

4 3 3
RADIOLOGY TEAM

Lecture 4 :

Radiology practical



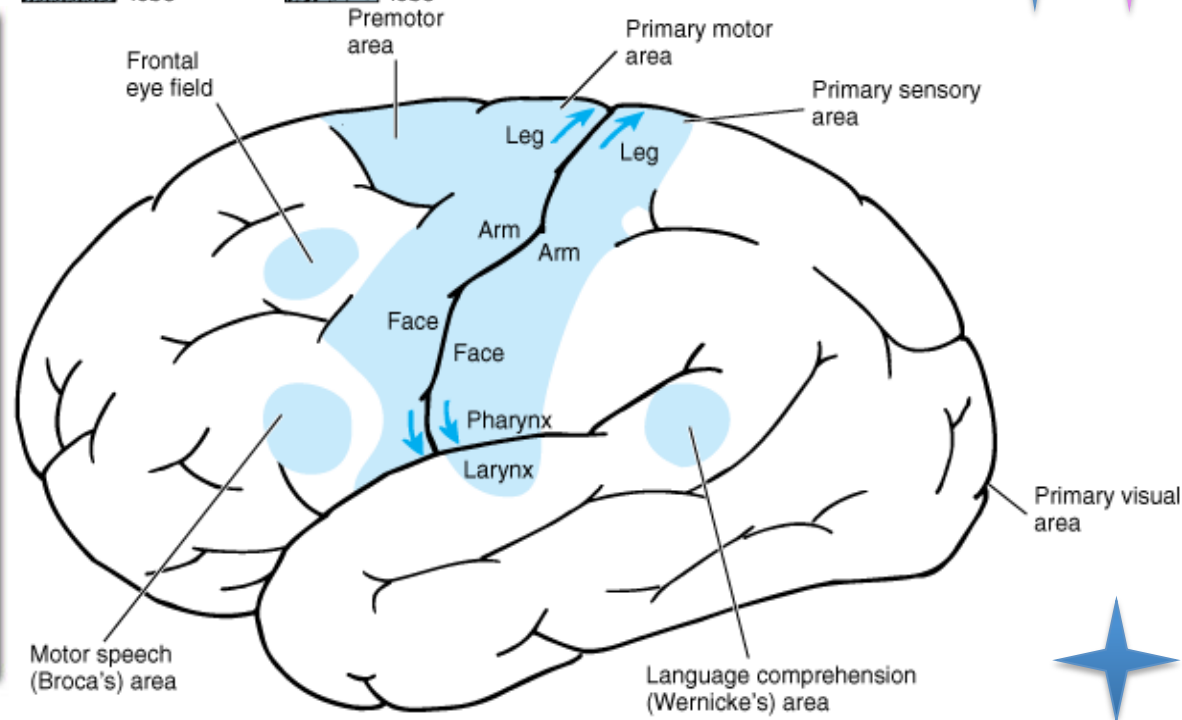
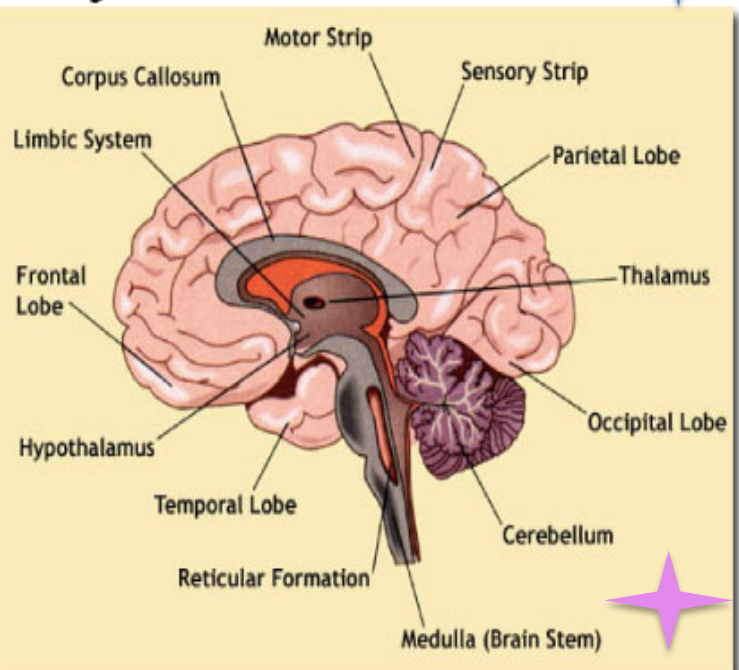
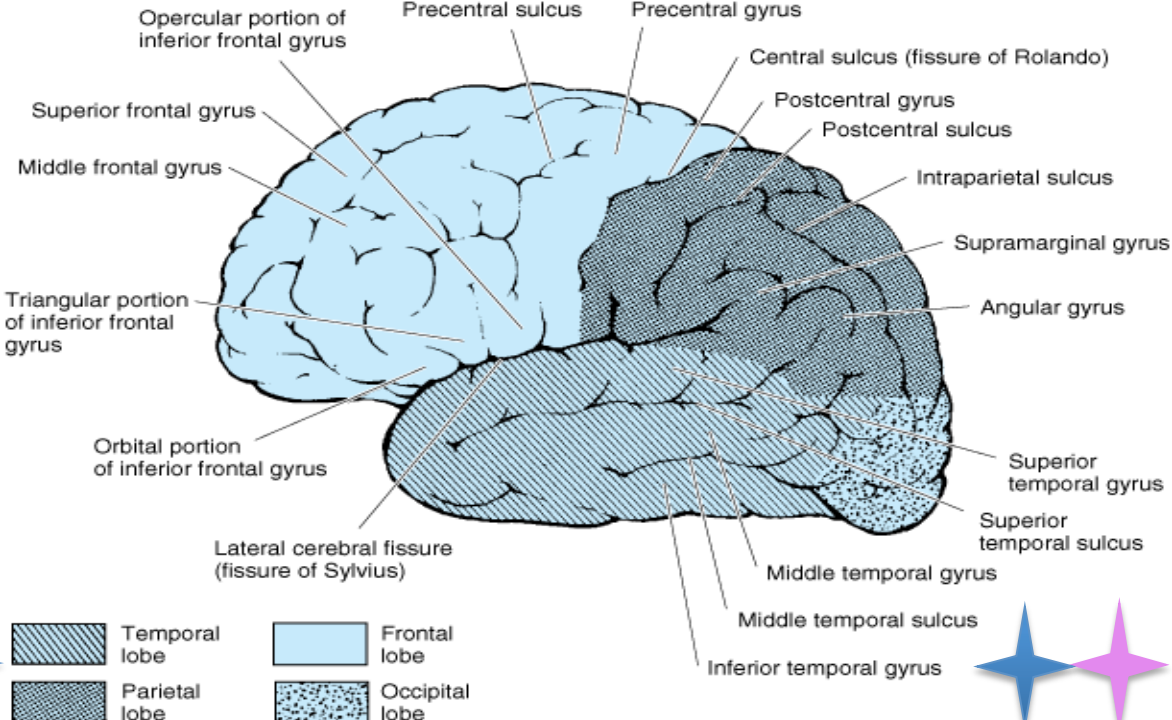
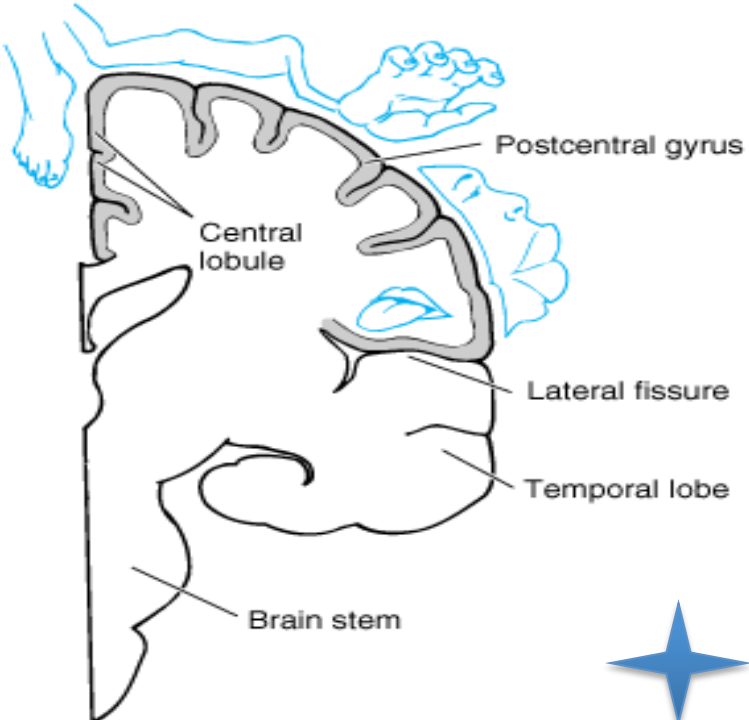
KSU | Collage of Medicine
2nd Year | CNS BLOCK



Male lecture



Female lectures



Brief Brain Anatomy



MR Signal Intensities

	T2WI	PD/FLAIR	T1WI
Solid mass	Bright	Bright	Dark
Cyst	Bright	Dark	Dark
Subacute blood	Bright	Bright	Bright
Acute & chronic blood	Dark	Dark	Gray
Fat	Dark	Bright	Bright

The Radiological Investigation Used For Evaluation of The Brain and Skull

- ✧ The newer imaging modalities have had a great impact on the diagnosis of diseases of the central nervous system.
- ✧ CT and MRI have become the standard investigations for disorders of the brain.
- ✧ Plain films are still the initial investigation for disorders of the bones of the skull – particularly fractures, but otherwise have limited uses.

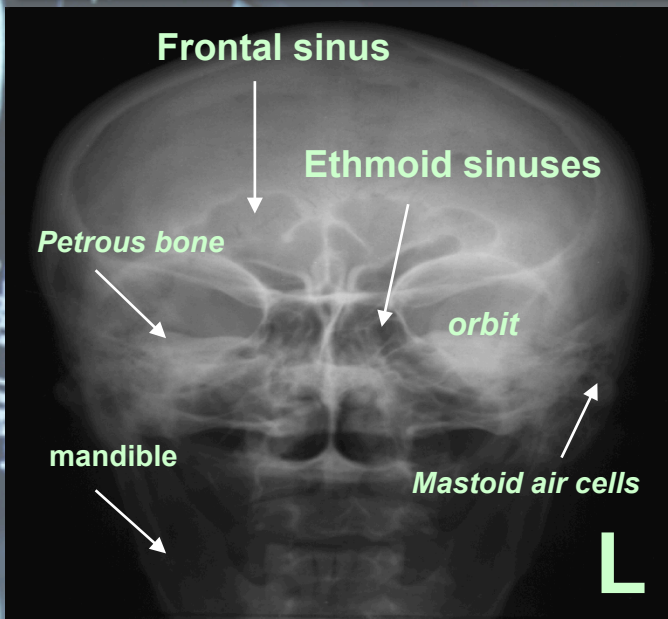
Plain x-ray skull



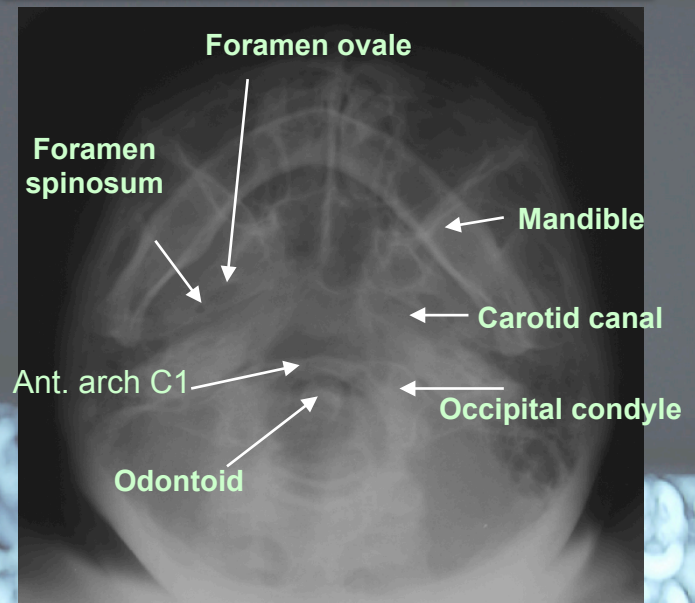
✧ Indications:

- trauma
- congenital
- calcification: normal or abnormal (vascular ,neoplasm)
- metastasis: lytic /sclerotic
- multiple myeloma
- metabolic disorders

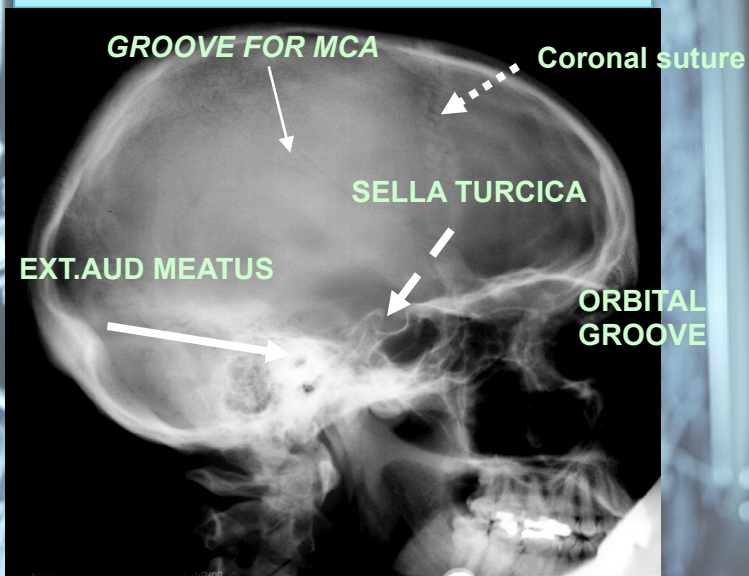
SKULL PA VIEW



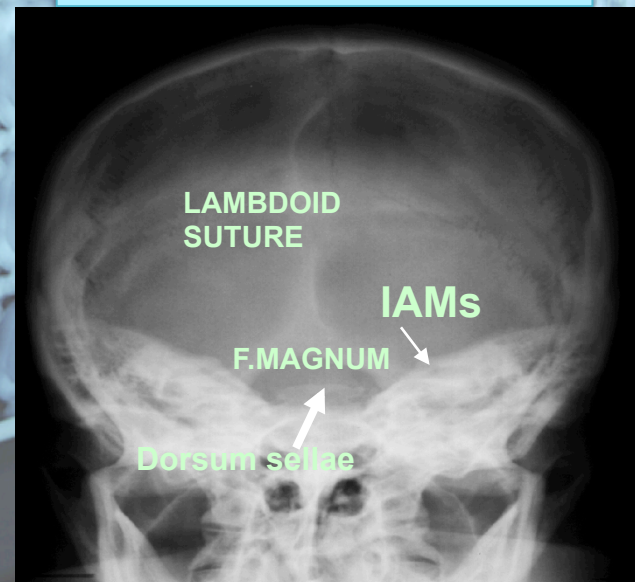
submentovertical VIEW



Skull X-RAY LAT. VIEW



TOWENS VIEW (AP)



CT SCAN..

- ✧ Using ionizing radiation
- ✧ Spiral CT can perform a head scan in 15 minutes pre & post contrast scans.
- ✧ The scan itself can take as little as 10 seconds.
- ✧ Patient preparation: nil
- ✧ Type of the contrast medium: iodinated contrast (non ionic L.O.C.M)
- ✧ Indications:
Trauma - detection of blood - strokes - tumours - infection Vascular disorders
- ✧ The axial plane is the routine projection but it is sometimes possible to obtain direct coronal scans.
- ✧ The window settings are selected for the brain, but may be altered to show the bones.

CT SCAN:



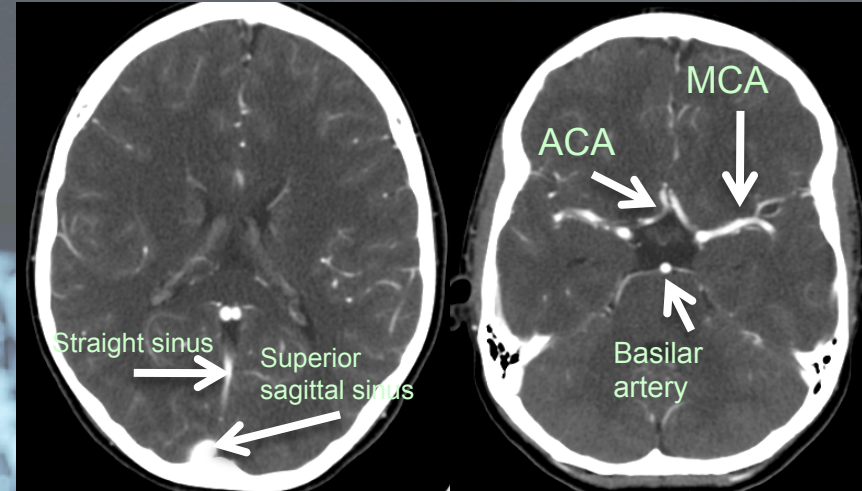
✧ NORMAL CT BRAIN

- CSF is seen as water density (black) within ventricular system and subarachnoid space.
- Grey matter is differentiated from white matter (white matter is relatively darker than grey matter).
- The falx is denser than the brain.
- Large arteries and venous sinuses can be recognized when opacified by contrast medium.
- Posterior fossa may be obscured by artifacts from overlying temporal and occipital bone.

CT SCAN :

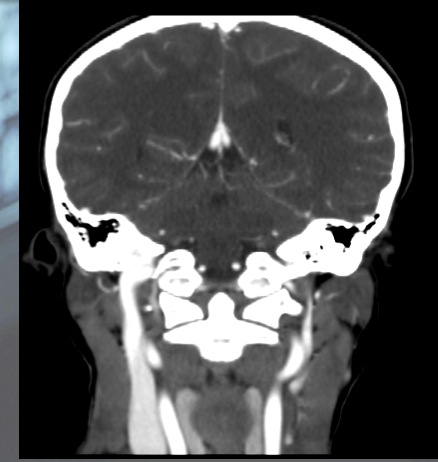
Contrast enhanced CT

- ✓ Contrast enhanced CT -- After IV injection of contrast medium
- ✓ Abnormality becomes visible or more prominent
- ✓ Contrast enhancement is due to breakdown of blood brain barrier allowing contrast to enter the lesion particularly in neoplasm, infection, inflammation and subacute stage of ischemia
- ✓ Also it is helpful in demonstrating blood vessels



Sagittal reconstruction

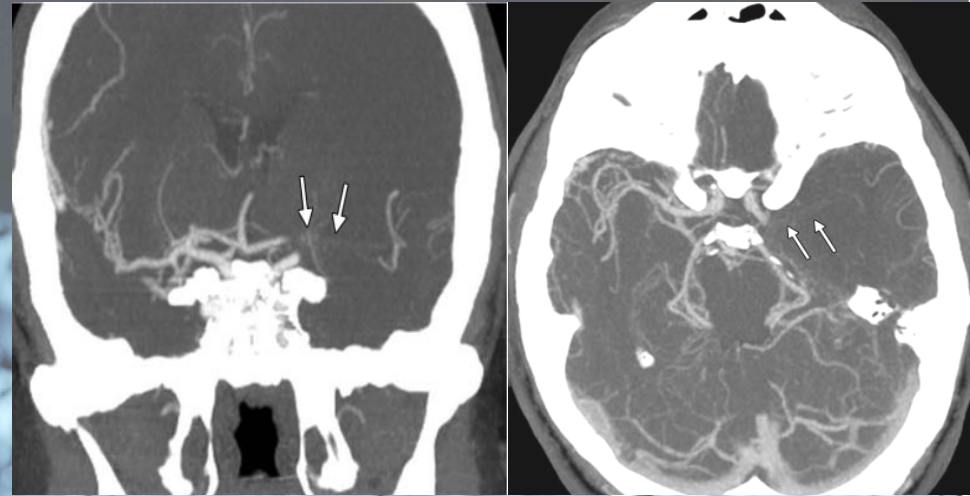
Coronal reconstruction



- ✓ Computerized reconstructions can be made from axial sections to provide images in coronal or sagittal planes

CT SCAN :

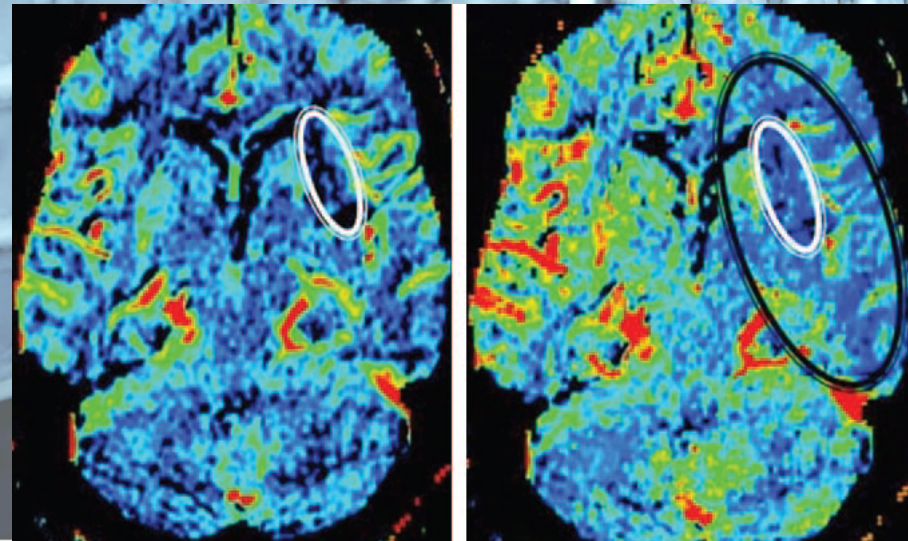
Occlusion of left middle cerebral artery



CT Angiography

Helpful in diagnosis of vascular abnormalities
e.g. stenosis, occlusion, aneurysm or vascular
malformation

CT PERFUSION



CT SCAN:

✓ The window settings are selected for the brain, but may be altered to shows the bones.

Bone window

Brain window

Bone window

Fracture

Acute extradural hemorrhage

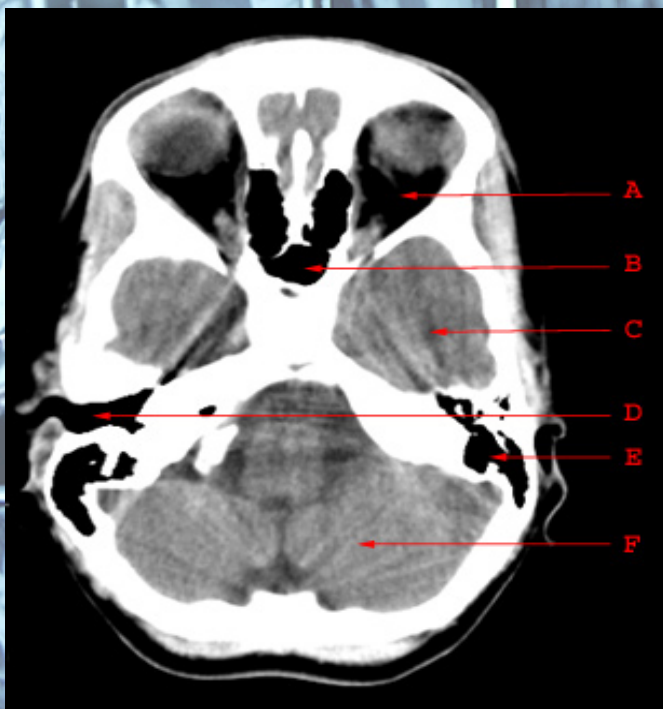
Fracture

CT SCAN :



- A. Orbit
- B. Sphenoid Sinus
- C. Temporal Lobe
- D. Externa Auditory Canal
- E. Mastoid Air Cells
- F. Cerebellar Hemisphere

- A. Frontal Lobe
- B. Frontal Bone (Superior Surface of Orbital Part)
- C. Dorsum Sellae
- D. Basilar Artery
- E. Temporal Lobe
- F. Mastoid Air Cells
- G. Cerebellar Hemisphere



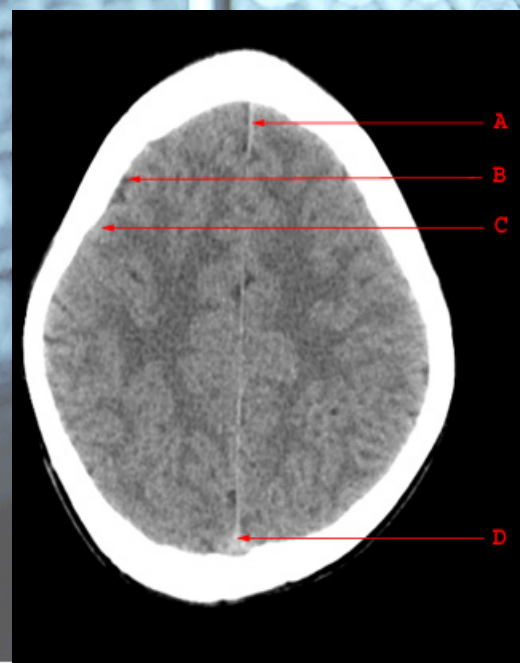
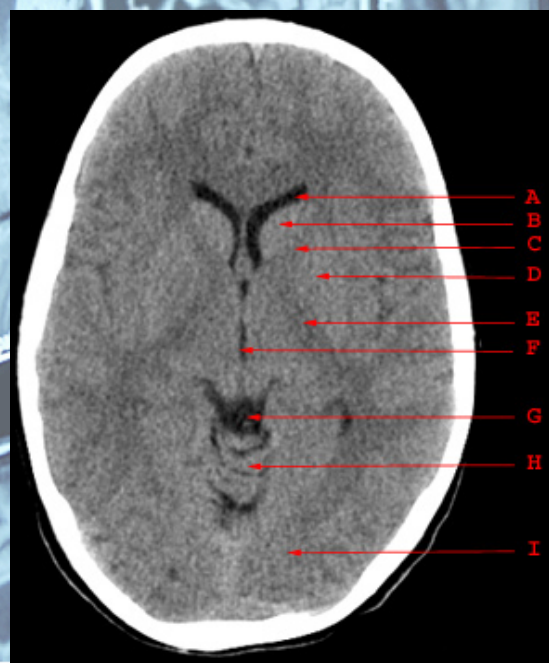
CT SCAN :



- A. Anterior Horn of Lateral Ventricle
- B. Head of Caudate Nucleus
- C. Anterior Limb of Internal Capsule
- D. Putamen and Globus Pallidus
- E. Posterior Limb of Internal Capsule
- F. Third Ventricle
- G. Quadrigeminal Plate Cistern
- H. Cerebellar Vermis
- I. Occipital Lobe

- A. Falx Cerebri
- B. Frontal Lobe
- C. Body of Lateral Ventricle
- D. Splenium of Corpus Callosum
- E. Parietal Lobe
- F. Occipital Lobe
- G. Superior Sagittal Sinus

- A. Falx Cerebri
- B. Sulcus
- C. Gyrus
- D. Superior Sagittal Sinus



MRI :

- ✧ No ionizing radiation
- ✧ No Patient preparation
- ✧ fasting for general anesthesia.
- ✧ Contrast medium: Gadolinium
- ✧ Indications:

Strokes – tumor – infection

Vascular disorders - white matter disease
some cases of trauma

- ✧ Contraindications

Cardiac pacemaker

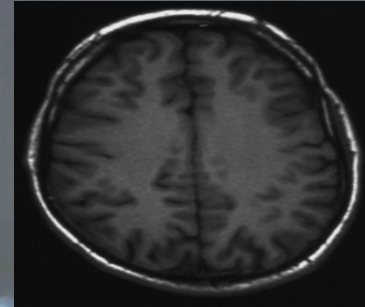
Intraocular ferrous foreign body

Pregnancy (1st trimester)

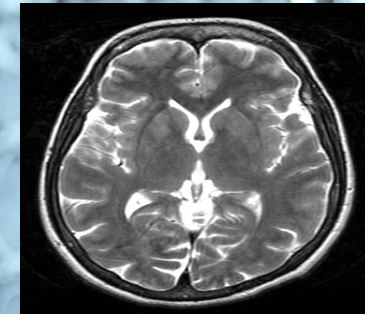
Claustrophobia

Nothing magnetic can be allowed
inside the MRI room

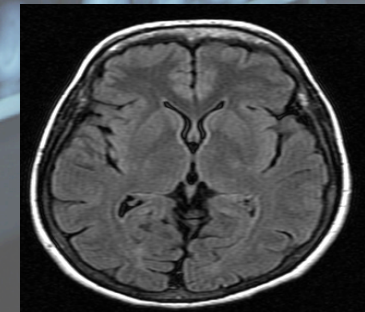
T1 weighted



T2 weighted



FLAIR



Acute stroke Initial imaging

✧ CT without IV contrast

- Rapid
- Reliable to exclude hemorrhage
- High sensitivity for acute blood
- Acute blood appears bright on CT relative to brain tissue.
- IV contrast only if suspicion of another etiology, e.g. tumor or AVM

✧ MRI

Acute stroke appears as :

- Normal to low signal on T1WI
- High signal on T2WI
- High signal on FLAIR
- High signal on DWI
- FLAIR and DWI most sensitive

Ischemic Stroke

✧ MRI

- Abnormal area becomes bright on DWI within 30 minutes of onset of ischemia
- High signal visible on T2WI in about 8 hours
- T1WI image becomes abnormal after ~16 hours
- Infarcted area remains bright on T2WI forever.
- As encephalomalacia occurs, infarct becomes progressively darker on T1WI until it matches signal of CSF

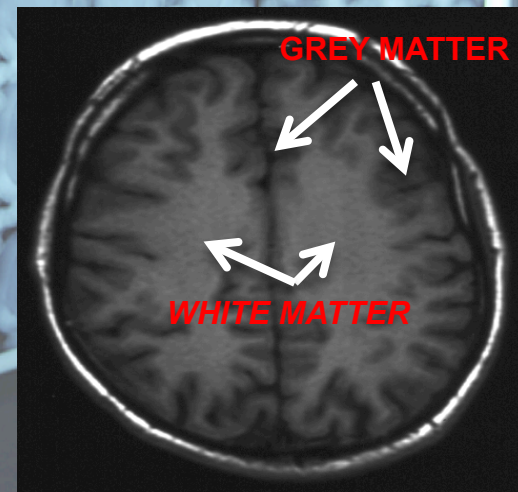
✧ Diffusion Weighted Imaging

- Super-sensitive
- Not super-specific
- False positives: Hemorrhage – MS – Abscess - Lymphoma and other tumors
- In uncertain situations, repeat in 2 weeks
- Infarct should normalize on DWI
- Area of ischemia visible within 30 minutes

MRI:

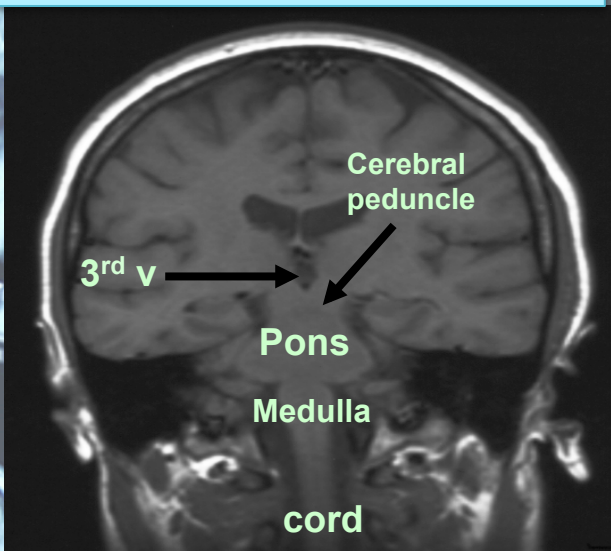
- ✧ MRI is a multiplanar technique (can produce images in Sagittal, axial and coronal planes) which is useful for assessment of extent of brain tumors and for better visualization of structures of posterior fossa and cranio-cervical junction.
- ✧ MRI is a multisequential technique (can create images in T1WI, T2WI, FLAIR, gradient and other sequences).
- ✧ It is possible to recognize flowing blood and therefore large arteries and veins stand out clearly without the need for contrast medium injection.

MRI BRAIN (AXIAL T1WI)

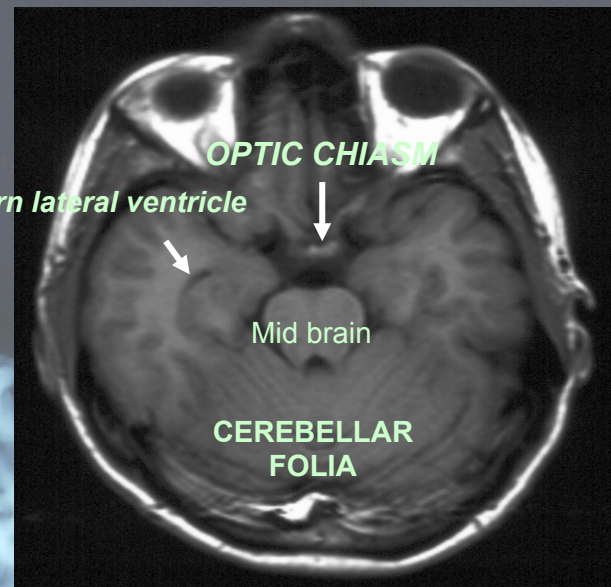


MRI:

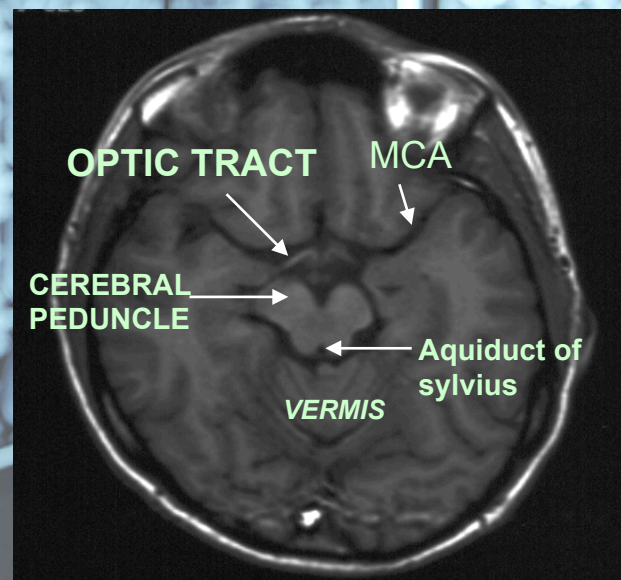
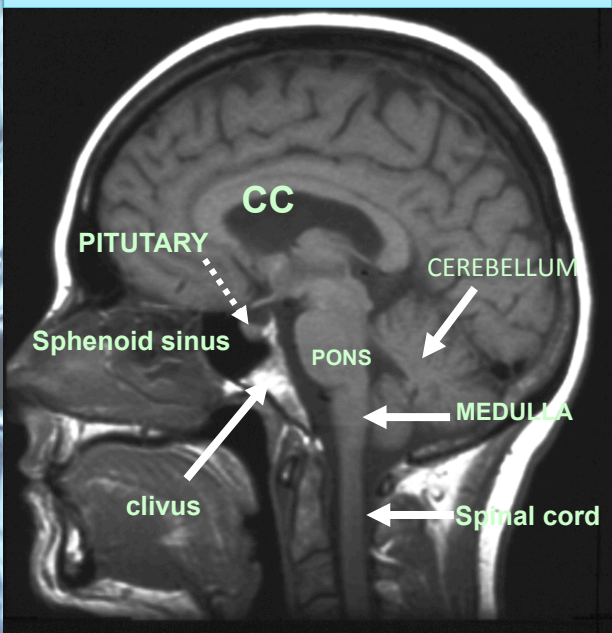
MRI BRAIN (CORONAL T1WI)



MRI BRAIN (AXIAL T1WI)



MRI BRAIN (SAGITTAL T1WI)



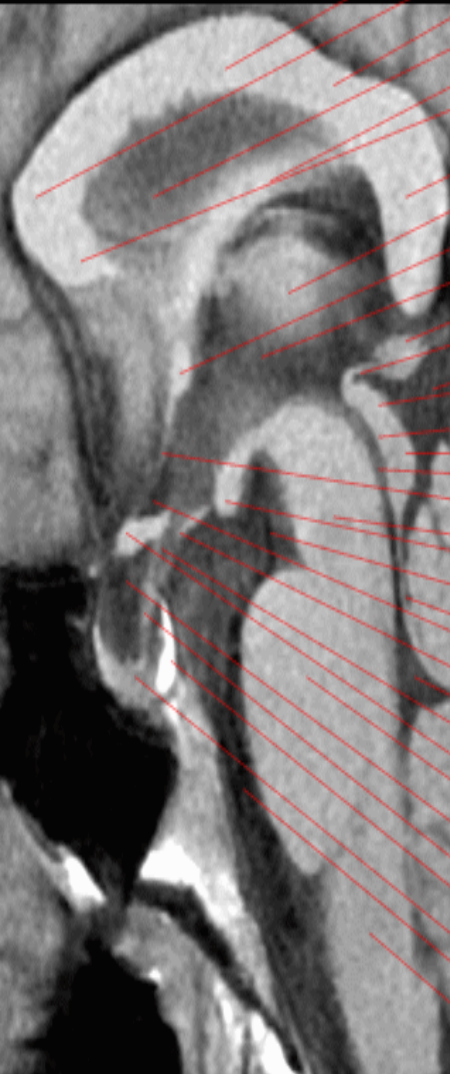
MRI:

✧ The Characteristic signal intensity of brain structures in different MRI sequences:



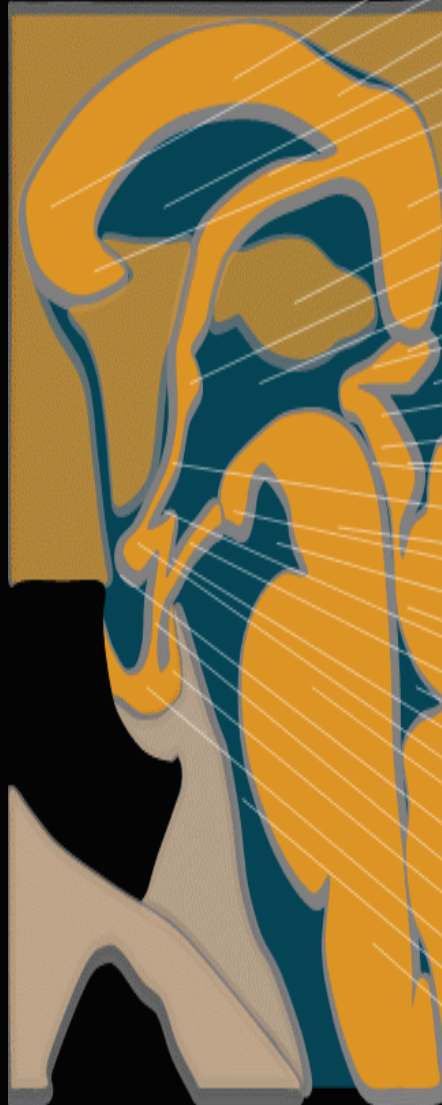
	Grey matter	White matter	CSF
T1WI	grey	light	dark
T2WI	light	dark	white
FLAIR	light	dark	dark

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
- Mamillary 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

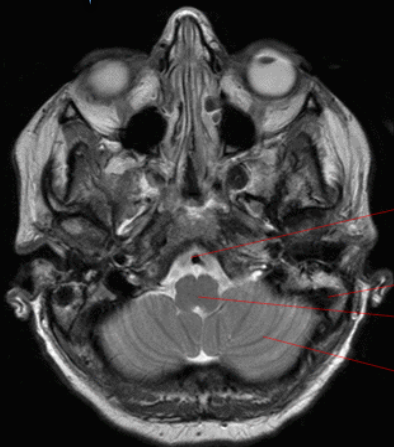
Brain Sagittal



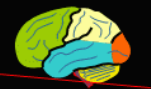
- Corpus callosum (body)
- Corpus callosum (genu)
- Corpus callosum (isthmus)
- Lateral ventricle (body)
- Fornix
- Corpus callosum (head)
- Corpus callosum (splenium)
- Thalamus
- Anterior commissure
- Third ventricle
- Pineal
- Posterior commissure
- Quadrigeminal cistern
- Superior colliculus
- Quadrigeminal plate
- Inferior colliculus
- Cerebral aqueduct
- Lamina terminalis
- Midbrain
- Mamillary body
- Interpeduncular cistern
- Superior medullary velum
- Supraoptic recess
- Tuber cinereum
- Fourth ventricle
- Infundibular recess
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- Infundibulum
- Neurohypophysis
- Adenohypophysis
- Prepontine cistern
- Medulla oblongata



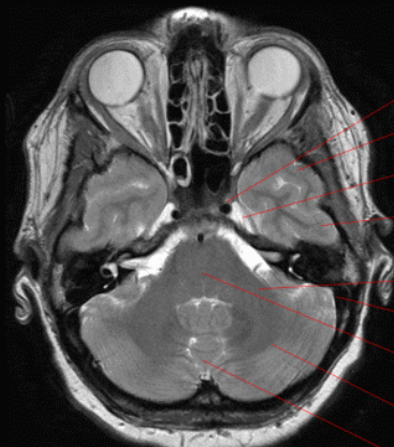
Brain
Axial T2



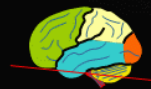
- Basilar artery
- Sigmoid sinus
- Medulla Oblongata
- Cerebellum



Brain
Axial T2



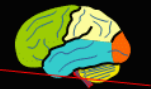
- Internal carotid artery
- Superior temporal gyrus
- Meckel's cave
- Inferior temporal gyrus
- Middle cerebellar peduncle
- Transverse sinus
- Pons
- Cerebellum
- Vermis



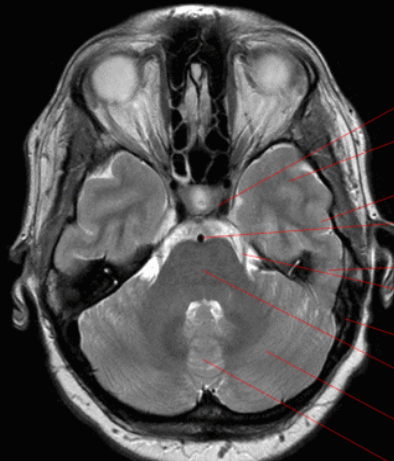
Brain
Axial T2



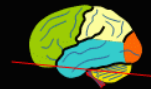
- Internal carotid artery
- Basilar artery
- Sigmoid sinus
- Medulla Oblongata
- Cerebellum
- Vermis



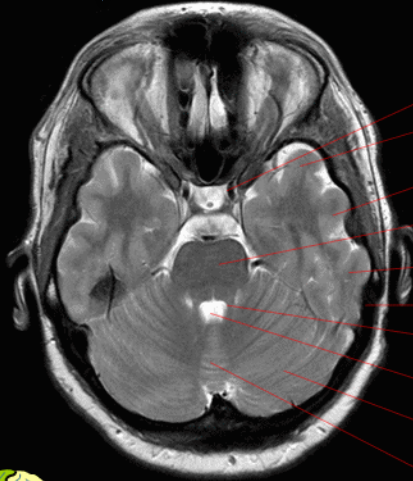
Brain
Axial T2



- Internal carotid artery
- Superior temporal gyrus
- Middle temporal gyrus
- Basilar artery
- Inferior temporal gyrus
- CN V
- Transverse sinus
- Pons
- Cerebellum
- Vermis

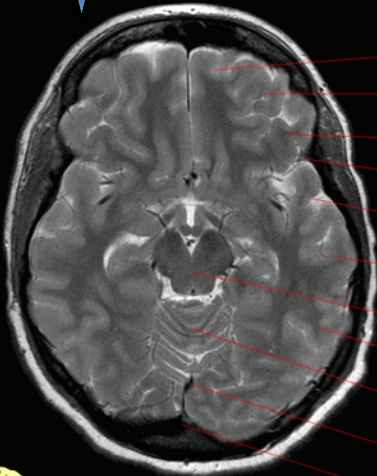


Brain
Axial T2



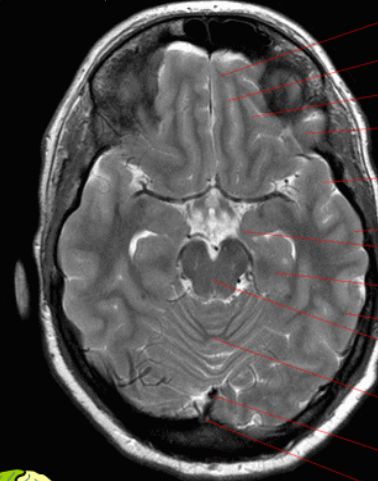
- Internal carotid artery
- Superior temporal gyrus
- Middle temporal gyrus
- Pons
- Inferior temporal gyrus
- Transverse sinus
- Superior cerebellar peduncle
- Fourth ventricle
- Cerebellum
- Vermis

Brain
Axial T2



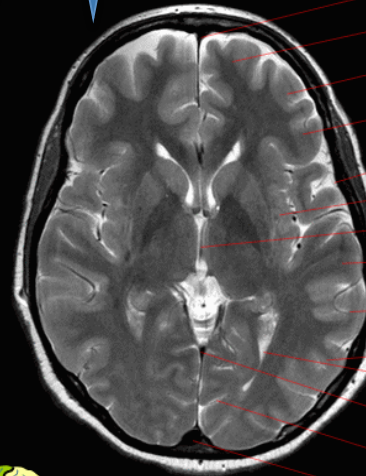
- Superior frontal gyrus
- Middle frontal gyrus
- Inferior frontal gyrus
- Lateral sulcus
- Superior temporal gyrus
- Middle temporal gyrus
- Midbrain
- Inferior temporal gyrus
- Vermis
- Straight sinus
- Superior sagittal sinus

Brain
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

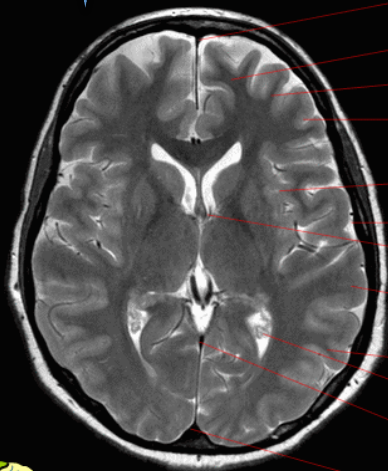
Brain
Axial T2



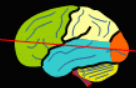
- Superior sagittal sinus
- Superior frontal gyrus
- Middle frontal gyrus
- Inferior frontal gyrus
- Lateral sulcus
- Insula
- Third ventricle
- Superior temporal gyrus
- Middle temporal gyrus
- Inferior temporal gyrus
- Occipital horn of lateral ventricle
- Straight sinus
- Calcarine sulcus
- Superior sagittal sinus



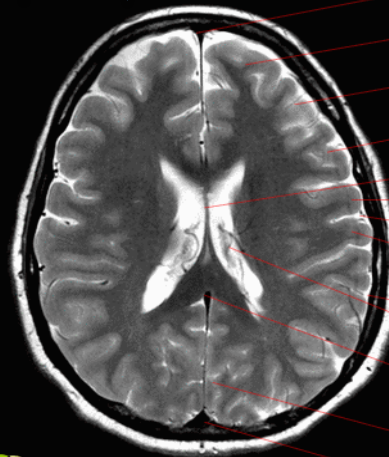
Brain
Axial T2



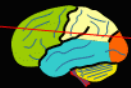
- Superior sagittal sinus
- Superior frontal gyrus
- Middle frontal gyrus
- Inferior frontal gyrus
- Insula
- Lateral sulcus
- Foramen of Monro
- Superior temporal gyrus
- Middle temporal gyrus
- Choroid plexus
- Straight sinus
- Superior sagittal sinus



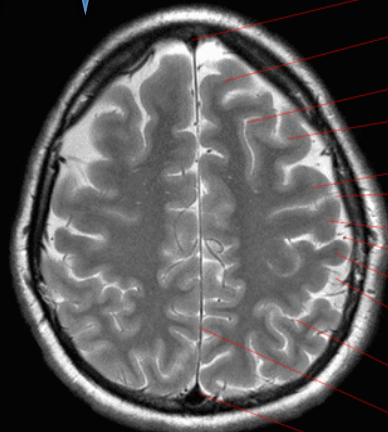
Brain
Axial T2



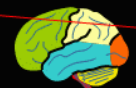
- Superior sagittal sinus
- Superior frontal gyrus
- Middle frontal gyrus
- Inferior frontal gyrus
- Septum pellucidum
- Precentral gyrus
- Central sulcus
- Postcentral gyrus
- Lateral sulcus
- Choroid plexus
- Inferior sagittal sinus
- Parietooccipital sulcus
- Superior sagittal sinus



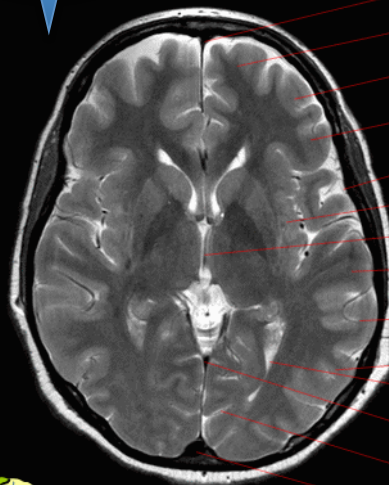
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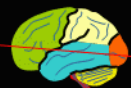
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- Superior frontal sulcus
- Middle frontal gyrus
- Inferior frontal gyrus
- Precentral sulcus
- Precentral gyrus
- Central sulcus
- Postcentral gyrus
- Postcentral sulcus
- Intraparietal sulcus
- Interhemispheric fissure
- Superior sagittal sinus

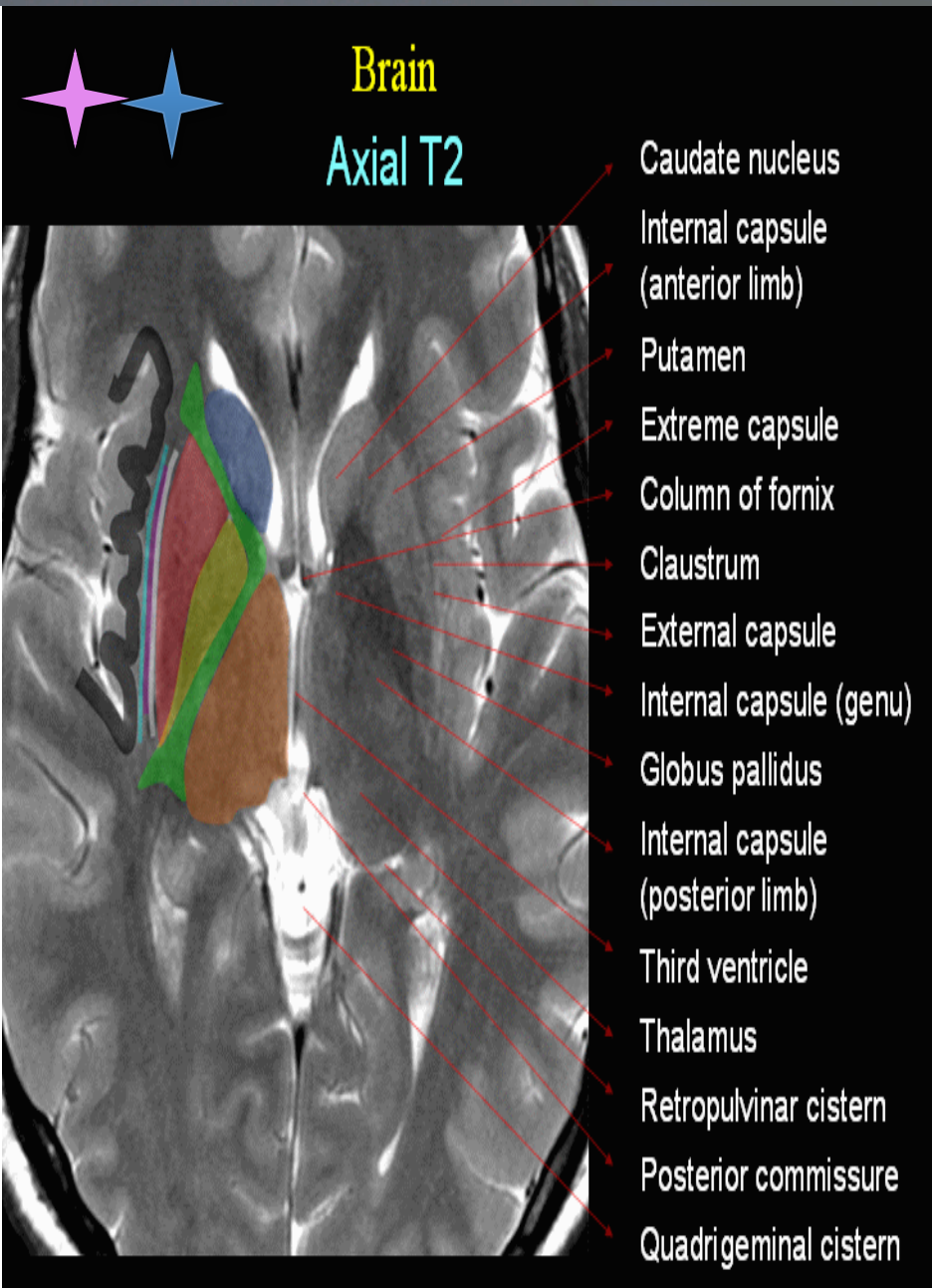
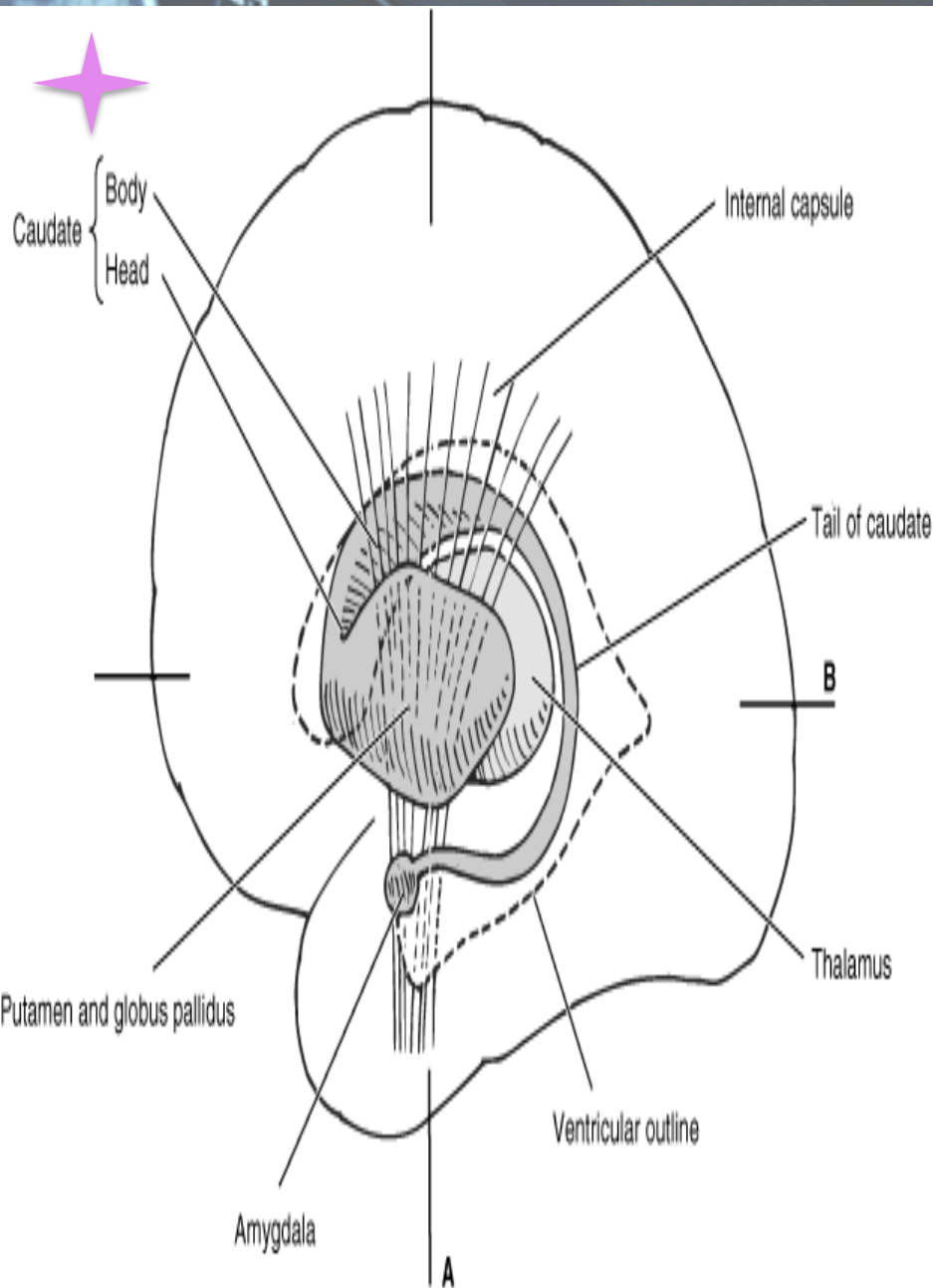


Brain
Axial T2

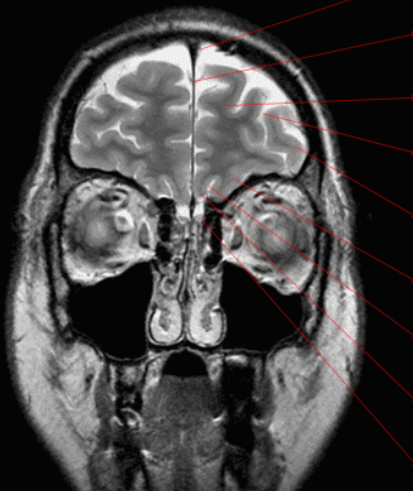
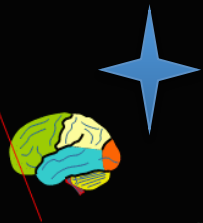


- Superior sagittal sinus
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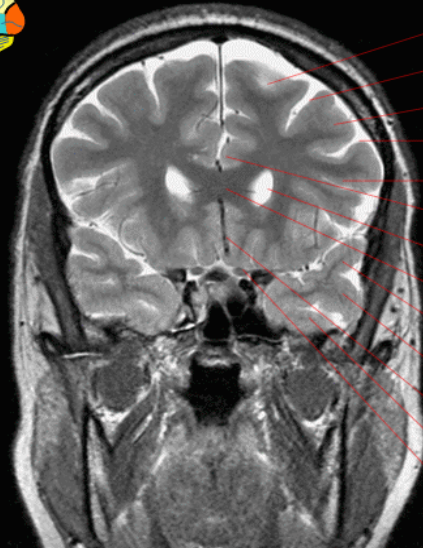
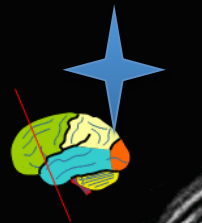


Brain
Coronal T2



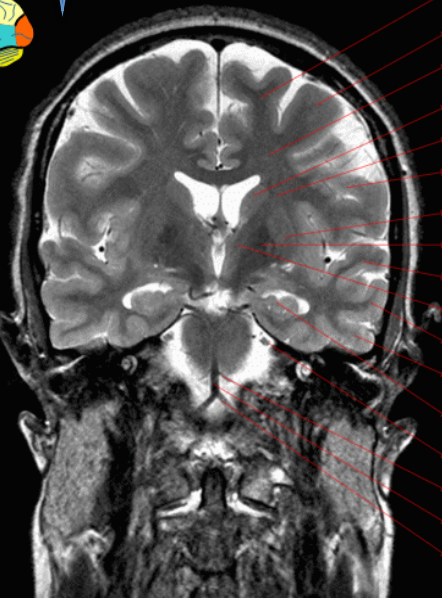
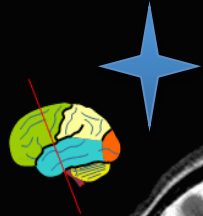
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- Interhemispheric fissure
- Superior frontal gyrus
- Superior frontal sulcus
- Middle frontal gyrus
- Medial orbital gyrus
- Olfactory sulcus
- Gyrus rectus
- Olfactory bulb

Brain
Coronal T2



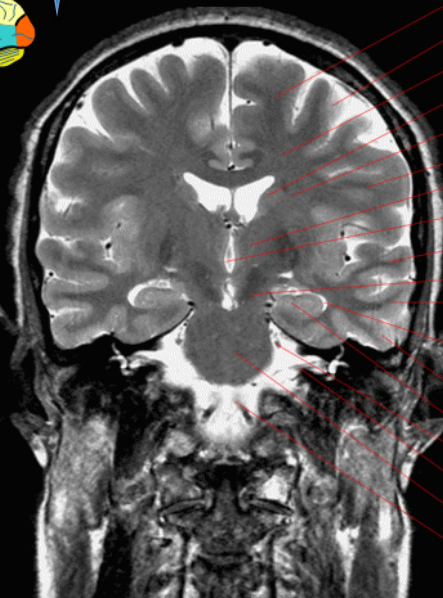
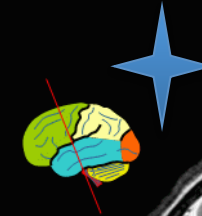
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- Middle frontal gyrus
- Inferior frontal sulcus
- Inferior frontal gyrus
- Cingulate gyrus
- Lateral ventricle (frontal horn)
- Corpus callosum (genu)
- Superior temporal gyrus
- Middle temporal gyrus
- Anterior cerebral artery
- Inferior temporal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

Brain
Coronal T2



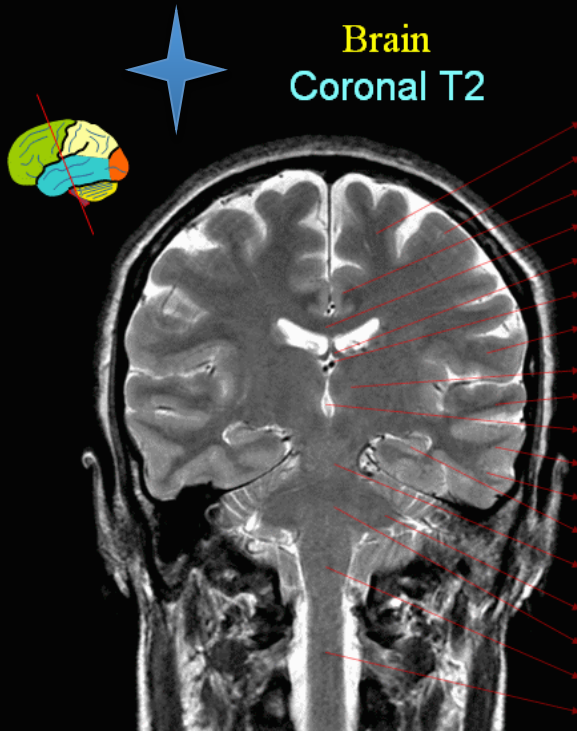
- Superior frontal gyrus
- Middle frontal gyrus
- Centrum semiovale
- Caudate nucleus
- Corona radiata
- Inferior frontal gyrus
- Putamen
- Globus pallidus
- Superior temporal gyrus
- Internal capsule
- Middle temporal gyrus
- Inferior temporal gyrus
- Hippocampus
- Trigeminal nerve (V)
- Superior cerebellar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

Brain
Coronal T2



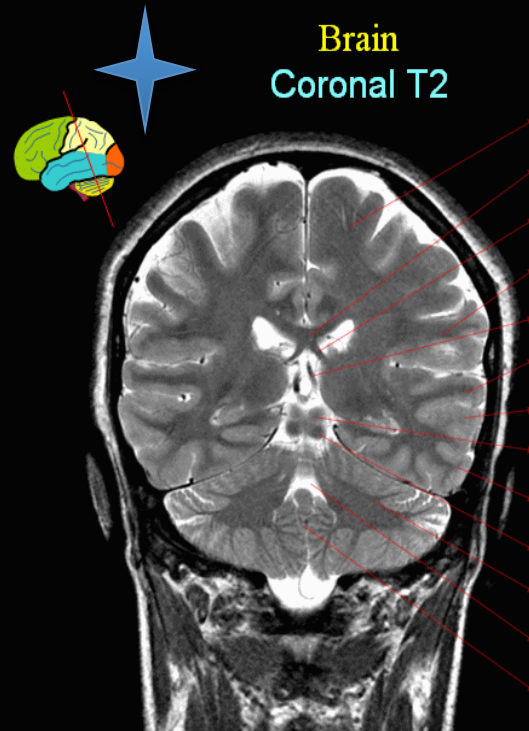
- Superior frontal gyrus
- Middle frontal gyrus
- Centrum semiovale
- Caudate nucleus
- Corona radiata
- Inferior frontal gyrus
- Thalamus
- Third ventricle
- Superior temporal gyrus
- Mid brain
- Middle temporal gyrus
- Lateral ventricle (temporal horn)
- Inferior temporal gyrus
- Hippocampus
- Trigeminal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

Brain
Coronal T2



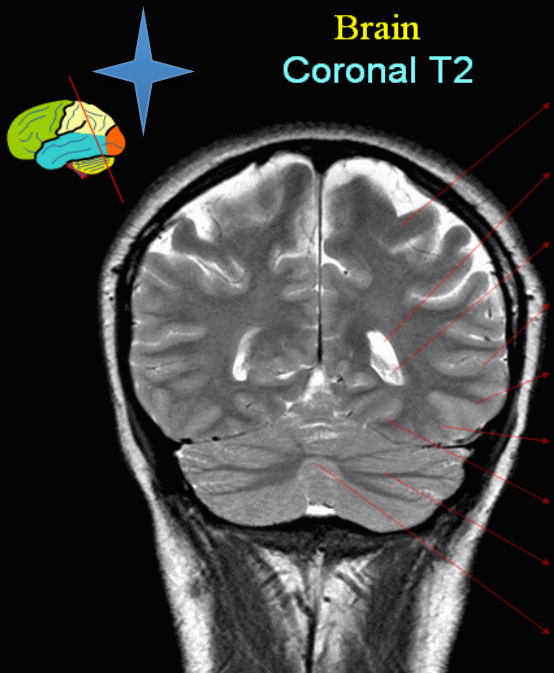
- Superior frontal gyrus
- Middle frontal gyrus
- Cingulate gyrus
- Corpus callosum (body)
- Fornix
- Internal cerebral vein
- Precentral gyrus
- Thalamus
- Superior temporal gyrus
- Third ventricle
- Middle temporal gyrus
- Inferior temporal gyrus
- Hippocampus
- Mid brain
- Middle cerebellar peduncle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

Brain
Coronal T2



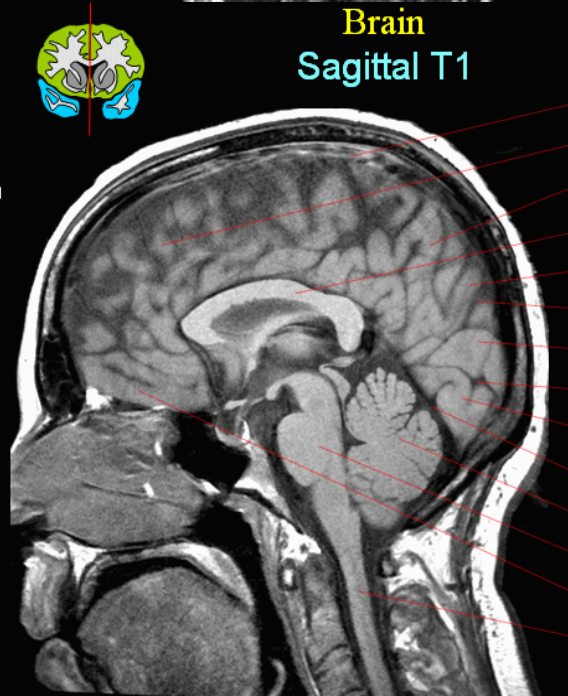
- Postcentral gyrus
- Corpus callosum (body)
- Fornix
- Supramarginal gyrus
- Internal cerebral vein
- Superior temporal gyrus
- Middle temporal gyrus
- Superior colliculus
- Inferior temporal gyrus
- Inferior colliculus
- Cerebellum
- Fourth ventricle
- Vermis

Brain
Coronal T2



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

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



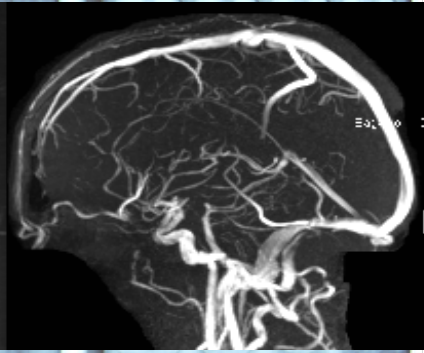
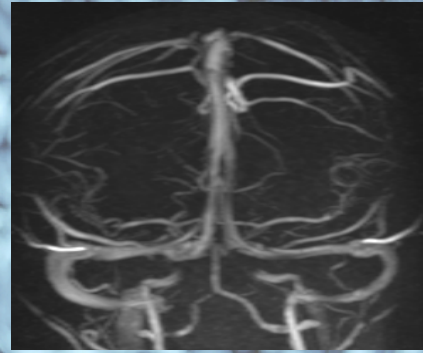
✧ MR Angiography :

- ✓ Can be done with or without intravenous injection of contrast material
- ✓ Assesses intra and extra cranial arteries for any abnormalities such as stenosis, occlusion or vascular malformation.



✧ MR Venography:

- ✓ Can be done with or without intravenous injection of contrast material
- ✓ Assess venous sinuses and major cortical veins
- ✓ Can confirm or exclude venous thrombosis

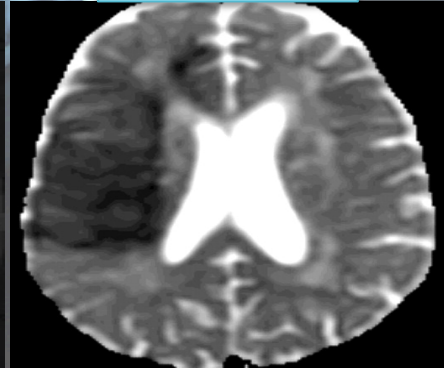
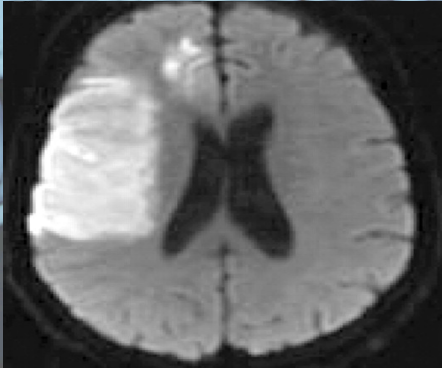


✧ MRI Diffusion:
Very helpful in assessment of:

- Early brain infarction.
- Brain abscess.
- Certain types of brain tumor.

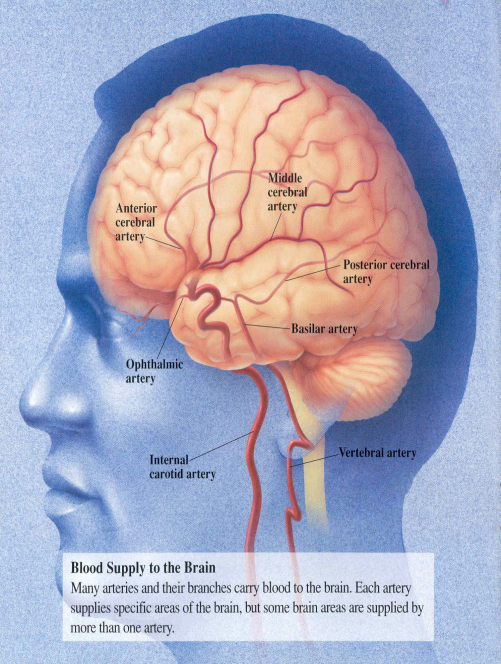
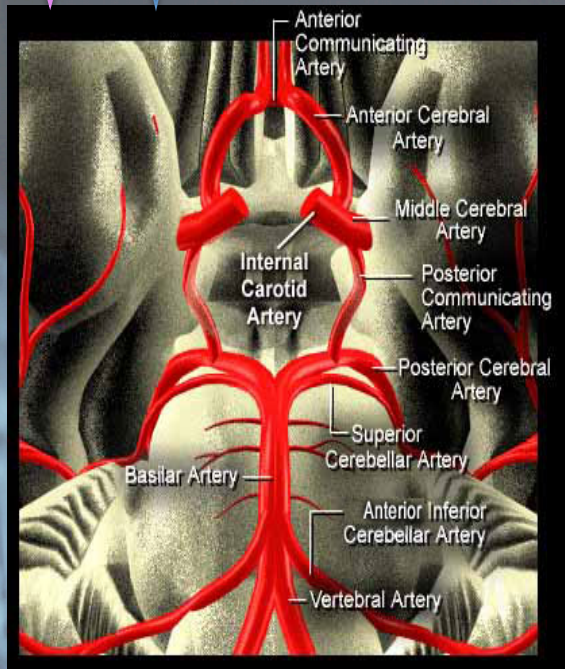
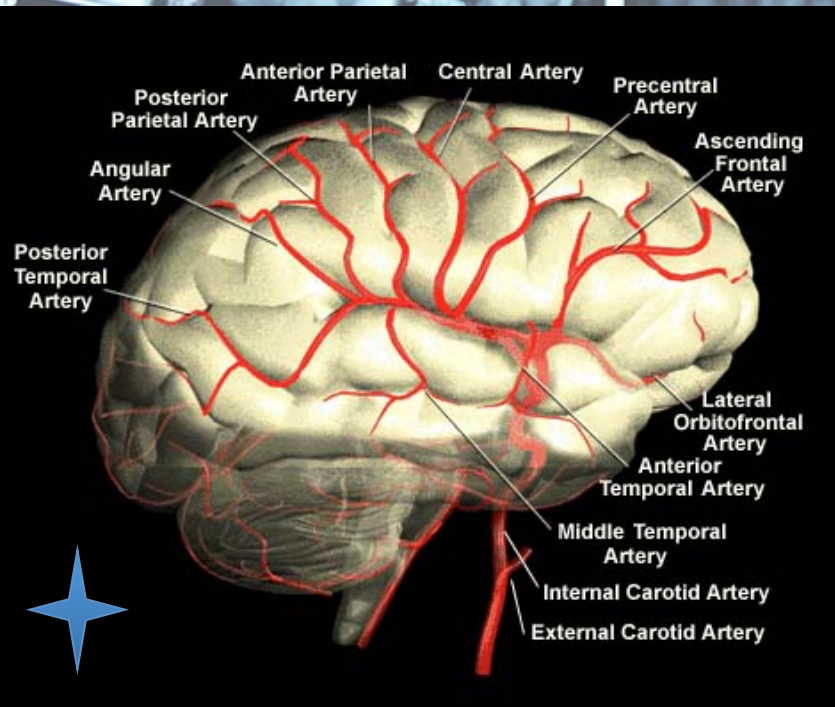
DWI

ADC map

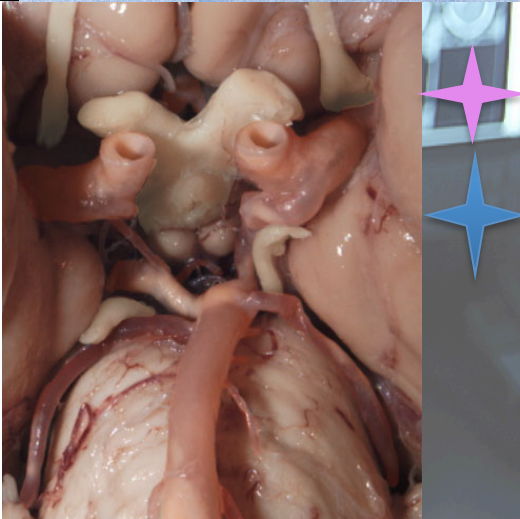
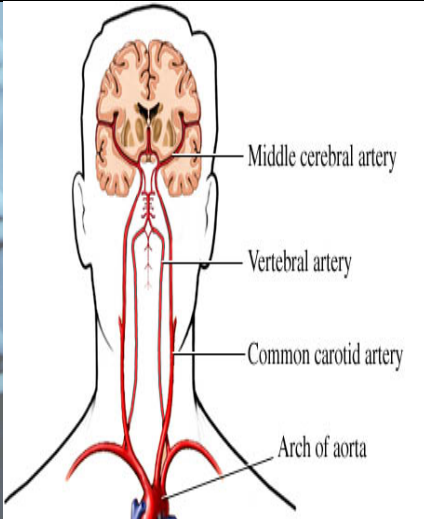


Circle of Willis

Middle Cerebral Artery



Blood Supply to the Brain
 Many arteries and their branches carry blood to the brain. Each artery supplies specific areas of the brain, but some brain areas are supplied by more than one artery.



Brain (Arterial territories)
Axial T2



- Anterior cerebral artery
- Middle cerebral artery
- Posterior cerebral artery
- Basilar perforating arteries
- Posterior inferior cerebellar artery



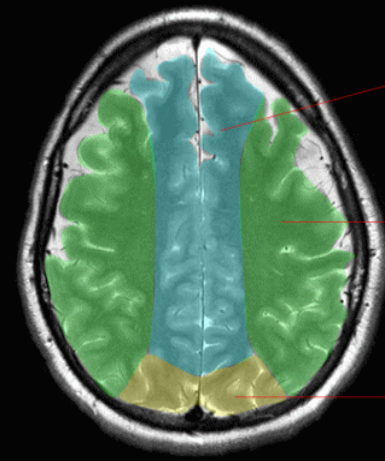
Brain (Arterial territories)
Axial T2



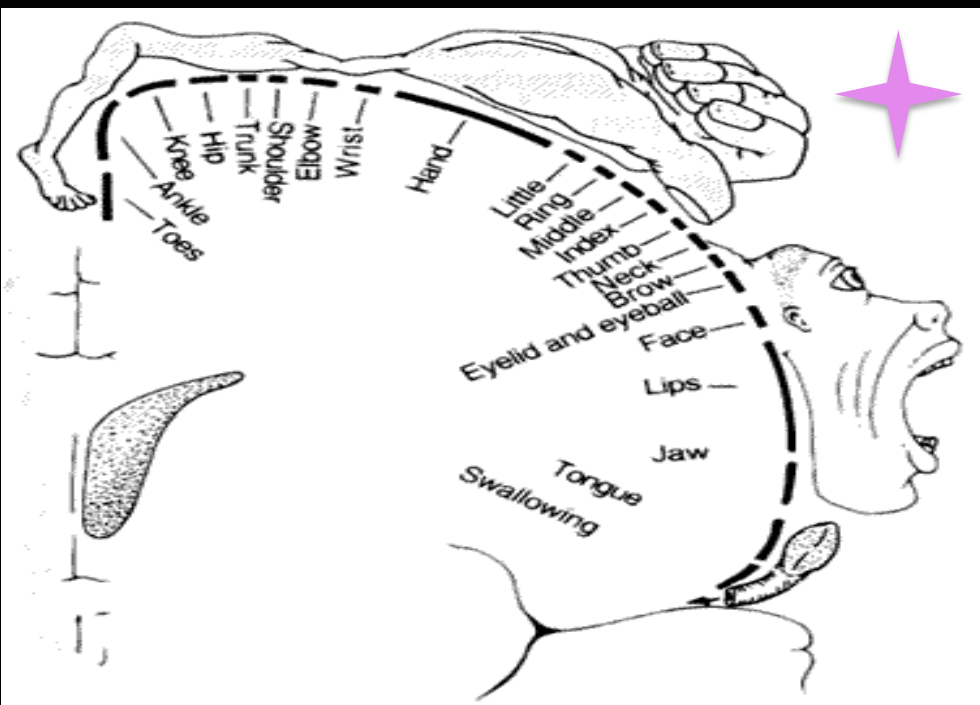
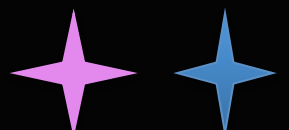
- Anterior cerebral artery
- Anterior choroidal artery
- Middle cerebral artery
- Basilar perforating arteries
- Superior cerebellar artery
- Posterior cerebral artery



Brain (Arterial territories)
Axial T2



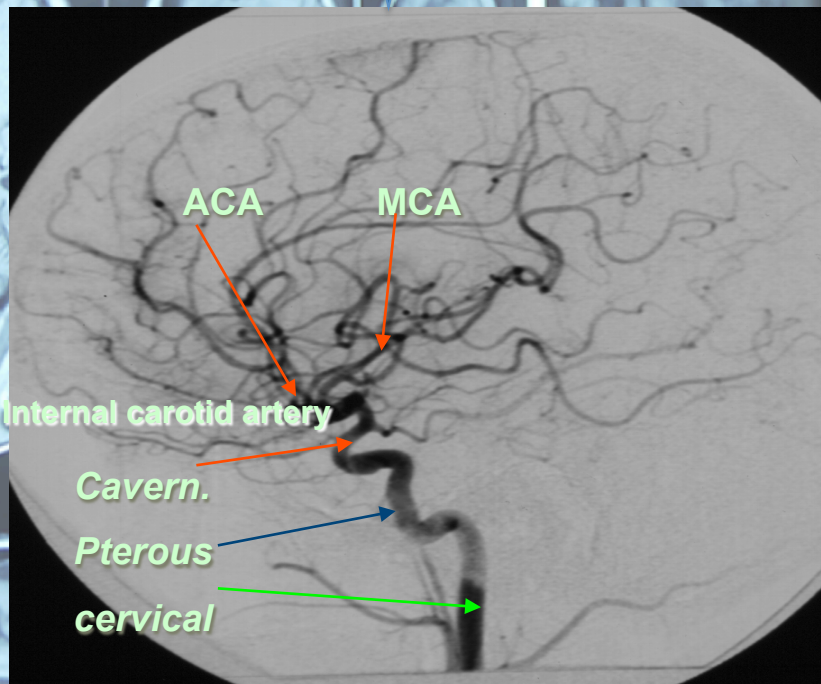
- Anterior cerebral artery
- Middle cerebral artery
- Posterior cerebral artery



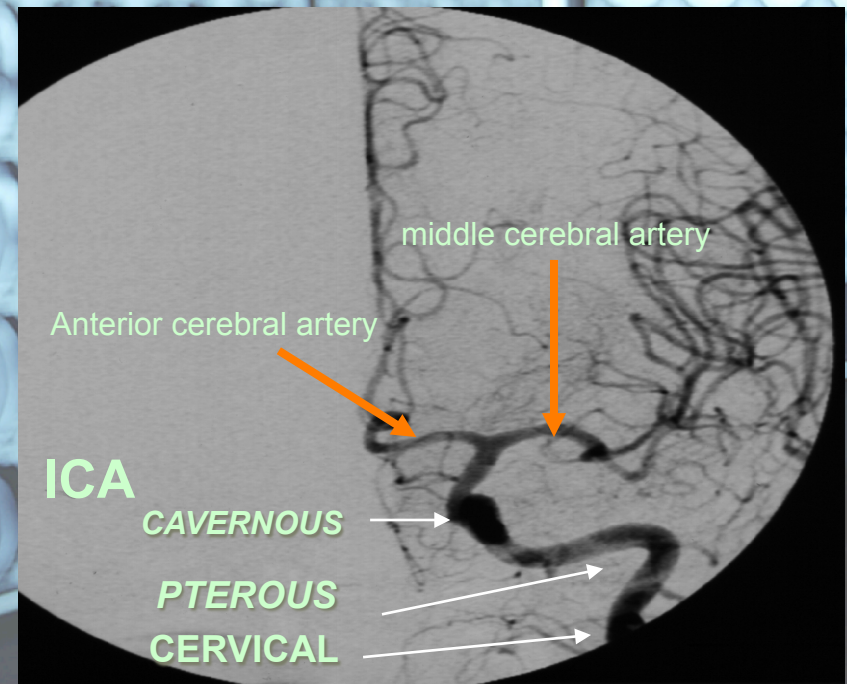
CEREBRAL ANGIOGRAM :

- ✓ Gold standard technique for assessment of intra and extra cranial vessels
- ✓ It can demonstrate different vascular diseases (stenosis, occlusion, vascular malformation and blood supply of brain tumors)
- ✓ It is an invasive technique – needs femoral artery puncture and cannulation.
- ✓ Recently its main is for treatment of acute occlusions, vascular malformations, aneurysms, or pre operative embolization of vascular supply of tumors.

ARTERIAL PHASE

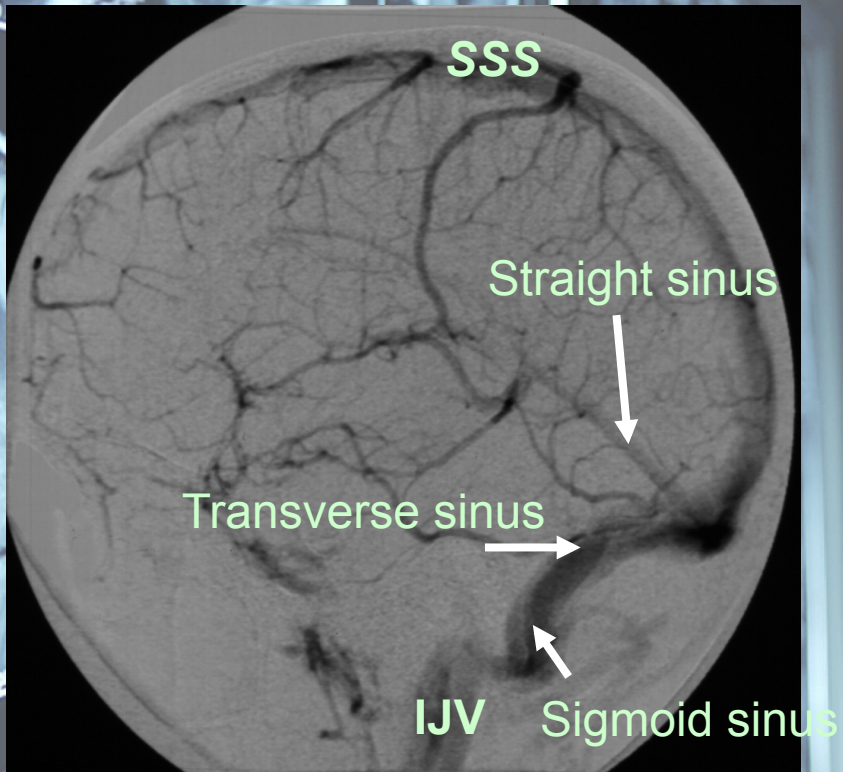


Lateral view

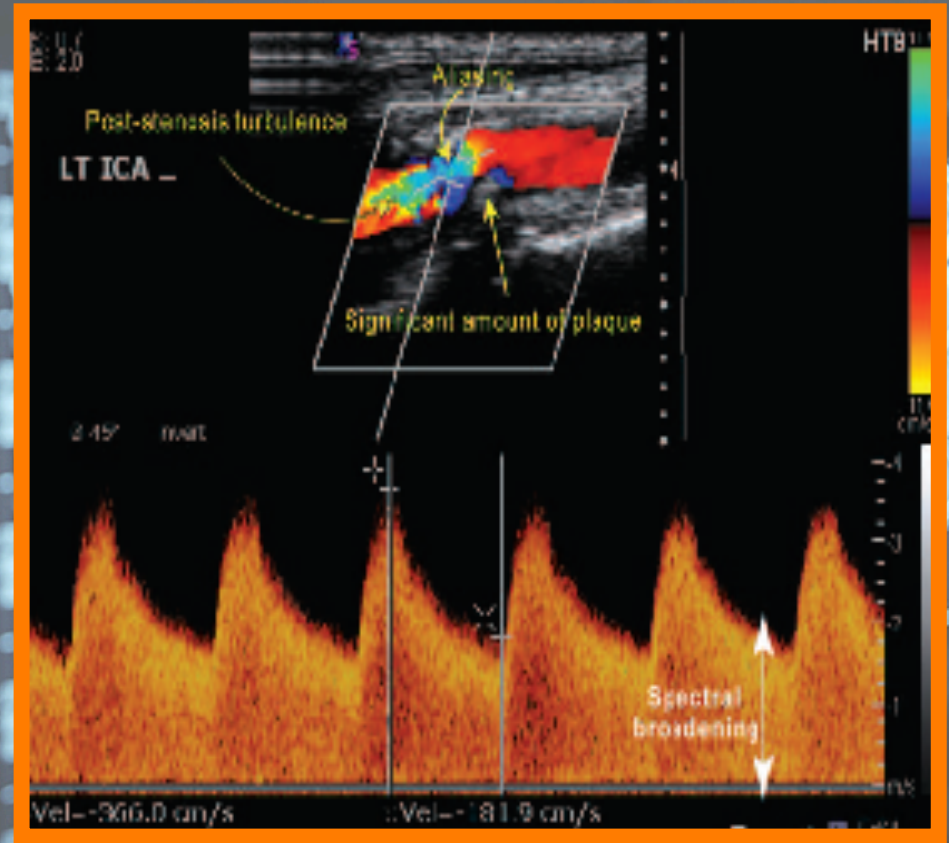


AP view

CEREBRAL ANGIOGRAM:
VENOUS PHASE



CAROTID DOPPLER:



ULTRASOUND NEONATAL BRAIN:

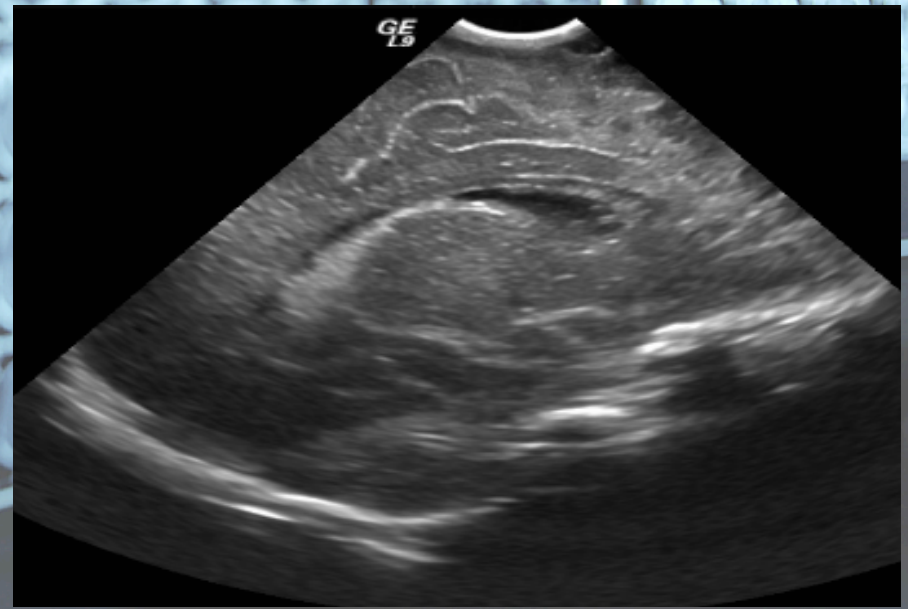
- ✓ Simple and easy way to scan the head of neonates and young babies with no discomfort to the baby
- ✓ Not using ionizing radiation
- ✓ Scanning is best done through an open fontanelle.
- ✓ Readily carried out even on sick babies in ICU.
- ✓ Particularly useful in detecting :

Hydrocephalus - Intracerebral hemorrhag - Congenital abnormality of the brain

CORONAL



SAGITTAL





Best Of Luck

Hope our work was helpful
We tried to make it easy, organized and complete.
If you have any Questions or comments please contact us :
433radiology@gmail.com