GOOD MORNING KNOWLEDGE

Basic Neuroanatomy In Clinical Practice

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Sesi 1

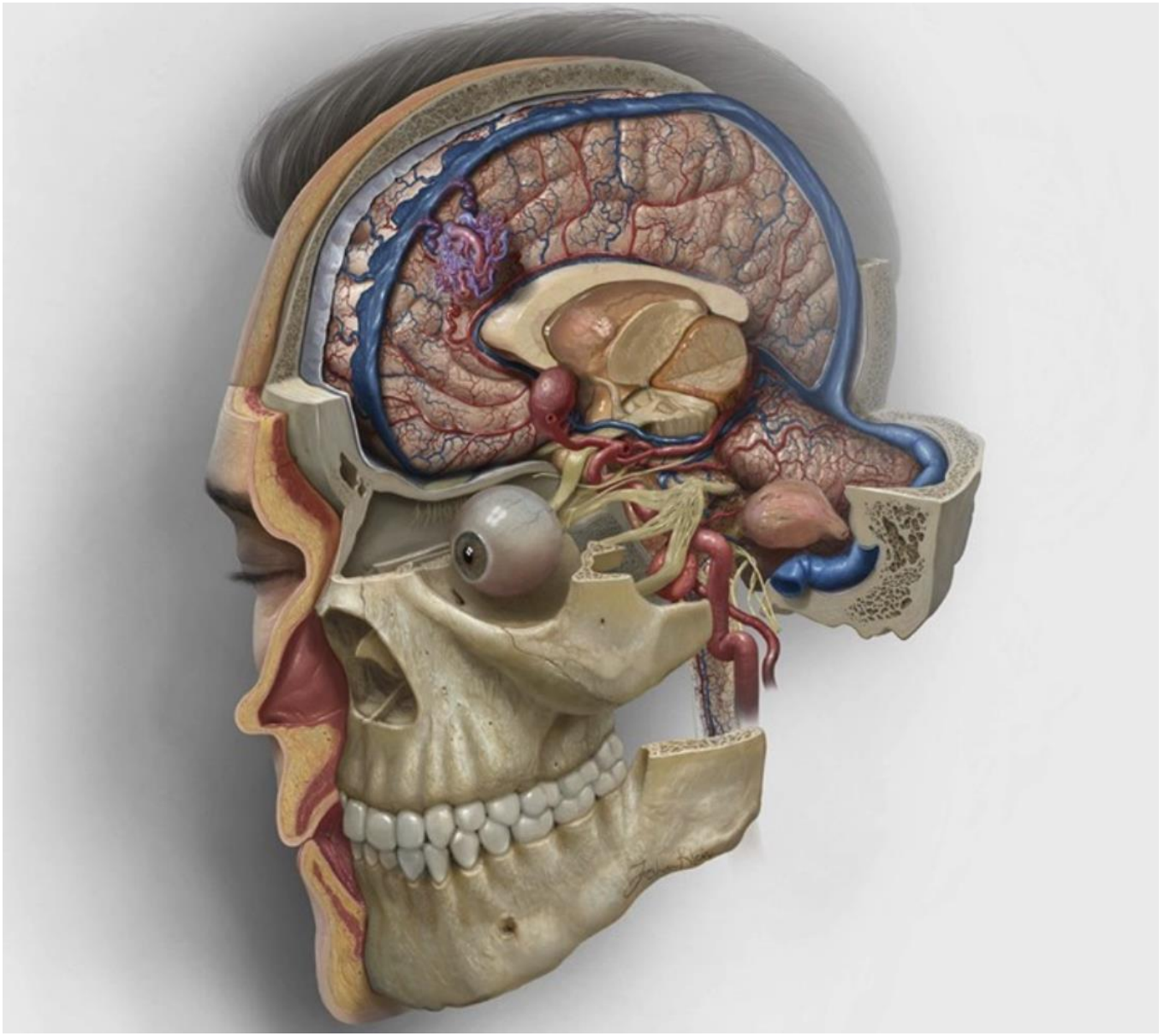
Review singkat (banget) NEUROANATOMI

Sesi 1

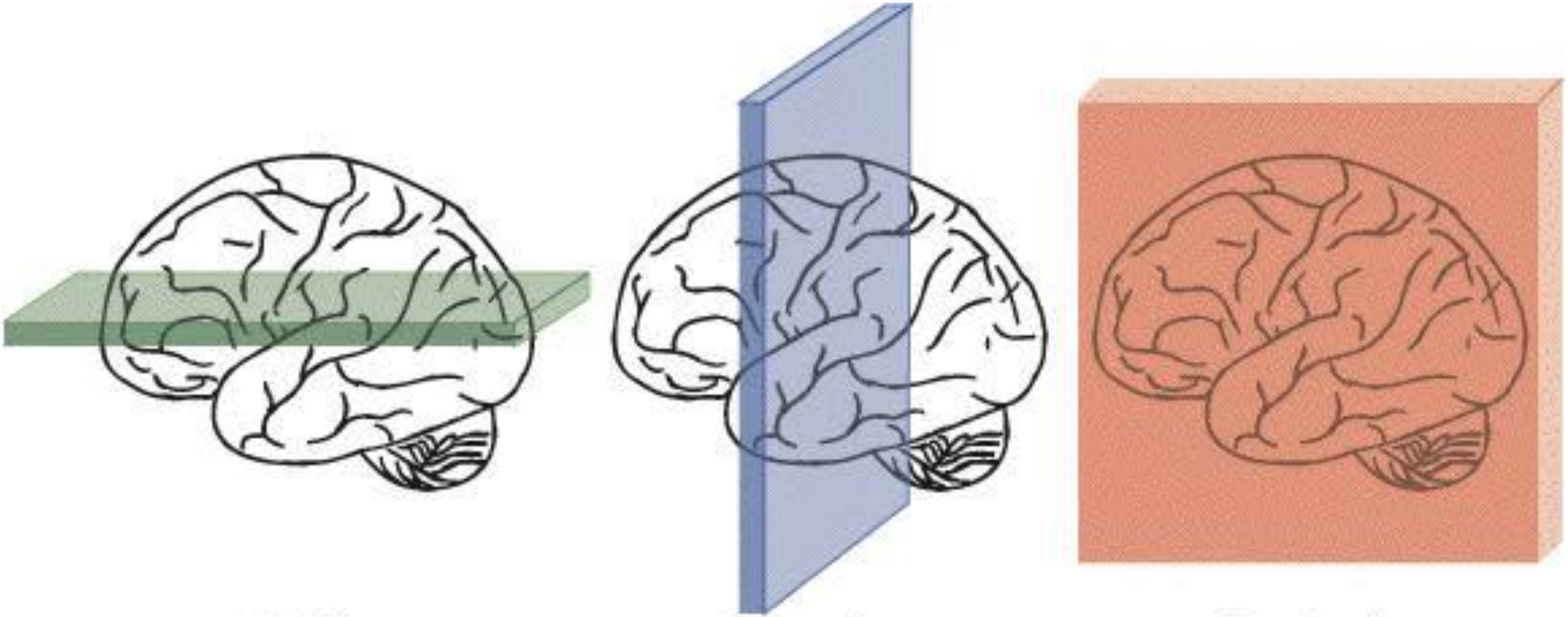
Outline

1. Konsep 3D dalam memahami Neuroanatomi
2. Embriology
3. Supratentorial
4. Infratentorial
5. Sistem Arteri dan Vena
6. Aliran CSF dan Sistem Ventrikel

1. Konsep 3D dalam memahami Neuroanatomi



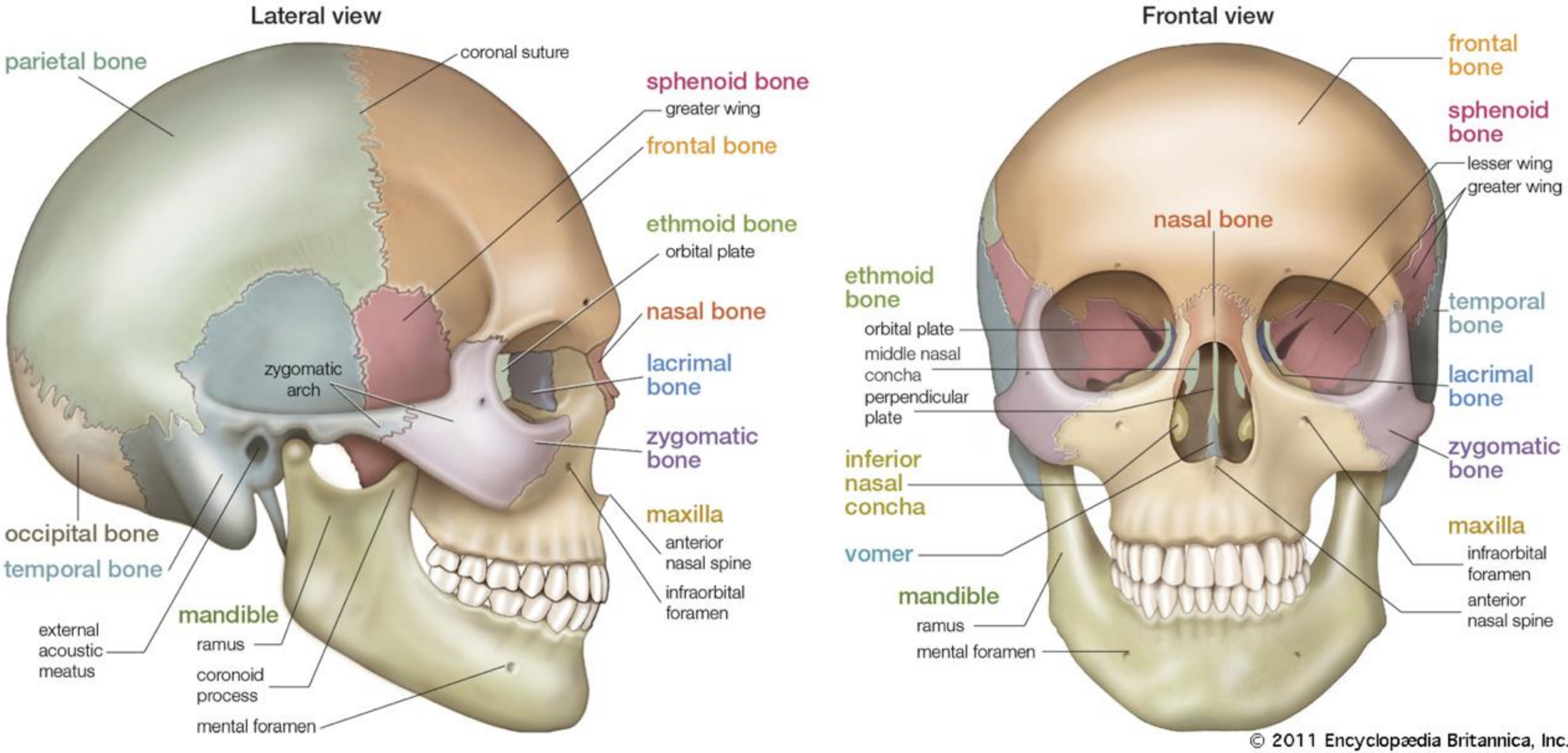
KUNCINYA ADALAH MENGAPLIKASIKAN PENGETAHUAN NEUROANATOMI KITA MENJADI KONSEP 3 DIMENSI DIDALAM PIKIRAN KITA

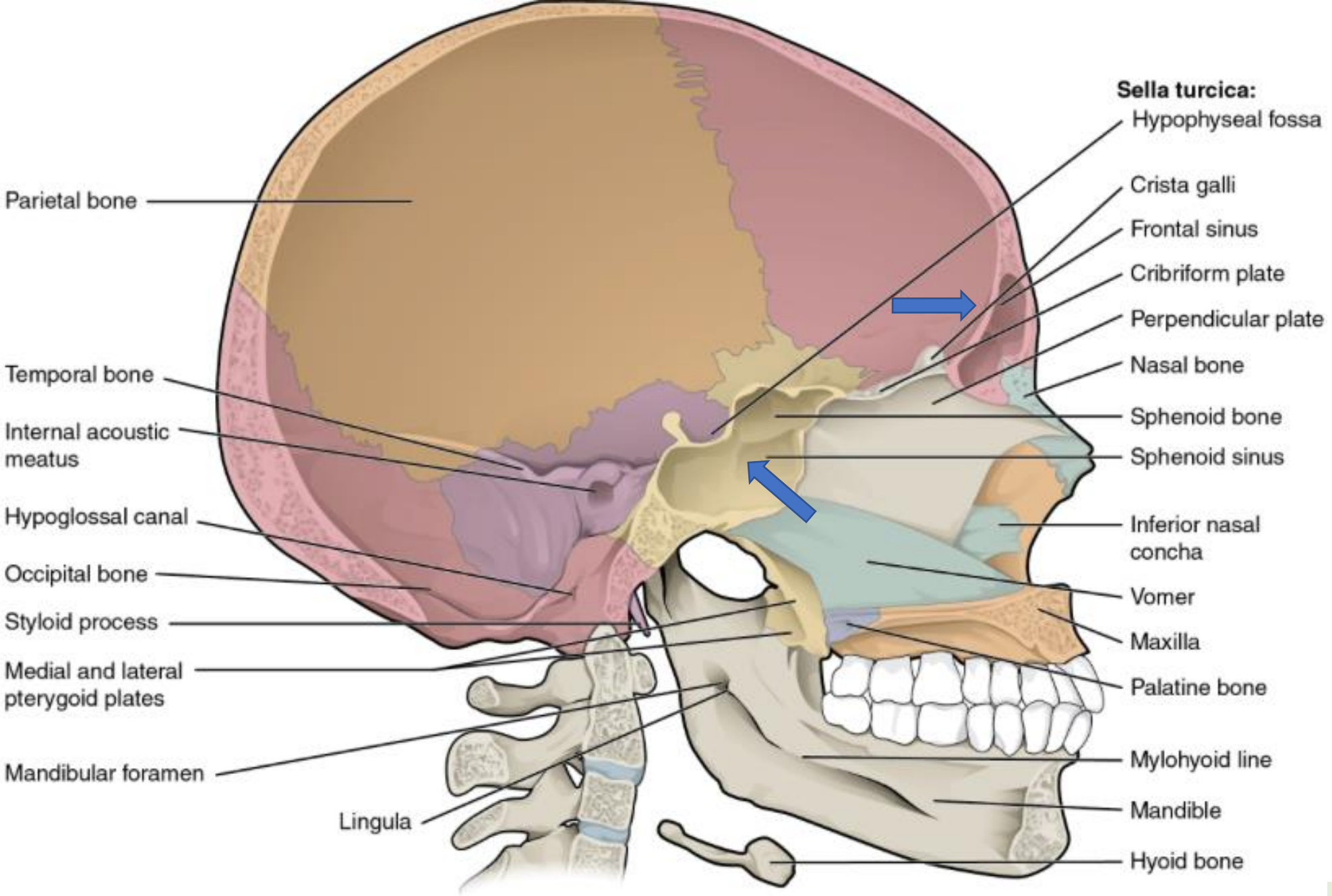


Axial

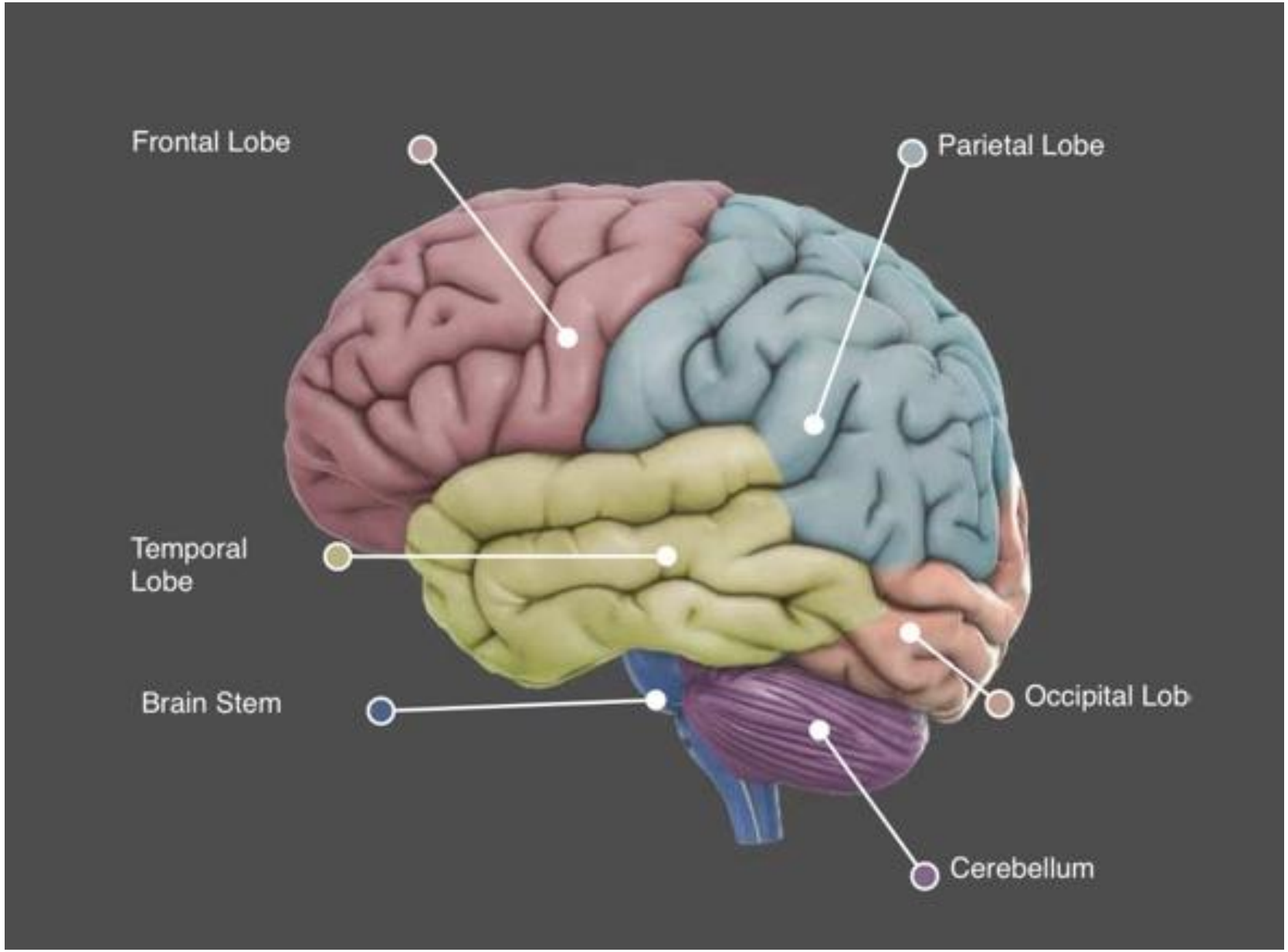
Coronal

Sagittal

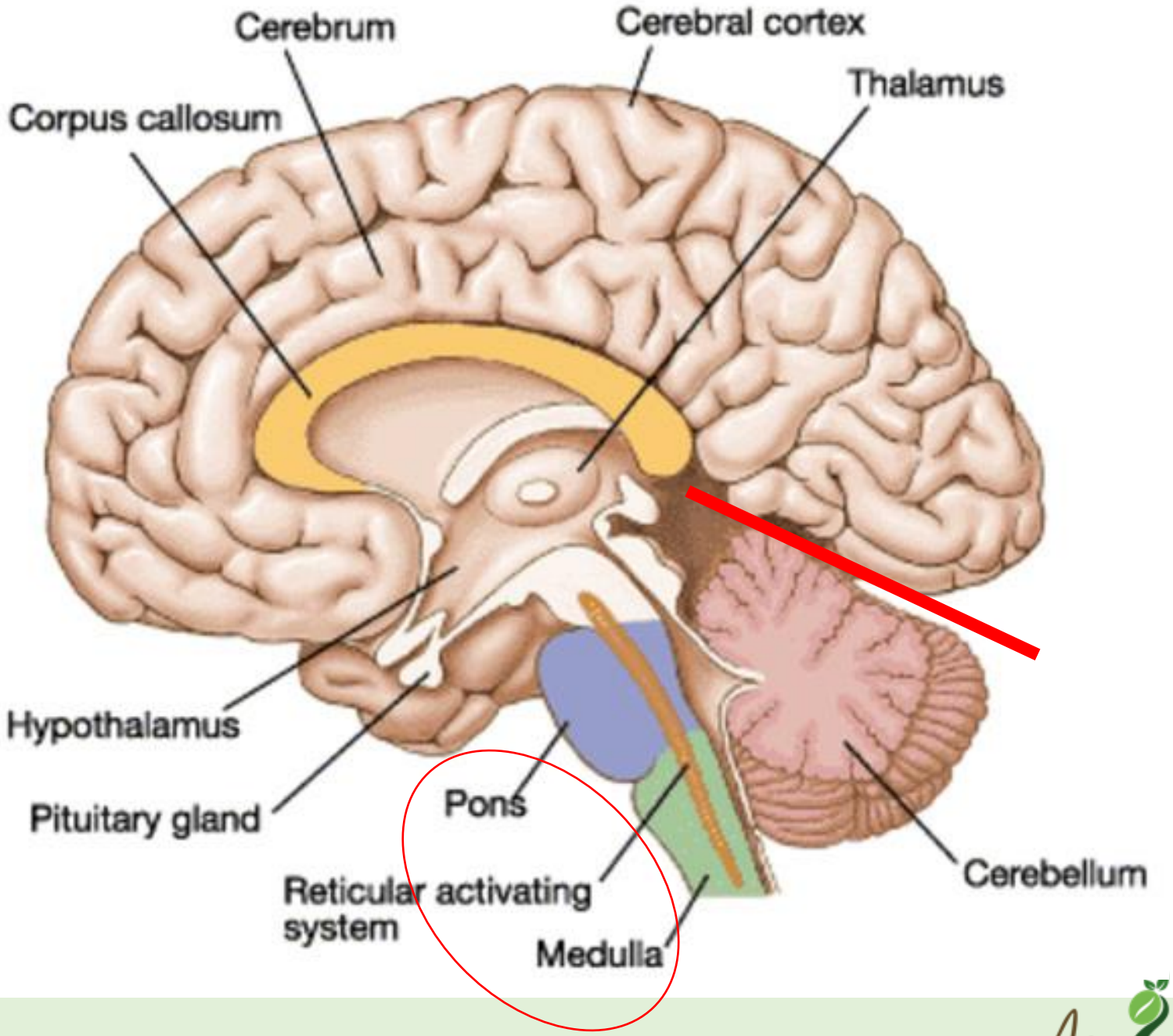




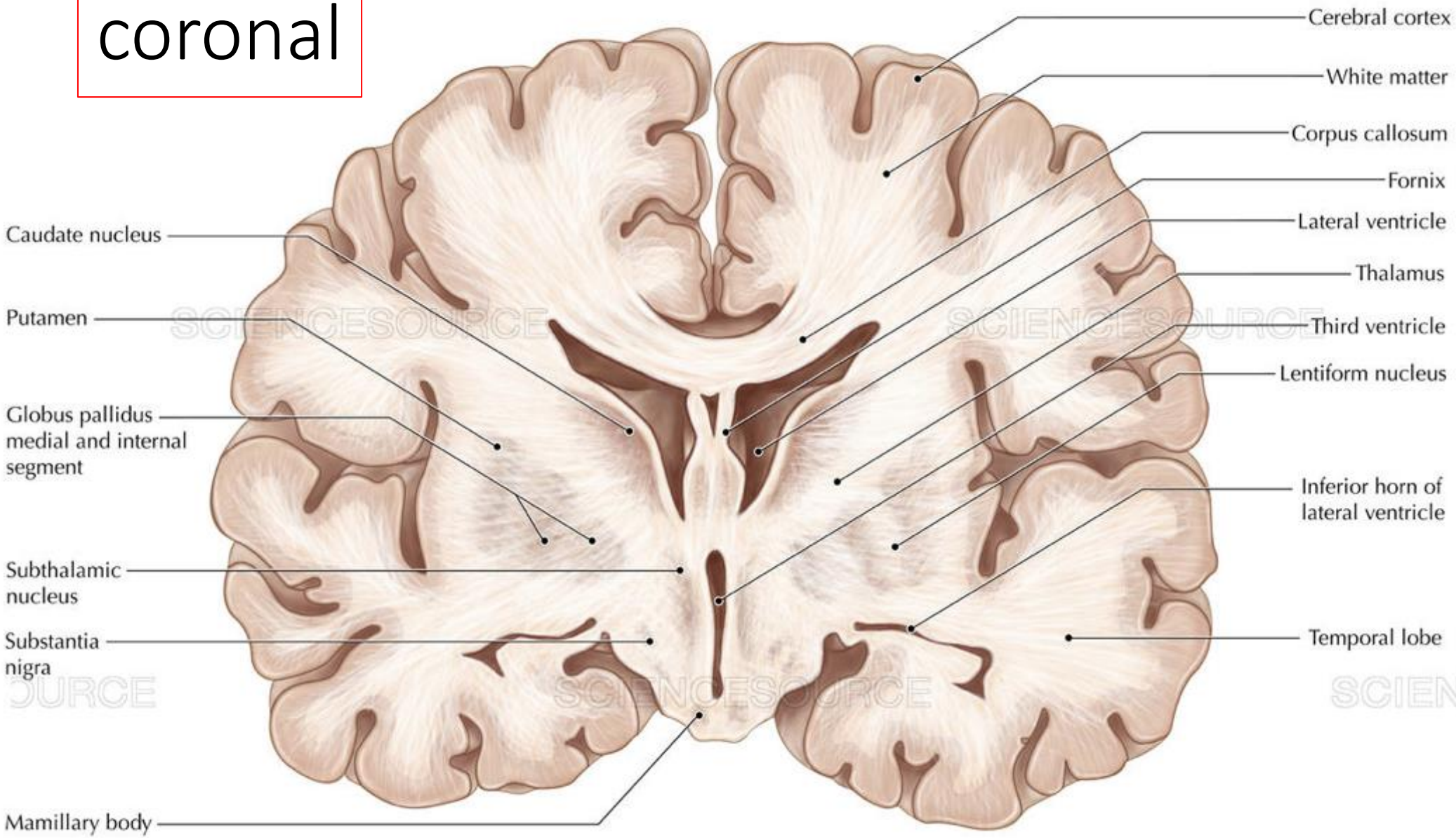
sisi Lateral

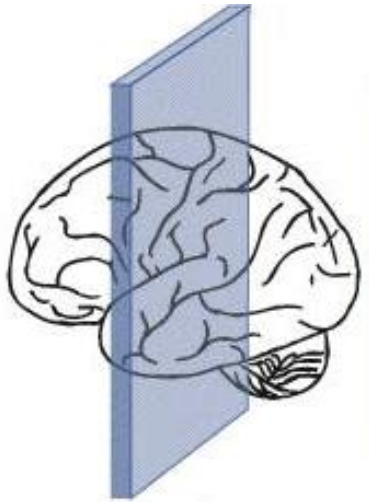


sisi medial

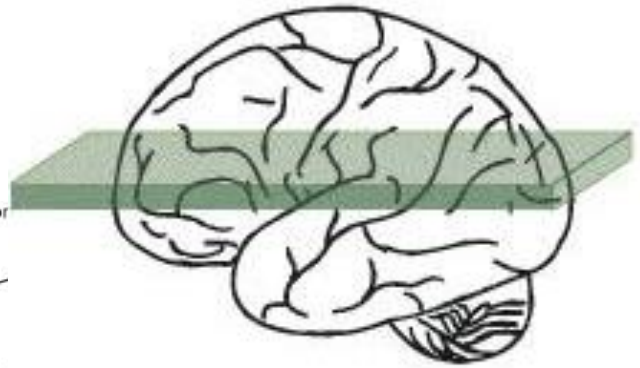


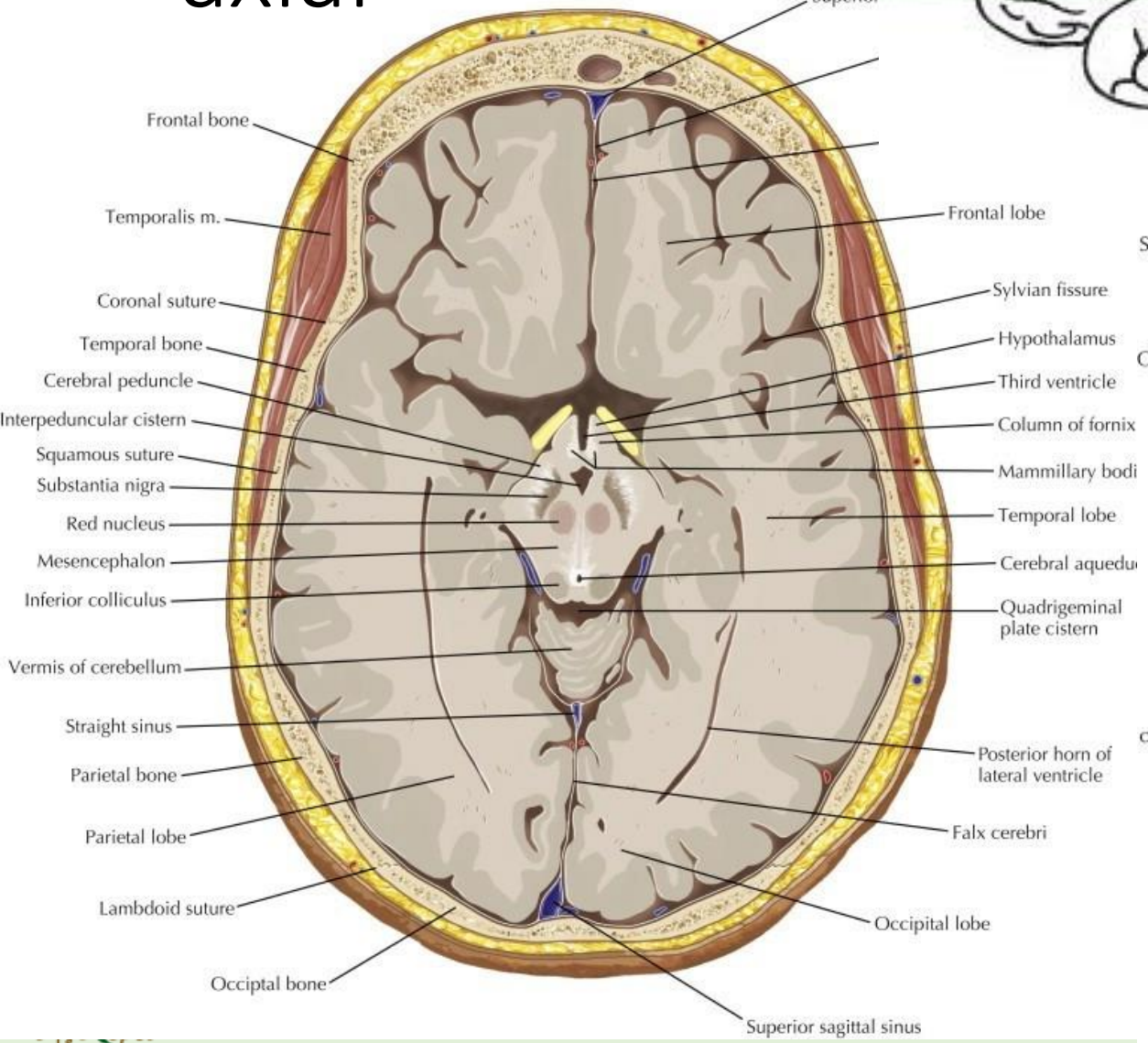
coronal

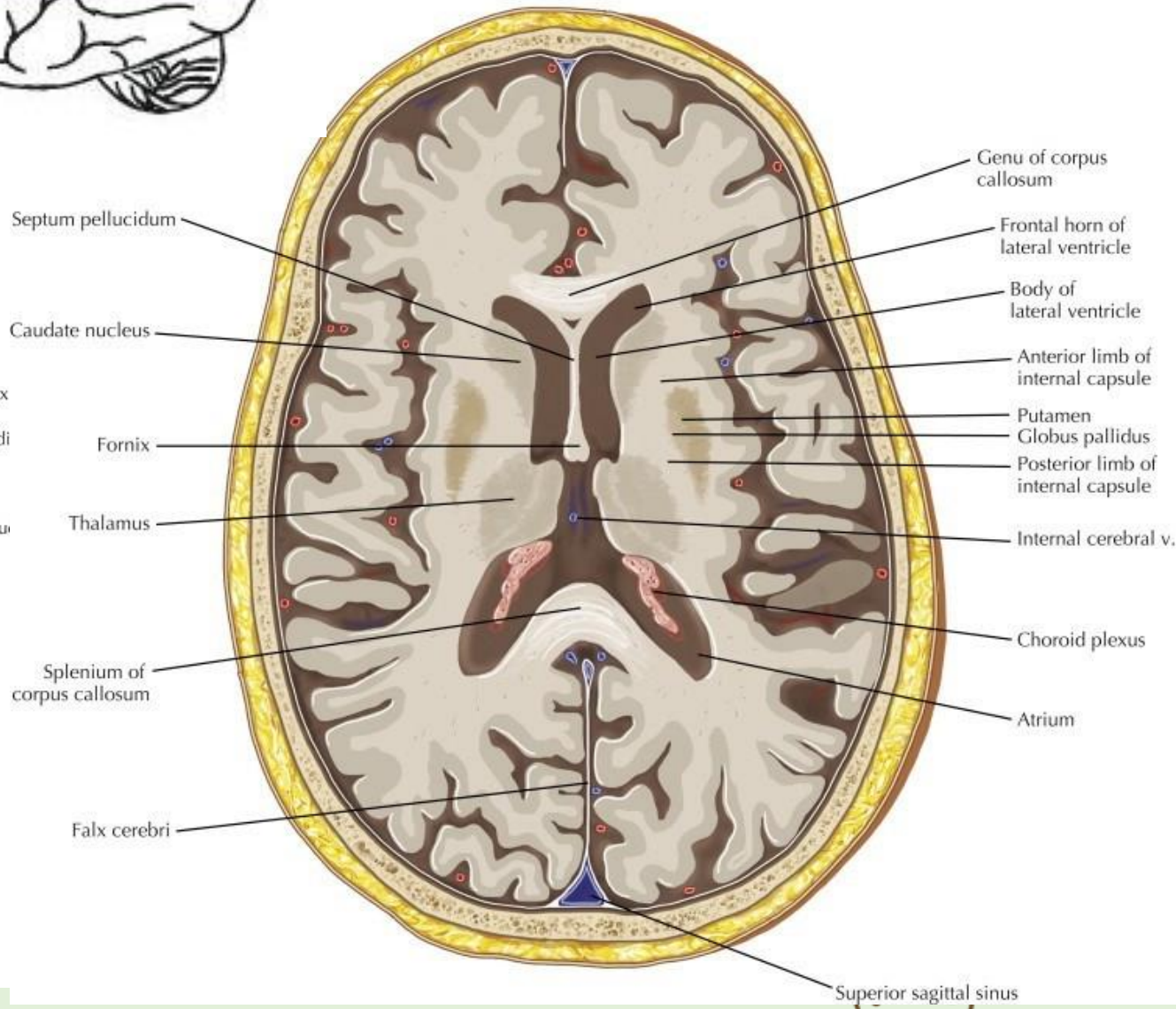




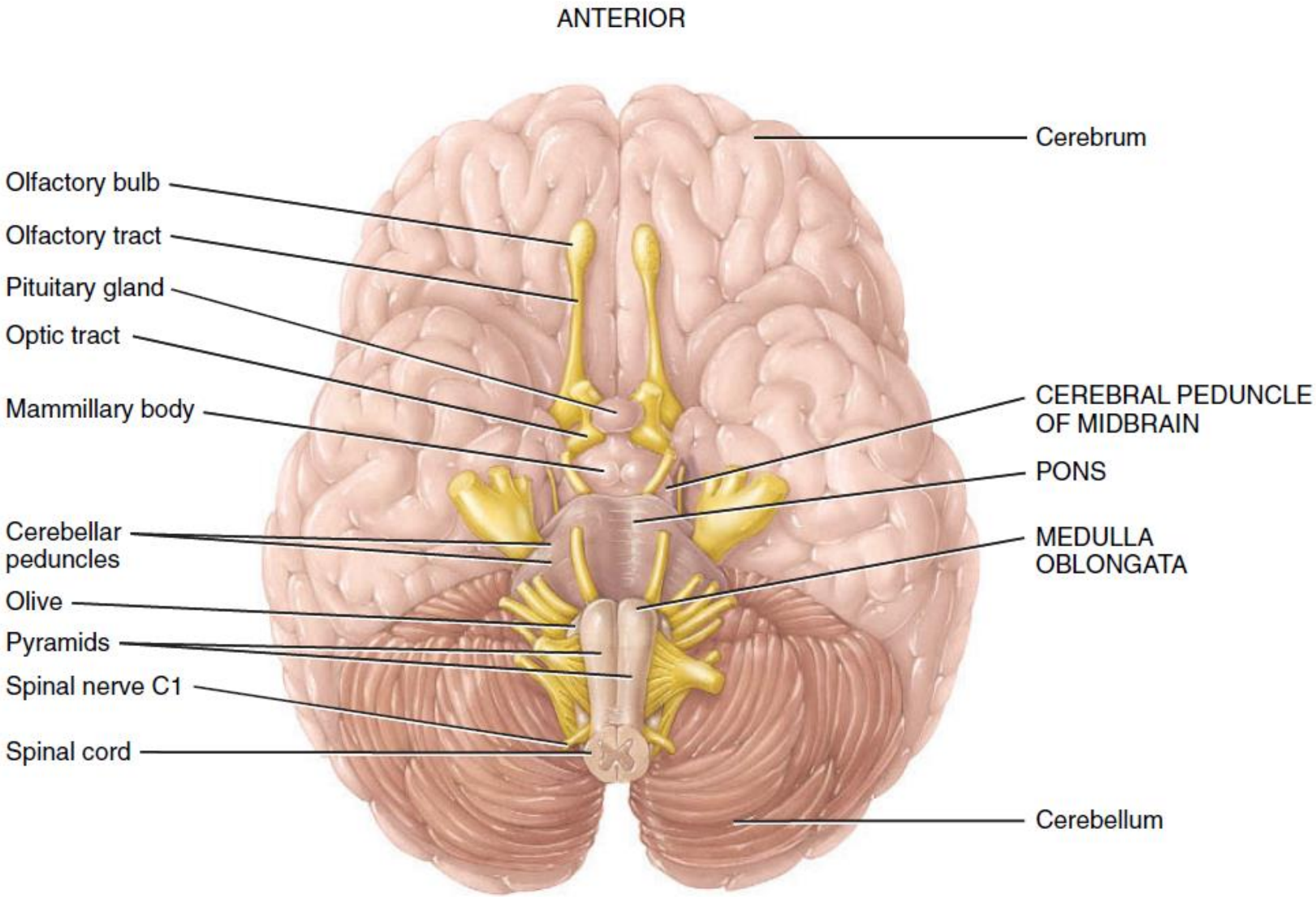
axial

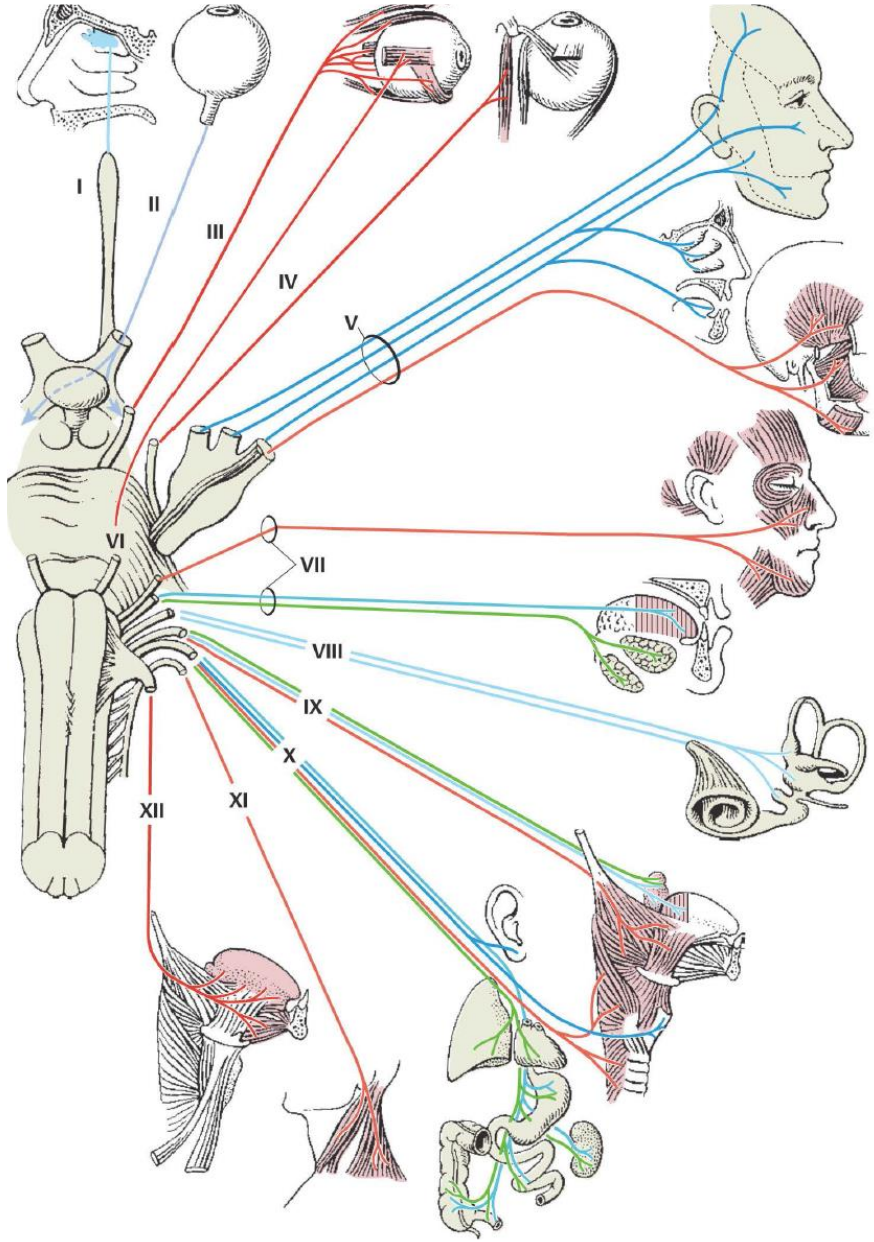




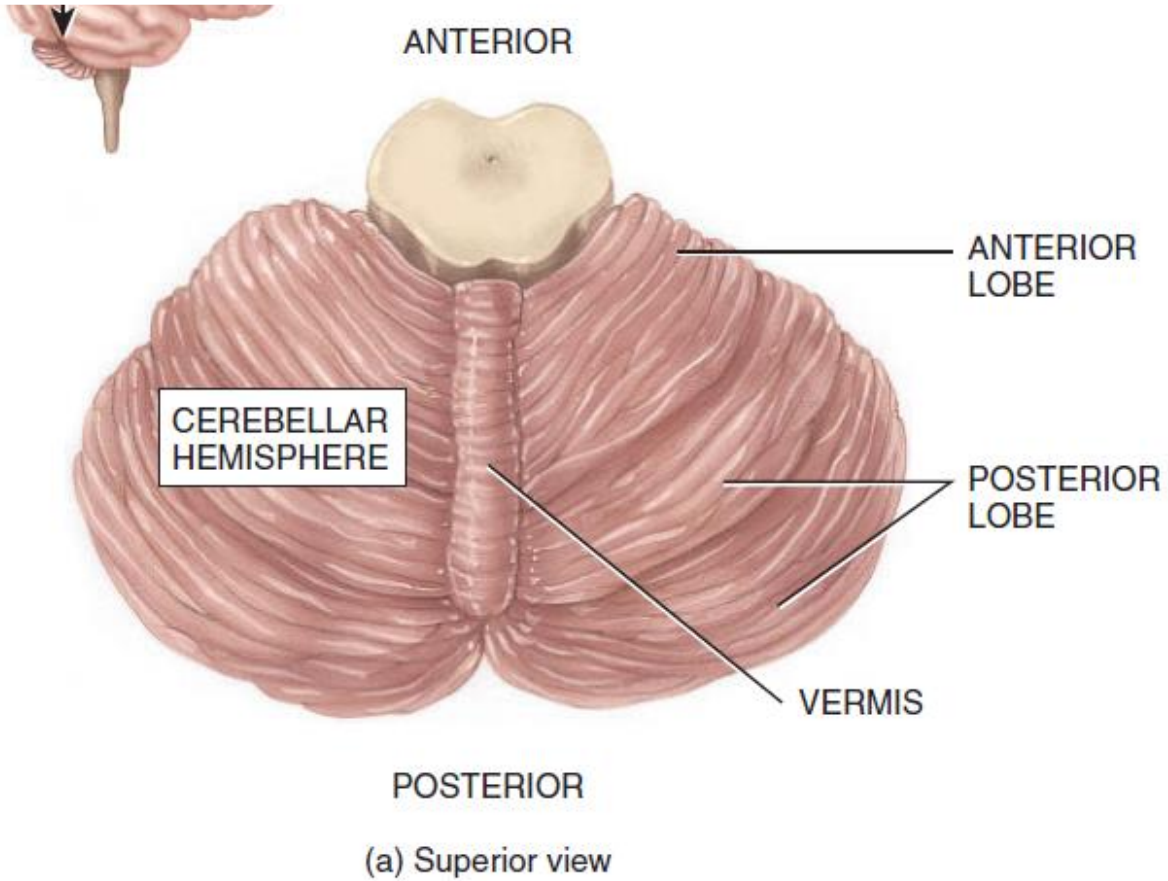


Brainstem dan Nervus Kranialis

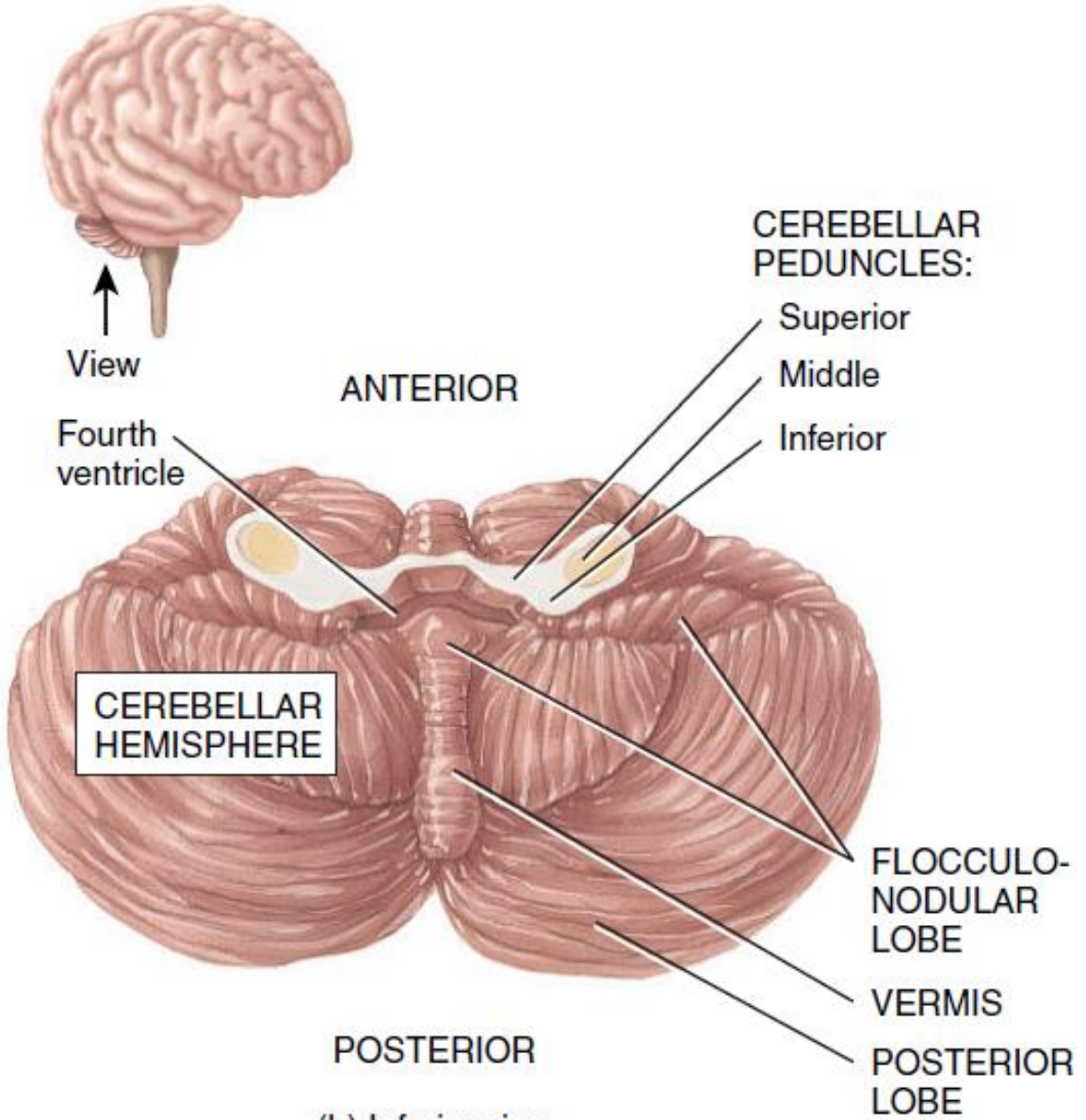




Cerebellum

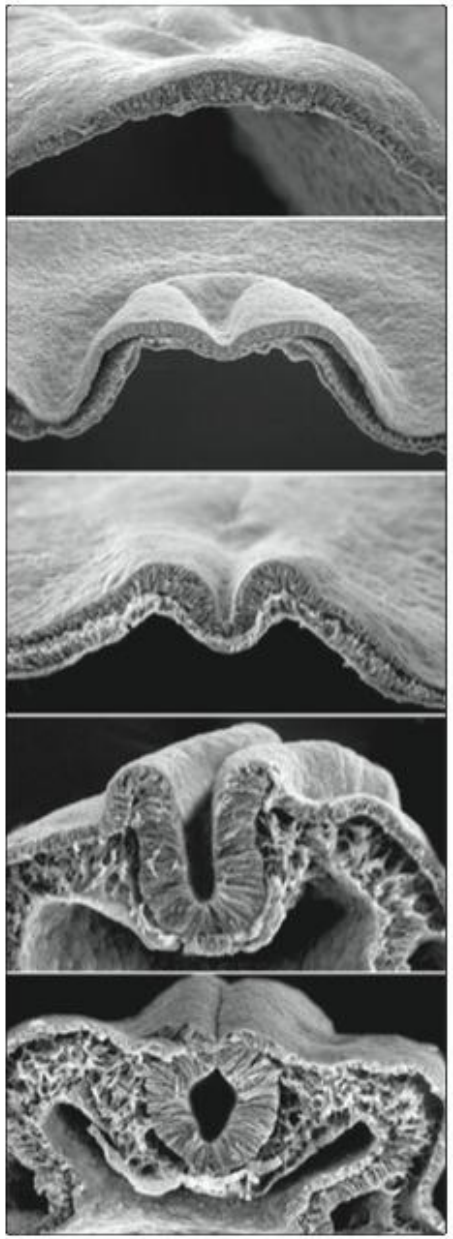


(a) Superior view



(b) Inferior view

2. Embriologi



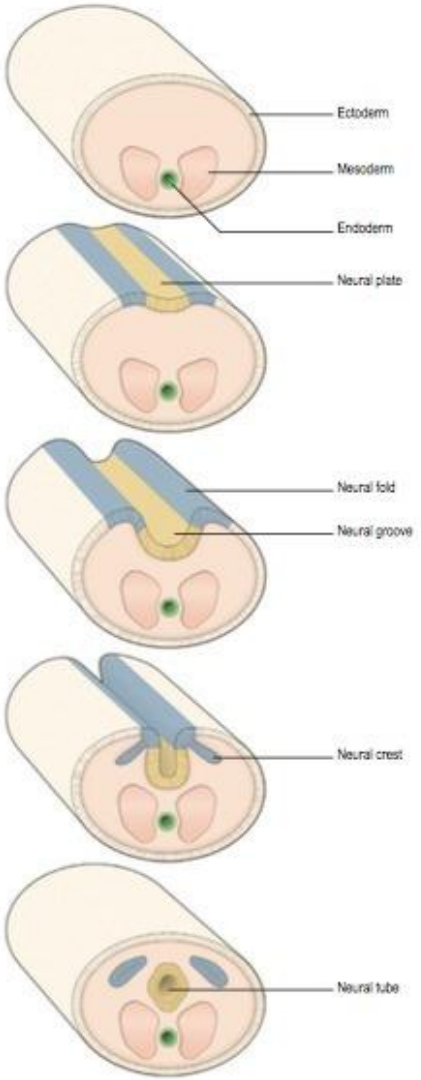
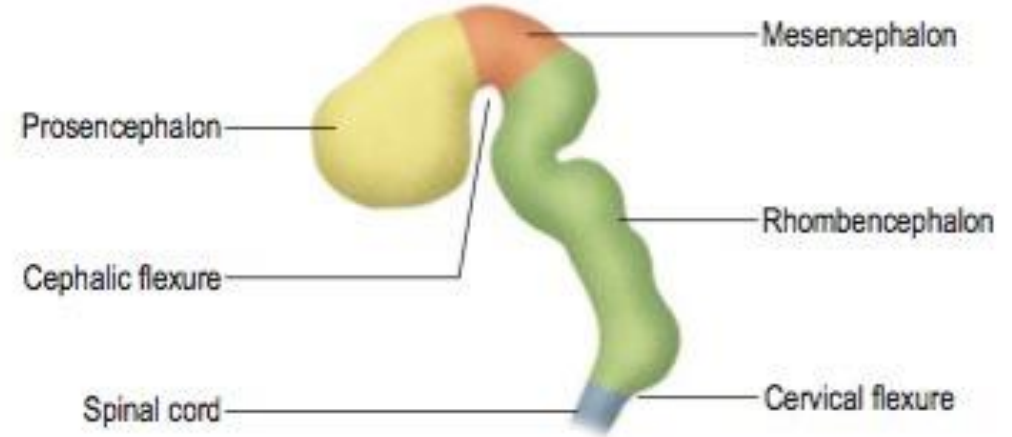


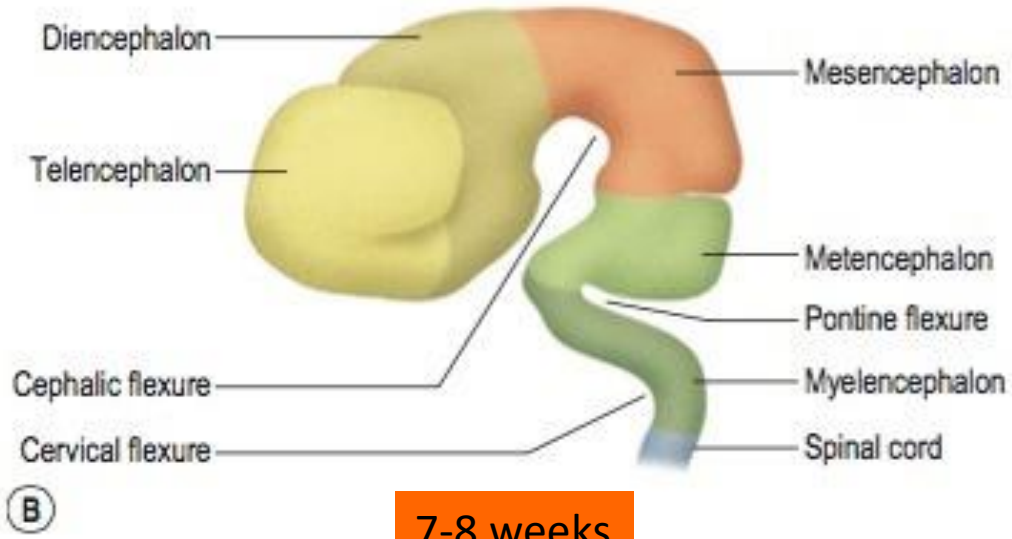
Figure 1.9 **Schematic representation of the formation of the neural tube from the embryonic ectoderm.**

Early week 2

Mid week 4



4-5 weeks



7-8 weeks

NEURULATION

BRAIN VESICLE FORMATION

VESICLES "cephalon"

- The neural tube differentiates into brain vesicles ("-cephalon").

BRAIN VESICLES

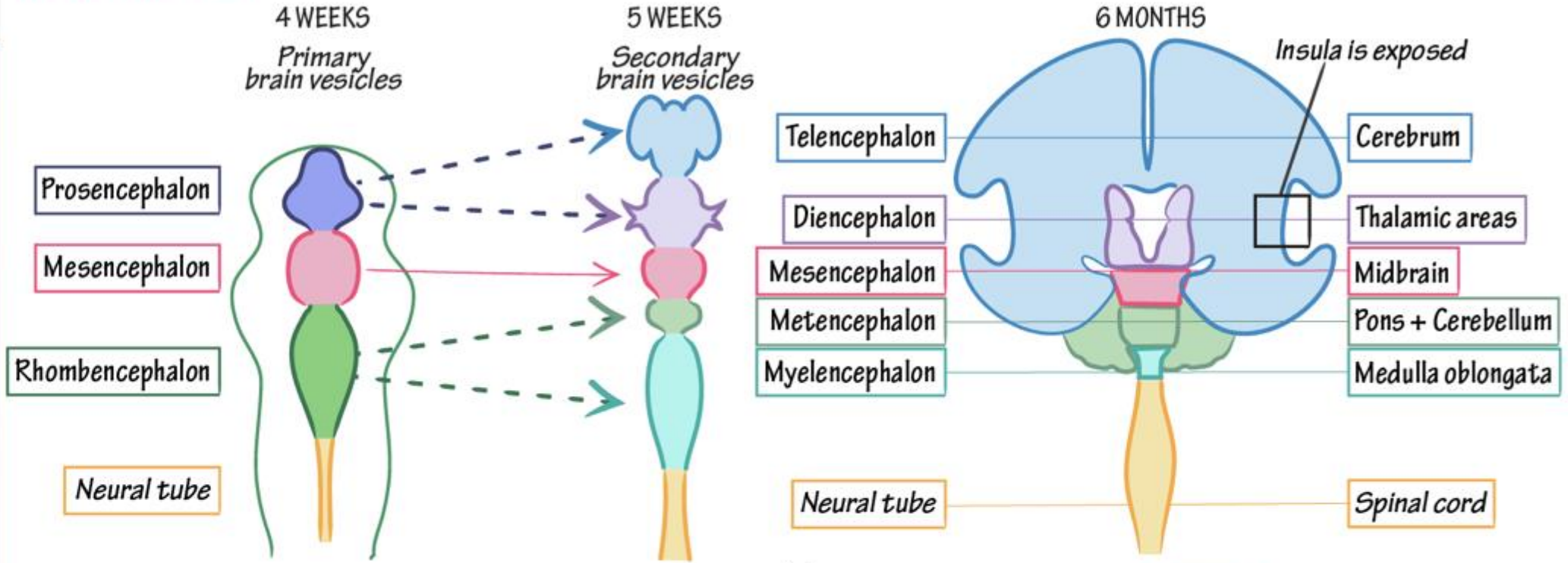
4 Weeks	5 Weeks
Primary	Secondary
3	5

- Prosen- → Telen-
- Prosen- → Dien-
- Mesen- → Mesen-
- Rhomben- → Meten-
- Rhomben- → Myelen-

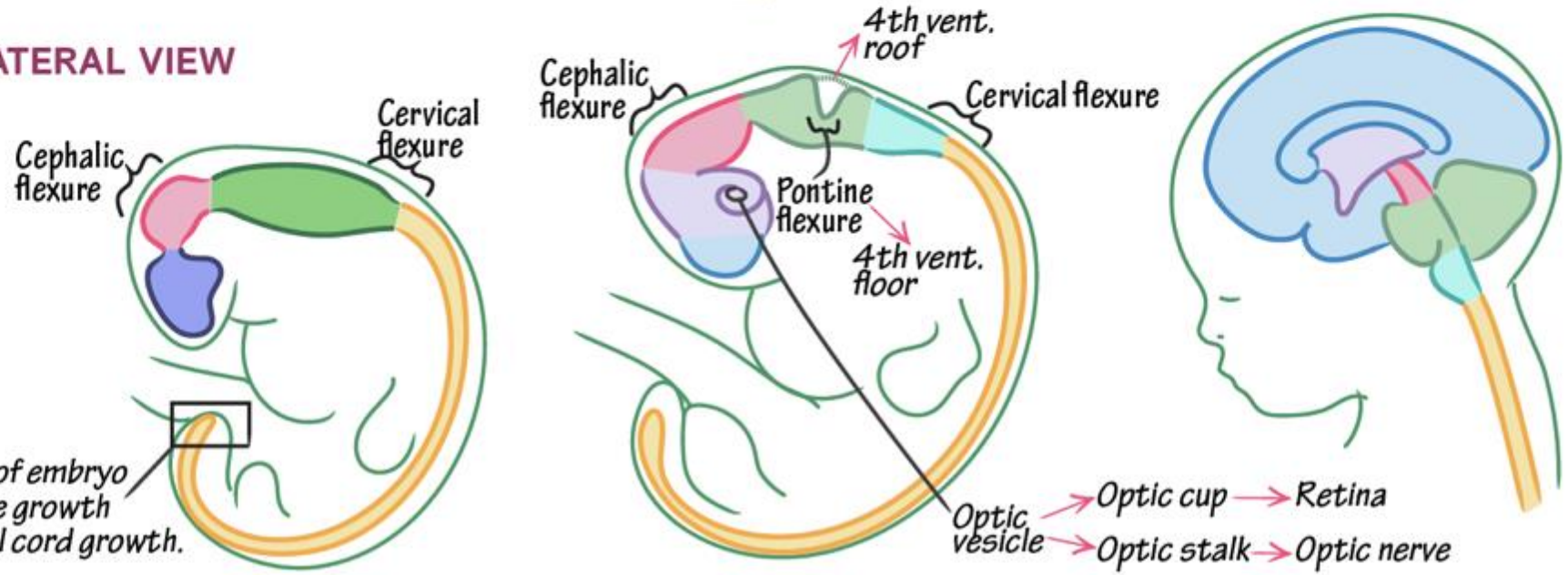
FLEXURES (3)

- Cephalic
- Pontine
- Cervical

CORONAL VIEW



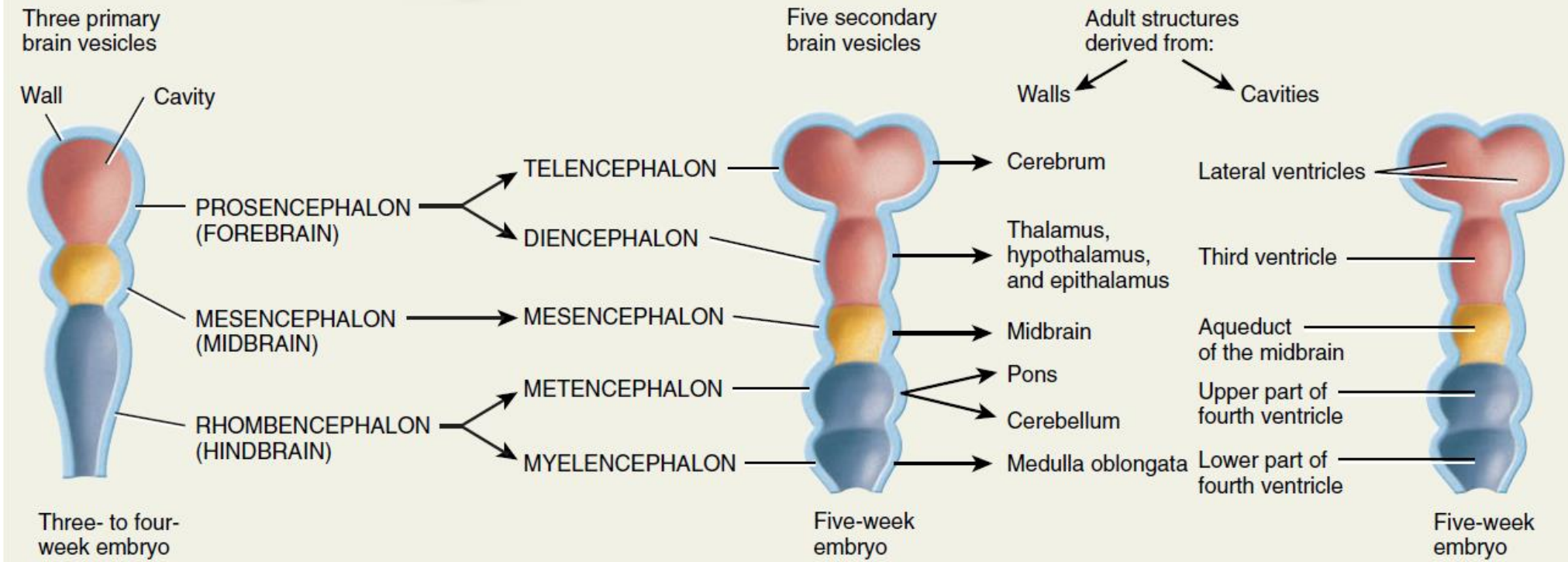
LATERAL VIEW



Neuroembriologi Dasar Otak

TABLE 14.1

Development of the Brain



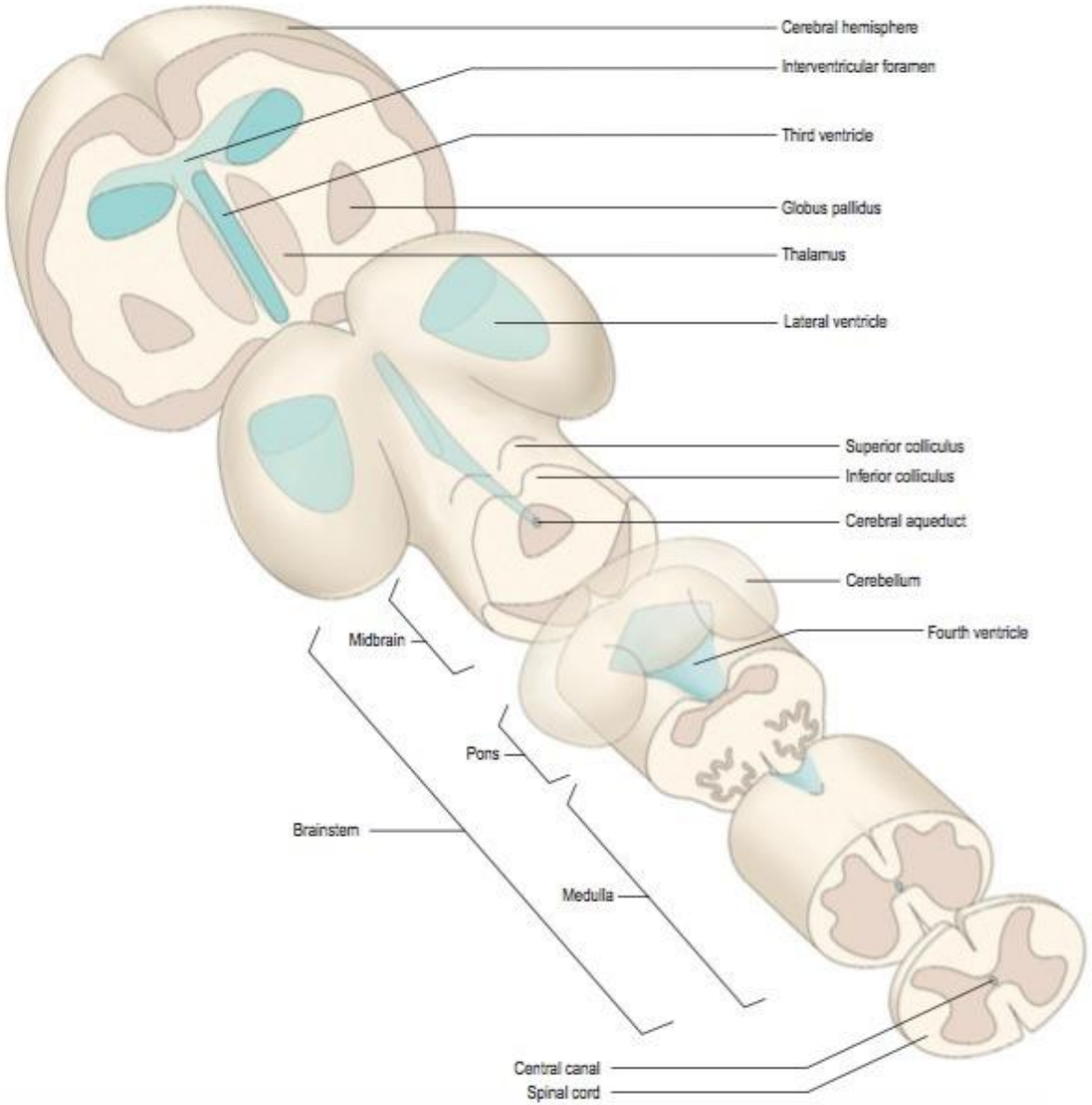
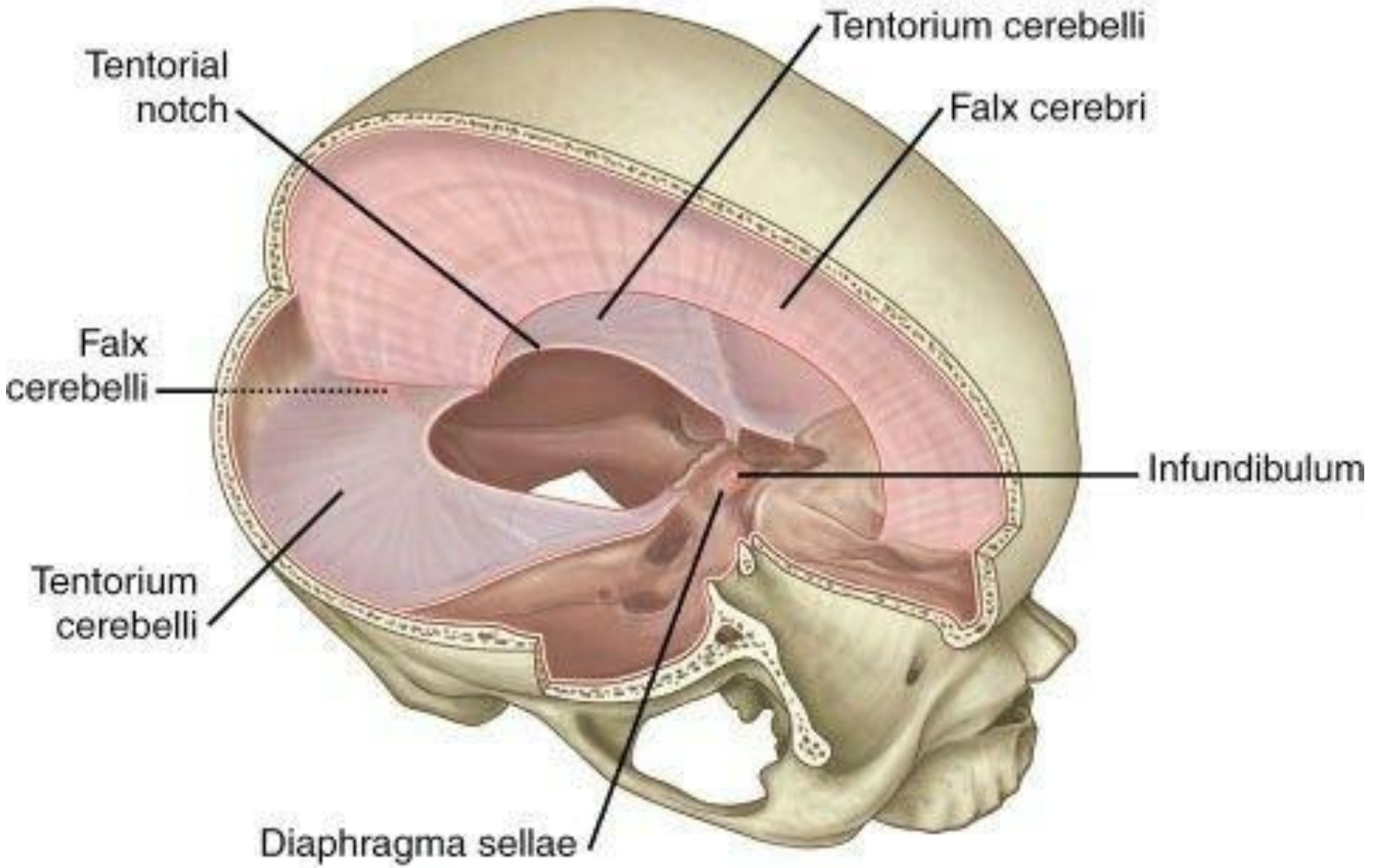


Figure 1.13 **Schematic representation of the major subdivisions and landmarks of the brain.**

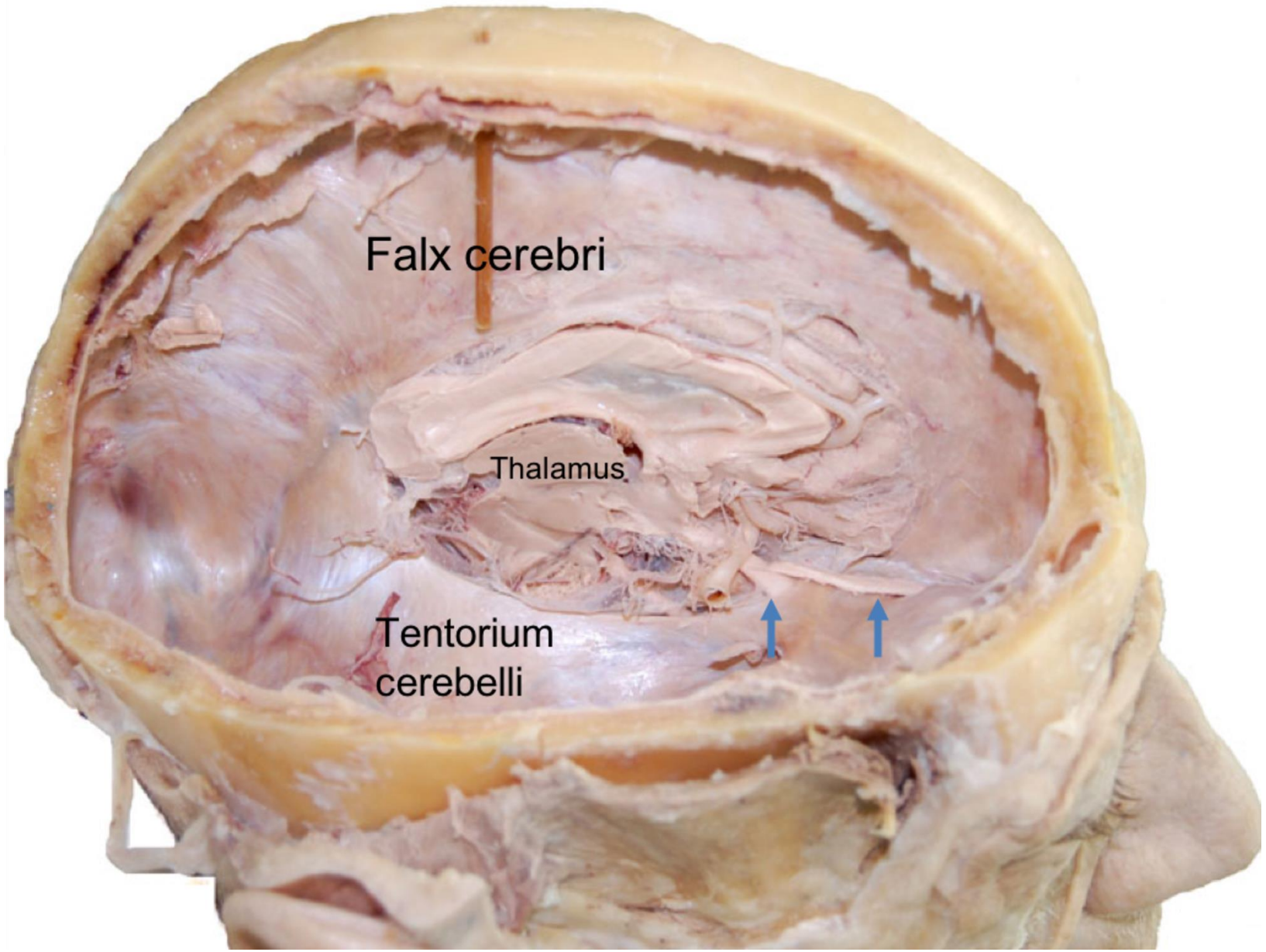
3. Supratentorial & Infratentorial



Tentorium cerebelli

The tentorium cerebelli - an infolding of the dura mater - forms a tent-like sheet which separates the cerebrum (brain) from the cerebellum

The tentorium is anchored by the petrous bones



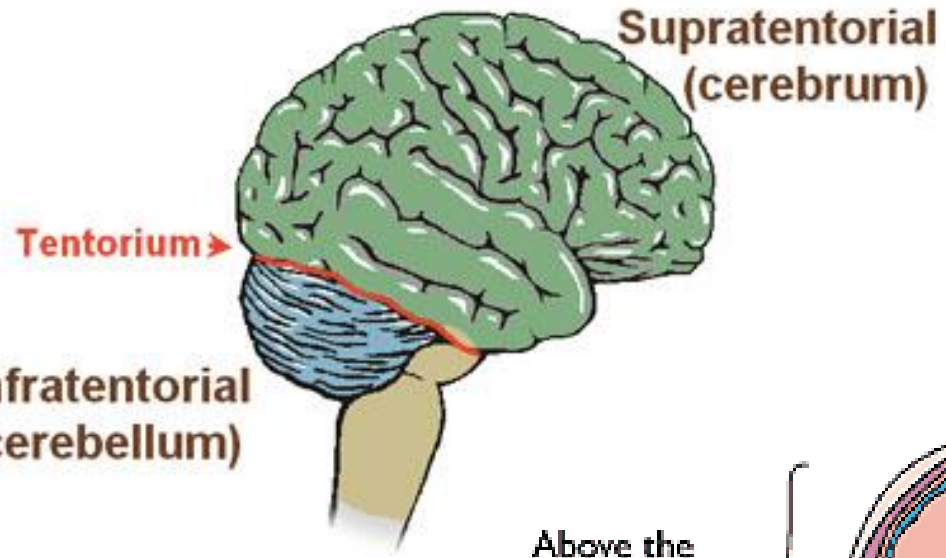
Tentorium cerebelli

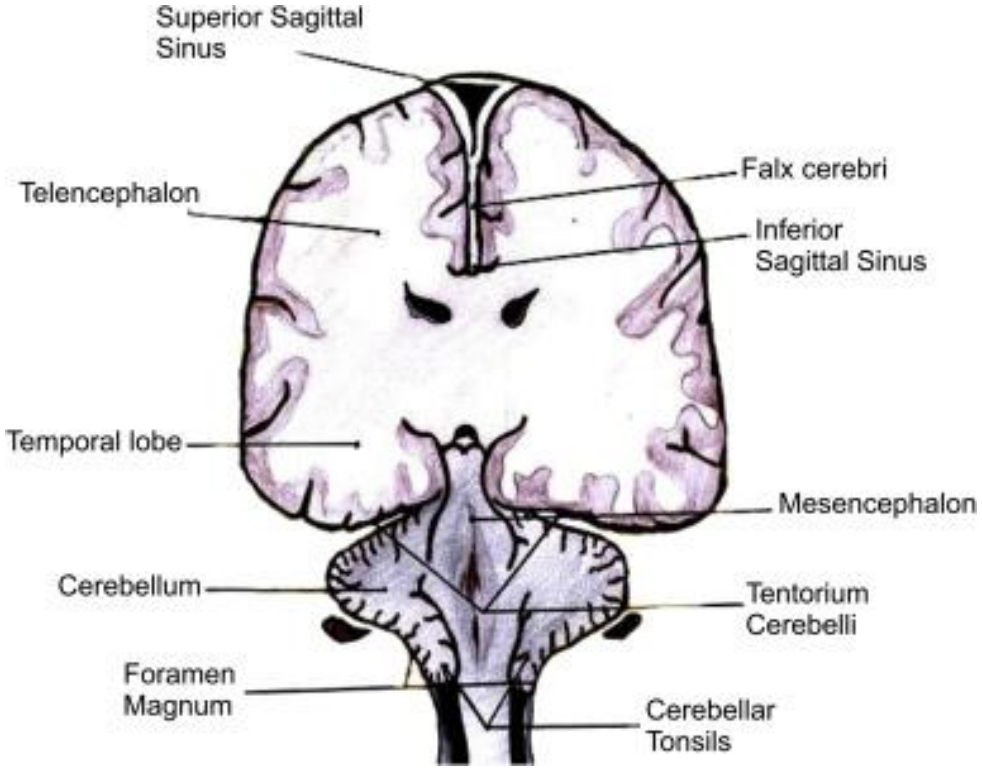
On axial slice CT images of the brain the tentorium is faintly visible passing over the cerebellum

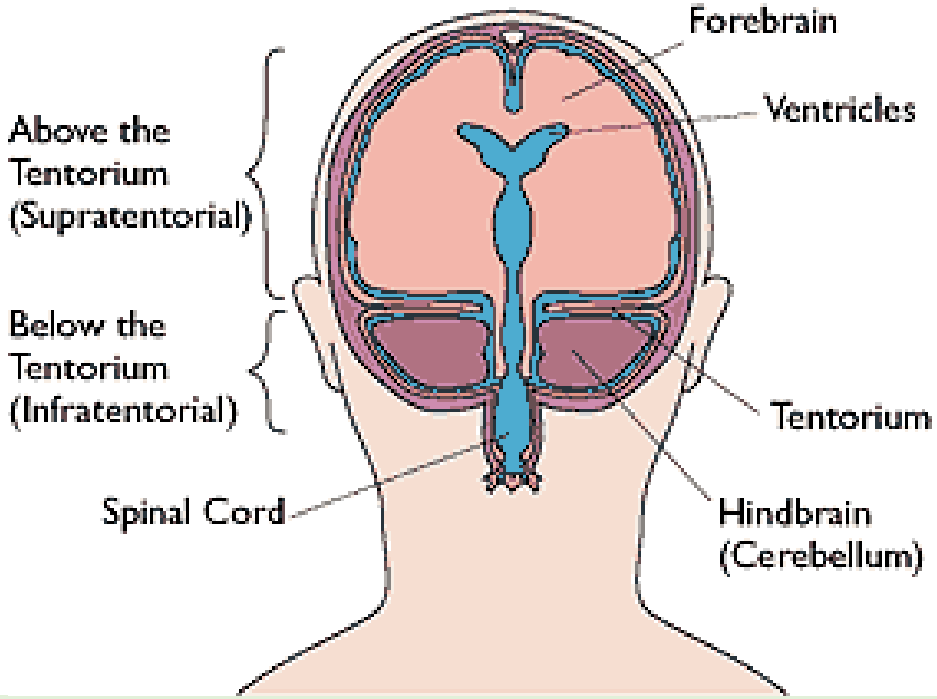
Tentorium cerebelli - clinical significance

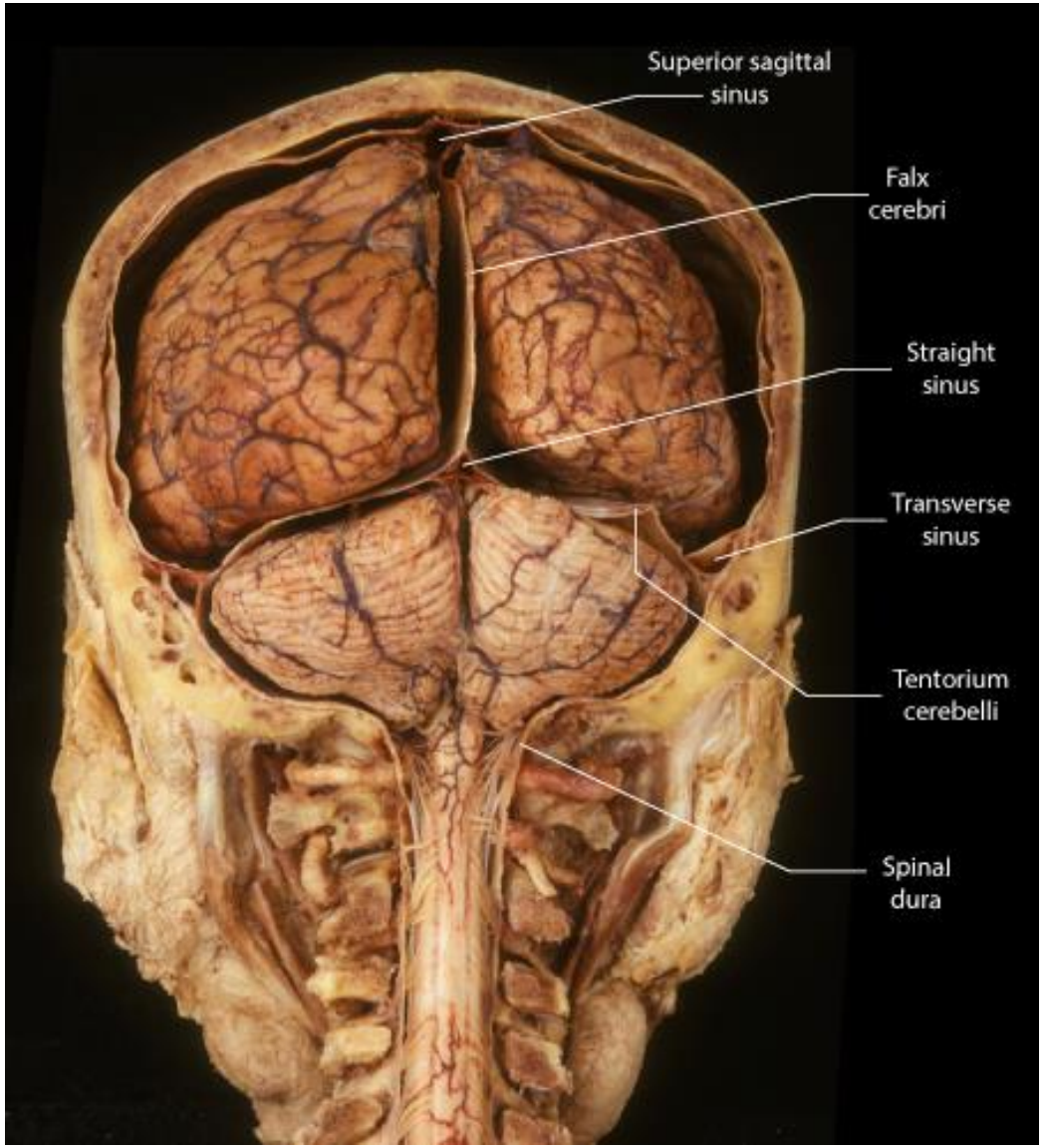
In the context of subarachnoid hemorrhage or subdural hematoma the tent may become more dense due to layering of blood.

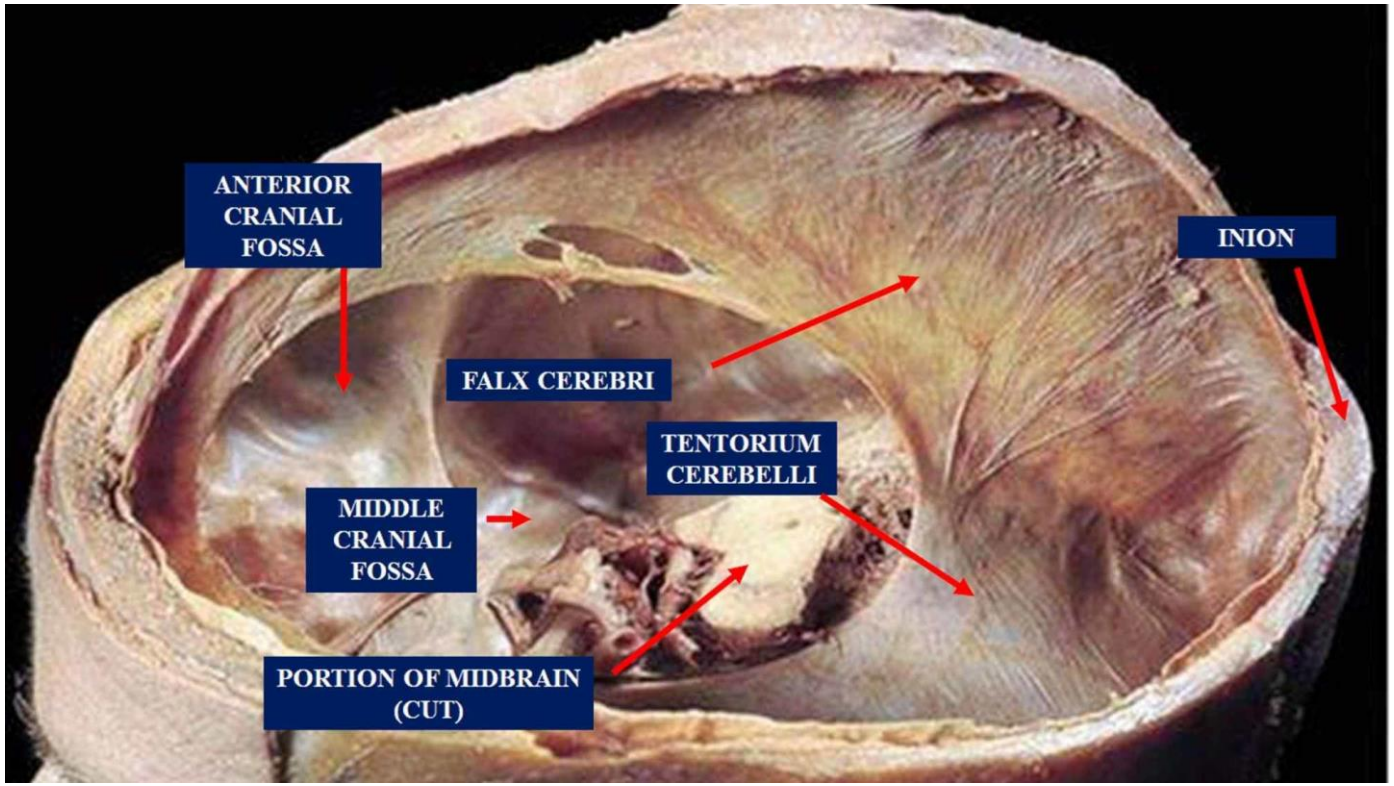
The Tentorium Cerebelli



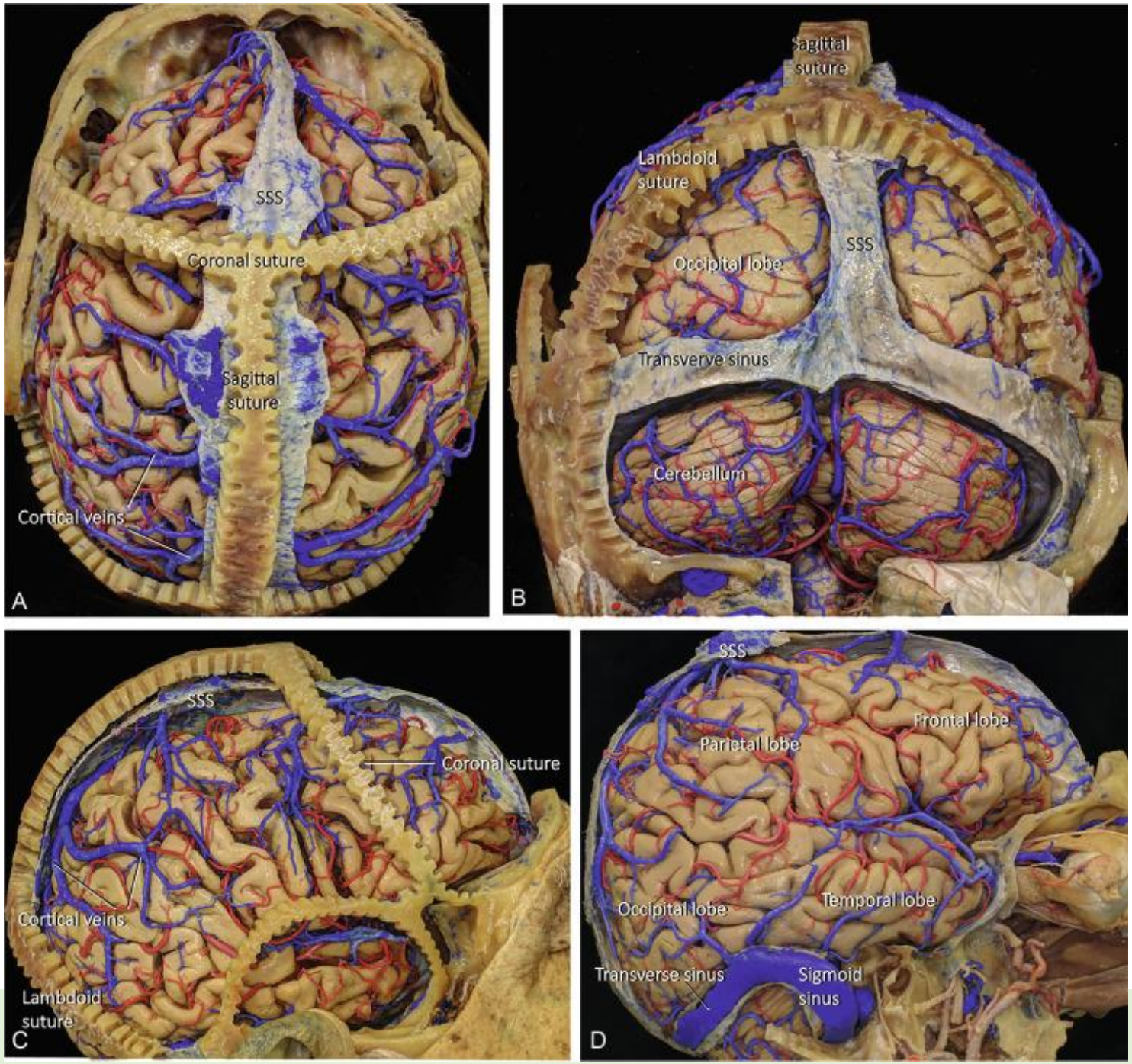


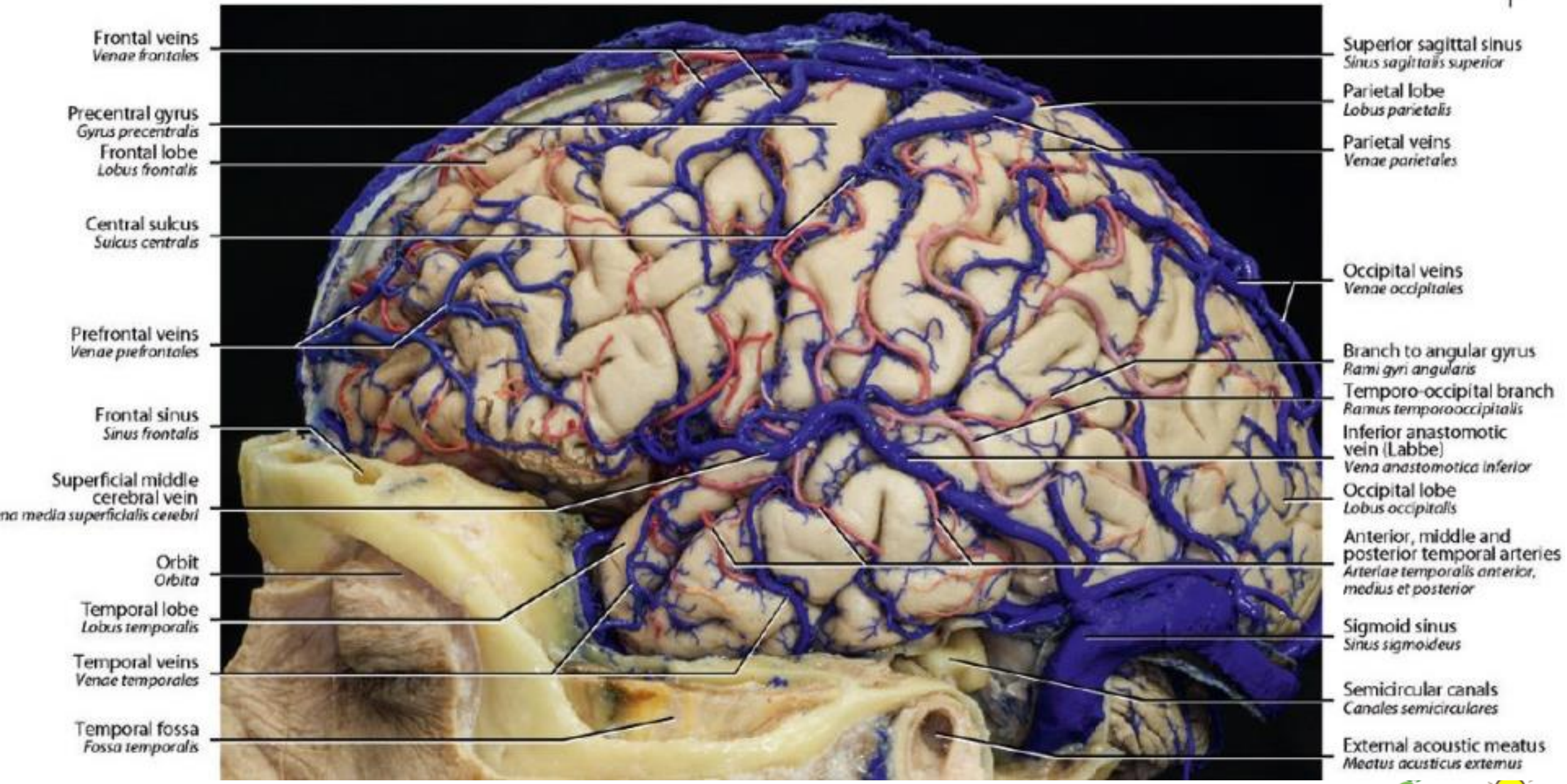


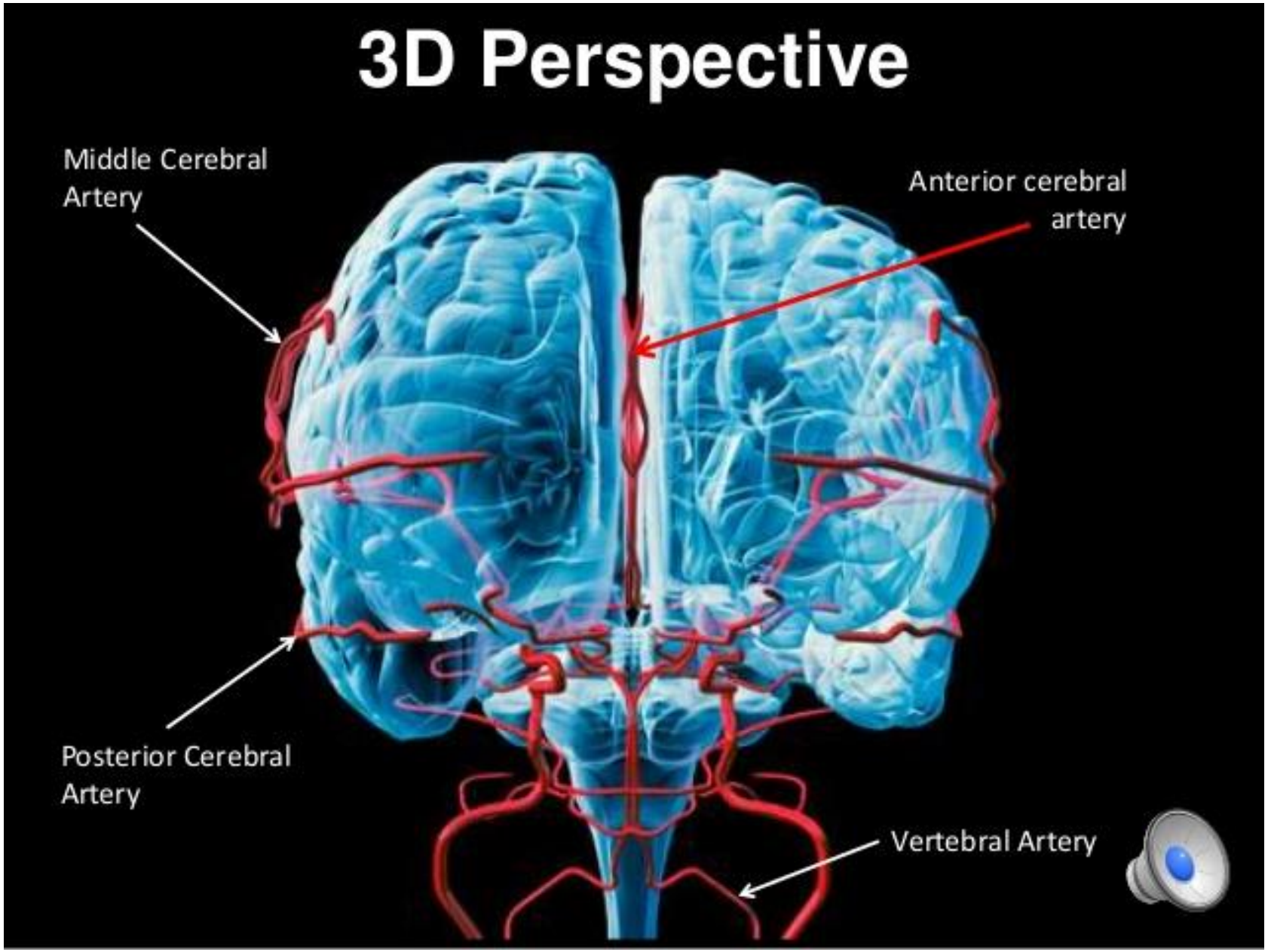


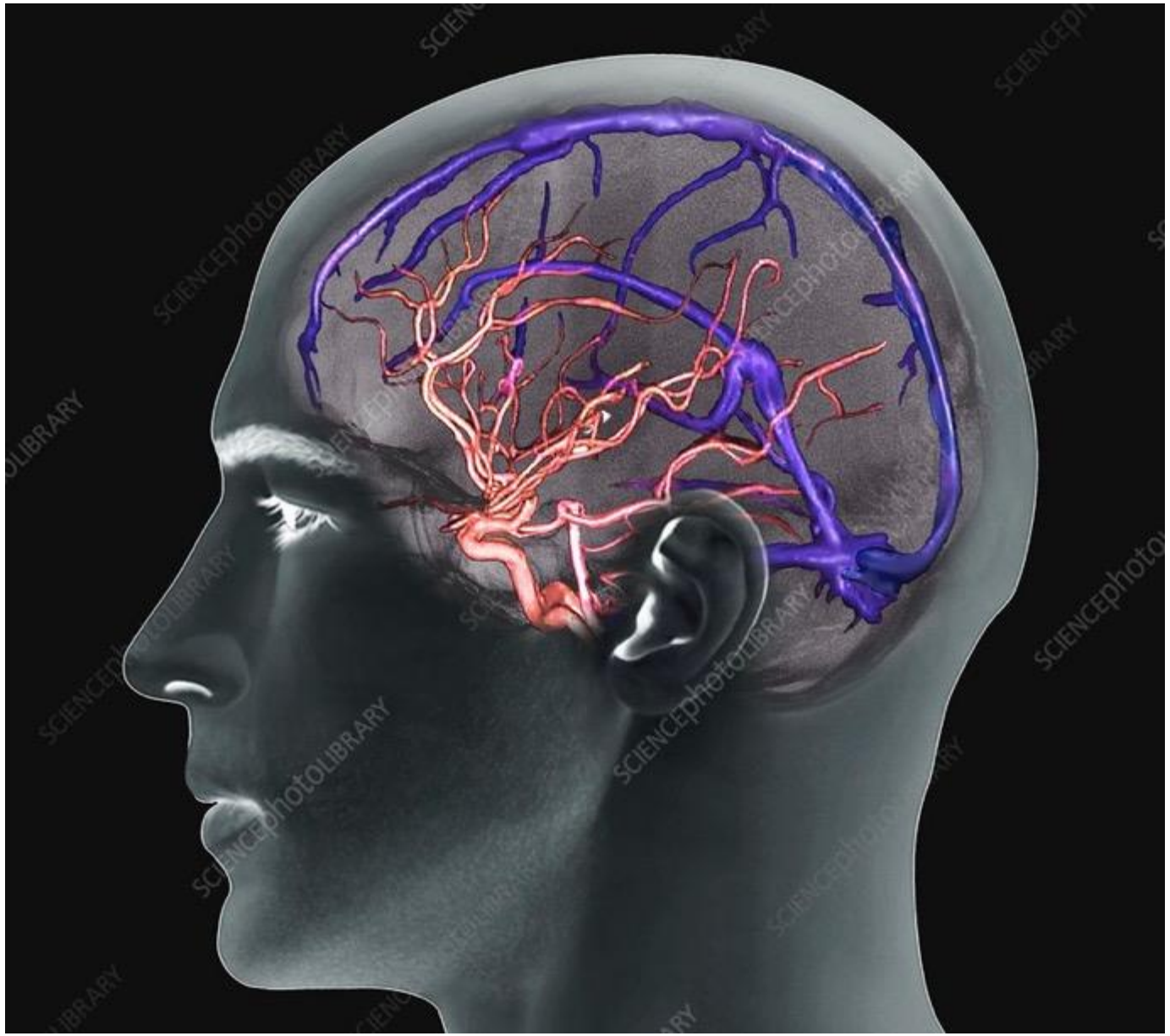


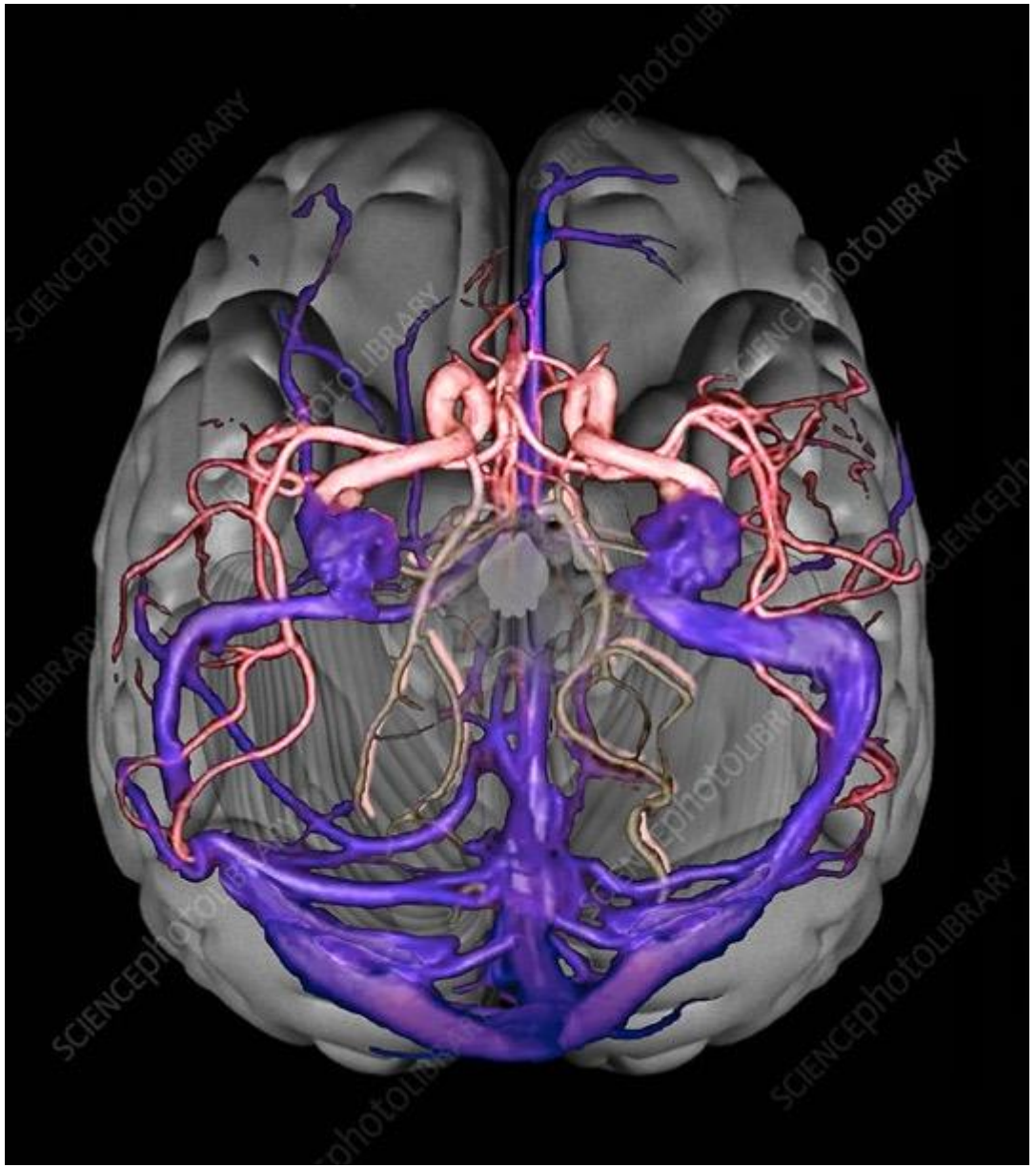
4. Sistem Arteri dan Vena



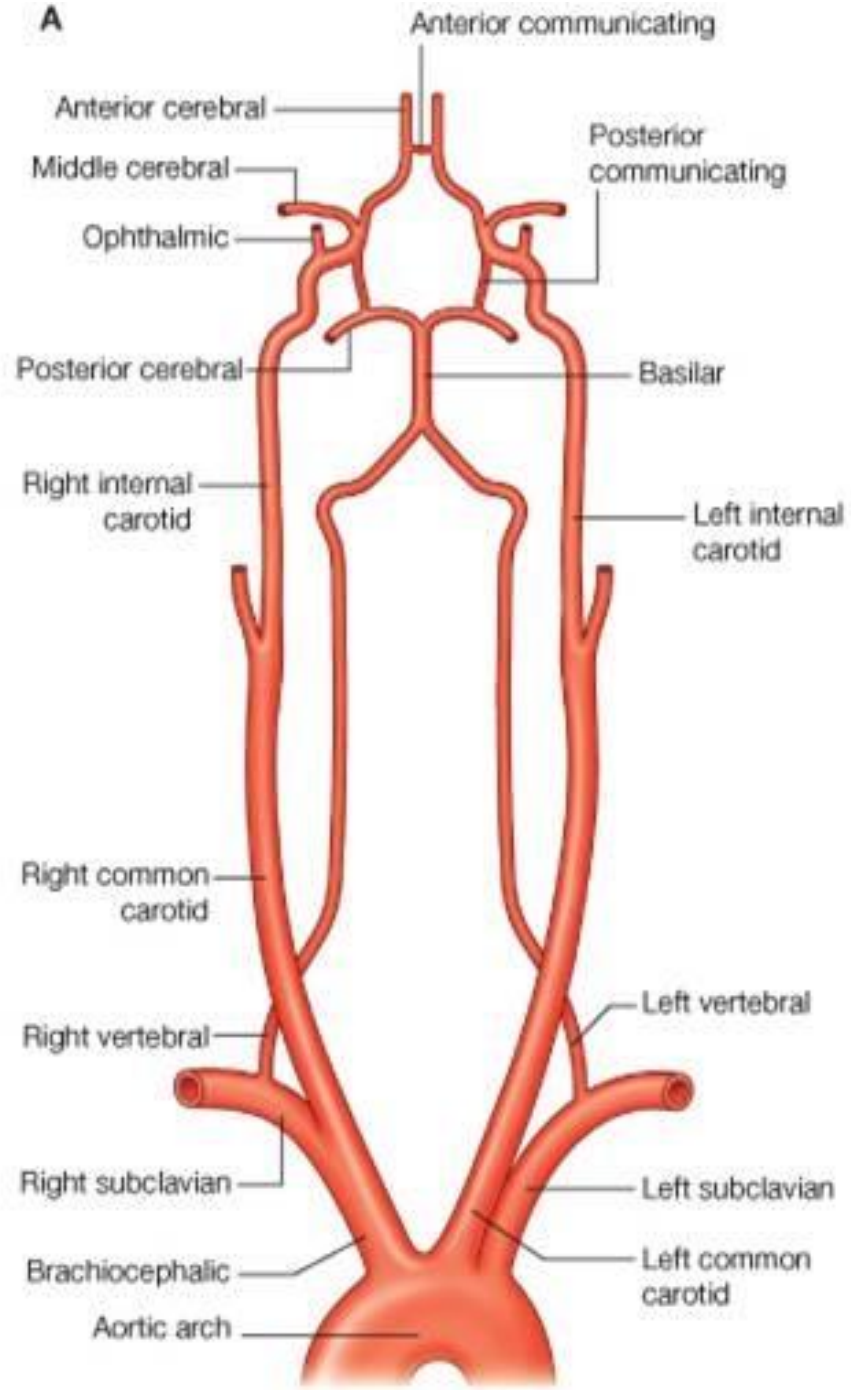




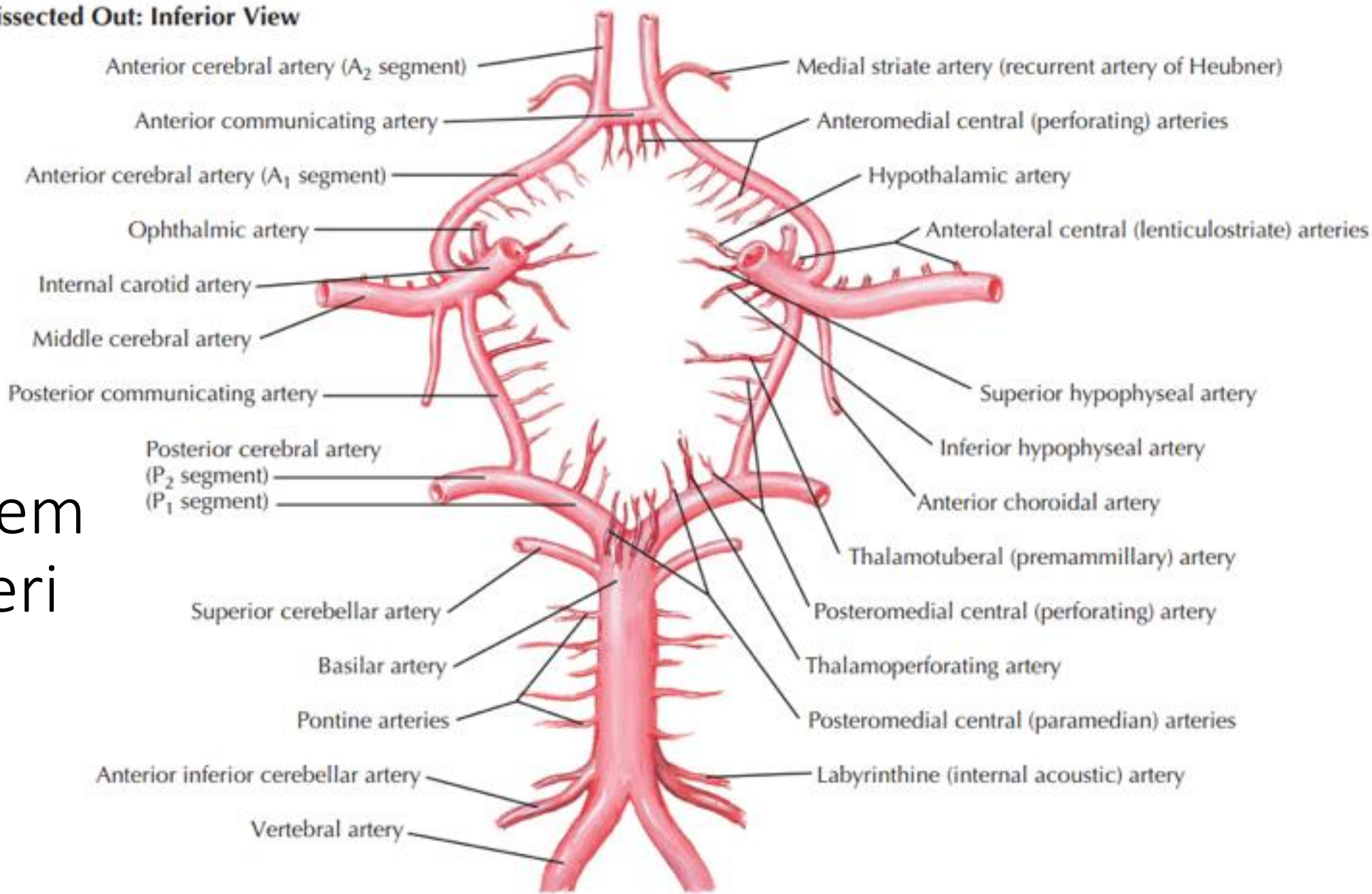


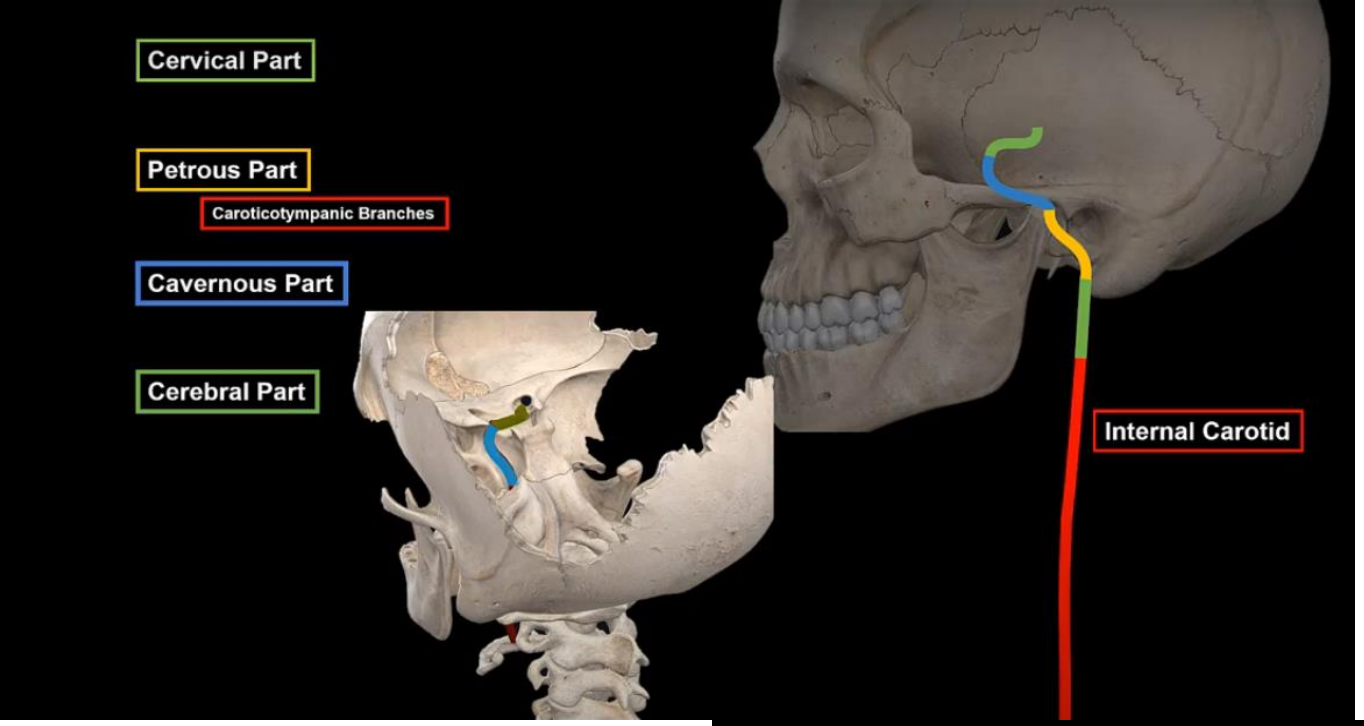


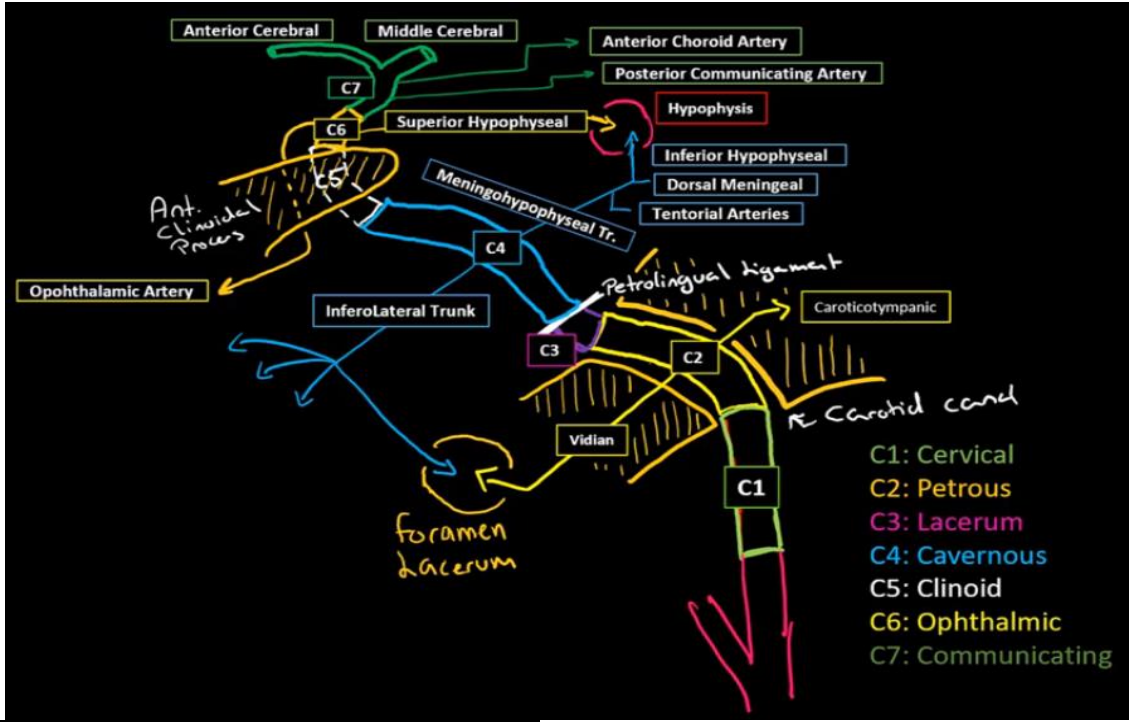
Sistem Arter

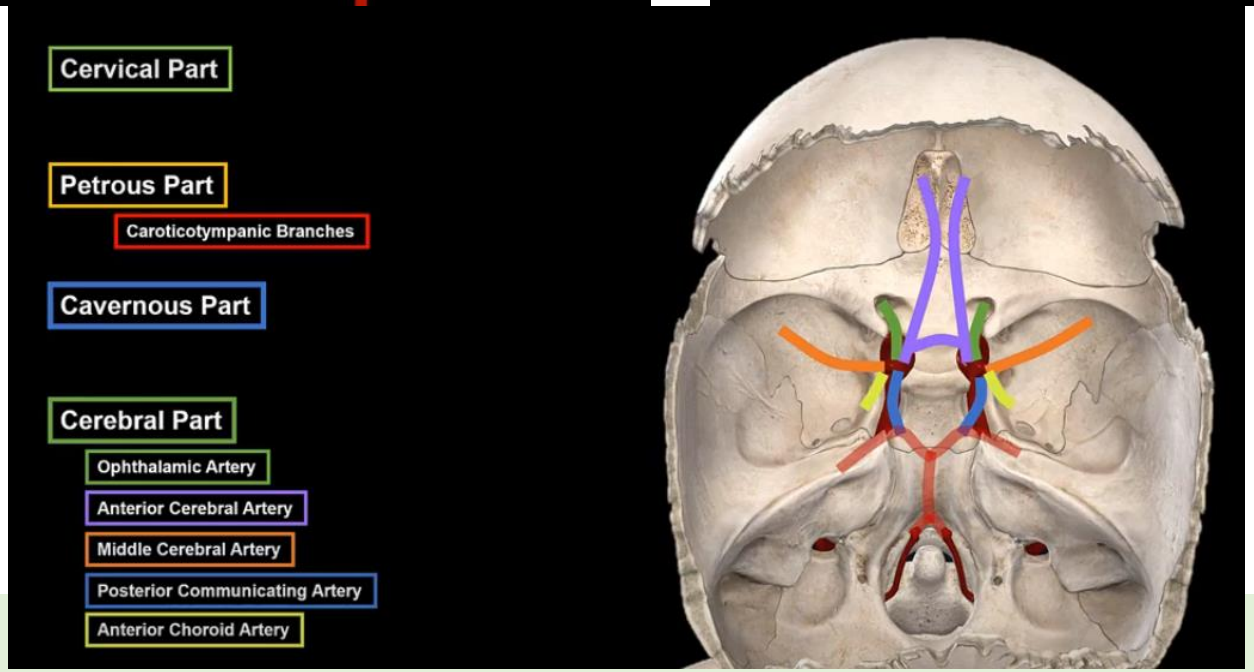


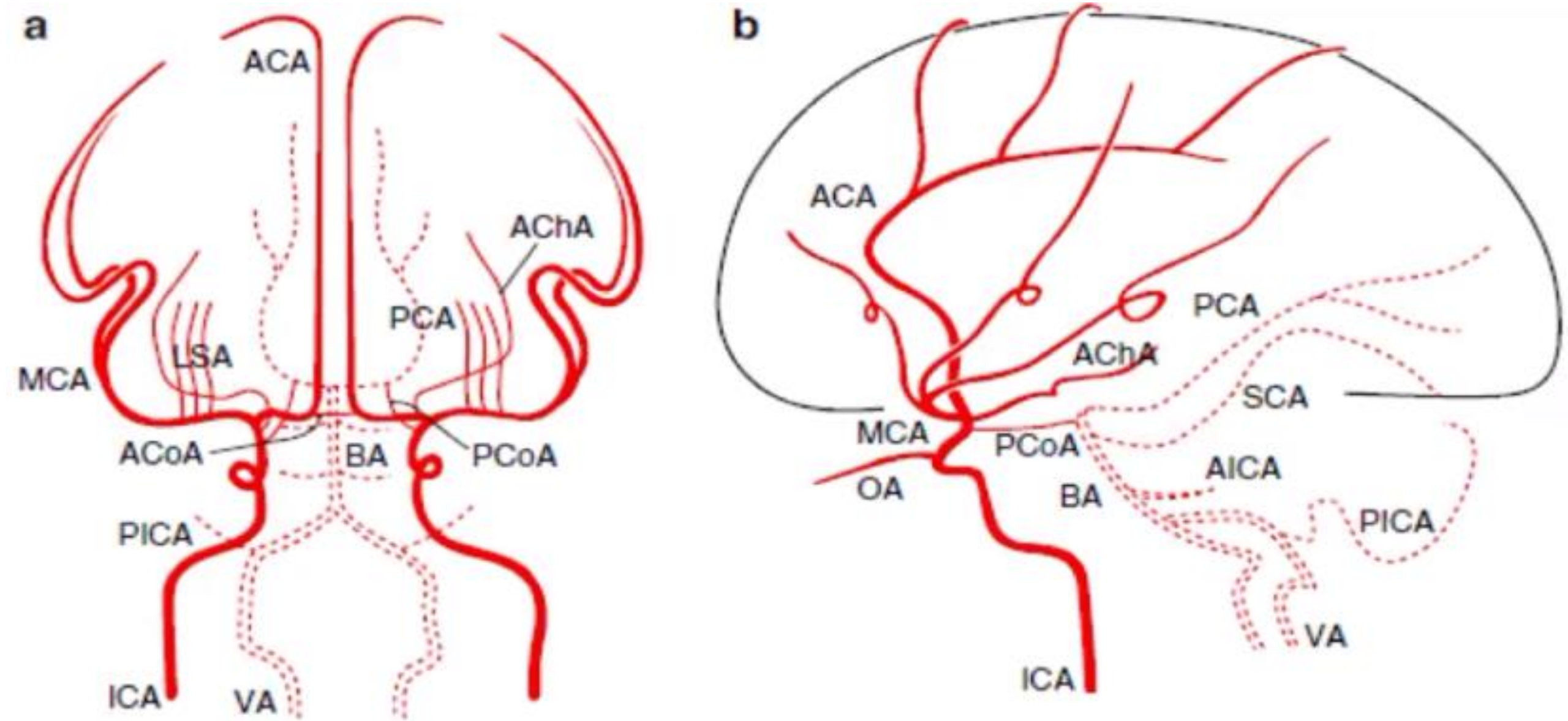
Sistem Arteri



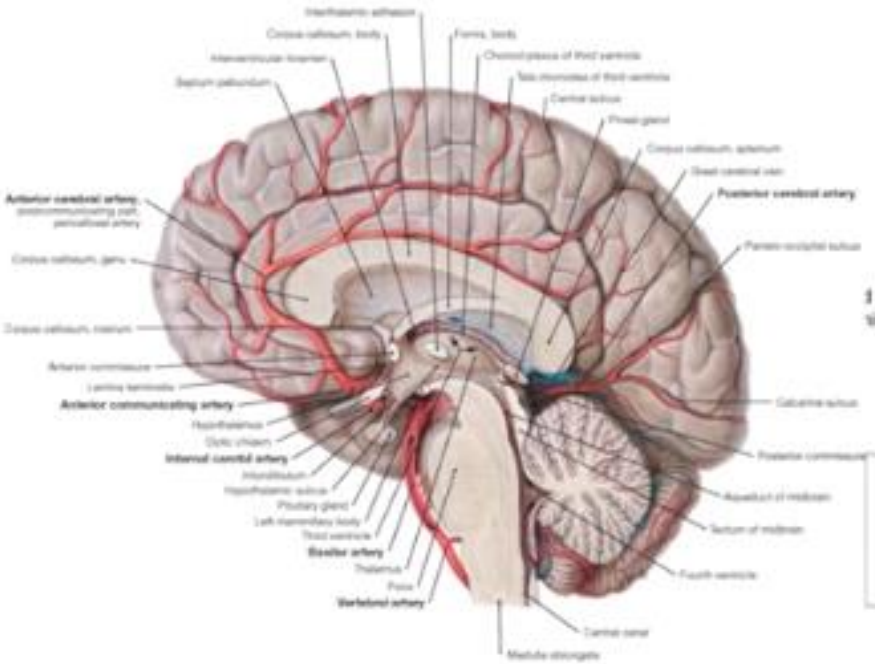


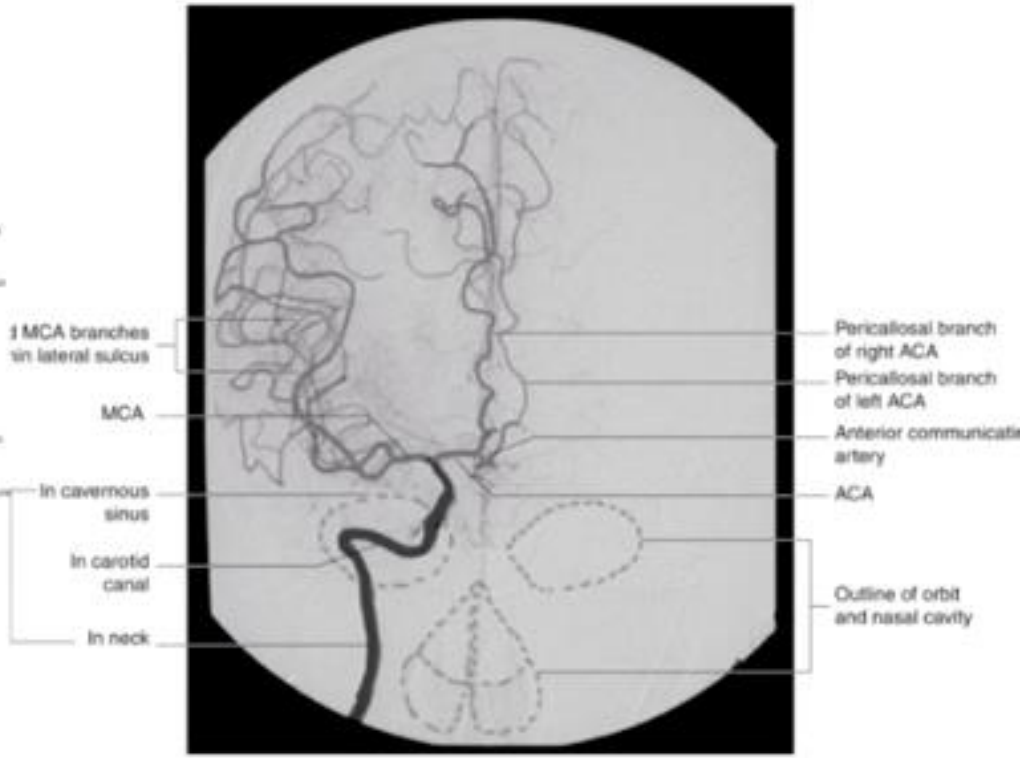


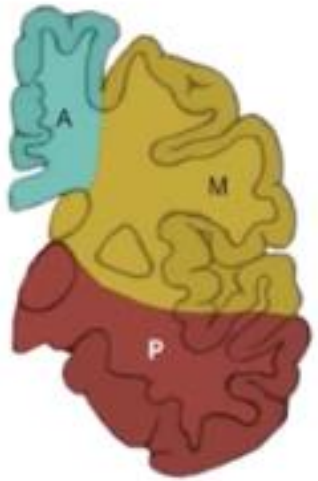


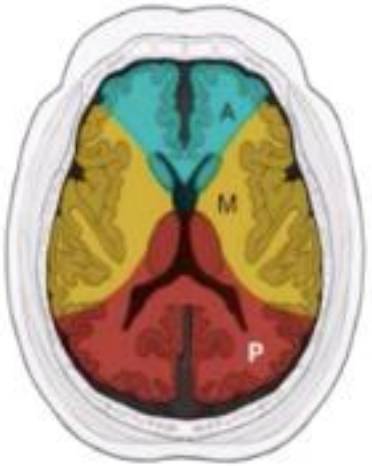


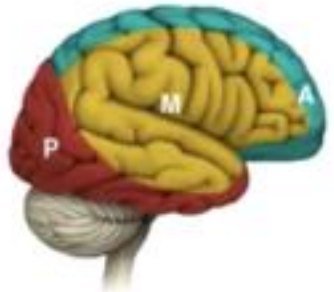
The anterior cerebral artery



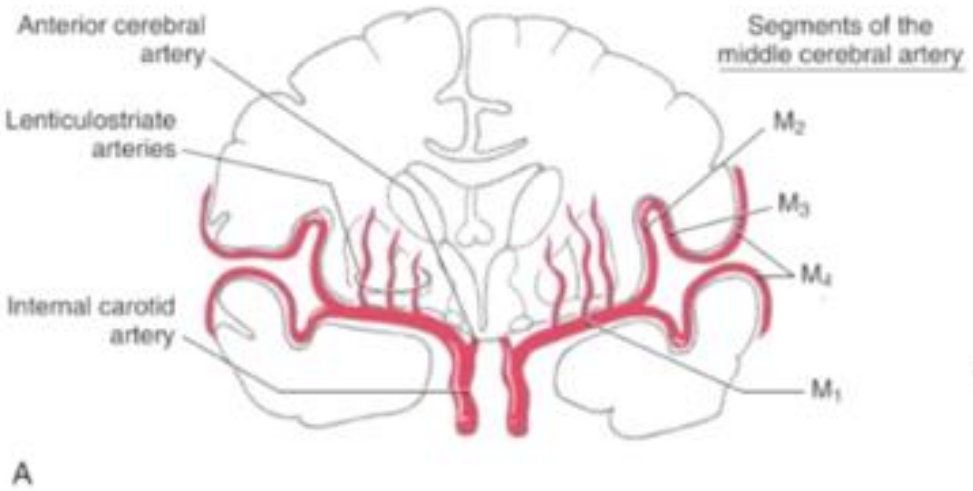


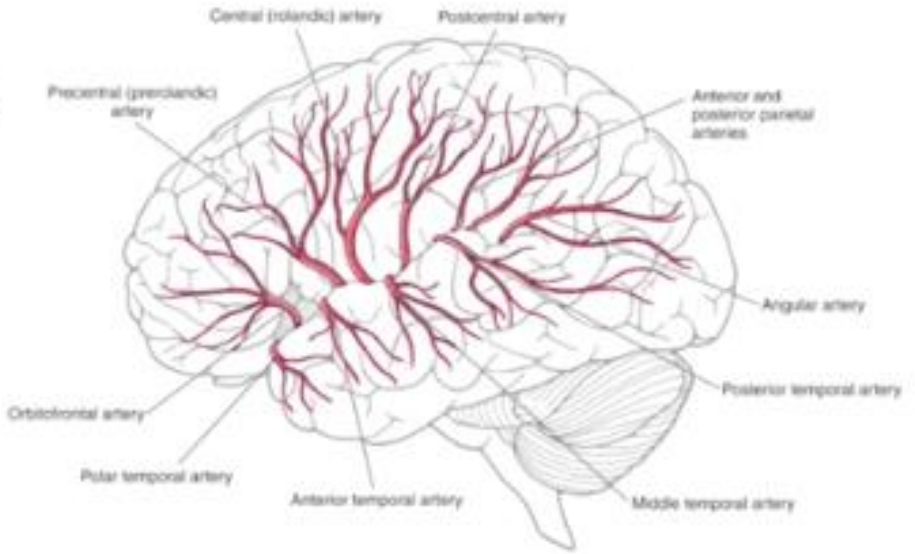


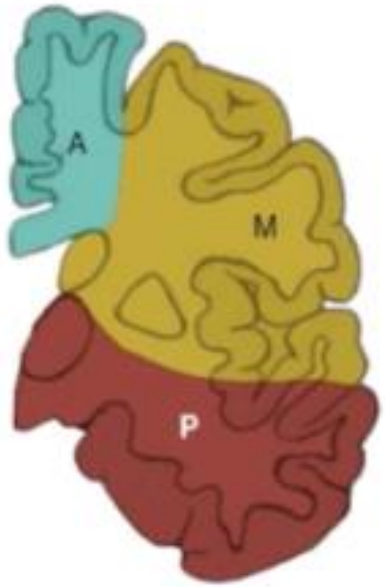


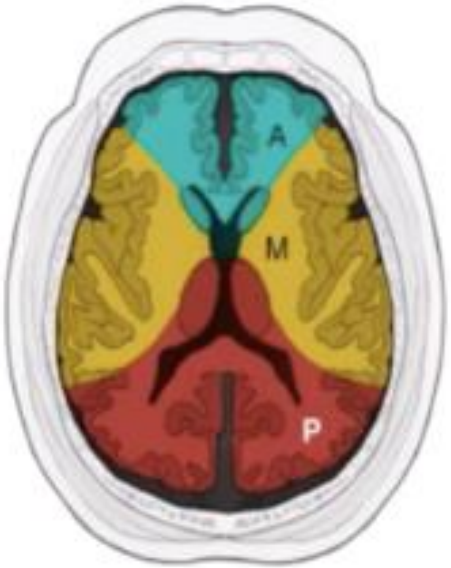


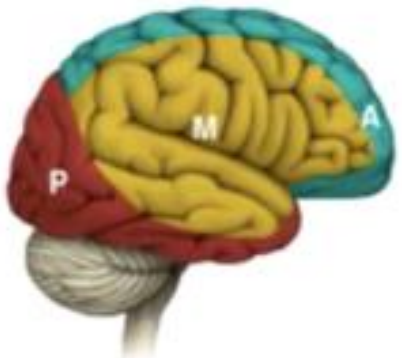
The middle cerebral artery

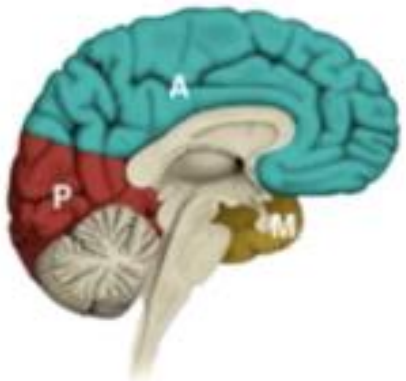


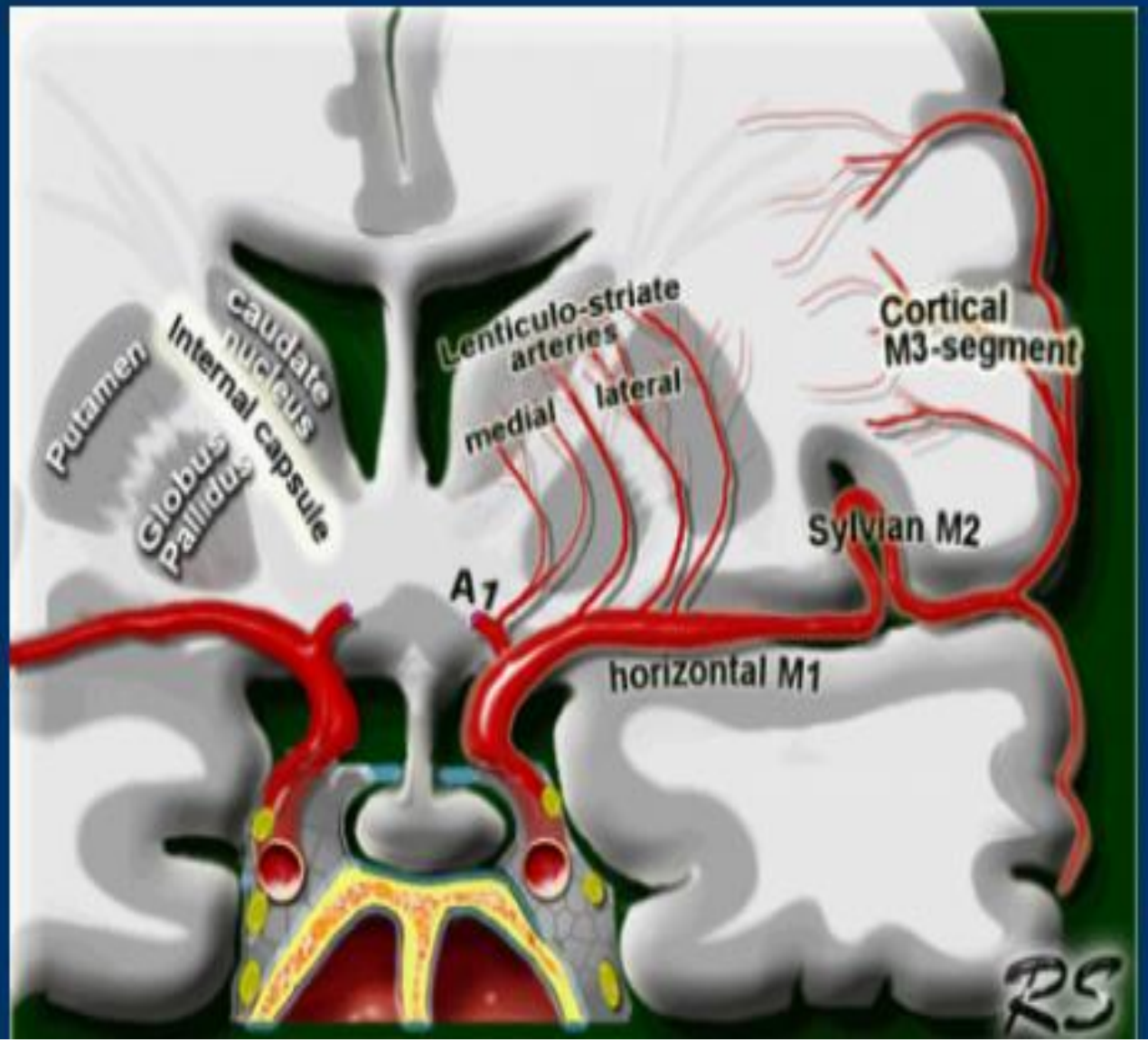












Lenticulostriate arteries

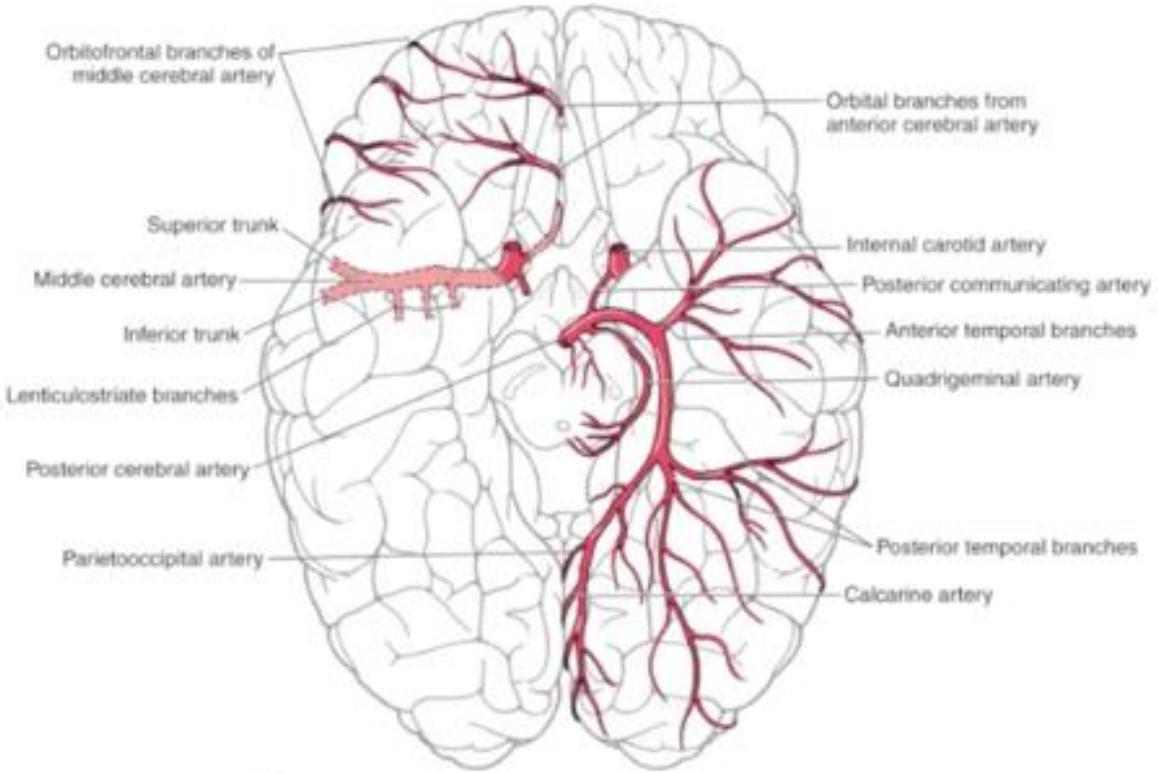
Medial lenticulostriate arteries

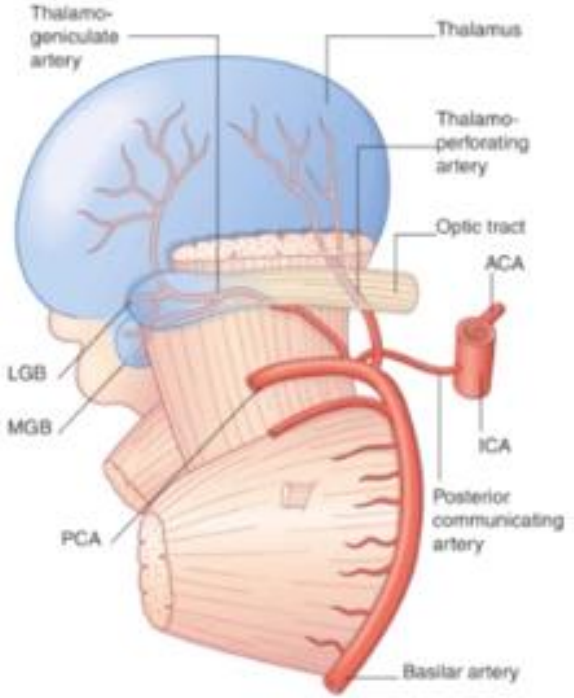
They are branches of the A1-segment of the anterior cerebral artery.
They supply the anterior inferior parts of the basal nuclei.
They also supply the anterior limb of the internal capsule together with the recurrent artery of Huebner, which also is a branch of the anterior cerebral artery.

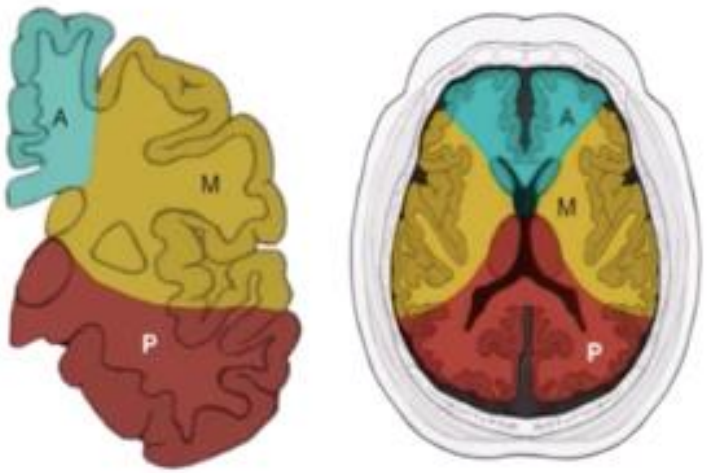
Lateral lenticulostriate arteries

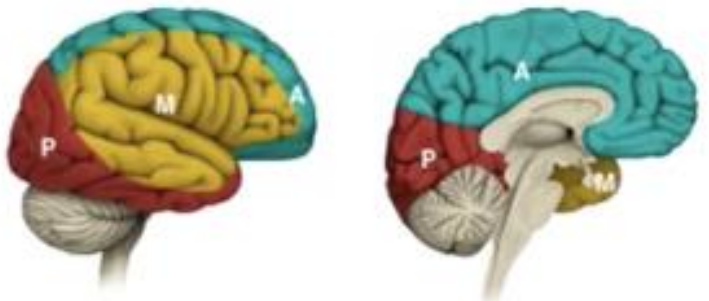
They are branches of the horizontal M1-segment of the middle cerebral artery.
They supply the superior part of the head and the body of the caudate nucleus, most of the globus pallidus and putamen.
They also supply the anterior limb of the internal capsule and parts of the posterior limb of the internal capsule, which is largely supplied by the anterior choroidal artery.

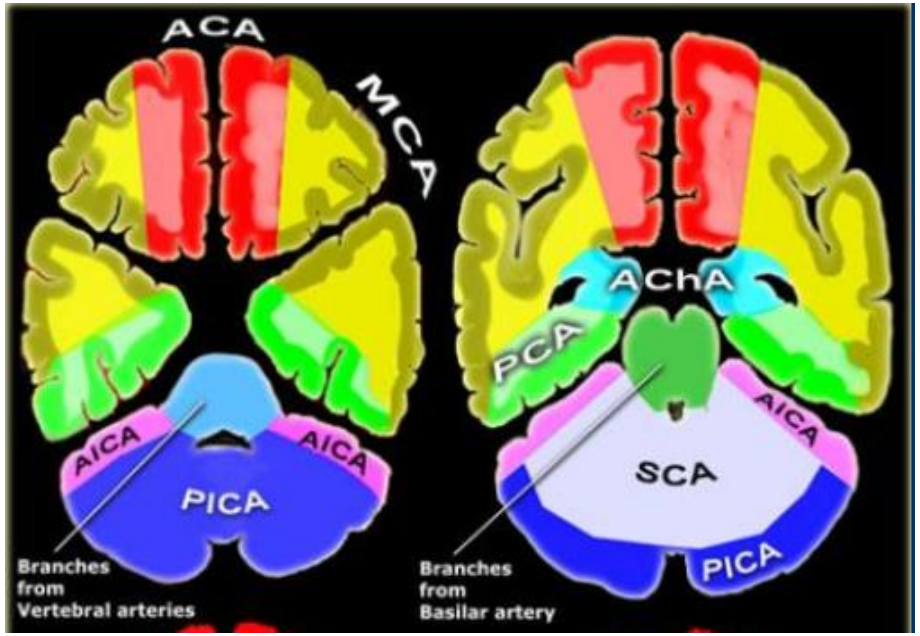
The posterior cerebral arteries

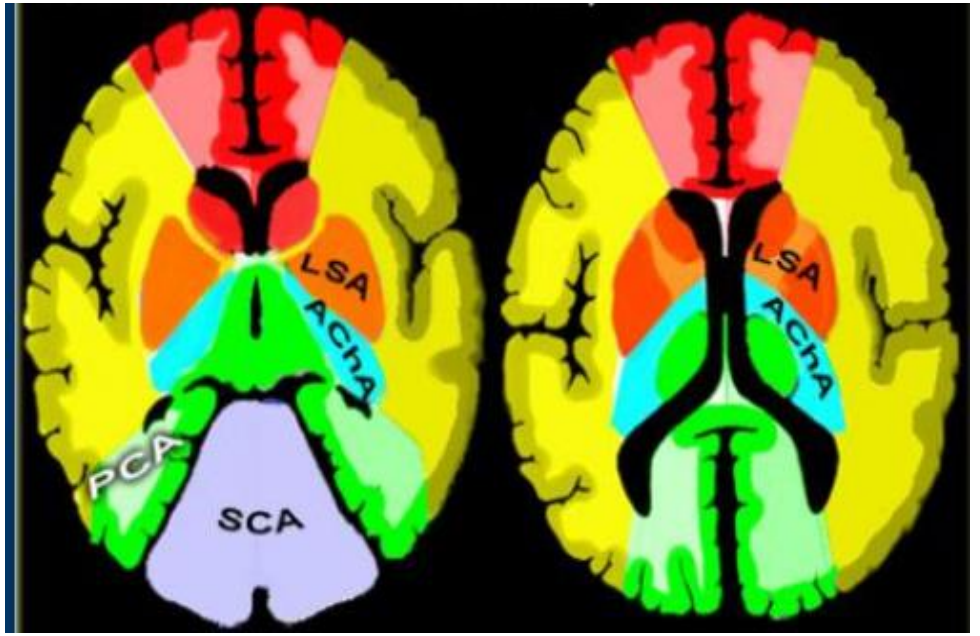


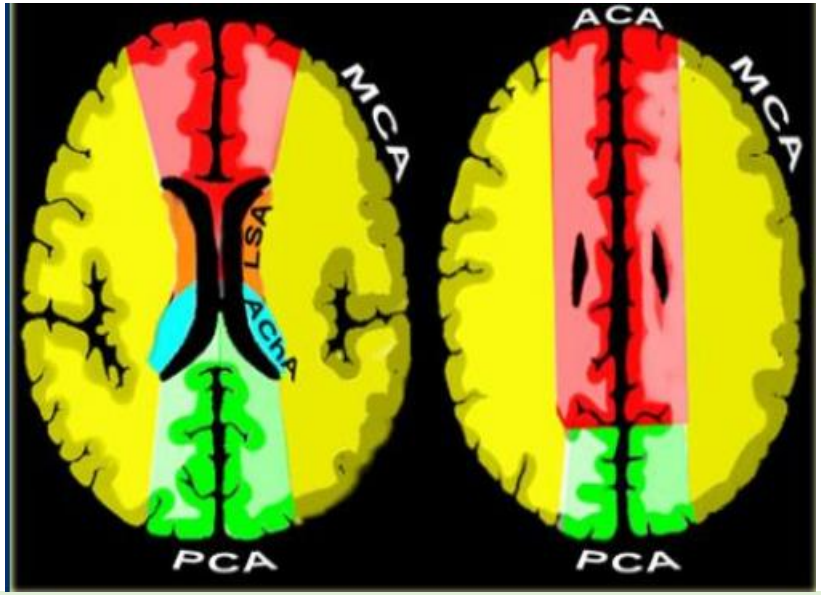


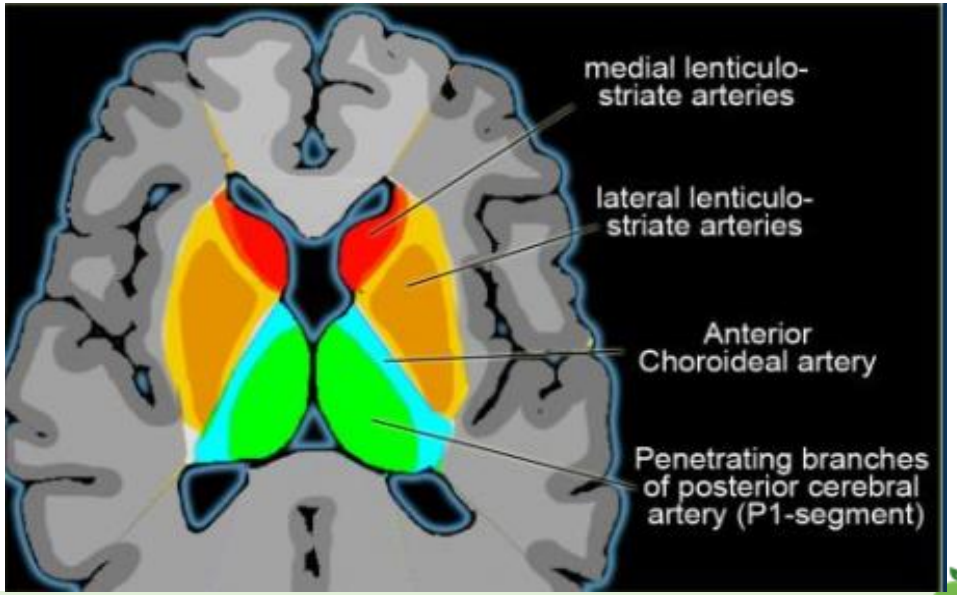




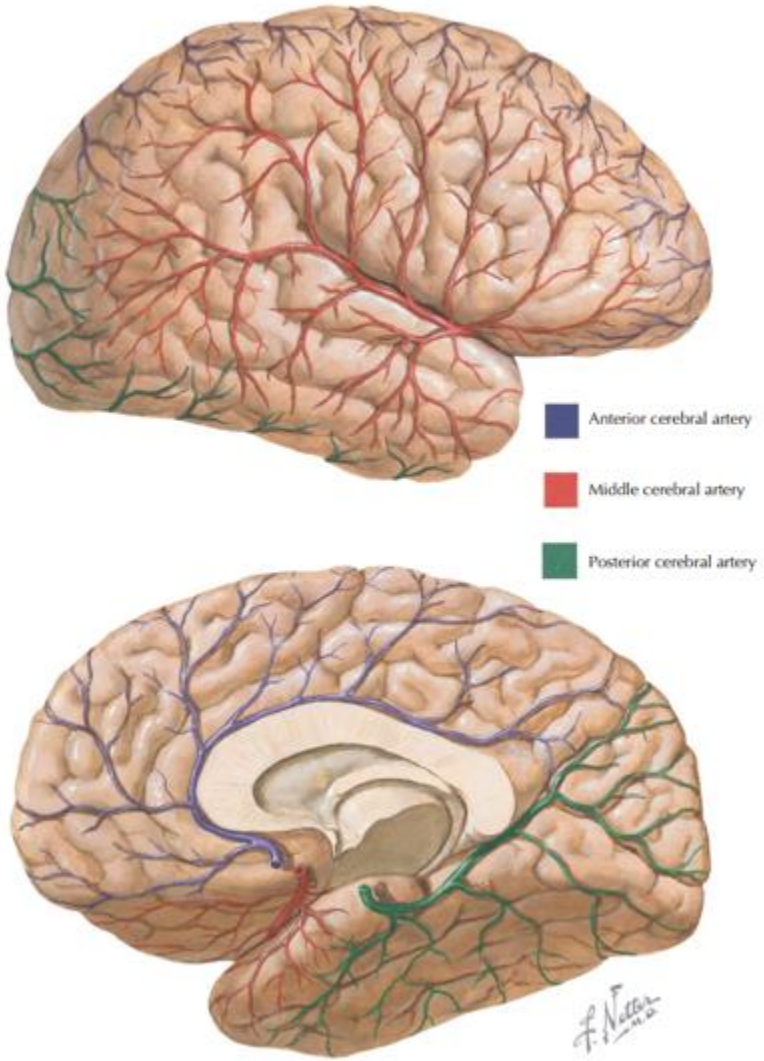

ACA
MCA
AChA
PCA
AICA
AICA
PICA
SCA
AICA
PICA
Branches from Vertebral arteries
Branches from Basilar artery

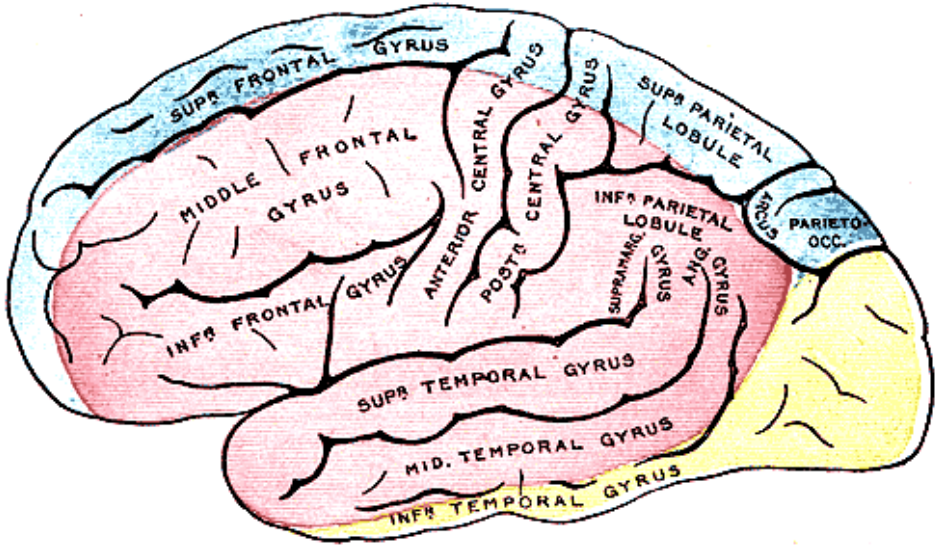

LSA
AChA
PCA
SCA
LSA
AChA

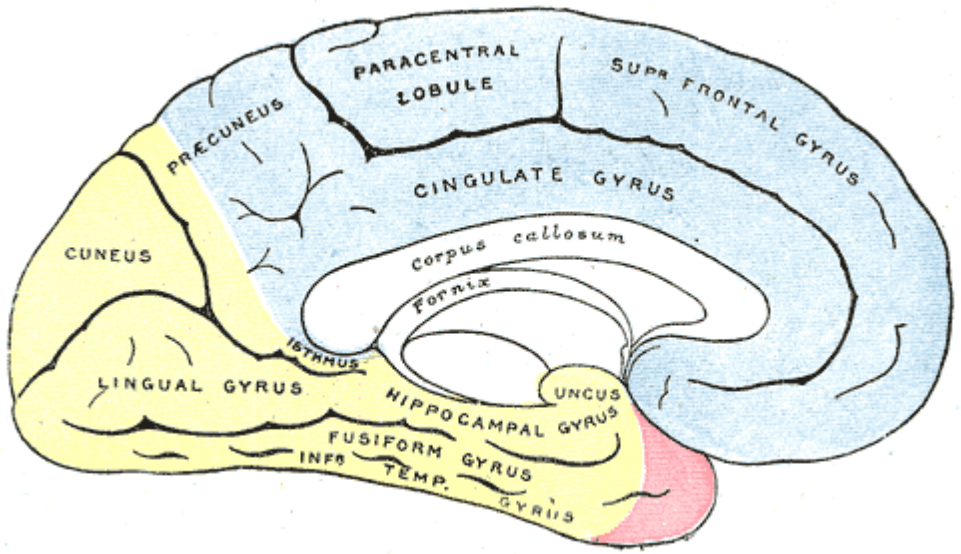

ACA
MCA
MCA
LSA
AChA
PCA
PCA


medial lenticulo-striate arteries
lateral lenticulo-striate arteries
Anterior Choroideal artery
Penetrating branches of posterior cerebral artery (P1-segment)

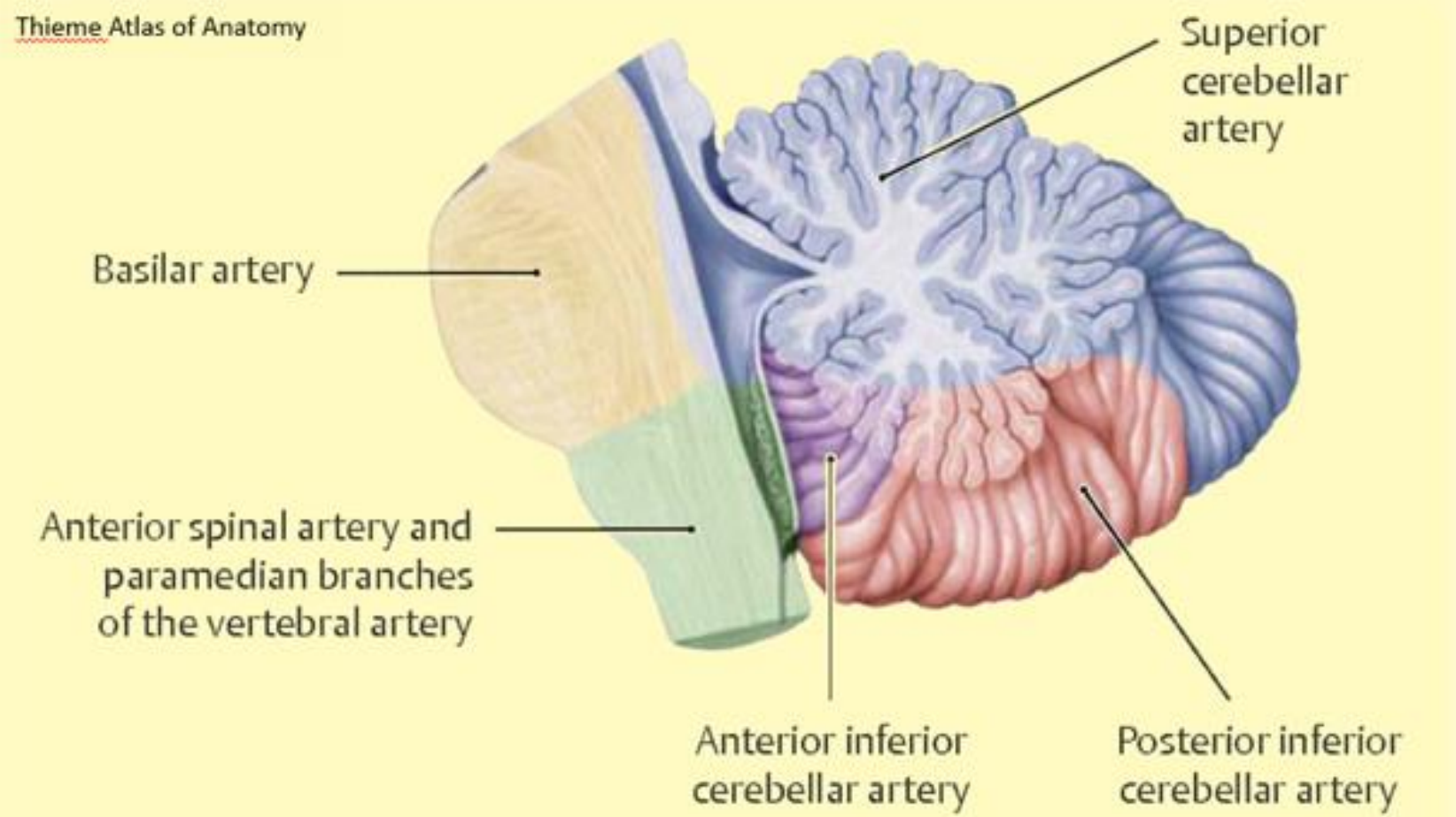
Vaskularisasi Otak







Arterial Supply to Cerebellum



Think: **Midbrain/SCP/Anterior lobe, deep nuclei/Superior Cerebellar Artery**
Pons/MCP/Basilar and AICA
Medulla/ICP/Posterior lobe/PICA

Sistem Vena Otak

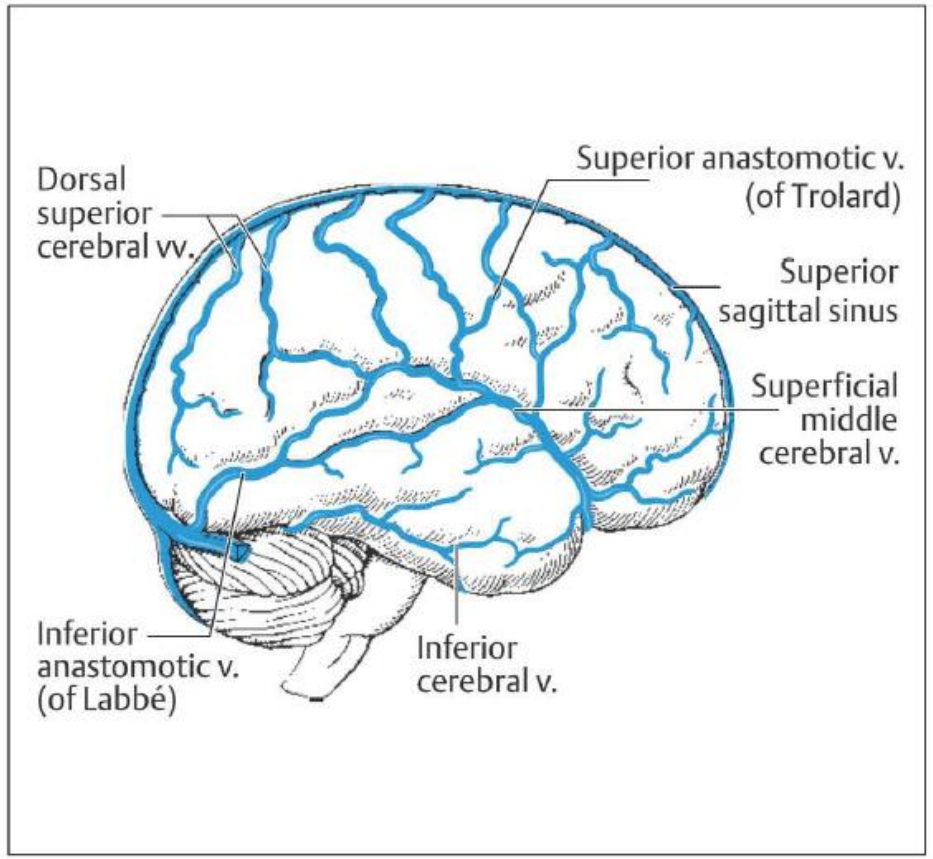


Fig. 11.13 **Veins of the brain, lateral view**

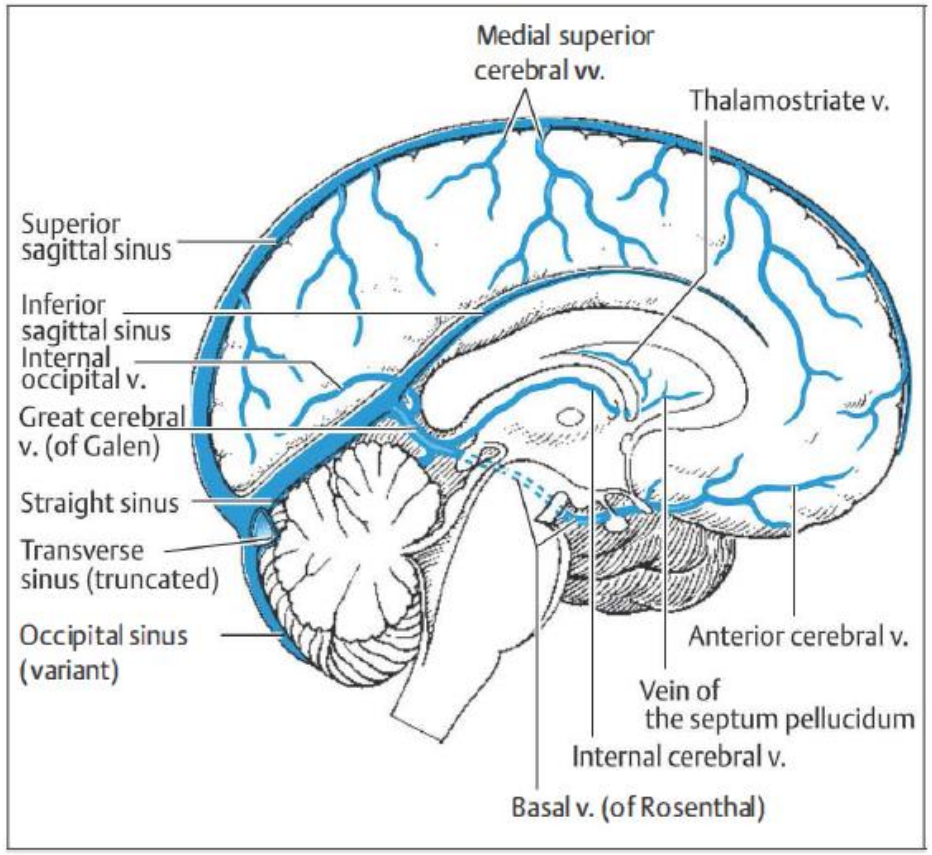
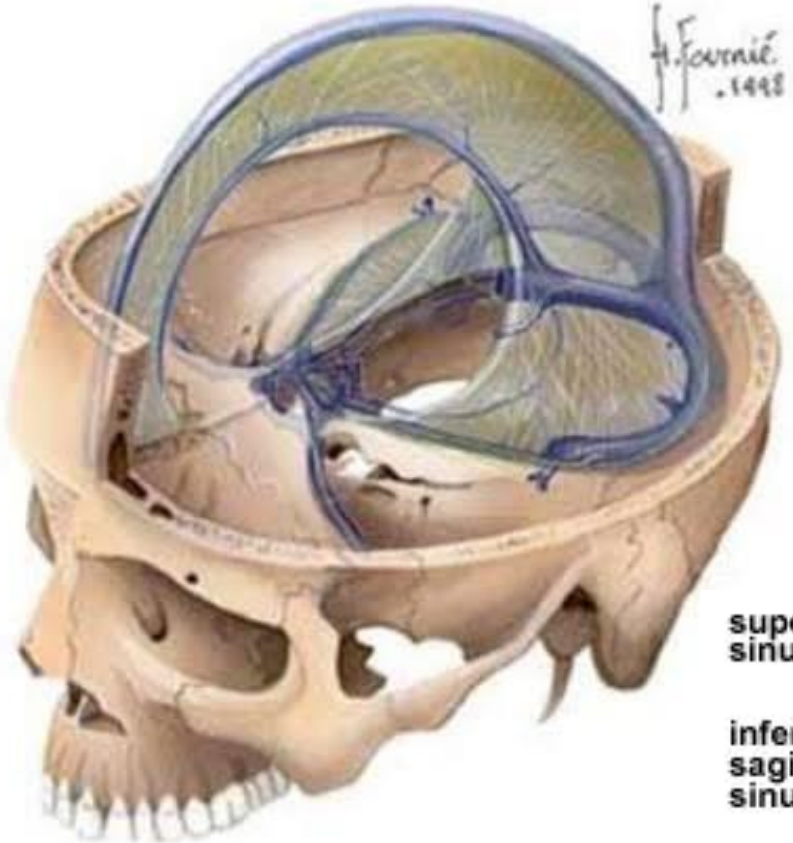
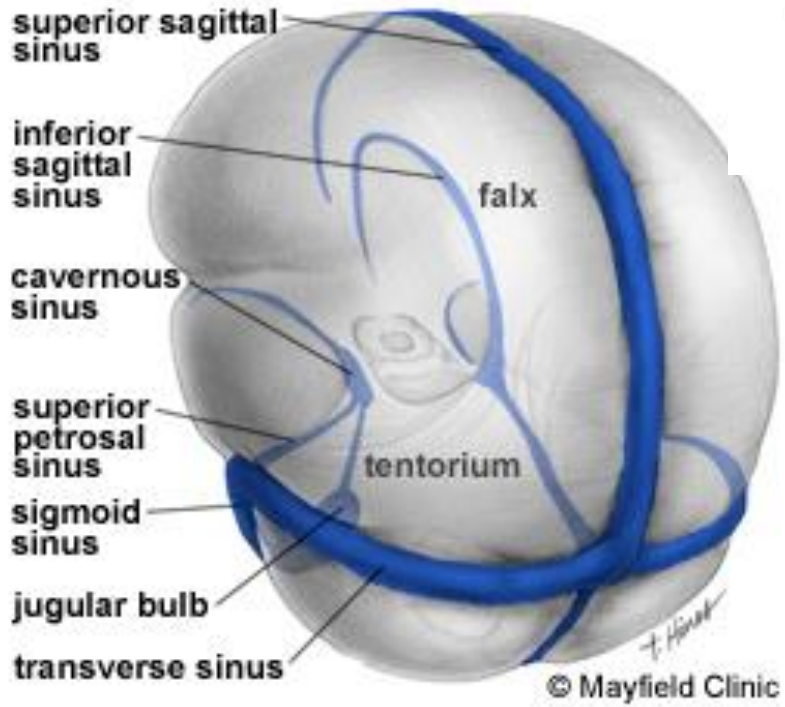
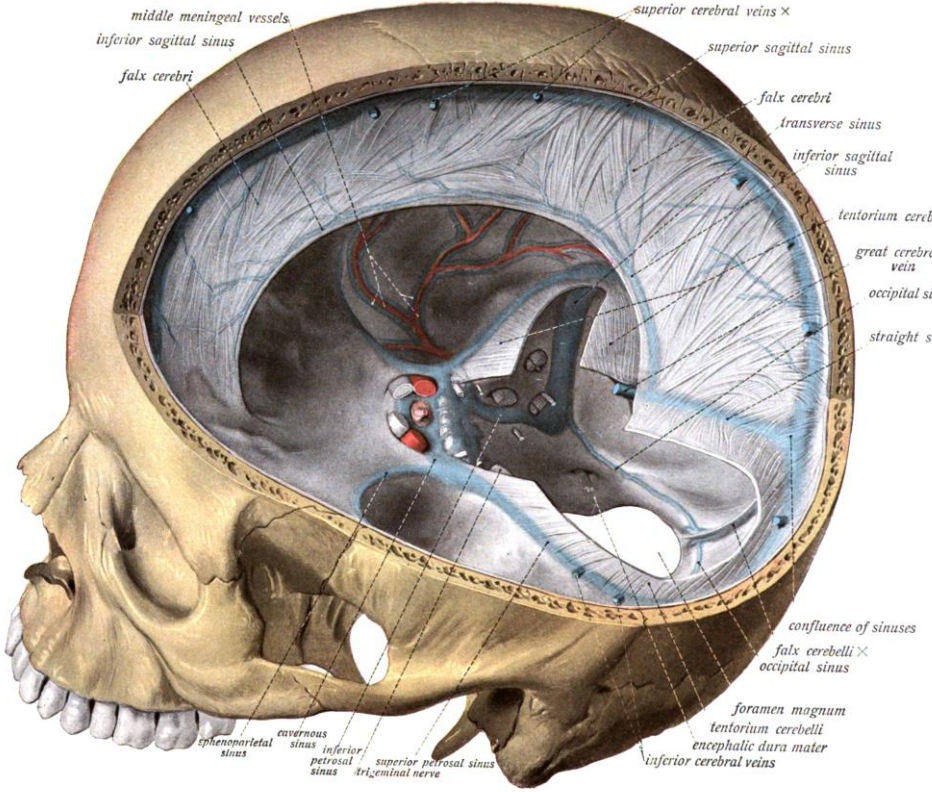


Fig. 11.14 **Veins of the brain, medial view**

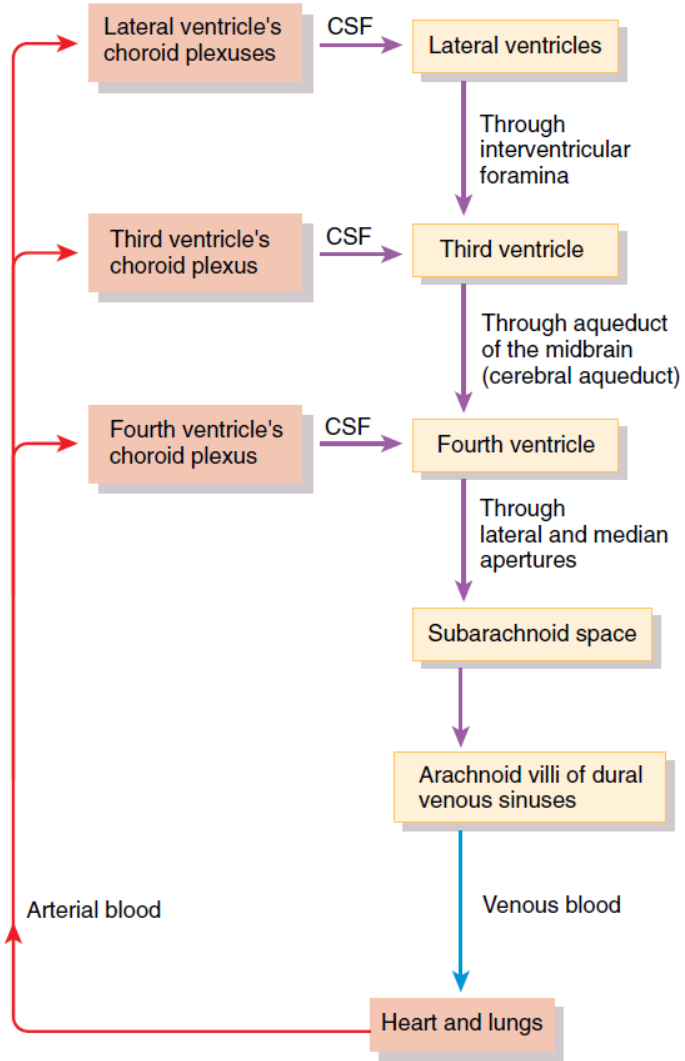


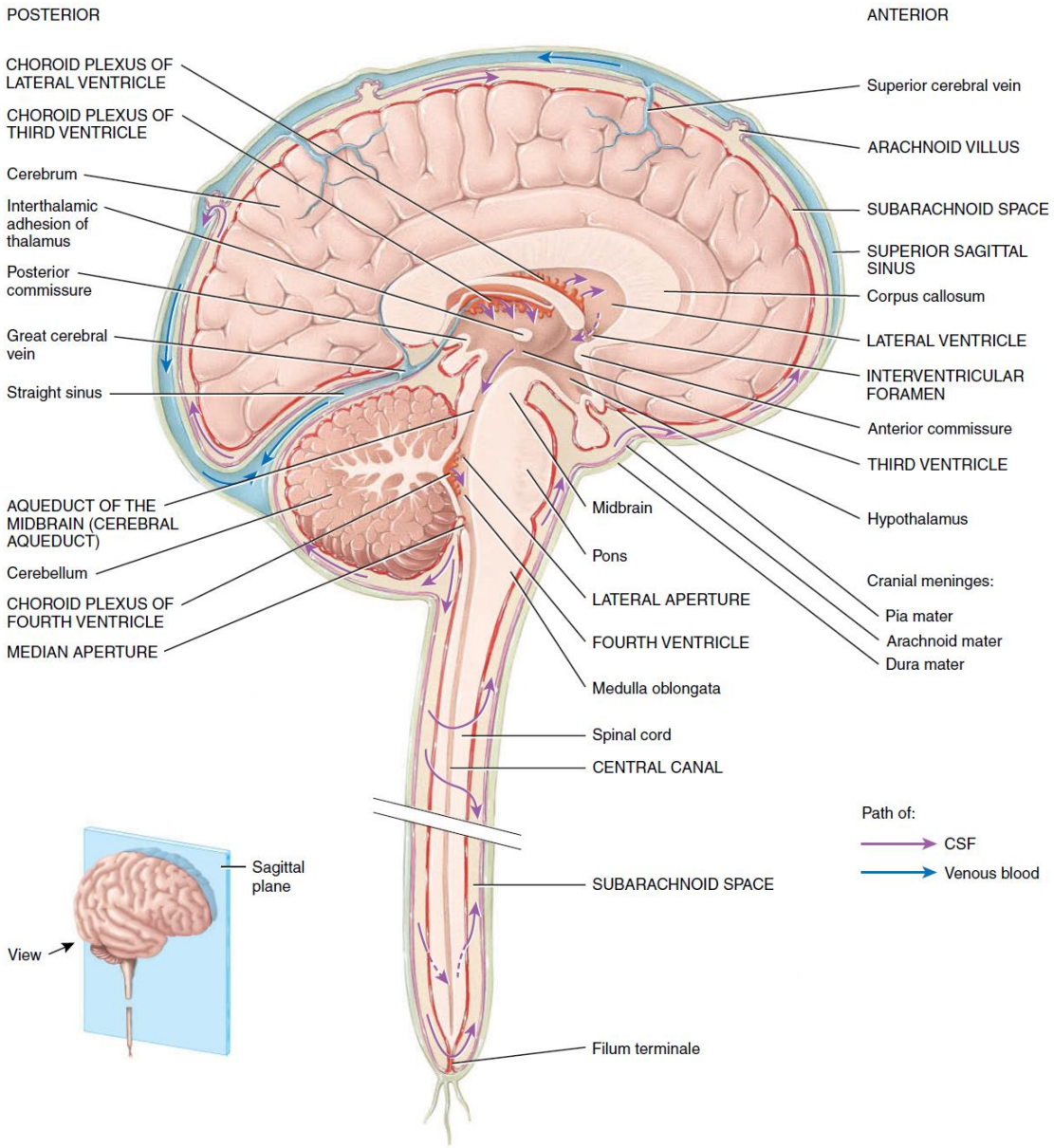


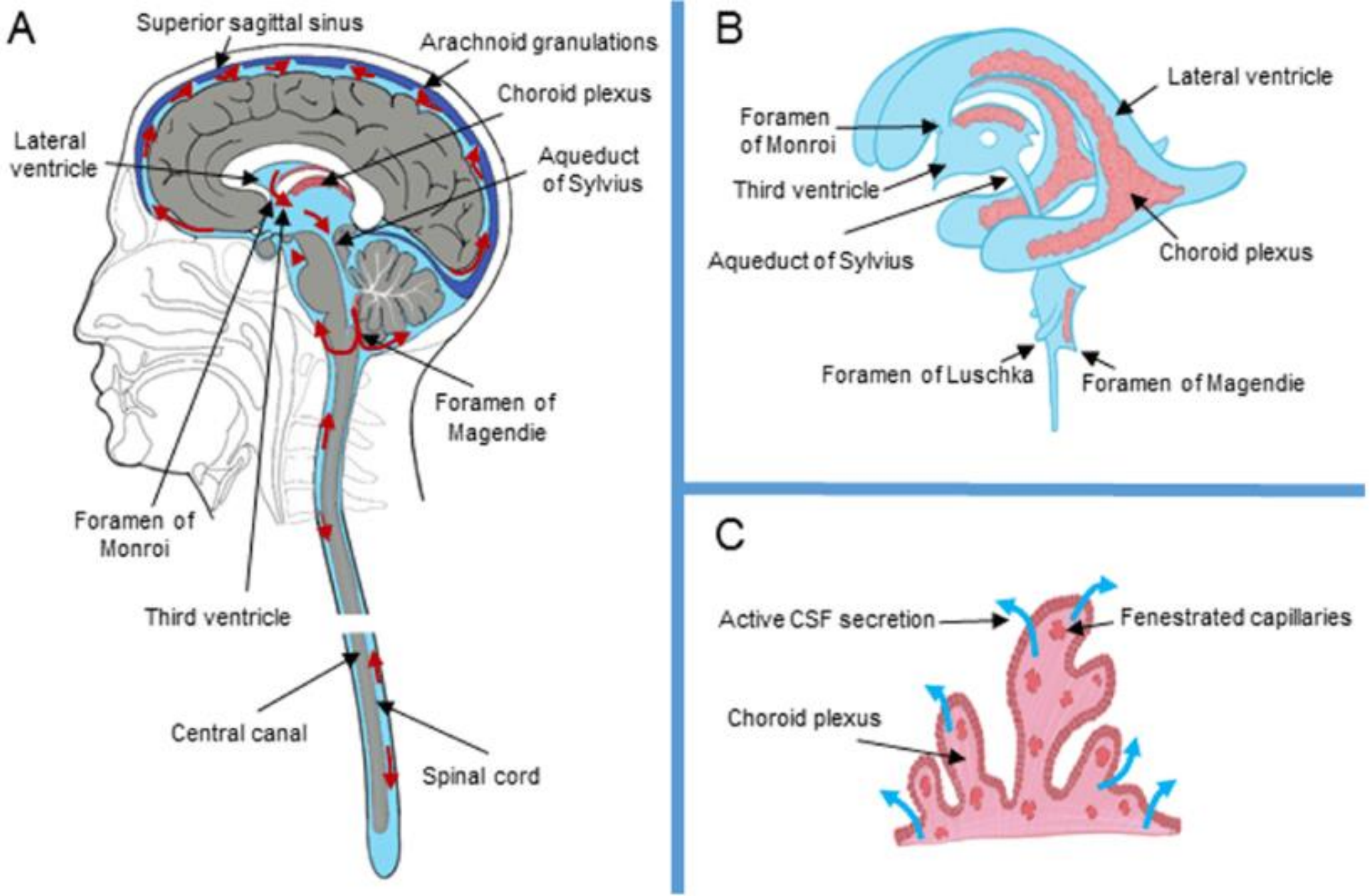


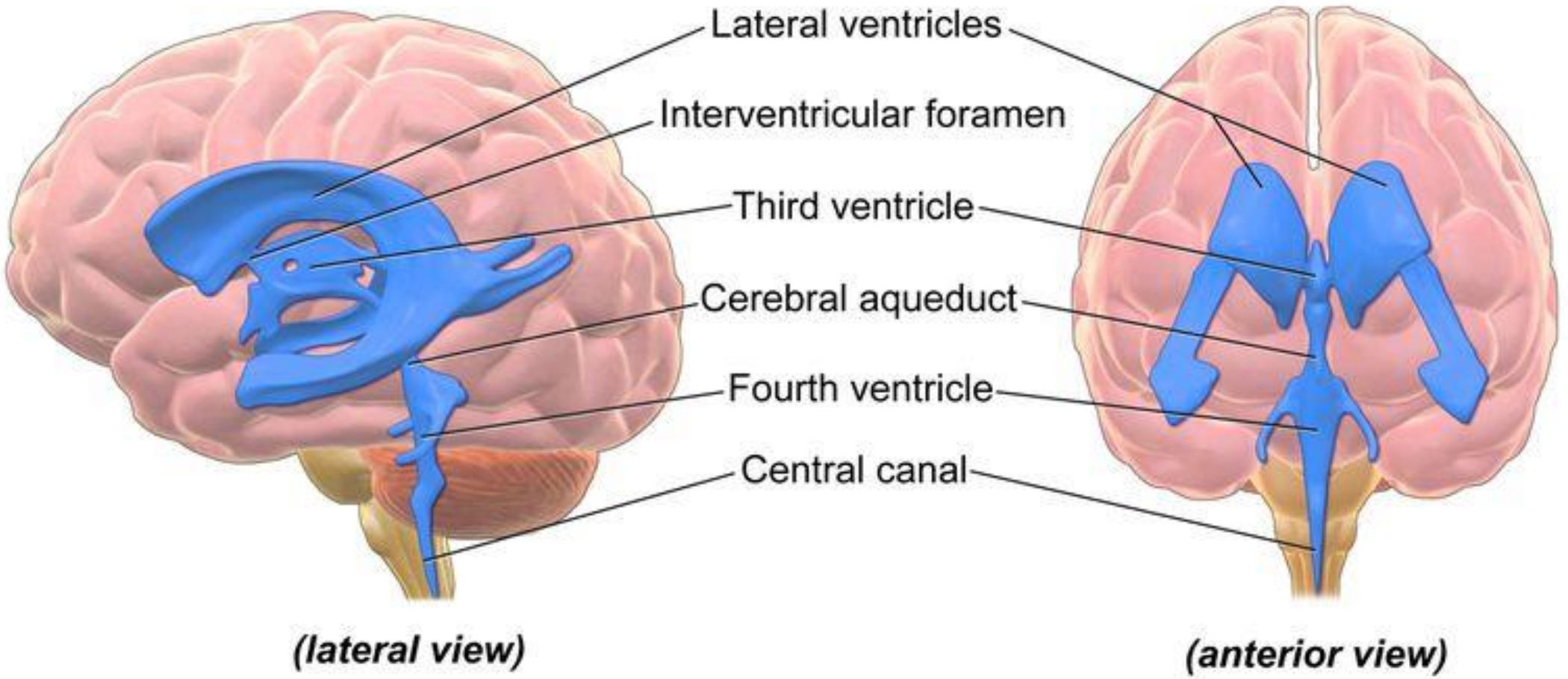
5. SISTEM VENTRIKEL DAN ALIRAN LCS

Sistem Ventrikel dan Sirkulasi CSF









Sesi 2

Aplikasi Neuroanatomi dalam Pemeriksaan Imaging

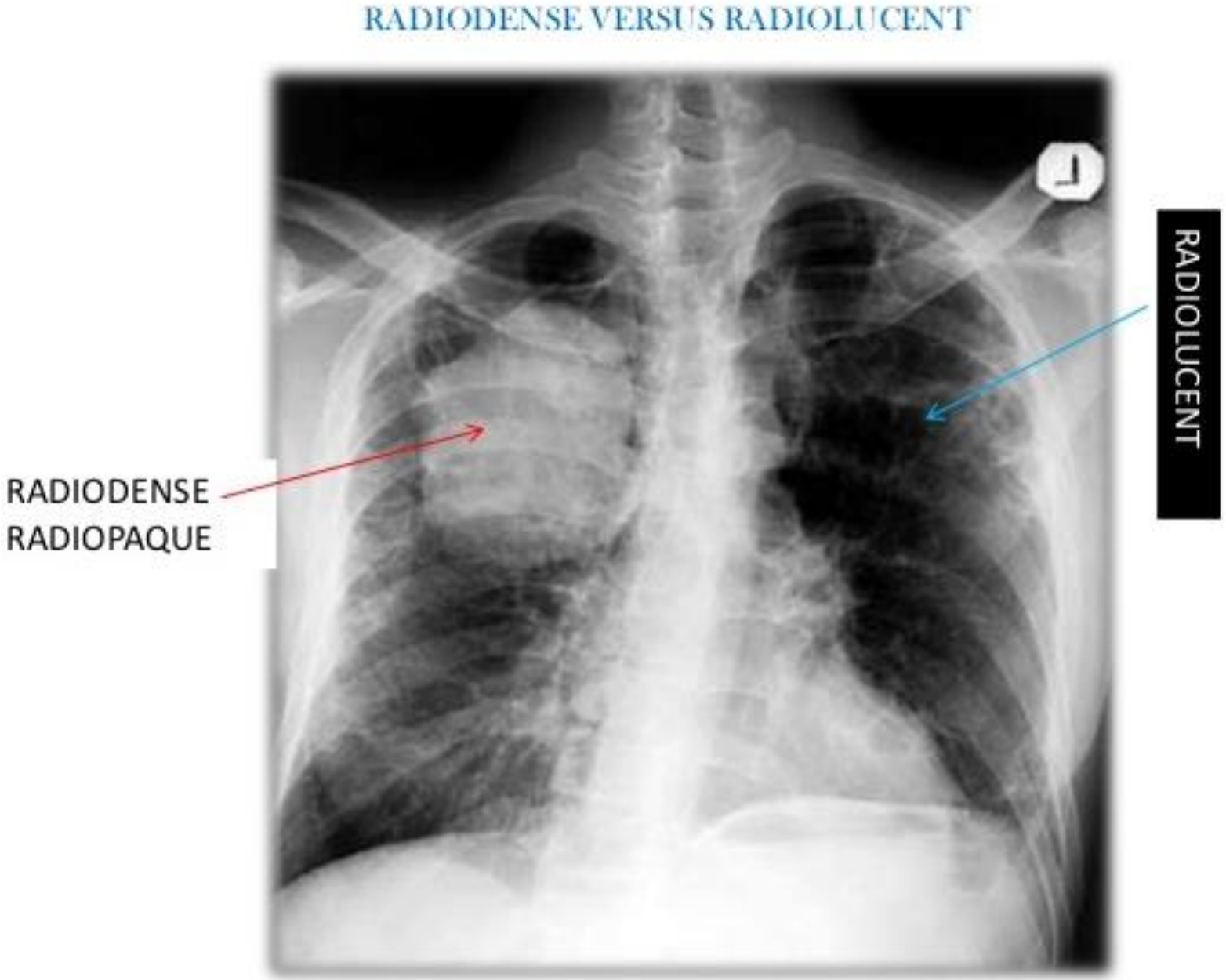
Sesi 2

Outline

1. Konsep dasar pemeriksaan imaging
    1. X ray Based
        1. Skull
        2. CT
        3. DSA
    2. Magnetic Based
2. Jenis potongan dalam pemeriksaan imaging
3. Gambaran normal pada CT scan
    1. Tulang
    2. Cerebral dan cerebellum
    3. Vaskularisasi

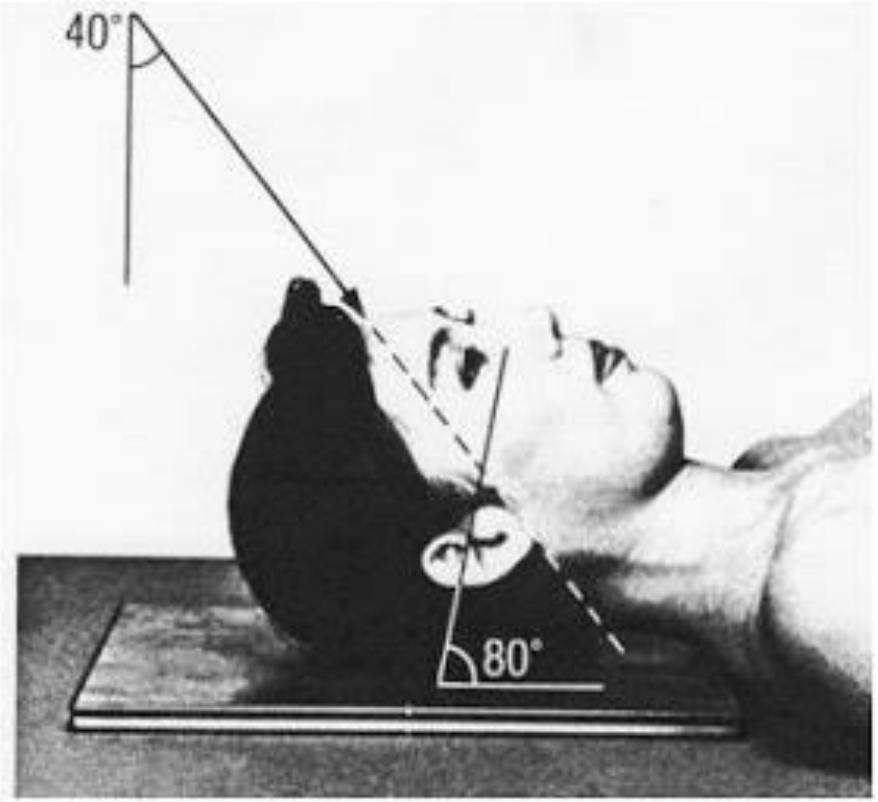
1. Konsep dasar pemeriksaan imaging

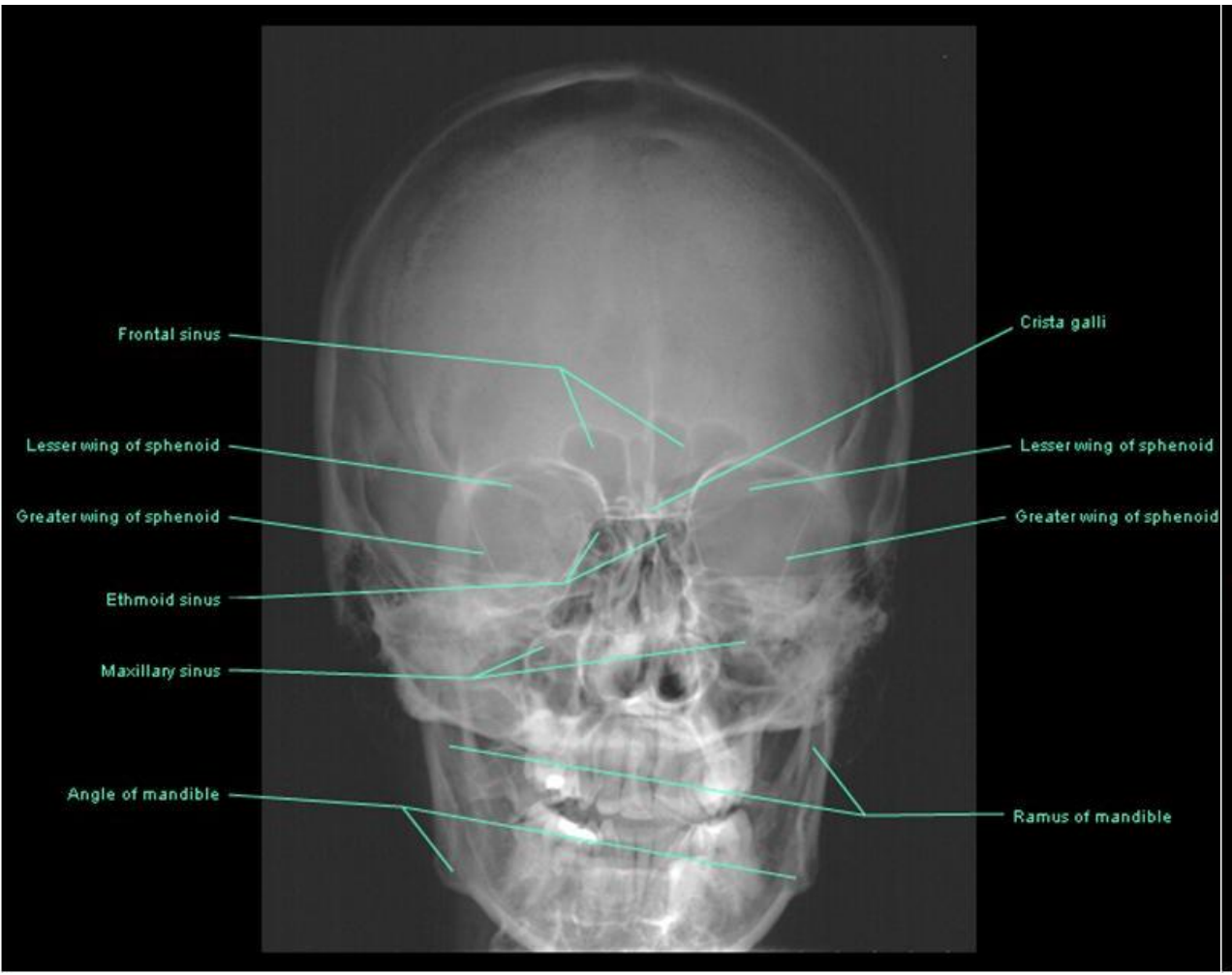
X - ray

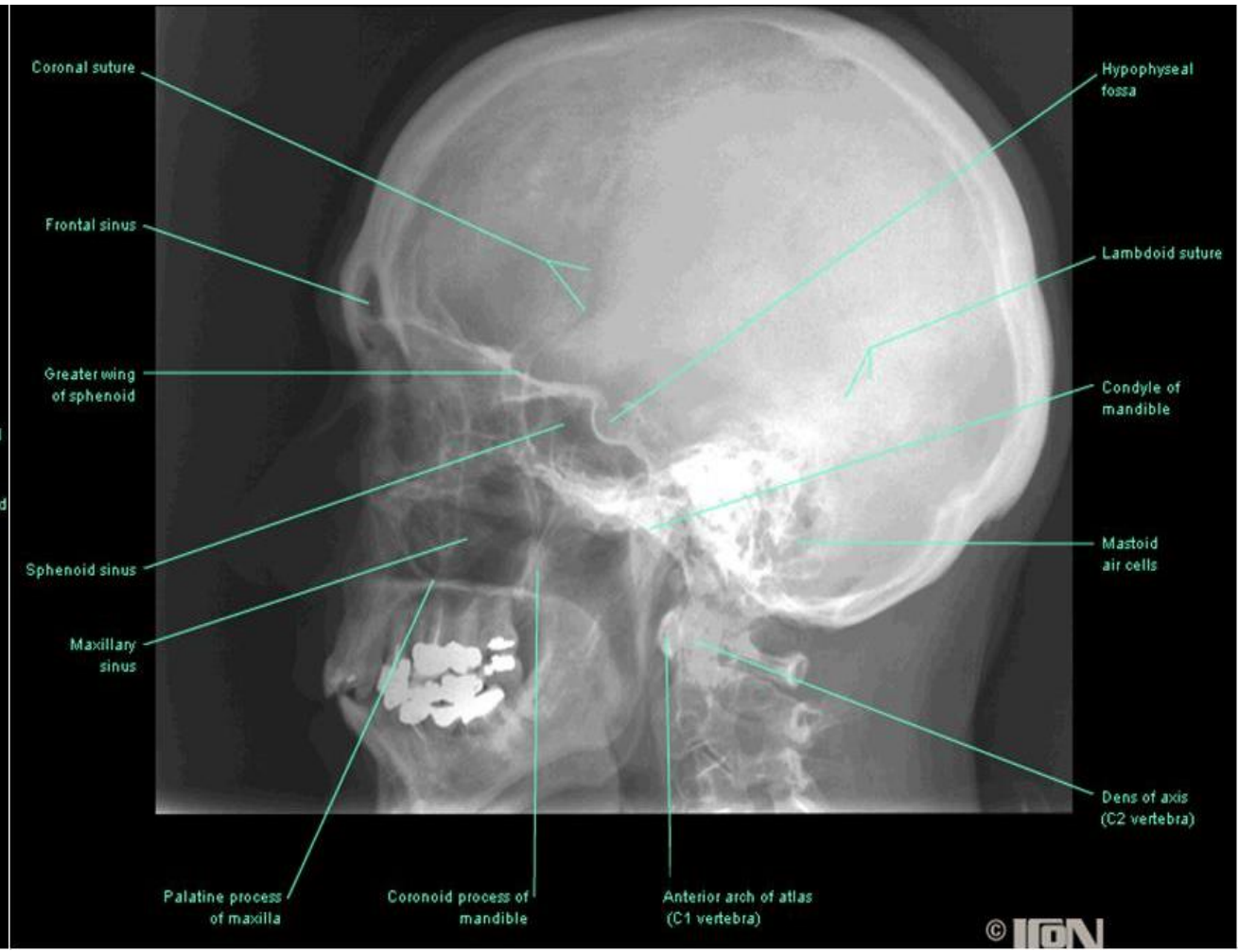

RADIODENSE VERSUS RADIOLUCENT
RADIODENSE
RADIOPAQUE
RADIOLUCENT

Skull X-ray

- Foto kepala atau skull biasanya dilakukan pada pasien post trauma capitis, pasien dicurigai kelainan pada sinus maupun mastoid.
- Foto skull jarang dilakukan pada pasien dengan kelainan saraf pusat
- Sudah ditinggalkan karena ada imaging lain seperti CT Scan dan MRI

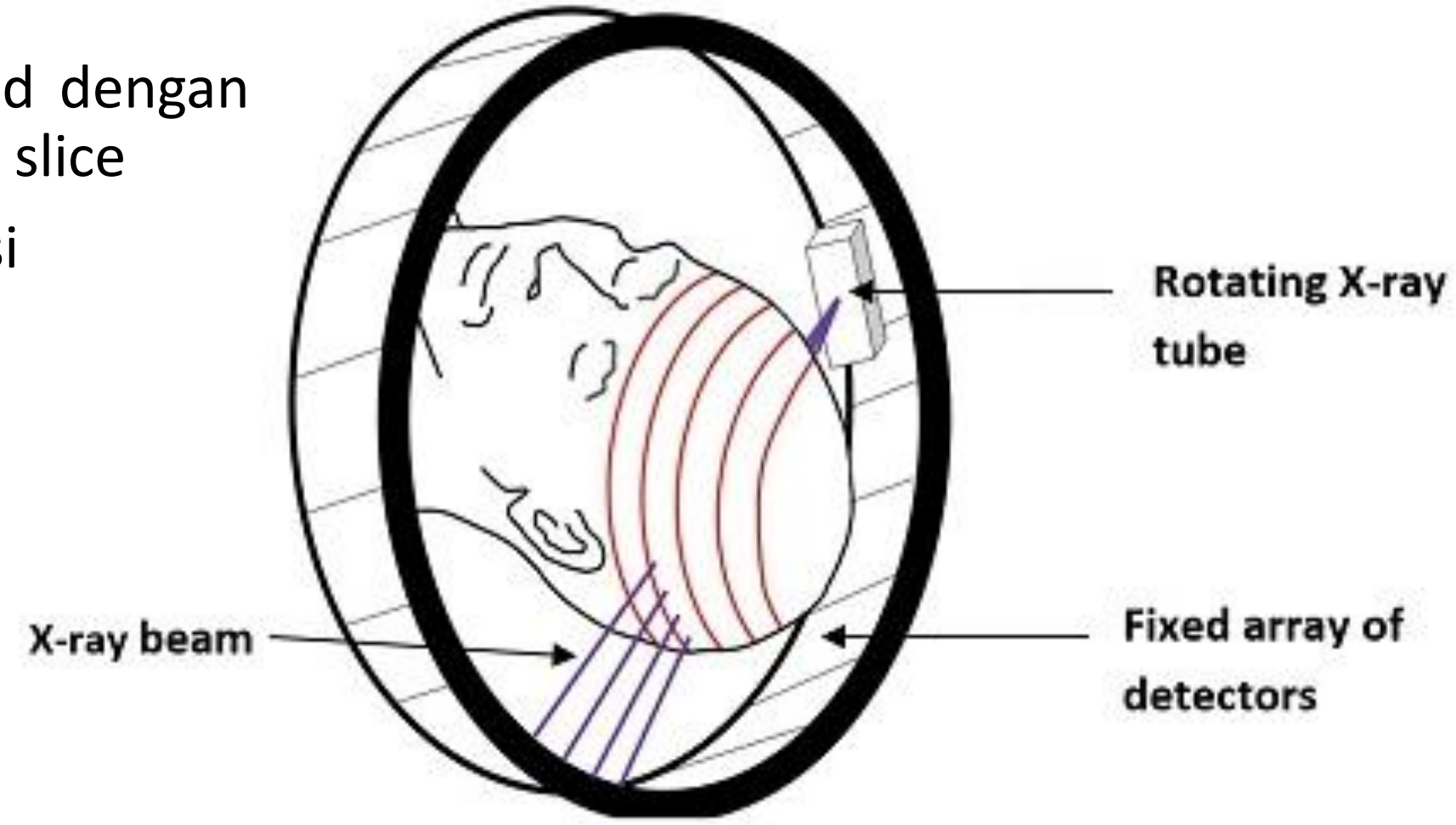






CT Scan

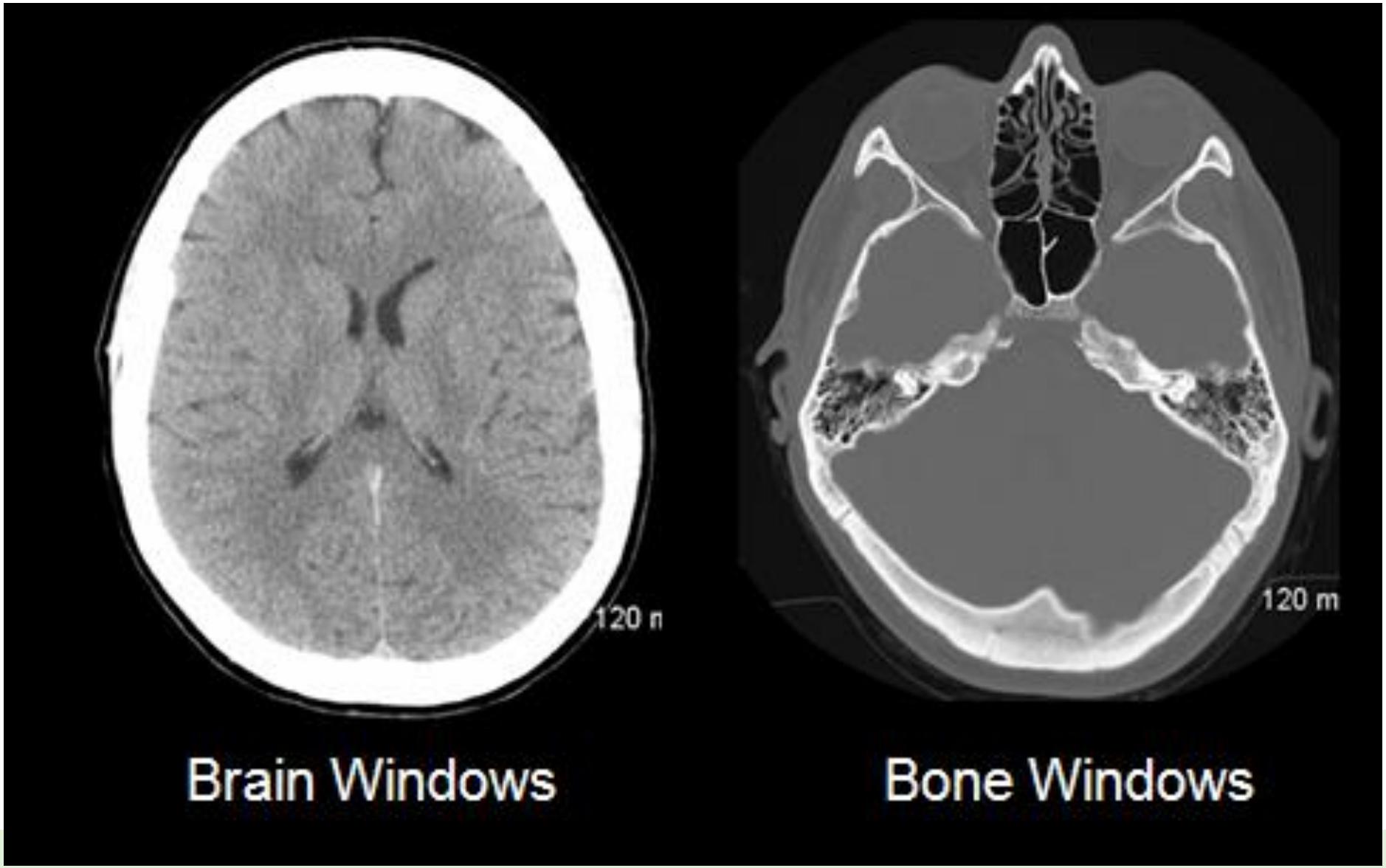
- Imaging x ray based dengan multipel potongan/ slice
- Bisa 3D rekonstruksi



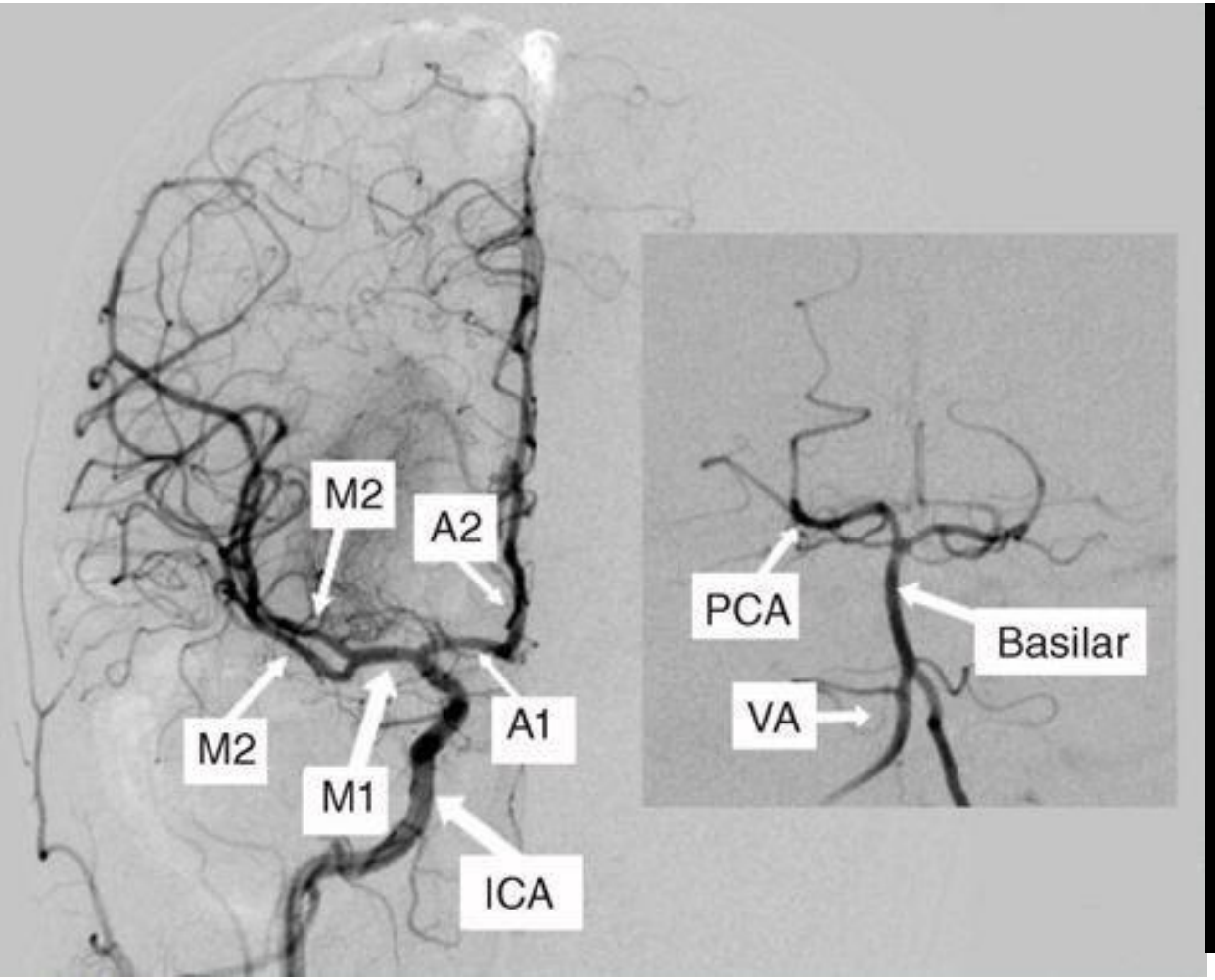
*taken before pandemics

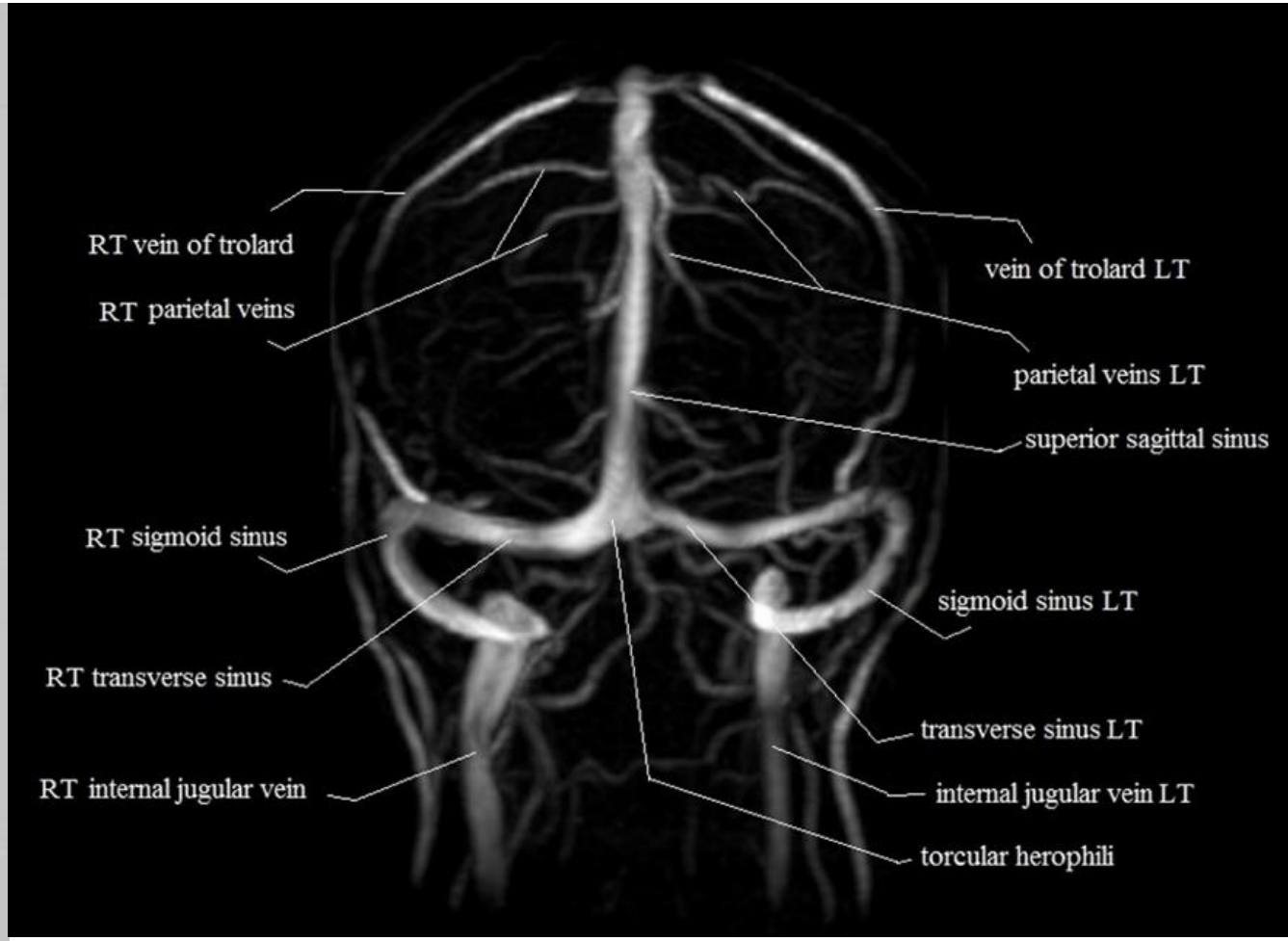

*taken before pandemics
TOSHIBA

Brain window vs Bone Window



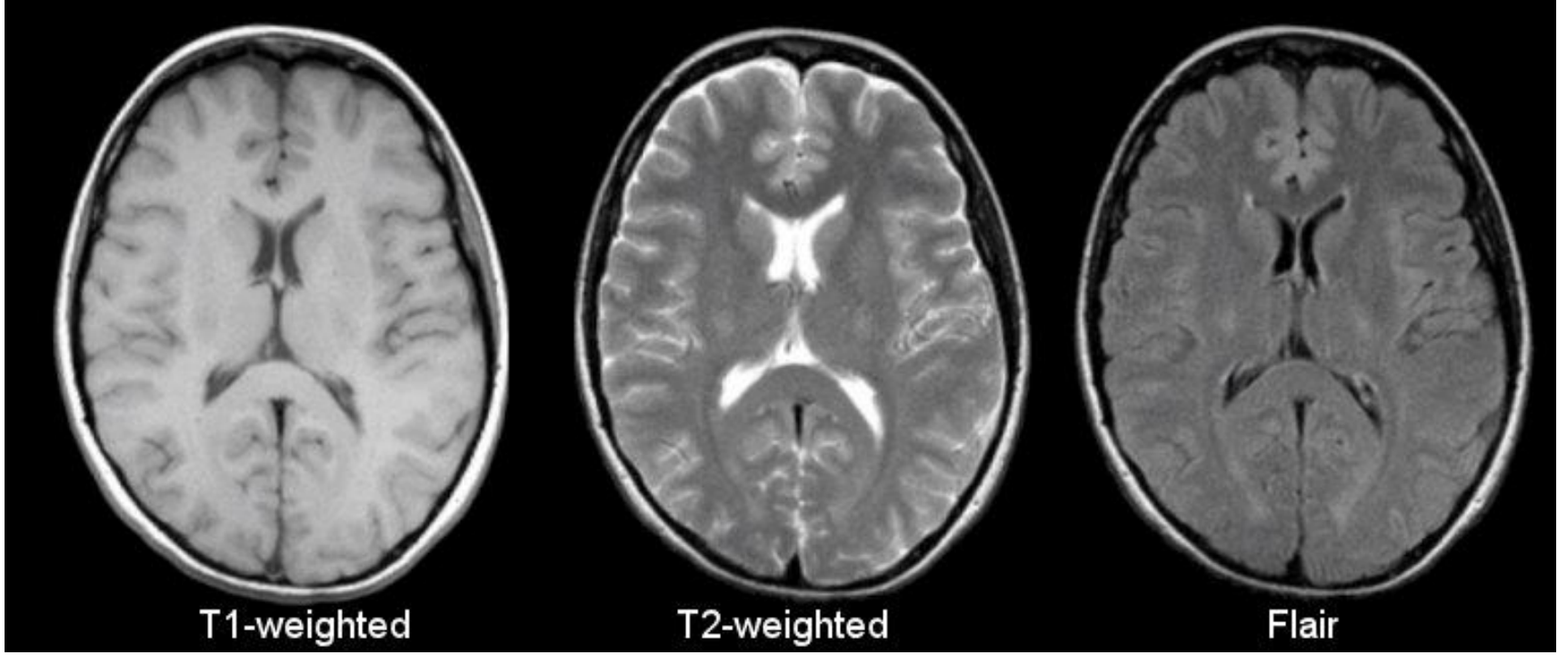
Digital Subtraction Angiography



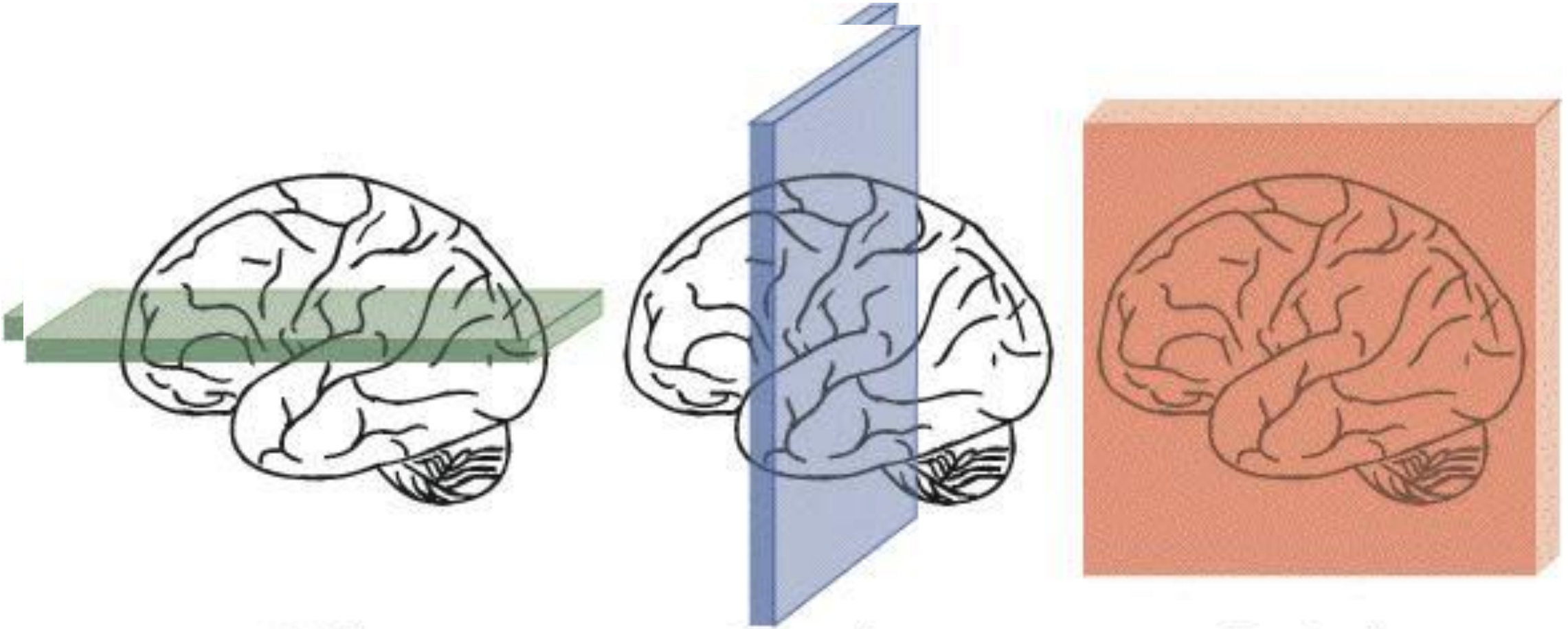


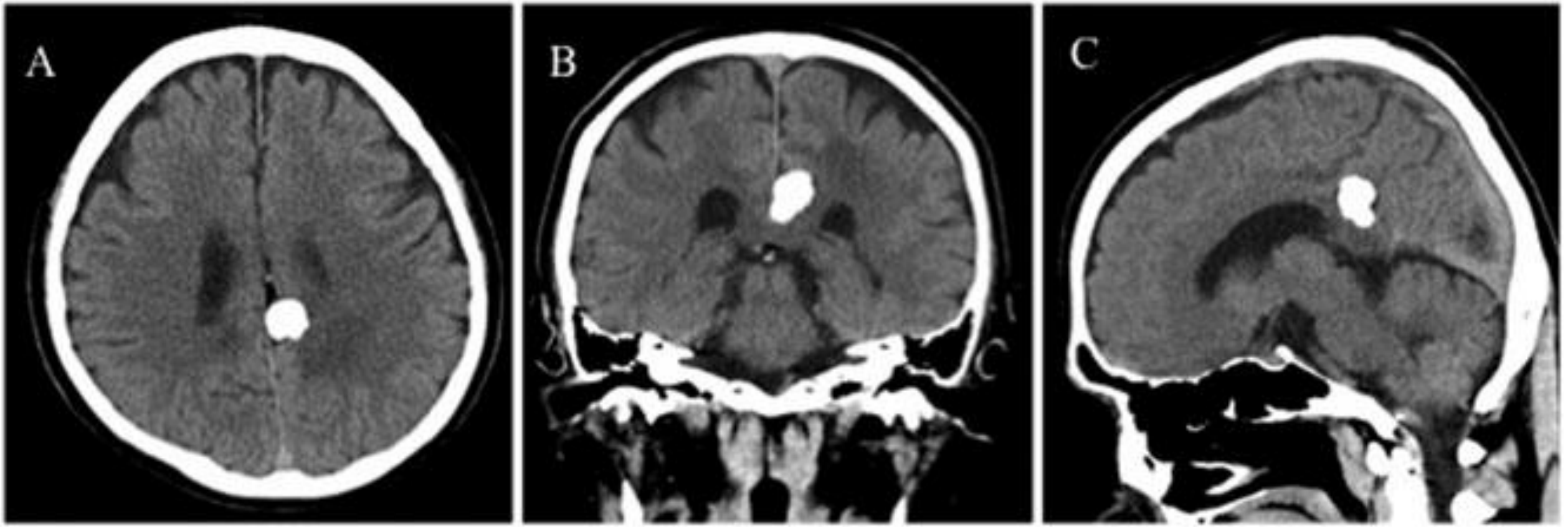
MRI (Magnetic Resonance Imaging)

- Menggunakan medan magnet
- Baik dalam mengevaluasi soft tissue



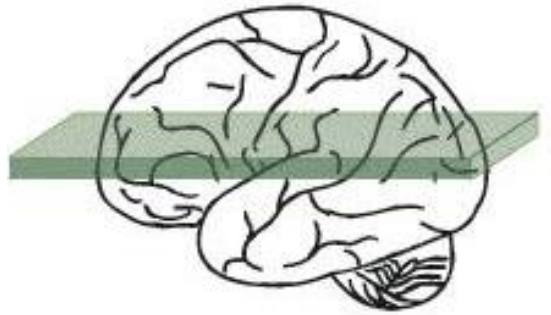
2. Jenis potongan dalam pemeriksaan imaging

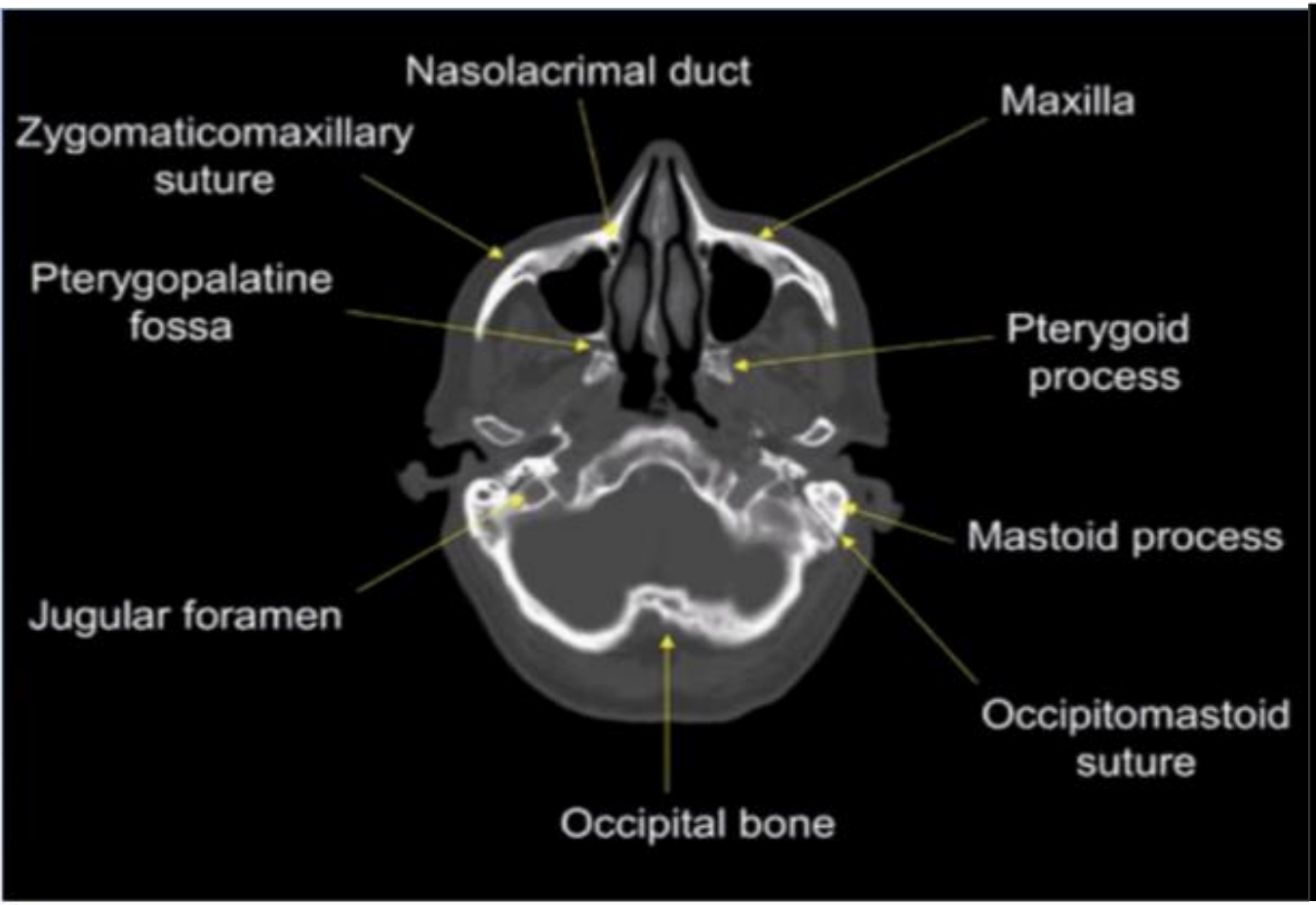


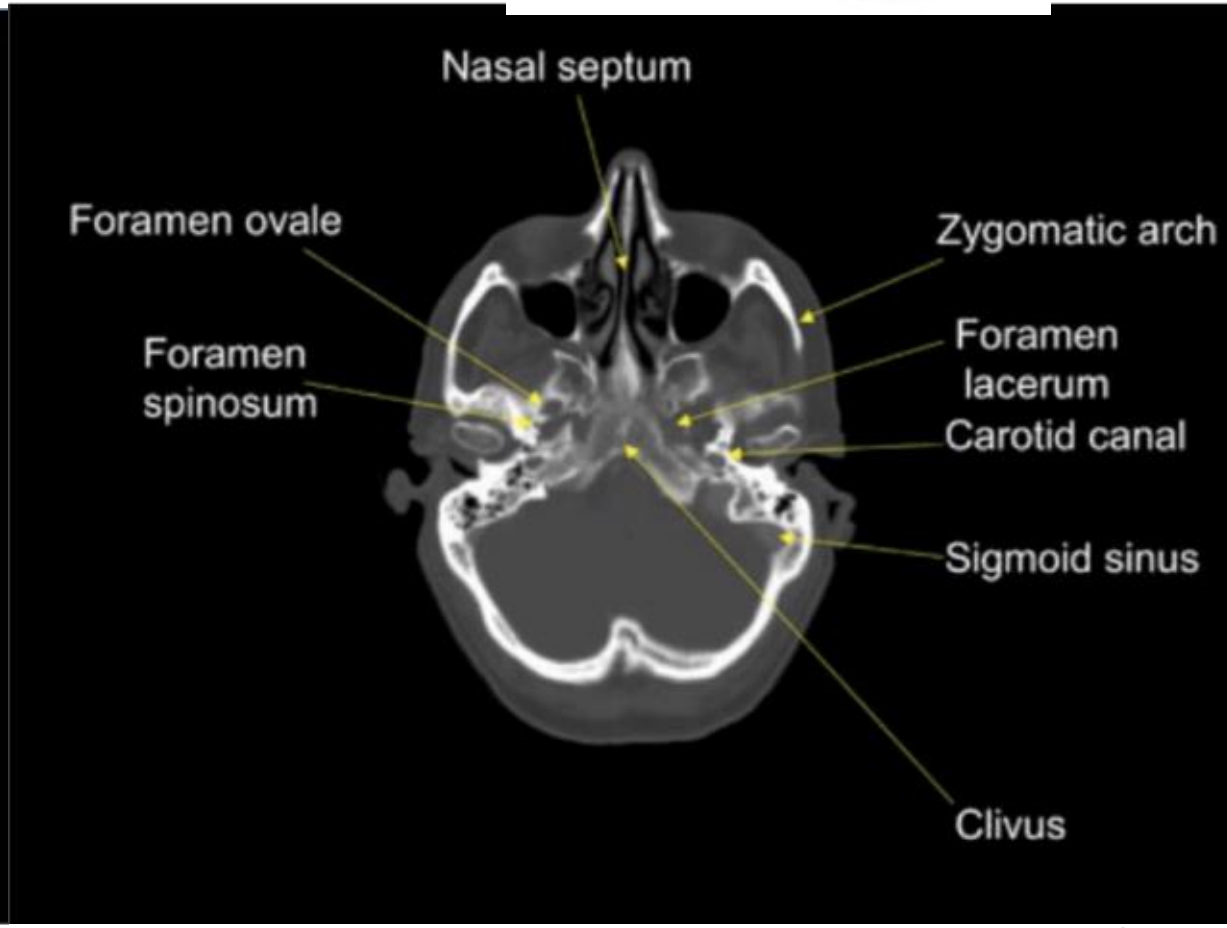


3. Gambaran normal CT Scan

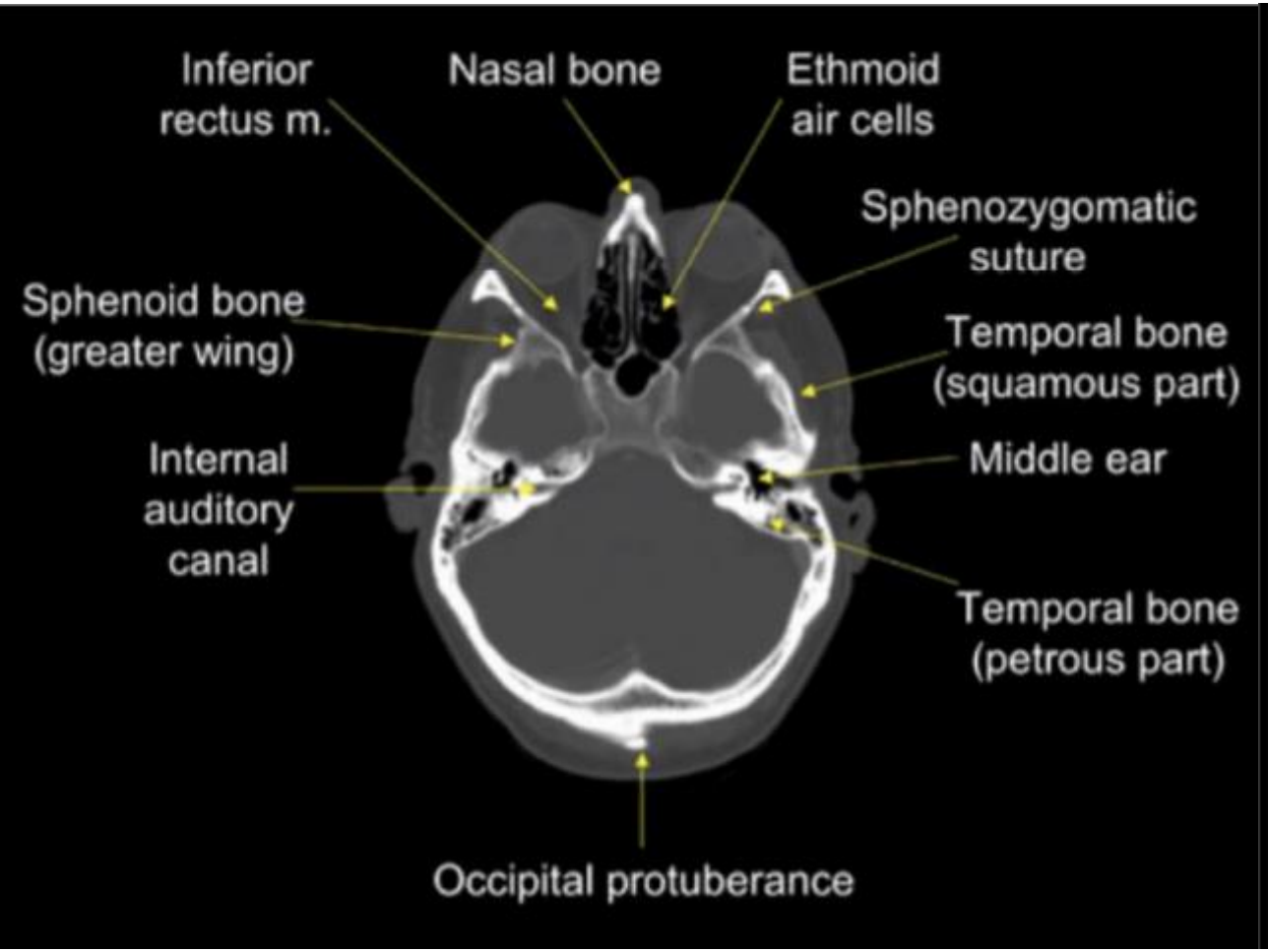
Bone Window

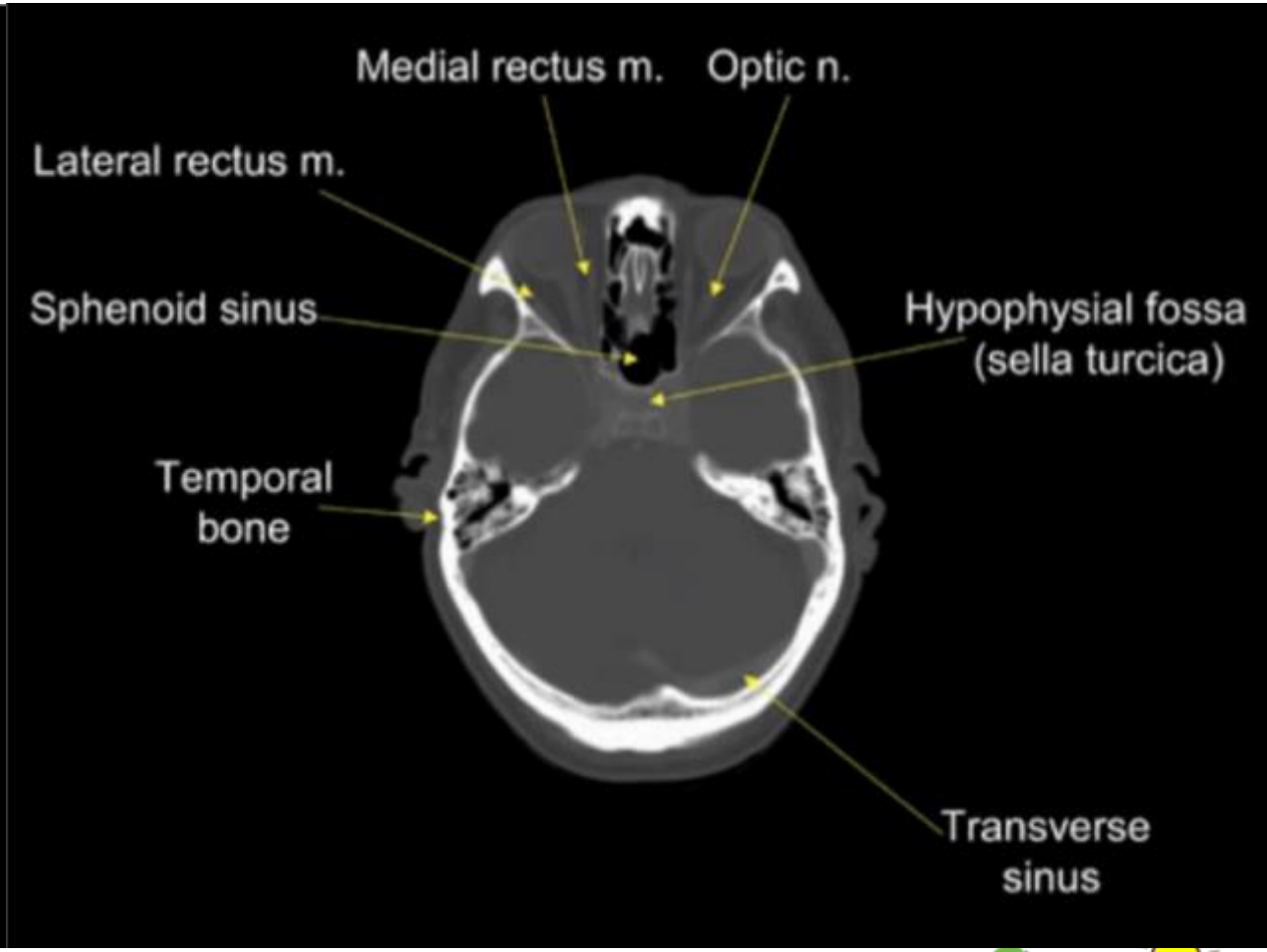



Nasolacrimal duct
Maxilla
Zygomaticomaxillary suture
Pterygopalatine fossa
Pterygoid process
Mastoid process
Jugular foramen
Occipitomastoid suture
Occipital bone

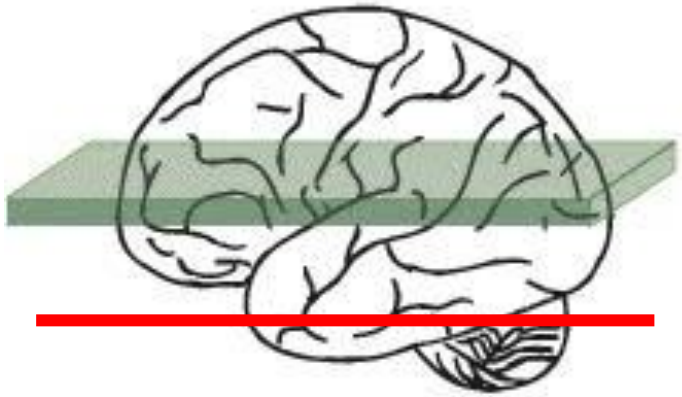

Nasal septum
Foramen ovale
Zygomatic arch
Foramen spinosum
Foramen lacerum
Carotid canal
Sigmoid sinus
Clivus

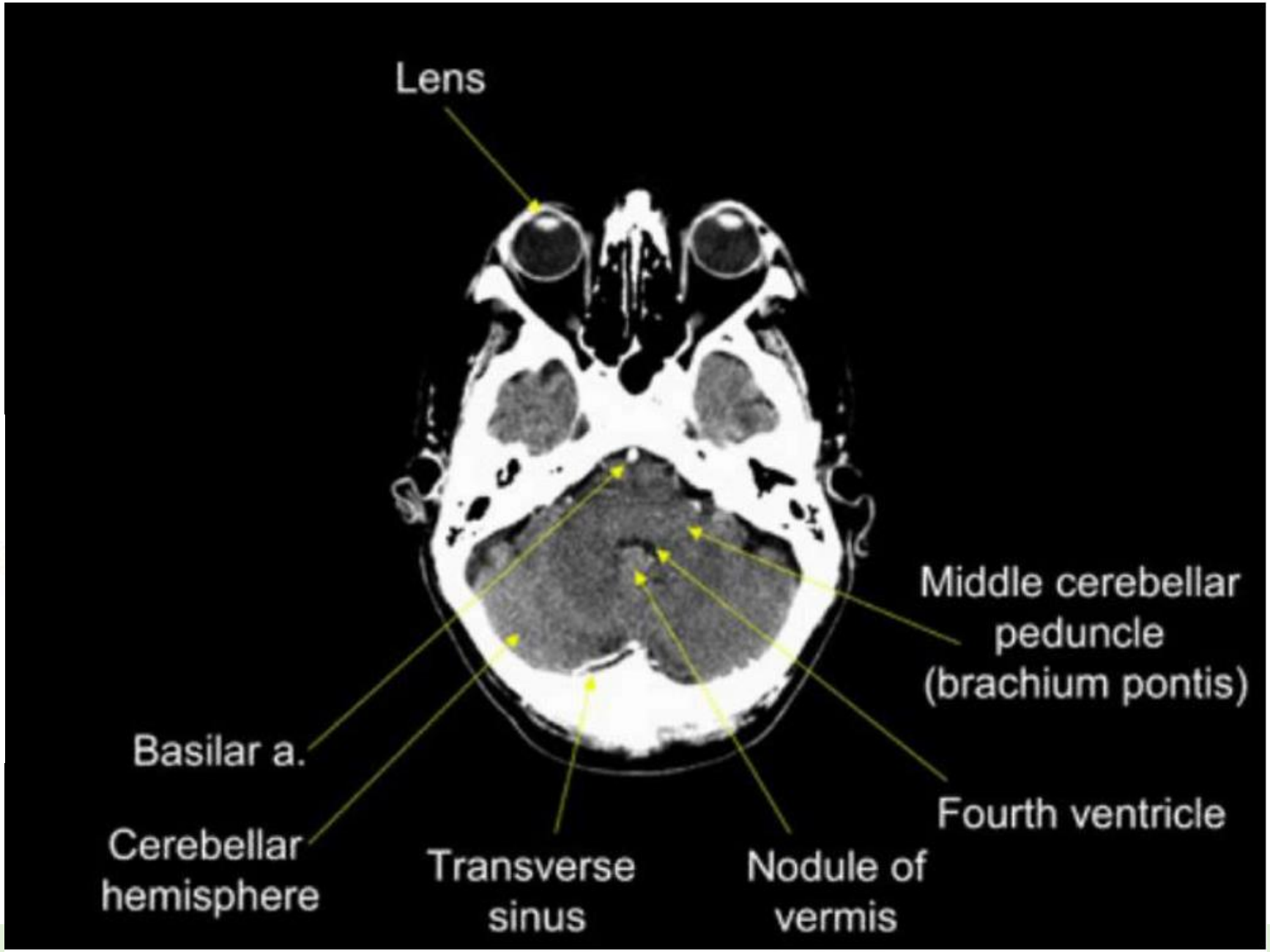
Bone Window


Inferior rectus m.
Nasal bone
Ethmoid air cells
Sphenozygomatic suture
Sphenoid bone (greater wing)
Temporal bone (squamous part)
Internal auditory canal
Middle ear
Temporal bone (petrous part)
Occipital protuberance


Medial rectus m.
Optic n.
Lateral rectus m.
Sphenoid sinus
Hypophysial fossa (sella turcica)
Temporal bone
Transverse sinus

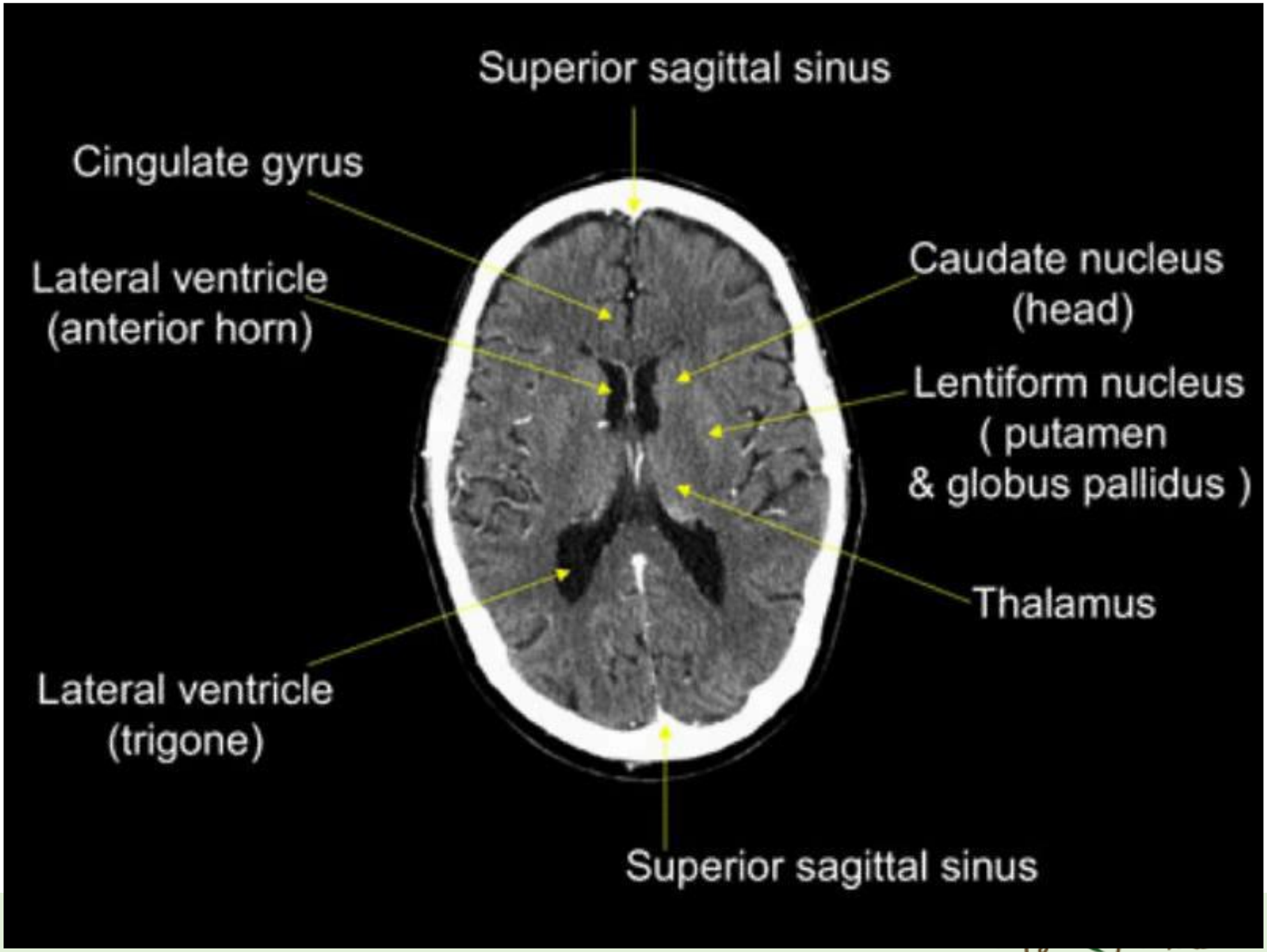
Cerebellum

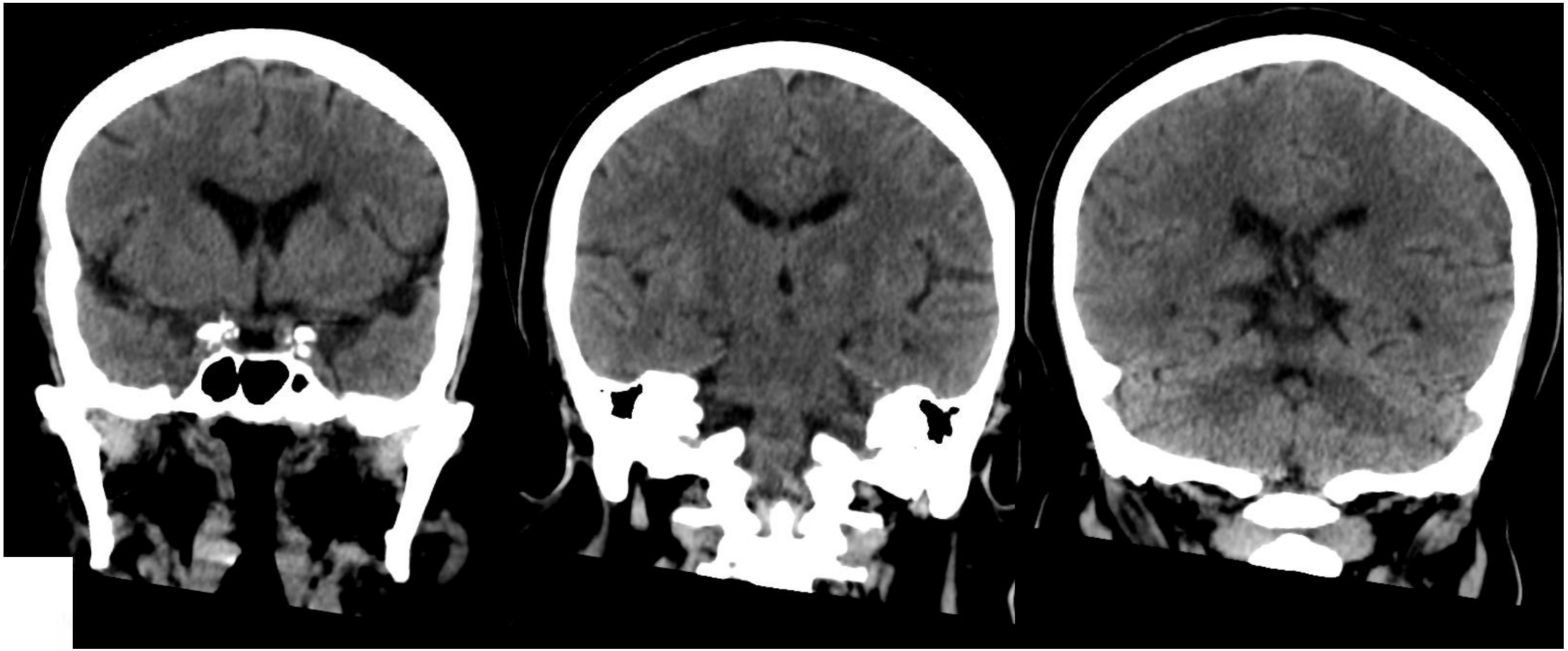


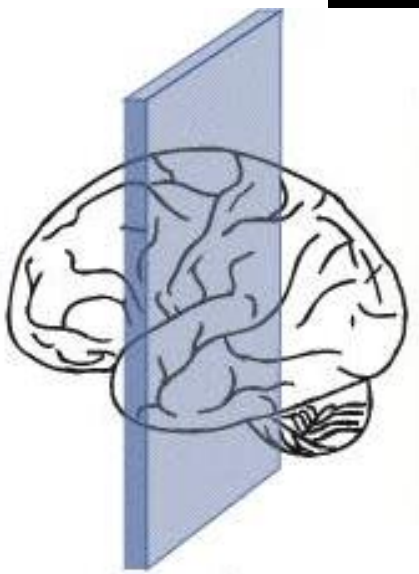


Identifikasi :

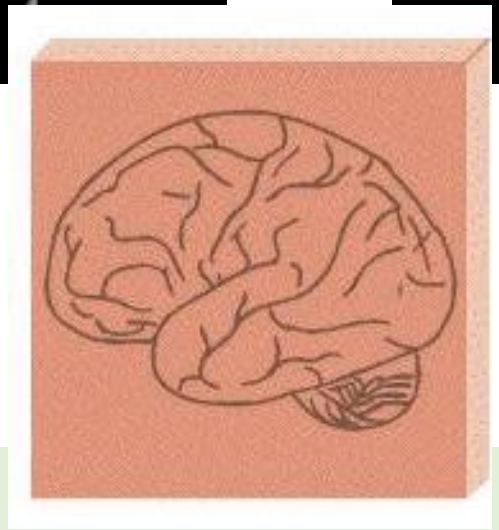
1. ventrikel
2. sulcus
3. MLS





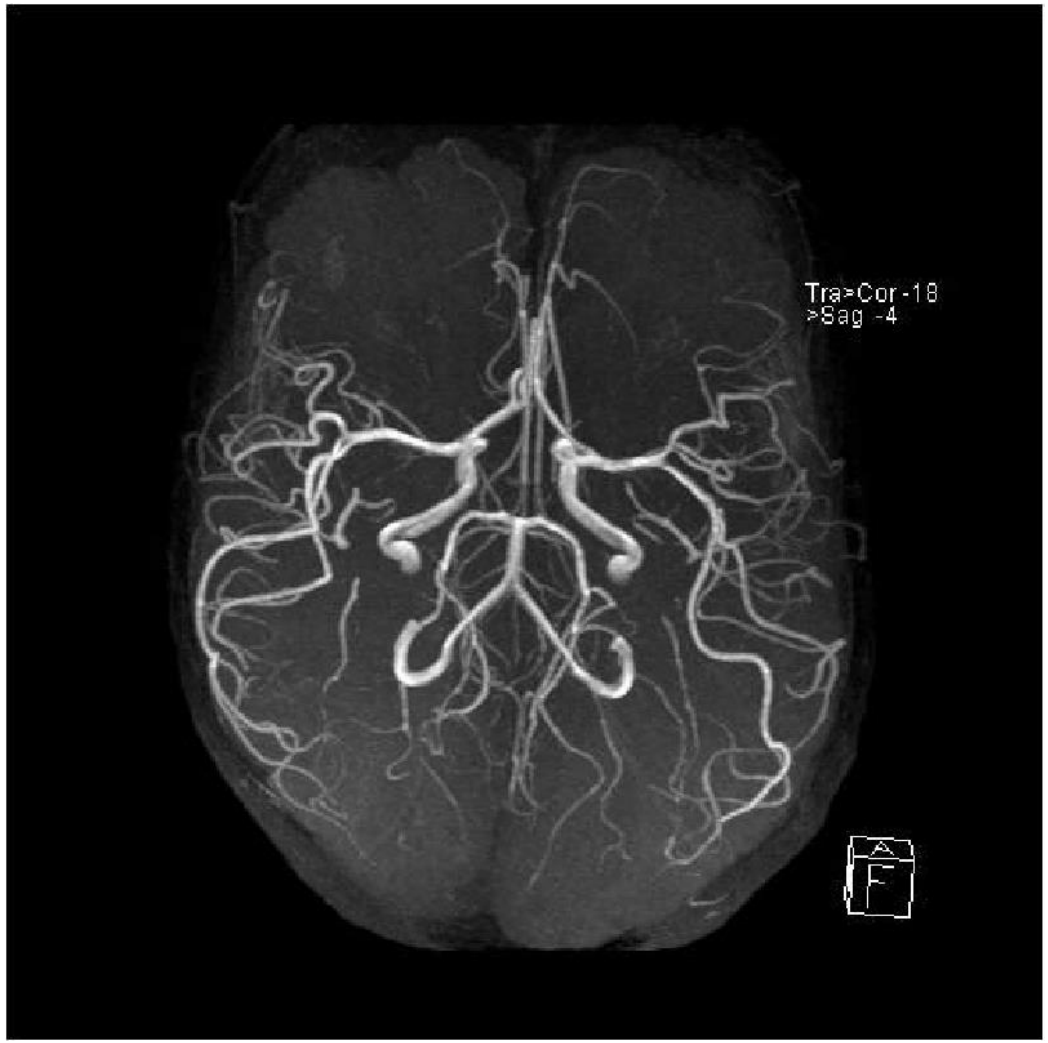


Coronal



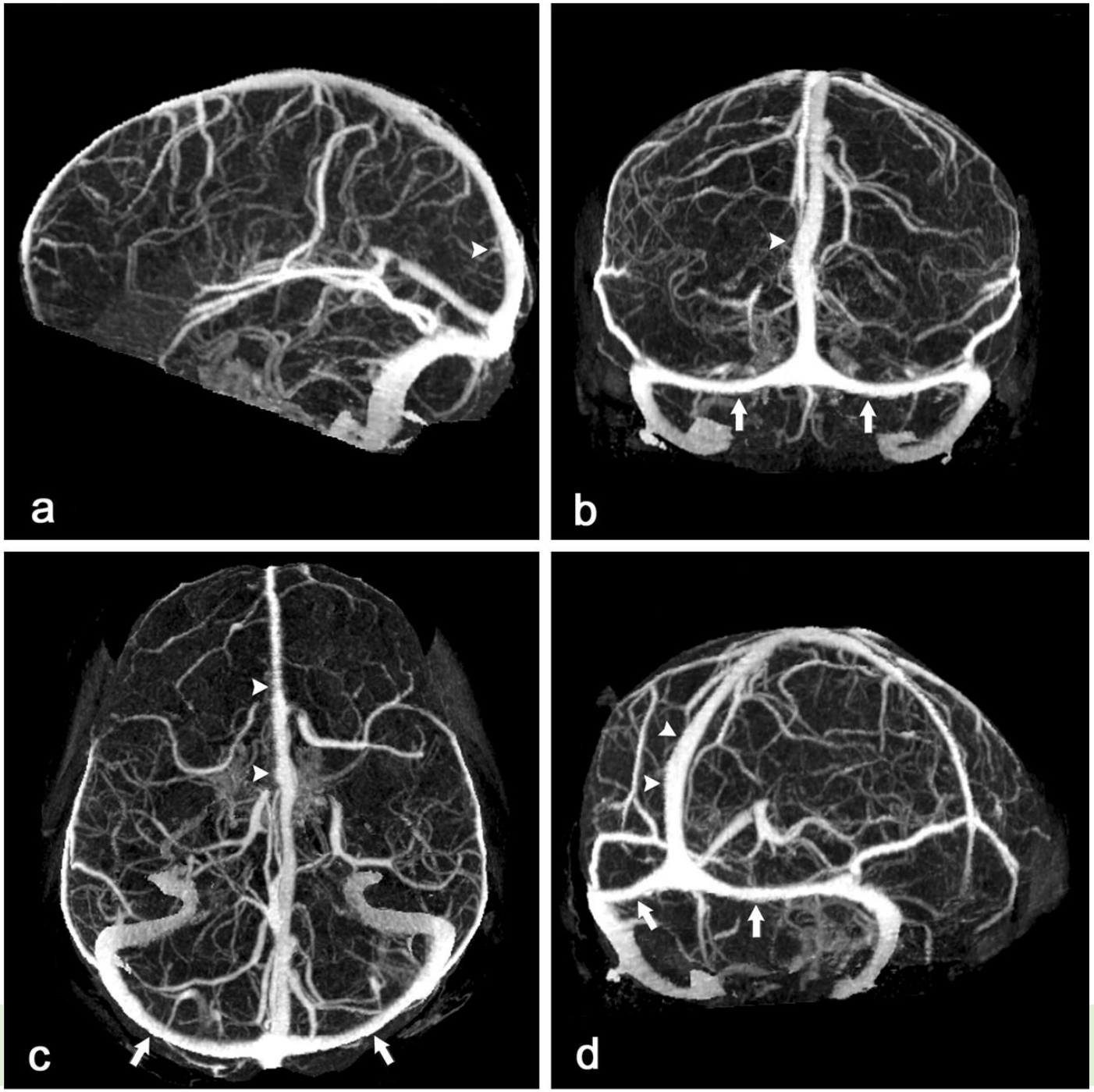
Sagittal

CT Angiography → ARTERI

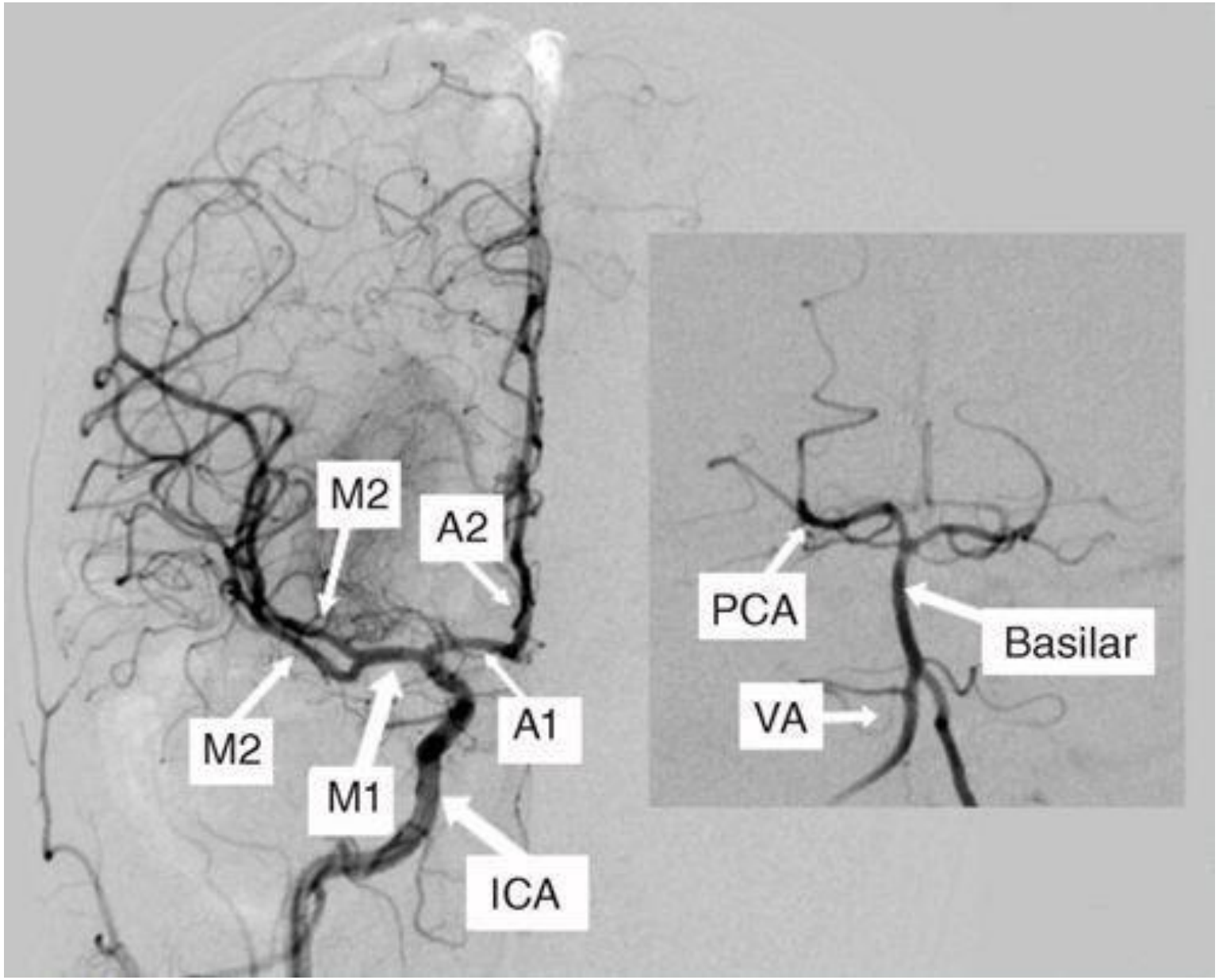


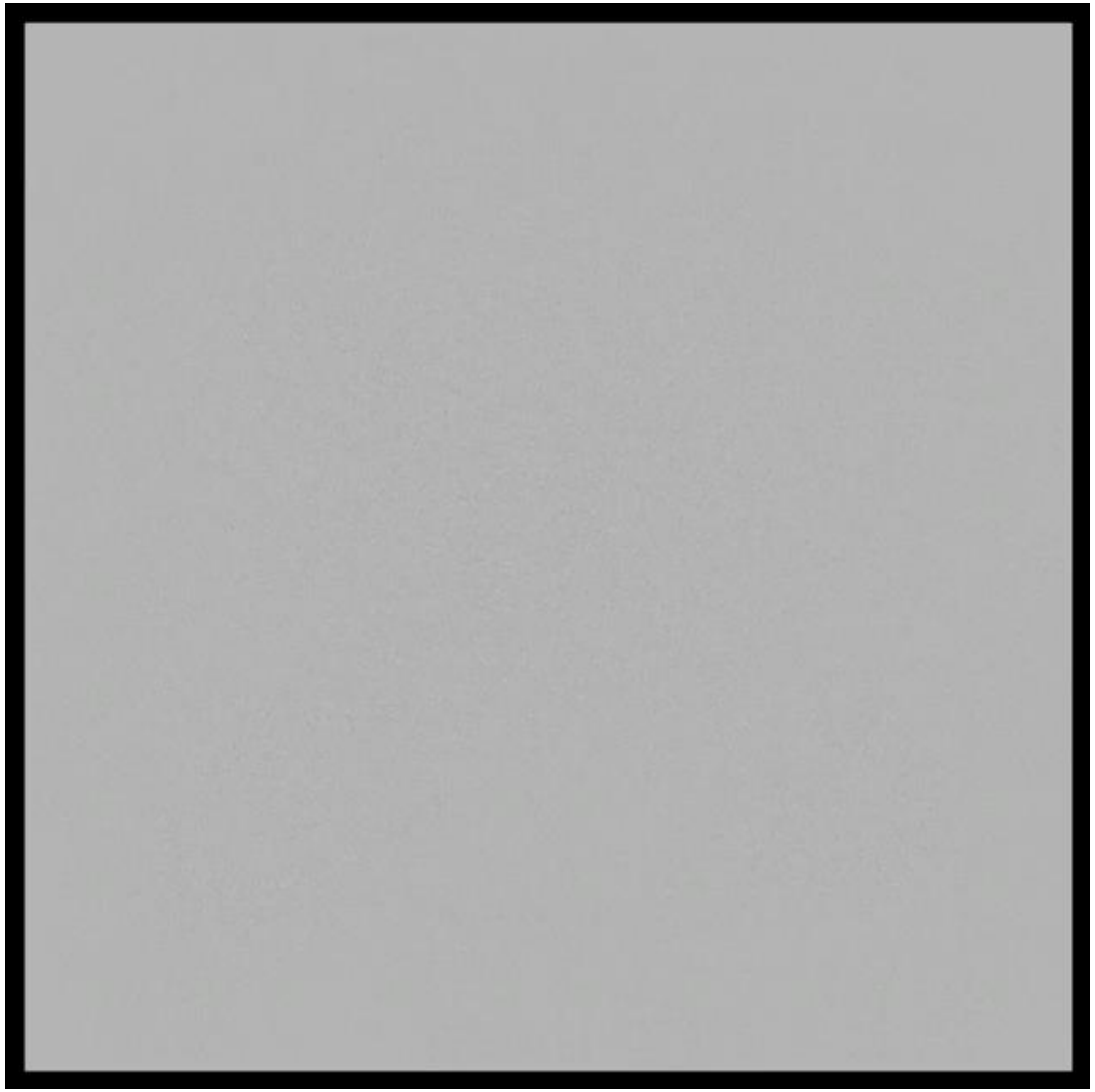
CT Venography

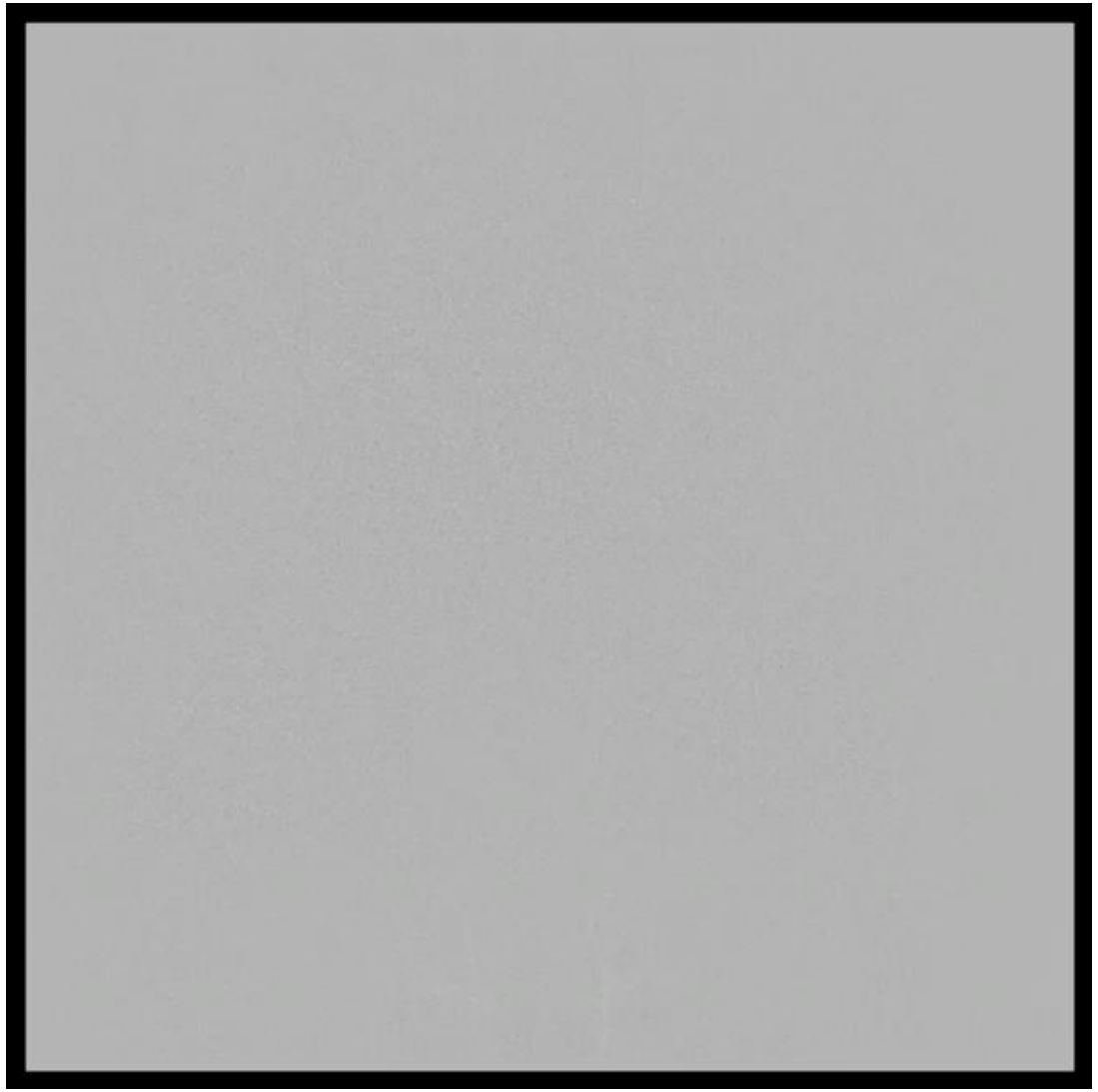
VENA



Digital Substraction Angiography (DSA)







Sesi 3

Tips untuk Mengidentifikasi Gambaran Patologis pada CT Scan

Sesi 3

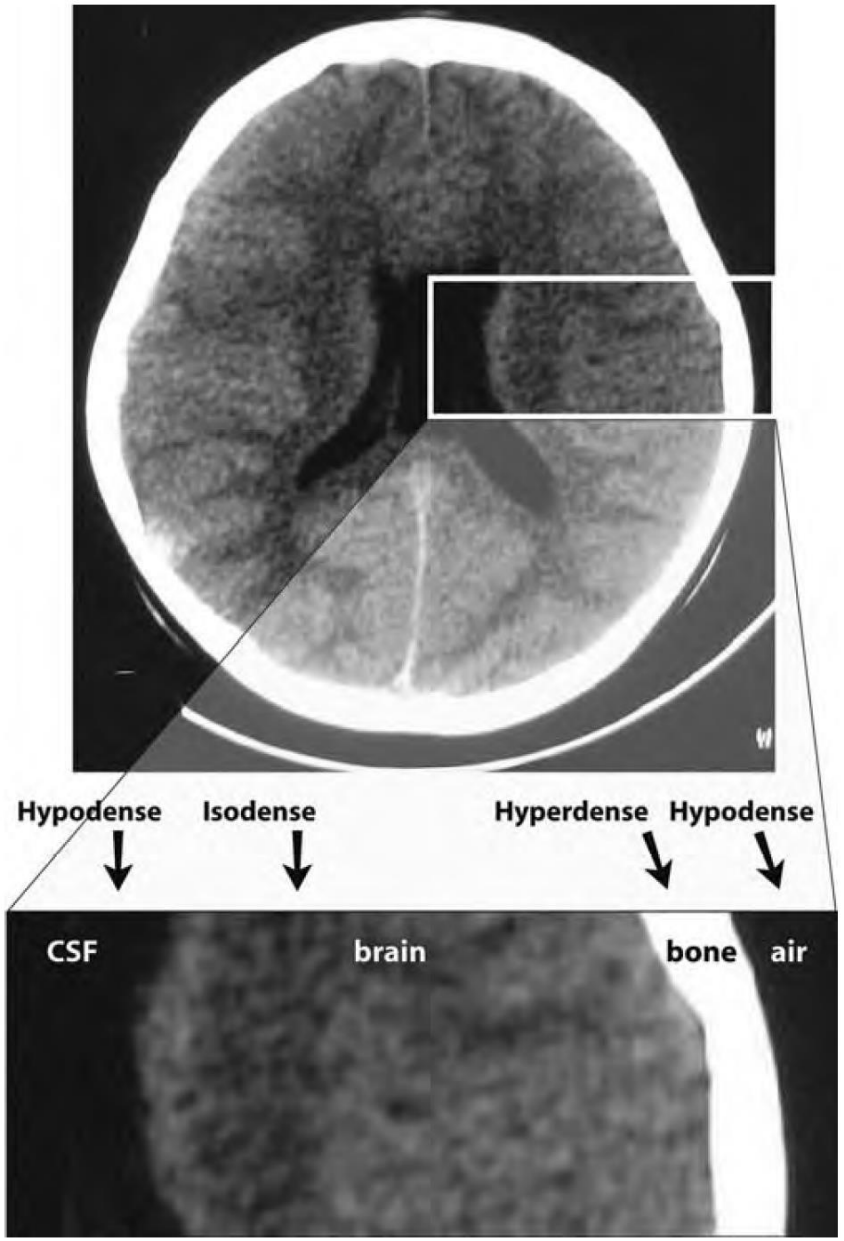
Outline

1. Gambaran umum patologis dalam CT
    1. Densitas → DOT (HU unit)
2. Gambaran **stroke perdarahan dan infrak**
    1. Infark (akut dan kronik)
    2. SAH
    3. IVH
3. Gambaran **trauma kepala**
    1. EDH
    2. SDH → kontracoup . Akut dan kronik
    3. ICH dan kontusional
4. Gambaran **tumor otak**
    1. Efek massa + MLS
    2. Perbedaan kontras dan tanpa kontras
    3. Kasus : meningoma , pituitary adenoma dan glioma

Gambaran **Patologis** Umum pada **CT Scan**

Densitas pada CT Scan

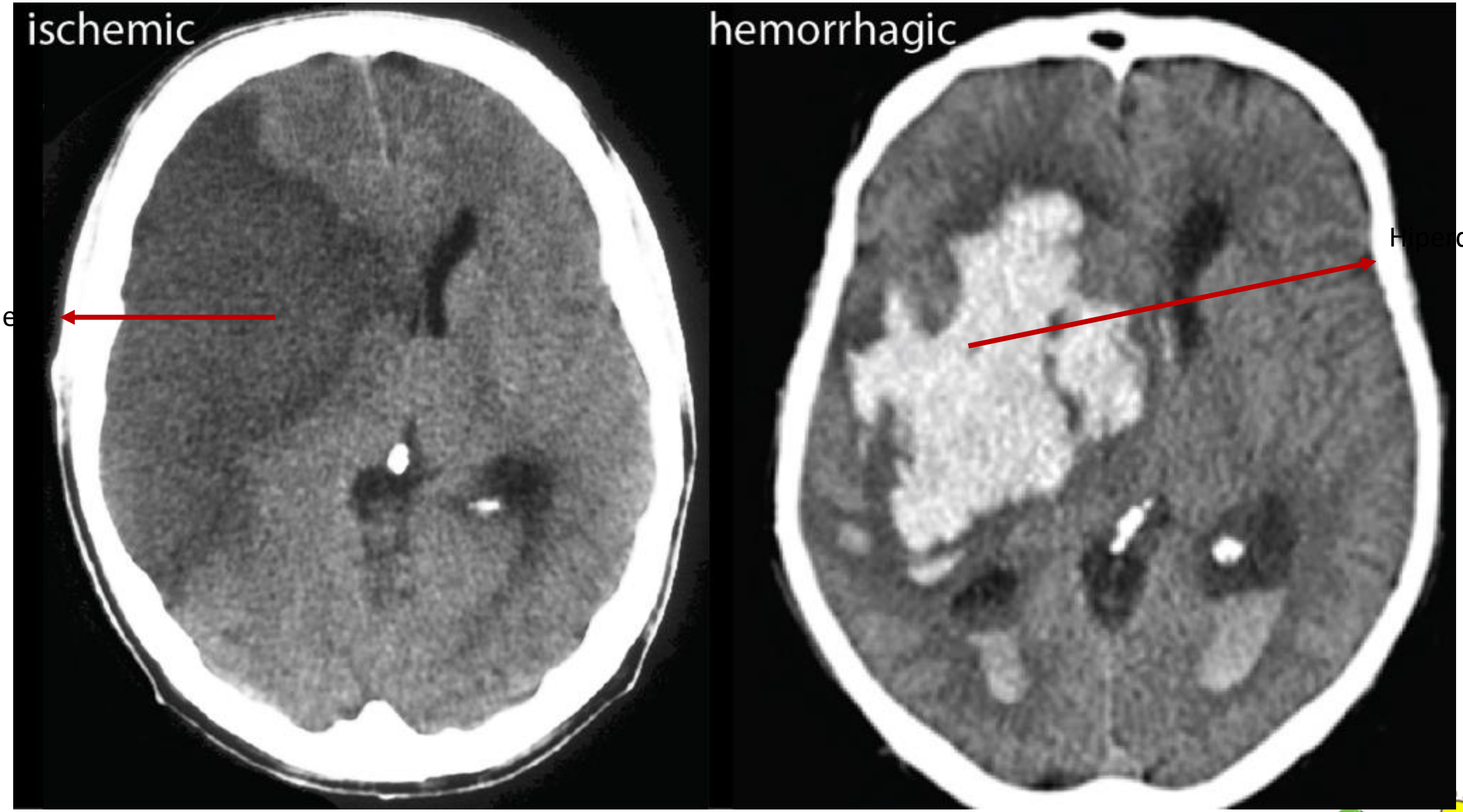
CT Number Ranges in Hounsfield Units (HU)	
Bone	+1000
White matter	+20 to 30
Muscle	+20 to 40
Gray matter	+30 to 40
Hemorrhage	+65 to +95
CSF (water)	0
Fat	-30 to -70
Air	-1000



M.H. Lev, R.G. Gonzalez, in Brain Mapping: The Methods (Second Edition), 2002

Stroke

Perdarahan v/s. Infark



Hipode

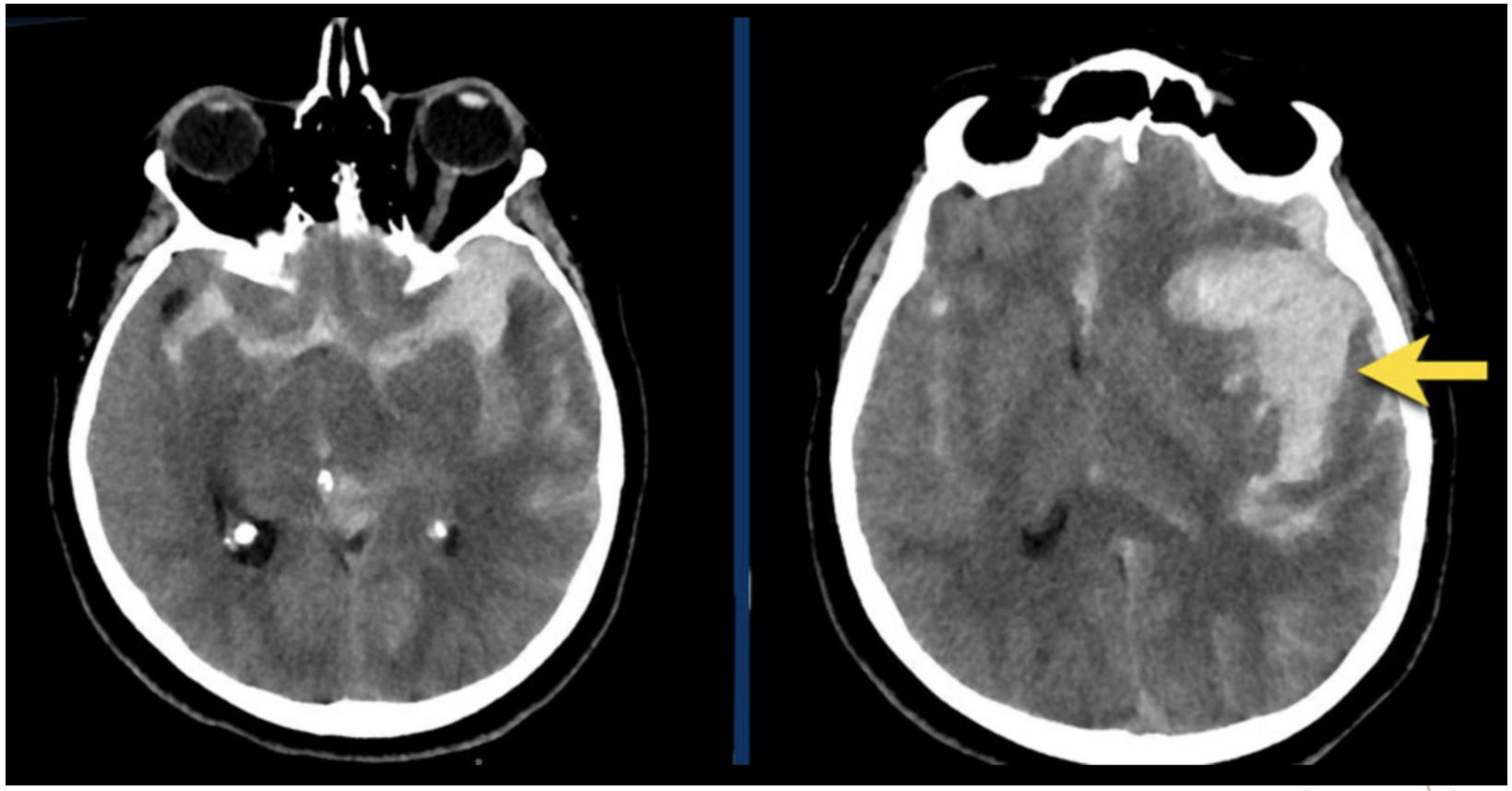
Hiperdens

Hyper Acute → Acute → Chronic Infarct

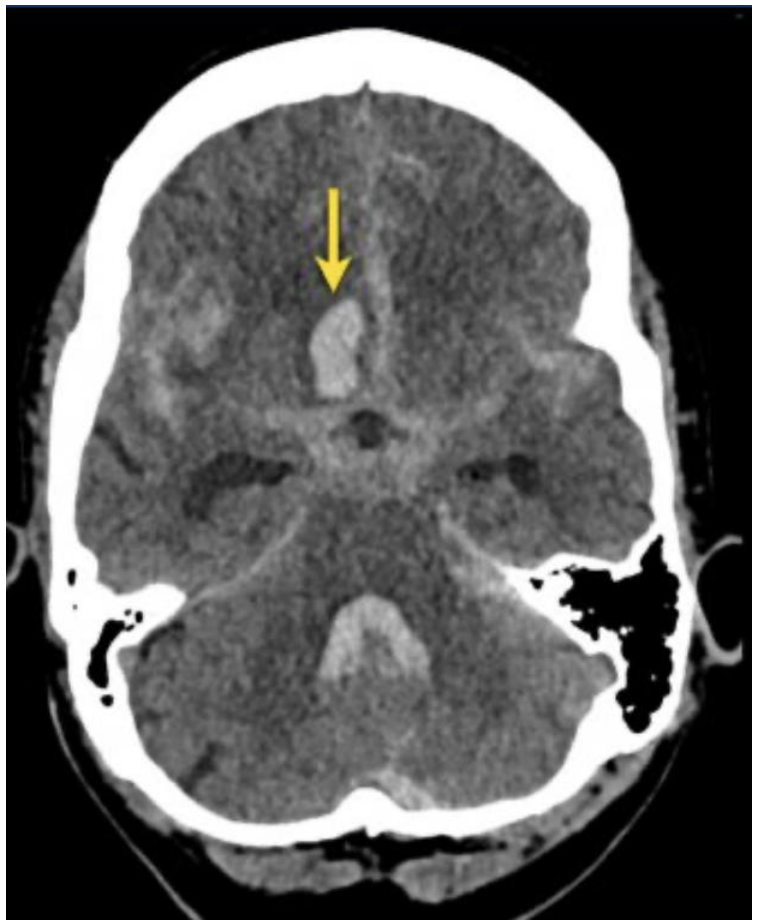
Stroke Perdarahan

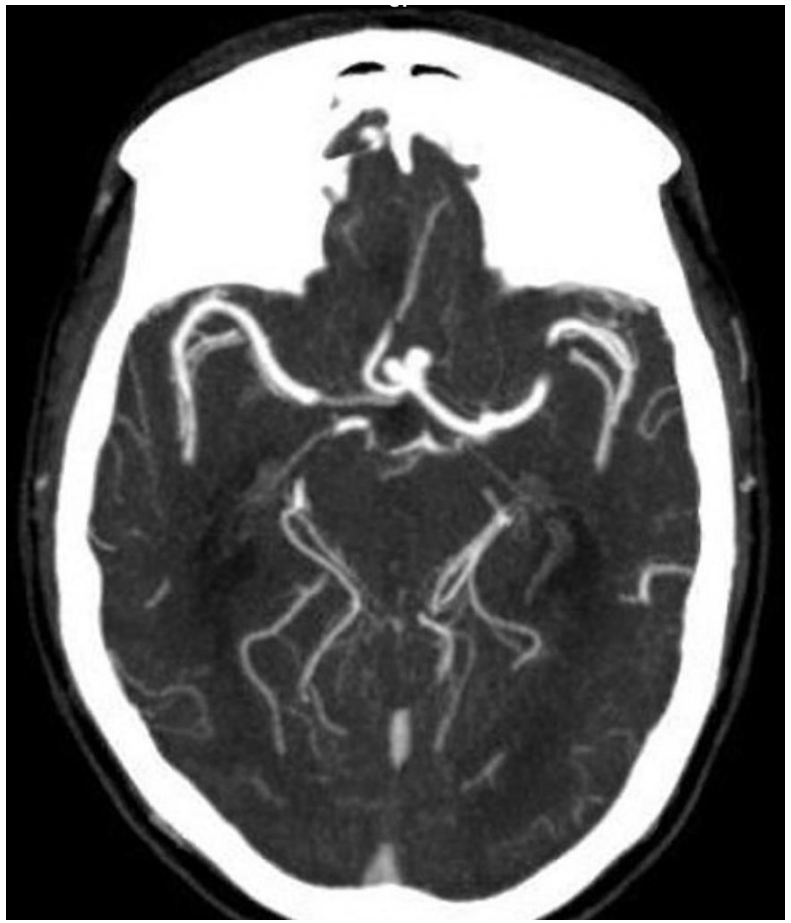
Tipikal ICH Hipertensive

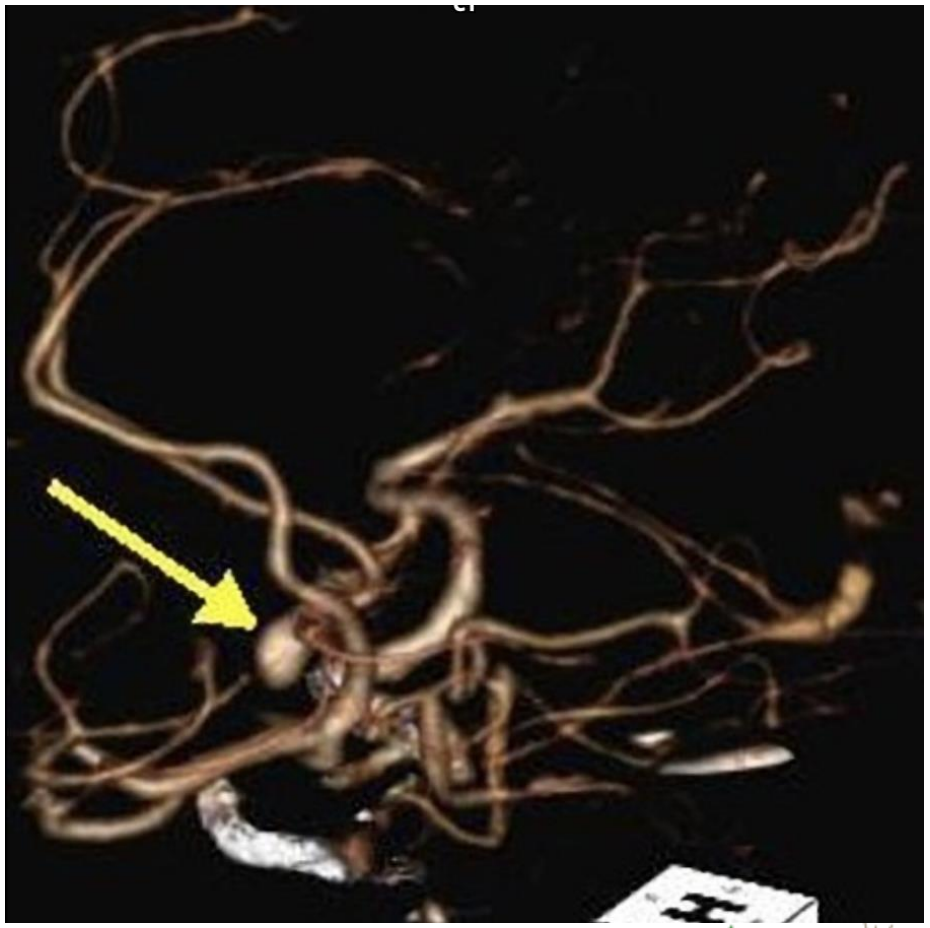
Malformasi vascular susp aneurisma



Spontaneus SAH



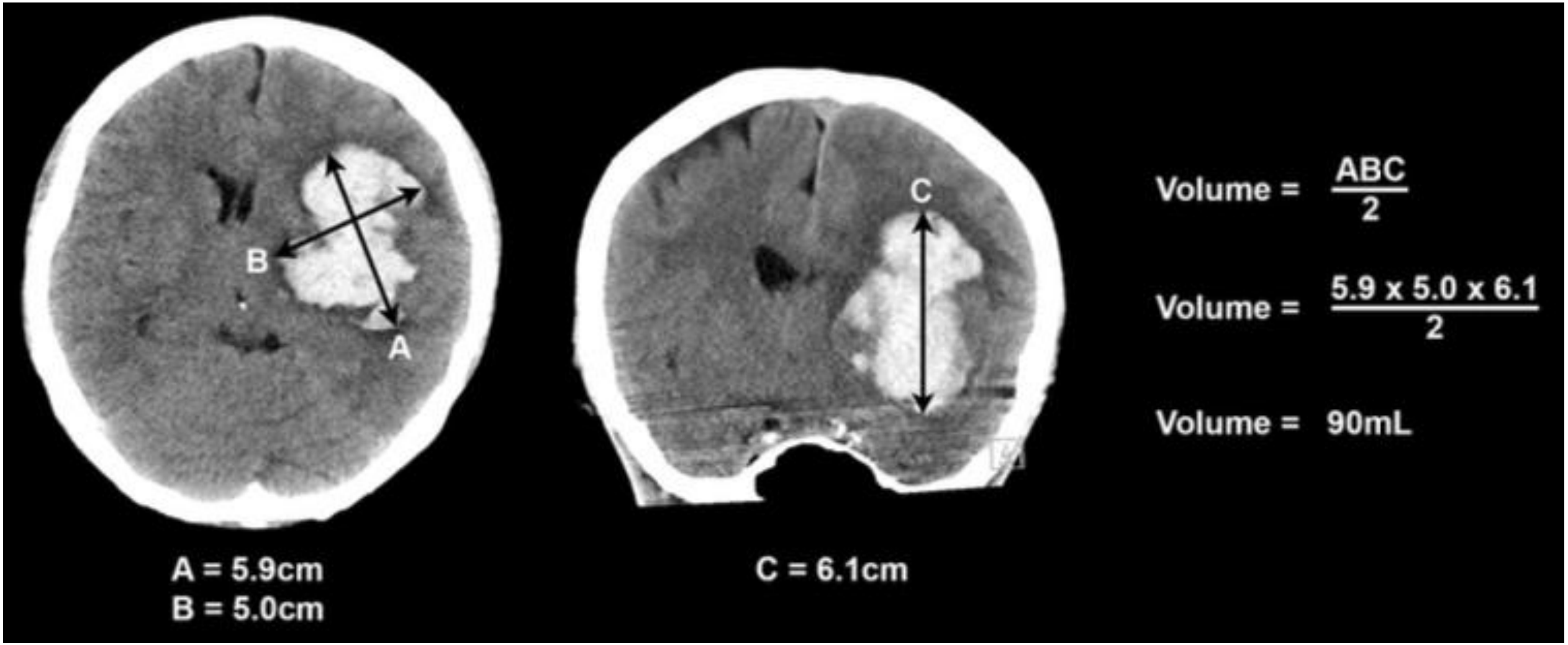




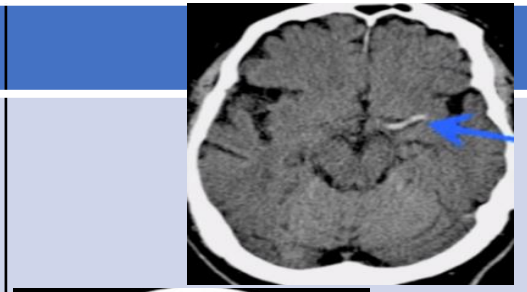
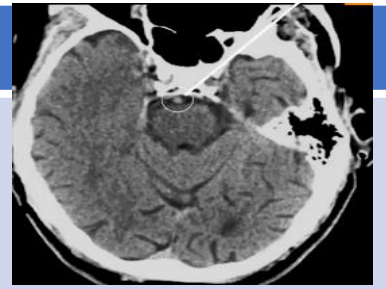
ICH Kortikal

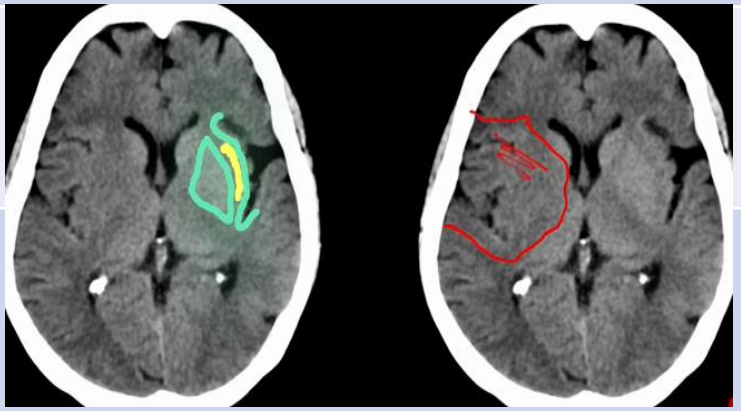
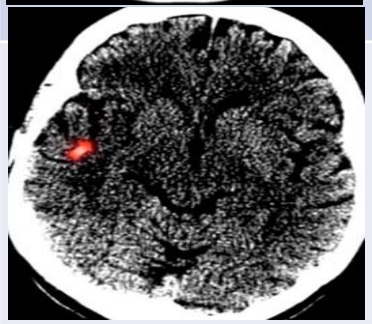
Susp. AVM

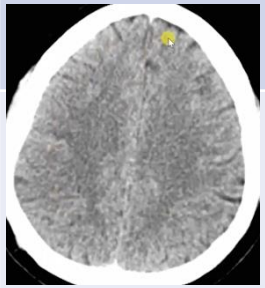
Volume


B
A
C
A = 5.9cm
B = 5.0cm
C = 6.1cm
Volume = ABC / 2
Volume = 5.9 x 5.0 x 6.1 / 2
Volume = 90mL

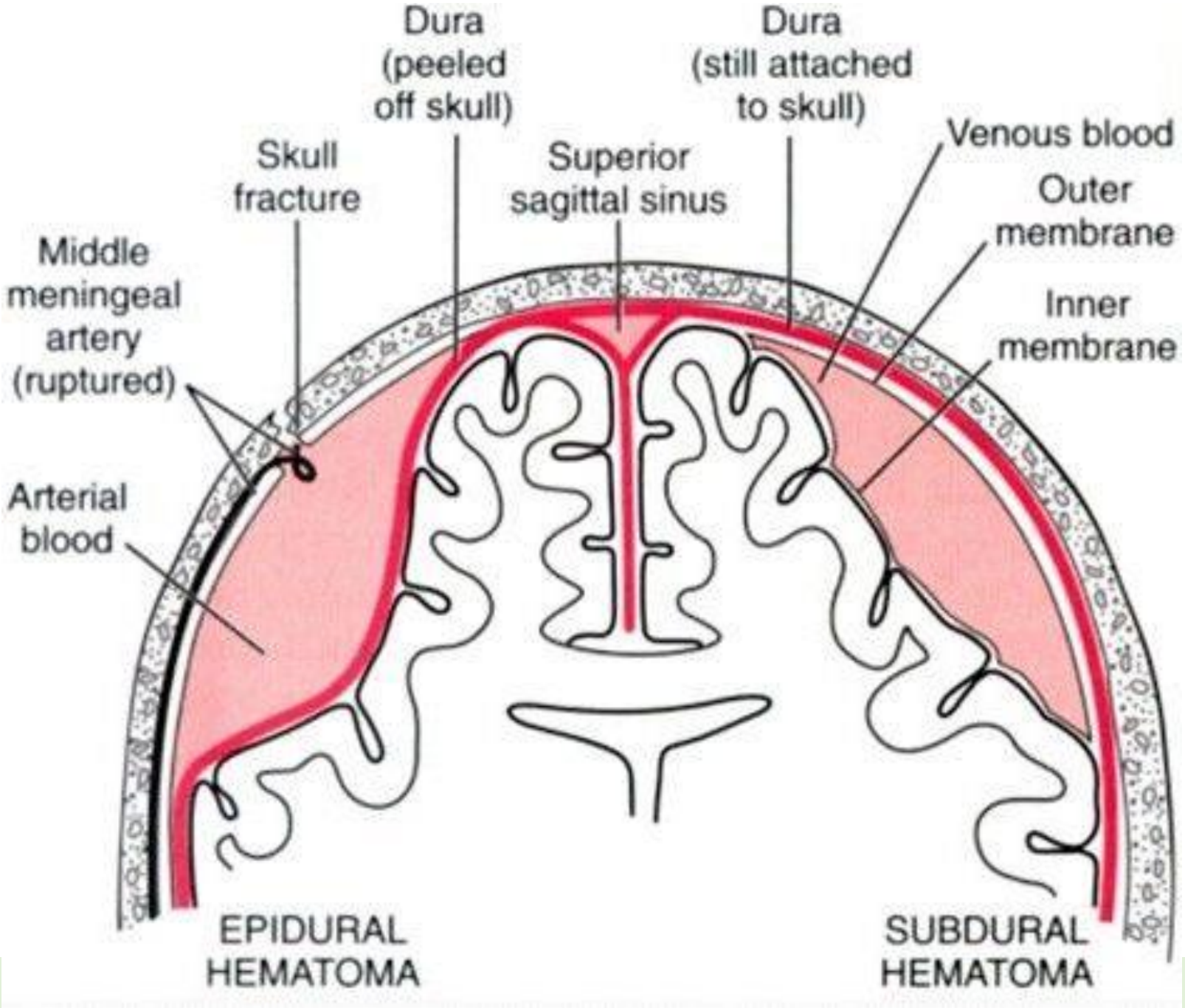
CT Scan Hiperakut Stroke	
Hyperdense Vessel Sign	Intraluminal thrombus
Loss of insular ribbon sign	Cytotoxic edema
Obscuration lentiform nucleus	Cytotoxic edema
Loss of Gray – White matter distinction	Cytotoxic edema
Area hypoattenuation	Irreverible tissue damage
Sulcal effacement	Mass effect

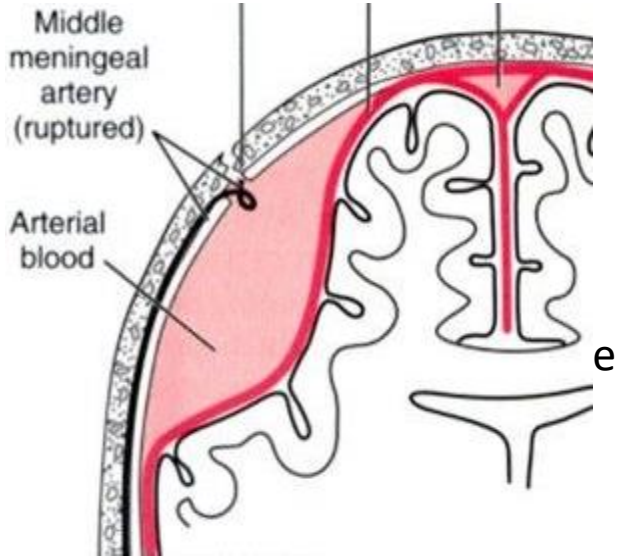



Gambaran Trauma Kepala



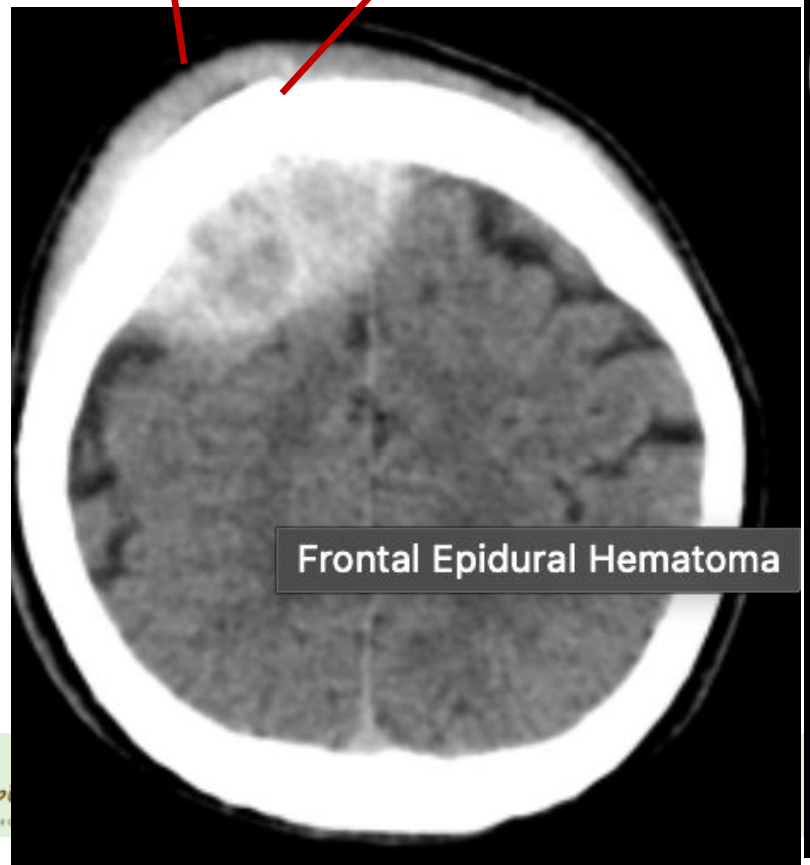
Epidural Hematoma (EDH)

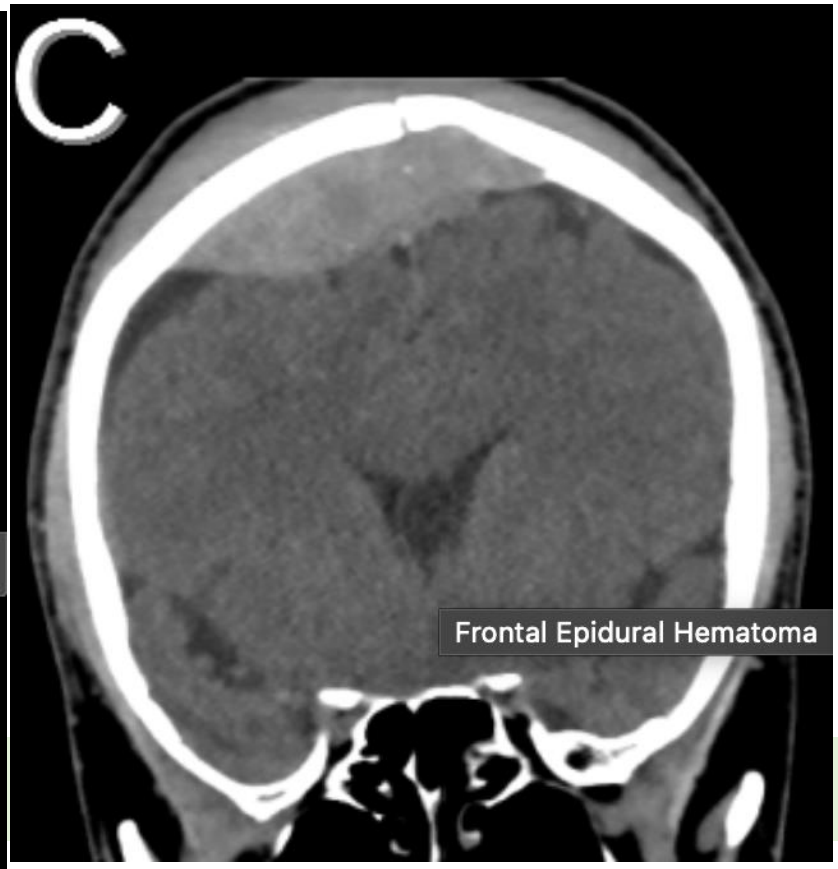


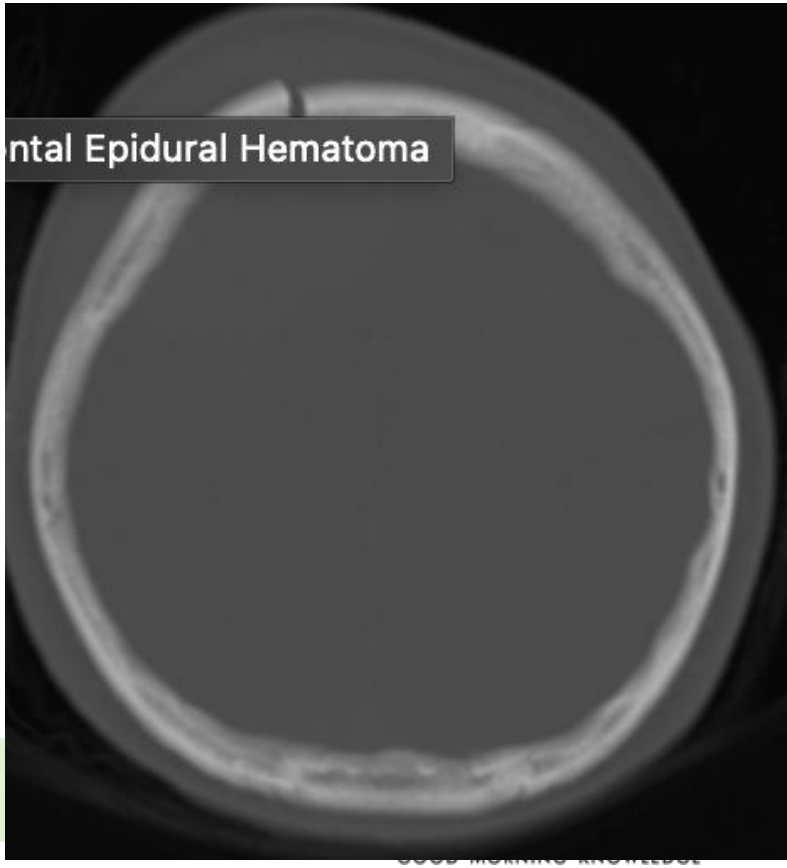
Biconvex

Coupe

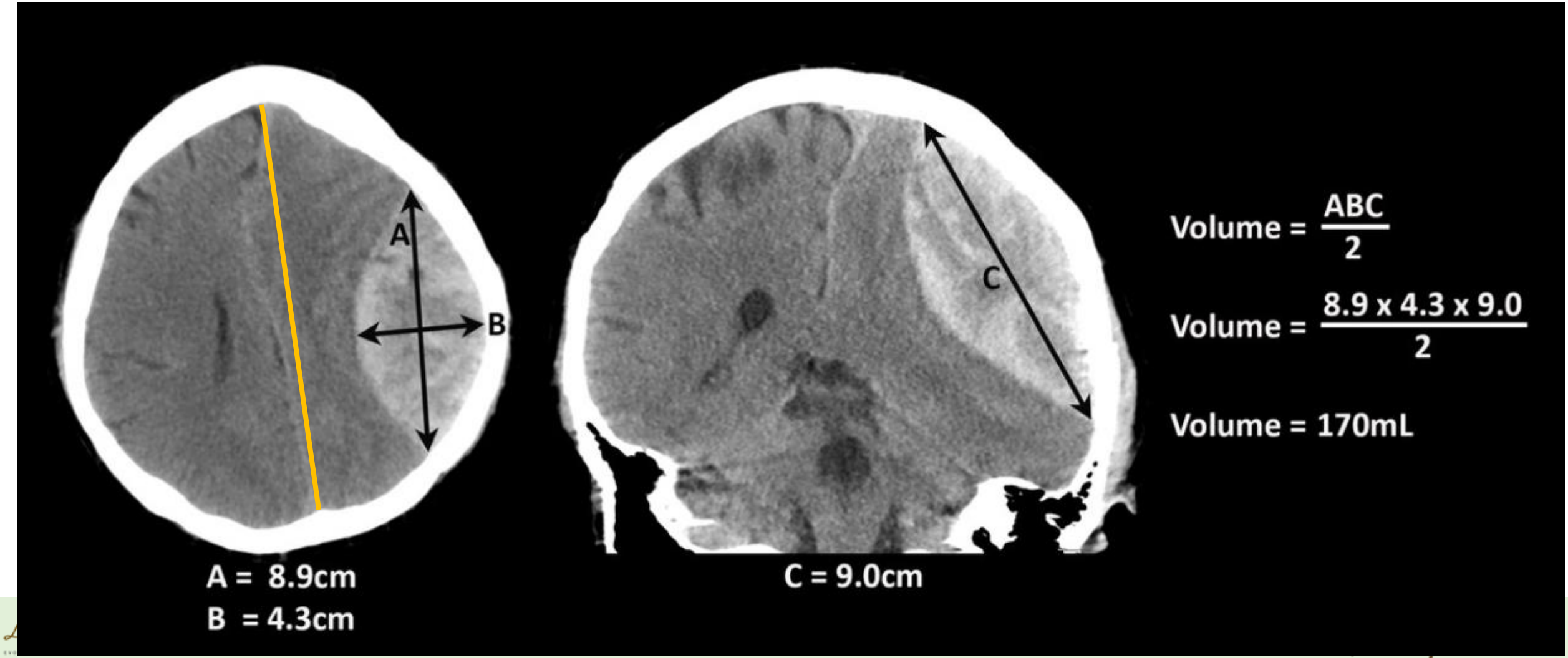
SCALP Hematom



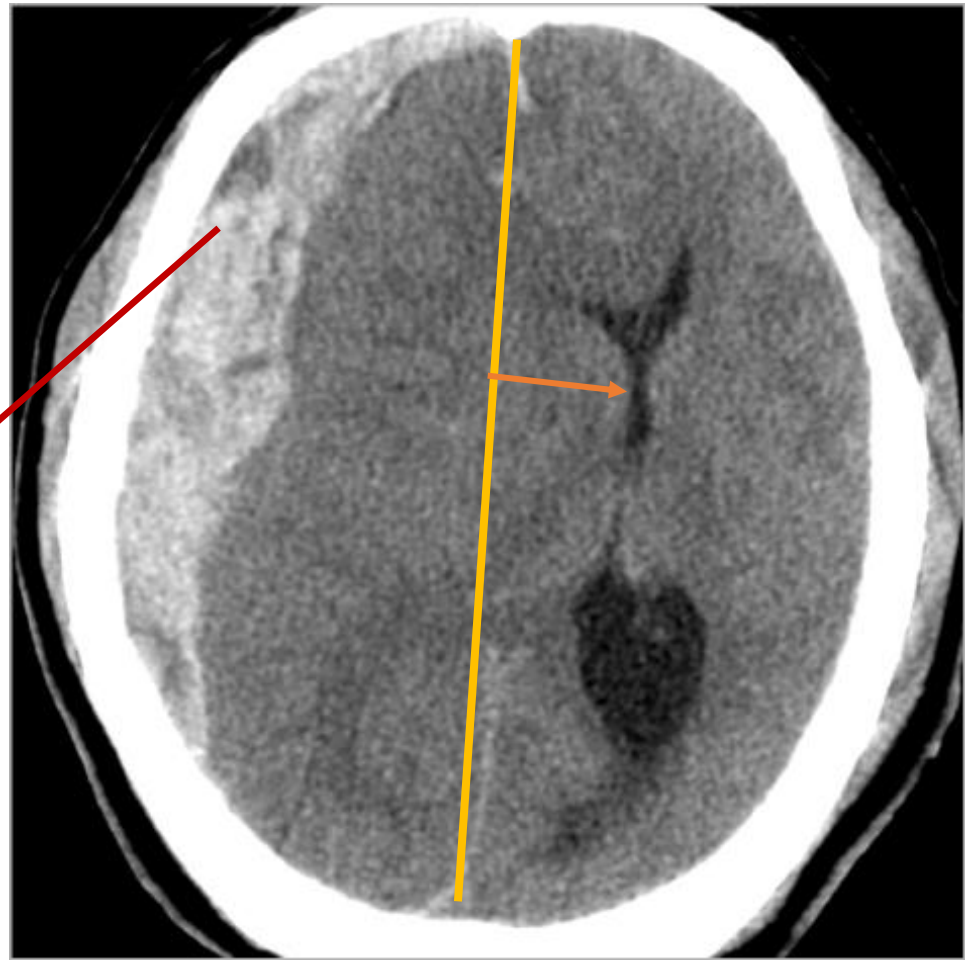




1. Volume
2. midline shift (MLS)

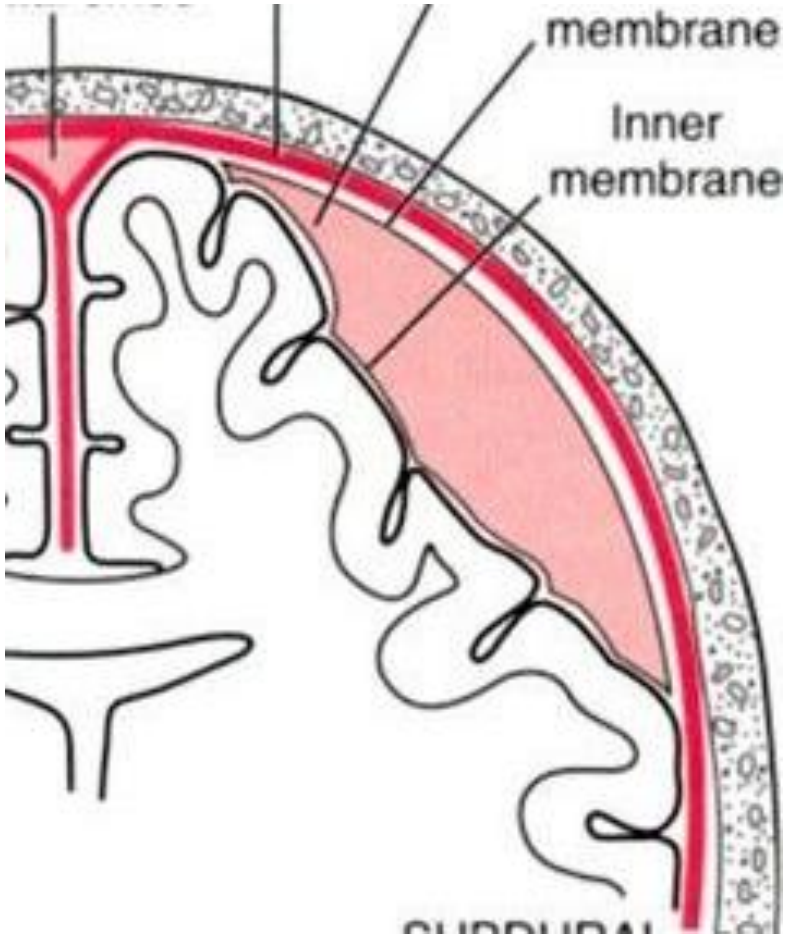


Subdural Hematoma

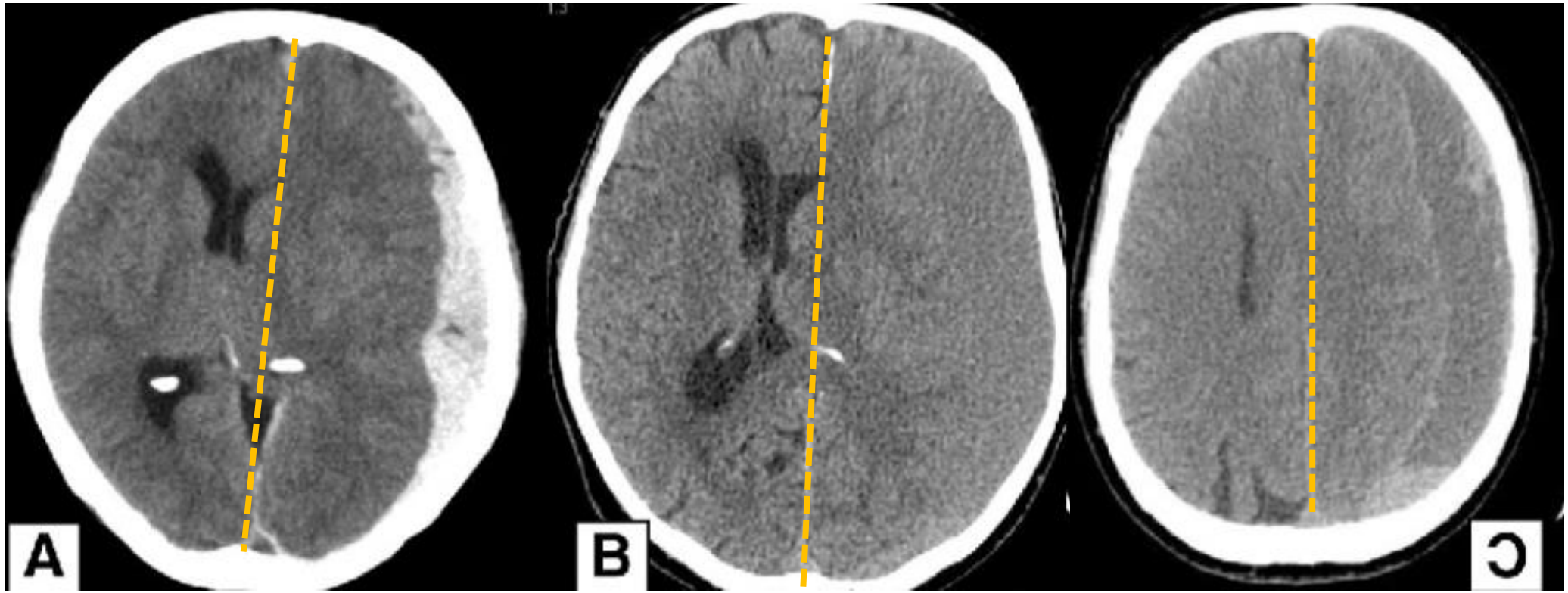


Biconcave

- Pria 58 tahun datang ke IGD dengan penurunan kesadaran setelah terjatuh dari tangga dirumahnya



SDH Acute → Sub-acute → chronic



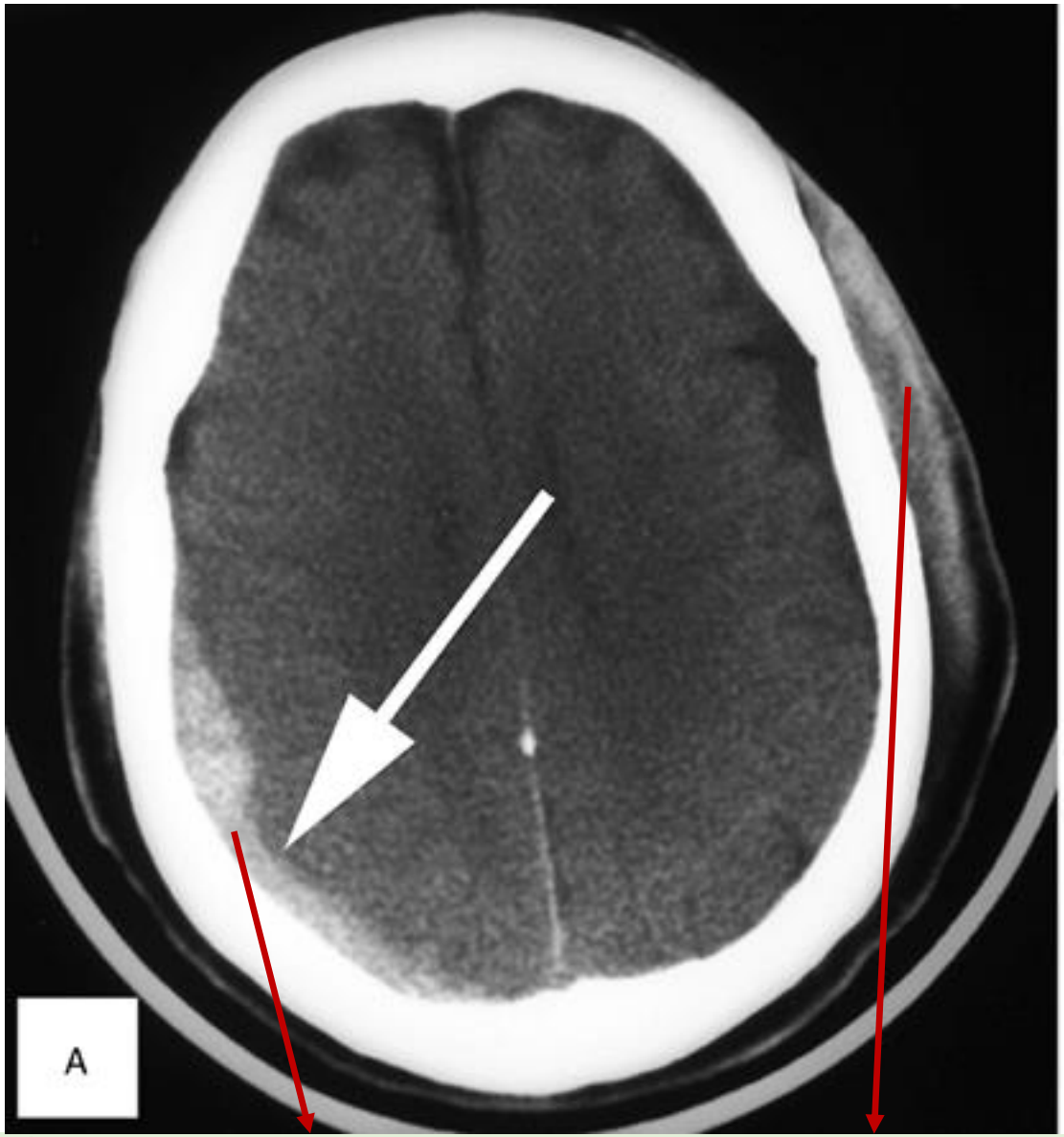
Acute

Sub-acute

Chronic

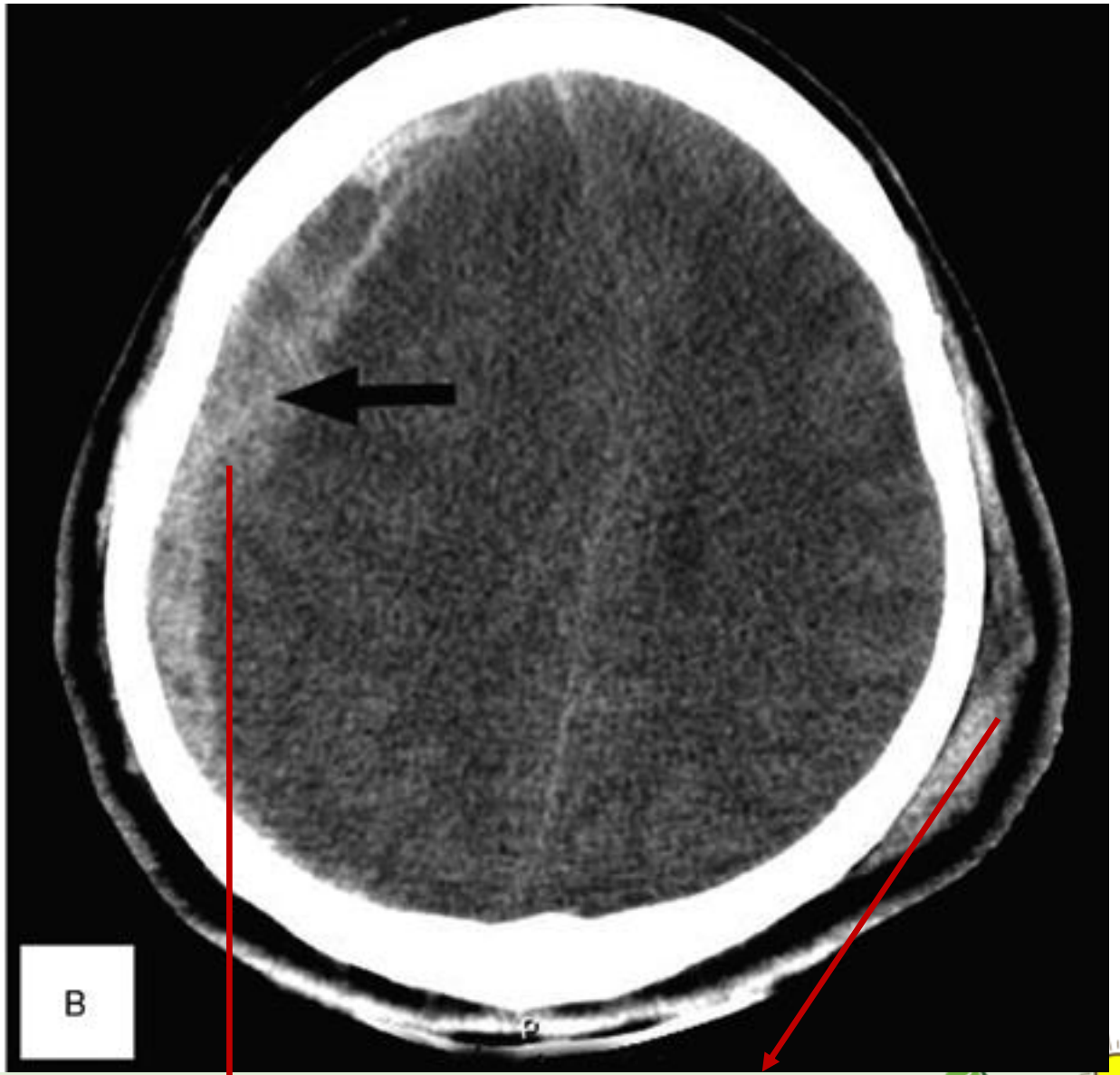
Perhatikan **MLS** (midline shift)

COUP AND COUNTRA COUP SDH



Lesi countra coupe

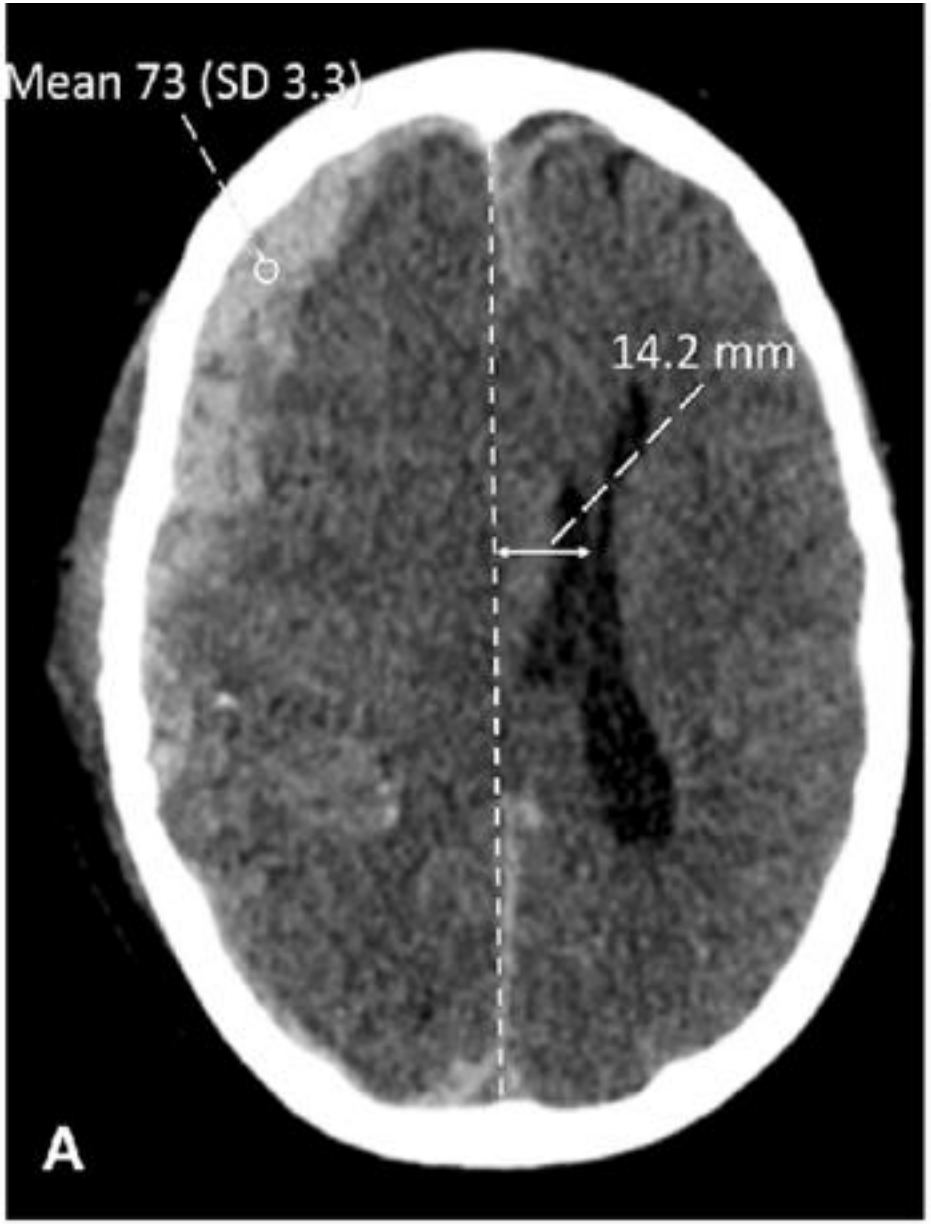
SCALP Hematome

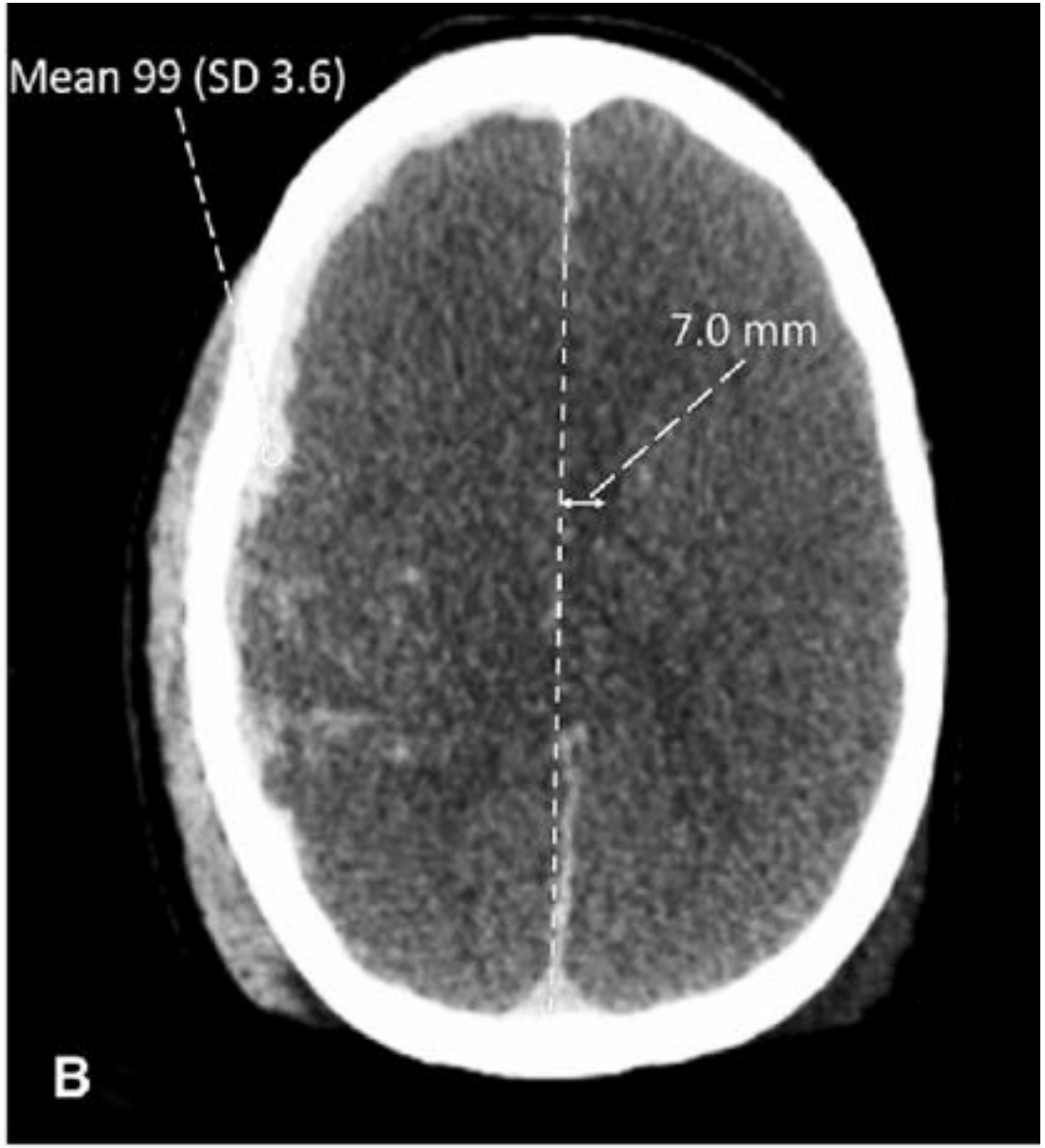


Lesi countra coupe

SCALP Hematome

Midline Shift (MLS) > 0,5 cm



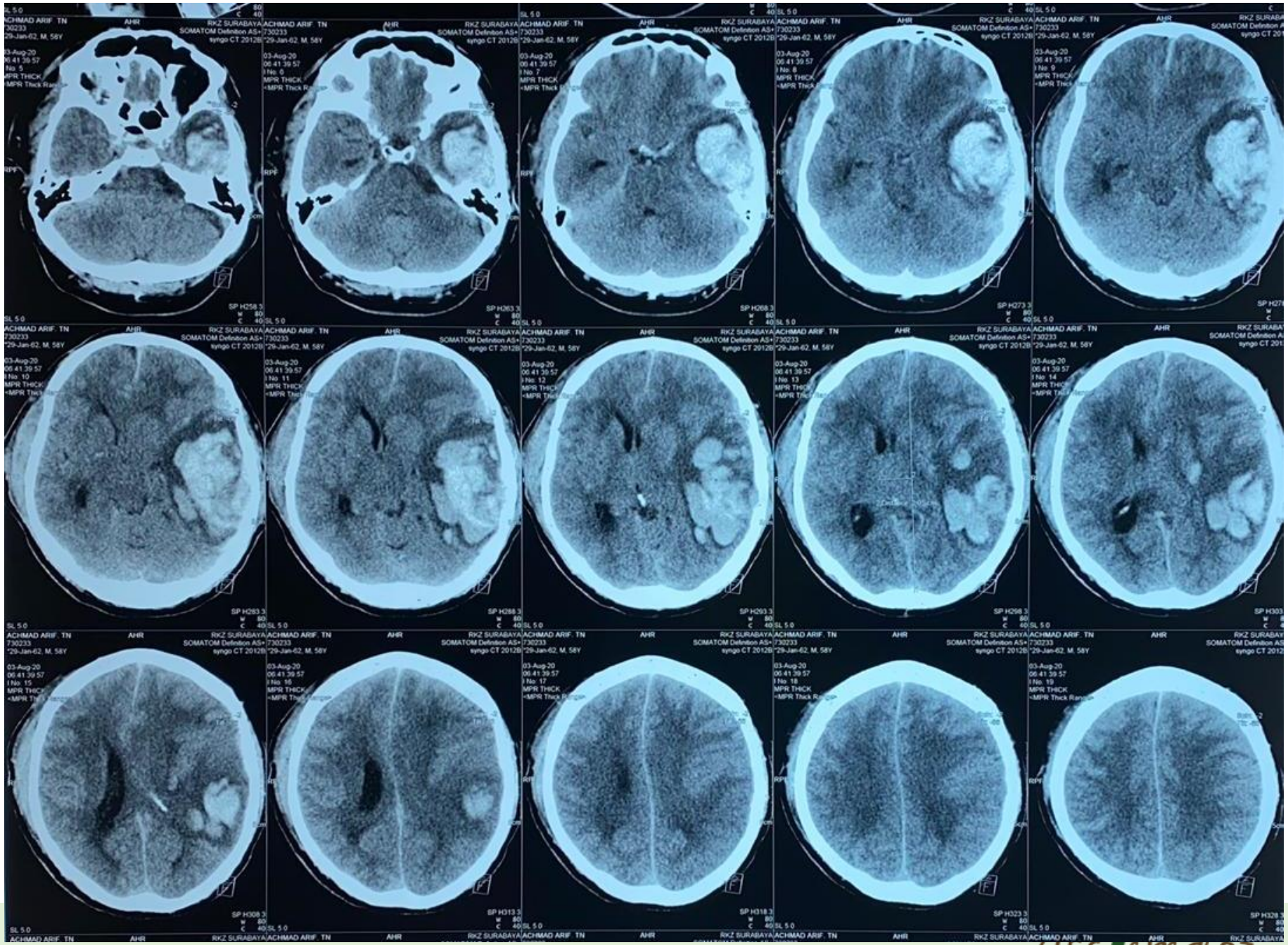


ICH vs. Kontusional

Disebut ICH jika volume > 5 cc atau diameter >2 cm,

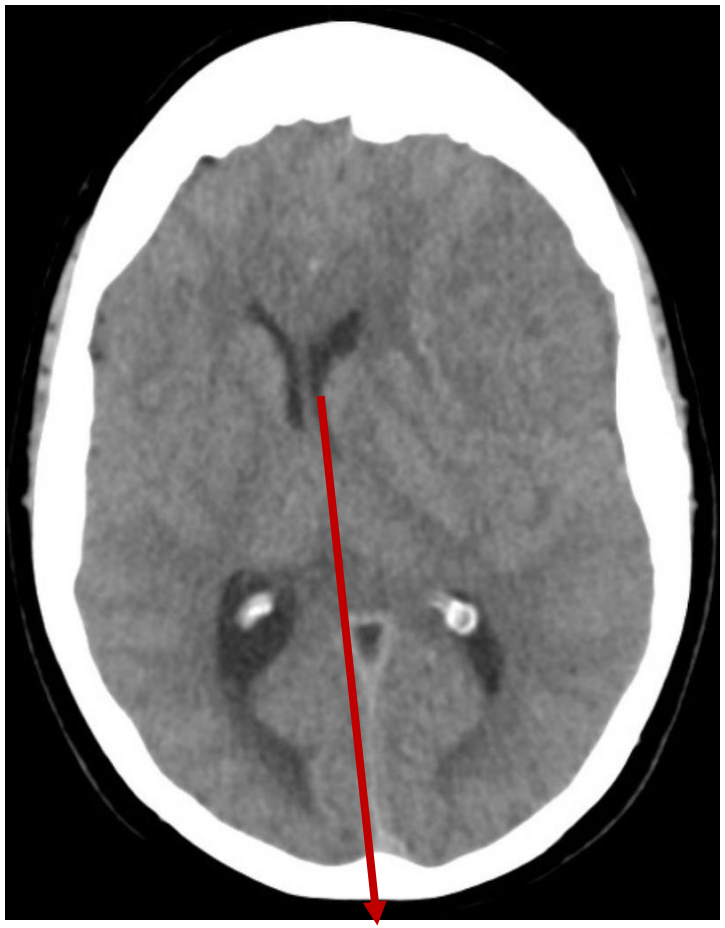
Kontusio jika volume < 5 cc atau diameter < 2cm

Traumatic ICH



Gambaran Tumor Otak

Tumor Otak **Ekstra-aksial**



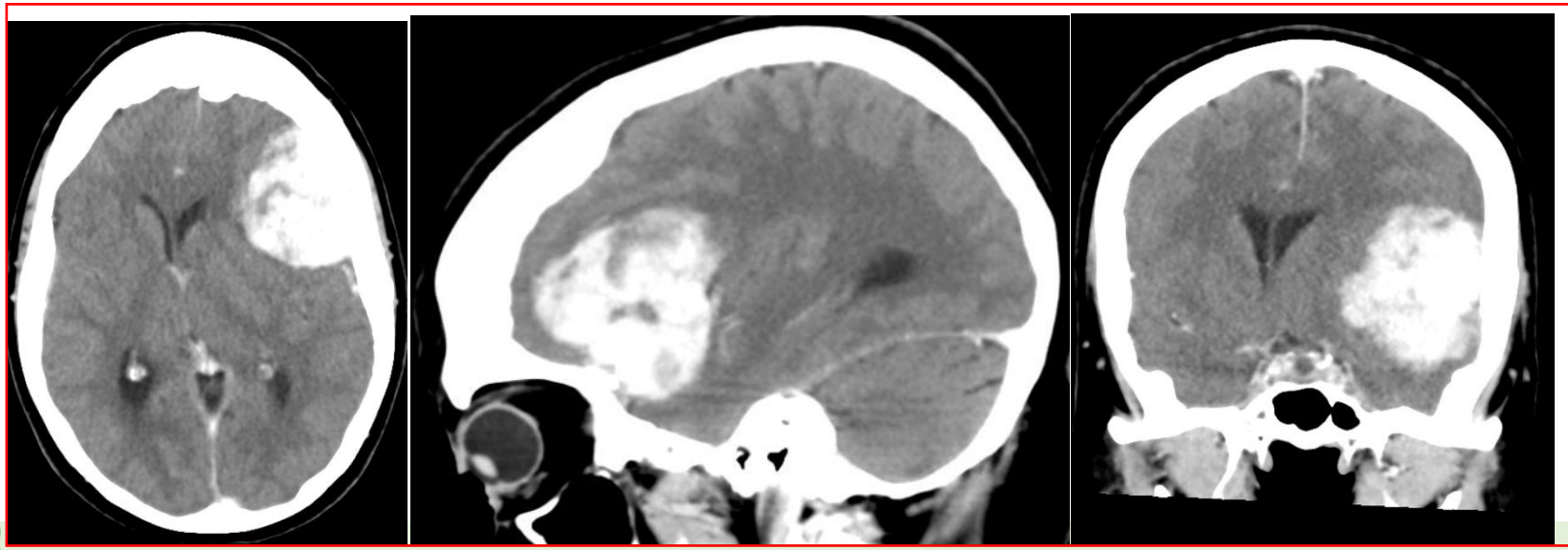
Efek massa

Efek massa

Perhatikan **MLS** (midline shift)

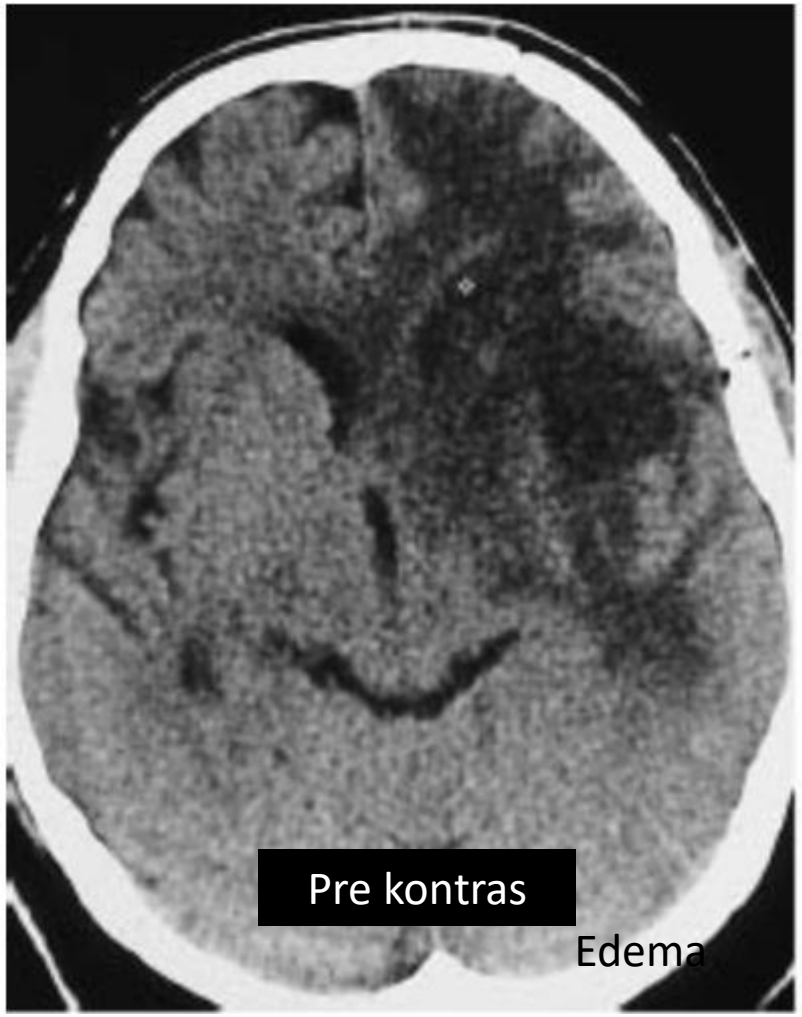
Meningioma

Pre Contrast



Post Contrast

Tumor Otak **Intra-aksial** → GLIOMA

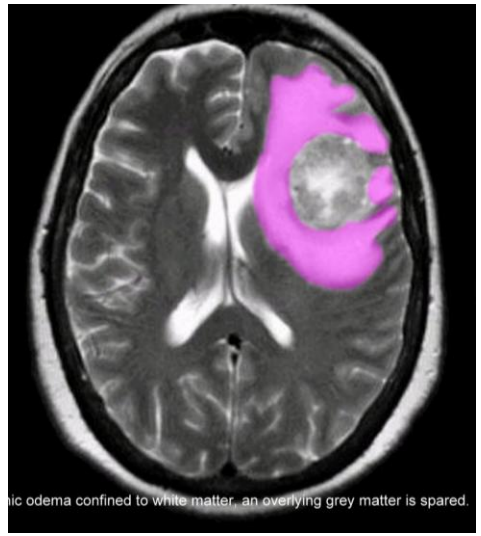


Pre kontras

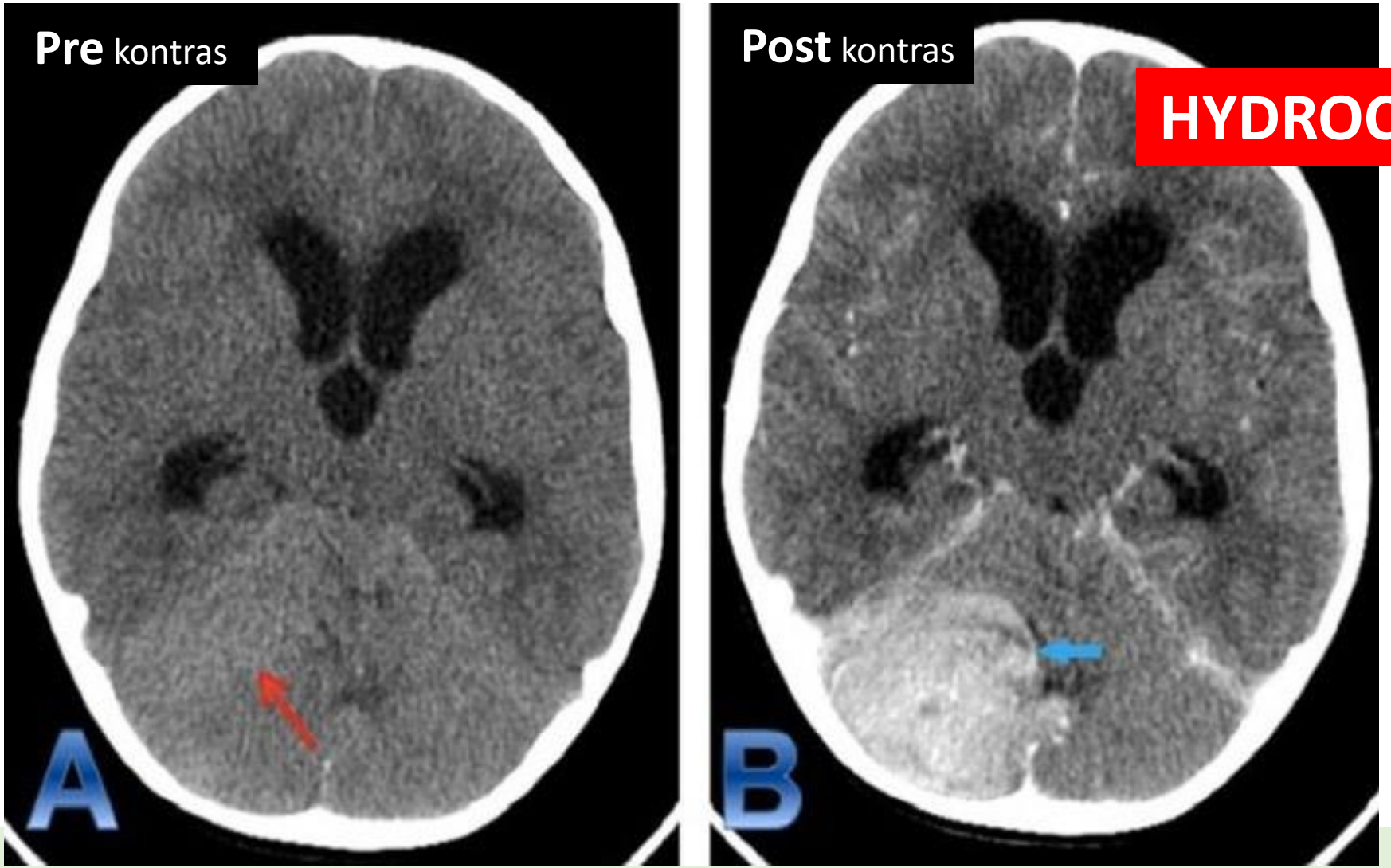
Edema

Post kontras

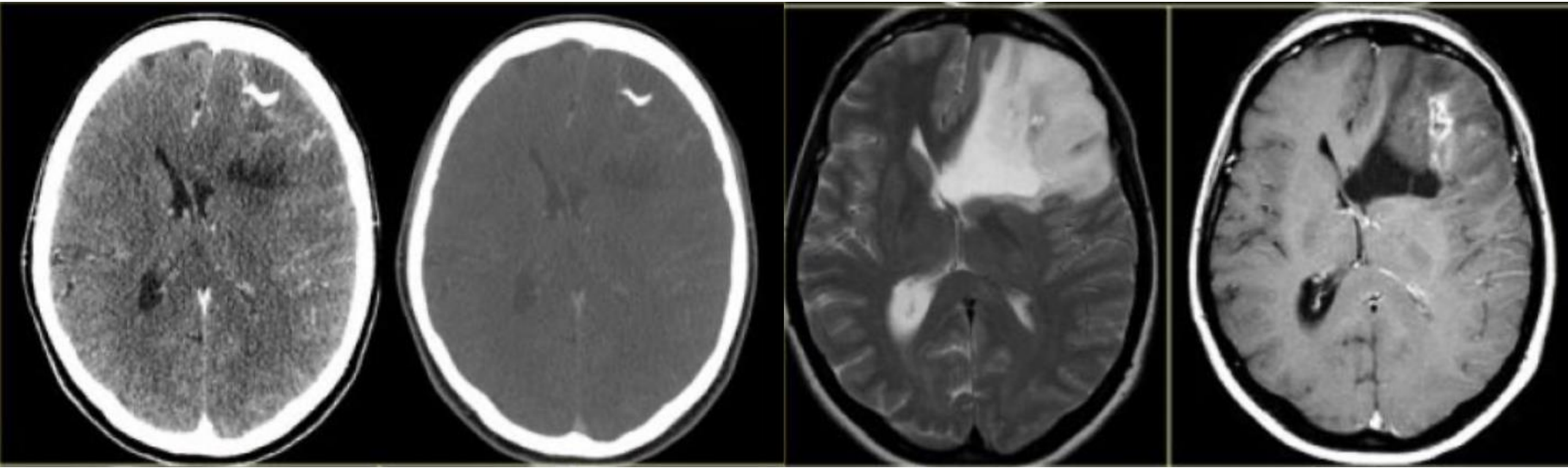
Tumor



CT Scan TUMOR pada **Fossa Posterior**



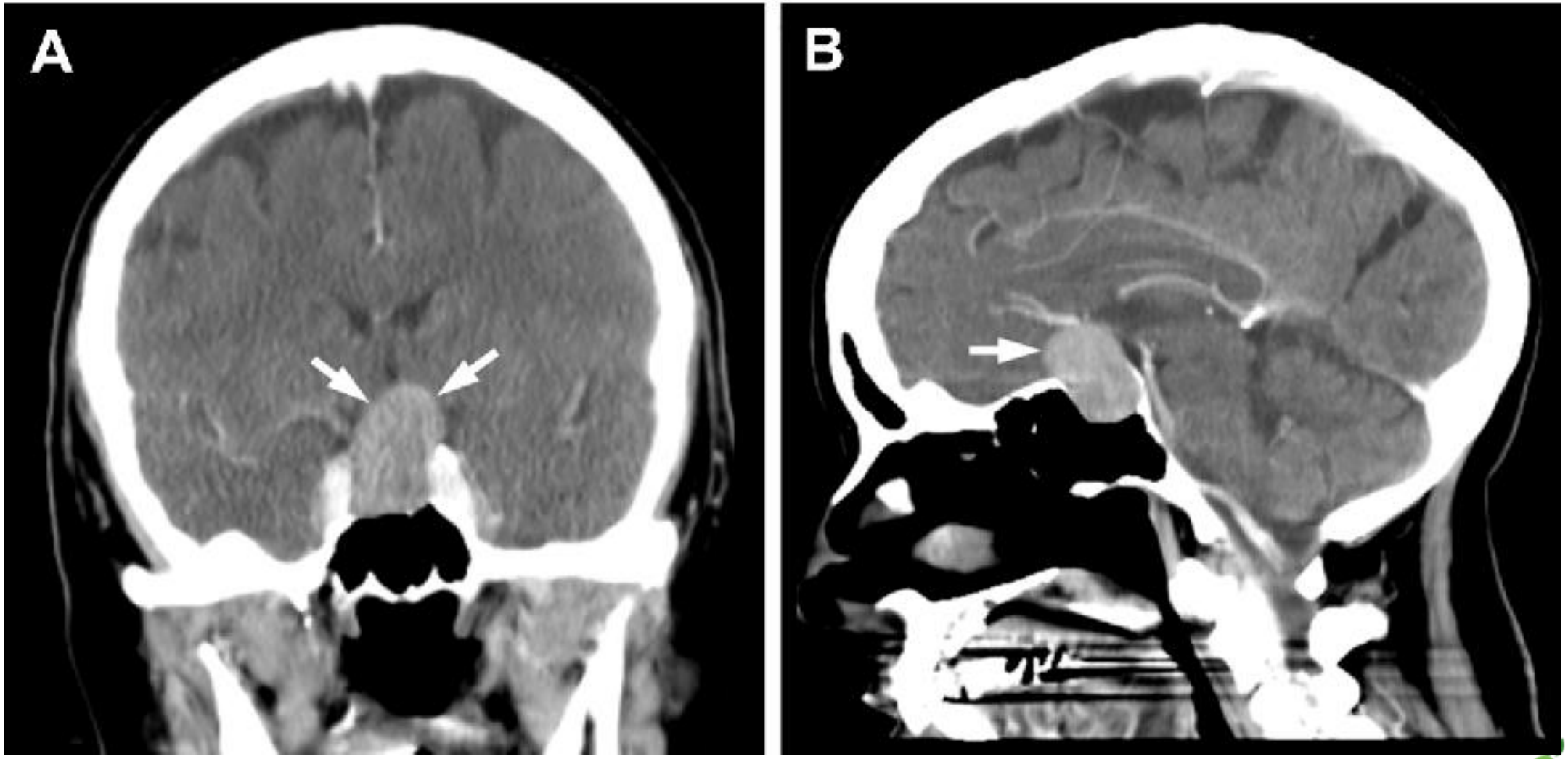
CT Scan **DAN** MRI



KALSIFIKASI

EDEMA PERITUMORAL

Macroadenoma Hipofisis



Macroadenoma Hipofisis