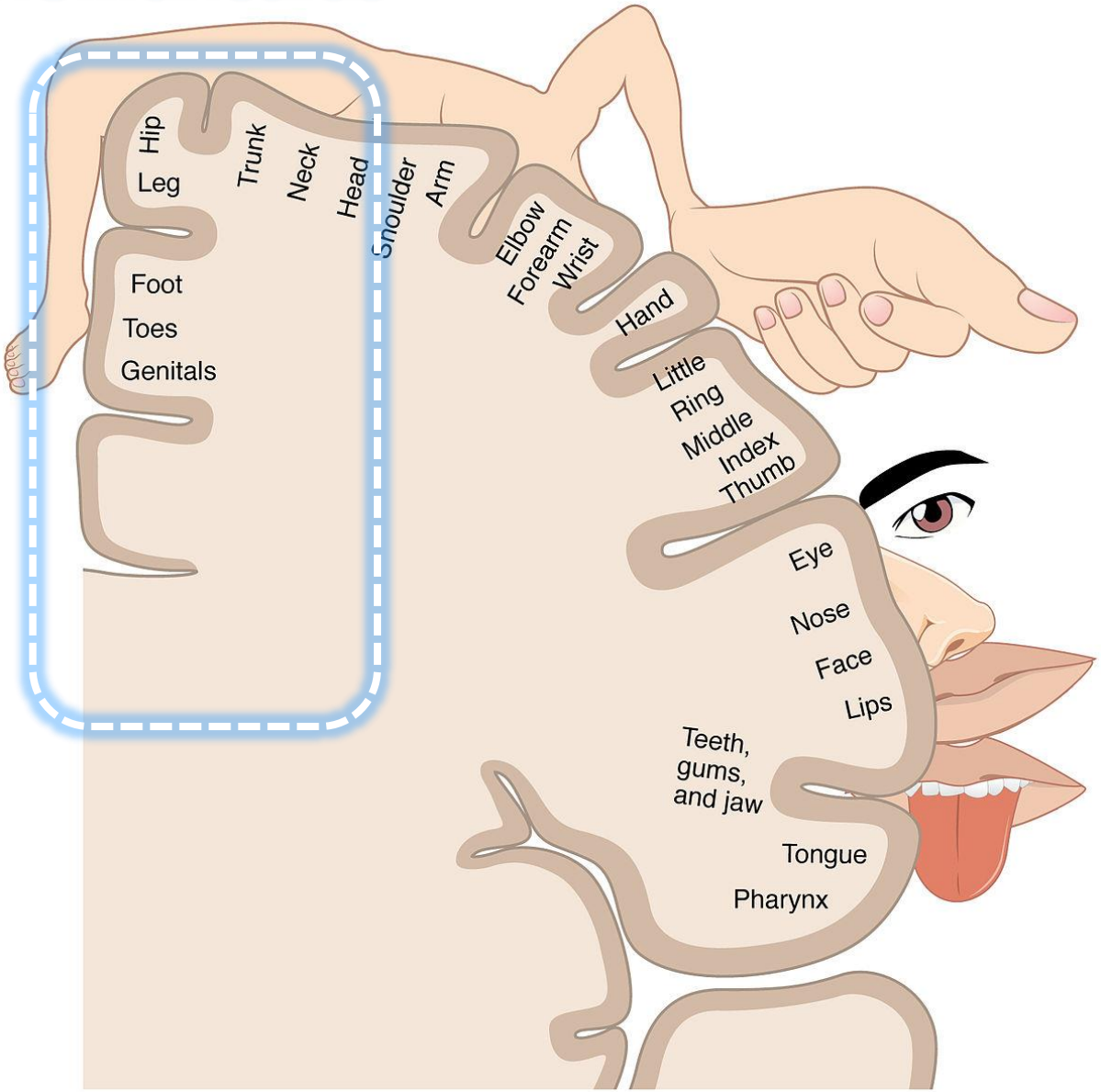


ACA Syndrome

- Rarely isolated, about 0.6-3% of all ischemic stroke

Features of ACA syndrome	• Contralateral weakness (leg > arm) ± sensory loss • Lack of initiation, abulia • Paratonia (gegenhalten), grasp reflex
Bilateral involvement	• Akinetic mutism, paraplegia, urinary incontinence, amnesia with apathy
Anterior corpus callosum	• Left arm apraxia (anterior disconnection syndrome)
Medial striate artery	• Contralateral weakness of face & arm (no sensory loss)
Other manifestations	• ± impaired articulation, soft whispering voice • Transcortical motor aphasia (dominant side) • Memory/emotional disturbances • Impaired motor planning & bimanual coordination • Disturbances of sphincter control, gait • Contralateral ataxic hemiparesis

Motor Homunculus



http://en.wikipaedia.org

Angiographic Correlation

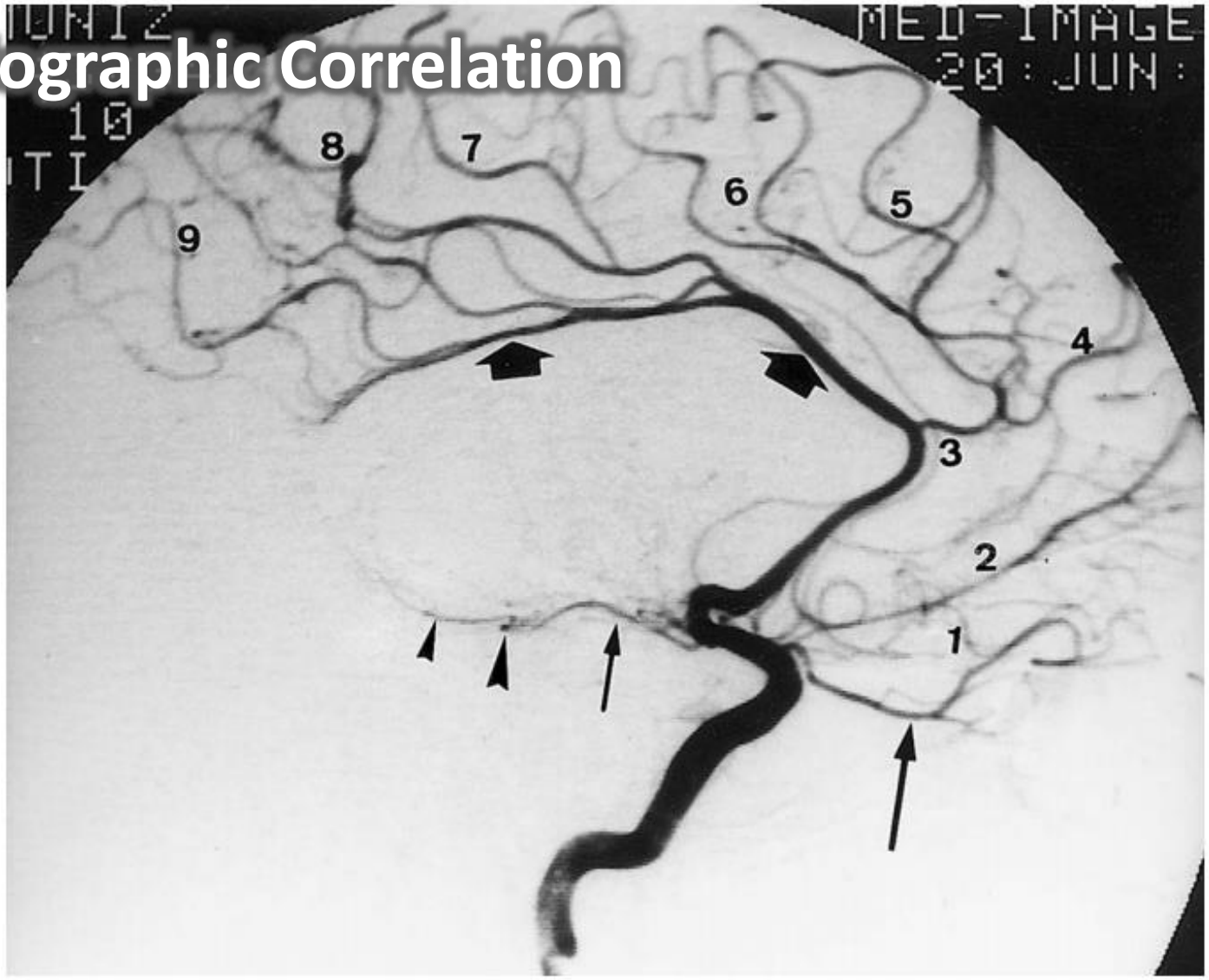


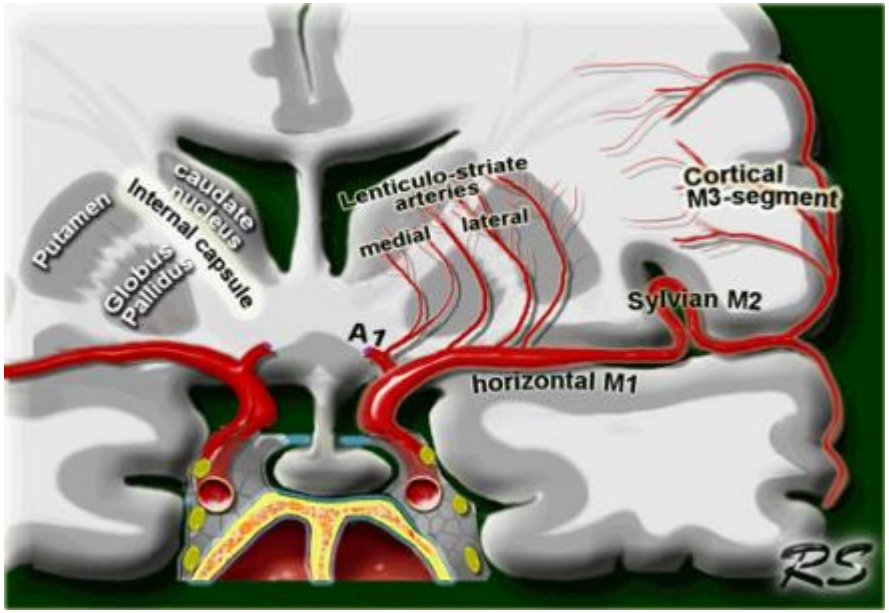
Figure 2.41. **Internal carotid artery, lateral view.** Occlusion of the middle cerebral artery. Anterior choroidal artery (small arrow) with superior deep branches. Pontochoroidal (large arrowhead) and plexal branches (small arrowhead). Pericallosal artery and branches: 1. Orbitofrontal artery (frontobasilar artery). Overlaps the ophthalmic artery (large arrow). 2. Frontopolar artery. 3. Common trunk of the internal frontal arteries, anterior (4), middle (5), and posterior (6). 7. Paracentral artery. 8. Superior internal parietal artery. 9. Inferior internal parietal artery. In this case there is no callosomarginal artery. The large, wide short arrows denote the pericallosal artery.

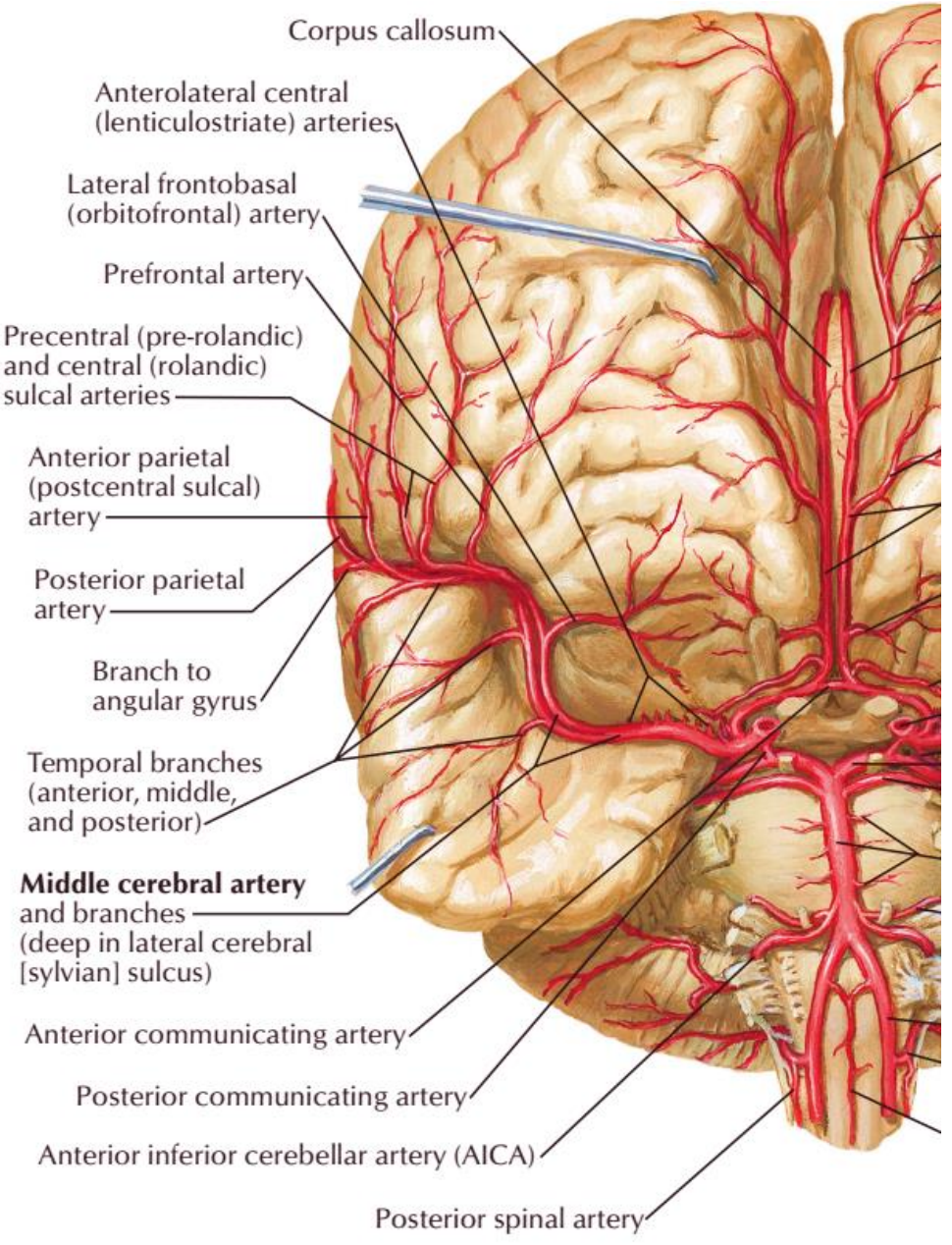
Uflacker R. Atlas of vascular anatomy: an angiographic approach, 2007

Netter FH. Atlas of human anatomy, 6th ed. 2014
http://www.radiologyassistant.nl

Middle Cerebral Artery

- Arise just below the anterior perforated substance
- Supplies most of the lateral surface of the cerebral hemisphere
- 3 parts :
  - Proximal (M1)
  - Sylvian (M2)
  - Distal (M3)





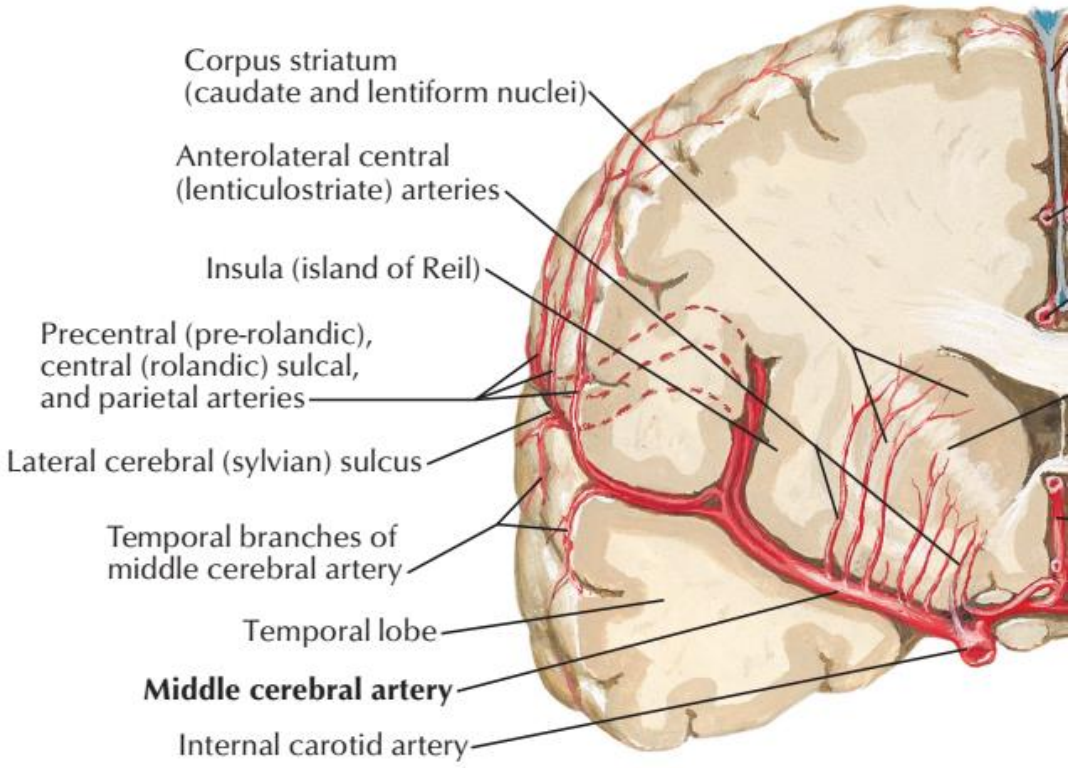
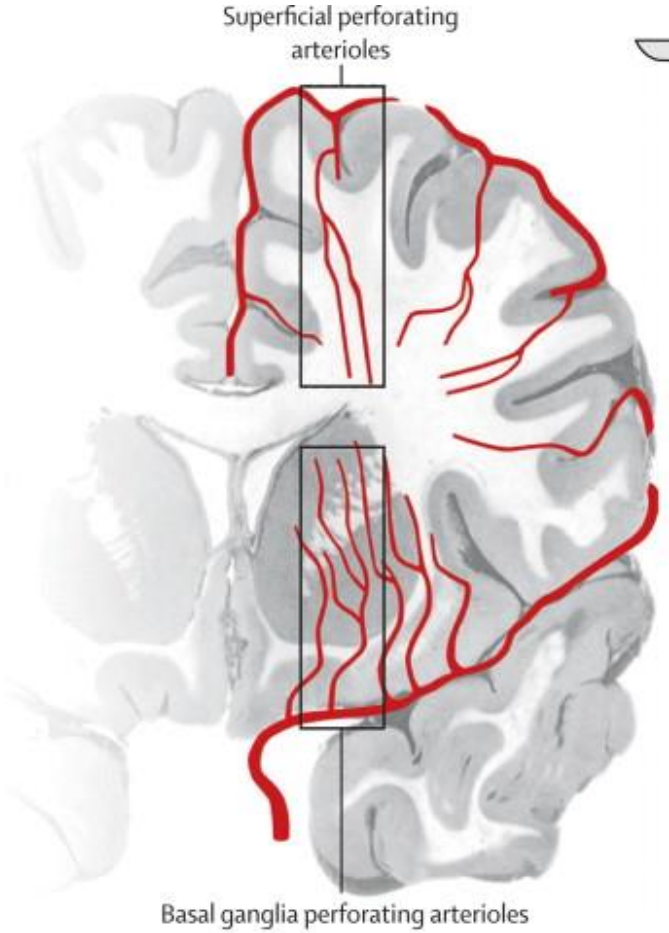


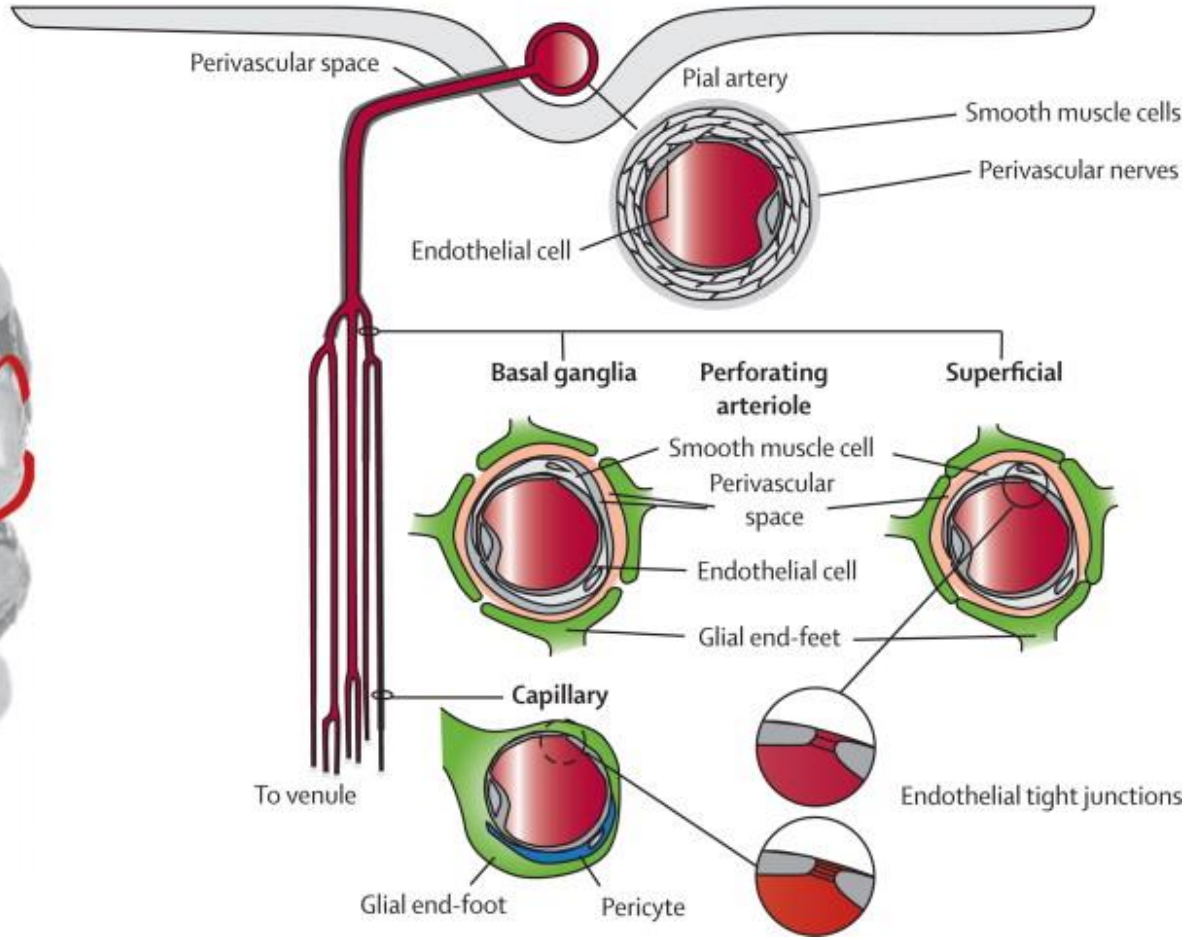
Fig. 13 Anterior view of a vascular cast of the perforating arteries of the right middle cerebral artery (*1*). *2* The anterior cerebral artery (cut); *3* the internal carotid artery

Lenticulostriate Artery (Lateral Striate Artery)

Supplies	• **Corona radiate, superior portion of anterior/posterior limb of internal capsule** • **External capsule, claustrum, putamen, part of the globus pallidus, body of the caudate nucleus**
Syndromes	• **Contralateral hemiparesis (mainly upper extremity)** • **Cortical symptoms (aphasia, neglect, apraxia)**

Netter FH. Atlas of human anatomy, 6th ed. 2014
Acta Neurochir 2015; 157: 743-54

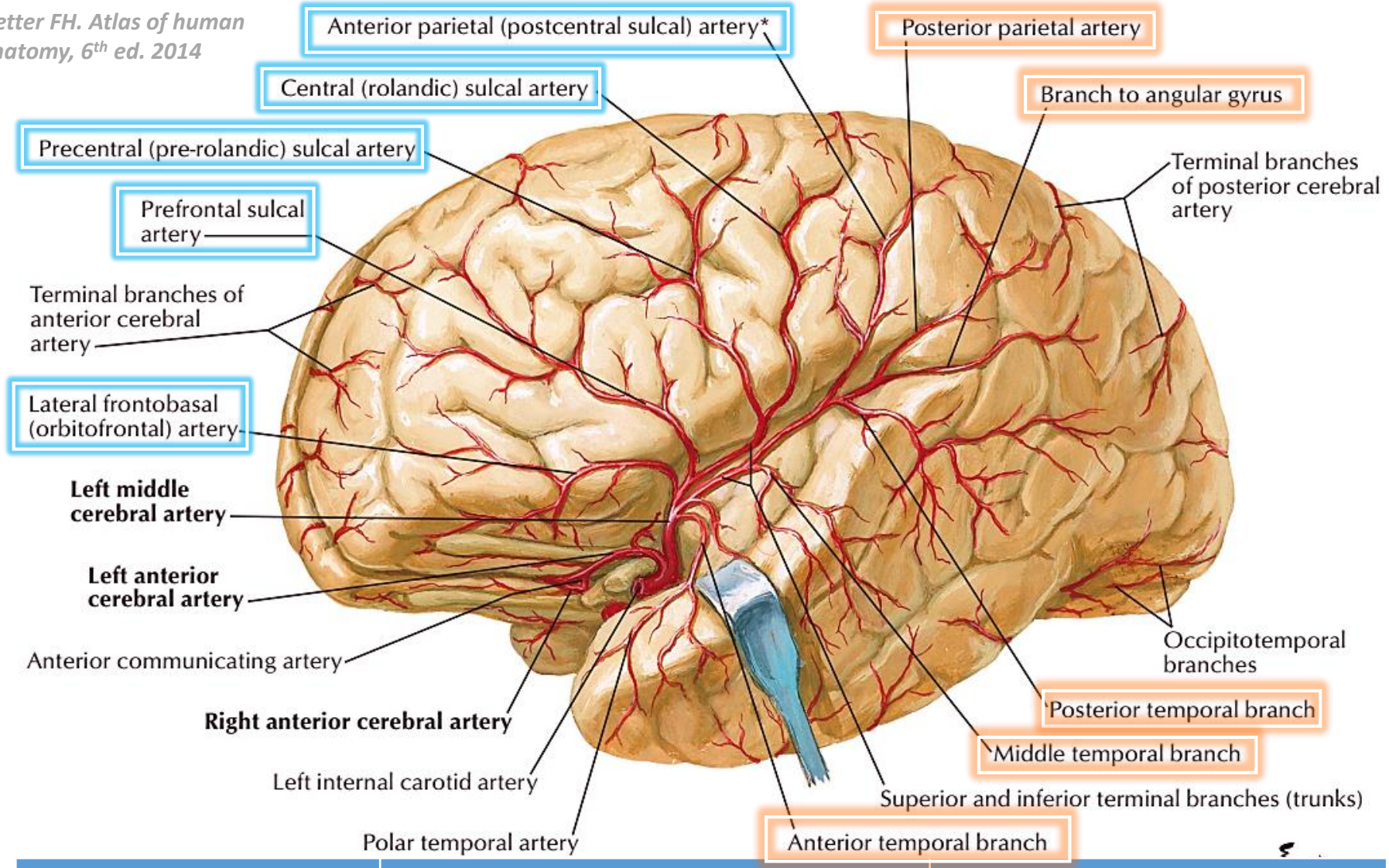




- **Perpendicular projection**
- **End-on arteries**
- **Watershed infarction**

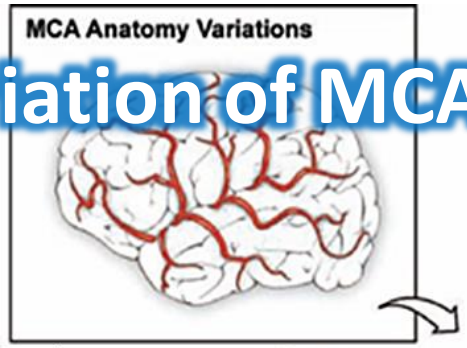
Lancet Neurol 2013; 12(5): 483-97

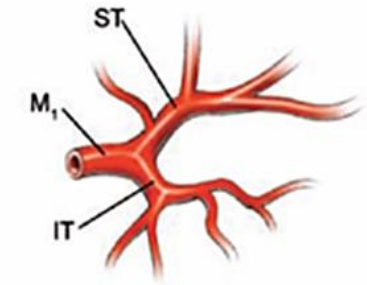
Netter FH. Atlas of human anatomy, 6th ed. 2014



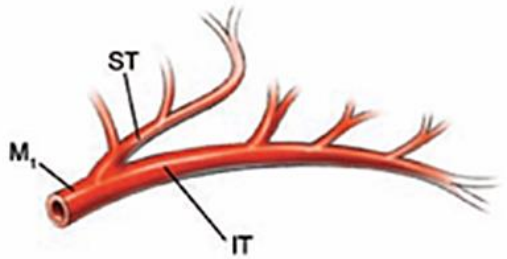
Main stem (occasional)	Superior division	Inferior division
• Orbitofrontal • Anterior temporal	• Prefrontal • Precentral • Central • Anterior parietal (postcentral)	• Posterior parietal • Branch to angular gyrus • Anterior, middle & posterior temporal

Variation of MCA

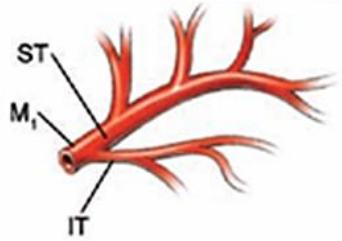




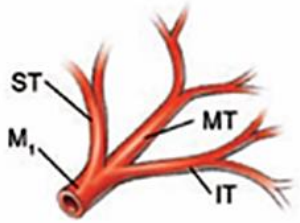
A. Bifurcation, Equal Trunks



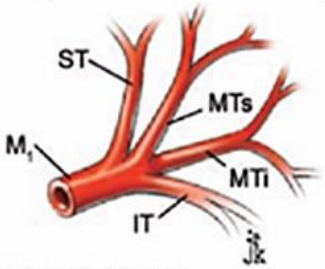
B. Bifurcation, Inferior Trunk Dominant



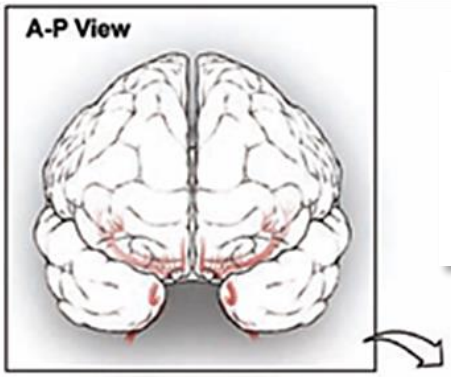
C. Bifurcation, Superior Trunk Dominant

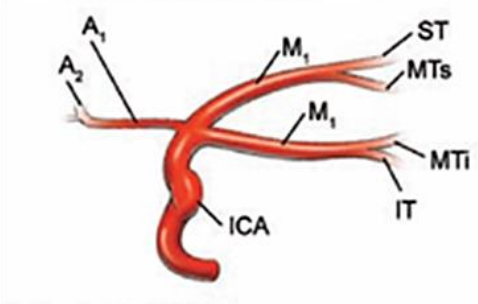


D. Trifurcation

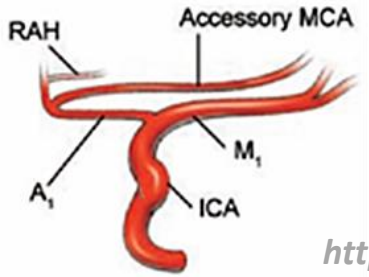


E. Quadrifurcation





F. Duplicated MCA



G. Accessory MCA

- **78% bifurcation**
- **12% trifurcation**
- **10% branching into many smaller branches**

https://neupsykey.com/middle-cerebral-artery-aneurysms-2/

MCA Syndrome

- The most common site of ischemic stroke
- Clinical features are extremely diverse

Features of MCA syndrome	• Contralateral weakness (face,arm > leg)
	• Contralateral hemisensory loss (face,arm > leg)
	  • Perioral & distal upper limb sensory dysfunction (cheiro-oral syndrome)
	• Paresis/apraxia of conjugate gaze to opposite side with transient tonic deviation toward the affected side
	• Contralateral homonymous visual field defect
	  • Whole optic radiation –> hemianopia
	  • Parietal –> inferior quadrantanopia
	  • Temporal – superior quadrantanopia

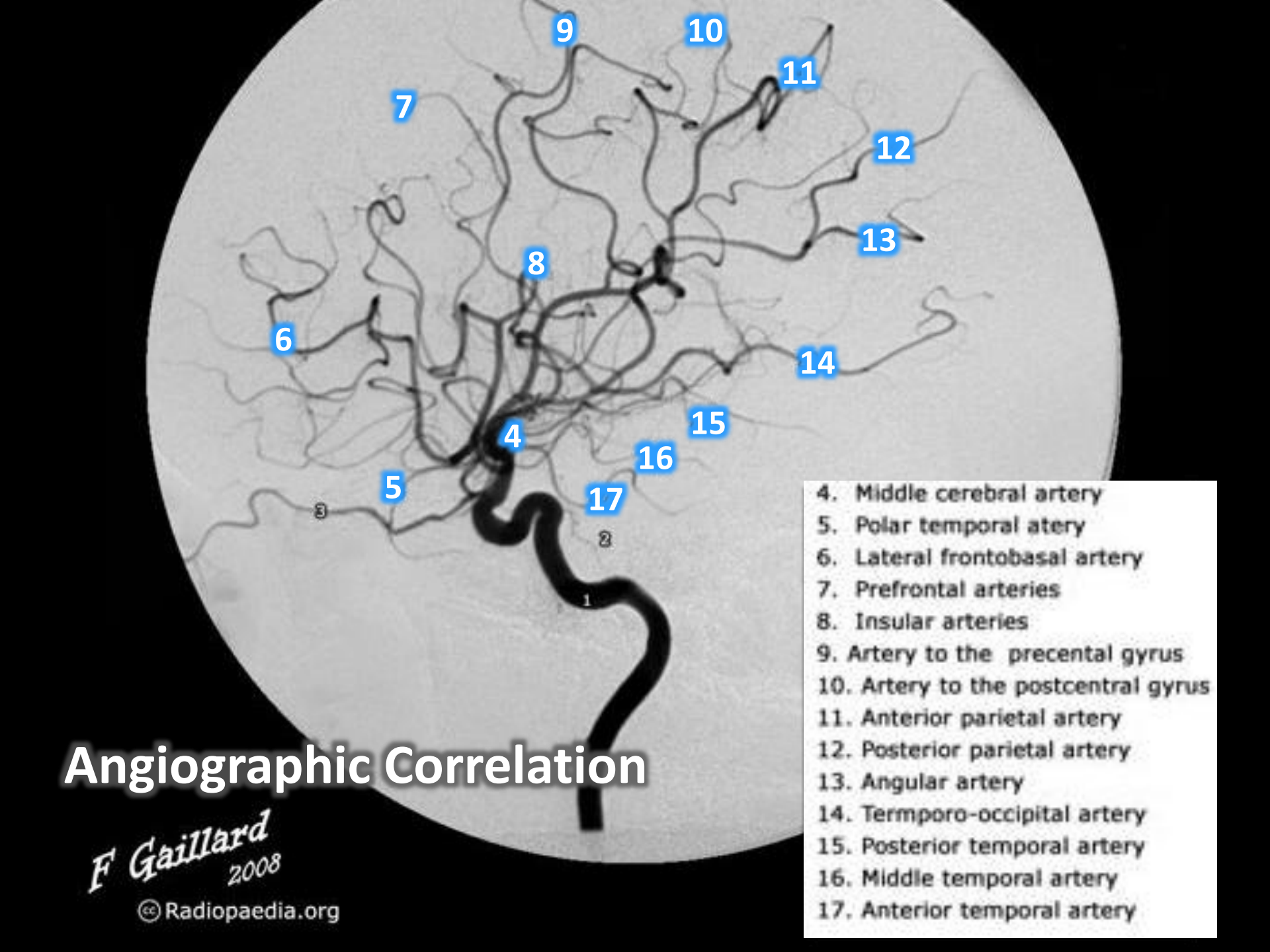
Dominant hemisphere	• Broca's, Wernicke's, conduction, or global aphasias • Left angular gyrus – alexia with agraphia or Gerstmann's syndrome
Nondominant hemisphere	• Inattention, neglect, denial, apraxia, aprosody • Acute agitated delirium, delusion, hallucinations

Territories	Contralat hemiparesis	Contralat hemisensory loss	Eye manifestation	Other cortical dysfunctions
Superior division	Face,arm > leg	Face,arm > leg	Preference to affected side (VF usually spared)	• Nonfluent aphasia (dominant) • Aprosodia, confusion, hemiinattention, anosognosia (non-dominant)
Inferior division	-	-	Contralat hemianopia/quadrant	• Conduction/Wernicke aphasia, Gerstmann's syndrome (dominant) • Left visual neglect (non-dominant)

Isolated cortical	M2/M3 segments
Global aphasia & disproportionate weakness	Distal M1 segment
Global aphasia & proportionate weakness	ICA or proximal M1 segment

Other MCA Syndrome

Insular cortex	• Somatosensory deficits, gustatory disorders • Vestibular-like manifestations • Cardiovascular disorders, including arterial hypertension and arrhythmias (increased risk of MI, sudden death) • Language & neuropsychological disorders (aphasia, dysarthria, somatoparaphrenia)
Double infarcts of dominant MCA	• Global aphasia without hemiparesis • Hemianopic hemiplegia without sensory impairment • Conduction aphasia with hemiparesis
Bilateral anterior opercular infarcts	• Foix-Chavany-Marie syndrome • Bilateral supranuclear facio-pharyngeal-glossomasticatory paresis with automatic-voluntary dissociation
Bilateral temporal infarcts	• Cortical deafness: Awareness of sound, but cannot interpret verbal or identify nonverbal auditory stimulus • Klüver-Bucy syndrome

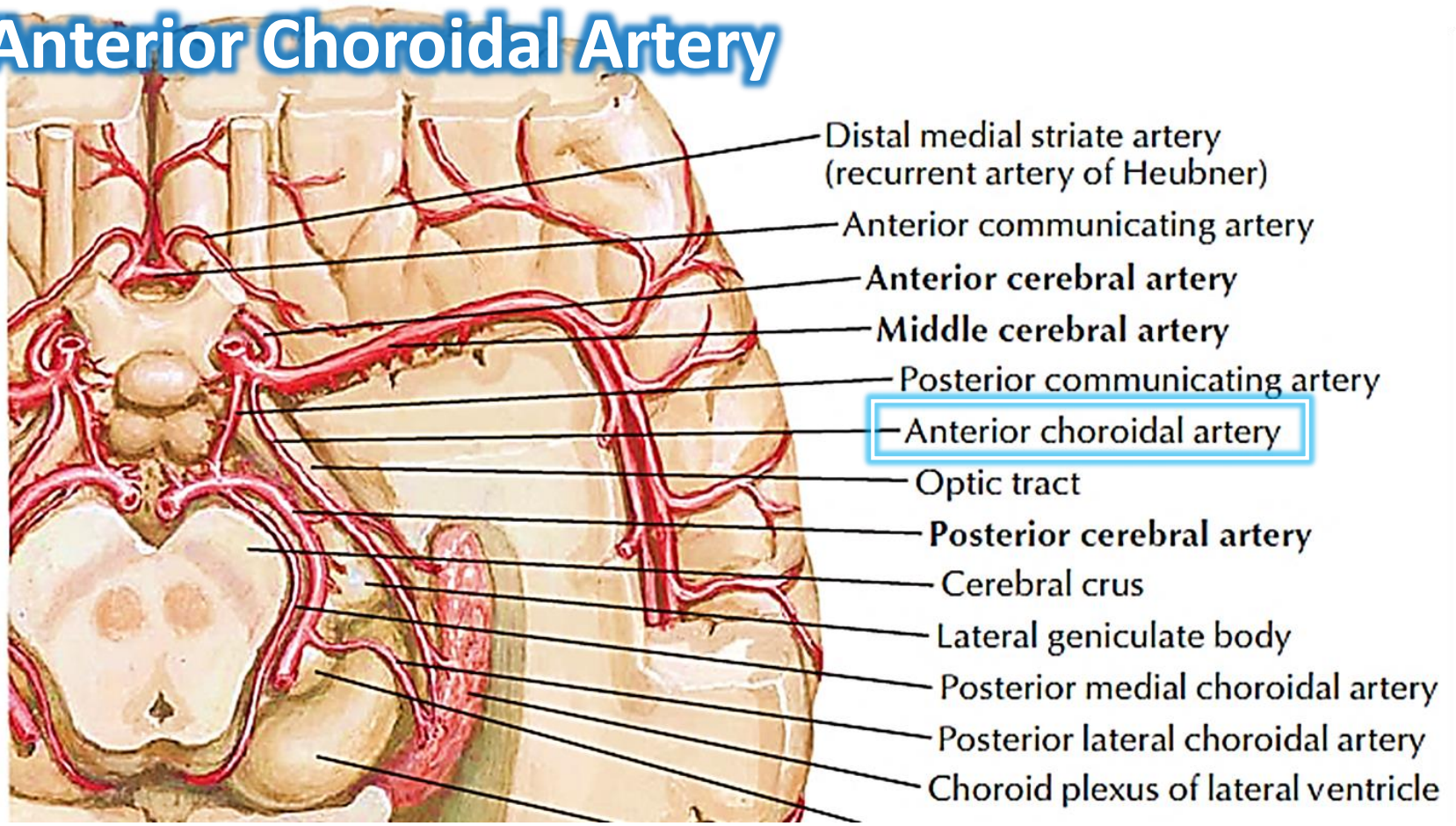


Angiographic Correlation

F Gaillard 2008

4. Middle cerebral artery
5. Polar temporal atery
6. Lateral frontobasal artery
7. Prefrontal arteries
8. Insular arteries
9. Artery to the precental gyrus
10. Artery to the postcentral gyrus
11. Anterior parietal artery
12. Posterior parietal artery
13. Angular artery
14. Termporo-occipital artery
15. Posterior temporal artery
16. Middle temporal artery
17. Anterior temporal artery

Anterior Choroidal Artery



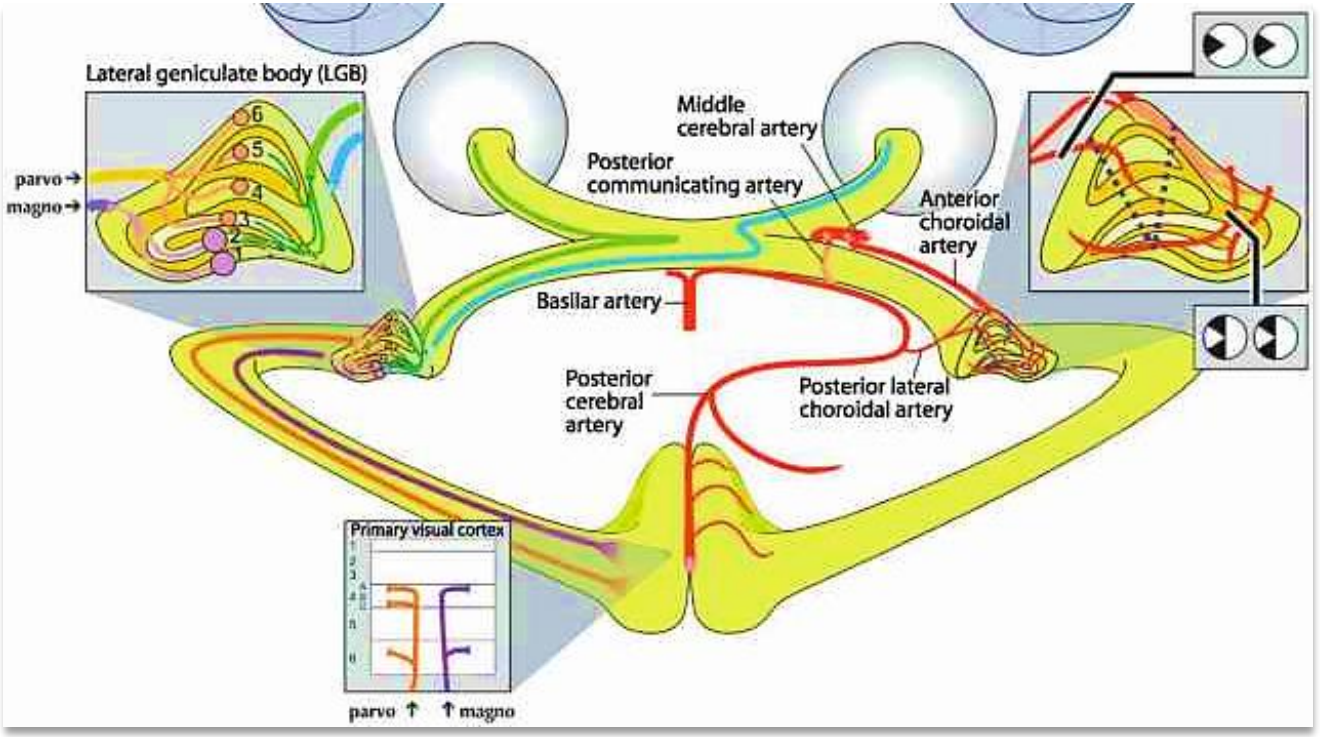
Supplies	• **Posterior 2/3 of posterior limb of internal capsule** • **Optic tract, lateral geniculate body (hilum and lateral part), optic radiation** • **Amygdala, uncus and adjacent medial temporal lobe** • **Posterior paraventricular corona radiata**

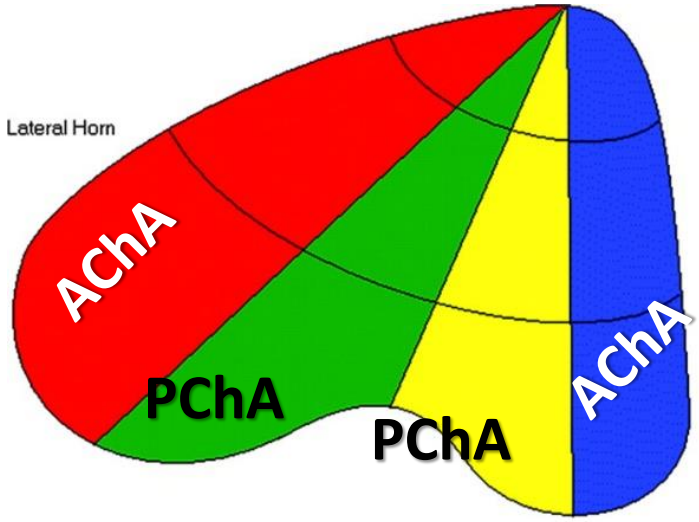
Netter FH. Atlas of human anatomy, 6th ed. 2014

https://www.clicktocurecancer.info/optic-nerve/iq.html

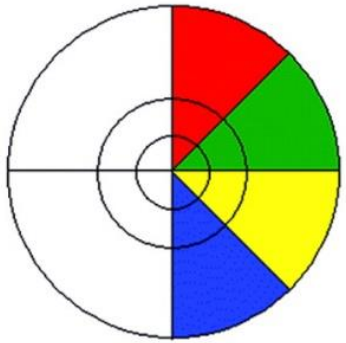
AChA Syndrome

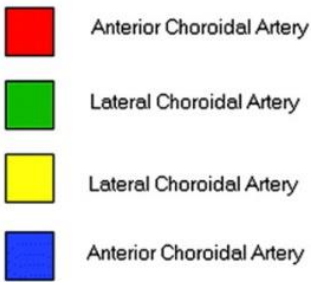
Features of AChA syndrome	• Contralateral hemiparesis • Contralateral hemisensory loss • Contralateral homonymous hemianopia sparing the horizontal meridian (quadruple sectoranopia)** • RAPD may be present in the eye contralateral to lesion
Bilateral AChA (extremely rare)	• Pseudobular mutism with facial diplegia • Bilateral hourglass-shaped VF defect

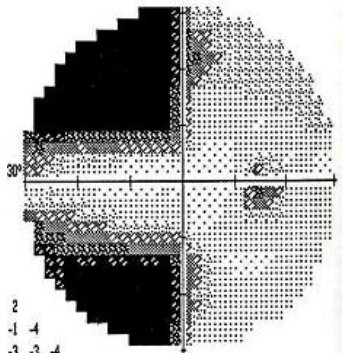




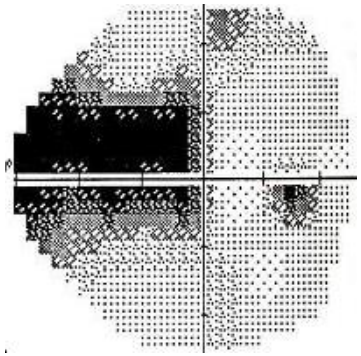
Representation of right visual field in the left LGB, seen in coronal section from behind.







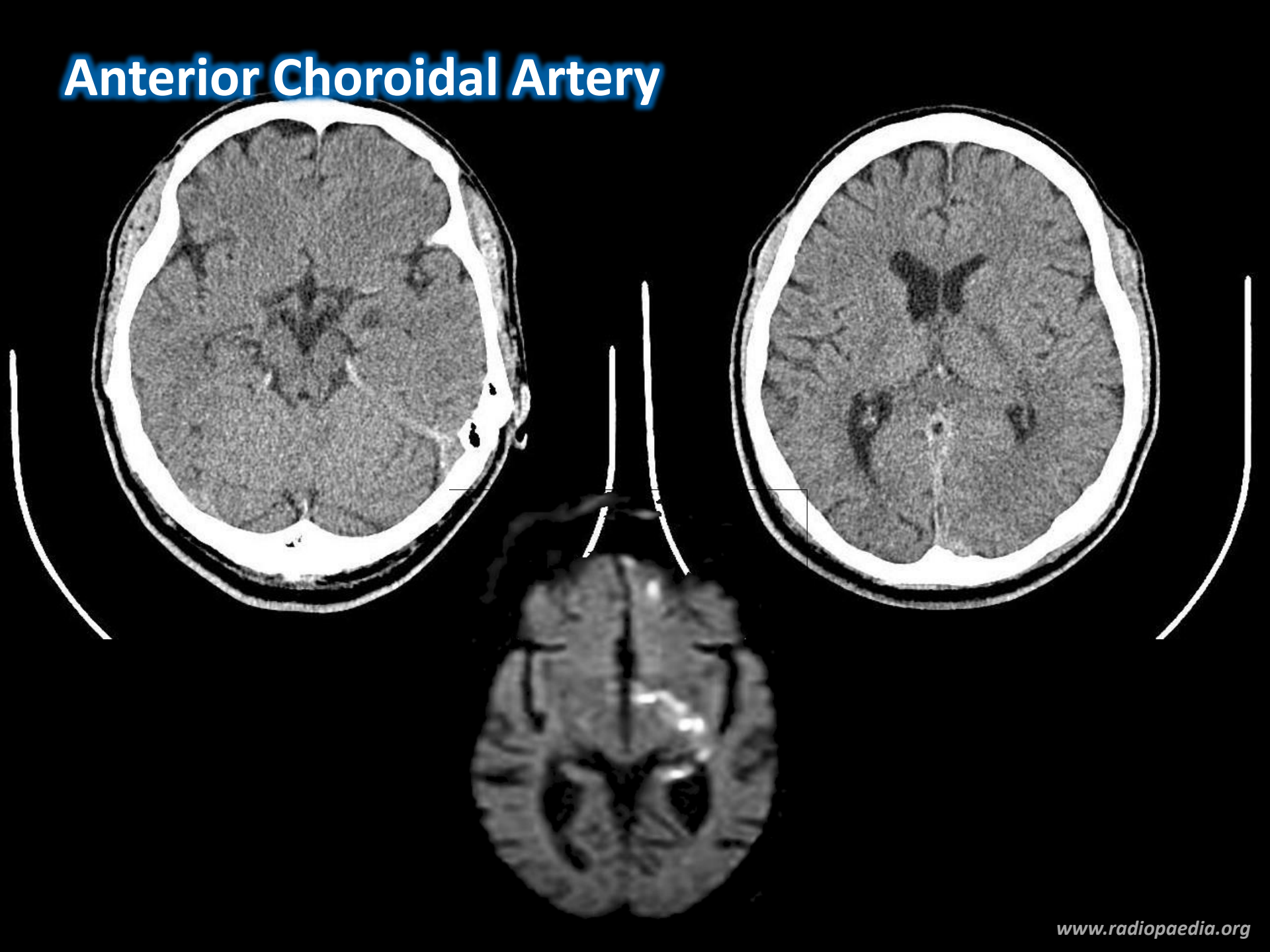
Quadruple sectoranopia
(Anterior choroidal artery)



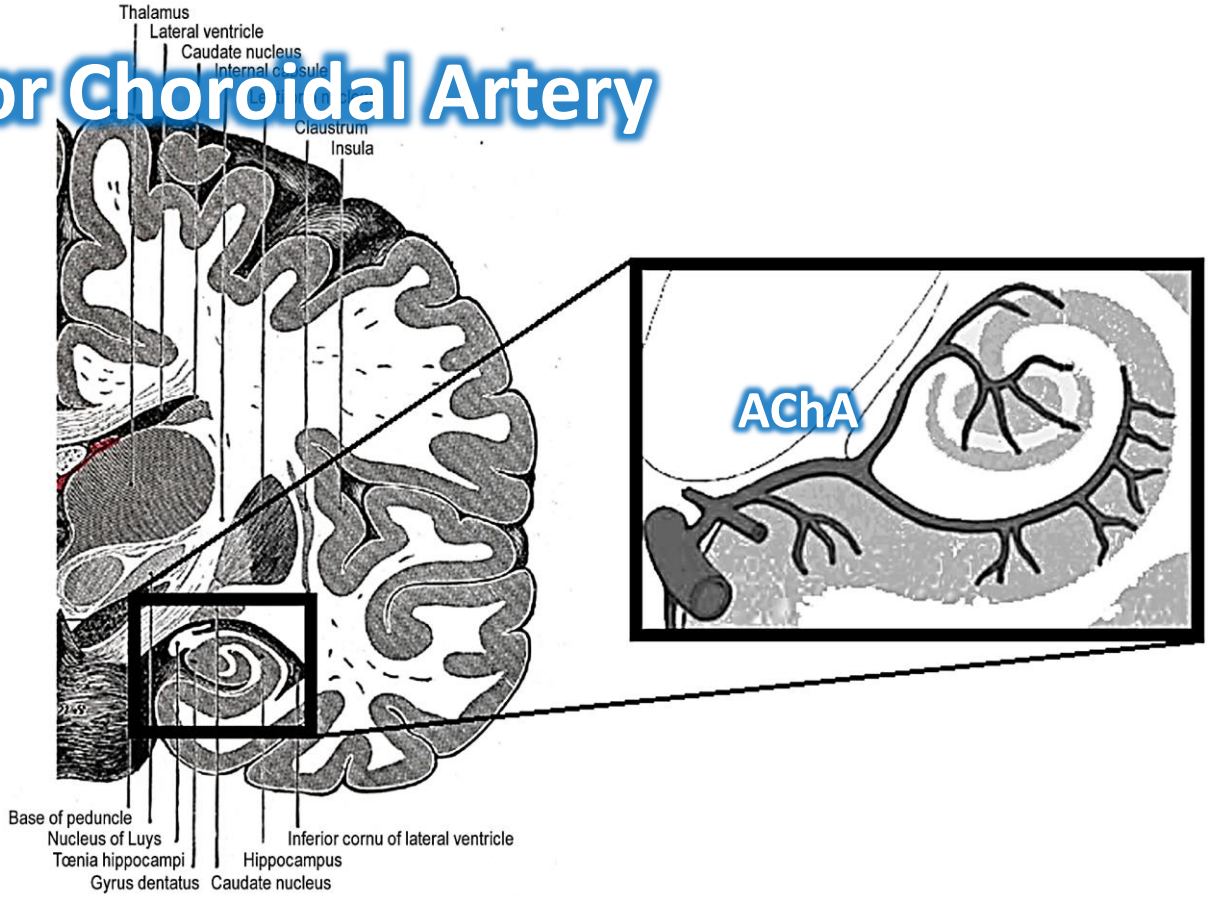
Horizontal sectoranopia
(Posterior choroidal artery)

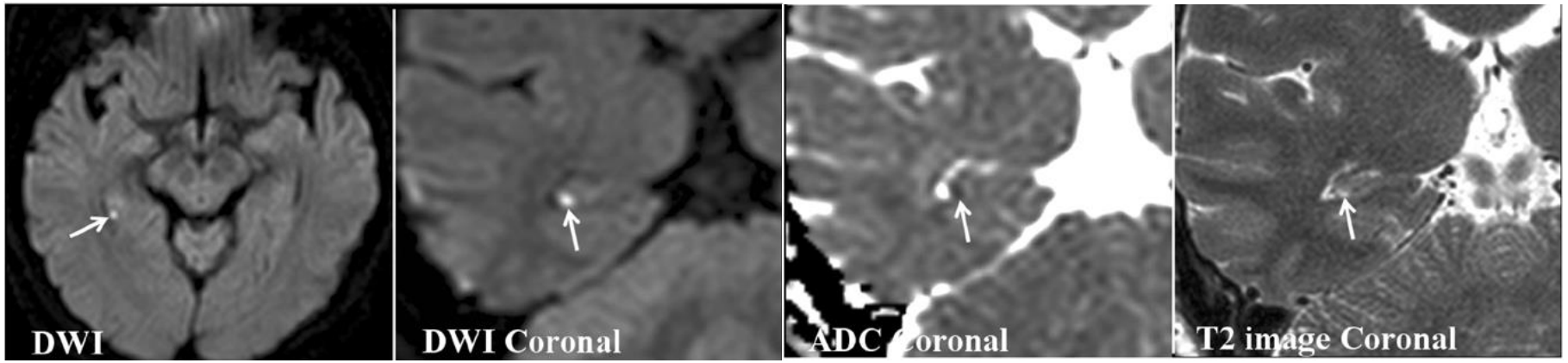
http://www.cybersight.org/bins/volume_page.asp?cid=1-2630-2760-2763&print=true

Anterior Choroidal Artery



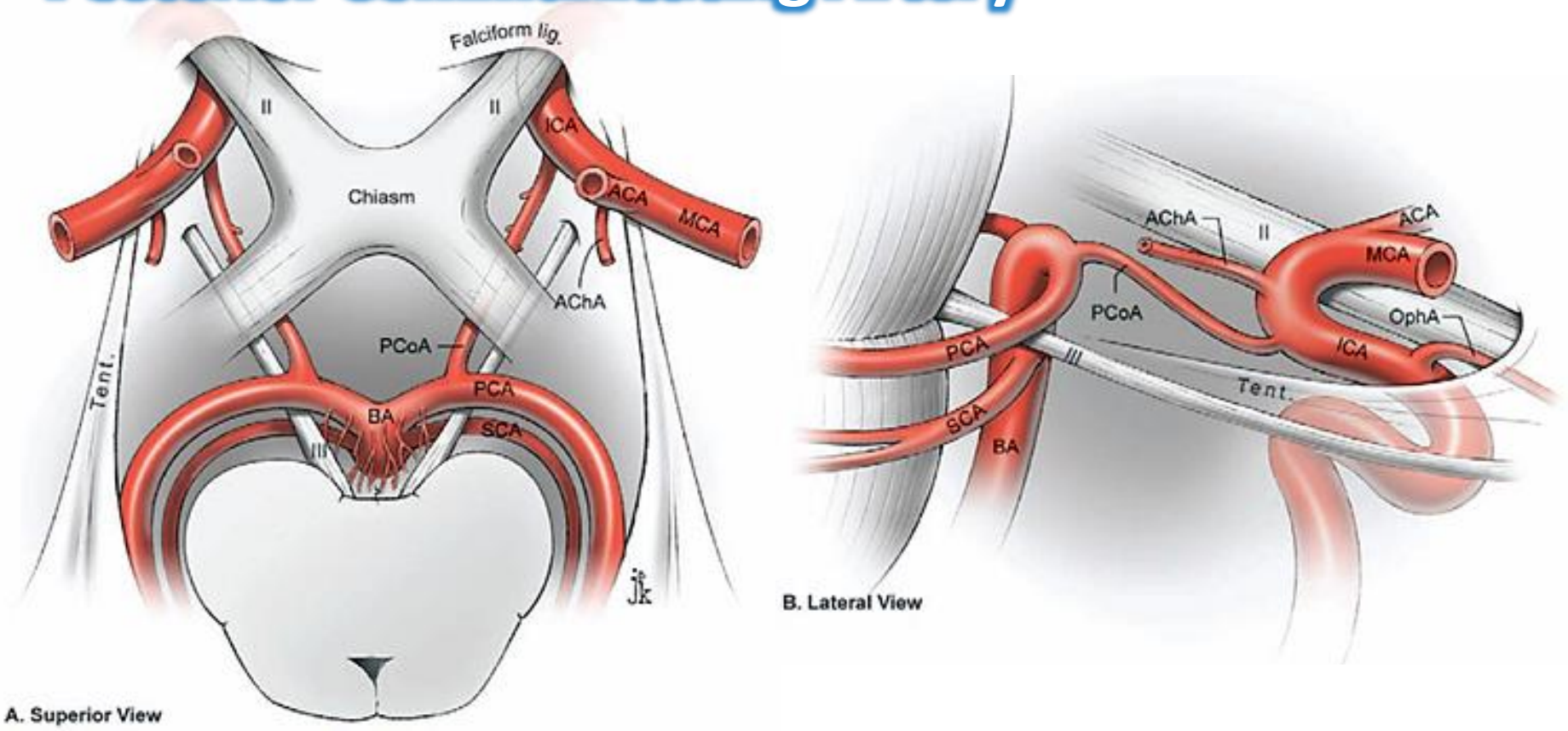
Anterior Choroidal Artery





J Clin Sleep Med 2013; 9(9) 921-7
J clin Neurol 2008; 4(2): 59-66

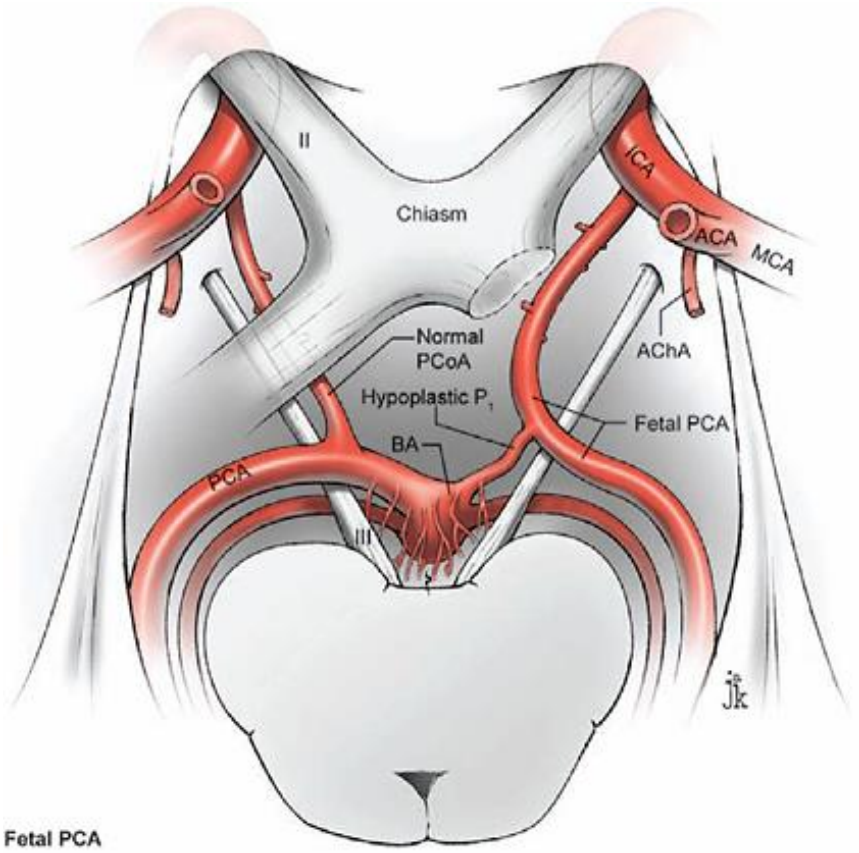
Posterior Communicating Artery



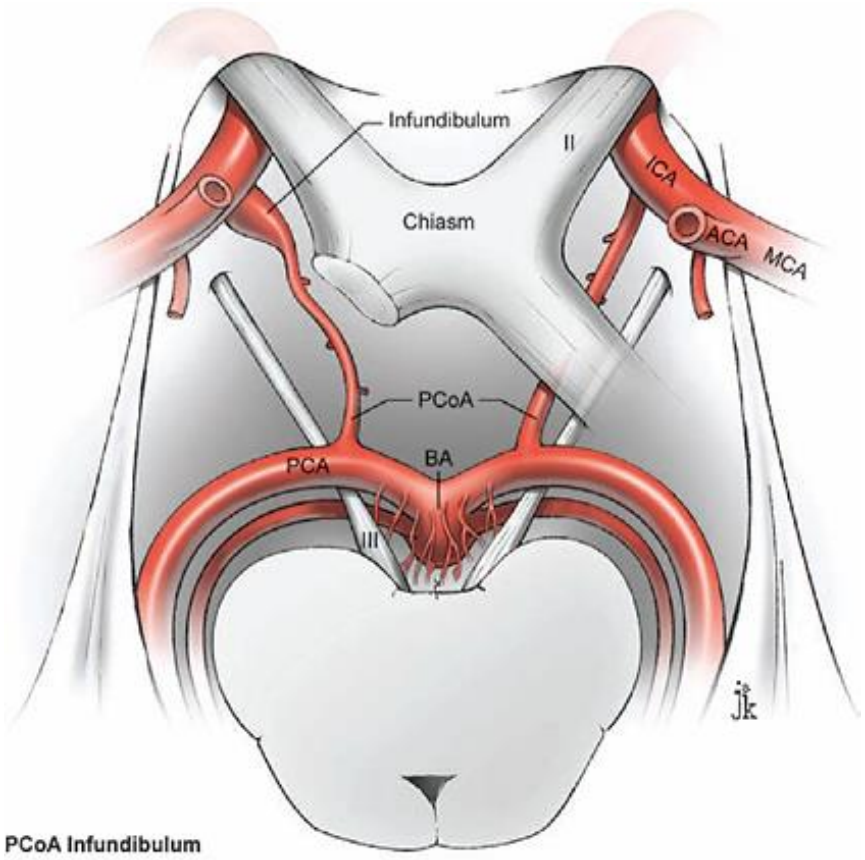
- **Interconnection between the anterior and posterior circulation**
- **Lied adjacent to CN.III**
- **Supplies the optic tract, CN.III and anterior part of thalamus (anterior thalamoperforate branch)**

https://neupsykey.com/posterior-communicating-artery-aneurysms-2/

Variations of Posterior Communicating Artery

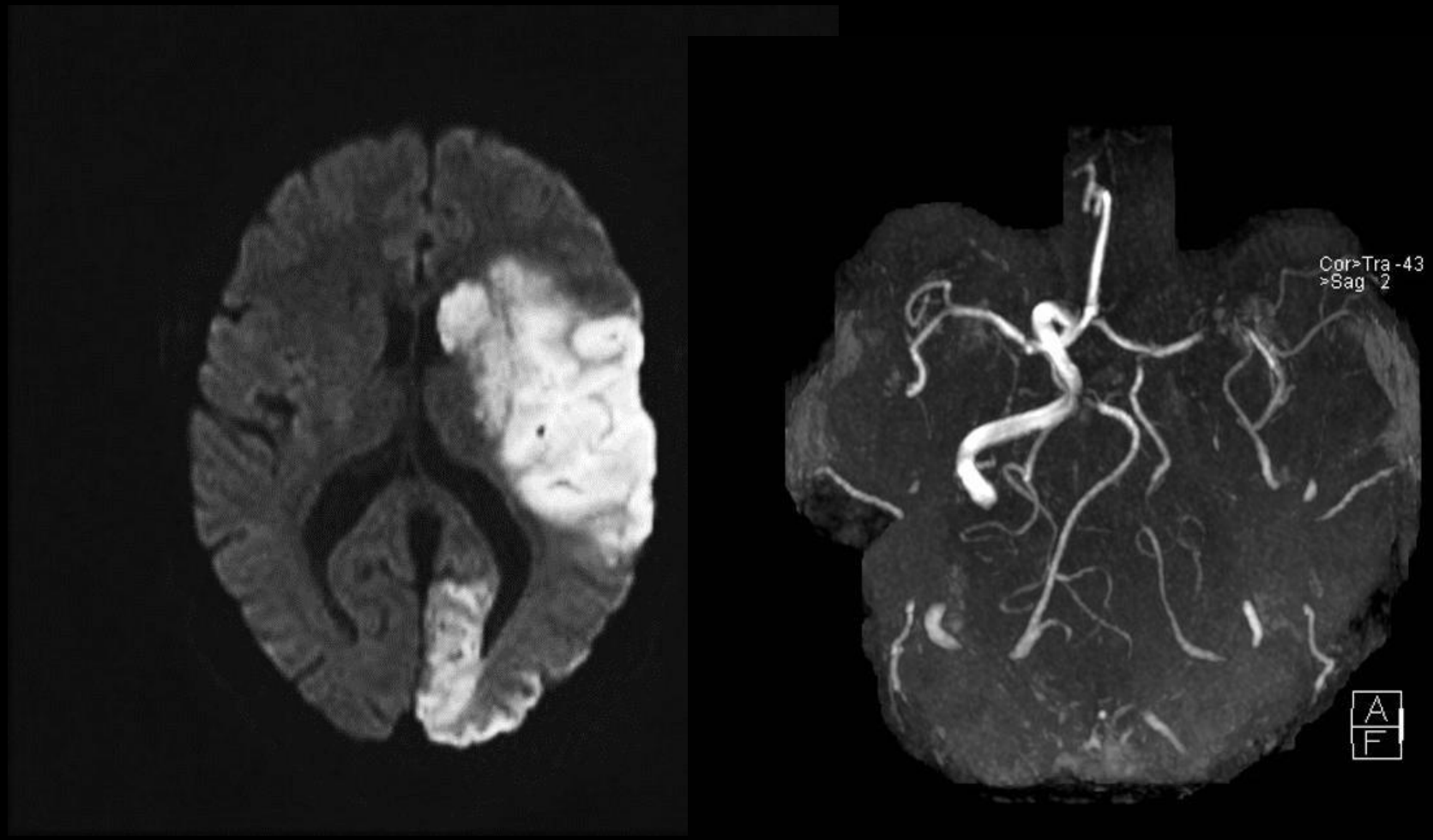


Fetal origin of PCA



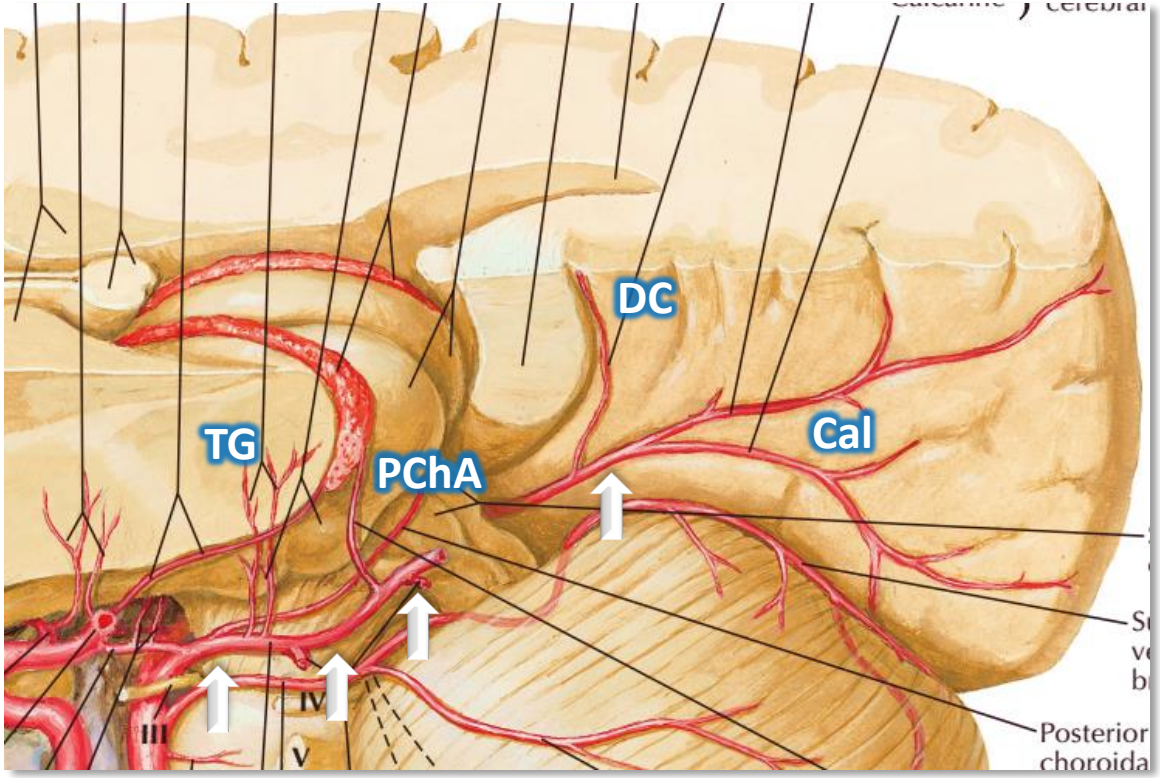
PCom Infundibulum

Fetal Origin of PCA with Left ICA Infarction



Posterior Cerebral Artery

- Terminal branch of the basilar artery
- 20-25% have fetal origin of the PCA
- Supplies midbrain, thalamus, inferomedial portions of the temporal lobes and the occipital lobe



Branches of PCA

- Perforating branches (posteromedial, posterolateral groups)
- Thalamogeniculate artery
- Posterior choroidal arteries
- Dorsal callosal artery (anastomose with pericallosal a. from ACA)
- Calcarine artery
- Parieto-occipital artery
- Anterior & posterior temporal arteries

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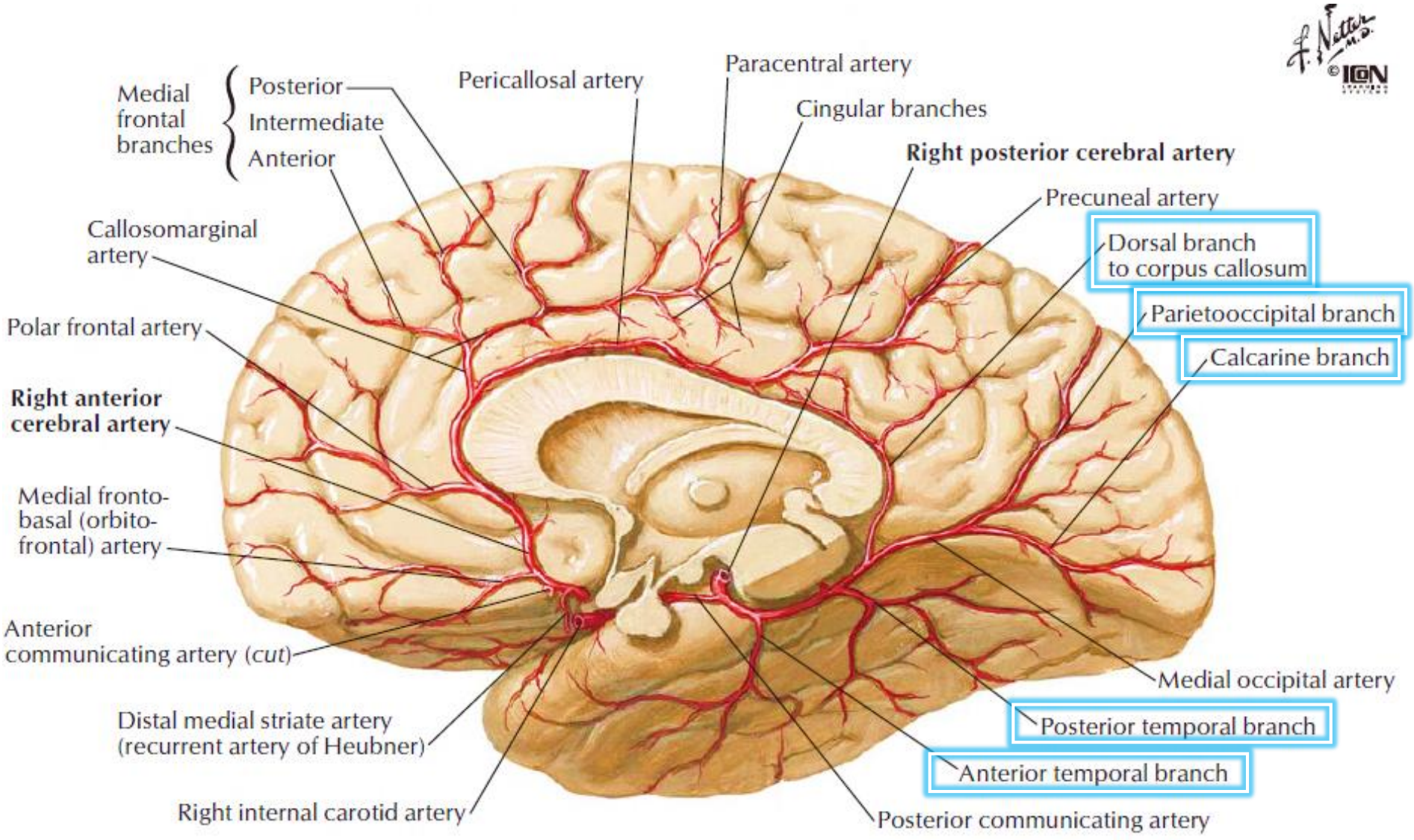


Note: Anterior parietal (postcentral sulcal) artery also occurs as separate anterior parietal and postcentral sulcal arteries

Netter FH. Atlas of human anatomy, 6th ed. 2014

PCA Syndrome

Features of PCA syndrome	• Contralateral homonymous visual field defect with macular sparing if not affecting occipital pole
	  • Whole striate cortex –> hemianopia
	  • Superior calcarine –> inferior quadrantanopia
	  • Inferior calcarine – superior quadrantanopia
	• Color agnosia ('what' pathway)
	• Prosopagnosia (fusiform gyrus)
	• Amnesia (esp. when affects the left side)

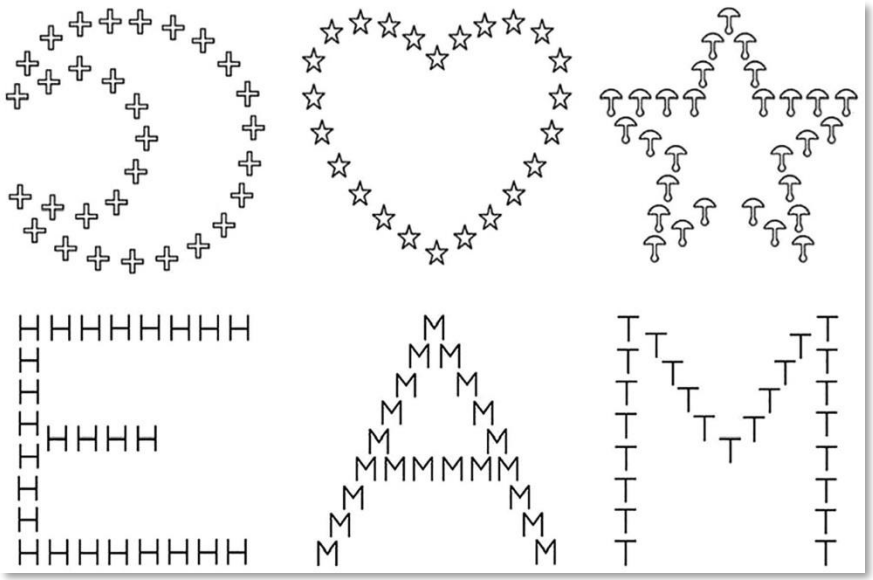
Thalamic involvement	• Paresthesia, altered position/pain/temperature sensations
Left PCA infarct	• Left occipital lobe + splenium of corpus callosum • 'Alexia without agraphia' (intact naming, writing, spelling, speaking) • Occasionally associated with color anomia, object/photographic anomia • Transcortical sensory aphasia

PCA Syndrome

Right PCA infarct	• Left visual neglect
Bialteral PCA infarcts	• Cortical blindness (bilateral homonymous hemianopia) • Anton's syndrome: Unaware of their blindness

Other manifestations	• Visual hallucination (formed, unformed) & visual agnosia
	  • Visual association cortex
	  • Released phenomenon (Charles-Bonnet syndrome)
	• Apraxia of ocular movement
	• Balint's syndrome:
	  • Optic ataxia – difficulty reaching the object under visual guidance
	  • Ocular apraxia – deficits in visual scanning
	  • Simultagnosia
	• Proximal PCA occlusion may simuate MCA occlusion when it causes hemiparesis, hemianopia, hemispatial neglect, aphasia, and sensory loss or inattention

Simultanagnosia



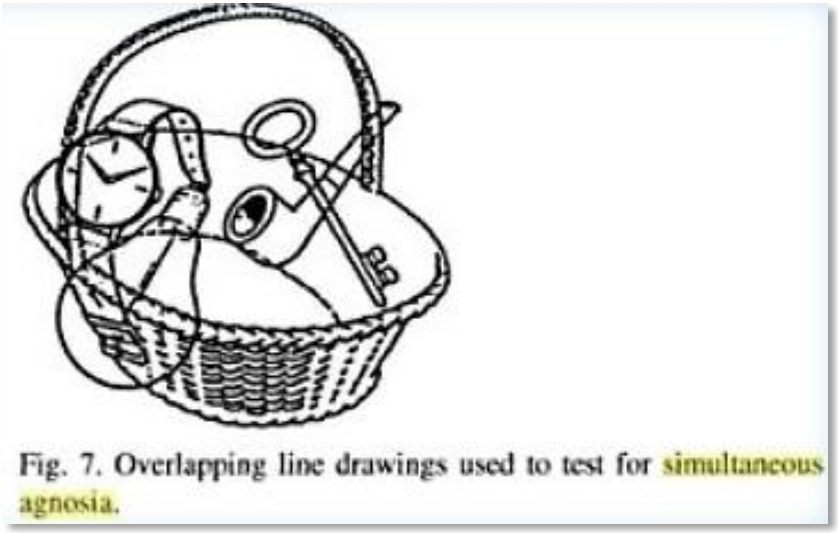
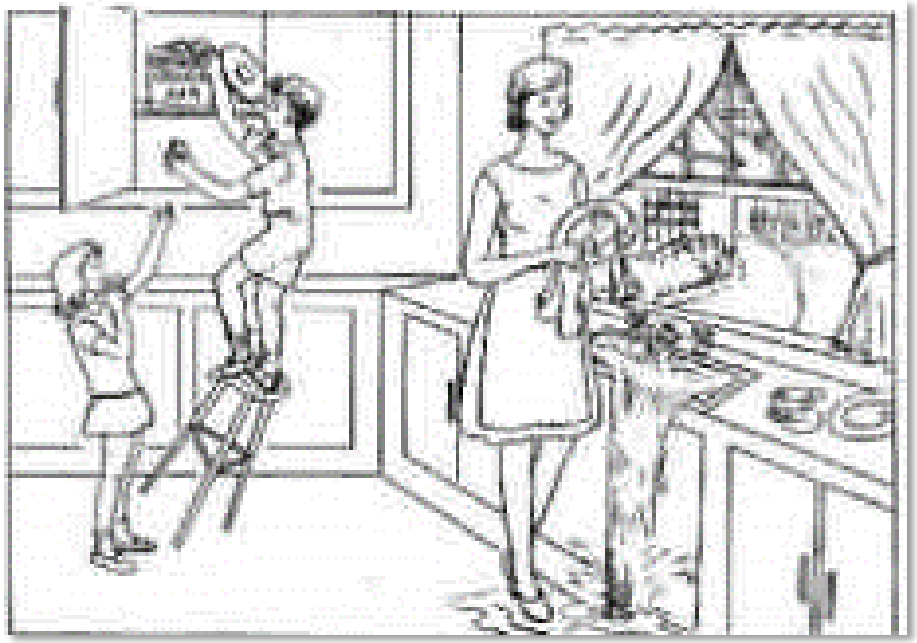


Fig. 7. Overlapping line drawings used to test for simultaneous agnosia.



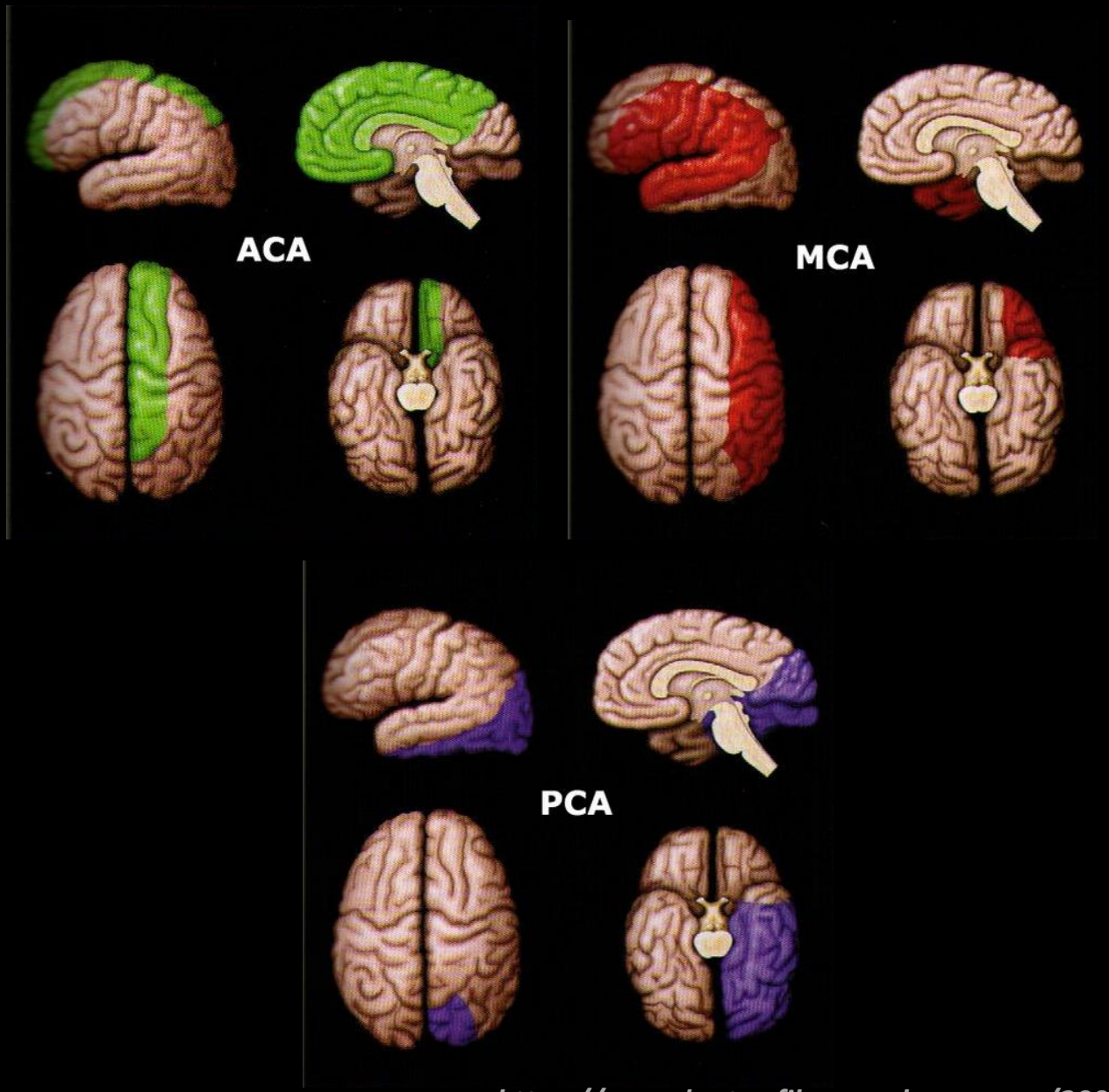
http://dx.doi.org/10.1136/practneurol-2015-001168

http://www.braininjury-explanation.com/consequences/invisible-consequences/agnosia

Neurovascular Anatomy (1):
Anatomy of the Anterior Circulation

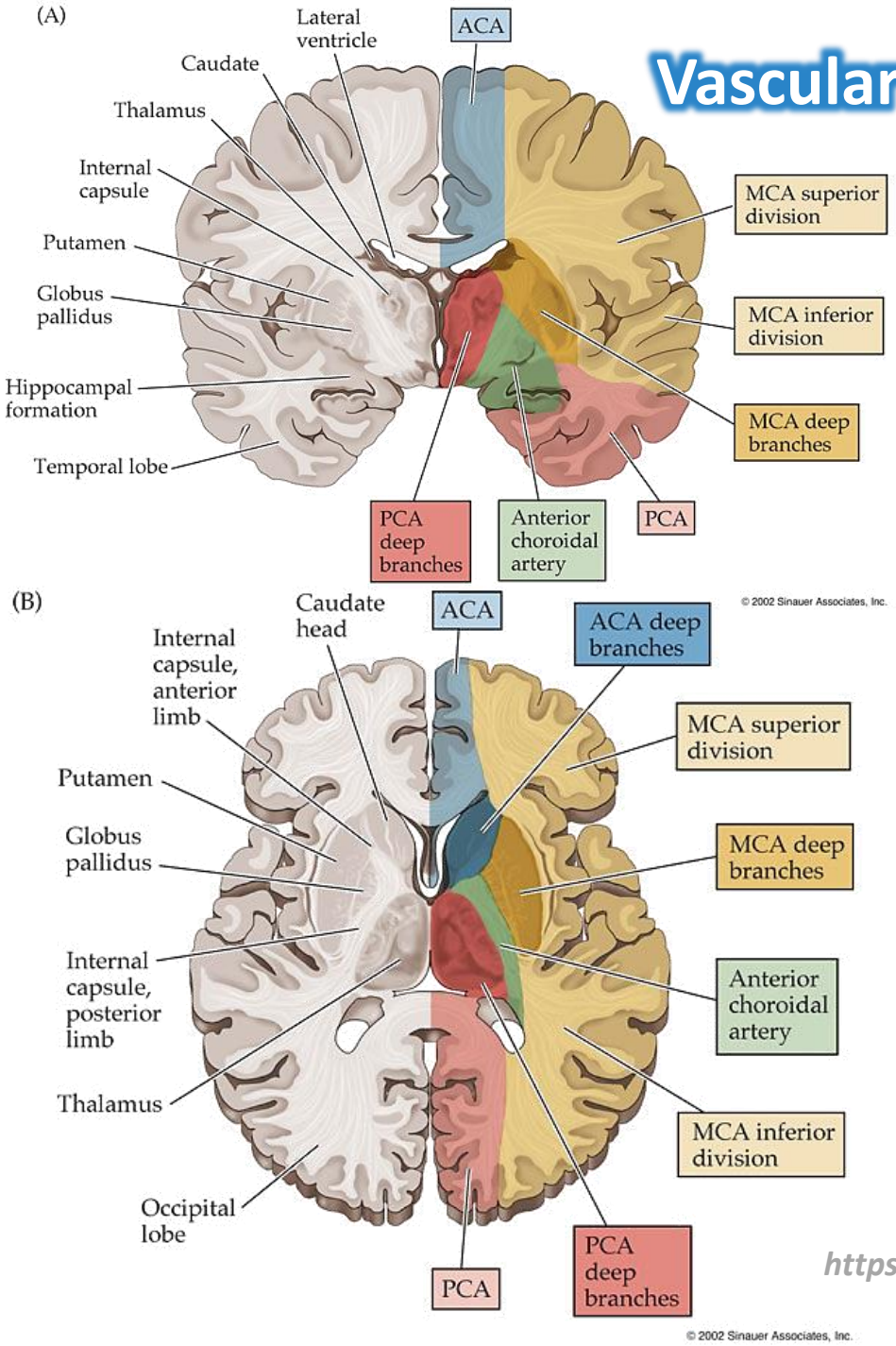
- Carotid artery system
- Ophthalmic artery
- Arterial circle of Willis
- **Arterial territories of the cerebrum**

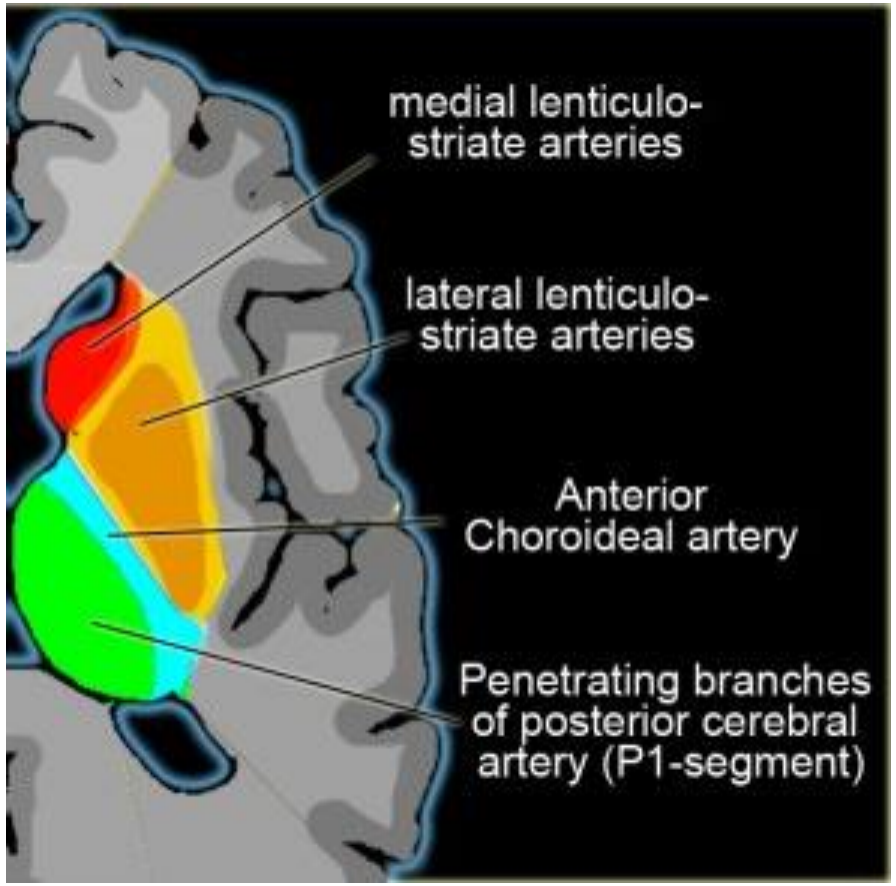
Vascular Territories of the Cerebrum



https://myradnotes.files.wordpress.com/2008/04/vascular1.jpg

Vascular Territories of the Cerebrum

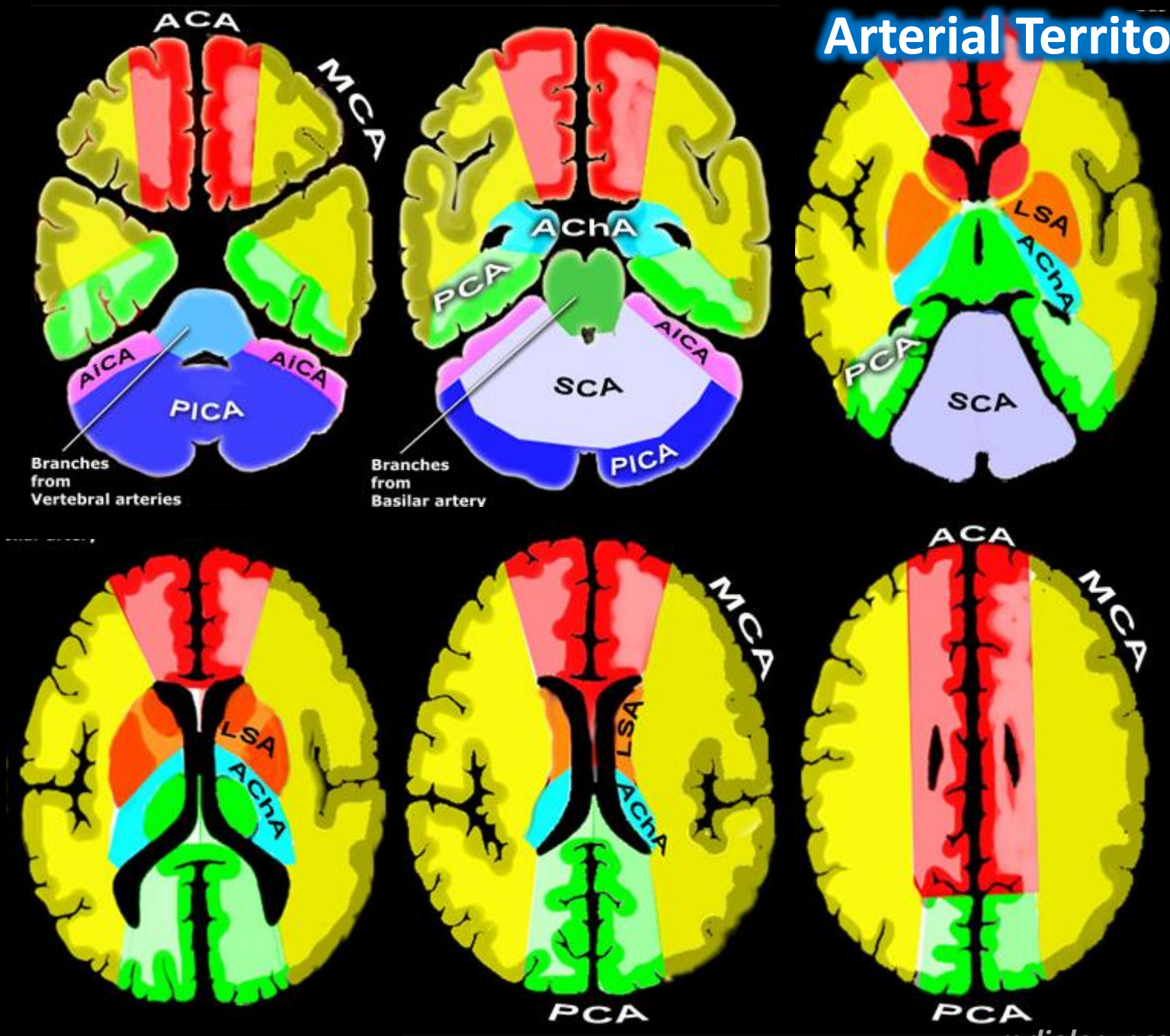




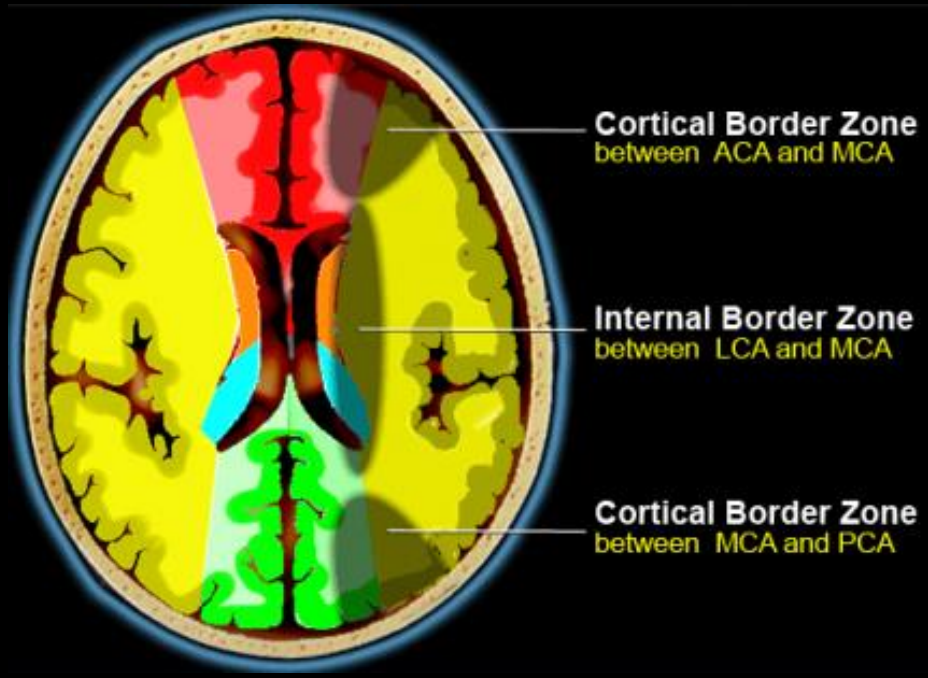
https://myradnotes.files.wordpress.com/2008/04/vascular1.jpg

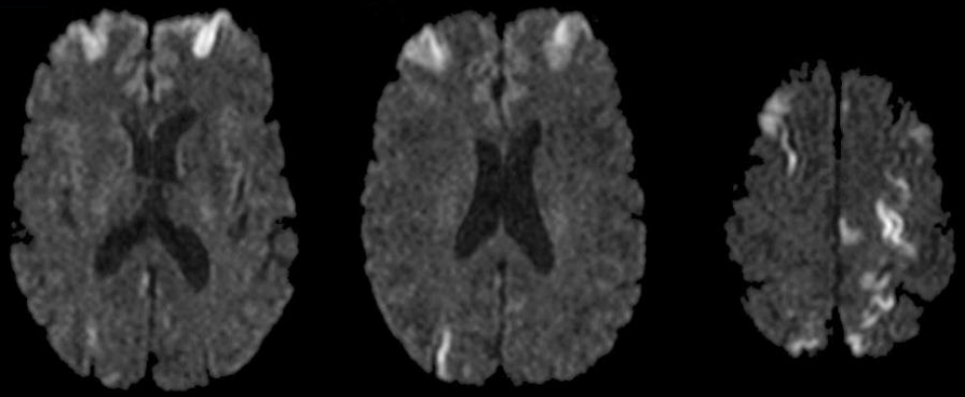
www.radiologyassistant.nl

Arterial Territories

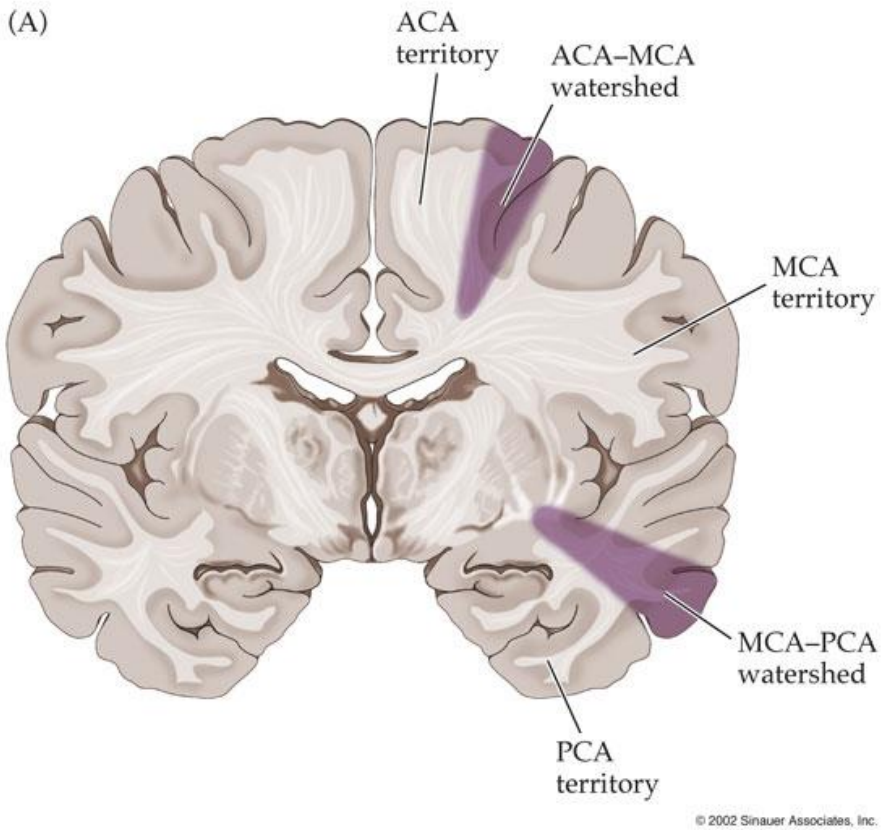


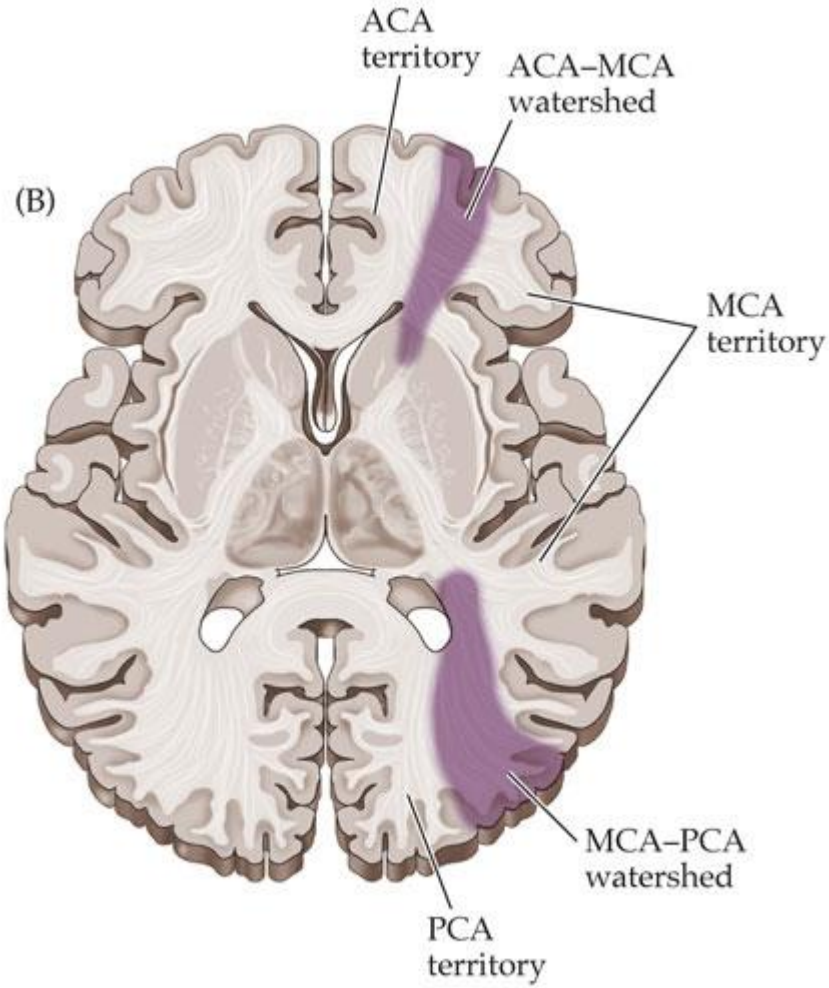
Border Zone Ischemia





http://www.neuroradiologycases.com/2012/09/ischemic-stroke-and-vascular.html
www.radiologyassistant.nl





Border Zone Ischemia

Types	Features
ACA-MCA	• Bibrachial cortical sensorimotor impairment, initially affecting whole limbs, but later confined to the hands & forearms • Disturbance of volitional saccade eye movements
MCA-PCA	• Cortical blindness that rapidly improves but leaves a marked dyslexia, dyscalculia, dysgraphia, and memory deficits for verbal and nonverbal material
All three major arterial systems	• Bilateral lower altitudinal visual field defect • Difficulty in judging size, distance, and movement • Disorders of smooth ocular pursuit

Neurovascular Anatomy (1):

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Mahidol University
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Neurovascular Anatomy (1):
Anterior Circulation Anatomy

Natthapon Rattanathamsakul, MD.
December 14th, 2017

STROKE CORE LECTURE