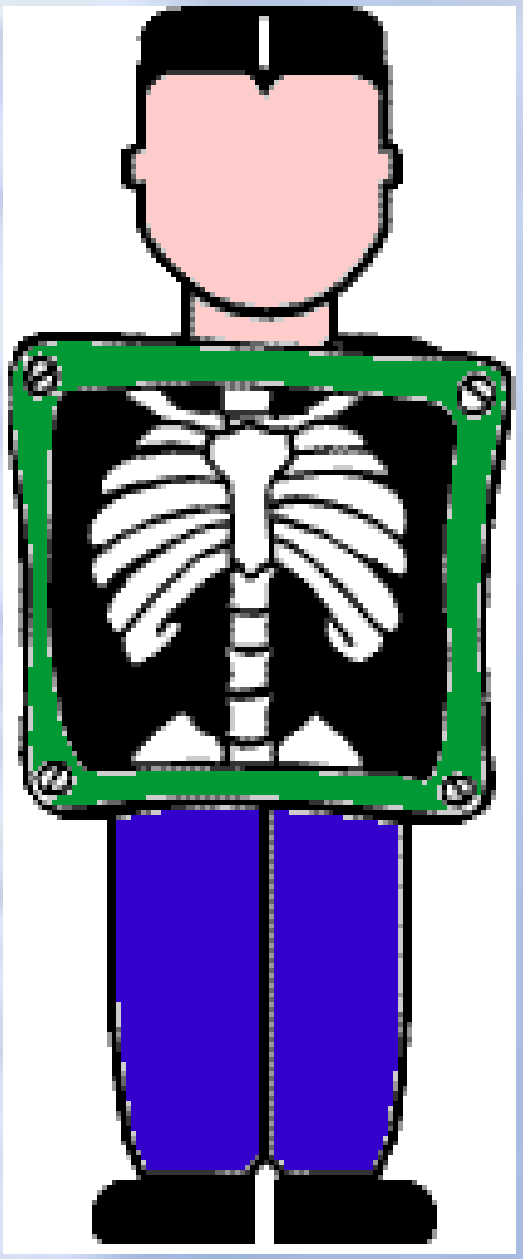


Chest Radiography Interpretation

Sequence For Radiography Reading

1. Correct name of investigation:

   Example: **Simple radiography of chest**

   (frontal or lateral view)

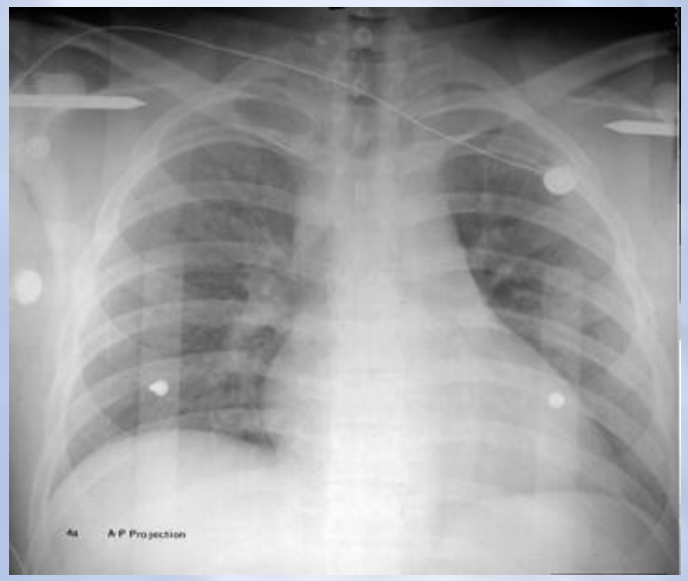
2. Radiological features (signs) by symptoms and syndroms:
   - Lungs
   - Pulmonary pattern
   - Hillum
   - Pleura
   - Mediastinum-aorta, trachea
   - Heart
   - Bone and Soft Tissue including abdomen
3. Conclusion (what pathology)

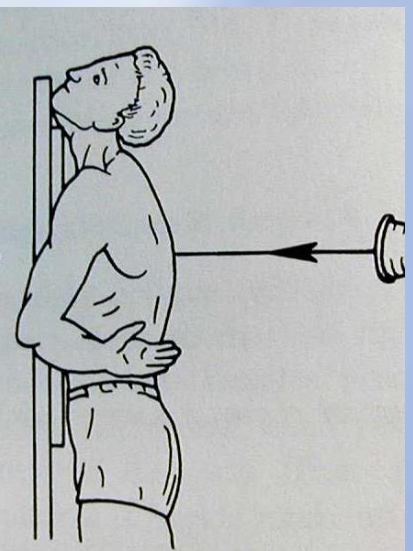
IMAGING MODALITIES

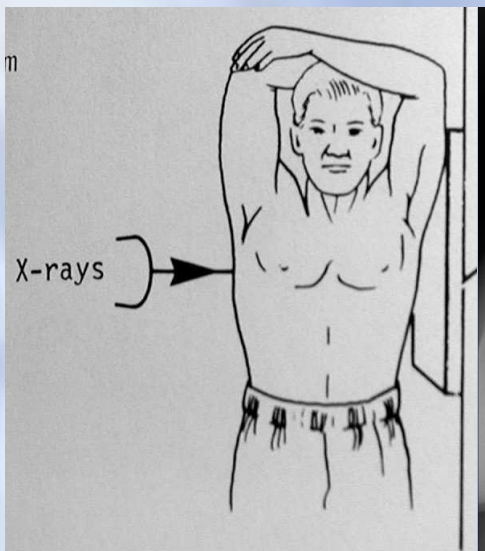
1. Plain chest Radiograph
2. Fluoroscopy
3. CT
4. Radionuclide lung scan
5. MRI
6. Ultrasound
7. Pulmonary angiography

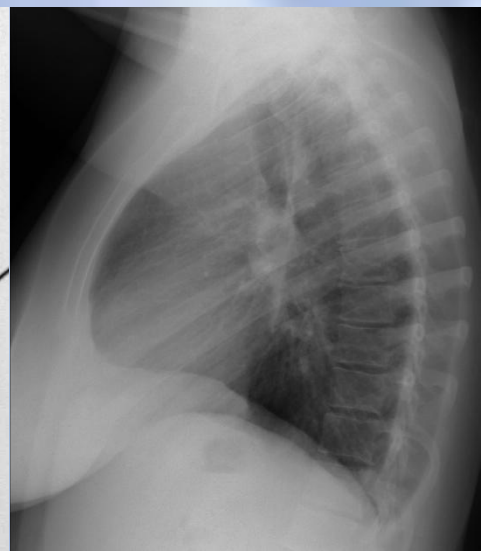
Chest Radiographs

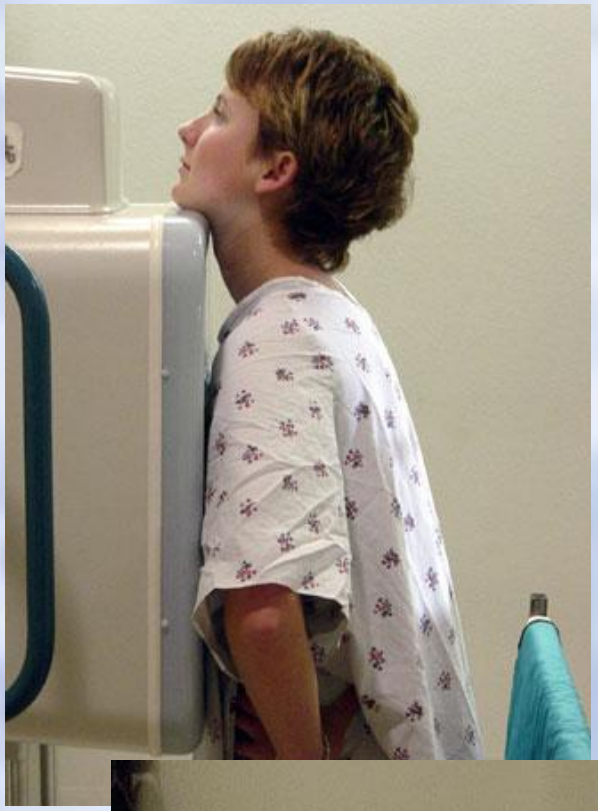
- Path of x-ray beam
  - PA
  - AP
- Patient Position
  - Upright
  - Supine





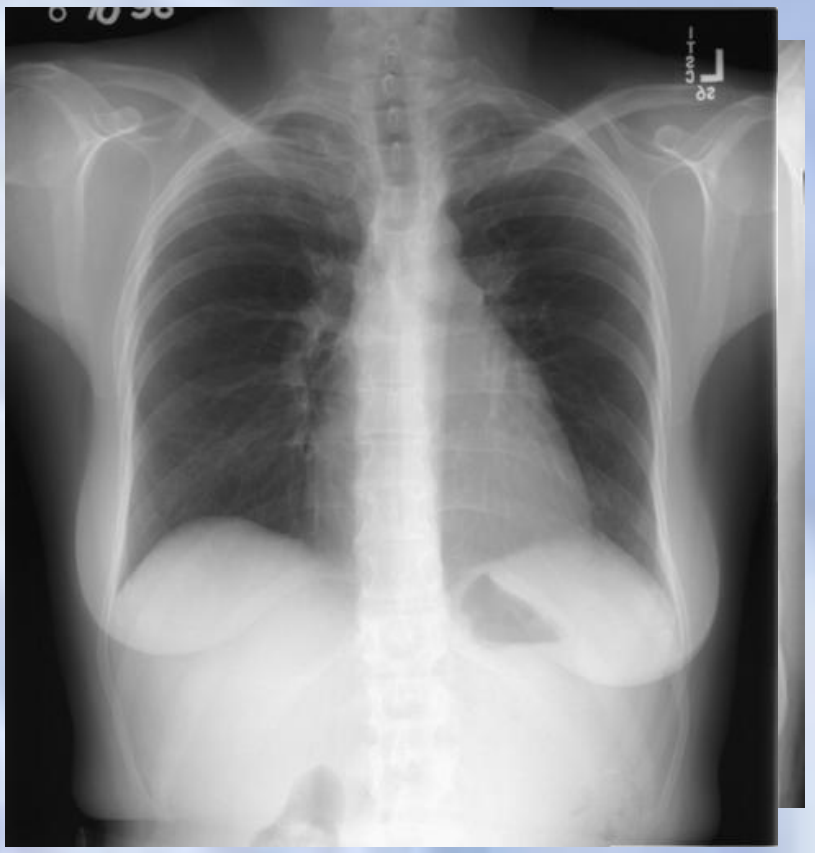






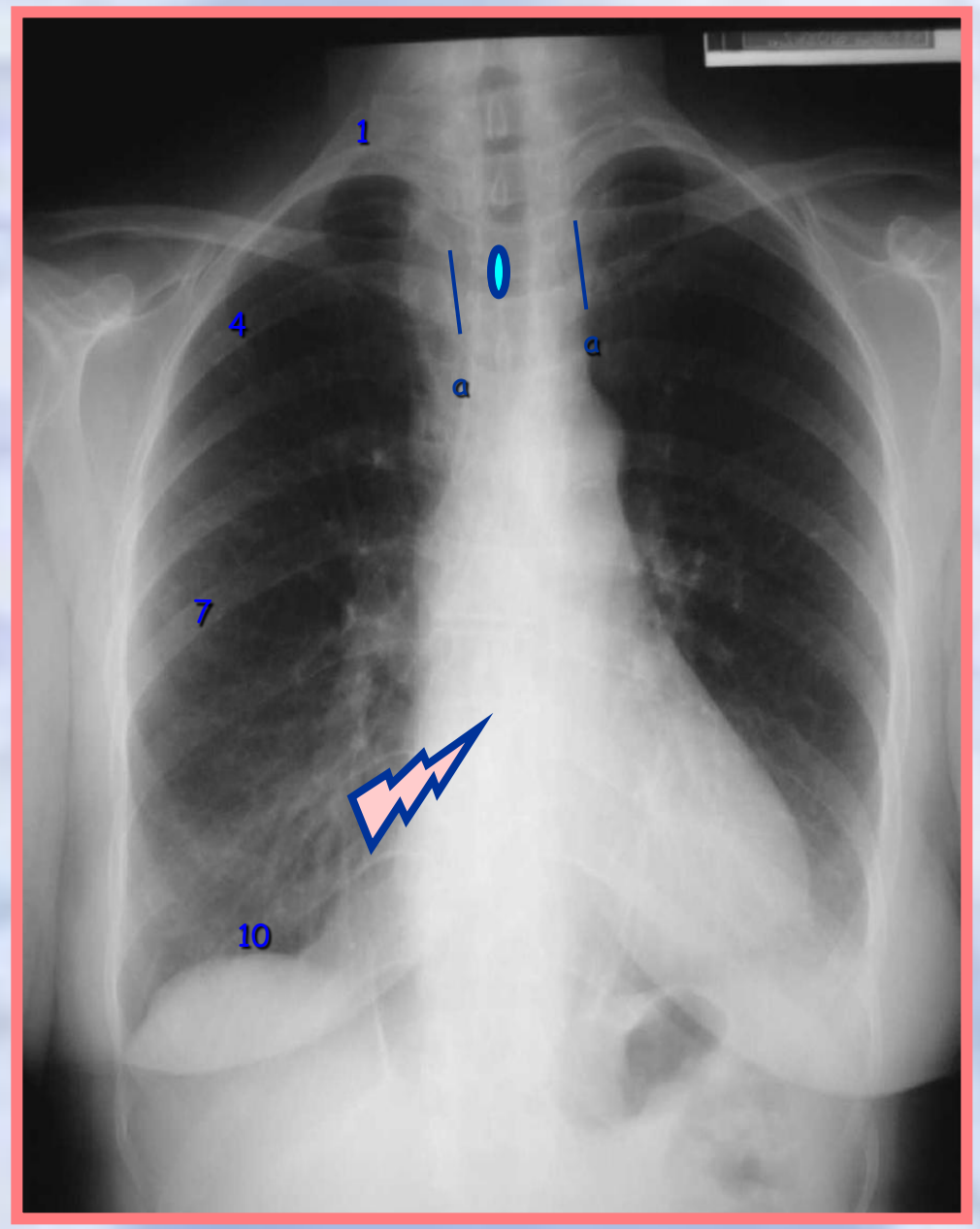
Essentials Before Getting Started

- Exposure
  - Overexposure
  - Underexposure
- Sex of Patient
  - Male
  - Female



Pitfalls to Chest X-ray Interpretation

- Poor inspiration
- Over or under penetration
- Rotation
- Forgetting the path of the x-ray beam



Postero-anterior view (PA)

Check technique:

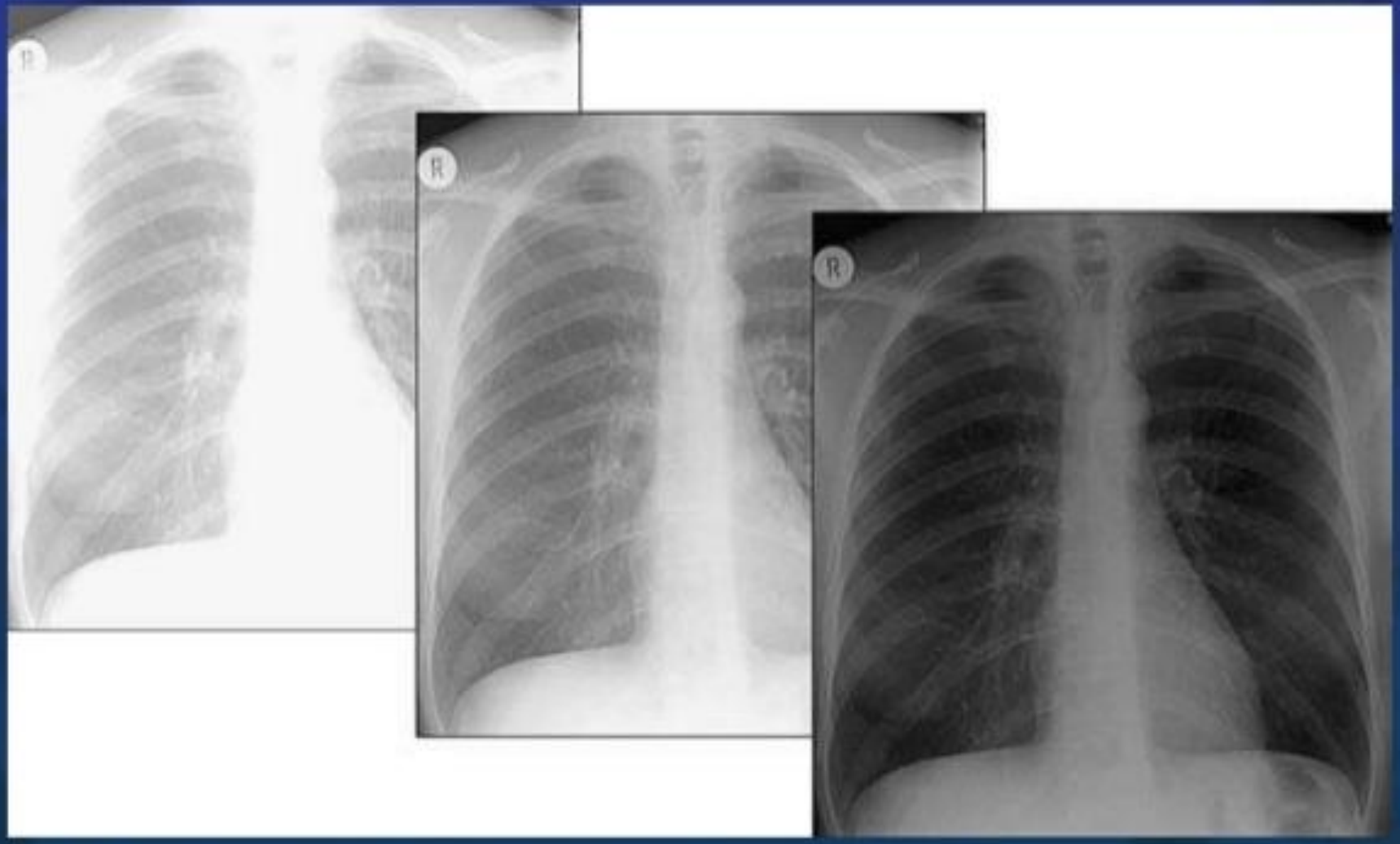
1: Adequate penetration of the mediastinum-is the thoracic spine seen?

2: Has the patient taken a good inspiratory effort? About 8-10 posterior thoracic ribs should be seen through the lungs. Breath:

- Inspiration
- Expiration

3: Is there any rotation of the chest? Assessed by checking the upper thoracic spinous process (oval) in relation to the medial ends of the clavicles (lines 'a') - this CXR is rotated to left

Penetration

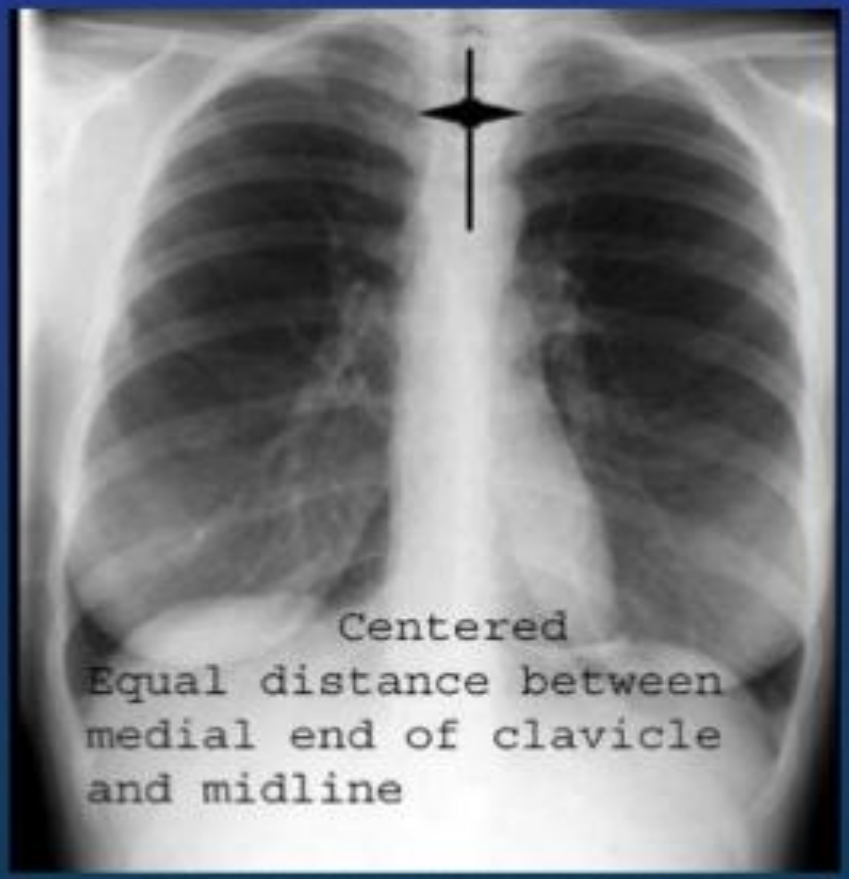


On a high quality radiograph, the vertebral bodies should just be visible through the heart.

Inspiration/Expiration

- If six complete anterior or ten posterior ribs are visible then the patient has taken an adequate inspiratory effort.
- Conversely, fewer than six anterior ribs implies a poor inspiratory effort and more than six anterior ribs implies hyper-expanded lungs.

Rotation



A well centred x-ray. Medial ends of clavicles are equidistant from the spinous process.

Systematic Approach

- Lung Fields, pulmonary pattern and hilum

Lung Fields without any pathology, radiologicaly = transparent

Pulmonary pattern and hilum can be:

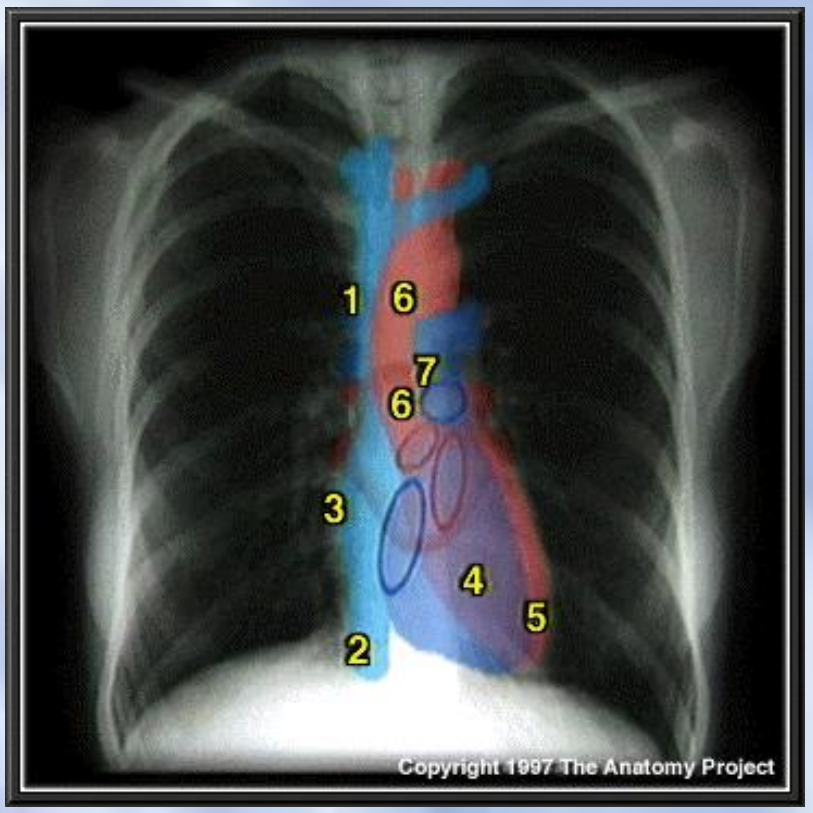
1. Structured if dimensions are1.5x3cm
2. Enhaced
3. Decreased (rare)
4. Deformed

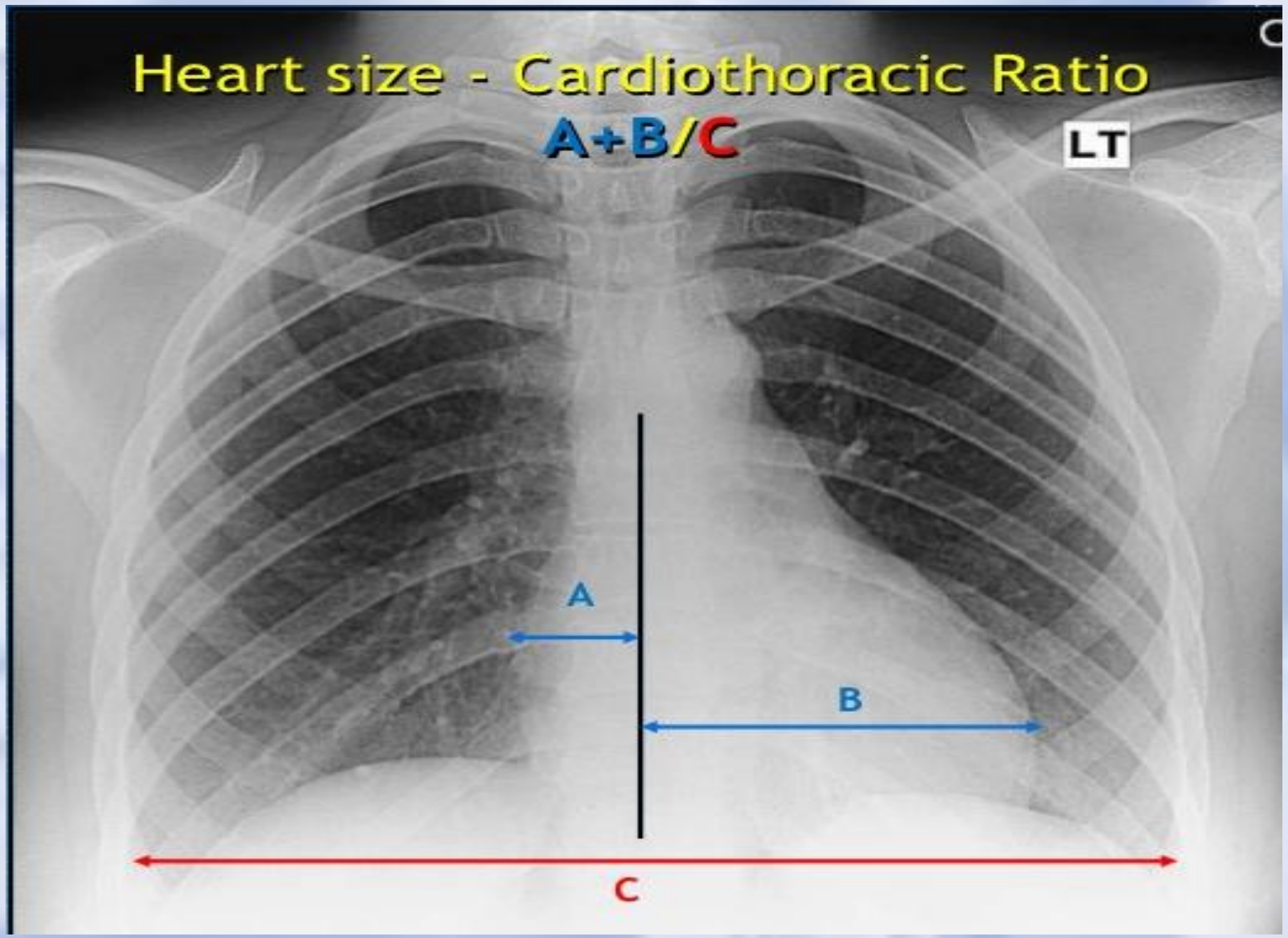
Systematic Approach

- Diaphragm and Pleural Surfaces
  - Diaphragm
    - border
    - Costophrenic angles
  - Pleural is not visible in case of no pathology
  - Interlobar fissures

Systematic Approach

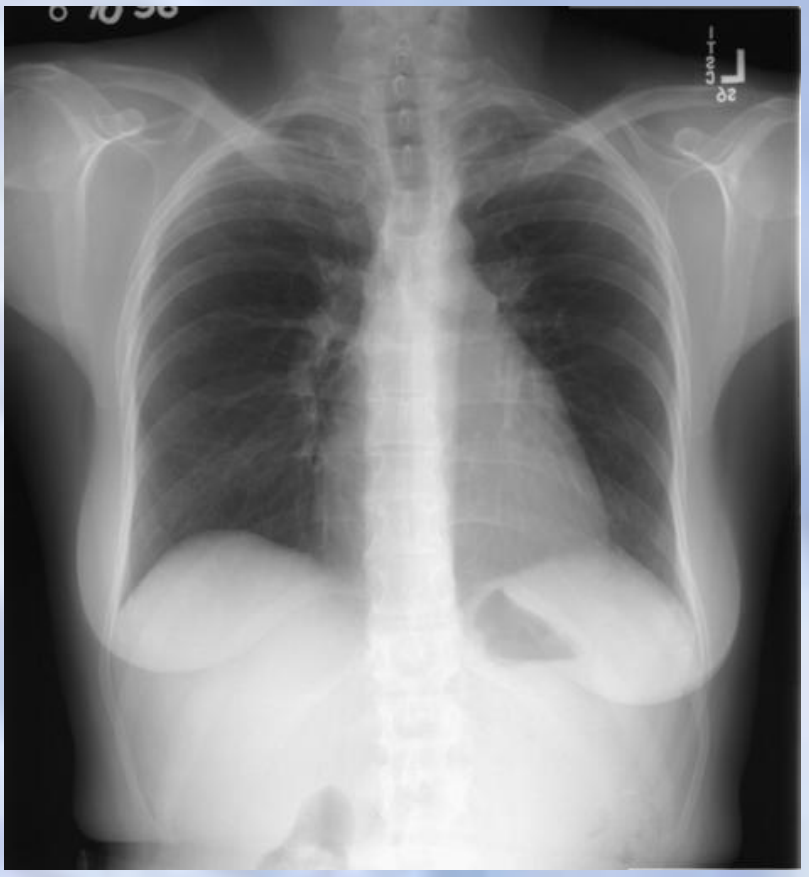
- Mediastinum and Heart
  - Heart size on PA
  - Measure CTR=cardio thoracic ratio




Heart size - Cardiothoracic Ratio
A+B/C
LT
A
B
C

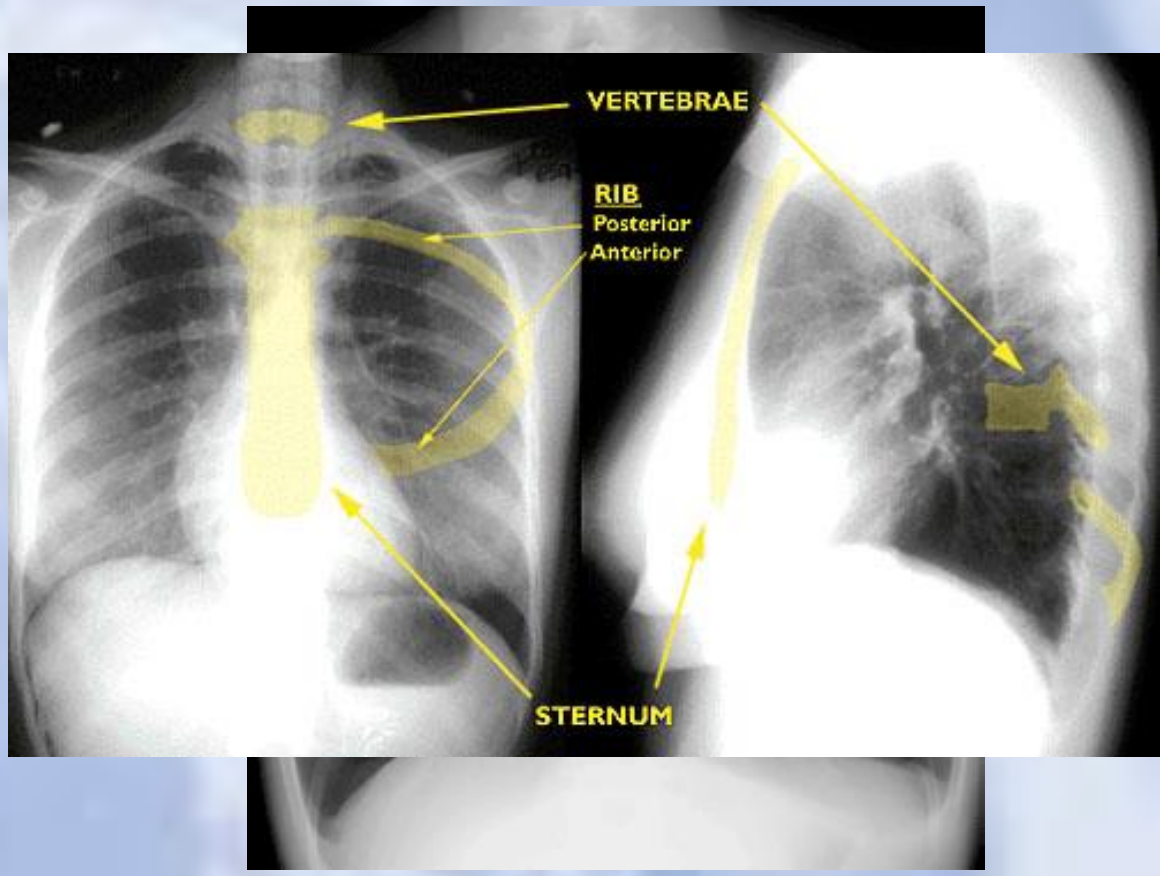
Systematic Approach

- Soft Tissues
  - Breast shadows
  - Supraclavicular areas
  - Axillae
  - Tissues along side of breasts



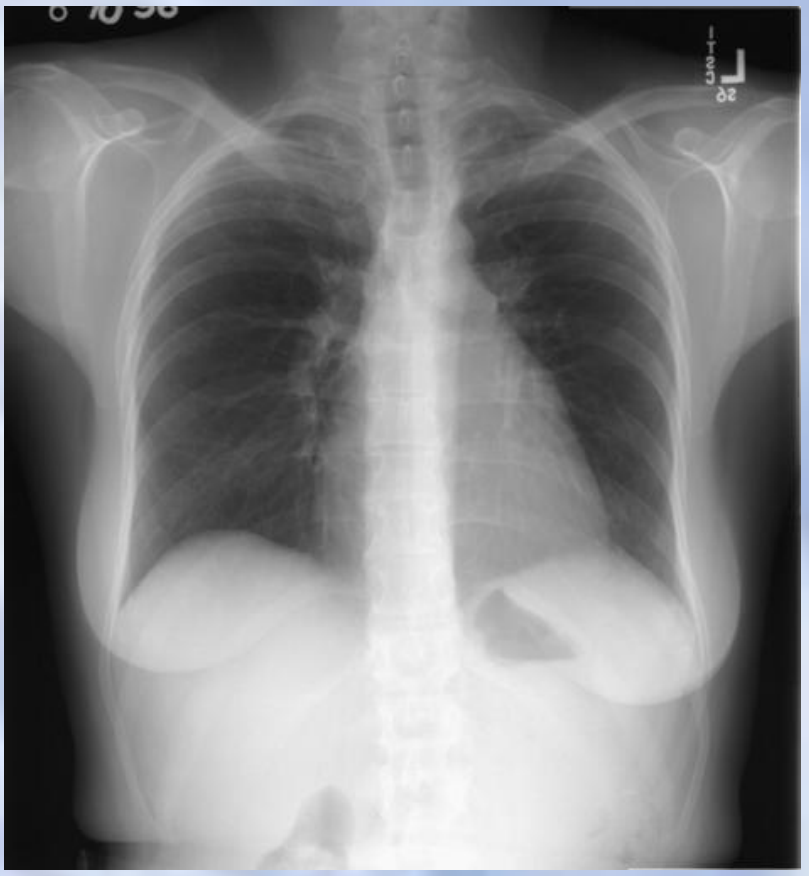
Systematic Approach

- Bony Fragments
  - Ribs
  - Sternum
  - Spine
  - Shoulder
  - Clavicles



Systematic Approach

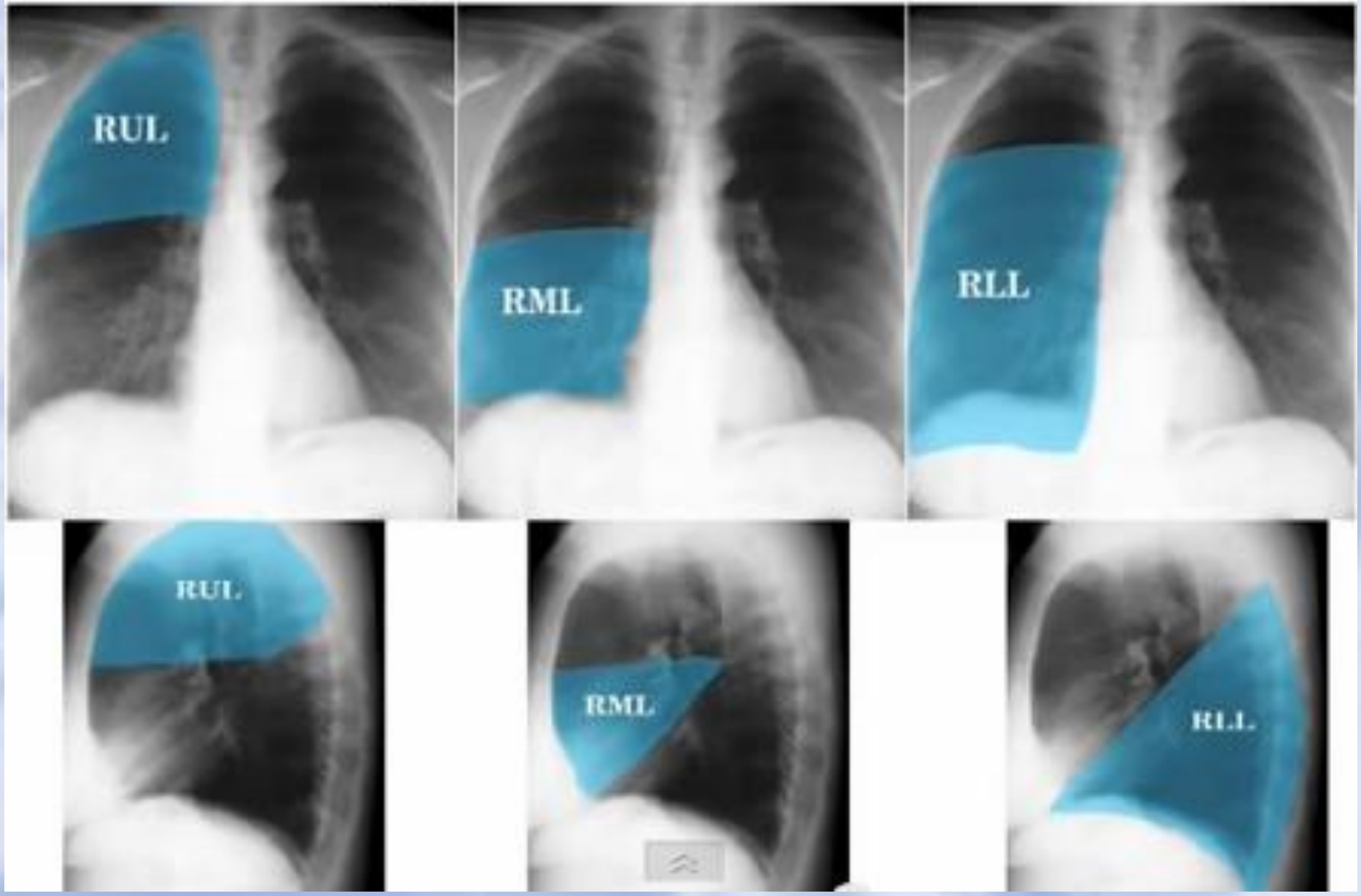
- Abdomen
  - Abdomen
    - Gastric bubble
    - Air under diaphragm



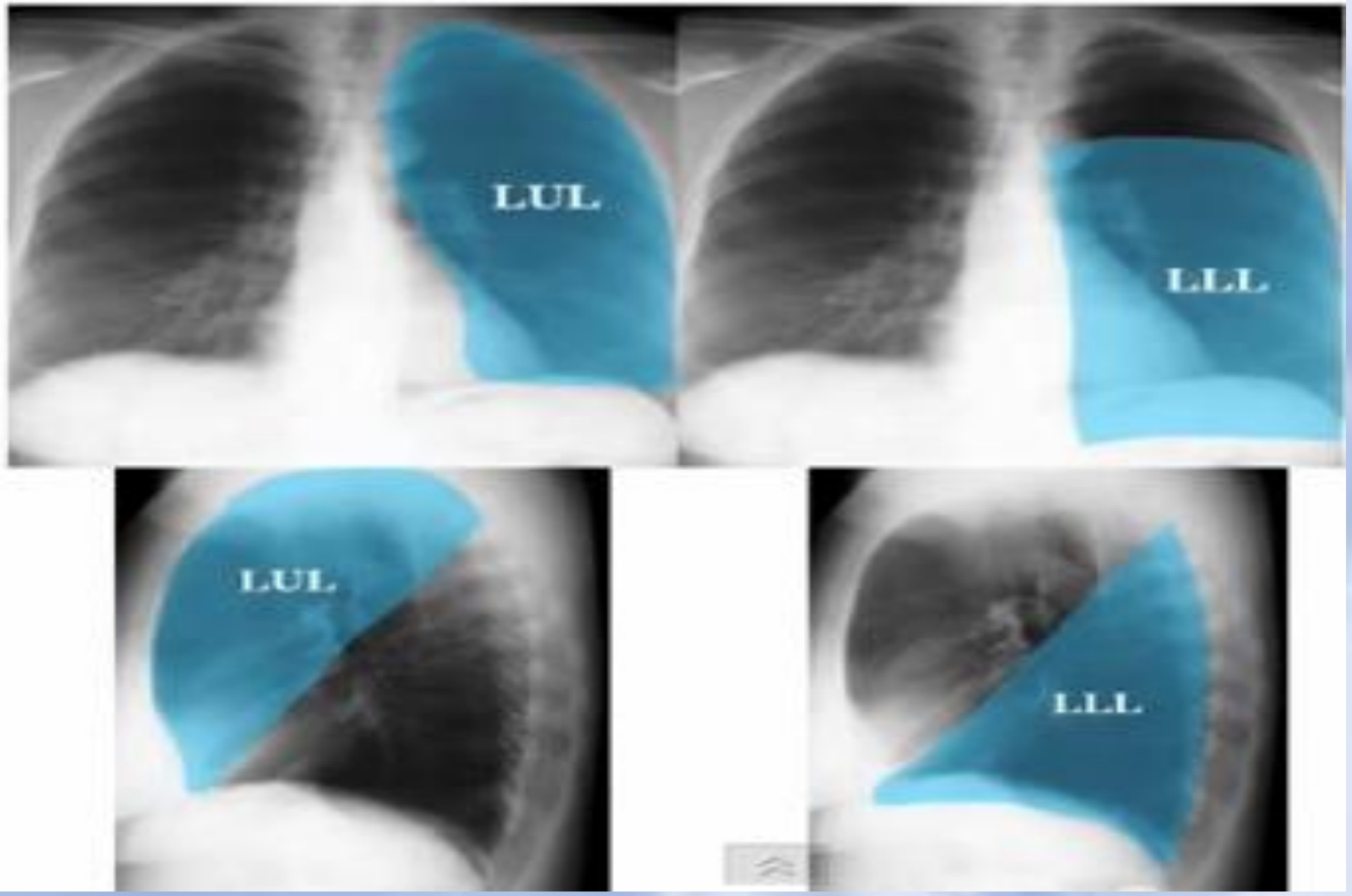
Lung Anatomy

- Right Lung
  - Superior lobe
  - Middle lobe
  - Inferior lobe
- Left Lung
  - Superior lobe
  - Inferior lobe

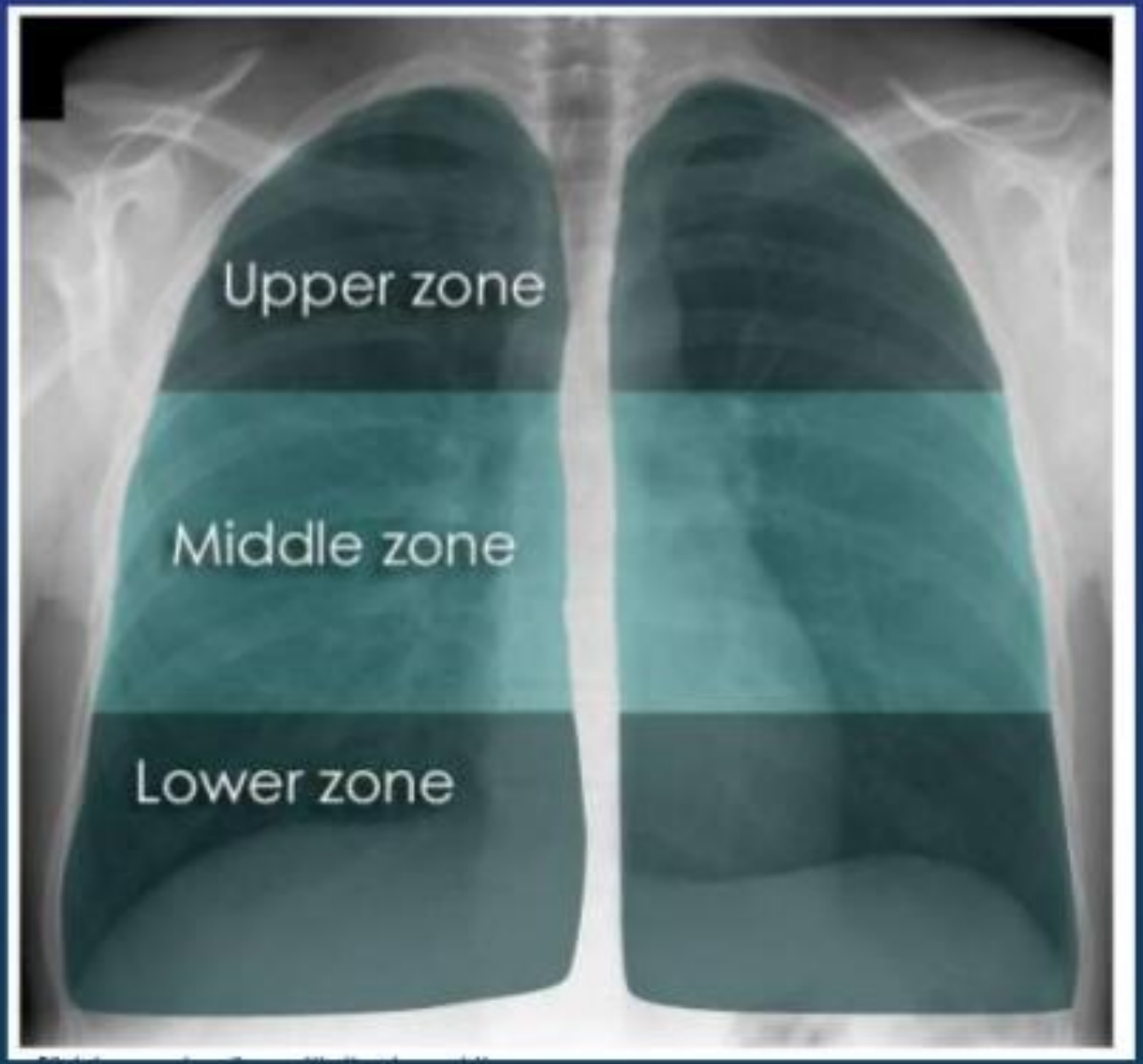
Right Lobe Position



Left Lobe Position



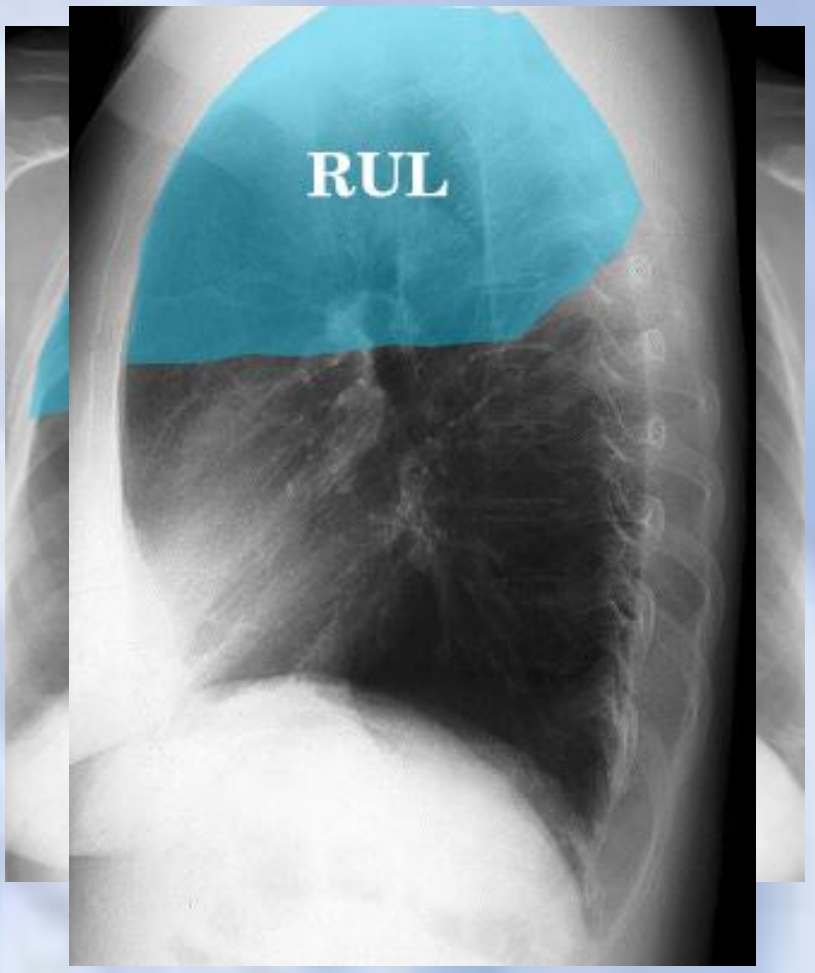
Lung Zones



Each of these zones occupies approximately one third of the height of the lungs.

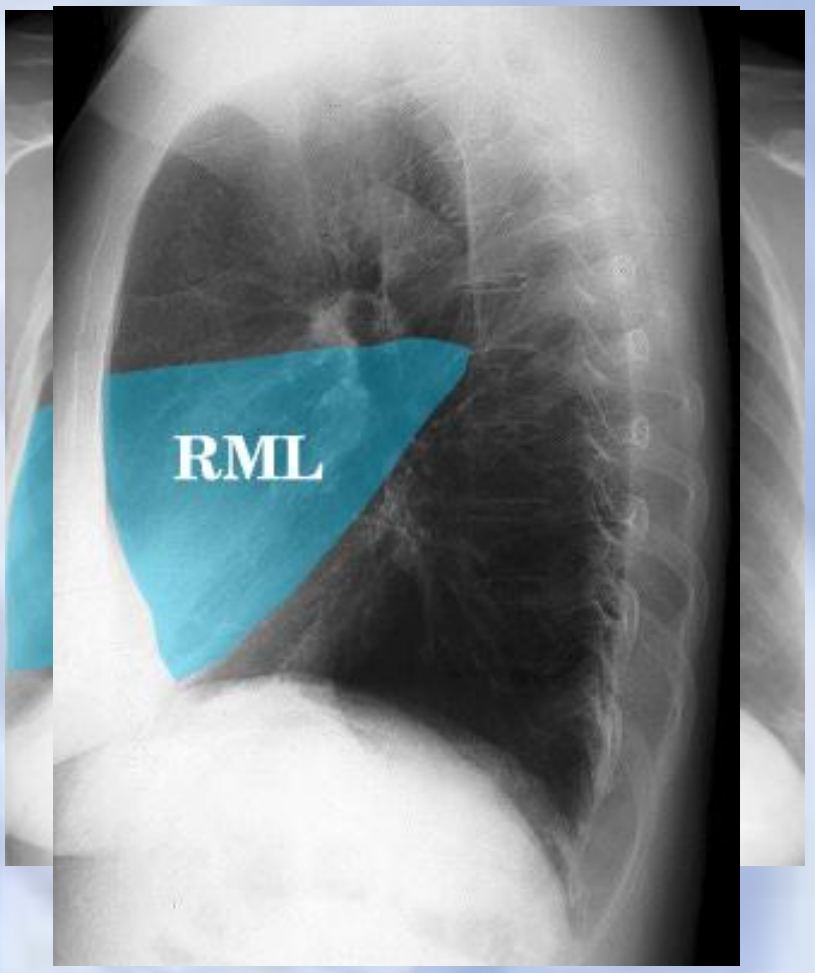
Lung Anatomy on Chest X-ray

- The right upper lobe (RUL) occupies the upper 1/3 of the right lung.
- Posteriorly, the RUL is adjacent to the first three to five ribs.
- Anteriorly, the RUL extends inferiorly as far as the 4th right anterior rib



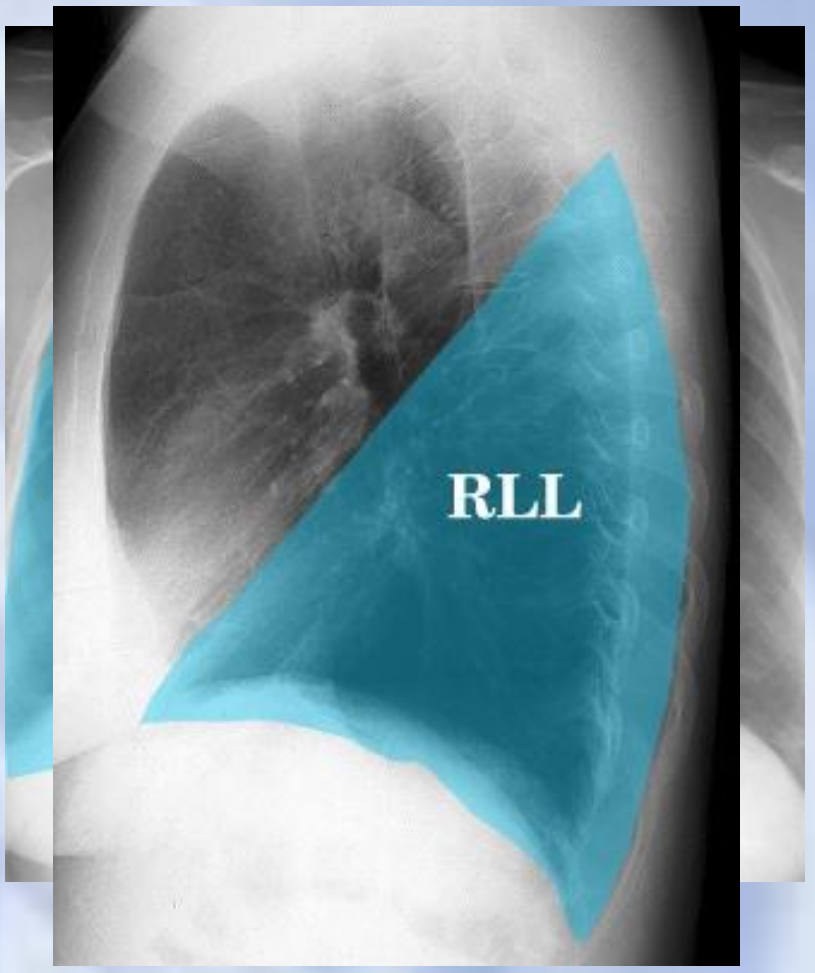
Lung Anatomy on Chest X-ray

- The right middle lobe is typically the smallest of the three, and appears triangular in shape, being narrowest near the hilum



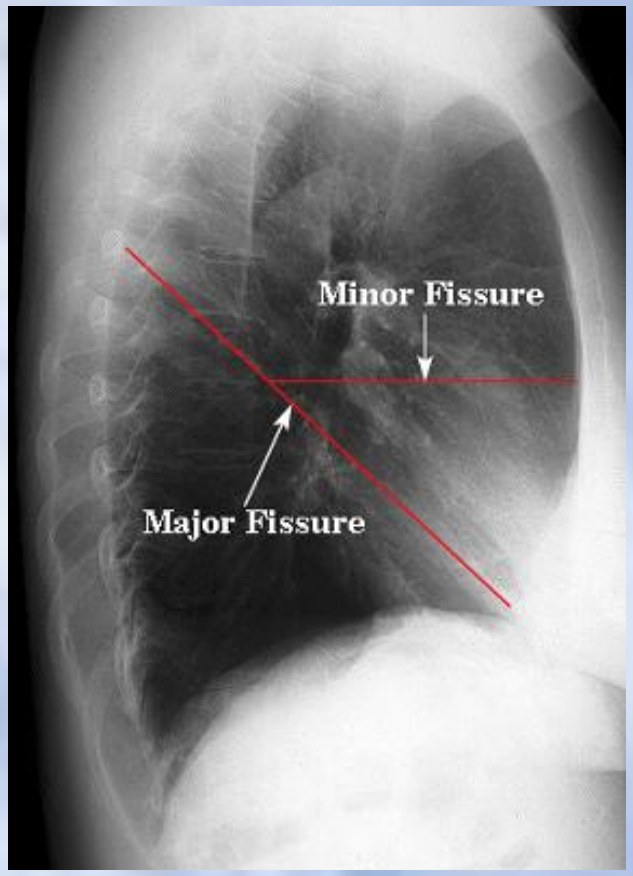
Lung Anatomy on Chest X-ray

- The right lower lobe is the largest of all three lobes, separated from the others by the major fissure.
- Posteriorly, the RLL extend as far superiorly as the 6th thoracic vertebral body, and extends inferiorly to the diaphragm.
- Review of the lateral plain film surprisingly shows the superior extent of the RLL.



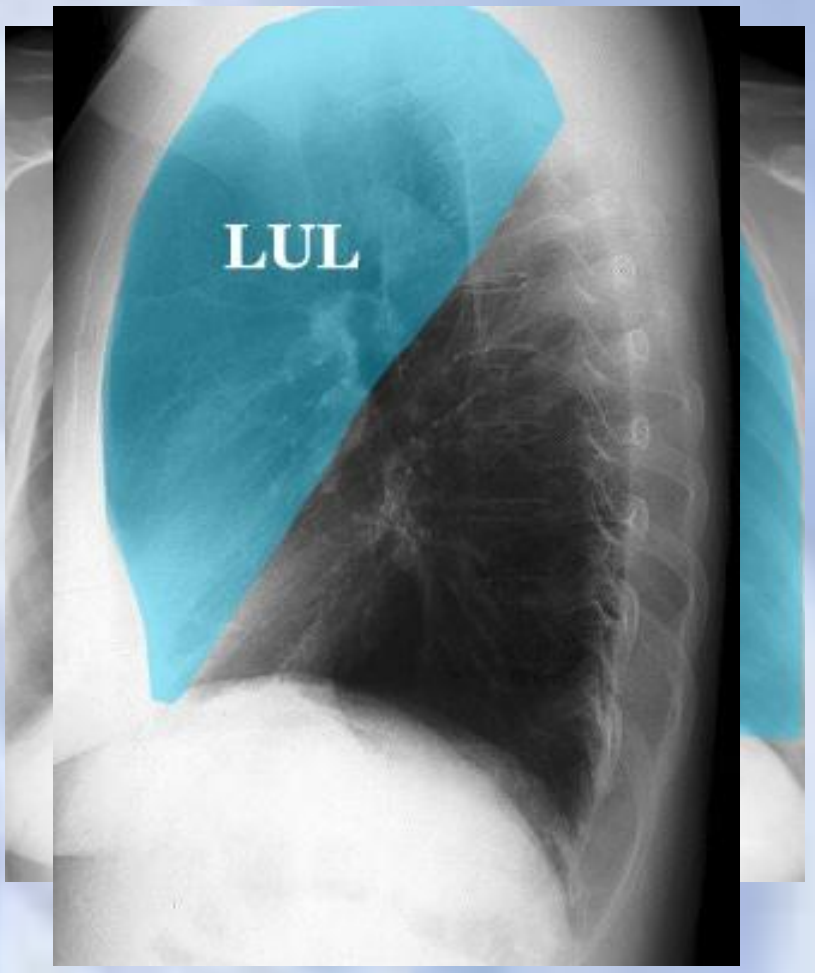
Lung Anatomy on Chest X-ray

- These lobes can be separated from one another by two fissures.
- The minor fissure separates the RUL from the RML, and thus represents the visceral pleural surfaces of both of these lobes.
- Oriented obliquely, the major fissure extends posteriorly and superiorly approximately to the level of the fourth vertebral body.



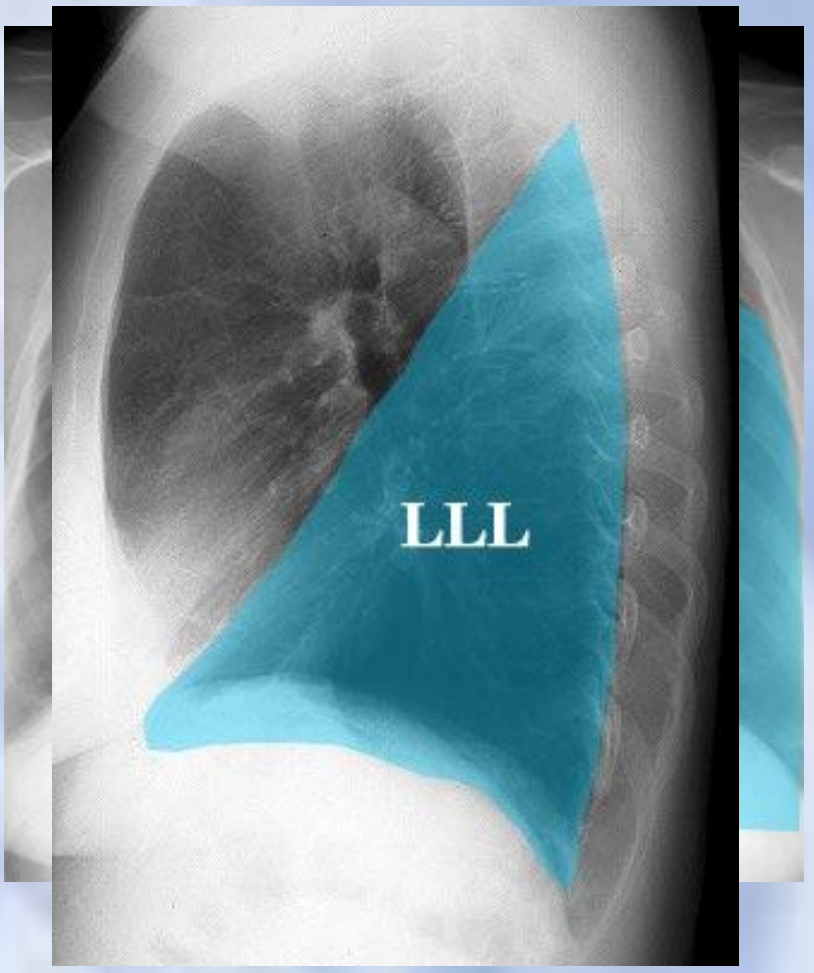
Lung Anatomy on Chest X-ray

- The lobar architecture of the left lung is slightly different than the right.
- Because there is no defined left minor fissure, there are only two lobes on the left; the left upper



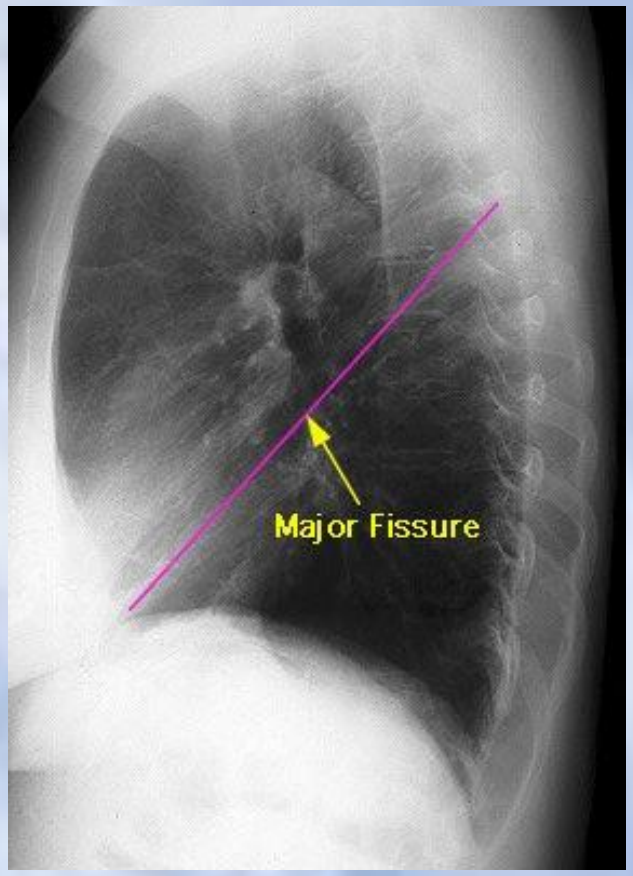
Lung Anatomy on Chest X-ray

- Left lower lobes



Lung Anatomy on Chest X-ray

- These two lobes are separated by a major fissure, identical to that seen on the right side, although often slightly more inferior in location.
- The portion of the left lung that corresponds anatomically to the right middle lobe is incorporated into the left upper lobe.



Chest Imaging

Radiological anatomy

- **Right Lung**
  - **Superior lobe:**
    - **1 - apical; 2 - posterior; 3 - anterior**
  - **Middle lobe:**
    - **4 - lateral; 5 - medial**
  - **Inferior lobe:**
    - **6 - superior (apical); 7 - medial basal;**
      8 - anterior basal; 9 - lateral basal;
      10 - posterior basal

Chest Imaging

Radiological anatomy

- **Left Lung**
  - **Superior lobe:**
    - **1 - apical; 2 - posterior; 3 – anterior; 4, superior lingular; 5, inferior lingular**
  - **Inferior lobe:**
    - **6 - superior (apical); 8 - anterior basal;**

      9 - lateral basal; 10 - posterior basal

Radiological semiology of pulmonary pathology

- Pulmonary opacity
- Pulmonary hyperlucency
- Changes of pulmonary picture
- Changes of hilum

Pulmonary opacification represents the result of a decrease in the ratio of gas to soft tissue (blood, lung parenchyma and stroma) in the lung. When reviewing an area of increased attenuation (opacification) on a chest radiograph or CT it is vital to determine where the opacification is. The patterns can broadly be divided into airspace opacification, lines and dots.

Classification of pulmonary opacification

1. airspace opacification
    - consolidation
    - atelectasis
    - ground-glass opacification
    - airspace nodules
    - branching, e.g. mucoid impaction
2. linear opacification
    - reticular interstitial pattern, e.g. usual interstitial pneumonia
    - reticulonodular interstitial pattern, e.g. sarcoidosis
    - linear interstitial pattern, e.g. pulmonary oedema
3. nodular opacification
    - miliary (<2 mm), e.g. miliary tuberculosis
    - micronodular (2-7 mm), e.g. acute hypersensitivity pneumonitis
    - nodule (7-30 mm), e.g. lung metastasis, lung granuloma
    - mass (>30 mm), e.g. bronchogenic carcinoma
4. pulmonary mucoid impaction,

Radiological semiology of pulmonary pathology

Pulmonary opacity

- **Number** (single / multiple, disseminated or not)
- **Dimensions** (nodular / large)
- **Location** (unilateral or bilateral / regions / lobes / segments)
- **Shape** (rounded / ring-shape / linear / triangle / irregular)
- **Borders** (well-defined, regular or irregular / ill-defined)
- **Structure** (homogeneous / heterogeneous)
- **Intensity** (subcostal / costal / supracostal)
- **Relation to the mediastinum** (without displacement / pushing / pulling)

Pulmonary hyperlucency

Def: Decreased lung density on images can be described as pulmonary hyperlucency on conventional chest radiographs and hypoattenuation on CT scans.

Hyperlucency on images can result from an excess of air in the pulmonary parenchyma or a decrease in mass of the pulmonary parenchyma caused by a reduction in vasculature or blood flow, reduction or obliteration of airways, or a combination of these potential causes.

Radiological semiology of pulmonary pathology

Pulmonary hyperlucency

Classification

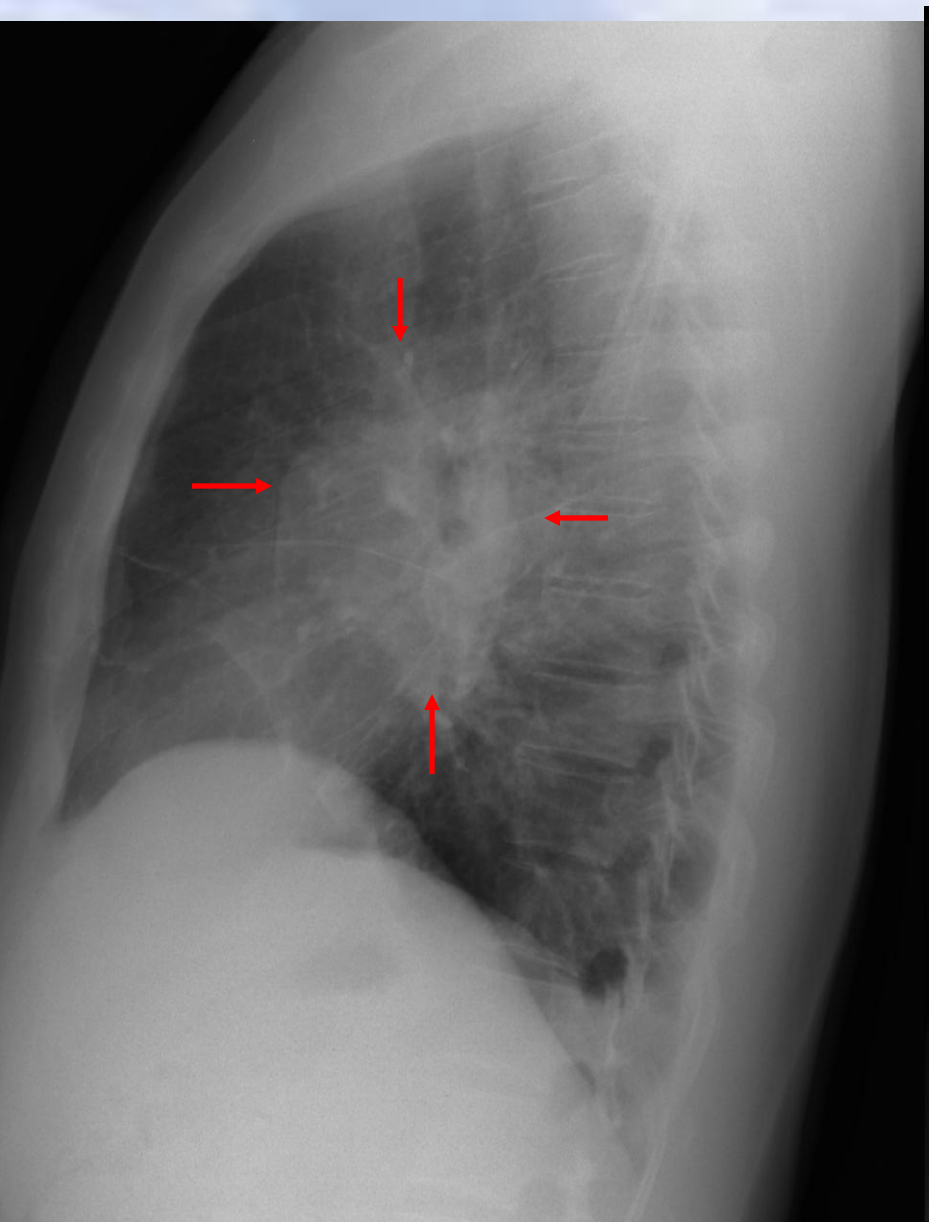
- **Outside or Inside the lungs**
- **unilateral or bilateral,**
- **focal or diffuse.**

Radiological semiology of pulmonary pathology

Changes of pulmonary picture

- **Deformation**
- **Enhanced**
- **Reduced**

Changes of hilum



NORMAL

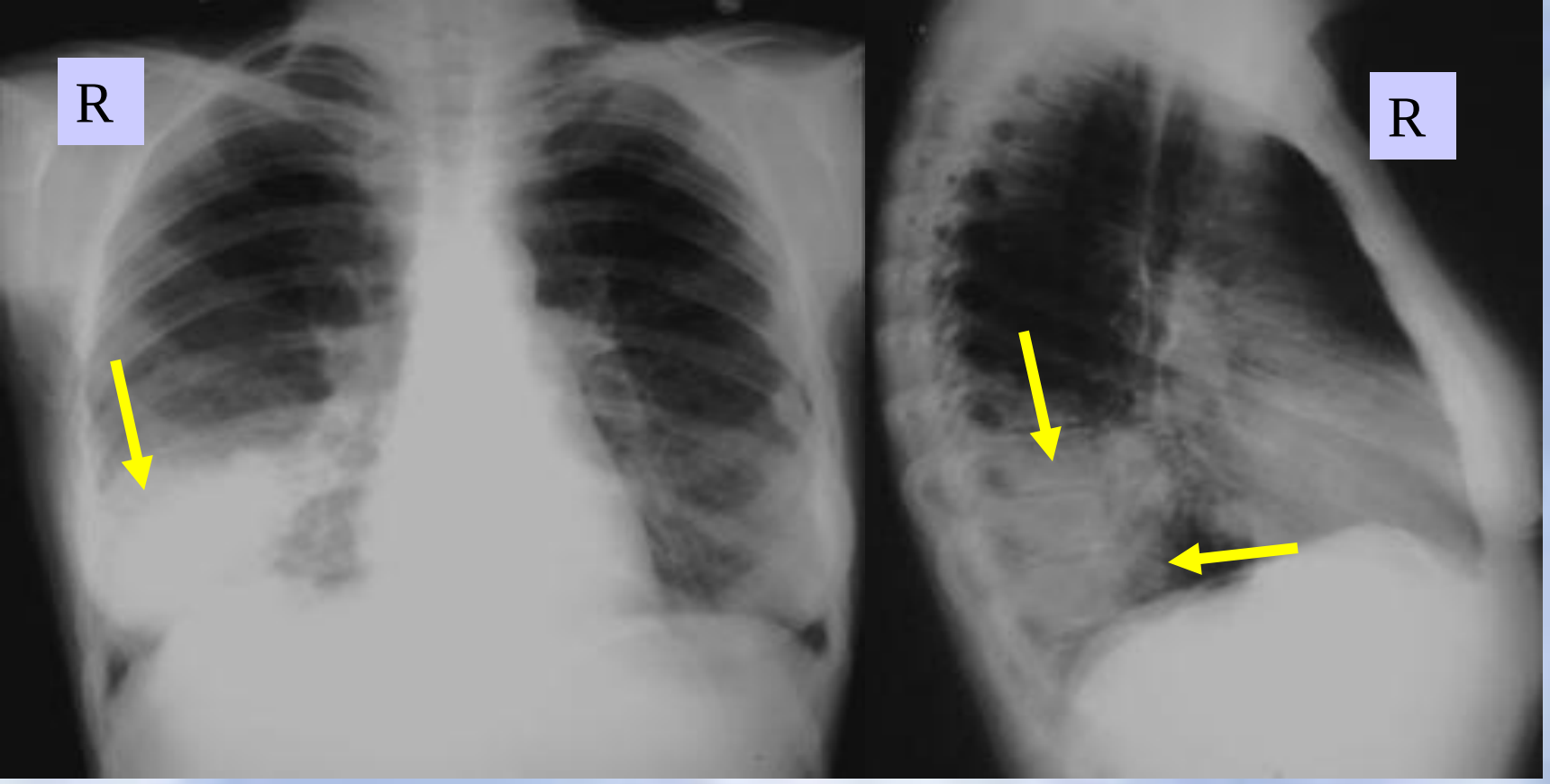
Unilateral Hilar Enlargement

- **Causes of hilar lymphadenopothy**
  - Neoplastic, e.g. spread from bronchial carcinoma, primary lymphoma
  - Infective, e.g. tuberculosis
  - Sarcoidosis (rarely unilateral)
- **Causes of hilar vascular enlargement**
  - Pulmonary artery aneurysm
  - Poststenotic dilatation of the pulmonary artery

Bilateral Hilar Enlargement

- **Causes of bilateral hilar lymphadenopathy**
  - Sarcoid
  - Tumors, e.g. lymphoma, bronchial carcinoma, metastatic tumors
  - Infection, e.g. tuberculosis, recurrent chest infections, AIDS
  - Berylliosis

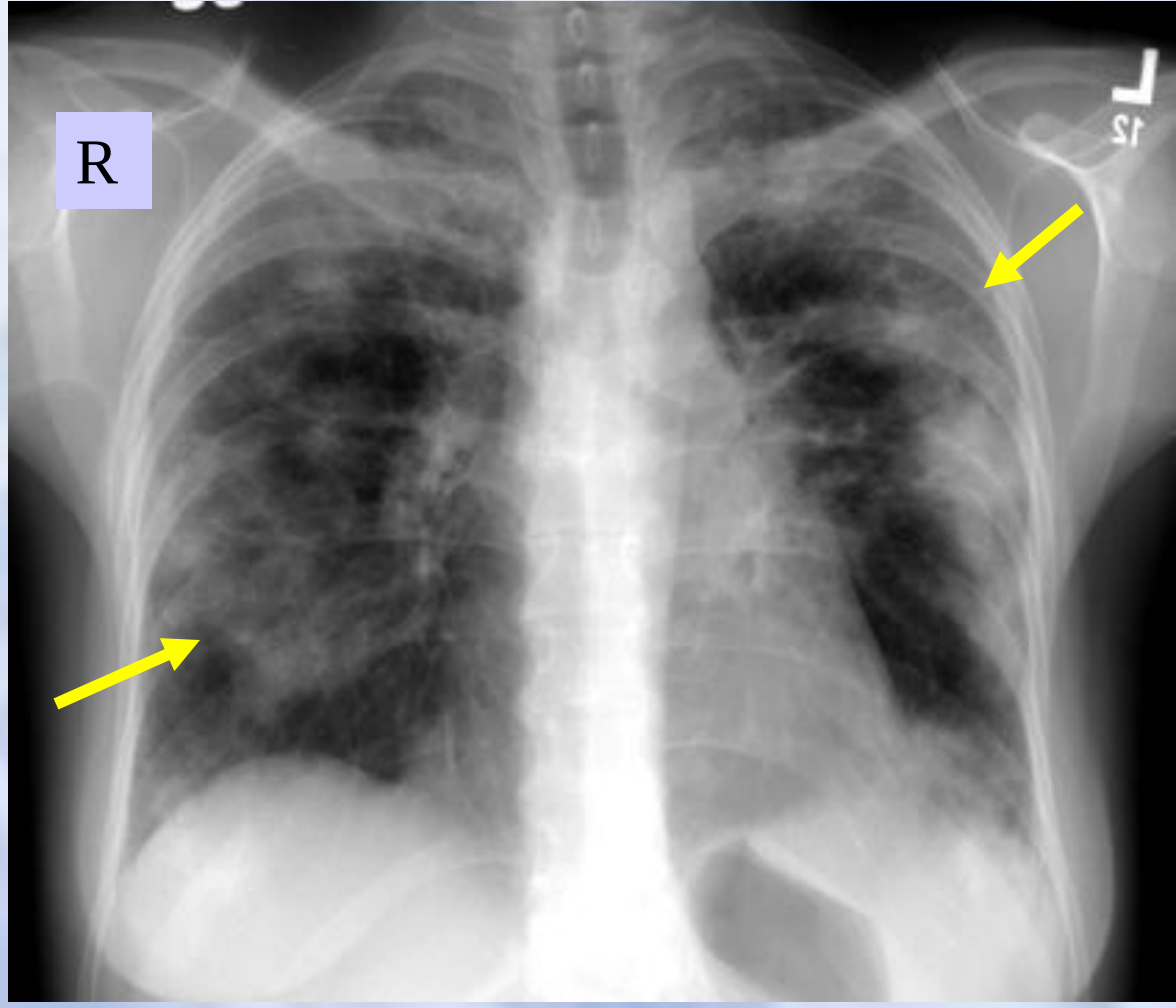
- **Causes of pulmonary hypertension**
  - Obstructive lung disease, e.g. asthma, COPD
  - Left heart disease, e.g. mitral stenosis, left ventricular failure
  - Left to right shunts, e.g. ASD, VSD
  - Recurrent pulmonary emboli
  - Primary pulmonary hypertension



1. Radiography of chest PA and lateral right view

2. The position of patient is correct. The image is with good and correct exposure. In the right lung, inferior lobe, S 10 is determined an opacity. It is single, limited, irregular shape and unclear borders, without displacement of mediastinum The structure of it is heterogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is unclear on right because of opacity, on left the contour is clear. The bones are structured and soft tissues are clear. The heart is not enlarged.

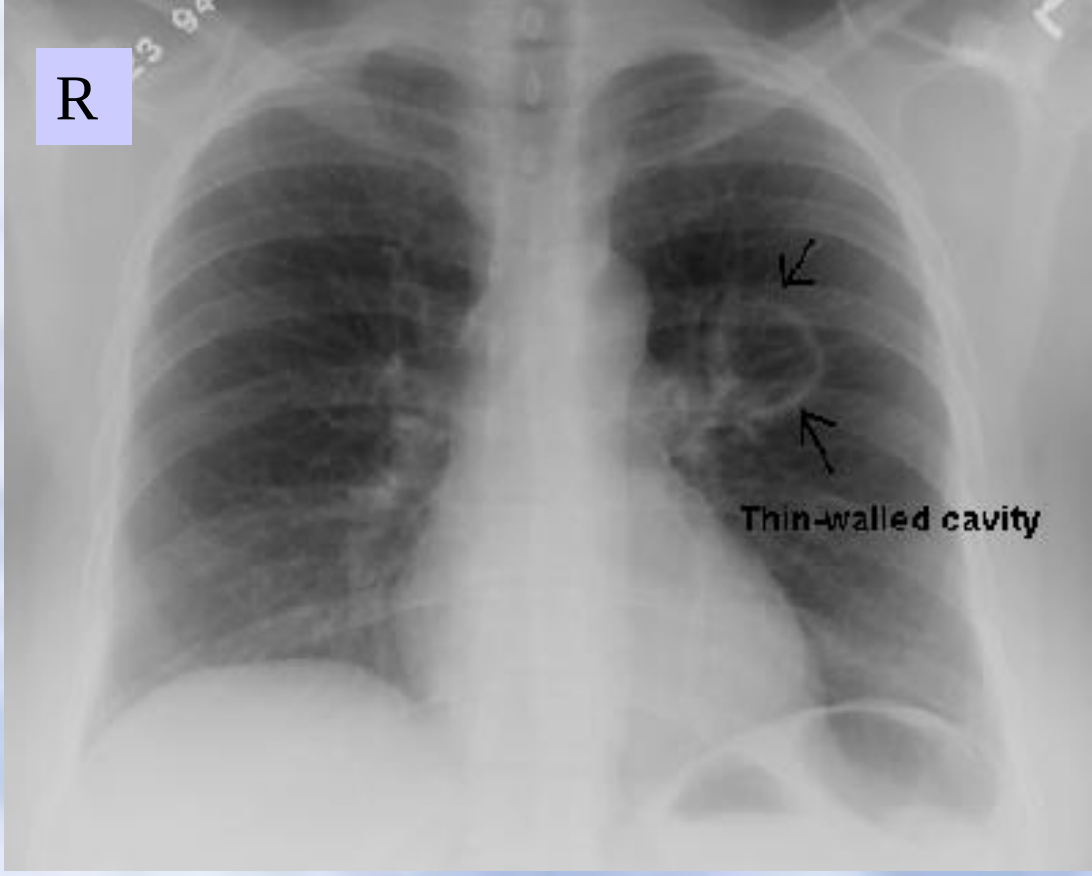
3. Conclusion: right side Pneumonia



1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. Bilateral, in medium and inferior zone in right lung and medium zone in left lung is seen multiple diffuse nodular opacities with irregular shape and unclear borders, without displacement of mediastinum The structure of it is heterogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

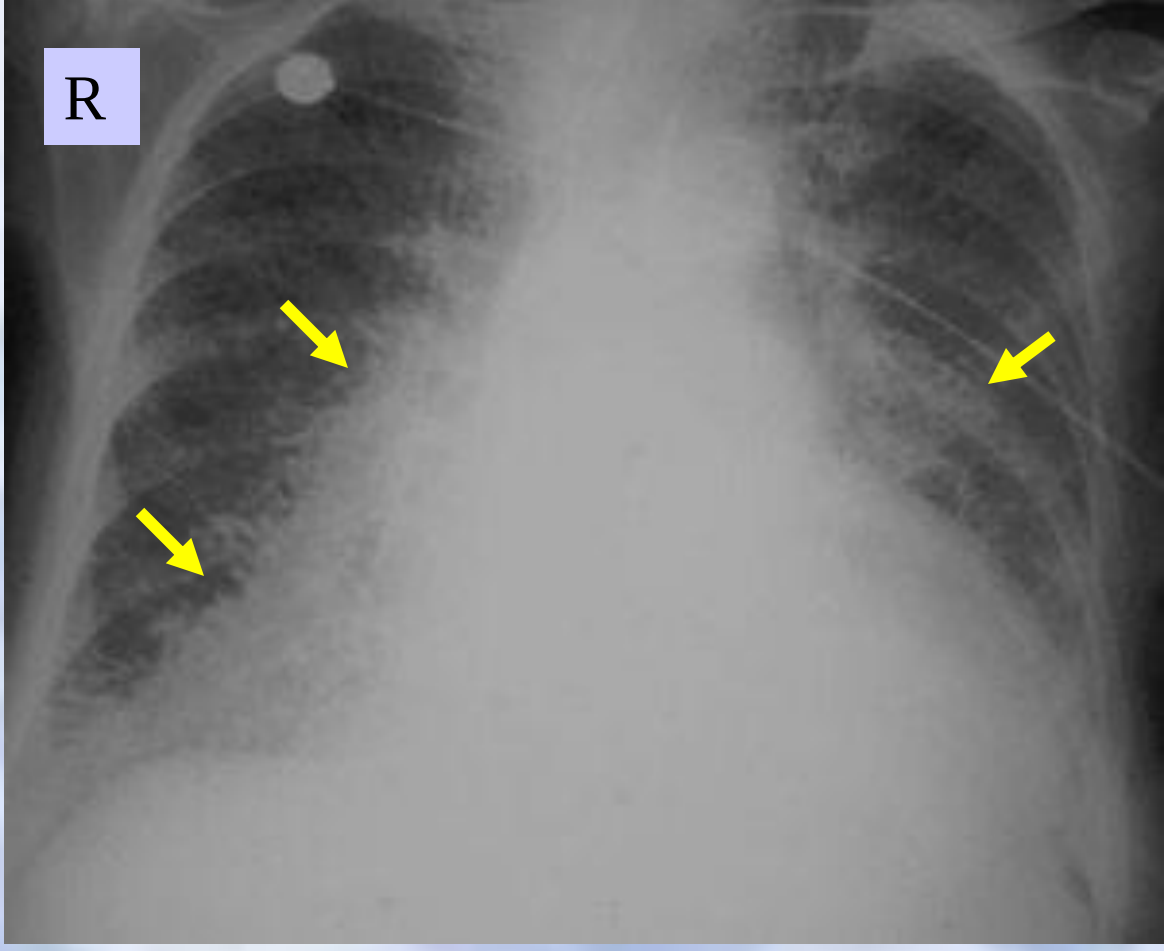
3. Conclusion: Bilateral Pneumonia



1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. In the left lung, medium zone, perihilar is determined a single ring shape opacity with clear and thick borders, without displacement of mediastinum The structure of it is heterogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

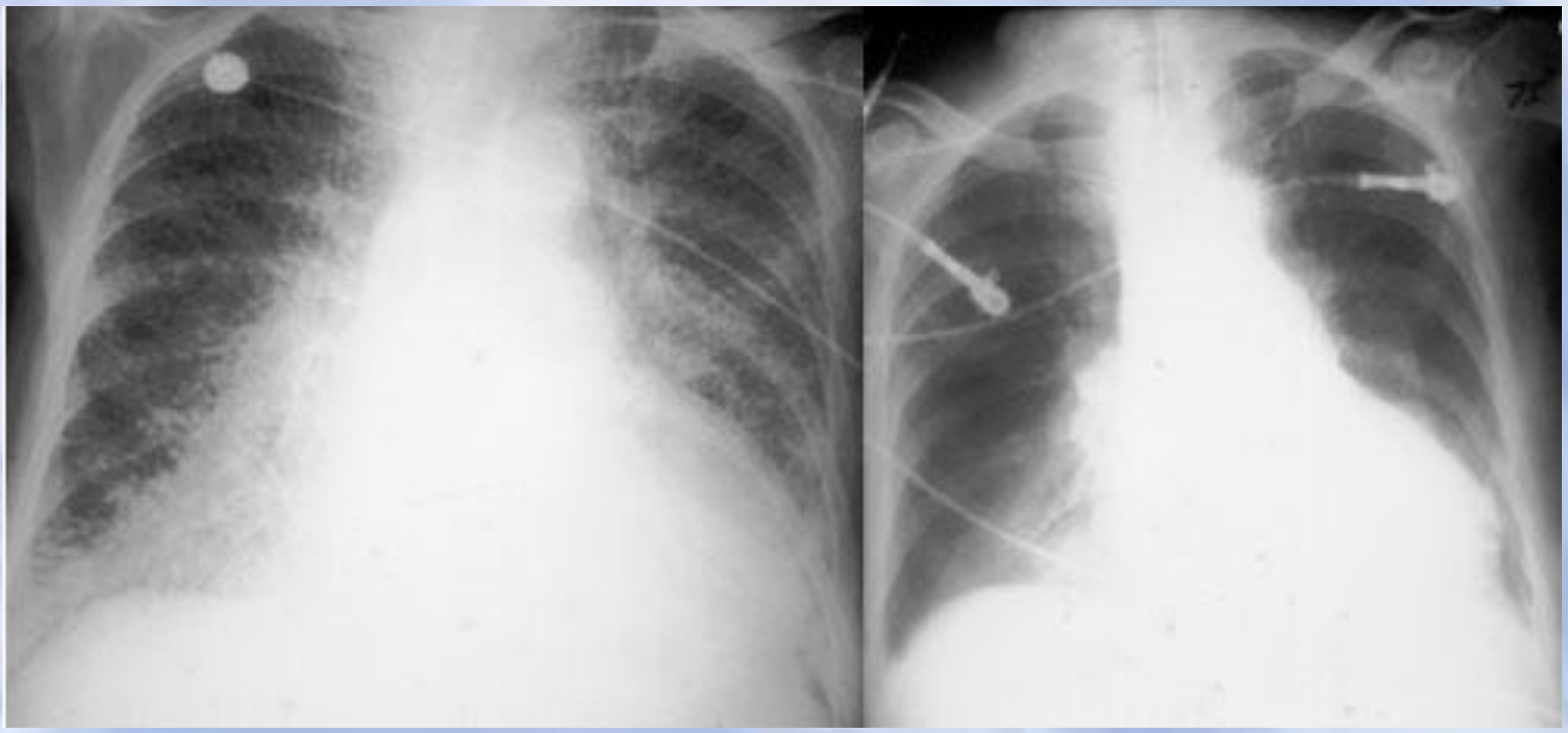
3. Conclusion: left lung central cancer



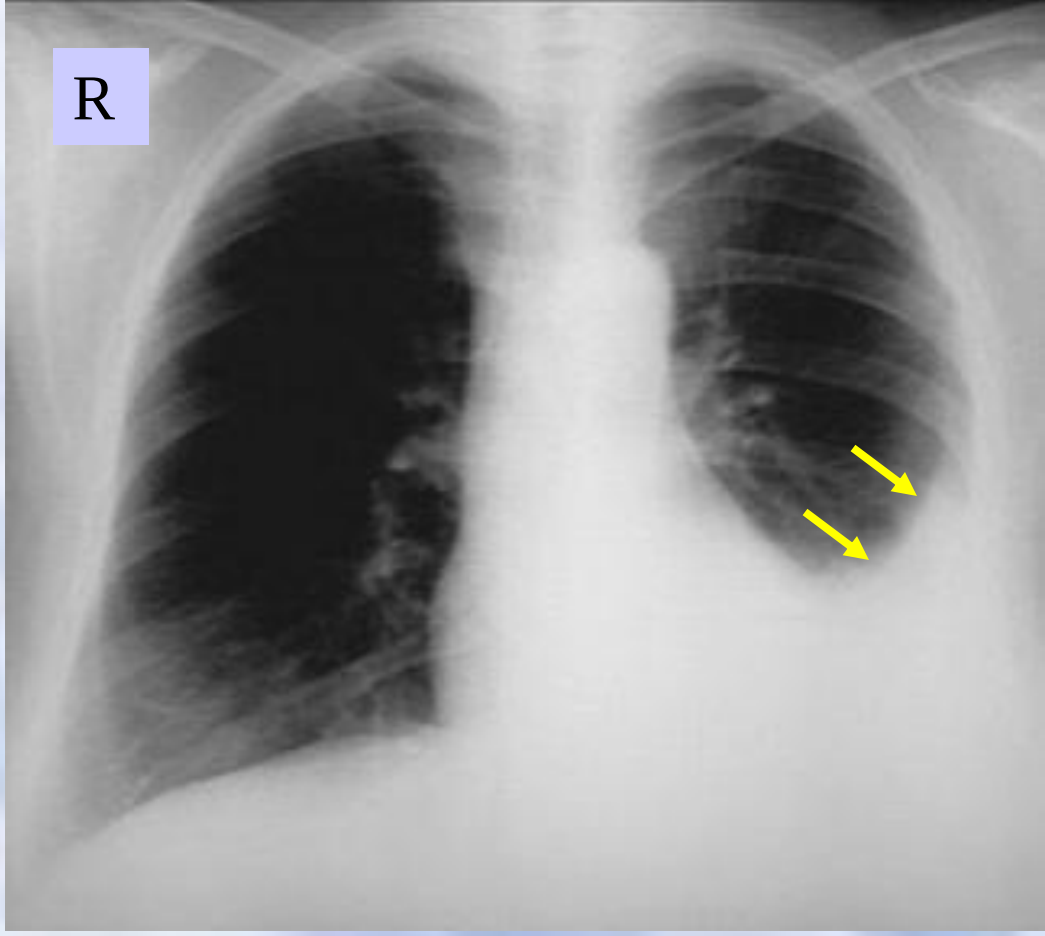
1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. Bilateral perihilar and inferior zone in right side is seen diffuse limited opacitiy with irregular shape and unclear borders, without displacement of mediastinum The structure of it is heterogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are dilated bilateral. The costophrenic angles are opacified. The diaphragm is not clear because of opacity. The bones are structured and soft tissues are clear. The heart is encrased, cardio-thoracic ratio (CTR)=0.6

3. Conclusion: pulmonary edema. Cardiomegaly



24 hours after diuretic therapy

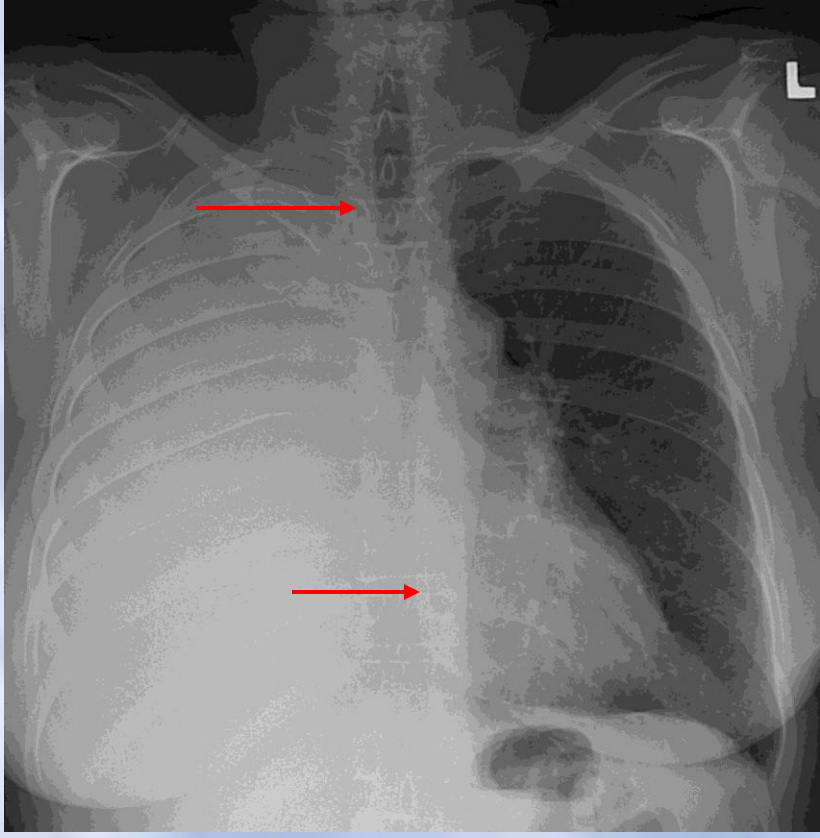


1. Radiography of chest frontal view

2. The position of patient is correct, the clavicles are simetric. The image is with good and correct exposure. On the radiography we determine radiological symptom of opacity. It is single, limited, localized in the left lung, inferior zone. The structure of opacity is homogeneous with displaced mediastinum organs, such us trachea and heart away from opacity. The pulmonary pattern is deformed. The pulmonary hilum unstructured. The costophrenic angles : on right is clear; on left is opacified. The diaphragm : on right is well defined; on left can't be seen because of opacity . The bones are structured. Soft tissues are clear. The heart is not enlarged.

3. Conclusion: left side pleural effusion

Mass effect with large effusion

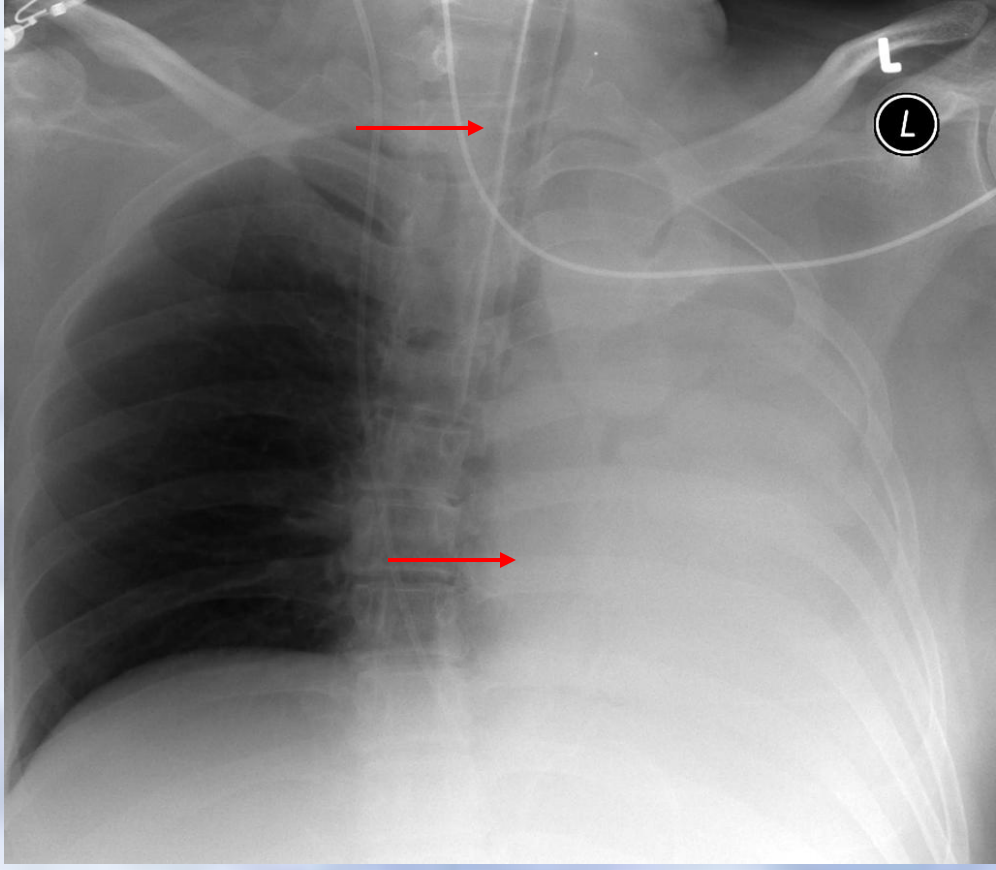


1. Radiography of chest frontal view

2. The position of patient is correct, the clavicles are simetric. The image is with good and correct exposure. The left lung is transparent. In the right side is seen single total opacity with homogeneous structure and with displaced mediastinum organs, such us trachea and heart away from opacity. In left side the pulmonary pattern is deformed and the pulmonary hilum structured. The costophrenic angles : on left is clear; on right is opacified. The diaphragm : on left is well defined; on right can't be seen because of opacity . The bones are structured. Soft tissues are clear. The heart is not enlarged.

3. Conclusion: right side pleural effusion

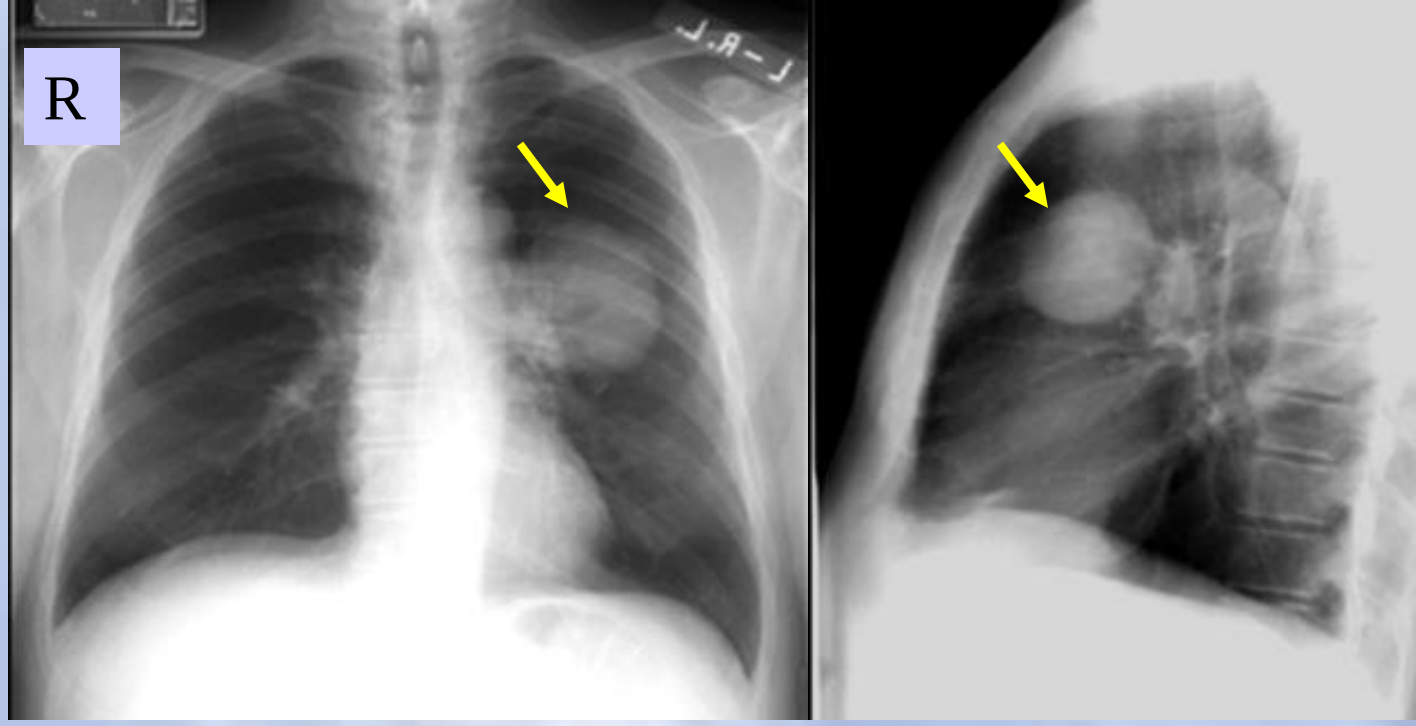
Volume loss with atelectasis



1. Radiography of chest frontal view

2. The position of patient is correct, the clavicles are simetric. The image is with good and correct exposure. The right lung is transparent. In the left side is seen single total opacity with heterogeneous structure and with displaced mediastinum organs toward to opacity. In right side the pulmonary pattern is deformed and the pulmonary hilum structured. The costophrenic angles: on right is clear; on left is opacified. The diaphragm : on right is well defined; on left can't be seen because of opacity . The bones are structured. Soft tissues are clear.

3. Conclusion: left lung atelectasis



1. Radiography of chest PA and left lateral view

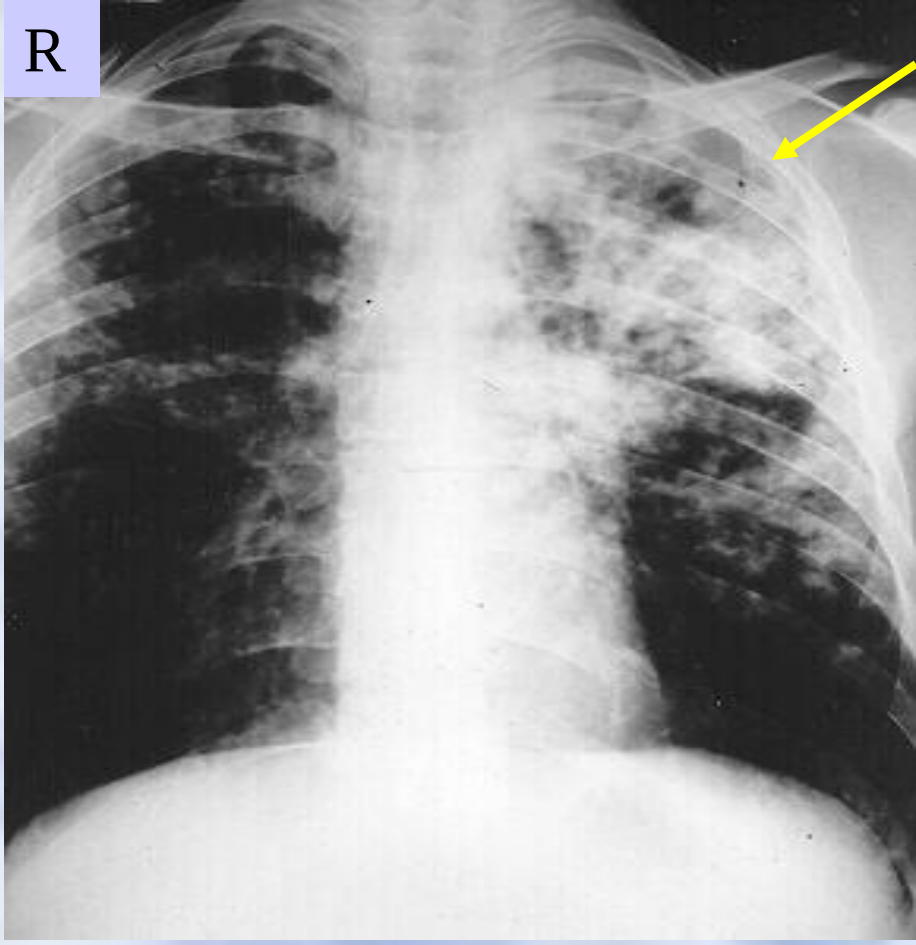
2. The position of patient is correct. The image is with good and correct exposure. In the left lung, superior lobe, S3, perihilar is determined a single round shape opacity with clear and thin borders, without displacement of mediastinum The structure of it is homogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

3. Conclusion: left lung benign mass (cyst)

1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. Bilateral, in medium and inferior zone is seen multiple nodular opacities with regular, clear borders, without displacement of mediastinum The structure of it is homogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

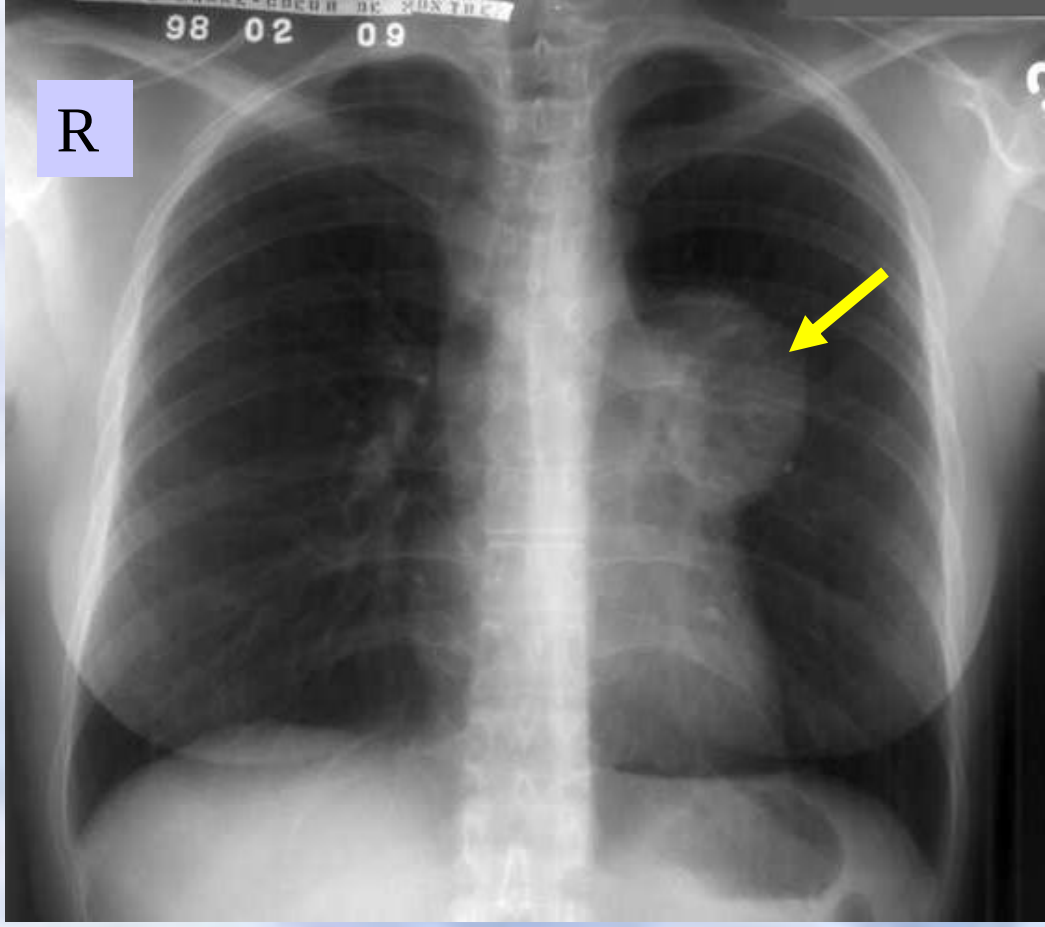
3. Conclusion: Bilateral lung metastasis



1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. In left lung, in superior and medium zone is seen diffuse nodular opacities with irregular shape and unclear borders, afecting the left hilum, without displacement of mediastinum The structure of it is heterogeneous. The pulmonary pattern is enhanced. The pulmonary hilum are unstructured bilateral. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

3. Conclusion: infiltrative tuberculosis

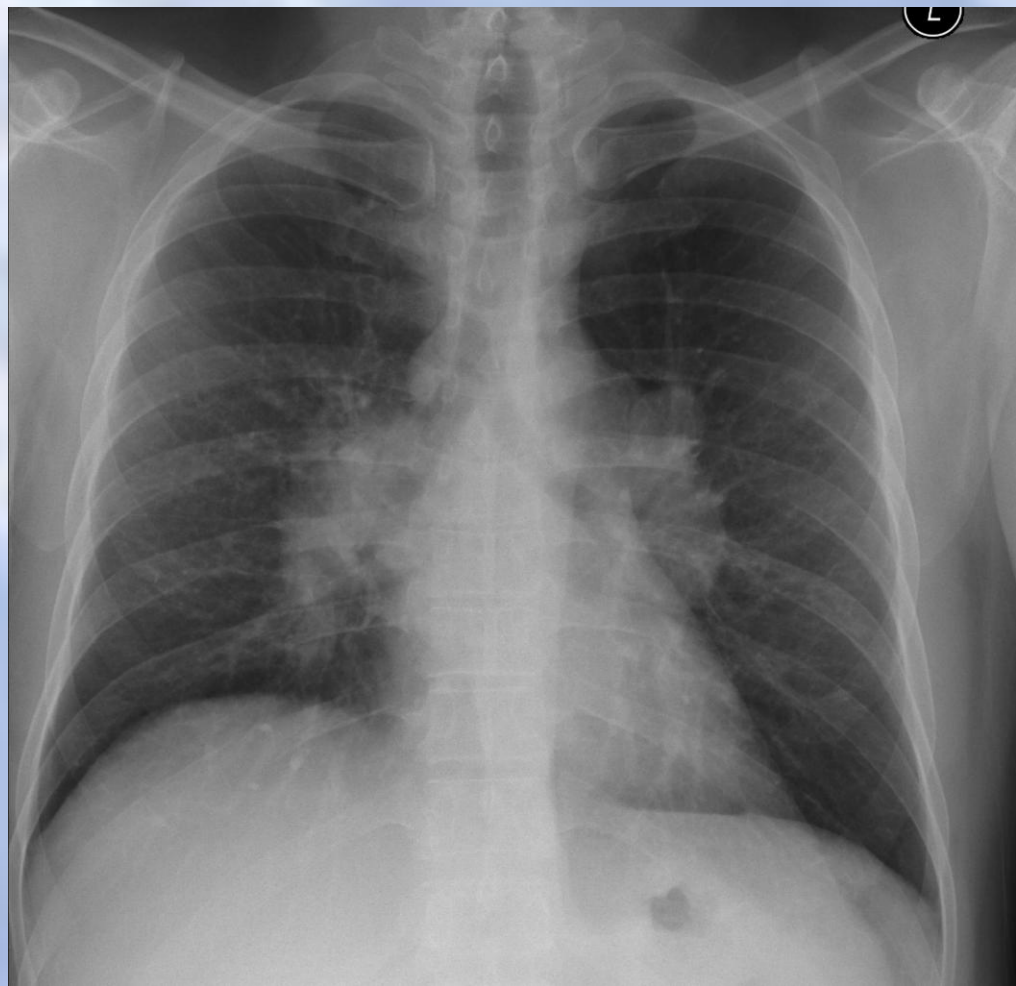


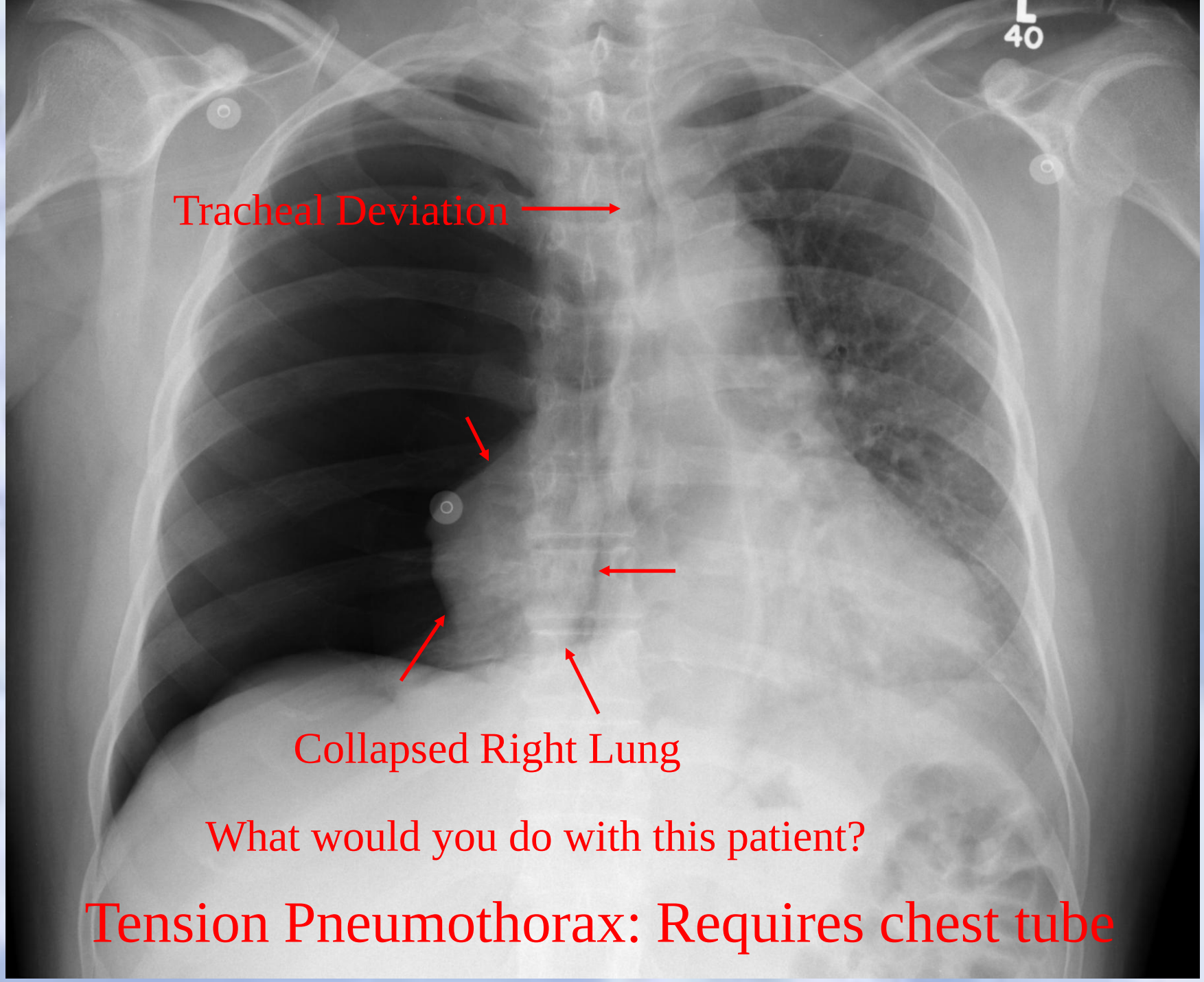
1. Radiography of chest PA view

2. The position of patient is correct. The image is with good and correct exposure. In the left lung, infrahilar is determined a single round shape opacity with clear and thin borders, without displacement of mediastinum The structure of it is homogeneous. The pulmonary pattern is enhanced. On right side the pulmonary hilum is structured. The costophrenic angles are free bilateral. The diaphragm is with clear borders. The bones are structured and soft tissues are clear. The heart is not enlarged.

3. Conclusion: unilateral left hilar lymphadenopathy

Bilateral Hilar lymphadenopathy





What would you do with this patient?

Tension Pneumothorax: Requires chest tube

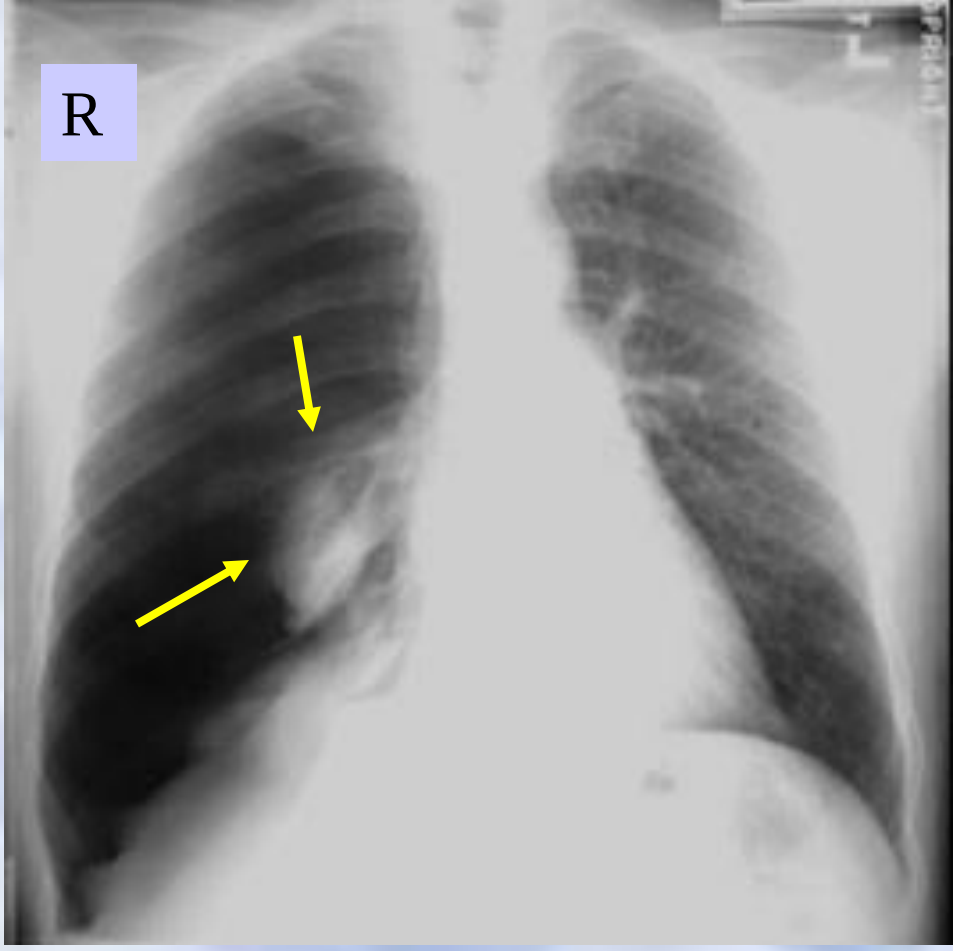
Causes of a pneumothorax

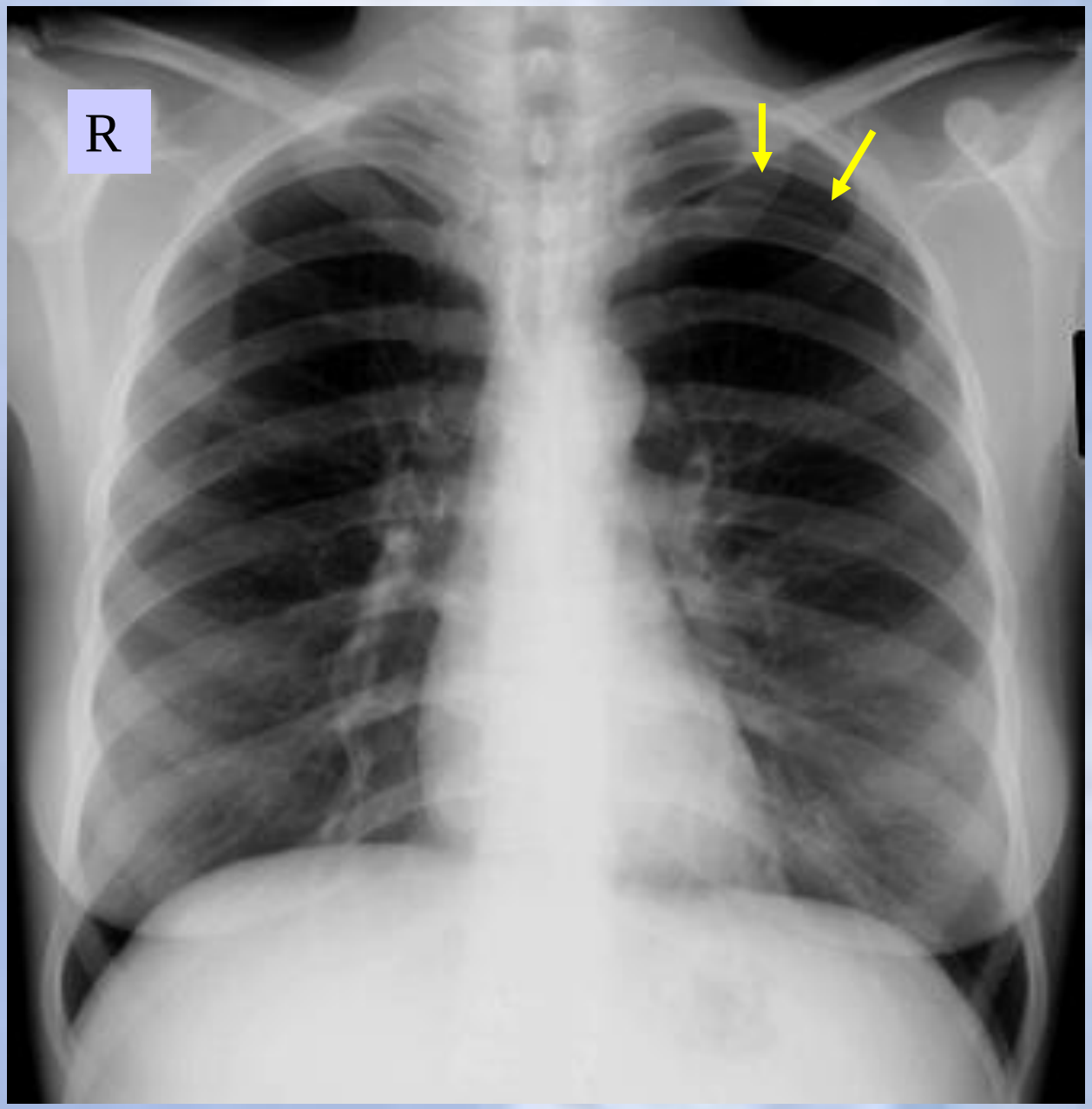
- Spontaneous
- Iatrogenic/trauma,
- Obstructive lung disease, e.g. asthma
- Infection, e.g. pneumonia, tuberculosis, Cystic fibrosis

1. Radiography of chest frontal view

2. The position of patient is correct. The image is with good and correct exposure. The right side is increased in size due to total hyperlucency, with absent of pulmonary pattern in that region and collapsed right lung. On left side the pulmonary pattern is enhanced and the pulmonary hilum is structured. The costophrenic angles are free bilateral. The diaphragm is well defined. The bones are structured. Soft tissues are clear. The heart is not enlarged.

3. Conclusion: right side pneumothorax.





Left side Limited Pneumothorax