

MED439  
KING SAUD UNIVERSITY

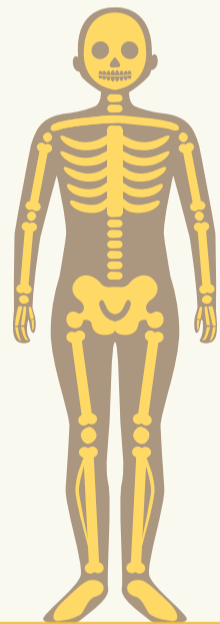
Revised & Approved



# Radiology of cerebral hemispheres

## -CNS BLOCK-

This document is the work and effort of students. It is only made as a reviewing material and is by no means to be relied on 100% during the studying or preparation for the exam.



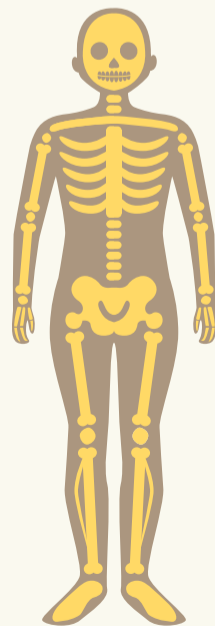
Color index:

Black: Main text  
Red: Important ★  
Yellow: Drs notes  
Gray: Extra

# Objectives

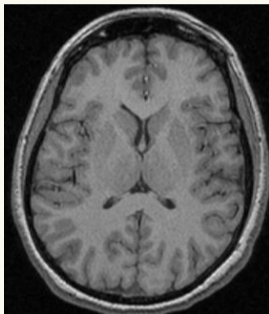
By the end of this lecture you should know:

1. Understand the imaging planes of the brain.
2. Identify the anatomical structure of cerebral hemispheres on radiological images on different planes.
3. Identify the location of different cerebral functions (motor /sensory/ language) on radiological images on different planes.
4. **Select the best plane for a particular cerebral anatomical structure.**

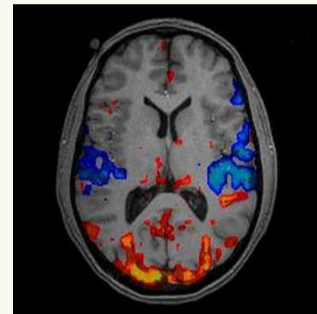


# What we image?

## Morphology



## Function



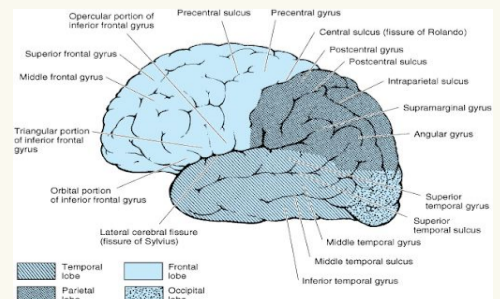
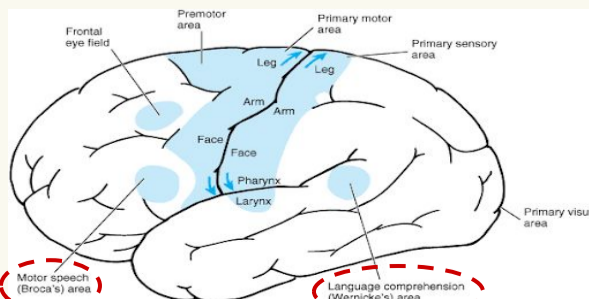
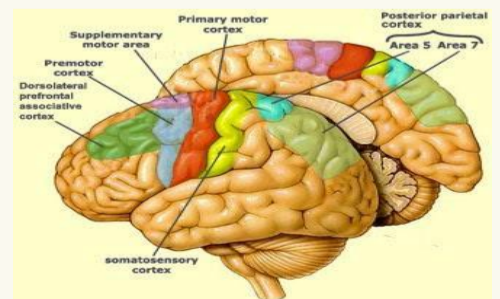
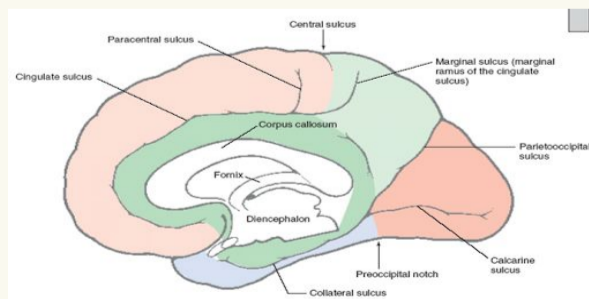
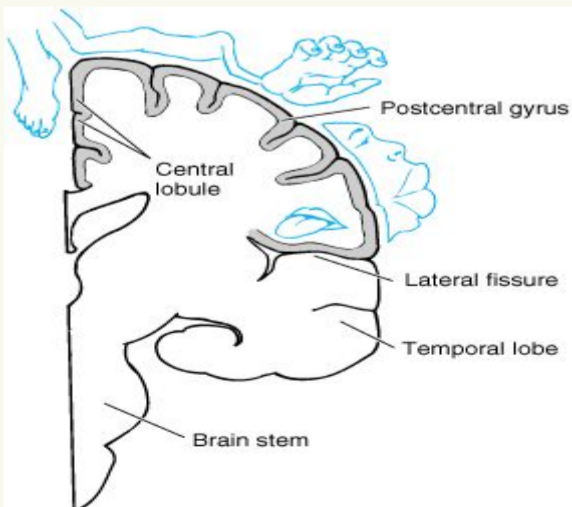
Computed Tomography (CT)	Magnetic Resonance Imaging (MRI)
Ionizing Radiation <i>So it is not used in pregnant and children</i>	No ionizing radiation
Quick (2-3 min)	Lengthy (15-20 min)
Low resolution	High resolution
Single plane	Multiple planes

• CT with **Contrast** shows blood vessels (Bright)

• MRI T1 Fluid is dark T2 fluid is bright  
• MRI Angio (MRA) doesn't need contrast because MRI is very sensitive to flow

## Anatomy recap: ★

- Central sulcus  
Anterior to it > precentral gyrus - Posterior to it > postcentral gyrus
- lateral sulcus ( Sylvian fissure)  
Superior to it > frontal and part of parietal - Inferior to it > temporal lobe
- sulcus that only see in the medial  
Cingulate -parietooccipital - calcarine - collateral sulcus



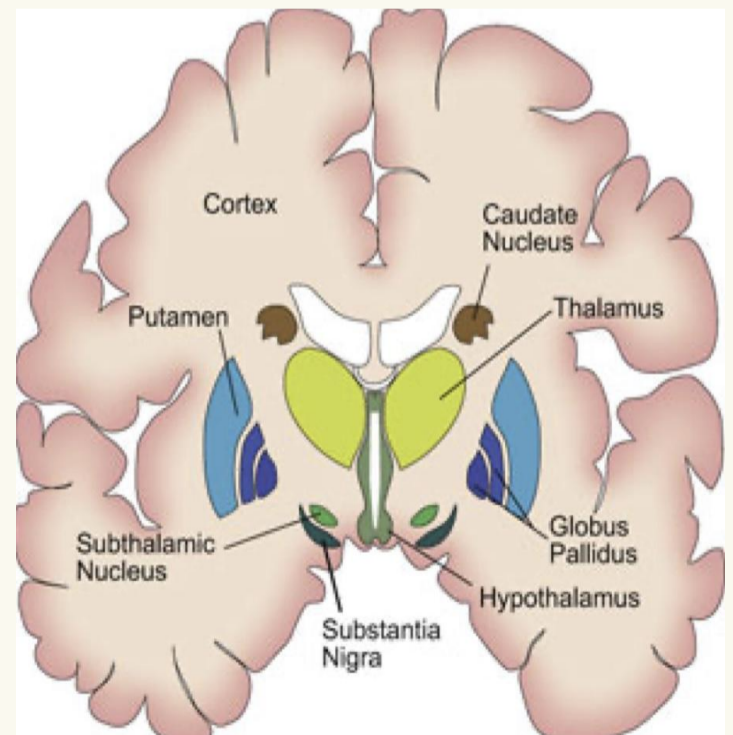
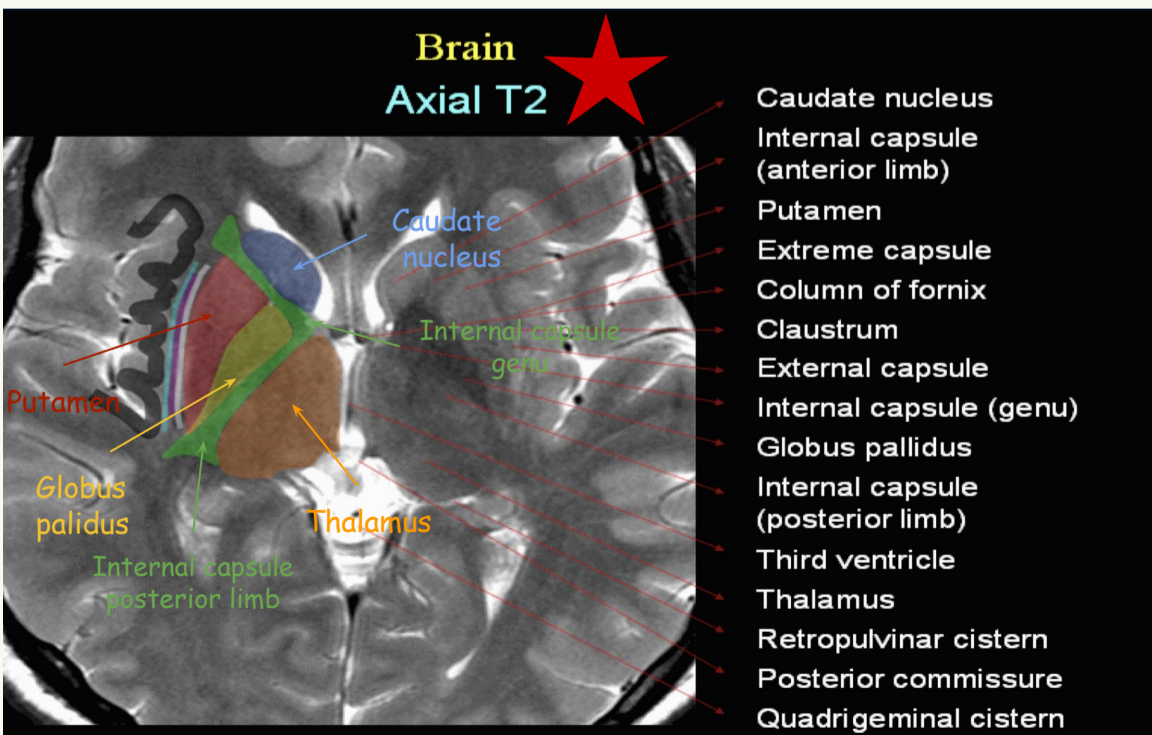
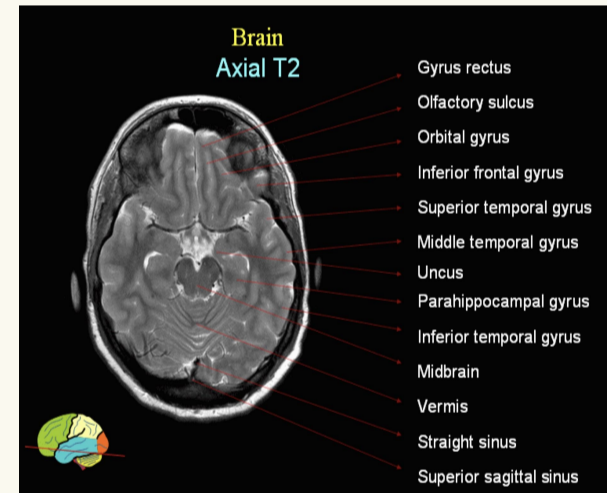
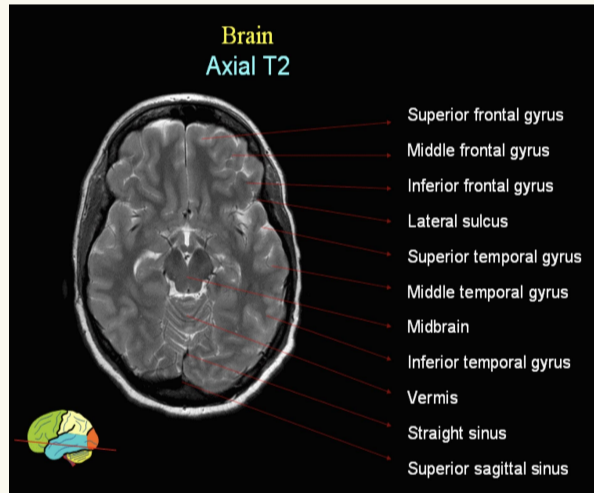
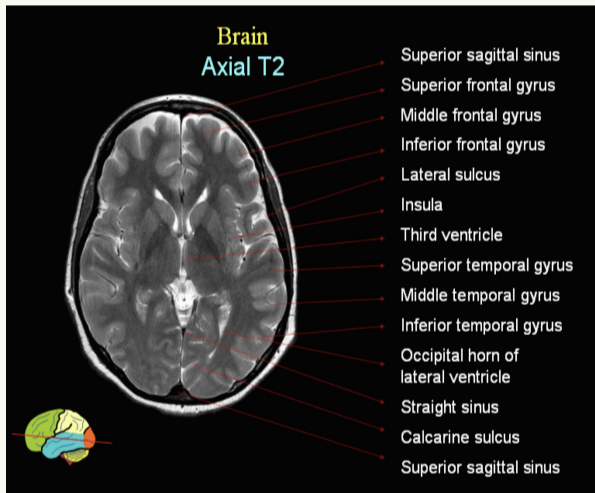
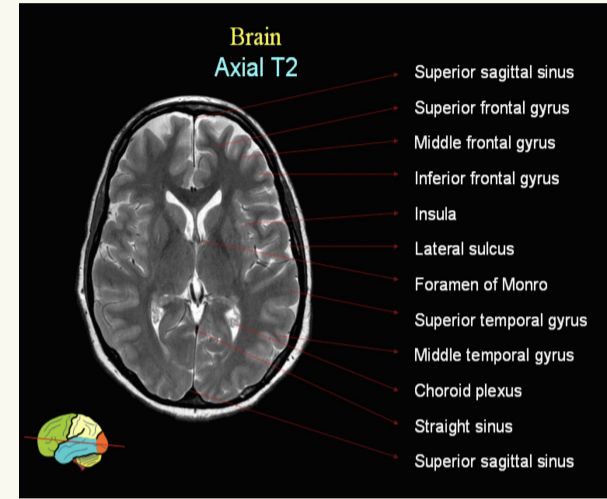
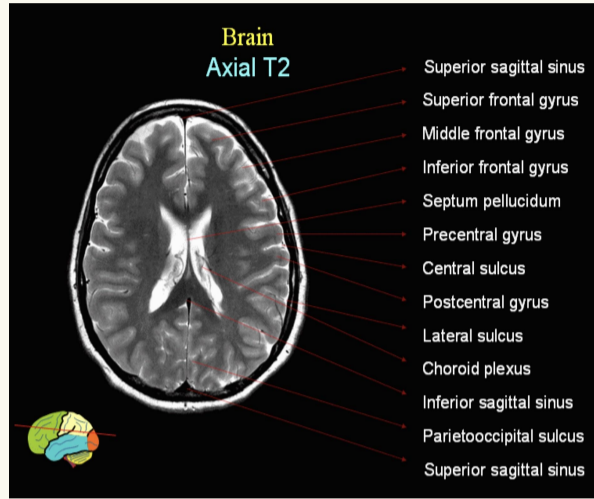
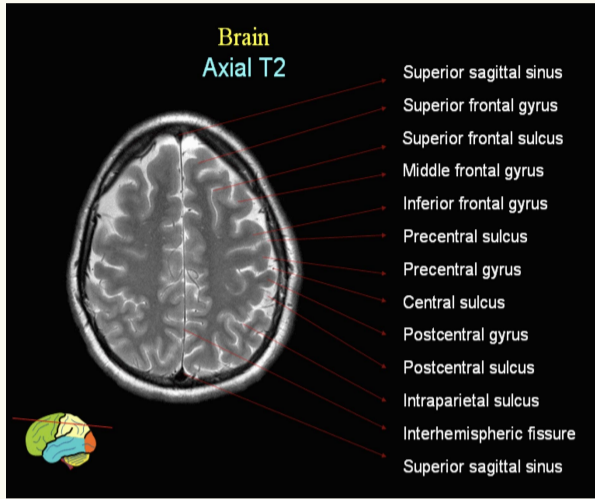
- **Broca's area:** in inferior frontal gyrus of dominant hemisphere usually left, if any lesion effect this area patient will understand but have difficult to speech (non fluent aphasia)
- **Wernicke's area:** in superior temporal gyrus if any lesion effect this area patient will not understand but will speak meaningless (fluent aphasia)



- **Axial:**

- insula lies deep in lateral sulcus ( Sylvius fissure ) and it cover by frontal and temporal lobe
- between Third ventricle and lateral ventricle there is a foramen of Monro

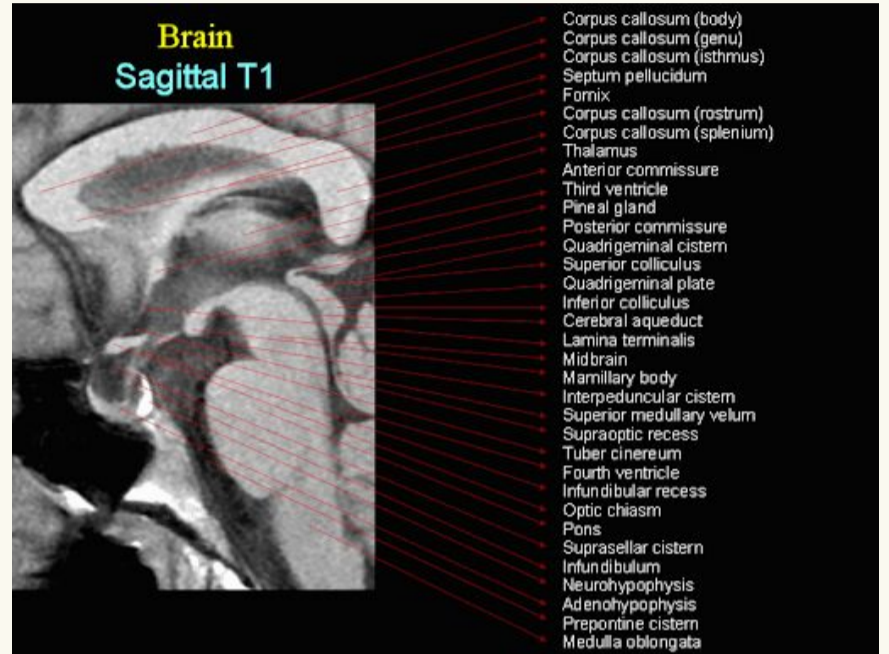
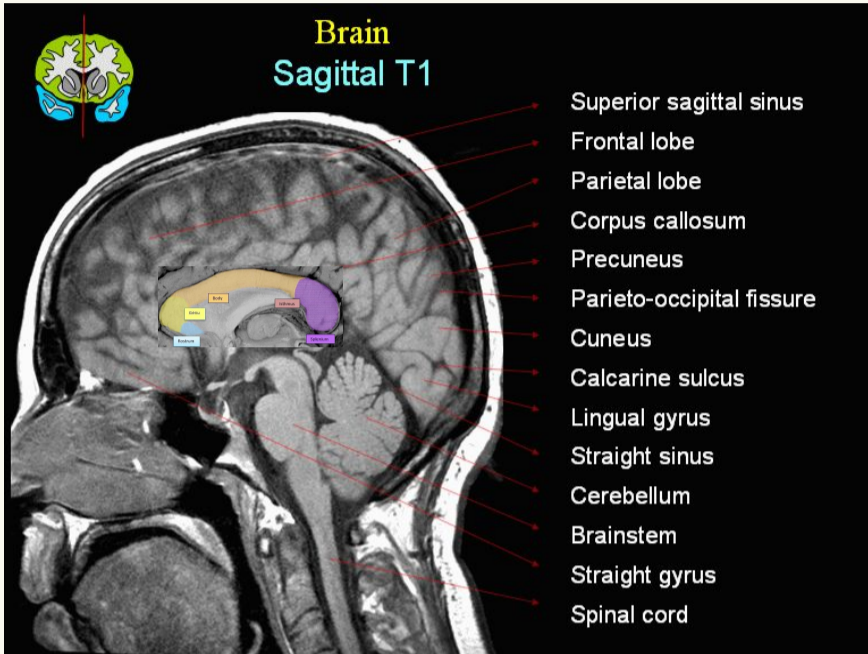
- the superior Sagittal sinus extend up down



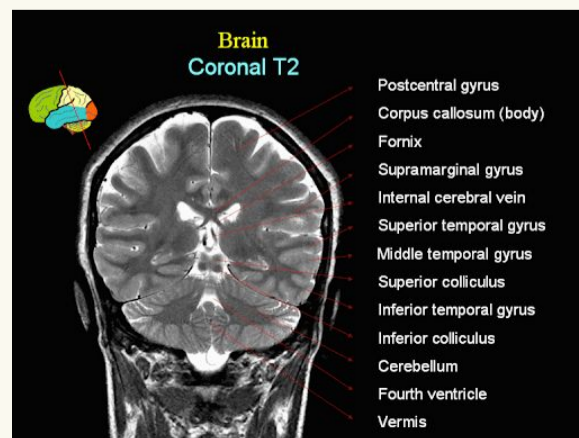
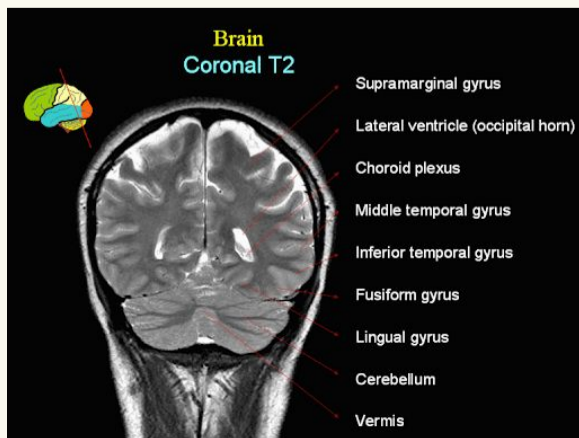
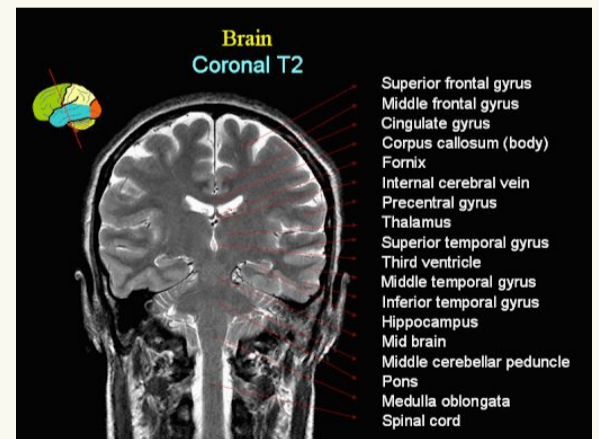
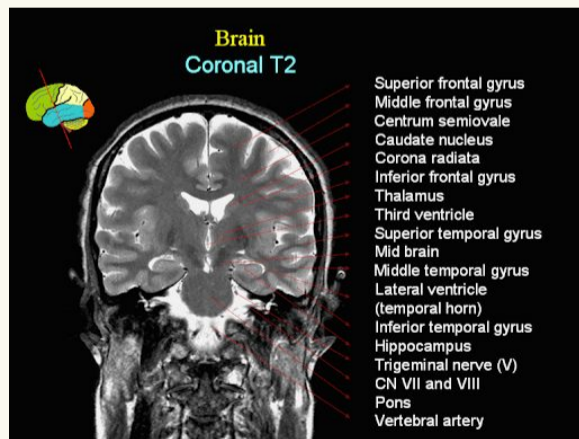
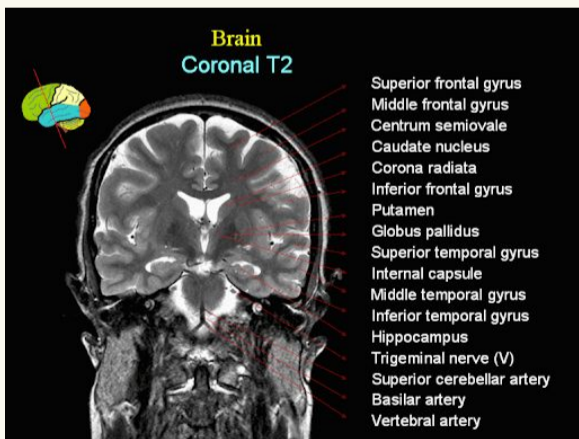
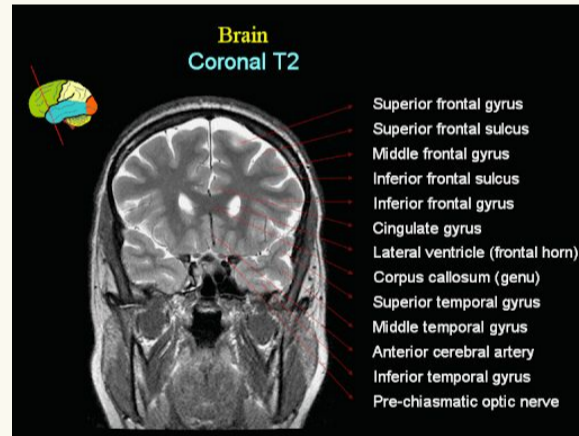
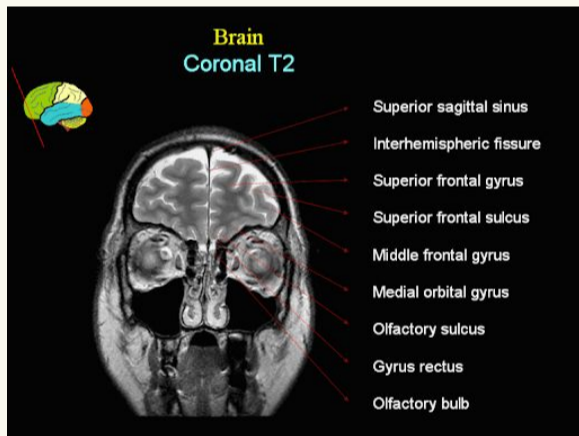
- if there a hypertension in basal ganglia it will lead to hemorrhage especially in putamen
- Putamen + globus pallidus = lentiform nucleus



• **Sagittal:**



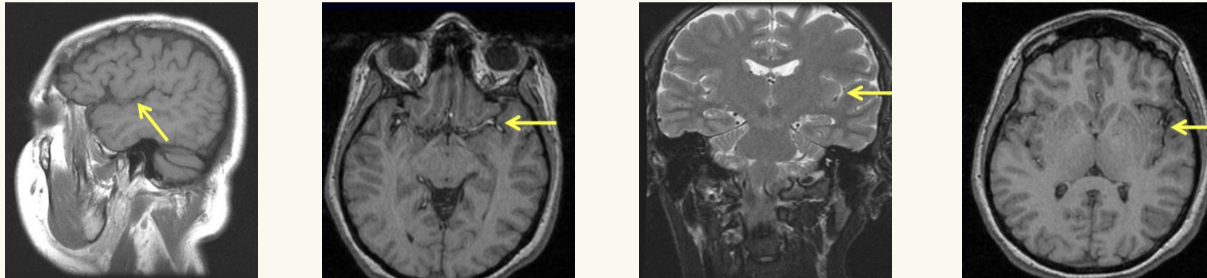
• **Coronal:**





# Multiplane Correlation

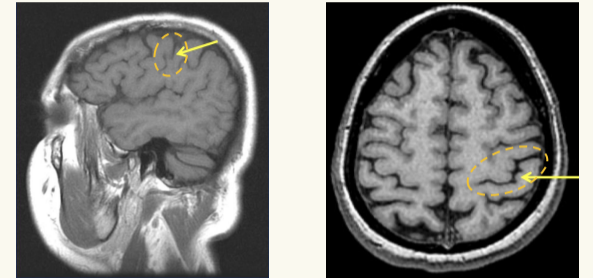
## Sylvian Fissure



Sylvian fissure (separate frontal lobe from temporal lobe).

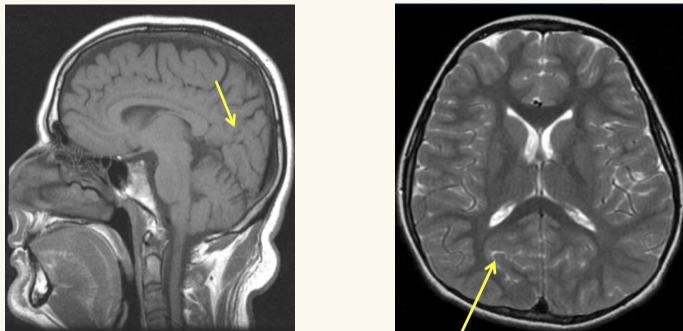
- **MCA runs here**
- It branches when it hits the insular cortex

## Central (Rolandic) fissure



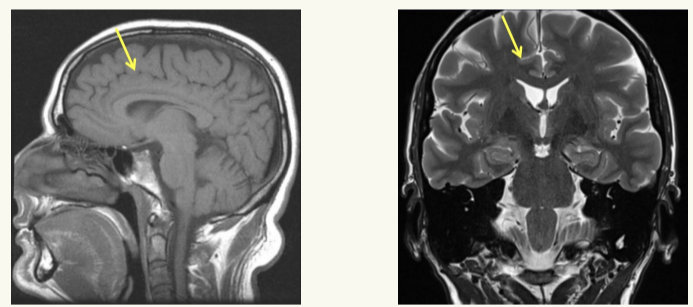
Central sulcus (Separate Frontal from parietal)

## Parieto-occipital fissure



Parieto-occipital sulcus (Separate parietal from occipital)

## Cingulate Sulcus



Cingulate sulcus (separate Cingulate gyrus from frontal lobe)

## • Shortcuts:

**SuFrG:** Superior frontal gyri

**PrCG:** Precentral gyri

**InFrG:** Inferior frontal gyri

**MFrG:** Middle frontal gyri

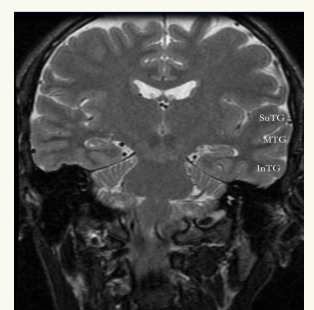
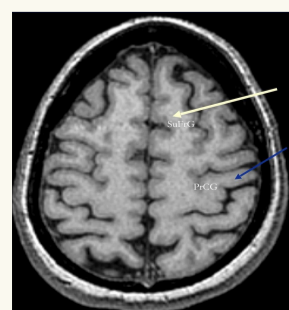
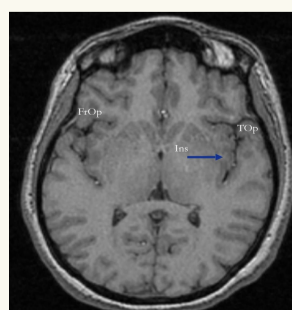
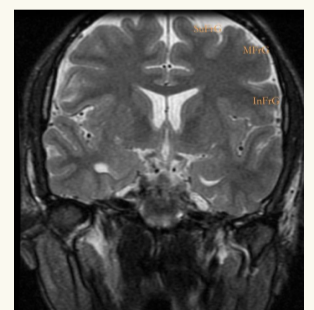
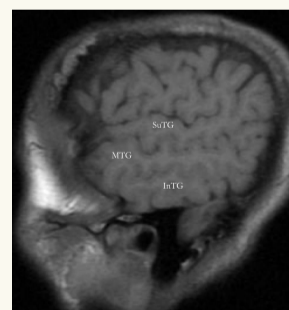
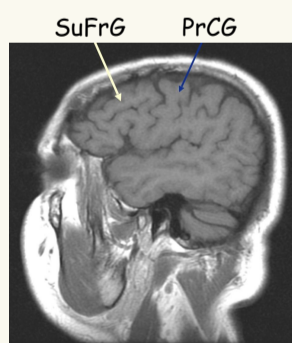
**Ins:** Insula: it lies deep in lateral sulcus (Sylvius fissure) and it cover by frontal and temporal lobe.

**TOp:** Temporal Lobe

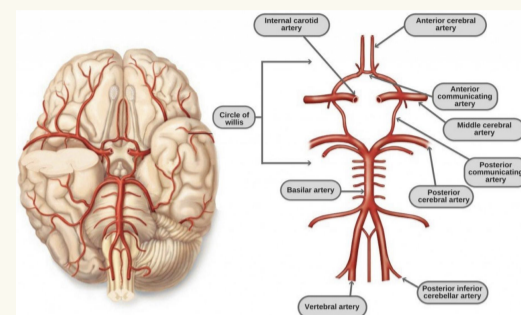
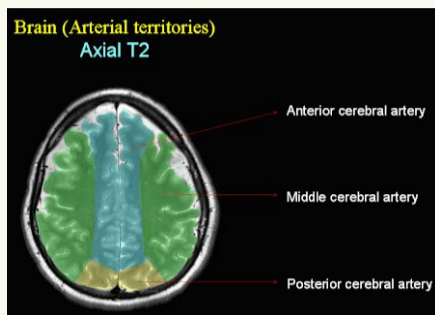
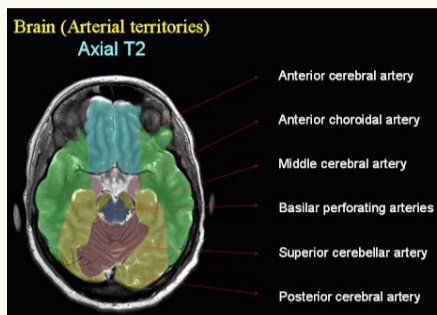
**SuTG:** Superior temporal gyri

**MTG:** Middle temporal gyri

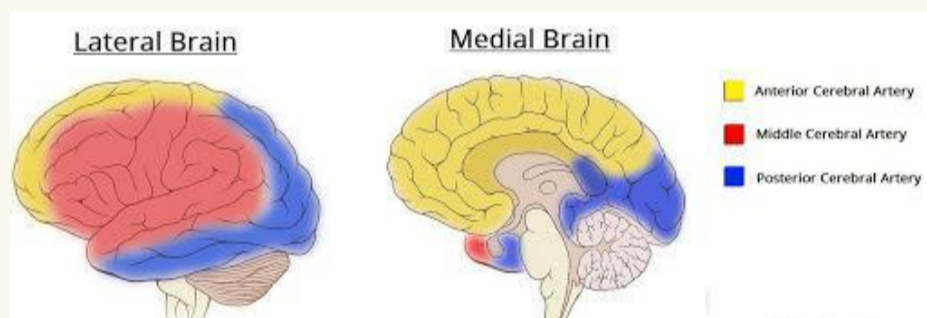
**InTG:** Inferior temporal gyri



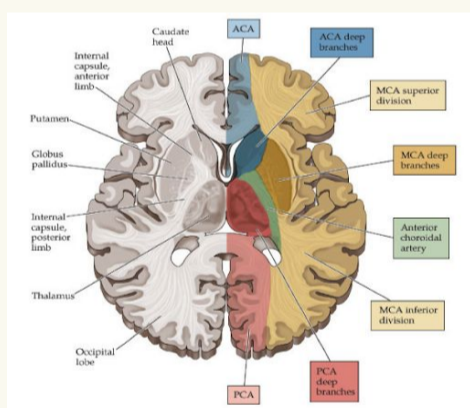
# Cerebral blood supply



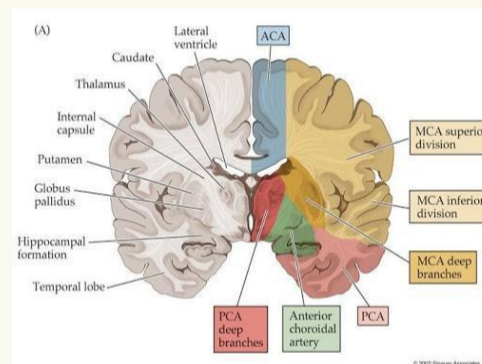
- lateral brain supply mostly by middle cerebral artery (frontal + parietal + temporal)
- medial brain mainly supply by anterior cerebral artery except occipital lobe supply by posterior cerebral artery
- hippocampus + posterior limb of internal capsule supply by anterior choroidal artery.
- Stroke in medial of frontal lobe >>> anterior cerebral artery
- Stroke in medial of occipital >> posterior cerebral artery
- Stroke in Prepontine >> basilar artery
- Stroke in thalamus >> posterior cerebral artery



## Axial ★



## Coronal ★

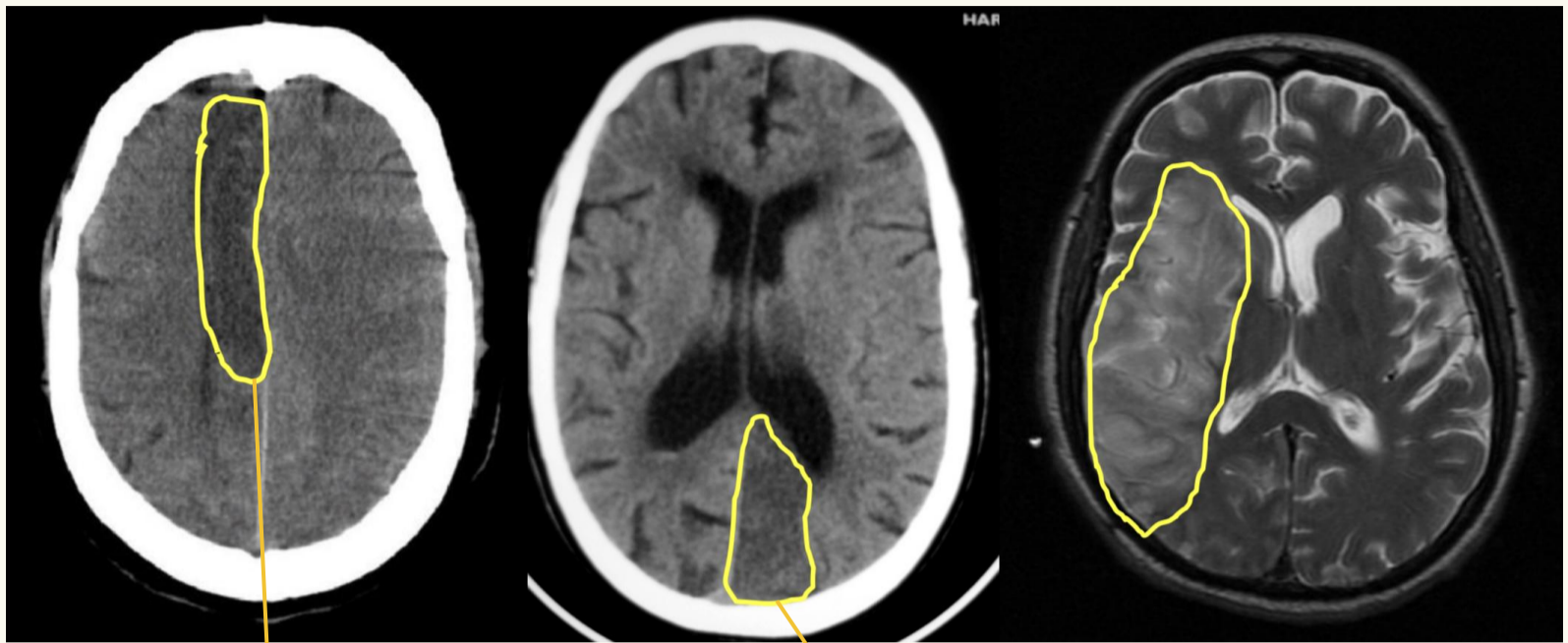


## Cerebral blood supply recap: ★

- Temporal = MCA & PCA
- Frontal = ACA & MCA
- Occipital = PCA
- Thalamus is supplied by PCA
- Superior temporal or inferior frontal = MCA
- Most medial part of the frontal and the medial surface of the brain = ACA
- The occipital and part of the temporal lobe = PCA
- anterior limb of internal capsule = branch of ACA
- Posterior limb of internal capsule = anterior choroidal artery "branch of MCA"
- If reaches the internal capsule will cause contralateral hemiparesis.
- ACA infarction = legs effects
- MCA= Hands, body, trunk and face
- Thalamus is supplied by PCA

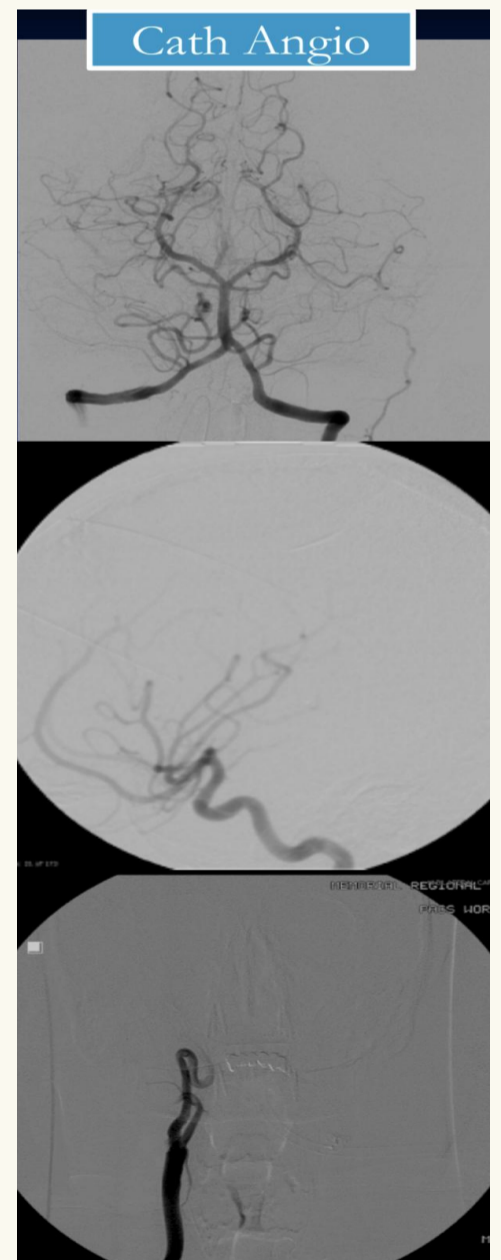
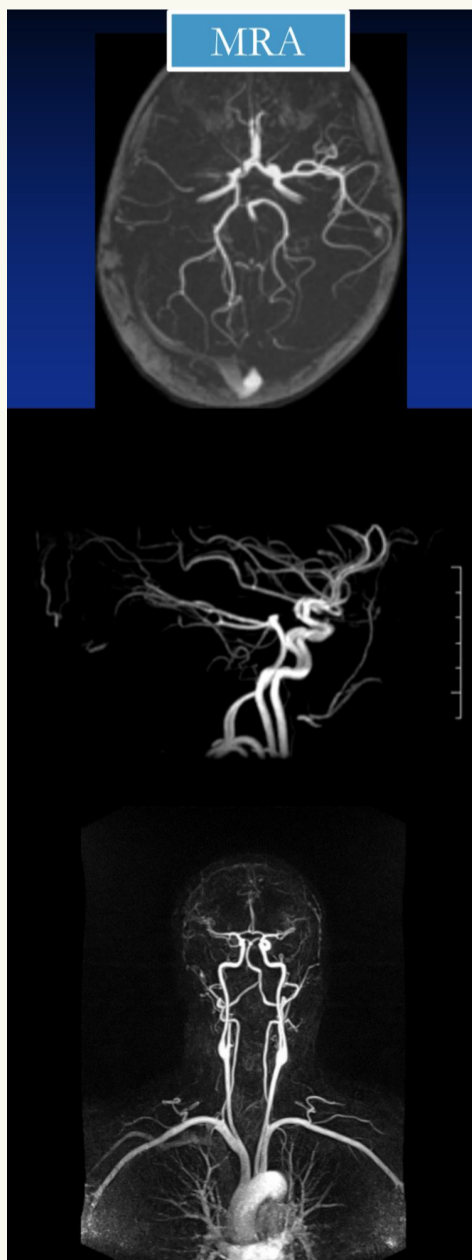
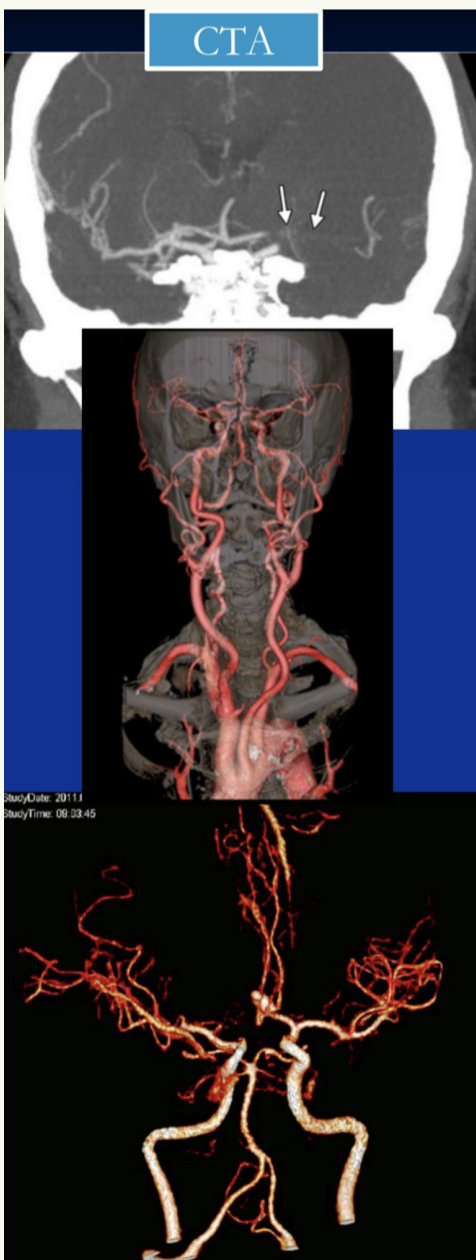
Anterior choroidal infarction causes FULL contralateral weakness (all corticospinal fibers go through internal capsule). If the infarction was in the cortex you will have partial weakness (arm or foot depending on location).





Medial part of hemisphere will affect the leg

Will cause bilateral hemisphere



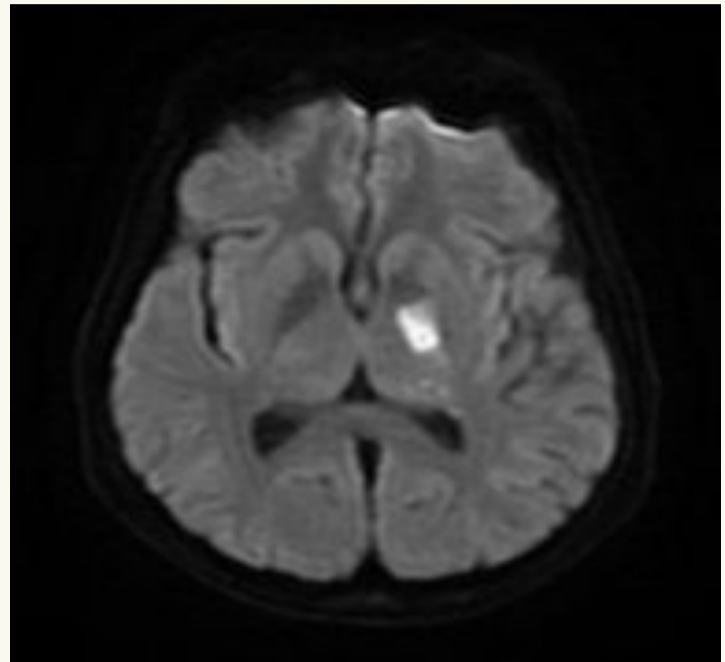
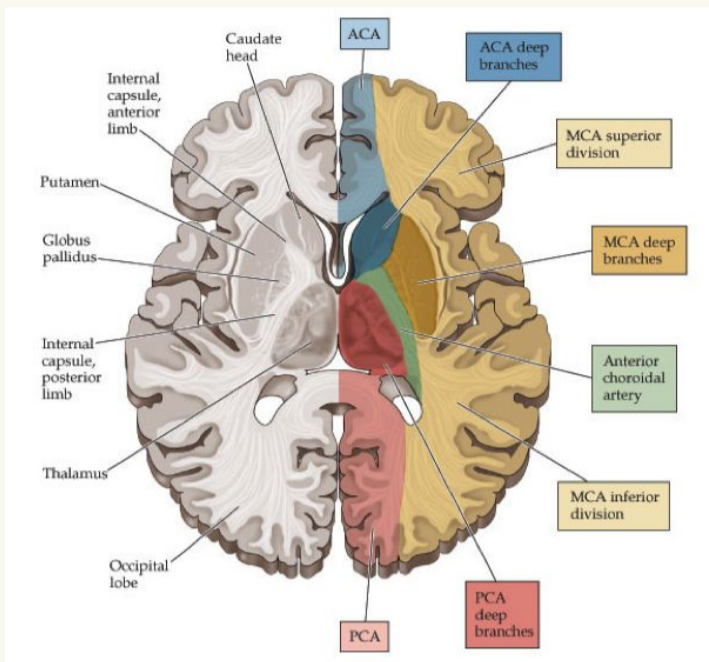




# Helpful Drs notes

- Central sulcus
    - Anterior to it > precentral gyrus - Posterior to it > postcentral gyrus
  - lateral sulcus ( Sylvius fissure)
    - Superior to it > frontal and part of parietal - Inferior to it > temporal lobe
  - sulcus that only see in the medial:
    - Cingulate -parietooccipital - calcarine - collateral sulcus
  - Broca's area: in inferior frontal gyrus of dominant hemisphere usually left if any Lesion effect this area patient will understand but have difficult to speech ( non fluent aphasia )
  - Wernicke's area : In superior temporal gyrus if any lesion effect this area patient will not understand but will speak meaningless ( fluent aphasia )
  - lesion is primary visual area will effect the vision
  - ★ insula lies deep in lateral sulcus ( Sylvius fissure ) and it cover by frontal and temporal lobe
  - ★ between third ventricle and lateral ventricle there is a foramen of Monro
  - ★ vessel that run in Sylvius fissure is ( middle cerebral artery)
  - ★ if there a hypertension in basal ganglia it will lead to hemorrhage especially in putamen
  - ★ putamen + globus pallidus = lentiform nucleus
  - ★ Cingulate sulcus located superior to corpus callosum
  - ★ lateral brain supply mostly by middle cerebral artery ( frontal+ parietal + temporal)
  - ★ How medial brain mainly supply by anterior cerebral artery except occipital lobe supply by posterior cerebral artery
  - ★ hippocampus + posterior limb of internal capsule supply by anterior choroid artery ( case )
- 
- CT with Contrast shows blood vessels (Bright)\*
  - MRI T1 Fluid is dark T2 fluid is bright\*
  - MRI Angio (MRA) doesn't need contrast because MRI is very sensitive to flow
  - Cath Angio contrast is injected in artery not vein
  - Important landmarks:
- 
- ❖ Lateral surface
    - ☐ Sylvian fissure (separate frontal lobe from temporal lobe).
    - MCA runs here
    - It branches when it hits the insular cortex
    - ☐ Central sulcus (Separate Frontal from parietal)
    - ☐ Temporal Lobe
    - Superior temporal sulcus
    - Inferior temporal sulcus
    - ☐ Frontal Lobe
    - Superior Frontal sulcus
    - Middle Frontal sulcus.
  - ❖ Medial surface
    - ☐ Cingulate sulcus (separate Cingulate gyrus from frontal lobe)
    - ☐ Parieto-occipital sulcus (Separate parietal from occipital)
    - Internal choroidal artery is a direct branch of internal carotid but sometimes it's a branch of MCA
    - Face hands and part of leg are supplied by MCA while distal leg and foot are supplied by ACA (Homunculus pic)
    - Anterior choroidal infarction causes FULL contralateral weakness (all corticospinal fibers go through internal capsule). If the infarction was in the cortex you will have partial weakness (arm or foot depending on location).

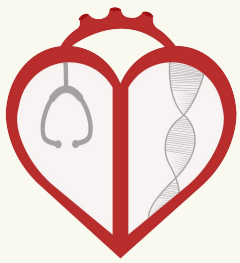
# MCQs



This MR image shows acute infarction.

<b>1-What is the artery involved?</b>			
A) Anterior cerebral	B) Anterior choroidal	C) Posterior cerebral	D) Middle cerebral
<b>2-What is the expected neurological deficit?</b>			
A) Right leg weakness	B) Right arm weakness	C) Right body side weakness	D) Left leg weakness
<b>3-Which of the following runs within the lateral/sylvian fissure?</b>			
A) MCA	B) ACA	C) PCA	D) Anterior choroidal
<b>4-Which of the following supplies the Anterior limb of internal capsule?</b>			
A) MCA	B) ACA	C) PCA	D) Anterior choroidal
<b>5-Damage to the lateral side of the hemisphere will affect predominantly?</b>			
A) Legs	B) Arms	C) Face	D) Toes





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## Team leaders

- Ibrahim Alabdulkarim 
- Reem Alamri 

## Team members

- Abdullah Almazro
- Abdulaziz Alomairy
- Renad Alosaimi
- Sara Alrashidi
- Abdulrahman Addweesh 

## Organizer

- Reema Alhadlq 

## Reviewer

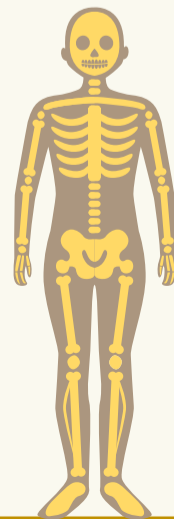
- Mansour Albawardy 

## Note taker

- Homoud Algadheb 

♥ Special thanks to  
Shatha Aldhohair

Editing file



 [@TeamRadiology](https://twitter.com/TeamRadiology)

[Radiology439@gmail.com](mailto:Radiology439@gmail.com)



Work done by