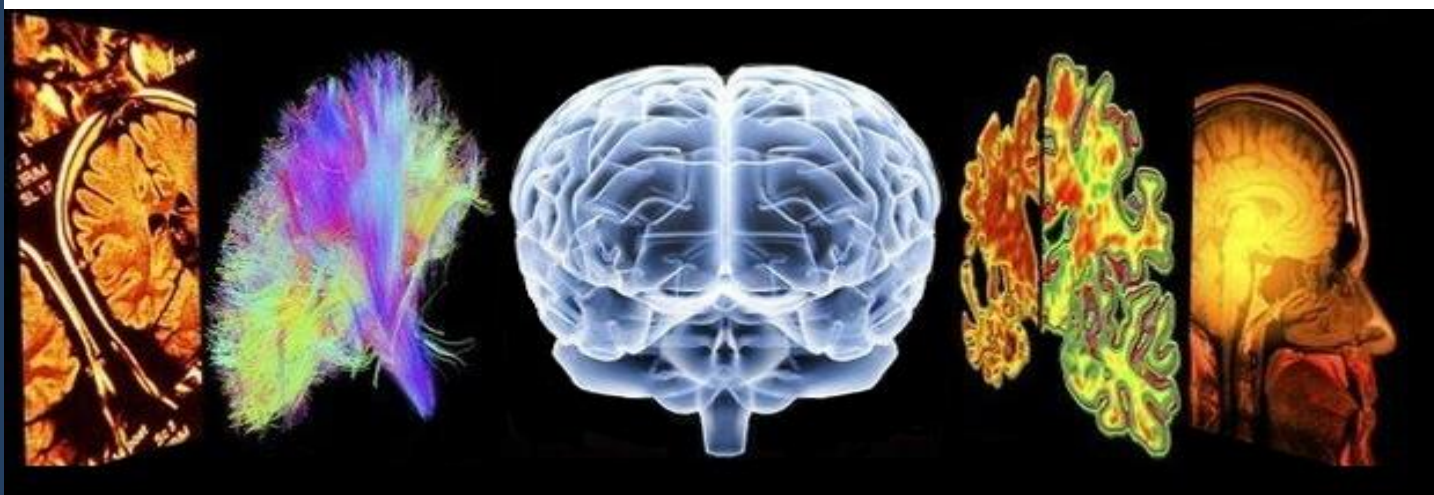




RADIOLOGY

TEAM 435

CNS PRACTICAL RADIOLOGY



We highly recommend studying practical anatomy first!

Please check out the this [link](#) for any future changes or additions.

Red = Important

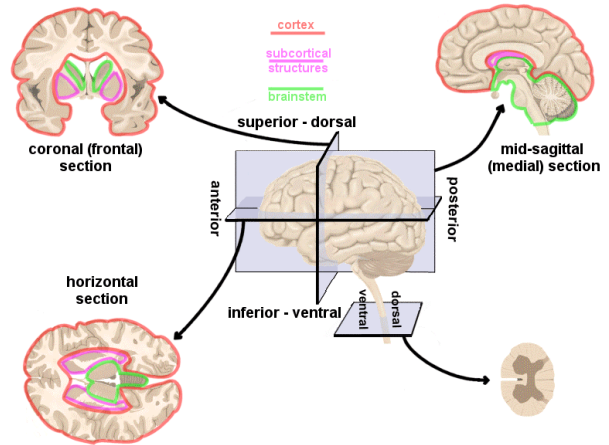
Grey = Extra notes

❖ Introduction:

at the beginning we're going to review some basics.

❖ Body sections:

- Coronal (frontal) plane.
- Midsagittal (median) plane.
- Transverse (horizontal) plane.

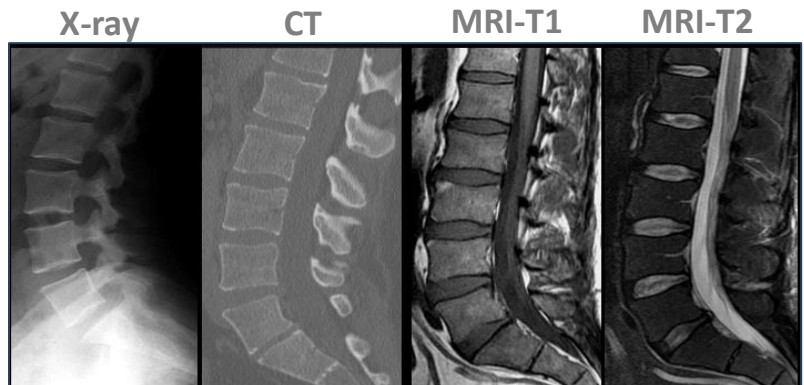


❖ Types of Imaging views:

- PA (posterior-anterior) view.
- AP (anterior-posterior) view.
- Lateral view
- Open mouth view.

❖ Imaging modalities:

- US (Ultra Sound)
- X-ray (Radiographs)
- Angiography.
- CT scan (Computerized Tomography)
- MRI (Magnetic Resonance Imaging)
 - T1 WI
 - T2 WI



❖ Coloration:

	US	X-ray	CT	MRI
Black coloration	Hypo-echoic	Radiolucent	Hypo-dense	Hypo-intense
White coloration	Hyper-echoic	Radiopaque	Hyper-dense	Hyper-intense



❖ Imaging modalities :

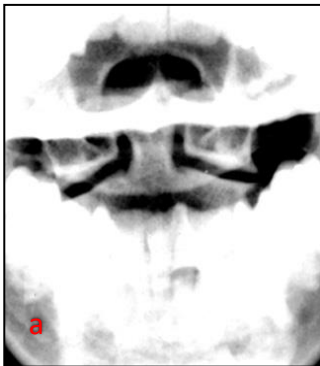
➤ X-Rays :

Often the first diagnostic imaging test ordered by physicians.

- quick and cheap.
- Uses small dose of radiation to visualize the bony parts.
- Can detect:
 - Spinal alignment and curvature.
 - Spinal instability – with flexion and extension views
 - Congenital (birth) defects of spinal column. (like scoliosis)
 - Fractures caused by trauma.
 - Moderate osteoporosis (loss of calcium from the bone)
 - Infections.
 - Tumors.
- **Important for assessing cervical spine.** Has to include all the cervical vertebrae + the junction between C7 and T1.



AP view - patient with scoliosis



Figures: a) open mouth view . b) an **adequate** AP view . c) an **adequate** lateral view . d) is **not an adequate** film; because only 6 vertebrae are seen , has to include all the 7 + the junction between C7 & T1.

➤ CT:

- Uses ionized radiation.
- Gold standard of imaging for Bone fractures
- Obtain 2-D images >> can be processed to 3-D images.
- Entire spine can be imaged within a few minutes.
- Detailed information regarding bony structures.
- **Limited information about spinal cord & soft tissues.**



Sagittal plane

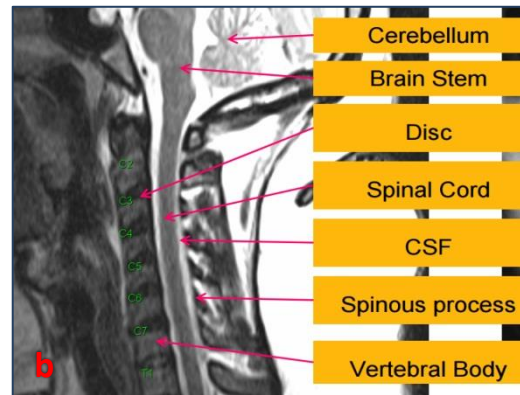


➤ MRI.

- Gold standard of imaging for spinal cord disorders.
- **No radiation**
- Can identify abnormalities of bone, soft tissues and spinal cord.
- Time consuming. (takes from 15 to one hour to get a full picture)
- Claustrophobic patients, uncooperative and children may need sedation or general anaesthesia
- **Contraindications include implanted devices e.g. cardiac pacemakers and electromagnetic devices.** (most of modern artificial joints and advanced cardiac pacemakers are MRI friendly)
- **Has 2 common sequences:**
 - **T1 weighted image.** (Fat = light color and CSF = dark color)
 - **T2 weighted image.** (Fat = dark color and CSF = light color)



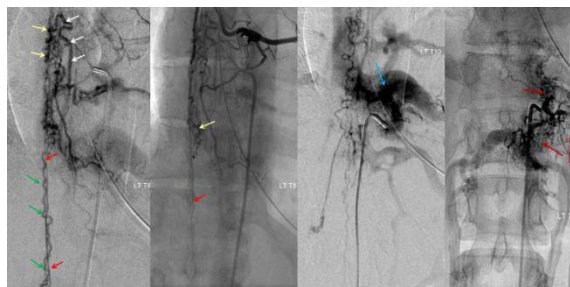
Figures: a) T2 WI – coronal section.



b) T2 WI – sagittal section.

➤ Angiography :

spinal angiogram is used to evaluate arteries and veins e.g. If you suspect arteriovenous fistula, arteriovenous malformation, vessel narrowing or blockage.

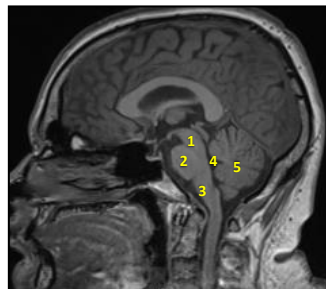
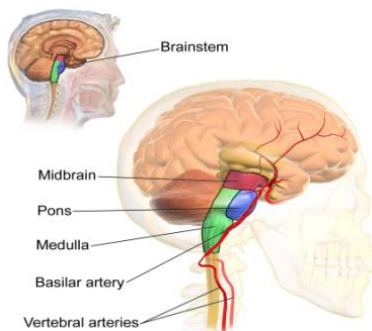


This image wasn't in the lecture its only for clarifying



❖ Brain Stem :

- 1- mid brain.
- 2- pons.
- 3- medulla oblongata.
- 4- 4th ventricle .
- 5- cerebellum.

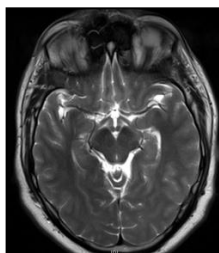


MRI T1 WI

➤ Midbrain .

Radiological Features:

- At the level of circle of Willis.
- Anteriorly two cerebral peduncles separated by interpeduncular fossa.
- Posteriorly four rounded prominences (superior and inferior colliculi).

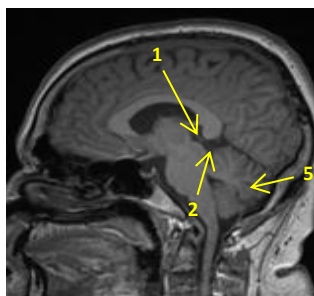


MRI axial T2WI

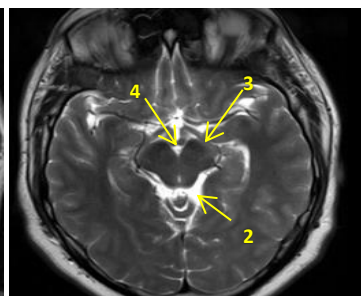


CT

1. superior colliculus
2. inferior colliculus
3. cerebral peduncle
4. interpeduncular cistern
5. Cerebellum.



MRI sagittal T1WI



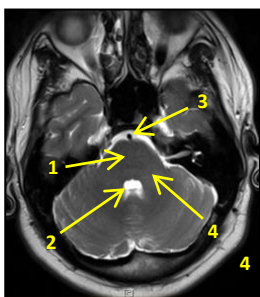
MRI axial T2WI

➤ Pons .

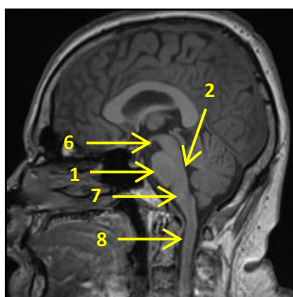
Radiological Features:

- Basilar artery lies in groove anteriorly.
- Posterior surface of the pons forms the upper part of the floor of the 4th ventricle.
- Bony anterior relation:
clivus centrally and petrous temporal bones laterally.

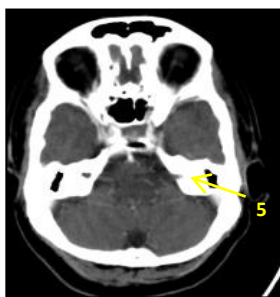
Pons is connected to the cerebellum by middle cerebellar peduncle Separated from the cerebellum by the 4th ventricle.



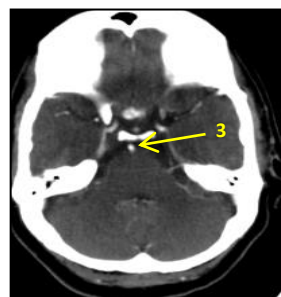
MRI axial T2WI



MRI sagittal T1WI



CT axial



CT axial

1. Pons.
2. 4th ventricle.
3. Basilar artery.
4. Middle cerebellar peduncle.

5. Petrous bone.
6. Midbrain.
7. Medulla
8. Spinal cord

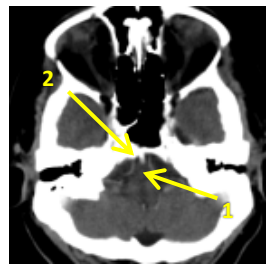


➤ Medulla oblongata .

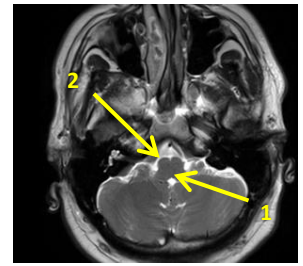
Radiological Features:

- The ventral median fissure is seen anteriorly with the pyramid laterally
- The 4th ventricle is seen posteriorly

Medulla is differentiated by the two pyramids separated by the ventral median fissure.



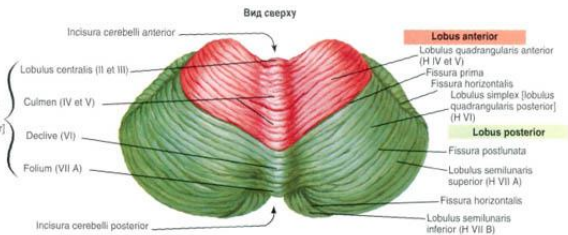
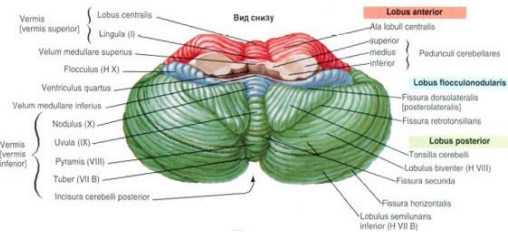
CT



MRI axial T2WI

1. Medulla.
2. 2 Pyramids.

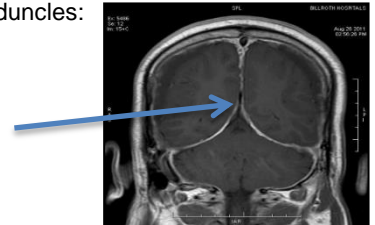
❖ Cerebellum :



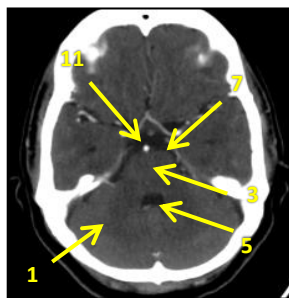
Radiological Features:

- On axial Ct & MRI the cerebellum is separated from the pons by the 4th ventricle and connected to the pons on each side by middle cerebellar peduncle, it is bounded anteriorly by petrous temporal bone.
- Cerebellum is connected to the brainstem by three pairs of cerebellum peduncles:
 - Superior.....connected to the midbrain.
 - Middle.....connected to the pons.
 - inferior.....connected to medulla oblongata.
- Two cerebellar hemisphere with midline vermis.

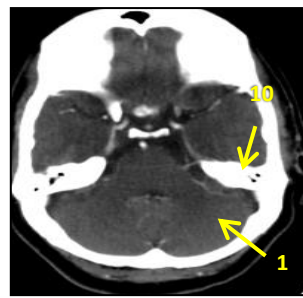
• This **fold** is an extension from the dura meninges separate the cerebellum from the occipital lobe it's called the tentorium.



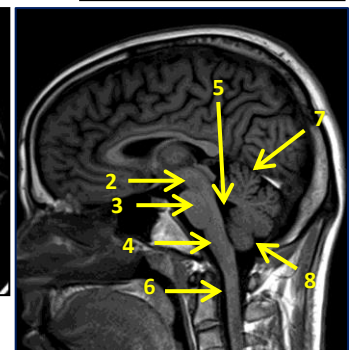
CT axial



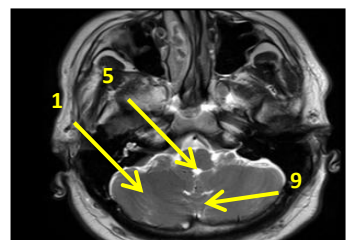
CT axial



CT axial



MRI sagittal T1WI

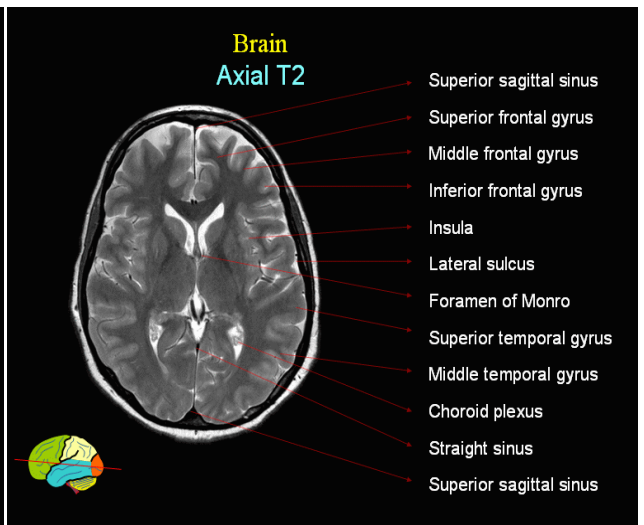
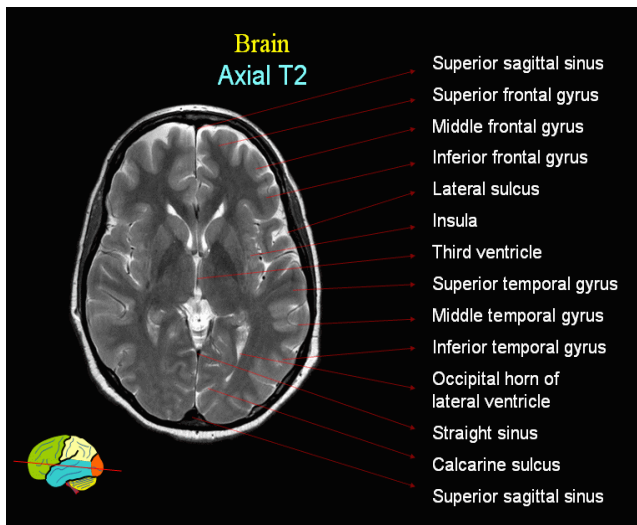
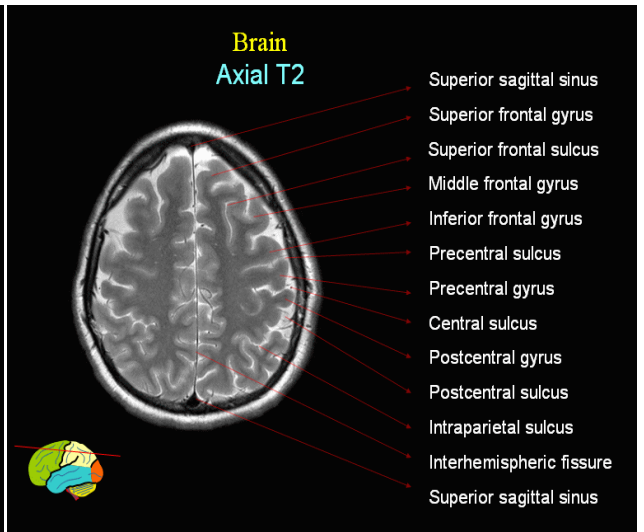
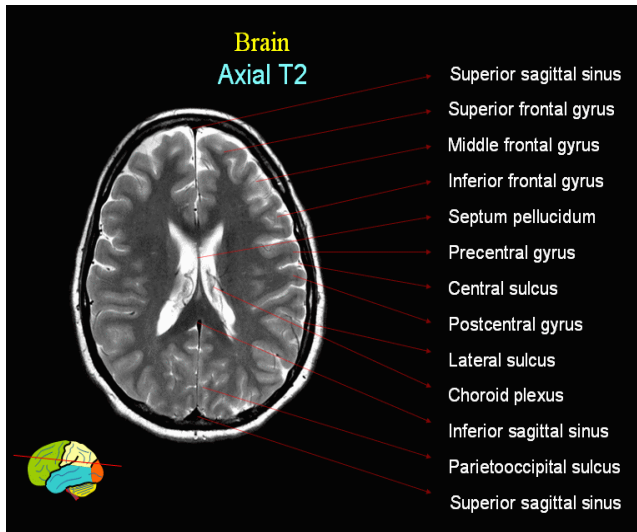
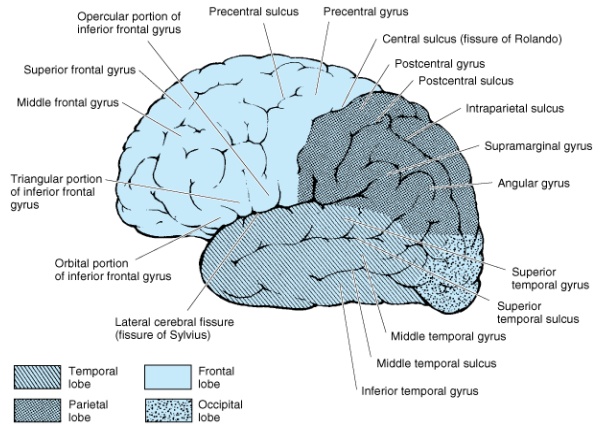
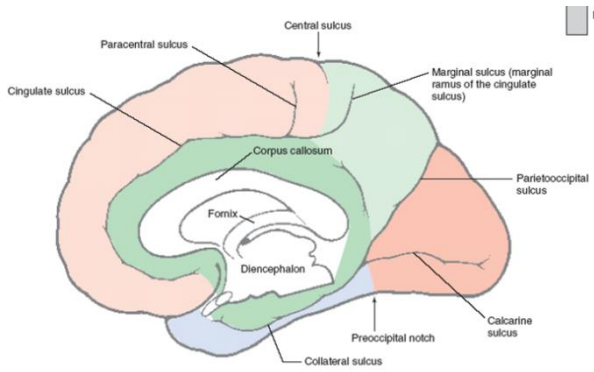


MRI axial T2WI

1. Cerebellum.
2. Mid brain.
3. Pons.
4. Medulla.
5. 4th ventricle.
6. Spinal cord.
7. Tentorium. Separates the cerebellum from the occipital lobe.
8. Tonsil. The most inferior part of the cerebellum.
9. Vermis. The median part of the cerebellum.
10. Petrous bone.
11. Basilar artery.



❖ Cerebral hemisphere :



Brain
Axial T2



- Gyrus rectus
- Olfactory sulcus
- Orbital gyrus
- Inferior frontal gyrus
- Superior temporal gyrus
- Middle temporal gyrus
- Uncus
- Parahippocampal gyrus
- Inferior temporal gyrus
- Midbrain
- Vermis
- Straight sinus
- Superior sagittal sinus

Brain
Axial T2



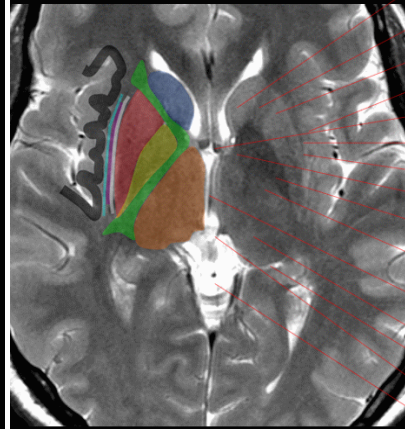
- Superior frontal gyrus
- Middle frontal gyrus
- Inferior frontal gyrus
- Lateral sulcus
- Superior temporal gyrus
- Middle temporal gyrus
- Midbrain
- Inferior temporal gyrus
- Vermis
- Straight sinus
- Superior sagittal sinus

Brain
Sagittal T1



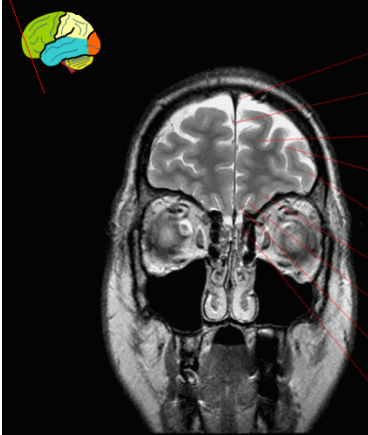
- Superior sagittal sinus
- Frontal lobe
- Parietal lobe
- Corpus callosum
- Precuneus
- Parieto-occipital fissure
- Cuneus
- Calcarine sulcus
- Lingual gyrus
- Straight sinus
- Cerebellum
- Brainstem
- Straight gyrus
- Spinal cord

Brain
Axial T2



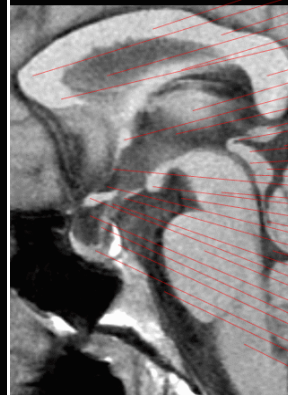
- Caudate nucleus
- Internal capsule (anterior limb)
- Putamen
- Extreme capsule
- Column of fornix
- Clastrum
- External capsule
- Internal capsule (genu)
- Globus pallidus
- Internal capsule (posterior limb)
- Third ventricle
- Thalamus
- Retropulvinar cistern
- Posterior commissure
- Quadrigeminal cistern

Brain
Coronal T2



- Superior sagittal sinus
- Interhemispheric fissure
- Superior frontal gyrus
- Superior frontal sulcus
- Middle frontal gyrus
- Medial orbital gyrus
- Olfactory sulcus
- Gyrus rectus
- Olfactory bulb

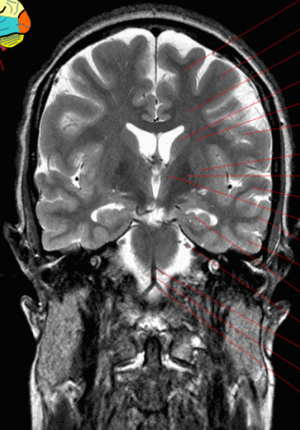
Brain
Sagittal T1



- Corpus callosum (body)
- Corpus callosum (genu)
- Corpus callosum (isthmus)
- Septum pellucidum
- Fornix
- Corpus callosum (rostrum)
- Corpus callosum (splenium)
- Thalamus
- Anterior commissure
- Third ventricle
- Pineal gland
- Posterior commissure
- Quadrigeminal cistern
- Superior colliculus
- Quadrigeminal plate
- Inferior colliculus
- Cerebral aqueduct
- Lamina terminalis
- Midbrain
- Mammillary body
- Interpeduncular cistern
- Superior medullary velum
- Supraoptic recess
- Tuber cinereum
- Fourth ventricle
- Infundibular recess
- Optic chiasm
- Pons
- Suprasellar cistern
- Infundibulum
- Neurohypophysis
- Adenohypophysis
- Prepontine cistern
- Medulla oblongata

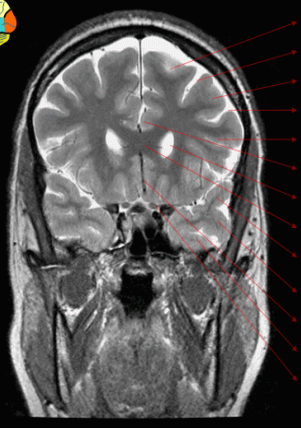


Brain
Coronal T2



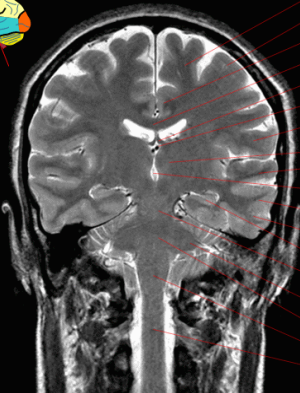
- Superior frontal gyrus
- Middle frontal gyrus
- Centrum semiovale
- Caudate nucleus
- Corona radiata
- Inferior frontal gyrus
- Putamen
- Globus pallidus
- Superior temporal gyrus
- Internal capsule
- Middle temporal gyrus
- Inferior temporal gyrus
- Hippocampus
- Trigeminal nerve (V)
- Superior cerebellar artery
- Basilar artery
- Vertebral artery

Brain
Coronal T2



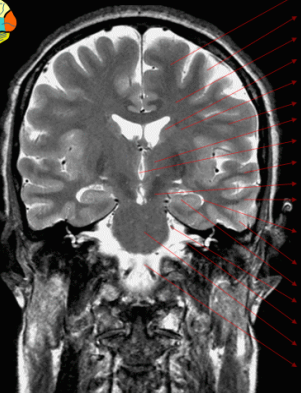
- Superior frontal gyrus
- Superior frontal sulcus
- Middle frontal gyrus
- Inferior frontal sulcus
- Inferior frontal gyrus
- Cingulate gyrus
- Lateral ventricle (frontal horn)
- Corpus callosum (genu)
- Superior temporal gyrus
- Middle temporal gyrus
- Anterior cerebral artery
- Inferior temporal gyrus
- Pre-chiasmatic optic nerve

Brain
Coronal T2



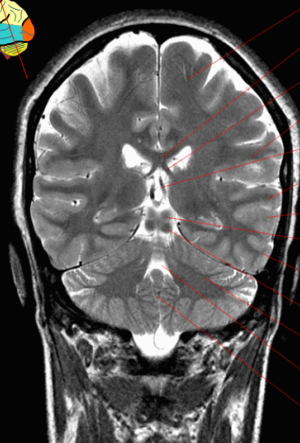
- Superior frontal gyrus
- Middle frontal gyrus
- Cingulate gyrus
- Corpus callosum (body)
- Fornix
- Internal cerebral vein
- Precentral gyrus
- Thalamus
- Superior temporal gyrus
- Third ventricle
- Middle temporal gyrus
- Inferior temporal gyrus
- Hippocampus
- Mid brain
- Middle cerebellar peduncle
- Pons
- Medulla oblongata
- Spinal cord

Brain
Coronal T2



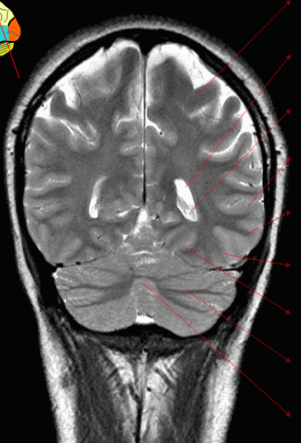
- Superior frontal gyrus
- Middle frontal gyrus
- Centrum semiovale
- Caudate nucleus
- Corona radiata
- Inferior frontal gyrus
- Thalamus
- Third ventricle
- Superior temporal gyrus
- Mid brain
- Middle temporal gyrus
- Lateral ventricle (temporal horn)
- Inferior temporal gyrus
- Hippocampus
- Trigeminal nerve (V)
- CN VII and VIII
- Pons
- Vertebral artery

Brain
Coronal T2



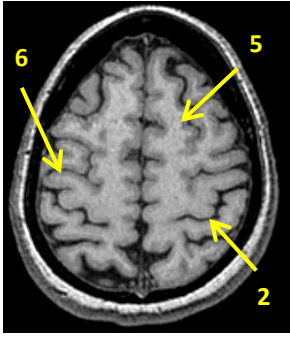
- Postcentral gyrus
- Corpus callosum (body)
- Fornix
- Supramarginal gyrus
- Internal cerebral vein
- Superior temporal gyrus
- Middle temporal gyrus
- Superior colliculus
- Inferior temporal gyrus
- Inferior colliculus
- Cerebellum
- Fourth ventricle
- Vermis

Brain
Coronal T2



- Supramarginal gyrus
- Lateral ventricle (occipital horn)
- Choroid plexus
- Middle temporal gyrus
- Inferior temporal gyrus
- Fusiform gyrus
- Lingual gyrus
- Cerebellum
- Vermis

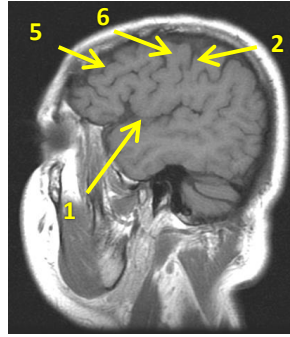




Axial MRI T1WI



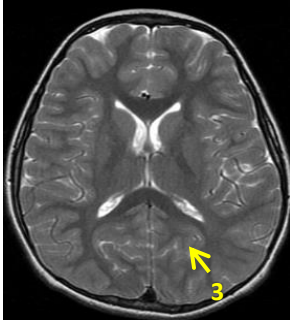
Axial MRI T1WI



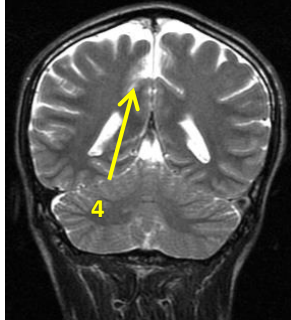
Sagittal MRI T1WI



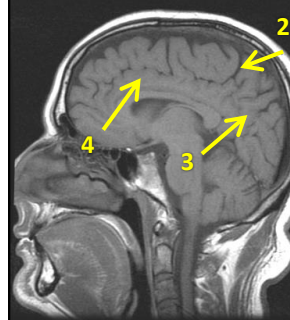
Coronal MRI T2WI



Axial MRI T2WI



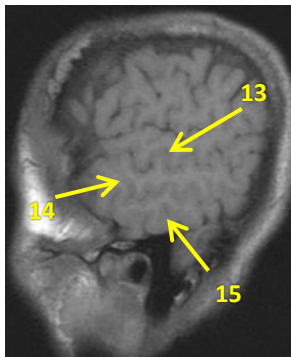
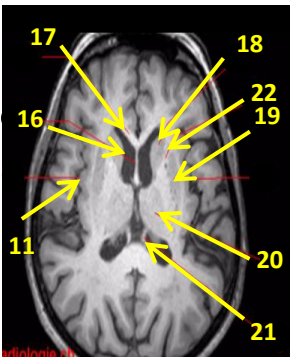
Coronal MRI T2WI



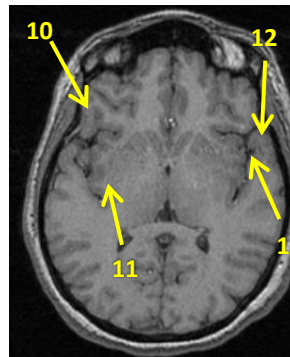
Sagittal MRI T1WI



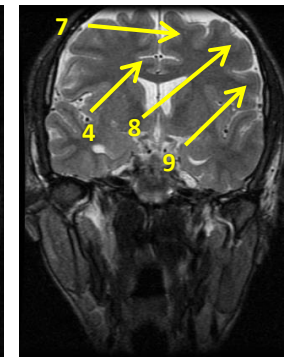
Axial MRI T1WI



MRI T1WI



Axial MRI T1WI



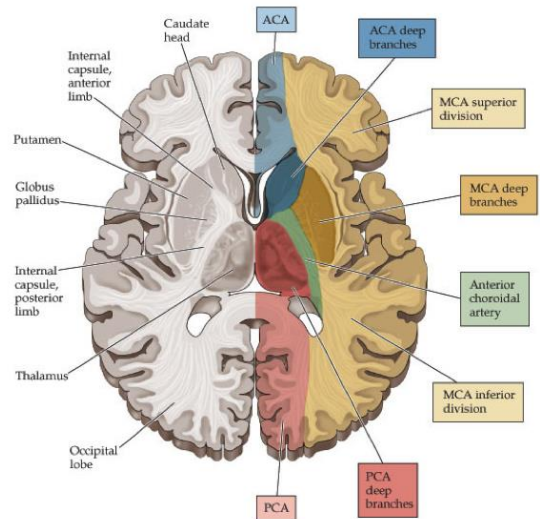
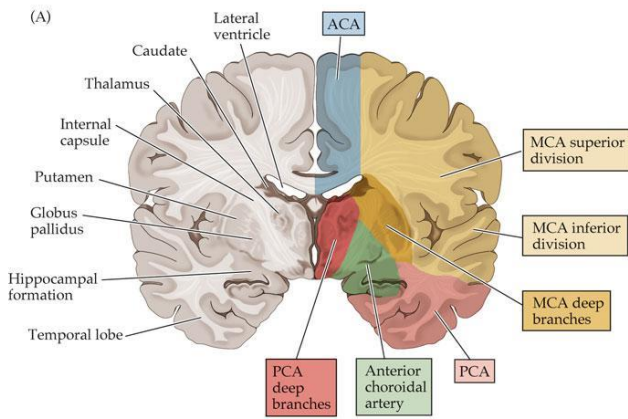
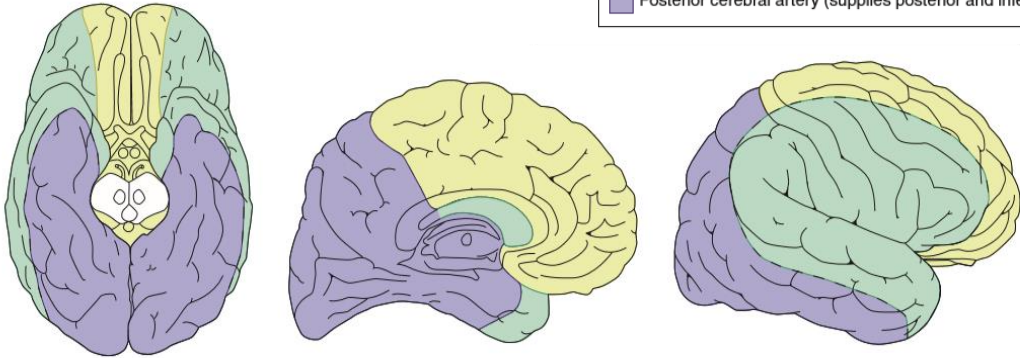
Coronal MRI T2WI

[For more brain radiological information.](#)

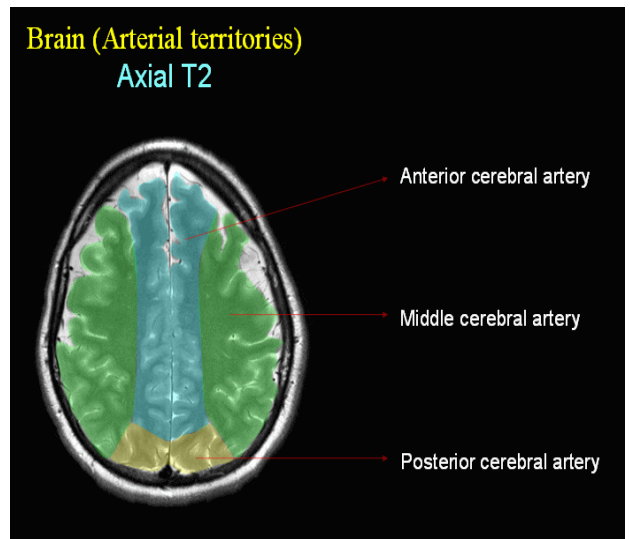
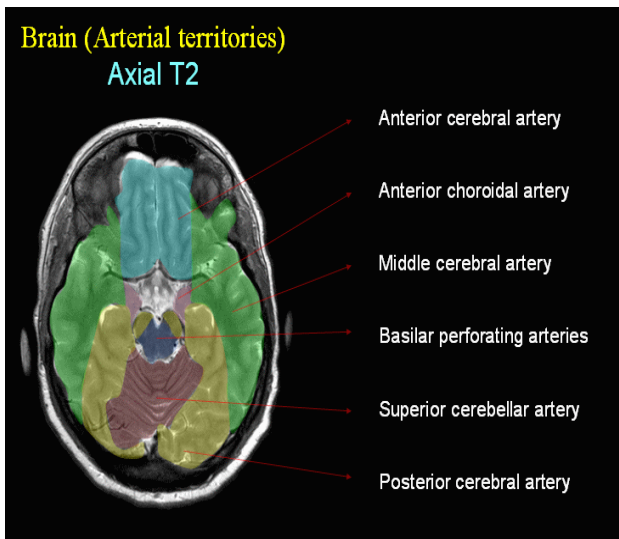
- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Sylvian fissure. (Separates the frontal and temporal lobes) 2. Central fissure. (Separates the frontal and parietal lobes) 3. Parietal-occipital sulcus. 4. Cingulate sulcus. (Separates the cingulate gyrus from the rest of the frontal lobes) 5. Superior frontal gyrus. 6. Pre central gyrus. 7. Superior frontal gyri. 8. Middle frontal gyri. 9. Inferior frontal gyri 10. Frontal operculum . 11. Insula. | <ol style="list-style-type: none"> 12. Temporal operculum. 13. Superior temporal gyrus. 14. Medial temporal gyrus. 15. Inferior temporal gyrus. 16. Septum pellucid. 17. Genu of corpus callosum. 18. Caudate nucleus. 19. Putamen. 20. Thalamus. 21. Pillars of the fornix 22. Anterior arm of internal capsule. |
|--|---|

❖ Cerebral blood supply :

- Anterior cerebral artery (supplies anteromedial surface)
- Middle cerebral artery (supplies lateral surface)
- Posterior cerebral artery (supplies posterior and inferior surfaces)



© 2002 Sinauer Associates, Inc.

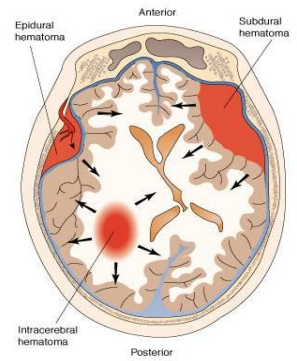


❖ Intracranial bleeding :



9 min

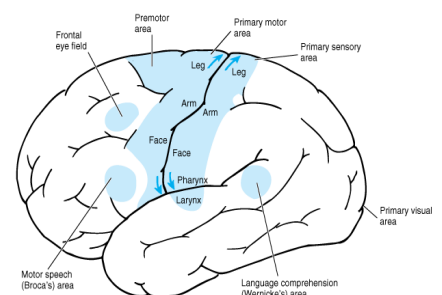
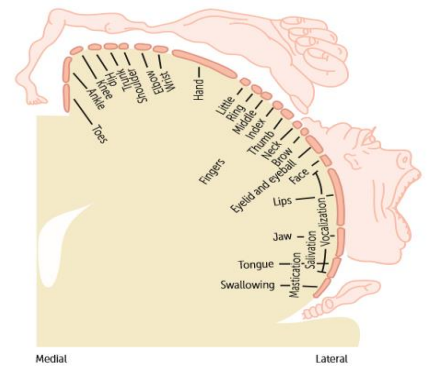
- **Epidural.** (between the skull and dura matter)
- **Subdural.** (between the dura and the brain surface)
- **Subarachnoid.** (between the arachnoid and pia matter)
- **Intraventricular.** (bleeding within the ventricles)
- **Intraparenchymal.** (bleeding within the brain parenchyma)



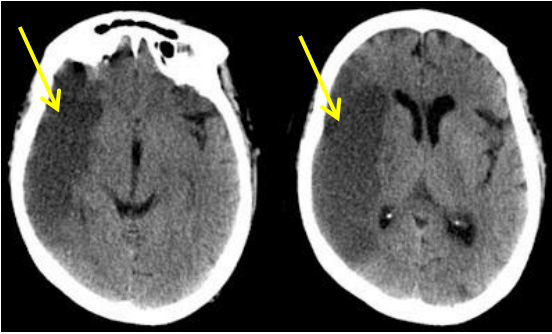
Epidural hemorrhage (EDH)	Subdural hemorrhage (SDH)
<ul style="list-style-type: none"> • Blood collection between inner table and dura. • Biconvex (lentiform). • Arterial 90% middle meningeal artery (branch of maxillary artery). • Occur at site of impact. • Does not cross sutures. • Can cross falx and tentorium. • Skull fracture in 90%. • Lucid interval-50%. (it's a temporary improvement in a patients condition after a traumatic brain injury, after which the condition deteriorate) • C/F: headache, nausea, vomiting, convulsions, herniation. 	<ul style="list-style-type: none"> • Blood collection between dura and arachnoid. • Rupture of bridging veins. • Crescent shape. • Cross sutures, but not dural attachments. • Can cause midline shift. • May extend along falx and tentorium.

*Important notes:

- ✓ Acute hemorrhage is seen more clear in **CT** scan while **MRI** can provide important clues about the etiology.
- ✓ Its important to identify the lesions location and what part of the body is affected and what function is lost.
- ✓ Medial surface of cerebral cortex represent the lower limb (so any lesion in this area will affect the legs).
- ✓ Lateral surface of the cerebral cortex represent upper limb and the face (so any lesion in this area will effect the face and hands).
- ✓ The medial cerebral artery pass through sylvian fuser so it supplies the frontal and temporal lobe (so any blockage in this artery will effect the frontal and temporal lobes).
- ✓ Frontal operculum has speech area (broca's and wenkins).

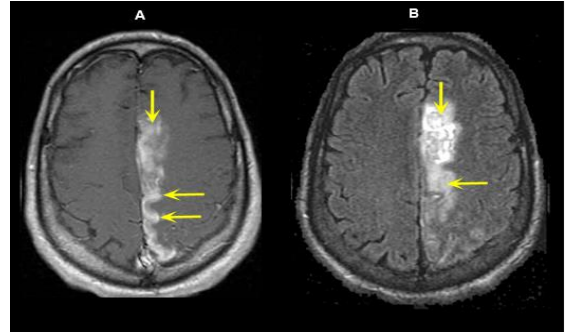


Axial CT



Lesion in the **lateral side** of the cerebral cortex.
Artery involved: middle cerebral artery.
Neurological deficit: upper limb and face.

Axial MRI

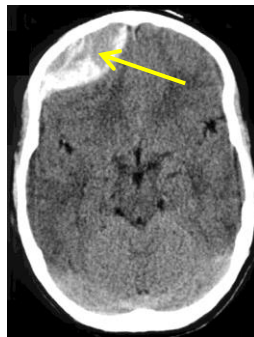


Lesion in the **medial side** of the cerebral cortex.
Artery involved: Anterior cerebral artery.
Neurological deficit: lower limb.

Epidural hemorrhage

The most common source of bleeding is the **middle meningeal artery**.

[For more information about the causes.](#)



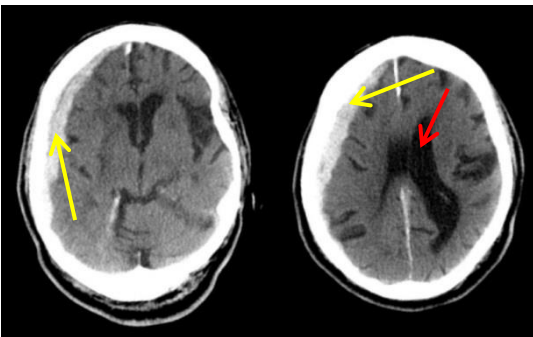
Axial CT



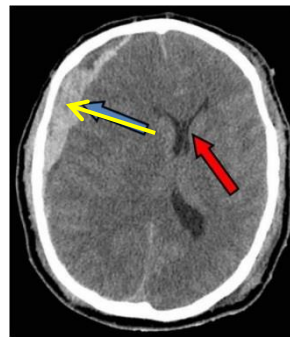
Axial CT



Axial CT



Axial CT



Axial CT



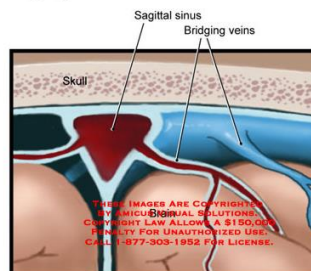
Axial CT

Subdural hemorrhage

The most common source of bleeding is the **bridging arteries**.
The lateral ventricle is pushed to the side.

[For more information about the causes.](#)

Torn Bridging Veins Result in Subdural Hematoma



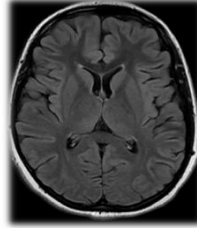
Axial CT



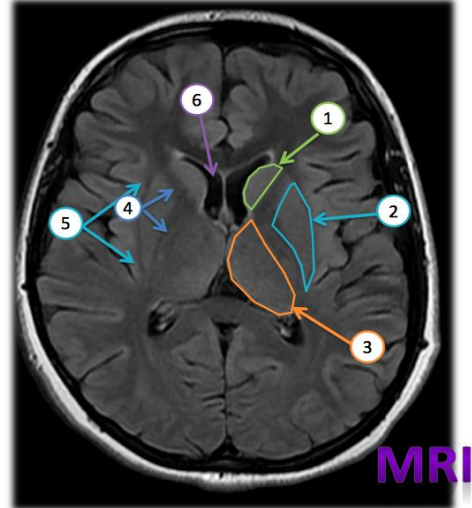
➤ Identify.



- 1-Thalamus
- 2- Pons
- 3- Calcarine fissure
- 4- Cingulate fissure



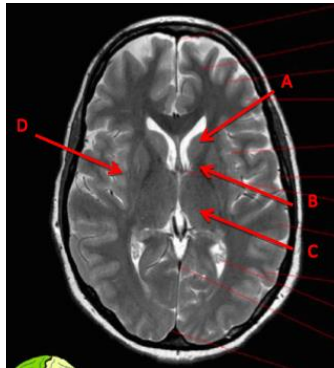
- 1. Caudate nucleus (head)
- 2. Lentiform nucleus
- 3. Thalamus
- 4. Internal capsule
- 5. External capsule
- 6. Lateral ventricle (anterior horn)



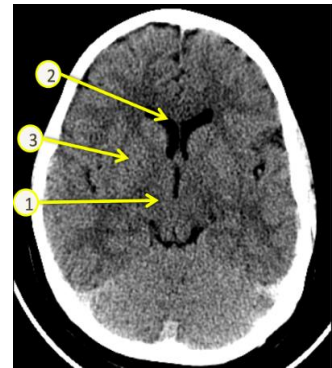
Which artery supply caudate?
Anterior perforating artery



- A: **Corpus callosum**
- B: **Cerebellum**
- C: **4th ventricle**
- D: **Pituitary gland**



- A: **Caudate**
- B: **Lentiform**
- C: **Thalamus**
- D: **Insula**



- 1-**Thalamus**
- 2-**Lateral ventricle**
- 3-**Lentiform nucleus**

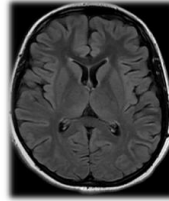
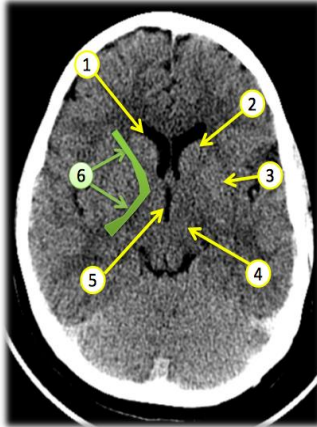


➤ Identify.

CT



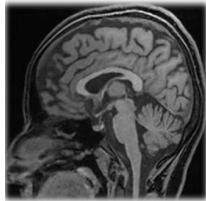
1. Frontal horn (lateral ventricle)
2. Caudate nucleus (head)
3. Lentiform nucleus
4. Thalamus
5. 3rd ventricle
6. Internal capsule



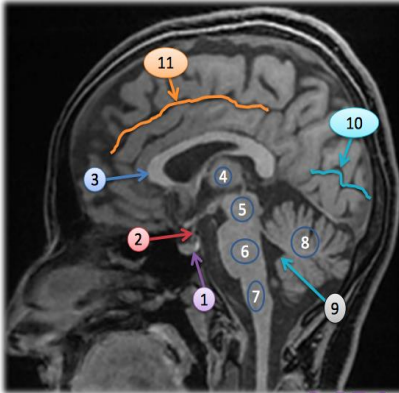
1. Frontal lobe
2. Insular cortex
3. Parietal lobe
4. Occipital lobe



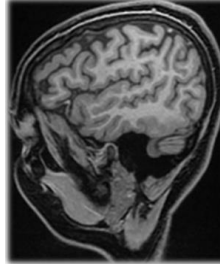
MRI



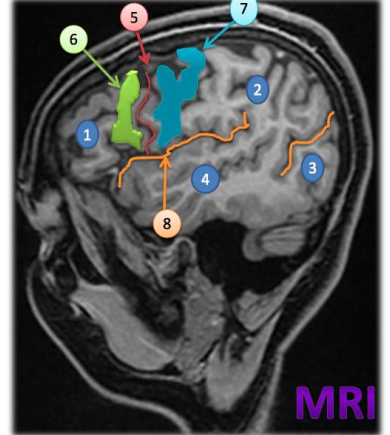
1. Pituitary gland
2. Pituitary stalk
3. Corpus callosum
4. Thalamus
5. Mid brain
6. Pons
7. Medulla oblongata
8. Cerebellum
9. 4th ventricle
10. Calcarine fissure
11. Cuneulate fissure



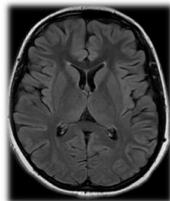
MRI



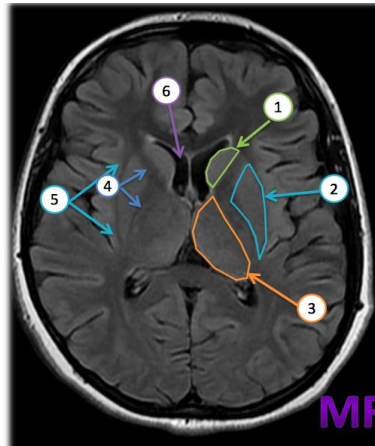
1. Frontal lobe
2. Parietal lobe
3. Occipital lobe
4. Temporal lobe
5. Central sulcus
6. Pre central Gyri (motor)
7. Post central Gyri (sensory)
8. Sylvain Fissure



MRI



1. Caudate nucleus (head)
2. Lentiform nucleus
3. Thalamus
4. Internal capsule
5. External capsule
6. Lateral ventricle (anterior horn)



MRI

شكر خاص لأخونا عبدالرحمن الكاف 434



Thanks for checking our team!

**Suffer now and live the rest of your
life as a great doctor !**

**For any suggestions or questions please don't hesitate to
contact us on:**

Email: radiology435team@gmail.com

Twitter: [@radiology_435](https://twitter.com/radiology_435)

Team members :

- **Monirah Alsalouli**
- **Deema Alfaris**
- **Farrah Mendoza**
- **Nora Albusayes**
- **Abdullah Aljunaydil**

Source:

- **Female & male slides.**

Logo designer:

- **Monirah Alsalouli**