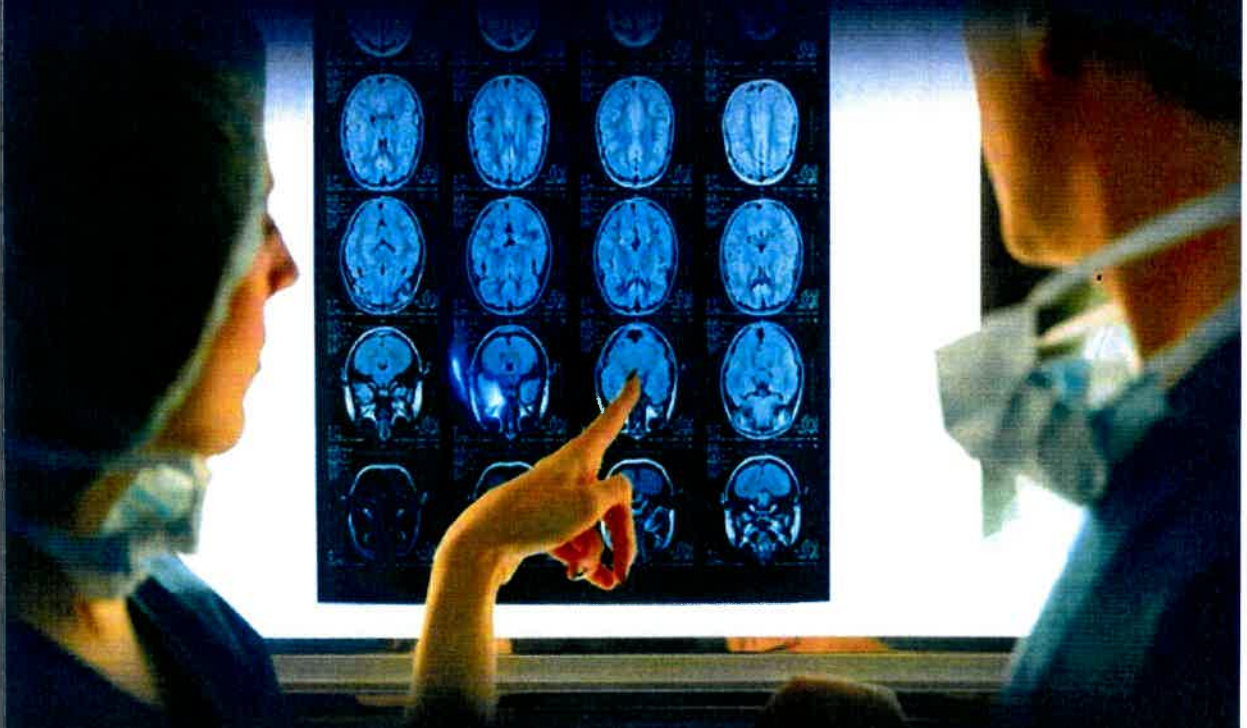


Concepts in Radiology

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Vol.-4



Authored By The Faculty of Conceptual Radiology

Concepts In Radiology

Volume - 4

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Section 8

Thoracic Radiology

CHAPTER 8.1



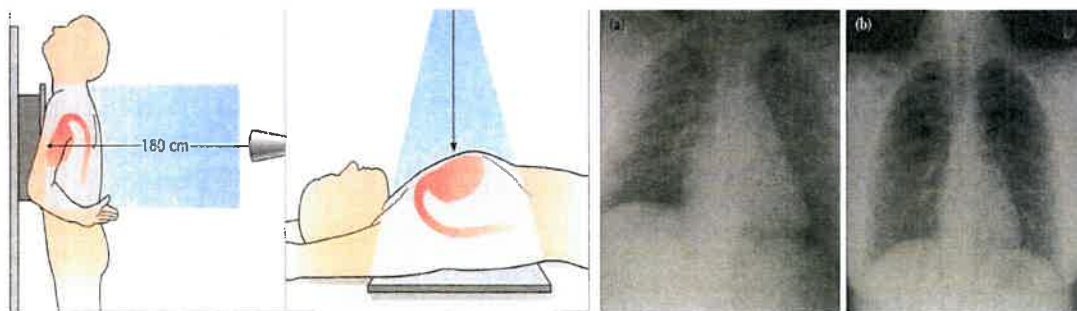
CXR Interpretation

BASICS

It is important to follow the order of the checklist while explaining the case.

- PATIENT AGE, SEX, HISTORY/EXAMINATION FINDINGS
- PREVIOUS IMAGING
- VIEW- It could be AP view or PA view. In case it is not mentioned, we can safely assume it to be a PA view. An AP view is usually mentioned in the x-ray film.
- TECHNICAL PARAMETERS “mnemonic-RIP” - These parameters tell if imaging is adequate or not, and its effect on the image.
 - Inspiration
 - Rotation
 - Penetration

PA VS AP VIEW



- PA view is considered ideal because it provides minimal magnification of the heart and provides a clearer image of the lungs. This is based on the principle that whatever structures are closer to the detector, they are closer to their actual size.
- The source(of x-ray) to the image distance should be 180 cm. This larger distance ensures that parallel beam x rays reach the heart and allow for minimal magnification. The non-divergent parallel beam of x rays ensure that magnification of structures closer to the image detector does not occur.

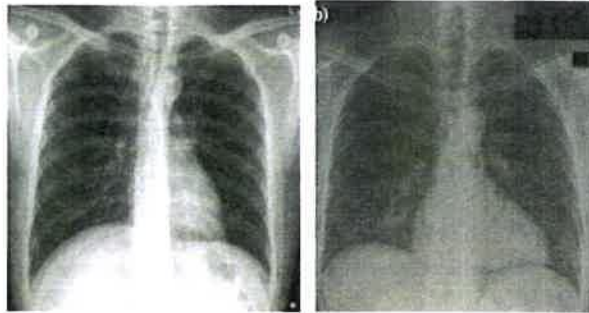
AP view

- Usually taken in an emergency/ICU setting where the patient is non ambulatory.
- The x-rays beam is divergent in AP view as the distance between the source and the image detector is shorter. Additionally, since the heart is not closer to the image detector, the heart appears enlarged on imaging in an AP view.
- Due to “apparent cardiomegaly”, one cannot comment on mediastinum, or on the cardiothoracic ratio.
- AP views provide a smaller visualisation of lung fields.



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INSPIRATION

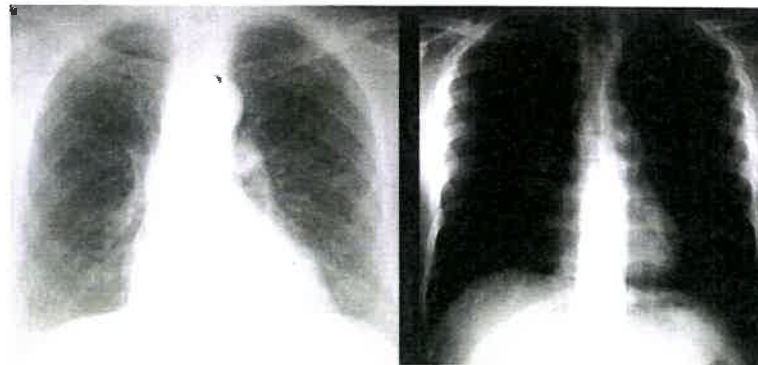


- For an “adequate inspiration”, one should be able to visualise:
 - 6 or more ribs anteriorly until the dome of diaphragm

OR

- 10 or more ribs posteriorly until the dome of diaphragm
- In an inadequate inspiration, there is apparent cardiomegaly/ enlarged mediastinum. Reason- This is because during inspiration, the contracting diaphragm pulls the heart down with it. Under inadequate inspiratory contraction, the heart is not pulled downwards and thus, appears stretched out on the lateral dimensions.
- Due to inadequate inspiration, the basal vessels of the lungs are going to be crowded. This may simulate a basal collapse or infection.

PENETRATION



Adequate penetration is defined as such, when lower thoracic vertebrae are visible through the heart.

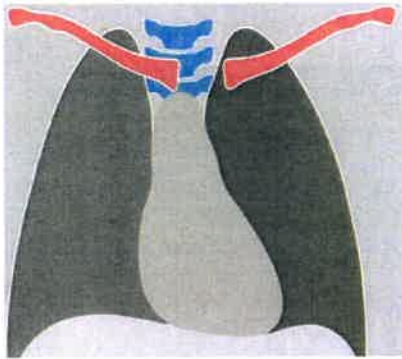
Underpenetrated film is one where the spine is not visible through the heart.

Overpenetrated film is usually identified by visible intervertebral discs through the heart.

ROTATION

A rotated film is assessed by examining the visible spinous processes of T1 to T4 vertebrae through the medial ends of both the clavicles.

- In the image below, the medial end of the left clavicle is farther away from the spinous process than the medial end of the right clavicle. “Whatever is away is the side of rotation”. In the image below, the xray is rotated to the left.
- Rotation on left side causes more xrays to pass through the left lung, making that lung hyperlucent/ blacker on appearance. Aortic arch or the left mediastinal structures also appear more prominent.



- Rotation on the right side as shown in the image below, makes the right lung field more lucent, and the right sided mediastinal structures such as SVC appear more prominent.



SYSTEMATIC APPROACH

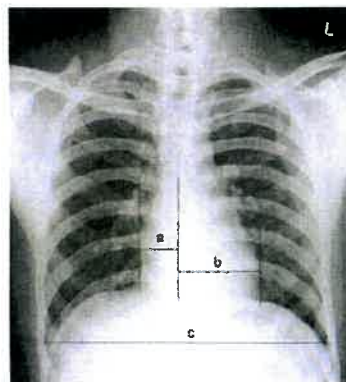
INSIDE OUT APPROACH:

- AIRWAY
- MEDIASTINUM
- CARDIAC SILHOUETTE

Cardiothoracic Ratio- $[(a+b)/c]$

Normal value is 0.42 to 0.50

In neonates, the value can be up to 0.6



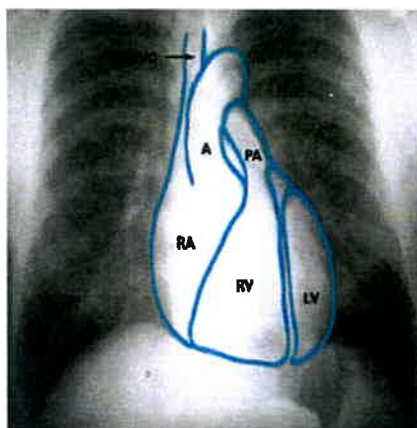
- STRUCTURES CONSTITUTING LEFT HEART AND RIGHT HEART BORDERS

- The right heart border includes:
 - SVC
 - RA (forms the main border of the right heart)
 - IVC (forms a very small part)
- The left heart border includes
 - Aortic knuckle (formed by aortic arch)
 - Pulmonary artery
 - Left atrial appendage (left auricle)
 - Left ventricle

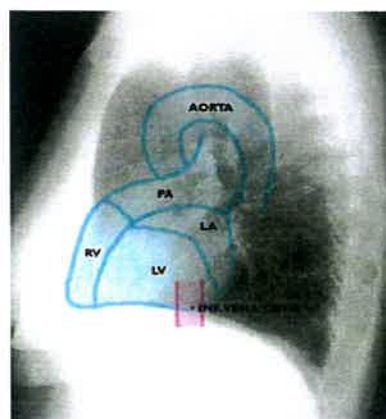
Aorto-pulmonary window is a concave impression visualised between aortic knuckle and pulmonary window. In case the shape of the AP window is not concave, one can expect some sort of a mass present here. Normal constituents of the AP window include fat, lymph nodes and recurrent laryngeal nerve passes here. The clinical importance of the AP window lies in the fact that any mass such as swollen lymph nodes, lymphoma or mass from CA lung could compress the RLN leading to hoarseness of voice.

Base of the heart is formed by the right ventricle.

Left atrium does not contribute to any heart border as it lies posteriorly.



- On lateral radiograph,
 - Left atrium is the most posterior heart chamber.
 - Right ventricle is the most anterior heart chamber.



CXR Interpretation

• HILUM

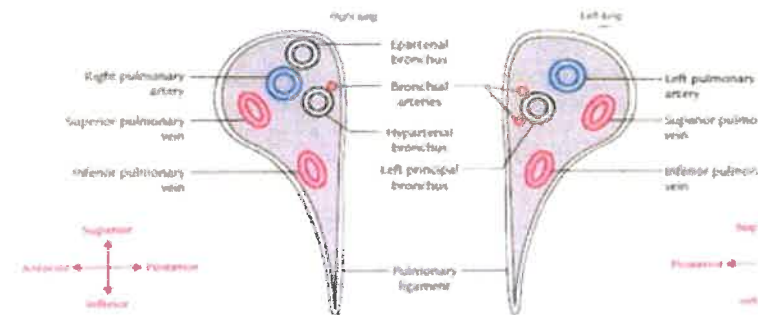
Main Contribution/ Main constituents of the radiological hilum comes from vascular sources: Pulmonary artery >>> Pulmonary veins.

- Minor contributions may come from fat, lymphatics and bronchial wall.

Three variables are used to assess the hilum

• 1. Position

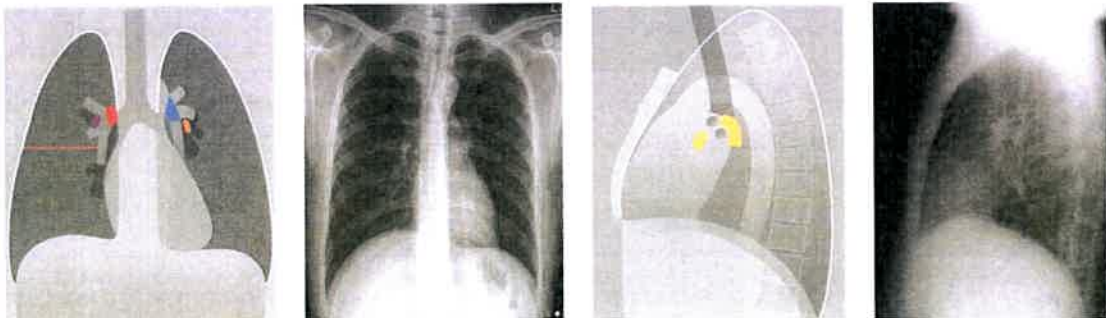
Left hilum is always higher than the right on the frontal view. In the 5% population, left and right hilum might be at equal level. But as a dictum, the right hilum would never be higher than the left. If right hilum is seen higher than the left hilum, a pathology is commonly expected (most commonly in context of a right upper lobe collapse)



• 2. Density

The lung fields are checked if they are symmetrical.

- In case hilum appears prominent with a lumpy bumpy orientation (rounded prominence), lymph nodes should be ruled out.
- If the hilum appears prominent, 'tapering' and without lumpy bumpy/rounded appearance, pulmonary vascular hypertrophy (Pul. Artery hypertension) should be ruled out.
- We can also assess the position by a V point, where the upper lobe and the lower lobe of each side meet.



- LUNGS
- CHEST WALL / BONES
- DIAPHRAGM

Continuity of chest wall and CP angles are also assessed (they should be sharp on both sides)

Diaphragms are also assessed, with right hemidiaphragm higher than the left, due to liver punching the right diaphragm up, or heart pushing left diaphragm down.

- ABDOMEN

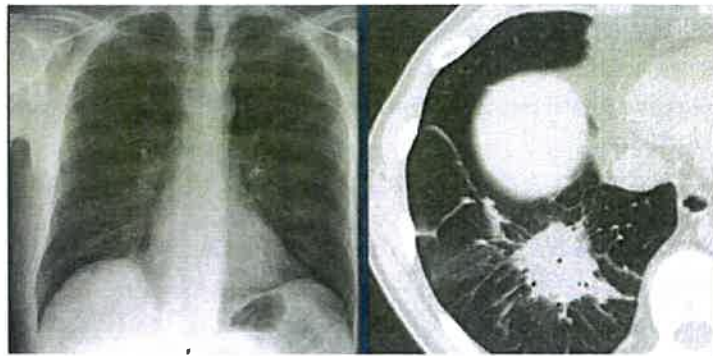
Air under the right hemidiaphragm is assessed to rule out pneumoperitoneum, and air under the left diaphragm normally seen because of a gastric air bubble.

- HIDDEN AREAS:

- Bilateral lung apices, Hilar areas, Retrocardiac area, Sub-diaphragm area.

HIDDEN ZONES

In the 1st image below, the posterior basal segment can be seen overlapping with the diaphragm creating an increased density. This turned out to be a malignant nodule in the basal zone of the right lung.



NORMAL VARIANTS



Calcified costal cartilages



Bifid Rib



Fused rib



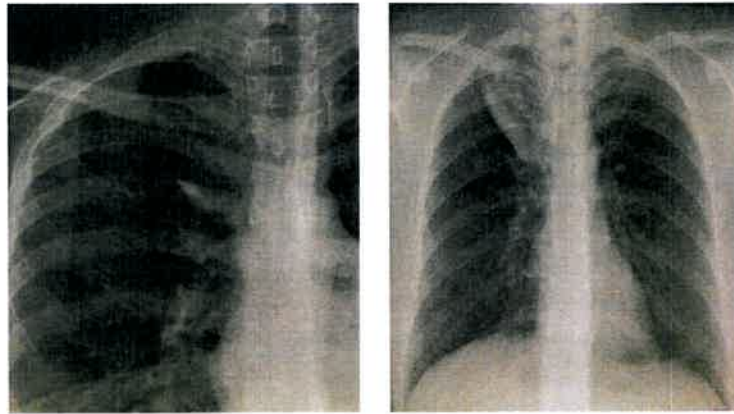
Cervical rib



Right sided aortic arch



Labelling errors



Azygos fissure- most common accessory fissure Azygos lobe consolidation

LATERAL VIEW

INDICATIONS OF LATERAL VIEW:

1. Confirm equivocal opacity
2. Localisation - Frontal view has overlaps between lobes. Lateral view can help localise between upper, middle and lower lobes.
3. Hidden areas can be better visualised- Retrocardiac, hilar, below diaphragm

CHECKLIST:

Diaphragm

- On lateral view, the right diaphragm can be seen 'throughout' and can be continuously traceable.
- On the other hand the left is not traceable due to cardiac silhouette.

Hilum

Fissures

- The more anterior one is the right oblique fissure. It starts at T4 marking of thoracic vertebra.
- Left oblique fissure is higher up, but ends more posteriorly and is more vertical than right oblique fissure.
- The right and left oblique fissure can be seen like "two propeller blades"
- The right horizontal fissure goes from the oblique fissure to the sixth costal cartilage.



Image below also shows a schematic of how the lateral radiograph looks like.

- Right and left pulmonary arteries are seen as shadows or opacities.
- Right airway(higher) and left airway(lower) are lucent.

Costophrenic angles-

- Anterior and posterior costophrenic angles can be visualised and have better sensitivity to diagnose pleural effusion than frontal radiograph.

Heart

Retrosternal lucency-

- in case this lucency is not visible, 2 things to rule out
 - Right ventricular hypertrophy
 - Right upper lobe or left upper lobe opacity/consolidation or collapse.

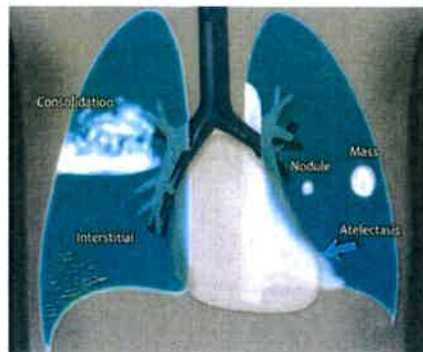
SPINE SIGN

- Due to more lung overlap in the lower areas, the spine keeps getting better visualised as we go down in lateral view. In case of blurring of spine in lower areas, it indicates a lower lobe consolidation.

CHAPTER 8.2

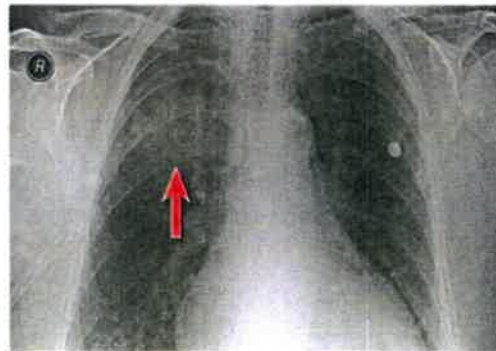


Chest X-Ray - Pattern-based Approach

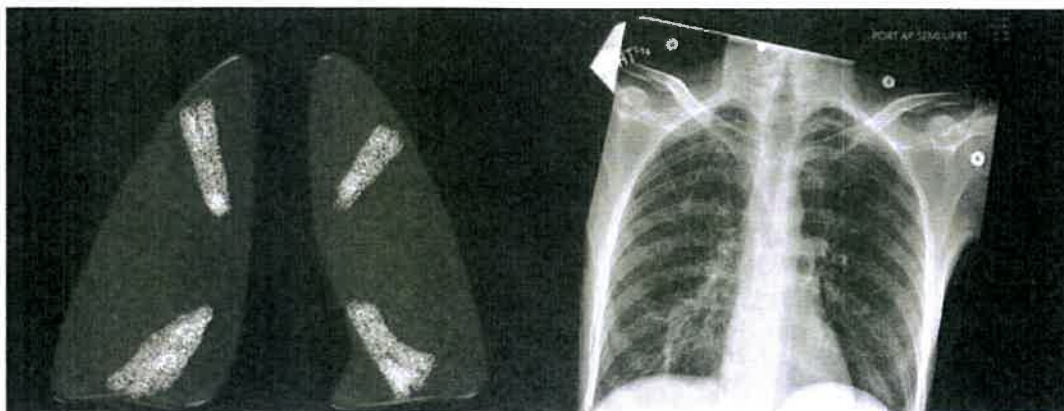


Airspace opacity –

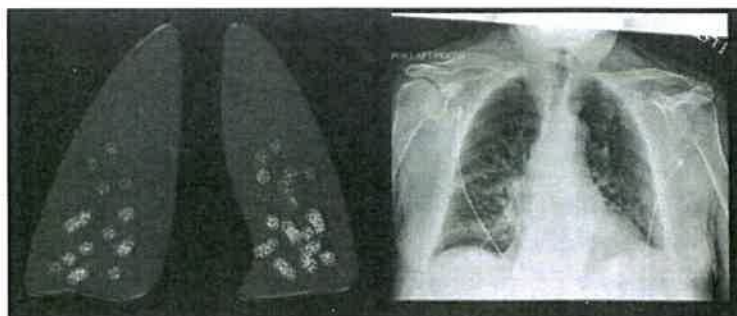
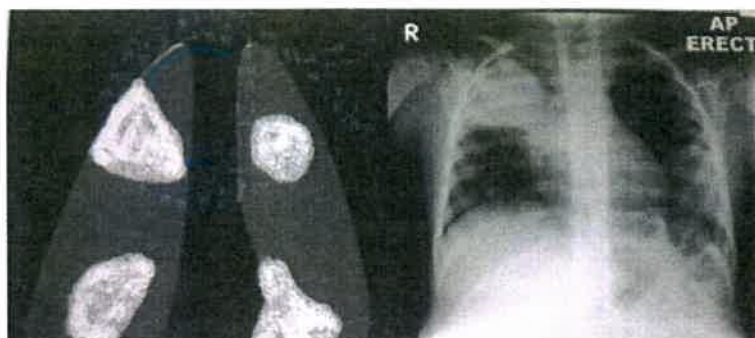
- Ill defined
- Homogeneous
- Opacity –
 - a) Linear
 - b) Patchy
 - c) Confluent
- Air bronchogram sign



LINEAR



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PATCHY**CONFLUENT****Consolidation approach –****Basis of content:****Water:**

Pulmonary edema –
can be cardiogenic
or non cardiogenic
PE (ARDS)

Pus:

Pneumonia –
can be infective
or aspiration
pneumonia

Blood:

- a) Diffuse
parenchymal
hemorrhage
- b) Pulmonary
contusion

Cells:

- a) Bronco
alveolar
carcinoma
- b) Lymphoma
- c) Eosinophilic
pneumonia
- d) Organizing
pneumonia
- e) Sarcoidosis

Infarct:

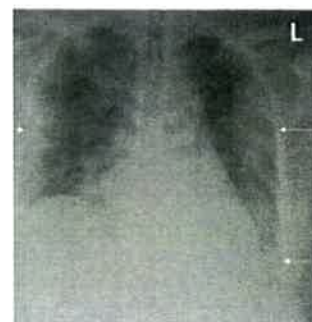
Pulmonary
infarct

Sequestration:

- a) MC – LLL
- b) CT – feeding
vessel

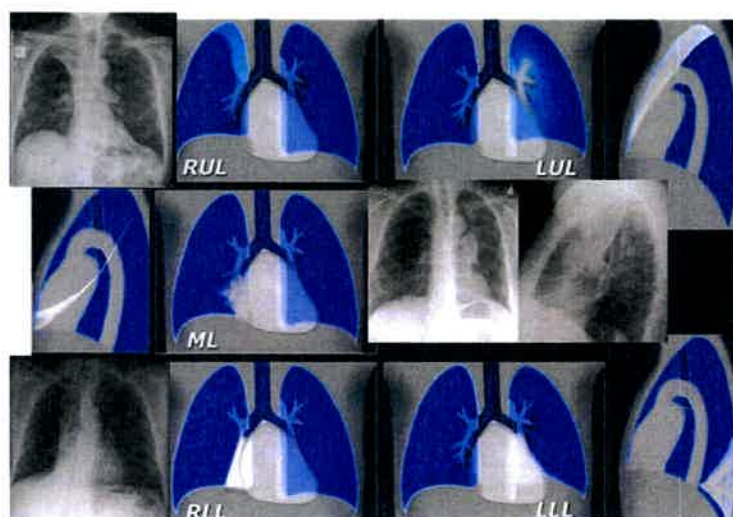


Basis of distribution: Perihilar vs Peripheral –	
Perihilar	Peripheral
a) Cardiogenic PE b) PCP (h/o HIV) c) Viral	a) ARDS b) Bronchoalveolar ca c) Eosinophilic pneumonia d) Organizing pneumonia



Approach to collapse –**A. Lobar collapse –**

- a) Causes – tumor(adult) /Foreign body (children) /granuloma /mucus plug/
- b) Airspace opacity +
 1. Direct sign –
 - Airspace opacification
 - Bronchovascular displacement
 2. Indirect sign –
 - Mediastinal shift I/L
 - Diaphragm tenting
 - Hilar displacement
 - Fissure displacement
 - Shifting granuloma (prior)
 - Compensatory hyperinflation

**Nodules and masses****Nodules –**

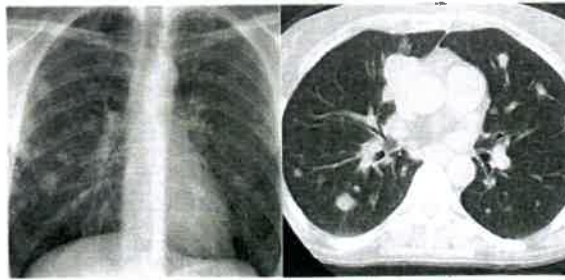
- a) Solid
- b) Ground glass
- c) Calcified
- d) Cavitary

Size –

- <3 cm – nodules
- >3cm –mass

Solitary vs multiple –

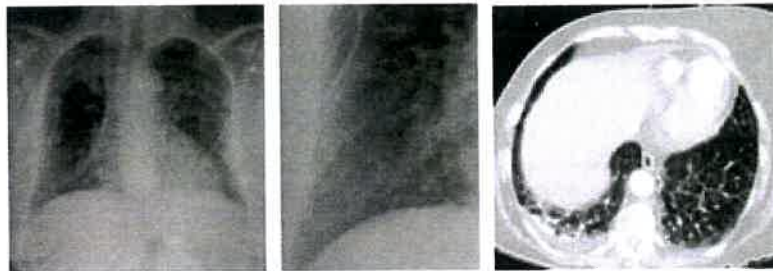
Solitary	Multiple
1. Granuloma – TB/fungal 2. Hamartoma – fat /calcification 3. CA lung- speculated margins 4. Solitary metastatic lesion 5. Bronchial atresia	1. Metastasis - Choriocarcinoma /clear cell RCC /follicular cell thyroid 2. Sarcoidosis 3. Wegener's GPA 4. RA 5. HHT –AVM 6. Septic emboli 7. Infections – TB/ Histoplasmosis / fungal –aspergillosis



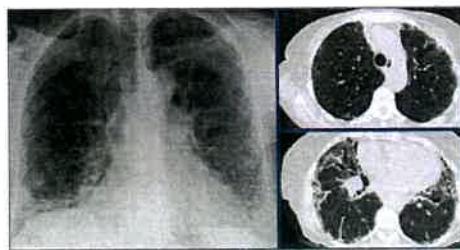
Interstitial pattern

Interstitial pattern –

- 1) Reticular
- 2) Nodular
- 3) Reticulonodular



Smooth interlobular –
Pulmonary edema



Honeycombing pattern – UIP

Classifying interstitial pattern –

