



Nervous system

Interactive lecture

Lecture 25



No objectives

Color index:

Black: *Main text*

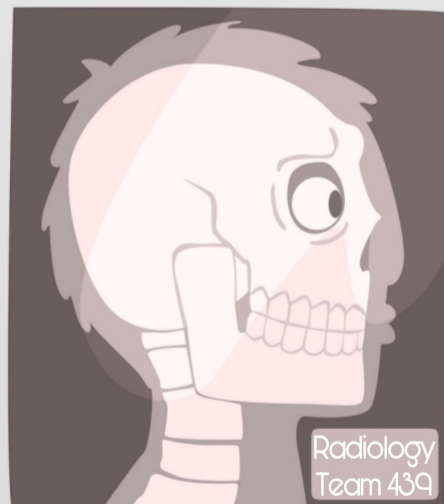
Red: *Important*

Yellow: *Golden notes*

Green: *Drs notes 439*

Dark green: *Drs notes 438*

Gray: *Extra*

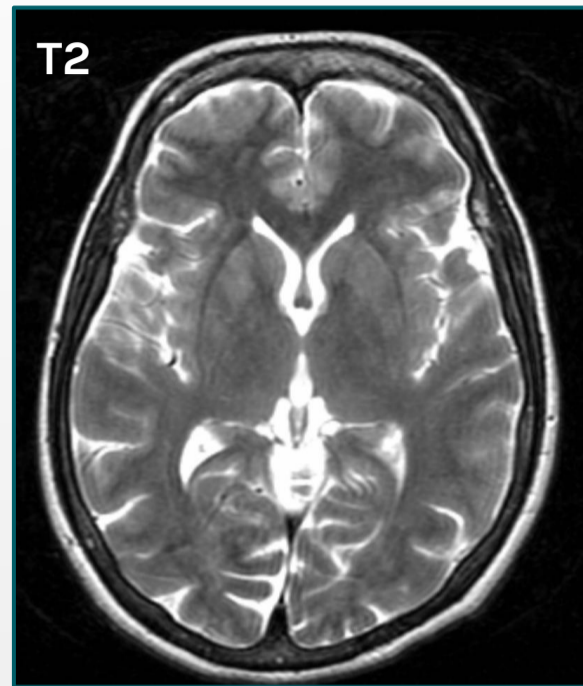


Introduction



CT

- bone is white & CS fluid is black
- White matter is darker than grey matter
- the darkest structure is the fluid in the ventricles



MRI

- bone is black
- T1: fluid is dark, white matter is lighter than grey matter.
- T2: fluid is bright
- Flair: fluid is dark, white matter is darker than grey matter

MCOs

Q1. which is true about CT ?

1. Bone is black
2. CSF is black
3. Gray matter is darker than white matter
4. Gray and white matter cannot be differentiated

1. (false, the bone color in CT is white)
 2. (true)
 3. (false,, the opposite is true “ there is more fluids in white matter)
 4. (no, we can not differentiate in one condition: brain edema either generalized or localized)
- Answer: 2

Q2. contraindication of MRI include all the following EXCEPT :

1. cardiac pacemaker
2. cochlear implants
3. metal close to the eye
4. neurostimulators
5. pregnancy (3rd trimester).

These days there are some devices which are MRI compatible

1. —
 2. —
 3. absolute contraindication (some metal are not ferromagnetic)
 4. (overstimulate)
 5. it's safe to do MRI in 2nd and 3rd trimester, for 1st trimester you could do MRI if it's absolute emergency, or postpone it to 2 or 3rd trimester. Generally it can be done in first trimester but it's safer during 2 or 3rd.
- Answer: 5, but MRI with contrast is contraindication

Q3. MRI diffusion (DWI) is particularly helpful in assessment of all of the following except :

1. Brain infarction
2. Brain abscess
3. Brain tumors
4. Hydrocephalus

1. mostly useful in brain infarction, can show early infarction “from 7-10 days”. all the other sequences can be normal.
 2. (helpful)
 3. (in some types of tumors)
 4. (not helpful) no fluid restriction like the 3 above choices
- Answer: 4

It is important to know Indications ,Contraindications , Advantages & disadvantages of each imaging modality

MRI diffusion

very helpful in assessment of :

- Early brain infarction.
- Brain abscess. you see an intra-axial ring enhancing lesion with central diffusion restriction on DWI
- Certain types of brain tumor. particularly highly cellular tumors (diffusion restriction)

it can't assess the detailed anatomy of the brain. it assess if there is diffusion restriction or not.

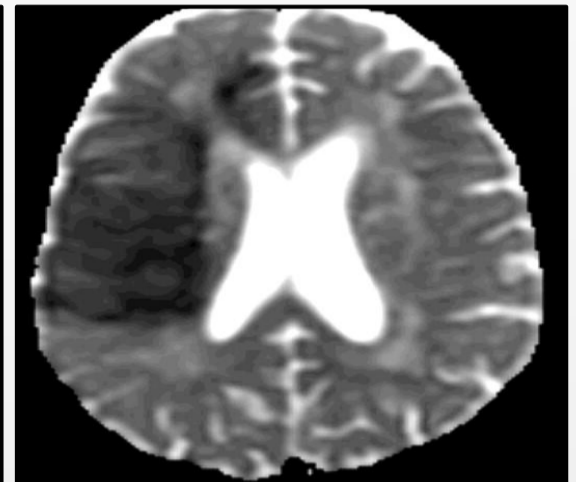
-If you order MRI diffusion sequence you got two images, what i mean by diffusion restriction is if you have a high signal intensity in DWI and a low signal intensity in ADC map, it's a diffusion restrain

What other imaging techniques are helpful in differentiating between high and low grade tumors

1. Spectroscopy
2. MR Perfusion



DWI



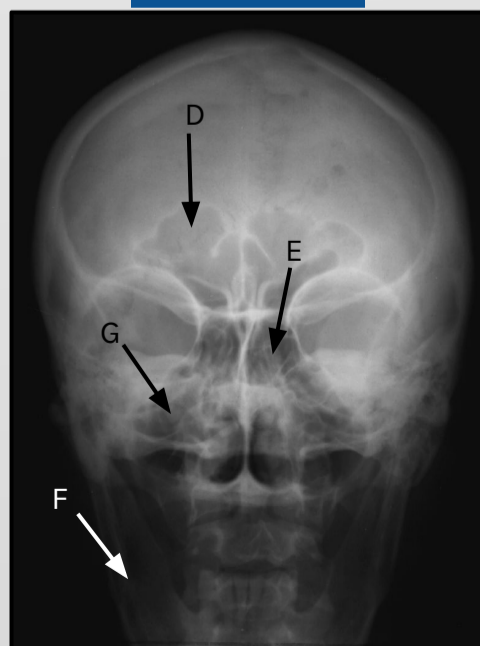
ADC map

Case 1

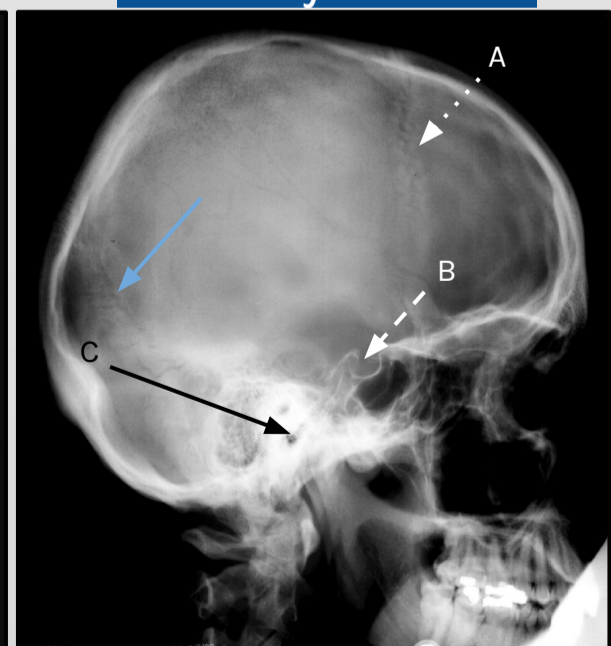
name the following structures :

- A. coronal suture: between frontal bone and parietal bone.
 - B. sella turcica: the pituitary gland is located within seen using CT or MRI
 - C. external acoustic meatus
 - D. frontal sinus
 - E. ethmoidal sinus
 - F. mandible
 - G. Maxillary sinus
- x-ray is rarely used these days, the only indication is looking for foreign bodies
- in the midline from anterior to posterior is the sagittal suture.
- lambdoid suture

Skull PA view



Skull X-Ray lateral view



Case 2

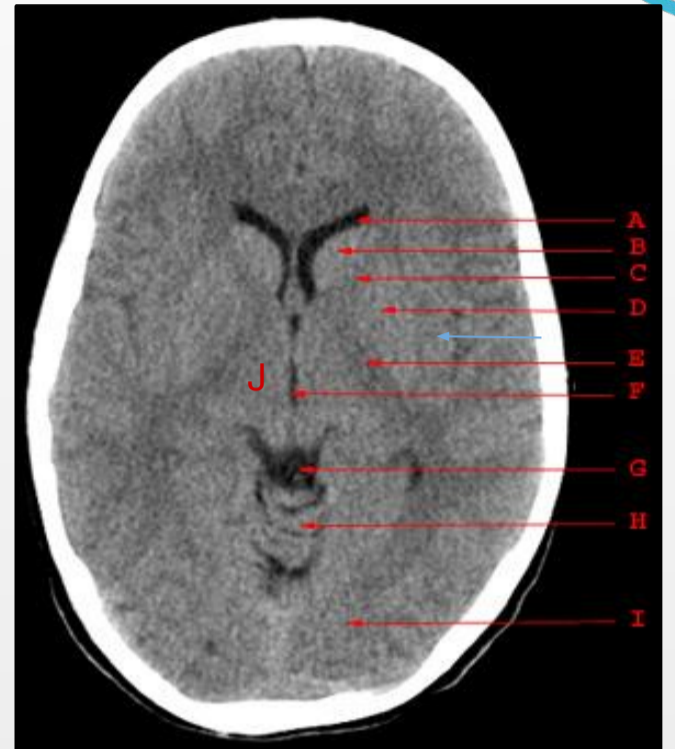
Label, Brain CT (Axial)

- A. Frontal horns of lateral ventricle
- B. **Caudate head (زبي حبة اللوز)**
- C. Anterior Limb of the Internal Capsule
- D. Globus Pallidus (lentiform nucleus)
- E. Posterior Limb of the Internal Capsule
- F. 3rd Ventricle
- G. **Quadrigeminal Plate Cistern**
- H. **Cerebellar Vermis**
- I. **Occipital lobe..**
- J. **Thalamus**

-Brain edema on CT shows loss of differentiation between grey and white matter

- Caudate head part of the basal ganglia

- Lentiform nucleus is consisted of two part medially is globus pallidus, laterally is **putamen (arrow)**.



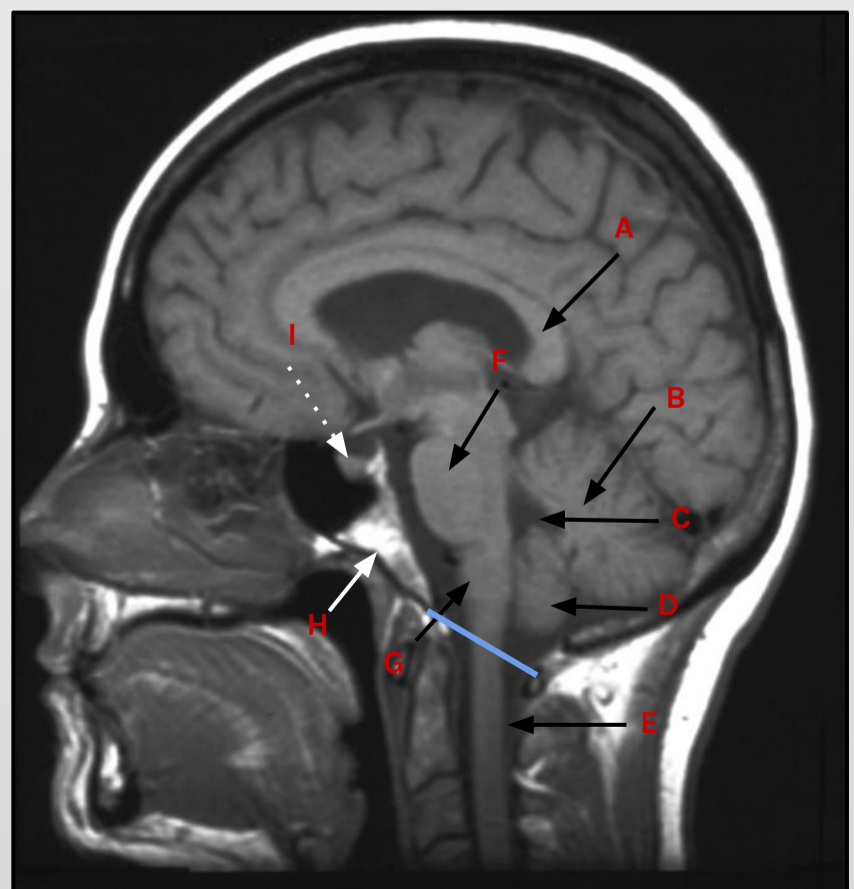
Case 3

Name the following structures :

- A. Corpus callosum (body)
- B. Superior vermis of cerebellum
- C. 4th ventricle
- D. Cerebellar tonsils
- E. Spinal cord
- F. Pons
- G. Medulla oblongata
- H. Clivus (it is hyper-intense because of the fatty bone marrow)
- I. Pituitary gland

-There could be congenital absence of Corpus callosum. it's formed of rostrum genu, body and splenium.

- Cerebellar tonsils is the most inferior part of the cerebellum normally above it is **this line**, above(foramen magnum), in case of increased intracranial pressure they will herniate through the foramen magnum



Case 4

Which of the following is true ?

1. This is CTA study (bone is black & it needs contrast)
2. **This is MRA study**
3. This can only be done with contrast (MRA can be done without contrast just depend on the flow)
4. This is good to diagnose cerebral venous thrombosis (this is not venography, you can differentiate between MRA & MRV by anatomy only).



Case 5

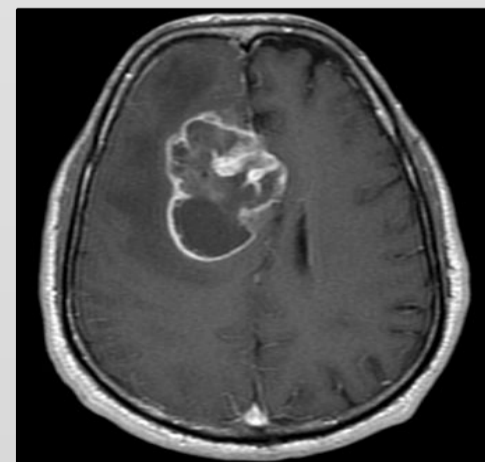
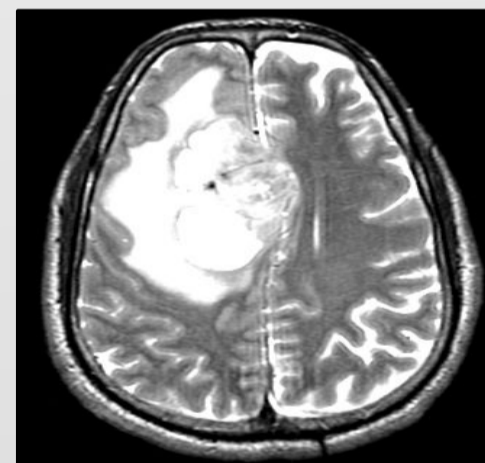
This lesion is most likely :

An MRI showed intra-axial lesion that is necrotic, irregular, strongly enhancing, and crossing midline. (intra-axial: in the brain not in the meninges, from the description we know that is malignant lesion)

1. Meningioma (NO, extra-axial, rarely necrotic)
2. Infarction (No, infarction is hypodense) (infarction is not a mass lesion it's ischemia in brain parenchyma)
3. Multiple sclerosis (NO should be multiple lesions in the periventricular and subcortical white matter - they do not cross midline - hypodense)
4. **Glioblastoma multiforme (GBM)** it cause significant edema surround it.

In the picture above what is the type of the edema ?
white matter edema which usually comes with tumors is a vasogenic edema because of leakiness of the blood vessels so fluid is not restricted in the cell but it is free in the interstitium (will not be seen in the DWI)

GBM is a malignant brain tumor, it is an intra-axial mass with significant surrounding edema that enhances strongly and sometimes peripherally, GBM can cross between the two cerebral hemisphere

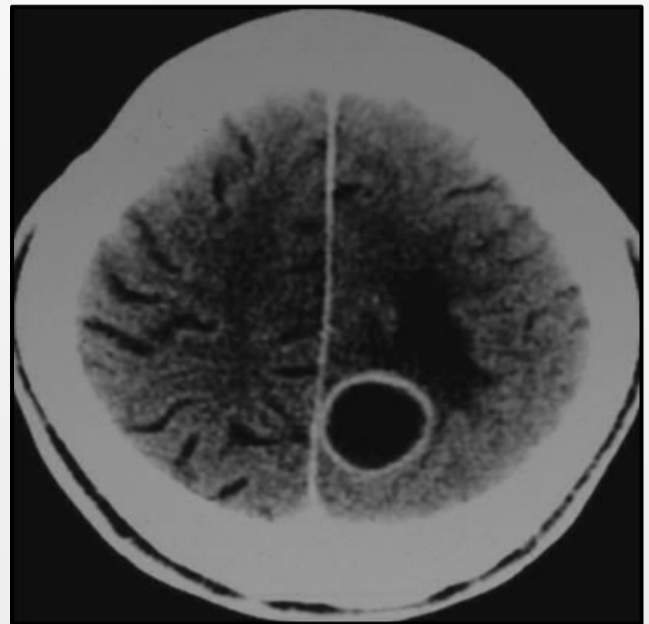


Case 6

The lesion on this CT is :

intra-axial, regular, necrotic cavity and there is edema around it (Typical abscess)

1. Meningioma (no it it is an extra-axial lesion) (show Homogenous enhancement)
2. **Abscess** (intra-axial ring enhancement) (peripheral smooth enhancement)
3. Multiple sclerosis (No, MS enhancement is incomplete ring and there is no edema around it)
4. Glioblastoma multiforme (does not fit the previous description)

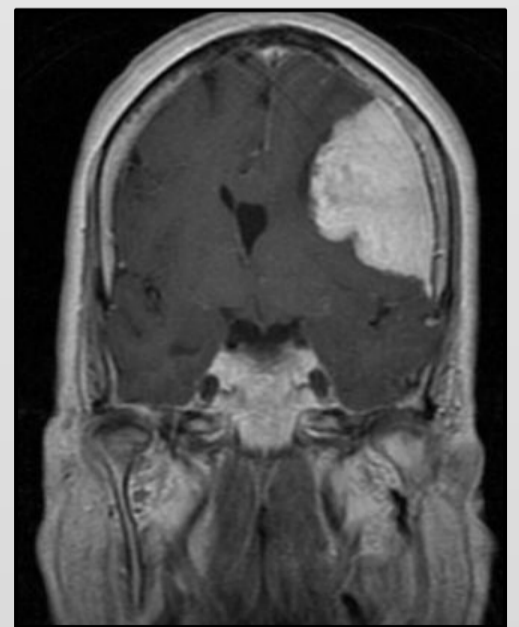
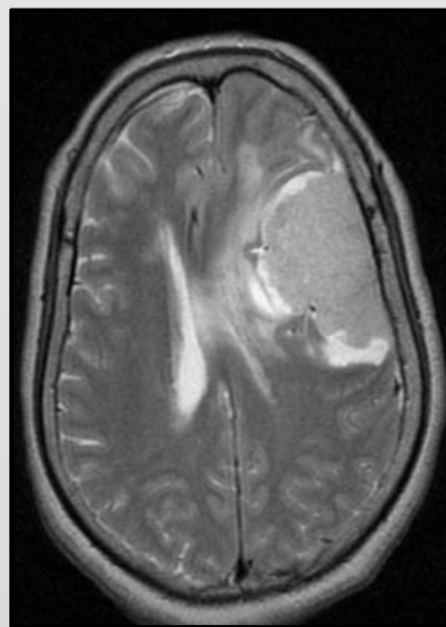


Case 7

The lesion on this MRI is?

1. **Meningioma**
2. Infarction
3. Metastasis (very rare to reach that size solitary)
4. Abscess (no necrotic cavity)

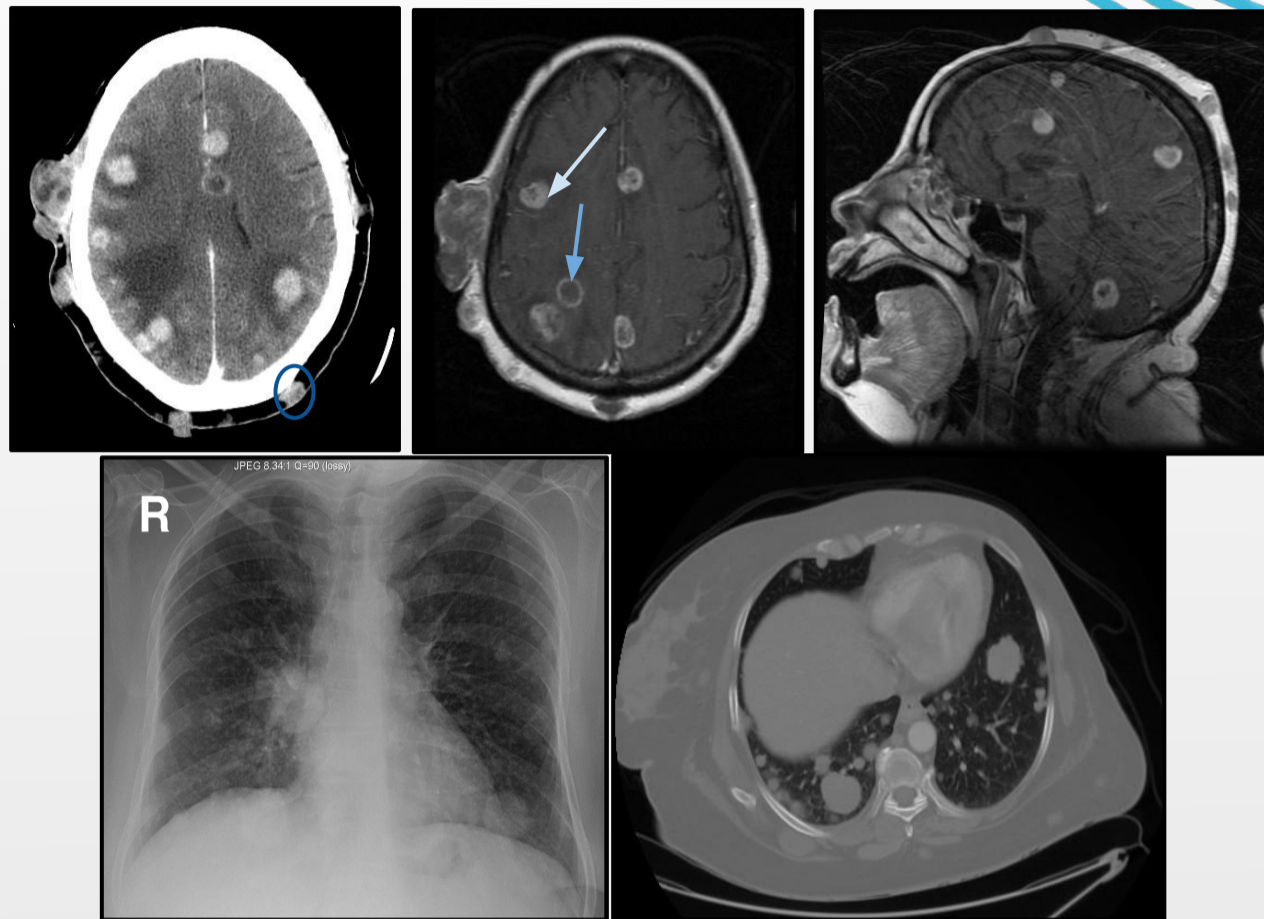
Extra axial (attached to dura), pushing the white and grey matter, non necrotic, CSF cleft sign (fluid in between it and the brain), solid enhancement(Homogenous enhancement)



Case 8

This is metastasis brain tumor that came from breast cancer.

- multiple, intra-axial, love gray-white matter junction. They could have solid enhancement or peripheral enhancement
- cutaneous metastasis
- multiple metastasis in the lung.

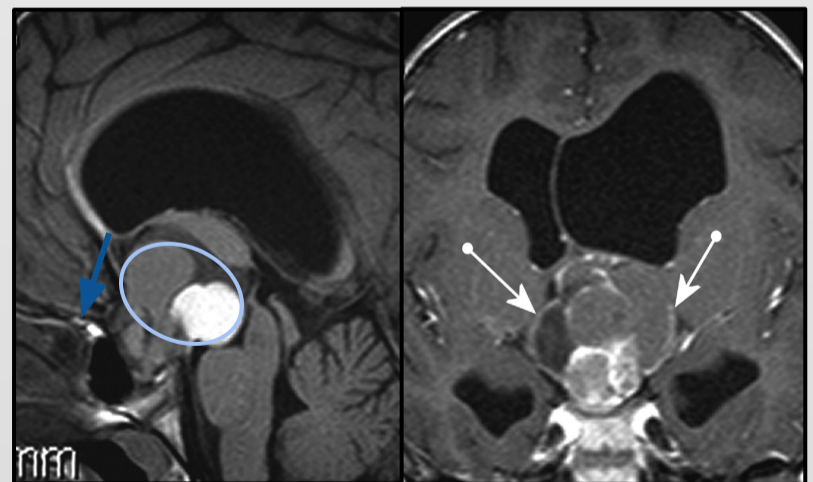


Case 9

The lesion on this MRI is :

1. Pituitary adenoma (supposed to have single cyst unless if not treated) (usually homogenous)
2. **Craniopharyngioma**
 - Multicystic present in children and elderly, hyperintense heterogeneous.
 - If we do CT, and there is a calcification then it's most likely Craniopharyngioma as calcification seen in 90%.
3. Meningioma (no it must be solid enhancement not cystic) (it could be sellar lesion but usually start from → plane of sphenoidale)
4. Glioblastoma multiforme (intra-axial so not from the differentials of suprasellar lesions)

Partially enhancing
most of this mass is cavities of different content.
Here look to the context of the question



How patients with craniopharyngioma can present?

- Headache
- Vision disturbance
- Pituitary dysfunction (ex. hypogonadism, growth retardation)

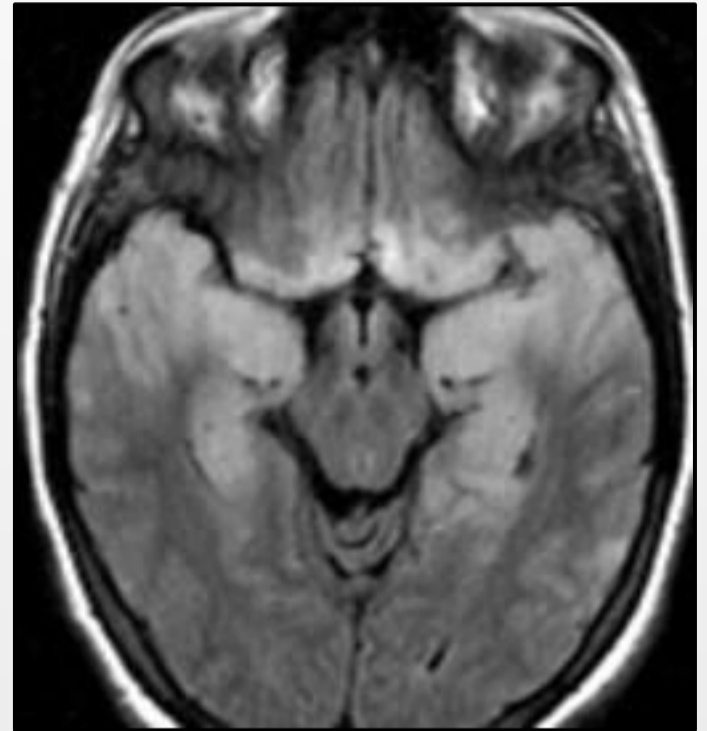
Case 10

The abnormalities on this MRI are due to :

1. Multiple sclerosis (disease of white matter and here gray matter is affected)
2. Meningitis (show as normal MRI or hydrocephalus, you should use contrast for meningitis)
3. Brain tumor
4. **Encephalitis** herpetic encephalitis the most important here is the pattern: bilateral and symmetrical increased intensity of the temporal lobe

- it's flair sequence.

Description: show bilateral almost symmetric high signal intensity located in the temporal and inferior frontal lobe.



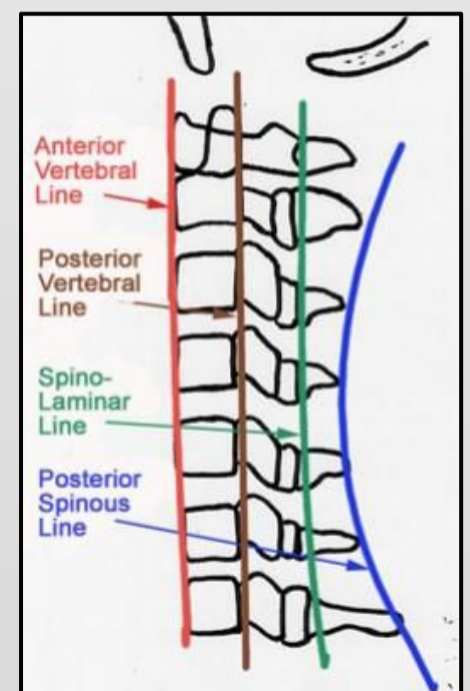
Case 11

Which of the following is true about the lines of the cervical spine ?

1. Red is intervertebral line
2. Brown is posterior spinous line
3. **Green is spinolaminar line**
4. Blue is posterior vertebral line

The lines are important in fractures and dislocation they should be smooth with no angulation

- Prevertebral soft tissues above C4 should be 7mm or less , below C4 could be up to 21mm
- The best projection to assess prevertebral soft tissue is the lateral X- Ray of the spine
- Prevertebral soft tissue can be thickened with fractures , improper positioning could give us a false impression of thickening



Case 12

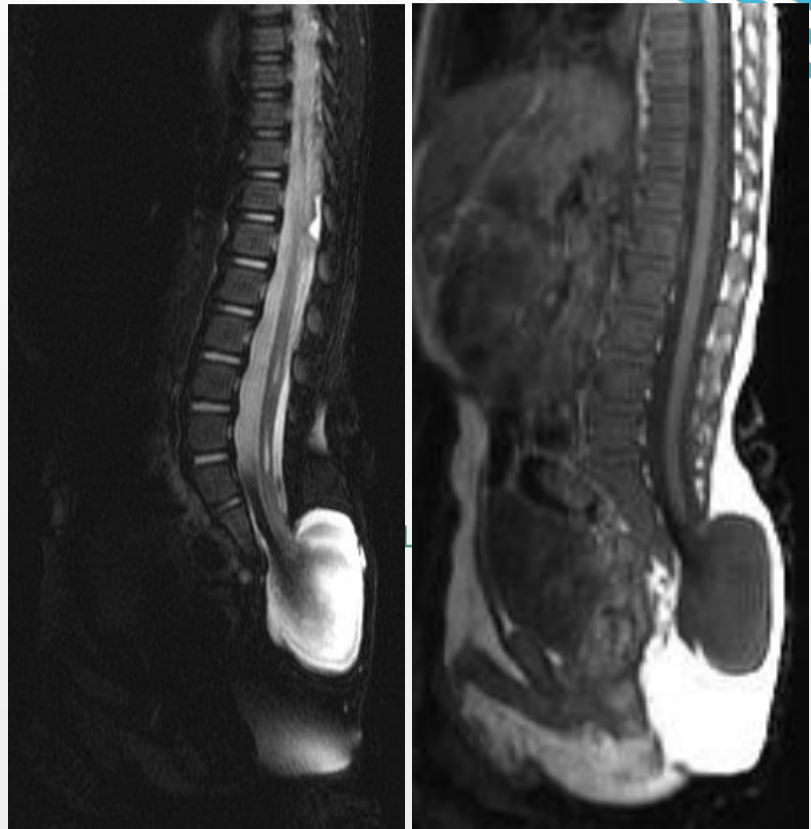
MRI of the spine shows :

herniation of a sac filled with CSF

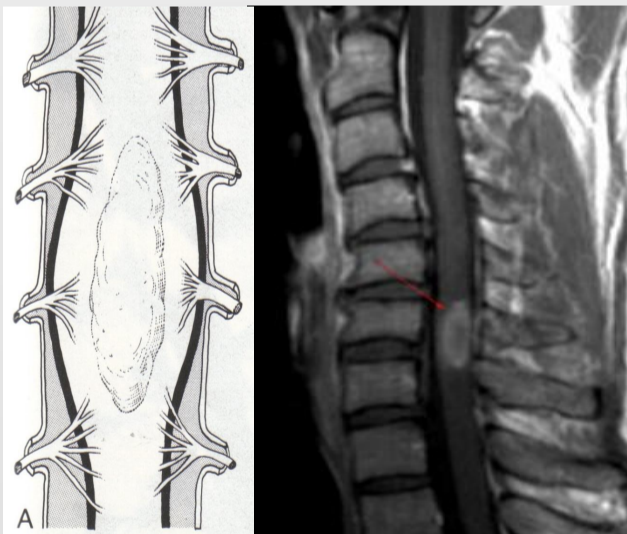
1. **Meningocele** (no neural tissue inside the sac)
2. Extradural tumor (no mass compressing the spinal cord)
3. Discitis (you'll see destruction of intervertebral disc)
4. Vertebral fusion

spinal cord ends at L2

-normally end at S1, it's Tethered spinal cord.



Intraspinal masses



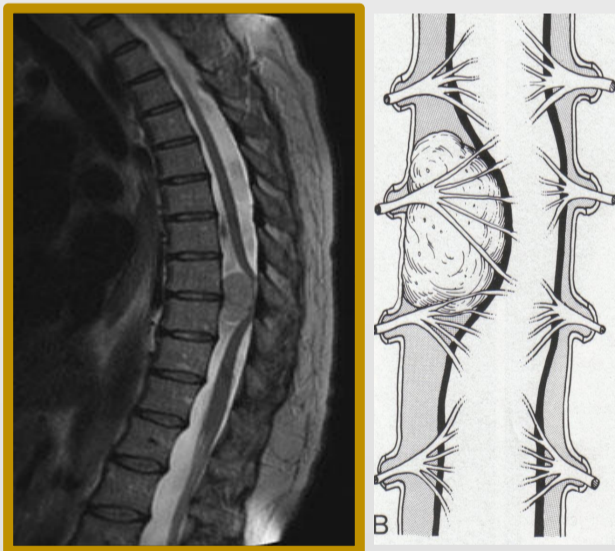
Patient A

A: Intradural intramedullary lesion (Inside the spinal cord)

DDx: spinal cord tumor, multiple sclerosis, lymphoma

most commonly:

1. Astrocytoma (peripheral irregular)
2. Ependymoma (central with hemosiderin cap)

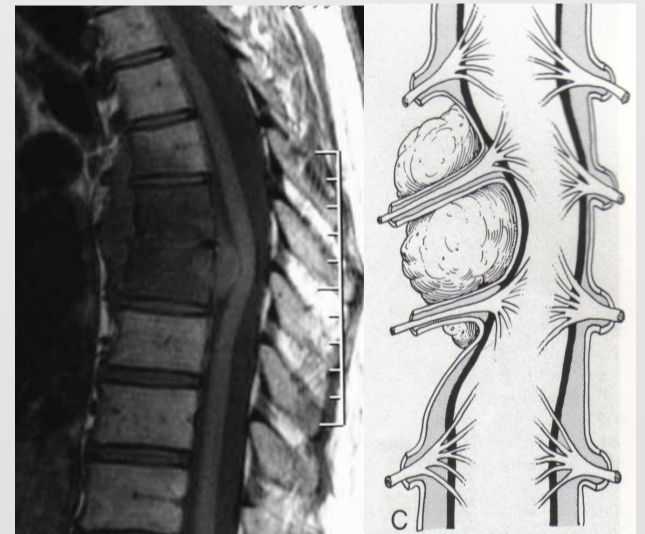


Patient B

B: Intradural extramedullary (outside the spinal cord)

DDx: **meningioma**, nerve sheath tumor (neuroma, fibroma)

-Spinal cord compression + CSF space widened



Patient C

C: extradural (Epidural)extramedullary

DDx: disk herniation, infections, abscess formation

-compress CSF and spinal cord.

Case 13

what is the difference between the two images?

The first one on the left is control normal the, 2nd is patient with cervical spondylosis vertebral disc space is narrowed, vertebral body endplate sclerotic it is spondylosis

- normal: This is how an image of cervical spinal should look like, show 7 cervical vertebrae.

- inadequate image which should be repeated.

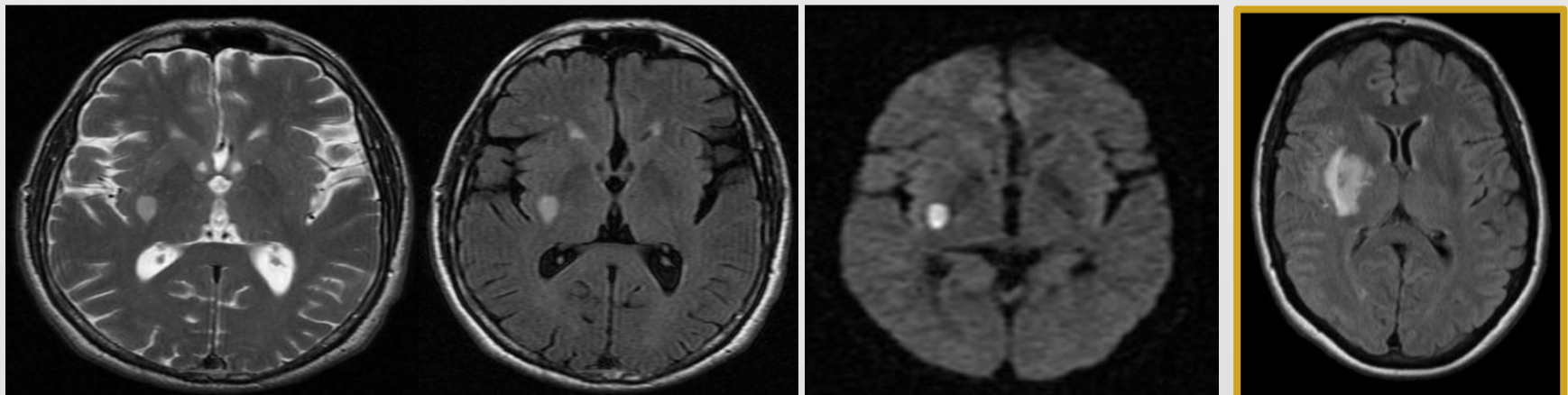


Case 14

T2WI

FLAIR

DWI



This MRI shows an infarction in the right basal ganglia.

A.The infarction is:

1. **Acute** (recent)(appeared in DWI) show as diffuse restriction.
2. Chronic (old)
3. Hemorrhagic. (you should do susceptibility weighted sequence)
4. In PCA territory. It's MCA territory

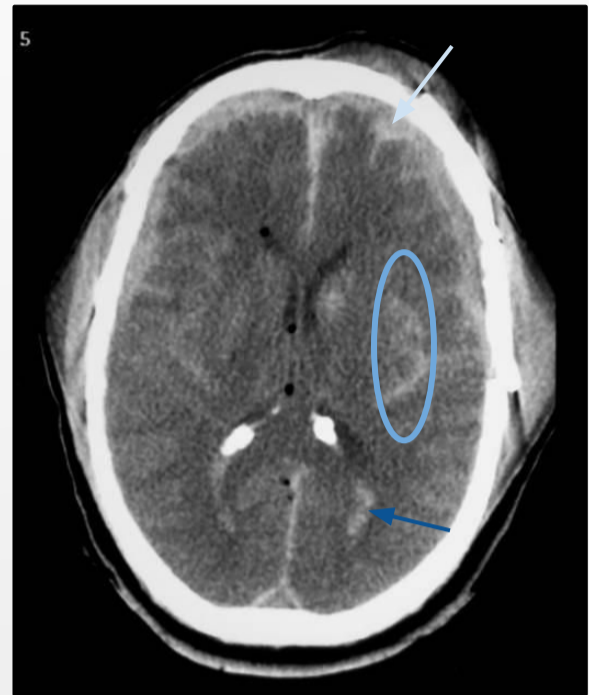
B.This patient is most likely to have :

1. Left monoplegia (caused by ACA)
2. **Left hemiplegia**
3. Diplegia (upper limbs paralysis)
4. No symptoms (Dr said it is difficult in our level to have a question with this option)

Case 15

This CT shows :

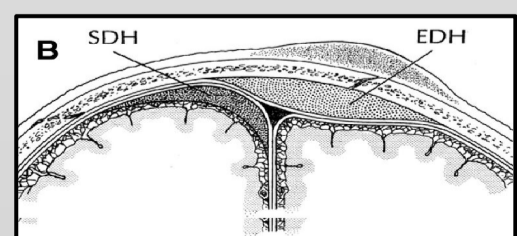
1. Subdural hematoma. crescentic in shape, and follow dura reflections
2. Subarachnoid hemorrhage. Along sulci
3. Intraventricular hemorrhage. occipital horn of lateral Ventricle, and there's hyper-density within.
4. **All of the above**



Case 16

The hematoma pointed by the arrow is :

1. **Acute epidural**
 - (Lentiform (Biconvex) collection between the dura and skull that crossed the midline)
 2. Chronic epidural
 3. Acute subdural
 4. Chronic subdural
 5. None of the above
- acute because it is bright



Case 17

This CT shows :

1. **Acute PCA infarct** (in PCA territory)
 - Hypodensity of brain parenchyma with Loss of gray / white matter differentiation
2. Chronic ACA infarct
3. Subarachnoid bleeding
4. Meningioma
5. Abscess

There is also intraventricular hemorrhage

How to differentiate between acute and chronic infarct ?

Chronic infarction have the same density as CSF



A 65-year-old man with history of DM and hypertension presented to the ER with sudden visual disturbance. **CT scan showed low density** in the medial aspect of the right occipital and temporal lobes as well as in the posterior aspect of the thalamus on the same side. Which of the following is the likely diagnosis?

- A. Right posterior cerebral artery infarction
- B. Left anterior cerebral artery infarction
- C. Generalized brain edema
- D. Brain metastasis

Answer: A

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