



CNS CASES DISCUSSION

DR. Ibrahim AlDrainy

TO all my love brothers and sisters

* Sorry I don't hold responsibility for any missing information or perhaps – I say perhaps – wrong material. **I swear to God** that I tried my best to present this lecture in the best way and I hope that what I wrote in enough to cover the subject .

If you have any question plz contact me at www.ksums.com or send to me at zizo2rad@hotmail.com

* المذكره رُوجعت علميا وتم إضافة نوات المحاضرة وإضافة ملاحظات

على الصور

* هذه المذكرة إهداء إلى دفعة ٤٢٤ على جهودهم في مساعدتنا وعلى

رأسهم مساعد الحمزة ويوسف خوجة

* وايضا اهديها الى أخونا معــد من دفعتنا الغالية

Noted and typed by

أخوكم عبدالعزيز السعد

rad Gp

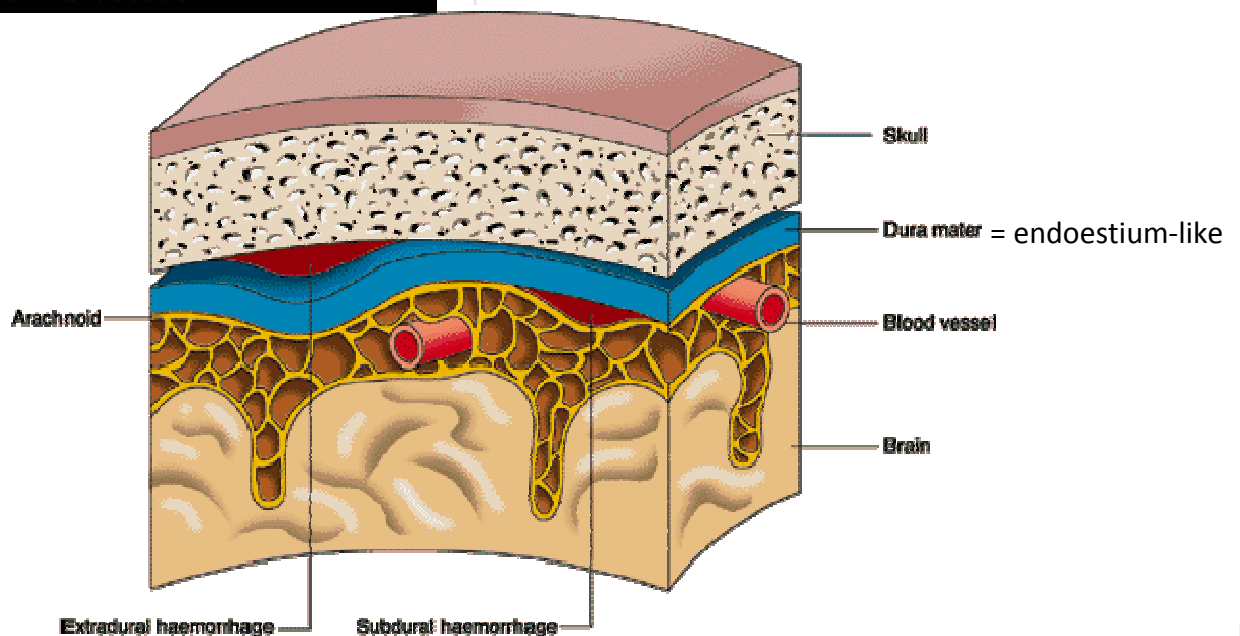
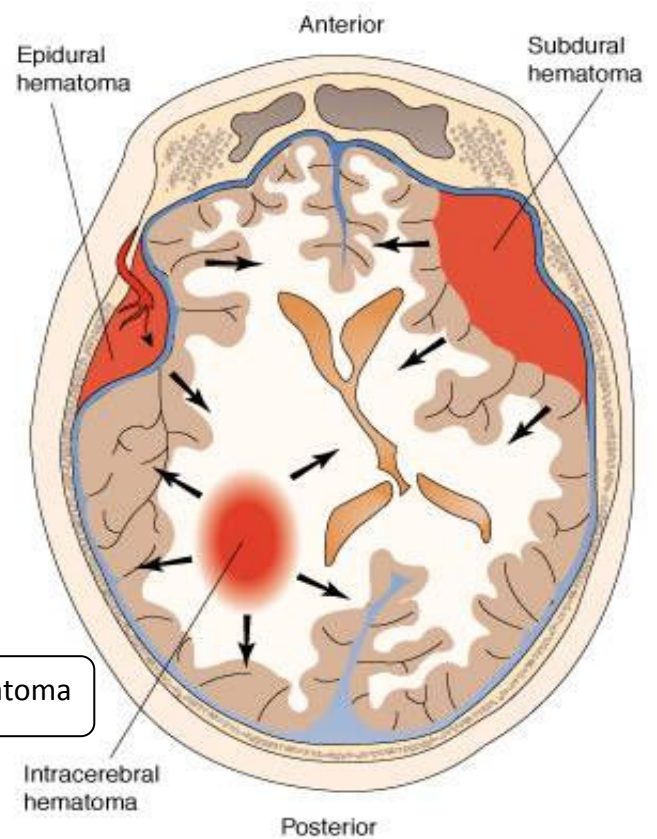
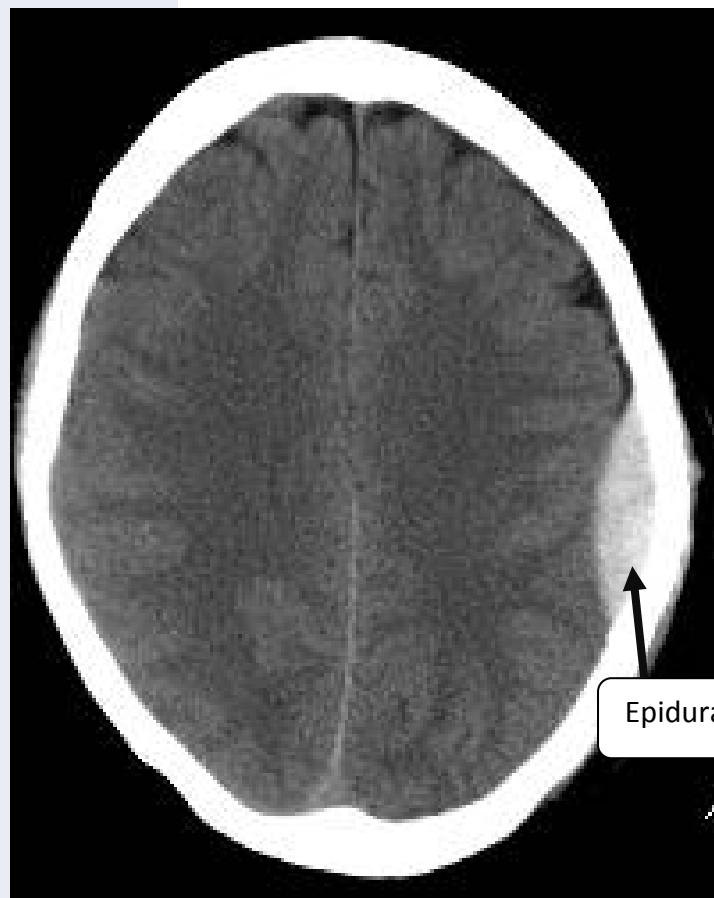
(dr.zeezu ☺)

أرجو قراءة آخر صفحة بالمذكرة للأهمية

*Intracranial Bleeding:

→ Intracranial Bleeding:

1. Extradural. (extra=epi)
2. Subdural.
3. Subarachnoid. (Deep to arachnoid)
4. Intraventricular.
5. Intraparenchymal. (in parenchyma) (may be caused by hypertension)



* Epidural Hematomas

- Usually occurs at the site of impact. So if the trauma on a one side, the hematoma will occur at the same side.
- They are biconvex in shape (lentiform=lens shape).
- Most of them are unilateral (95%).
- Most of them are supratentorial .
- Most of these hematomas are associated with fractures (90%).
- Infratentorial are more serious than the supratentorial hematomas because it will cause brain stem compression (cardiac & respiratory centers). So the infratentorial epidural hematoma is more serious than the supratentorial epidural hematoma.
- They cannot cross the sutures of the skull, but can cross tontorium and falx. So any blood outside the dura can cross the reflection of the dura. But if it is under the dura (subdural), it can not cross the dural reflection (because it reflects in the falx). So subdural hematoma have to come into the falx rather than crossing to the other side.
- Sometimes you see air into the hematoma (20%) which can be explained as fracture with (= plus) scalp laceration allow the air to inter or when the fracture going into paranasal sinuses which lead to entering of the air into epidural or subdural space and go with the hematoma. So if we see the air inside the cranium we have to think of:
 - 1-Bone fracture with scalp laceration,
 - 2-Bone fracture with communication to paranasal sinuses, or mastoid.
- The source of the bleeding in epidural hematomas is usually arterial (90%, venous 10%) and most of the causes are traumatic so the nontraumatic causes are rare .
- Patients initially maintain the consciousness then they loss it (Lucid Interval is 50%).
- The symptoms of the patient depend on the (severity) of the hematoma.
- Symptoms (symptoms of increase intracranial pressure) includes : headache, nausea, vomiting, convulsions and (herniation→cause diplopia) .

* Subdural hematoma (SDH)

1. The hematoma has one side convex and the other side is concave, it is crescentic in shape,
 2. It crosses the sutures (unlike the epidural ones),
 3. Also they are **longer** than the epidural hematoma (epidural ones are just small and localized because they are in the space between the dura and bone, but the subdural is in the potential space between the dura and arachnoid so it is big and can go even to falx).
- Subdural one also depends on the age of the blood.
 - Usually the new (acute) blood in CT scan is a white color. But if we have dark blood it indicates either chronic or hyperacute hematoma.
 - A midline shift (as we see in this case) is a really bad sign and it may need an immediate surgical intervention to reduce the pressure inside the cranium.
 - So the subdural hematoma is :
 - Blood between dura and arachnoid,
 - Crescentic shape, (convex-concave shape)
 - Supratentorial that can cross sutures but can not cross the dural reflections which are the falx and the tentorium.
 - Trauma is the most common cause. (may also cause by coagulopathy)
 - Stages of this hematoma on imaging (not clinical) are:
 - 1- Acute : from 6 hrs to 3 days.
 - 2- Subacute: with the time the blood starts to be less dense (more black) than the acute one. It takes from 3 days to 3 weeks.
 - 3- Chronic: from 3 weeks and more. It is black in color (may be lentiform shape (look like lens shape))
 - MRI is useful in these cases because it's multisequential capability (we can do multiple sequences, with each sequence we can look to the pathology in a different windows and different angles). So hematoma may not appear in T2 and appear in T1, may not appear in T1 and appear in T2 and so on.
 - The other advantage of MRI is multiplaner capability, so we can do axial, sagittal and coronal. But with CT imaging we have basically the axial.
 - Sometimes the SDH is only in the falx, this happen (especially) in patients who are on anticoagulation drugs.
 - SDH is lentiform when it becomes old.

- Recent blood of a lens shape is more likely to be epidural hematoma.
- SDH in healthy children (no congenital malformation) is sometimes sign of child abuse or a non accidental injury especially if the child is shaken or brought to the bed vigorously, they may develop these subdural hematomas. These hematomas differ in their age (stage) some presented as acute or subacute, but there are other signs that detect the child abuse like retinal hemorrhage and bone fractures .
- Hyperacute stage related to the first 4 hours of presentation. On imaging the blood to be dense has to be clot but in this stage the blood not clotted (fresh blood) so it appears black. As we mention the old blood (chronic) will also appears black because it is transformed to cyst while the blood lysed and absorbed by the circulation (where hemoglobin lysed and will be fragmented and the heme particles will be extracted and circulated to the body).

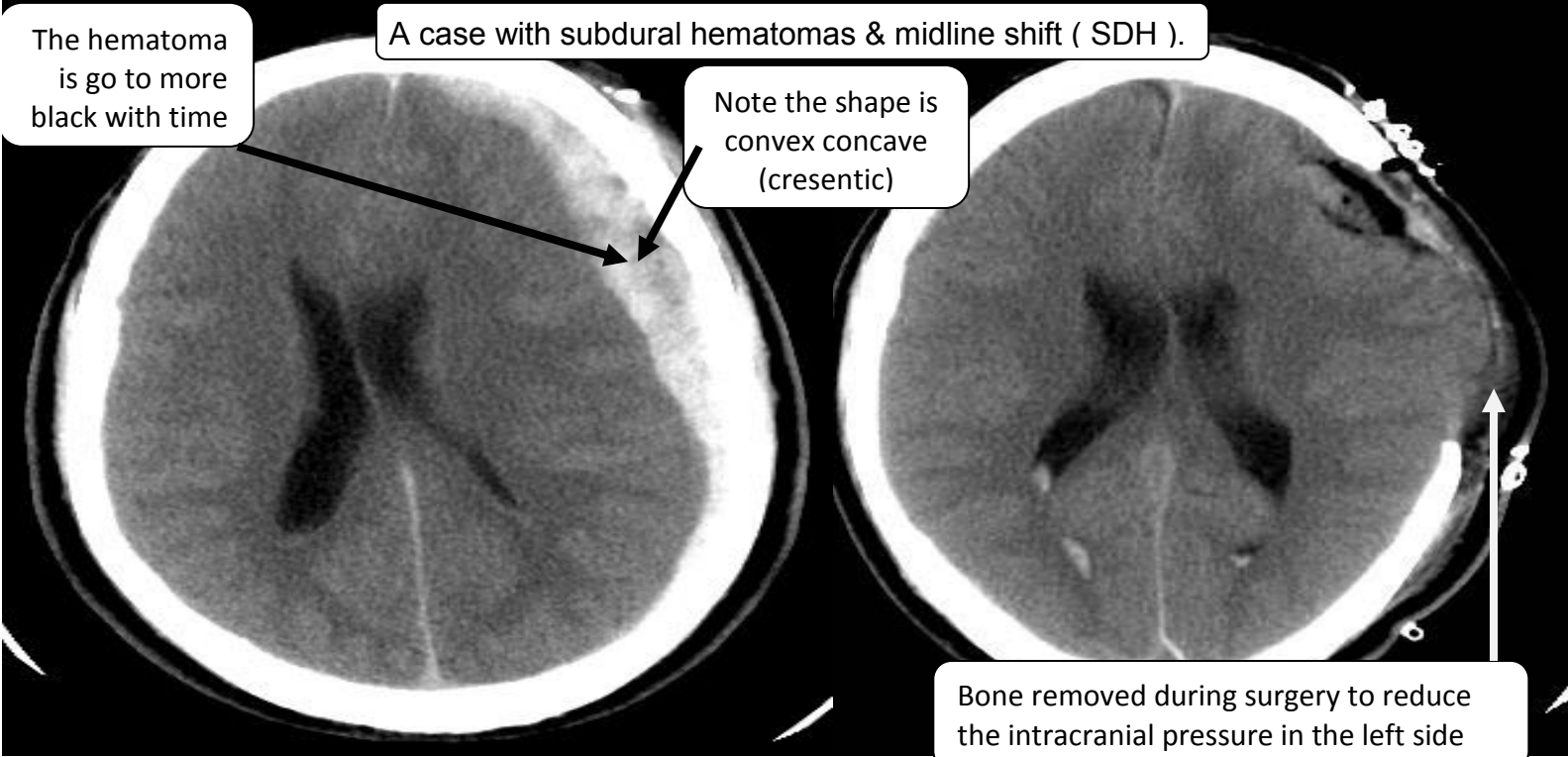
Note

The bone on MRI is black, but on CT it is white. We see the white structure on MRI around the skull, it is a subcutaneous fat.

The hematoma is going to be more black with time

A case with subdural hematomas & midline shift (SDH).

Note the shape is convex concave (crescentic)

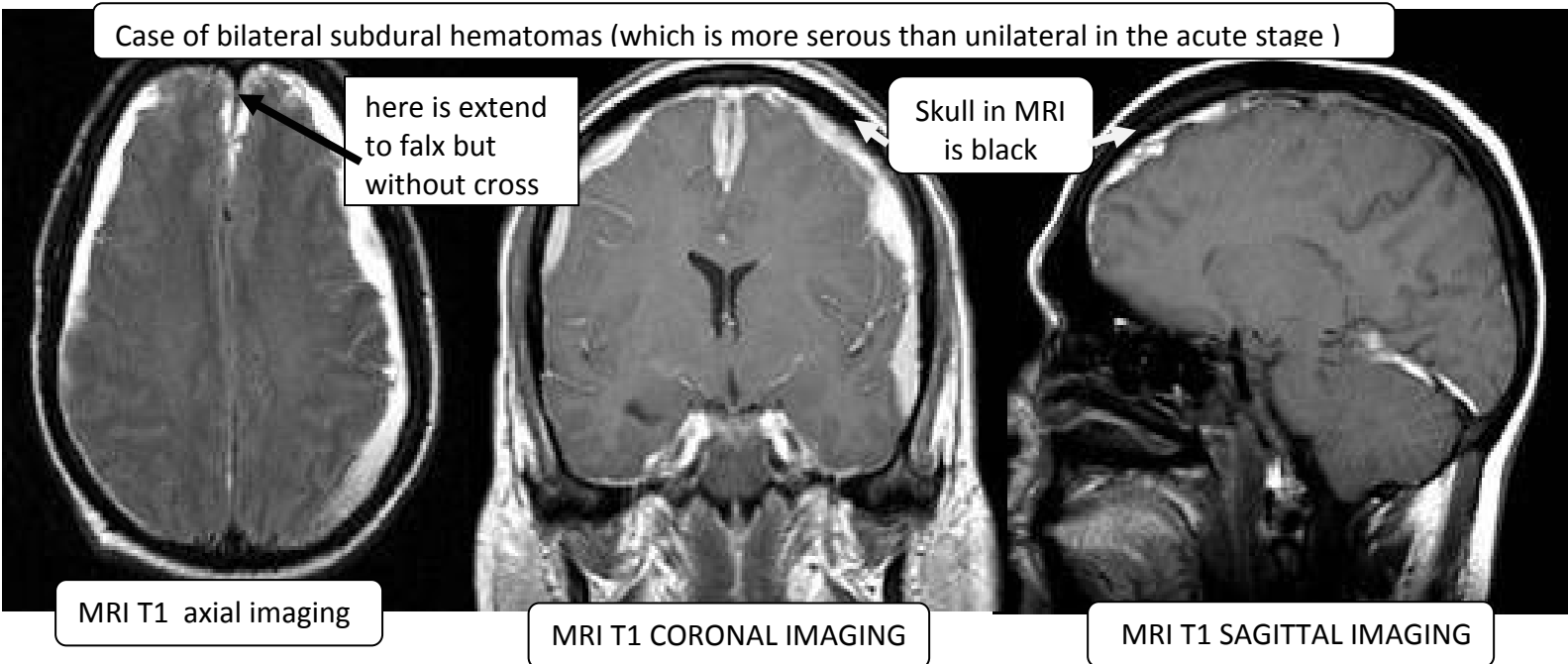


Bone removed during surgery to reduce the intracranial pressure in the left side

Case of bilateral subdural hematomas (which is more serious than unilateral in the acute stage)

here it extends to the falx but without crossing it

Skull in MRI is black

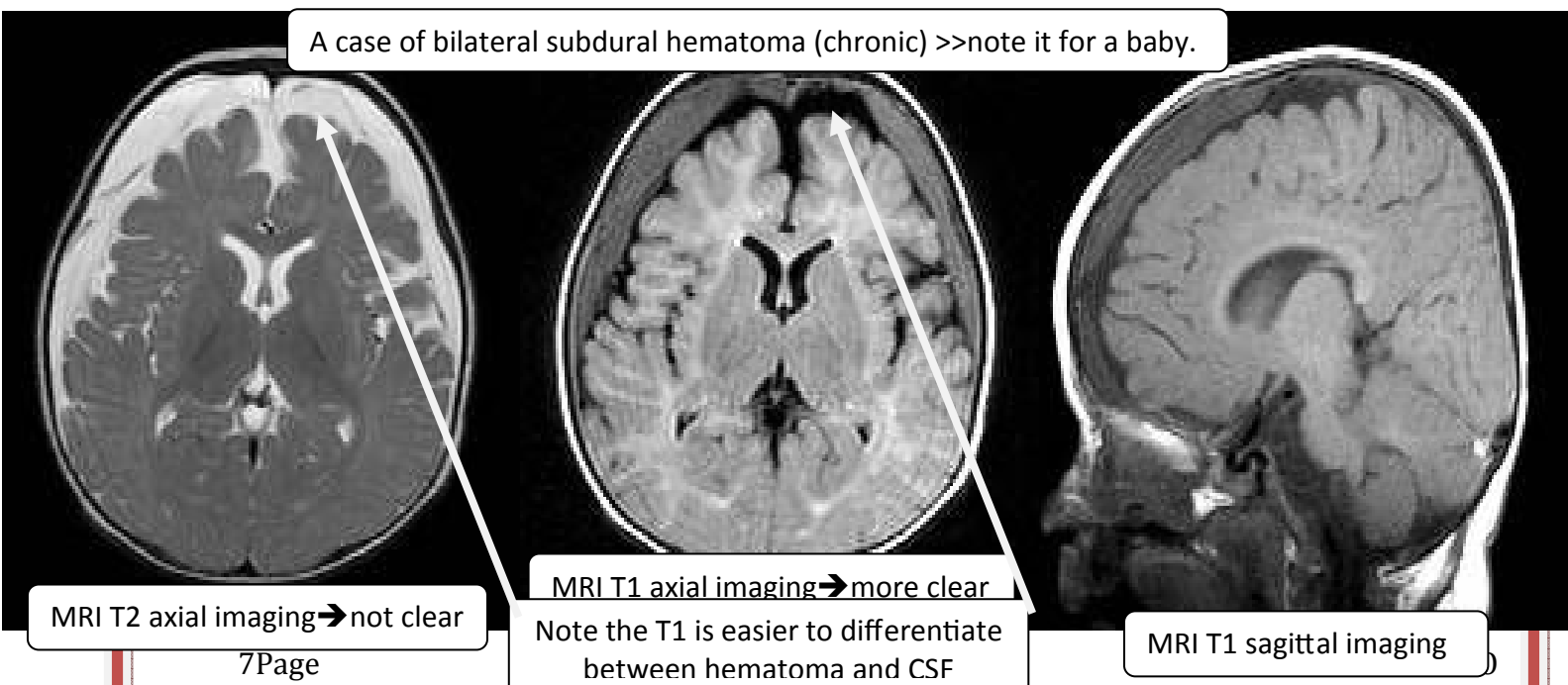


MRI T1 axial imaging

MRI T1 CORONAL IMAGING

MRI T1 SAGITTAL IMAGING

A case of bilateral subdural hematoma (chronic) >>note it for a baby.



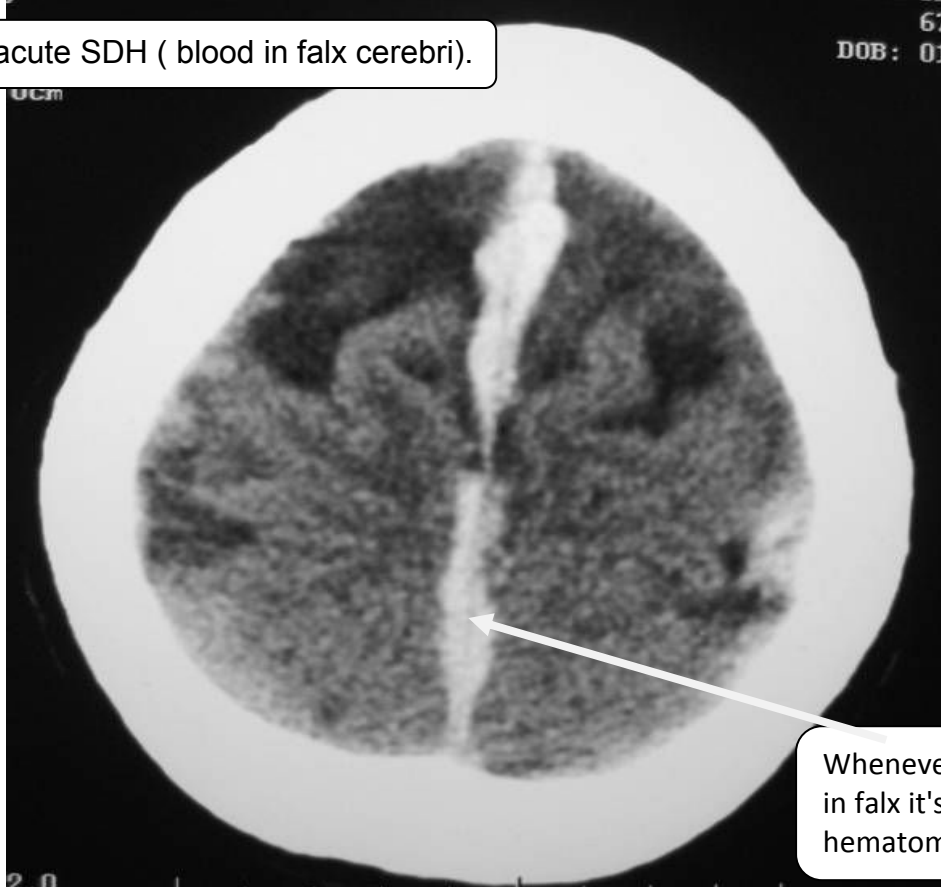
MRI T2 axial imaging → not clear

MRI T1 axial imaging → more clear

Note the T1 is easier to differentiate between hematoma and CSF

MRI T1 sagittal imaging

CT imaging shows acute SDH (blood in falx cerebri).



Whenever there is blood in falx it's mean subdural hematoma

Crescent shape

Lens shape

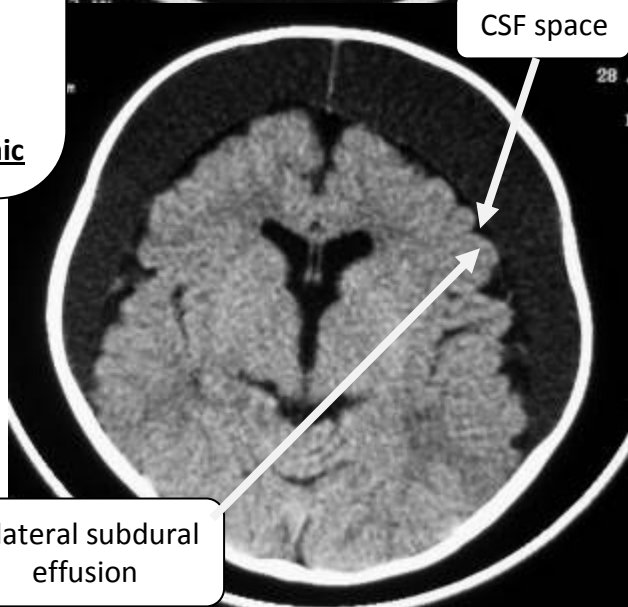
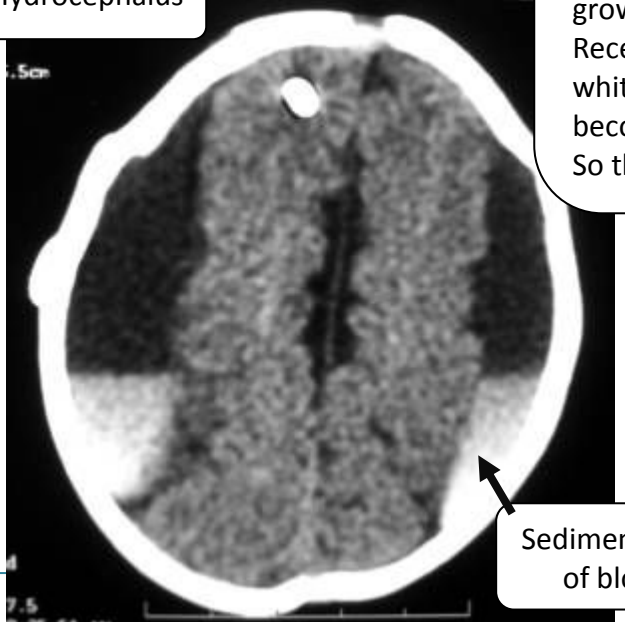
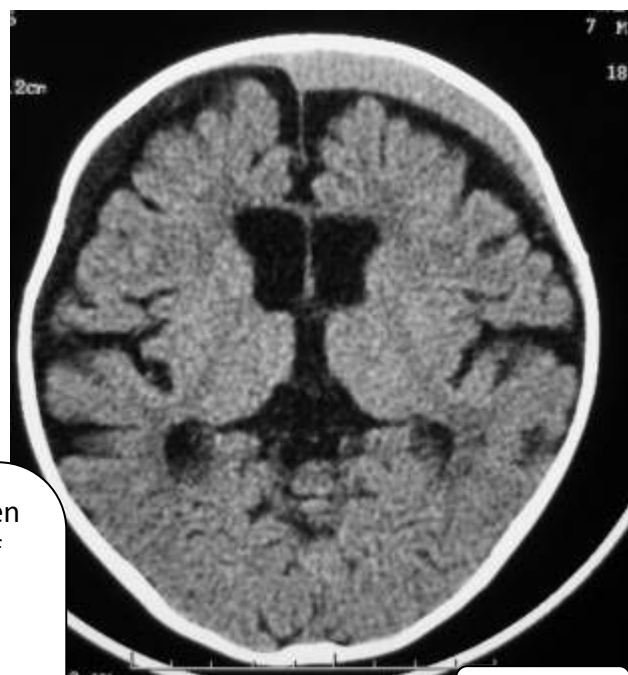
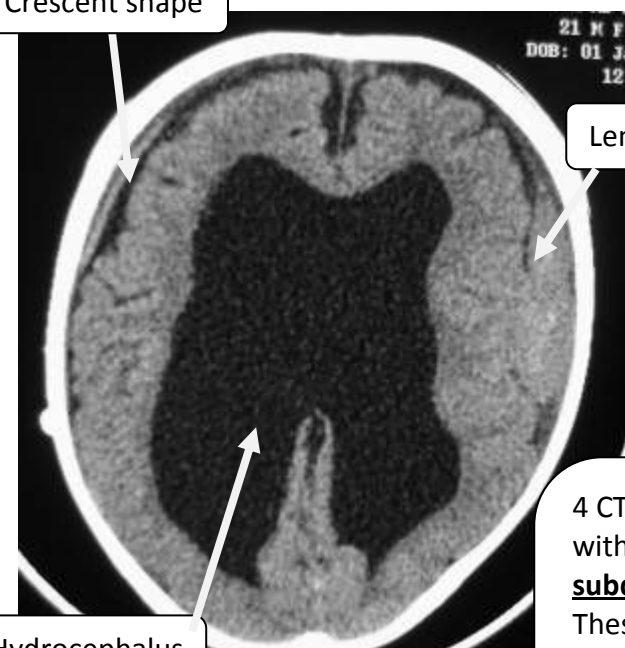
Hydrocephalus

4 CT imaging for children with various pictures of **subdural** hematoma . These children have growth retardation . Recent blood that look white with time it will become black. So this imaging is **chronic**

Sedimentation of blood

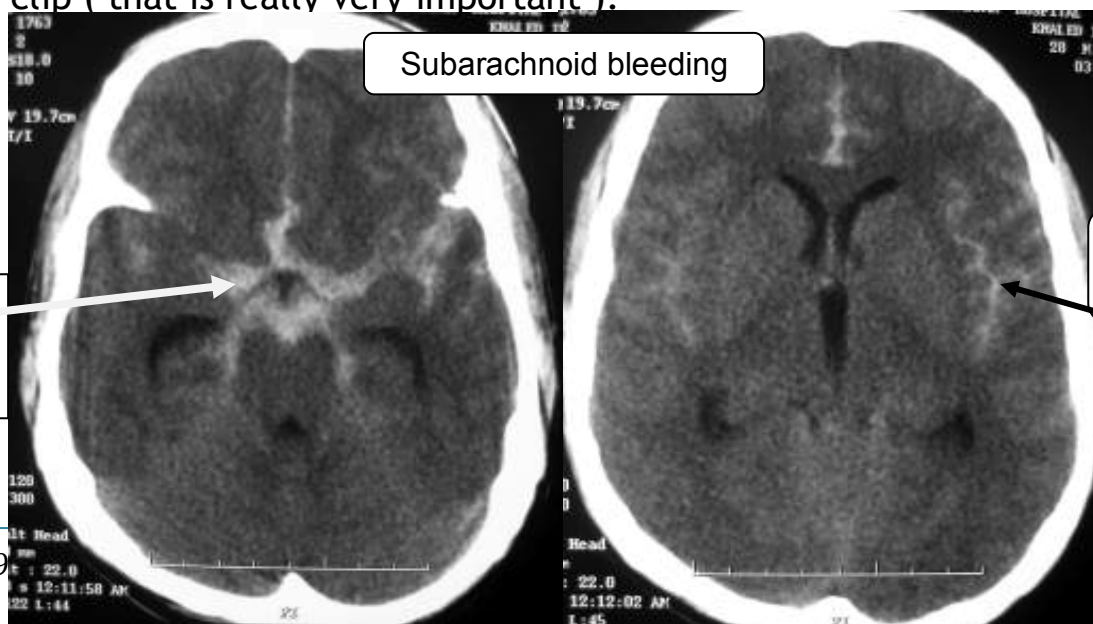
Bilateral subdural effusion

CSF space

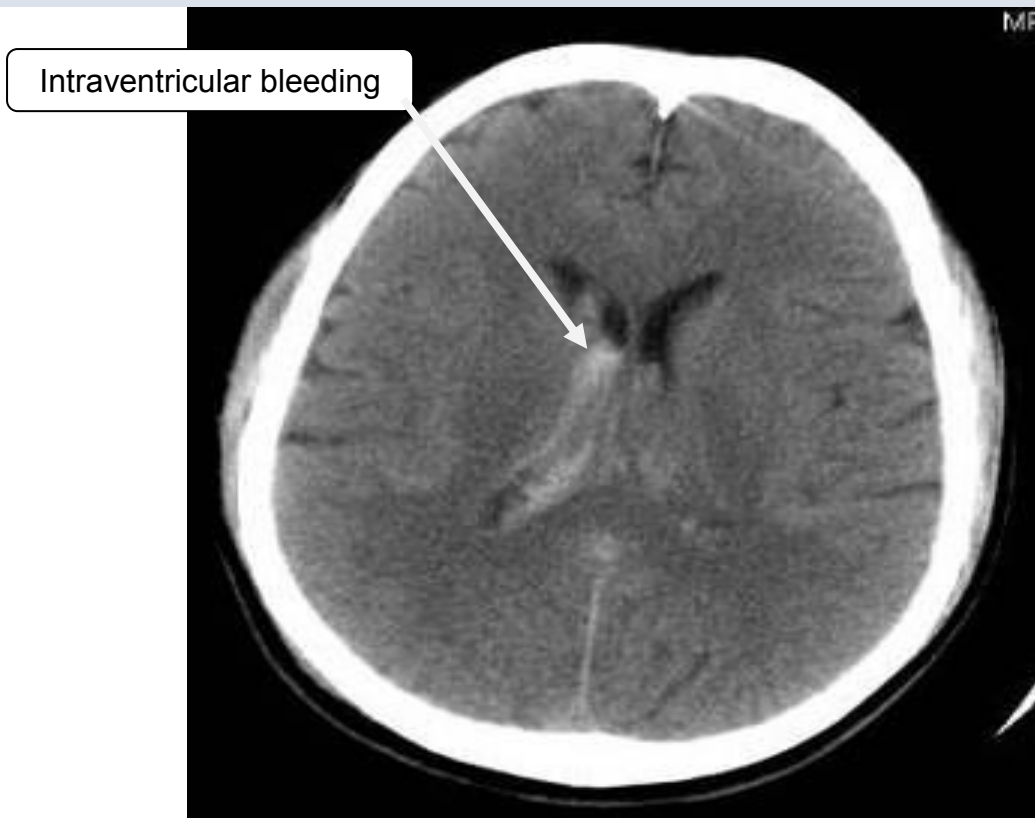


* Subarachnoid hemorrhage

- Easy to be diagnosed on CT (because it follows the subarachnoid space) and used to be diagnosed previously by lumbar puncture to see if there is blood.
- CT scan is the 1st choice imaging modality for intracranial bleeding, but MRI is more sensitive to pick up the changes. So the CT scan is the 1st choice because it is available, accessible and suitable for ventilated pt..
- Blood is between the pia mater and arachnoid mater.
- Mostly traumatic
- There are also nontraumatic causes which are mostly caused by aneurysm or AVM (arteriovenous malformations) or coagulopathy.
- Symptoms includes: headache, vomiting, blurred vision, [neck rigidity& photophobia]
- May go to acute or delayed complications. [Similar to meningitis]
- One of the acute complications is acute hydrocephalus(acute & delayed) ; because this blood may obstruct the foramen of monro or (aquiduct of Sylvius) then it will cause obstruction of the ventricular system. In the late stage that blood in the subarachnoid space may damage the arachnoid villi in the meninges, then the absorption of the CSF will be abnormal (reduced then CSF will accumulate in the brain and cause hydrocephalus).
- Presence of blood into the subarachnoid space while the arteries of the brain run in the subarachnoid space as well, will cause irritations to the arteries and they will go to the vasospasm which may lead to infarction and this is one of the acute complications and usually it happens during the 1st week of bleeding then it is relieved. If the bleeding is not due to trauma but rather due to aneurysmal rupture there is always risk of rebleeding (if the aneurysm is not treated) and that is why we have to know the cause and source of the blood if it is not traumatic. We have to do angiography whether CT, MRI or catheter angiogram to find the aneurysm and treat it either by endovascular embolisation, or by surgical clip (that is really very important).

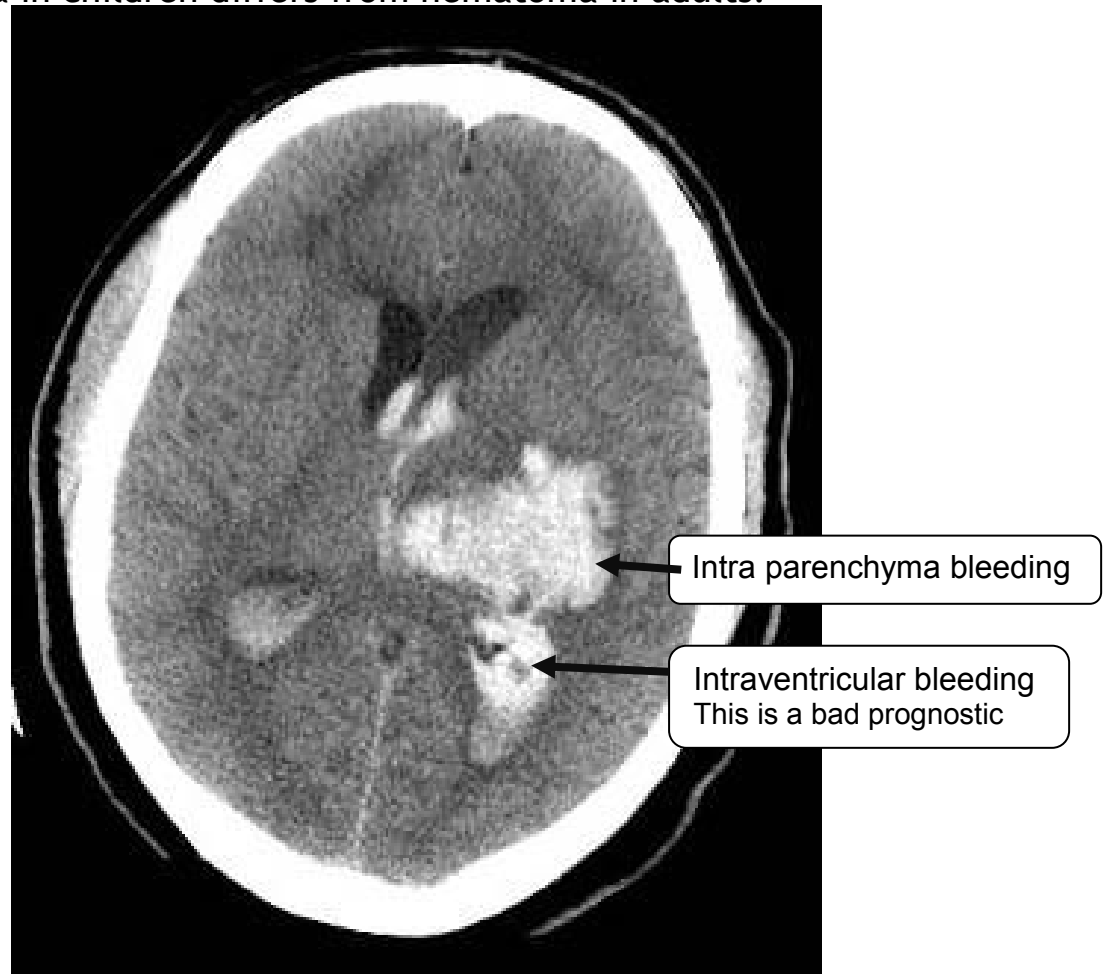


* Intraventricular bleeding



- Trauma can cause intraventricular bleeding.
 - Arteriovenous malformations.
 - Aneurysms.
 - Premature children may have parenchymal bleeding .
 - Infarction may be complicated with hemorrhage which is another serious issue.
 - Patients who are on anticoagulation drugs or have coagulopathies in general may have bleeding whether it is parenchymal or sometimes subdural.
 - One of the important causes usually is tumor. Sometimes especially for the highly malignant one they may present first time with intracranial bleeding. So this is sometimes is very important.
 - The difference between meningitis and subarachnoid hemorrhage is in the onset. Subarachnoid H. is immediate and more acute than meningitis.
 - Typically patients with SAH presented and tell their doctors that this is the worst headache in their life. But meningitis they look ill, feverish then worse gradually. So the history and physical examination is very essential and imaging does not give the whole pathology of the patient.
- 📖 Note\ One of the most common sites of traumatic brain damage cause is the gray white matter junction.

- We could have more than hematoma in traumatic brain injuries, like subarachnoid and interparenchymal.
- The hematoma does not start by a type then progress to other types of hematoma in trauma, but there is one or more which could happen at the same time depending on the mechanism and severity of the trauma.
- Hematoma in children differs from hematoma in adults.



- Blood in basal ganglia (as in the picture) is typical for hypertensive bleeding (intracranial bleeding due to uncontrolled blood pressure), this is where it happens.
- In a case of this patient, blood starts in the parenchyma and rupture into ventricle and this is very bad sign.
- The 2nd most common location for hypertensive bleeding is the brain stem. So the location sometimes is helpful for the diagnosis of the cases.

* parenchymal bleeding:

Causes : 1- HTN

3- AVM (arterio-venous malformation)

5- prematurity of children

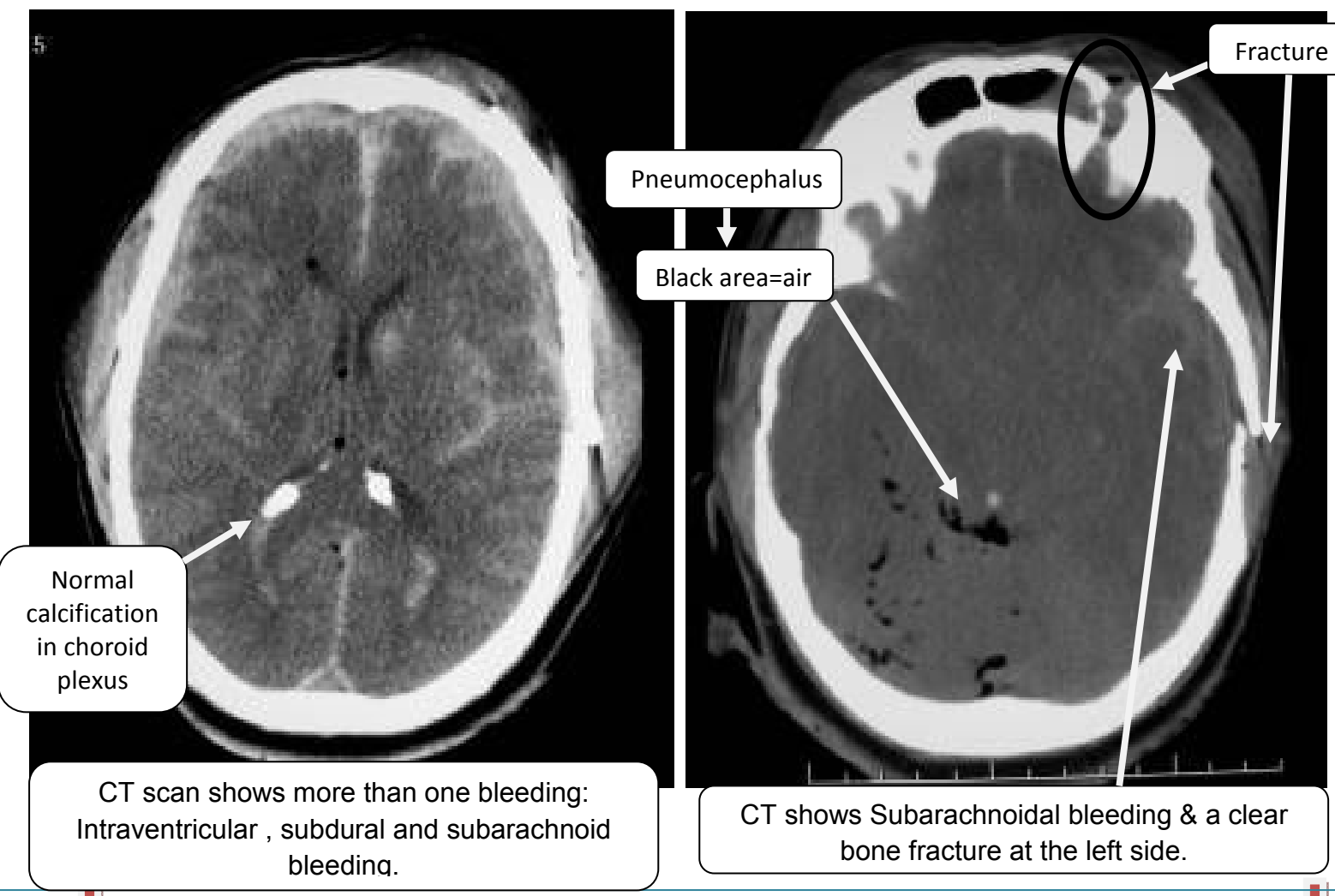
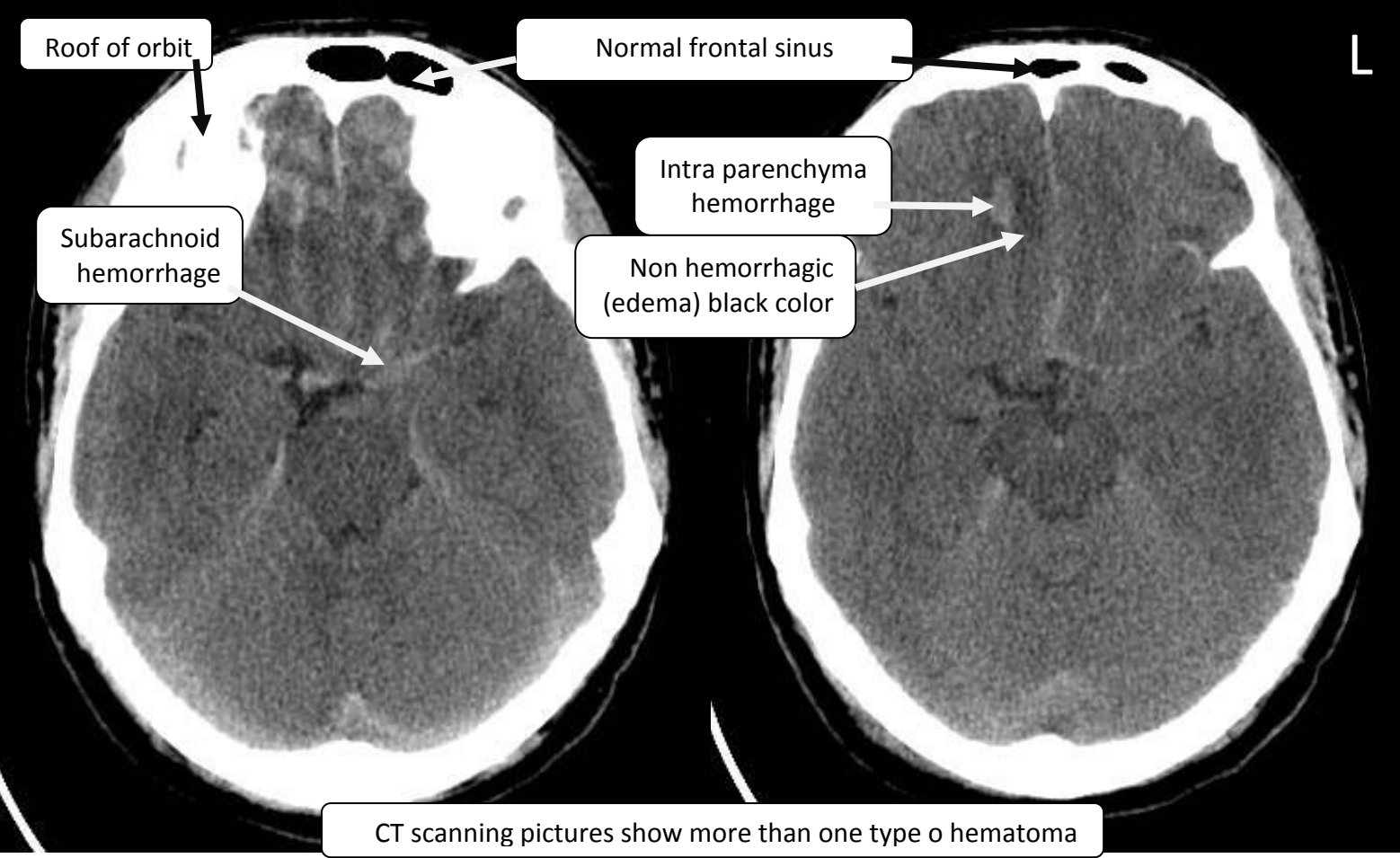
7-infarction

2- trauma

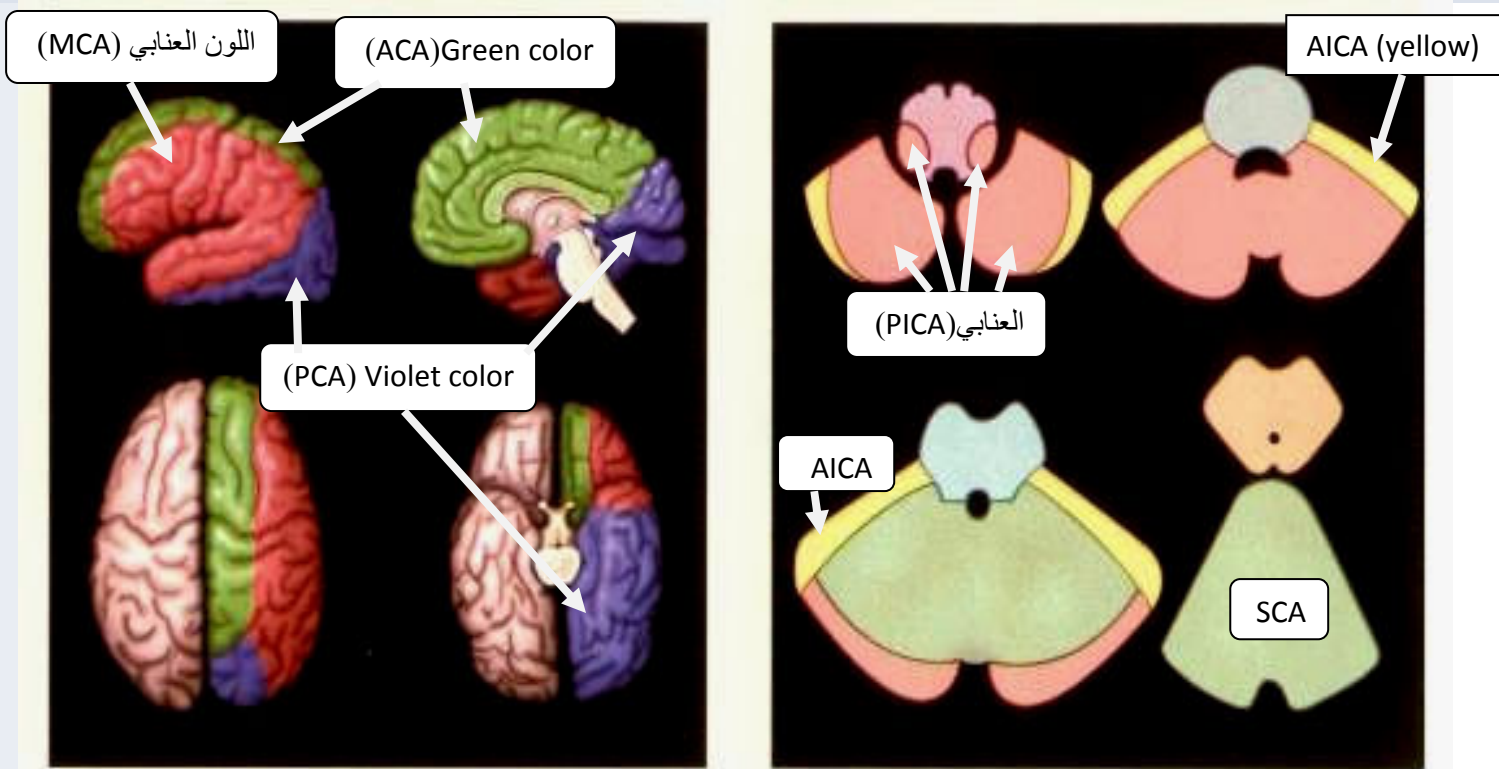
4-aneurysm

6-tumors

8-coagulopathy

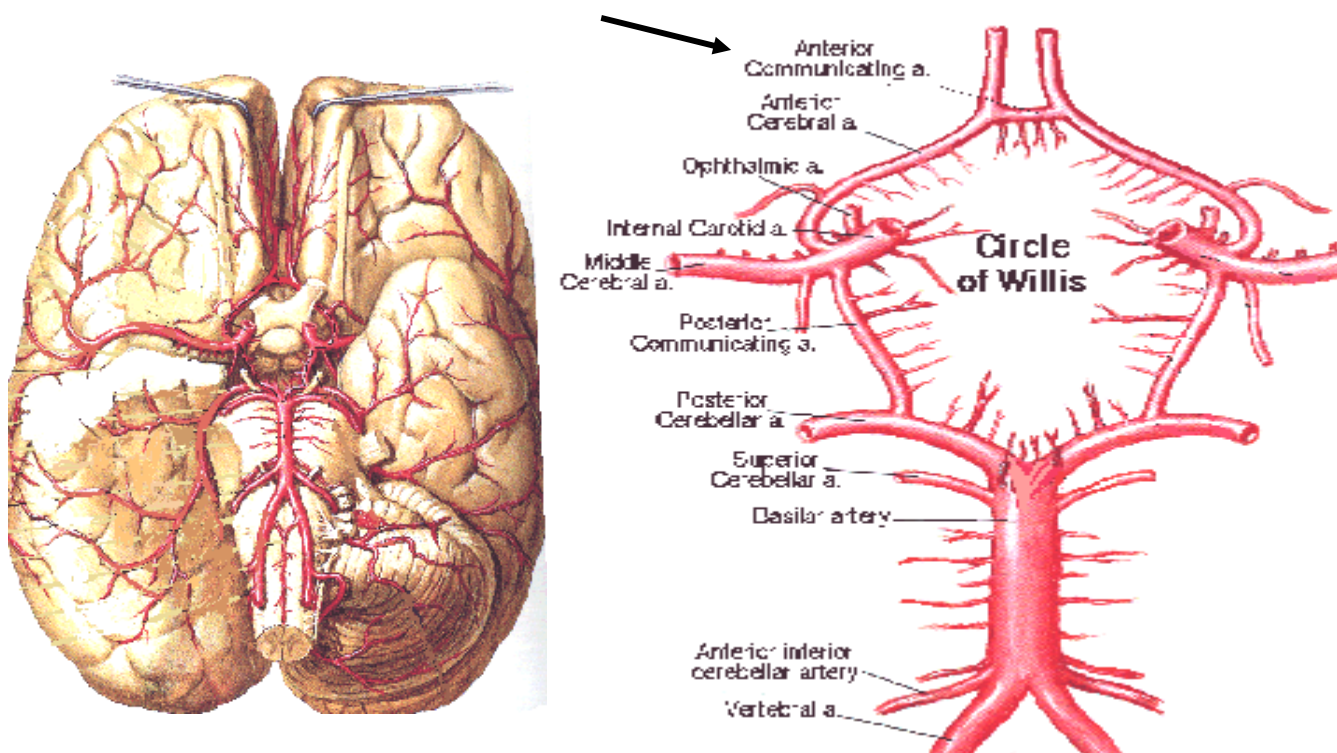


*INFARCTIONS

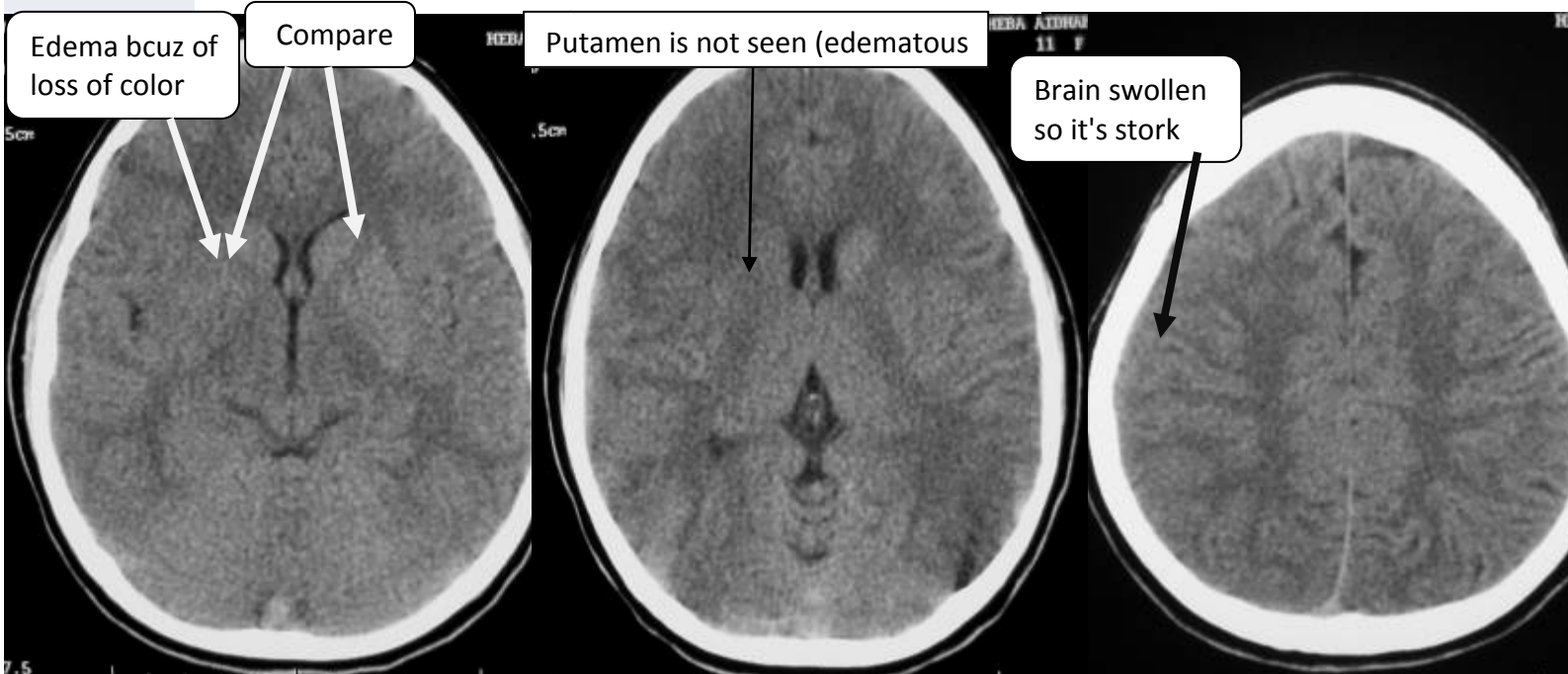


❖ Introduction:

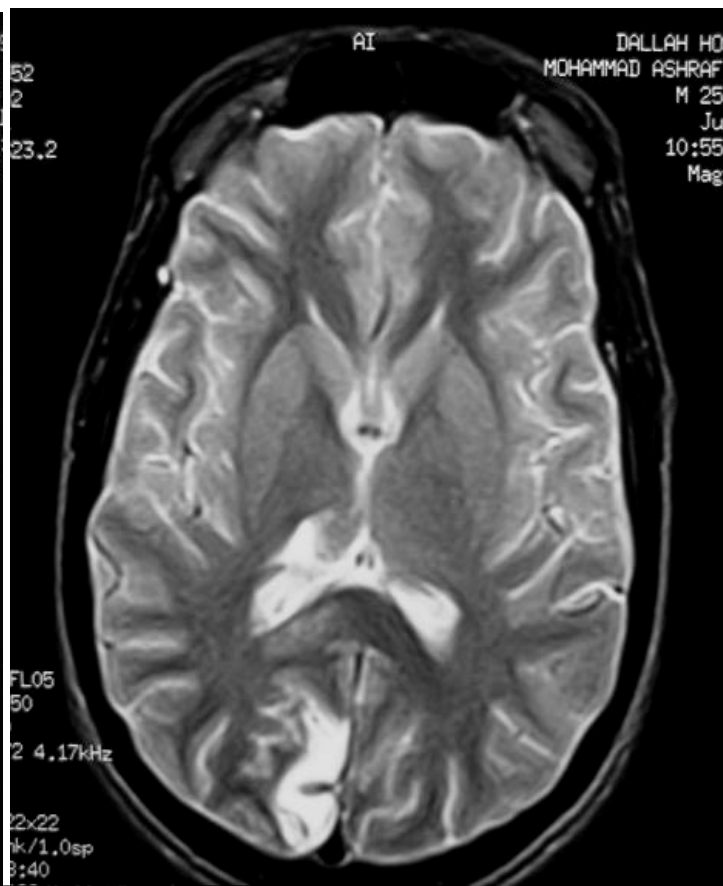
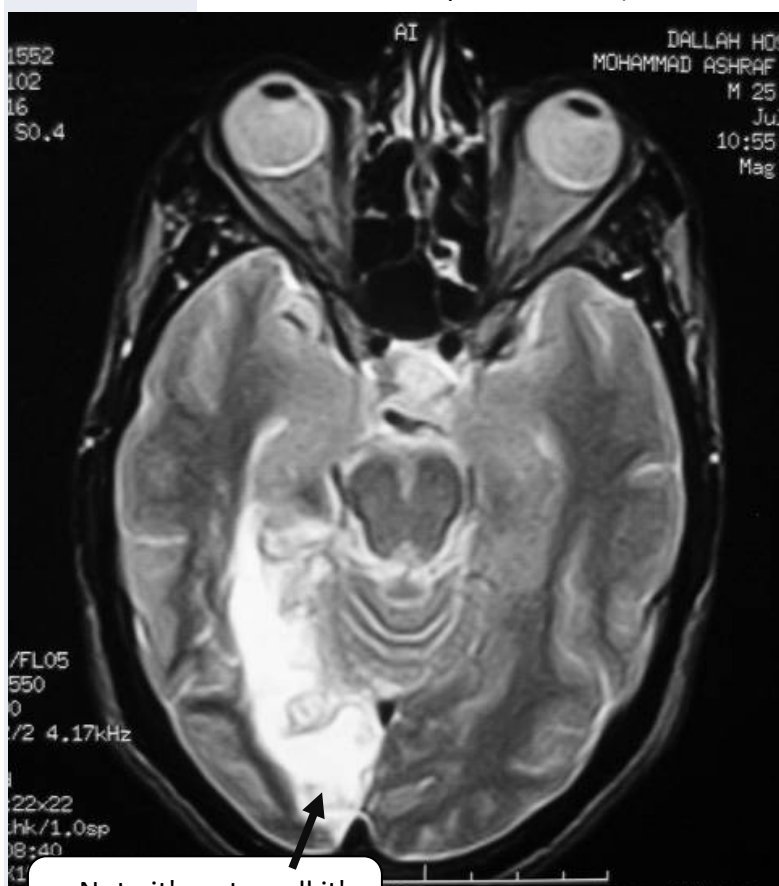
- The anterior cerebral artery (ACA) supply the medial aspects of the cortical brain as far back as the parieto-occipital sulcus also supply a strip of cortex about 1 inch. So ACA supply the leg area of the precentral gyrus.
- The middle cerebral artery (MCA) supply the entire lateral surface of the hemisphere (except for the surface supplied by the ACA), occipital pole, inferiolateral surface of hemisphere. So MCA supply all the motor area except the leg area.
- The posterior cerebral artery (PCA) supplies inferolateral & medial surface of the temporal lobe & lateral & medial surfaces of the occipital lobe. So supply visual cortex.
- Different parts of the brain are supplied by different arteries.
- The lateral aspect of medulla and inferior aspect of cerebellum are supplied by the posterior inferior cerebellar artery (PICA, which is a branch of the vertebral artery). The lateral aspect of cerebellum is supplied by the anterior inferior cerebellar artery (AICA, which is a branch of the basilar artery).
- The top of the cerebellum is supplied by the superior cerebellar artery (which is a branch of the basilar artery).

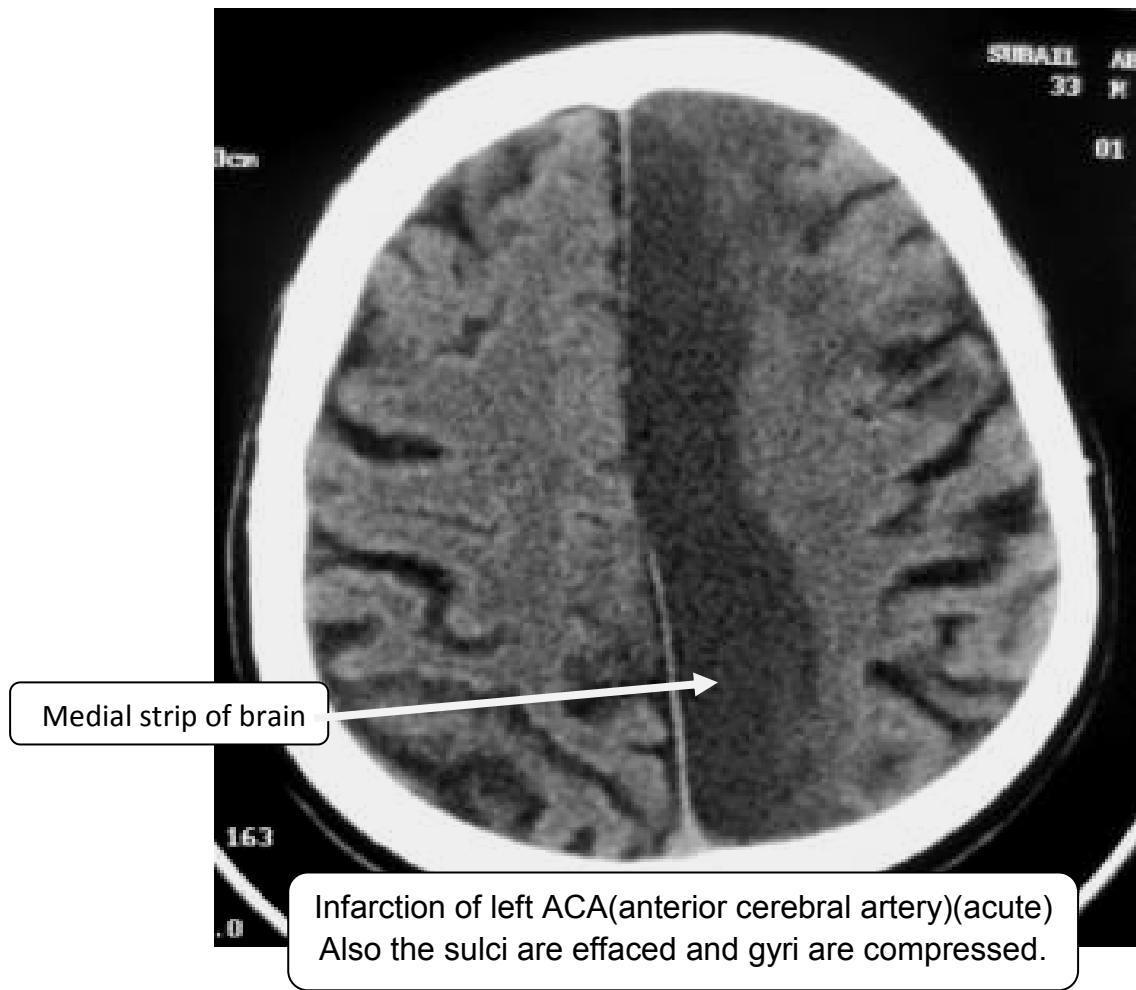
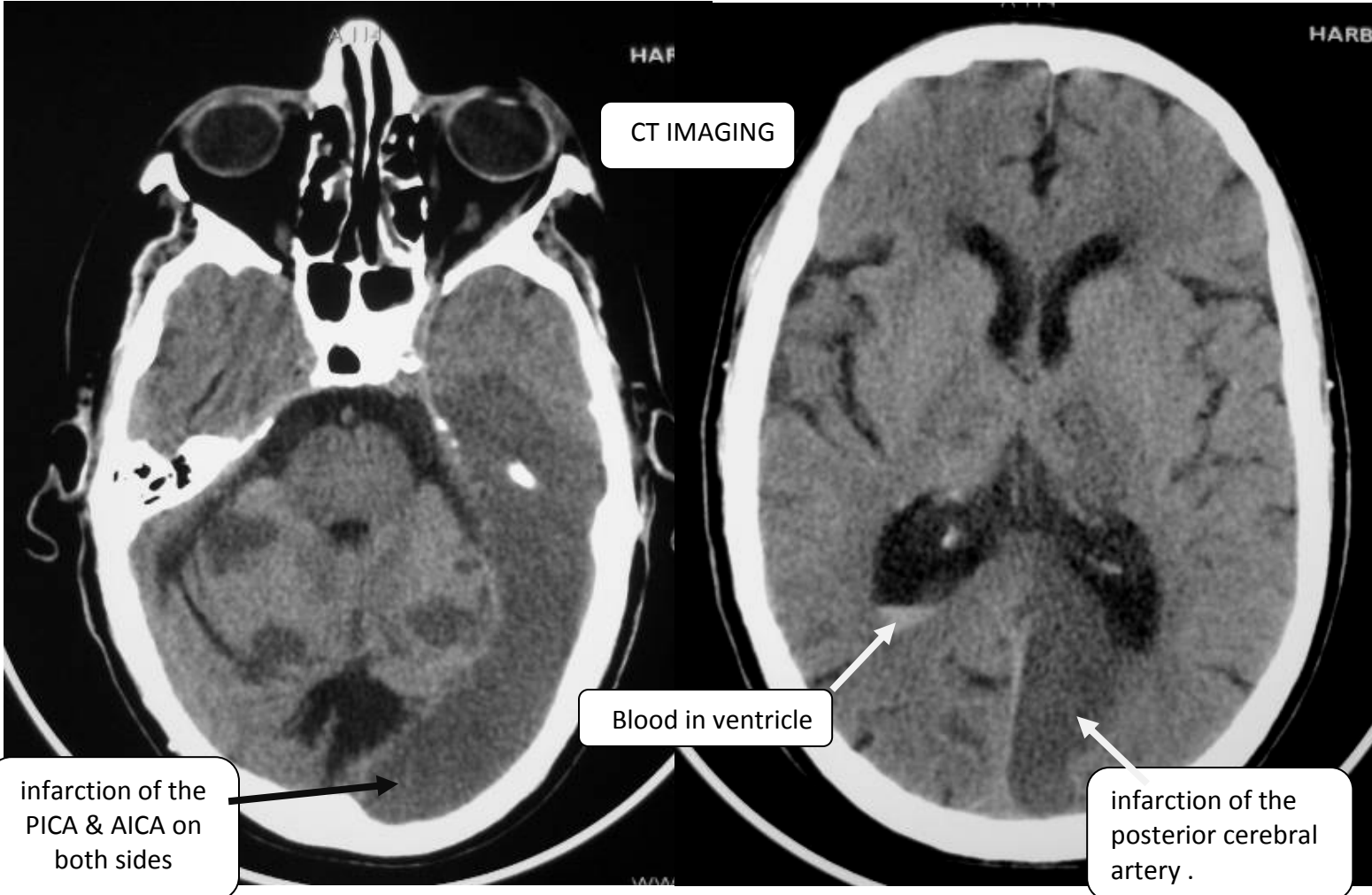


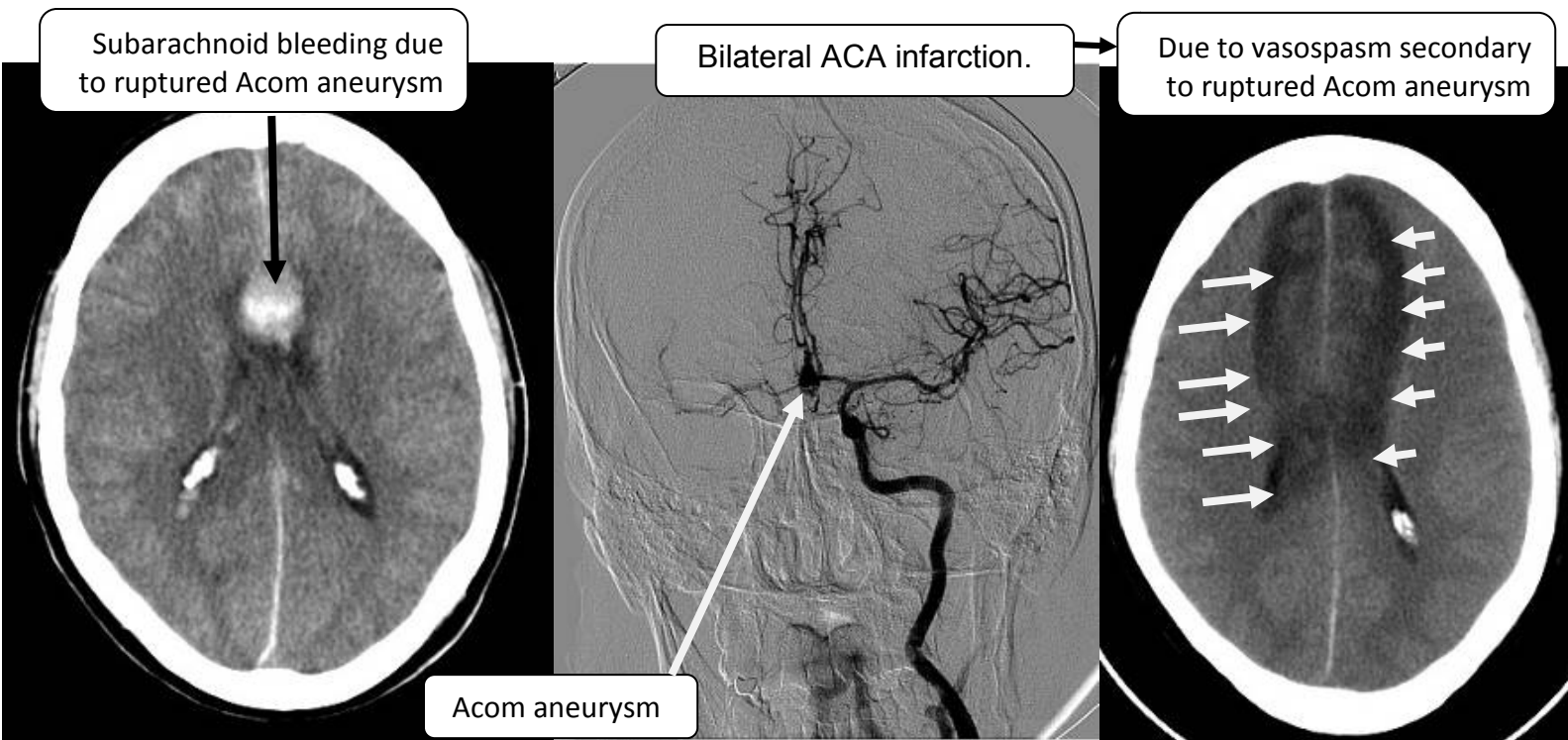
- What happens in infarction from beginning is when the supply of the blood to the cell reduced, it will swell; because the cell membrane becomes defective and there is a lot of fluid influx to the cell which kill the cell (this is at the initial stage, swelling with mass effect). With time the edema is relieved and every thing go back to normal (even the midline shift), but the area will continue to be hypodense because the cell have been replaced by the fluid. Then with time there is shrinking of the brain and gliosis (seems to be fibrosis but it is not that because there is no connective tissue where fibrosis happens, rather gliosis). So this is for acute infarction.
- Multiple infarcts in PICA and AICA territories may arise because of a proximal lesion (continuous showering of the vertebral artery or from heart problem). Usually atherosclerosis of the vertebral artery. So sometimes go to AICA, sometimes PICA or may be to posterior cerebral artery.
- If there is infarction of the anterior cerebral artery, the medial aspect of the frontal parietal lobe will be affected and that is reflected to parts that is represented in that area which is lower limbs. But MCA (middle cerebral A.) will affect the upper trunk (but affect the area where the corticospinal tract pass in the internal capsule then there will be hemiparesis, upper & lower limbs).
- When there is an old infarction it will reduce the pressure on the brain and that will affect the ventricles which will have secondary ventricular dilatation. The sulci will be wide because there is loss of brain tissue as well as the gyri become narrow.
- The type of infarction can tell us about the mechanism.



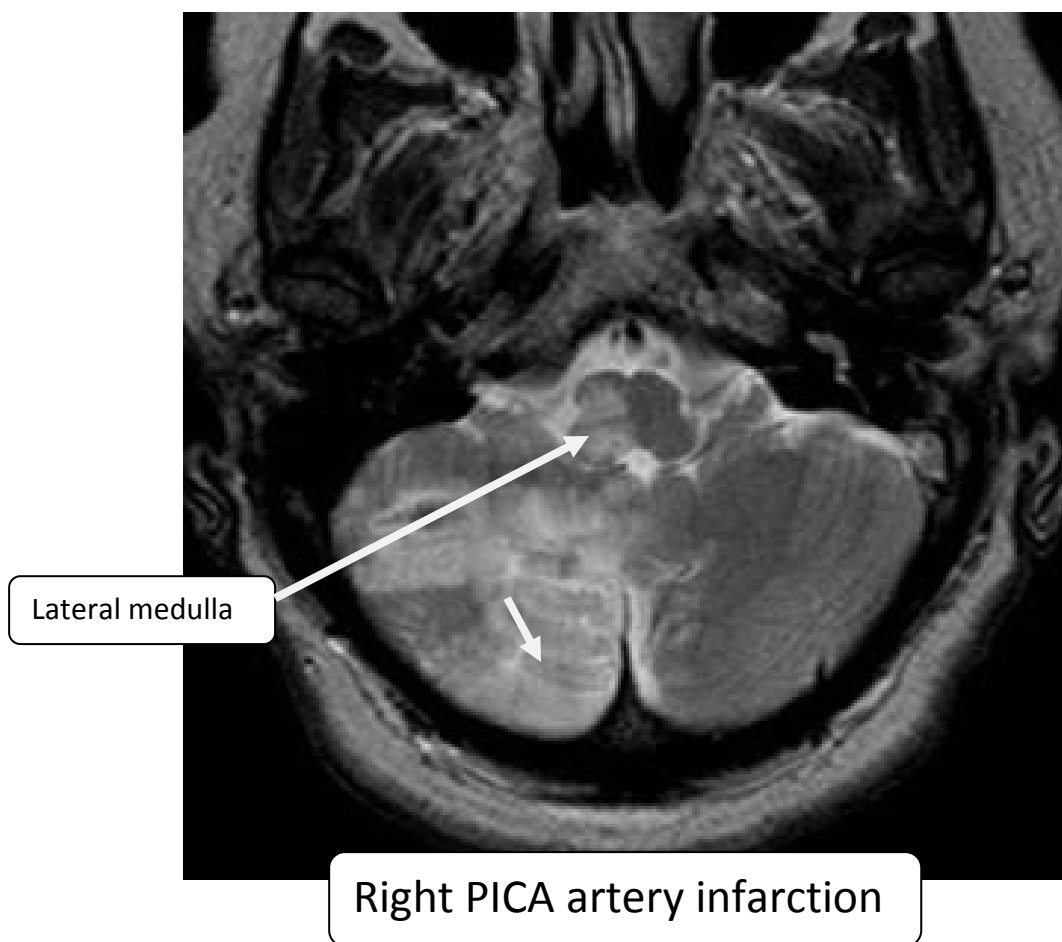
- For this case (three CT images) there is edematous brains with various pictures of changes:
 - Left one: shows Rt. ventricle compression because of edema affecting the near putamen which looks like absent while the left one is intact.
 - Middle picture: shows slightly compressed lateral ventricle and edema of both putamen and caudate head.
 - Right one: shows generalized edema and changes of the general appearance (highly compressed sulci).





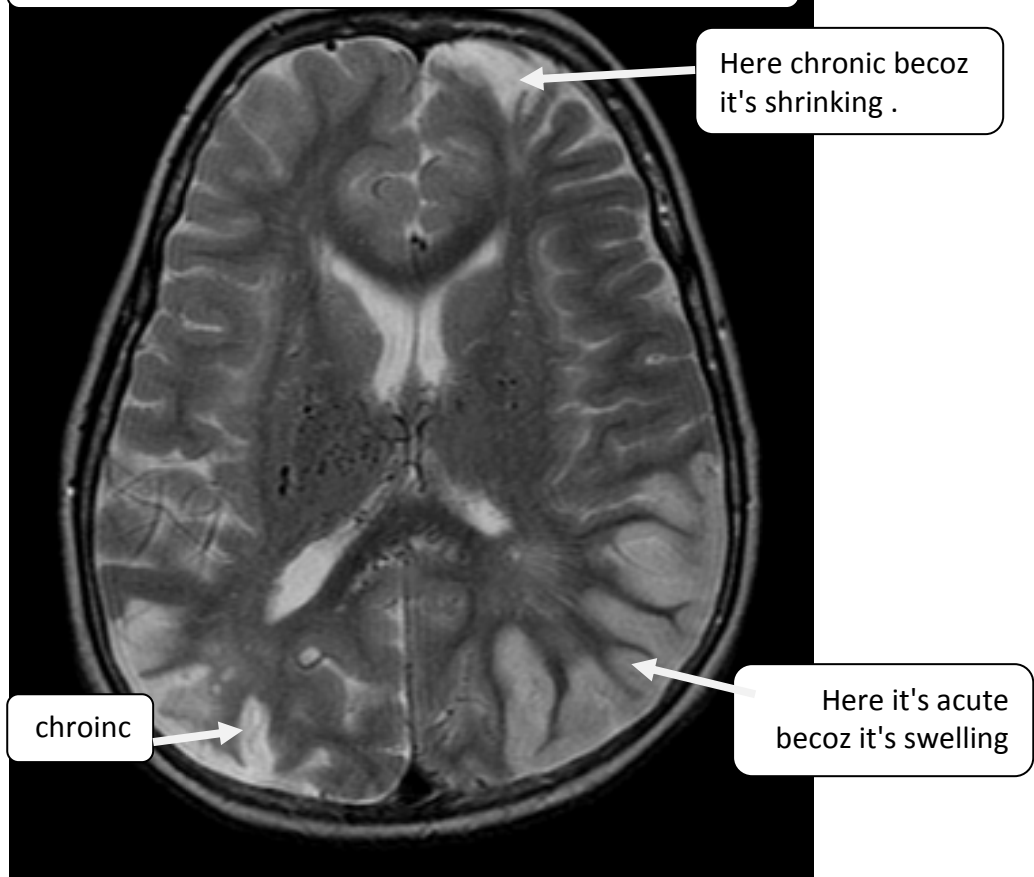


Left one: MRI T2 imaging shows right MCA infarction.
Right one: an MRA (MR Angiogram) shows absent right MCA due to thrombosis.



MRI T2 imaging shows bilateral old infarction of MCA

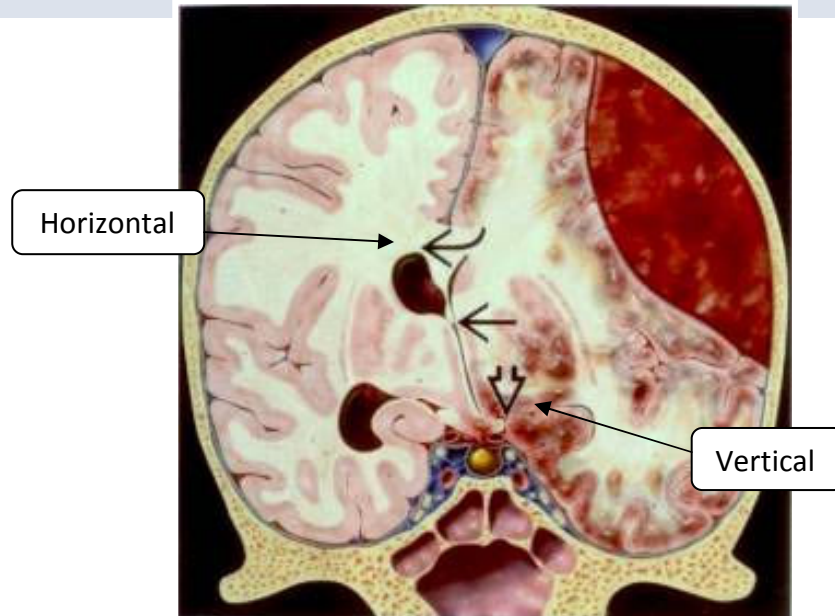
Note in this images there is acute and chronic infarction



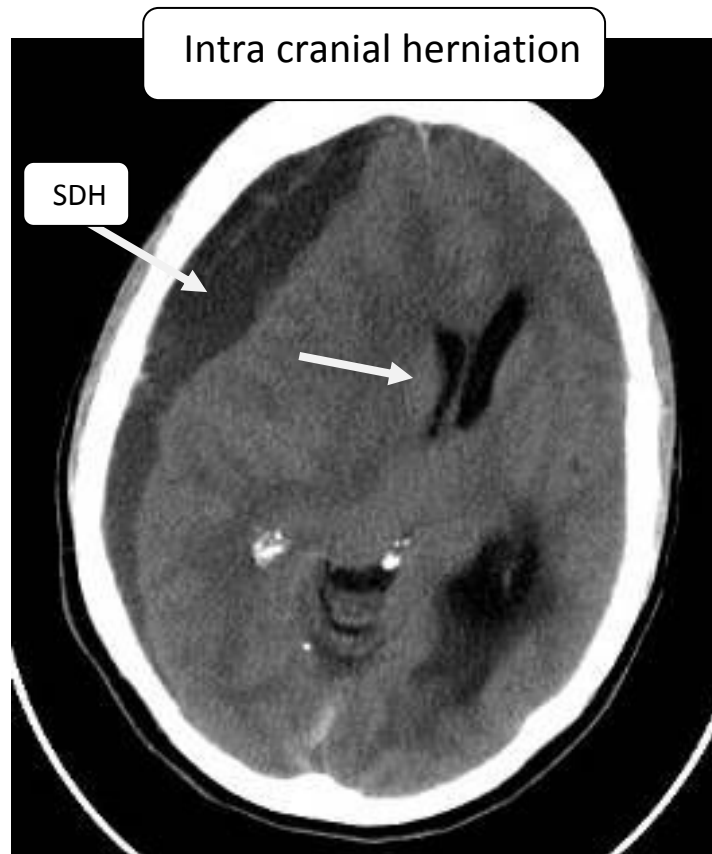
MRI T2 imaging shows infarction of the right posterior cerebral artery (PCA) and water shed infarction (between ACA & MCA)

- Sickler patients are at risk of infarction. They are prone to recurrent infarction.
- Sometimes the infarction is between 2 territories. Like in the picture it is between MCA and ACA. It is called water-shed zones, where each artery in the area between of them leave it without supply. These cases happen when patient have hypovolemia or shock or hypotension.

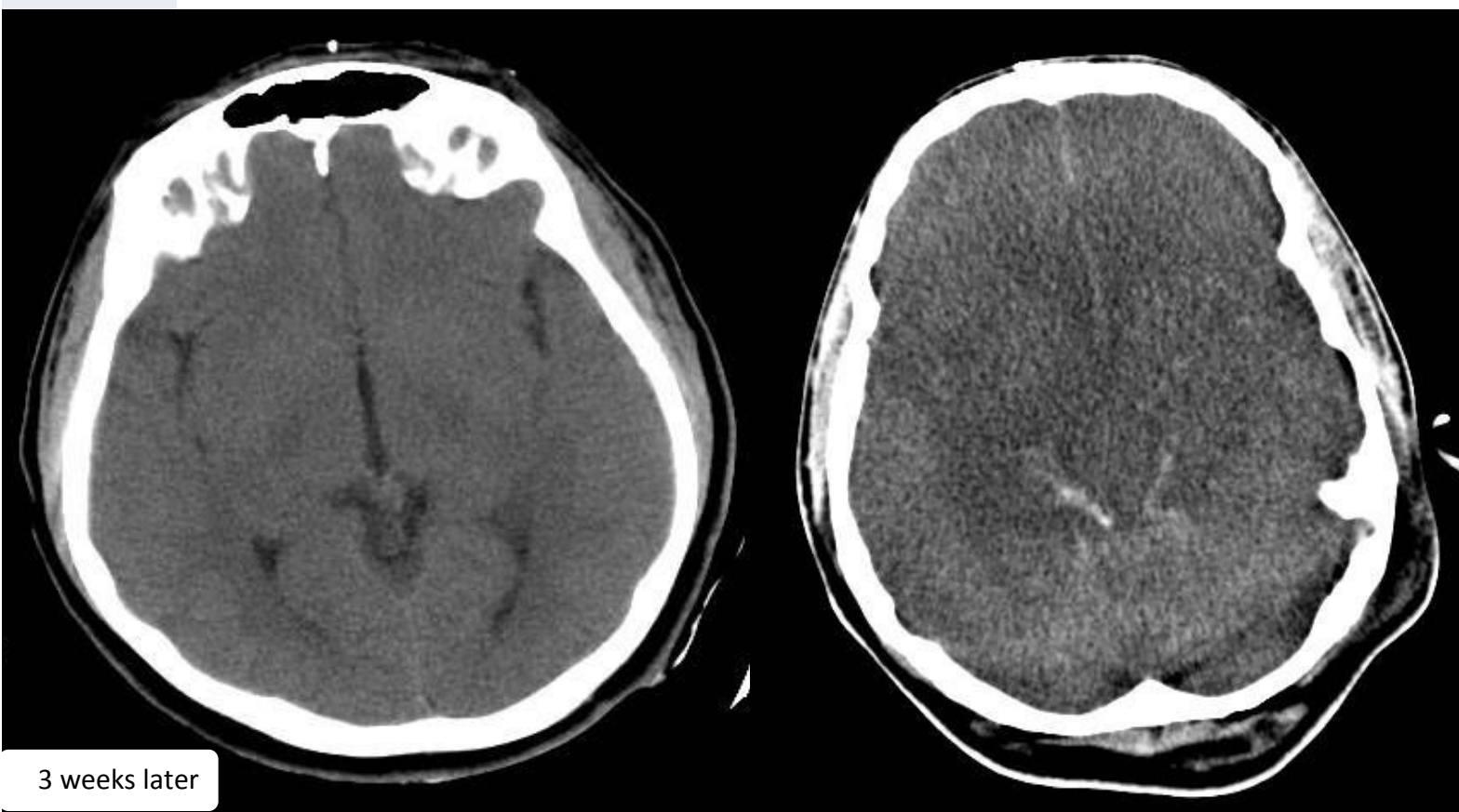
*INTRACRANIAL HERNATIONS



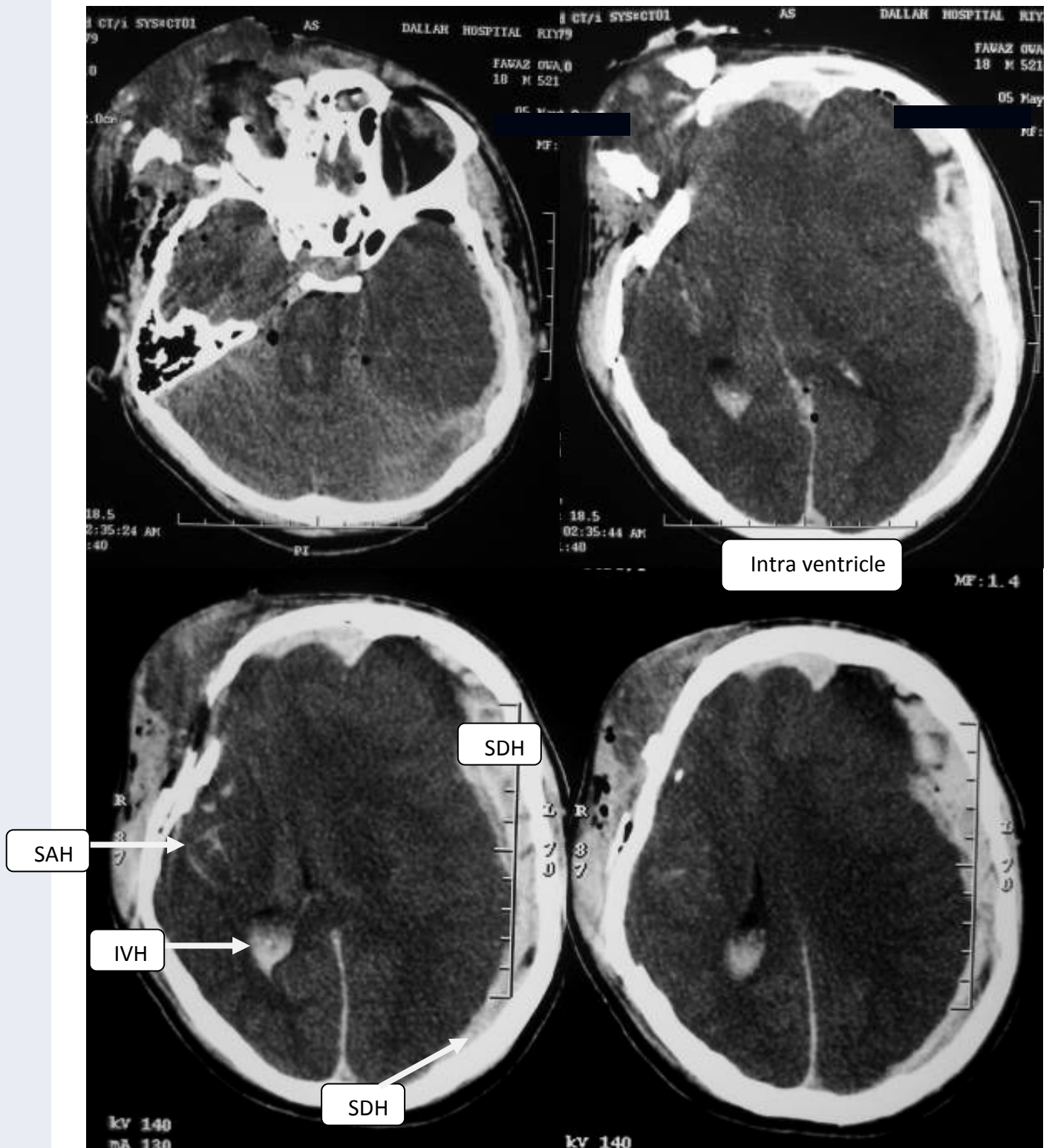
- **B**rain may herniate under the falx causing subfalcian herniation. This may compress the anterior cerebral artery and it will cause infarction in the ACA. In this herniation the foramen of morrow will be occluded and the ipsilateral ventricle will be displaced but the contralateral will be dilated.
- If the pressure is high there will be transtentorial herniation which could be unilateral or bilateral (if there is unilateral mass it will be unilateral herniation and if there is bilateral mass it will be bilateral herniation) and the area which is pressed is posterior cerebral artery against the tentorium by the brain. Then there will be occipital infarction or PCA infarction.
- Any mass effect like hematoma or edema can cause brain herniation.
- It is not important to differentiate what is the age (stage) of hematoma as long as you know the case have midline shift which indicates bad picture and needs immediate intervention.
- When there is edema of the brain the picture of the case will change because every thing is swallowed and you don't see fissures, sulci or gray and white matters and this is the typical appearance of brain edema. Brain edema can happen due to anaphylactic shock, trauma, arrest or any other cause.



A CT imaging shows (hyperacute) subdural hematoma with midline shifting (السهم الأبيض). This is not chronic SDH becoz if it is chronic it will not have this degree of mass effect.



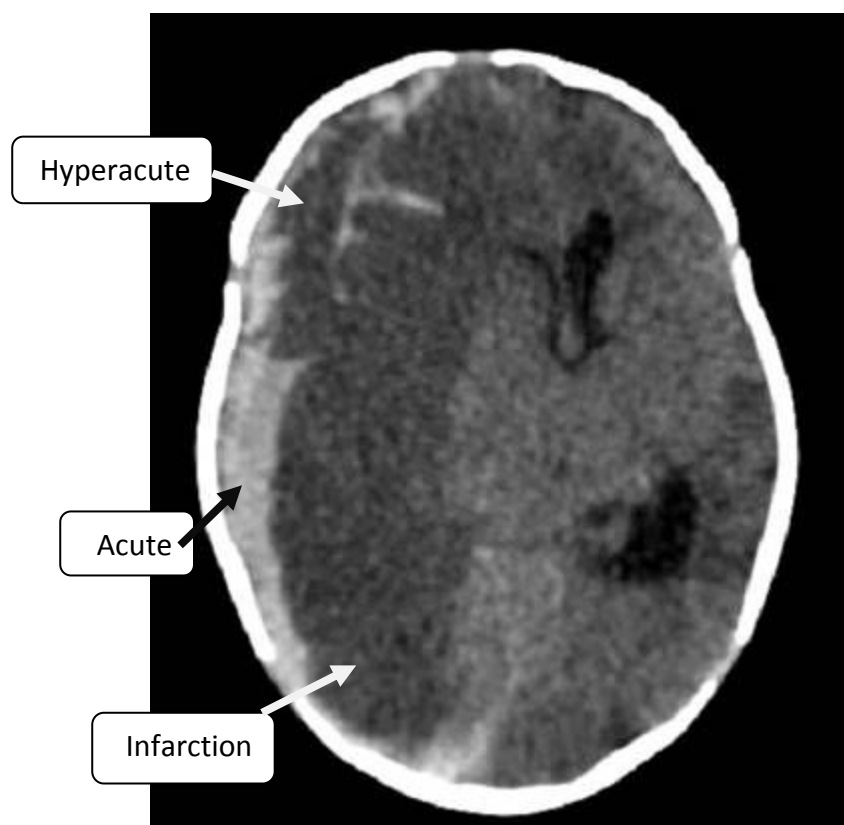
A CT imaging shows generalized brain edema with compressed ventricles. Edema is relieved after 3 weeks (left picture).



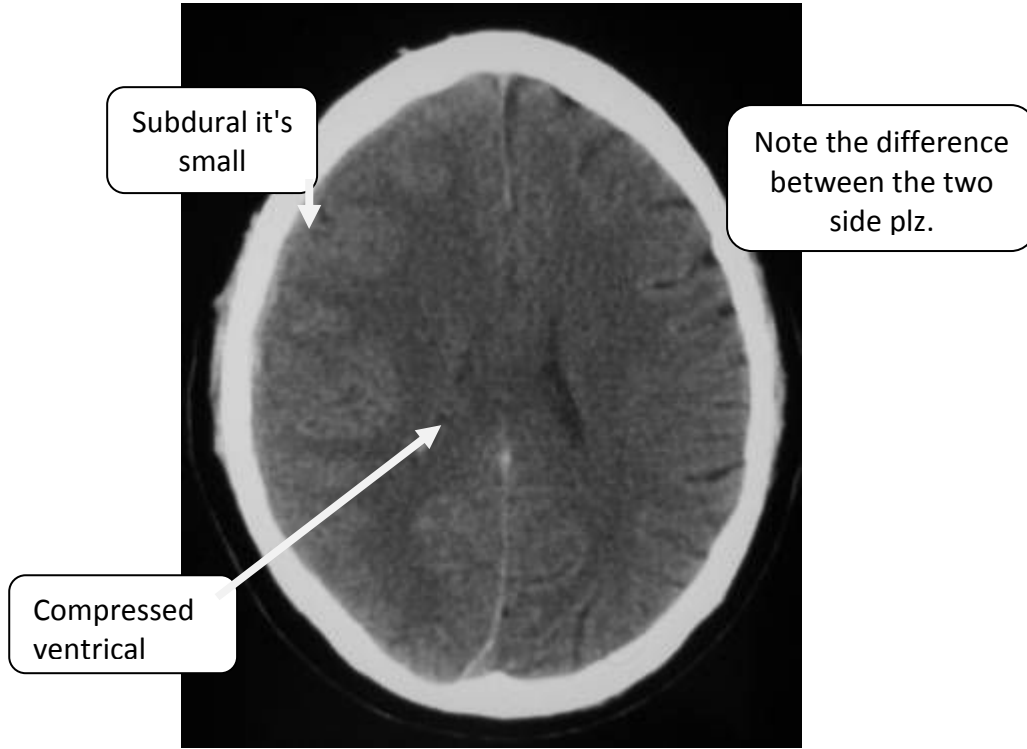
A case of trauma and all types of bleeding, midline shifting and pneumocephalus.



- Two CT images (same patient) :
 - Left one: shows right MCA infarction and intraventricular and intraparenchymal bleeding.
 - Right one: shows right MCA infarction and generalized brain edema.



CT imaging shows unfused skull bones (child) with subdural bleeding.



CT imaging shows very narrow right subdural bleeding that extend from the front to back.

Done

Abdul-Aziz Al-Saad

إخواني أخواتي الأعزاء

بما إننا أول دفعه تضع ملاحظات على الصور وتكتب ملاحظات من الدرس ومحاولة مراجعتها من قبل أعضاء قسم الاشعة وعدم وجود مرجع كافي يعتمد عليه لذا أتمنى منكم مساعدتي بإرسال ملاحظاتكم عند وجود أي أغلاط إملائية أو نحويه أو علمية رغم حرصنا على عدم وجود أغلاط ولكن نبقي بشر والكمال لوجه الله فقط.. كما أتمنى أبدء أرائكم وانتقاداتكم على المذكرات علما بأنه سوف يتم حذف ما ليس له دخل بالدرس أو ما كتب بالعربي مثل ما هو مكتوب هنا (يعني الكلام ذا) .. وقد وضعت تلك الأشياء لوضع حالة من المرح وتغيير الجو ... كل هذا الاهتمام لنخرج هذه المذكرة على الوجه الأكمل لكي نعطي هذه المذكرة للدفعات القادمة وتكون مرجعا ممتاز خصوصا وان بعض الكتب لا يوجد فيها بعض المواضيع التي تمت دراستها وسوف تكون رسمية باسم دفعه ٤٢٥

لابدء ملاحظاتكم الرجاء ارسالها الى zizo2rad@hotmail.com او من خلال www.ksums.com

شكرا لكم يا حبايبي ☺