



INVESTIGATION OF CNS

DR . HAMDY HASSAN

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 the Gad** 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 zizo4rad@hotmail.com

* شكر خاص للدكتور حمدي على مراجعته للمذكرة ومساعدته لنا .

* اشكر إخواني الطير و خالد العودان على مساعدتي في كتابة النوات .

* هذه المذكرة إهداء إلى أخي حسام العمري على جهوده الجبارة في

خدمة الدفعة

☛ هذا الرمز شيء مهم .

نظرا لانو لا يوجد بالاسلايدات أي شرح سوا الصور .. فكل ما هو مكتوب عبارة

عن نوات بالمحاضرة

أخوكم عبدالعزيز آل سعد

rad Gp

(dr.zeezu ☺)

* Investigation used for evaluation of the brain and skull

Note

1. Plain x-ray Skull
2. CT Scan
3. MRI
4. MRA , MRV & CTA
5. Catheter angiogram
6. Duplex US of carotid arteries
7. Ultrasound for neonatal brain

The standard modalities of brain are (CT & MRI)
The standard modalities of skull (X-ray & C.T) .
All this investigation are non-invasive except catheter angiogram which is invasive .
MRA = MR angiography used for assessment of arteries .
MRV= MR venography used for assessment of veins
CTA= CT angiography used for assessment of vascular structures .

* Plain x-ray skull

➔ No need for any preparation .

➔ Indications:

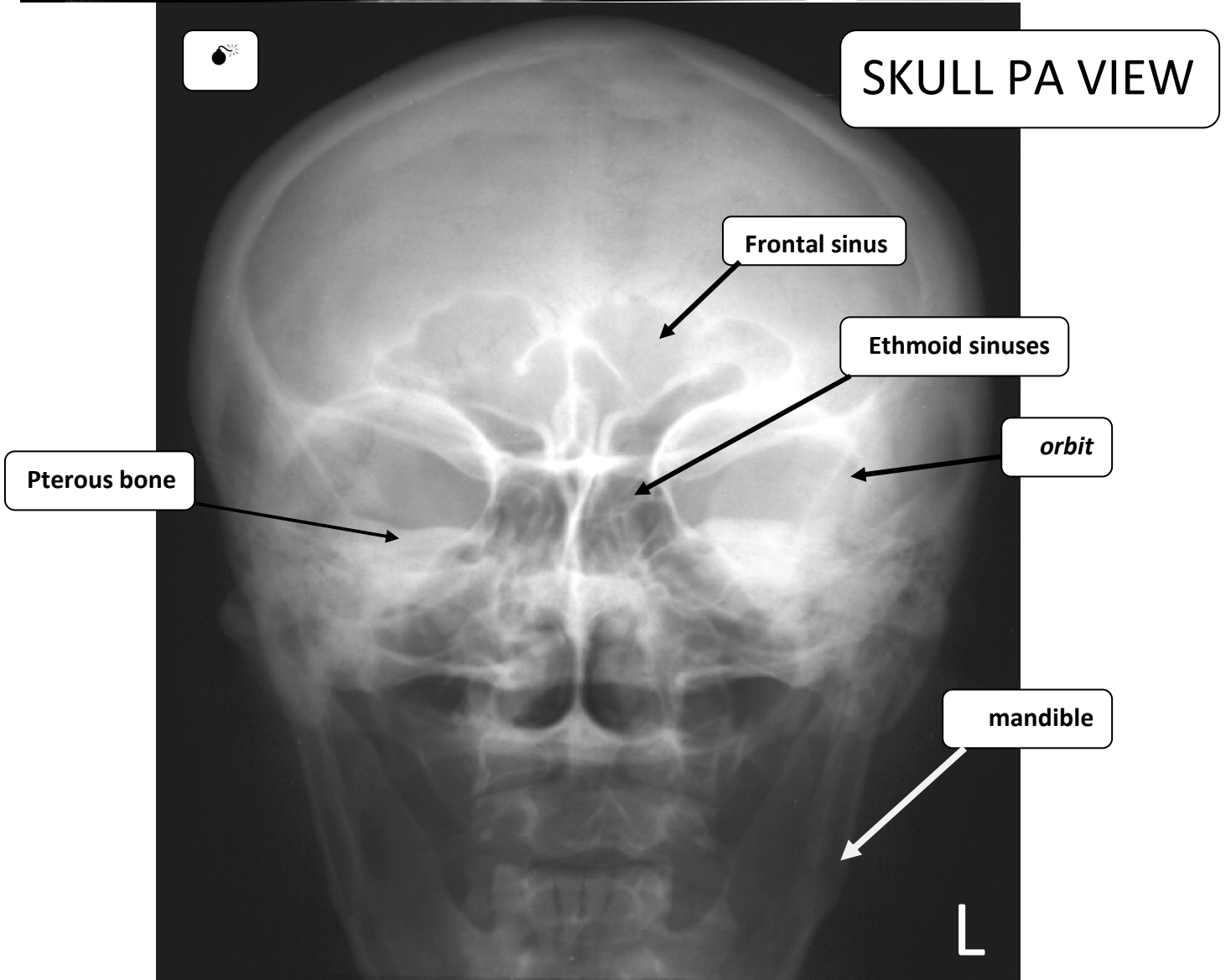
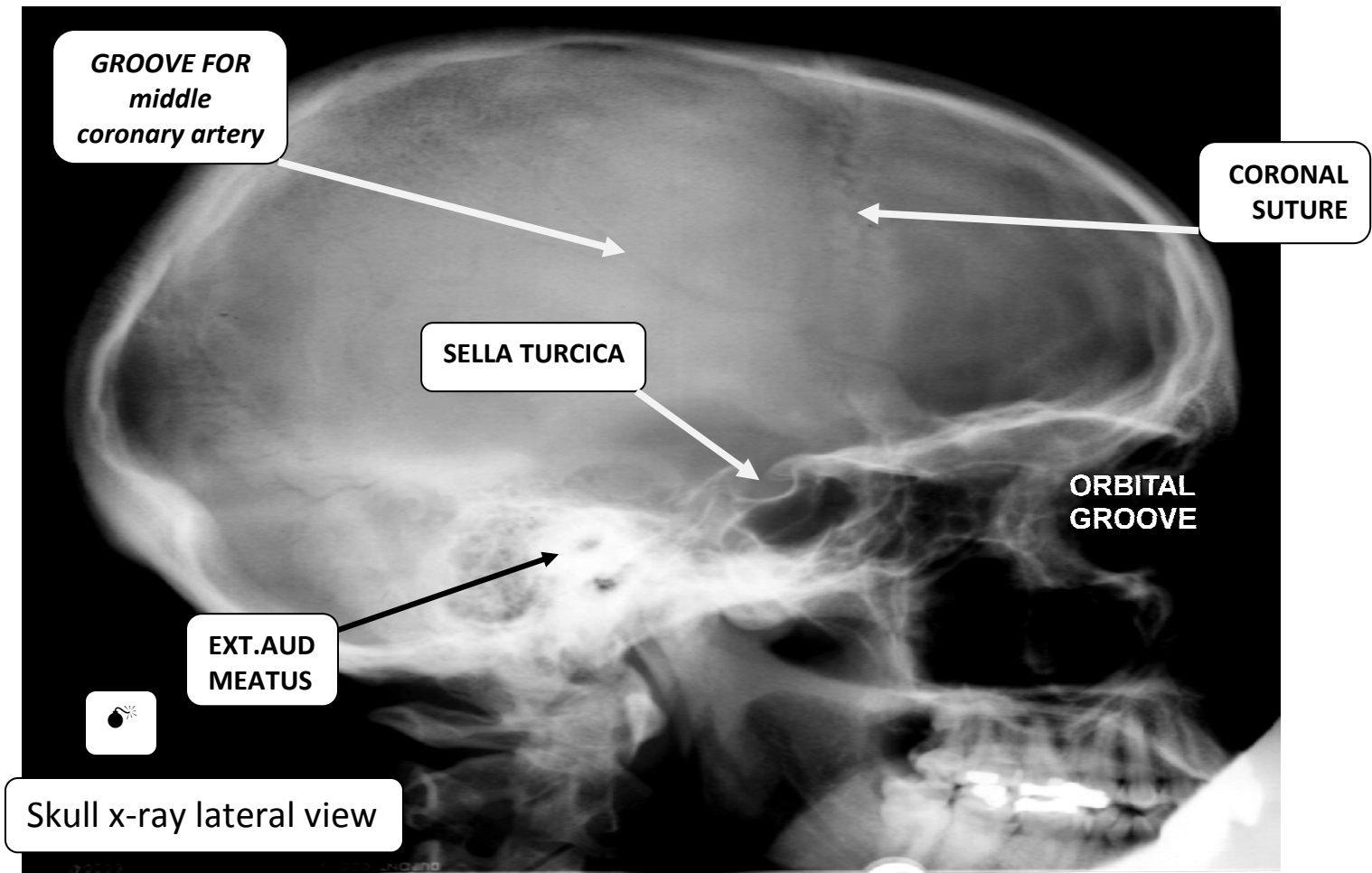
- 1- Trauma (one of the most imp. indication) ☛
- 2- congenital abnormality (e.g. microcephaly)
- 3- Intracranial calcification, may be normal (e.g. choroid plexus or pineal) abnormal (tumor , vascular malformation)
- 4- Metastatic lesions (either lytic(destructive) or sclerotic (hyperdense lesion in bone))
- 5- Multiple myeloma (lytic).
- 6- Metabolic disorders e.g. hyperparathyroidism that show special appearance called " salt and pepper " << next lecture in sha Allah

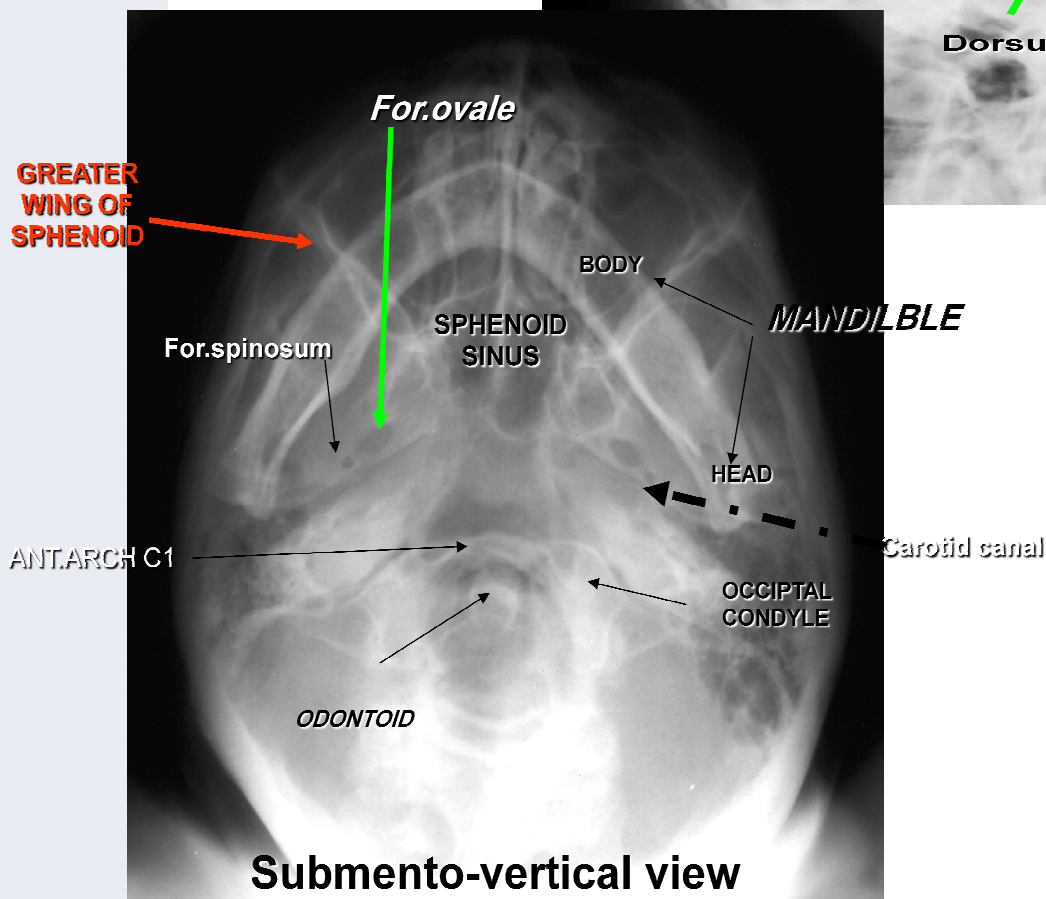
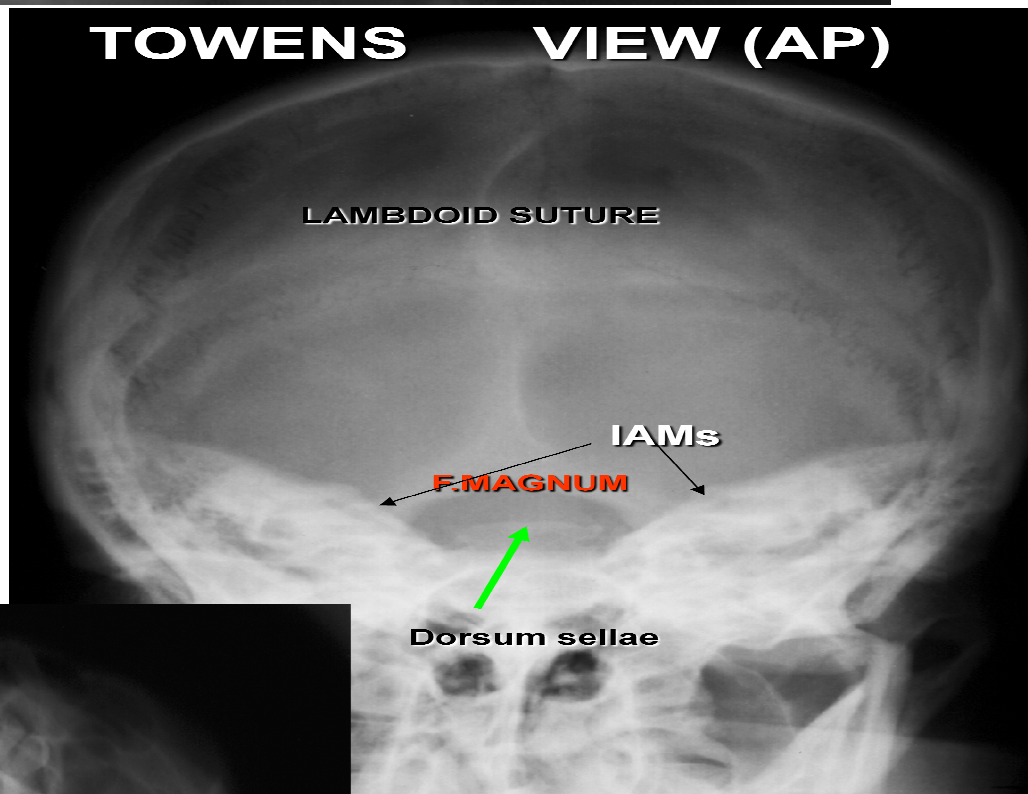
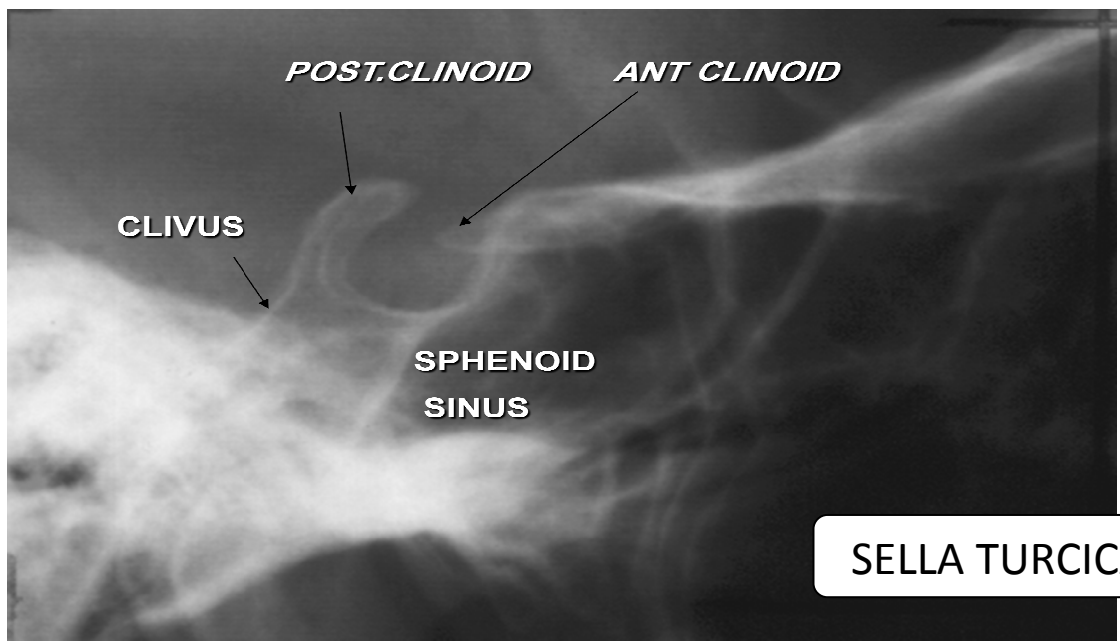
➔ We CANN'T use the plain x-ray for detection of infarction.

➔ We have different types of view:

- 1- Lateral view.
- 2- Occipitofrontal view (PA)
- 3- Townes view (AP): which shows petrous bone and internal auditory meatus.
- 4- Submento-vertical view: it is used to assess the base of the skull especially some important foramina like ; foramen ovale , foramen spinosum and rotundum as well as carotid canal.
- 5- Localized view for sella turcica .

This two view are basic view ☛





* CT SCAN

- **U**sing ionizing radiation (disadvantage)
- Lower scattered radiation than x-ray ☼
- No need for a special preparation except in case of using IV contrast that need fasting and making sure that there is no allergy for the contrast or contraindication like renal failure, cardiac patients and bronchial asthma .
- Type of the contrast medium : iodinated ☼ (hyperdense) contrast (non ionic L.O.C.M = low osmolar contrast medium)
- Spiral CT can perform a head scan in 15 minutes pre & post contrast scans , The scan itself only takes as little as 10 seconds (advantage over MRI)
- Patient preparation: nil.
- Indications: ☼
 - 1- Trauma : CT is better than MRI due to: ☼
 - Takes shorter time.
 - Availability.
 - It is better in bone assessment.
 - Easy detection of acute hemorrhage.
 - In pediatrics CT only need simple sedation becoz it only takes short time but MRI that may need GA .
 - 2- Detection of blood: in any location, in any stage and hemorrhage due to any cause e.g. HTN, rupture aneurysm hemorrhagic infarction or hemorrhagic tumor.
 - 3- Strokes: we use it as a first line modality (CVA) because of availability, take short time, low cost, easy and no pt. preparation need.
 - 4- Tumors.
 - 5- Infection.
 - 6- Vascular disorders.
- CT can be easily detecting acute hemorrhage but in case of subacute hemorrhage the MRI is better. ☼
- All of these also are indications for MRI BUT the MRI is better becoz it has good tissue contrast & good resolution as well as it is a multiplanar modality ☼ so it is better than CT in these cases.

Contraindication: In pregnant women there is relative contraindication to do brain CT (it has Lower scattered radiation + we can cover the abdomen of pregnant women). ☢️
Also if we using a contrast there is some contraindicated to the contrast it self .

There are two types of CT image: تفصيلها بالمحاضرة القادمة

Bone window to assess the bones.

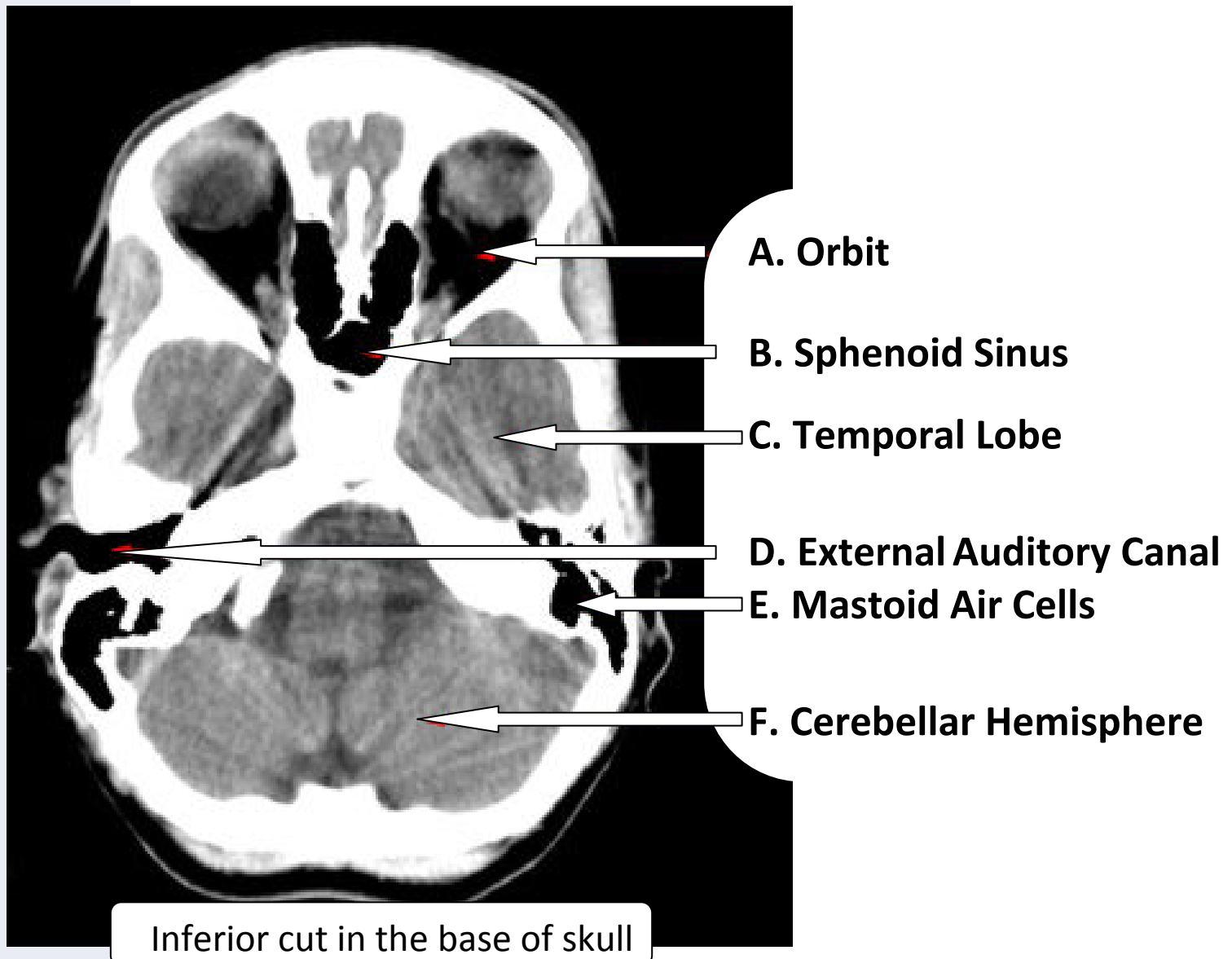
Brain (parenchyma) window: to assess brain parenchyma

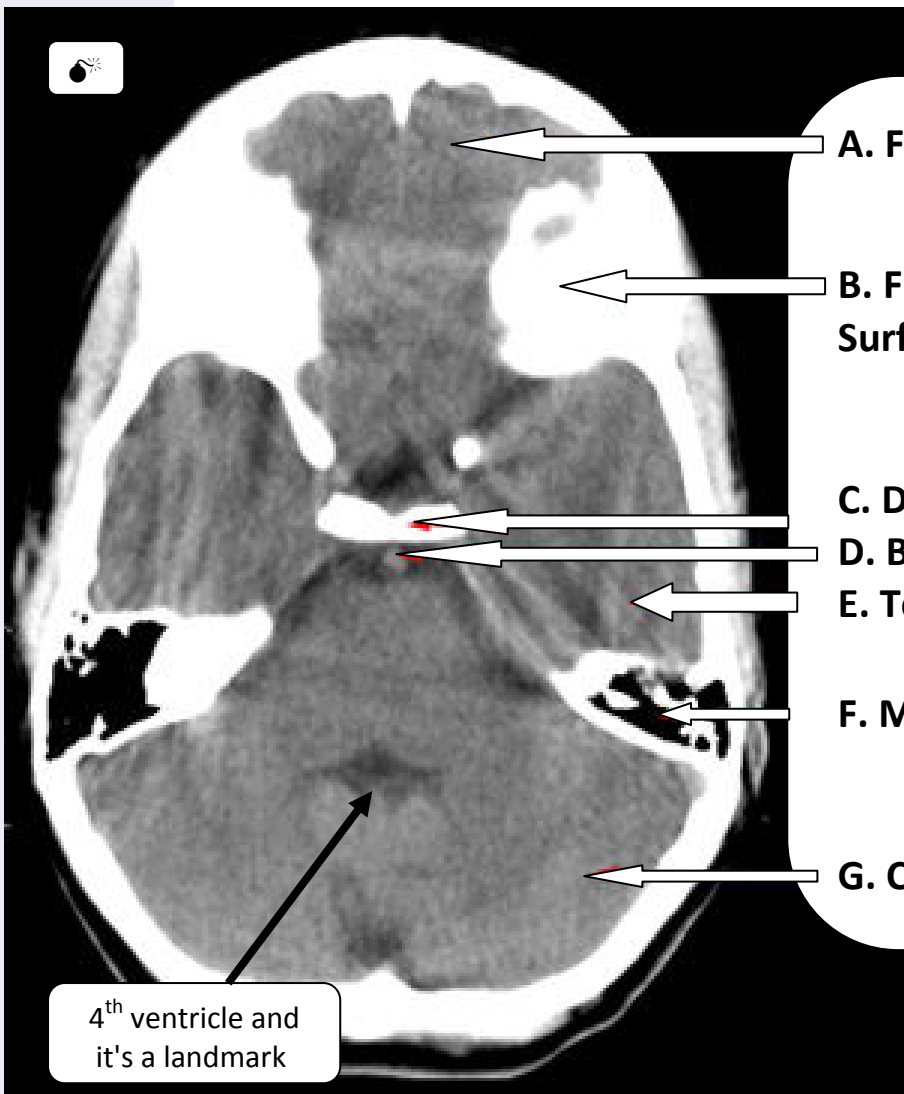
CT can give :

1- Direct axial

2- Direct coronal

But sagittal plane can not be directly generated ,however a computer reformatted the section to show the sagittal but not directly .





A. Frontal Lobe

B. Frontal Bone (Superior Surface of Orbital Part)

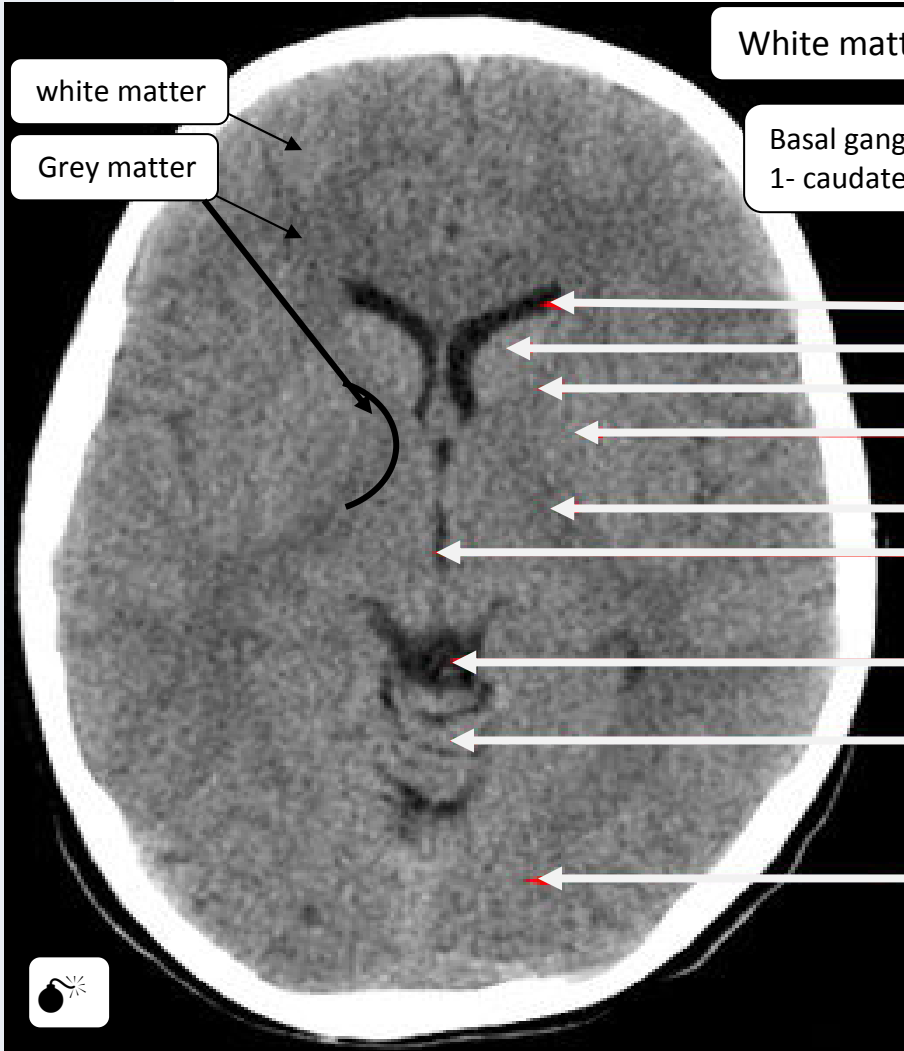
C. Dorsum Sellae

D. Basilar Artery

E. Temporal Lobe

F. Mastoid Air Cells

G. Cerebellar Hemisphere



White matter is more dark than grey matter

Basal ganglia is deeply seated grey matter :
1- caudate nucleus 2- lentiform

A. Anterior Horn of the Lateral Ventricle

B. Caudate Nucleus (grey)

C. Anterior Limb of the Internal Capsule

D. Putamen and Globus Pallidus

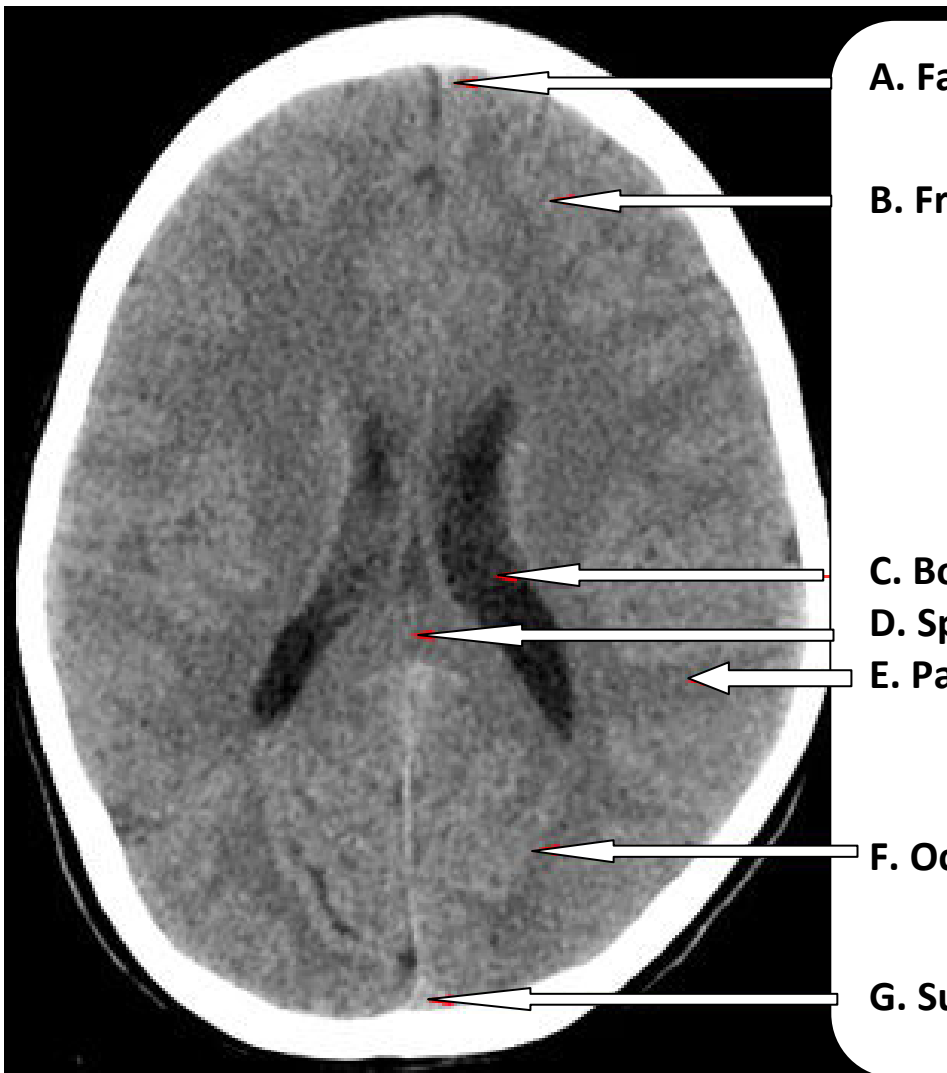
E. Posterior Limb of the Internal Capsule

F. Third Ventricle

G. Quadrigeminal Plate Cistern

H. Cerebellar Vermis

I. Occipital Lobe



A. Falx Cerebri

B. Frontal Lobe

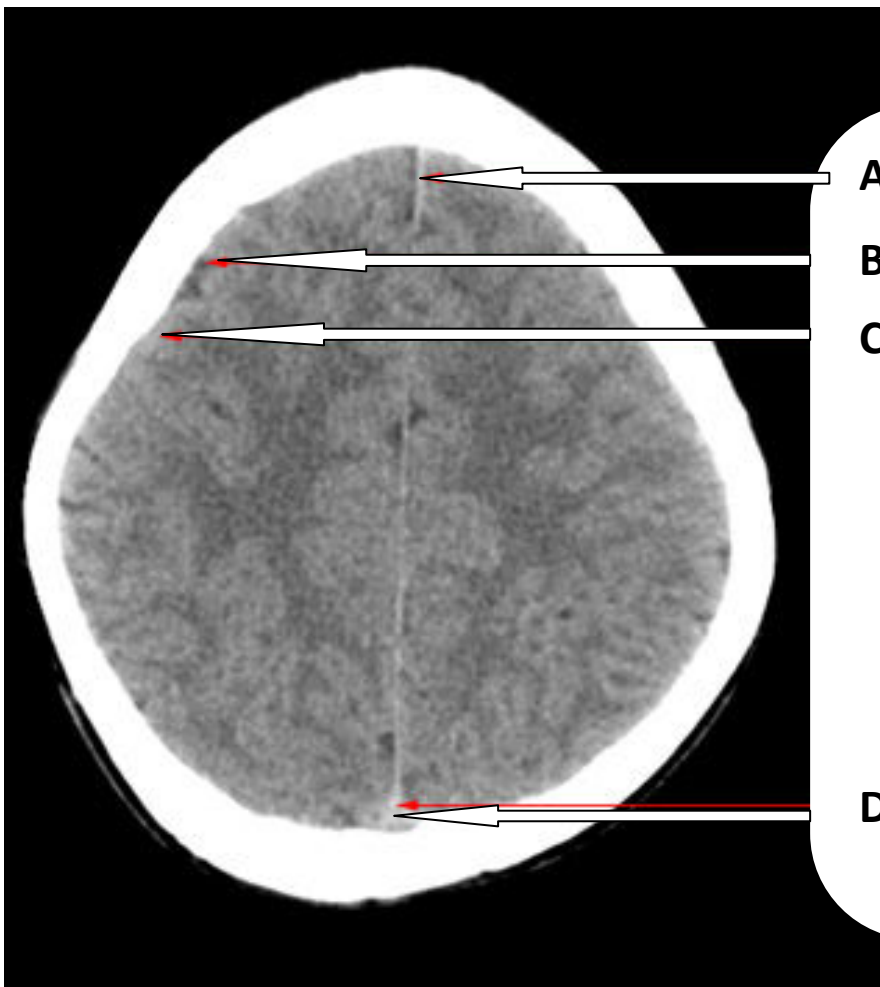
C. Body of the Lateral Ventricle

D. Splenium of the Corpus Callosum

E. Parietal Lobe

F. Occipital Lobe

G. Superior Sagittal Sinus



A. Falx Cerebri

B. Sulcus

C. Gyrus

D. Superior Sagittal Sinus

* MRI

There is no ionizing radiation becoz it's use a magnetic field so it's more safe.

Patient preparation: Nil unless fasting for general anesthesia(GS).

Contrast medium: Gadolinium (it's not like iodine and it's has less side effect)

Indications:

1. Strokes (remember MRI is more effective but CT is faster)
2. Tumors.
3. Infection.
4. Vascular disorders.
5. White matter disease.(use more than CT)
6. Some cases of trauma.

Indicated as CT expect NOT FOR TRUMA as 1st modality but we can use it later

➔ MRI is superior to CT in assessment of white matter disease .

➔ Contraindications: ⚡⚡

1. Cardiac pacemaker (absolute contraindication)
2. Cochlear implants (absolute contraindication)
3. Ocular prostheses (absolute contraindication)
- ➔ 4. Intraocular ferrous foreign body (absolute contraindication)
5. Neurostimulators (absolute contraindication)e.g. insulin pump
6. Pregnancy in 1st trimester (relative contraindication) .
7. Claustrophobia (relative contraindication) .

يعني مثل
رصاصه بالعين
او مواد تلحيم
الحديد مشان كذا
نفحصه بال x-ray

➔MRI can do direct saggital view but in CT we can do it by image reconstruction.

➔We have many sequences of MRI and the most important 3 are:

T1: CSF is black , grey matter is darker than white matter .

T2 : CSF is white, grey matter is brighter than white matter .

FLAIR : CSF is black but white matter is darker than grey matter .

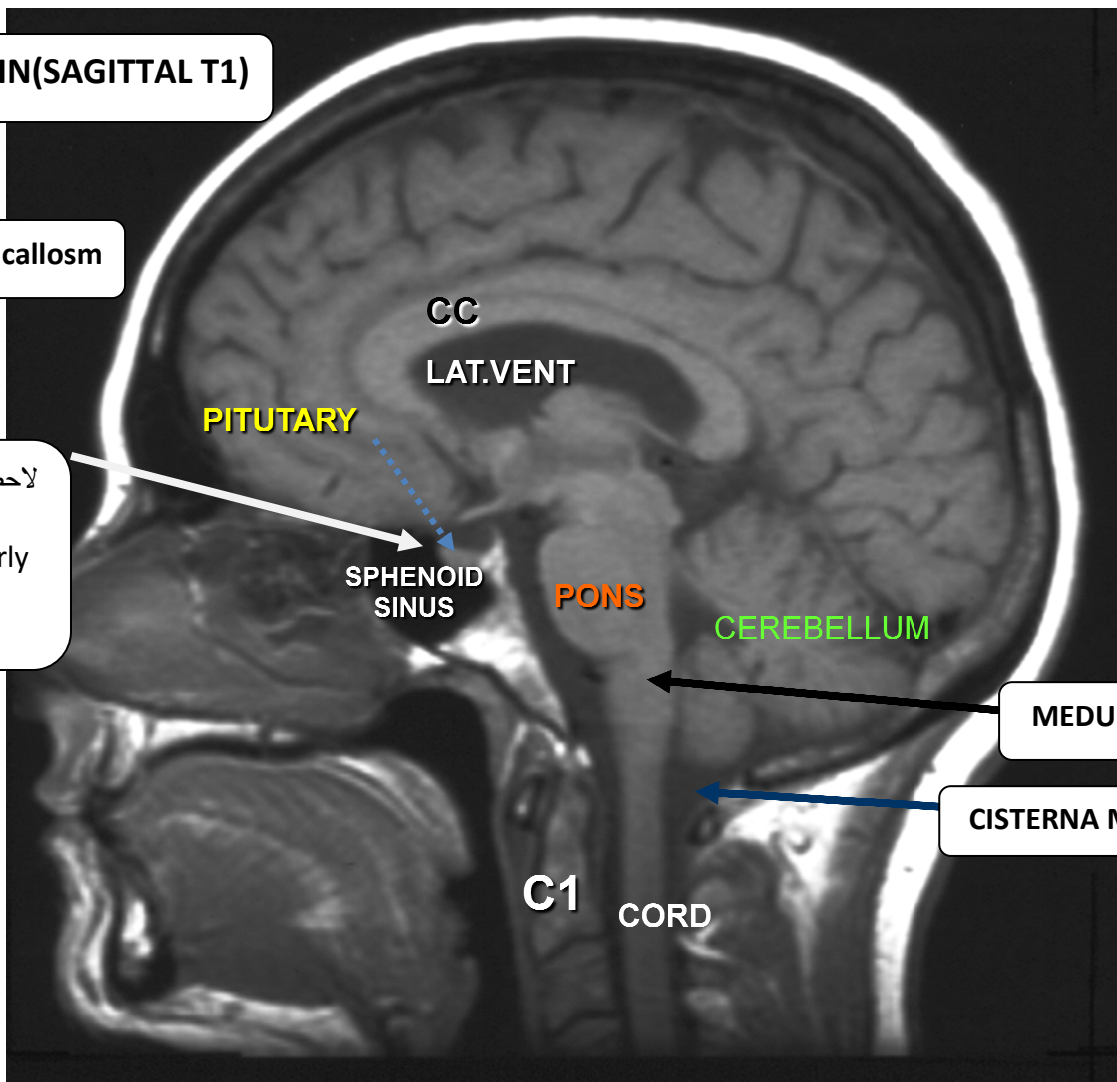
➔ IN flair the fluid attenuation is fluid in a cavity e.g. vent. System it will be attenuated i.e. fluid appears dark, but if interstitial fluid e.g. edema it would appear bright. FLAIR is (Fluid Attenuation Inversion Recovery)

In T1
W=W
G=G

MRI BRAIN(SAGITTAL T1)

CC = corpus callosm

لاحظ انو ما تأثر باليون
كثير مثل CT
So we can clearly
see pituitary
gland in MRI



MRI BRAIN(AXIAL T1)

SUP. OPHTHALMIC
VEIN

TEMPORAL HORN
OF
LAT. VENTRICLE

PARAHIPPOCAMPAL
GYRUS

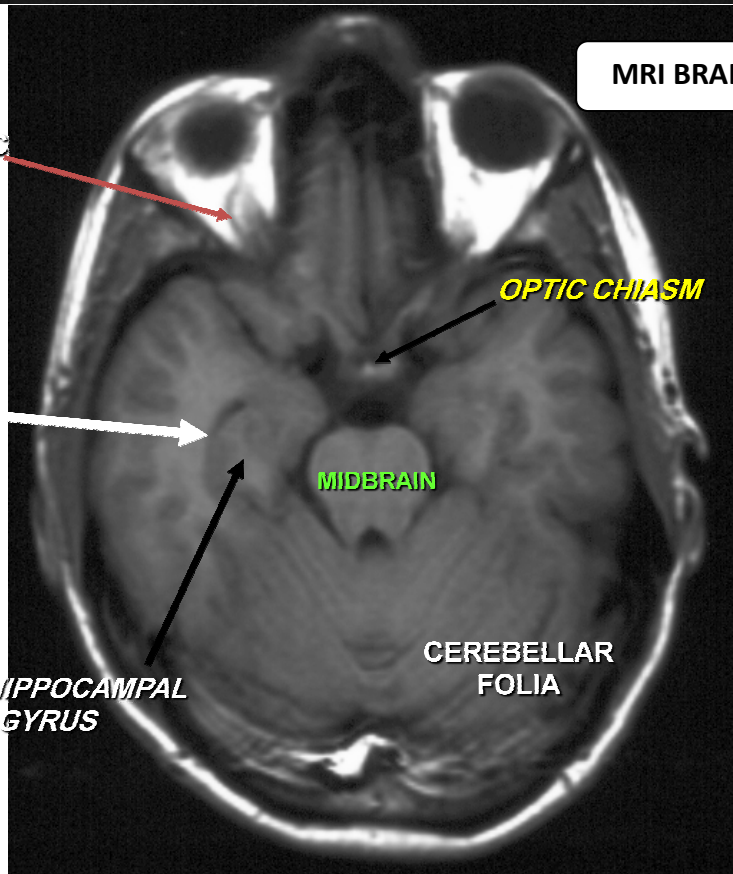
OPTIC CHIASM

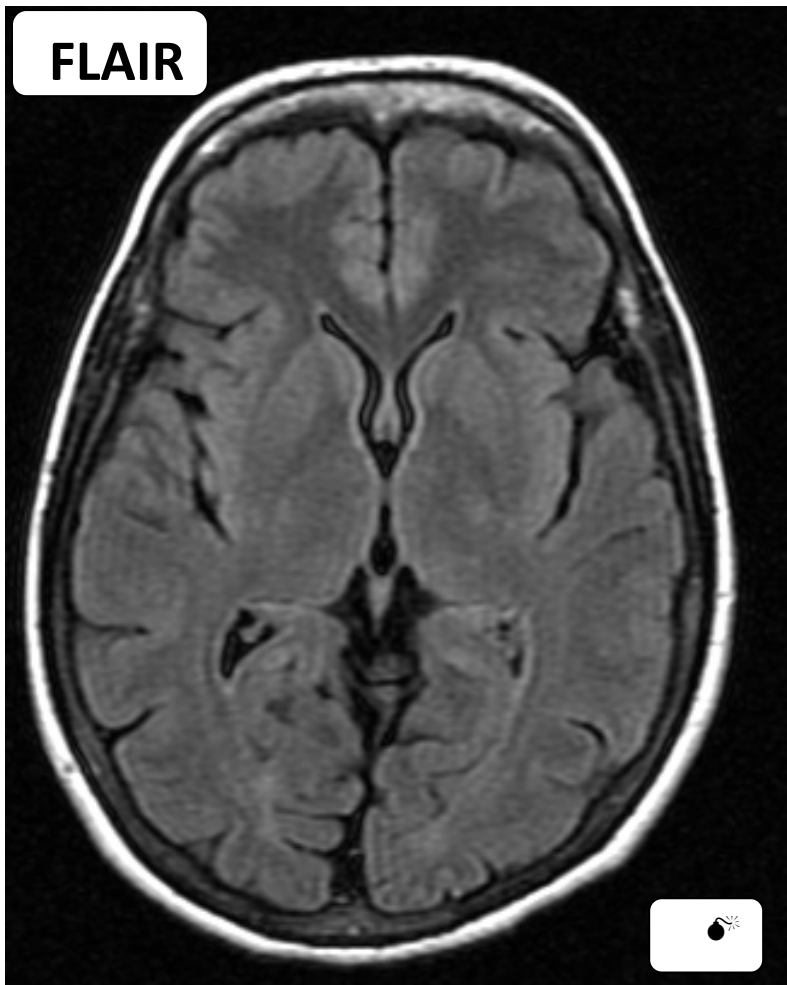
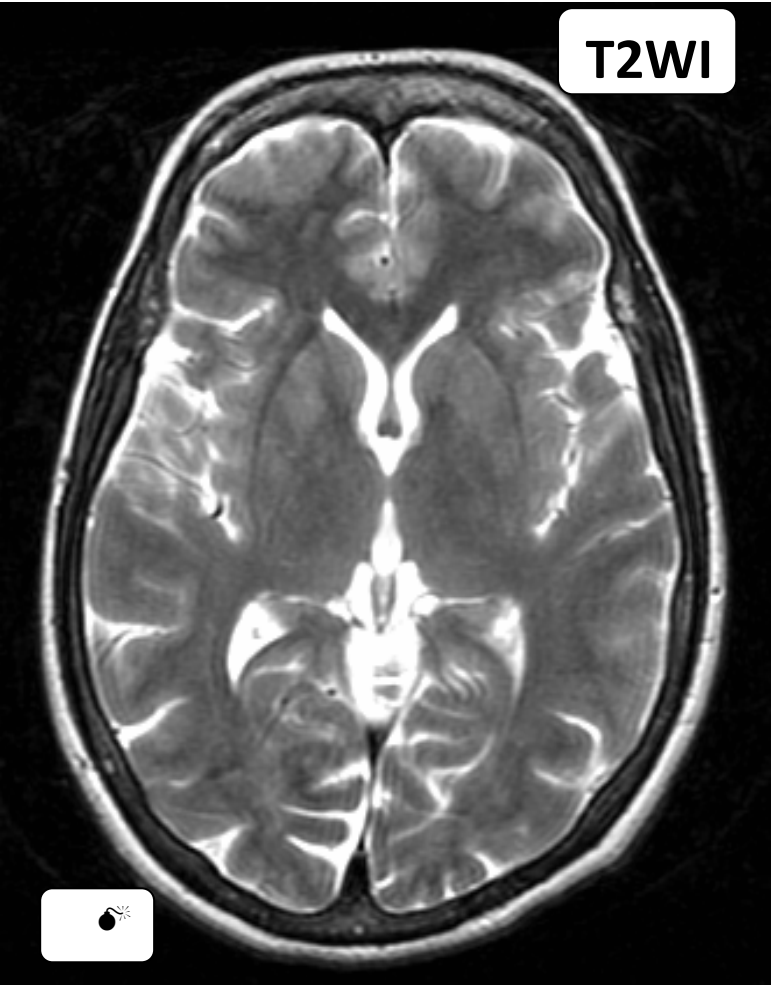
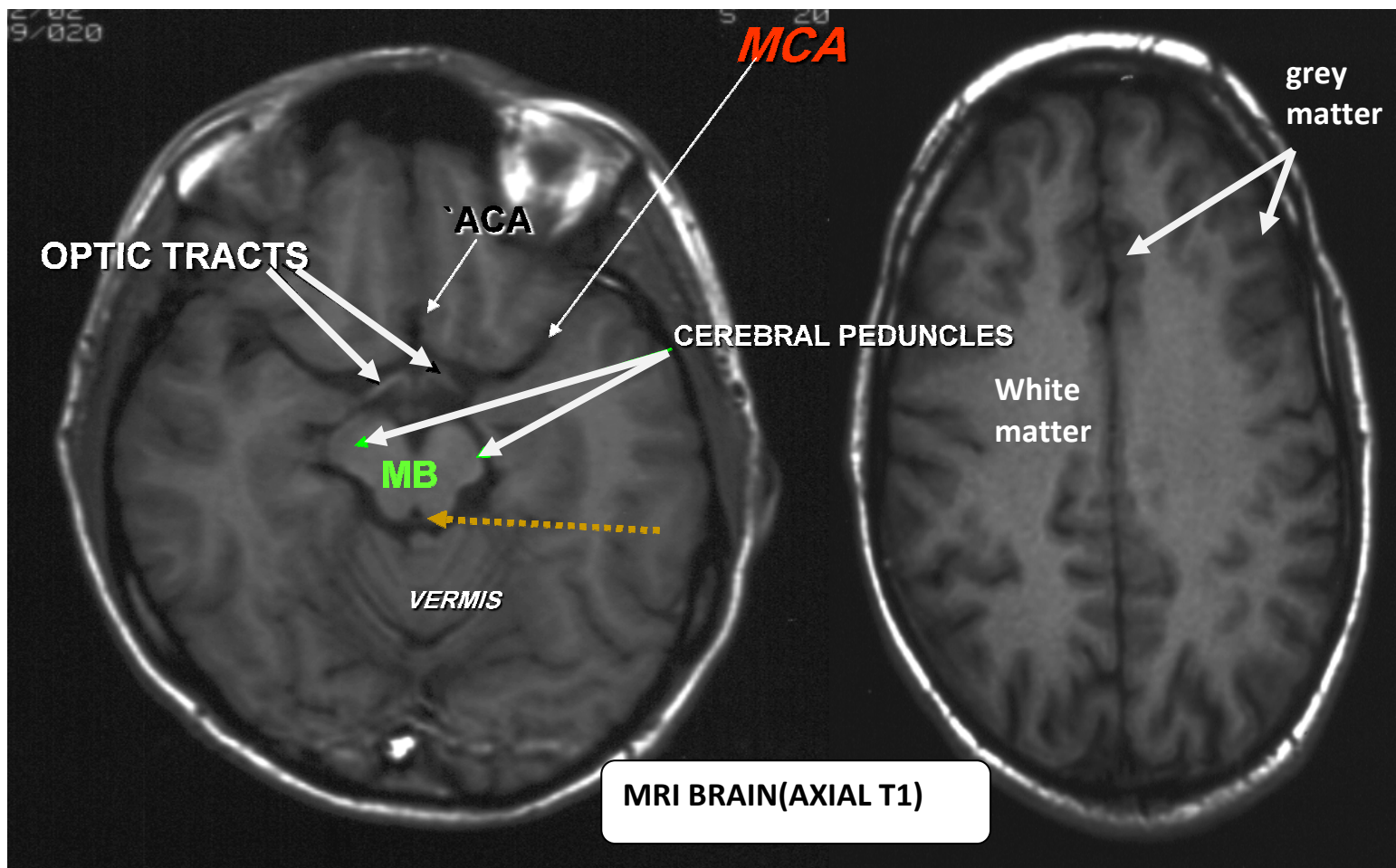
MIDBRAIN

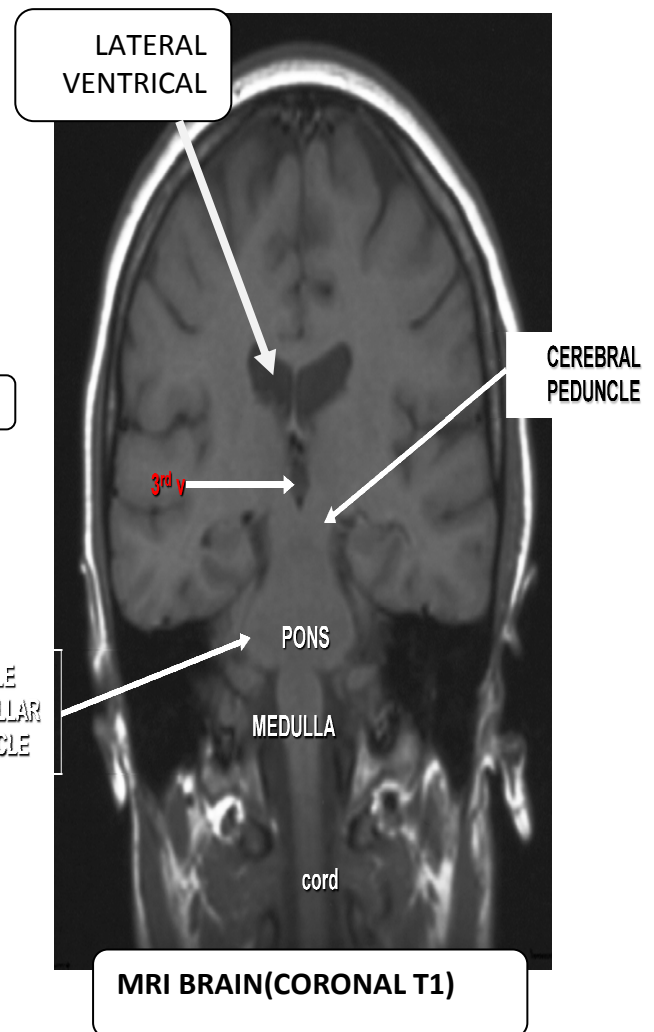
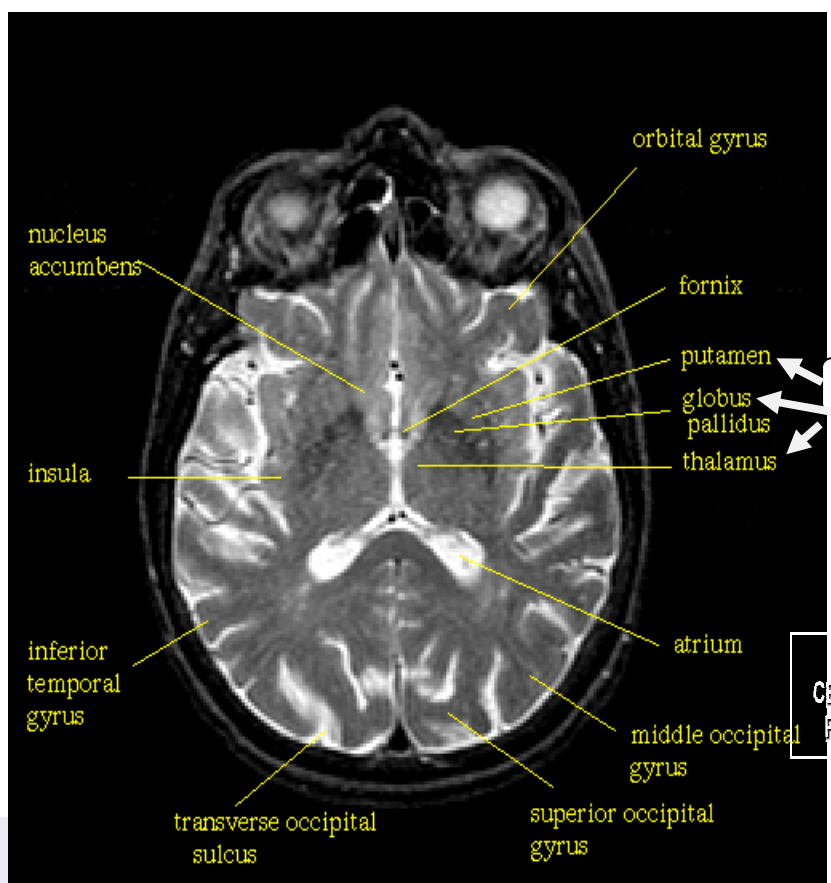
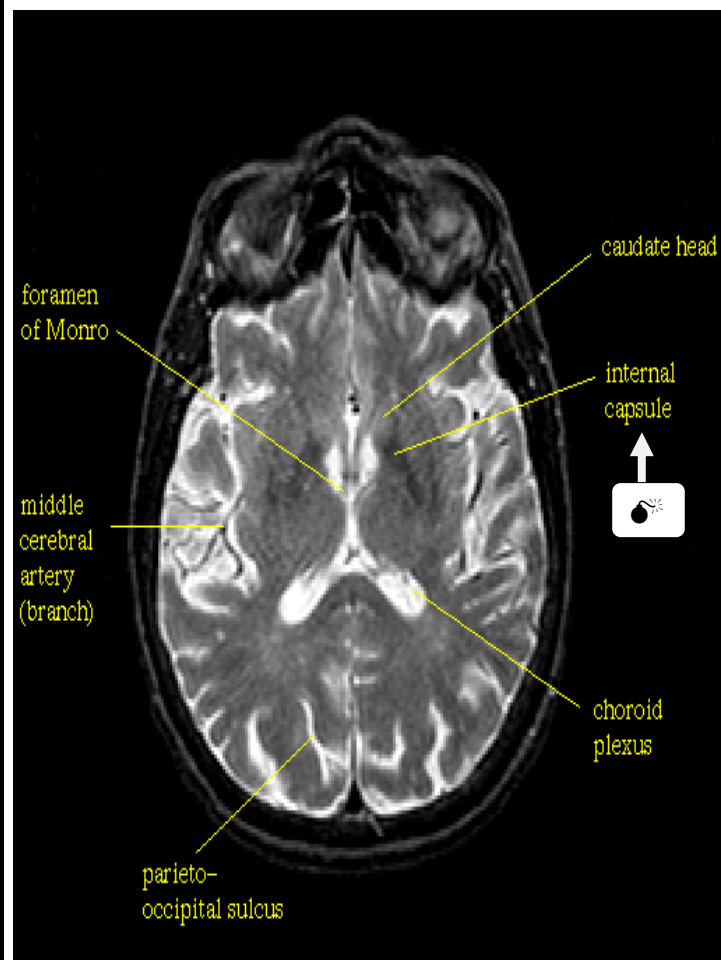
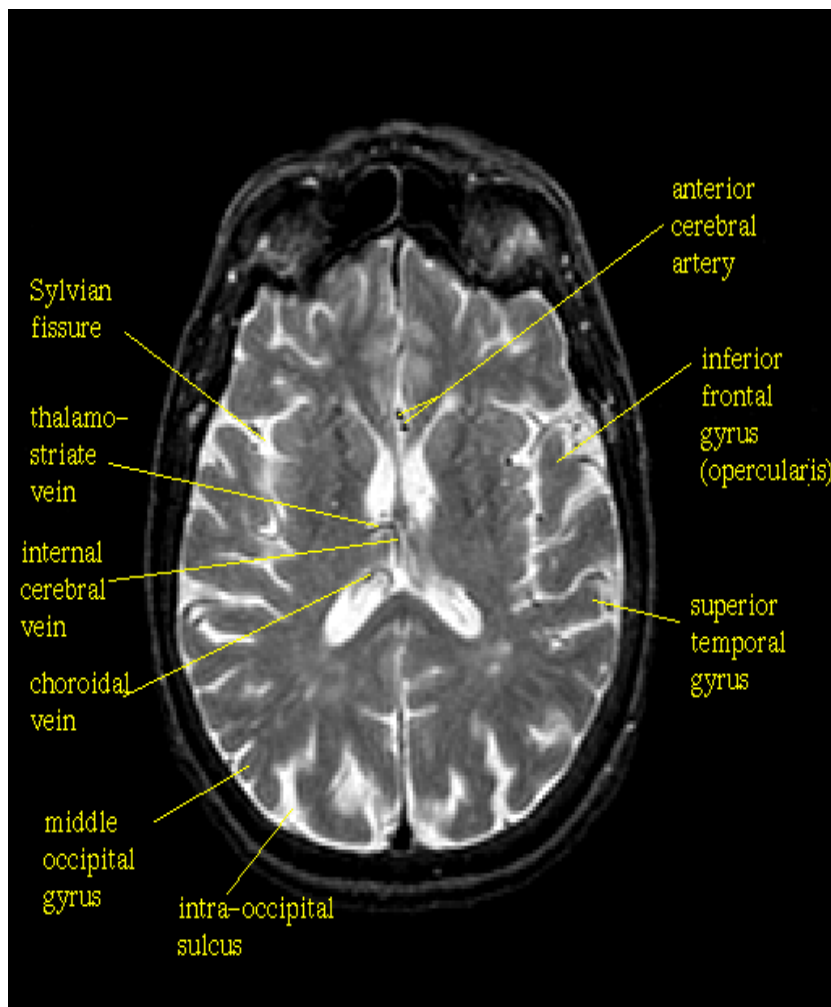
CEREBELLAR
FOLIA

In MRI NO artifact
from bone
مثل ما بصير با CT

We can see
vessels without
contrast

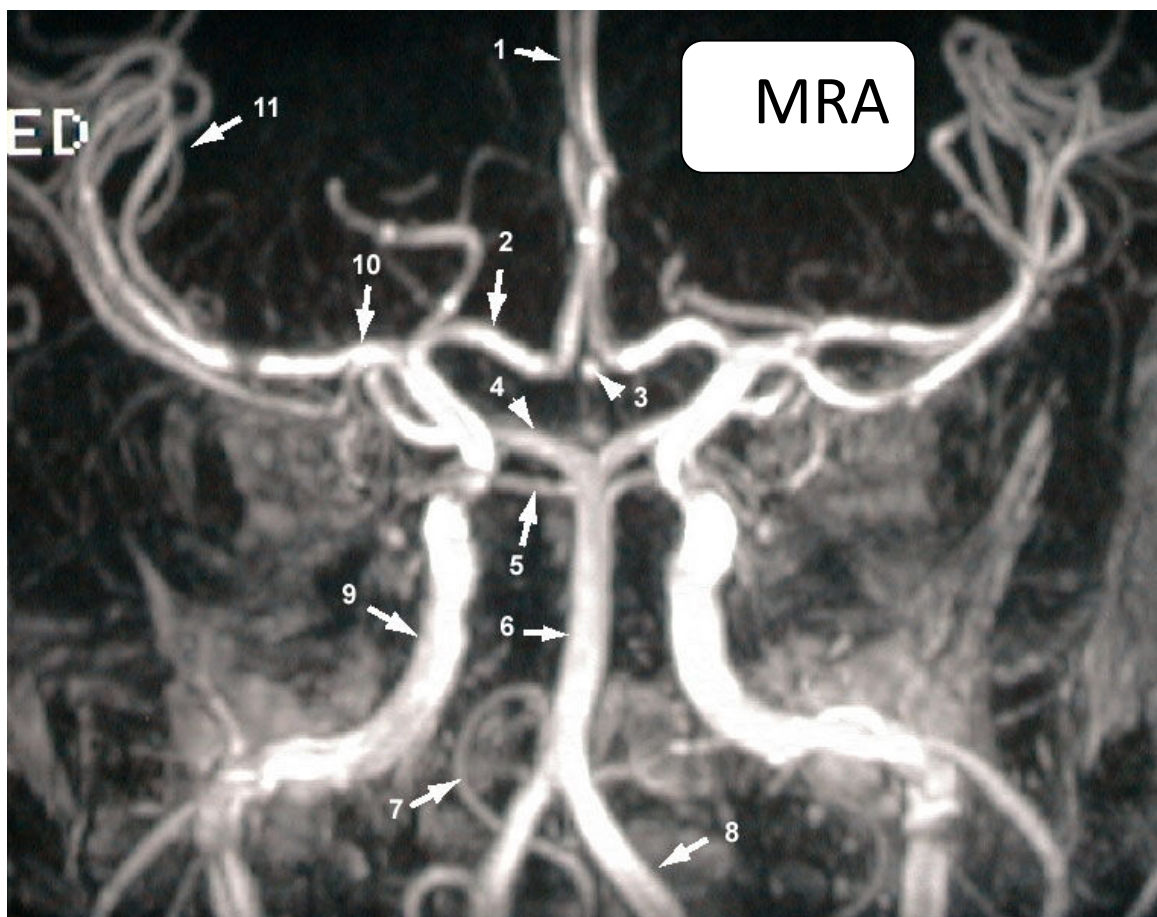






* Angiogram (catheter, MRI ,CT)

- When we do it in CT or MRI → Non-invasive, but in catheter angiogram → invasive .
- CTA should be with contrast , MRA can be with or without .
- In MRA (MR Arteriogram) and MRV (MR Venogram) can be done without contrast and the technique is called "time of flight" which depends on blood flow in the vessel and this technique is better to be used in the brain.
- In catheter angiogram, the early images taken will show the arteries then, after seconds, the image will show the veins (late phase).
- Catheter angiogram cannot be used without contrast ☹️.
- catheter angiogram can be used for diagnosis and treatment.



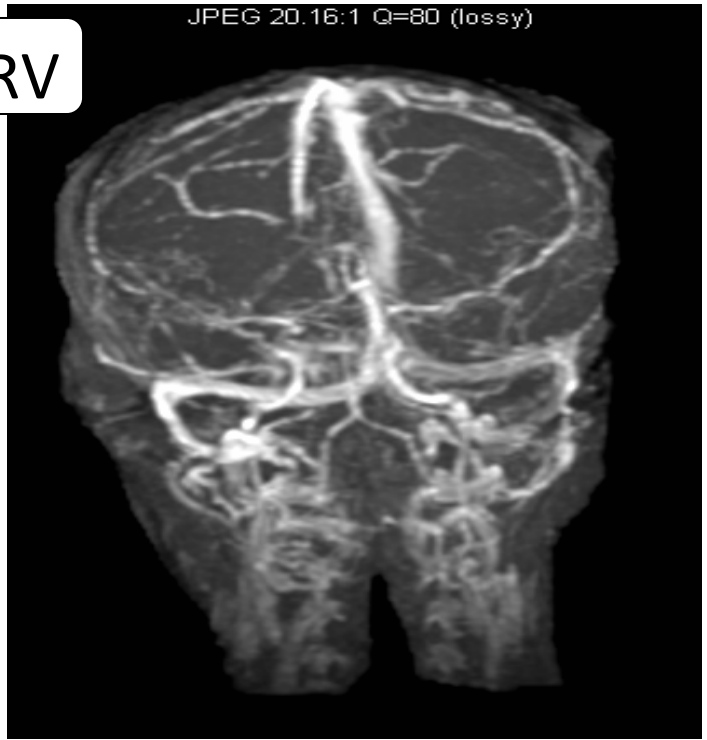
- 1 A2 segment of R anterior cerebral a. 2 A1 segment of R anterior cerebral a.
- 3 R anterior communicating a. 4 R posterior communicating a. 5 R superior cerebellar a.
- 6 basilar a. 7 R posterior inferior cerebellar a. 8 L vertebral a. 9 R internal carotid a.
- 10 R middle cerebral a. 11 R temporal arteries

NO need to memorize it just
YOU should know it's MRA

JPEG 21.42:1 Q=80 (lossy)

JPEG 20.16:1 Q=80 (lossy)

MRV



Carotid angiogram AP view
(arterial phase)☀

ANT.CEREBRAL
ARTERY

MIDDLE CEREBRAL
ARTERY

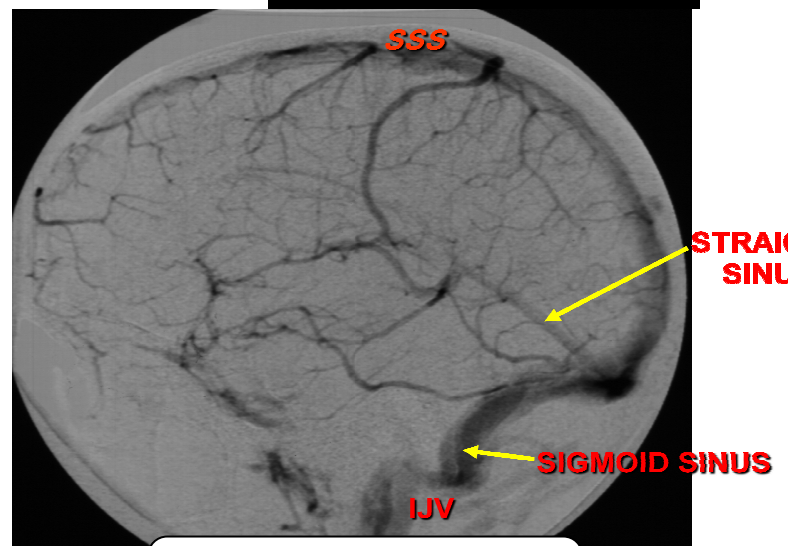
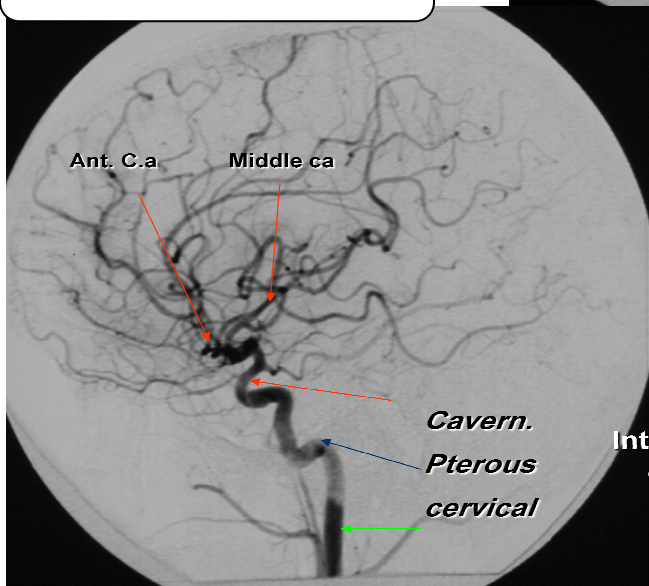
CAVERNOUS

PTEROUS

CERVICAL

**INTERNAL CAROTID
ARTERY**

Carotidangiogram lateral
view (arterial phase)



Carotidangiogram lateral
(venous phase)

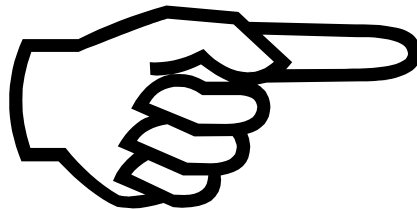
* Carotid Doppler

The easiest technique to assessing the blood vessel.

(Advantage) → there is no preparation

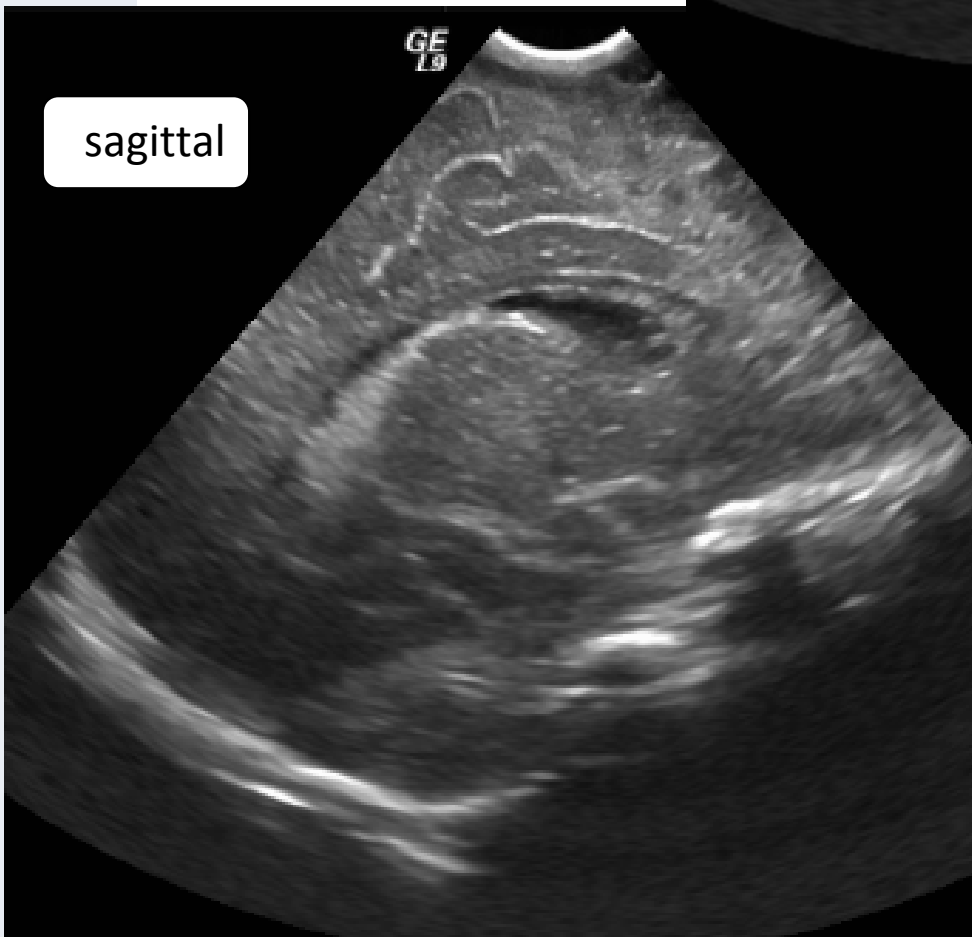
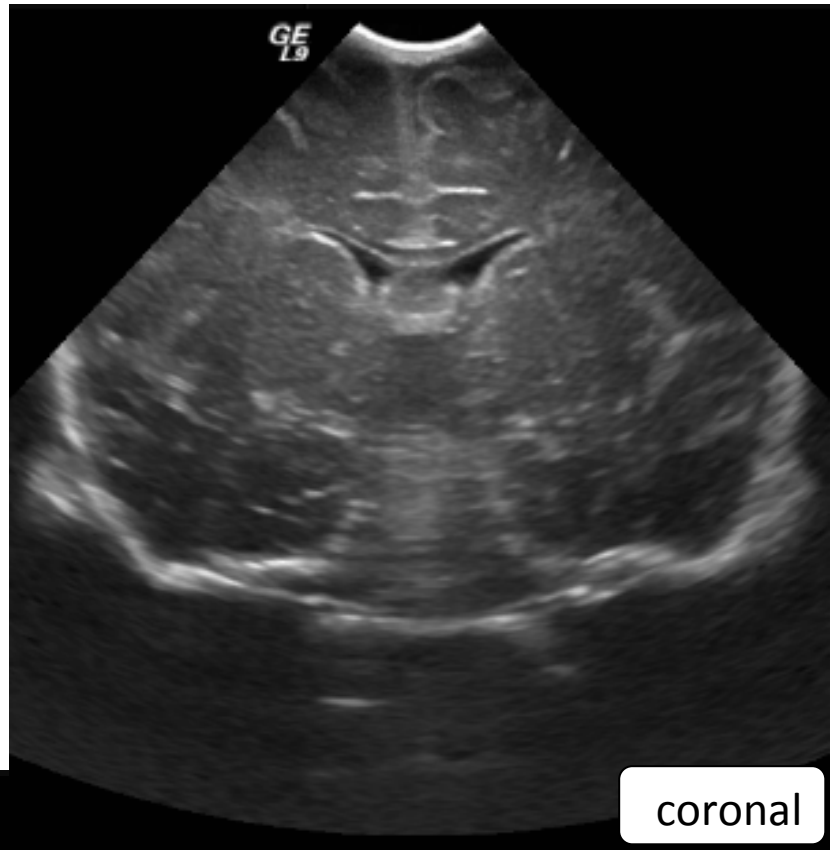
(Disadvantage) → its operator dependent)

It's commonly used in case of TIA (transient ischemic attack)



***US NEONATAL HEAD**

→ we put the prop at the anterior fontanial



Done
Abdul Aziz alsaad