CHEST IMAGING

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CHEST IMAGING

- Chest imaging remains major component of diagnostic radiology.
- The chest x-ray is the most commonly performed diagnostic x-ray examination.
- A chest x-ray makes images of the heart, lungs, airways, blood vessels and the bones of the spine and chest.

Chest X-ray makes images of organs of different body systems including heart, lungs, airway and bronchi, bones of the spine & Ribs

Anatomy of the lungs

The Right lung is larger than the left, because most of the heart encroaches on the left lung.

- **The right lung has three lobes:**
  - upper lobe
  - Middle lobe
  - Lower lobe

- **The left lung has two lobes:**
  - upper lobe
  - lower lobe

Anatomy of the lungs / 2

Adjacent lobes are separated by an interlobar fissure.

In the Right Lung, there are:
1- Minor (Transverse) Fissure
2- Major (Oblique) Fissure
3- Azygus Fissure: around the Azygus vein at the Apex of the right Lung
4- Superior Accessory Fissure: in the right lower lobe, separating the Superior (Apical) segment from the four basal Segments

In the right lung:

- The minor (transverse) fissure separates the upper lobe from the middle lobe.
- The major (oblique) fissure separates the upper and middle lobes from the lower lobe.

All Fissures consist of two layers (parietal & Visceral) Except the Azygus Fissure which consists of four layers (2 parietal & 2 visceral)

In the left lung:

- **The major or oblique fissure separates the upper lobe from the lower lobe.**

Segmental anatomy

Segments of the right lung

Upper lobe segments:

- Apical segment
- Anterior segment
- Posterior segment

Middle lobe segments

- Lateral segment
- Medial segment

Segmental anatomy / 2

Right lower lobe segments:

- Superior segment
- Medial basal
- Anterior basal
- Lateral basal
- Posterior basal

Segmental anatomy / 3

Left lung segments:

Upper lobe

- Apical posterior segment
- Anterior segment
- Superior lingular segment
- Inferior lingular segment

The lingular segment in the left lung is similar in position to the right middle lobe.

Segmental anatomy / 4

Left lower lobe segments:

- Superior segment
- Medial basal
- Anterior basal
- Lateral basal
- Posterior basal

Routine plain chest radiography:

- Postero-anterior view (PA)
- Lateral view.

Sometimes Lateral view is required and it can be:
1- Left Lateral: the left side of the Pt close to the cassette
2- Right Lateral the right side of the Pt close to the cassette

- The term PA refers to the direction of the x-ray beam which traverses the patient from posterior to anterior.

lung apex will be above the clavicle.

PA chest radiography is preferred to AP, why ?

Most of the time, CXR is taken PA in which the Pt is standing with the Xray cassette (film) in front of him, and the Pt is holding the cassette so that :
1- the heart is close to the cassette >>>The heart is normal in size
2- Clavicles go down below Apex
3- Scapulae pushed away from the lung fields

- Less magnification of the heart.
- More lung fields are visualized.
- The PA projects the scapula away from the lung fields.
- The apices of the lungs are closer to the film in the PA and appear more clear.

Other plain chest radiography:

- **Antero-posterior view (AP)**
  - ★ very ill patients who are unable to stand.
  - ★ infants and small children.
- **Inspiration-expiration films**
  - ★ suspected bronchial foreign body aspiration.
  - ★ suspected small pneumothorax.

Routinely, CXR should be done while the Pt is in deep inspiration. But sometimes expiratory films are required as in cases of suspected bronchial foreign body aspiration and suspected small pneumothorax.

Good for follow-up
NOT Diagnostic!!

يا
ح تشوفي إنه
الحكان
More lucent
سواد
insp. exp.

Before reading the x-ray film, the following should be checked:

1. **Request form**
   - name, age, sex and date
   - clinical information.
2. **Technical factors:**
   - markers. right/left
   - centering (patient position).
   - degree of inspiration.
   - exposure (penetration).

Any CXR image without name, date, or markers should not be reported
In any CXR, you should check centering, degree of inspiration and exposure. If one of them is disrupted for example if the Pt is rotated (not centralized properly) you may ask to repeat the image with the Pt centralized, however you can interpret and report the image without repeating it to avoid exposing the Pt to radiation.

1- Centering: to ensure that the Pt is centralized, look at the spinous processes & trachea, they should be central in the midline and equidistant to both medial ends of clavicles

bones need lower exposure

3- Exposure:
look at the retrocardiac disc spaces, they should be JUST VISIBLE
* if the retrocardiac disc spaces are very clear + Lungs are dark black = Overexposure
* if the retrocardiac disc spaces are not visible + Lungs are bright white = Underexposure

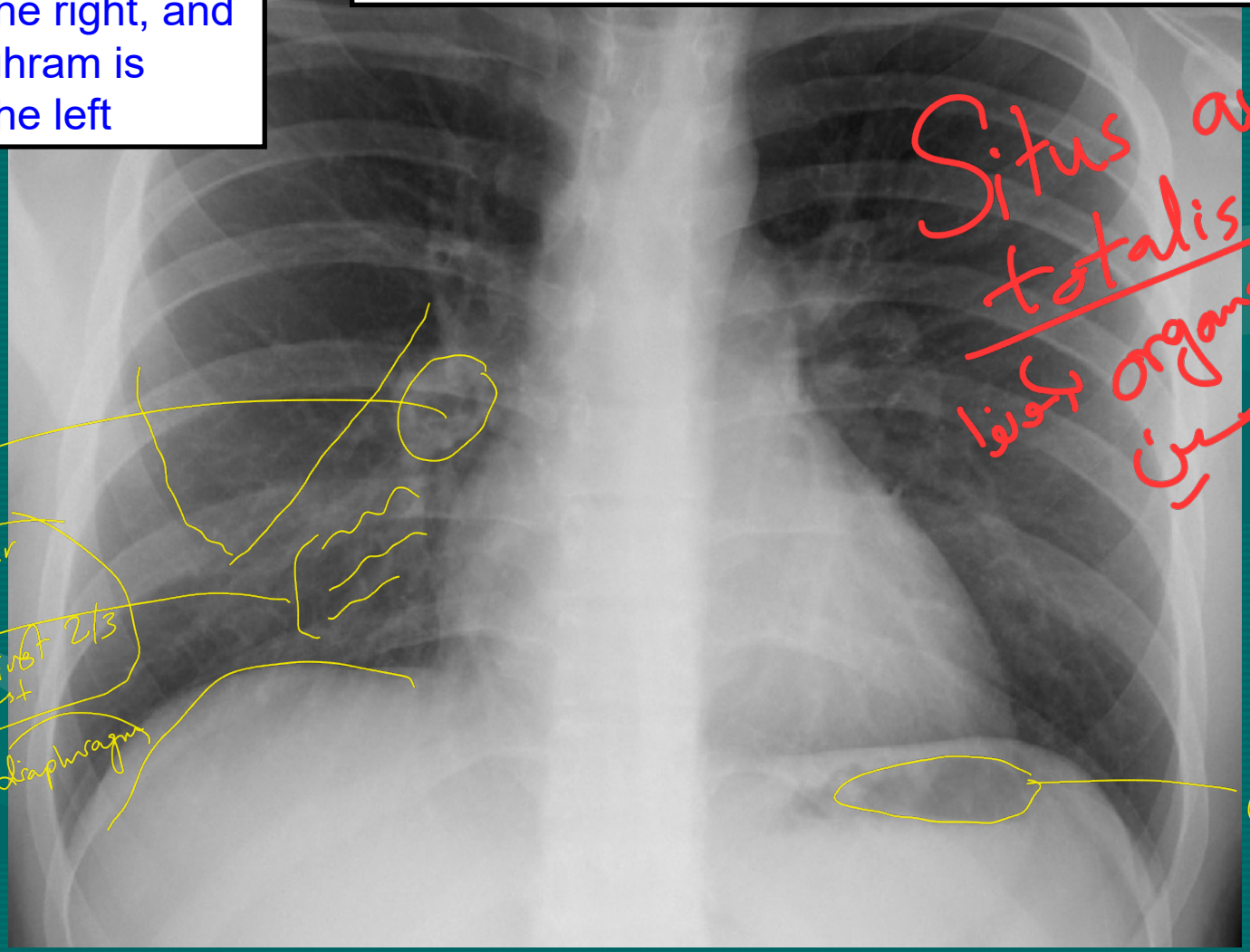
at any X-RAY, we look for
heart size
costophrenic angle
bones (fracture..)
normally: the left helium is higher than the right, and the right diaghram is higher than the left

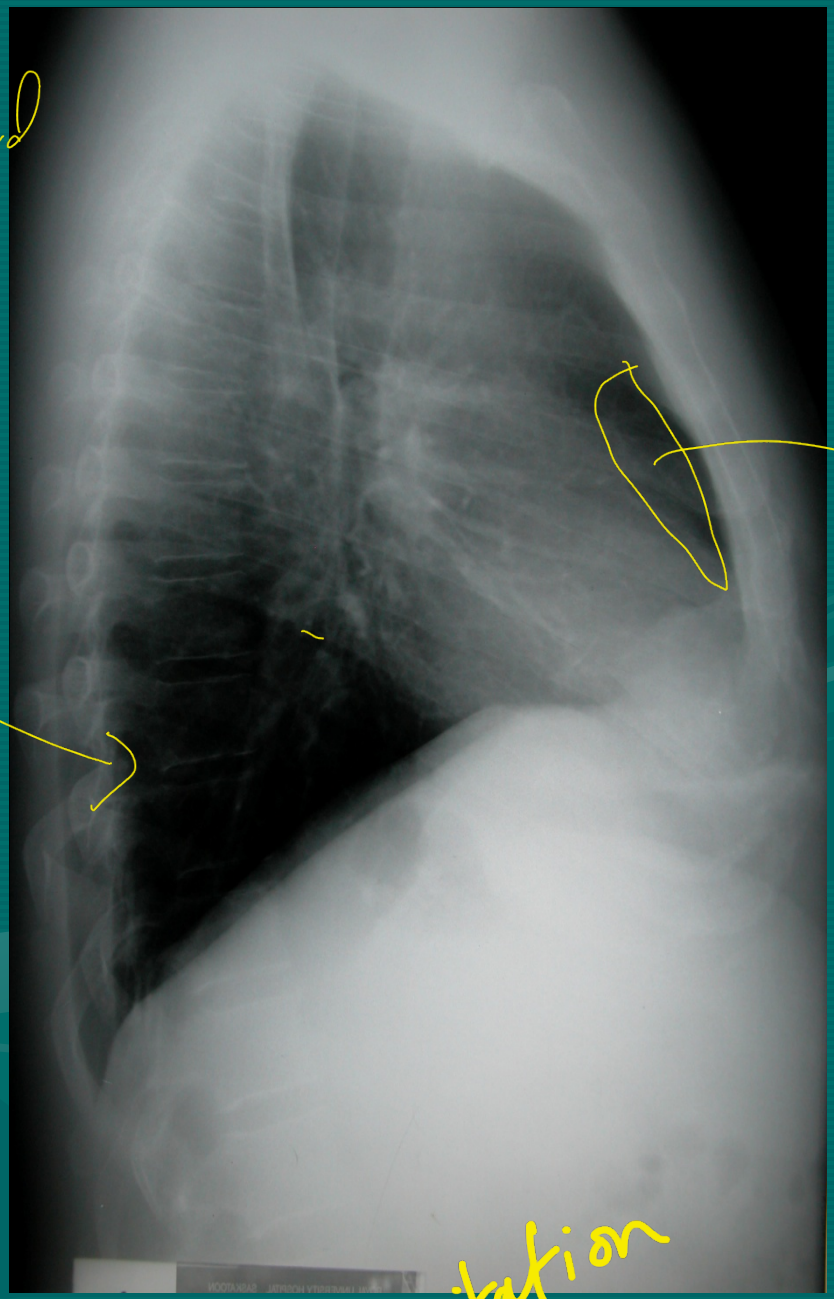
2- Degree of Inspiration:

* There should be 6 ribs anteriorly with the 6th one crossing the Diaphragm
* the heart is normal in size in inspiratory films & enlarged in expiratory films

How can we judge whether the heart in normal in size or enlarged?

By calculating the Cardiothoracic Ratio; Normally, the widest diameter of the heart should be 50% or less the widest diameter of the chest in adults and 60% or less the widest diameter of the chest in children





as we go downward
↑ lucency

Retrosternal space should be clear.

sub mediastinal pathology

cavitation

PNEUMONIA

- Is an inflammation of the lung, which can be caused by a variety of micro-organisms, including bacterias, viruses, and fungi.
- Lobar pneumonia: inflammation confined to a lobe of the lung.
- Bronchopneumonia: refers to bilateral multifocal areas of consolidation.

1- Lobar Pneumonia: may affect one or more segment , one or more lobe or the entire lung
2- Bronchopneumonia: usually in the hilar region, unilateral or bilateral

Pneumonia can be classified into:

- **Primary pneumonia :** arising in a normal lung.
- **Secondary pneumonia**

result of a disease or abnormality already present in the lung.

Pneumonia can be primary or secondary,
example: Lymphoma >>> LN enlargement >>> compression >>> secondary pneumonia

Pneumonia / 2

- With treatment most types of bacterial pneumonia can be resolved within 2 weeks.
- Viral pneumonia may last longer.
- Mycoplasmal pneumonia may take 4 weeks to resolve completely.

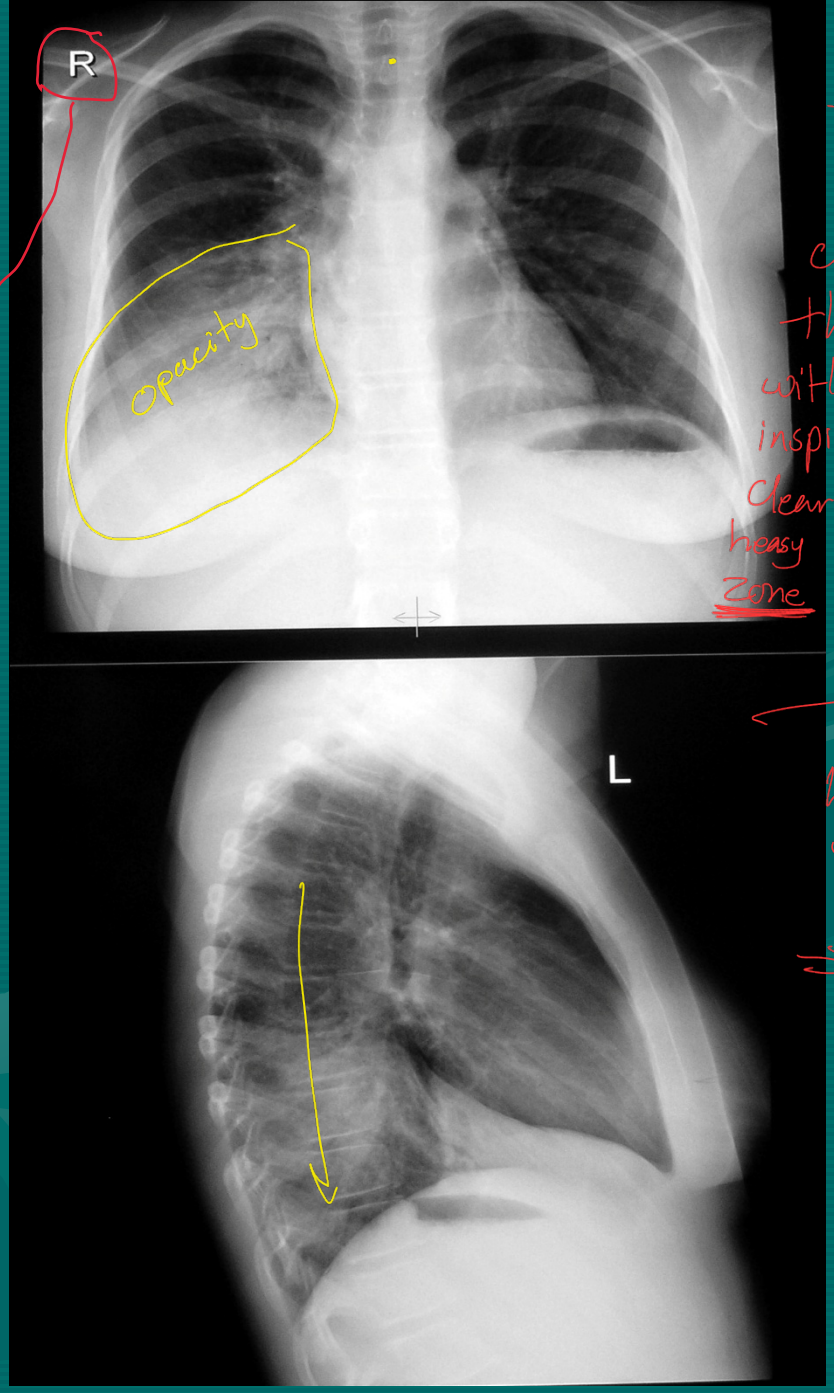
- What examinations should be considered in patients with pneumonia that does not resolve as promptly as it should ?

Bronchoalveolar ca. => الكريفيما طلبت

- ✓ **CT scan**
- ✓ **Bronchoscopy**

On writing CXR report for a Pt with pneumonia, request a follow up CXR two weeks after starting treatment, mostly but not always, bacterial pneumonia resolves within 2 weeks و Viral pneumonia takes up to month , Atypical pneumonia (example Mycoplasmal pneumonia) takes 4-6 weeks
if your pt doesn't improve with the follow up then you should consider CT to avoid other pathologies

CXR PA and Lateral view showing infiltration (consolidation) of the right lower lobe typical for lobar pneumonia



if you saw this R on the other side, this might indicate that the heart is on the other side - dextrocardia

Situs inversus - when all organs are opposite

this take a risk for volvulus

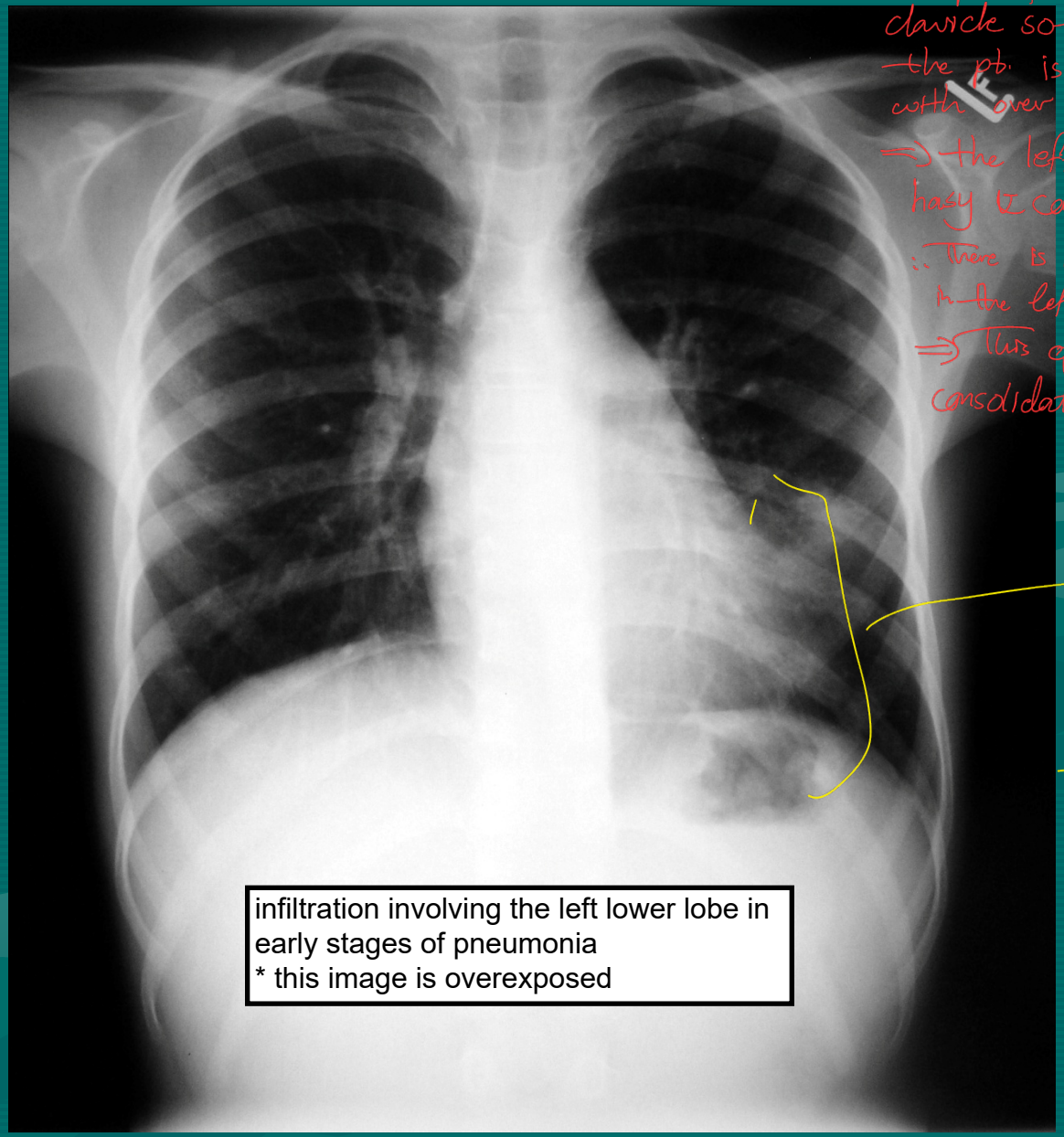
هذا بدل ذحيحي بالصدر

→ this is plain chest X-ray the apex is above the clavicle so this is PA view. the pt. is well centralized with good exposure & fully inspiration. The left lung field is clear but the right lung field has heasy opacity located in the Rt. lower zone.

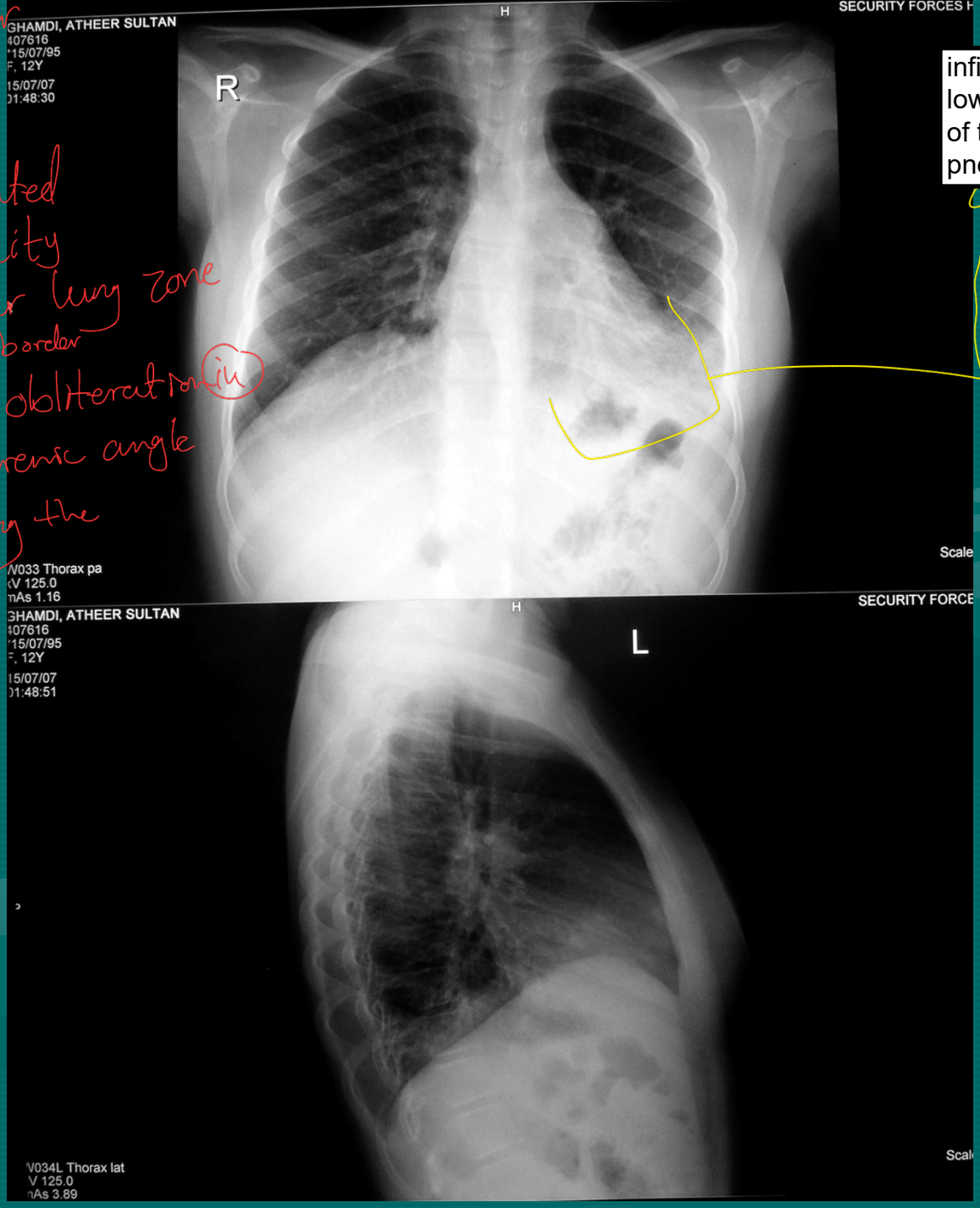
→ This is lateral view. as we go downward we have opacity, triangular in its shape. located in the Rt. lower lobe posteriorly

⇒ Mostly this is consolidation (pneumonia)

* This is plain chest xray.



infiltration involving the left lower lobe in early stages of pneumonia
* this image is overexposed

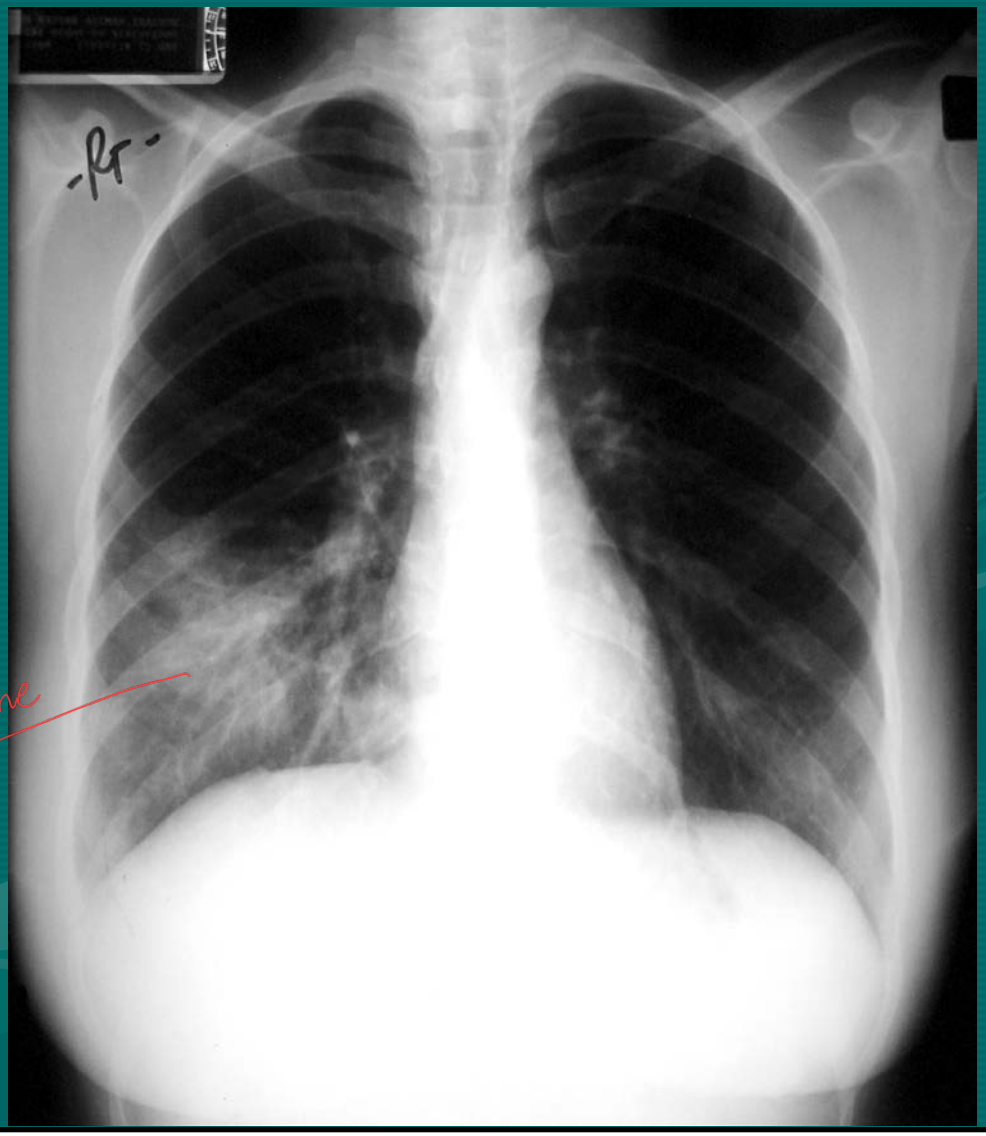


infiltration involving the left lower lobe plus obliteration of the costophrenic angle = pneumonia & effusion

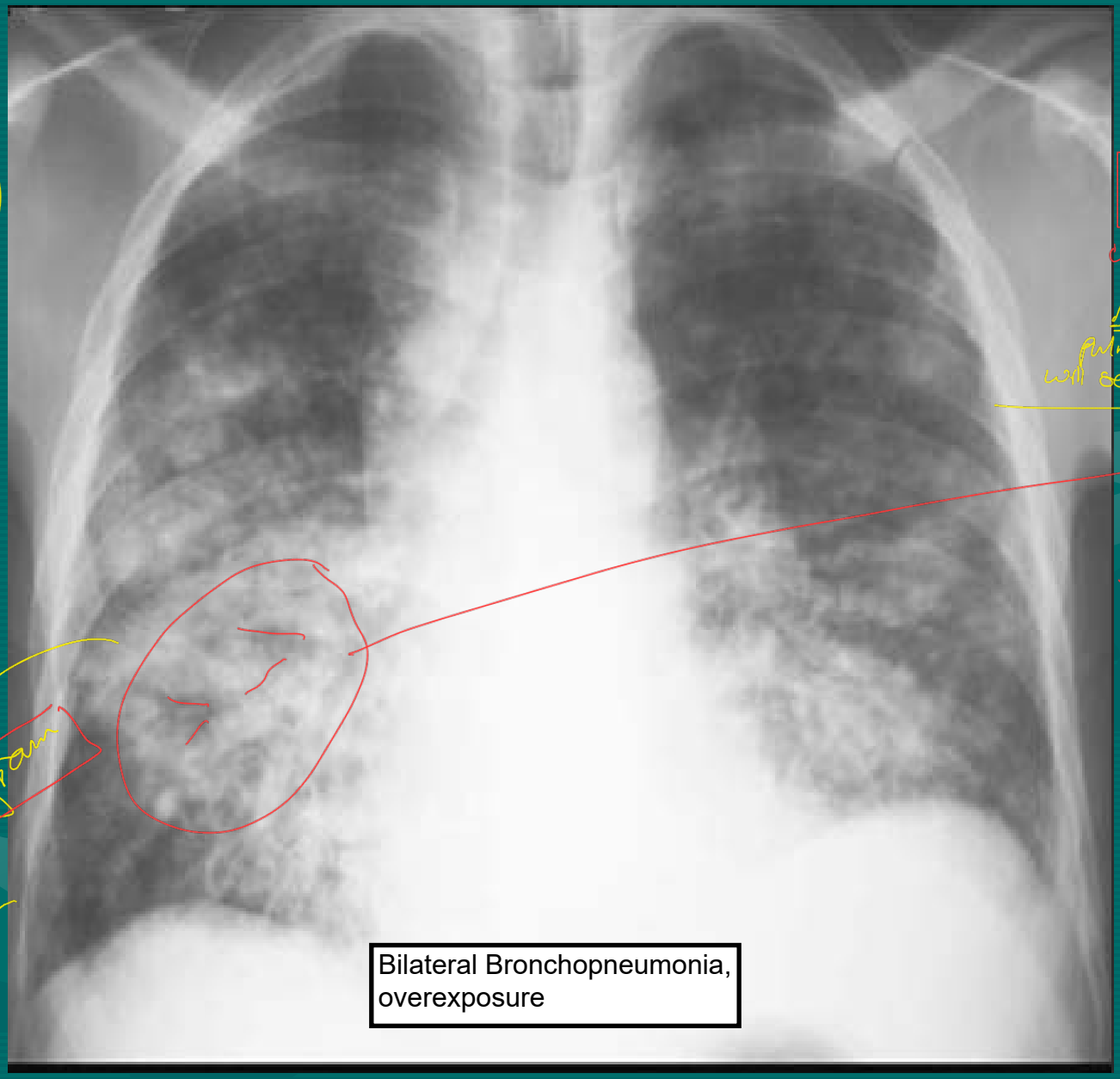
heart not sharply demarkated & costphrenic angle is obliterated & ll b/l diaphragm also not clear ∴ effusion

The left border of the heart is not clear & can't be sharply demarkated ⇒ there is opacity in the left lower lung zone obscuring Lt. heart border ⇒ also there is obliteration in the Lt. costophrenic angle & silhouetting the diaphragmatic outline ∴ Pneumonia & effusion

Whenever there is an abnormal area of shadowing (increased density/whiteness) in the lungs, the diagnosis of infection or cancer should be considered likely causes



CXR alone is not sufficient for definitive Dx for example this image can be cancer so you should correlate your initial Dx with the Pt clinical data and CXR. and follow up the Pt if no improvement you do CT looking for cancer



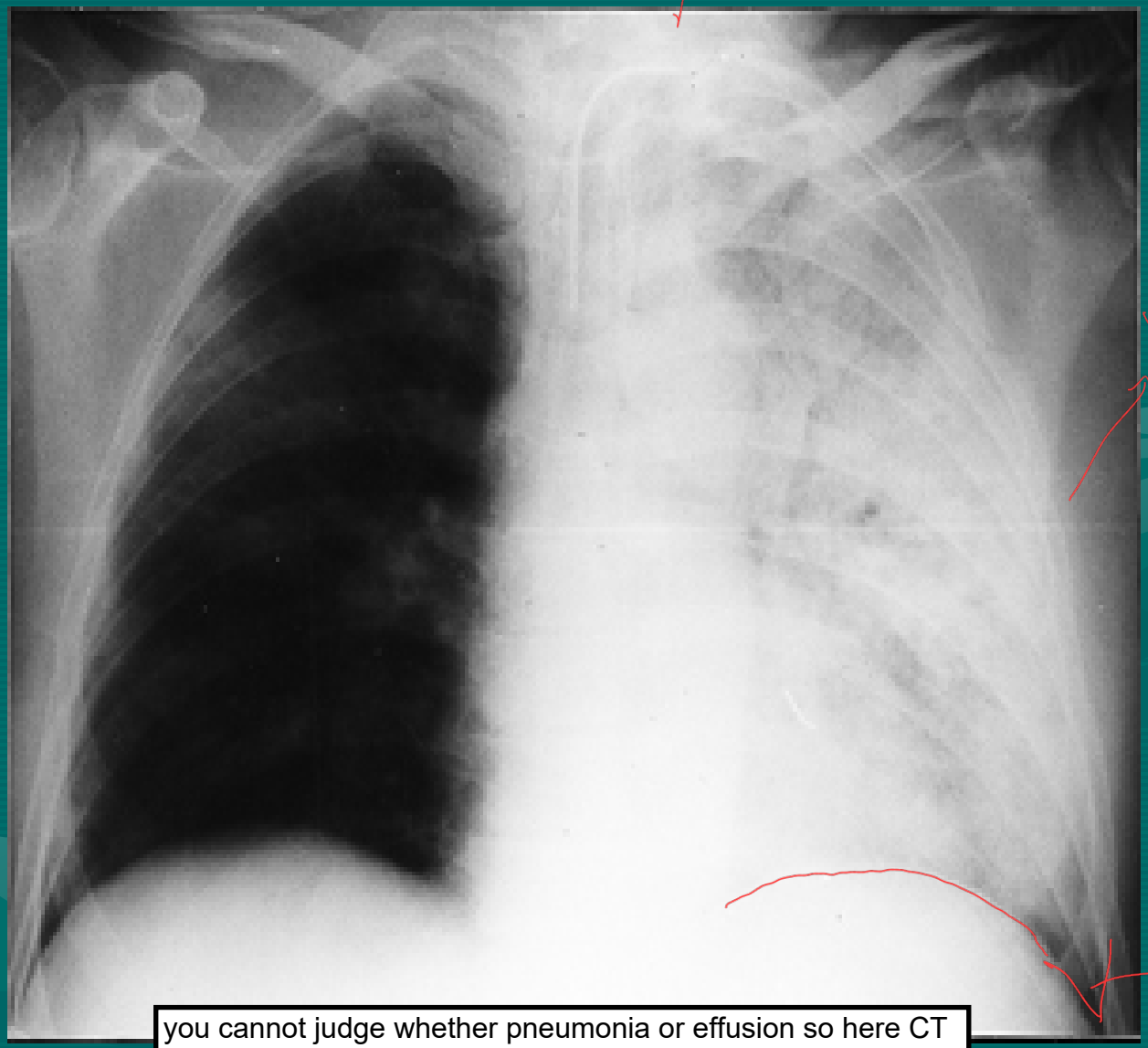
Bilateral Bronchopneumonia, overexposure

Patchy infiltration

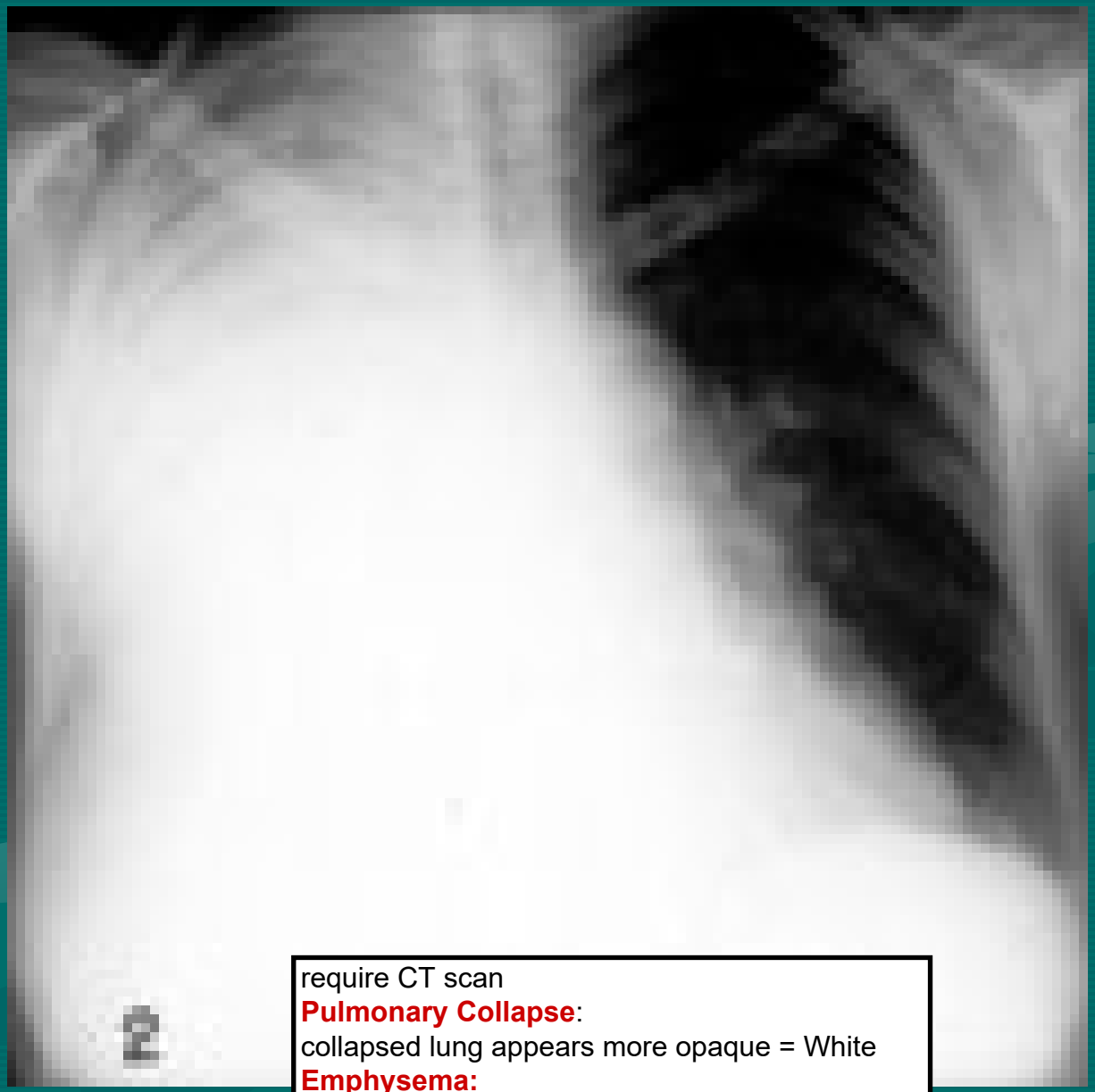
Air bronchogram

* Opacity
  - Patchy & bilateral
  - Bronchopneumonia
  - Pulmonary edema
    Note in cardiogenic pulmonary edema you will see cardiomegaly

Here, there is lucent lines [these are bronchi that outlined by air]
↳ these are called air bronchogram
we can see it in pneumonia.



you cannot judge whether pneumonia or effusion so here CT scan is a must since the
management of Pleural effusion (Chest Tube) is totally different from the management of pneumonia
P.S: the Pt has tube



require CT scan
Pulmonary Collapse:
collapsed lung appears more opaque = White
Emphysema:
the opposite of collapse; the lung is more translucent = Black

Pulmonary collapse

- Pulmonary collapse or atelectasis refers to a decrease in volume of a lung, lobe or segment.
- Obstruction to flow of air is the most common cause of collapse.
- Air in the alveoli is absorbed and because no further air enters the alveoli distal to the obstruction, the lung tissue collapses and becomes more opaque

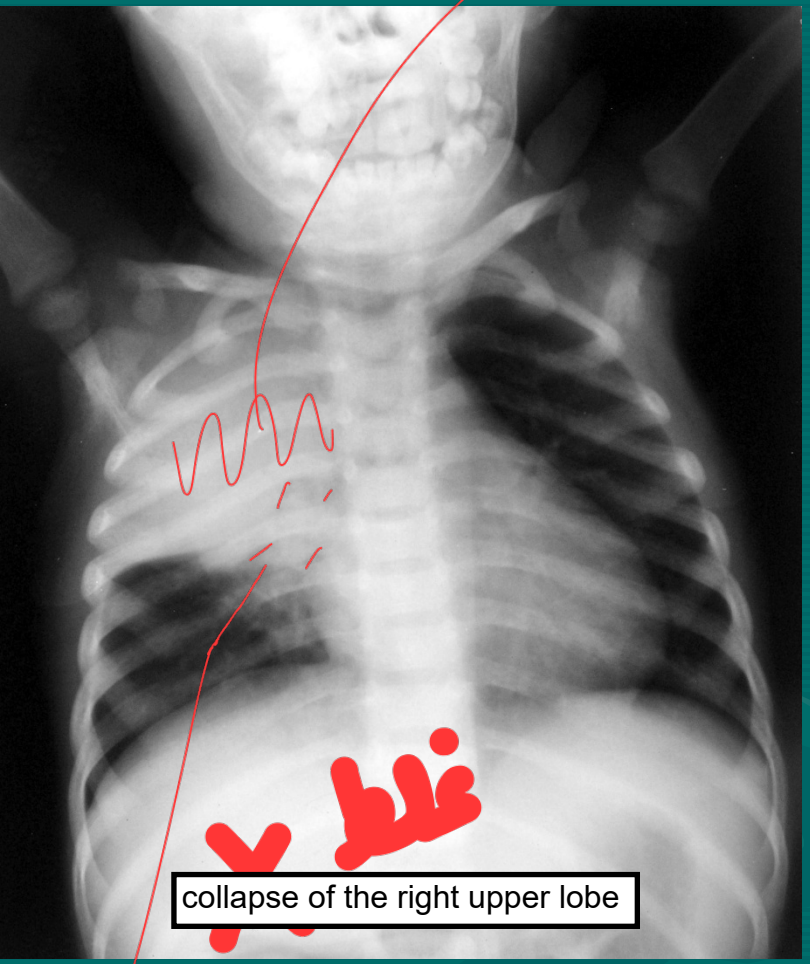
Pulmonary collapse / 2

- Common causes of bronchial obstruction causing collapse:

- Bronchial carcinoma
- Mucus plug (pneumonia, postoperative).
- Foreign body.
- Inflammatory bronchial disease (bronchial tuberculosis).
- Extrinsic compression of airway by tumor or enlarged lymph nodes.

Pneumonia

Haziness



collapse of the right upper lobe

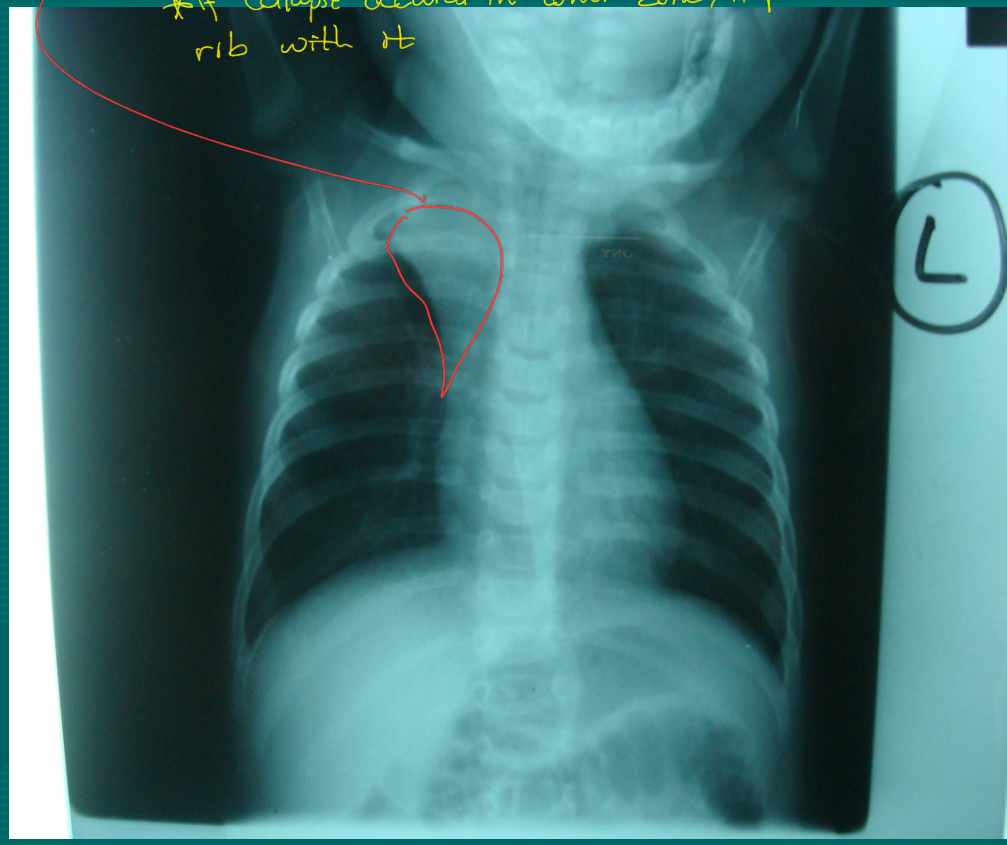
air bronchogram

Collapse

Sharply demarkated opacity ⇒ :- Atelactesis

↓ Volume → Rib crowdings

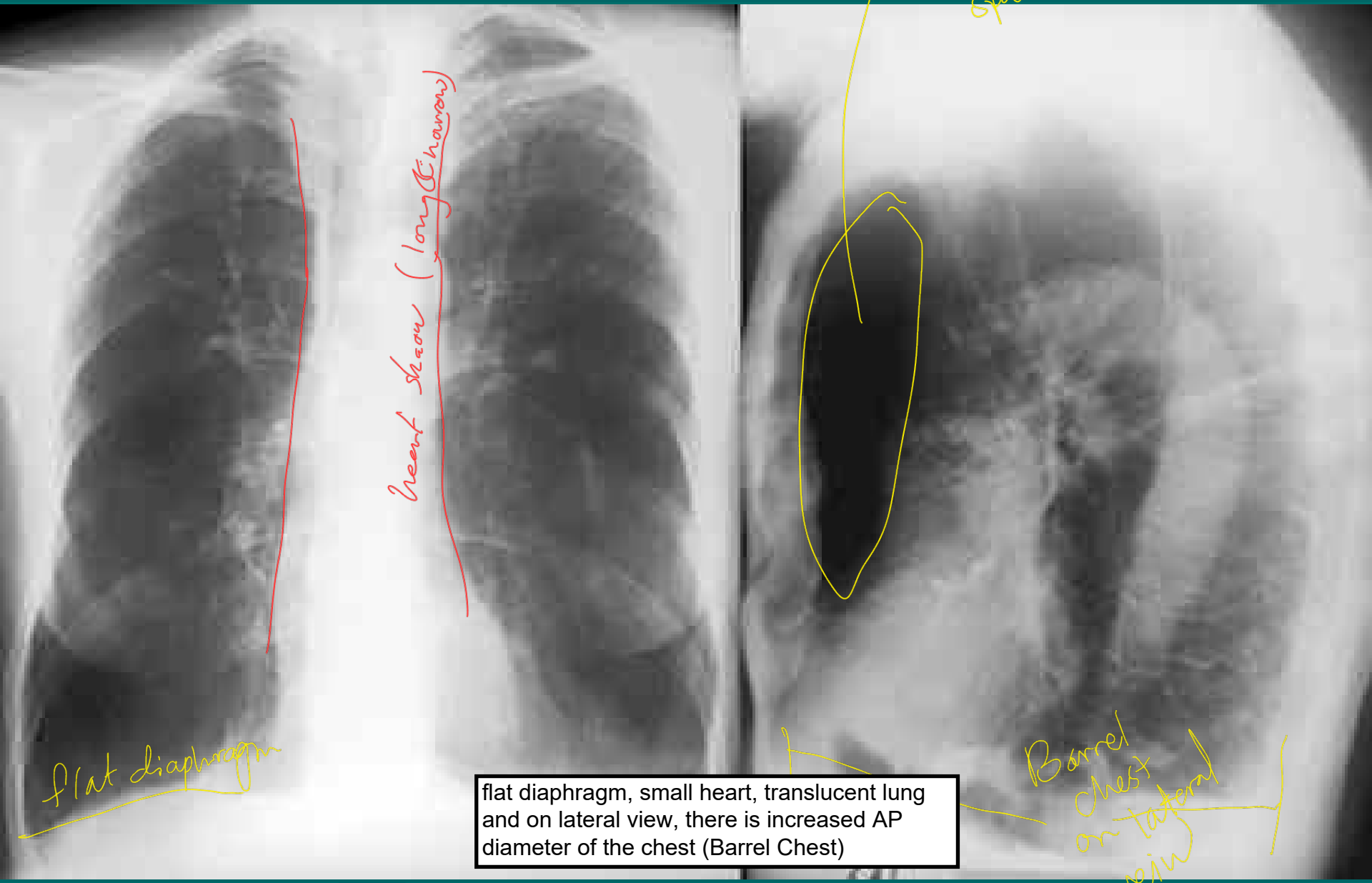
*if collapse occured in lower zone, it pulls down the rib with it



No air bronchogram

Emphysema

- Is an increase in the size of the air spaces distal to the terminal bronchioles, with dilatation or destruction of their walls.
- The lung appear more translucent with reduction in size and number of the small vascular markings.
- The diaphragms are low and flat.
- The heart shadow is long and narrow.
- The postero-anterior diameter of the chest is increased in the lateral view resulting in **barrel chest.**



flat diaphragm, small heart, translucent lung and on lateral view, there is increased AP diameter of the chest (Barrel Chest)

Pleural effusion

Is fluid collection in the space between the parietal and visceral layers of the pleura, usually contains serous fluid, but may have differing contents.

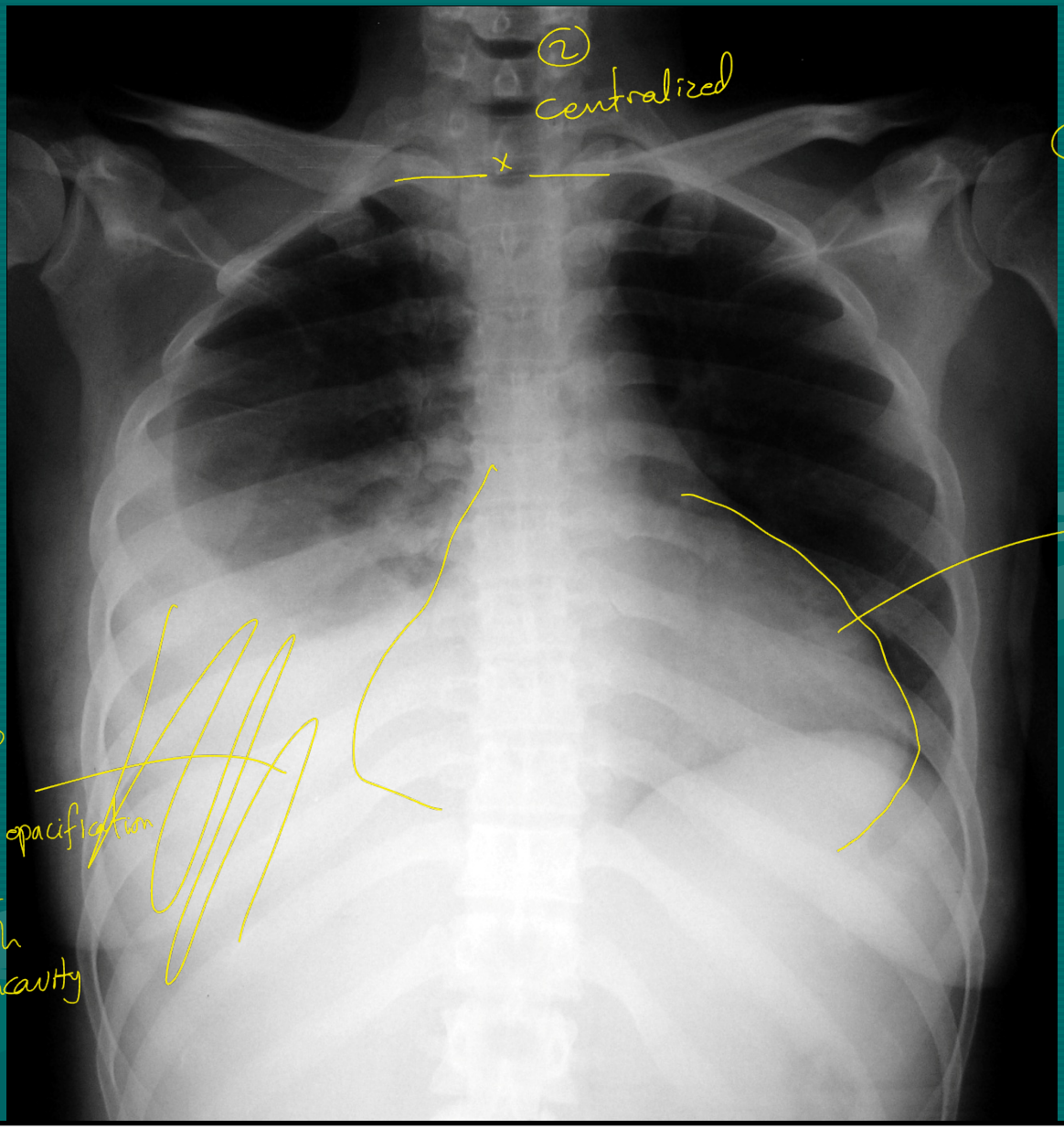
- **Haemothorax**: blood, usually following trauma. also w/ pneumonia pts.
- **Empyema**: purulent fluid (pus). → with HF pts. or cardiomegaly
- **Hydropneumothorax**: fluid and air. - (you will see air fluid level post-surgery)

Pleural Effusion
is most common in the lower lobes but it can be:
1- Localized: between interlobar fissures
2- Localized Lateral: in the upper lobes
* According to the amount of fluid, effusion may involve the whole lung or - if < 200 cc – not detected

Pleural effusion / 2

Radiological features of pleural effusion on a chest x- ray:

- Homogeneous opacification.
- Loss of the diaphragm outline.
- No visible pulmonary or bronchial markings.
- Concave upper border which appear higher laterally.
- blunting or obliteration of the costophrenic angle.



(1) * AP view
apex is at the upper clavicle.

(2) centralized

(3) good exposure.

(4) 7 ribs. (5) Not full inspiration

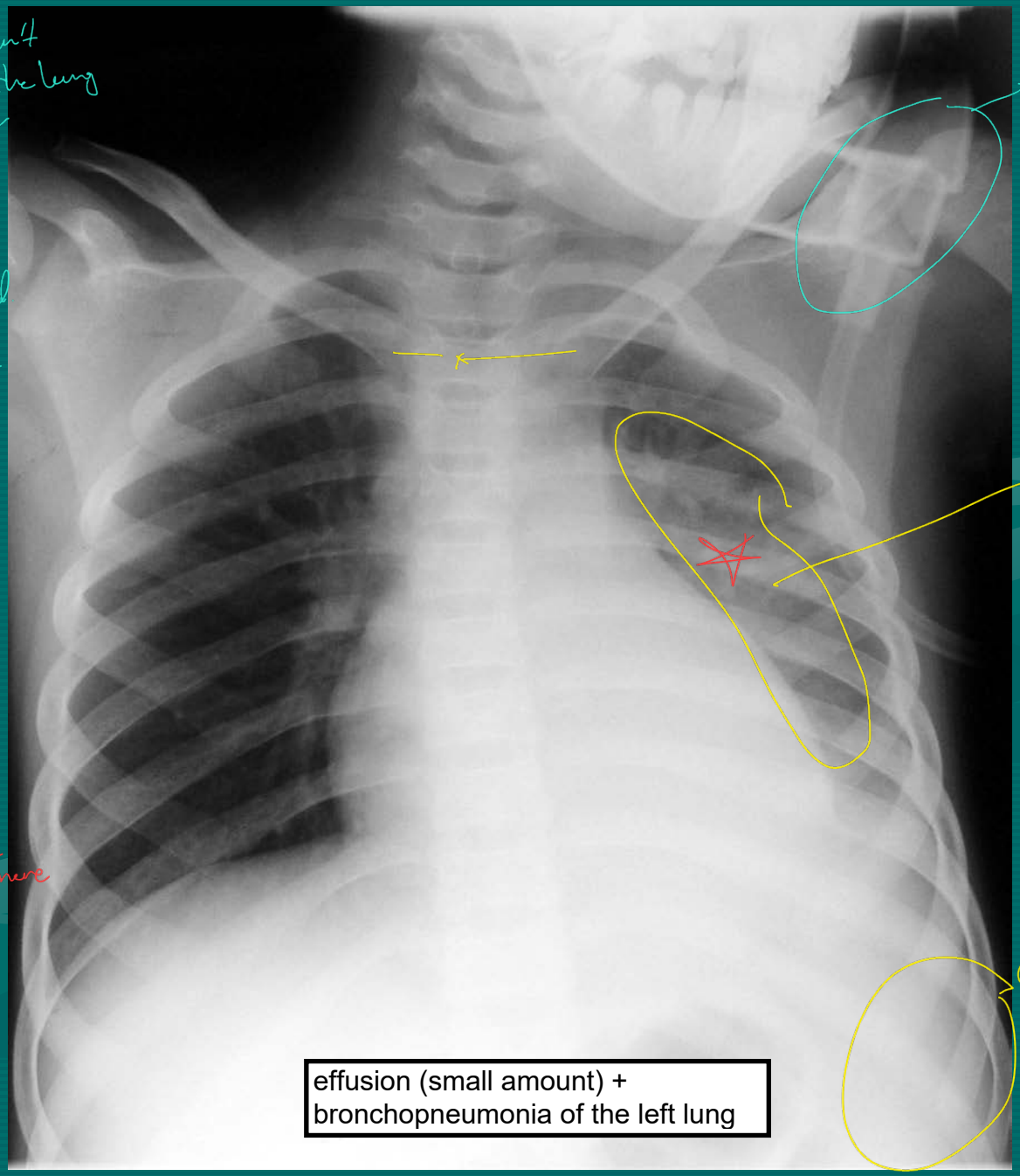
(6) There is homogenous opacification in the Rt lung field, causes obliteration in the Rt. CPA. silueting the Rt. hemidiaphragmatic outline.
& I can't see broncho-vascular markings through this homogenous opacification

(6) the cardiothoracic ratio is increased which indicates cardiomegaly

(7) This large amount of opacification has high upper border with concavity (meniscus sign)

(8) DDx
cardiomegaly with large amount of [illegible] pleural

Loss of the diaphragm outline, loss of vascular markings, Homogeneous opacification, obliteration of the costophrenic angle
How to differentiate between effusion and collapse?
Put the Pt in Lateral decubitus position so if effusion, fluid will go up and if collapse it wont change



effusion (small amount) + bronchopneumonia of the left lung

Pneumothorax

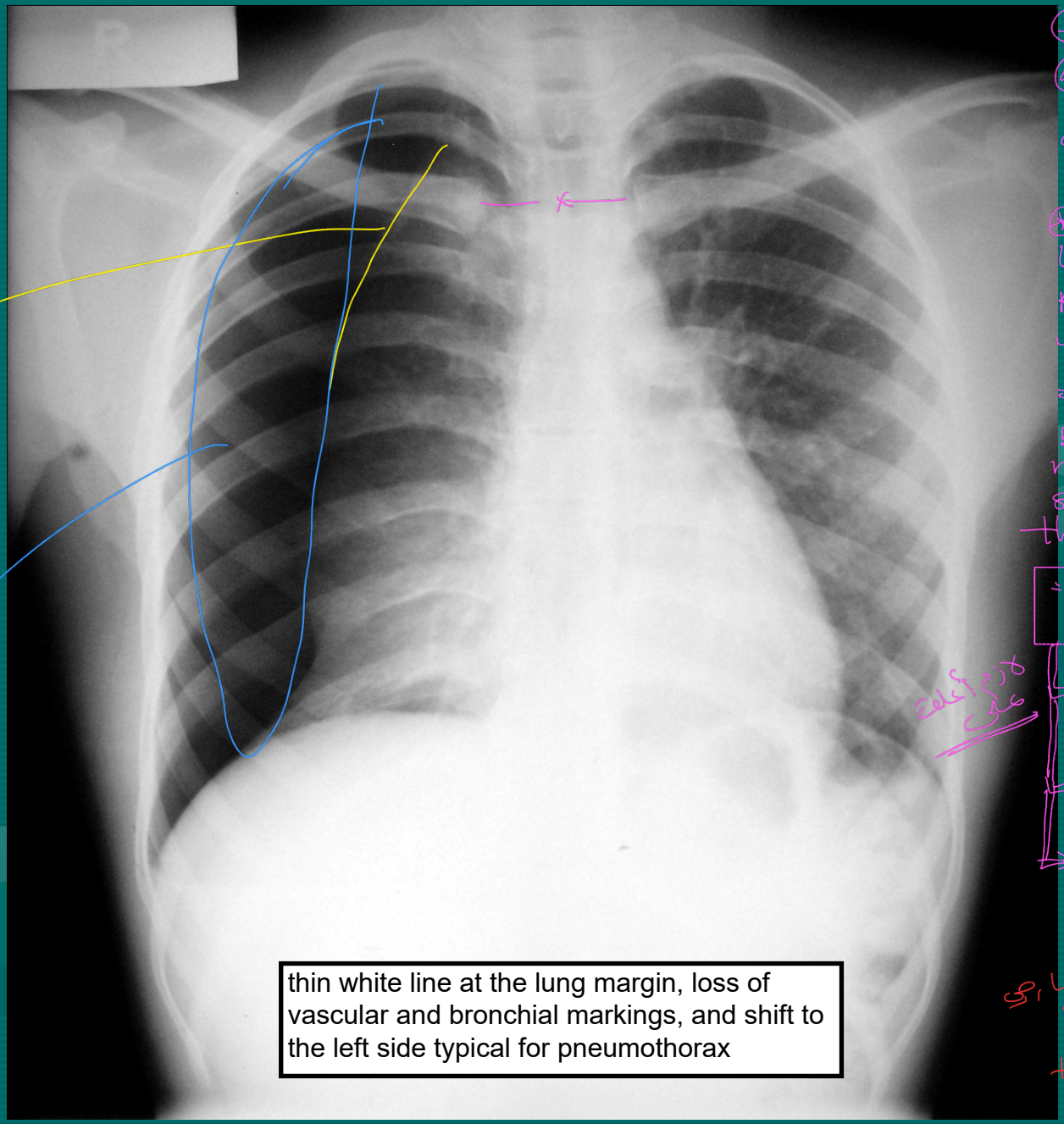
- Is the presence of free air in the pleural space, by a tear in either the parietal or visceral pleura.

- The most common cause of pneumothorax is chest injury, but the most common cause of spontaneous pneumothorax is rupture of sub-pleural emphysematous bullae (bleb).

Radiological features of pneumothorax

- **Lung edge:** a thin white line at the lung margin, represent the visceral pleura.
- **Absent lung markings** between the lung edge and chest wall.
- **Mediastinal shift:** occur when a tension pneumothorax develops.

Chilaiditi Syndrome
Displacement of large bowel in-between the liver and the diaphragm, gas in these bowel loops must be differentiated from air under diaphragm



thin white line at the lung margin, loss of vascular and bronchial markings, and shift to the left side typical for pneumothorax

Wt. lung edge

Wide lucency of lung tissue

Chest xray

PA

The pt. is well centralized, with over exposure, and fully inspiration

There is large lucency occupying the Rt. lung field with white lung edge.

⇒ This lucency has no bronchovascular markings & I can't see the lung tissue through it.

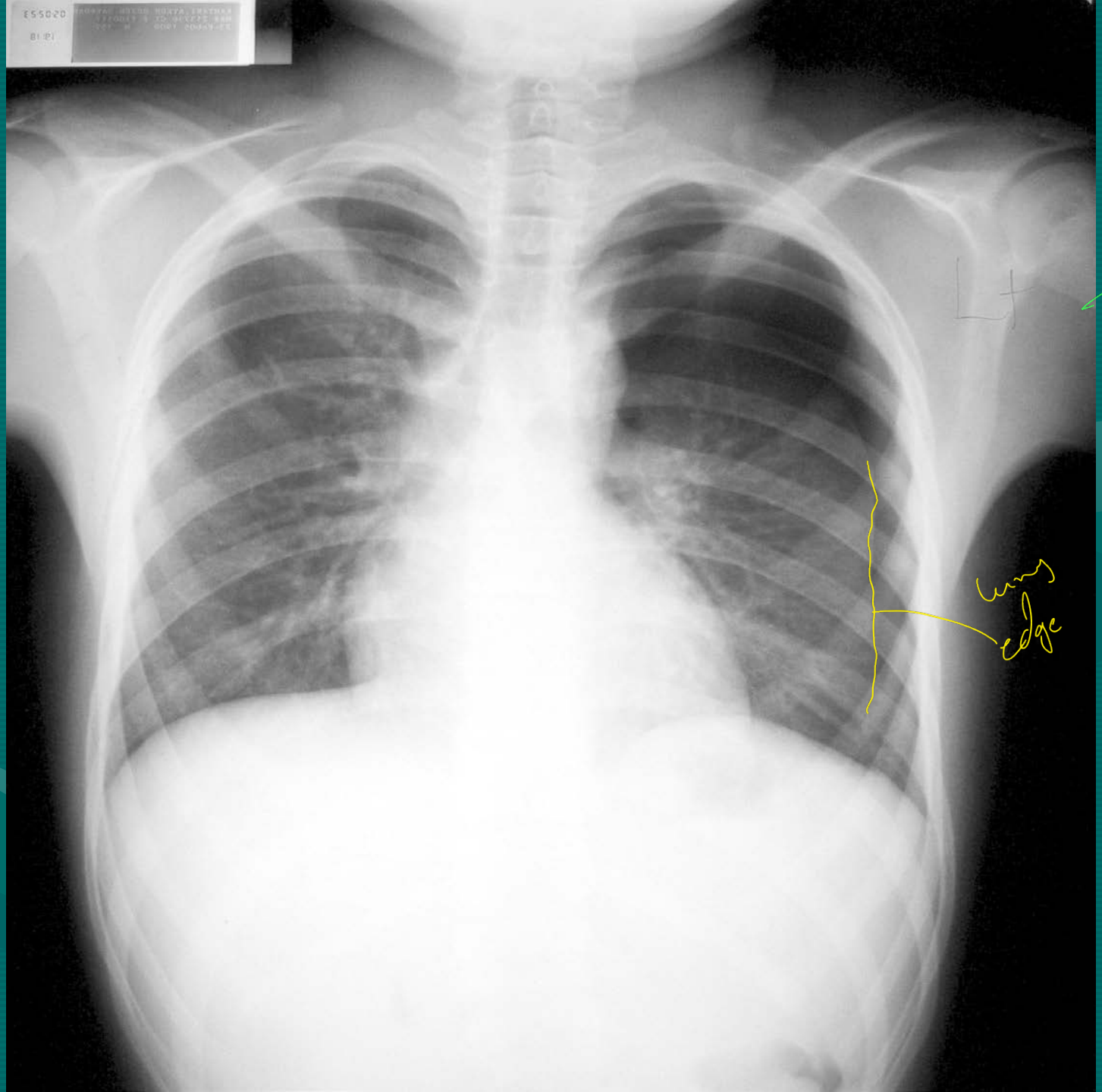
∴ I will think about pneumothorax

No mediastanal shift

Trachea: centralized

Heart: is in its right position, there is no shifting

Note tension pneumothorax shift trachea to the opposite side


Pneumothorax on Lt. side
lung edge

Solitary Pulmonary Nodule
< 3 cm = nodule
> 3 cm = mass

WHAT IS SOLITARY PULMONARY NODULE ?

- It must be nodular or roughly spherical.
- Not larger than 3cm in diameter.
- About 40% of solitary pulmonary nodules are malignant.
- A nodule is assessed for its:

- size

The larger the nodule, the greater the likelihood of malignancy.

- Margins

Irregular contour or spiculated margins increase the probability of malignancy

If the nodule has smooth well-defined outline, then it is more likely to be benign, so you hould confirm your impression by CT , if on CT confirms, then send the Pt home and request follow up after 6 months

- Calcification

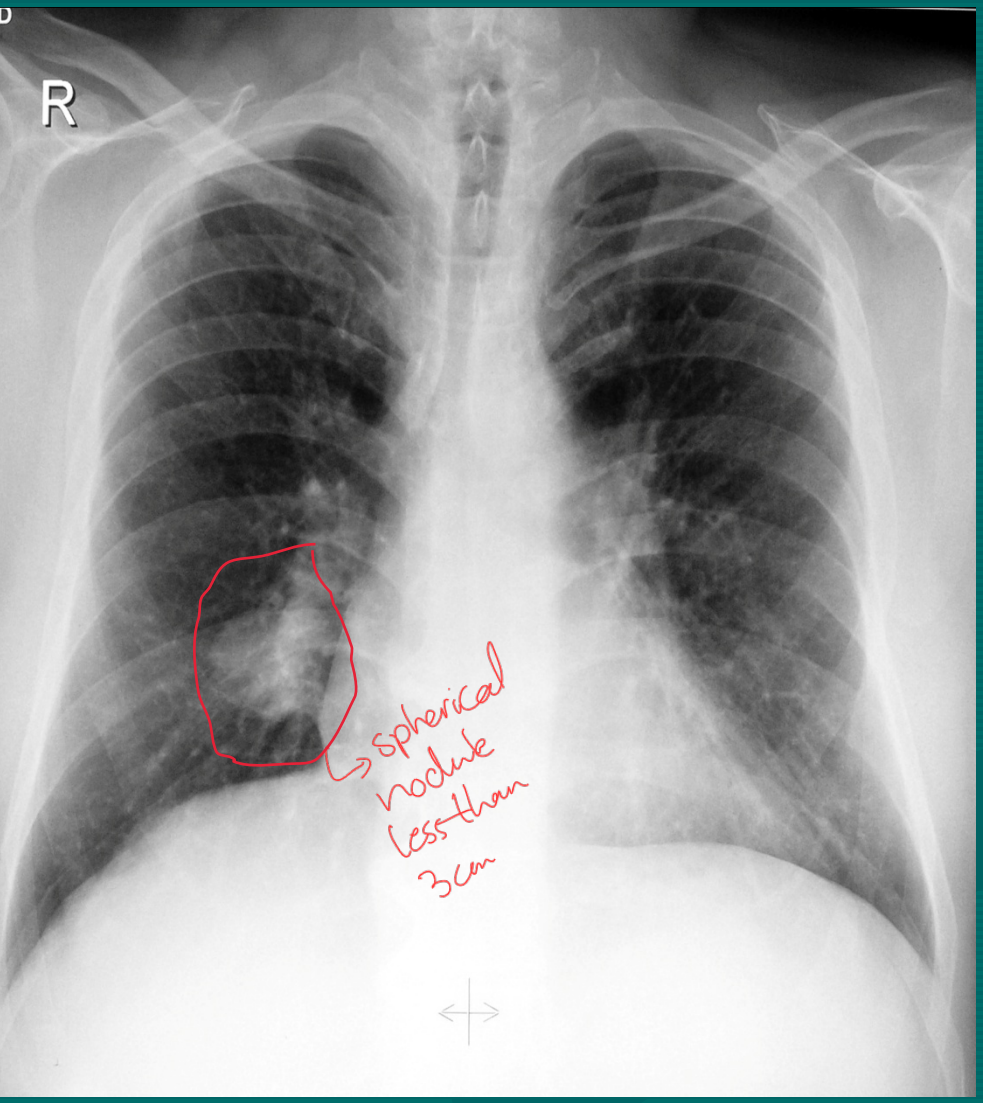
The presence of calcification within a nodule are in favor of benign lesion.

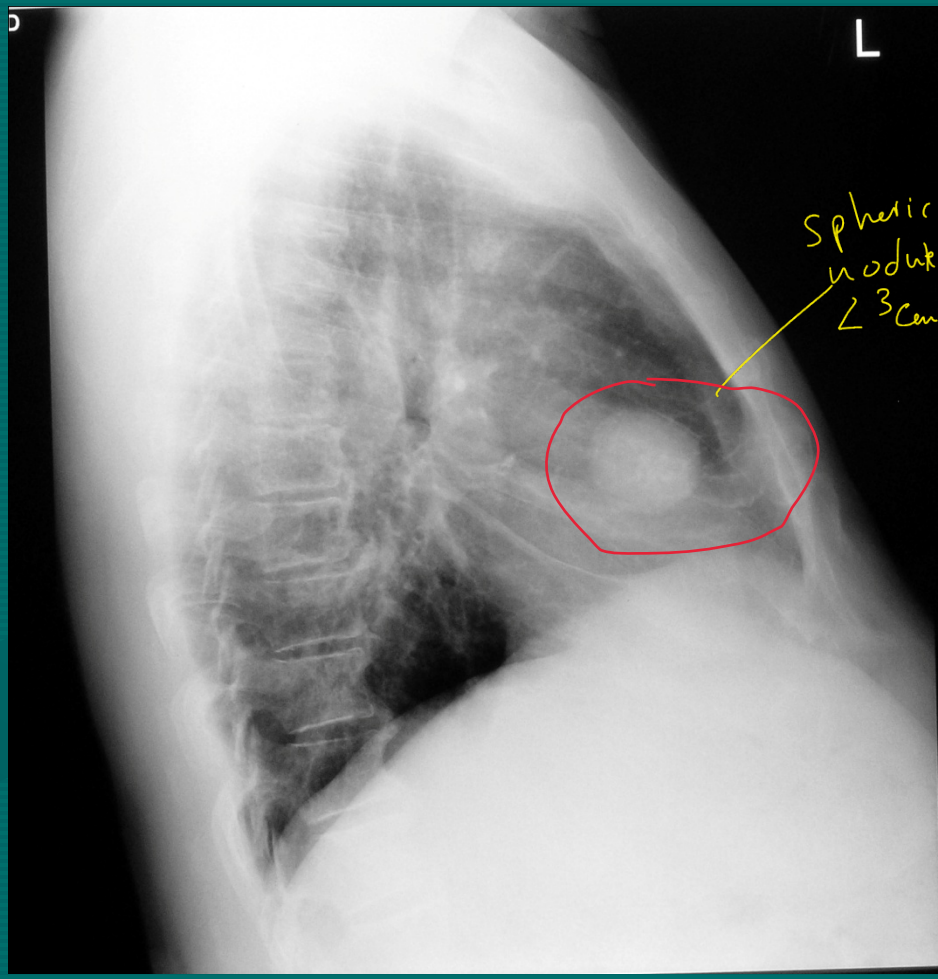
CAUSES OF SOLITARY PULMONARY NODULE

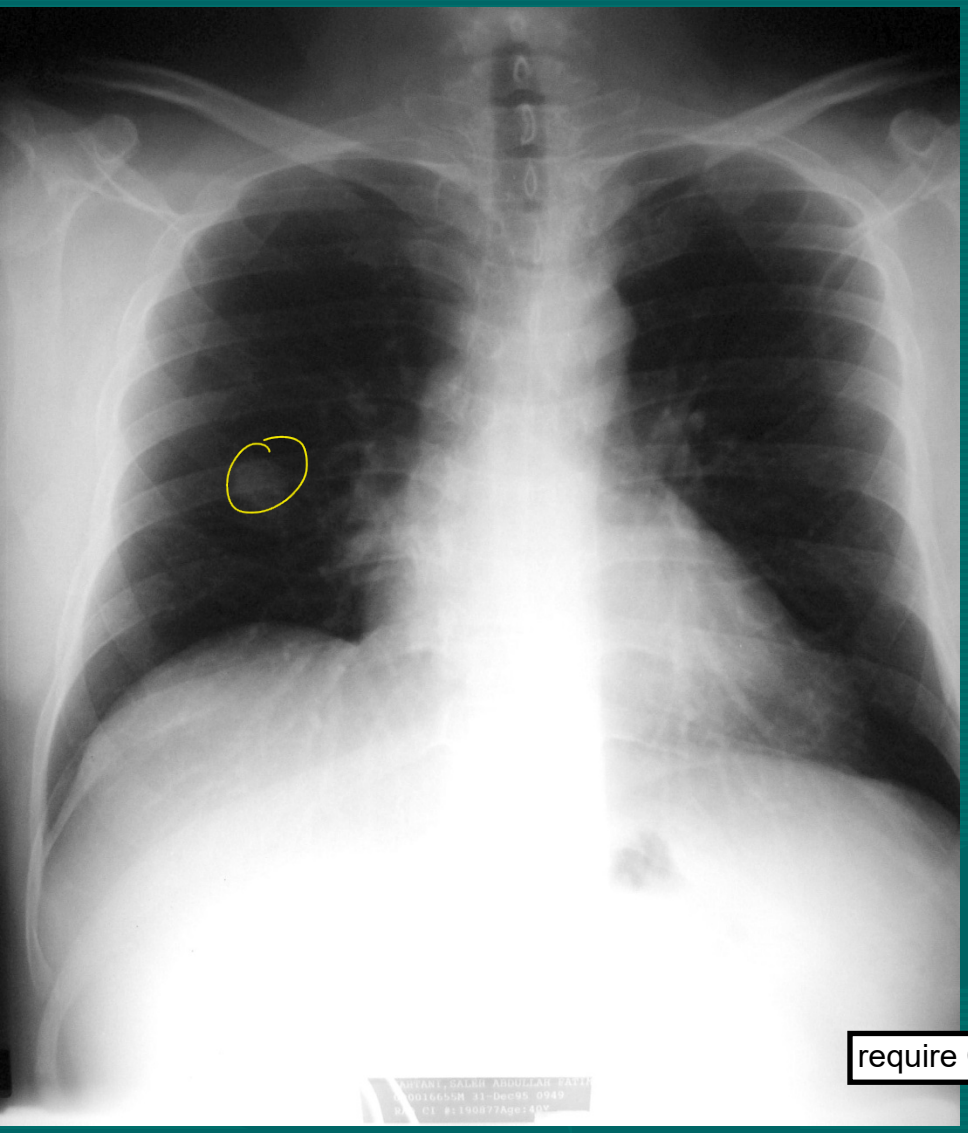
- Bronchial carcinoma.
- Metastasis. → usually (are) multiple & bilateral
- Hamartoma. mostly due to trauma
- Bronchial adenoma.
- Granuloma. → calcification
- Abscess. nodule → opace → لكن اذا ضغط → air-fluid level → بتغطي لل gas-forming micro-organism → this is abscess
- Hydatid cyst. If not ruptured → opace cyst contain fluid → opace → ruptured اما اذا بتنتوي خطوط متعرجة
- Bronchogenic cyst → Most commonly located in the carina
- Arterio-venous malformation.
- Rheumatoid nodule.

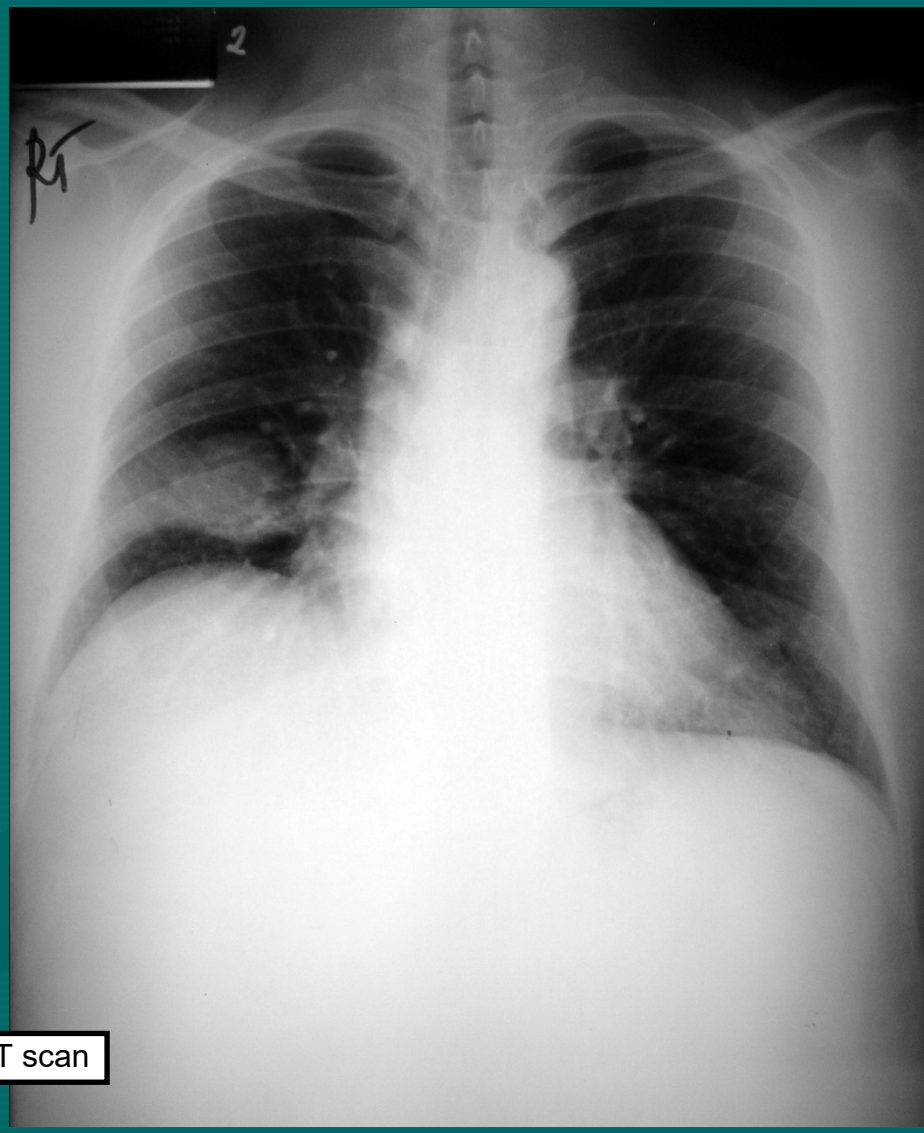
smooth well-defined pulmonary nodule = most likely benign >>> need CT

1. Margin
2. Regularity
3. spherical or not
4. smooth or not
5. calcified or not









require CT scan

THE MEDIASTINUM

The mediastinum is situated between the lungs and extends from the thoracic inlet superiorly to the diaphragm inferiorly.

The mediastinum is divided into three parts:

1- Anterior mediastinum

Is the space in front of the anterior pericardium and trachea.

2- Middle mediastinum

Lies within the pericardial cavity.

3- Posterior mediastinum

Lies behind the posterior pericardium.

Mediastinum can be divided by two ways
1- Superior & Inferior Mediastinum the Inferior is divided into Anterior, middle, and posterior
2- The whole Mediastinum is divided into Anterior, middle, and posterior

Retrosternal space

ANTERIOR MEDIASTINAL MASSES

DDX for Anterior mediastinal mass
4 Ts 1- Thymus tumor
2- Thyroid
3- Terrible Lymphoma
4- Teratoma
Plus
Pericardial Cyst + Diaphragmatic hernia

- Lymphoma.
- Thyroid (Retrosternal goiter).
- Teratoma.
- Thymic tumor.
- Pericardial cyst.
- Diaphragmatic hernia (morgagni hernia).

Diaphragmatic Hernia
1- Morgagni hernia: congenital, present as an anterior mediastinal mass
2- Bochdalek hernia: congenital, present as an posterior mediastinal mass, discovered soon after birth because of the associated distress Syndrome

Rule
Anterior masses obscure the outline
Posterior masses don't obscure the outline

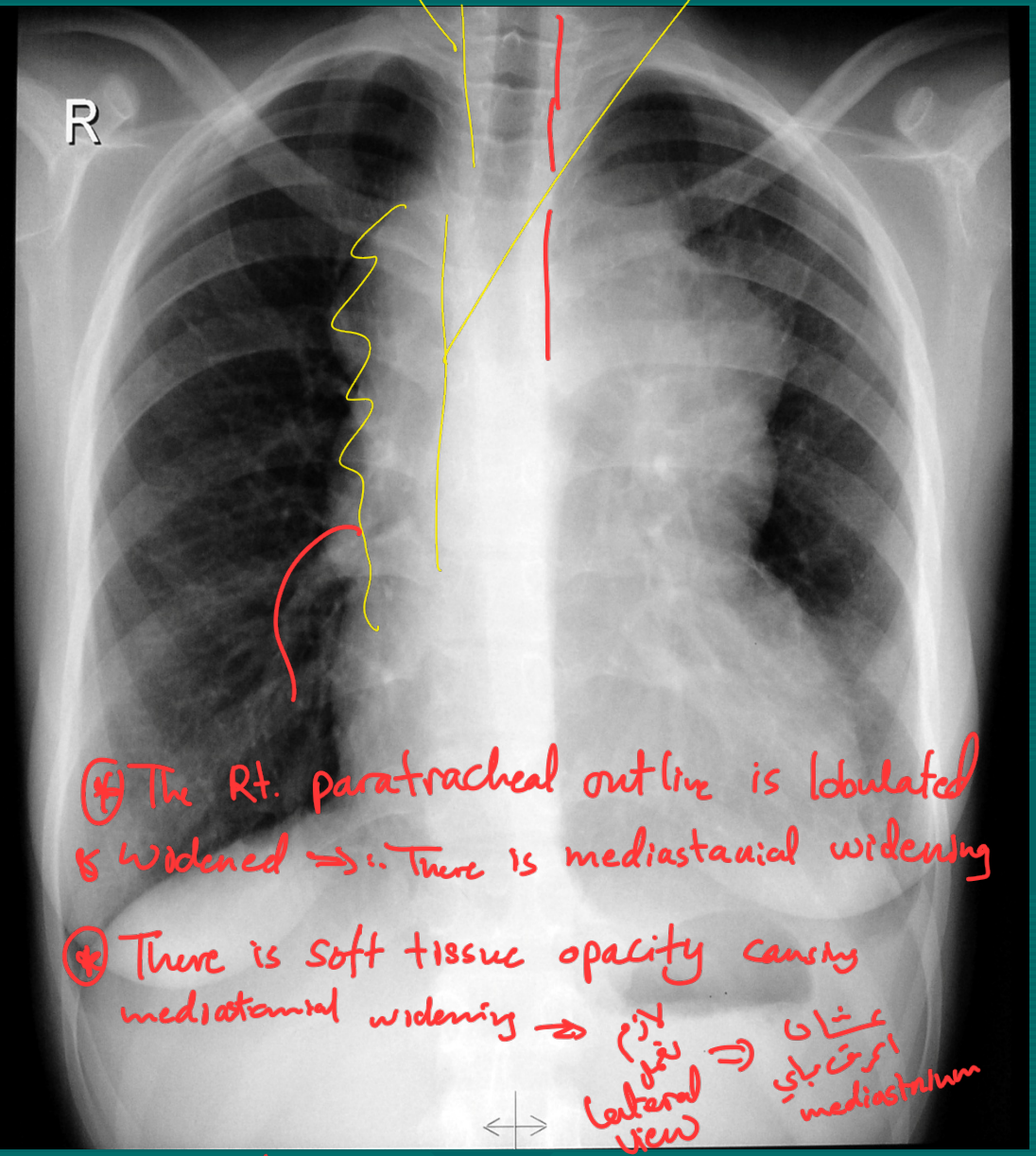
MIDDLE MEDIASTINAL MASSES

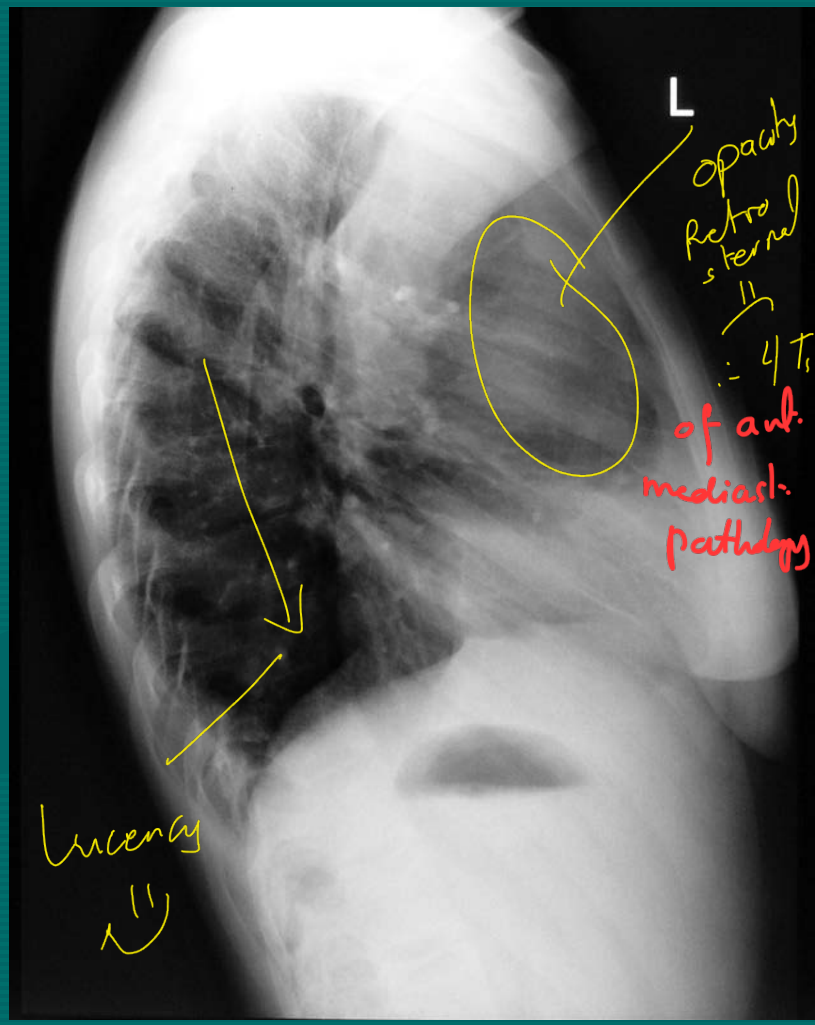
* Middle mediastaninum
  - Pericardium
  - Heart
  - Great vessles → aortic arch
  - LNs → infections, inflamm., tumor

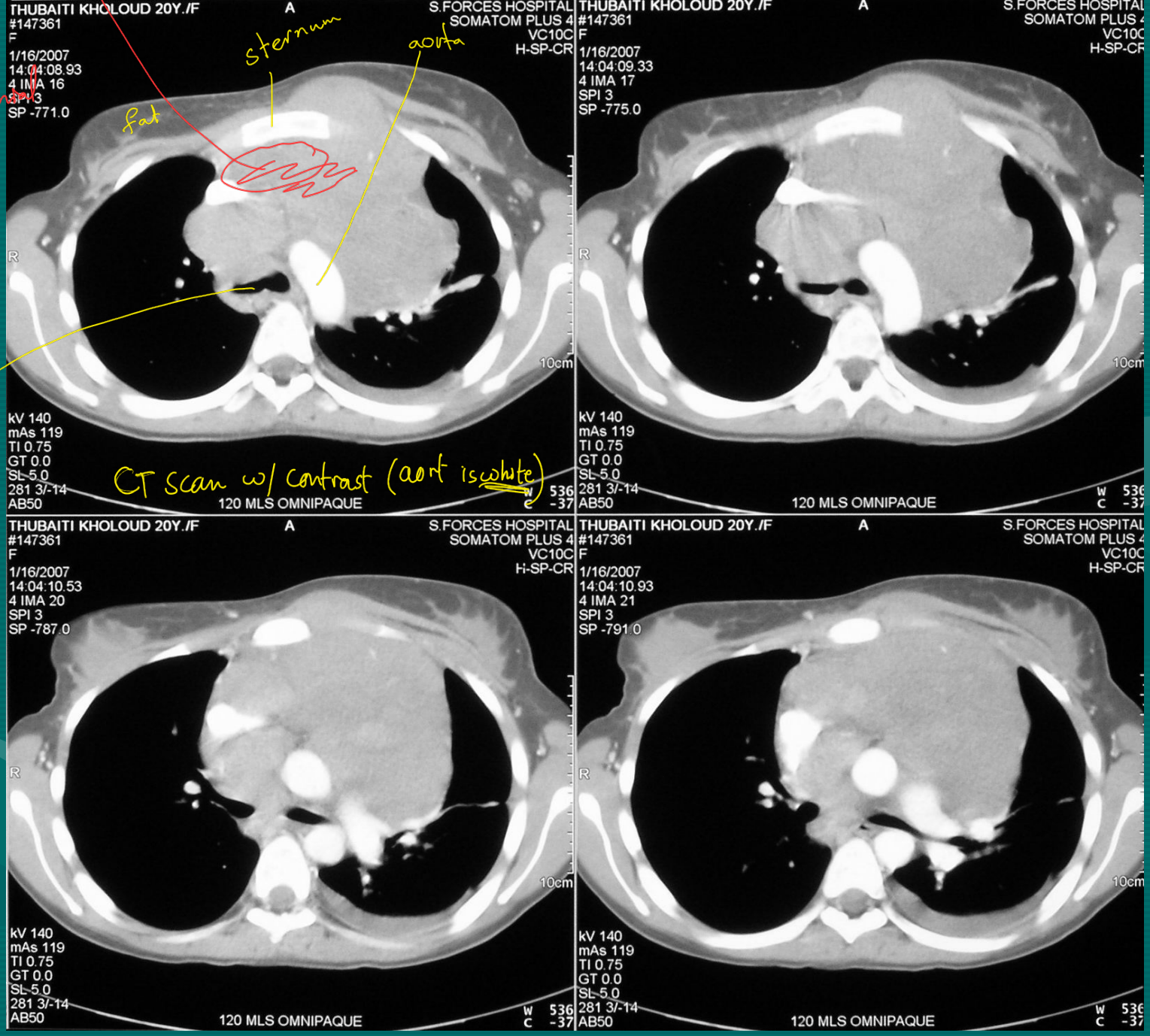
- Lymph node enlargement:
  - lymphoma
  - primary tuberculosis
  - sarcoidosis
- Bronchogenic cyst.
- Aneurysm of aortic arch.

* Paratracheal lines & Para vertebral lines (right & left)
  - smooth
  - not wide
    - if wide, this indicates mediastanial widening

outline is not clear = anterior mass
next step is CT: which shows soft tissue mass in the anterior mediastinum



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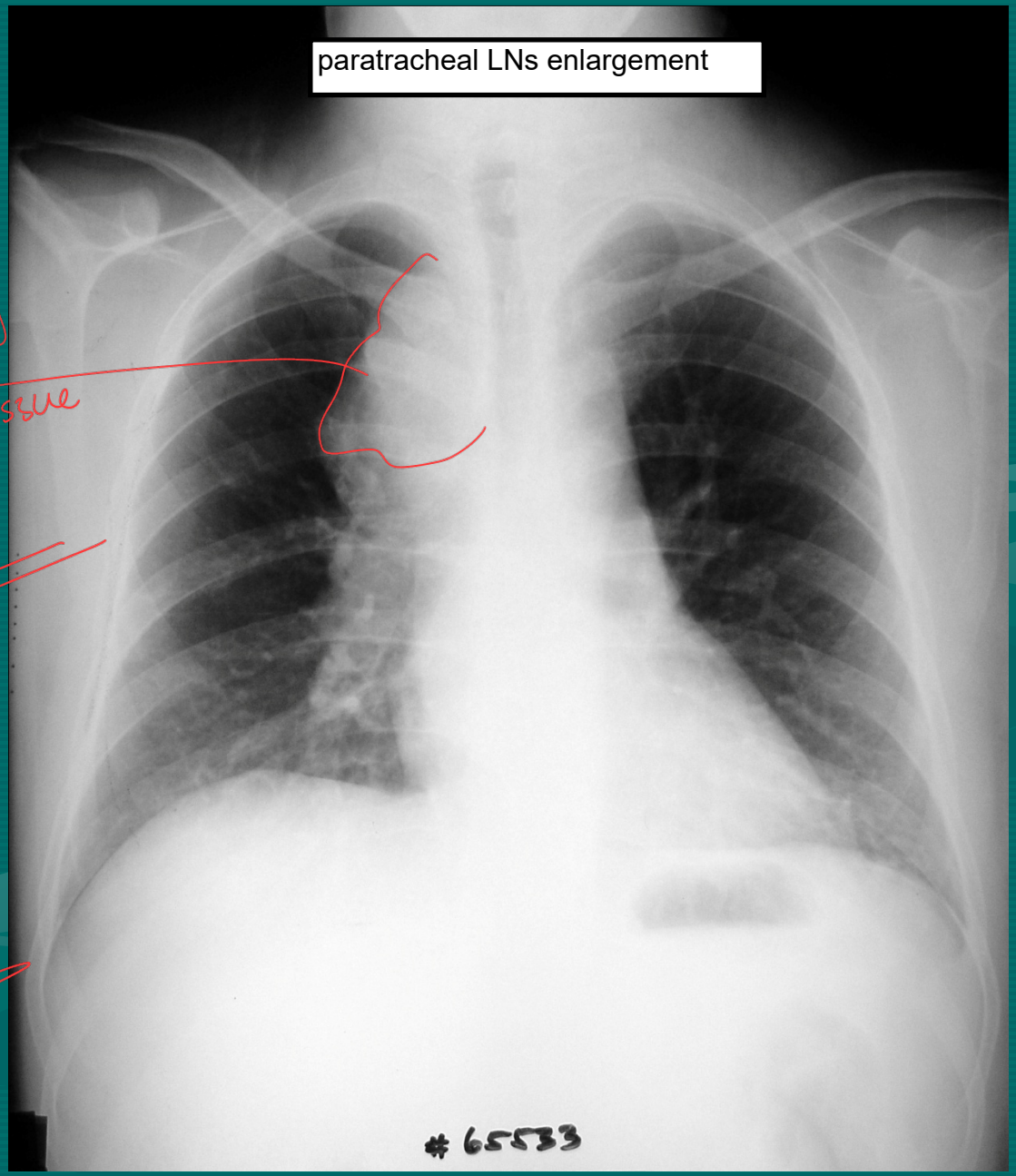
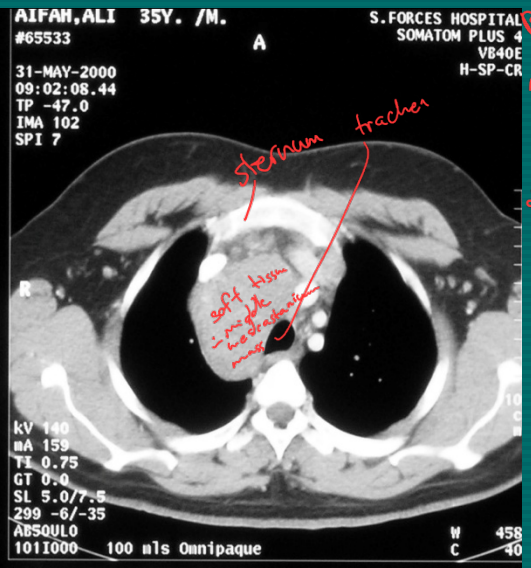


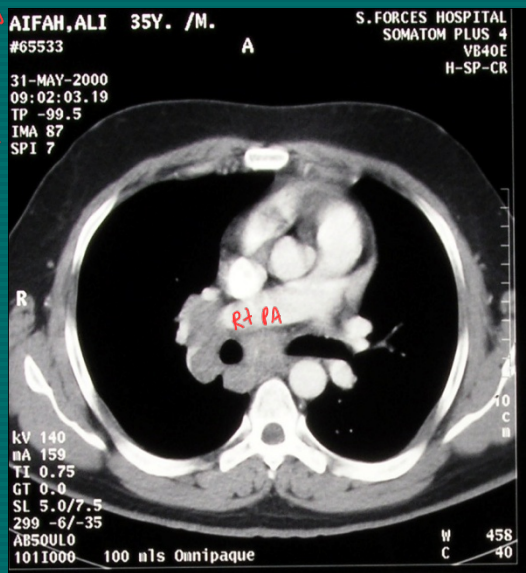
Mediastanal widening with soft tissue opacity

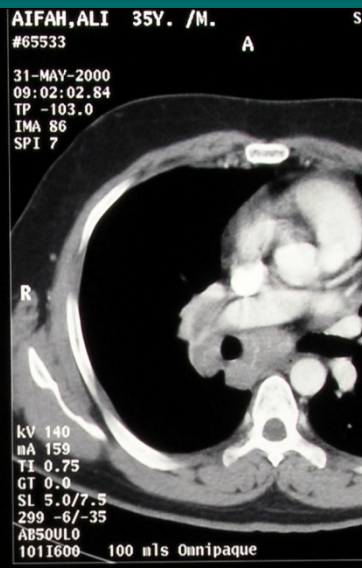
CT تظهر ال
عند المرض
midiastanium
في ال
pathology #

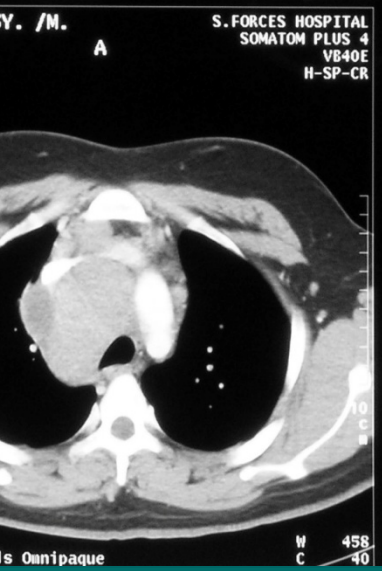
CT w/ contrast

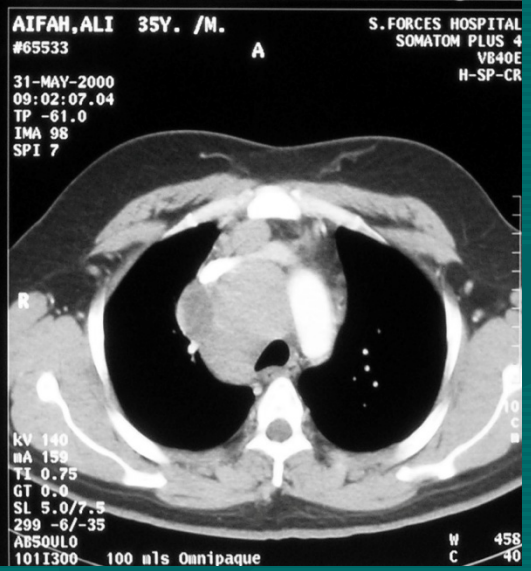
paratracheal LNs enlargement

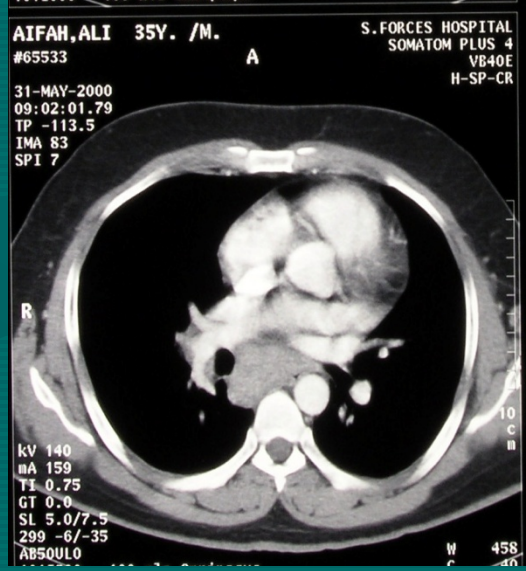


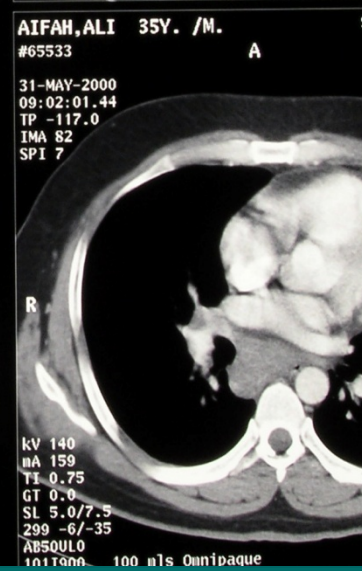










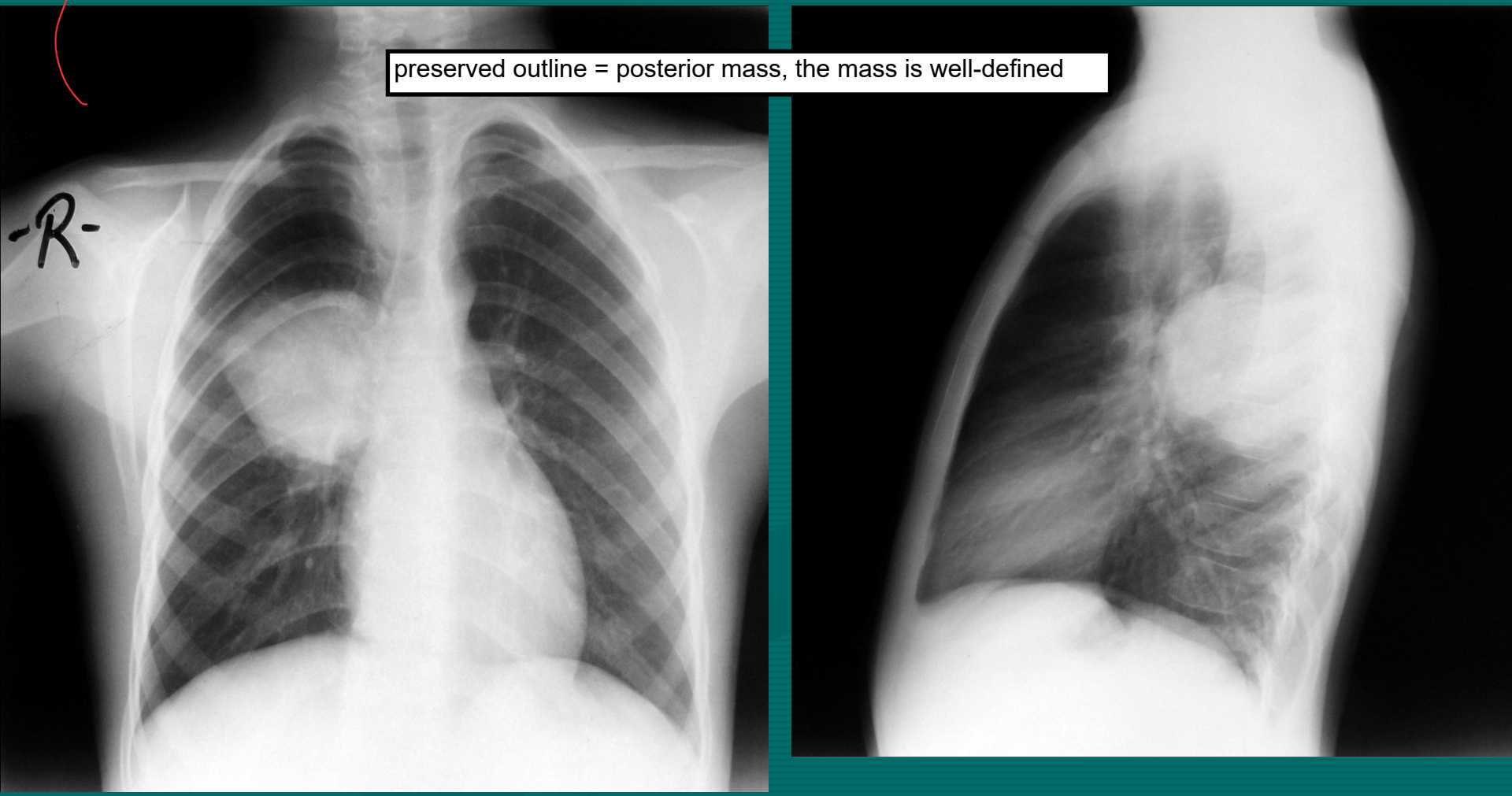


POSTERIOR MEDIASTINAL MASSES

- Neurogenic tumors
  - Neurofibroma
  - Ganglioneuroma
- Aneurysm of descending aorta.
- Hiatus hernia.
- Dilated esophagus (especially achalasia).
- Paravertebral mass or abscess.

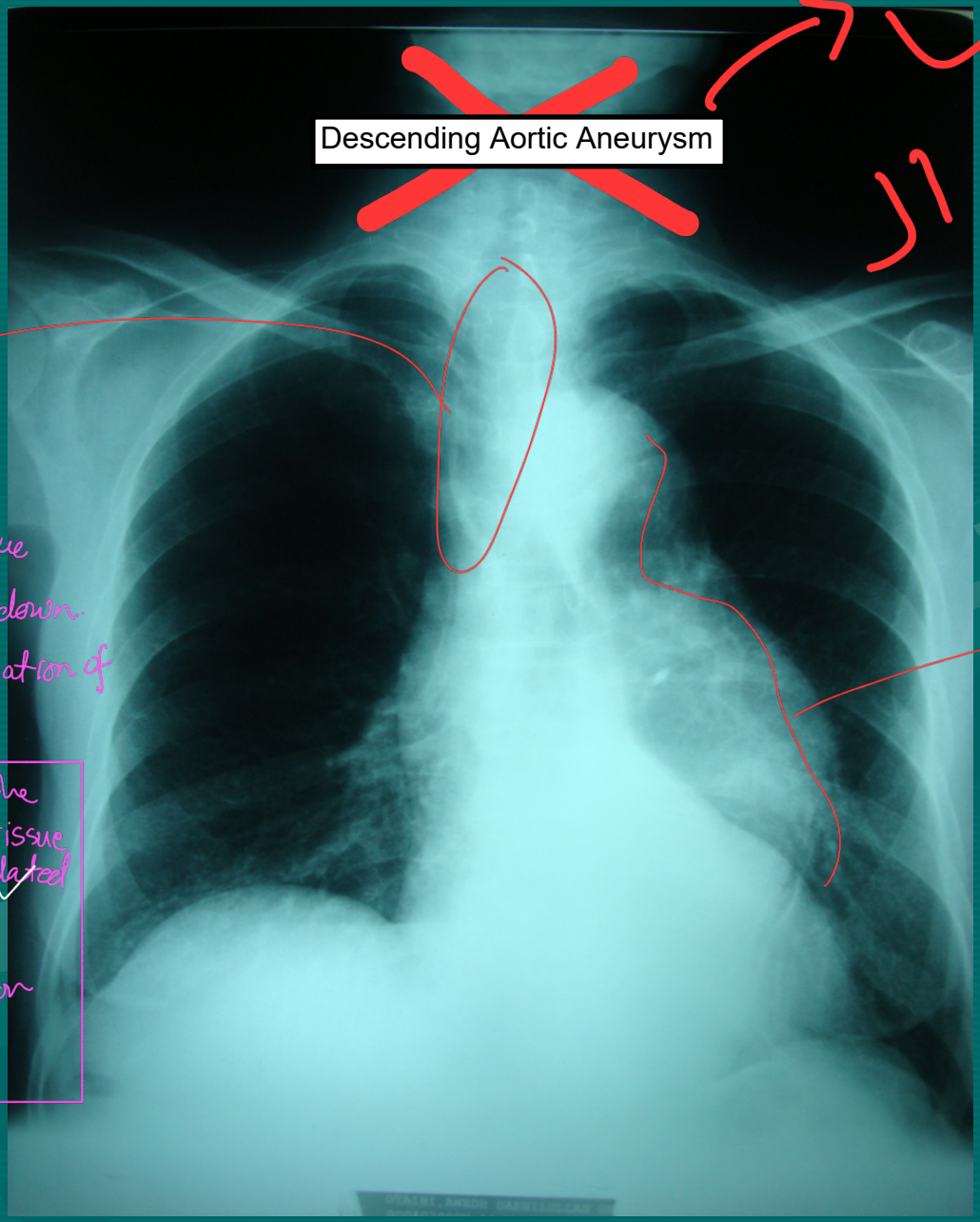
* Soft tissue opacity → large, located in the Rt. hilum

for further details ⇒ CT



preserved outline = posterior mass, the mass is well-defined

ما بنحرف



نشوف الـ CT

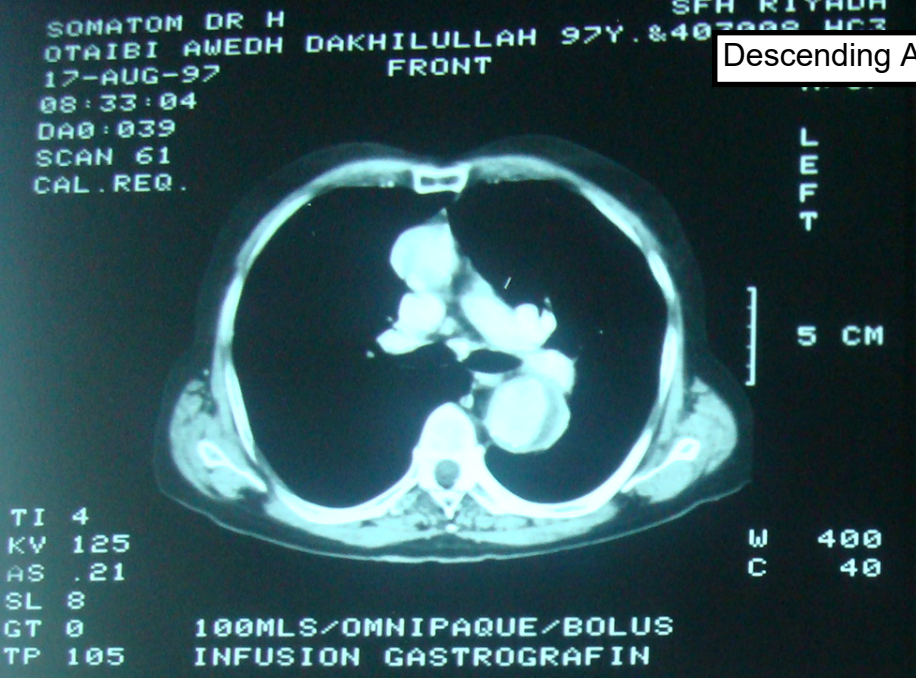
Tracheal deviation

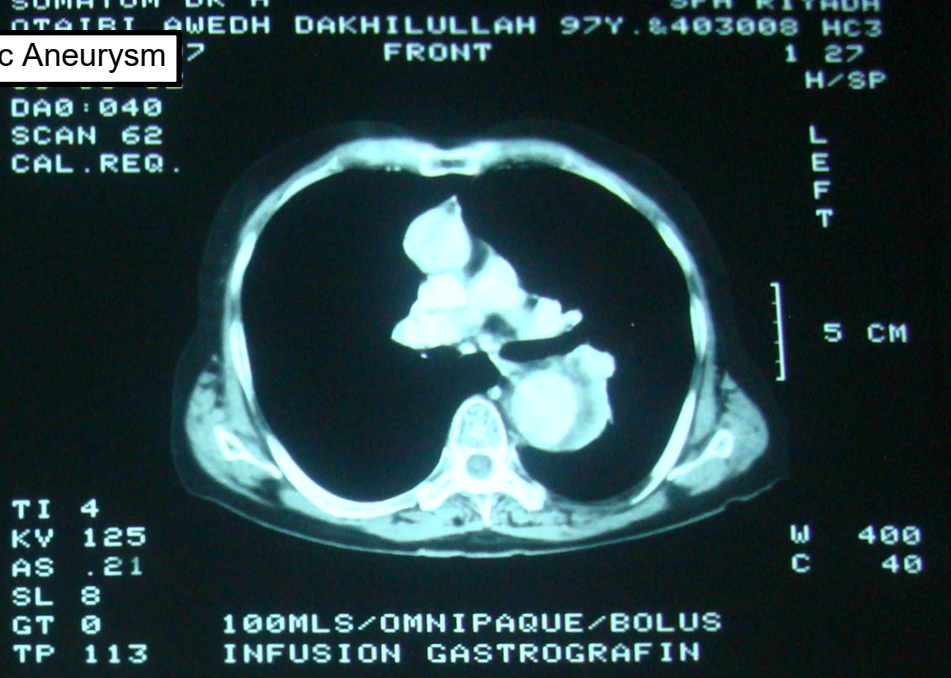
* Paravertebral soft tissue are opace all the way down, lobulated, causing deviation of the trachea

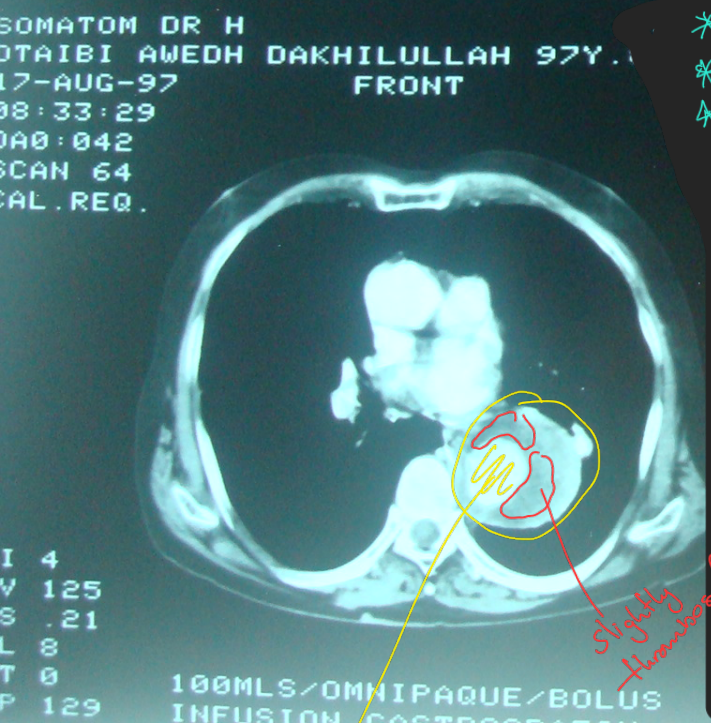
⇒ There is widening of the mediastinum by soft tissue opacity which appear lobulated on the left side causing compression on the trachea leading to deviation of it to the Rt. side.

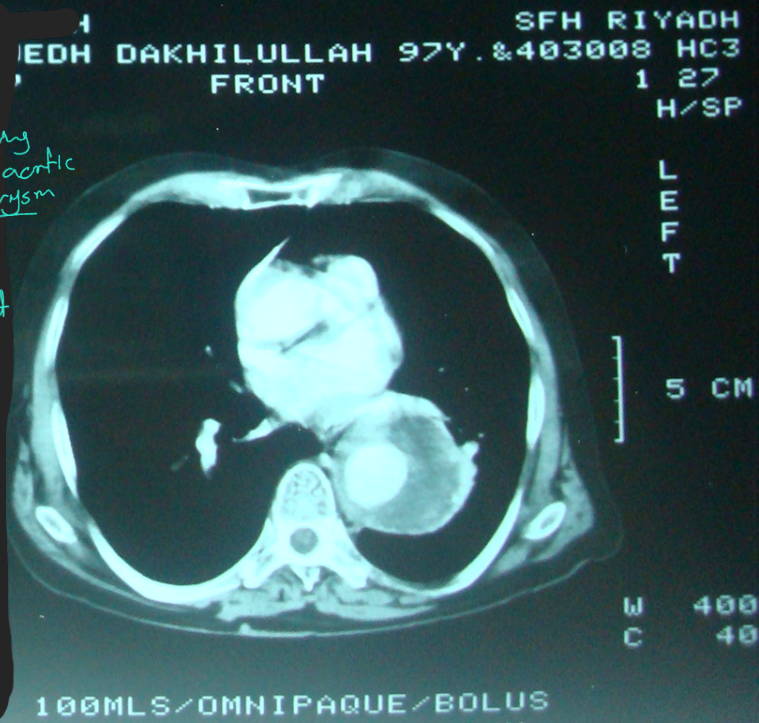
Widening mediastinal lobulated with soft tissue opacity

Descending Aortic Aneurysm





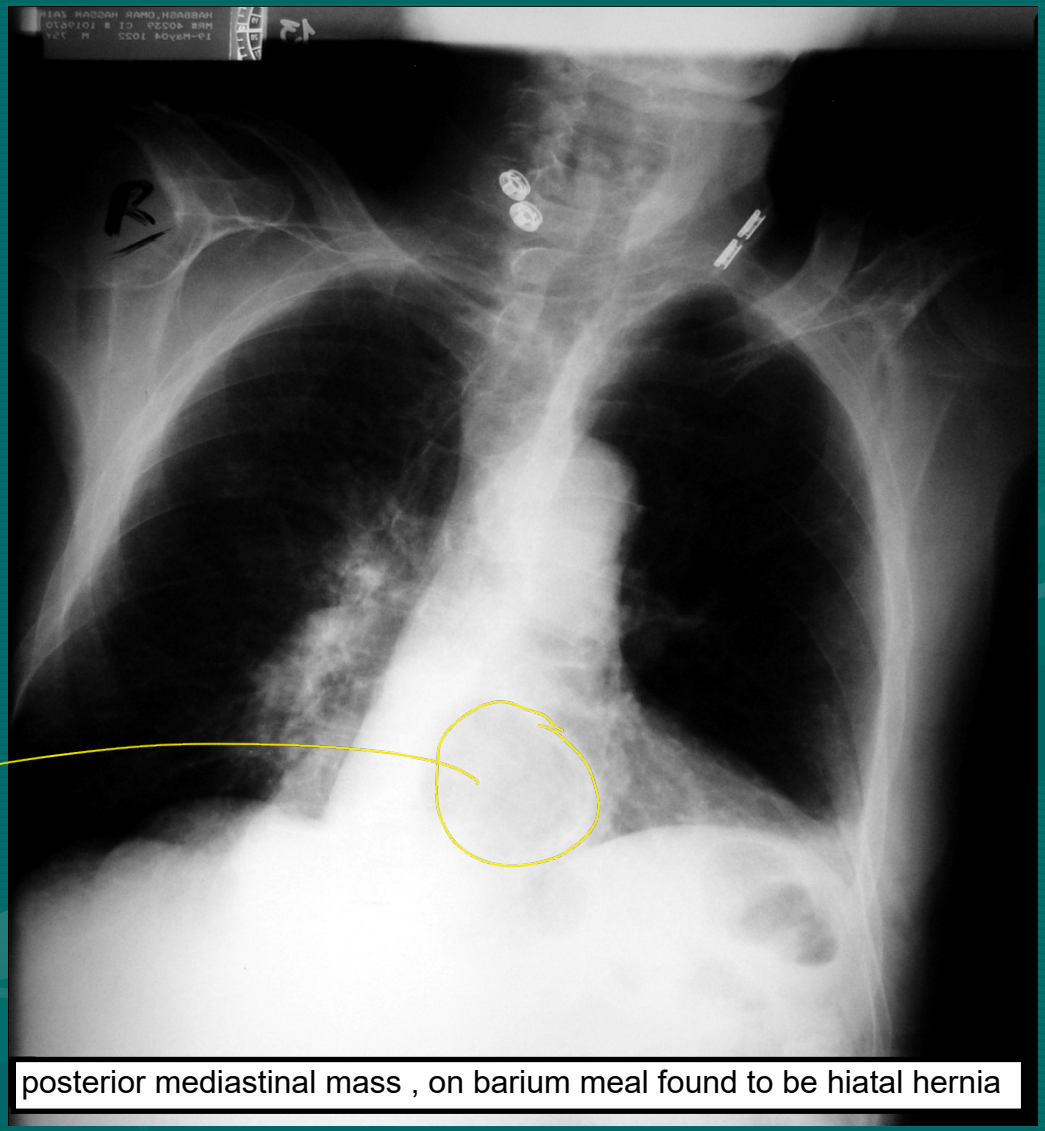




*CT with contrast
* Post. mediastanial mass
* Contrast in dilated mass
↳ ↓BV. → dilated = descending thoracic aortic aneurysm

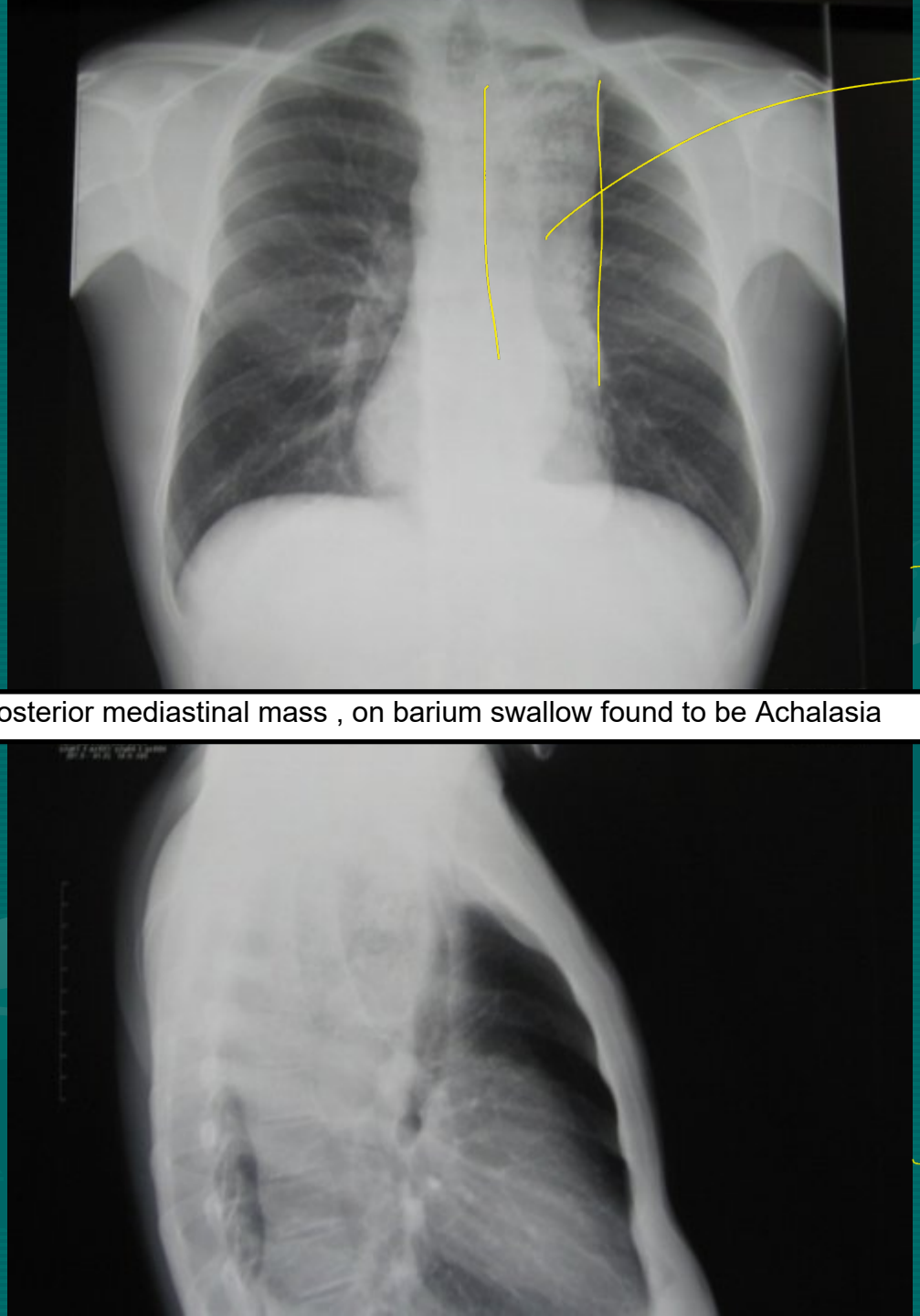
Slightly thrombosed
(area w/ poor enhancement by contrast)

Slightly thrombosed



posterior mediastinal mass , on barium meal found to be hiatal hernia

posterior mediastinal mass , on barium meal found to be hiatal hernia



posterior mediastinal mass , on barium swallow found to be Achalasia

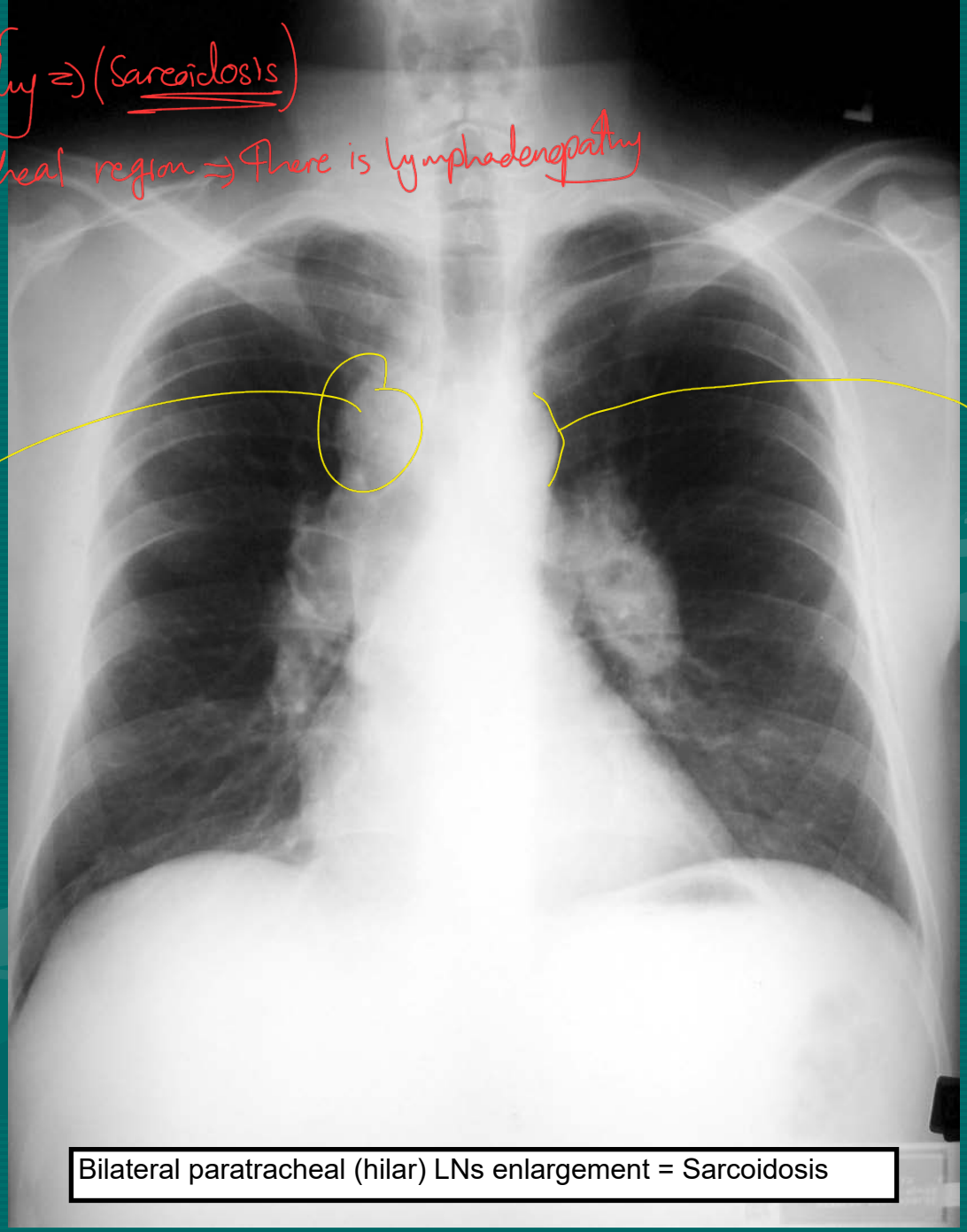
posterior mediastinal mass , on barium swallow found to be Achalasia

(Lt Lat) Barium swallow

* The esophagus is dilated

* GES is narrow bird peak sign

∴ Achalasia



Bilateral paratracheal (hilar) LNs enlargement = Sarcoidosis

TUMORS OF THE LUNG

- Lung cancer is the commonest fatal malignancy.
- The strongest risk factor is cigarette smoking.
- More than 95% of malignant tumors arise from the respiratory epithelium and are termed bronchogenic carcinoma.
- Less than 5% of lung cancers are of rare cell types, such as carcinoid tumors, lymphoma, or metastasis.

Types of lung cancers

1- Adenocarcinoma

- Is the most common type of lung cancer, making up 30-40% of all cases.
- Usually arise peripherally as solitary pulmonary nodule.

The alveolar cell carcinoma is a subtype of adenocarcinoma and arise within the alveoli producing areas of consolidation and the appearance resemble bronchopneumonia.

Types of lung cancers / 2

2- Squamous cell carcinoma

radioopaqe mass with a central cavity (radiolucent)

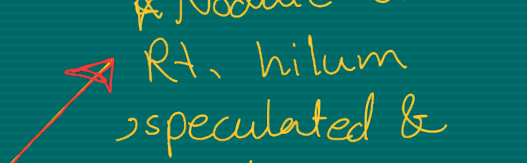
- They typically occur in central bronchi.
- Grow slowly and cavitate more often than other cell types.

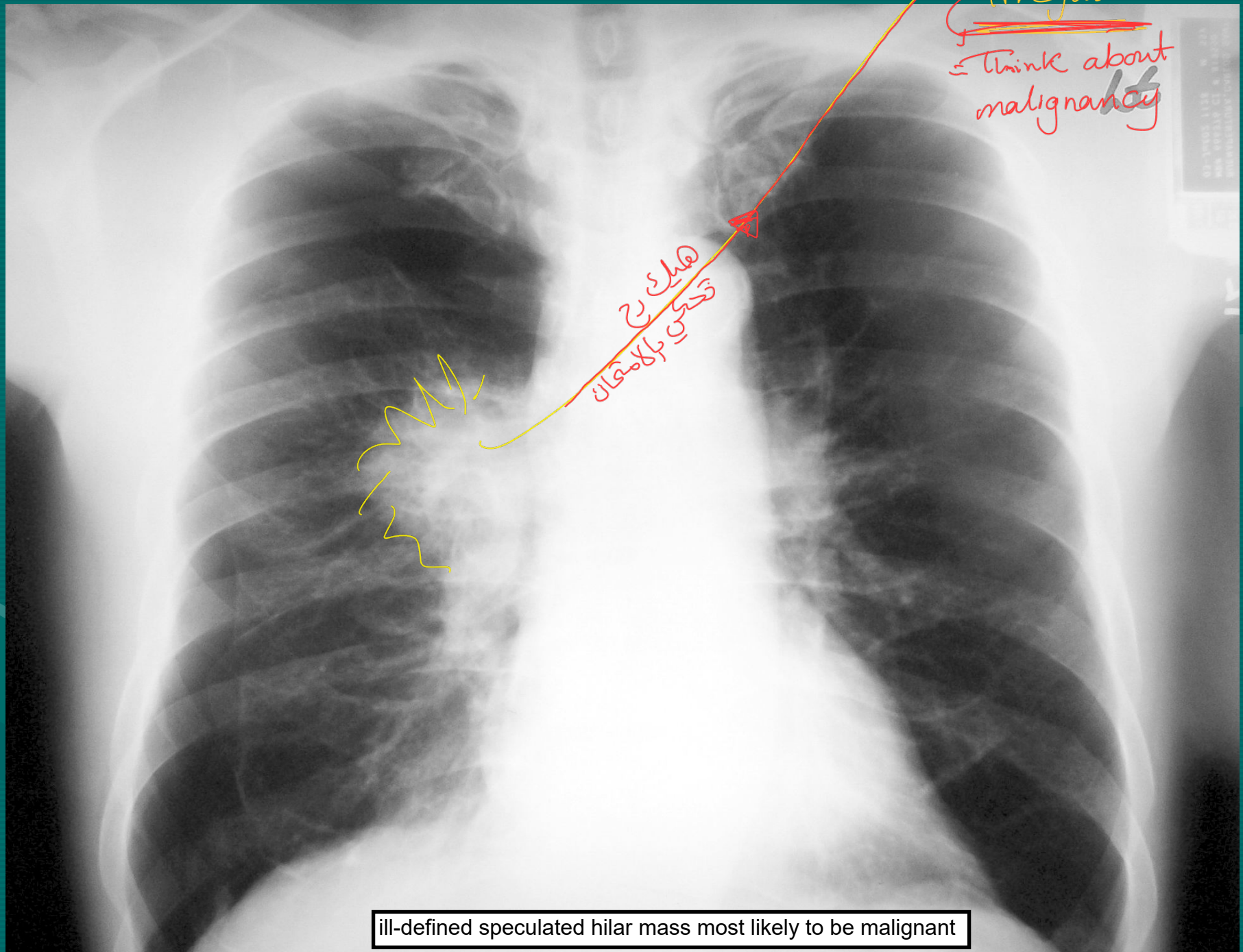
3- Small (oat) cell carcinoma.

- Are usually central in location.
- Have the fastest rate of growth.
- Typically associated with mediastinal adenopathy.

4- Large cell carcinoma.

- Usually arise at the periphery of the lung.
- The growth is relatively rapid.





ill-defined speculated hilar mass most likely to be malignant

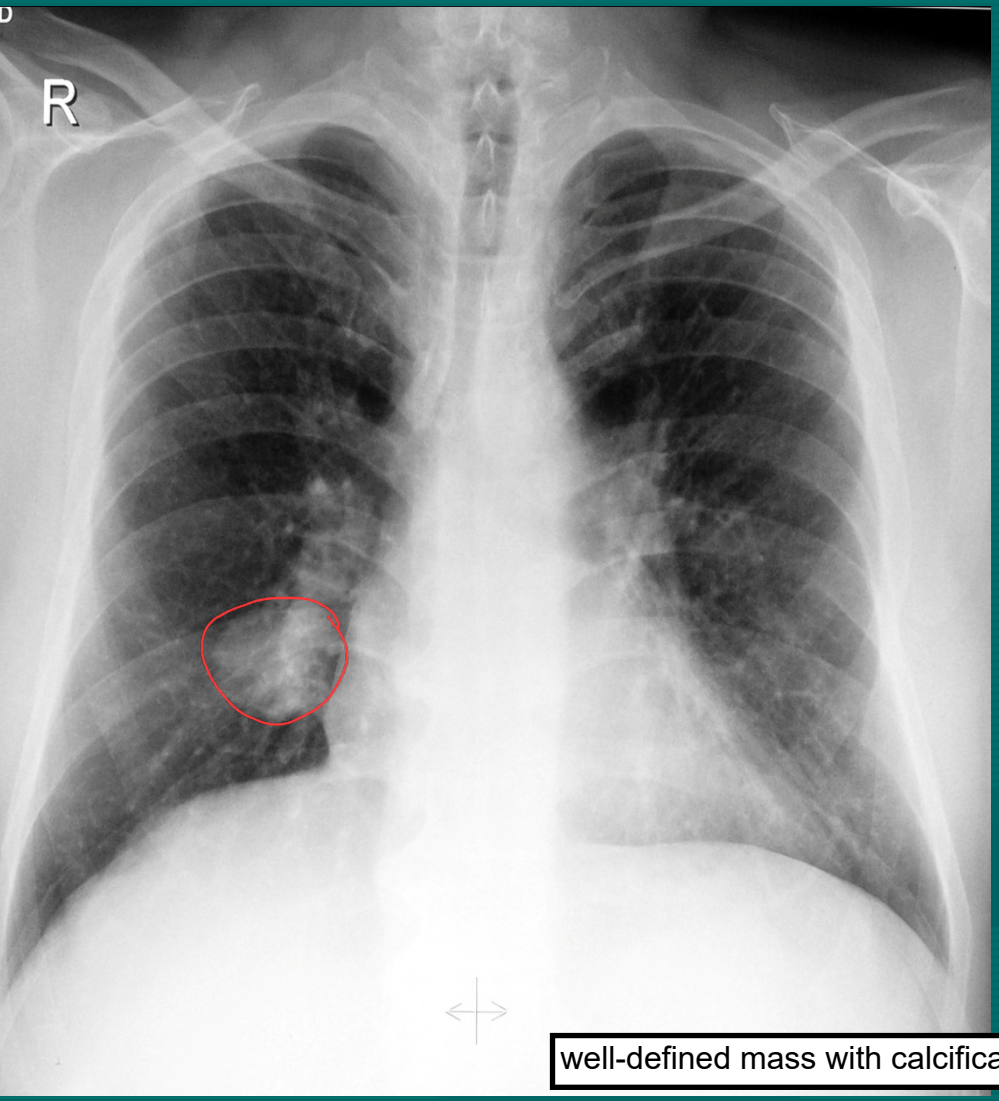
BENIGN TUMORS OF THE LUNG

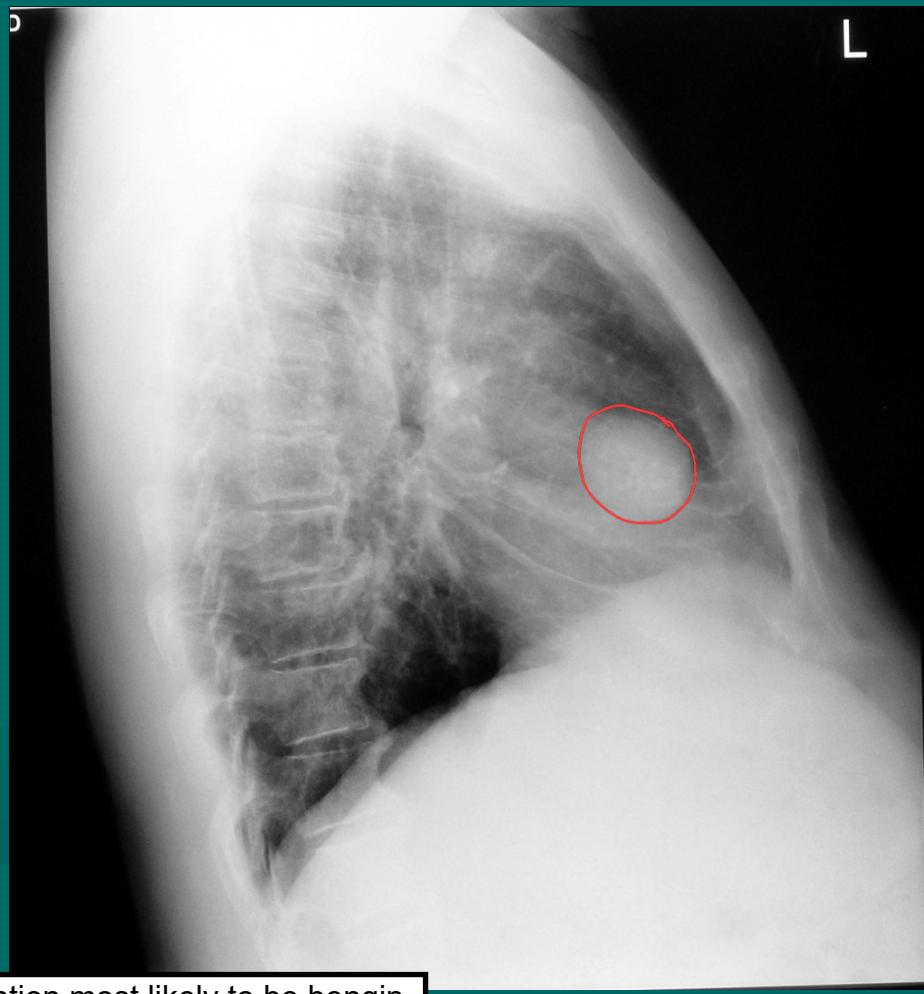
- Hamartoma.

- Is the most common benign tumor of the lung.
- Appear as solitary, well marginated,rounded mass.
- Calcification (popcorn) is present in 40% of cases.
- Fat is seen in up to 50% of hamartomas.

- Adenoma.

- The vast majority of cases occur around the hilum and appear as round, well-defined nodule.





well-defined mass with calcification most likely to be bengin

well-defined mass with calcification most likely to be bengin

Lung metastasis

Lung Metastasis
well defined
usually multiple
usually bilateral
variable in size and location

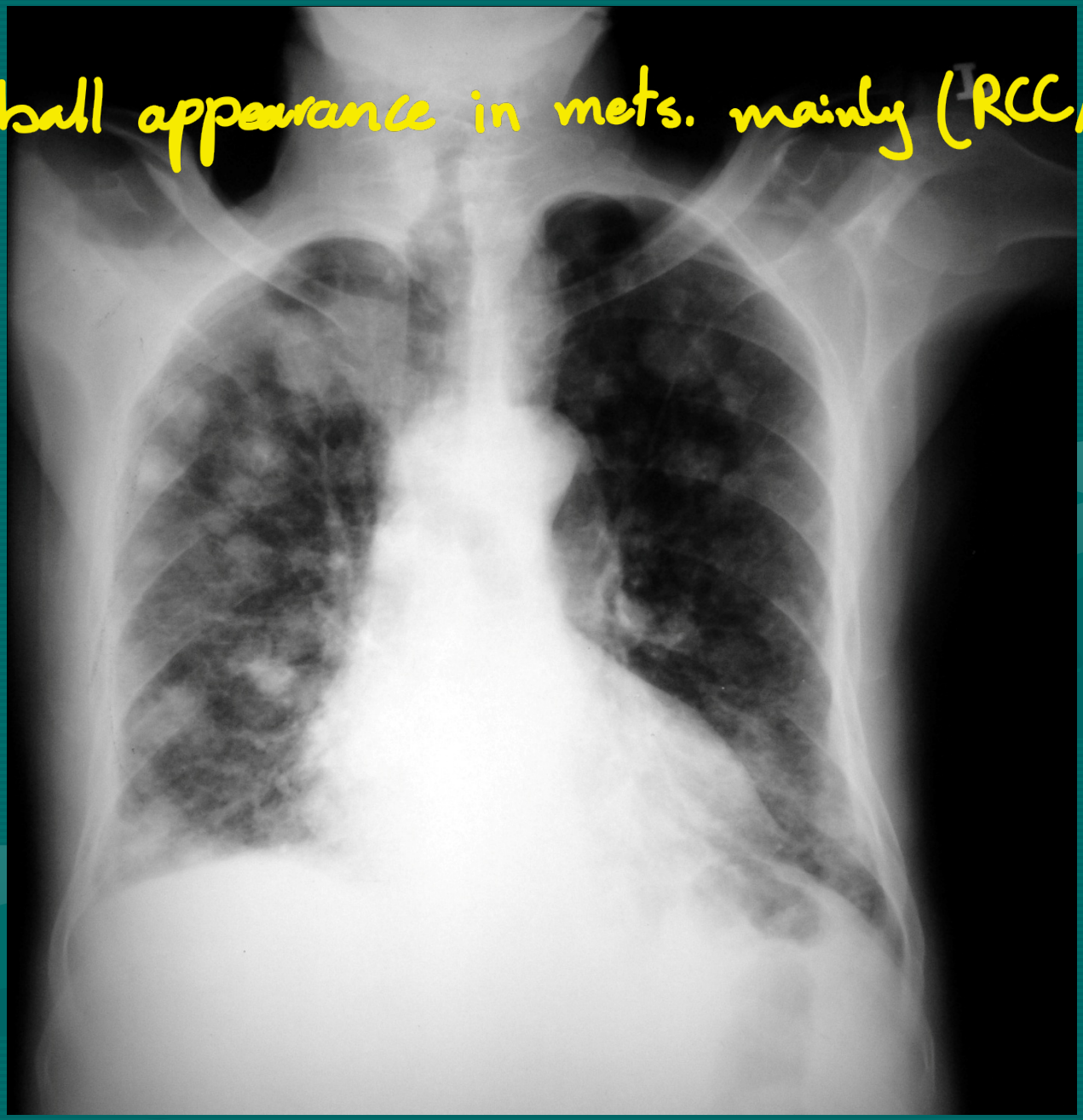
- The commonest primary tumors producing lung metastasis are breast, renal tract, thyroid, bone, and testicular tumors.

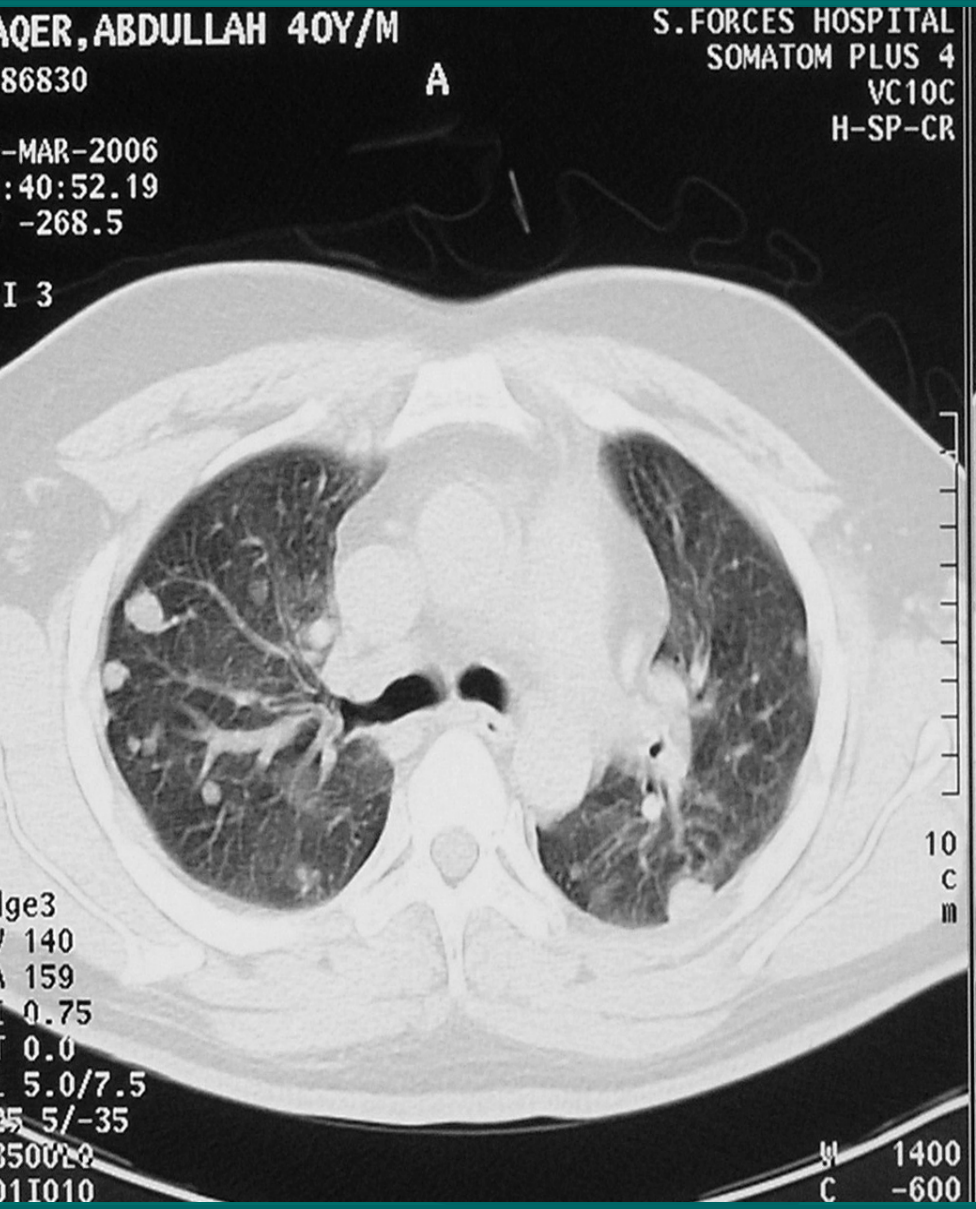
- Metastasis to the lung are usually bilateral and tend to be peripheral and more numerous at the lung bases.

- Lung metastasis are spherical in shape with a well-defined margin.

Mahasan.
لاحظ كيف عكس الصورة

* Cannon ball appearance in mets. mainly (RCC, chorio carcinoma)

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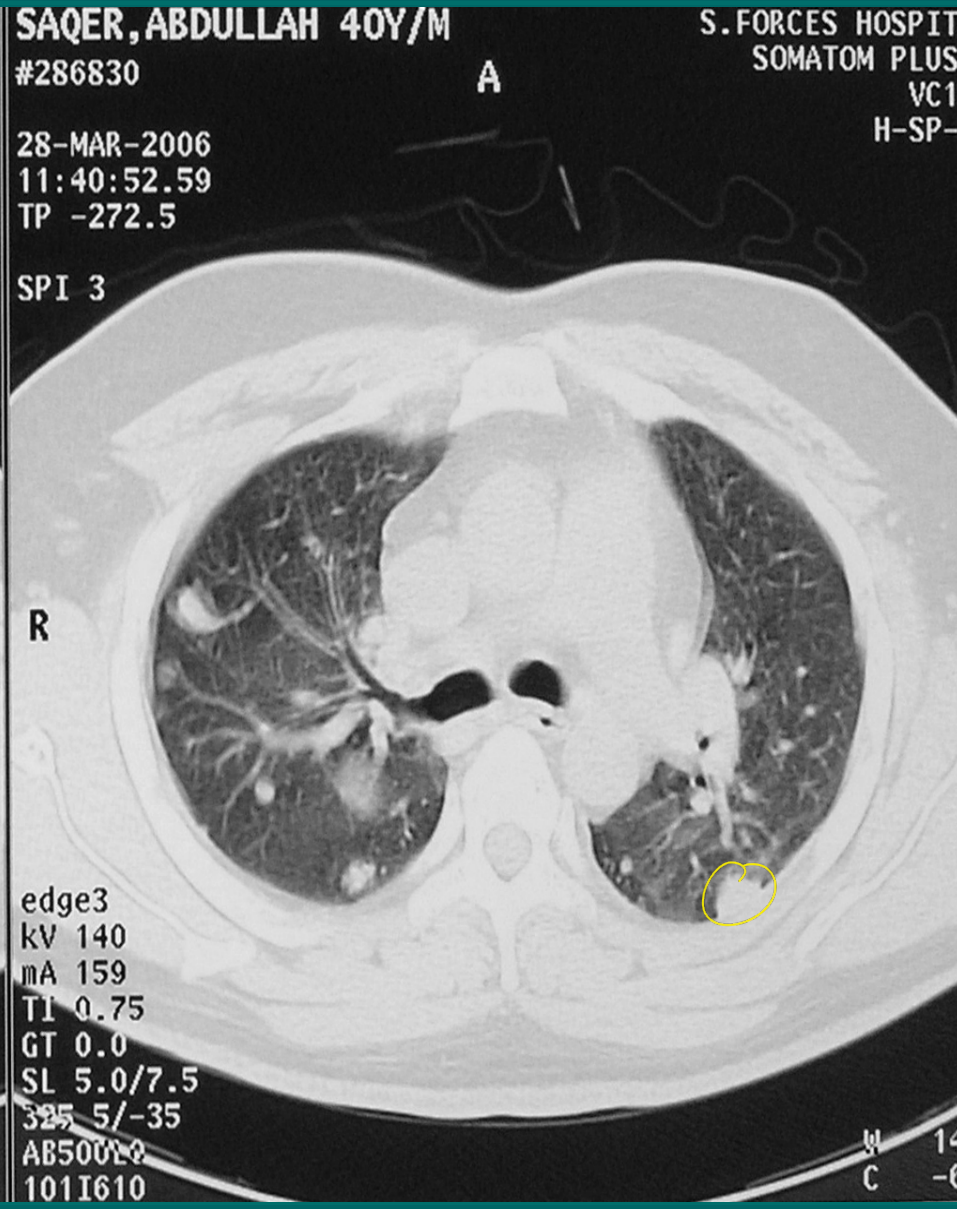
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Chest Trauma
upper Chest Trauma carries risk of injury to vascular structures
Lower Chest Trauma carries risk of injury to liver, spleen & diaphragm

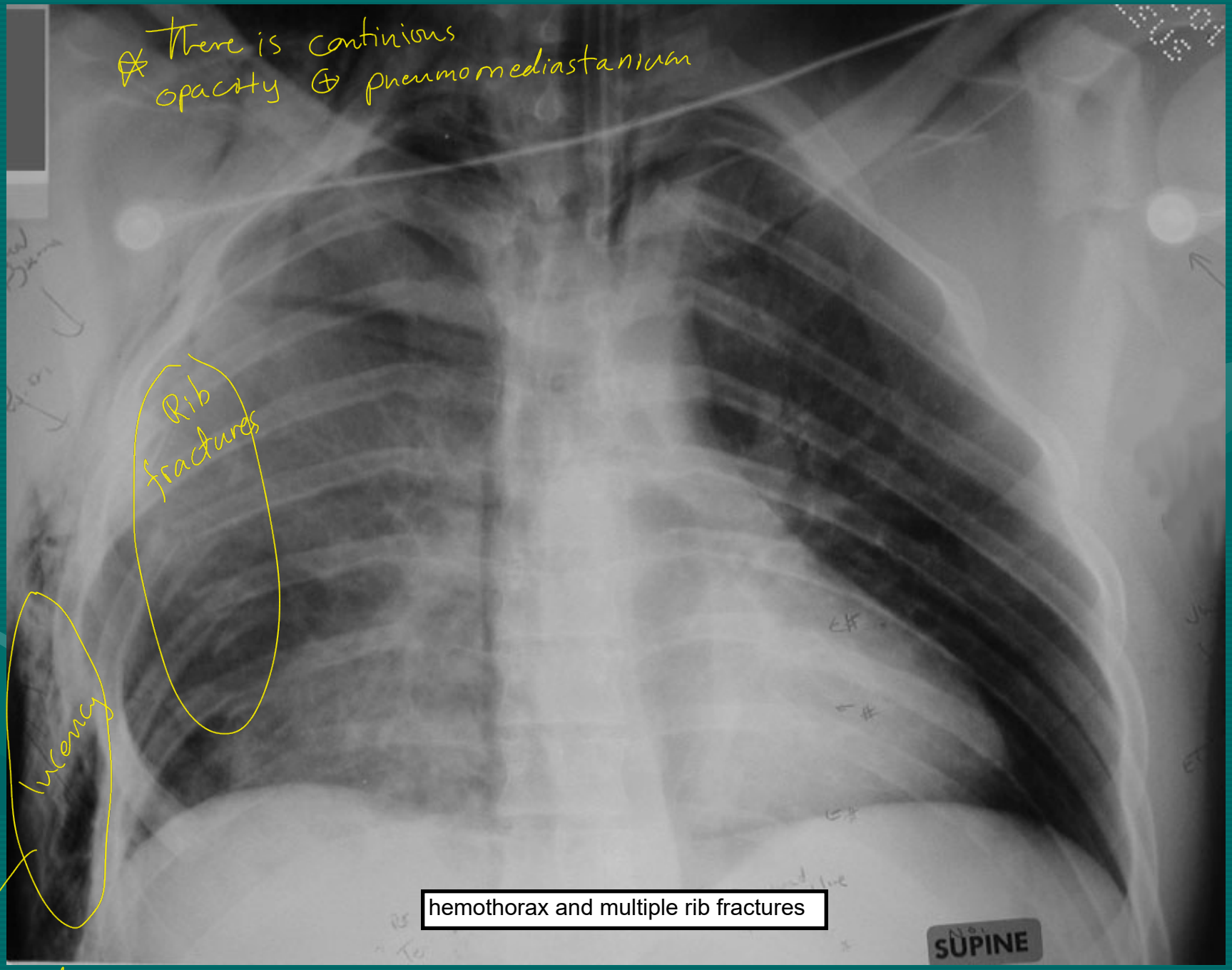
Chest trauma

- Chest trauma can be as blunt or penetrating.
- Penetrating chest trauma can injure vital organs such as the heart and lungs.
- The common clinical problems associated with chest injury include pulmonary contusion, pneumothorax and hemothorax.
- Fractures of the lower ribs may be associated with diaphragmatic tears and spleen or liver injuries
- Fractures of the upper ribs can be associated with injuries to adjacent great vessels.

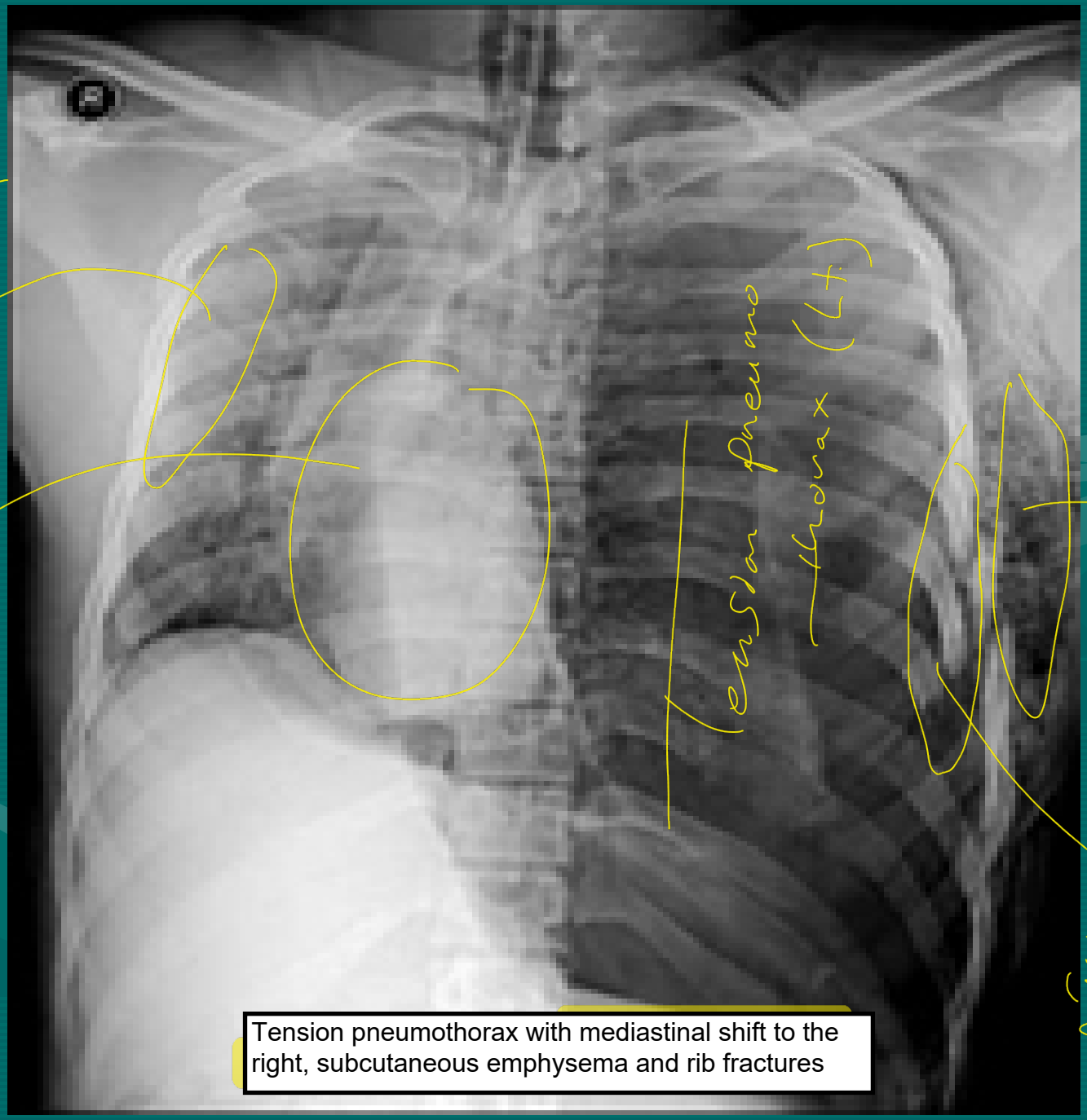
Chest trauma / 2

What is the ABCDE approach to guide the radiographic search for thoracic injury ?

- Air : extra pulmonary (pneumothorax, subcutaneous emphysema, pneumomediastinum).
- Bones – rib fracture, thoracic spine, scapula and sternum fractures.
- Contusions and lacerations in the lung.
- Diaphragm - rupture.
- Effusions – hemothorax.



hemothorax and multiple rib fractures



Tension pneumothorax with mediastinal shift to the right, subcutaneous emphysema and rib fractures


Thank You

NEURORADIOLGY

Dr_Khalil .Abo oura
Dr_Ahmad .Abuain
Radiologest .PHH

Eman Humaidat

4 ventricles: 2 lateral ventricles, connected to the 3rd by the foramen of monro.. 3rd & 4th connected by cerebral aqueduct of sylvius

White matter connecting 2 hemispheres: corpus callosum (rostrum, genu, body, splenium)

CT: you take axial, then reconstruction on the computer to get coronal section
MRI: multiplanar: axial, sagittal, coronal.. (T1, T2 or FLAIR)

Conventional angiography is invasive (like heart catheterisation), it's the gold-standard but is invasive..
So, Angiography using CT or MRI are good substitutes + are non-invasive

Ultrasound: hypo- or hyper- echoic (hyper is bright, hypo is dark)
X-ray: radio-opaque or radio-luscent
CT: hypo- or hyper- dense (bone is hyper-dense , white.. While fluid is hypo-dense)
MRI: signal intensity…

T1>> fluid is hypo-intense (black), WM is white, GM is grey
T2>> fluid is hyper-dense (white), WM is grey, GM is white
FLAIR>> same as T2 but fluid is black (Fluid-attenuated inversion recovery)

Neuroradiology

- Neuroradiology is a subspeciality of radiology focusing on the diagnosis and characterization of abnormalities of the nervous system, spine, head and neck.
- The imaging modalities include:

- **Plain radiography**
- **CT scan**
- **MRI**
- **Angiography**: is being replaced in many instances by MRA
- **Ultrasound:** is used in limited circumstances.

Neuroradiolgy / investigation

Plain film

The plain skull film may reveal:

- Calcification
- Pituitary fossa enlargement
- Bone lesion or secondary deposit.
- Fractures

■ In macroadenoma >1cm .. may cause bone erosions
■ Bone lesions : as in pts of multiple myeloma→ on lateral skull x-ray we may see bone lesions

Very limited role in imaging the brain
We can use X-ray to rule out fracture but we typically use CT scan since it gives a clearer picture about the injury

ULTRASOUND

- The neonatal brain can be scanned through the open anterior fontanelle for:
  - Hydrocephalous
  - Interventricular or intracerebral hemorrhage
  - Suspected intracranial pathology.
- Doppler studies are used for the diagnosis of carotid artery stenosis.

Neonates have the ant & post fontanelles + the mastoid process is cartilaginous – not ossified

★ craniosynostosis : when the sutures or the fontanelle are prematurely closed in infants before the full formation of the brain

★ Treatment by opening the sutures, to allow the baby's brains an adequate space to grow and develop.

★ Doppler for carotid artery : in elderly a calcifications in the carotid artery occurs which lead to narrowing or stenosis in it

CT and MRI

- CT is especially valuable in acute head injury (recent brain hemorrhage), stroke, and suspected subarachnoid hemorrhage.

In acute emergencies, CT is used rather than MRI bcz of it's availability, cost-effectiveness, rapid results + CT is enough in most acute cases

((CT scan doesn't show ischemic changes in the first 6 hrs))
BUT even in ischemic stroke, CT scan is important to exclude haemorrhage (helps the physician to decide whether it's ok to give anticoagulant..) we can use MRI later for the characterisation of the infarction

- MRI scan demonstrate the brain using a multiplanar facility in axial, coronal, and saggital planes, with excellent views for the posterior fossa.

Use CT for detection of haemorrhage in acute events, MRI for anything else… tumours, localisation & timing of ischemic strokes, pituitary lesions >> MRI is better

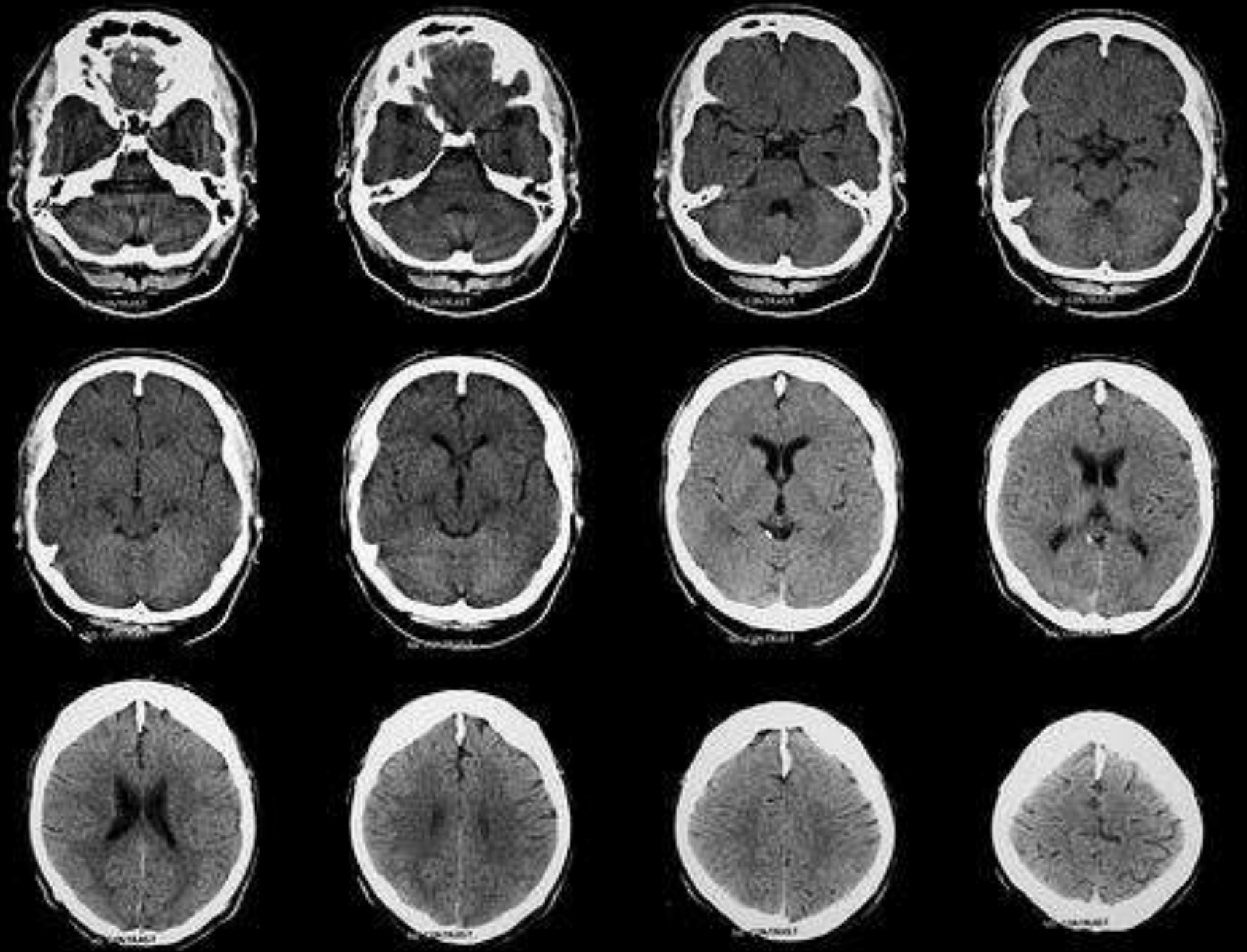
CT and MRI / 2

MRI is superior to CT in:

- Lesions of the pituitary fossa.
- Spinal cord abnormalities.
- White matter disease.
- Demyelinating plaques in multiple sclerosis.
- Differentiation of grey and white matter.

MRI indication:
Lesion in pituitary fossa :MRI for pituitary >>sagittal T1 with and without contrast

CT-scan, axial, normal…
Bone is hyper-dense
Fluid is hypo-dense



Normal MRI, axial

T1...
WM is white
GM is grey
Fluid is hypo-intense (black)

T2...
WM is grey
GM is white
Fluid is hyper-intense (white)

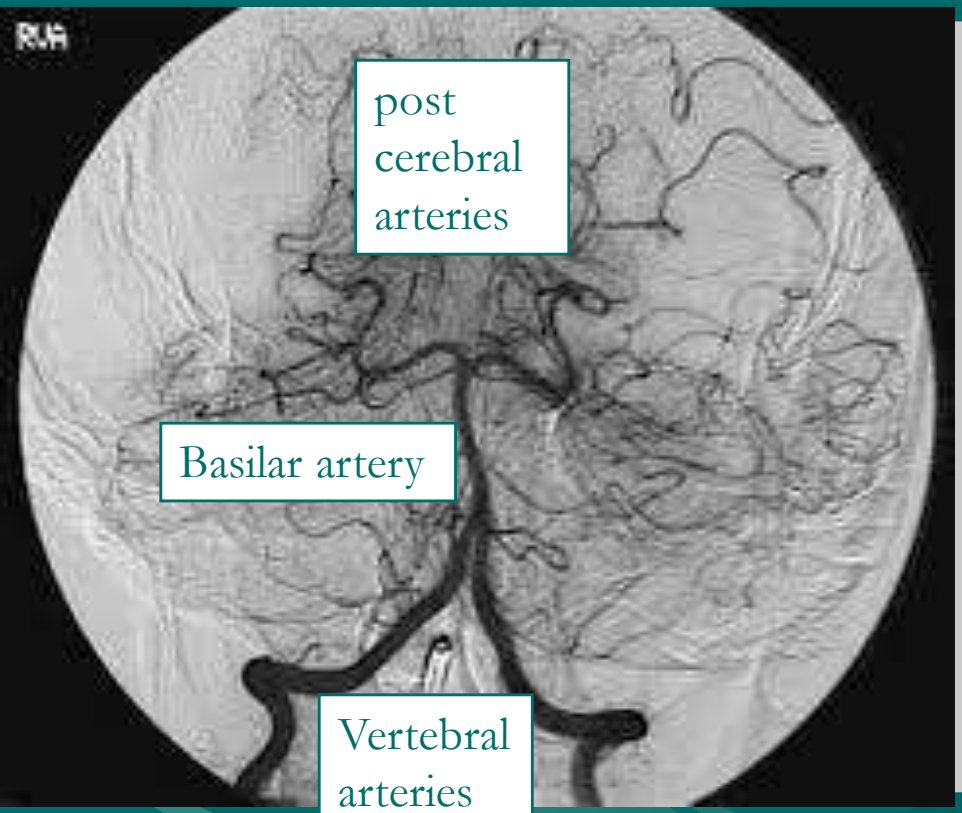
FLAIR...
WM is grey
GM is white
Fluid is hypo-intense (black)

Arteriography

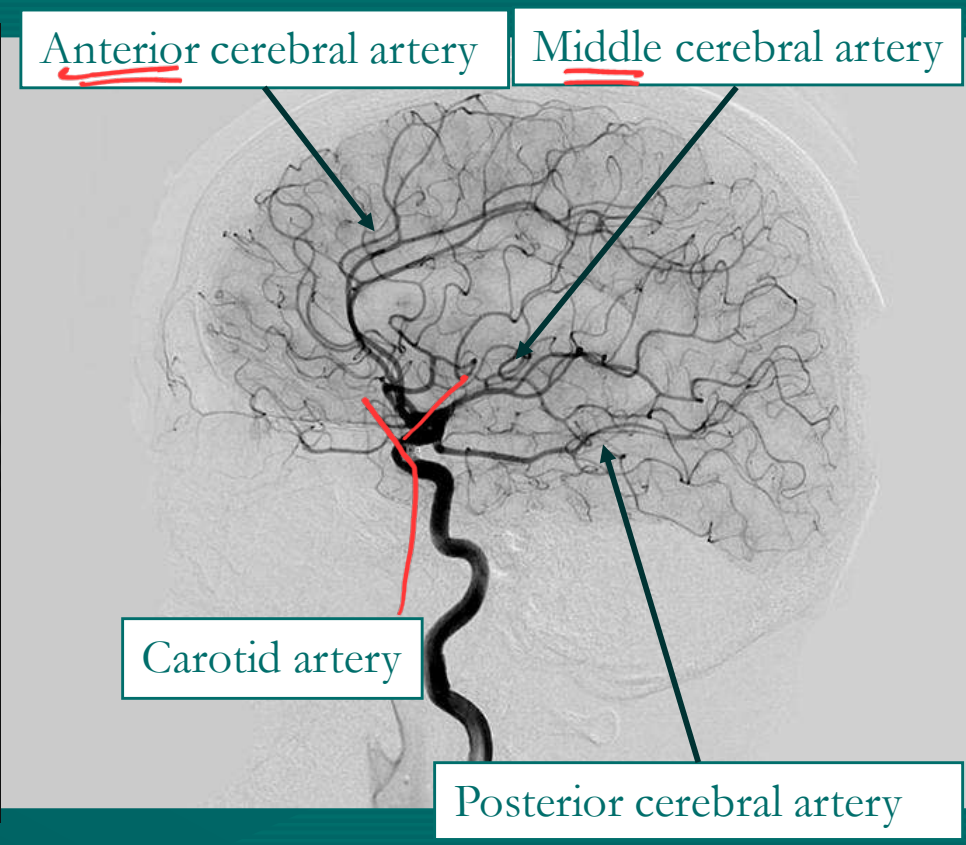
- Cerebral angiogram is useful in evaluation of aneurysm and arterio-venous malformations.
  - Arteriography … if I suspect brain aneurysm or AVM
- CTA and MRA demonstrate cerebral arterial and venous circulation and has replaced conventional angiography in many situations.

MRA can be used without contrast

The posterior circulation – coronal plane



Sagittal plane



Circle of willis can only be seen on transverse plane

BRAIN infarction

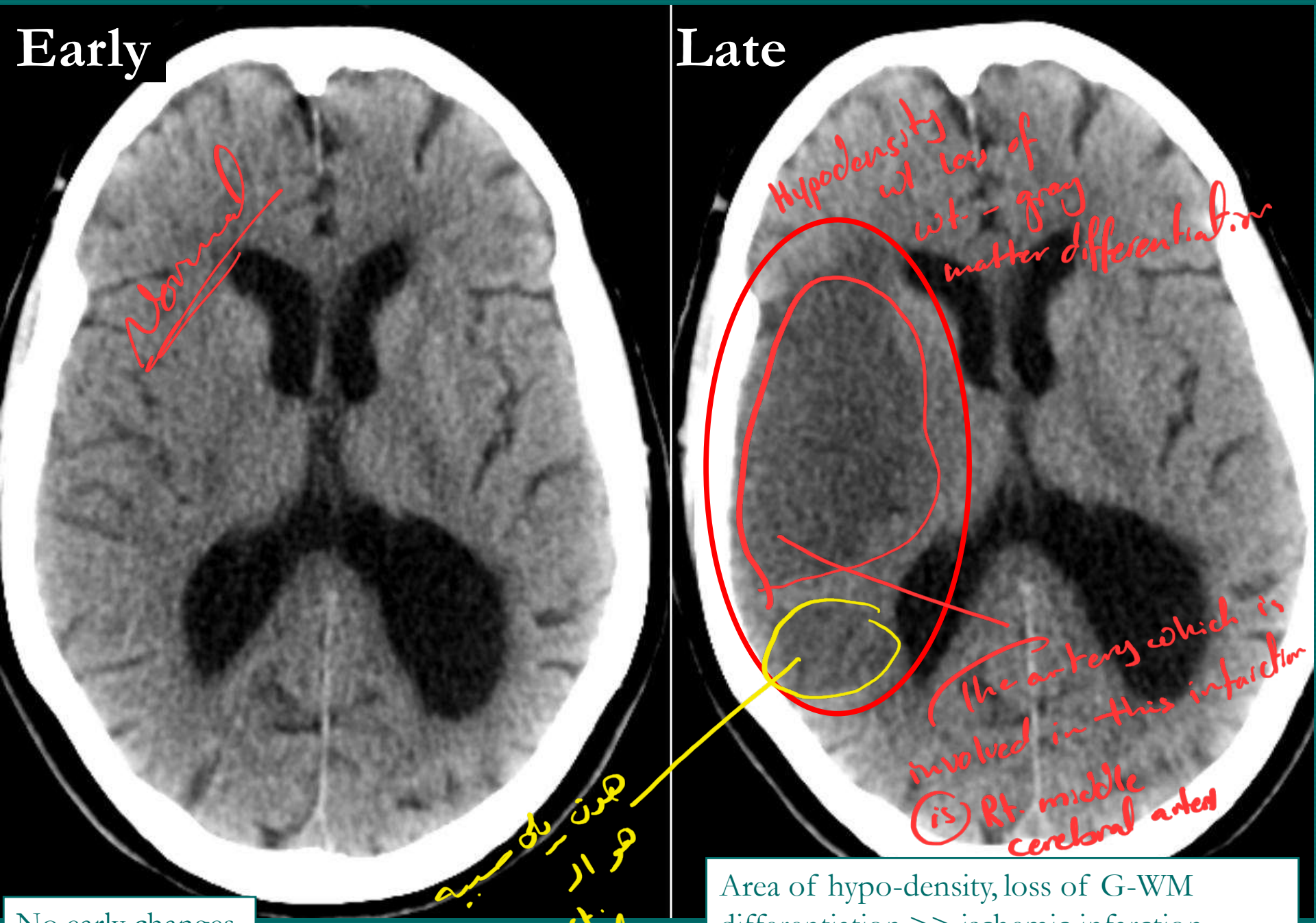
- Ischemic infarction of the brain result from interruption of the blood supply to a portion of the brain.
- The main sign of infarction is an area of decreased attenuation (hypodense) within the cerebral substance with effacement of the adjacent sulci.

- **Hemorrhage** may develop within the infarct, (about 10-15%), and is seen as an area of hyperdensity.

Haemorrhagic transformation>> stop the anticoagulant

Brain oedema involving the grey matter >> enlargement of GM >> loss of grey-white differentiation

Usually, the brain responds to triggers by oedema..
Ischemic infarction >> oedema >> hypo-density on CT (but these changes are late, appear after 6hrs..)
So, ischemia is hypo-dense while haemorrhage is hyper-dense

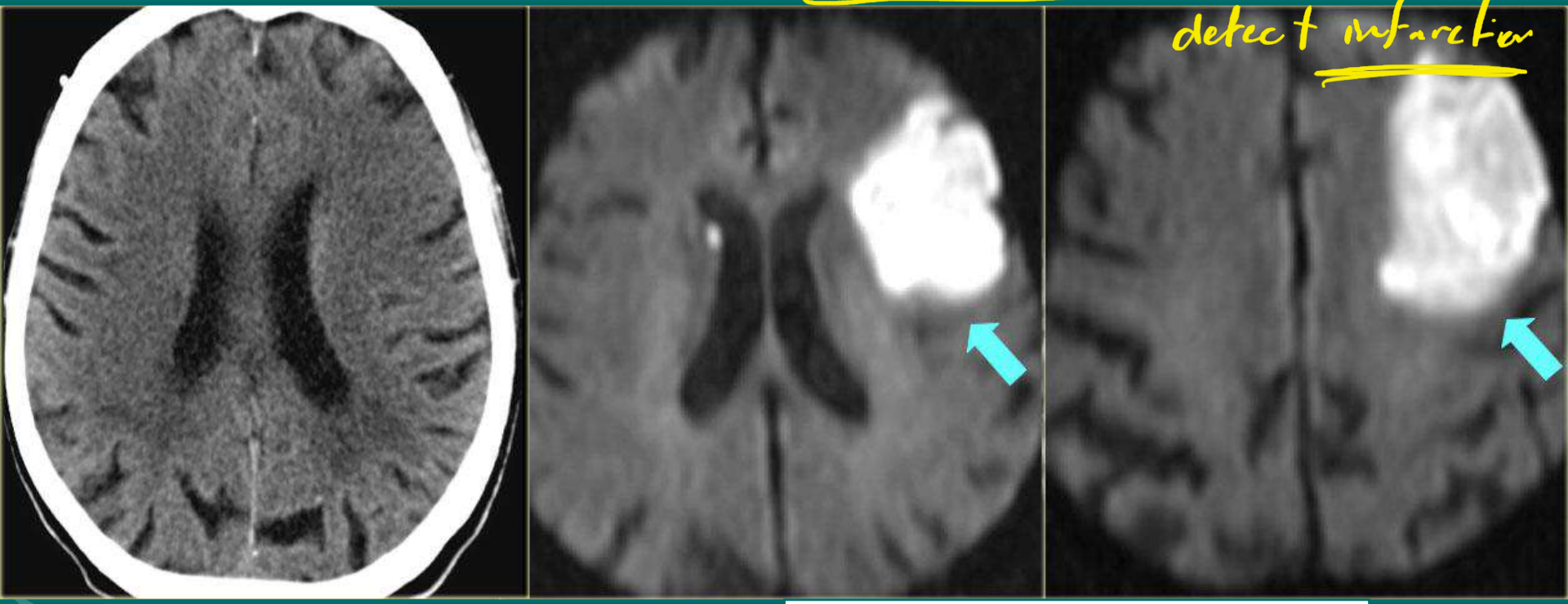


No early changes

Area of hypo-density, loss of G-WM differentiation >> ischemic infarction

CT vs Diffusion

Most sensitive sequence of MRI that is used to detect infarction



No early changes on CT

Diffusion is the most sensitive MRI sequence for detection of early ischemic changes (within minutes) >> shows areas of hyper-intensity

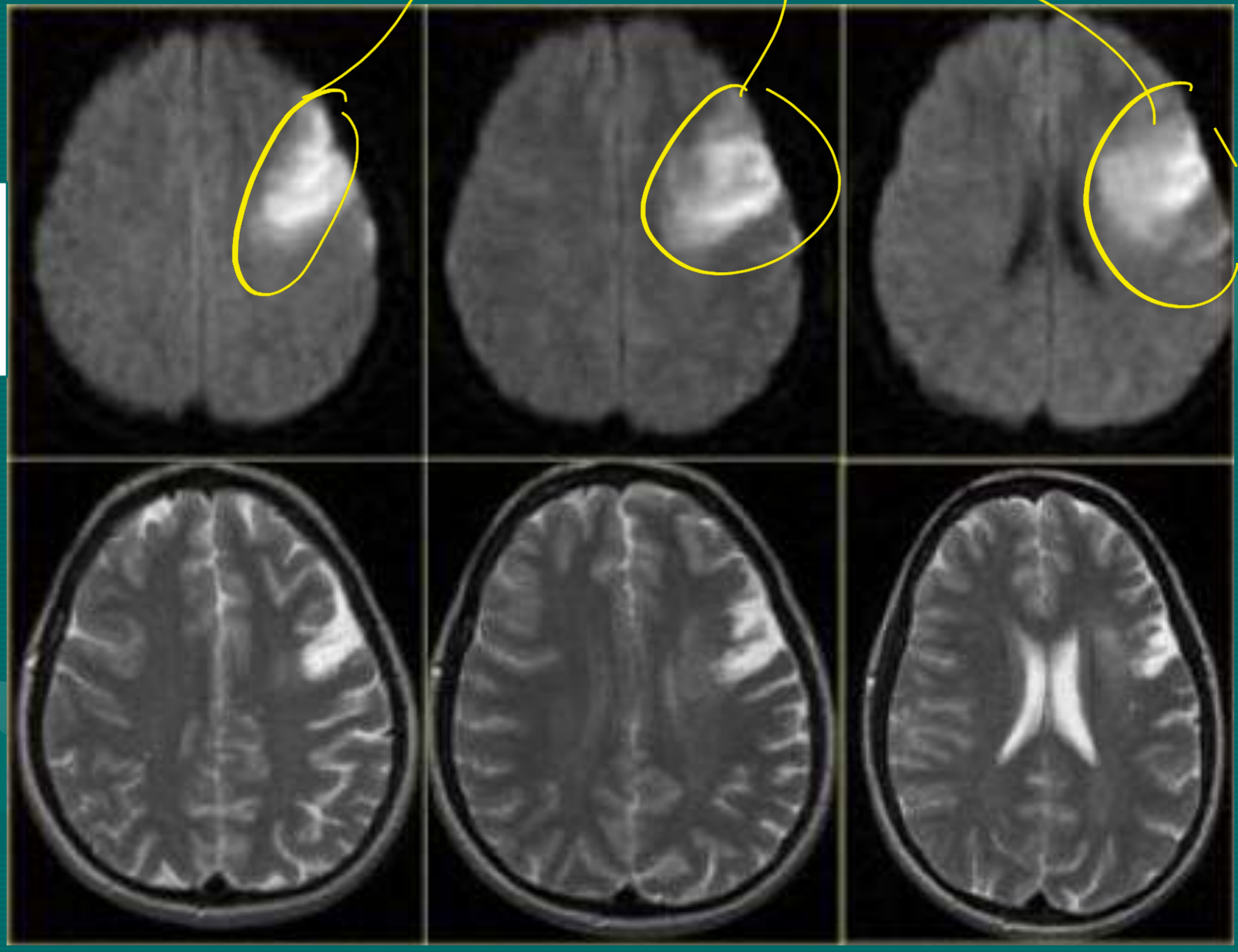
Important note

هكذا الـ infarction ← دة فعل الدماغ هو إنه يصير يكون

Fluid

Diffusion

Very clear ischemic changes within mins



T2

Minimal early changes

Small arteries (like perforators/thalamo-striate arteries) >> small infarcts

Lacunar infarction

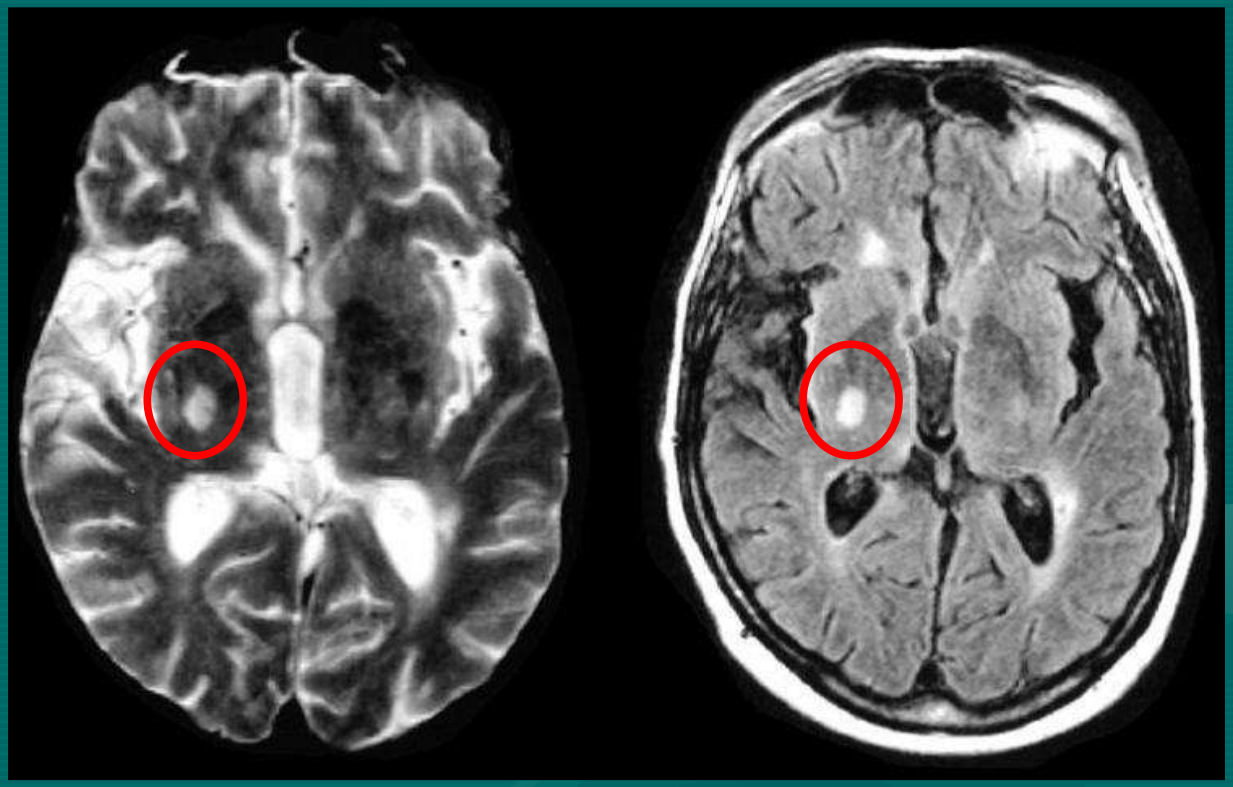
- Lacunar infarcts are small, deep cerebral infarcts, occur as a result of occlusion of small distal intracerebral arteries.
- Lacunar infarcts are usually less than 1cm in diameter and appear in the region of the internal capsule, basal ganglia, thalamus and brainstem.

deep areas

- Lacunar infarcts are commonly seen in patients with small vessel disease.

Small vessel dzs: HTN/DM/small vessel vasculitis

CT scan.. Late ischemic changes



MRI diffusion ??

Lacunar infarct at basal ganglia

CT and MRI in brain infarction

Why CT is the modality of choice for the initial evaluation of stroke ?

- CT is superior to MRI in detecting recent brain hemorrhage, and the role of CT is to exclude the presence of intracerebral hemorrhage, because the treatment of an infarct will differ depending on whether hemorrhage is present or not.
- MRI is superior and more sensitive than CT in the evaluation of any kind of edema and for the detection of acute infarction.

Brain hemorrhage

- Intracerabral hemorrhage:

Usually takes the shape of the structure affected

Is bleeding in the brain caused by rupture of a blood vessel.

- May occur in any part of the brain, but the frequent sites are: basal ganglia, thalamus and cerebellum.
- A third of intracerebral bleeds result in intraventricular hemorrhage.
- **Most common causes are:**

Usually affects basal ganglia, brainstem, cerebellum..
Usually taking the shape of these structures

- Chronic hypertension
- Rupture aneurysm or arterio-venous malformation

You need to determine the cause for the management
HTN >> treated medically
Aneurysm/AVM >> treated surgically

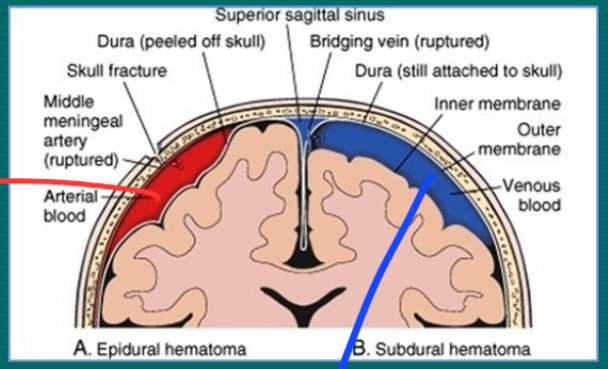
On CT scan >> haemorrhage is hyper-dense acutely, (hypo-dense later?)

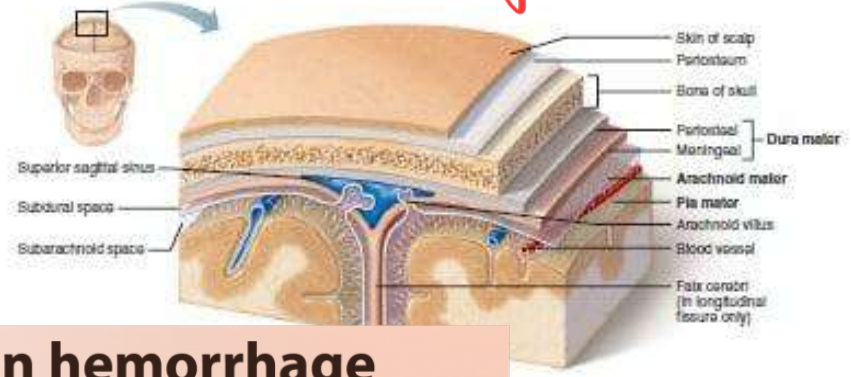
- Intracerebral hemorrhage

CT scan
Haemorrhage is hyper-dense.. Taking the shape of basal ganglia >> HTN

Intracranial Hematomas Head injury

- Intra parenchymal hematoma
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage

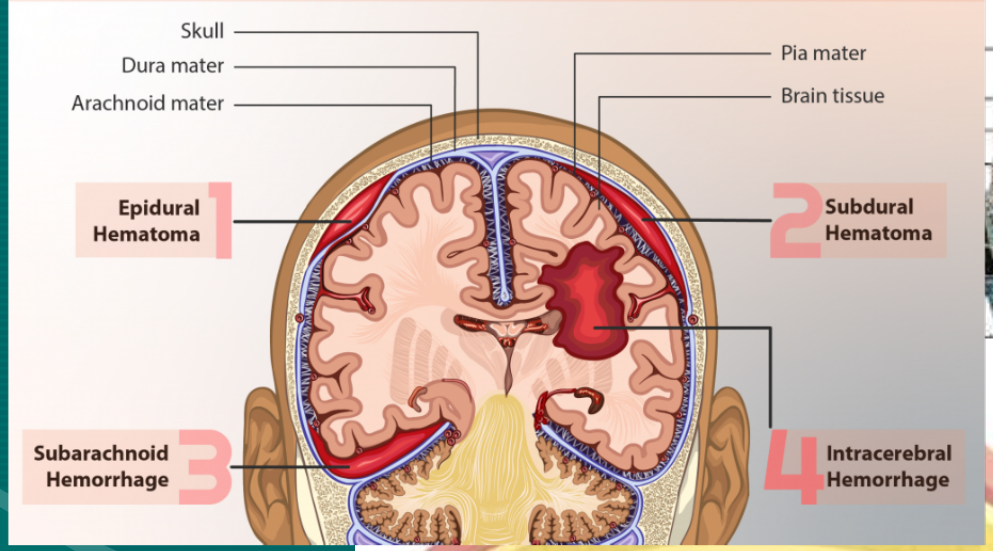


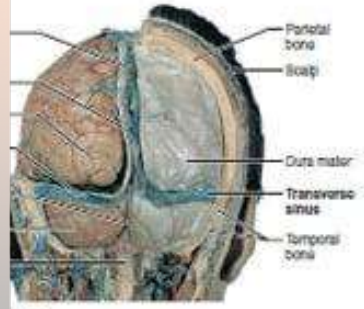


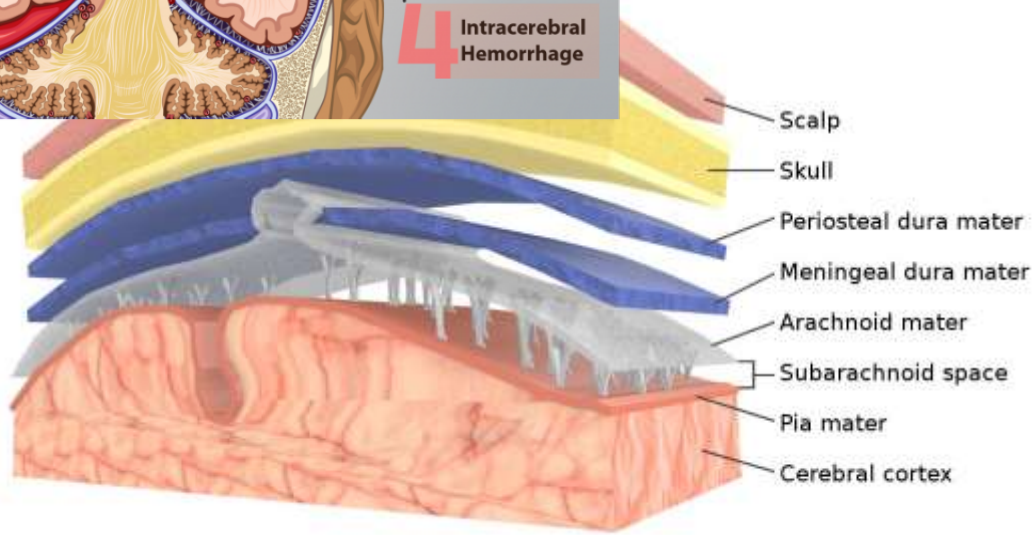
Wide space

* Usually associated with trama NOT fractures.
* Venous in its origin (∴ slow) لهيك بتاخد كل المكان اللي حوليها
Crescent shape.
* In chronic phase بتكون Hypodense: لانه الدم بصير له liquification (fluid جوا)
* In acute phase
↳ Hyper dens.

Types of brain hemorrhage







Epidural Hematoma

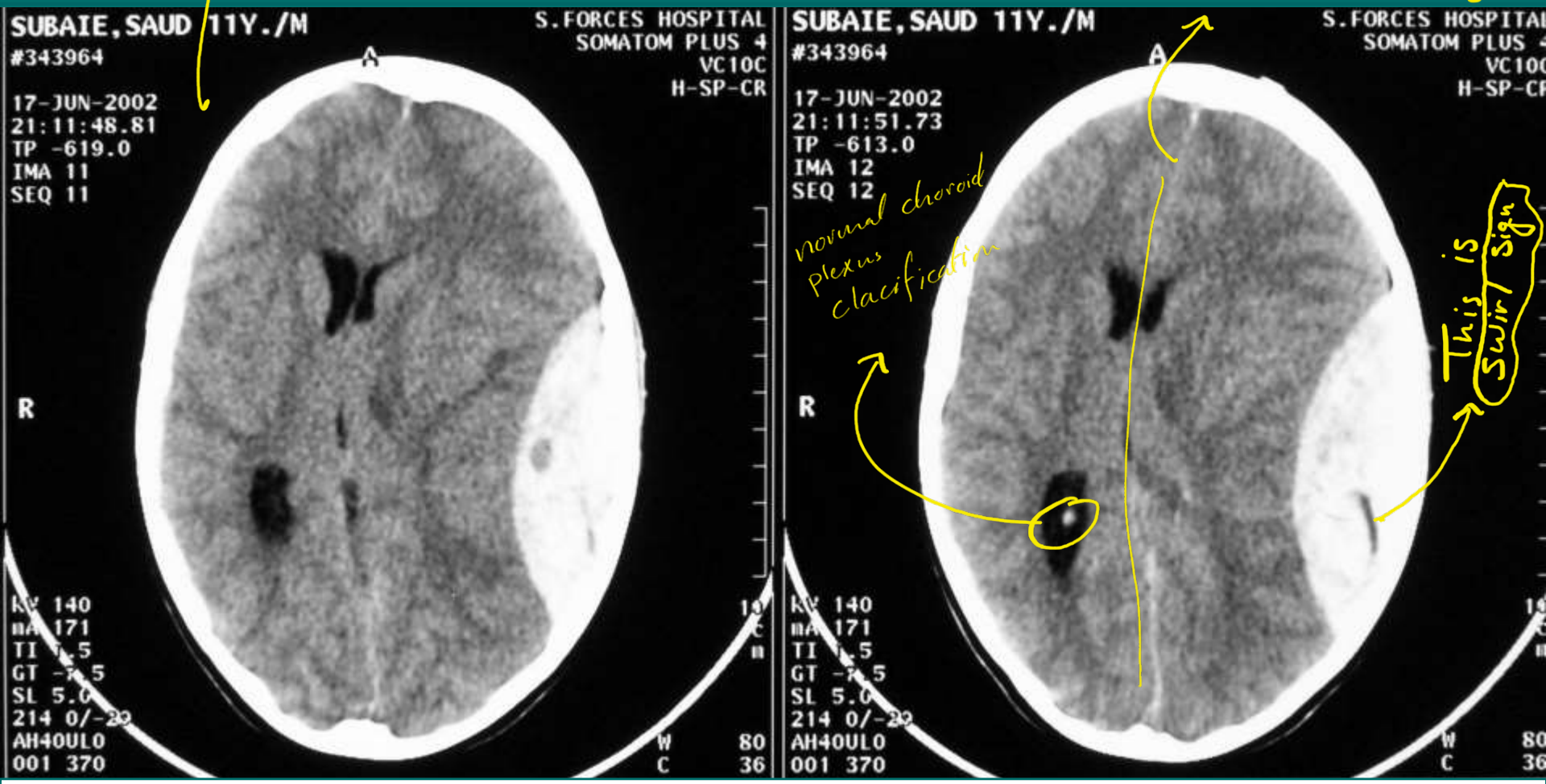
- Collection of blood between the inner table of the skull and the dura
- Most often occurs as a result of an arterial injury, usually middle meningeal artery or one of its branches, and therefore are usually temporo-parietal in location.
- The typical CT appearances of epidural hematoma is biconvex or lenticular, high density lesion.

Dura is attached to sutures >> epidural haematoma is limited in that space >> appears biconvex
It's usually caused by fractures/trauma
Blood is arterial
Most commonly temporo-parietal

* Always. You should refere the pt. for ER hospital ⟹ لانه التزيف قاعد يضيق مجال arterial

Haemorrhage is typically homogenous
Sometimes it's not >> SWIRL SIGN
Since the space is limited, and blood is arterial in origin (there's a high blood flow) >> blood swirls within this space
These swirls appear as hypo-dense areas within the hyper-dense are of haemorrhage

Epidural haemorrhage – arterial blood – high blood flow – actively bleeding lesions >> this may eventually cause herniation



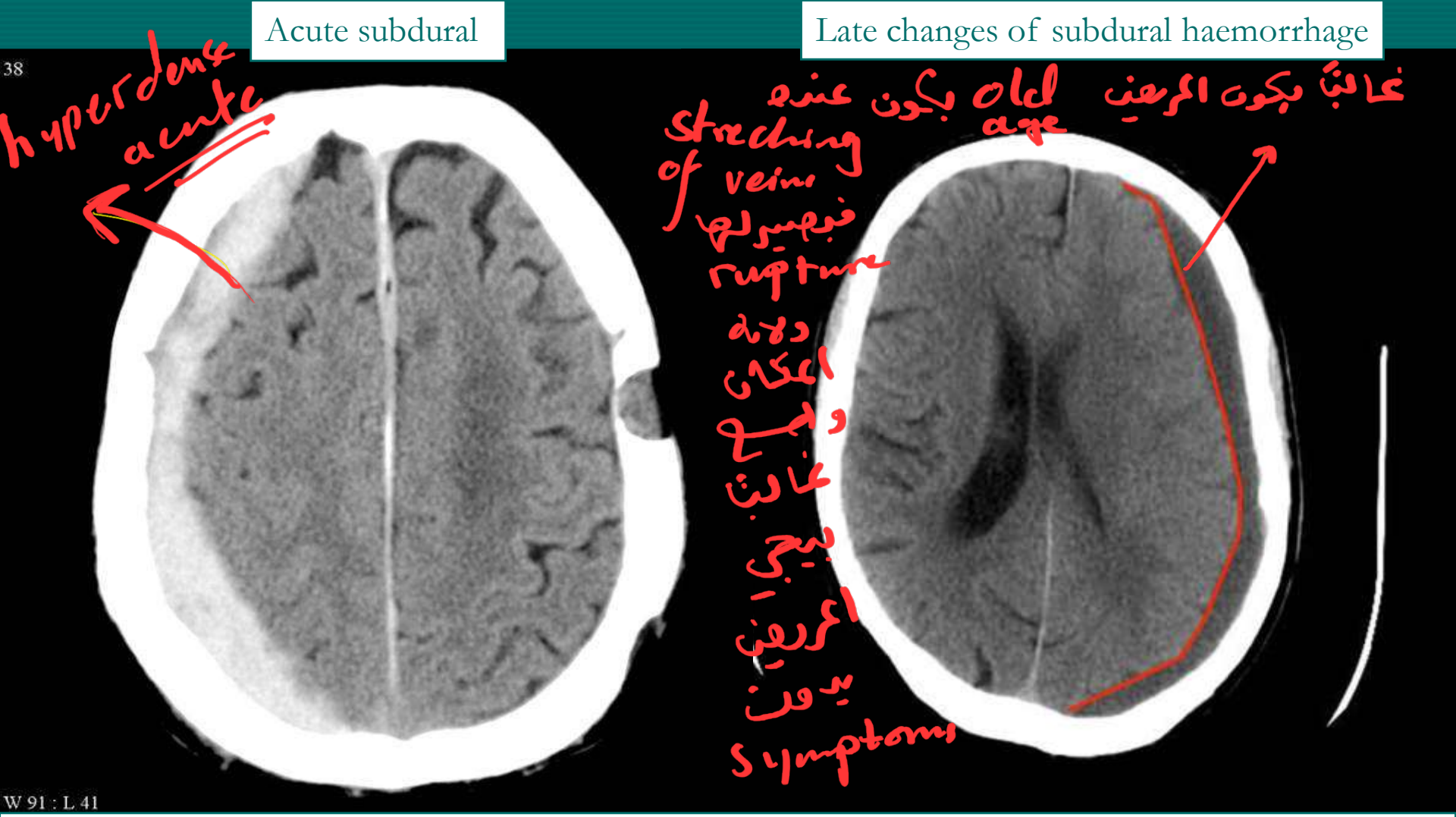
This is brain CT scan, ventricular level, young male pt.. Well defined biconcave hyperdense area in the parieto-occipital lobe of the left side causing shifting of the midline to the right side and compression of the left-side structures. It is epidural haematoma

Subdural Hematoma

- Collection of blood between the dura and arachnoid
- Result from venous injury, usually tear of the bridging cerebral veins within the subdural space.
- The characteristic appearance of acute subdural hemaotma on CT is hyperdense crescent-shaped collection with concavo-convex configuration.

Occur in extremity of ages very old or very young
Very old: have brain atrophy and stretched veins may be spontaneous or due to minor trauma
In young, maybe a major trauma
Usually not related to fractures
Blood is venous
Not limited by the sutures >> crescent shape

in acute: hyperdense crescent shape
in chronic : hypodense due to liquefaction; all cells becomes in fluid status (bcz it's venous blood)
as patient is lying on bed so cells and fluid accumulate posteriorly >> the hematoma appears more hypo-dense anteriorly but more hyper-dense posteriorly

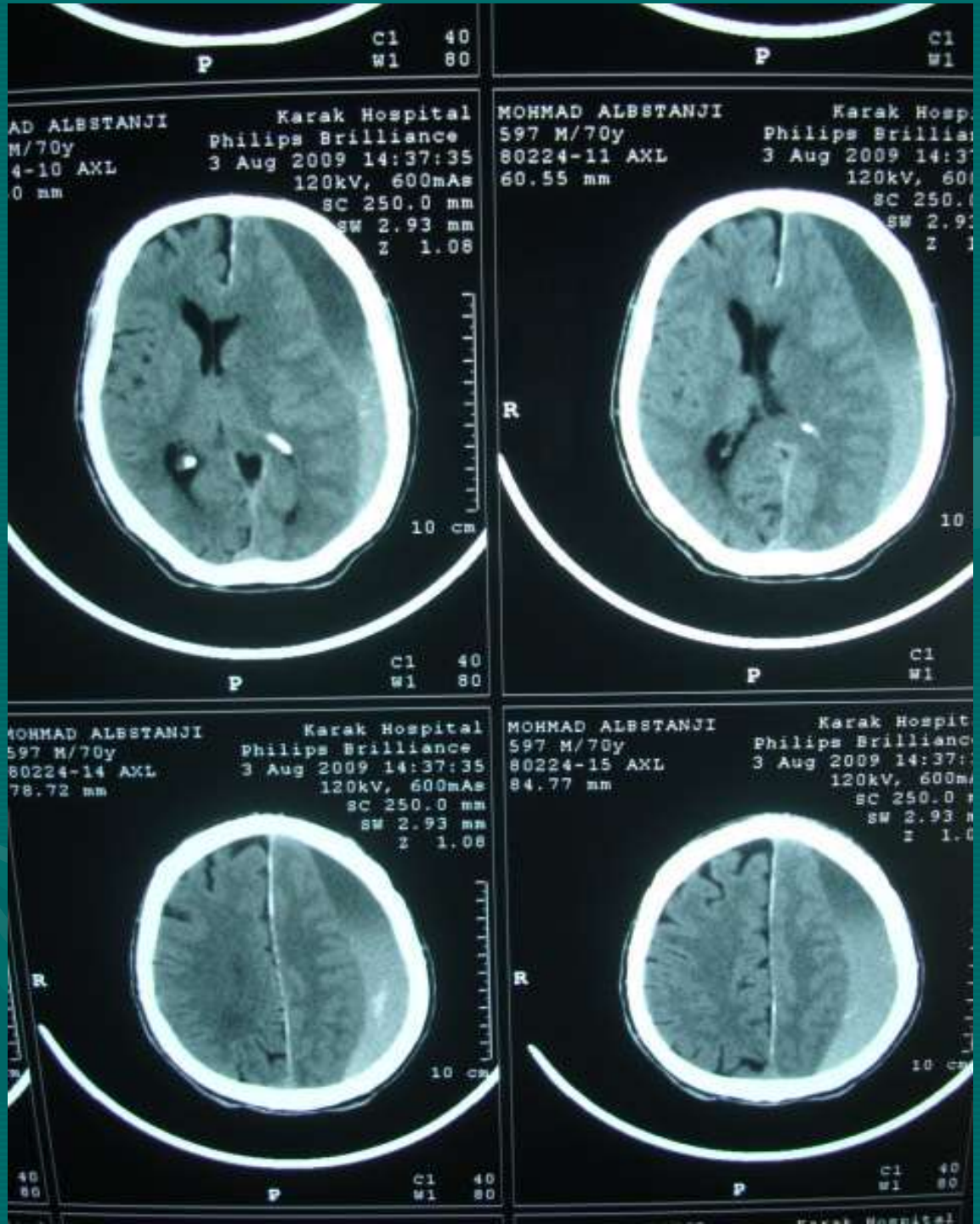


Epidural vs subdural haematoma…

Epidural must be immediately referred to tertiary centre with neurosurgery unit.. Bcz the blood is arterial (high flow) it may rapidly deteriorate.. Pt must be continuously monitored there, since at any moment a surgery may be required..

While subdural haematoma is venous, should be referred but we're not as much in a hurry.. Since it may progress rapidly but may also stop with proper medications and monitoring

Also subdural - late



Sub. arachnoid spaces
1) btw sulci & gyri
2) basal cisterns
موجودين حوالين ال brain stem
(Pons . medulla ...)

Subarachnoid Hemorrhage

- Hemorrhage into the CSF spaces, and frequently present in the acutely injured patient.
- SAH appear as hyperdensities filling the CSF spaces (basal cisterns, cerebral sulci, sylvian fissures and interhemispheric fissure).
- Subarachnoid hemorrhages are most often the consequence of penetrating injury, rupture aneurysm and systemic hypertension.

Most common cause is traumatic (penetrating injury)
But most common non-traumatic is rupture aneurysm

small peri aneurysms

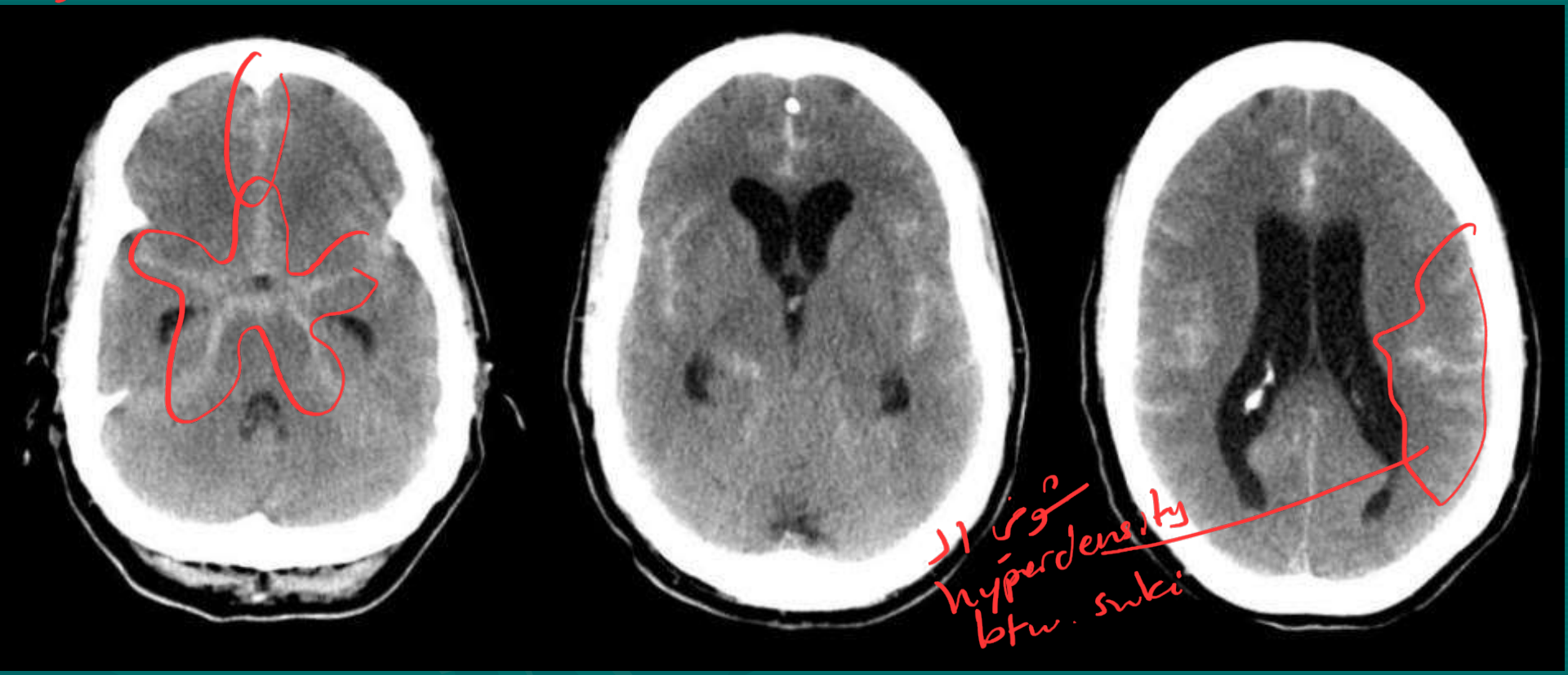
Best seen using MRI T2 star sequence (hypo-intense).
But it's quite expensive and not always available..

Signs of SAH: vomiting ,meningeal(sings like neck stiffness) sever sudden headache→ The worst headache

On CT, CSF spaces normally appear hypo-dense.. In SAH, you find areas of hyper-density

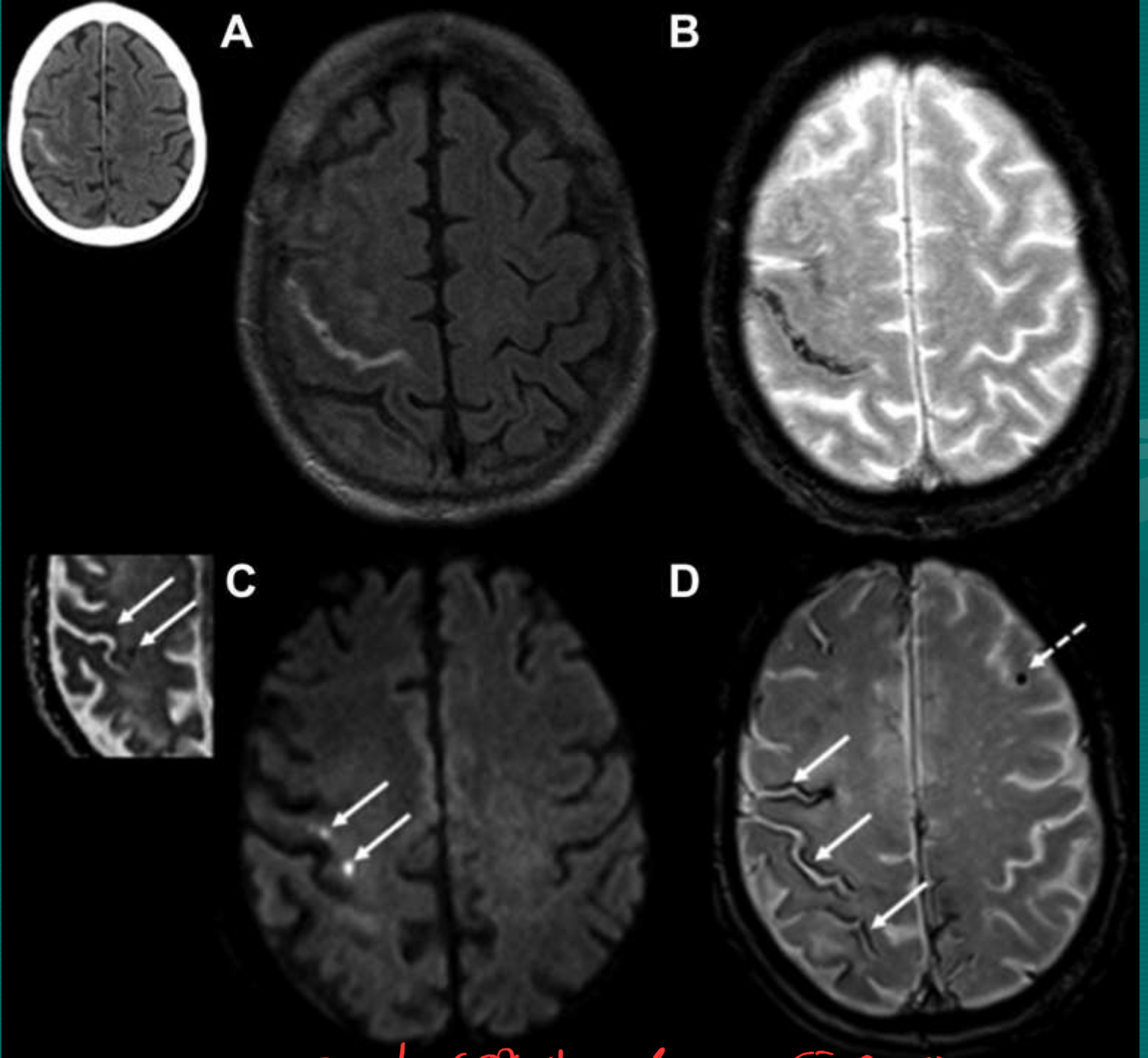
* Large aneurysm will cause subarachnoid .

Muti-axial CT, multiple areas of hyper-density filling the sulci



http://casemed.case.edu/clerkships/neurology/Web%20Neurorad/SubarachnoidHemorrhage3.htm

T2 star sequence is the most sensitive to pick subarachnoid hemorrhage. BUT in emergency → CT



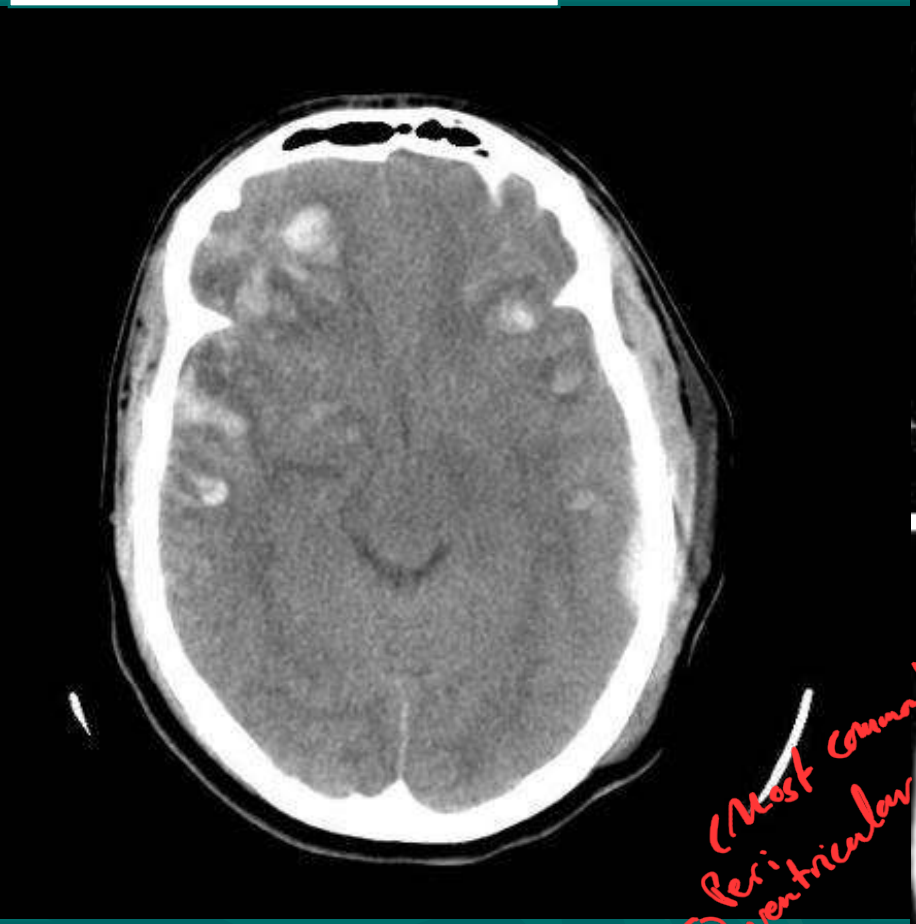
MRI

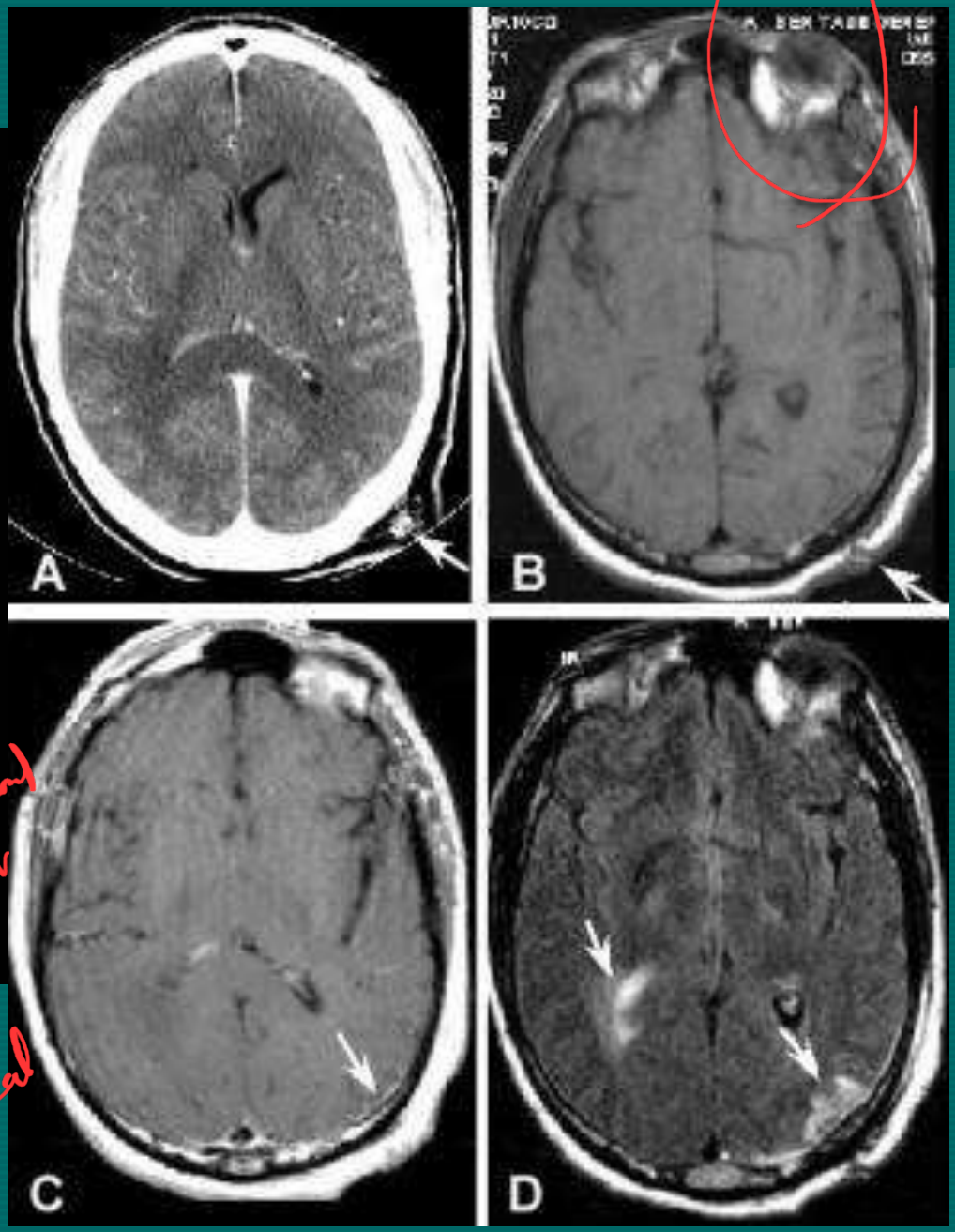
Cerebral Contusion

- Bruising or crushing of brain tissue.
- Two types of cerebral contusion:
  * nonhemorrhatic (necrotic)
  * Hemorrhagic
- The hemorrhagic areas may not be evident in the very acute stage or in the first 24 hours.

Usually due to acceleration-deceleration like car accidents >> shearing of axons >> brain respons to triggers by oedema >> multifocal areas of hypo-density on CT >> within these areas there may be haemorrhage (haemorrhagic contusions) >> areas of hyper-density within hypo-density

Hyper- within hypo-density





auto immune dis

white matter affecting the myelin

to ① Peri ventricular (Most common)

② sub cortical

The most common WM dz

Multiple sclerosis (MS)

MRI is the most sensitive to pick it.

- **MS is a white matter disease**, affects areas of the brain and spinal cord, destroying the fatty layer (the myelin sheath) which wraps around nerve fibers, resulting in areas of demyelination.
- Most common in young people and about two thirds of patients are female.
- The demyelinating lesions (plaques) present with a characteristic relapsing and remitting course.

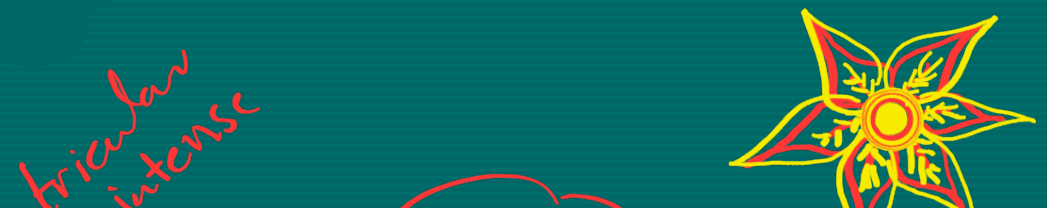
* Most common form of MS is Relapsing

CT may not show lesions.. we should also do MRI for spinal cord.
-Hyper-intensty lesions in the deep white matter/ subcortical white matter mostly periventricular and perpendicular to the lateral ventricles
-Flair is the best sequence.. used with contrast to detect active lesions this is important in follow up during treatment

hyperintense regions on T2 & flair

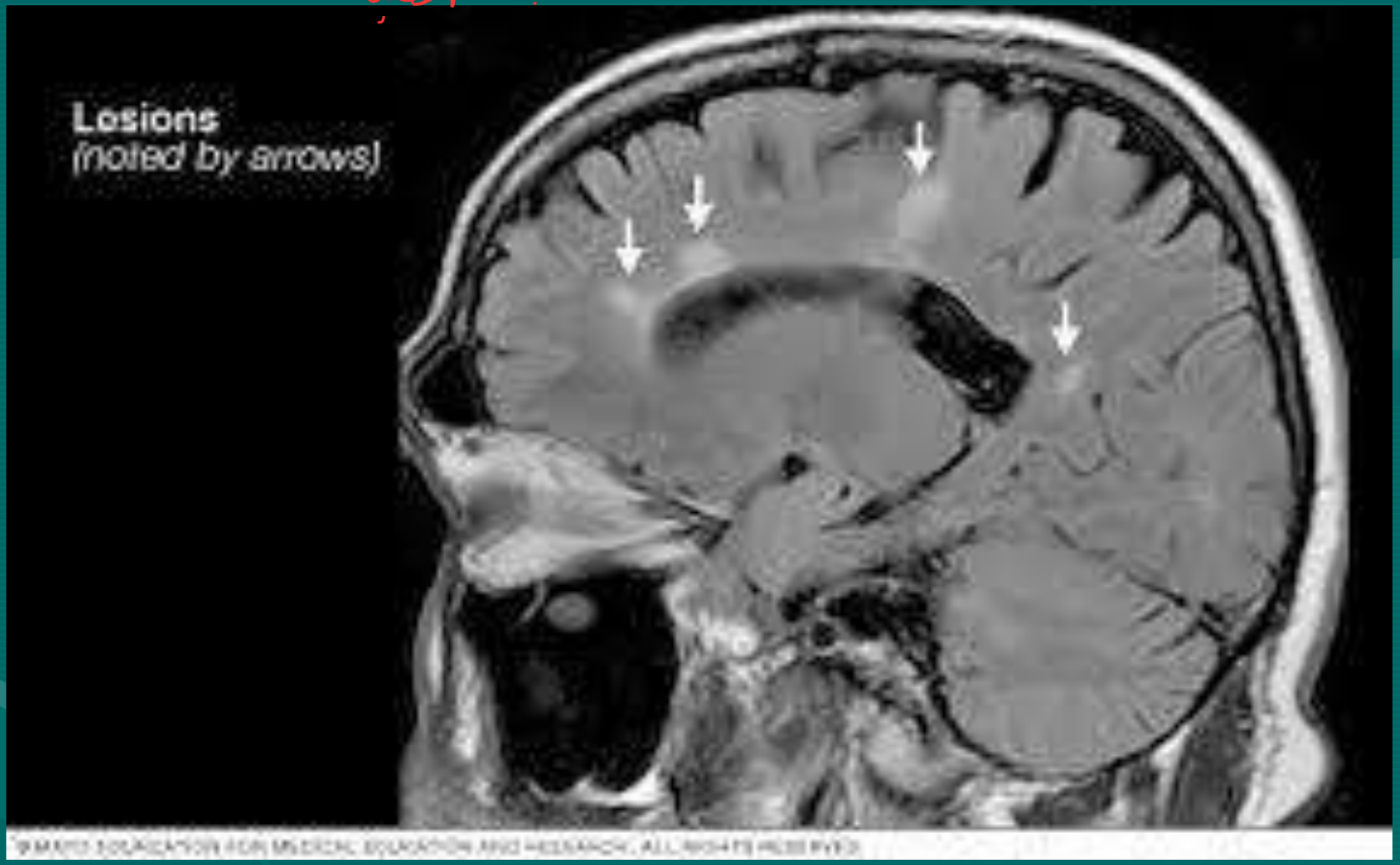
Multiple sclerosis / 2

- **MRI is the investigation of choice.**
- The demyelinating plaques appear as focal discrete areas of abnormal high signal intensity on T2-weighted images.
- The common location of plaques are in the periventricular region, corpus callosum, and to a lesser extent in the brain stem, cerebellum, optic nerves and in the spinal cord.
- Contrast enhancement of the plaques indicate active disease.



On T2, both CSF and the lesions are hyper-intense >> we may miss the lesion
That's why FLAIR is the sequence of choice for MS, as it supresses the CSF so we can see the lesions more clearly

*Contrast is imp. in MS
to know if the lesion is active or not
(بناخد الصبغة)



Brain Tumors

Metastasis can be intra- or extra- axial

Primary brain tumors can be classified as:

Intra-axial tumors:

arising in brain parenchyma. [*Glial tumors]

Extra-axial tumors:

arise from cells outside the brain, such as the meninges and cranial nerves.

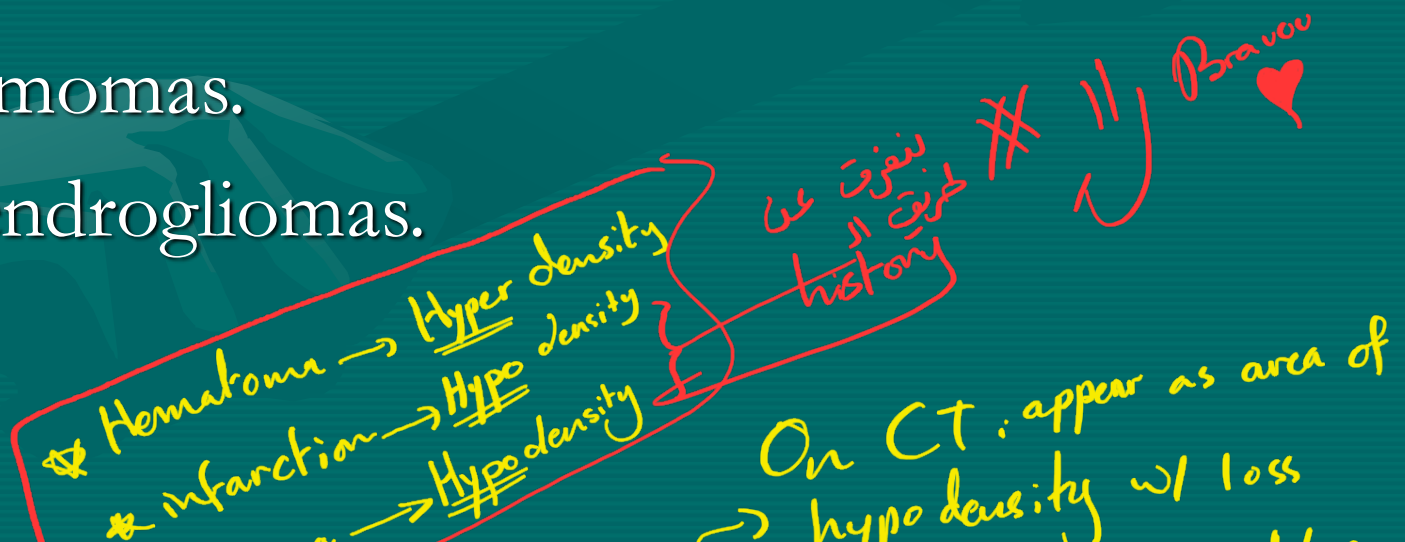
Most common primary brain tumours in adults : Supratentorial tumours
Most common primary brain tumours in children : infratentorial tumours
Tumours can be seen without contrast but we always use it to intensify the picture(low grade tumours there is no enhancement but grade 4 there is enhancement)

Brain tumors / 2

GLIOMAS:

More than 50% of primary intracranial tumors are gliomas, and constitute a heterogenous group of tumors including:

- Astrocytomas.
- Ependymomas.
- Oligodendrogliomas.

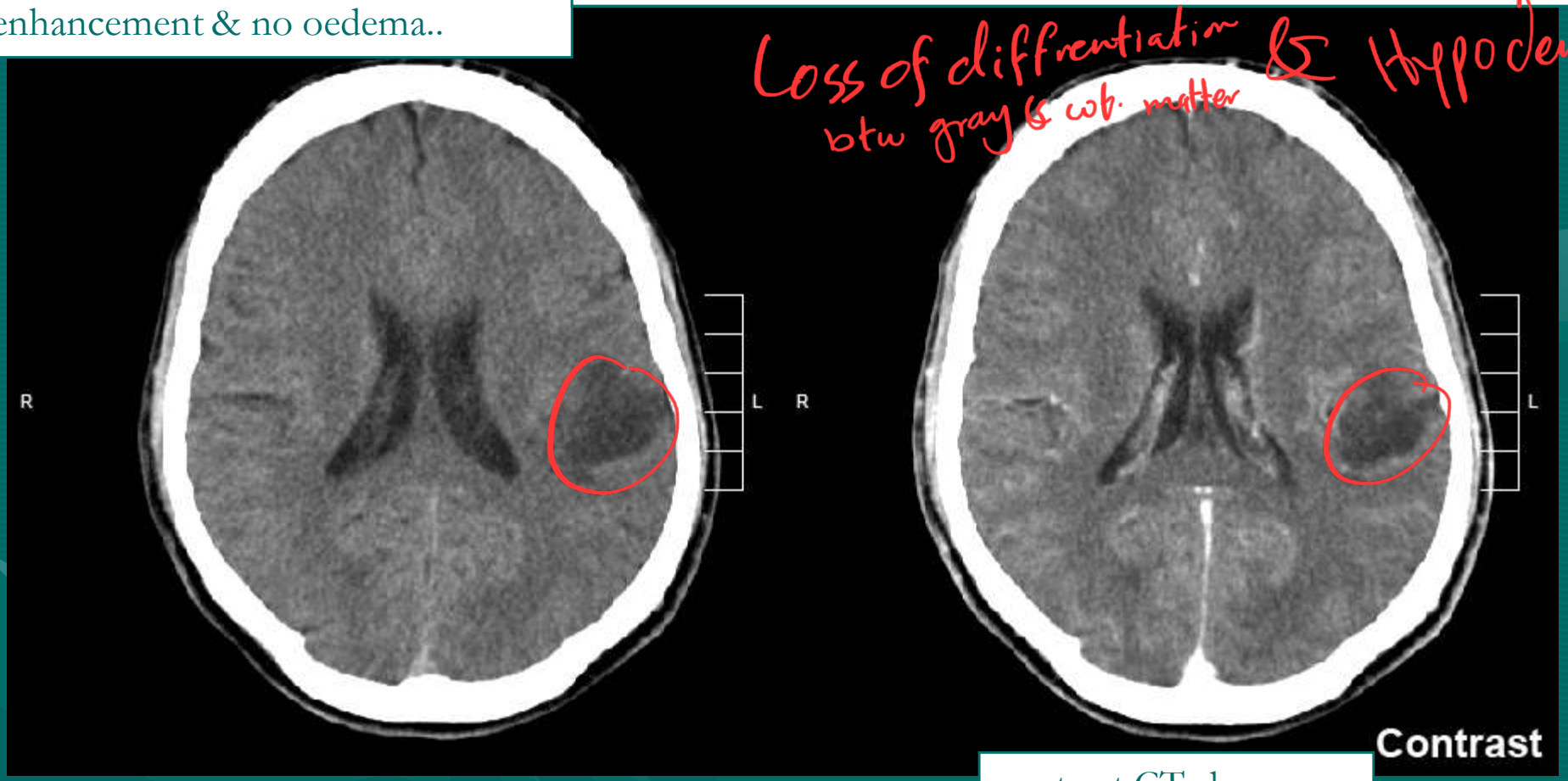


Astrocytomas

- Arise from astrocytes
- Graded into four grades depending on the severity and prognosis (grade I favourable prognosis and grade IV worst prognosis)
- The low grade astrocytomas are most commonly in young adults.
- The high grade astrocytomas (grade 1V) are called glioblastoma multiforme.

MRI is the best for brain tumours but we can use CT scan. Low grade gliomas on CT appear as areas of hypodensity.. With no contrast enhancement & no oedema..

Areas of hypodensity could be infarction or tumour – diagnosis depends on history
Acute onset of weakness/paraesthesia >> probably infarction
History of headache for a long time>> tumour

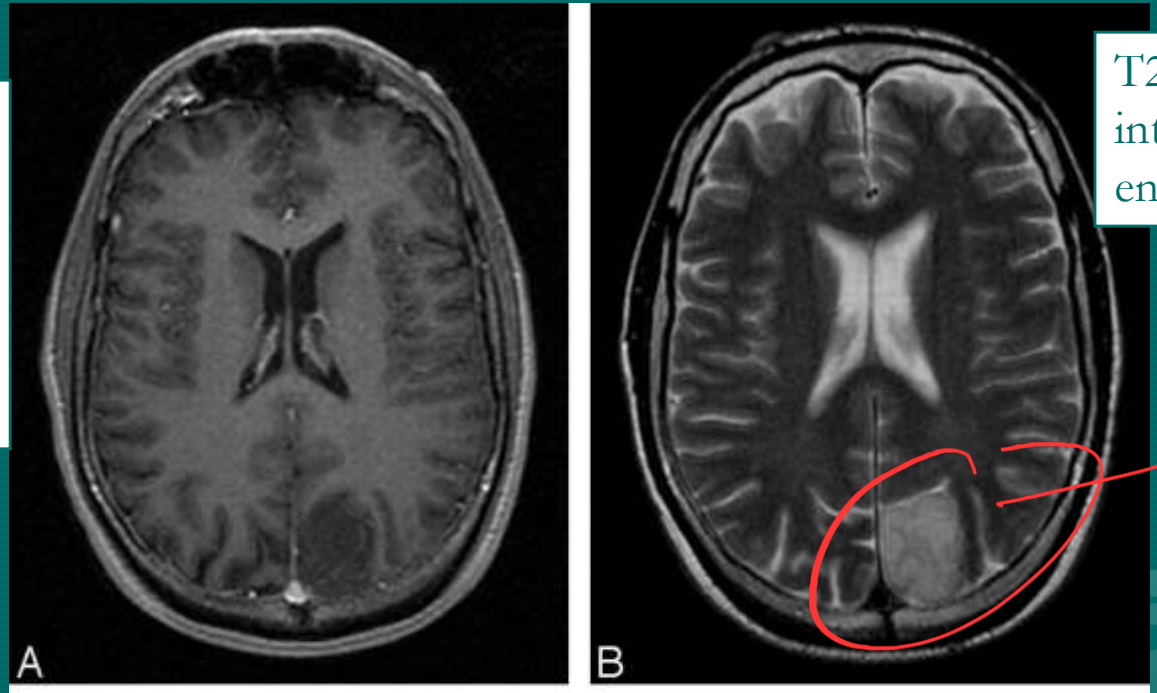


-the superior sagittal sinus with contrast is enhanced so there is no thrombosis if its not enhanced it will give empty delta sign
-NEXT STEP is MRI

contrast CT shows low grade tumor- no shift, no enhancement, not haemorrhage, lesion is well defined

T1.. Hypo-intense.. No contrast enhancement.. Well-defined, no oedema >> low-grade glioma

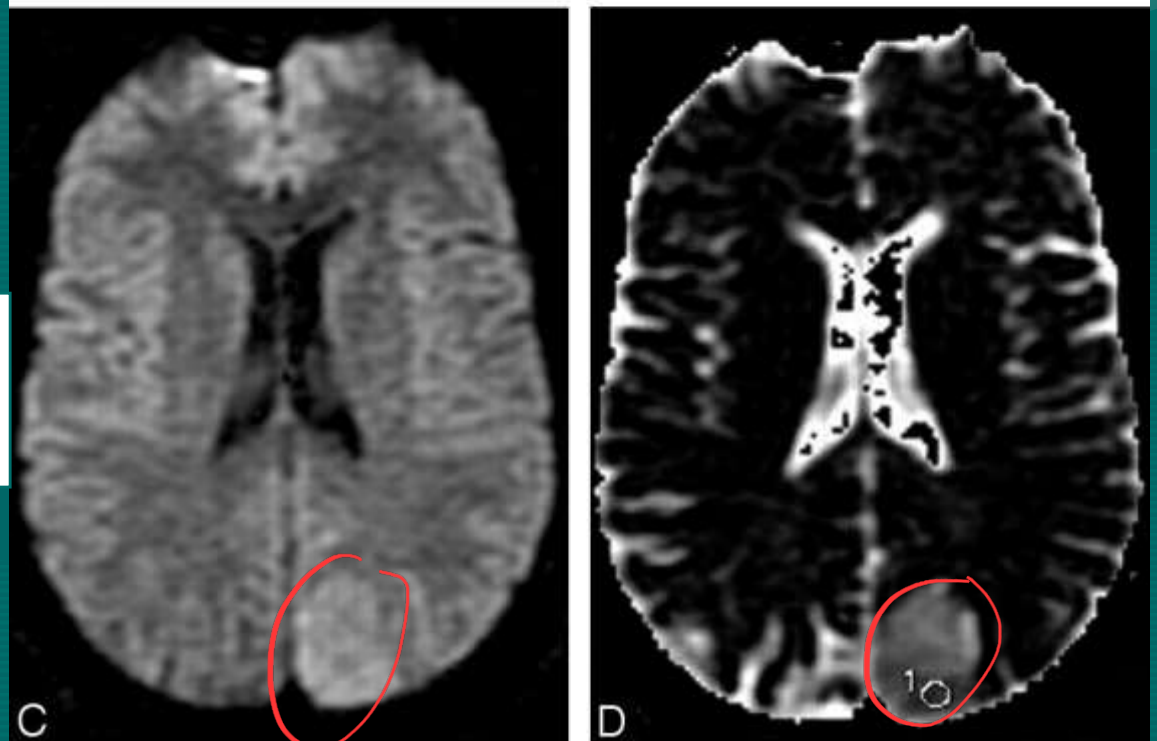
T2>> hyper-intense, no enhancement



Mass
No necrosis
Not surrounded by edema

Low Grade Glioma

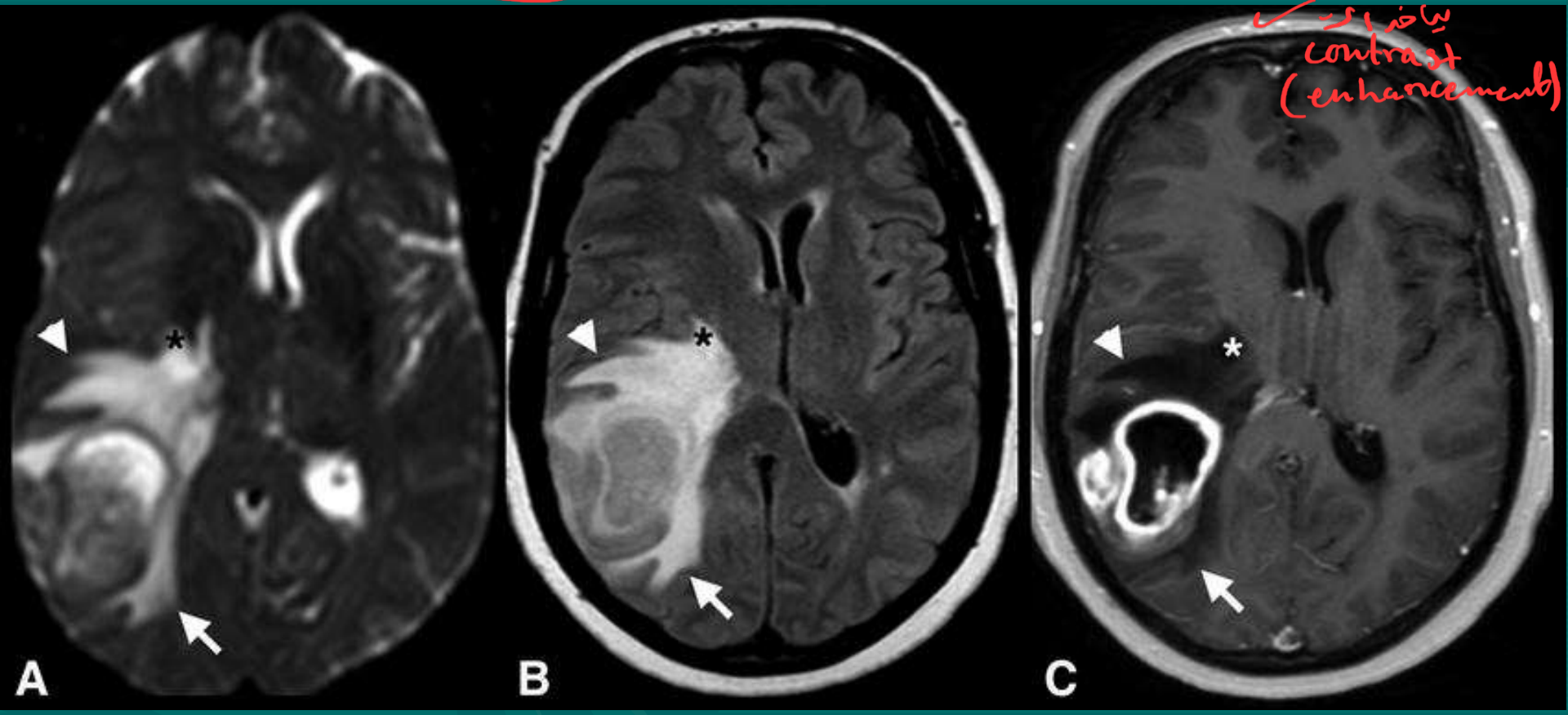
FLAIR>> hyper-intense, no enhancement



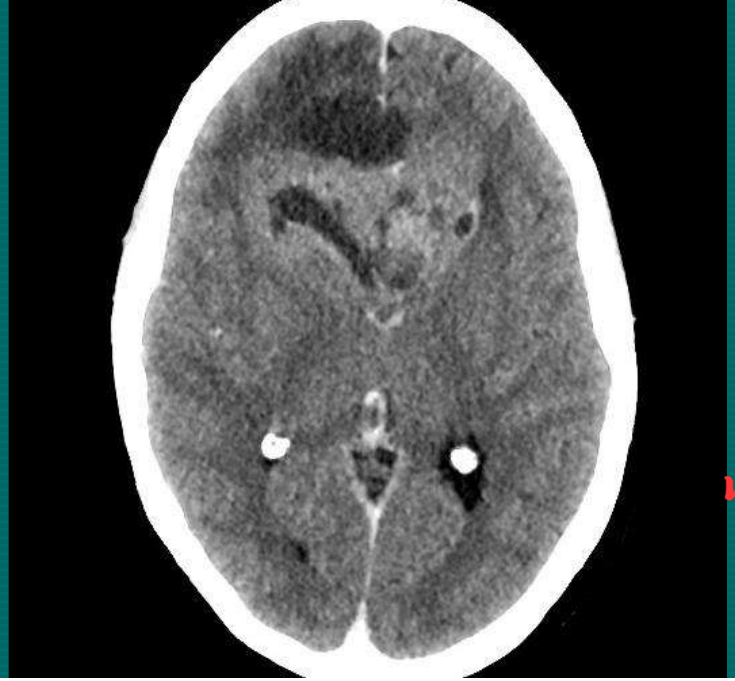
GBM

Glioblastoma multiforme

mass (بيضاوي)
Hg.
necrosis
edema
بياخد contrast (enhancement)

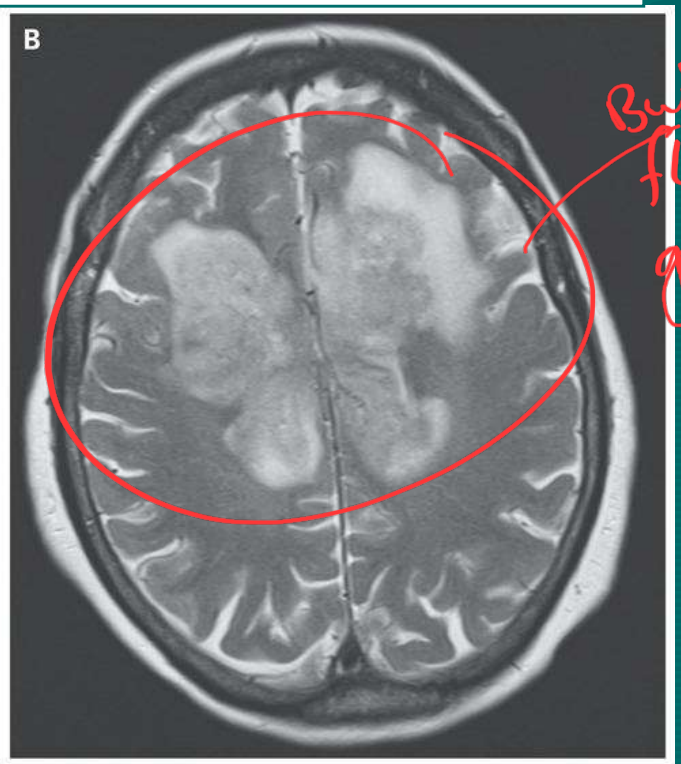


High-grade glioma>> Contrast-enhancement, with oedema, may have cystic or necrotic changes + pts are usually elderly



High-grade glioma affecting corpus callosum

Few lesions affect the corpus callosum..
When you see a lesion there, it could be lymphoma, GBM, MS demyelenating
MS: hyper-intense lesions, multiple
GBM: heterogenous enhancement, diffuse enlargement, >> butterfly glioma



Cerebellar tumors (infratentorial tumors)

In adults:

until prove the other wise

- The most common cerebellar lesion is a metastasis. Even if solitary metastatic lesion
- The second most common tumor is a hemangioblastoma.

In children:

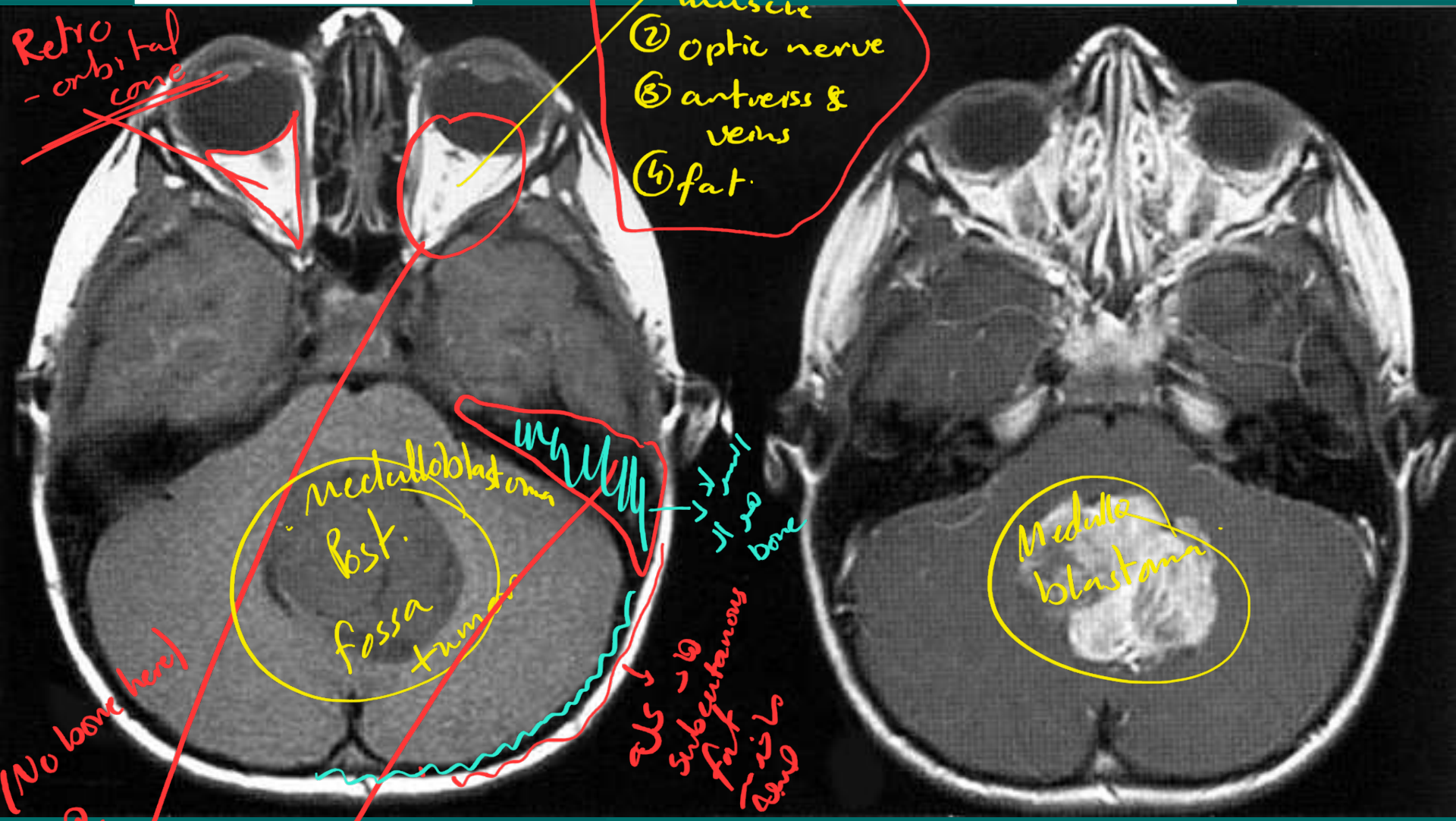
The most common cerebellar T. in children

1. Medulloblastoma: is the most common malignant brain tumor of childhood.
2. Astrocytoma.
3. Ependymoma.
4. Brain stem glioma.
5. Atypical teratoid rhabdoid tumour (ATRT)

Mass occupying the 4th ventricle

T1- pre-contrast

T1- post-contrast



If this pt is young >> medulloblastoma
If pt is adult >> metastasis

What are the common extra-axial tumors ?

- Meningiomas
- Neuromas
- Metastasis
- Pituitary tumors

Extra-axial tumours could arise from meninges, BVs, skull, pituitary, nerve sheath neuromas (most commonly schwannomas) or metastasis

Meningiomas

Most sensitive image is MRI

* Most commonly affect females.

- Represent 15-20% of primary brain tumors.
- They are benign, well circumscribed lesions, arising from any part of the meningeal covering of the brain, most commonly in the parasagital region and sphenoid wing.
- Small punctate calcifications can be seen in 25% of tumors.
- CT or MRI show well defined lesions enhancing strongly and diffusely after intravenous contrast.

* اهم اشي بتكون ملزقة بالـ

Extra-axial, well-defined, homogenously enhancing on MRI, sometimes with oedema
May see calcifications within the lesion (25%)
Typically affecting middle aged women
MRI is better than CT scan

Right frontal lobe convexity tumour (meningioma) with massive oedema causing compressing effect (we don't usually see as much oedema - this is atypical meningioma)

without contrast

w/ contrast

hyperintensity in the

Pituitary tumors

MRI is the best ⇒ Pituitary gland.

- The plain films show pituitary fossa enlargement or erosion.
- Adenomas smaller than 1cm are microadenomas, and larger adenomas are macroadenomas.
- MRI is superior to CT in detecting adenomas.

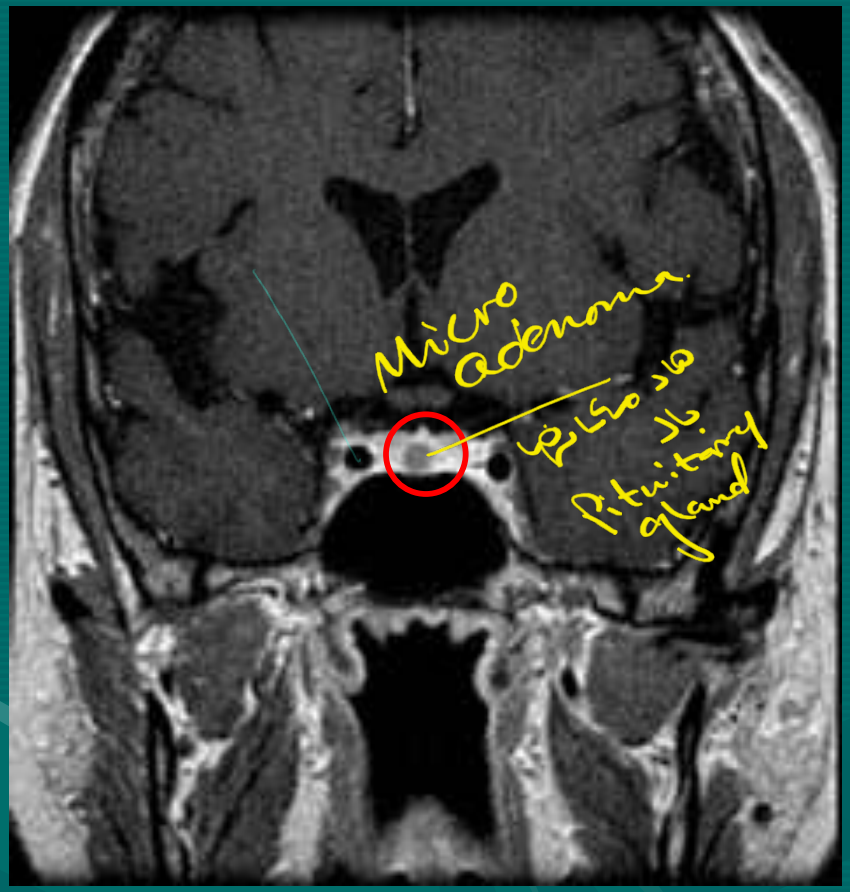
Micro- are usually functional, usually prolactinoma >> on imaging: well-defined area within the gland, less enhancing than the rest of the gland
Macro- involve the whole gland, extending beyond the suprasellar area, compressing the optic chiasm >> bitemporal hemianopia , usually non-functioning.. On imaging: large, homogenously enhancing pituitary, on coronal section you see 'figure of 8'

Acoustic neuroma:

- Arise in or near the internal auditory canal and may cause widening and erosion of the canal.
- MRI is more sensitive than CT in its detection.

Neuromas arise from nerve sheath, they follow the tract of the nerve
Usually affects vestibulocochlear nerve >> called schwannoma, the nerve leaves the pons to inter the internal acoustic meatus through the cerebellopontine angle (CP angle) >> so, part of the tumour will be seen interring the internal acoustic meatus>> ice-cream cone shape
Well-defined, homogenously enhancing, may see cystic changes
To differentiate meningioma & schwannoma, meningioma doesn't extend to the internal acoustic meatus >> no ice-cream cone shape

MRI T1>> Small, well-defined area within the pituitary, less enhancing than the rest of the gland >> micro-adenoma of the pituitary gland



T1 w/ contrast

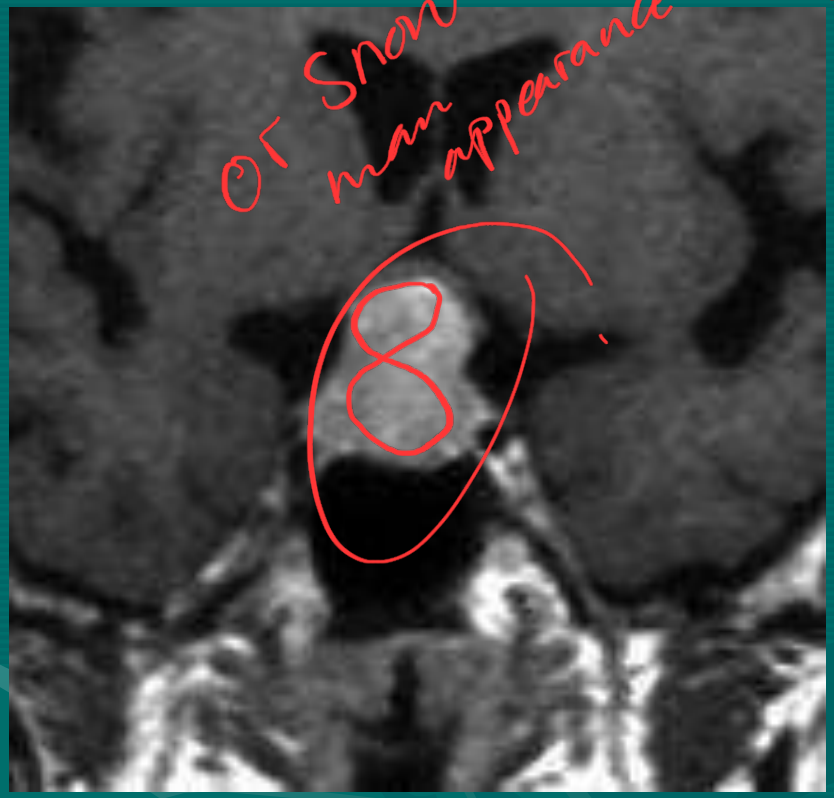
T1 w/ contrast

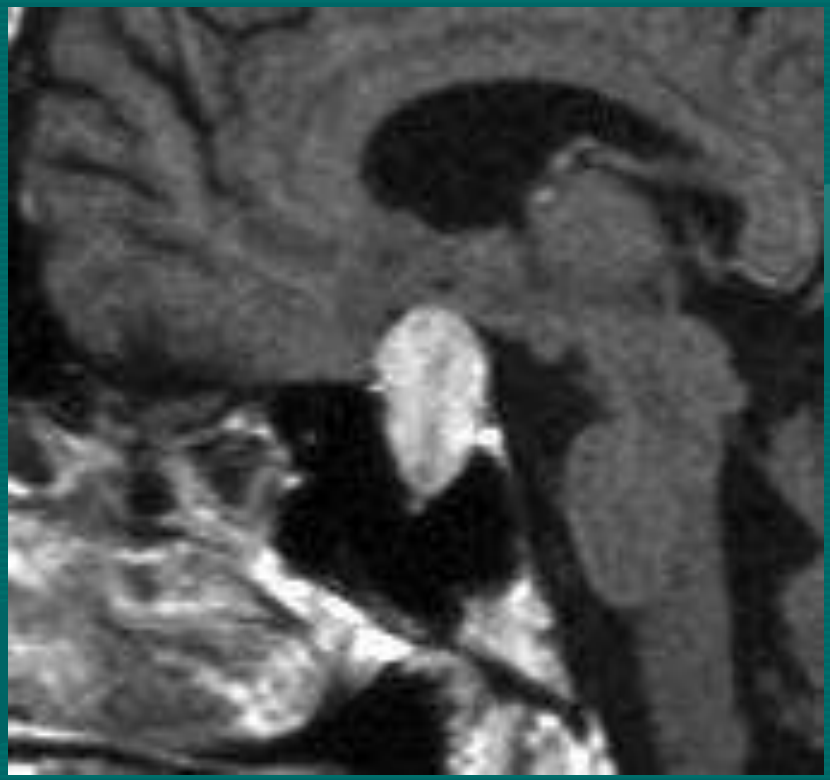
Hypointensity in Pituitary gland

MRI T1 >> large, homogenously enhancing pituitary 'figure of 8' on coronal section, involving the whole gland, extending beyond the suprasellar area, compressing the optic chiasm

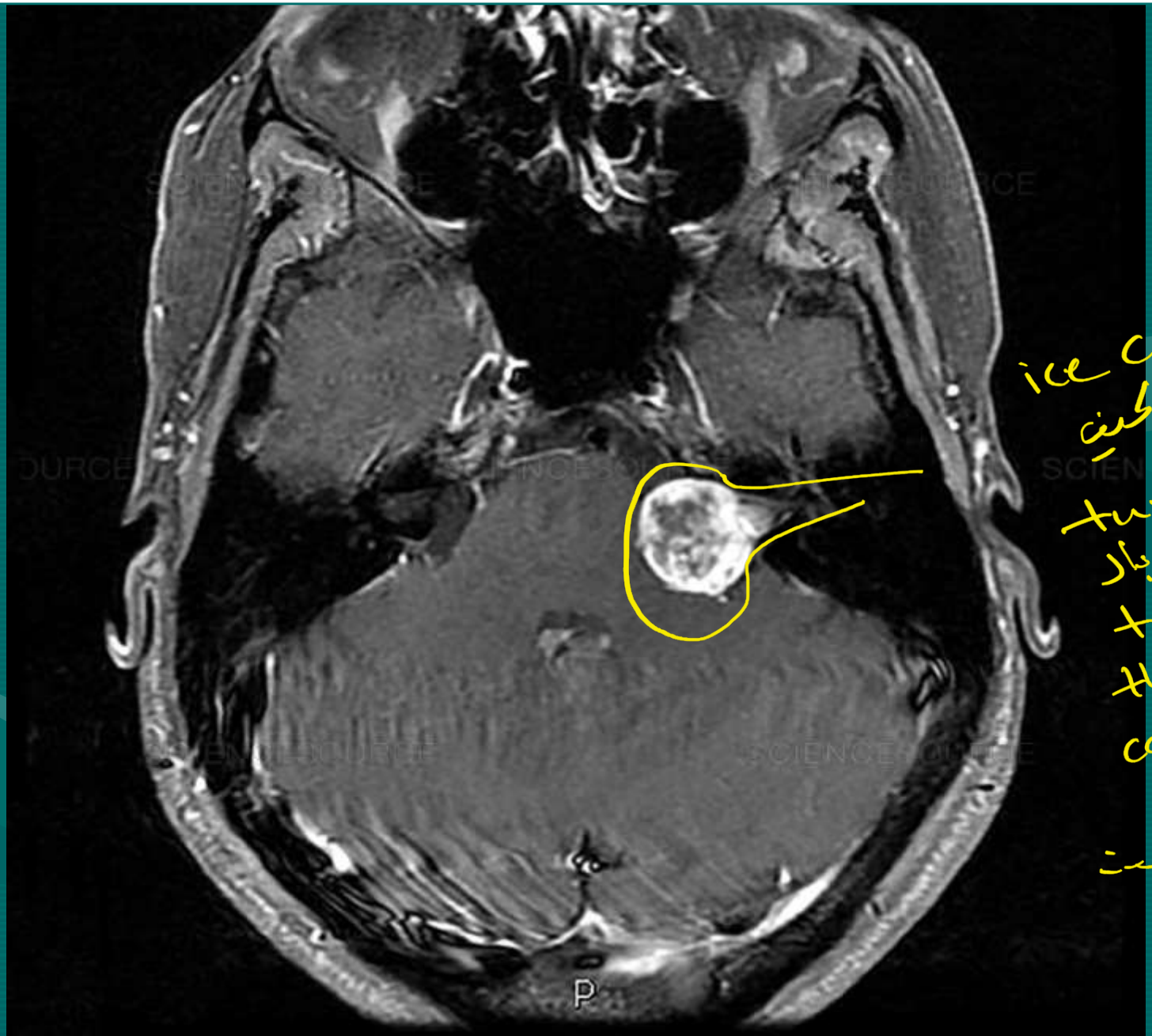
Macro adenoma

OT Snow man appearance

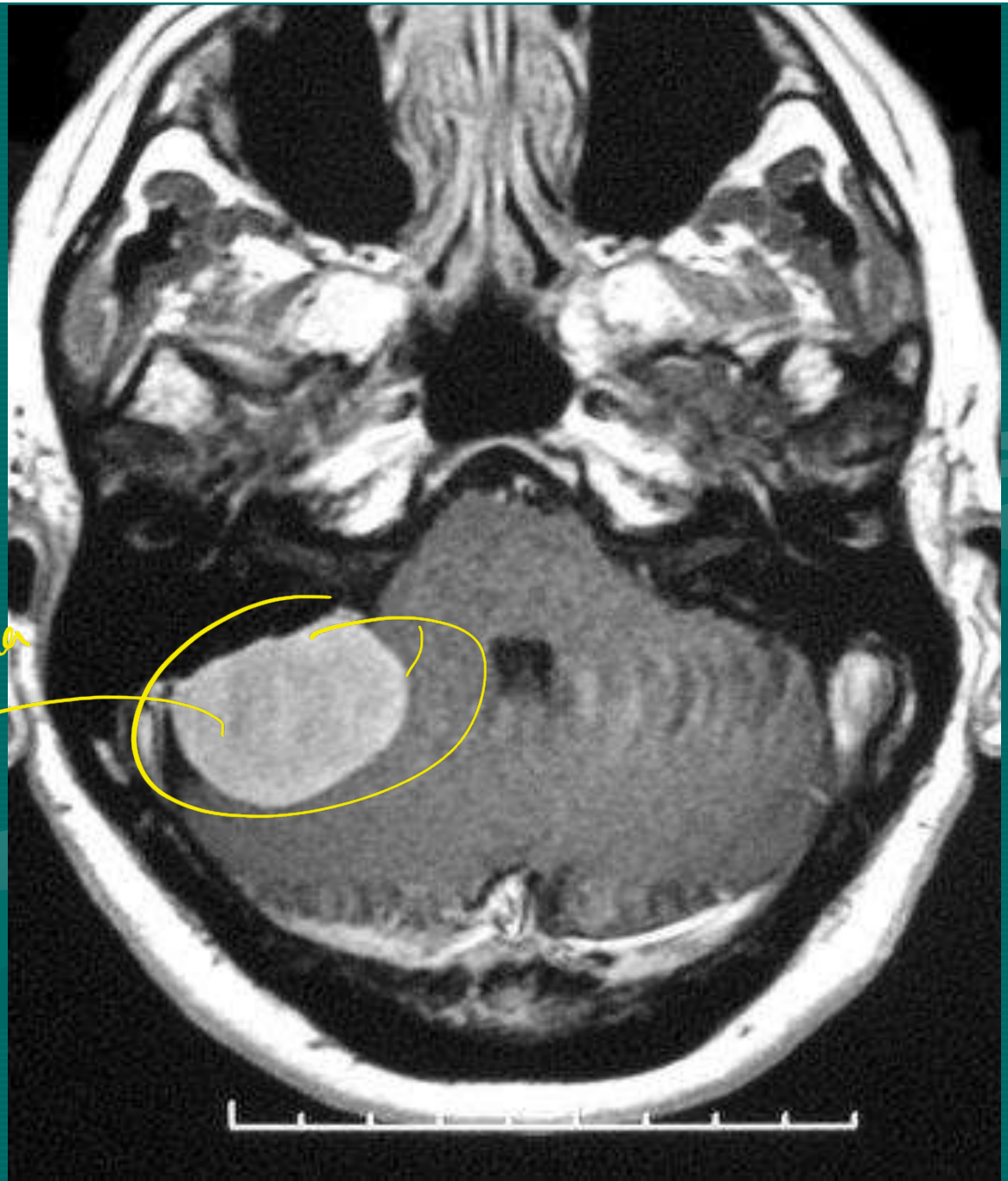




MRI FLAIR with contrast >> Well-defined, homogenously enhancing, ice-cream cone shape on CP angle >> schwannoma



Well-defined, homogenously enhancing, no ice-cream cone shape on CP angle >> meningioma



Most commonly intra-axial but could be extra-axial

Brain metastasis

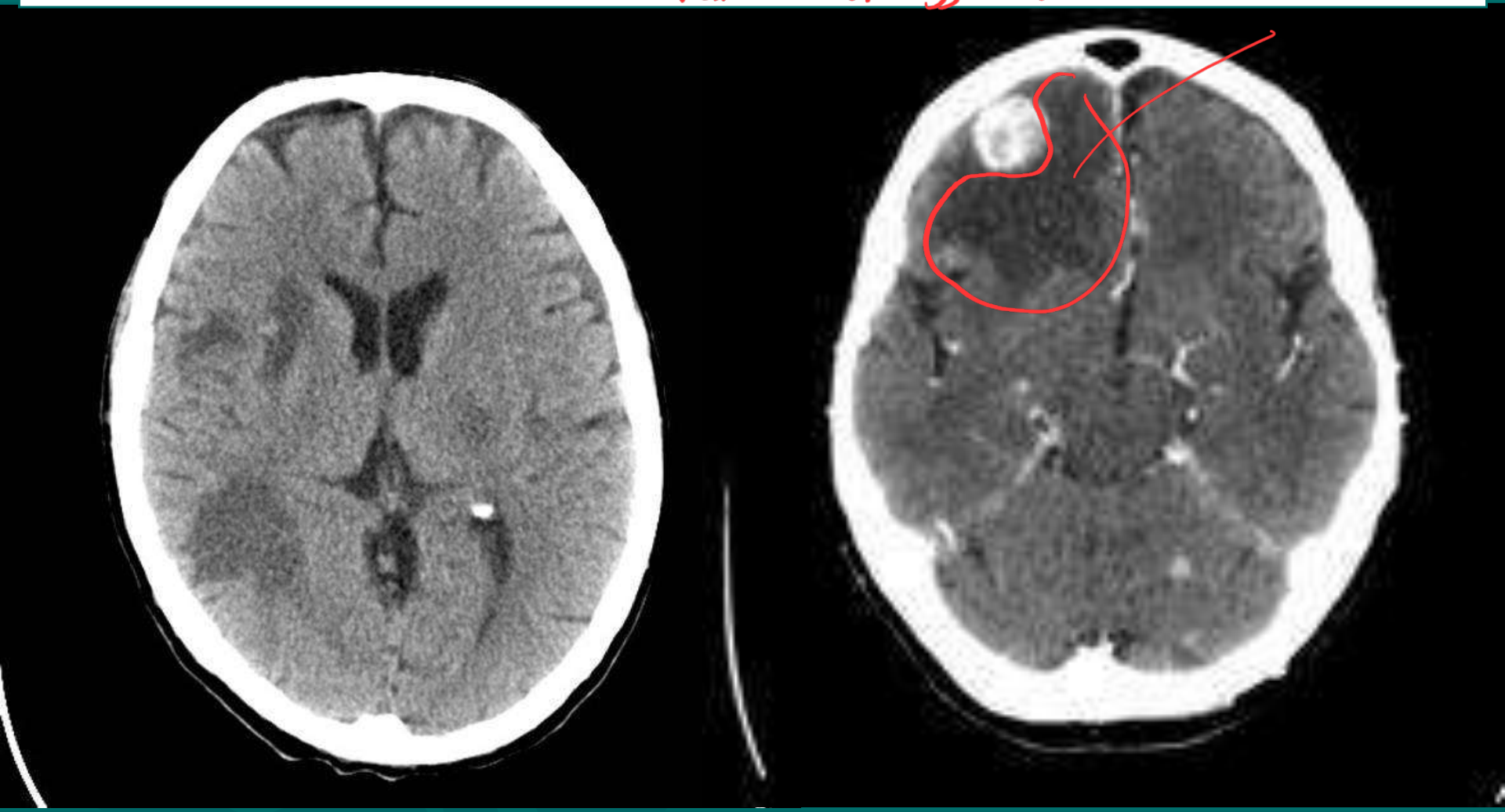
*Single legion, adult, in Post fossa ⇒ Metastasis is the 1st differential

- The majority are multiple (80%)
- They can occur anywhere in the brain, but the gray-white matter junction is the commonest site.
- Metastatic lesions are usually associated with a considerable amount of surrounding edema.
- Brain metastasis are commonly from bronchial, breast and gastro-intestinal tumors.

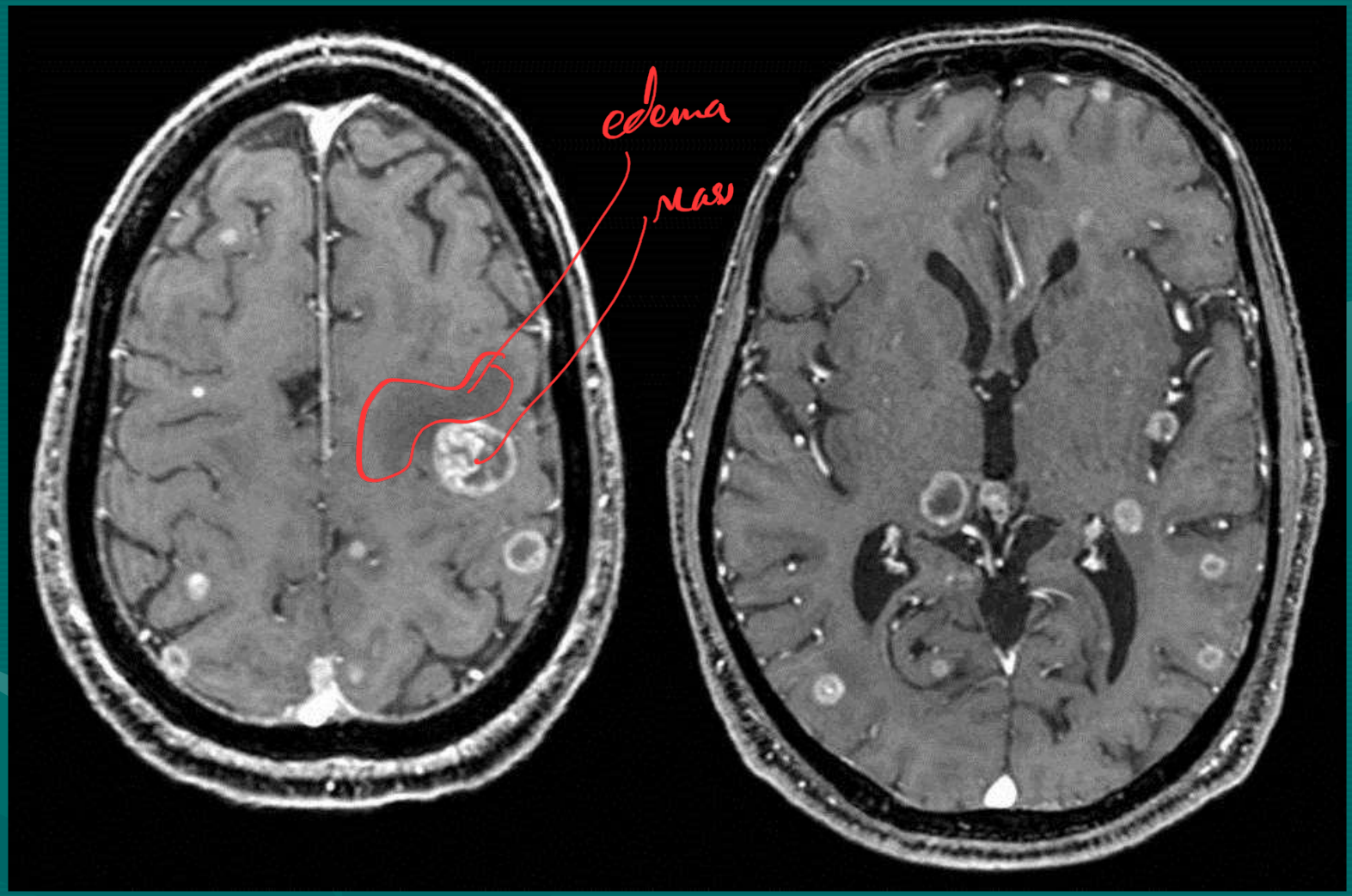
+ melanoma (melanoma produces haemorrhagic mets)

Radiologically>> multiple, well-defined, ring-enhancing lesions, usually at grey-white matter junction, oedema out-proportional to the size of the lesion

CT w/out contrast >> we may see the oedema but not the lesion itself
With contrast >> ring-enhancing….



MRI T1 >> Multiple lesions, ring-enhancing



**** Notes after the first lecture :

- When writing a report for brain tumor It's imp to know :
- If it is supra or infra "in posterior fossa"
- Age
- Cystic or solid
- Calcifications : in some tumors it is rare to find calcifications and in others it is common >>>> as in the(craniopharyngioma)In childs 90% Calcifications while in (medulloblastoma)it is impossible to find calcifications → Knowing these things about the mass helps us to determine the type of it .

**** In the barium follow through >>> the abdominal films which are taken in the first hour the pt should be in prone position because by the compression that the table makes on the pt's abdomen , the ileum would be visualized clearly .. after the first hour the films taken in supine position.


Thank
You

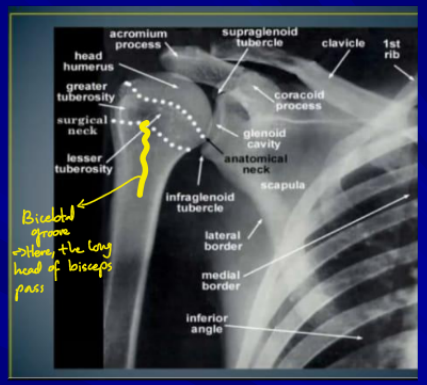
Shaden Fadda

musculoskeletal system

Notes

* Scaphoid bone is the most commonly injured bone of carpal bones.

* 2 joints of shoulder
  1. Glenohumeral j.
  2. Acromioclavicular j.



* In knee joint
  - Normaly, you have some opacity in the subcondral bones (in medial & lateral tibial condyles) & femoral condyles opacification is NOT NORMAL

الأجزاء تحت الغضروف

* 2 joints of knee
  1. Tibiofemoral j => you can see it on AP view
  2. Patello femoral j => you see it on lateral view

* The base of 5th metatarsal bone is one of the common sites of avulsion fracture
  - The tendon which is attached to the 5th metatarsal (is) tendon for the peroneus previs muscle

الـ tendon اللي بتربط العضلة بالعظم ↩ الـ bone كمان

* ↑ pre-vertebral soft tissue thickness may => Reflect prevertebral hematoma which might

be caused by ligamentus injury

- What is the muscyloskeletal system ?

  Is all of the bones in the body and the associated tissues such as muscles, tendons, ligaments and cartilage that connect them.

- The average adult human skeleton has around 206 bones.

· The largest sesamoid bone in the body is patella

Imaging modalities

- ***Plain film:***

· views should always be obtained in two projections (AP / LATERAL)

  - Plain films still remain the mainstay of radiological investigation of the skeletal system .
  - views should always be obtained in two projections.

- ***Ultrasound*** :
  - neonatal hip for congenital dislocation .
  - soft tissue lesions and abscesses.
  - joint effusions .
  - Muscular and tendinous tears.

Ultrasound:
1- in CDH :"congenital dislocation of hip" → any baby should have a pelvic plain x-ray at three months even if diagnosed by the ultrasound
2- joint effusion → as if we suspect baker's cyst so we need US

initial > xray /
best > CT

CT in skeletal system

We need CT scan of the spine because the x-ray sometimes doesn't give the result of the definite fracture The doctor should define the area that should be scanned to avoid high exposure

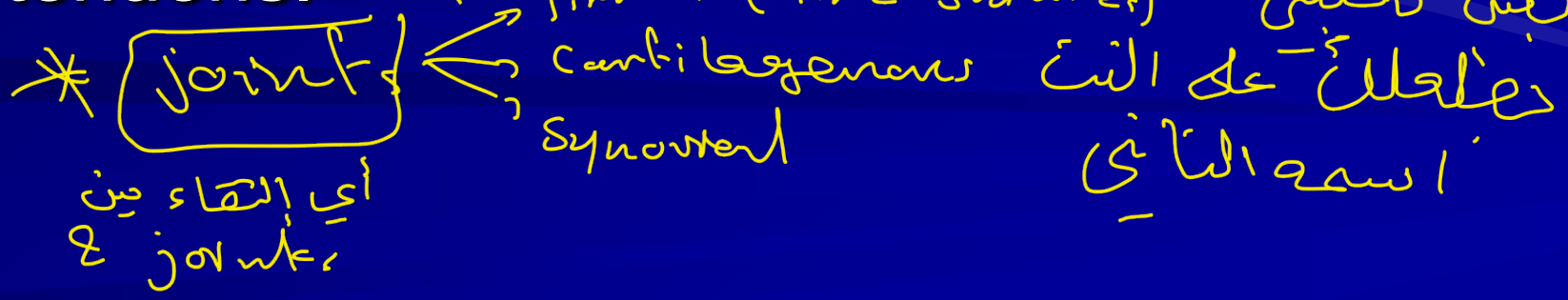
CT is very helpful in :

- assessment of bone tumours prior to surgery .
- evaluation of certain fractures , such as the acetabulum, spine and calcaneum .
- study of the spinal column .

MRI / Skeletal system

- MRI assists the investigation of bone tumours, soft tissue masses and joint .

- MRI is extremely sensitive in injuries to cartilage , muscle , ligaments, menisci and tendons.



Osteoarthritis

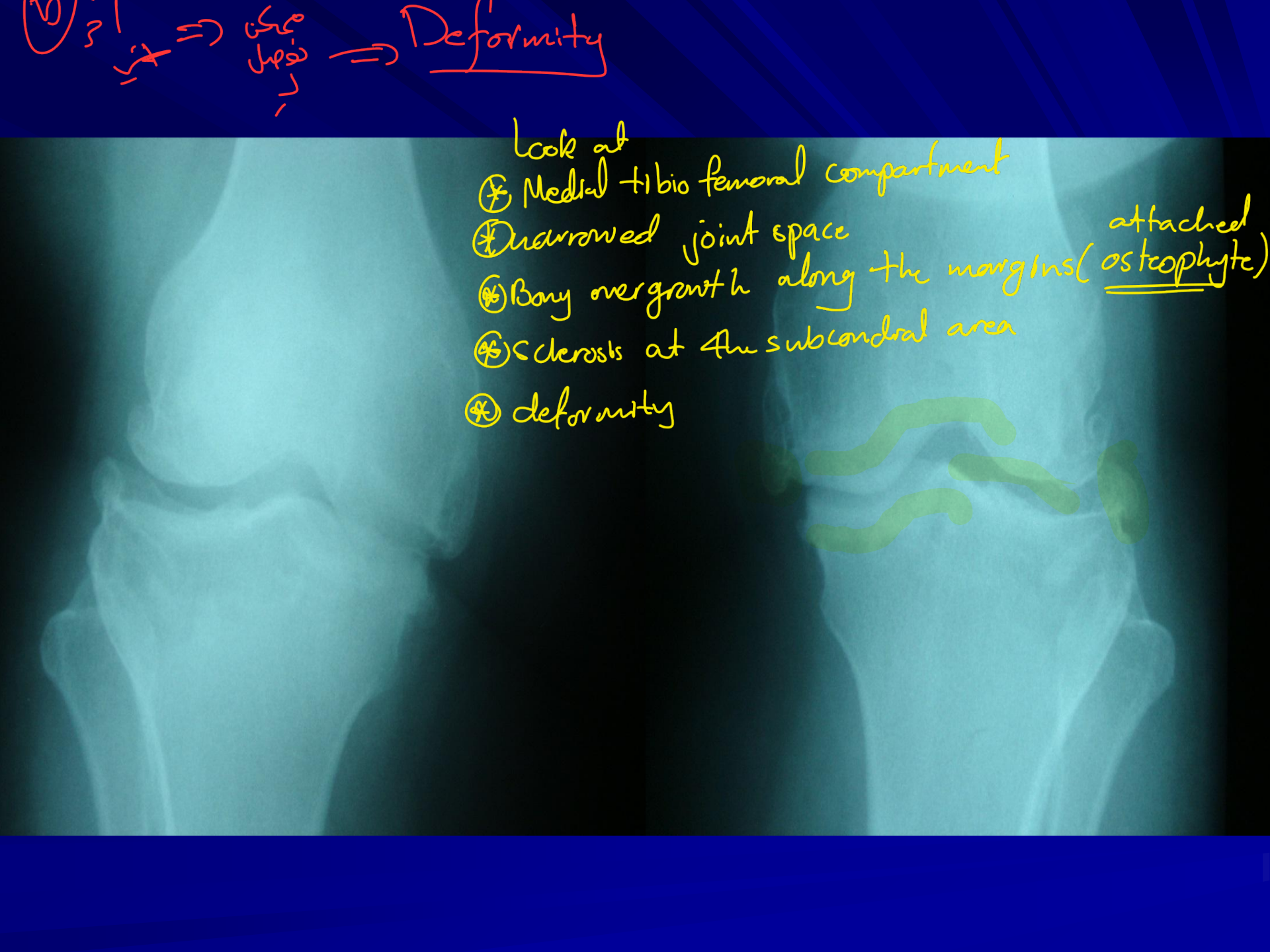
(degenerative joint disease)

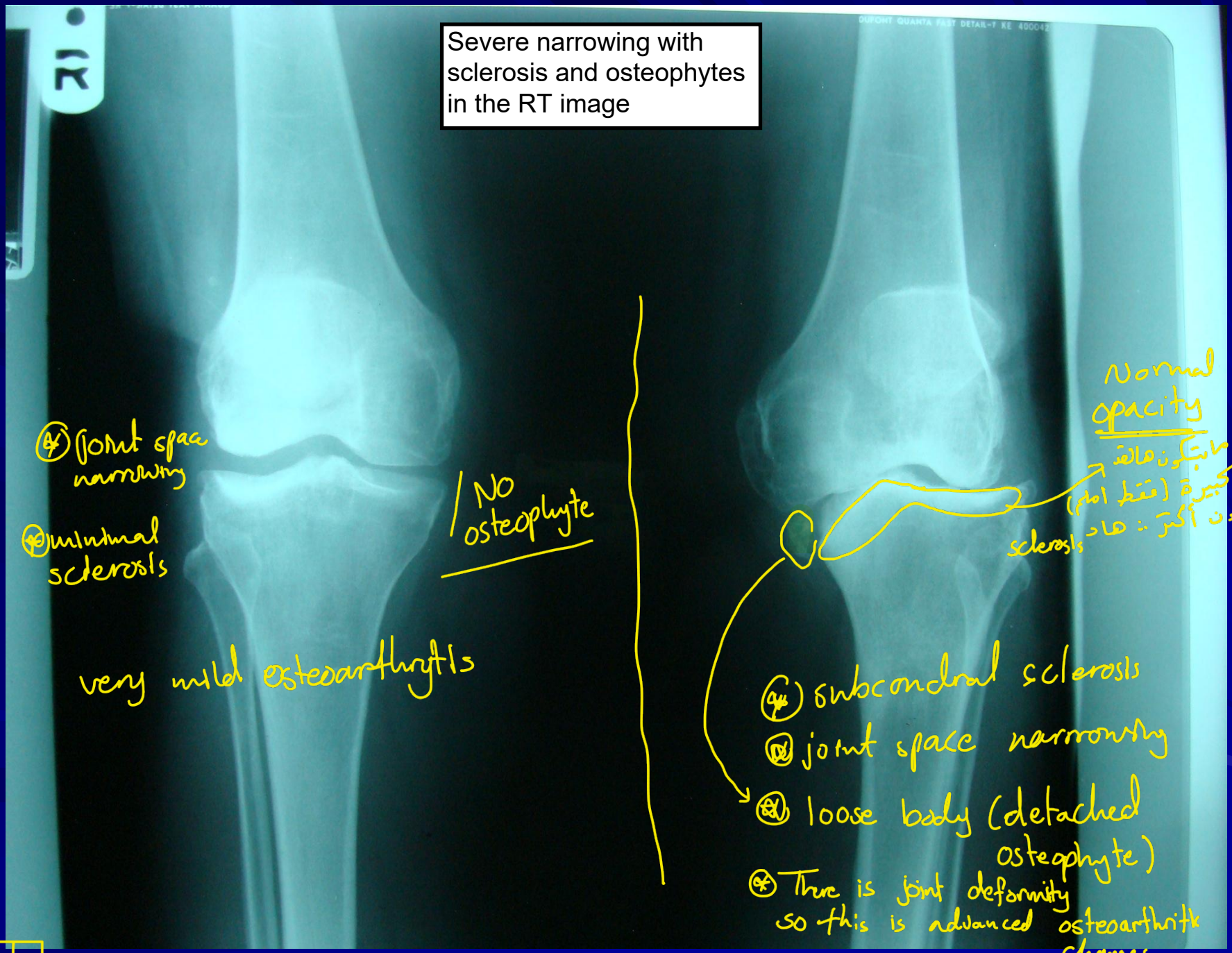
- Is a degenerative condition affecting the articular cartilages and subchondral bone.
- Is part of the normal aging process.
- Secondary osteoarthritis results from previous trauma and joint infection.
- Any joint may be affected, but the knees, hips, and shoulders are frequently involved.

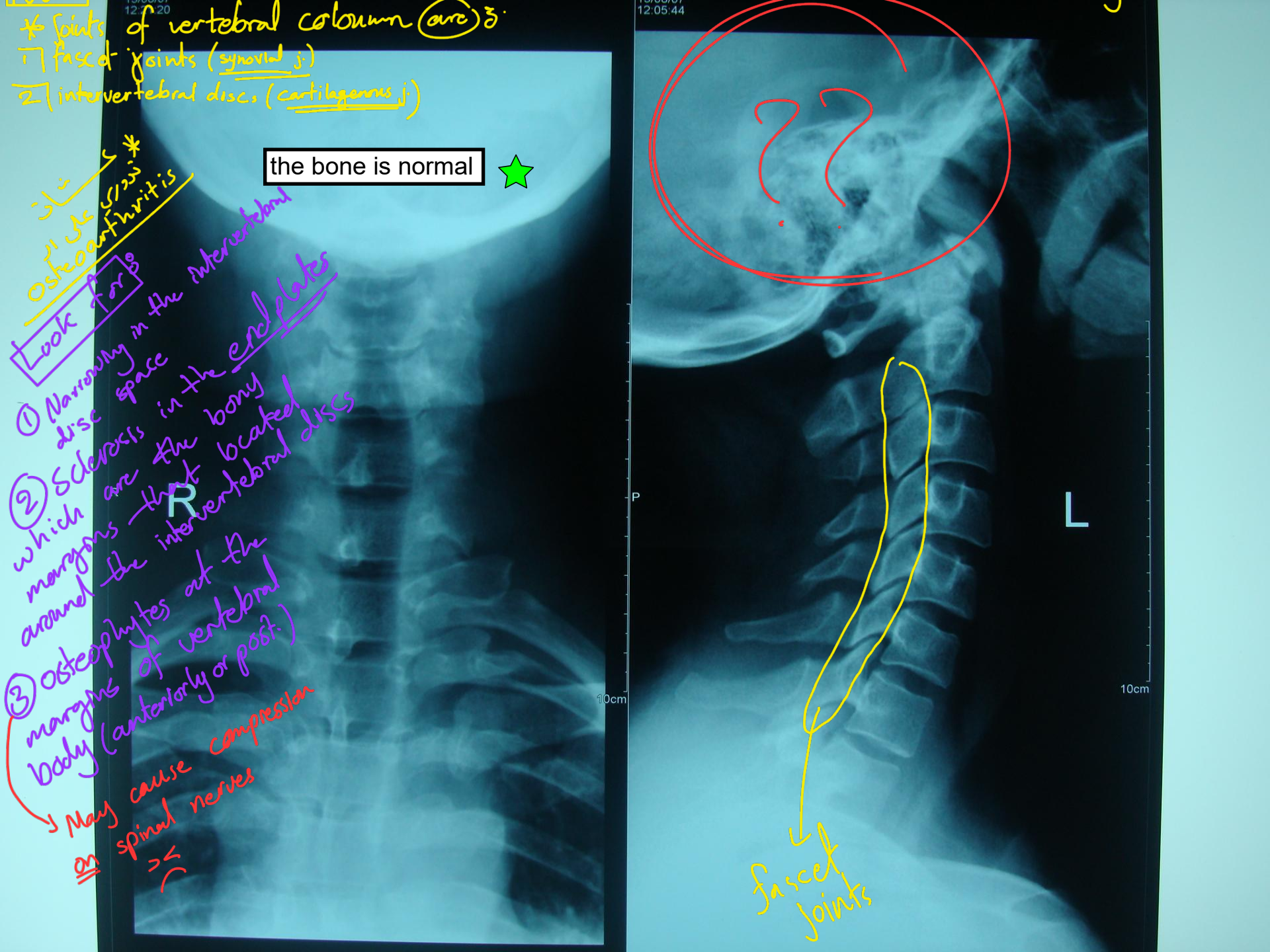
Osteoarthritis / 2

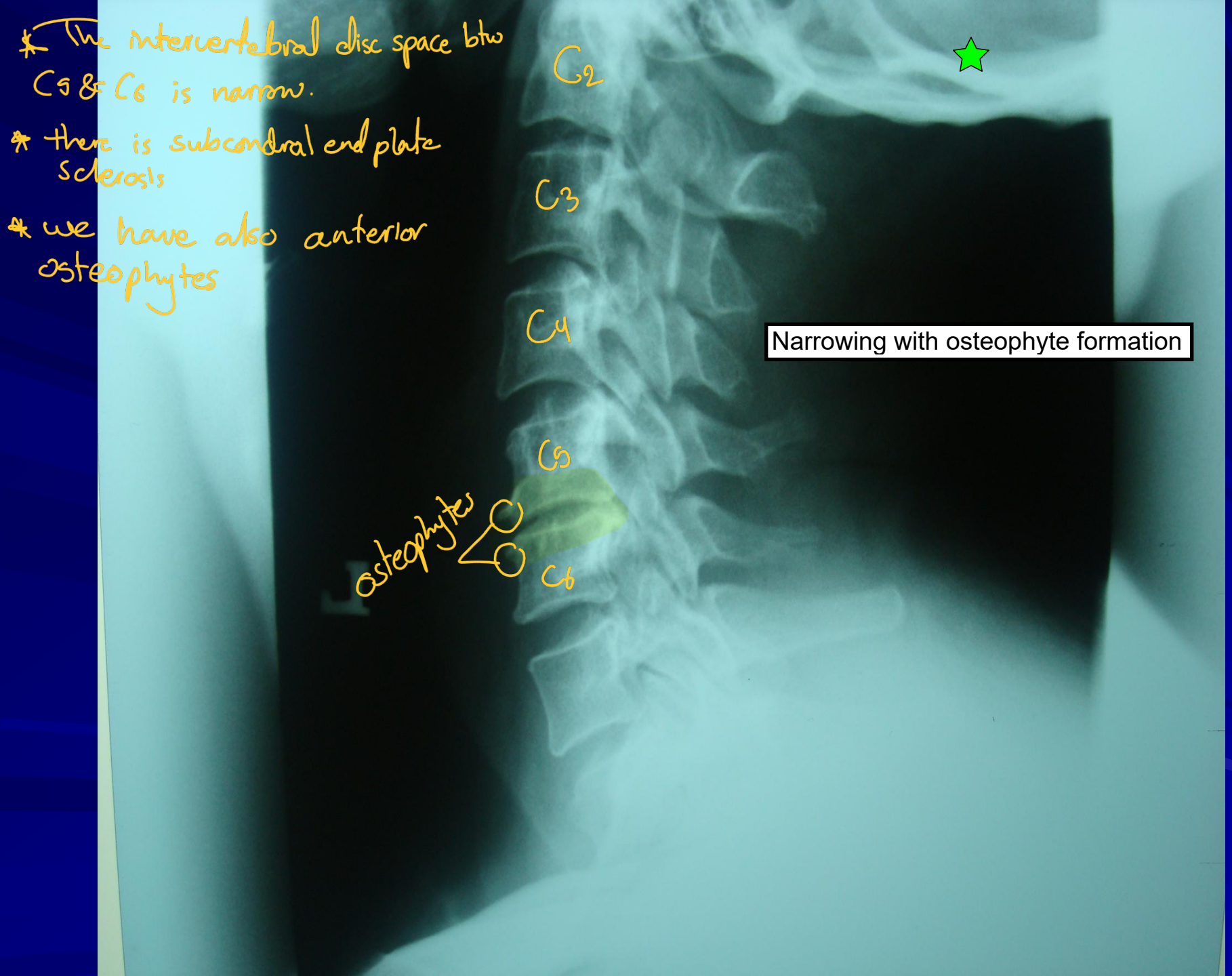
Radiological features:

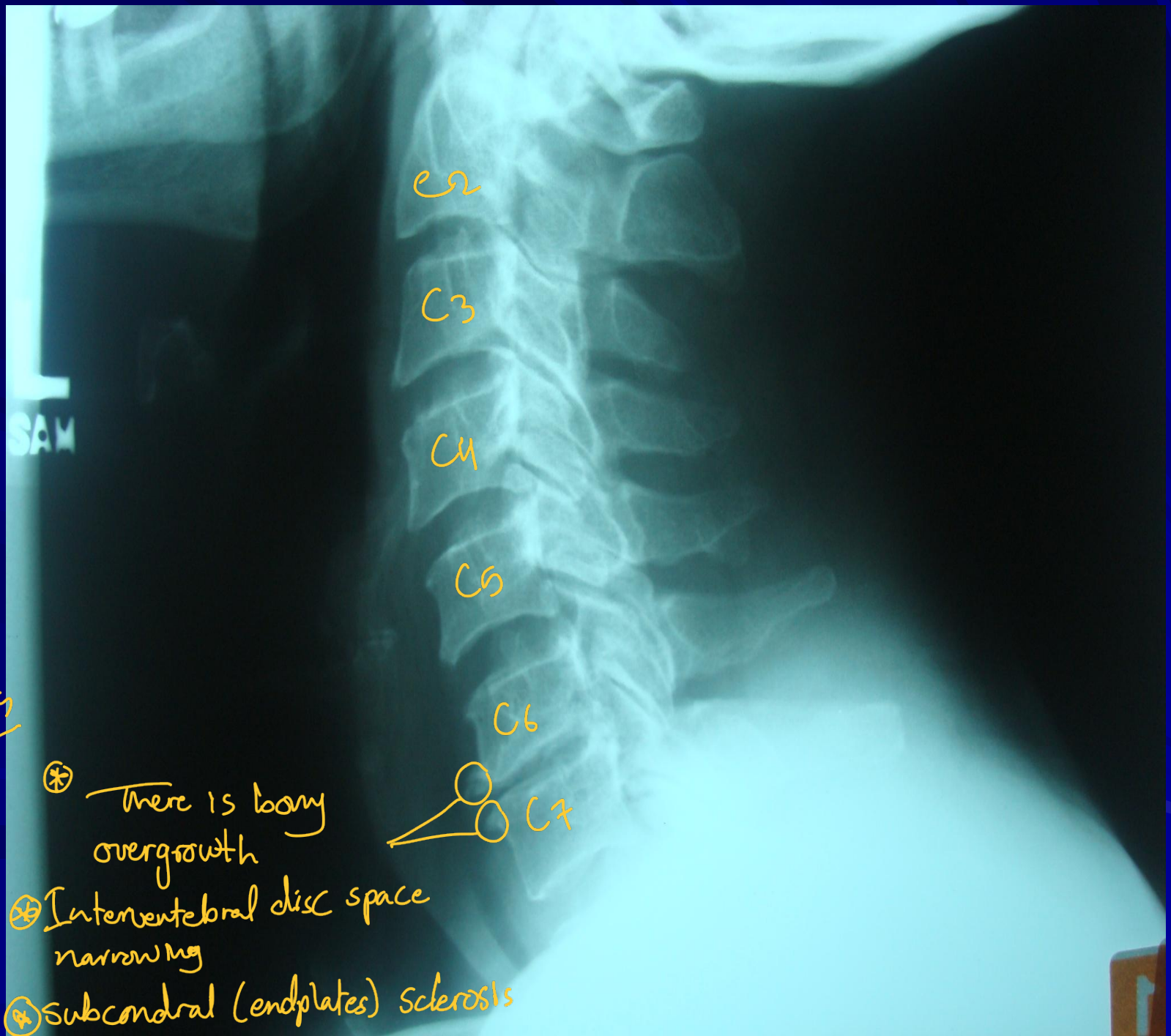
- **Osteophytes formation:** are spurs of bone which forms at joint margin.
- **Joint space narrowing.**
- **Sclerosis with Secondary degenerative cysts formation.**
- **Loose bodies:** result from separation of cartilage and osteophytes.
- Articular chondral loss or thinning.


Deformity
Look at
Medial tibio femoral compartment
Narrowed joint space
Bony overgrowth along the margins (osteophyte) attached
Sclerosis at the subchondral area
deformity


Severe narrowing with sclerosis and osteophytes in the RT image
Joint space narrowing
minimal sclerosis
NO osteophyte
very mild osteoarthritis
Normal opacity
sclerosis
subchondral sclerosis
joint space narrowing
loose body (detached osteophyte)
There is joint deformity so this is advanced osteoarthritic changes


* joints of vertebral column (arc) 3:
1- facet joints (synovial j.)
2- intervertebral discs (cartilaginous j.)
the bone is normal
Osteoarthritis
Look for:
① Narrowing in the intervertebral disc space
② Sclerosis in the end plates which are the bony margins that located the intervertebral discs around
③ Osteophytes at the margins of vertebral body (anteriorly or post.)
May cause compression on spinal nerves
R
L
P
10cm
10cm
facet joints


* The intervertebral disc space btw C5 & C6 is narrow.
* there is subcondral end plate sclerosis
* we have also anterior osteophytes
C2
C3
C4
C5
C6
osteophytes
Narrowing with osteophyte formation



osteoarthritis

- There is bony overgrowth
- Intervertebral disc space narrowing
- subcondral (endplates) sclerosis

Osteomyelitis ★

Most common in pediatric age group

associated w/ trauma / foreign body

Infection of bone tissue

* Hematogenous vs direct spread.

* Staphylococcus Aureus is responsible for the majority of cases.

* neonates: metaphysis and/or epiphysis ★
* children: metaphysis ★
* adults: epiphyses and subchondral regions

* بيبقى بارا metaph. وبعدين بروح لل epiphys. عن طريق ال anastomosing vessels ★

هتحول بتكبروا after 18 month

d/t usually associated w/ septic arthritis

(*) مجرد ماوصل المريض لهاي الاعراض . خلص صار المريض عنده Chronic osteomyelitis هاد مريض مزمن رح يلازمه كل حياته .

Coneventional Radiological features:

- May be normal in the first 10 days or two weeks. ★
- The earliest sign is soft tissue swelling due to edema.
- Periosteal reaction
- Bone destruction

BM edema لح يكون في

On X-RAY we don't see the BM edema

* We see it only on MRI

·periosteal reaction :the outlines are irregular like the saw
·osteomyelitis and malignancy “METS” have the same signs on the bone so we can differentiate between them clinically

BM is soft tissue

The BEST modality to look for bone marrow edema.

THE BEST SEQUENCE IS

MRI

!! هيجيلك # Stir sequence

↳ fluid sensitive sequence!!

thick بيقل ↑ pressure within the bone so the pus will try to escape out of the bone to the surrounding soft tissue

involucrum بال focal opening هيشوف * cloaca

Bone marrow edema is the earliest sign.

The cloaca is an opening in an involucrum which allows drainage of purulent and necrotic material out of the dead bone.

(very thick periosteum)

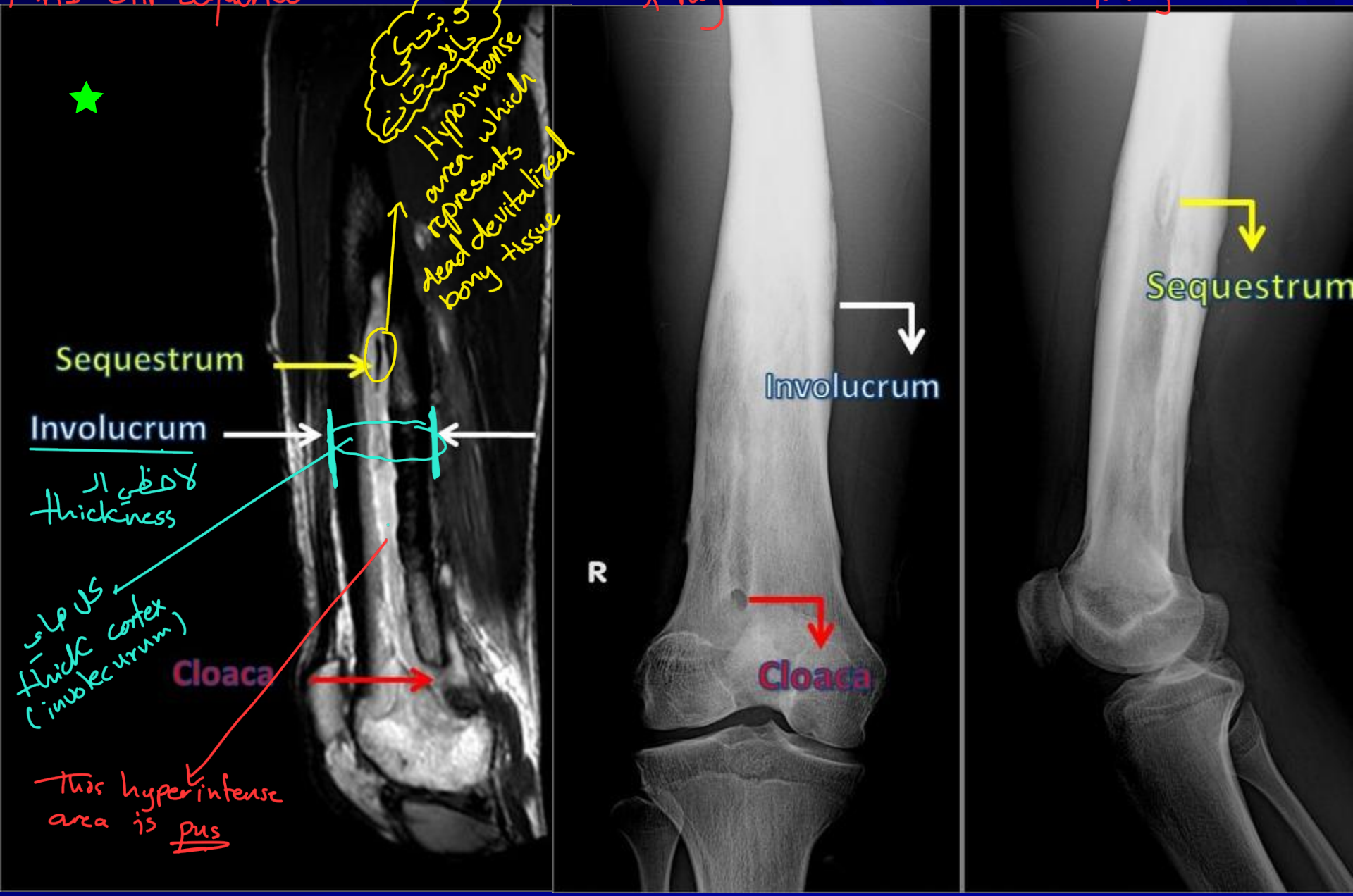
Involucrum is a complication of osteomylitis and represents a thick sheath of periosteal new bone surrounding a sequtrum.

لما الـ periosteum يعمل growth كتير بتكون عندي

Necrotic tissue

Sequtrum is defined as a piece of devitalised bone that has been separated from its surrounding bone during the process of necrosis.

you will see area of sclerosis found inside the bone marrow (on xray)

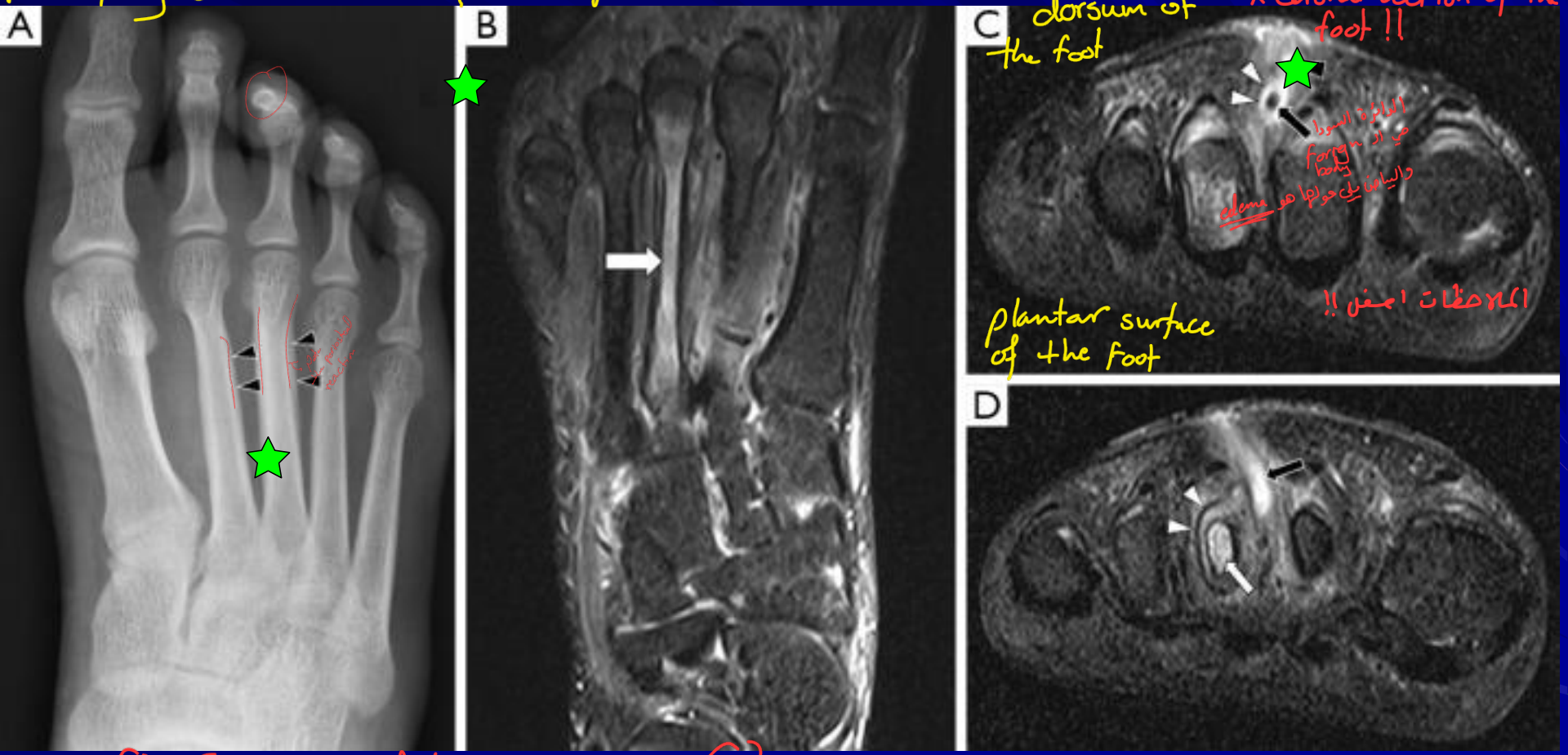

MRI Stir sequence
X-ray
x-ray
Hypointense area which represents dead devitalized bony tissue
Sequestrum
Involucrum
thickness
thick cortex (involucrum)
Cloaca
This hyperintense area is pus
Involucrum
R
Cloaca
Sequestrum

The arrow heads represents very thin periosteal bony overgrowth called periosteal reaction

لكن الطافي كمان بان x-ray هاي بنفس

لكن الطافي كمان بان MRI Stir sequence
⇒ it is very easy to detect hyperintense area within the BM of 3rd metatarsal
→ it represents edema

The black spot in pic C is foreign body causes reaction and infection and direct spread if infection to the bone



* Pic (C) & I see area of hypo intense in the dorsum aspect of soft tissue in the 3rd metatarsal. surrounded by area of hyperintensity. Its most likely that it is edema within the BM caused by foreign body
direct spread to the 3rd metatarsal

BM tumor
↓
Soft tissue
∴ MRI is the best

Multiple Myeloma

↳ Plazma cell tumor → usually multiple lesions
→ if single it is called plazmacytoma

- Is a tumor of plasma cells (malignant proliferation). ★ ★
- The most common bones involved are: the skull, spine, pelvis and ribs.
- The disease may occur in a disseminated form, or as a localized solitary mass (Plasmacytoma).

axial skeleton

*Usually affects old ages
↳ Bone pain
↳ Osteoporotic

The most common bones involved are the skull, spine, pelvis and ribs → so if we suspect a multiple myeloma in a Pt, we need to make a lateral skull , chest , spine , pelvis x-ray → lytic lesion (black) → if single called “plasmacytoma”

Multiple Myeloma / 2

* Multiple lesions of well defined osteolytic lesions (lucency) usually within the BM.

Radiological features:

- At time of presentation 80% have skeletal abnormalities.

So the bone is hypodense.

Plain films reveal:

- Generalized osteoporosis.
- Scattered lytic lesions with well defined margins
  - ↳ lucency
- Compression fractures of the vertebral bodies. (There will be reduced or complete loss of height of the vertebral body)

Osteoporosis is a bone disease that occurs when the body loses too much bone, makes too little bone, or both. As a result, bones become weak and may break from a fall or, in serious cases, from sneezing or minor bumps

* So, Usually the first presentation of multiple myeloma (IS) compression fracture

pushed out lesions with sharp edges through cortex

للامتحان

*Skull xray

* There is multiple well defined lucent lesions through the skull
→ it is most likely to be osteolytic lesions that may represent multiple myeloma

Multiple myeloma
appendicular أكثر من الـ axial يعني بالـ

Multiple lytic lesions

* The most common bony part which is affected by mets (is) vertebral column
Because it is the most vascularized part of the skeleton

Bone metastasis

- Are the most common malignant bone tumors. * The most common primary malignant bony lesion (is) osteosarcoma
- Any primary tumor may metastasize to bone, but the most frequents are:

Breast: usually lytic in nature but may be sclerotic or mixed.

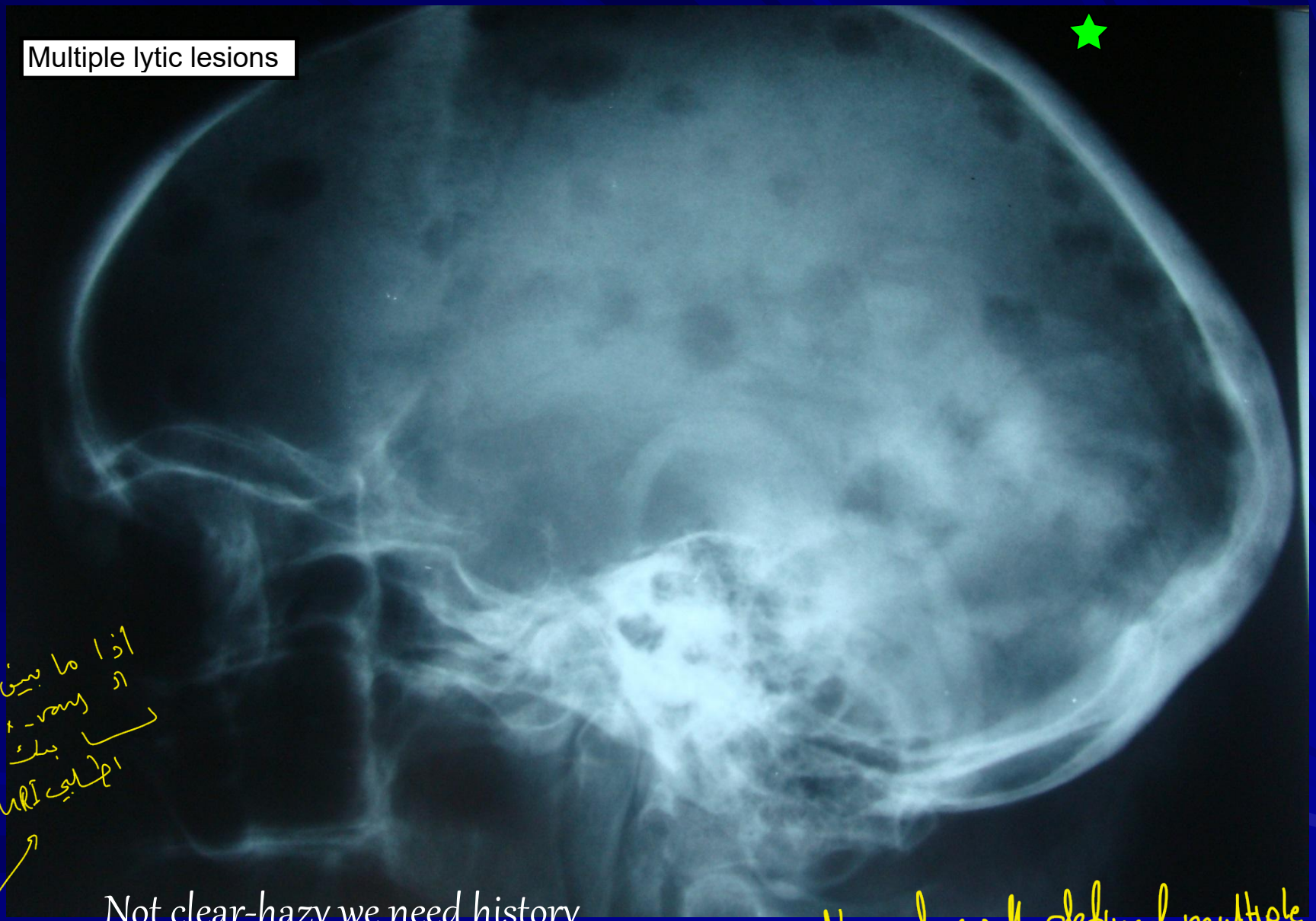
Prostate: the vast majority are sclerotic.

Lung, Kidney, thyroid,: lytic lesions

Adrenal gland: predominantly lytic.

* Bony metastatic lesions
  - Purely osteolytic → RCC , adrenals
  - Purely osteoplastic (sclerotic) → Prostate
  - Mixed → الباقي

Multiple lytic lesions



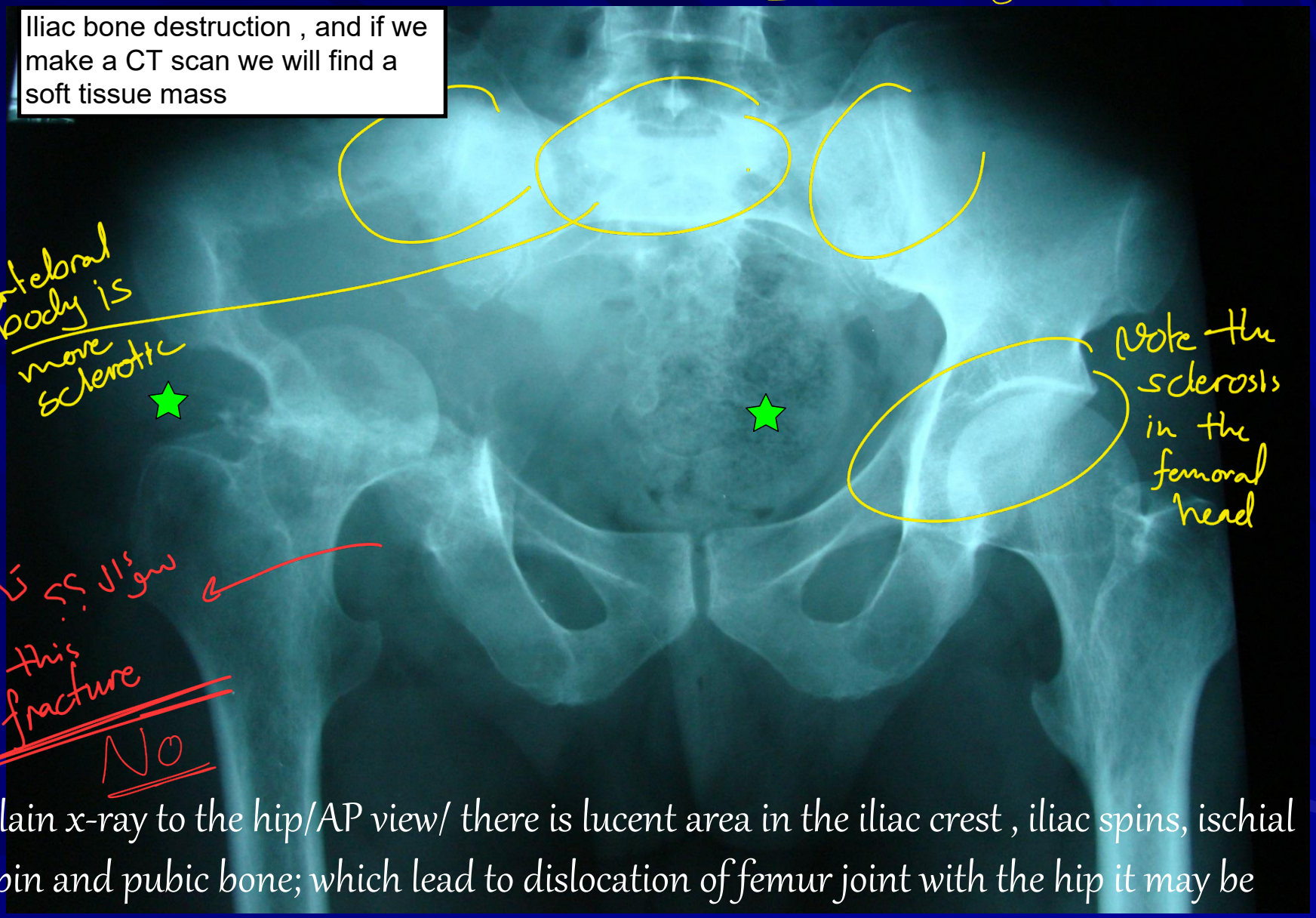
Not clear-hazy we need history

* old age has bence & johns protiens
  ↳ multiple myloma
But young pt. with primary T. → Mets.

* scattered well-defined multiple lytic lesions
  ↳ غالبا من الدرسترون

BM biopsy

ما بعرف اذا الـ Mets / multiple myloma



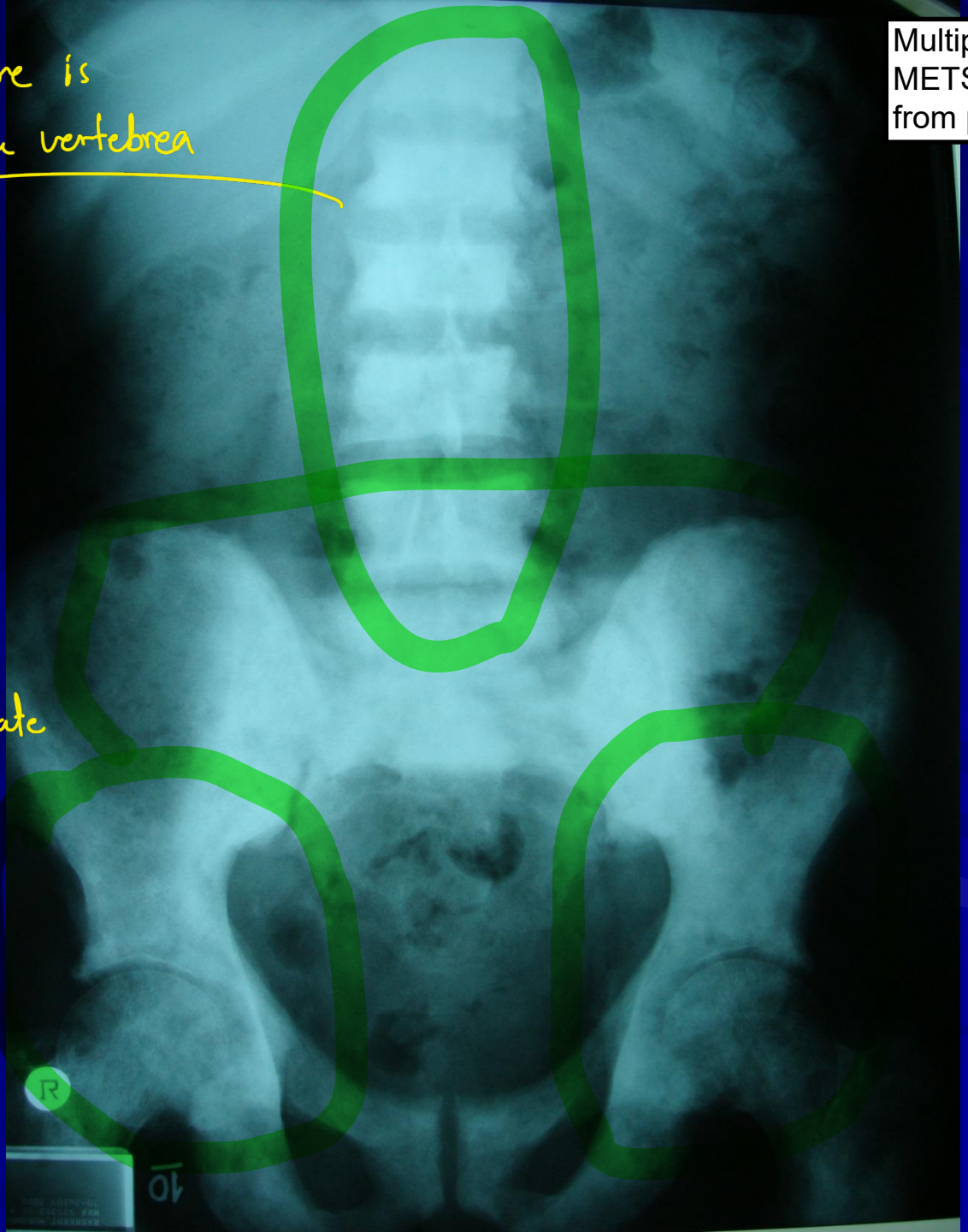
Plain x-ray to the hip/AP view/ there is lucent area in the iliac crest , iliac spins, ischial spin and pubic bone; which lead to dislocation of femur joint with the hip it may be caused by primary osteolytic or secondary metastasis

Note how there is sclerosis in the vertebrea

Multiple vertebral body METS → most commonly from prostate ★

→ prostatic cancer

* Note the punctate sclerosis in the femoral head around the acetabulum.



Skeletal trauma

- Plain films are the initial evaluation of a patient with suspected skeletal trauma.
- At least two views (A.p, and lateral) should always be obtained.
- In any significant head or spine injury, CT scan is the initial investigation.
- CT will detect fractures as well as underlying intracerebral hemorrhage or contusions.

FRACTURES

Fracture: is a break in the continuity of bone.

Closed fracture: Fracture with intact skin.

Open fracture: Fracture with skin and soft tissue wound connecting the fracture to the external environment.

Open fracture → penetrates the skin

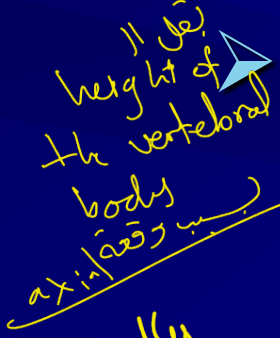
Types of fracture

- Linear fracture. line that crosses the 2 corteces
- Comminuted fracture: a fracture with multiple fragments * More than 3 fragments at the site of the fracture
- Avulsion fracture: a fragment of bone is detached from the site of a ligament or tendon insertion.
- Pathological fracture: a fracture through diseased bone.
  - ↳ normal load on ds. bone

Pathological fracture → as if there is a cyst or a lesion and a fracture occurs there

Types of fractures /2

Greenstick fracture: Incomplete fracture that usually occurs in children . The bone may also buckle without an actual break.



Compression fracture: force is applied in the longitudinal axis of bone, usually occurs in the spine.

Depressed fracture: usually occurs in the skull.

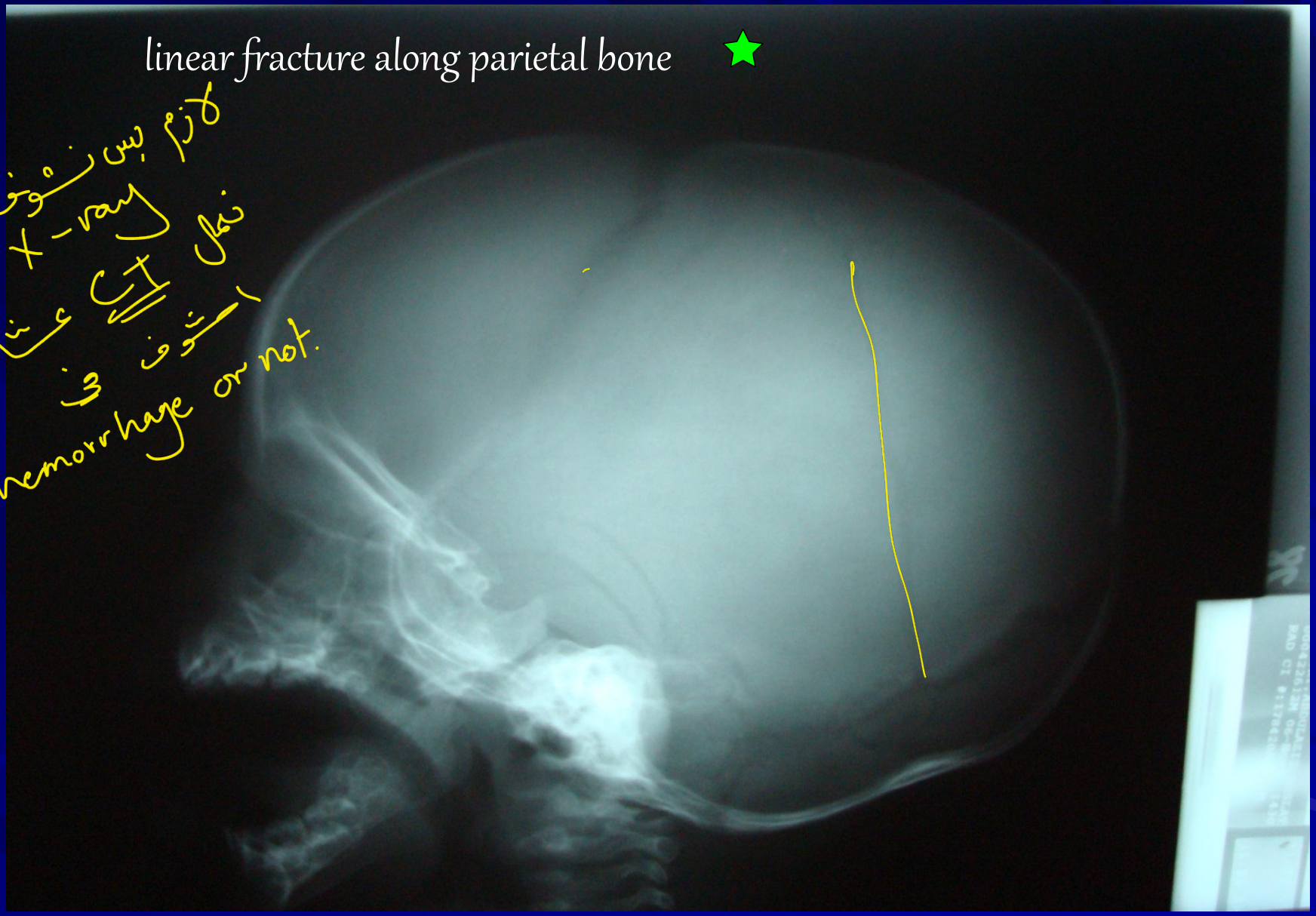
Green stick fracture : especially at the area of the radius in childs
Boxer's fracture : usually at the base of the 4th or 5th metacarpal bone

Types of fractures /3

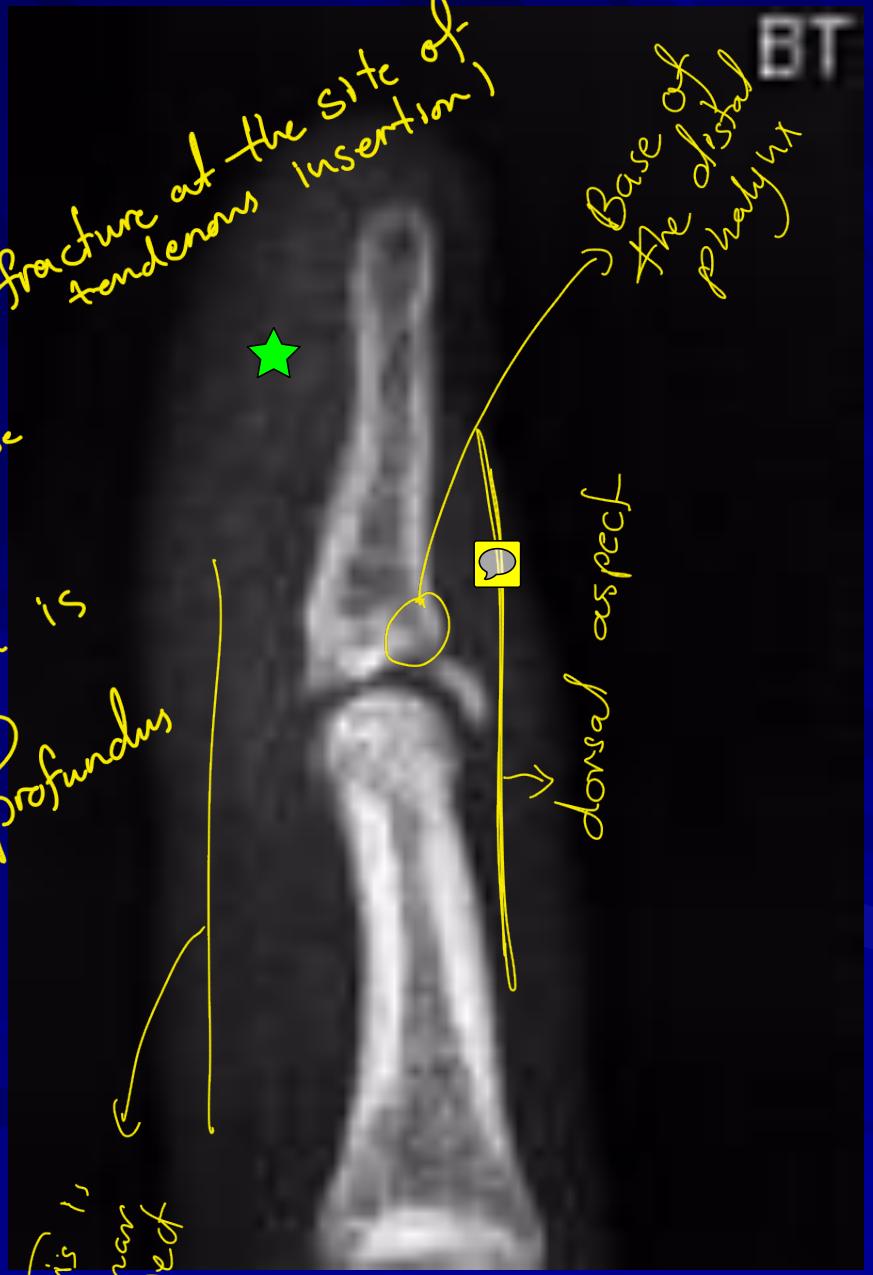
- Stress fracture: Is incomplete fracture caused by repeated stress , or over-use to bone, in the form of a fine crack.

  most common in the proximal shaft of the tibia and fibula (long distance runners and ballet dancers).

- **March fracture:** is a type of stress fracture, also known as fatigue fracture of second and third metatarsal bones caused by recurrent overstress, is more common in soldiers.

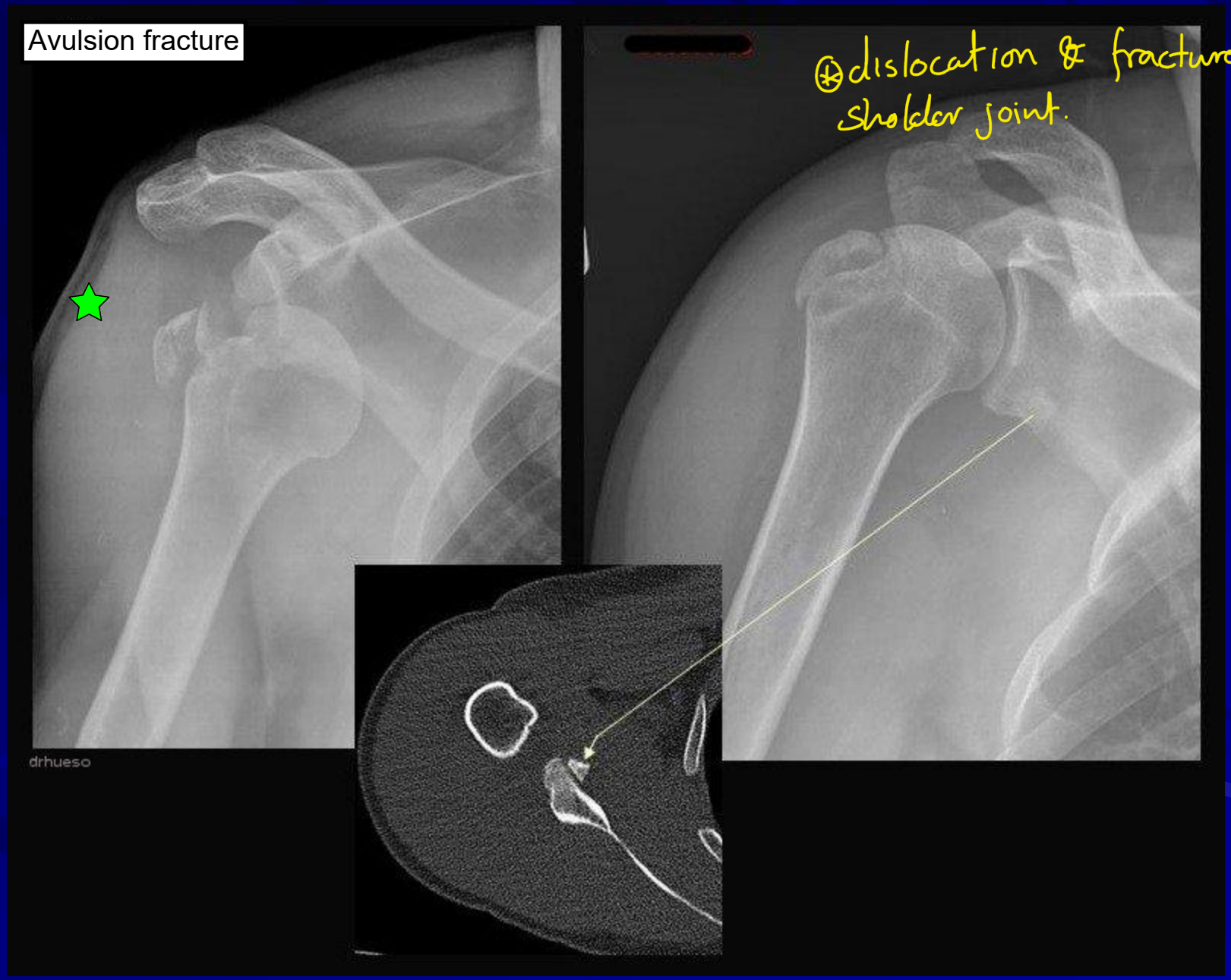

linear fracture along parietal bone
لازم بس نشوف الـ
X-ray
عشان
CT
نكمل
نشوف في
hemorrhage or not.

linear fracture involves the 3rd metacarpal bone

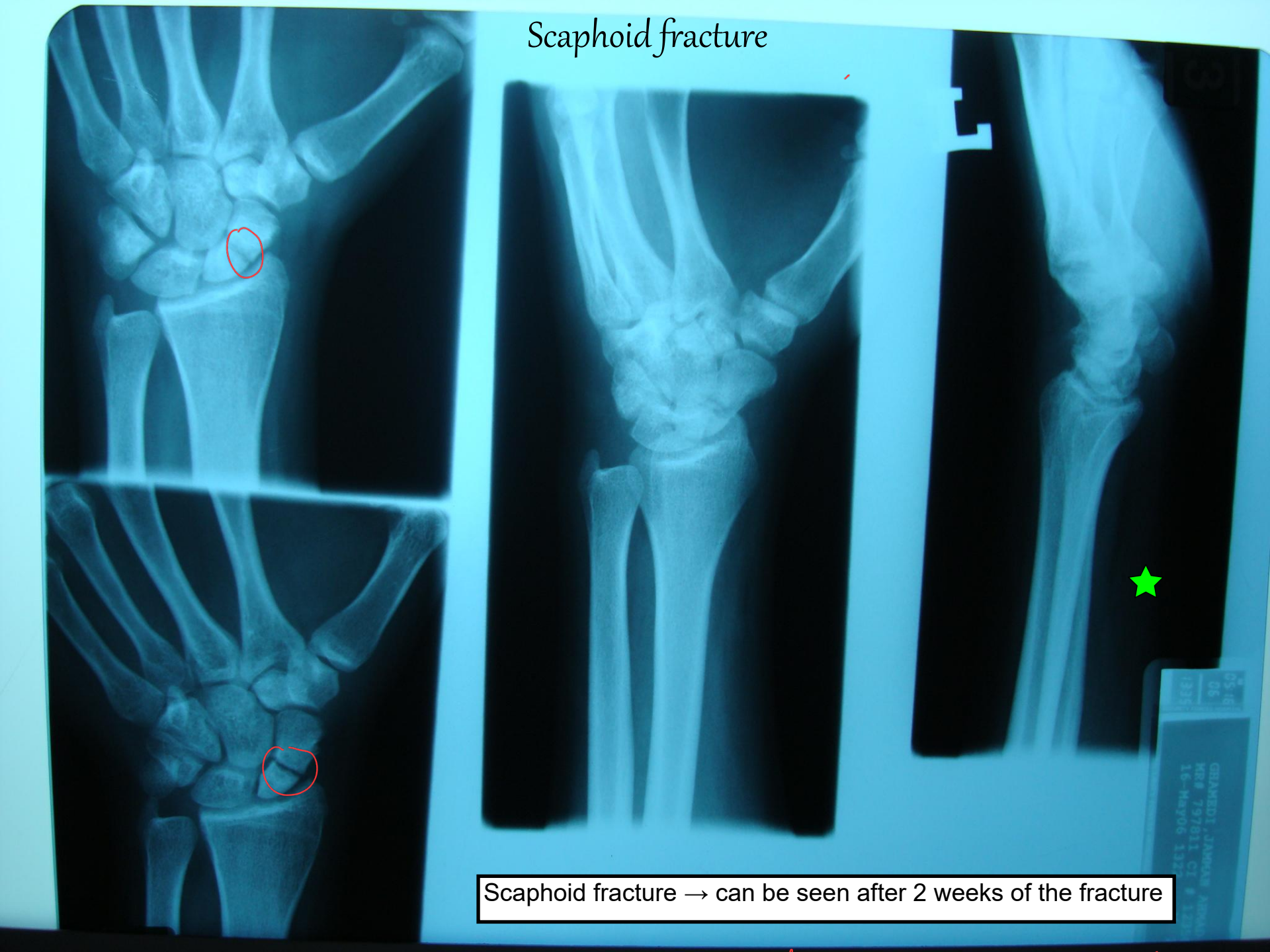


* index finger
* Lateral view
* Avulsion fracture (fracture at the site of tendenous insertion)
anterior part of the base of distal phalynx
* the tendon which is inserted here (IS) flexor digitorum profundus
extensor

aut :- frontal :- palmar
=> :- flexion


Avulsion fracture
⊛dislocation & fracture of shoulder joint.
drhueso

Scaphoid fracture



Scaphoid fracture → can be seen after 2 weeks of the fracture

Scaphoid fracture

* كيف نعرف إنه المريض عنده Scaphoid F. من الـ Clinical picture ؟

* **Tenderness of the snuff box**

Here, normal x-ray doesn't exclude the fracture

قد يكون يكون الـ fracture within the core of the bone

you have 2 options

CT or MRI to take definitive diagnosis

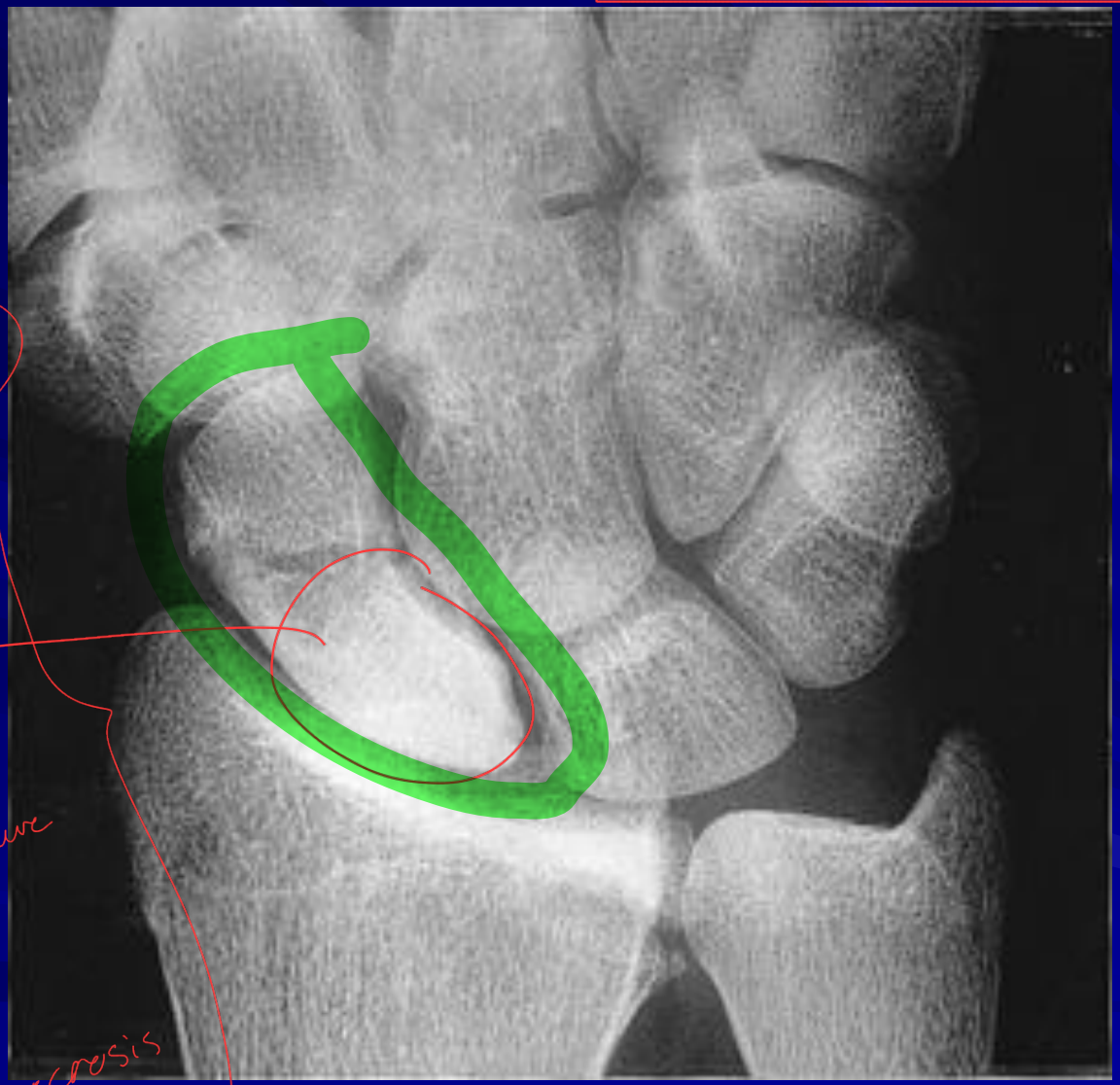
Treat it as scaphoid fracture وبعد أسبوعين تابعي الصورة

لو ما بان عليه osteonecrosis وكمان لا

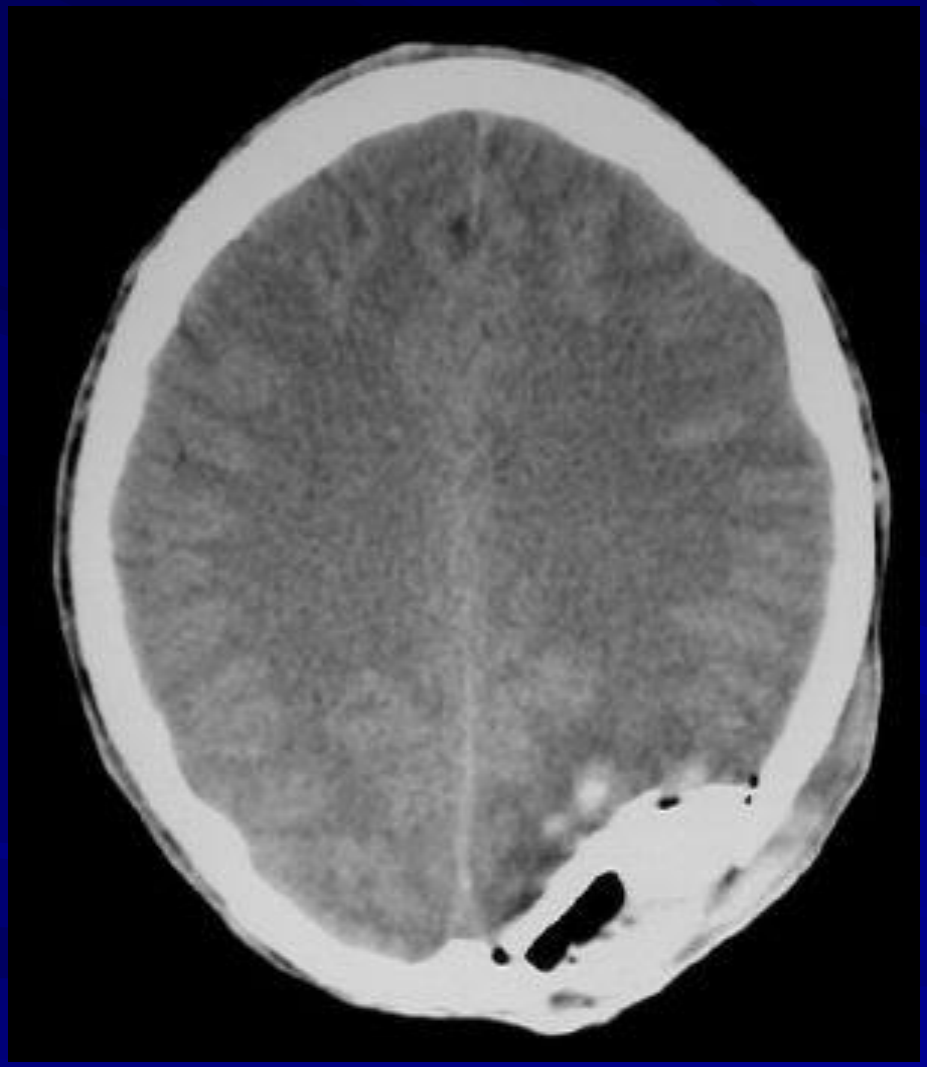
Note من هامش الـ

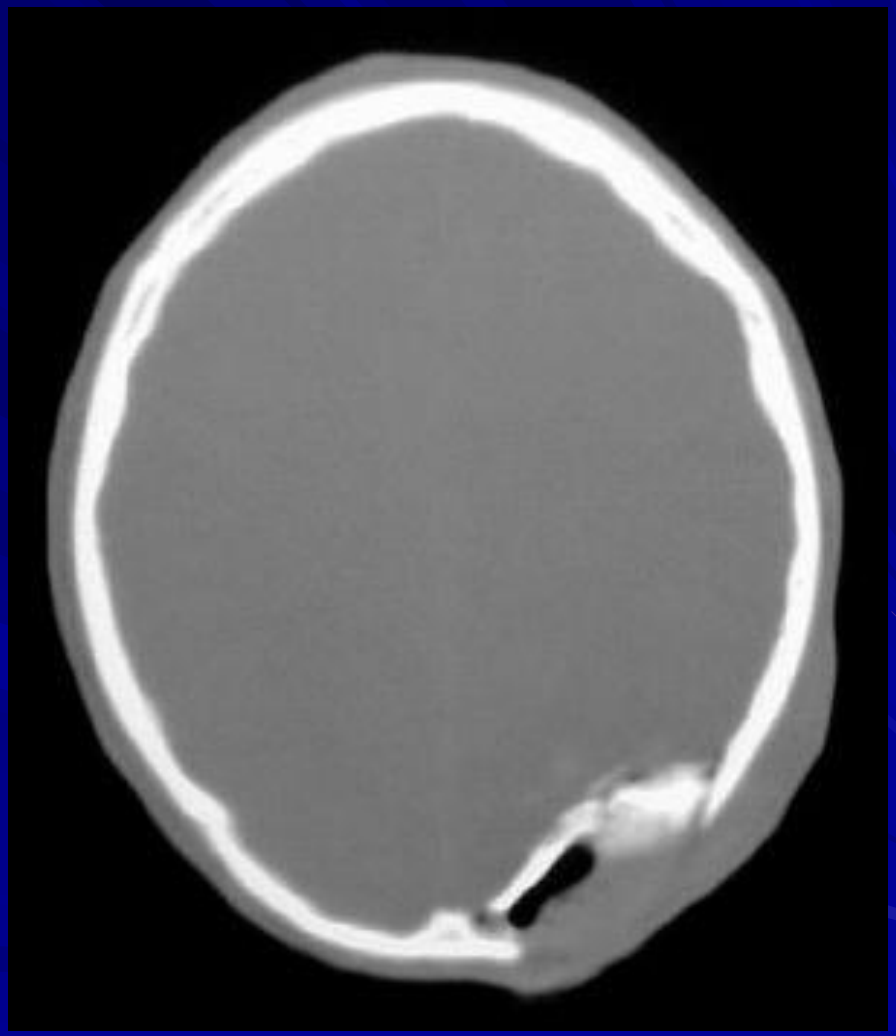
sclerosis

عبارة عن osteonecrosis, طلع المريض بـ scaphoid fracture لكنه ما تعالج فبعد فترة صار عنده sclerosis and osteonecrosis



Occipital depression>>
depressed fracture





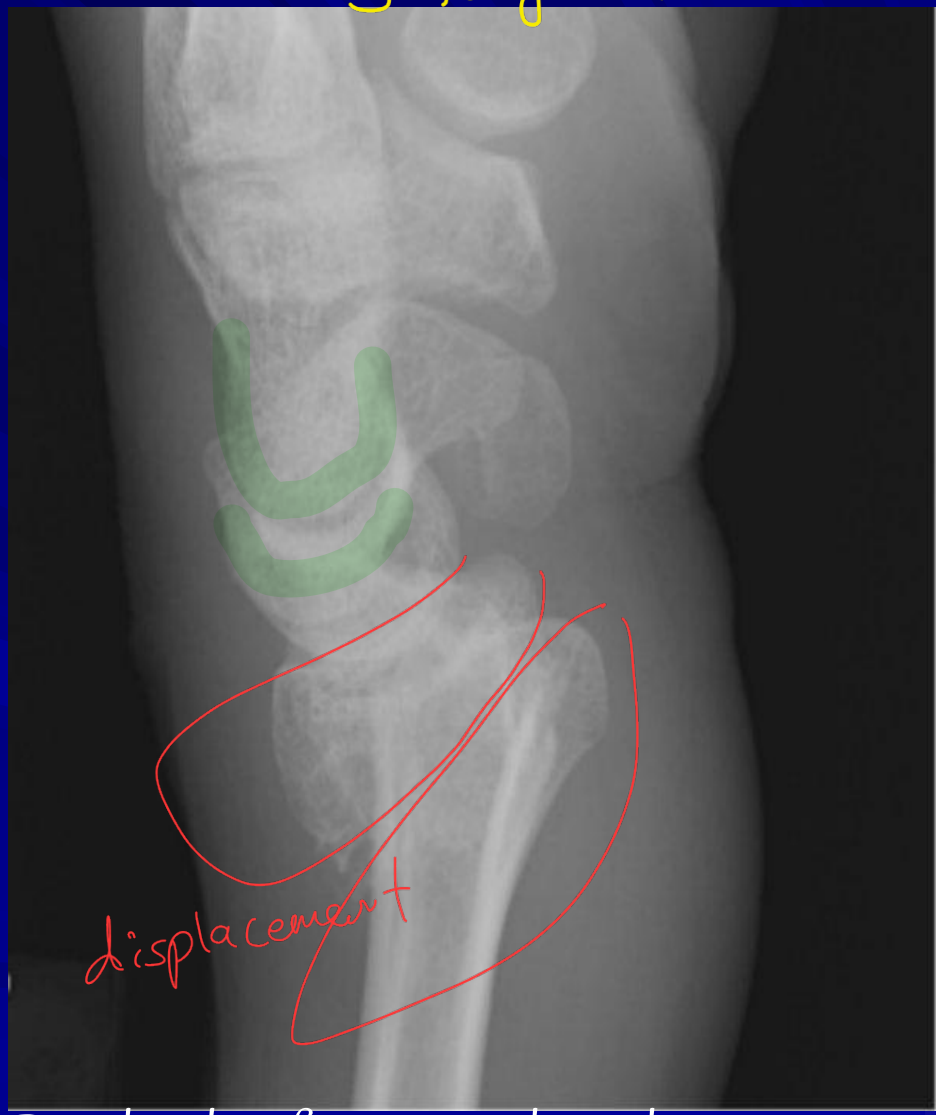
* AP view of the wrest joint

↳ there is fracture at the distal of the radius

displacement

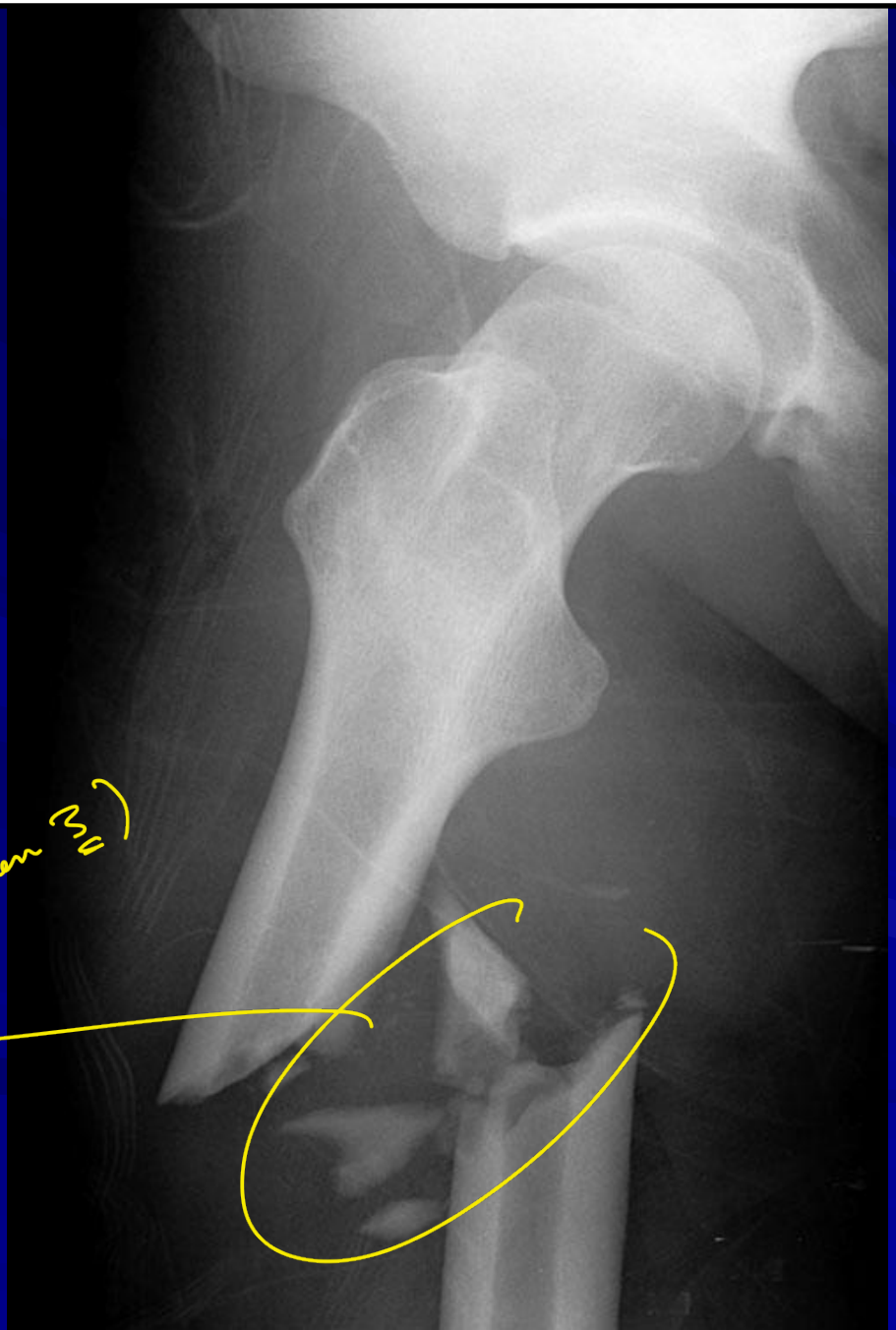
* lateral view

↳ dorsal displacement of bony fragment



Distal radius fracture on lateral view

Comminuted fracture (open or closed depends on the skin)



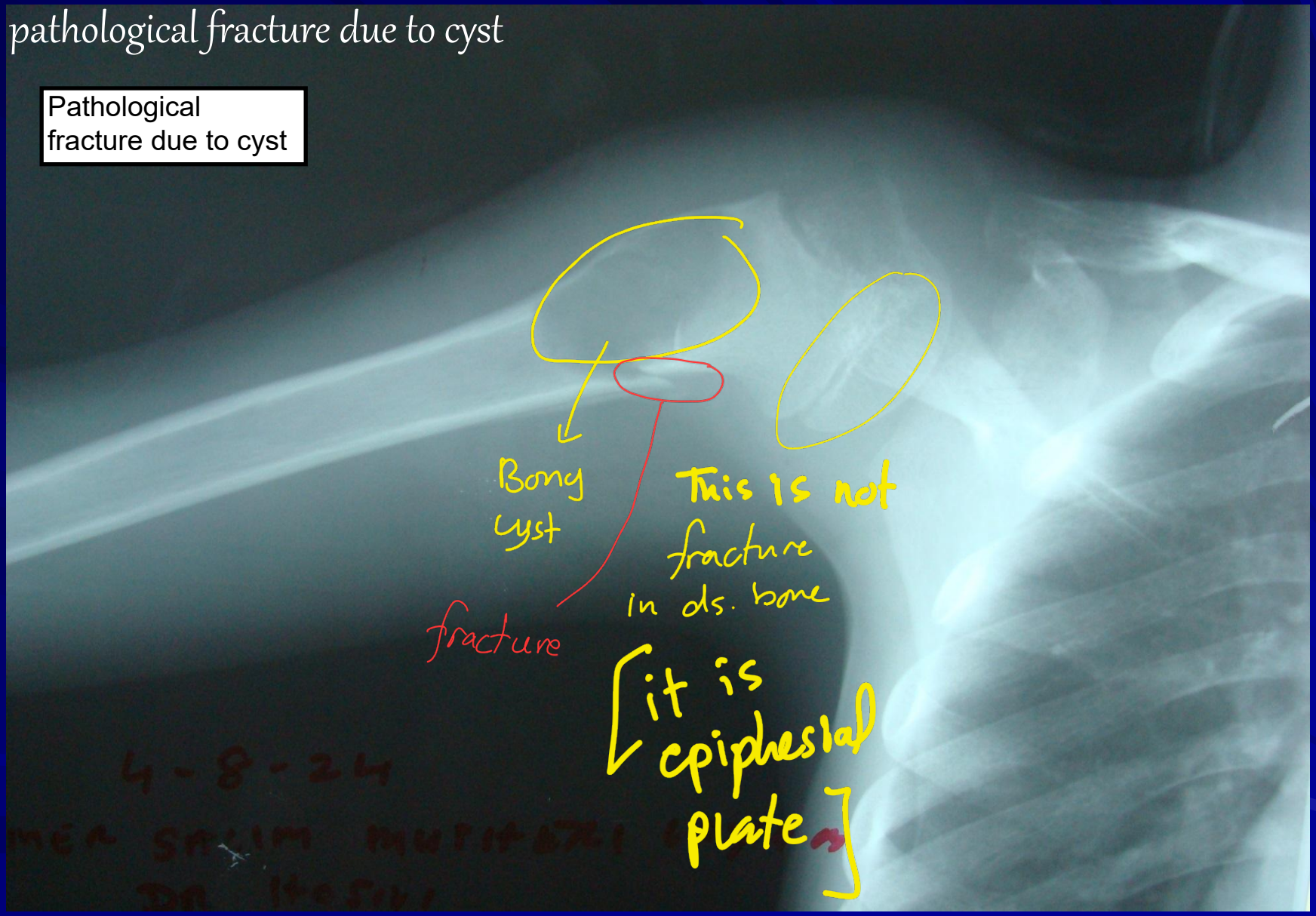
Green stick fracture
→ discontinuity of one cortex while the other is intact

Buckling fracture

Green stick fracture

pathological fracture due to cyst

Pathological fracture due to cyst



SPINAL INJURIES

The spinal injury can be classified in three types:

1 - Compression fracture.

2- Burst fracture.

3- Fracture-Dislocation.

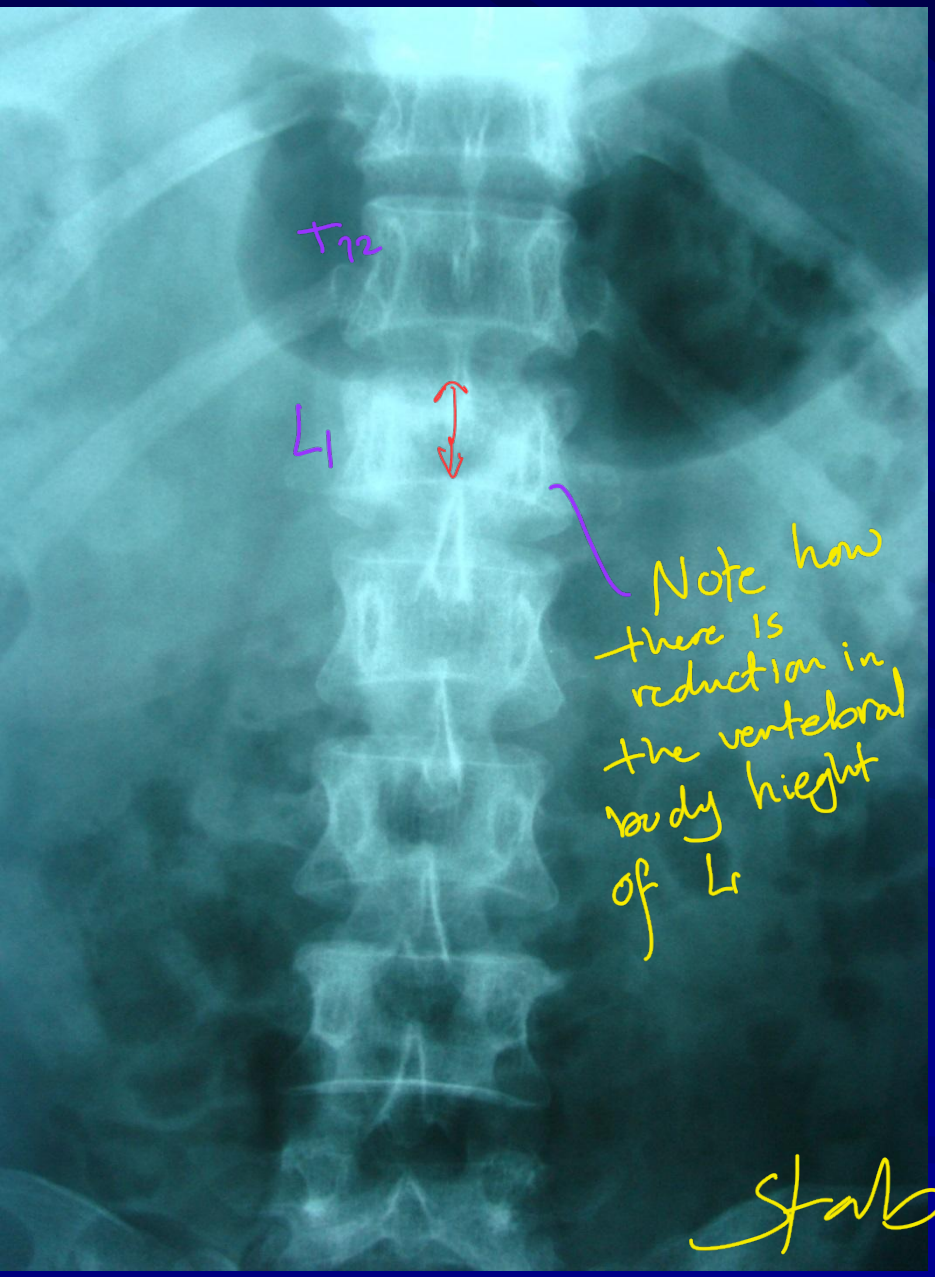
It involves ant. & middle vertebral columns so it may affect spinal canal ∴ (unstable fracture)

⇒ usually affect vertebral bodies ∴ affect ant. vertebral columns. So it will not affect the spinal canal & spinal nerves ⇒ so it is stable fracture

انفجار

- fractures are 2 types : stable , unstable
- any fragment may compress on the spinal cord

غالبًا بكسر بسبب axial loading with rotation

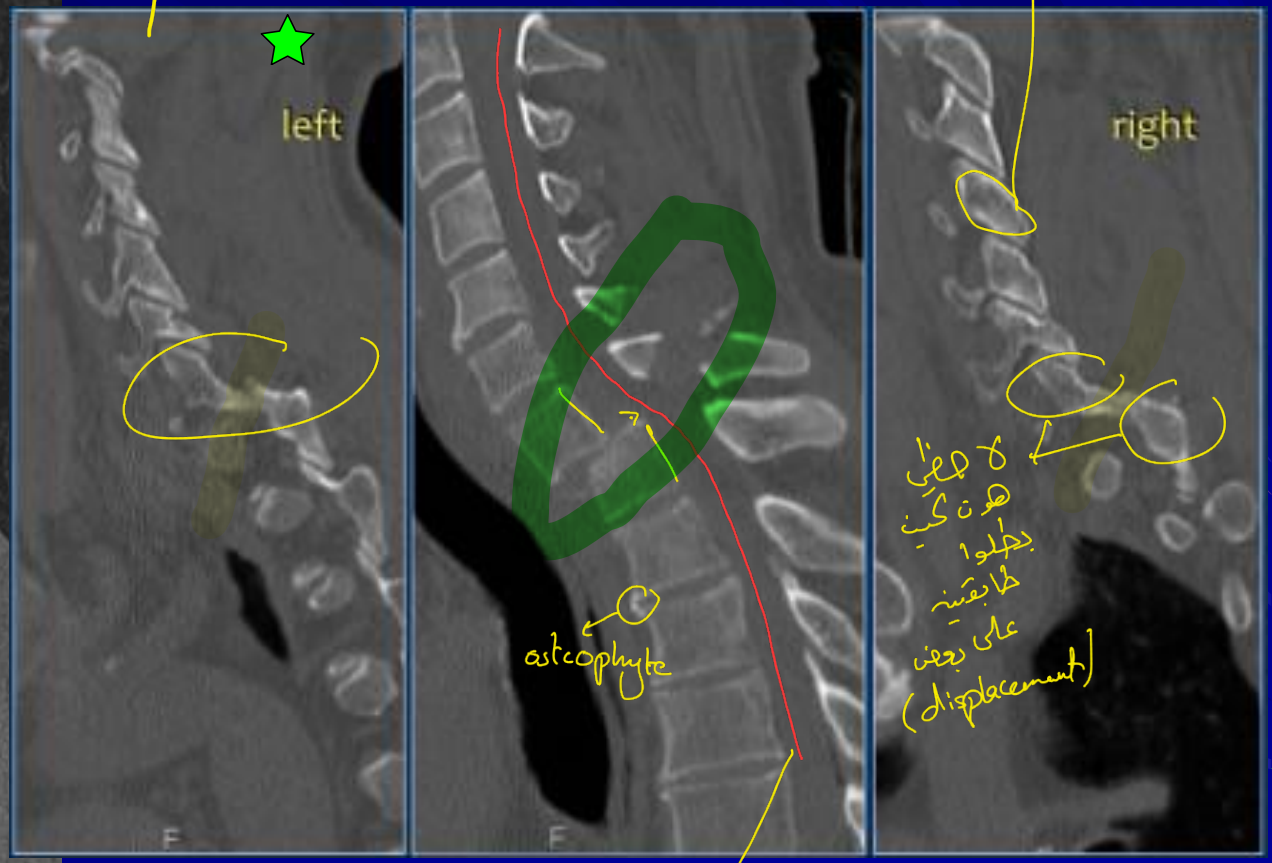


Stable fracture

اسئلة صافنات !؟

unstable F.
↑
Burst F.

dislocation



this is articular facet
لازم يكونوا كلهم طابقين على بعض

لاحظي كيف حالة ال spinal canal is narrowed

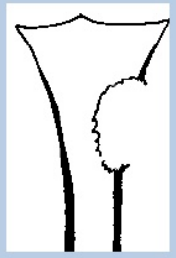
Benign bone tumour

- Are generally well defined and have a sharp narrow zone of transition between normal and abnormal bone . (where in malignant tumour is ill-defined)
- Benign lesions sometimes cause thinning of the adjacent cortex, however cortical destruction is more typical of malignant lesions .
- A well defined sclerotic margin is in favour of benign lesions and rare in malignant lesions .
- Periosteal reaction: lamillated (onion), sun-burst and codman triangle (interrupted).

The presence of soft tissue component increase the likehood of malignancy

Benign bone tumours / 2

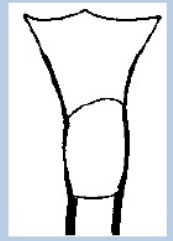
- *Non-ossifying fibroma*
- *Chondroma*
- *Osteochondroma*
- *Osteoma*
- *Ostoid osteoma*
- *Osteoblastoma*
- *Simple bone cyst*
- *Aneurysmal bone cyst*
- *Haemangioma*
- *Giant cell tumor*

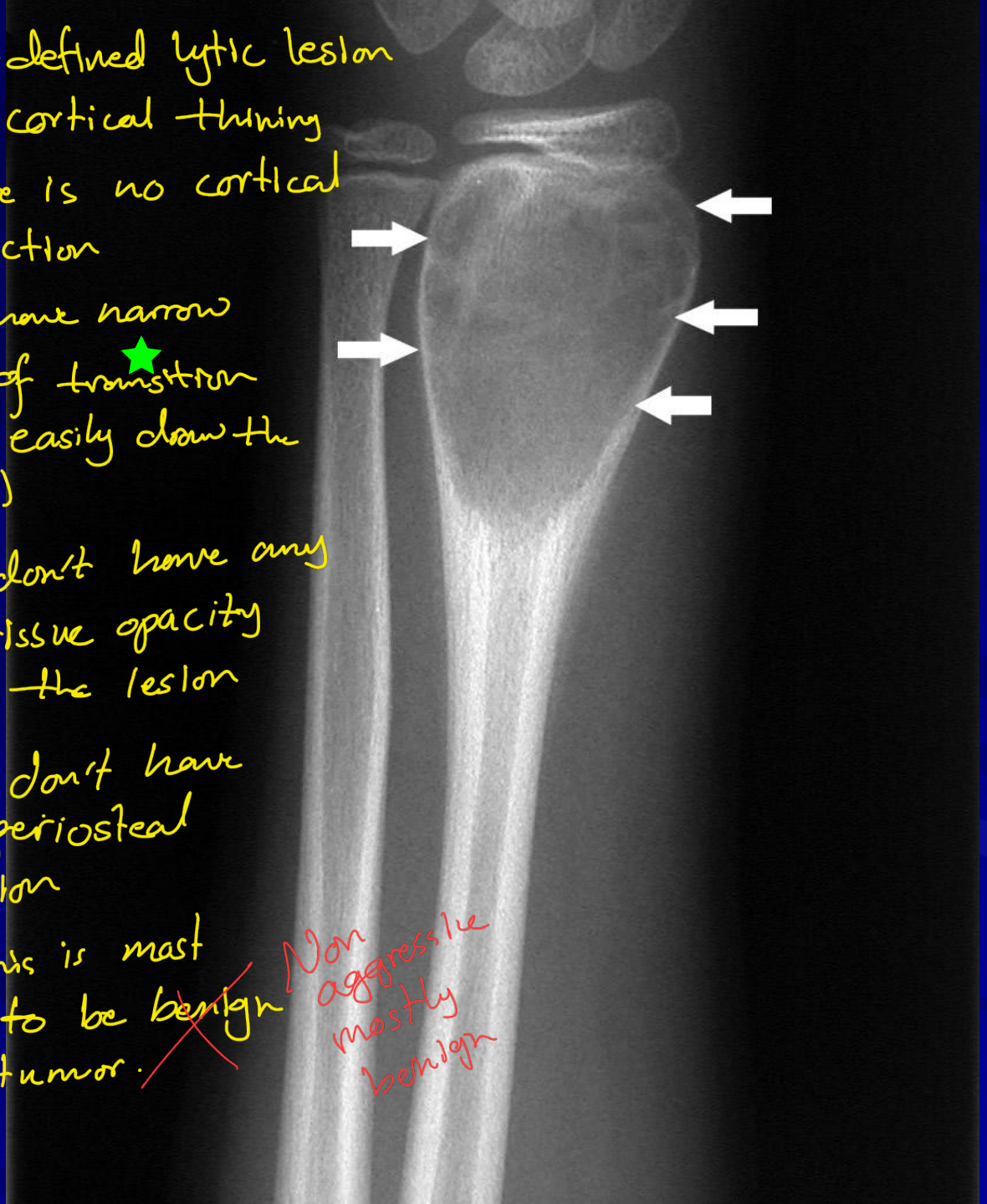


Cortical erosion

"Cortical Erosion"
destruction of cortex by a lytic or sclerotic process.

"Endosteal Scalloping"
Thinning of the cortex by an intraosseous process





*well-defined lytic lesion with cortical thinning

⇒ There is no cortical destruction

⇒ we have narrow zone of transition (I can easily draw the lesion)

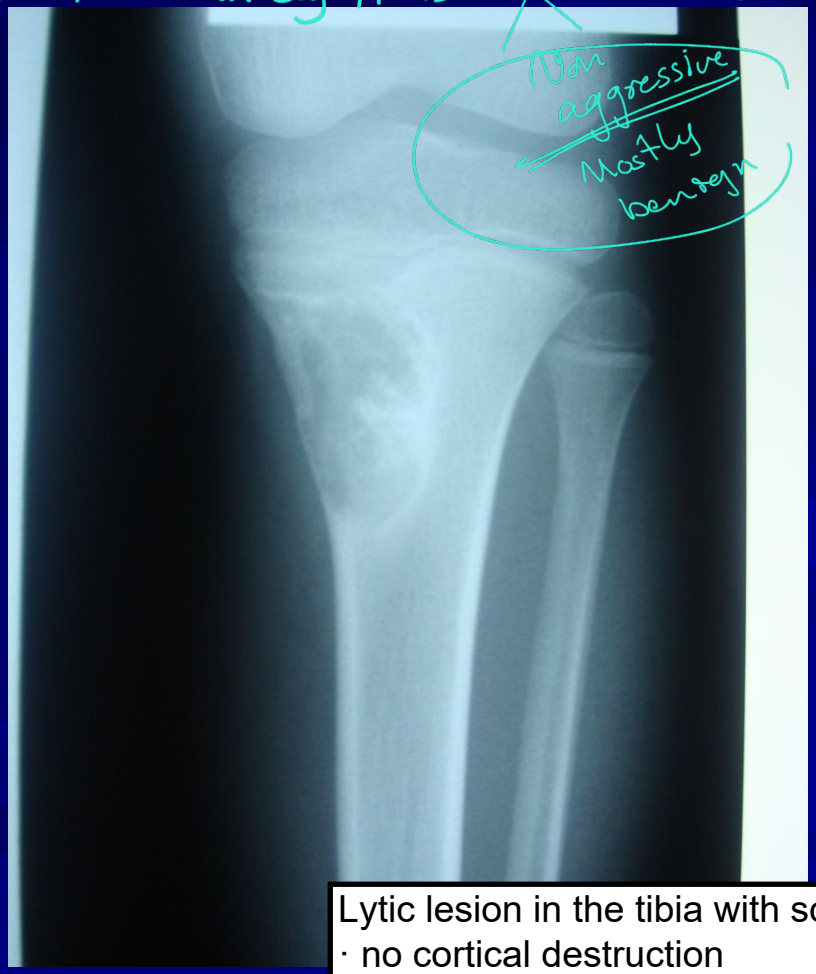
⇒ we don't have any soft tissue opacity inside the lesion

⇒ We don't have any periosteal reaction

⇒ So this is most likely to be ~~benign~~ Non aggressive mostly benign bone tumor.

- well defined lesion that has narrow zone of transition
- It has sclerotic margins ⇒ So it is more likely to be non aggressive (More benign)
- No periosteal reaction
- No cortical destruction
- No soft tissue opacity inside the lesion

⇒ = Most likely it is ~~benign~~ bony lesion



Lytic lesion in the tibia with sclerotic rim
· no cortical destruction
· no soft tissue mass
· there is a thinning in the cortex not destruction (intact cortex)

Malignant bone tumour

- Are destructive lesions , often associated with periosteal reaction , and have a wide zone of transition between normal and abnormal bone.
- Periosteal reaction: lamillated (onion), sun-burst and codman triangle (interrupted).
- The most common malignant bone tumour is a metastasis and it’s often solitary .

Malignant bone tumors / 2

Radiological features :

- Plain film: shows an area of bone destruction
- CT and MRI are the best imaging modalities to evaluate tumours and determine bone and soft tissue involvement
- Features that may be verified by CT / MRI:

  - tumour vascularity
  - infiltration of surrounding tissue
  - relationship to nerves and vessels

Malignant bone tumours / 3

The most common primary malignant bone tumors are:

- ***Osteogenic sarcoma***
- ***Ewings tumour***
- **Chondrosarcoma**
- **Fibro sarcoma**

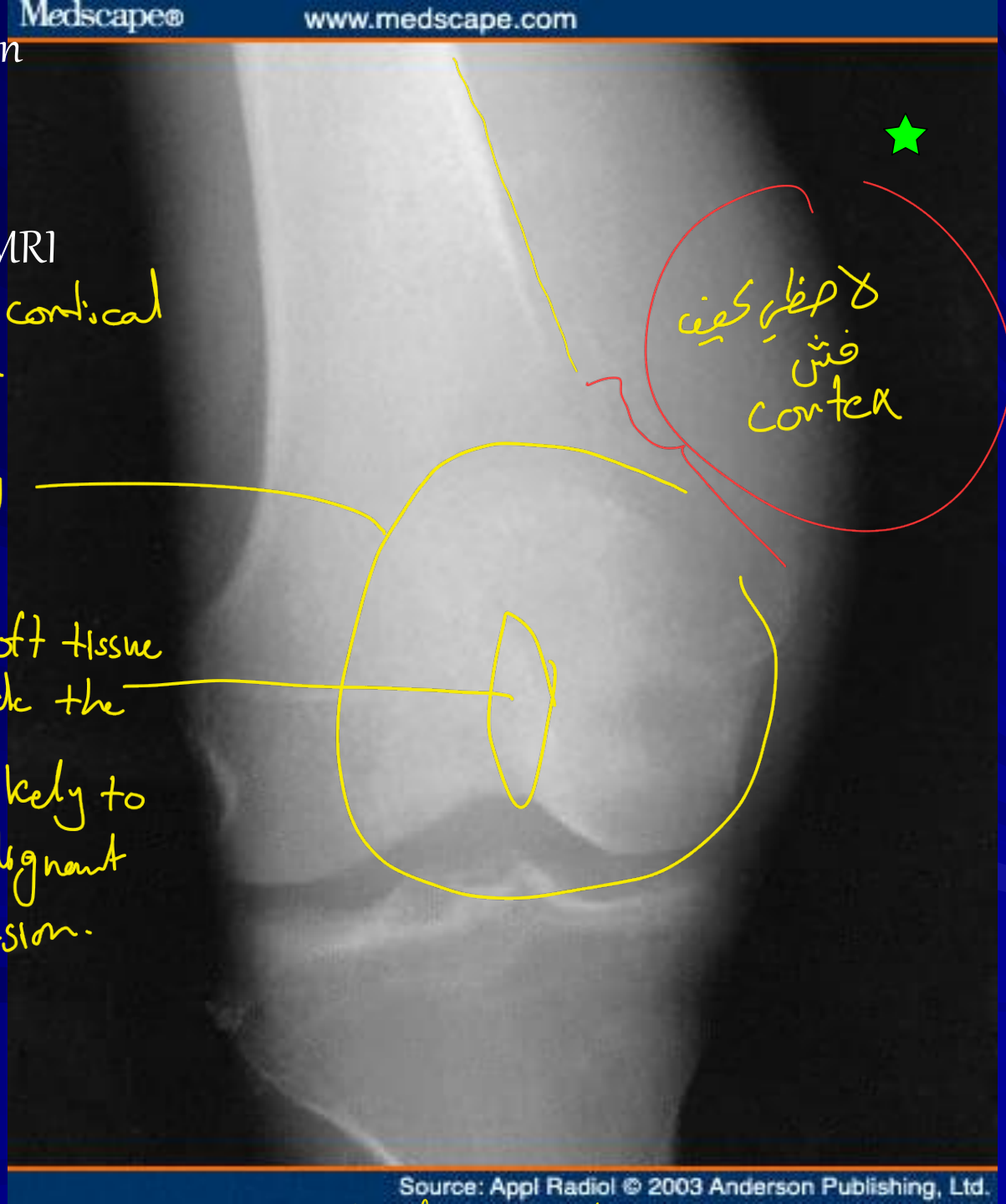
Determined according to the age

Destructive lesion and soft tissue swelling
wee need CT & MRI

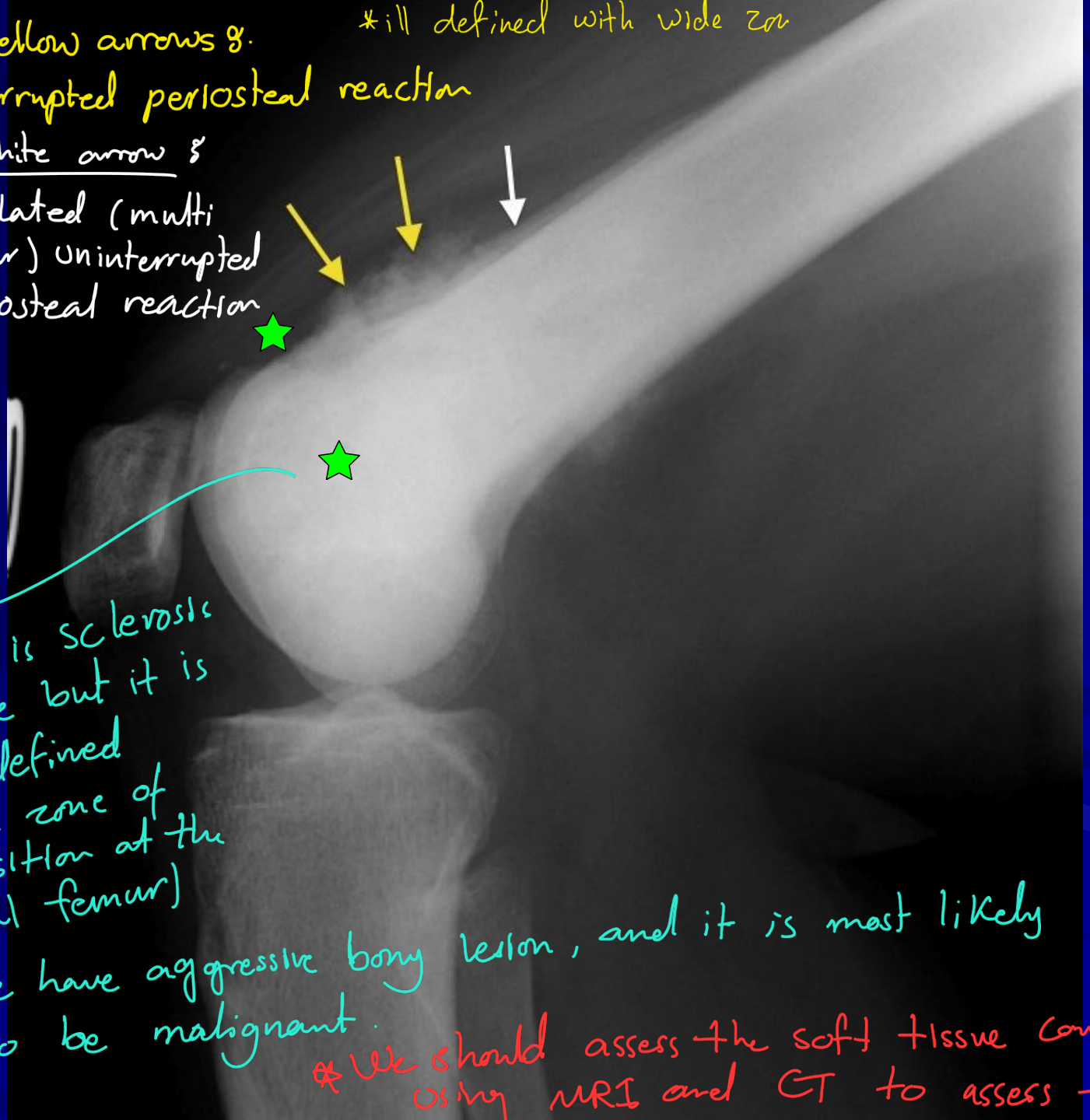
* we have cortical destruction

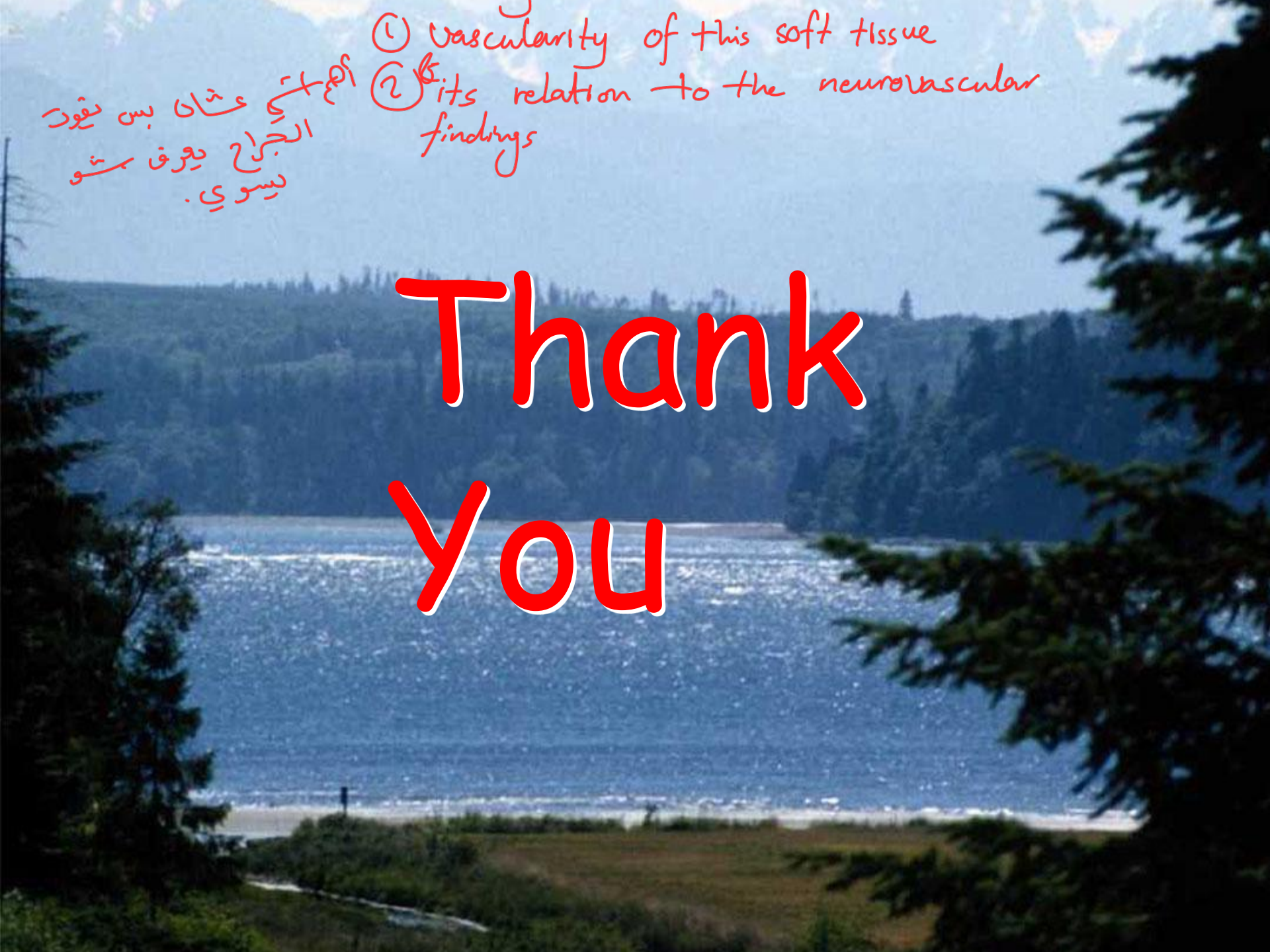
* ill-defined sclerosis.

* there is soft tissue opacity inside the lesion
  ∴ most likely to be malignant bony lesion.



الصورة
بكي بالفيديو
اوضح بكتير
من هاد


* Yellow arrows &
interrupted periosteal reaction
* White arrow &
lamellated (multi - layer) uninterrupted periosteal reaction
*ill defined with wide zo
There is sclerosis inside but it is ill-defined (wide zone of transition at the distal femur)
* we have aggressive bony lesion, and it is most likely to be malignant.
* We should assess the soft tissue component using MRI and CT to assess the

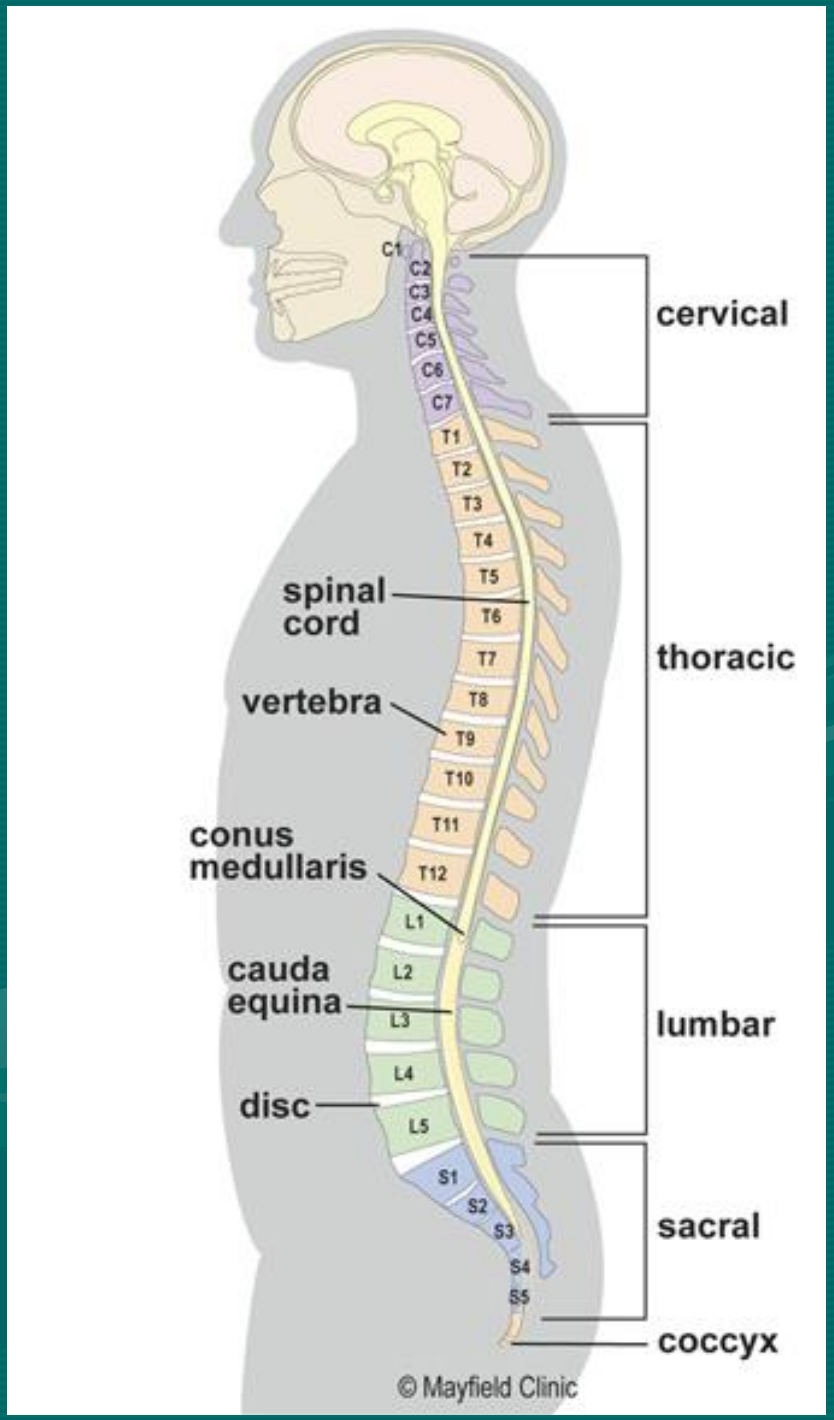

① Vascularity of this soft tissue
② its relation to the neurovascular findings
أهم شي عشان بس نقود الجراح يعرف بشو يسوي.
Thank You

Shaden Fadda

SPINE IMAGING

Spine anatomy

- The vertebral column forms the central bony axis of the spine, and is composed of 33 vertebrae.
- 7 Cervical vertebrae
- 12 Thoracic vertebrae
- 5 Lumbar vertebrae
- 5 Fused sacral segments
- 4 Fused coccygeal segments

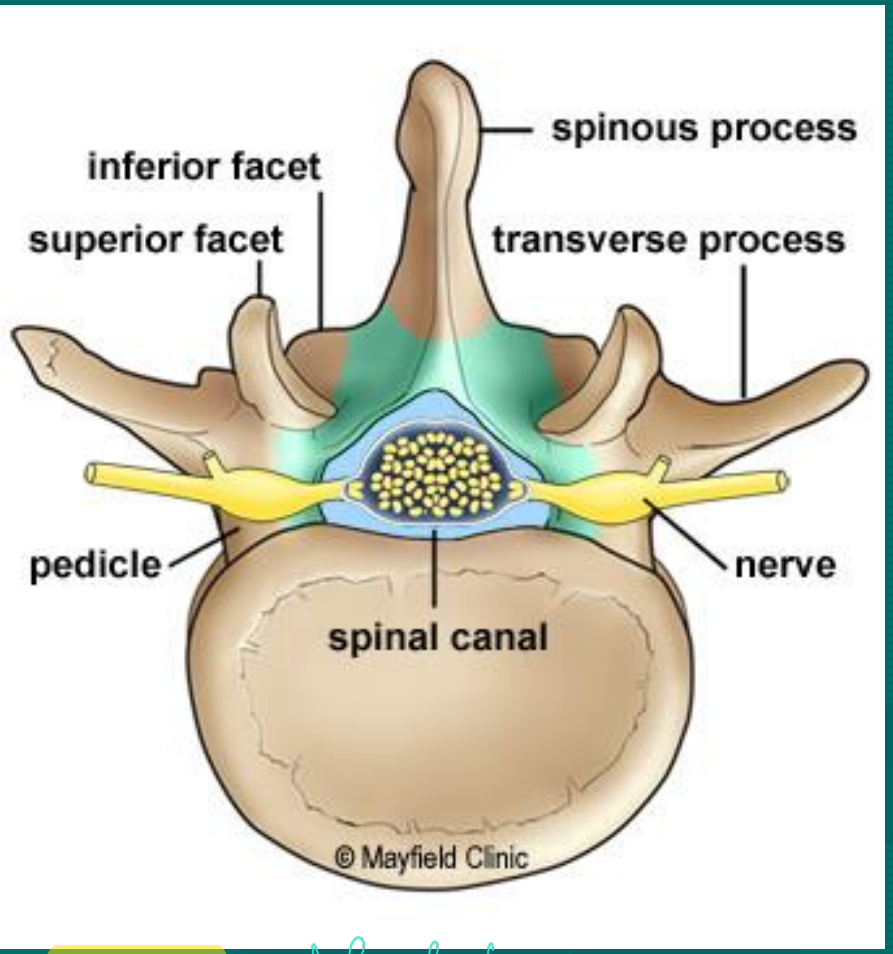

C1
C2
C3
C4
C5
C6
C7
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
spinal cord
vertebra
conus medullaris
cauda equina
disc
cervical
thoracic
lumbar
sacral
coccyx
© Mayfield Clinic

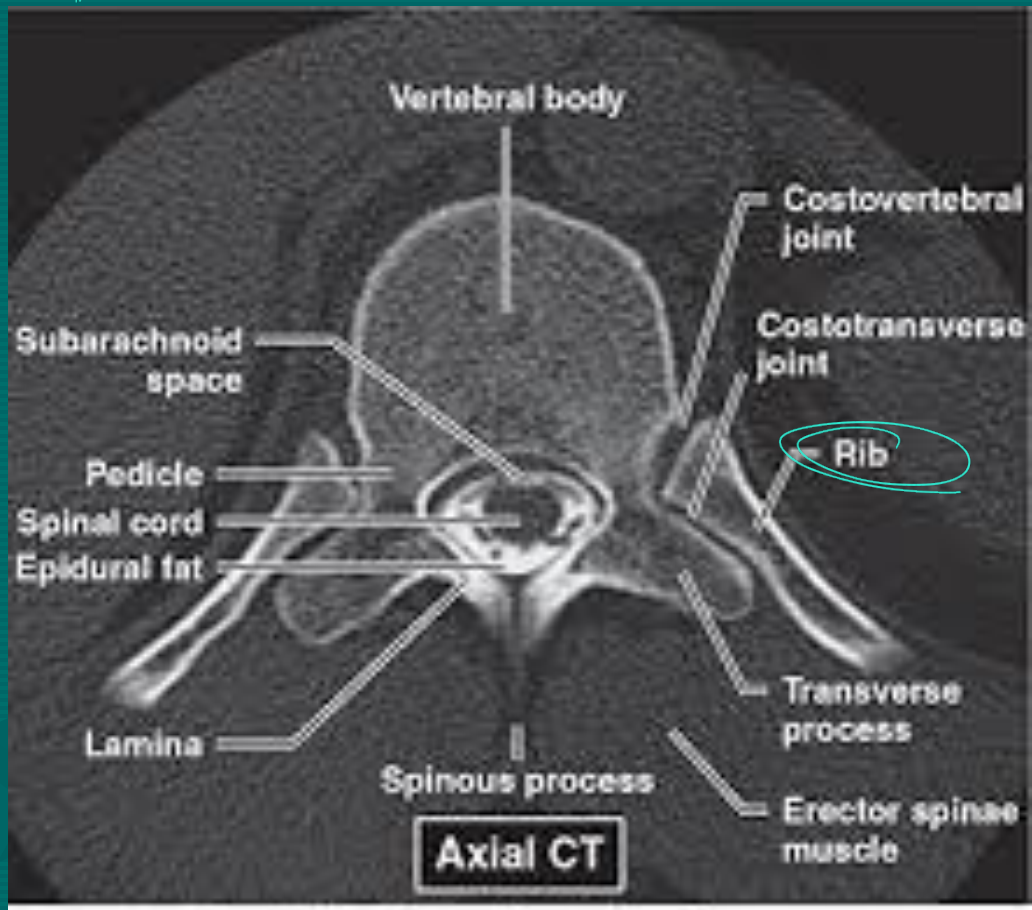
Spine anatomy / 2

- A typical vertebra consist of two parts:
  - Anterior (the body)
  - Posterior (neural arch)
- The two parts of the vertebrae enclose the vertebral canal which contains:
  - The spinal cord.
  - The meninges.
  - The associated vessels.

* Atypical vertebrea ⇒ C_1 (atlas), C_2 (axis)

This is pic of thoracic vertebrea



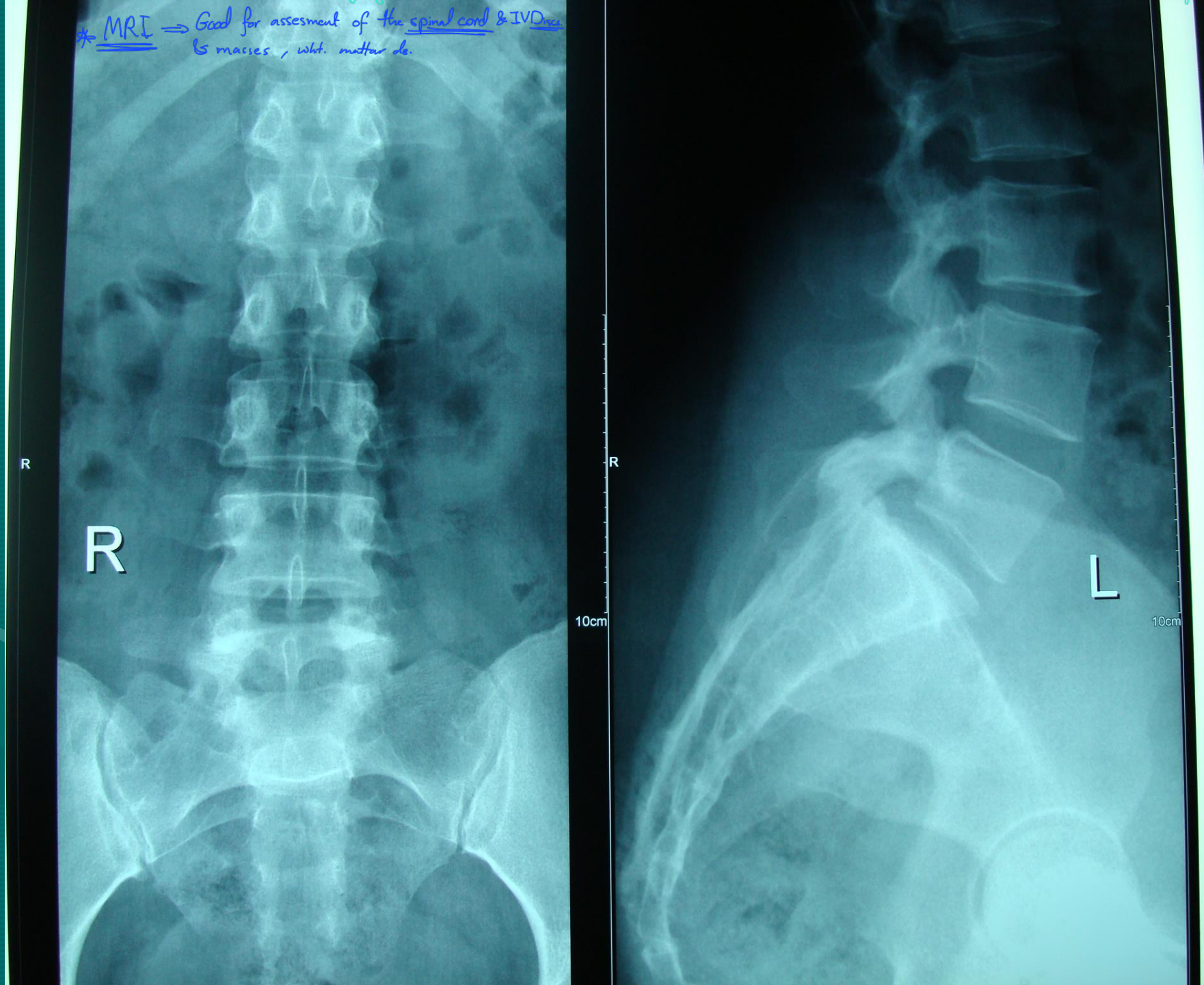


Source: Lynn N. McKinnis: Fundamentals of Musculoskeletal Imaging, 4th Edition: www.FADavisPTCollection.com

X-ray good for fractures

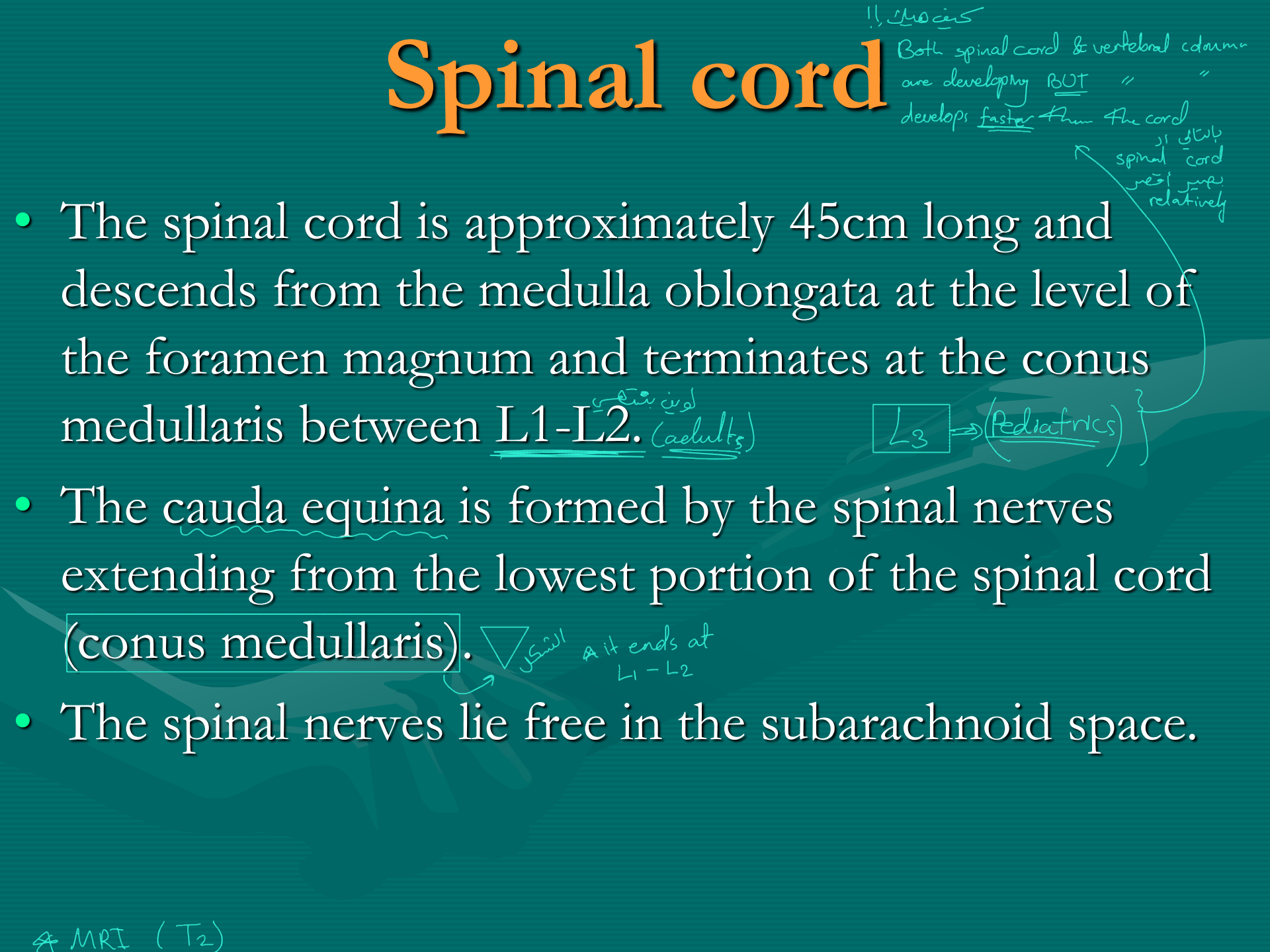
Hemorrhage associated w/ fractures ⇒ We use CT

*US ⇒ Not used for spine imaging bcs the bone will cause totally reflection of sound waves BUT US can be used in infants bcs their bones are still cartilagenous

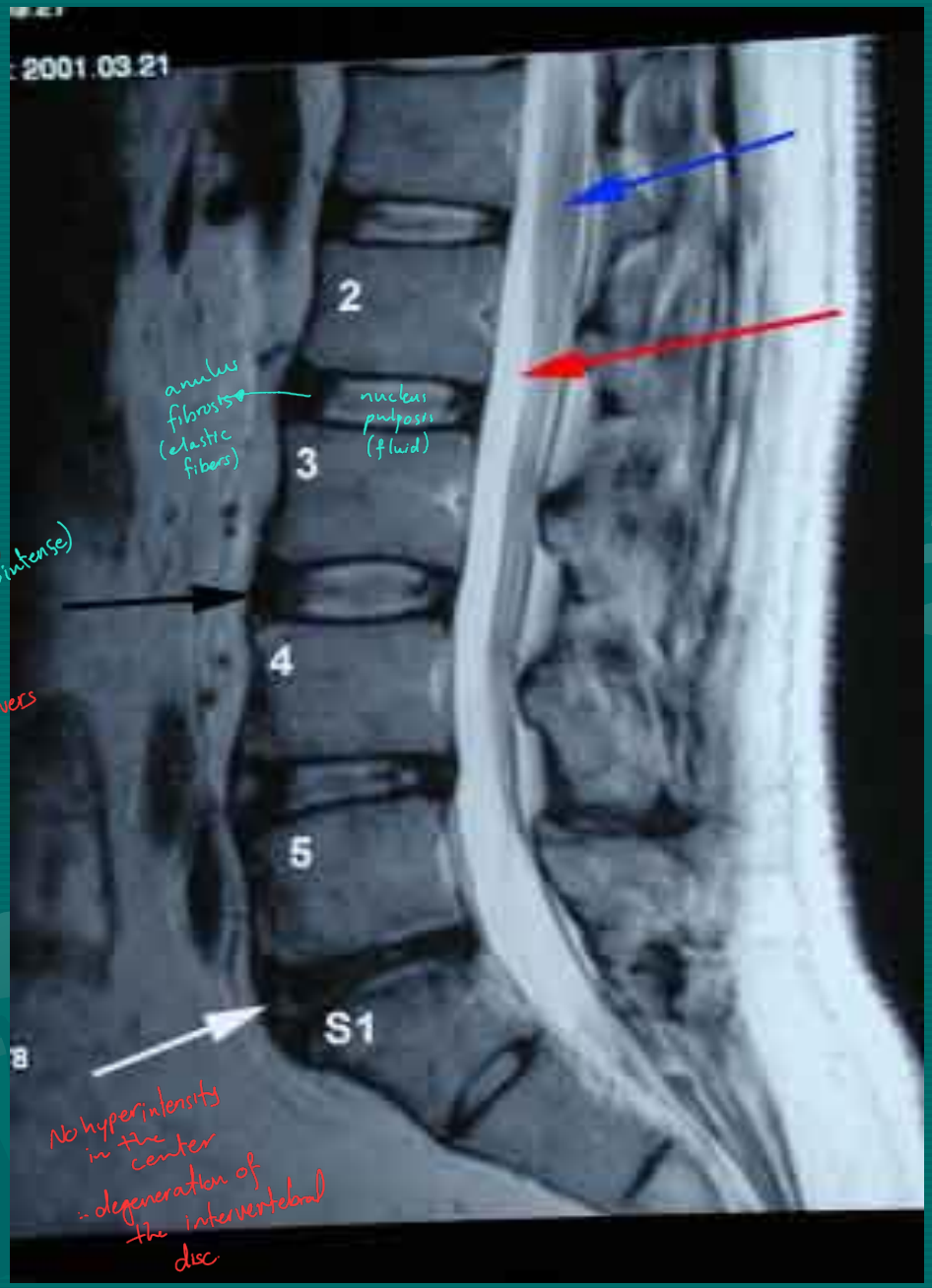

* MRI ⇒ Good for assesment of the spinal cord & IVDiscs & masses, wht. matter de.
R
R
10cm
R
L
10cm

Spinal cord

- The spinal cord is approximately 45cm long and descends from the medulla oblongata at the level of the foramen magnum and terminates at the conus medullaris between L1-L2.
- The cauda equina is formed by the spinal nerves extending from the lowest portion of the spinal cord (conus medullaris).
- The spinal nerves lie free in the subarachnoid space.



* Sagittal view of lumbar spines



* Intervertebral disc

annulus fibrosus (elastic fibers = hypointense)

nucleus pulposis (hyperintense) ∵ it is gelatinous fluid

shock absorbers

* In ageing → gelly like material within nucleus pulp. ∴ elastic fibers of annulus fibrosis

DEVELOPMENTAL ANOMALIES OF THE LUMBAR SPINE

* Termination of the spinal cord at a lower level than expected (L_1-L_2) ⇒

- Sacralization or Lumbarization.
  - *Sacralization of L_5 ∴ L ⇒ (4) S ⇒ (6)
  - *Lumbarization of S_1 ⇒ Lumbar ⇒ 5+1 / Sacrum ⇒ four
  - [Transitional vertebrea]
- Spina bifida. → defect in the post. neural arch.
  - Level I: no fusion in the spinous process
  - Level II: meningiocele
    - meninges are protruding posteriorly through the bony defect
  - Level III: meningiomyelocele
    - meningies & part of the cord are protruding posteriorly through this bony defect
- Synostosis (Block (fused) vertebra).
  - There is partial or complete fusion btw. 2 adjacent vertebrea
- Hemivertebra.
  - *a condition where half of a vertebra in the spine doesn't form.
- Butterfly vertebra.
  - * There is central depression of the vertebral body ⇒ They result in scoliosis
- Myelomeningocele.
- Tethered cord. *
- Diastematomyelia.
  - * splitting of the cord into 2 parts (you will see that the cord is composed of 2 segments ⇒ fibrous / bony separation

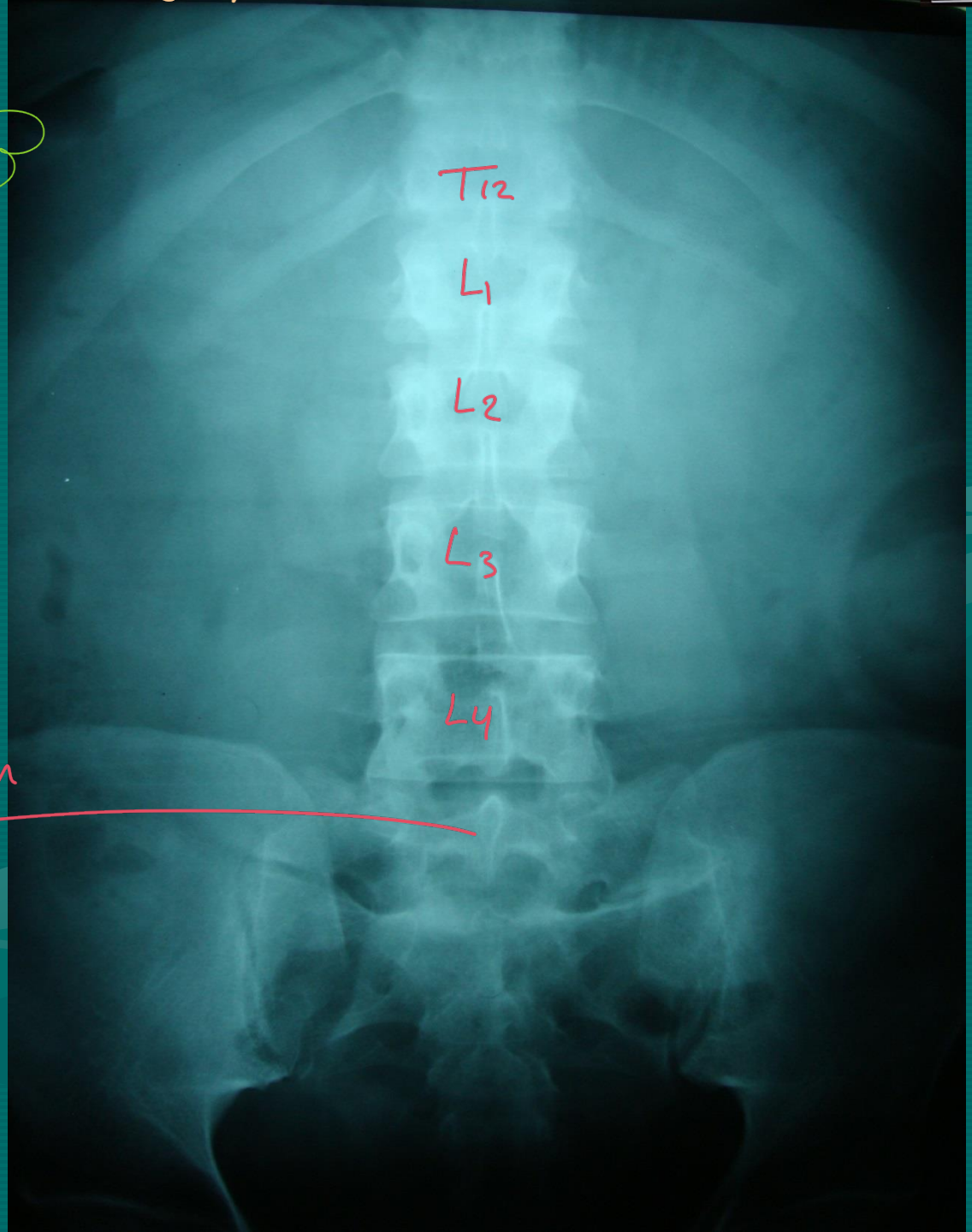
* AP

كيف نعد ال vertebrea ؟

Rib بندور على آخر

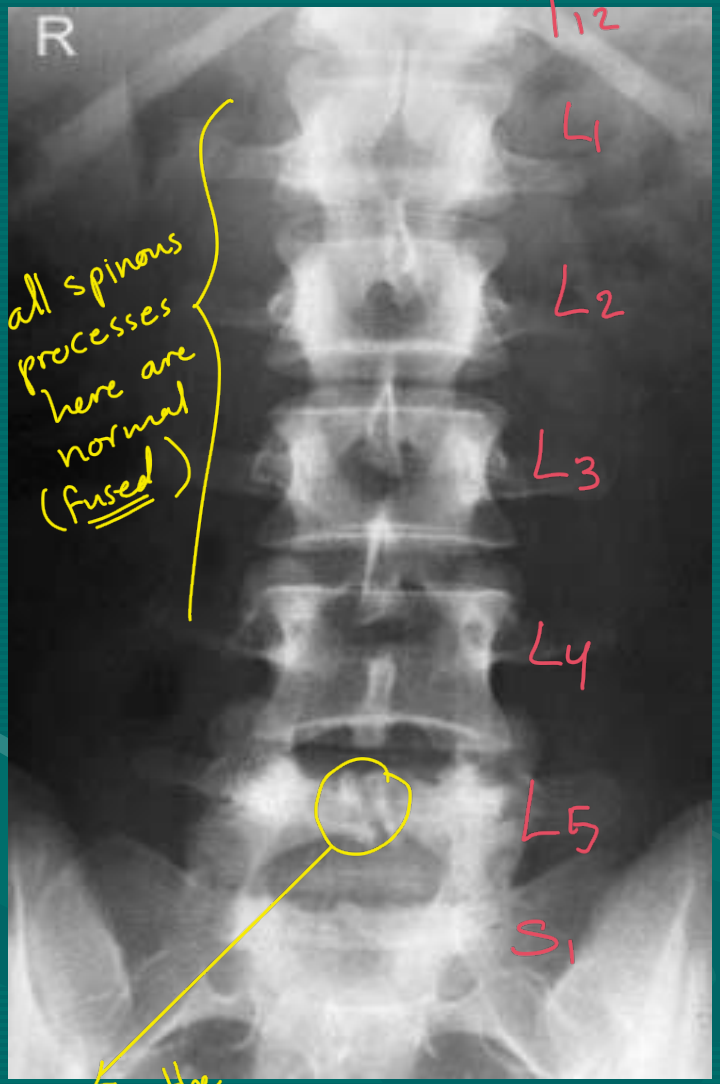
الم إذا ماسك

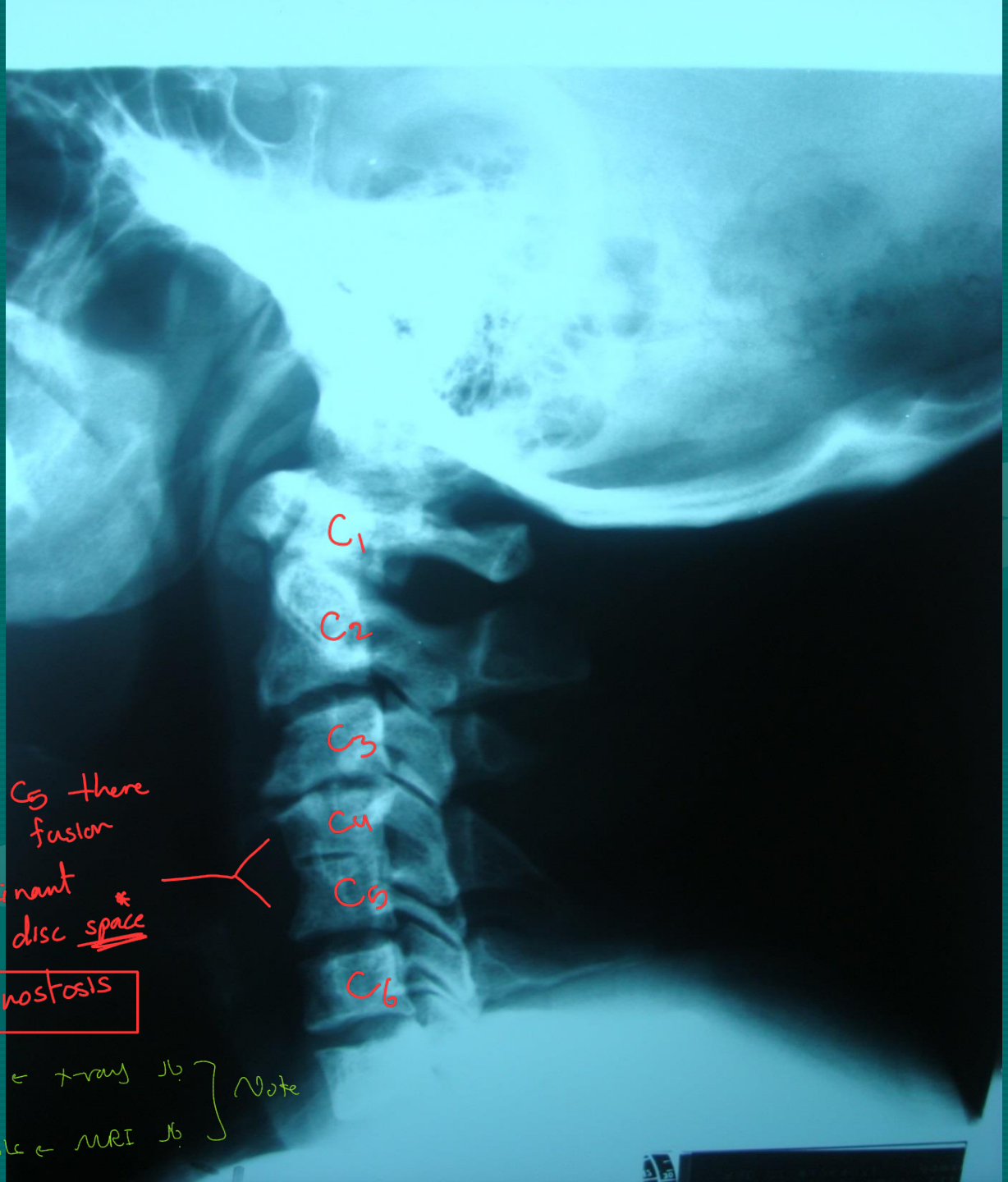
T_{12} فيه



Sacralization of L5

# of vertebrae
(15) Normal

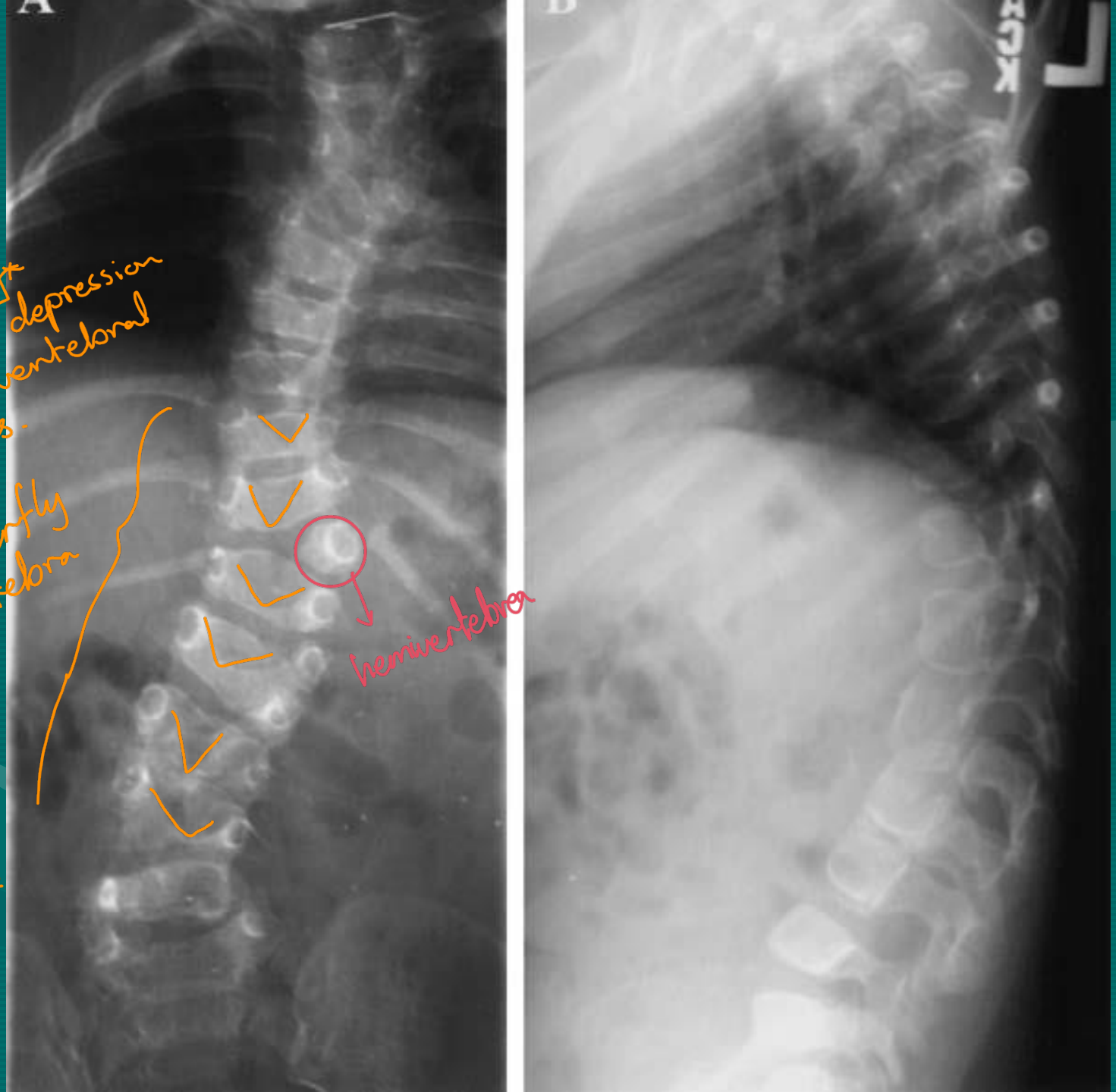


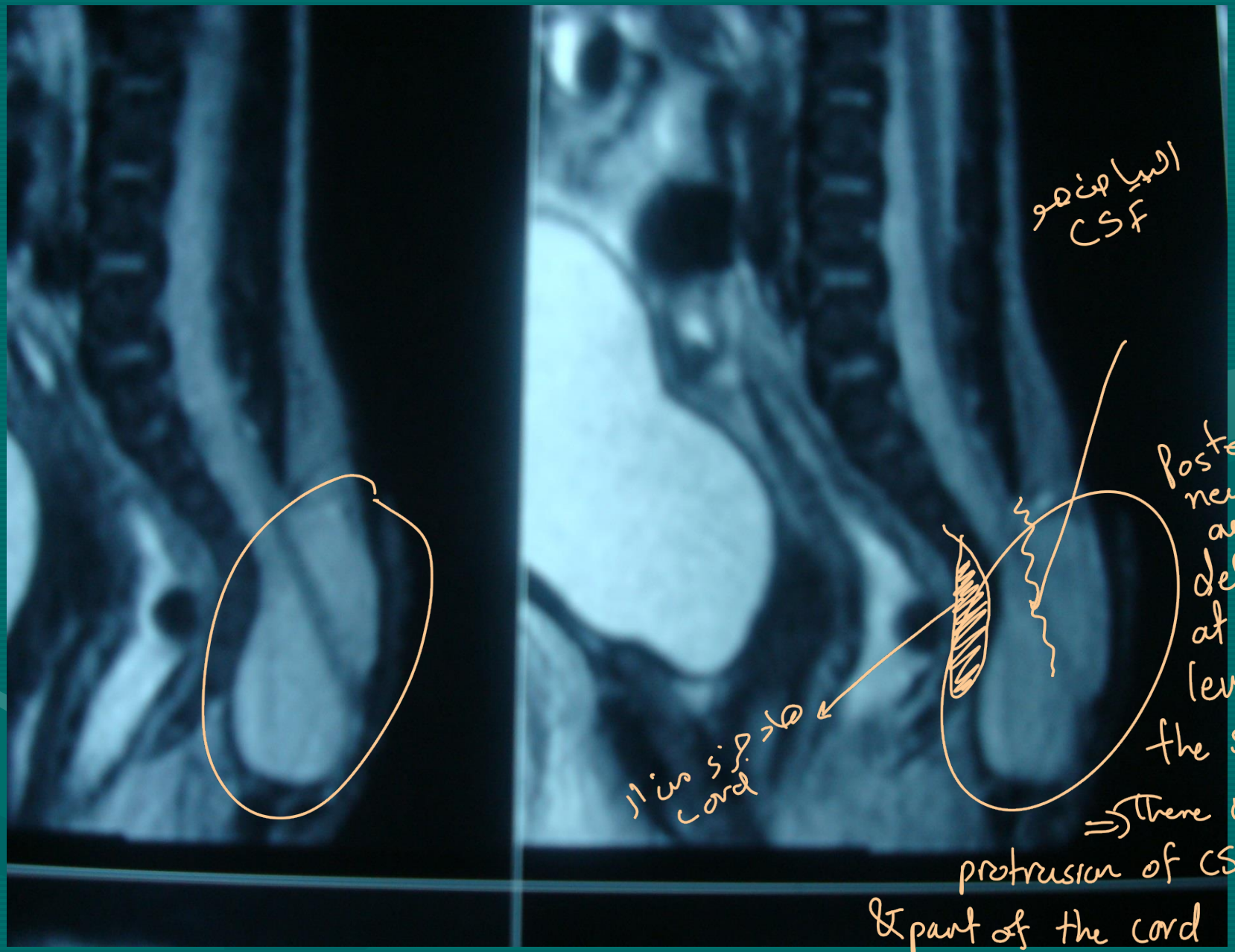


Btw C4 & C5 there is partial fusion & I see remnant interverteboal disc space*

*Partial Synostosis

Intervertebral disc space = بنسميه في الـ x-ray
بالـ MRI بنشوف الـ disc الحقيقي ← Note


A
B
It is due to central depression in the ventebral bodies.
Butterfly vertebra
hemivertebra
Result is Scoliosis


السيا منحو
CSF
Posterior neural arch defect at the level of the sacrum
⇒ There is protrusion of CSF & part of the cord
∴ Meningimyelocele

Tethered cord

ال spinal cord

ال منتهي عند ال level of L4


These 2 cylindrical structures that are found in the spinal canal are spinal cord that is splited into 2 parts
∴ Diastematomyelia

SPONDYLOLISIS AND SPONDYLOLISTHESIS

Fracture

What is spondylolisis ?

* لازم يكون Bilateral defect

- Is a defect in the region of the pars interarticularis of a vertebra, most commonly at the fourth and fifth lumbar level.
- This defect which was considered to be a congenital abnormality, is now thought to be almost always the result of unhealed stress fracture.

* why do vertebral bodies are aligned to each others ?

① Pars interarticularis

② facet joints

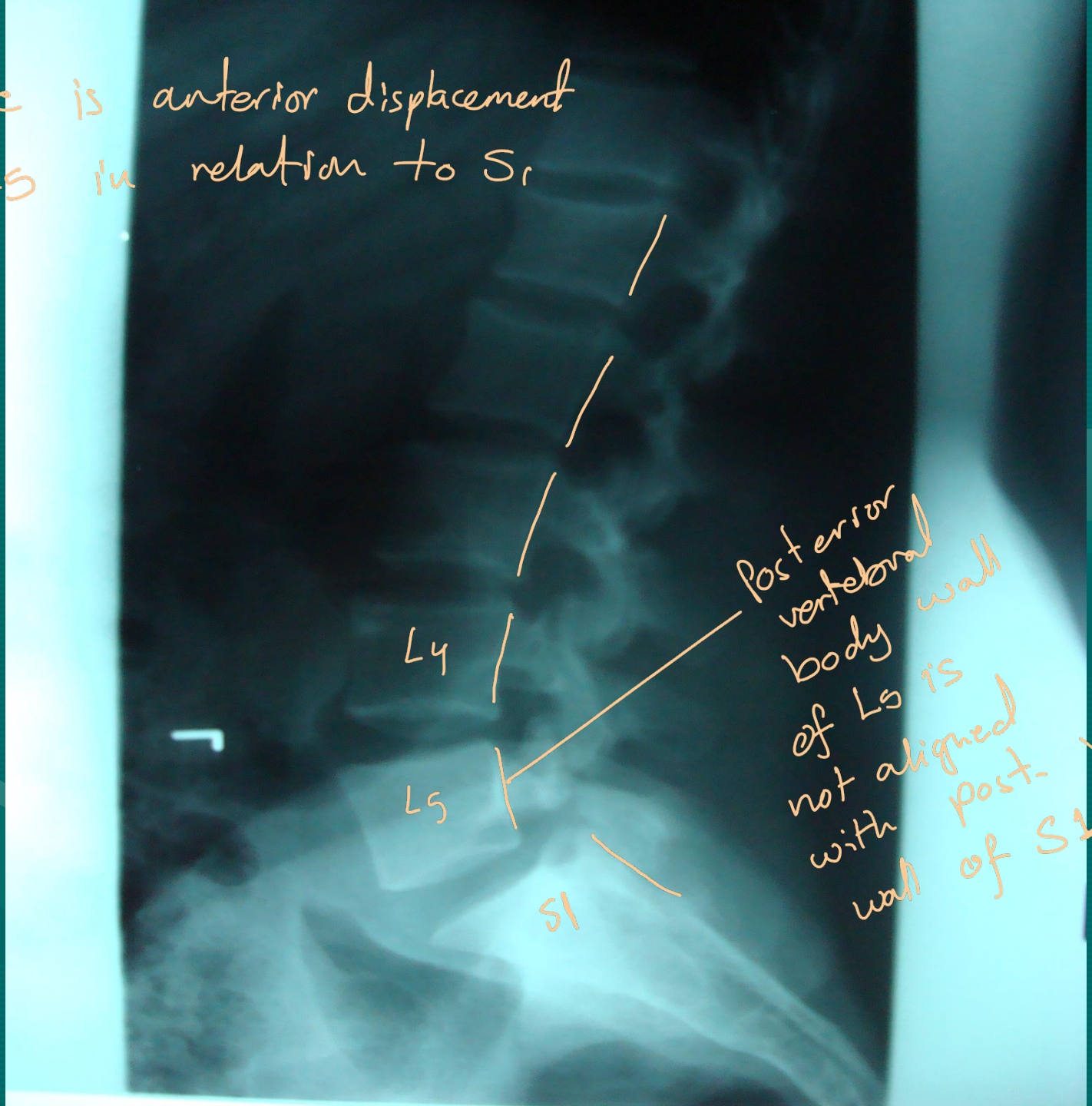
any defect in ① or displacement in ② will result in ant.

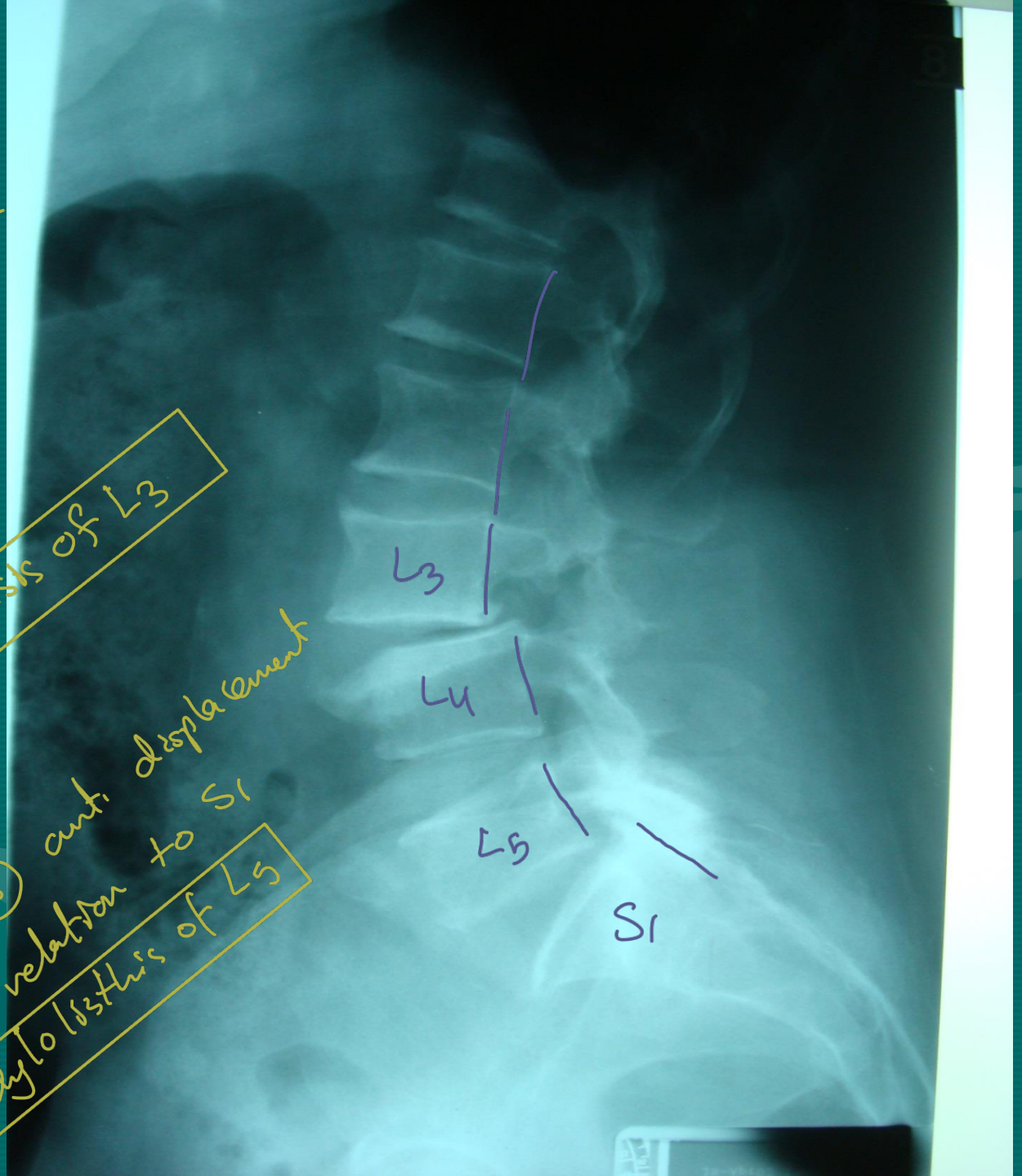
WHAT IS SPONDYLOLISTHESIS ?

Is anterior slipping or subluxation of a vertebra (or the spine above) in relation to the vertebrae below.

The main causes of spondylolisthesis are:

- Spondylolisis, is the most common cause
- Degenerative disc disease and osteoarthritis of the facet joints.
- Fracture of the posterior elements of the vertebra


There is anterior displacement of L5 in relation to S1
L4
L5
S1
Posterior vertebral body wall of L5 is not aligned with post. vertebral wall of S1



*we have anterior displacement of L3 in relation to L4

Spondylolisthesis of L3

also there (is) ant. displacement of L5 in relation to S1

Spondylolisthesis of L5

INTERVERTEBRAL DISC PATHOLOGY

- **The intervertebral disc** which lies between each two vertebral bodies is composed of a central gelatinous core known as the nucleus pulposus and surrounded by fibro cartilage called annulus fibrosus.
- **Most common articular disorders :**

❖ Degenerative disc disease.

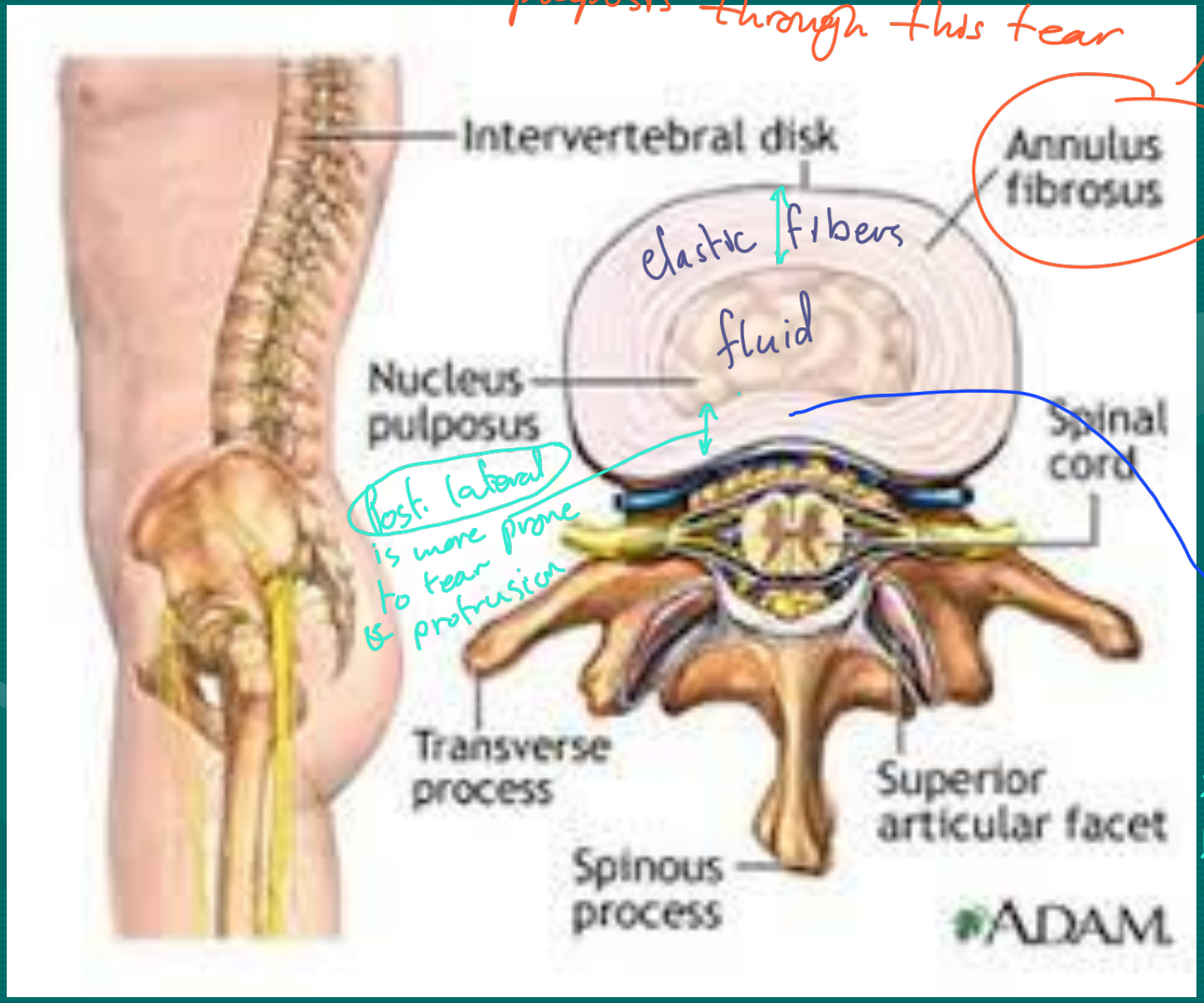
❖ Disc bulging and herniation.

❖ Infection.

س الواحد يحمل شي ثقيل فجأة

فيحدث tear فيها بسبب

Protrusion of nucleus pulposis through this tear



annulus fibrosis Post. is more thin so tear tends to happen more posteriorly

Rcs of the precense

DEGENERATIVE DISC DISEASE

- Is not really a disease but a term used to describe the natural degenerative changes in the intervertebral discs .
- Disc degeneration is part of the natural process of aging, and is one of the most common causes of low back pain.
- **The DDD is characterized by:**

- Disc space narrowing.
- Osteophytes formation at the vertebral body margins.
- Subchondral bone sclerosis (mainly at the end plates).
- In some cases, collection of gas is seen in the intervertebral disc (vacuum disc phenomenon).

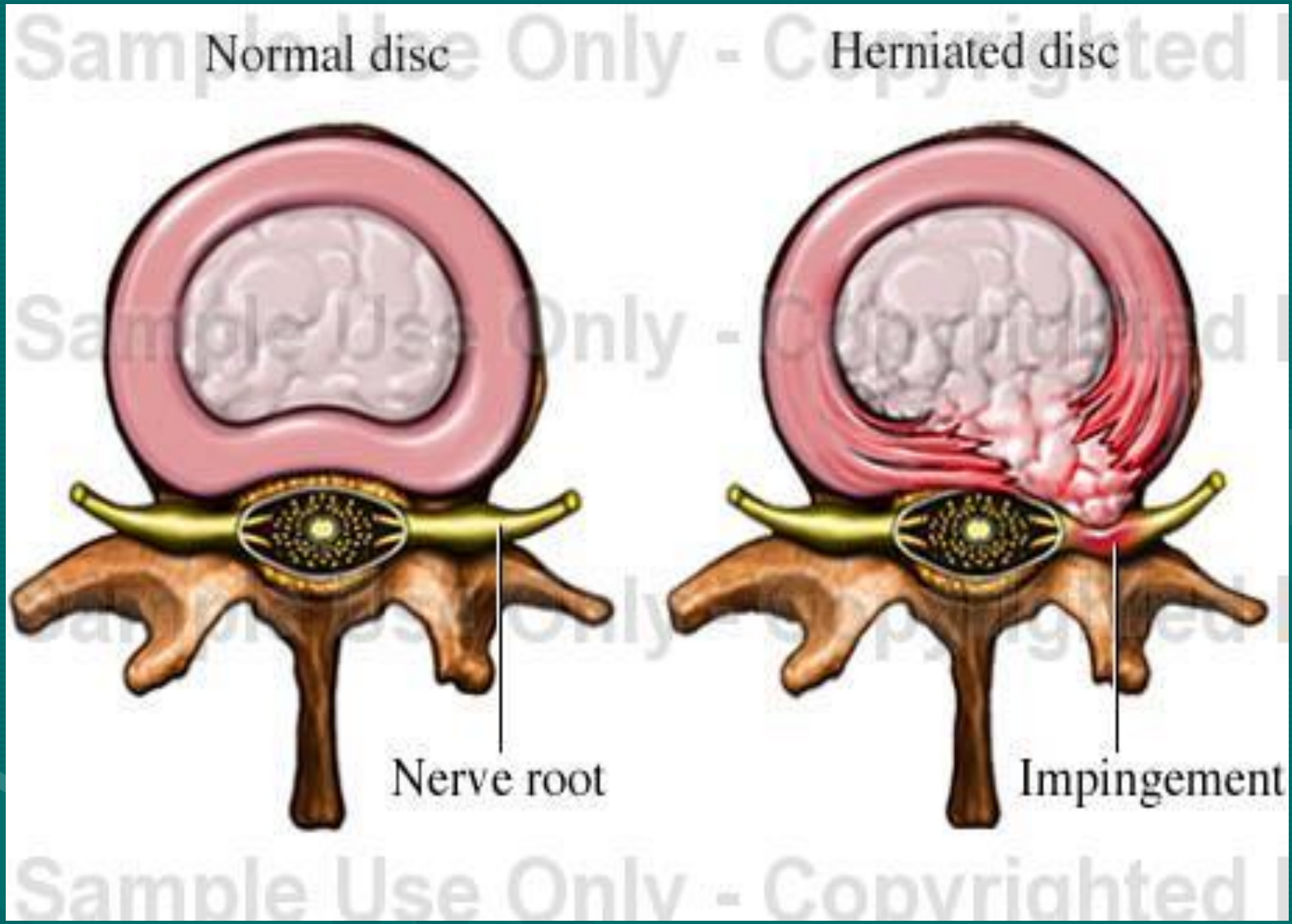
DISC HERNIATION

- The herniated disc is a portion of the nucleus pulposus extends through a tear in the annulus fibrosus, resulting in a focal protrusion at the margin of the disc.
- About 90% of disc herniation occurs at L4-L5 and L5-S1, with most of the remainder at L3-L4.
- **Types of disc herniation:**

✓ Prolapse.

✓ Extrusion.

✓ Sequestration.


Normal disc
Herniated disc
Nerve root
Impingement

Disc Protrusion

DISC PROLAPSE

The herniated nucleus pulposus extends through a tear in some of the annular fibers, but still confined by the intact outer most annular fibers

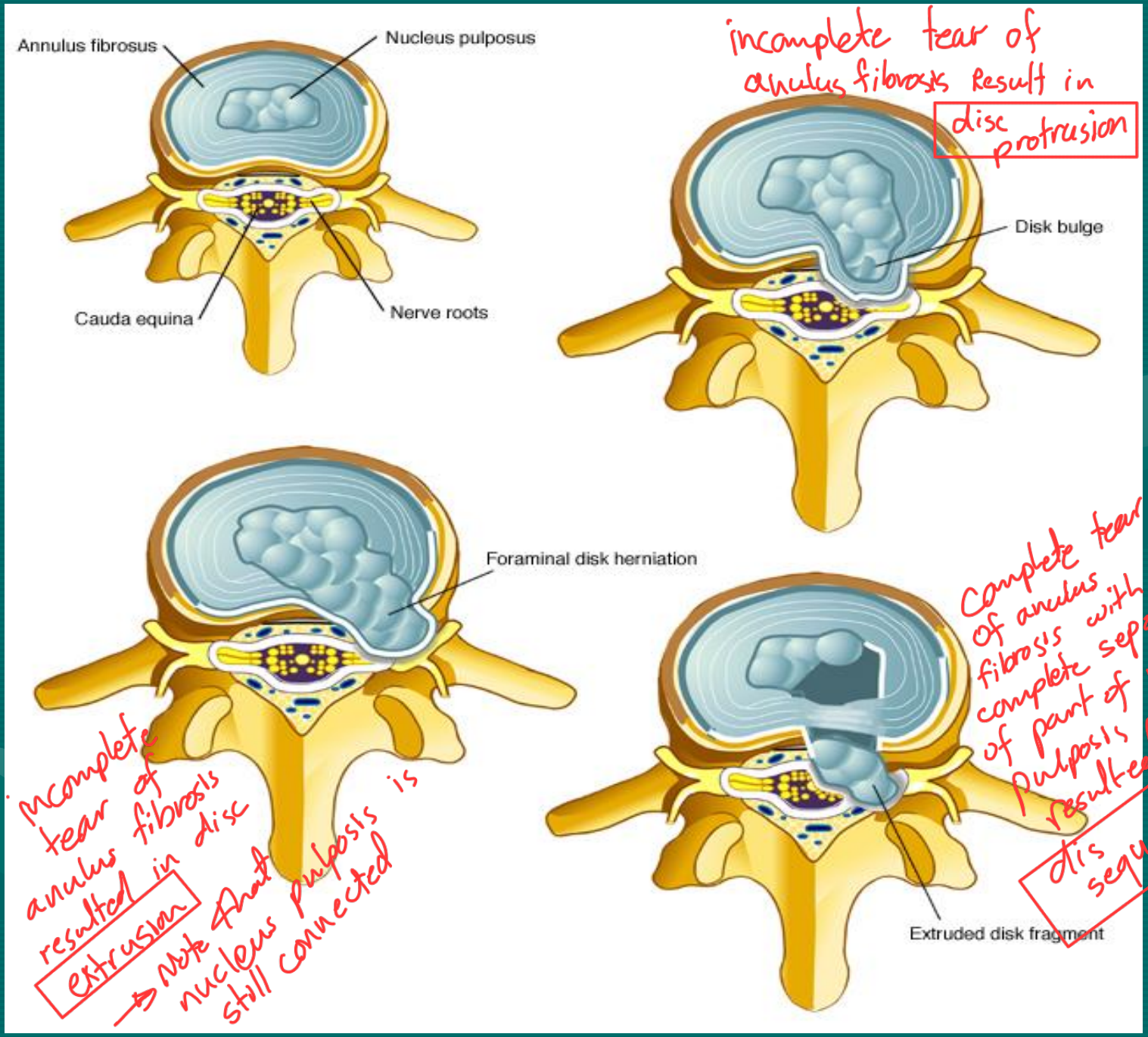
DISC EXTRUSION

- The herniated nucleus pulposus penetrates through a complete tear of the annulus fibrosus.
- The extruded disc material may extend superiorly or inferiorly, but remain attached to the parent disc.

DISC SEQUESTRATION
(Free fragment)

- The disc herniates through a complete tear and penetrate the posterior longitudinal ligament and lies within the epidural space.

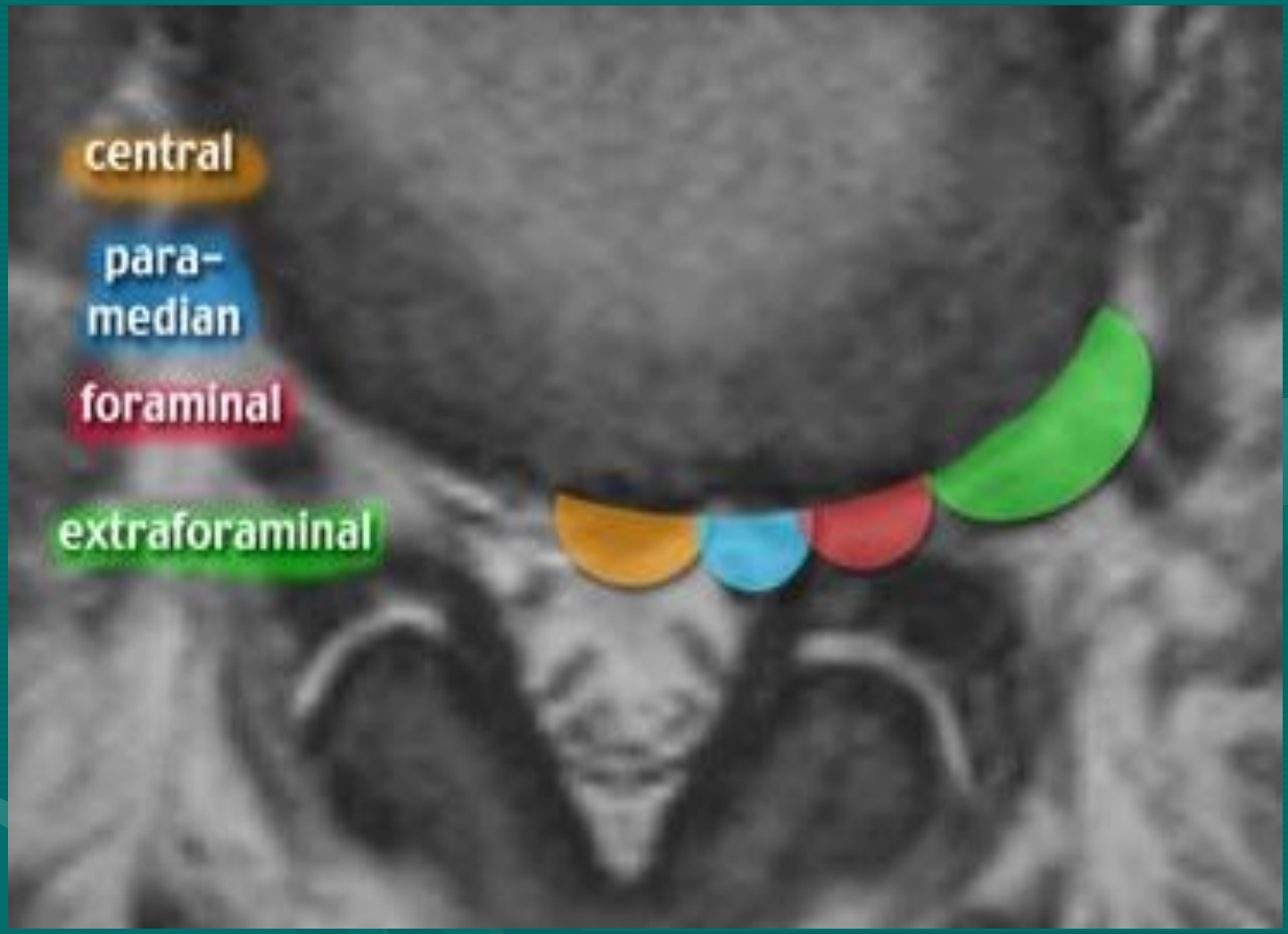
- The herniated disc breaks free of the parent disc and can migrates superiorly or inferiorly within the epidural space or into the neural foramen as a separate fragment.



incomplete tear of annulus fibrosis result in disc protrusion

Complete tear of annulus fibrosis with complete separation of part of nucleus pulposis resulted in its sequestration

Incomplete tear of annulus fibrosis resulted in disc extrusion → Note that nucleus pulposis is still connected



MRI (T_2) sagittal view

* Between L4 and L5 there is dehydration of the disc. with protrusion of it into the CSF space causing compression on cauda equina

⇒ This is herniated disc btw L4 & L

Disc herniation / plain film

Can plain film be used to diagnose disc herniation ?

NO

Then why are plain films routinely ordered for patients with low back pain ?

Plain film is essential and may reveal the presence of one of the common causes of back pain such as:

- Degenerative disc disease.
- Sacralization
- Facet joint osteoarthritis.
- Spondylolisthesis.
- Neoplastic disease.

LUMBAR SPINE TUMORS

Can be classified into two groups:

1- Bone Tumors.

2- Spinal Canal Tumors.

TUMORS OF THE SPINE

1- Tumors of bone

* Hemangioma of Vertebral body. The most common bony tumor arise in the spine
- Osteoid osteoma → arise in the post. neural arch associated w/ painful scoliosis
- Osteoblastoma → arise in post. neural arch
- Aneurysmal bone cyst
- Histiocytosis x (Eosinophilic granuloma)
- Multiple myeloma
- Metastasis

* The most common site of bone metastasis is SPINE !! bcs it is the most vascularized part of the skeletal system

Tumors of the spinal canal

- **Intramedullary:** occur inside the cord (T. arise from the neural cells itself)

1. Ependymoma
2. Astrocytoma
3. Lipoma

- **Extramedullary-intradural:**

Occur within the meninges covering the spinal cord:

1. neurofibroma and schwannoma
2. Meningiomas
3. Dermoid and epidermoid

Tumors of the spinal canal /2

Extramedullary

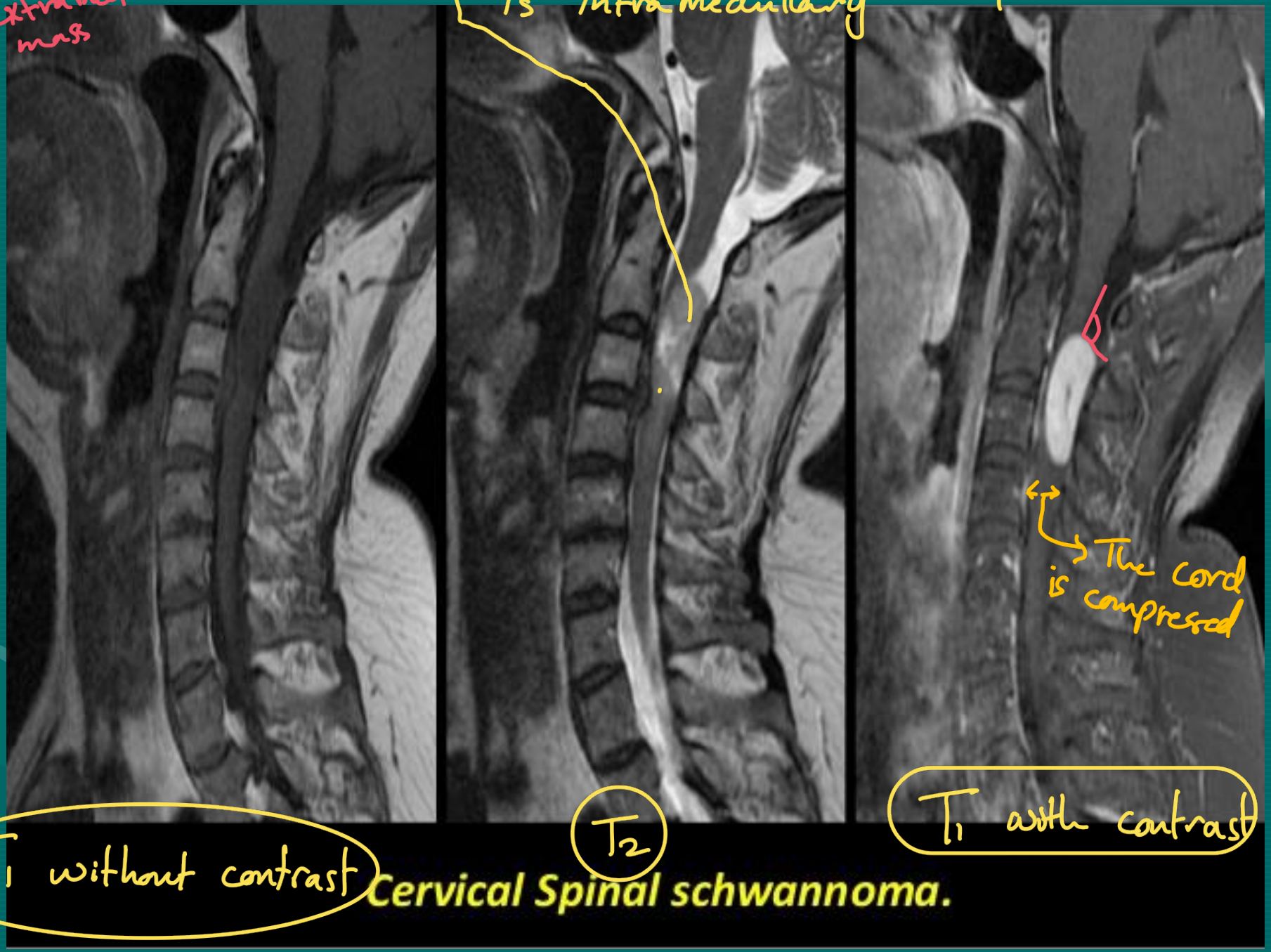
- **Extradural:**

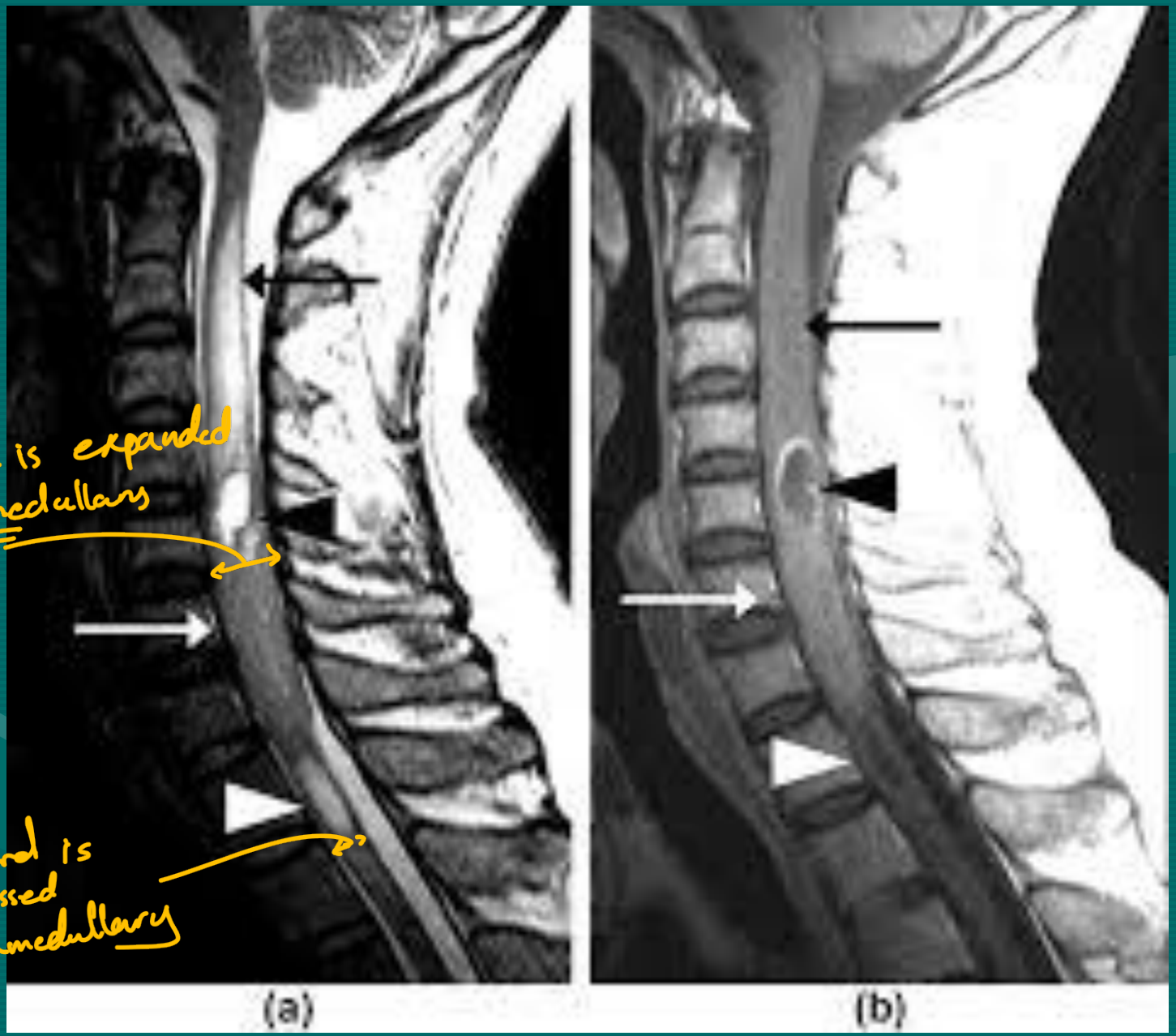
Appear between the meninges and the bones of the spine:

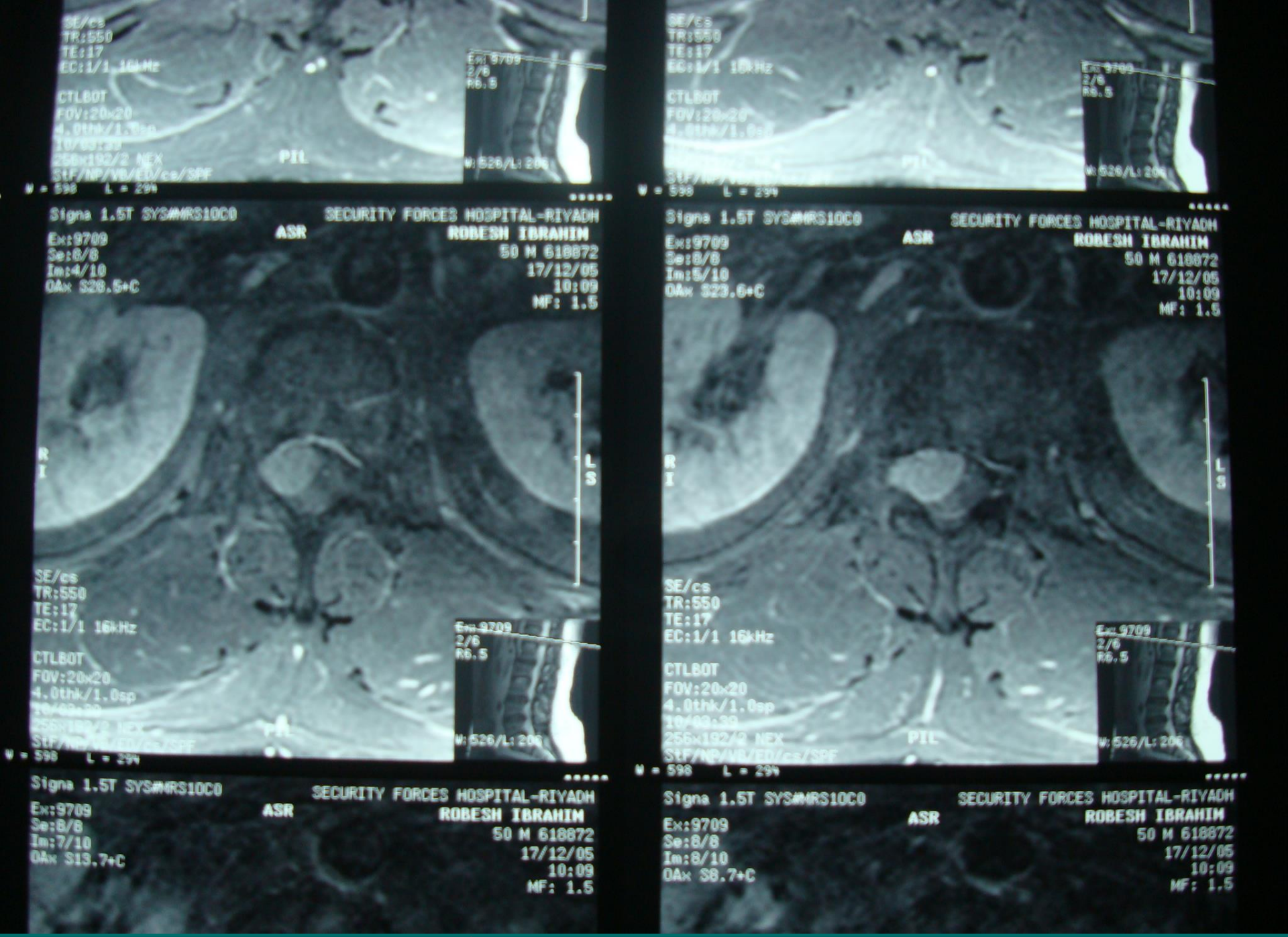
1. Metastasis:
2. Meningiomas

The tumor is compressing the cord anteriorly
So lesion is coming from outside (extra medullary) and compressing the cord anteriorly
* If you see that the cord surrounds the T, this

The mass is hyperinten
-se it is compressing the cord
:- Extramed.


∴ T1 extramed. mass
is intramedullary
The cord is compressed
T1 without contrast
T2
T1 with contrast
Cervical Spinal schwannoma.


The cord is expanded
∴ intramedullary
The cord is compressed
∴ extramedullary
(a)
(b)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Se:8/8
Im:4/10
OAx S28.5+C
SE/cs
TR:550
TE:17
EC:1/1 16kHz
CTLBOT
FOV:20x20
4.0thk/1.0sp
256x192/2 NEX
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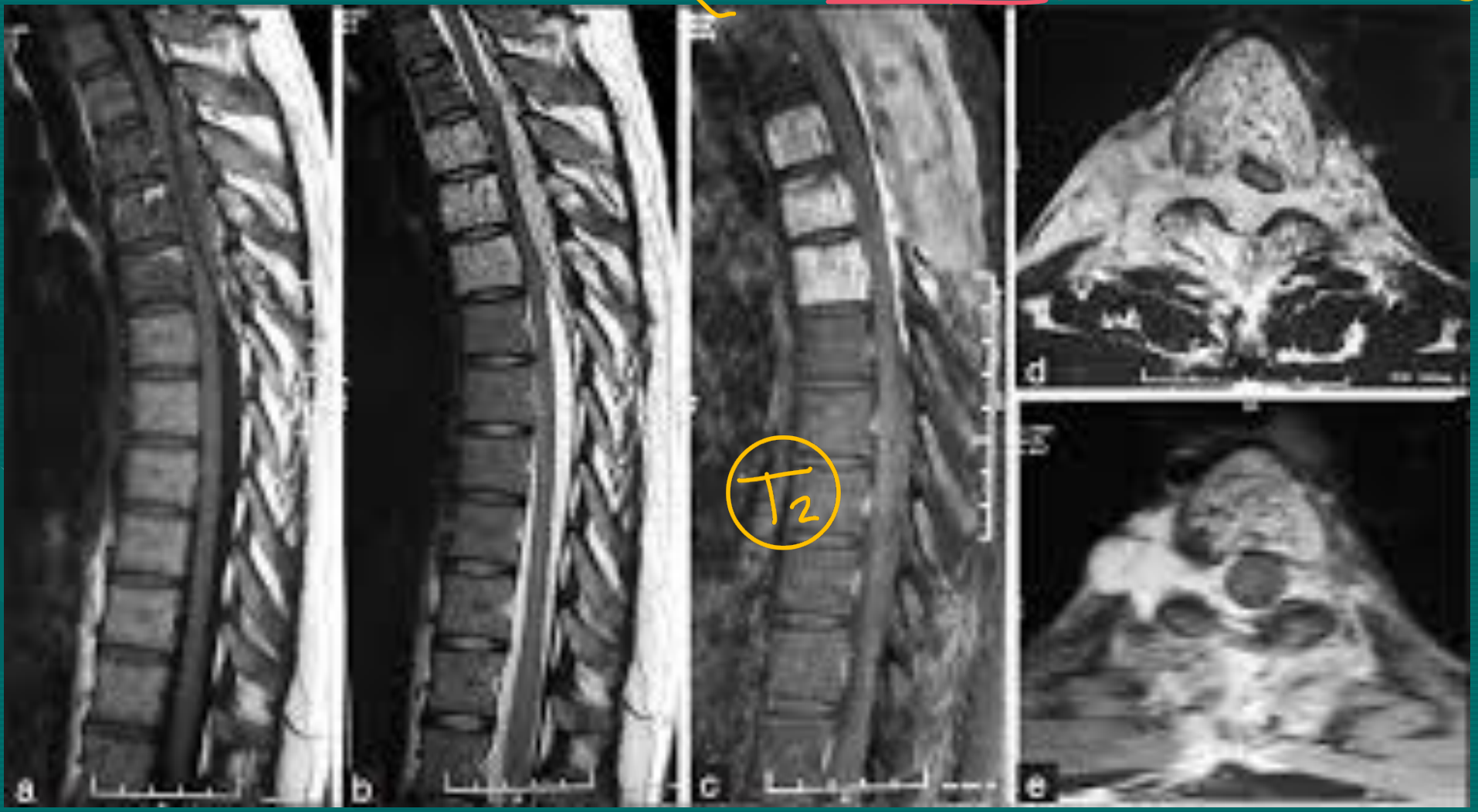
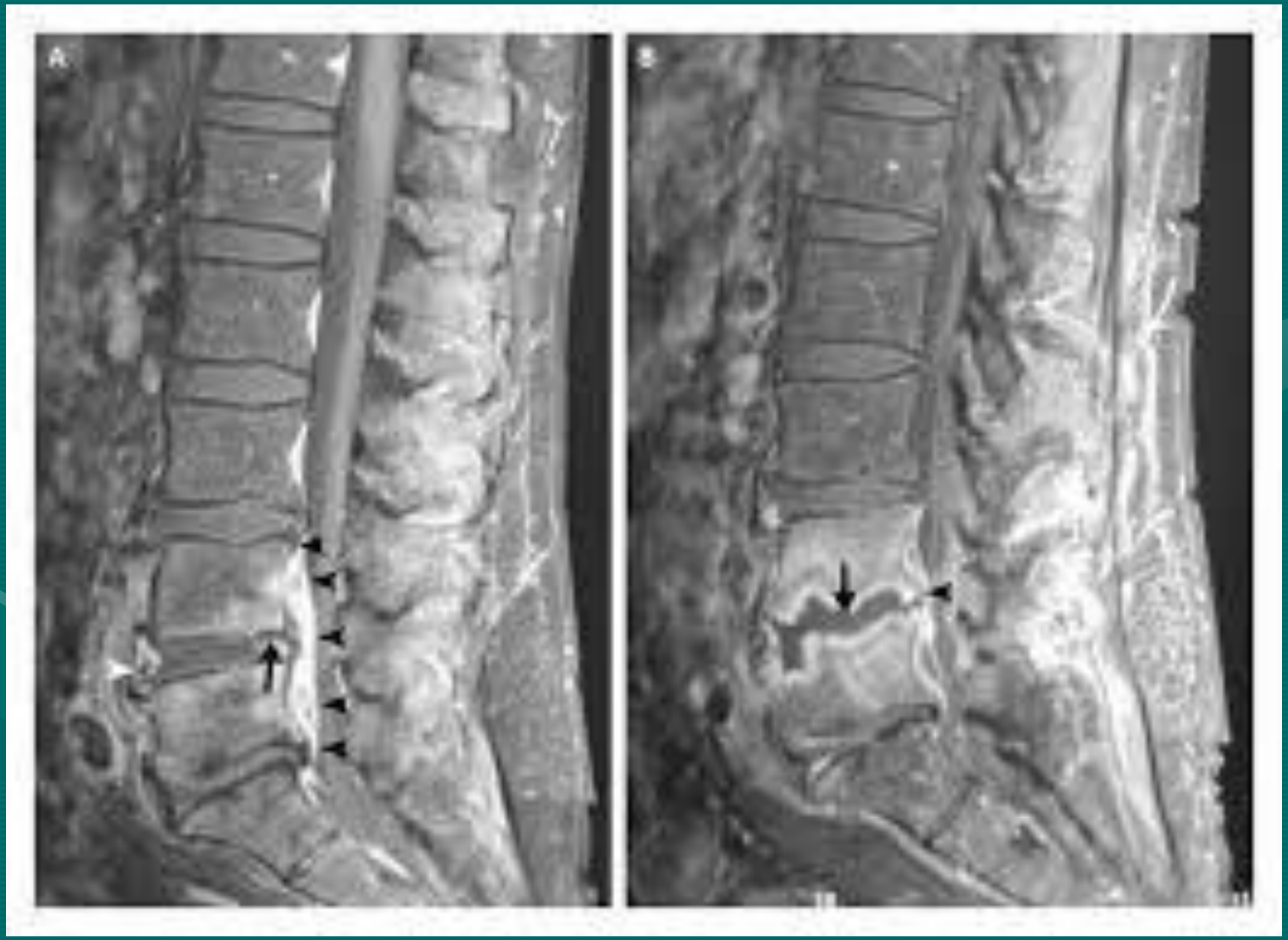
OAx S8.7+C

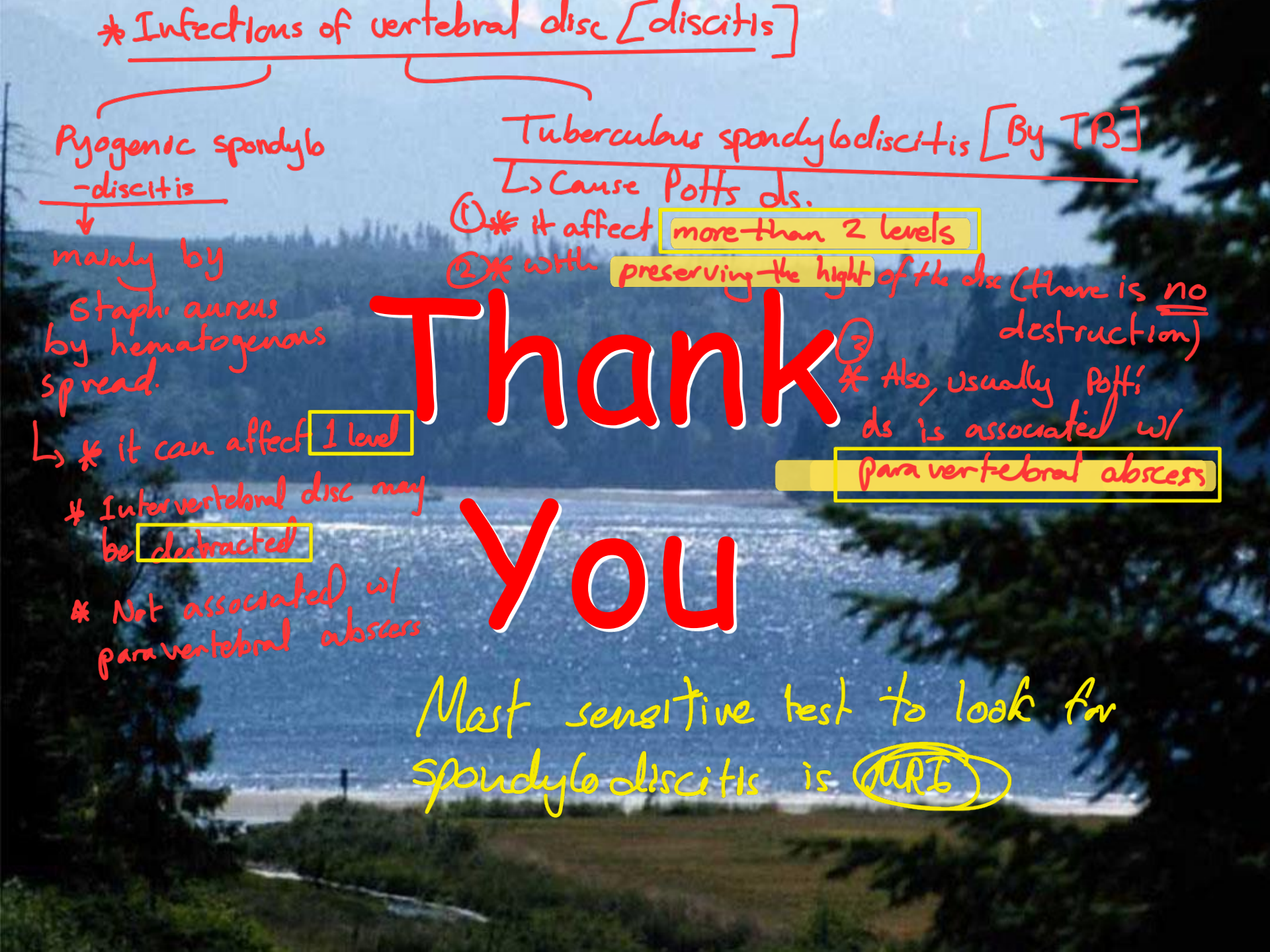
Which is the most bony Tumor of spine

There is hyperintence lesions within the vertebral bodies

This is [Hemingioma of vertebral body]




A
B


* Infections of vertebral disc [discitis]
Pyogenic spondylo -discitis
mainly by Staph. aureus by hematogenous spread.
* it can affect 1 level
* Intervertebral disc may be destructed
* Not associated w/ paravertebral abscess
Tuberculous spondylodiscitis [By TB]
Is Cause Potts ds.
① * it affect more than 2 levels
② * with preserving the hight of the disc (there is no destruction)
③ * Also, usually Potts ds is associated w/ paravertebral abscess
Thank You
Most sensitive test to look for spondylodiscitis is MRI