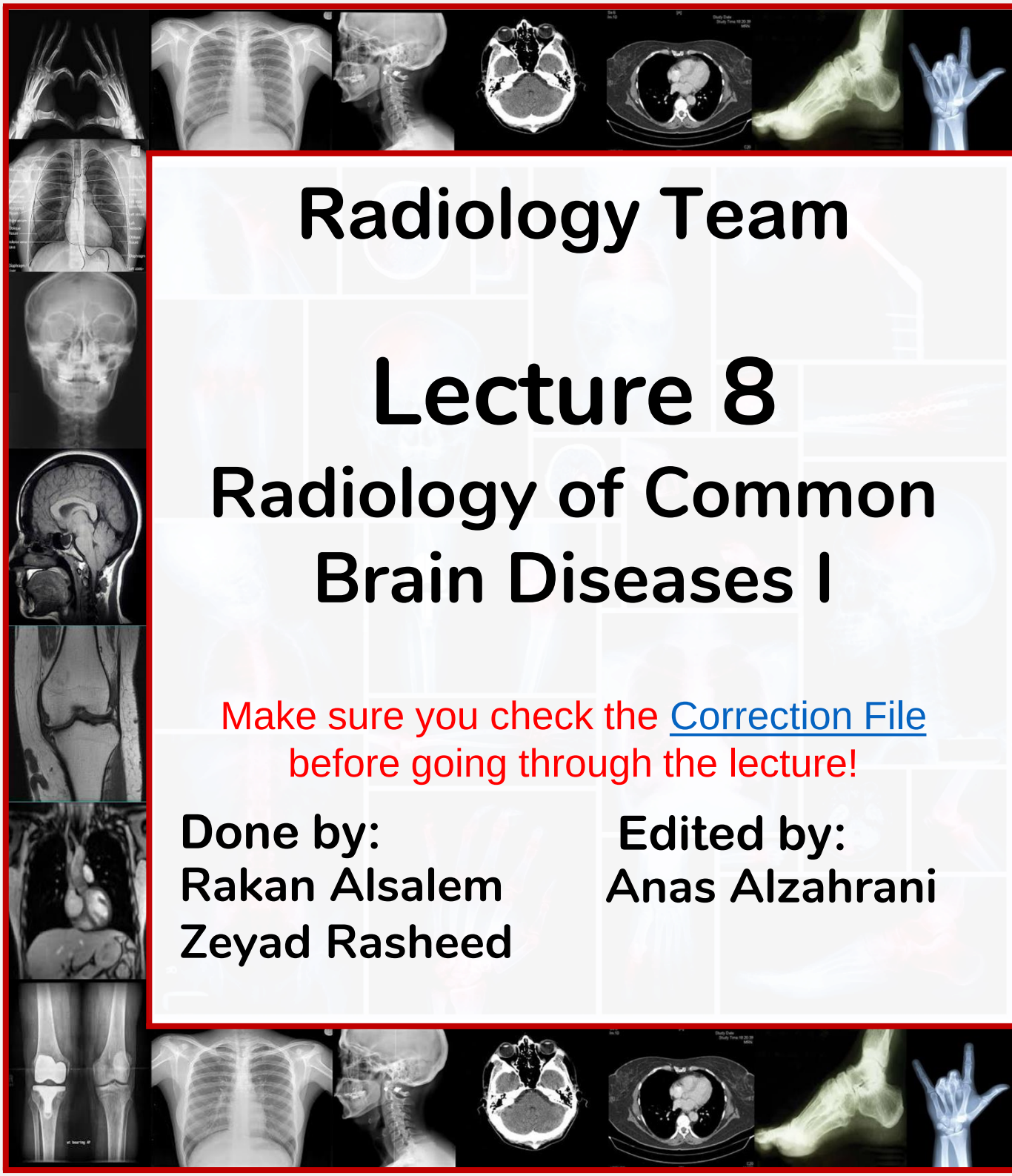

Radiology Team

Lecture 8

Radiology of Common Brain Diseases I

Make sure you check the Correction File before going through the lecture!

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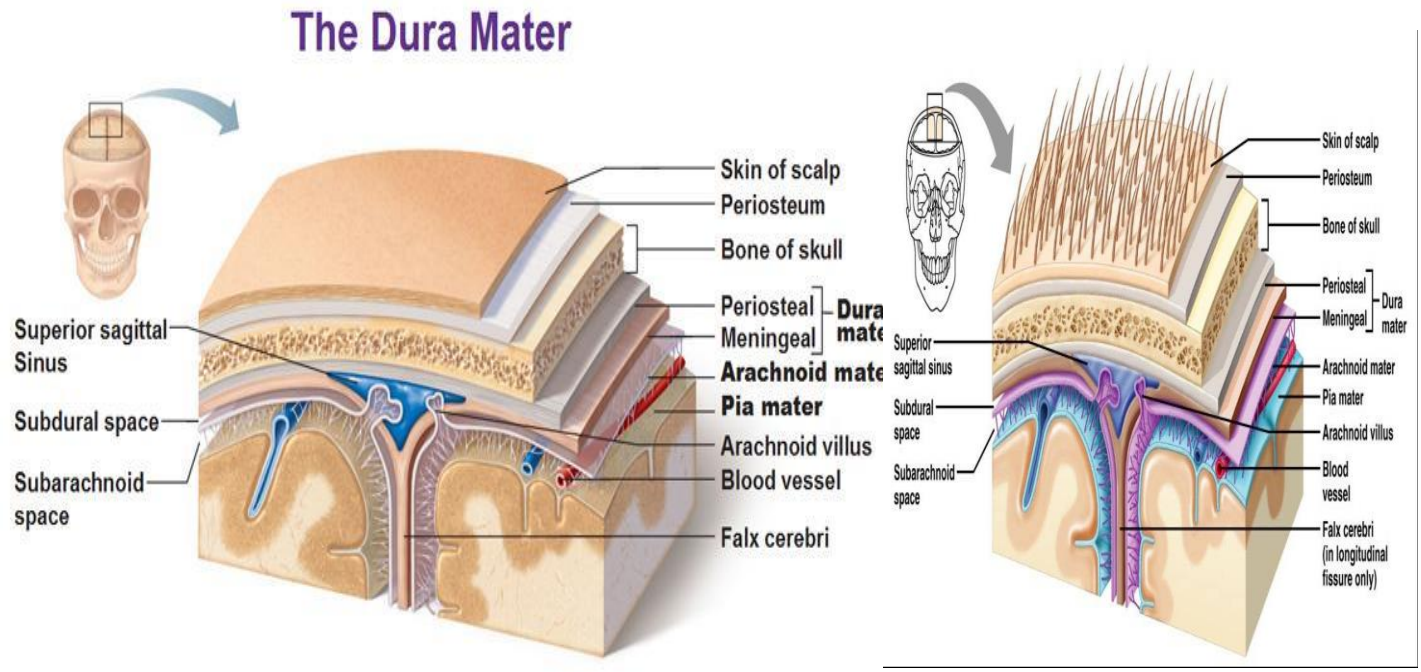
Color Index:

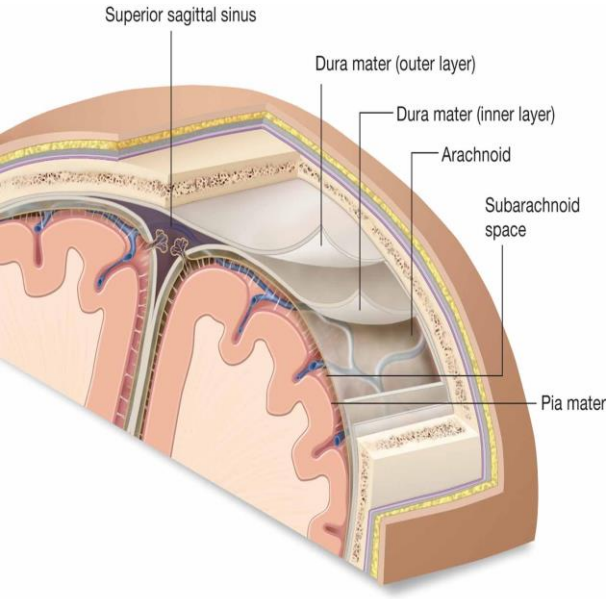
• Important • Females' notes • Males' notes • Explanations
• 433 & 432 Teamwork

Brain diseases

- Intracranial bleeding
  - Brain ischemia
  - Brain edema
- Intracranial tumors
  - Brain infections
  - Brain inflammation

INTRODUCTION AND ANATOMY OF THE BRAIN



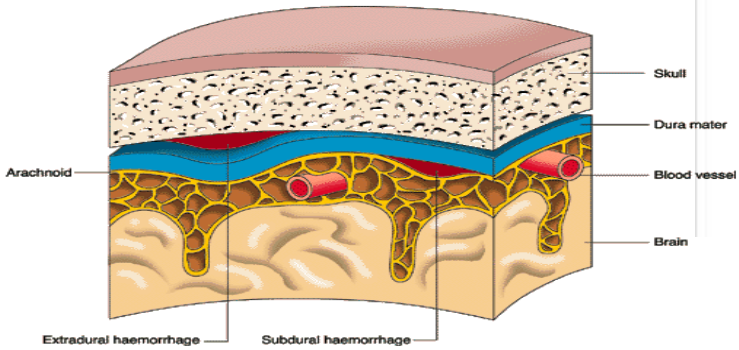


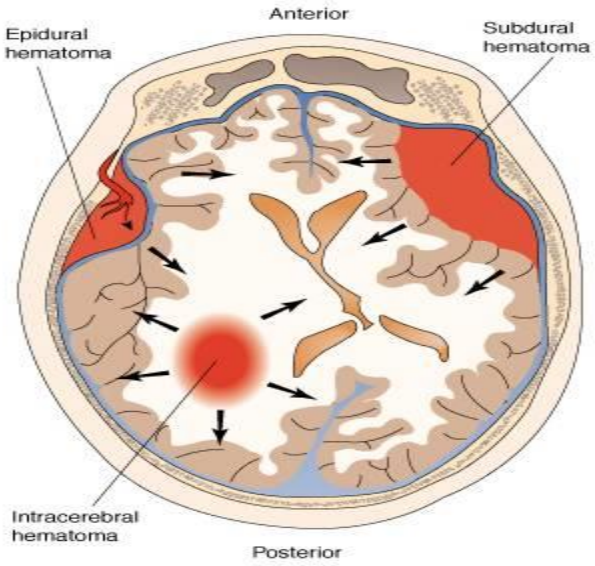
The inner Dura the (meningeal) is attached firmly to the outer one (periosteal) there is no space in between, so consider them one layer. The outer layer follows the bone and the inner layer reflects in the interhemispheric fissure or to the occipital lobe and cerebellum to make the Dural reflections (falx cerebri & falx cerebelli)

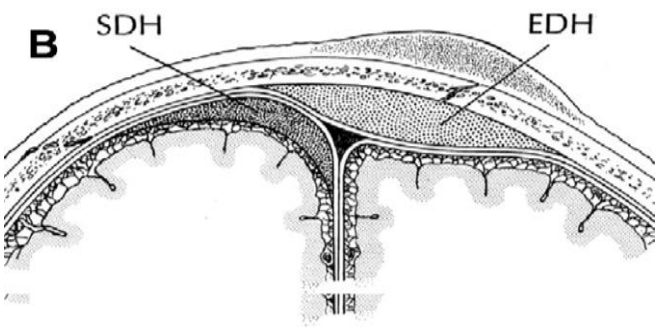
So anything or any disease that is beneath the Dura should be called subdural, anything between the Dura and the bone is called epidural. Then after Dura is the white layer called the arachnoid then the subarachnoid space (which contains the CSF). the layer directly above the brain is the Pia matter.

Intracranial Bleeding

- Extradural (Epidural)
- Subdural
- Subarachnoid
- Intraventricular
- Intraparenchymal





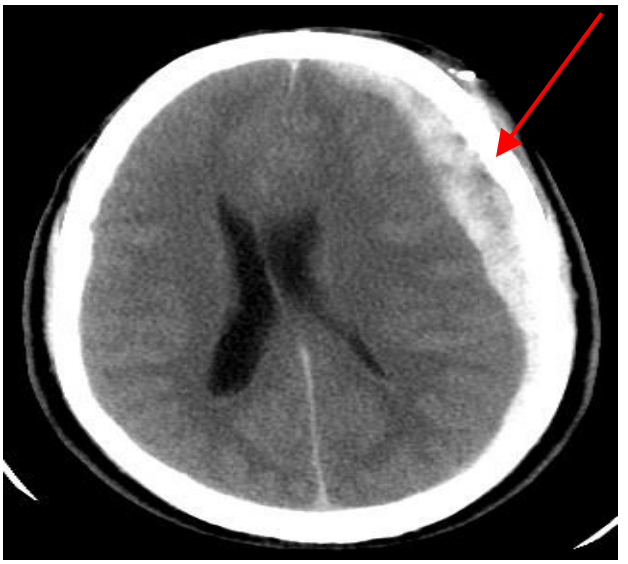


I. Epidural hemorrhage(EDH)

- Blood collection between inner table and dura.
- Biconvex (lentiform)
- Occur at site of impact
- 95% unilateral, supratentorial
- Does not cross sutures
- Can cross falx and tentorium
- Skull fracture in 90%
- Air seen in 20%
- Arterial 90%, Venous 10%
- Non-traumatic-rare
- Lucid interval-50%: : After head impact loss of consciousness then becomes awake for sometimes then lose it again.
- C/F: headache, nausea, vomiting, convulsions, or herniation.

II. Subdural Hemorrhage

- Blood collection between dura and arachnoid.
- Crescent shape
- Supratentorial
- Cross sutures, but not dural attachments
- May extend along falx and tentorium
- Trauma is the most common cause.

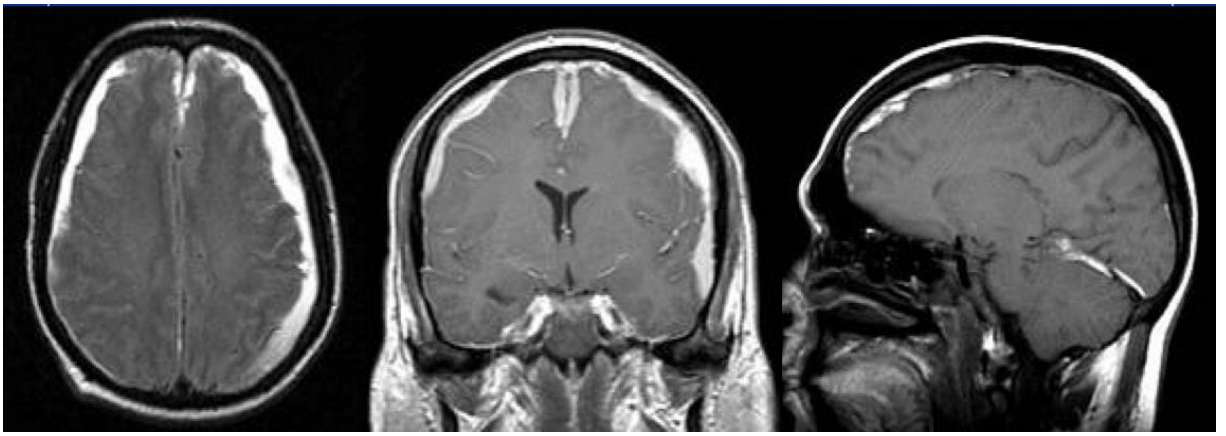


❑ **Blood in CT:**

1. Hyper-acute "within minutes" (black)
2. Acute: hyper-dens 6h-3d (white)
3. Sub-acute isodense from 3d-3w (gray).
4. Chronic: hypo-dense (black) more than 3 Ws

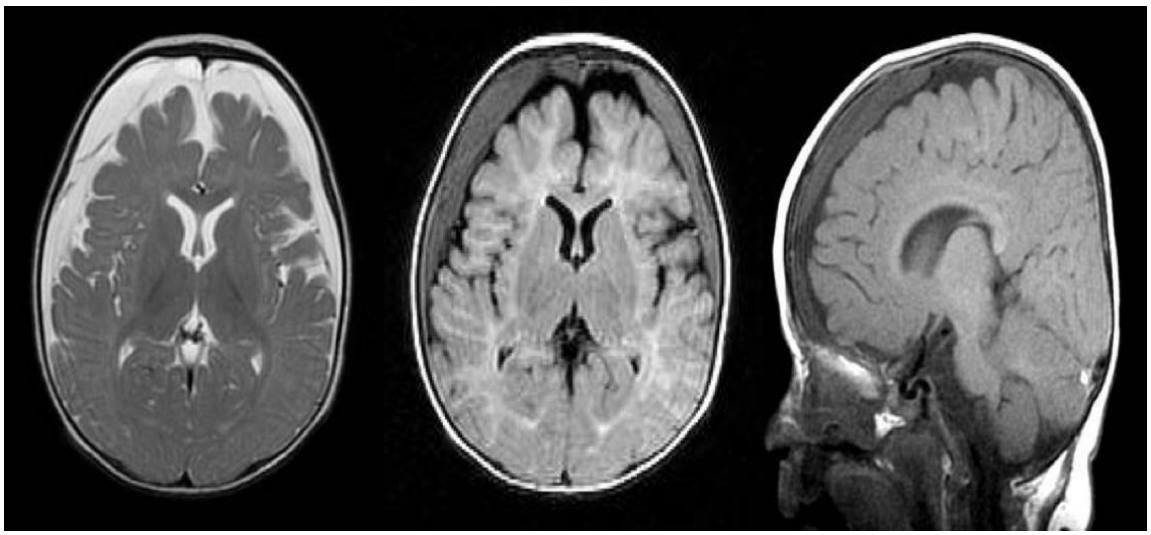
- **Why we classify them ?**

Because the density of the blood will reduce with time.

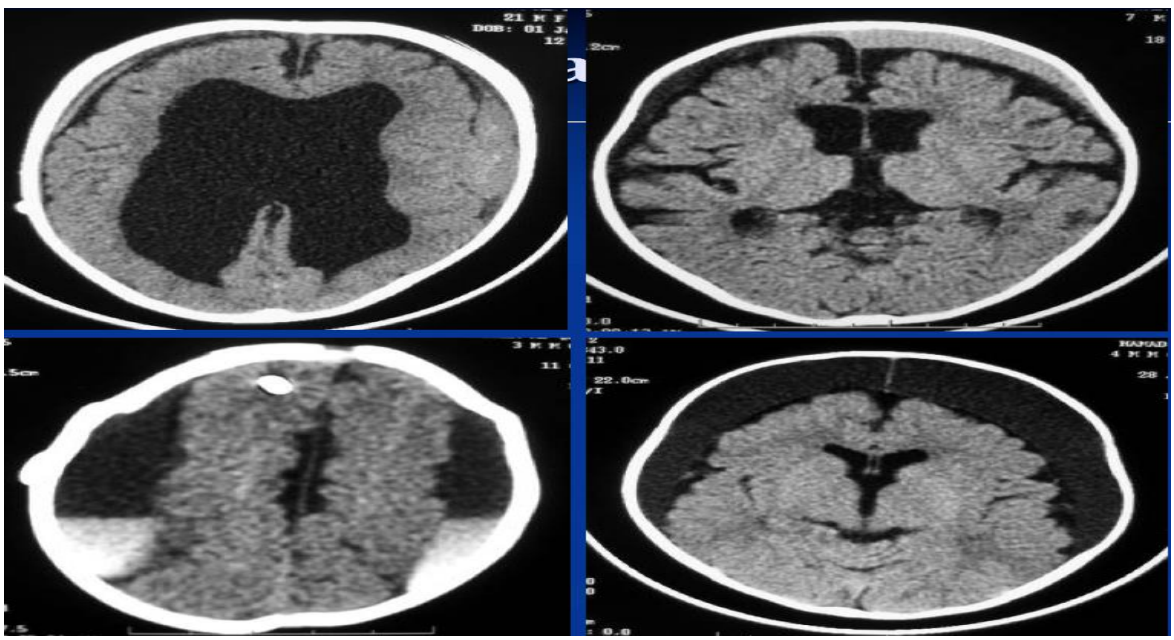


This is MRI because bone is black, and over it is the skin, which is white, here there is subdural hematoma, which is outside the brain and enters the Dural reflections.

II. Subdural Hemorrhage (CONT'D)



T2 (MRI), the fluid is bright and hematoma is bright, so to differentiate we do CT scan, on CT fluid is dark and hematoma is grey, if hematoma is grey it means it's subacute or chronic. Here it is bilateral subdural hematoma

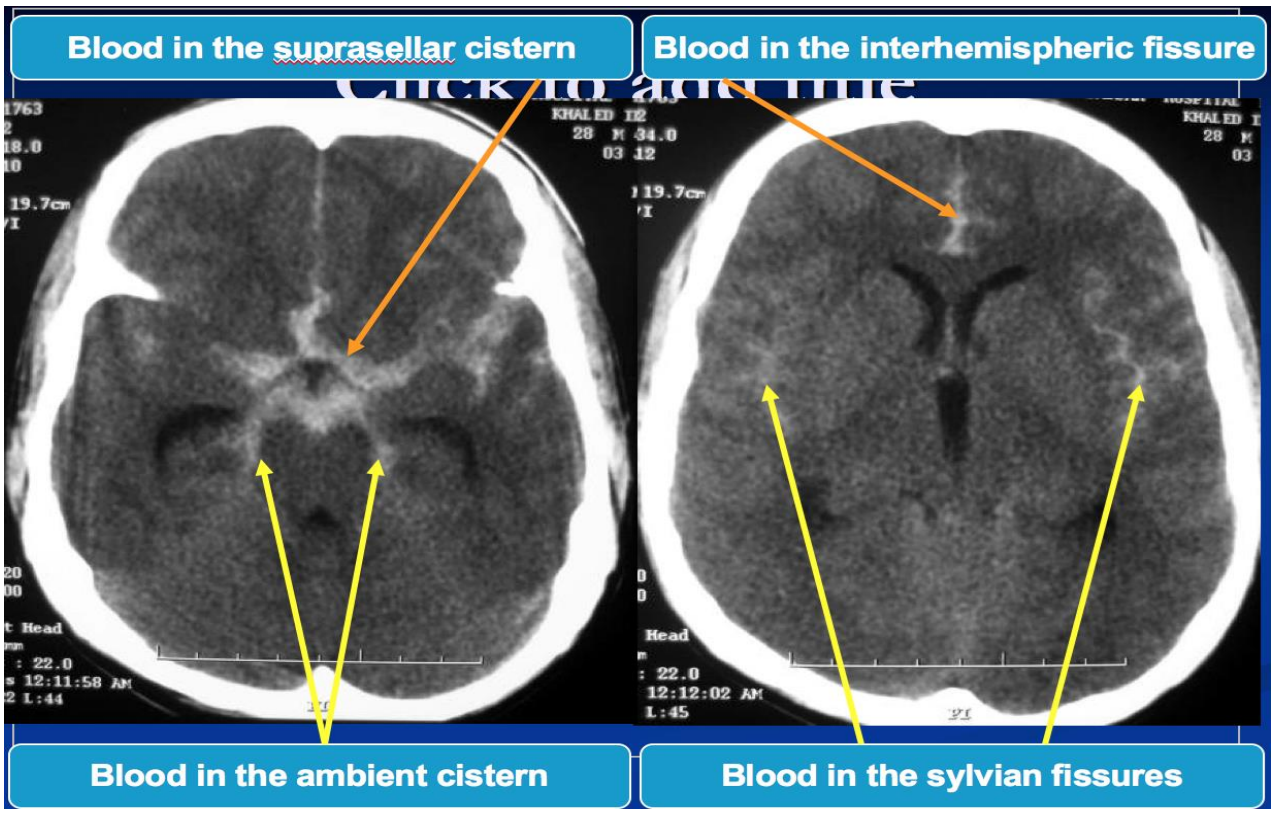


III. Subarachnoid Hemorrhage

- Blood between pia and arachnoid
- Traumatic (most common)
- Non-traumatic
- C/F: headache, vomiting, blurred vision, neck rigidity
- Complications: hydrocephalus (acute/delayed), vasospasm, rebleeding.

When young patient come complaining of worst headache in his life think about SAH.

- Most common non traumatic cause for SAH is Rupture Aneurysm.
- Most important step in the management is prevent the vasospasm because it will lead to infraction.
- It mimic Meningitis but without fever so, they describe it as chemical Meningitis.

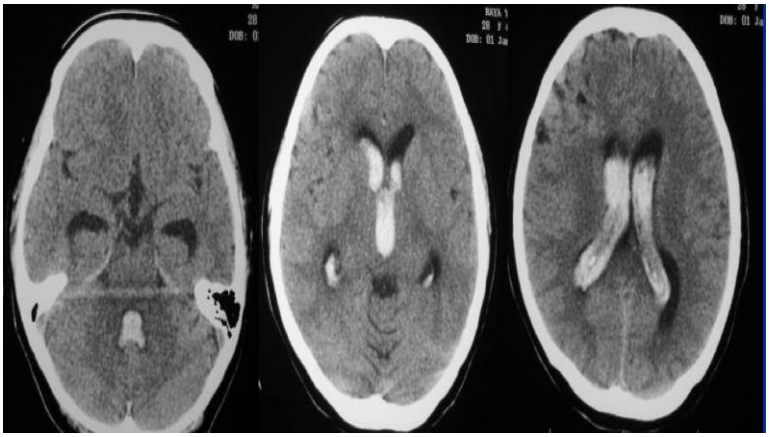


Hallmark:

We see a blood in spaces that should be filed with CSF.

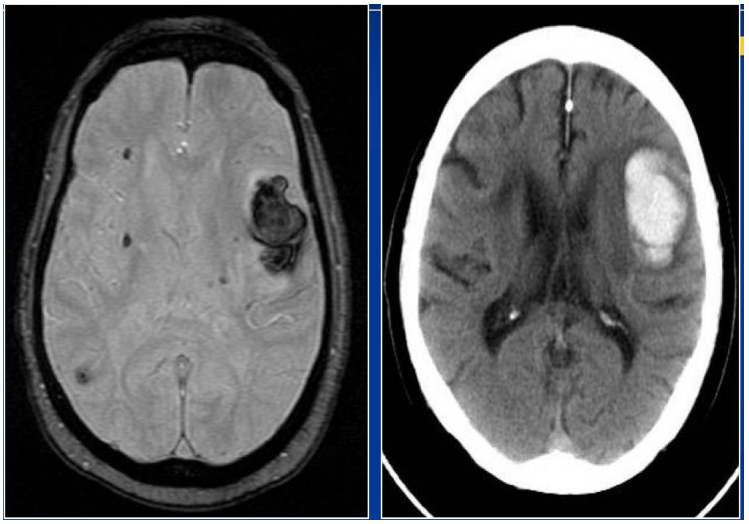
iv. Intraventricular and Parenchymal bleeding:

Blood in the 4th ventricle ,3rd ventricle ,and lateral ventricles.



Blood in the ventricles and the parenchyma, so intraventricular and intraparyncemal hemorrhage.

Parenchymal bleeding



- **Causes of Parenchymal bleeding:**

HTN, trauma, AVM, aneurysm, **permaturity**, tumors, infarction, coagulopaty.

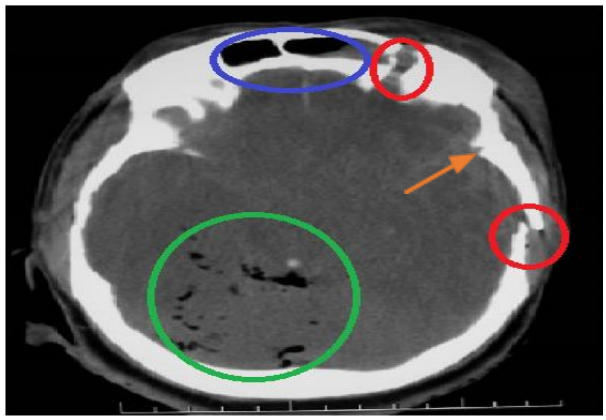
NOTE: Premature neonate are caring risk to have parenchymal and intraventicular bleeding .

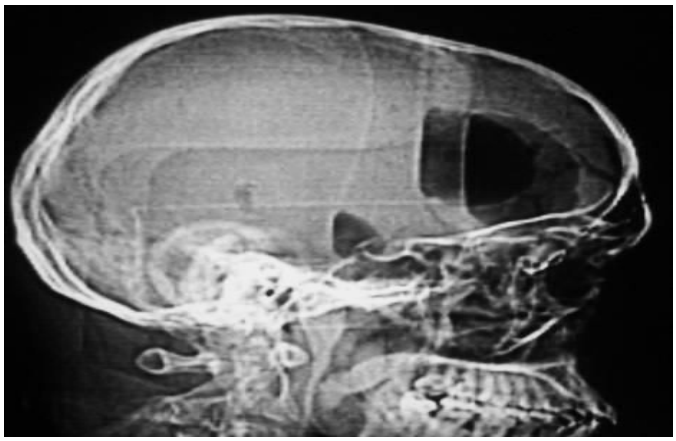
Trauma

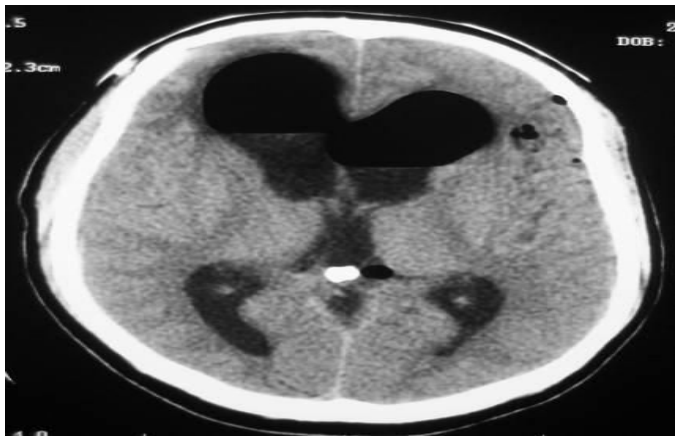
The black area is air (green circle), it is called (pneumo--cranium) or (pneumo--cephalous). Air can escaped to brain parenchyma by fracture to base of skull (THE SINUS) or laceration of skin with the skull fracture seen in red circles (SKIN need to be lacerated in case of pnumocranum if not lacerated and air is found inside then think of base skull fracture)

Subarachnoid bleeding in the sylvian fissure (lateral sulcus)

Blue circle: bleeding to the frontal sinus accompanied the skull fracture







Massive (pneumo--cranium

Blue arrows: area of calcification

Green arrow: Subdural hemorrhage

Orange arrow: external hemorrhage (hematoma)* صعرور

Epidural bleeding is the only bleeding not present in this case

NOTES: Untreated base skull fracture complications:

- Normal flora and other pathogen will escape to the brain causing repetitive meningitis
- CSF leaking through sinus leading to CSF rhinorrhea
- PNUMOCRANUM

The lateral aspect of the brain is supplied by middle cerebral artery (MCA)

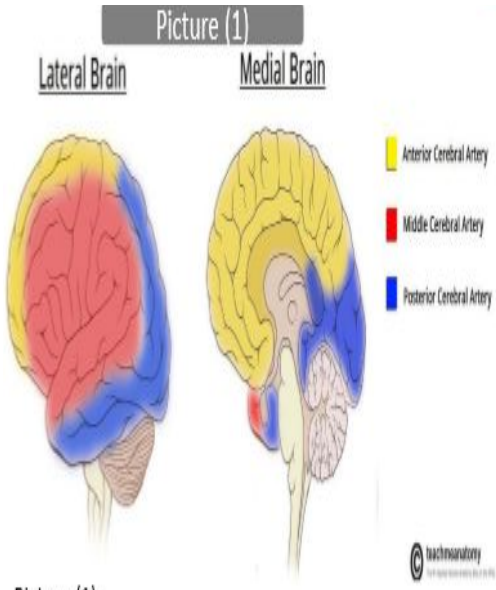
The medial aspect of the brain (around Sylvain fissure) is supplied by anterior cerebral artery (ACA)

The temporal and occipital aspect is supplied by posterior cerebral artery (PCA)

Note:
ACA supply the medial aspect of the frontal lobe

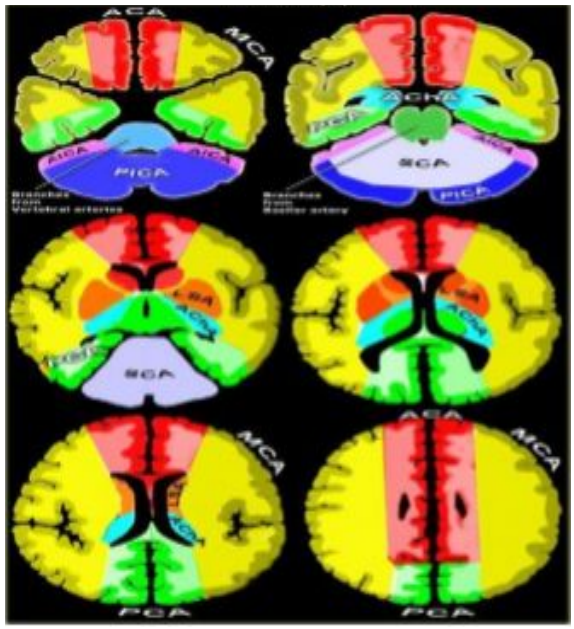
Basal ganglia including the internal capsule is supplied by MCA (MCA cores in sylvan fissure)

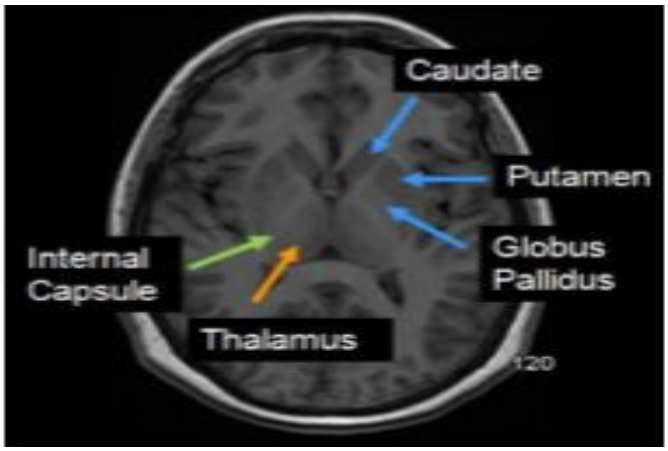
PCA supply thalamus

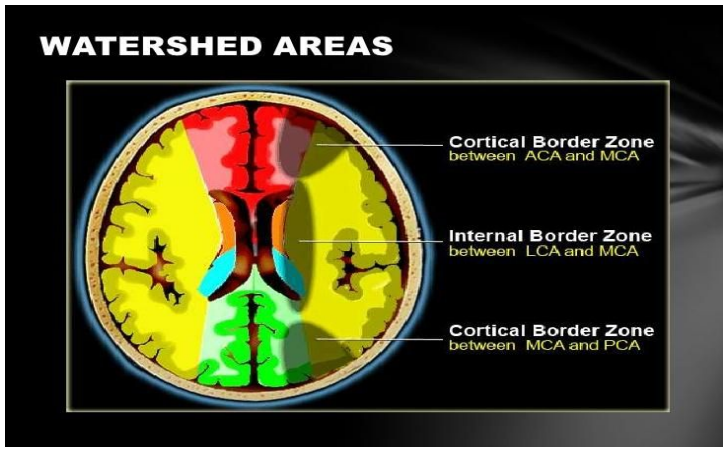


Picture (1):

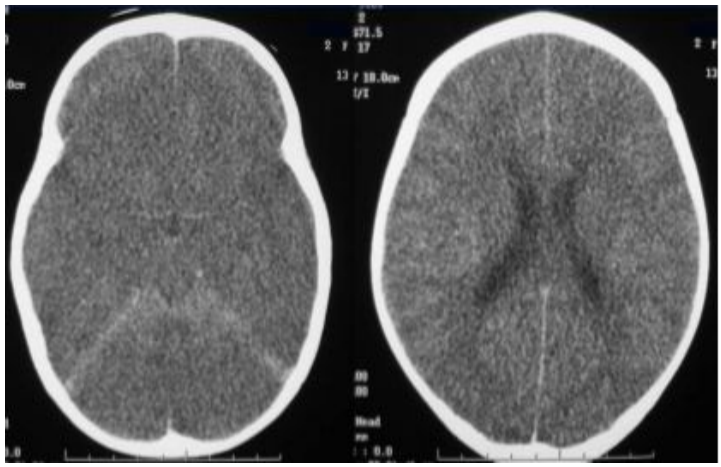
- The inferior part of cerebellum and the lateral part of medulla is supplied by posterior inferior cerebellum artery (PICA) which is a branch of vertebral artery
- The anterior part of cerebellum is supplied by anterior inferior cerebellum artery (AICA) which is a branch of basilar artery.
- Top of cerebellum is supplied by superior cerebellar artery (SCA)

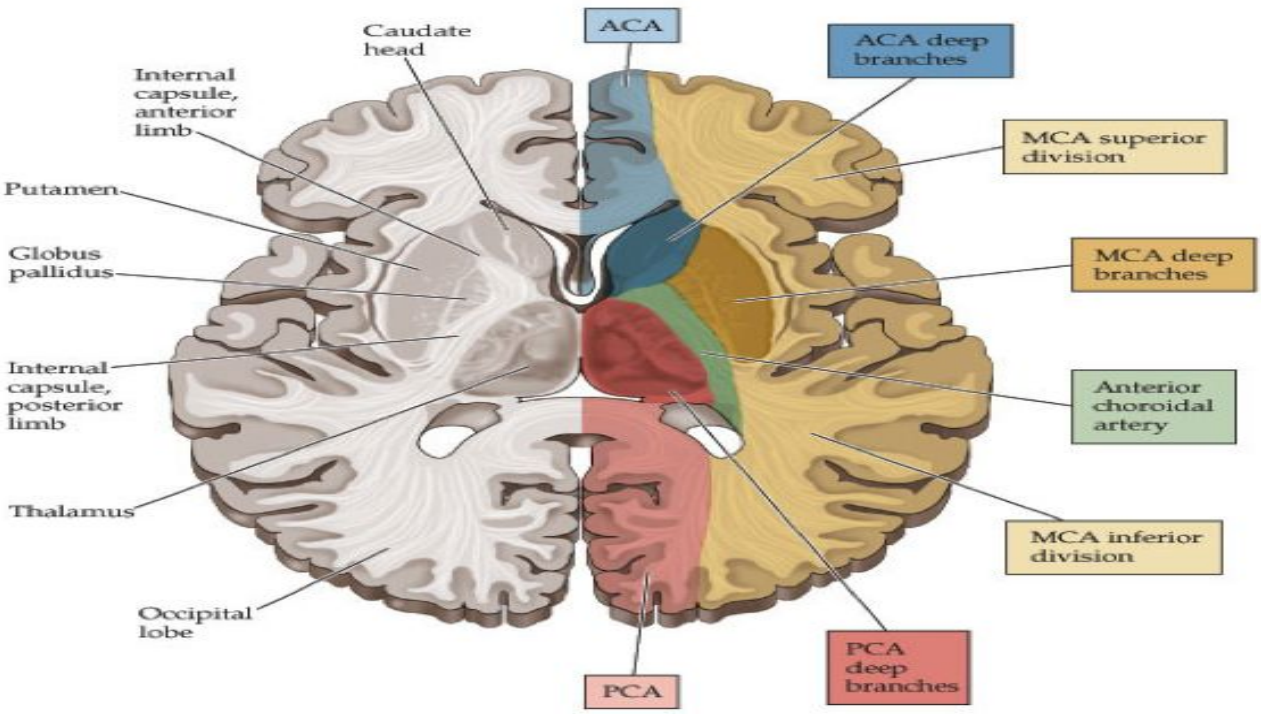


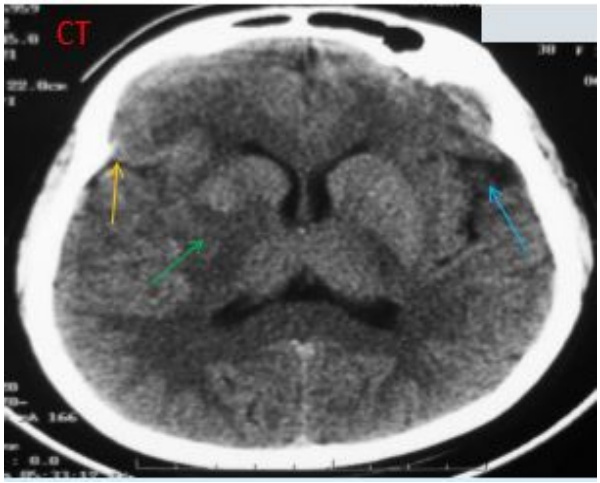


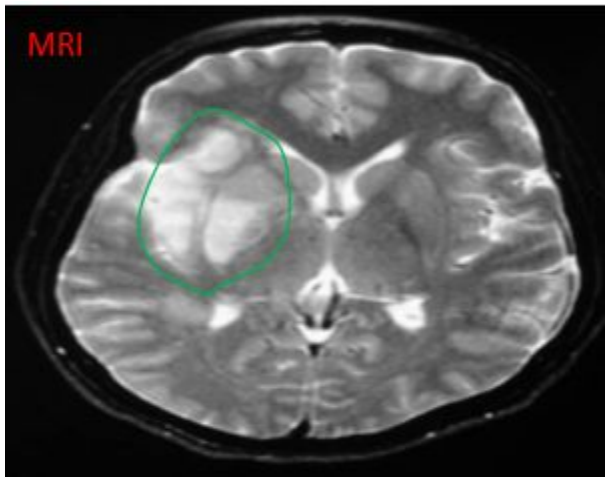


If you see a lesion that follow the vascular territory then think of ischemia (thrombus)









You have to compare between 2 sides of image

Green arrow: The putamen & the Globus pallidus are abnormal on the right side they are dark compared to left side which is normal.

Blue arrow: The sylvian fissure which is normally widely open in the left side compared to right side (orange arrow) which is small which indicates edema compress the Sylvain fissure because of ischemia so, if there is ischemia there is edema(fluid) so, (lose appearance of the structure).

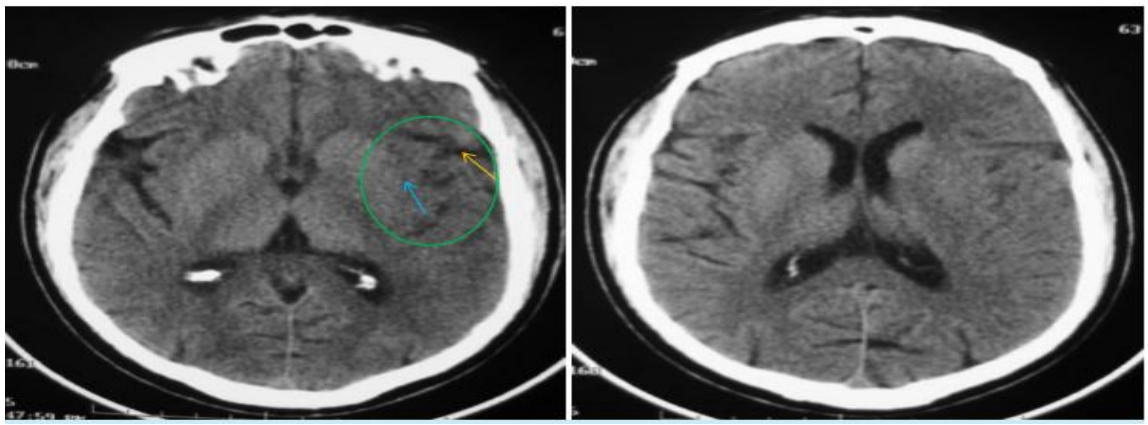
T2WI-MRI shows:

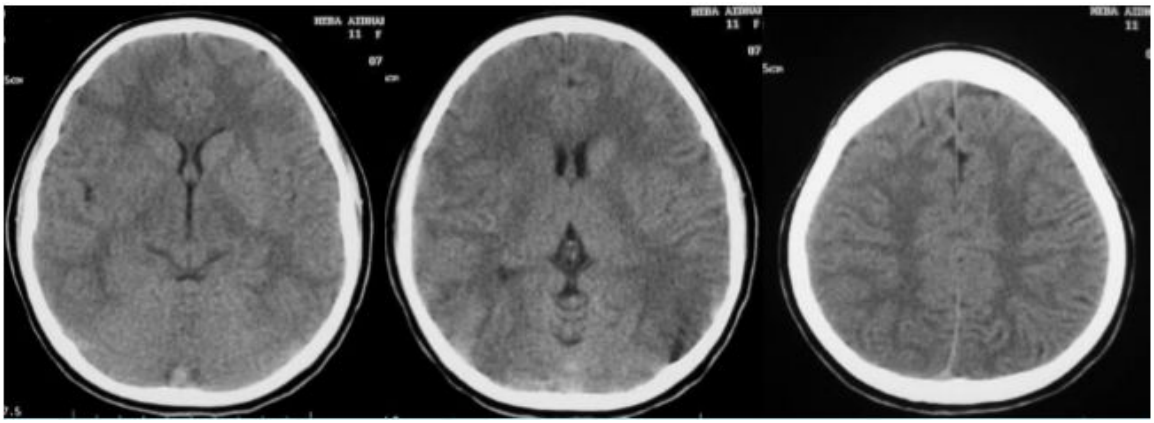
The green circles: shows abnormal fluid (edema) which is formed because of infraction. The basal ganglia and the sylvain fissure are the effected parts in pic above with some surrounding structures (insular cortex)

Note: the basal ganglia, Sylvain fissure and insular cortex are supplied by the middle Cerebral Artery.

★MCA Manifestation

Patient presented with sudden right hemiplegia





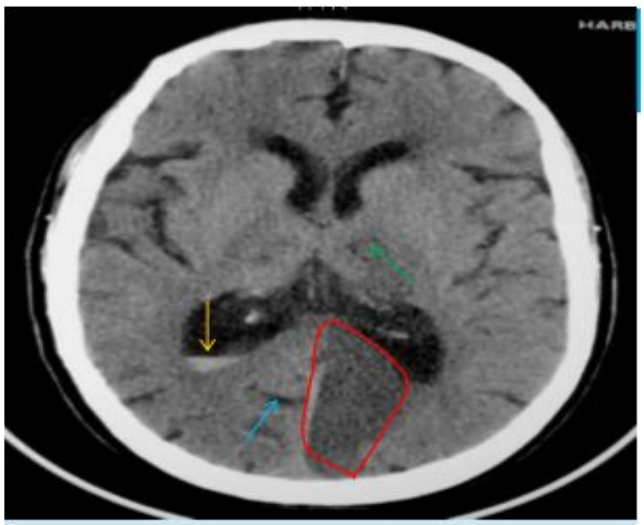
MCA infarction that involved basal ganglia

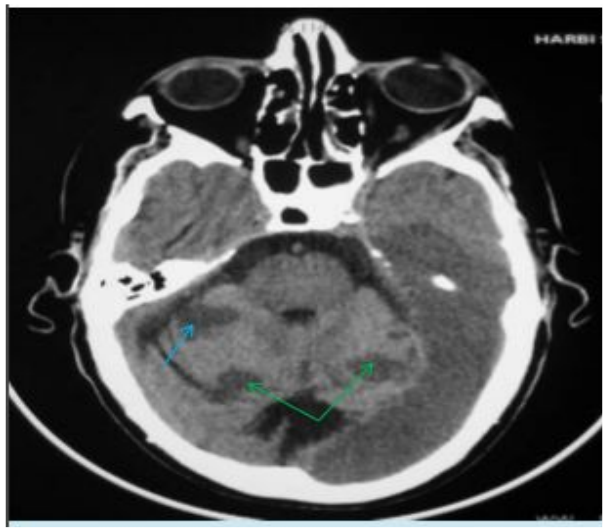
They present with motor deficit either hemiparesis or hemiplegia. if sylvian fissure get involved they present with aphasia (sylvian fissure contains wernicke's and broca's areas).

- Basal ganglia hemiparesis or hemiplegia
- sylvian fissure aphasia (wernicke's and broca's areas)
- infraction edema

★PCA Manifestation

Patients usually presents with vision loss (hemianopia)





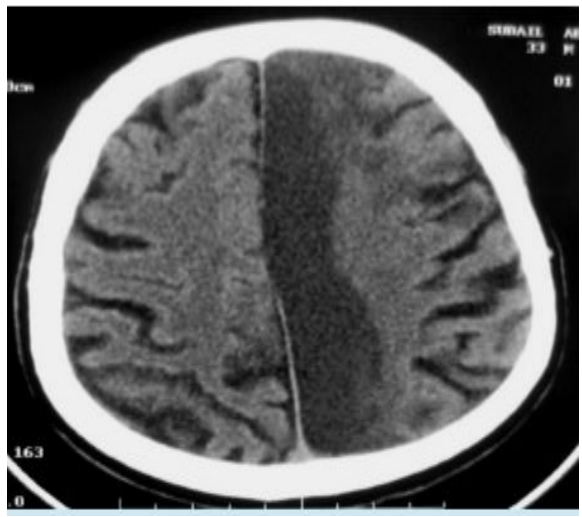
- Red circle: This is PCA infarction involved occipital lobe and it affects posterior part of thalamus.
- The blue arrow: The calcarine fissure is absent in the left side which indicates a swelling and when it is swollen it means acute not chronic.
- The yellow arrow: There is bleeding in the ventricle.

✓ There are other infarctions in the cerebellum by the superior cerebellar artery and inferior cerebellar artery.

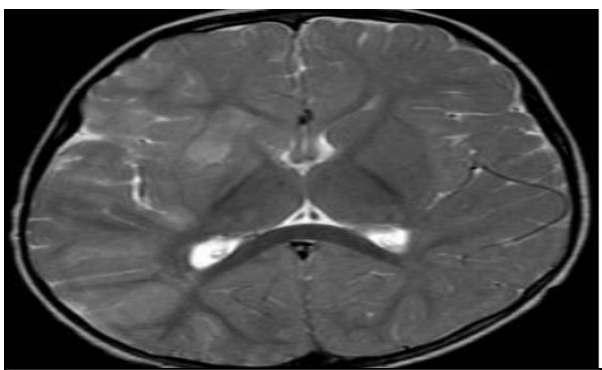
★Acute ACA Infarction:

MONOPLEGIA

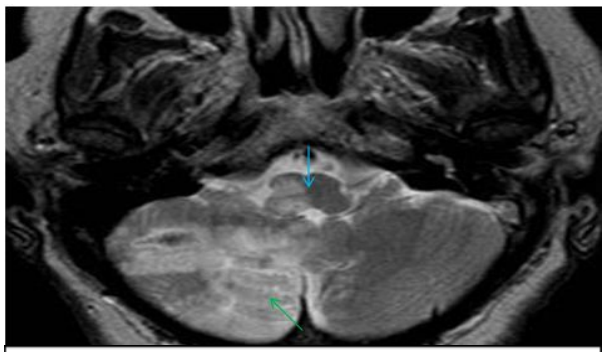
- Infarction in the anterior cerebral artery
- The calcarine sulcus in the left side is not seen here and the falx is pushed to the other side (edema)so this indicates that this is acute ischemia , but if there is shrinking of brain tissue >chronic ischemia.
- How this patient will present clinically? Paralysis of the right leg (monoplegia)., the hand and face will not be affected because they are represented downwards.



Finding:
- Bilateral Anterior Cerebral Artery ischemia due to anterior cerebral artery aneurysm.
- Clinical presentation: Paralysis of both legs (paraplegia).



There is MCA infarction



Lower part of cerebellum is infarcted.

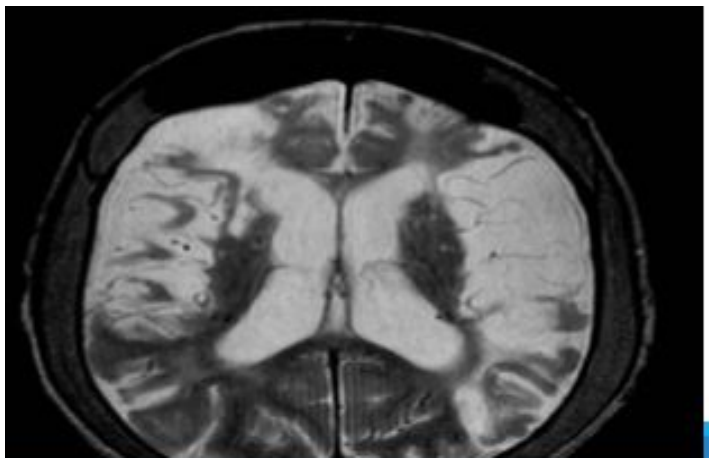
We know it's lower because medulla oblongata is seen and these structures is supplied by PICA.

This conditions is called lateral medullary syndrome

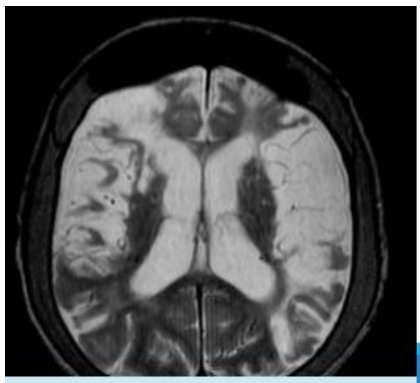
★MCA Infarction:

Important:
To differentiate between acute and chronic infarctions
- Acute infarction: Swelling of Gyrus
- Chronic infarction: Gyrus is shrinked and Sulcus is swollen

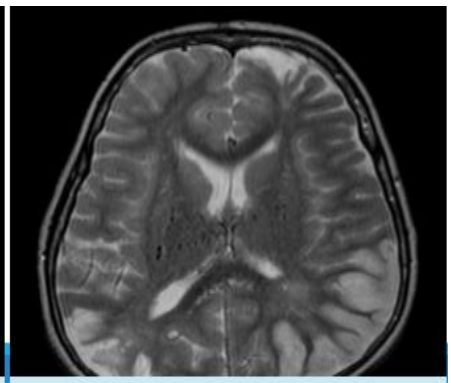
Chronic bilateral MCA infarction



Multiple infarctions in SCA



Chronic Bilateral MCA infarction.



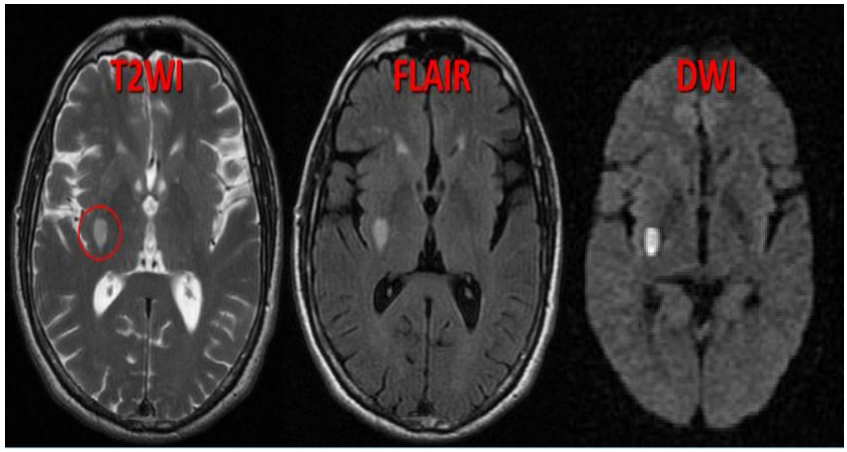
Multiple infarctions in SCA patients

Infarction of basal ganglia (posterior limb of internal capsule) which is supplied by MCA

Corticospinal tract is passed from here this infarction will cause contralateral hemiplegia

DMI: Diffusion weighted imaging
It has superior benefit because it will show the recent infarction only (7 days)

The other will show infarction irrelative to the time of infarction but this can catch the infarction within one hour (very sensitive)



Brain Edema

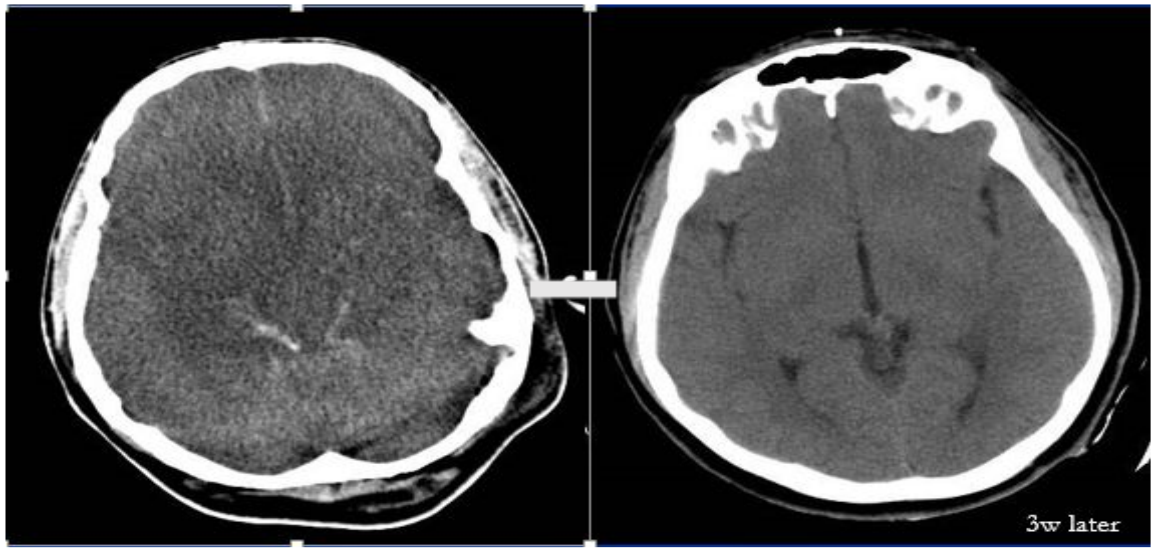
Edema	Vasogenic	Cytotoxic
Definition	The edema is extracellular and found within the interstitium.	The fluid within the cell and this will kill the cell because water is toxic to cells.
Example	Trauma,Infection and Inflammation.	Ischemia/infarction /trauma is the usual cause why? Because hypoxia will diminish **NA/K pump** this will lead to water shift intracellular causing the edema.
Imaging findings	• **Compressed ventricles** • **Effaced sulci & cisterns** • **Denser cerebellum in relative to other structures.** • **Edema is fluid thus will appear dark in CT scan** • **Low signal on T1, high signal on T2 & FLAIR** • **Both could be generalized or localized.** • **Both may Co-Exist** • **Brain herniation** • **Vascular compression-ischemia.**	

❖ **Remember:**

- Edema will lower the contrast between gray and white matter so you won't differentiate between them specially if edema within the gray matter.

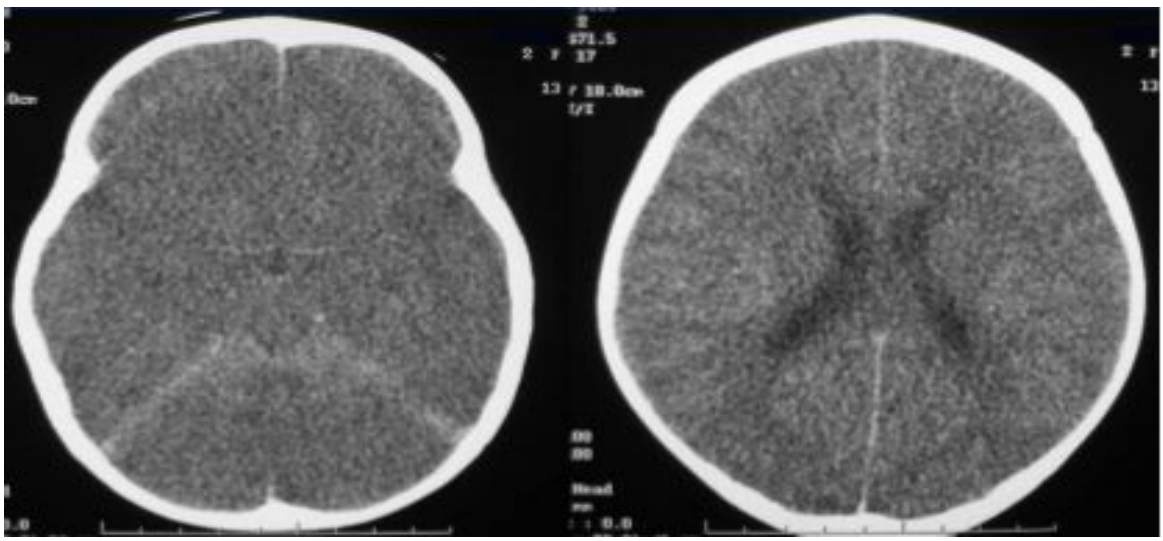
- Severe edema will compress the vessels causing ischemia that will increase the edema again >> (brain death).

Edema	Vasogenic	Cytotoxic
Location	White matter	Gray matter
DWI	Non -restricted	Restricted
Shape	**Finger -like**	**Diffuse**



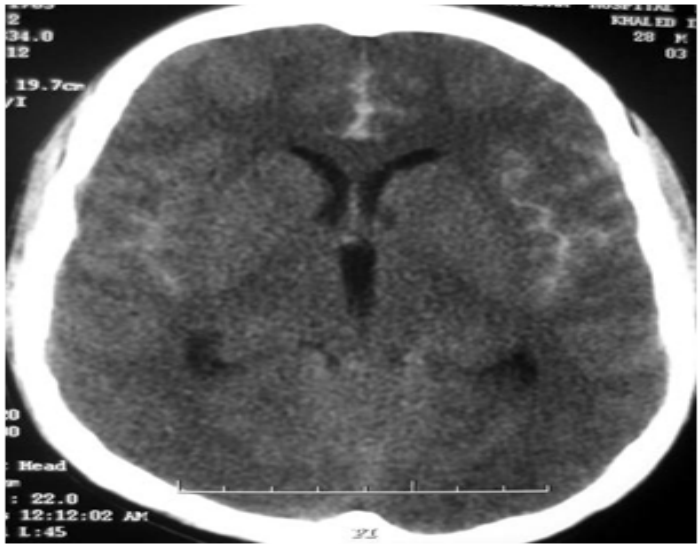
Before treatment

Post treatment (you can see ventricles and start to differentiate between white and grey matters)



MCQs

•1 – Patient presented at the ER complaining of sever headache describe it as the worst ever she had and neck rigidity , you did a CT scan and you found this .



What is your diagnosis

•A-Subdural hemorrhage

•B-Subarchanid hemorrhage

•C-Paranchymel bleed

•D-Epidural hemorrhage

•2- Patient presented to ER complaining of headache , vomiting . You did a CT scan for the brain and you have made the diagnosis as Epidural hematoma .

Which of the following correlate with EDH in the CT?

•A- Biconvex (lentiform) lesion

•B-Crescent shape

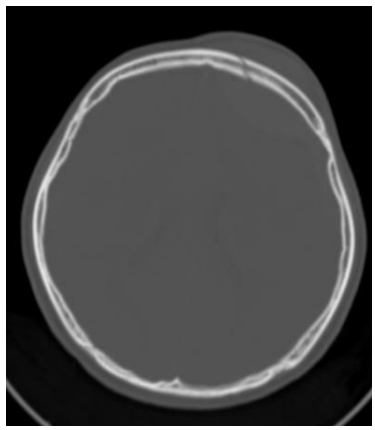
•C- The blood Cross the sutures

•D-Blood filed the ventricles

Answers: 1-(B) 2-(A)

Doctor's Questions

The cause of this hematoma is:
- Anticoagulation
- Hypertension
- Ruptured aneurysm
- **Trauma**

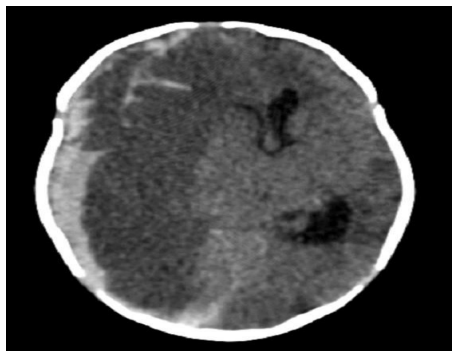


This CT shows:

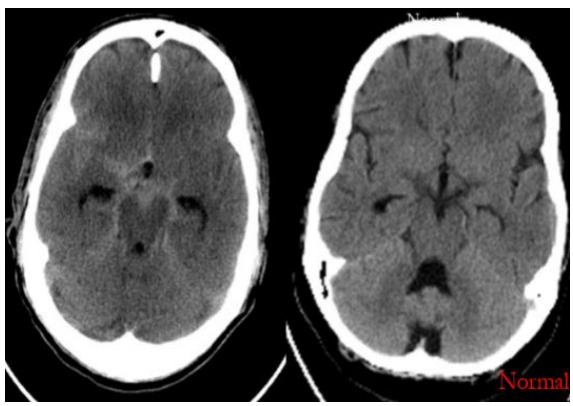
- Epidural
- Subdural
- Subarachnoid
- IntraParenchymal

This CT shows:

- Subdural hematoma
- Subarachnoid hemorrhage
- MCA infarction
- All of the above

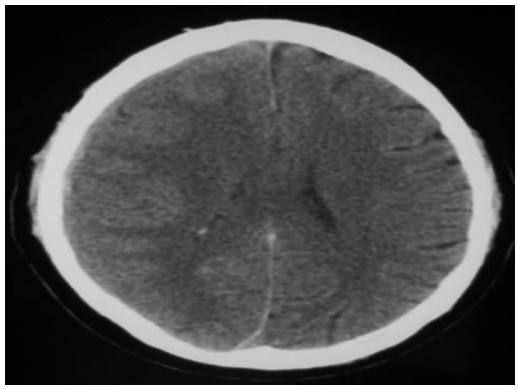


This CT show"
1) Subdural hematoma
2) Subarachnoid hemorrhage
3) MCA infarction
4) all of them



This CT shows:

- Epidural hematoma
- Subdural hematoma
- MCA infarction
- Normal brain



1- Subdural Hematoma.

2- Obliterated CSF space.

3- Compressed lateral Ventricles.

4- Normal Sulcus

Thank You