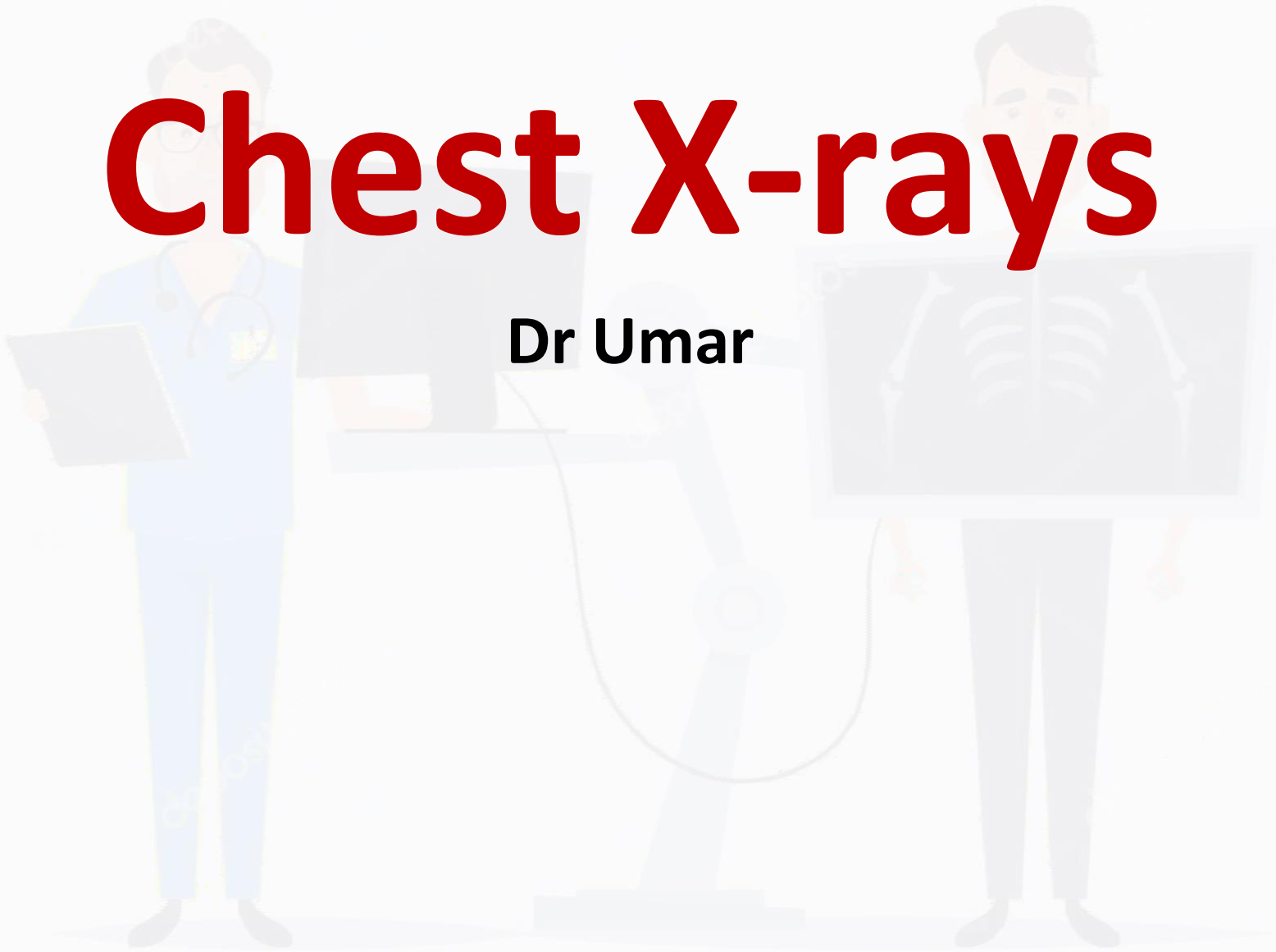
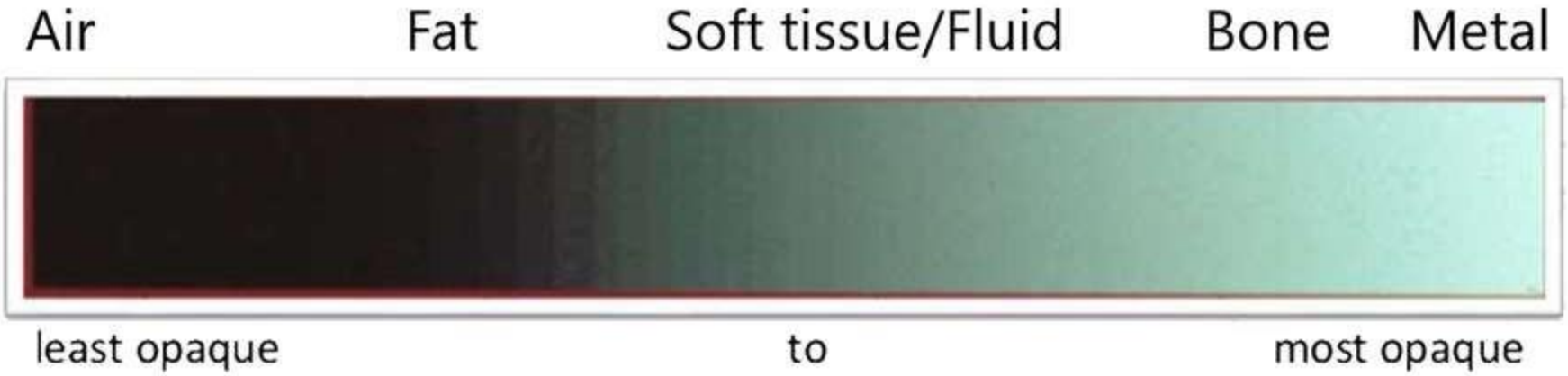
Chest X-rays

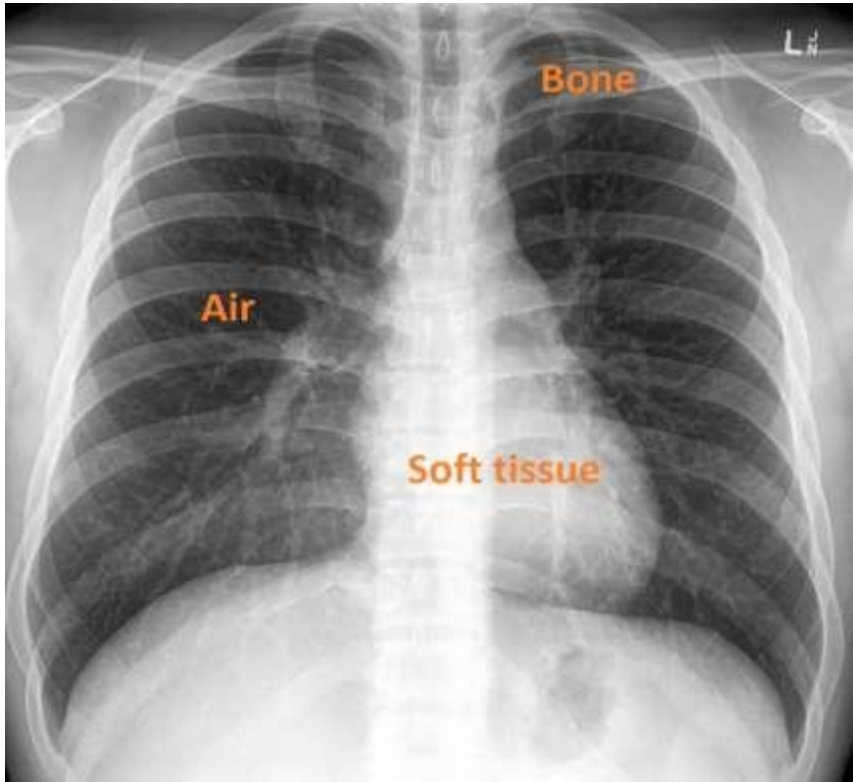
Dr Umar



Radiographic Densities



Different tissues in our body absorb X-rays at different extent



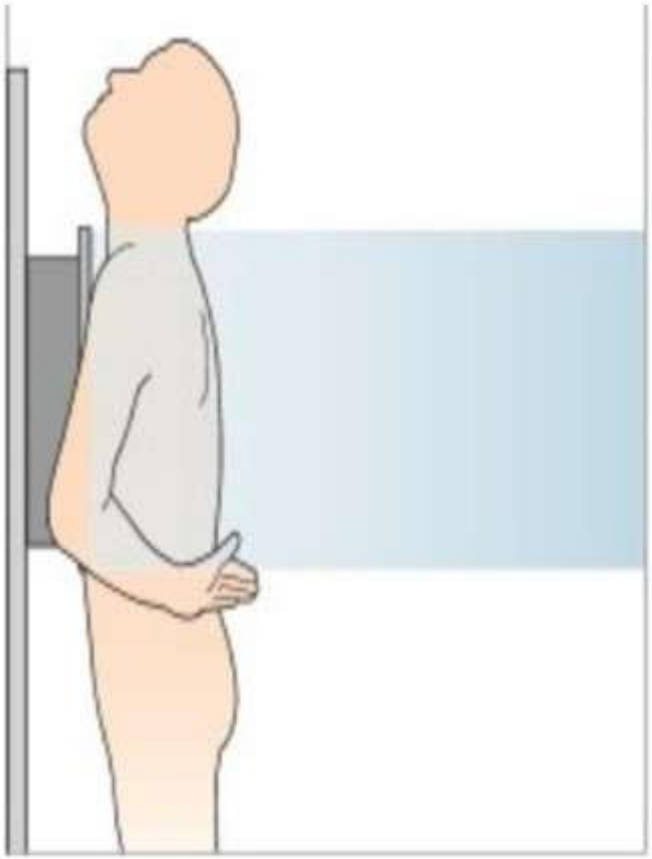
Technical aspects…**P-VERB**

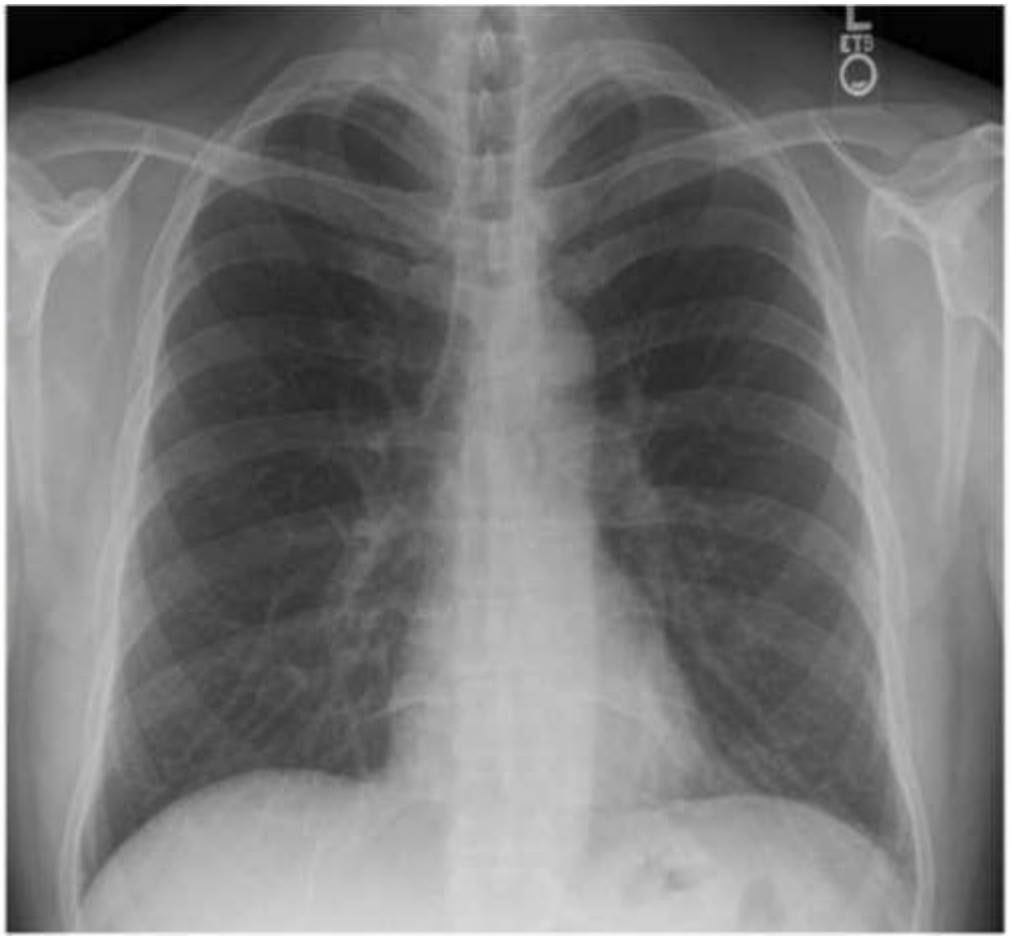
1. **P**atient's details
2. **V**iew : PA vs AP or lateral
3. **E**xposure
4. **R**otation
5. **B**reath: Inspiration or Expiration

4 major views

1. Posterior-anterior (PA)
2. Anterior-Posterior (AP)
3. Lateral
4. Lateral decubitus

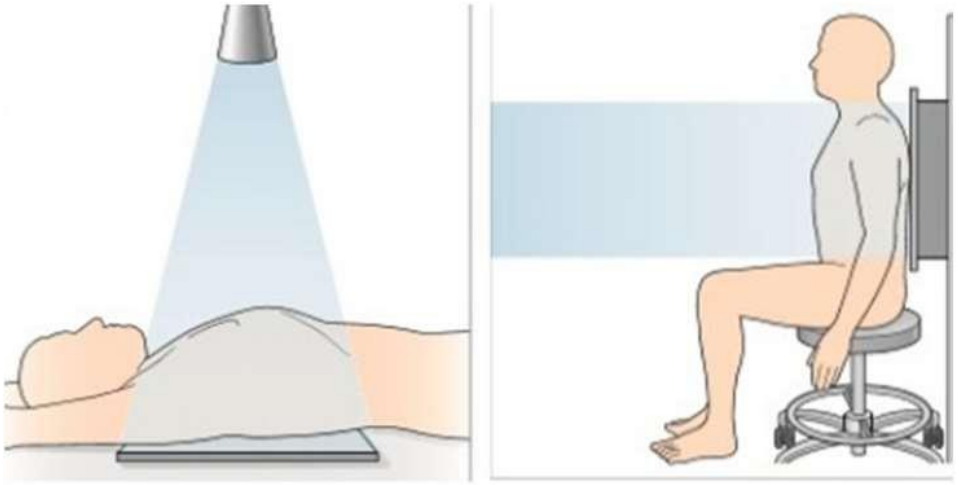
PA view

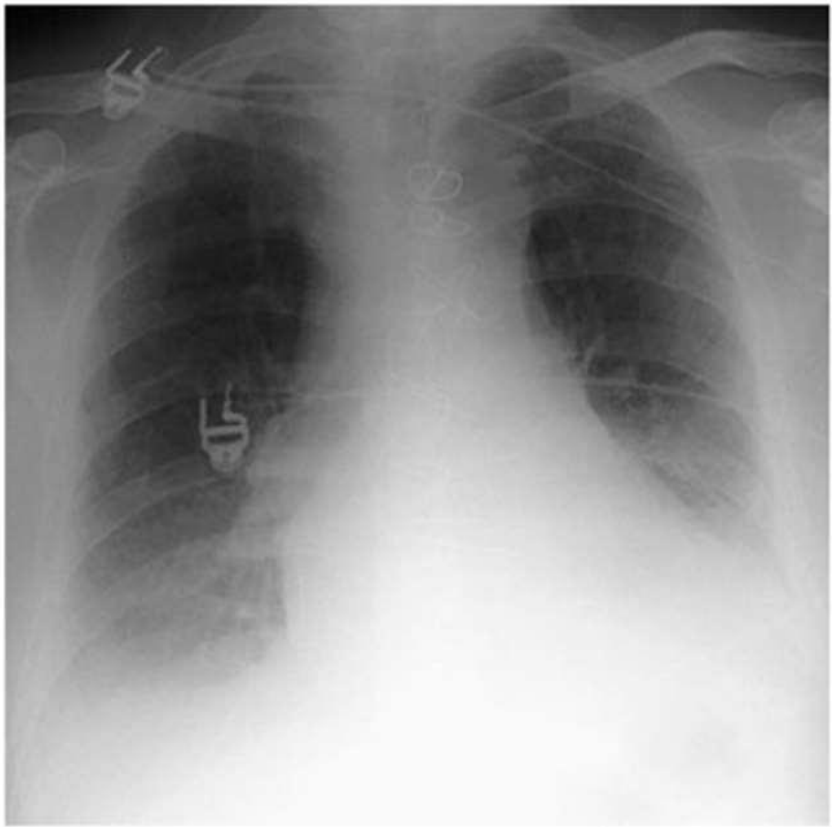




- Standard view for routine Chest x-rays
- Taken in full inspiration

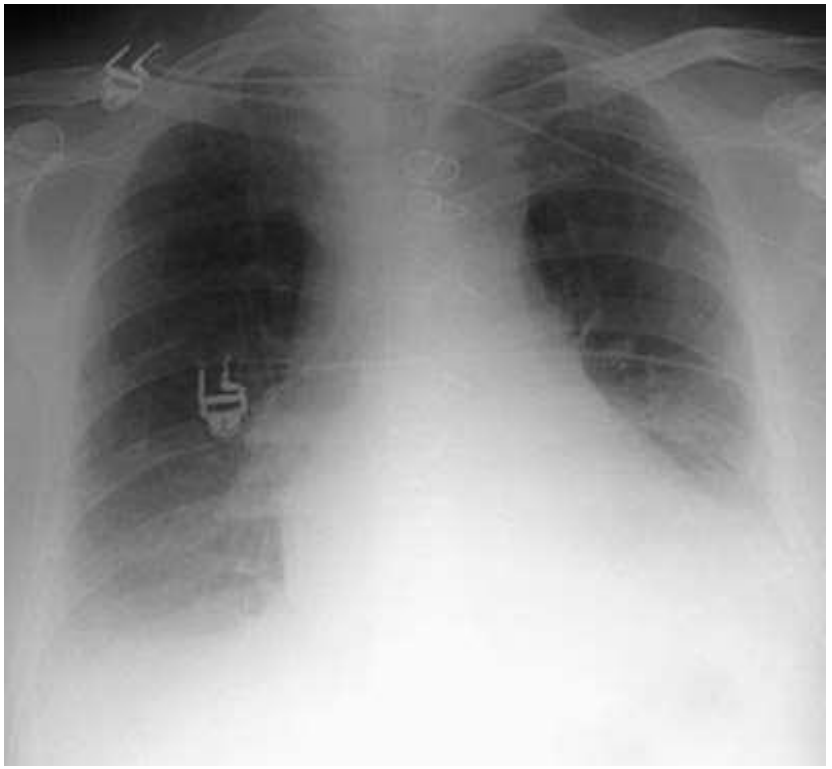
AP view





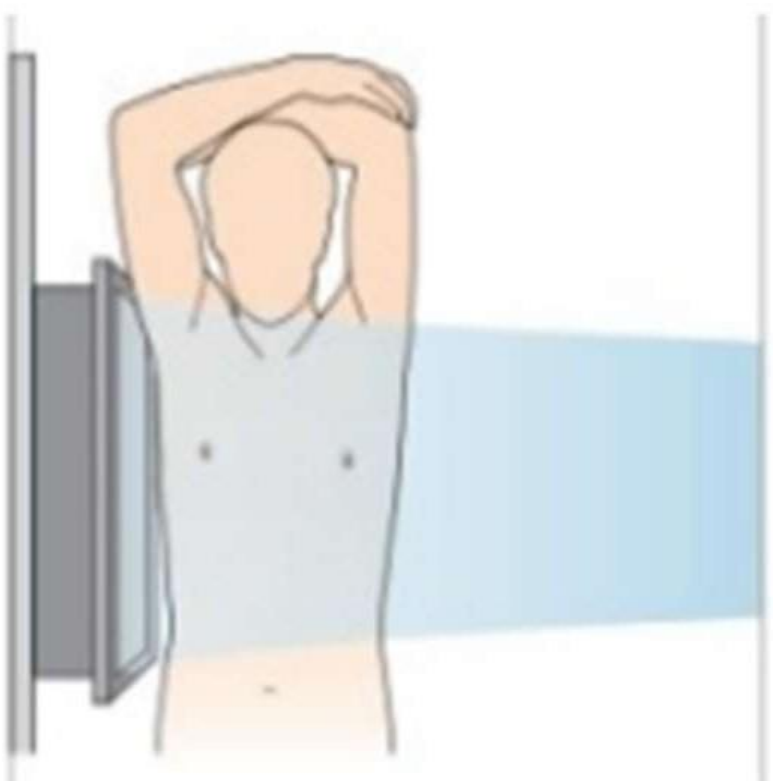
- Patient is too ill to stand or non-cooperative
- Heart at a greater distance from film, appears enlarged

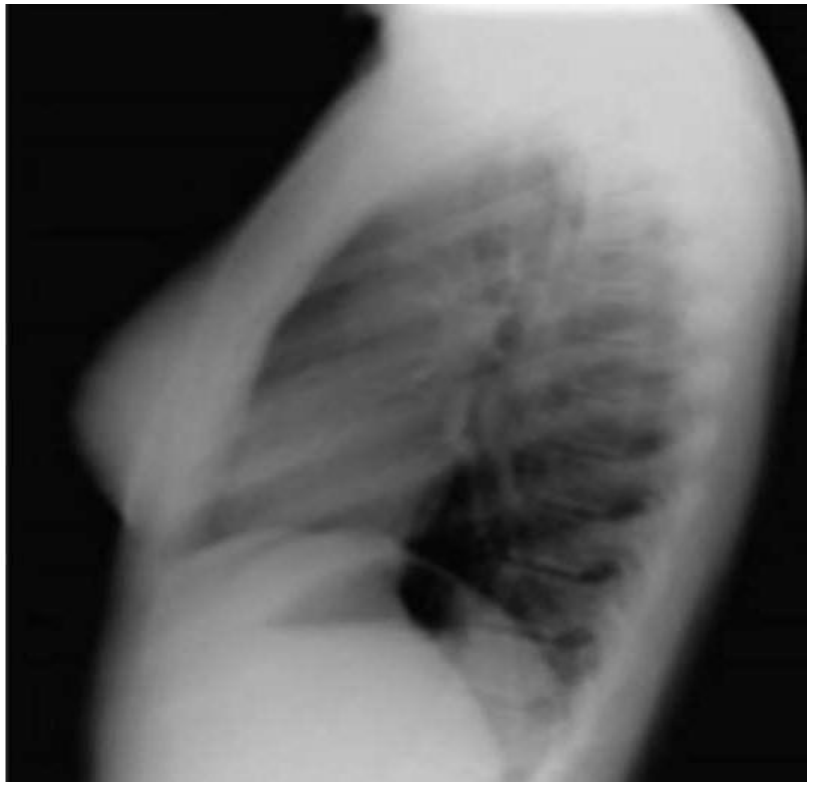
PA vs AP view



	PA view	AP view
Clavicle	Over lung fields	Above lungs apex
Scapulae	Away from lung fields	Over lung fields
Ribs	Posterior ribs distinct	Anterior ribs distinct
Heart		Relatively enlarged

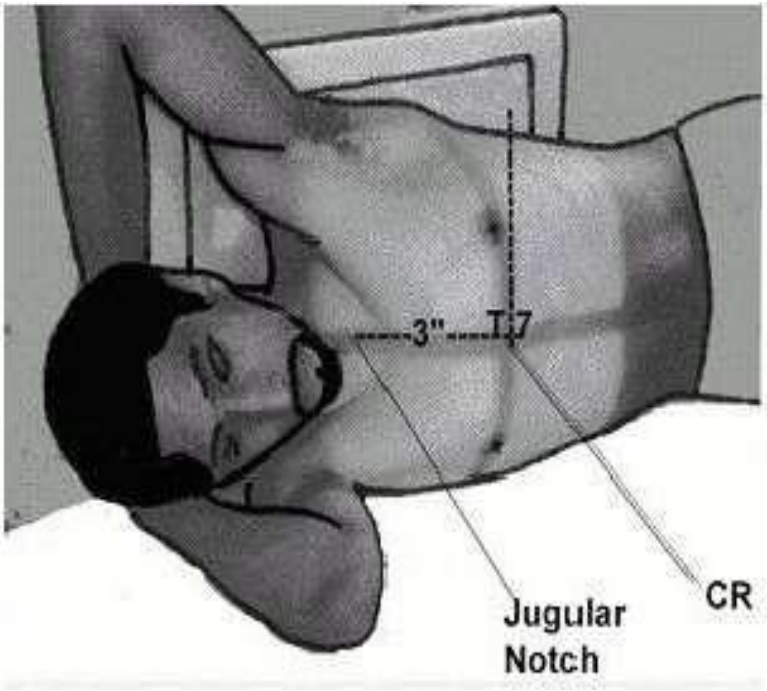
Lateral view

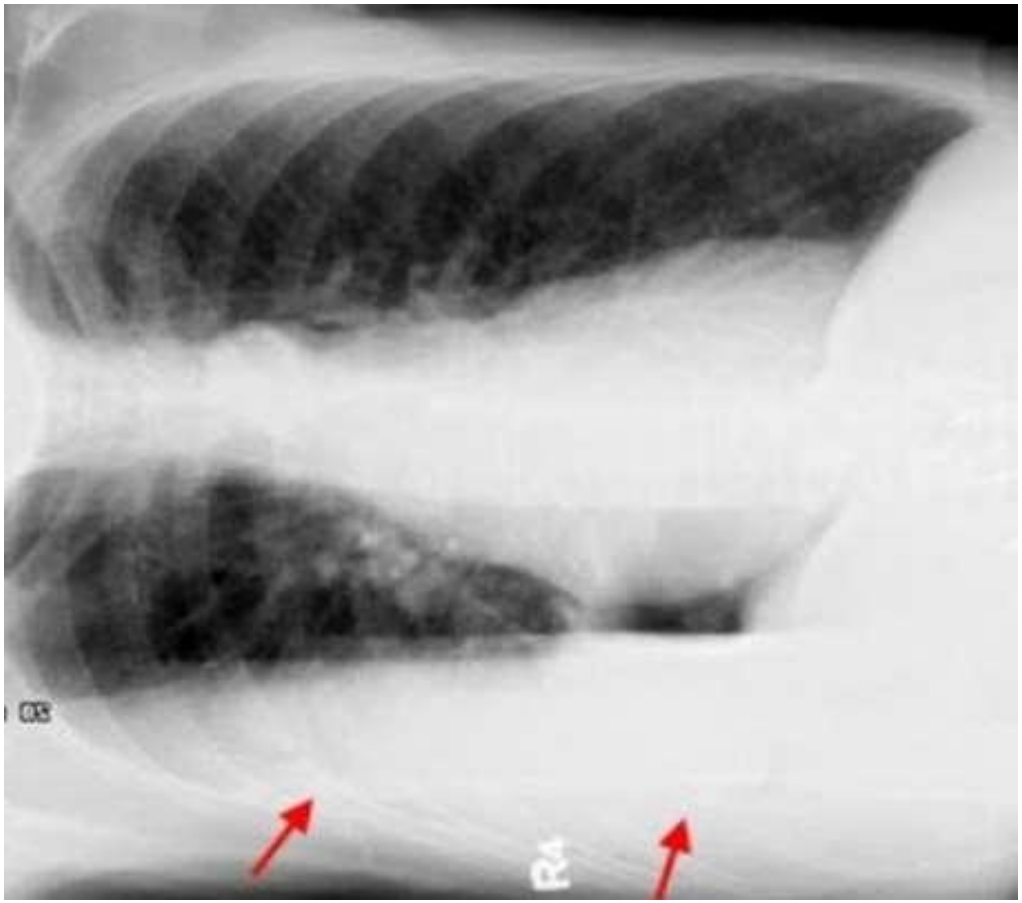




- Lung lobes, mediastinum & bony thoracic cavity better visualized
- Useful for lobar pathology, mediastinal masses, encysted pleural fluid & basal consolidation

Lateral decubitus view





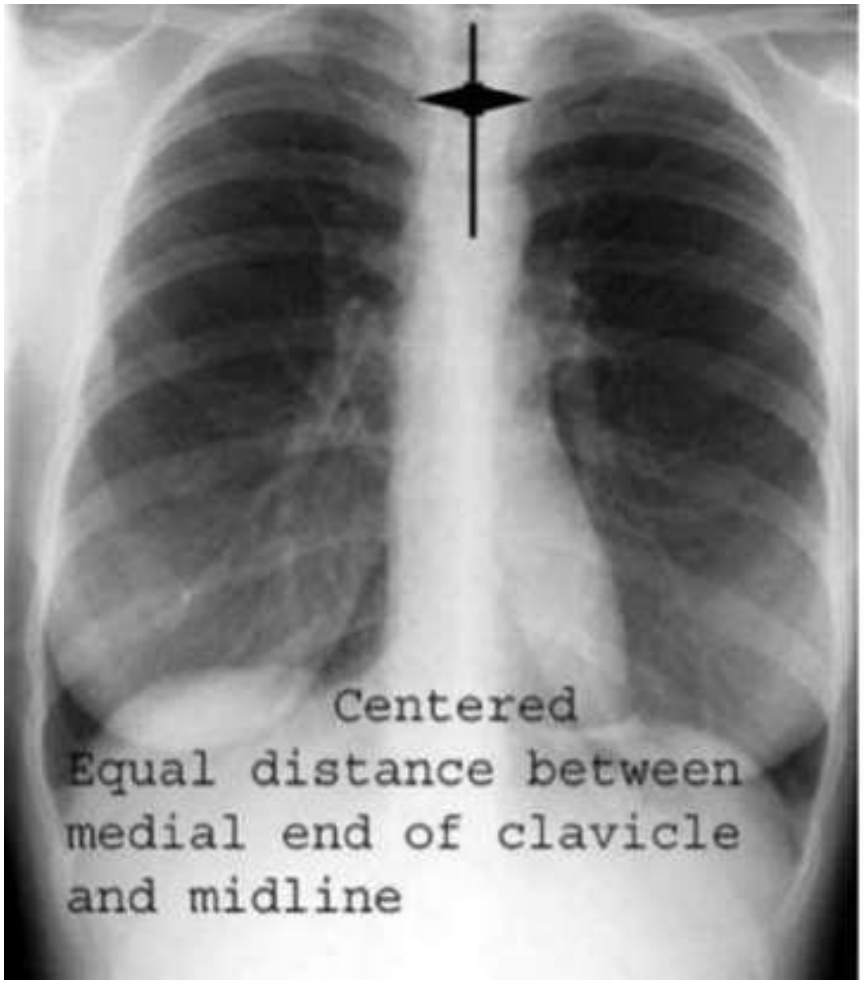
- Specialized projection to demonstrate small pleural effusions or pneumothorax

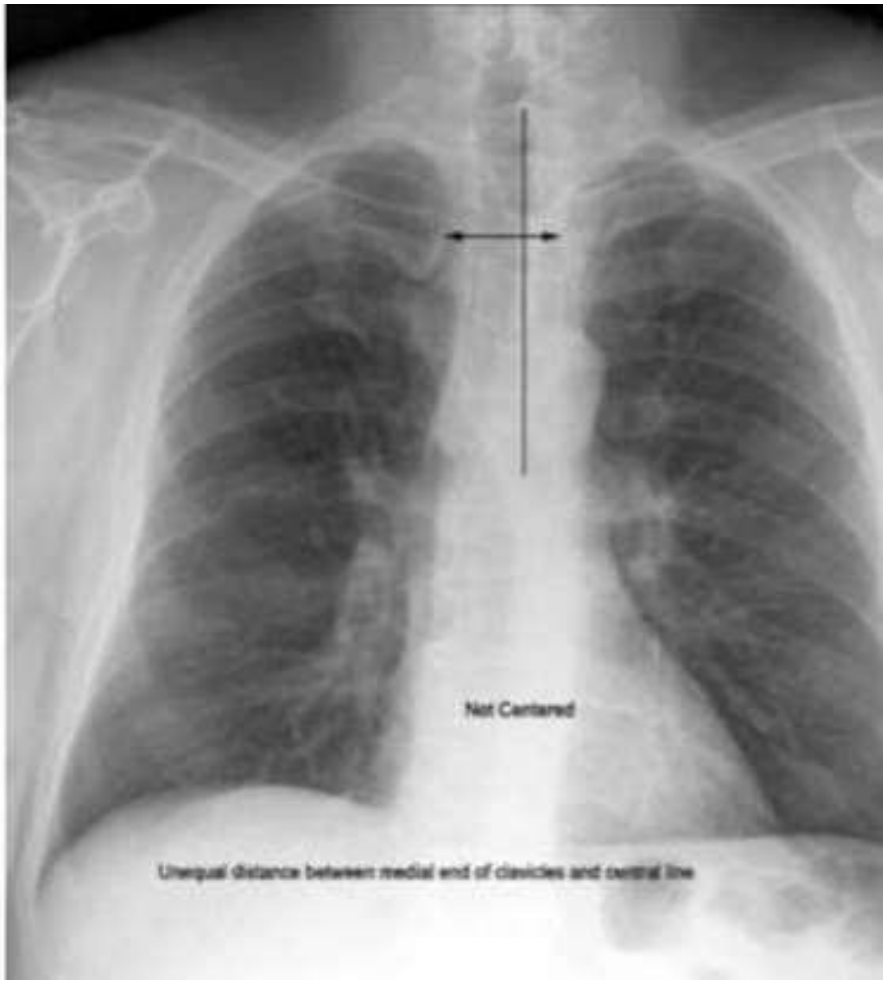
Exposure

- **Adequate exposure**: Inter-vertebral spaces barely visible through the heart shadow

Over-exposed film	Under-exposed film
Inter-vertebral spaces clearly visibile through heart shadow	Inter-vertebral spaces clearly visibile through heart shadow

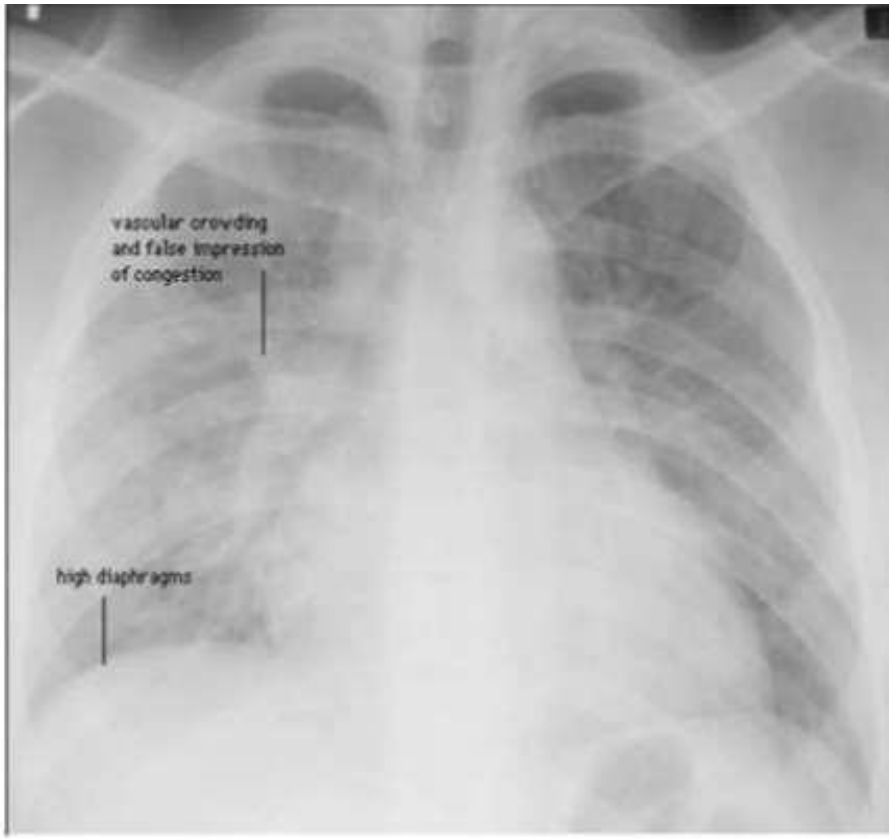
Rotation


Centered
Equal distance between
medial end of clavicle
and midline


Not Centered

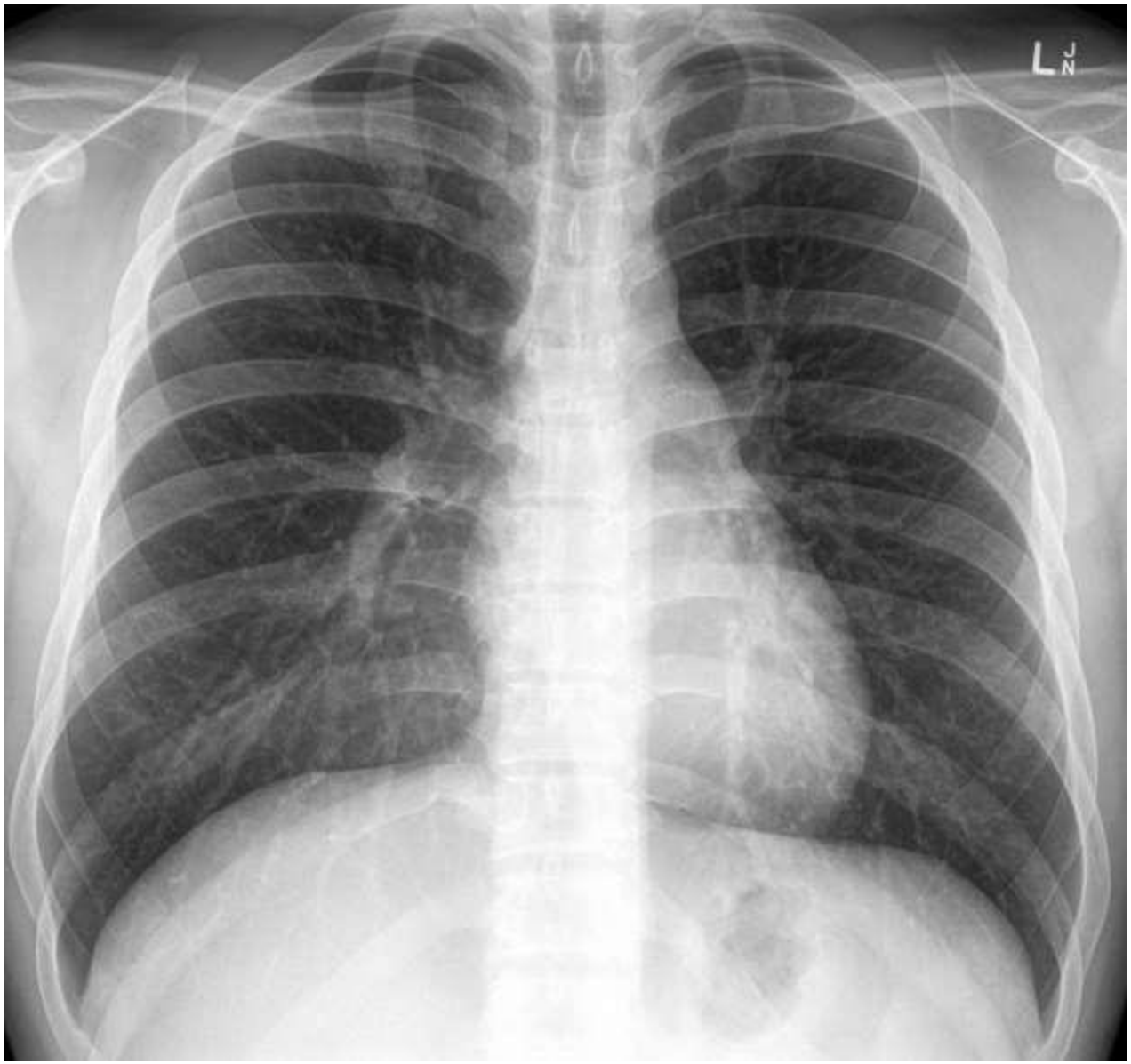
Good Inspiration

- 6 anterior ribs visible
- 10 posterior ribs visible



Inspiration **Expiration**

Normal Chest X-ray

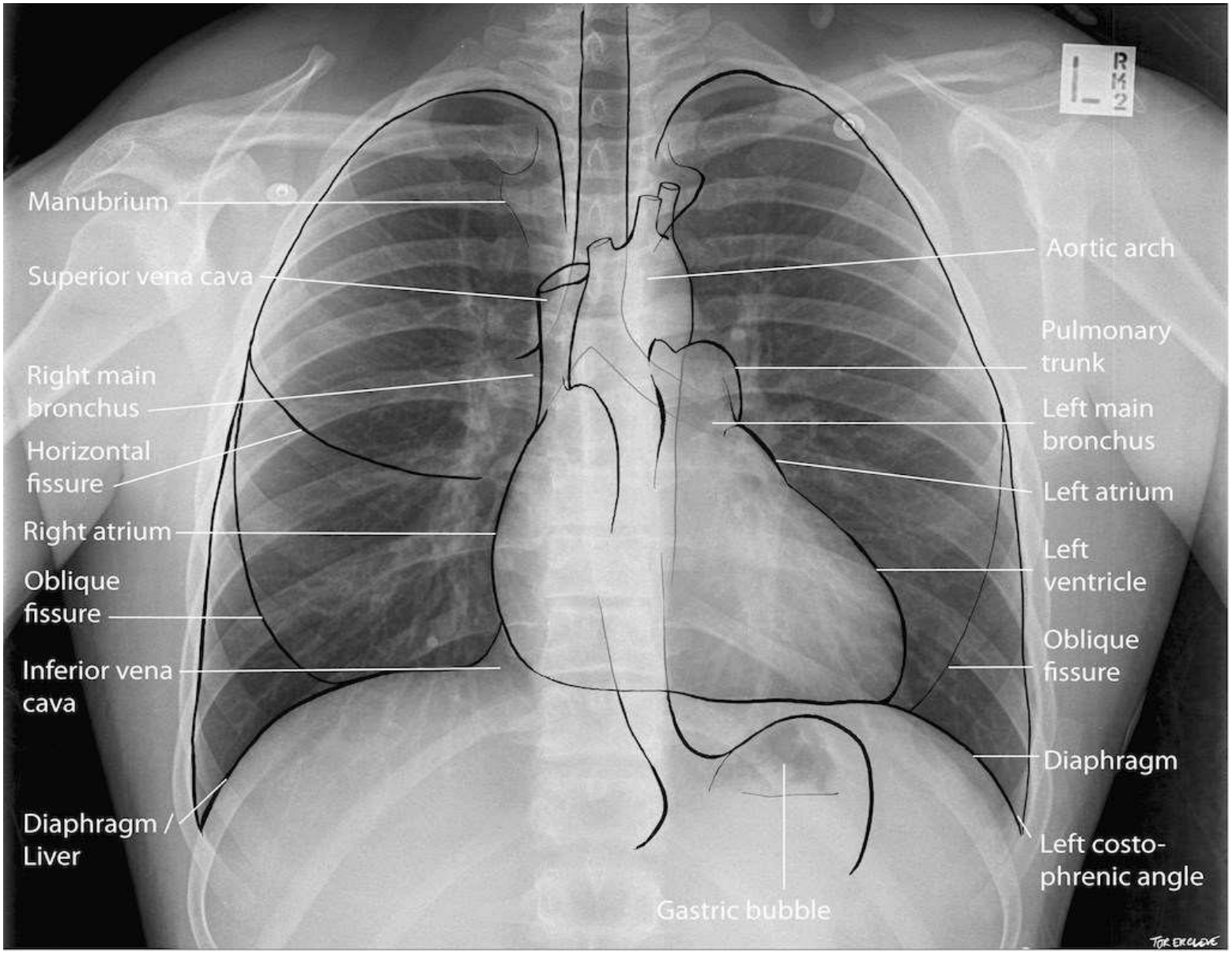


Interpreting Chest X-rays

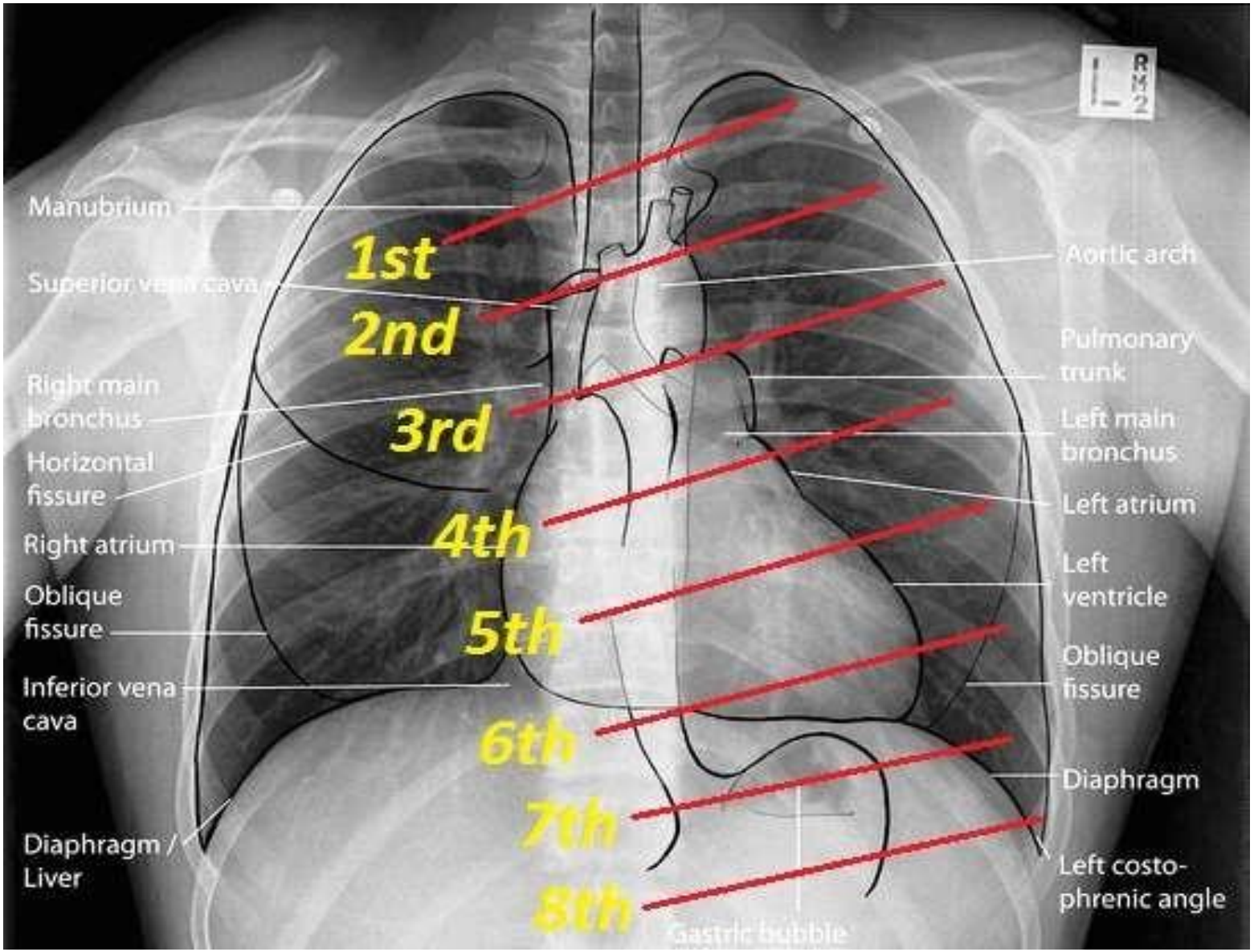
ABCDEFGH approach

- **A**irway
- **B**ones & soft tissue
- **C**ardiac shadow
- **D**iaphragm
- **E**ffusion (pleura)
- **F**ields (lungs)
- **G**astric bubble
- **H**ila & mediastinum

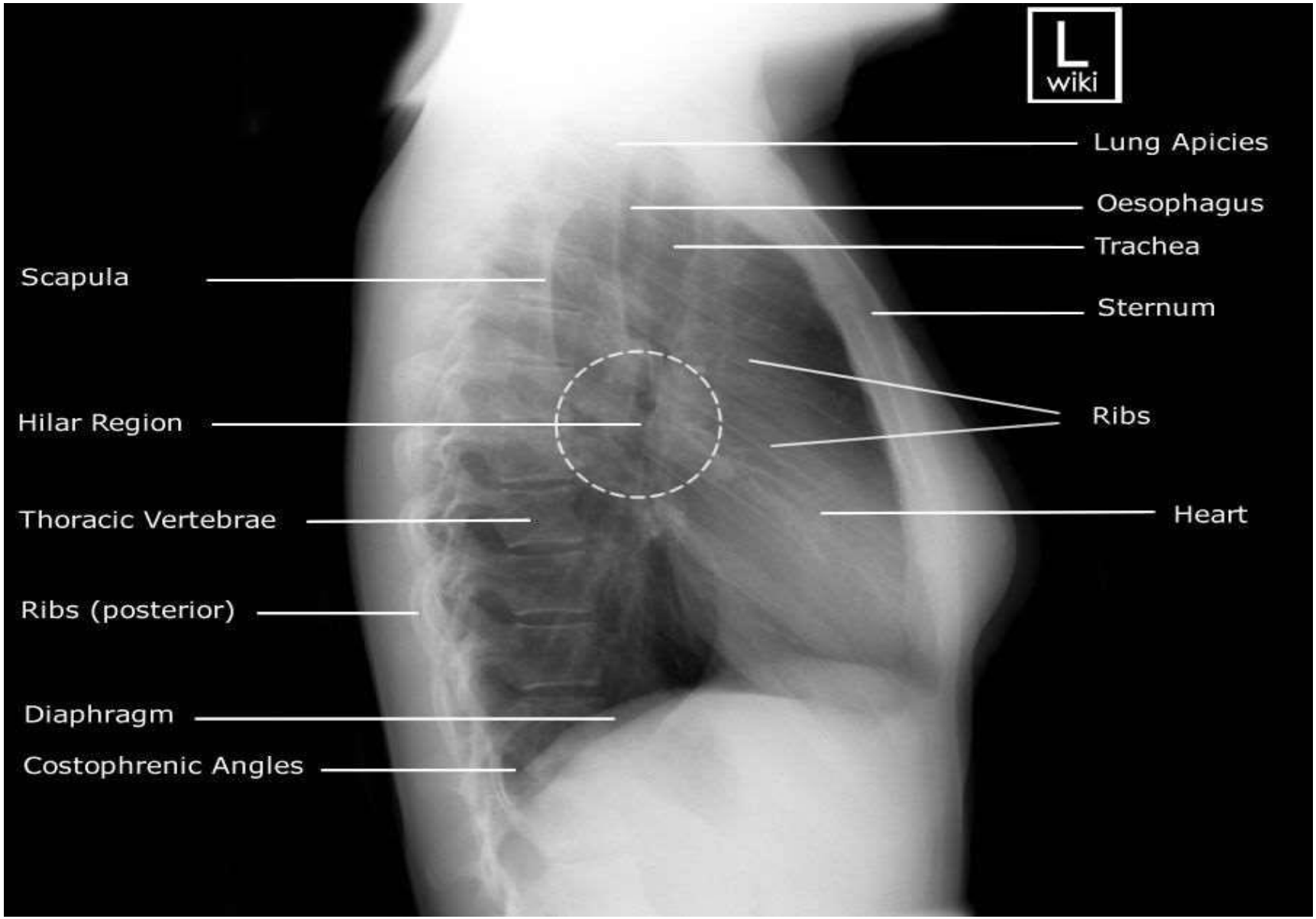
Normal Chest X-ray



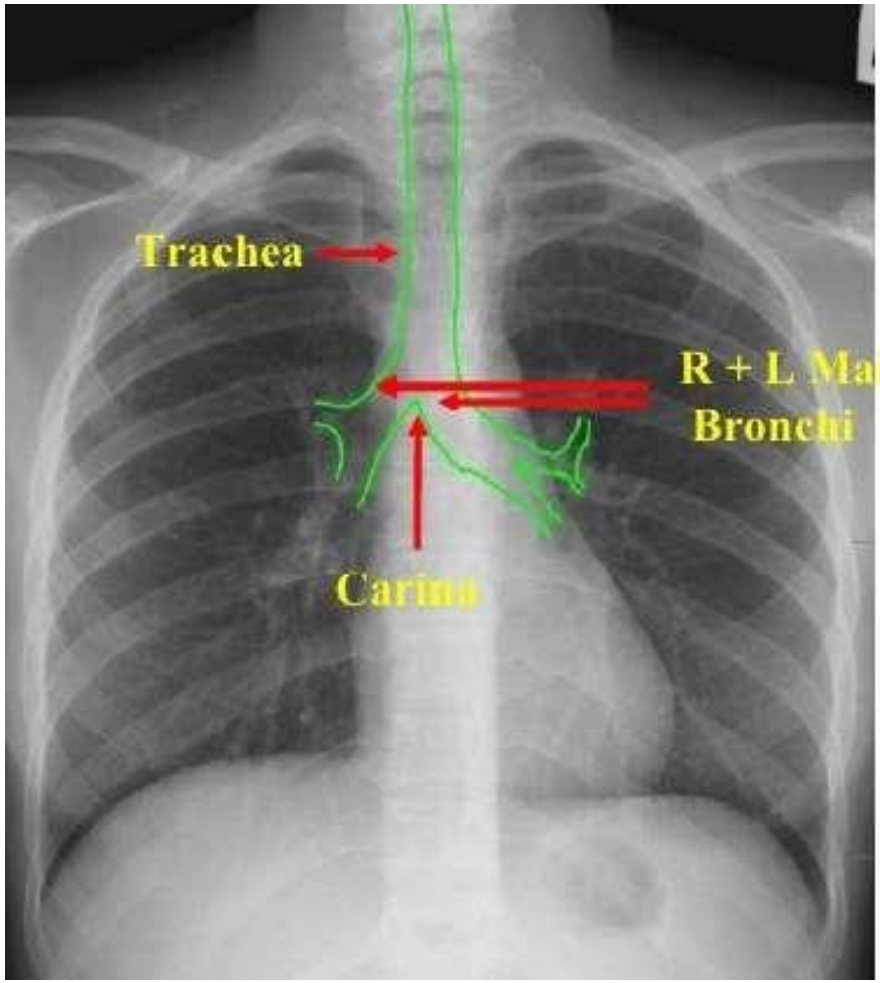
Counting Ribs

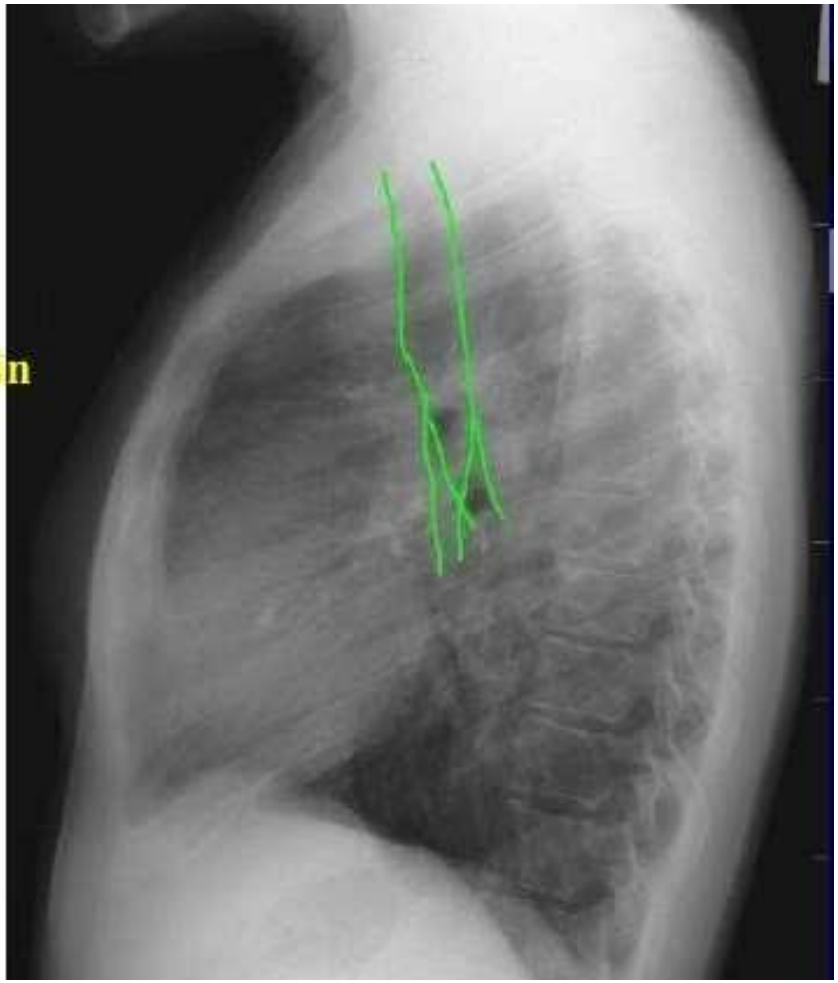


Lateral view

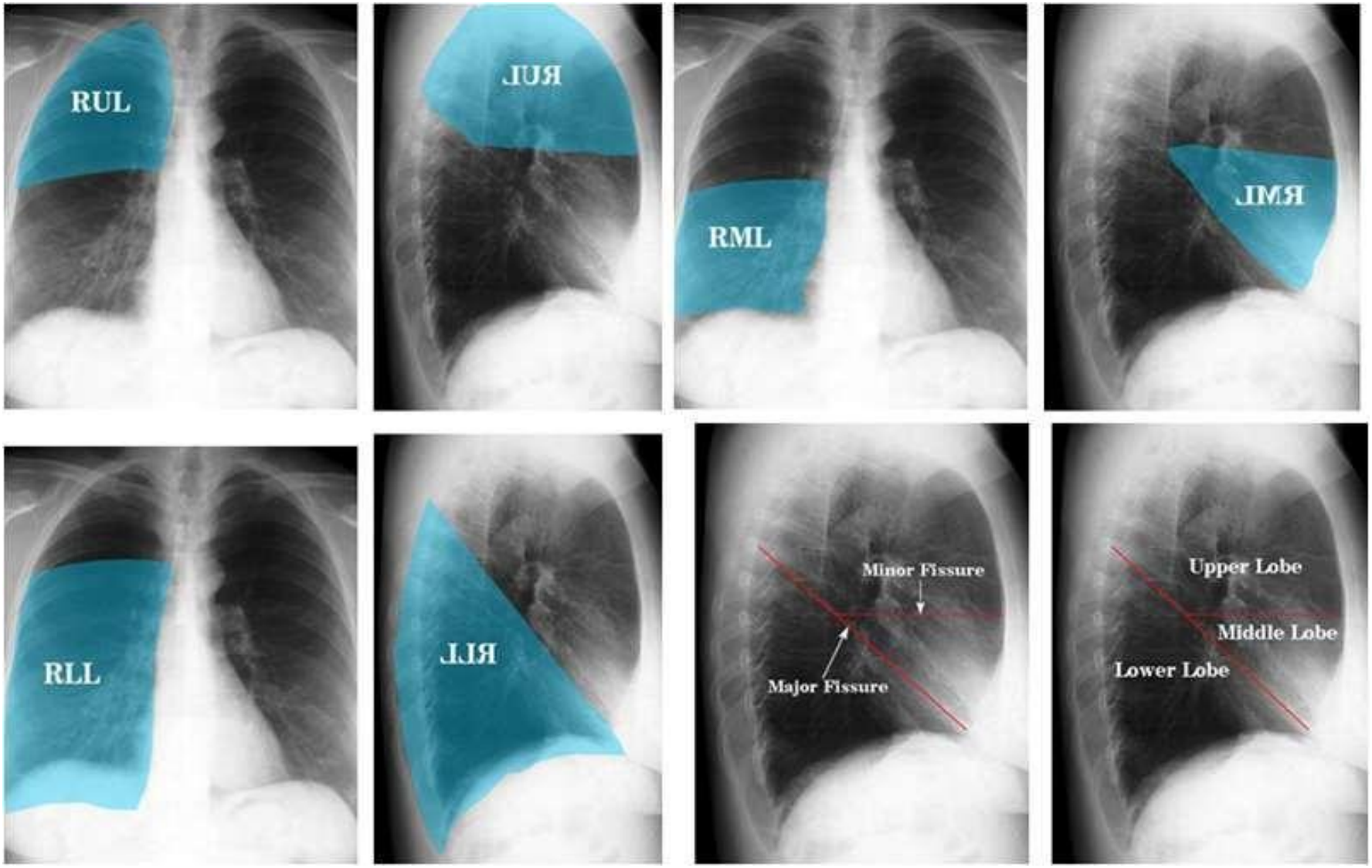


Airway

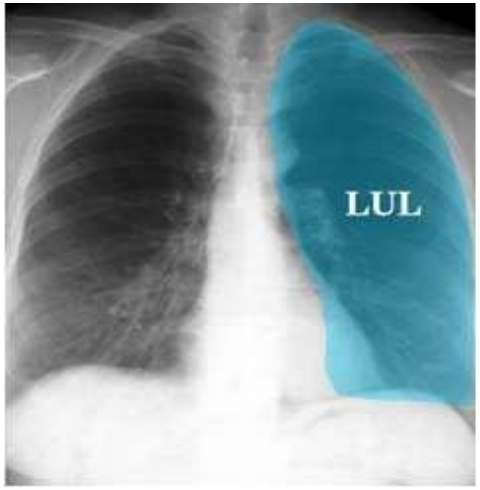


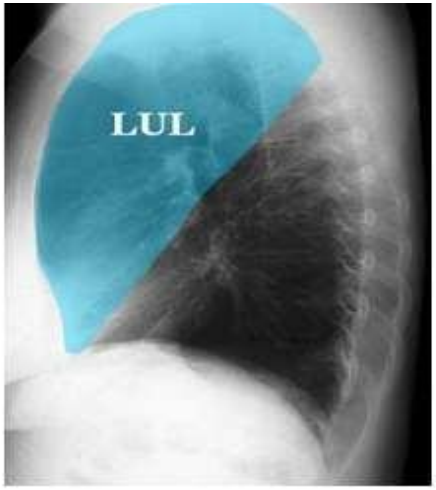


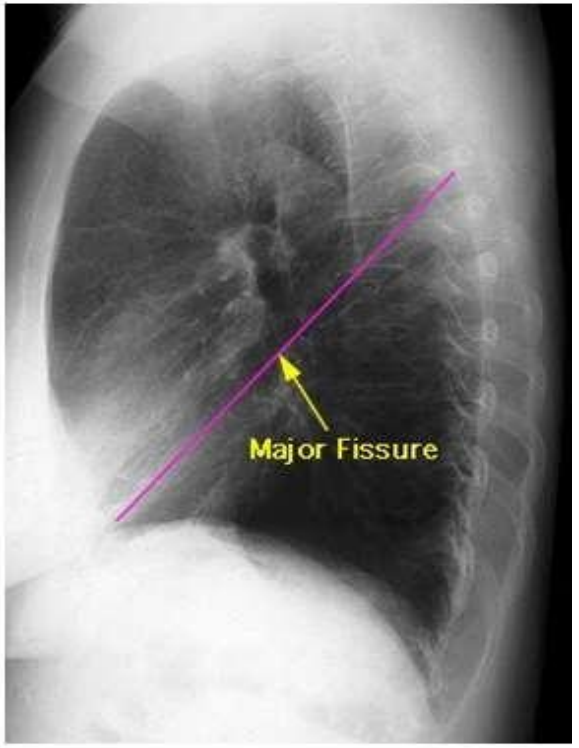
Right Lung Anatomy

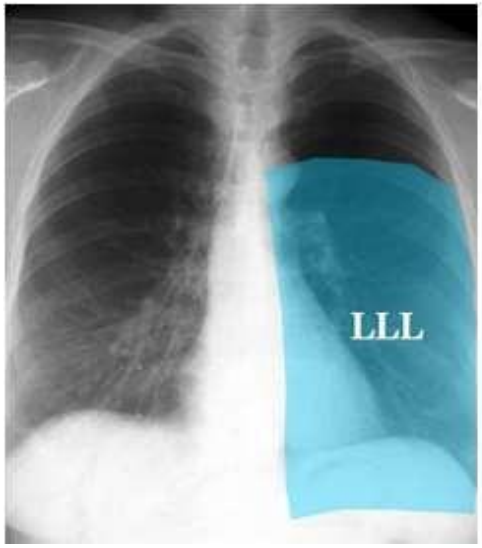


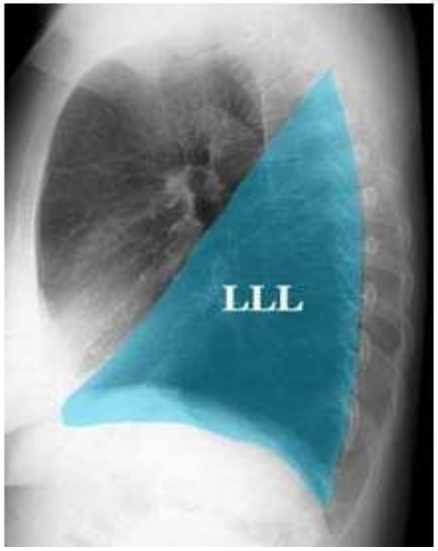
Left Lung Anatomy











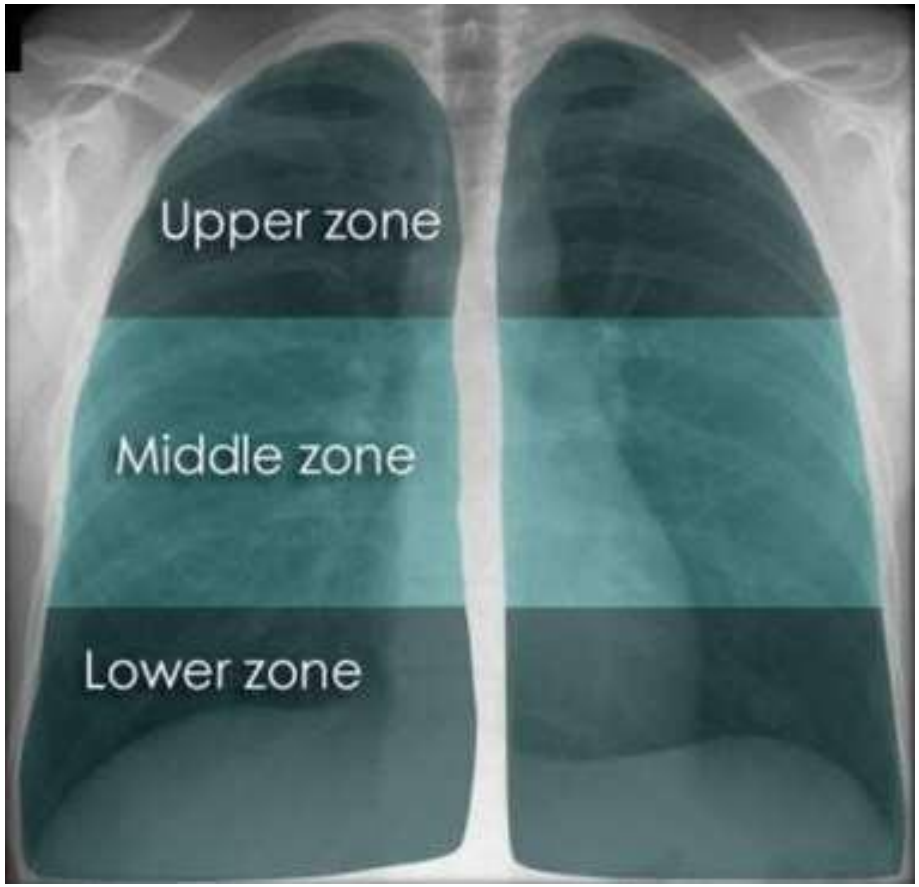
Lung Zones

Upper zone: above line through anterior end of 2nd rib

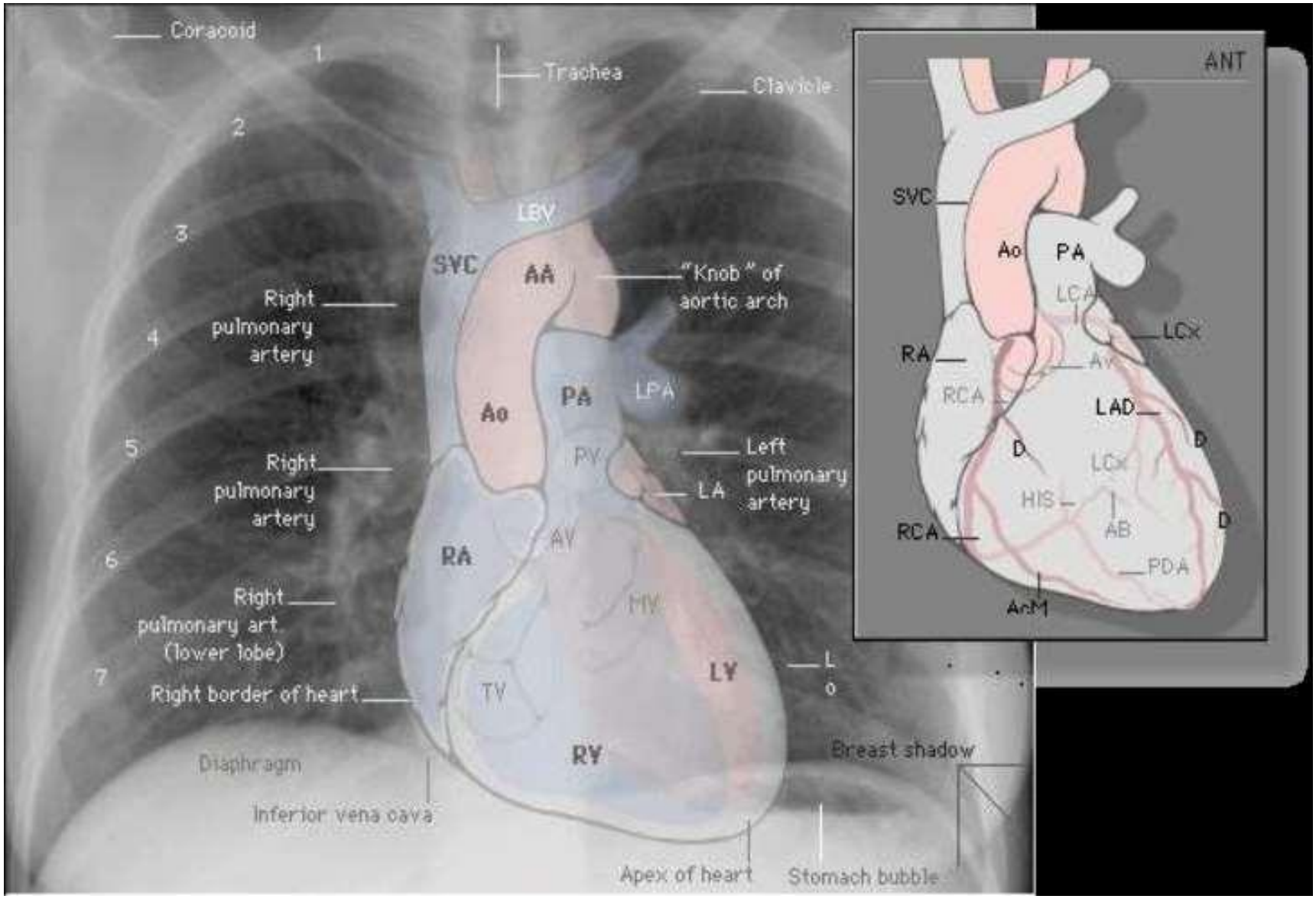
Middle zone: between upper zone and line through anterior end of 4nd rib

Lower zone: below mid zone

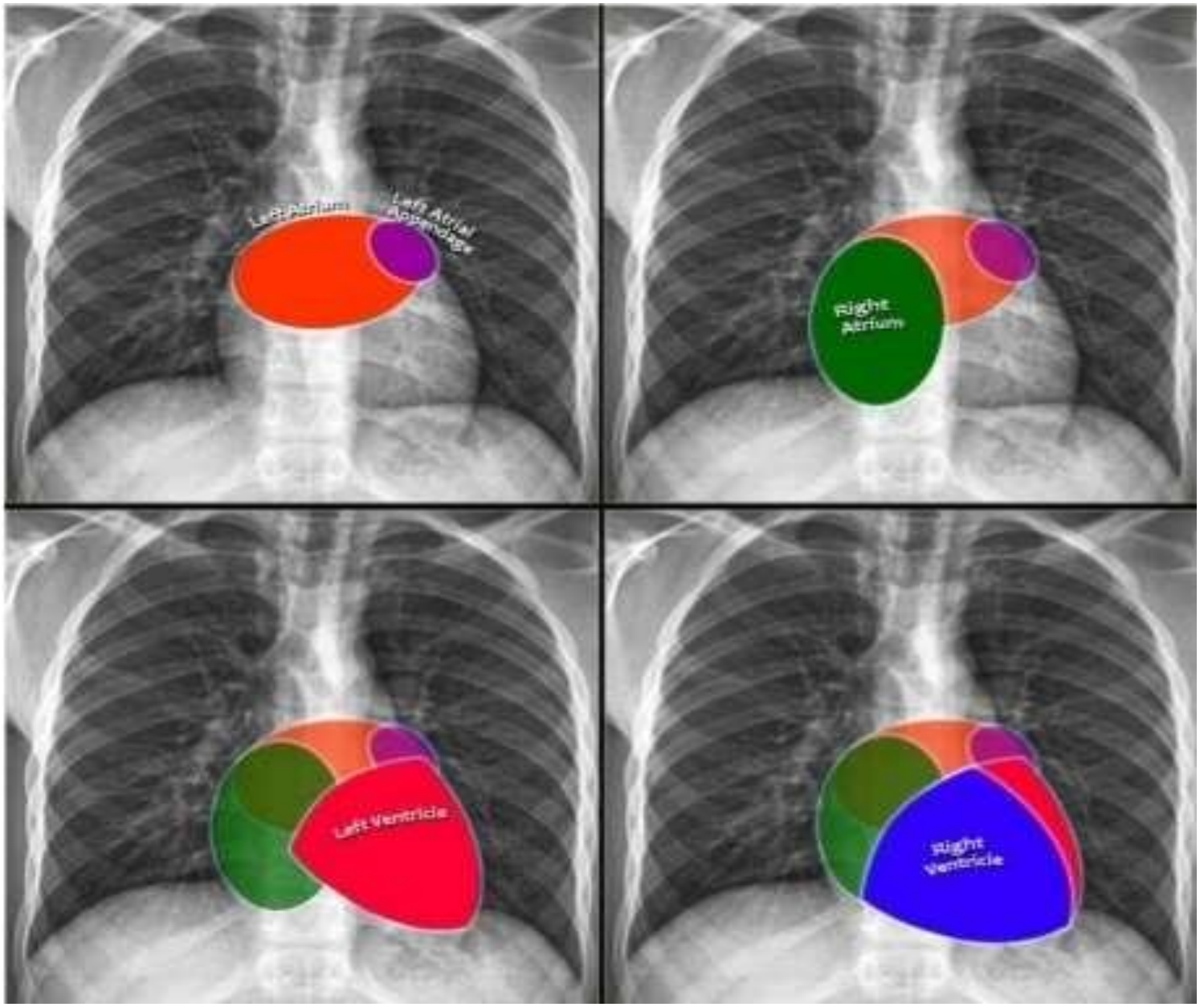
- Radiological zone doesn't usually correspond to lung lobe
- To see a lobe, always take a lateral film



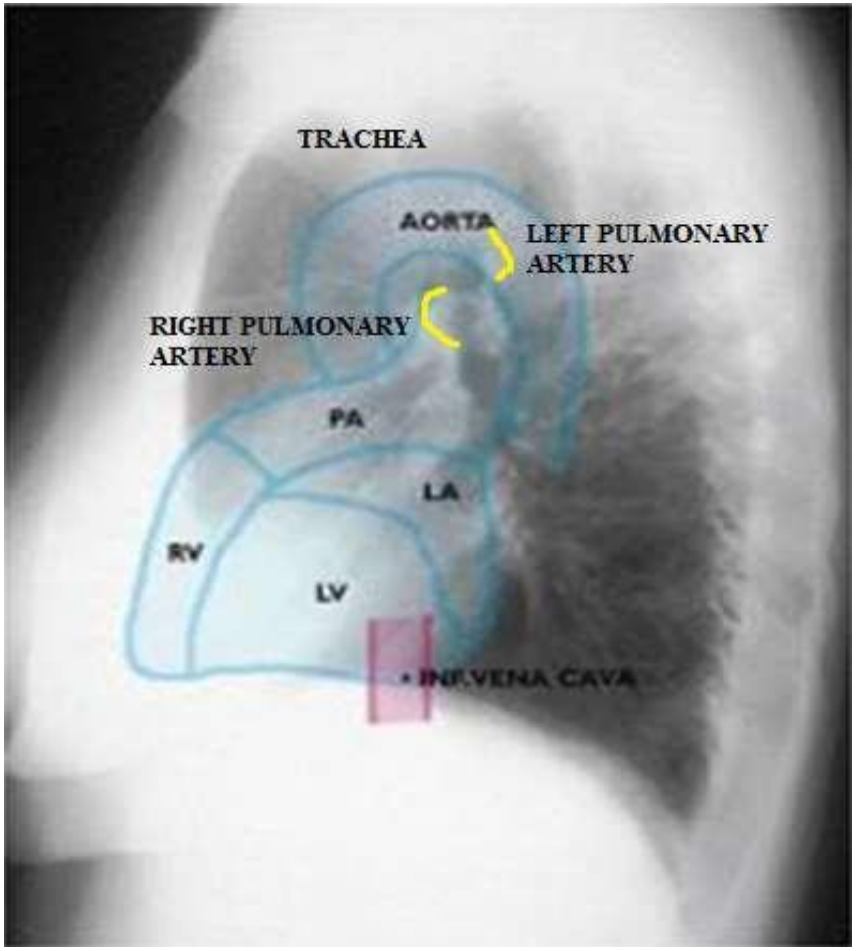
Cardiac Anatomy

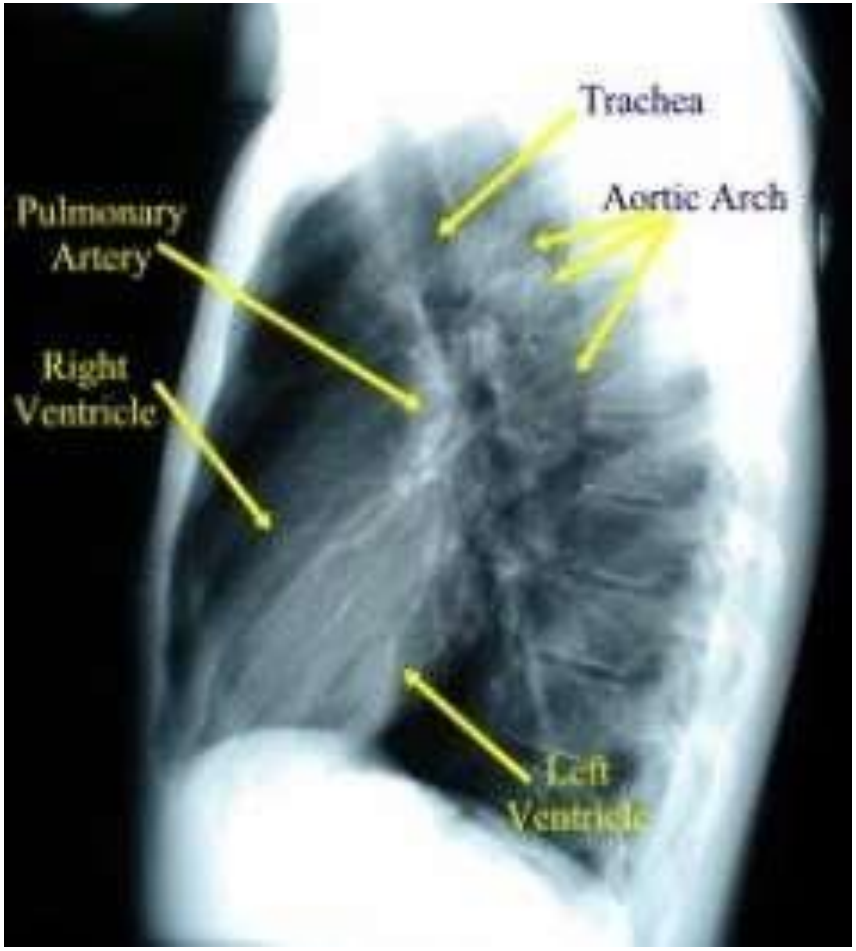


Cardiac Anatomy



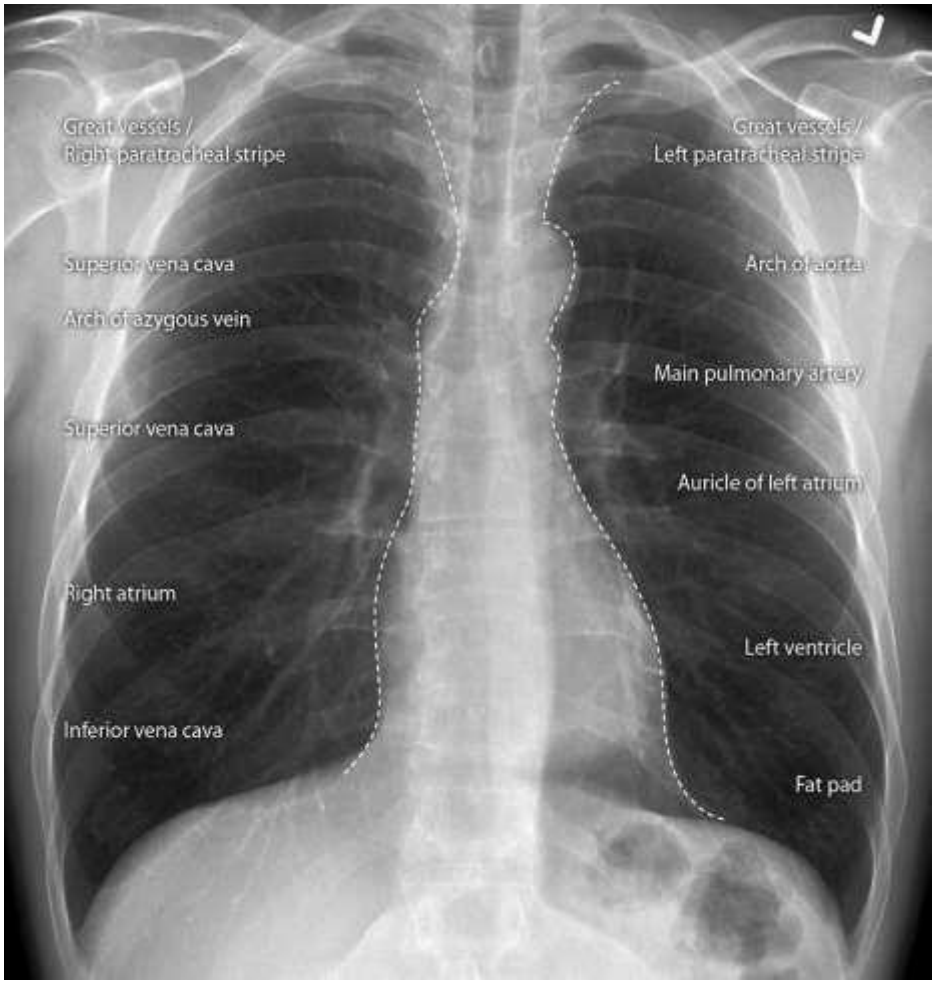
Cardiac Anatomy





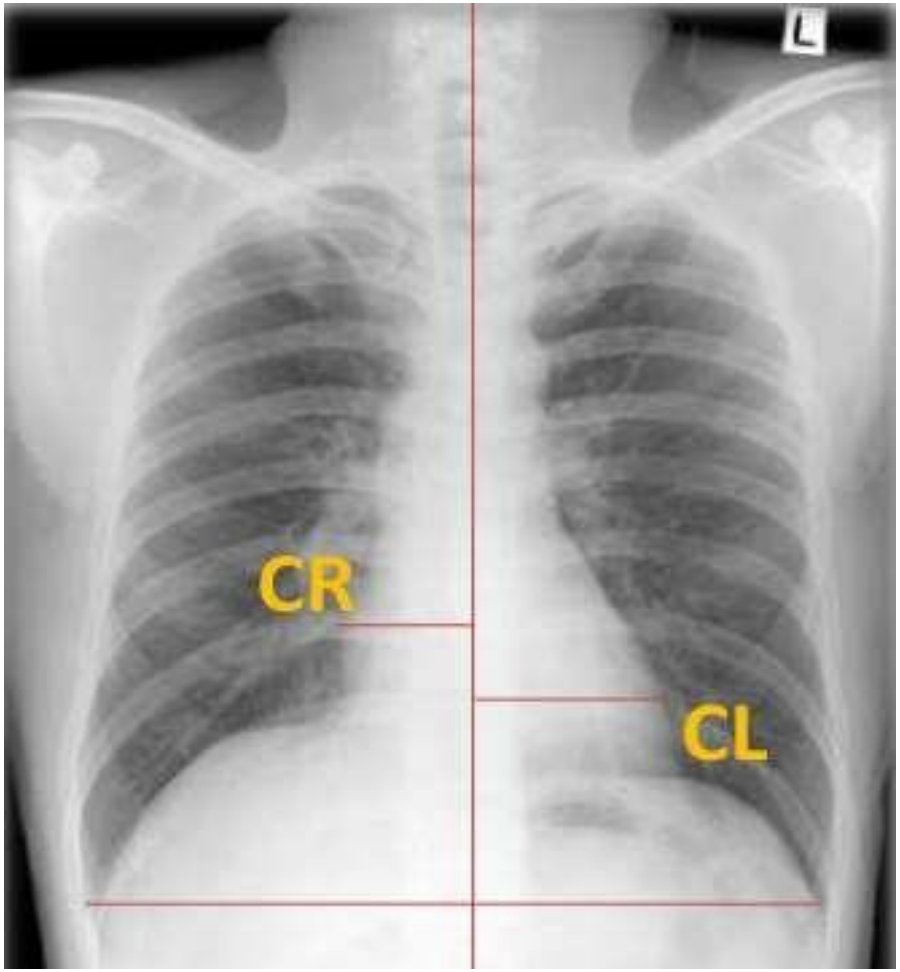
Silhouette sign

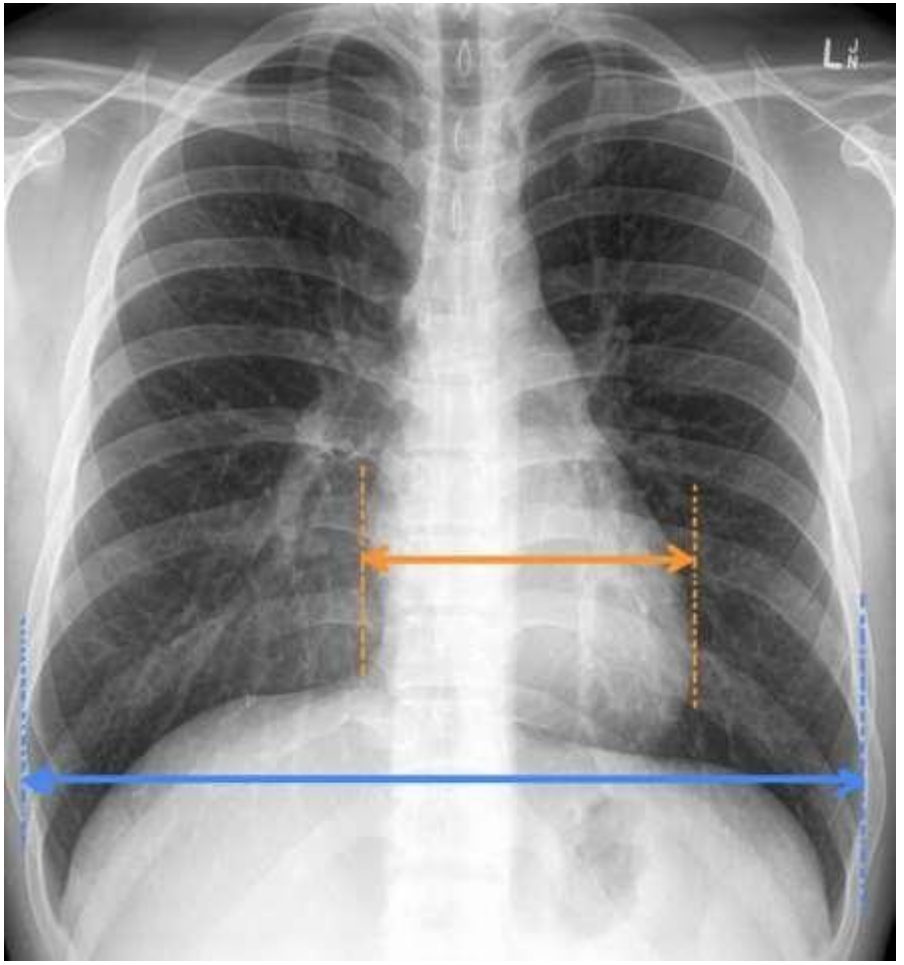
Lobe	Adjacent structure
RUL	Ascending aorta
RML	Right heart border
RLL	Right hemidiaphragm
LUL	Aortic knuckle Left heart border (lingula)
LLL	Left hemidiaphragm Descending aorta



Cardio-thoracic Ratio

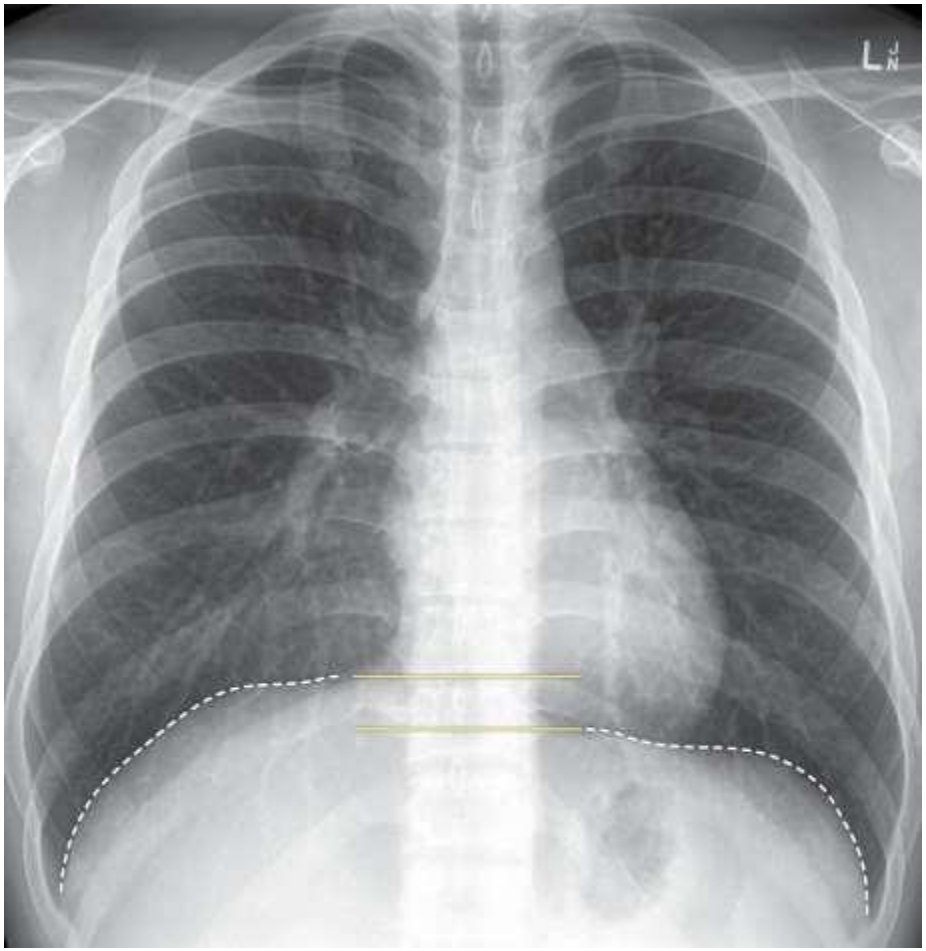
(PA view)

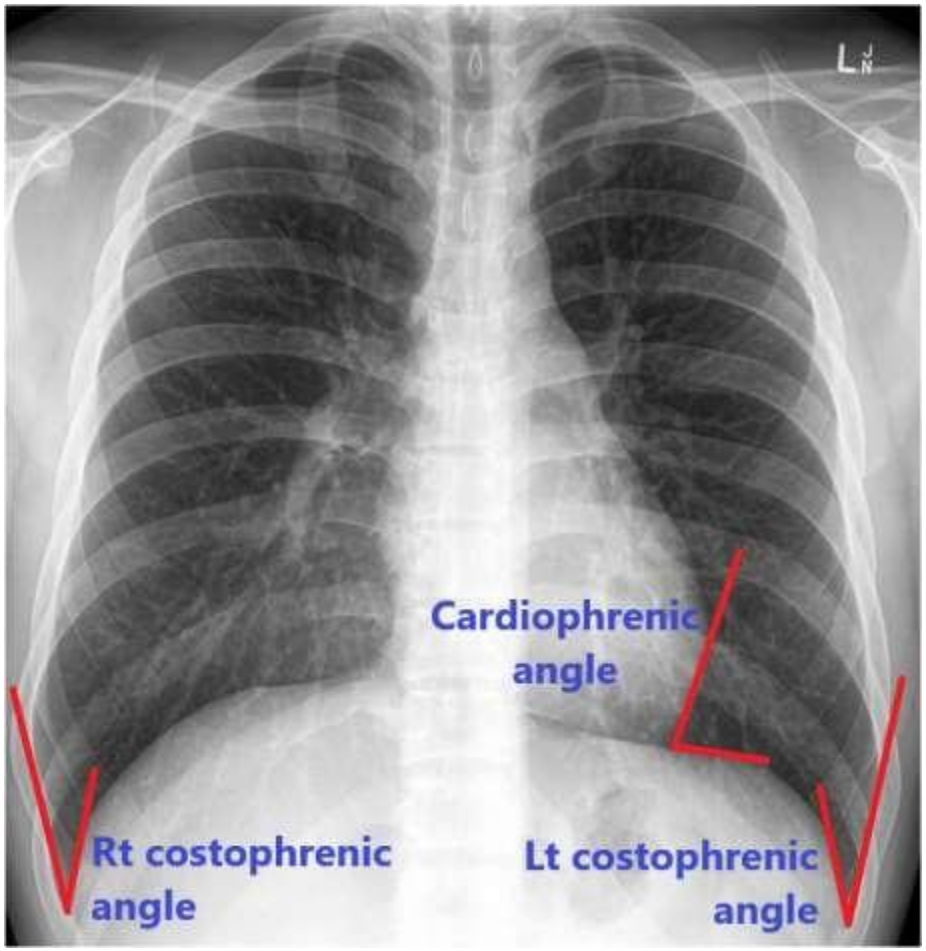




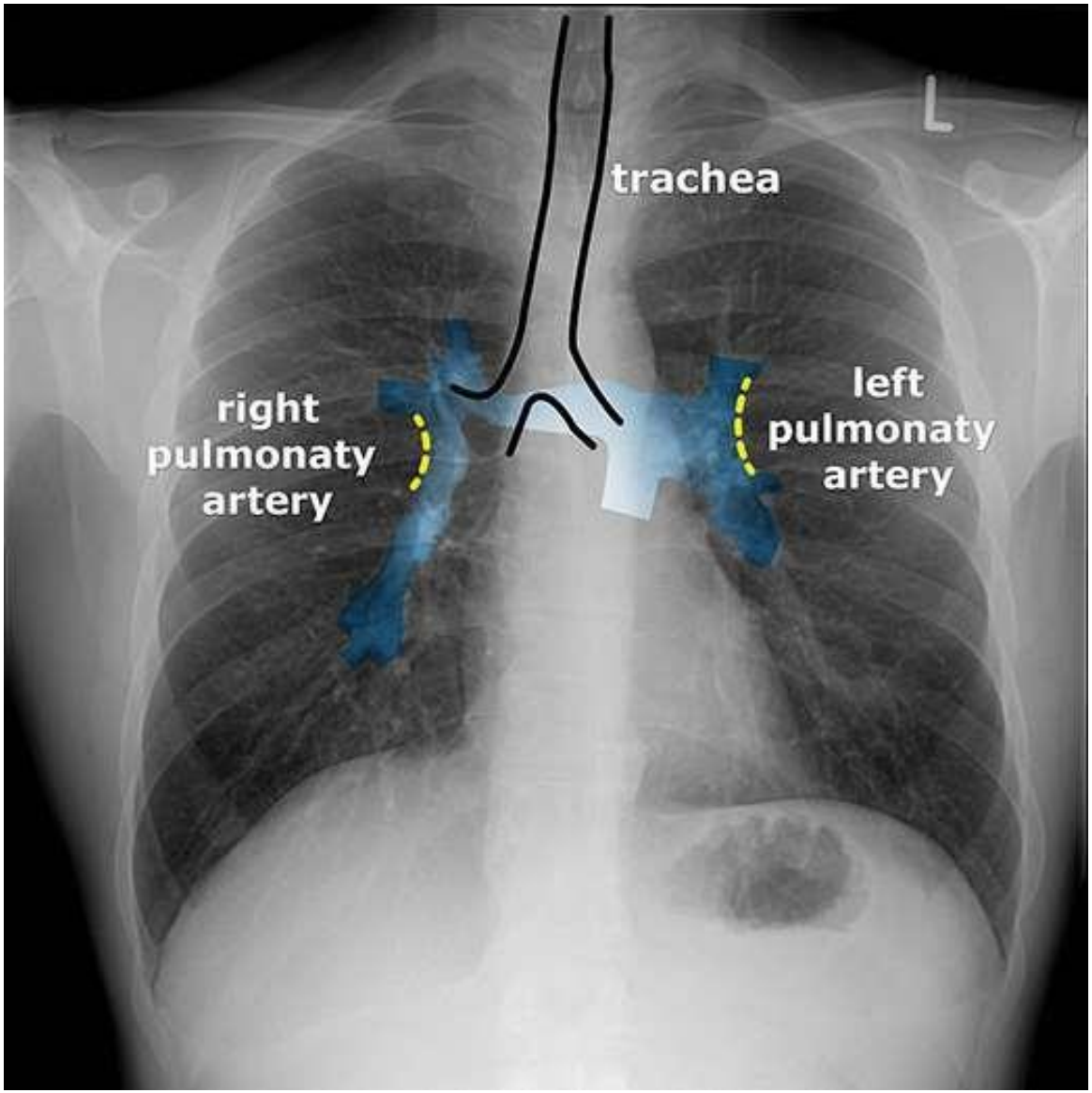
Normal CT ratio <0.5

Diaphragm



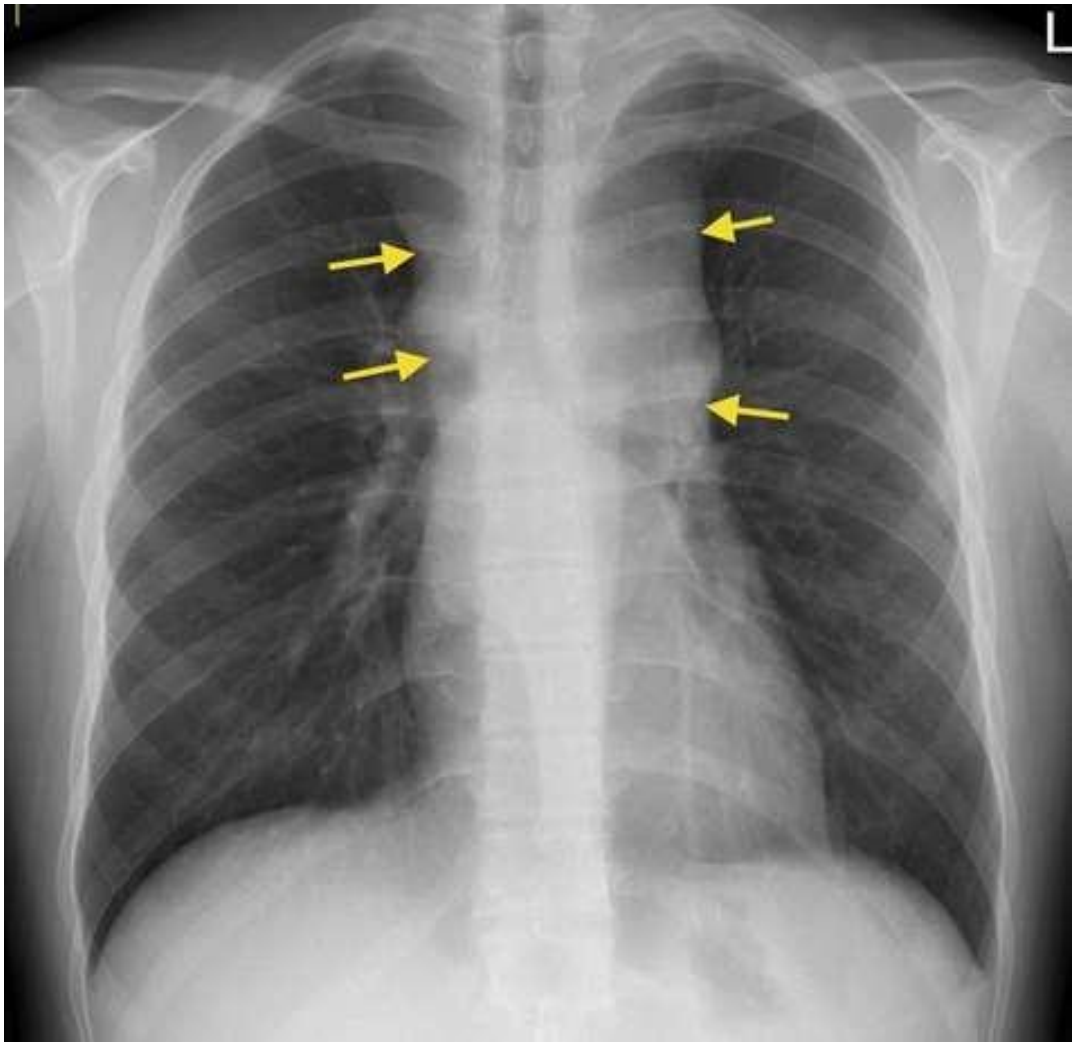

Cardiophrenic angle
Rt costophrenic angle
Lt costophrenic angle

Hila

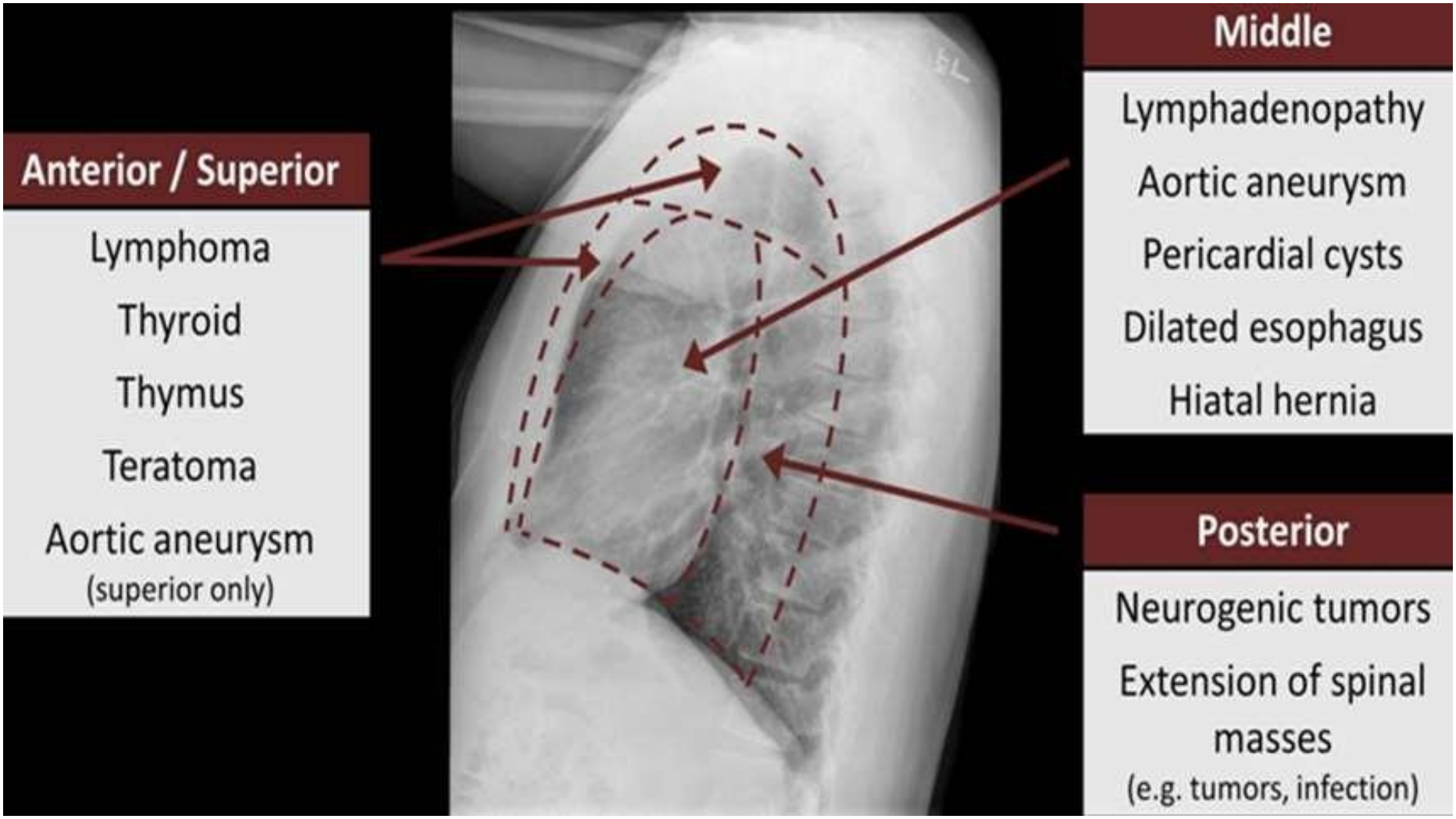


Mediastinal widening

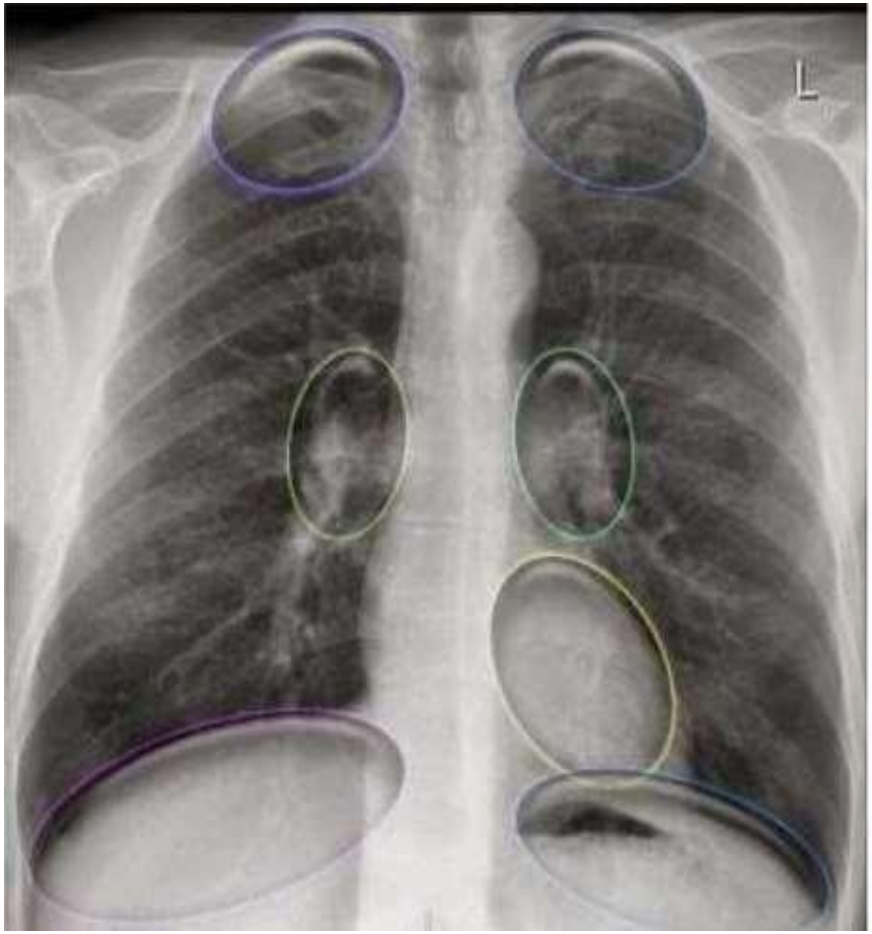
Definition:
Mediastinum width greater than 6 cm on erect PA view or 8 cm on supine AP view

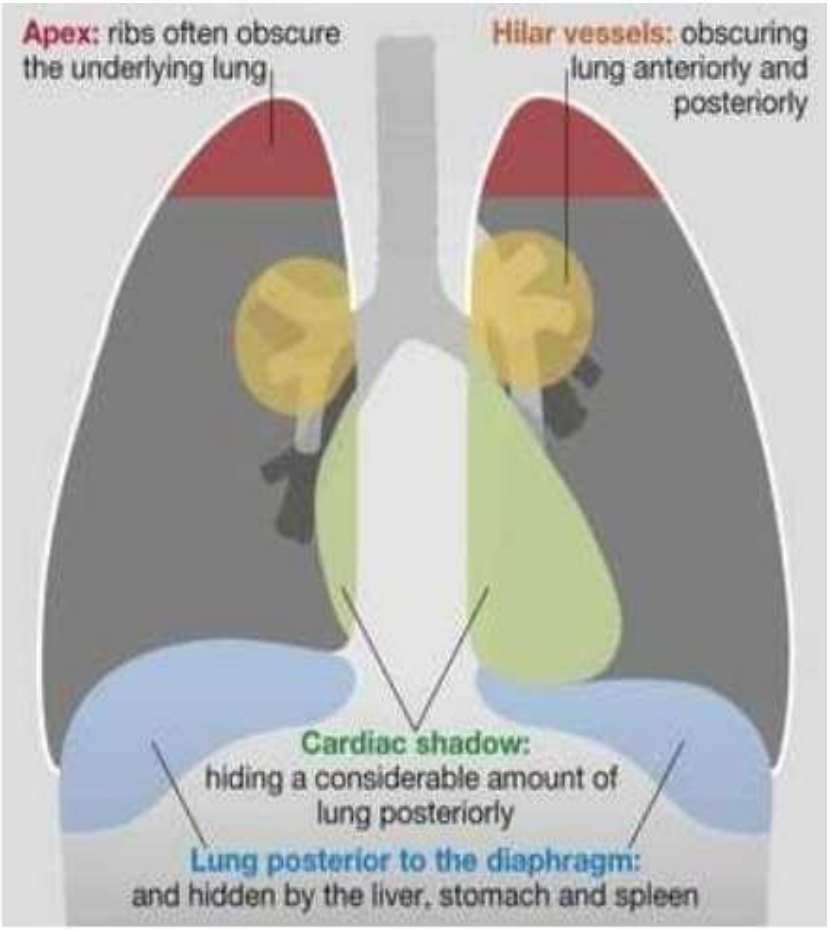


Mediastinal Masses



Hidden Areas





CARDIAC PATHOLOGY

Cardiac X-rays

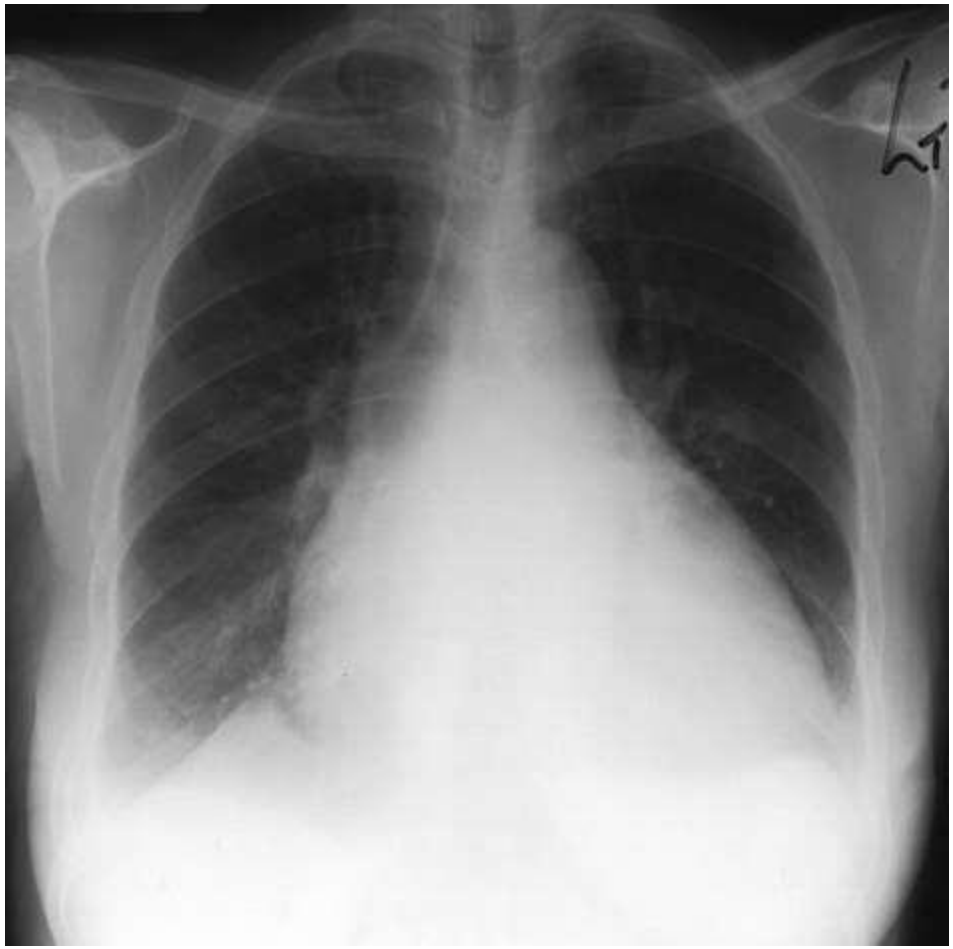
- Right ventricular enlargement
- Left ventricular enlargement
- Mitral stenosis
- Congestive heart failure
- Pericardial effusion
- Pulmonary hypertension

Right Ventricular Enlargement

- CT ratio >0.5
- Cardiac apex is round and elevated above diaphragm
- Cardio-phrenic angle is acute

Left Ventricular Enlargement

- CT ratio >0.5
- Cardiac apex displaced downwards & to left
- Cardio-phrenic angle is obtuse & merges with diaphragm



Mitral Stenosis

- Cardiomegaly (RV type)
- Straightening of left heart border
- Double right heart border
- Splaying of carinal angle

Mitralisation of heart

Mitralisation of heart means straightening of the left border of heart

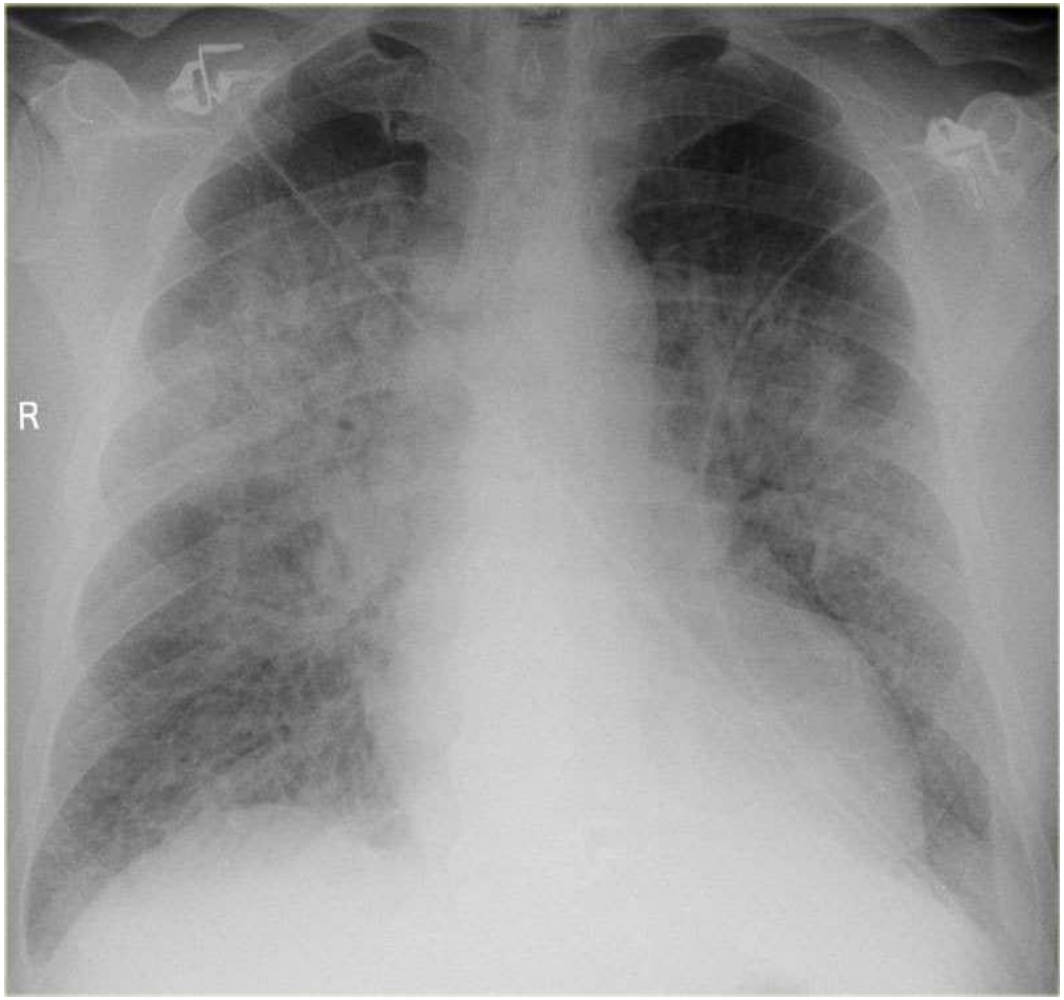
1. Aortic knuckle: small
2. Pulmonary conus: enlarged
3. Left atrial appendage: prominent
4. Left border of left ventricle: no change

Congestive Heart Failure

- Increased interstitial markings
- Upper zone vascular redistribution
- Bilateral Pleural effusion
- Cardiomegaly (LV type)

Congestive Heart Failure

- “Bat-wing” appearance
- Kerley B lines
- Cardiomegaly (LV type)
- Min pleural effusions



Pericardial Effusion

- CT ratio >0.5
- Globular heart shadow
- “Water bottle” sign

Pulmonary Hypertension

- Enlarged pulmonary arteries
  - >16 mm right descending pulmonary artery (PA view)
  - >18 mm left descending pulmonary artery (lateral view)
- Prominent pulmonary outflow tract
- Peripheral pulmonary vessels pruning
- Right ventricular hypertrophy

LUNG PATHOLOGY

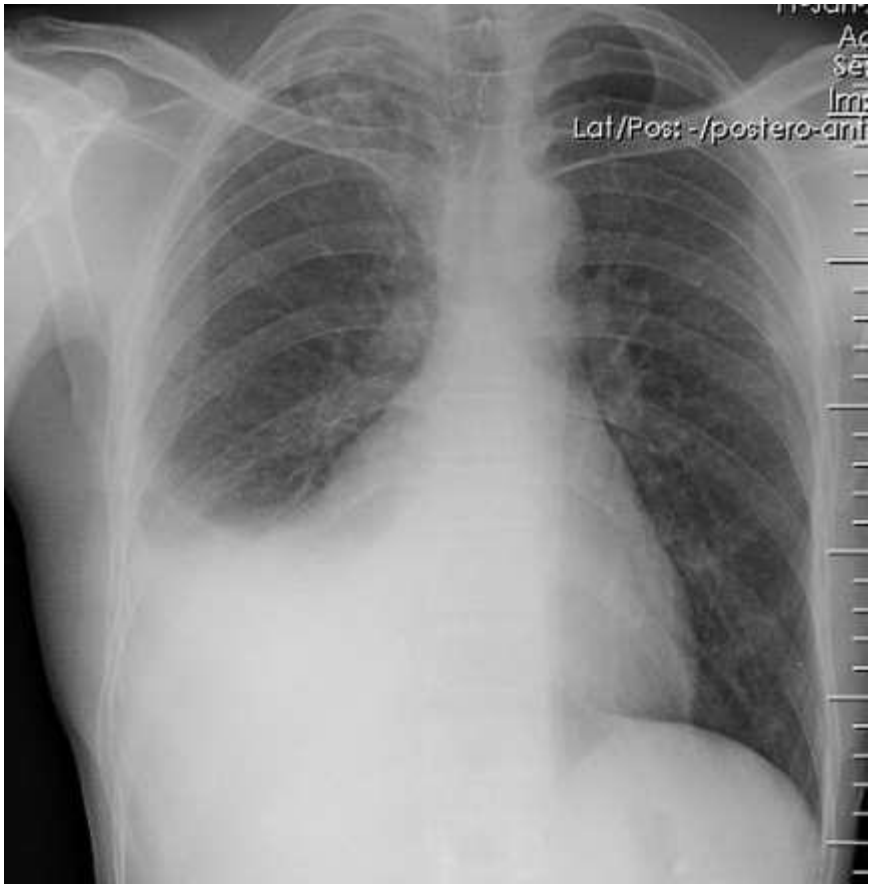
The white lung fields
(radio-opacity)

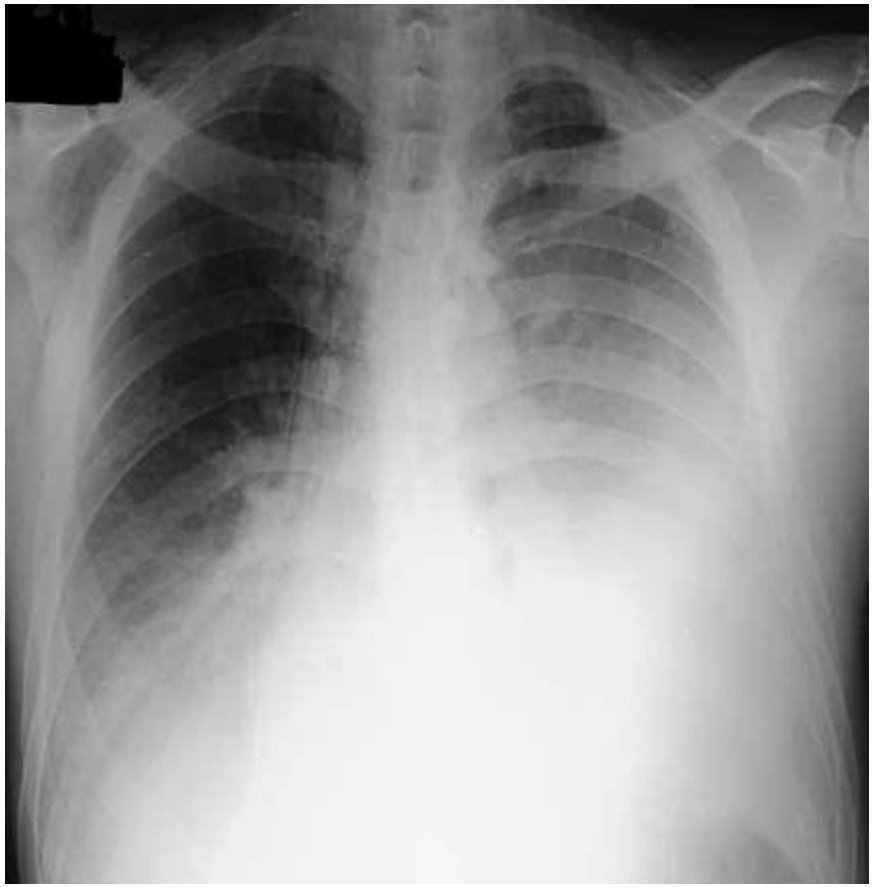
- Pleural effusion
- Consolidation
- Collapse
- Fibrosis
- Coin lesion
- Miliary lesion
- Lung mass
- Hilar Lymphadenopathy
- Pulmonary edema
- Hemithorax

The black lung fields
(radio-lucency)

- Pneumothorax
- Hydropneumothorax
- Cavitating lesion
- Emphysema
- Subcutaneous emphysema

Pleural Effusion



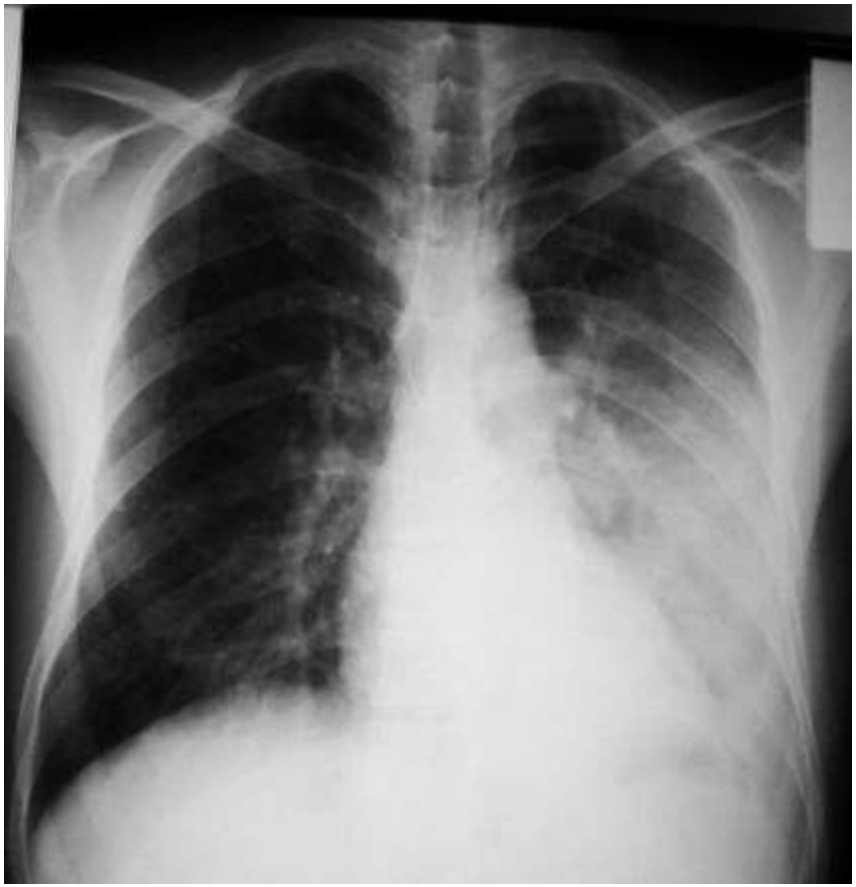


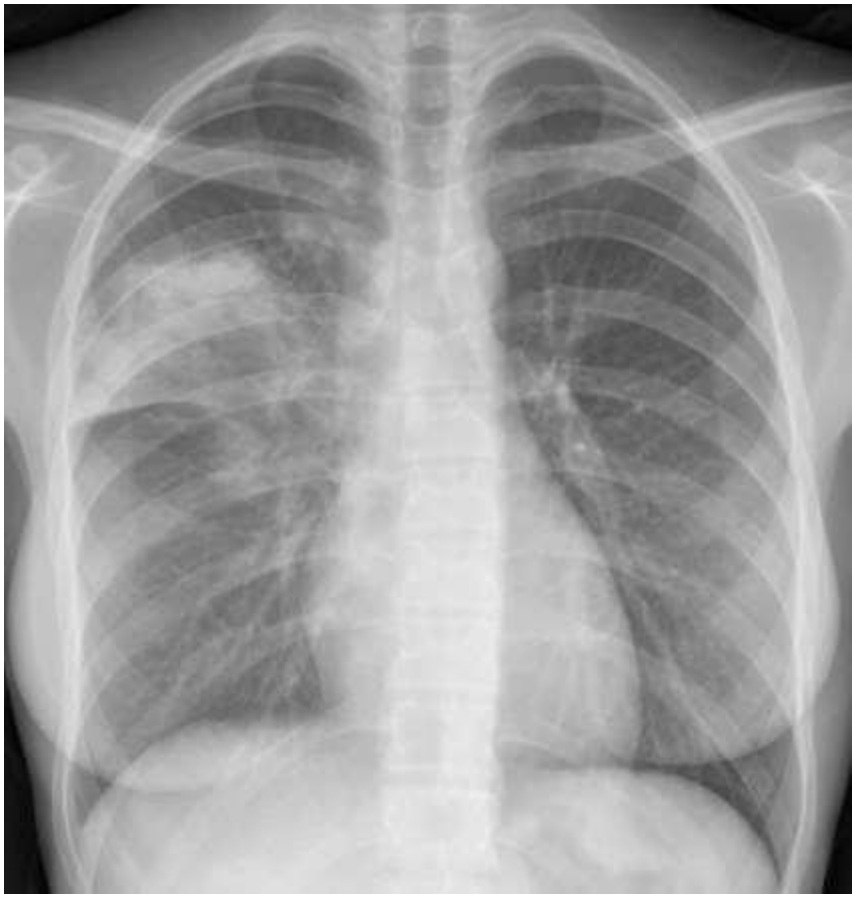
Pleural Effusion

How to detect minimal pleural effusion ???

- CXR-PA: 150-175 ml
- CXR-lateral decubitus: 10-50 ml
- USG thorax: 3-5 ml

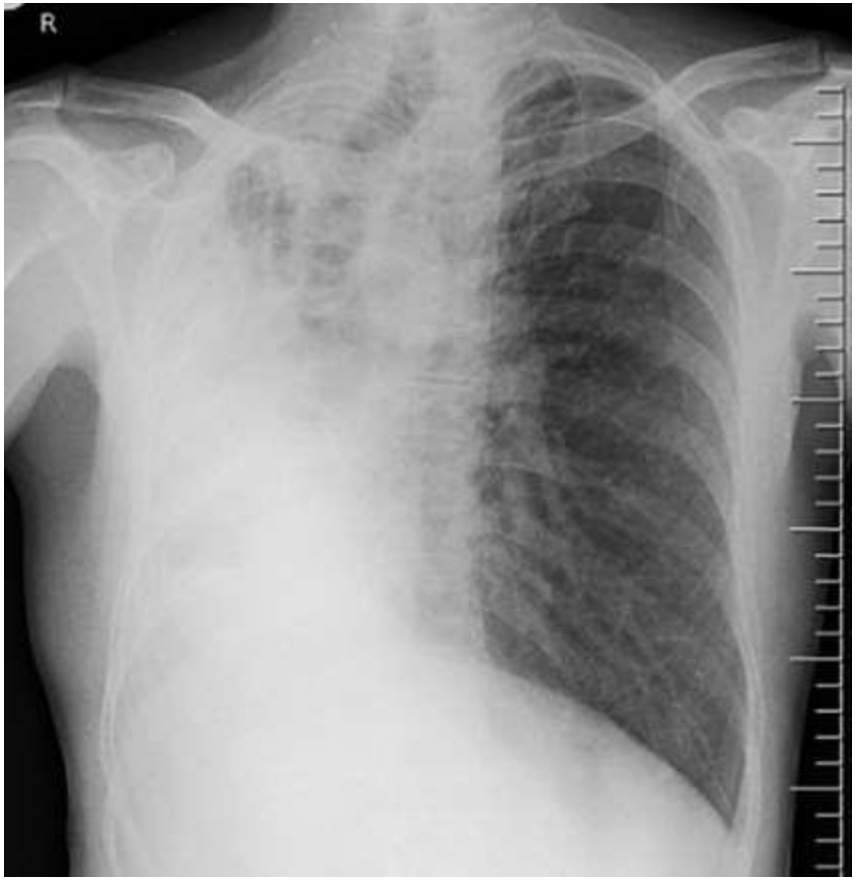
Consolidation



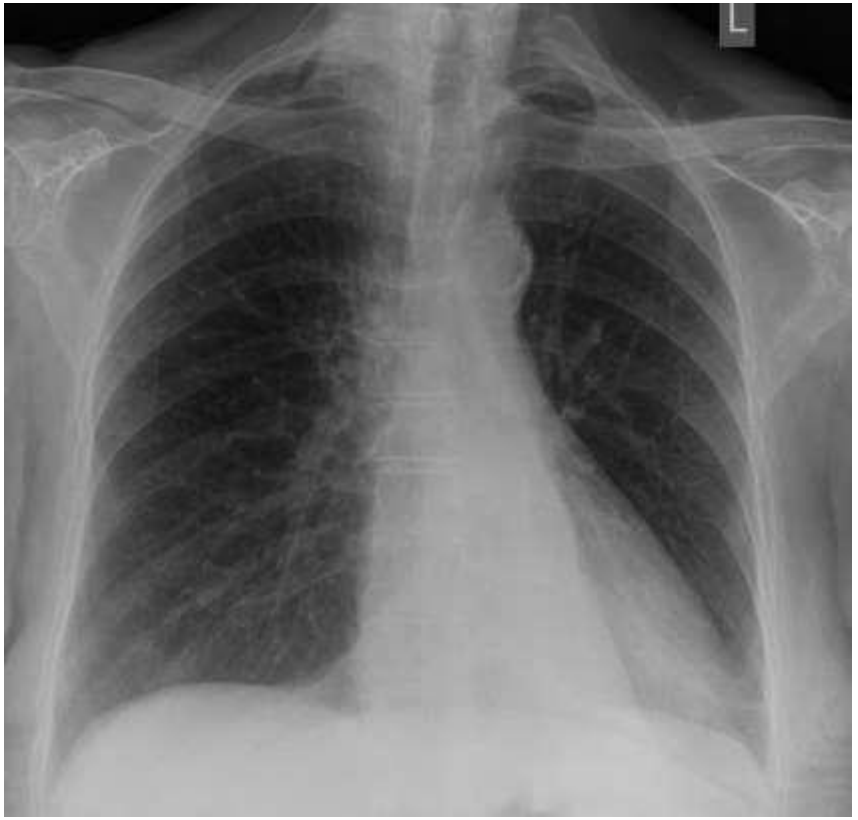


Consolidation

Collapse



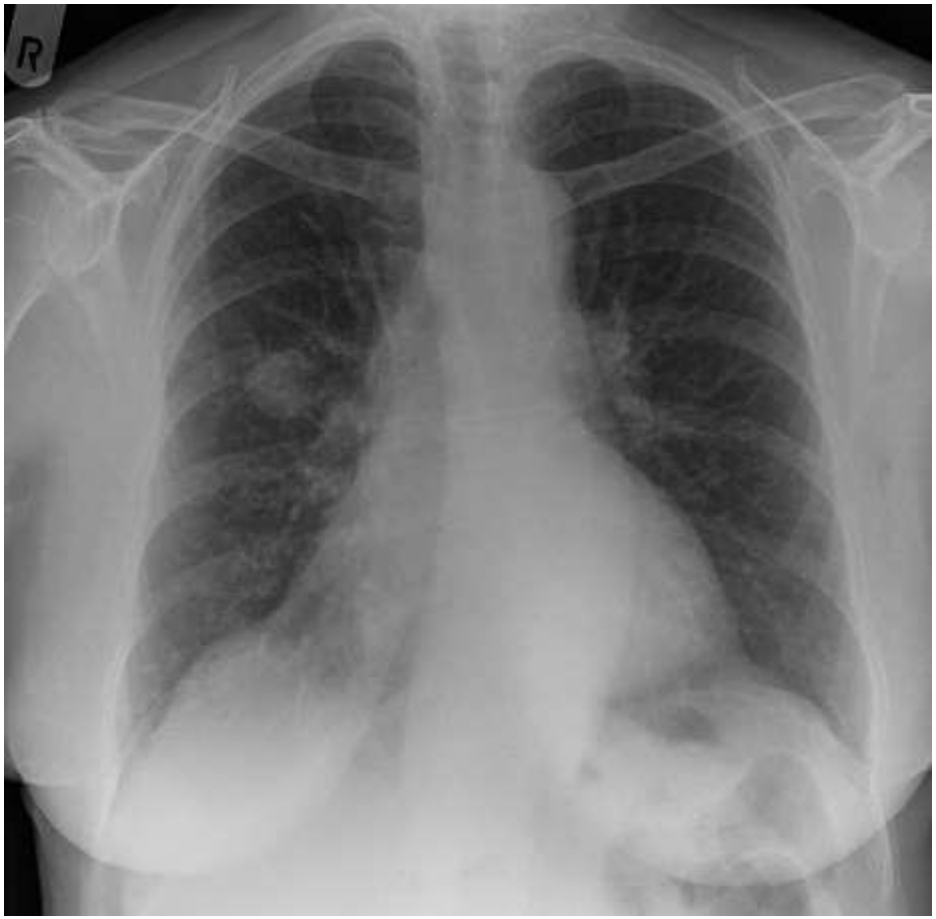
Collapse



Fibrosis

Solitary Pulmonary Nodule (Coin lesion)

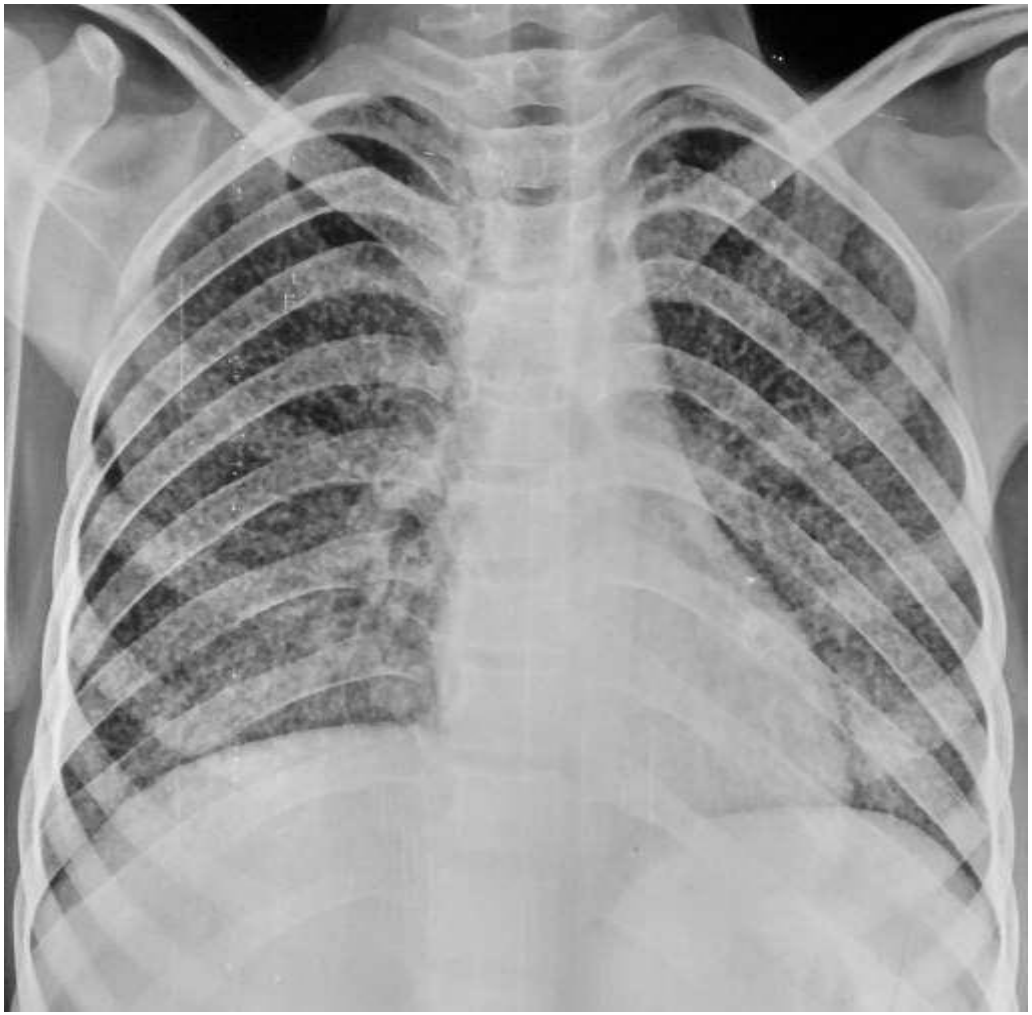
- Granulomas: tuberculoma, histoplasmosis, aspergilloma
- Bronchial carcinoma
- Bronchial adenoma
- Lung abscess
- Encysted pleural effusion
- Pseudotumor
- Pulmonary hemartoma
- Hydatid cyst
- Rheumatoid nodule
- Wegners's nodule



40% SPN are malignant

Miliary lesions

- Miliary tuberculosis
- Sarcoidosis
- Pulmonary eosinophilia
- Histoplasmosis
- Pneumoconioses
- Hemosiderosis
- **Miliary metastasis** thyroid, renal, breast, prostate, osteosarcoma

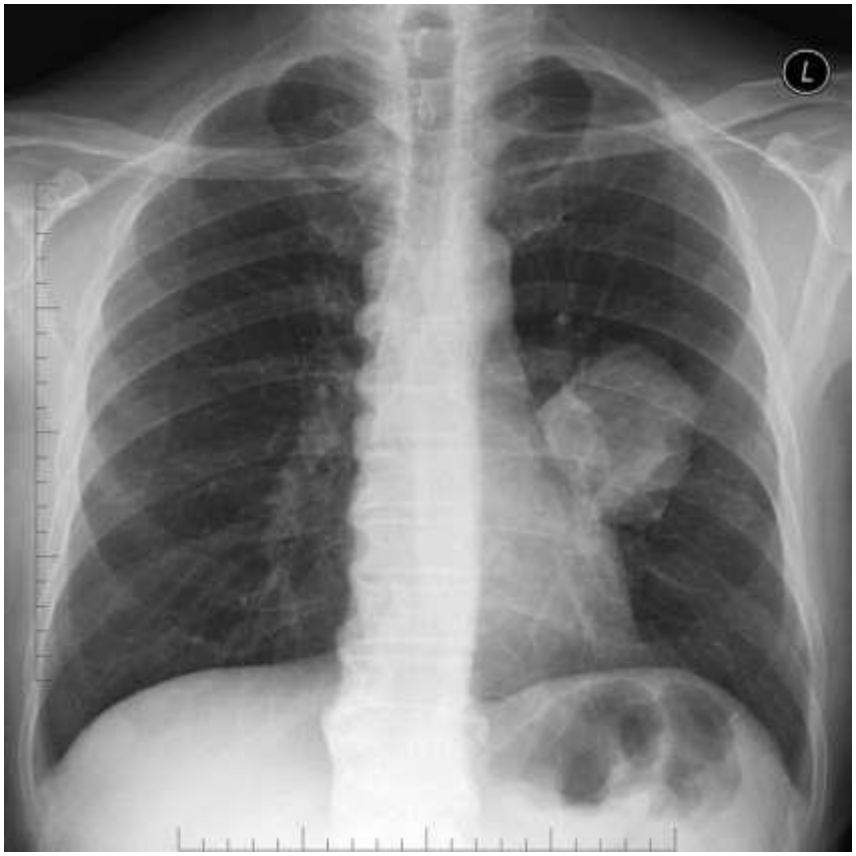


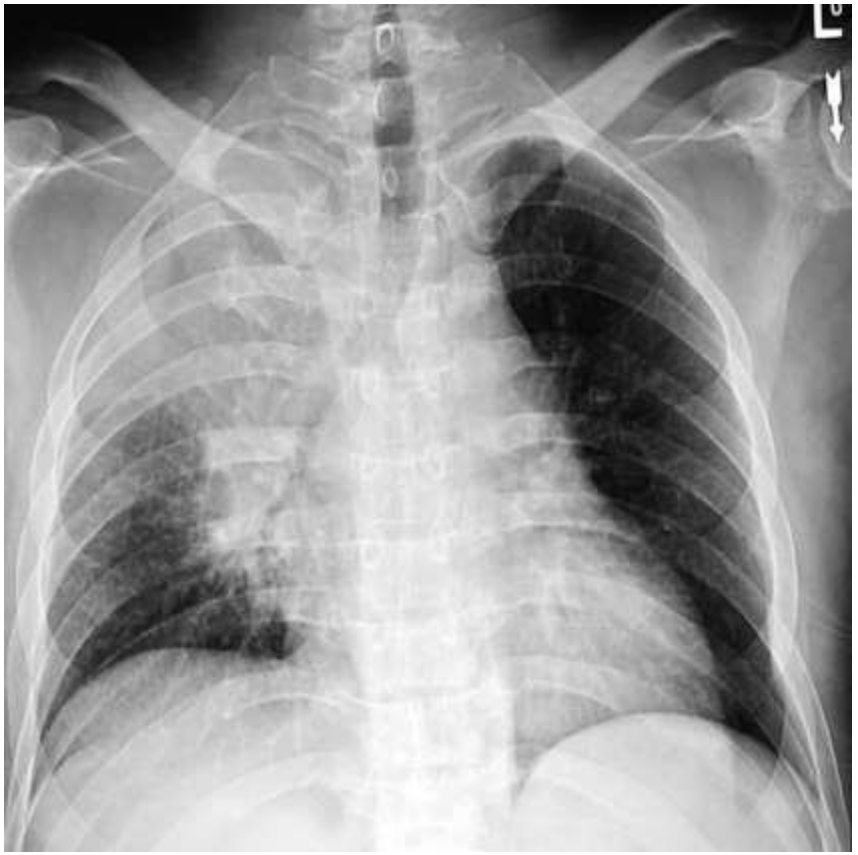
Pulmonary Metastasis

Miliary nodules: <2 mm
Pulmonary nodule: 7-30 mm

Pulmonary micronodule: 2-7 mm
Pulmonary mass: >30mm

Lung Mass





Hilar Lymphadenopathy

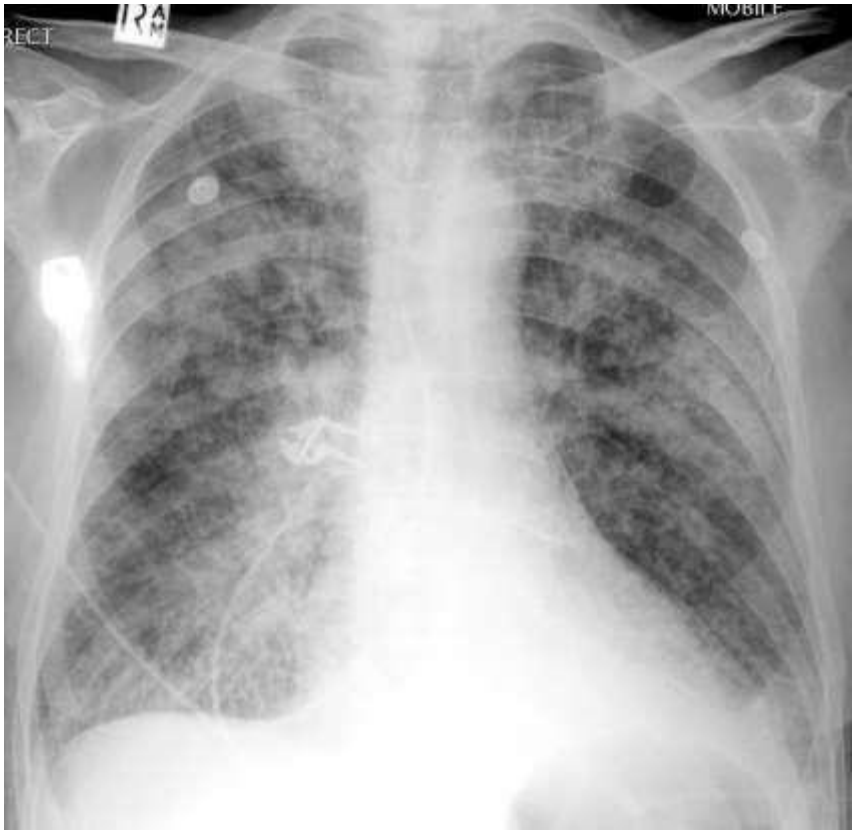
Bilateral hilar lymphadenopathy

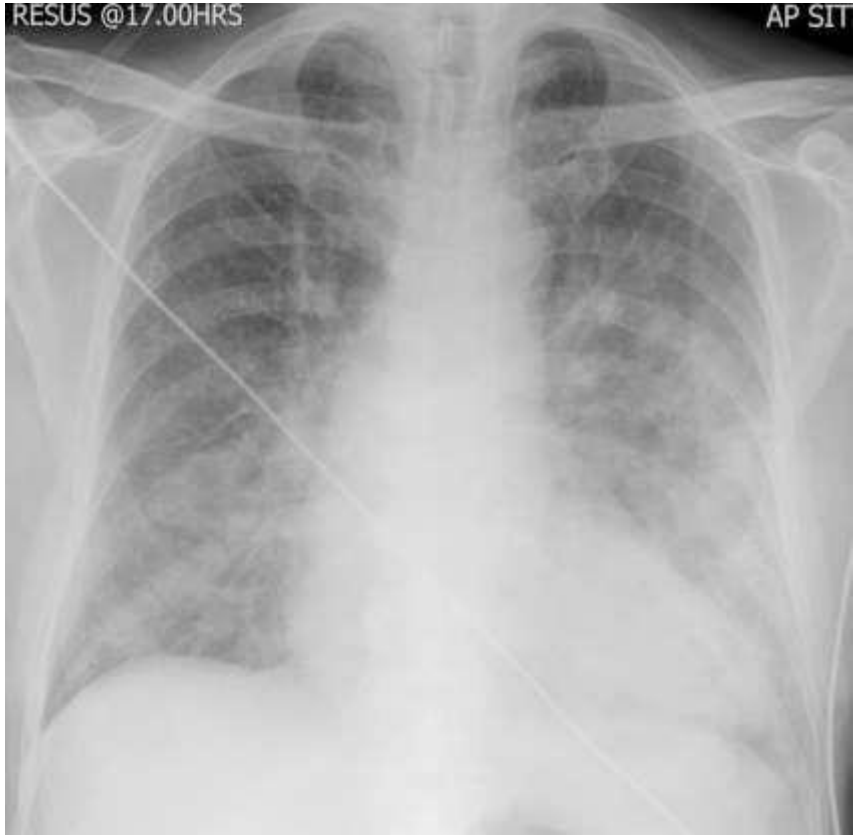
- Sarcoidosis
- Lymphoma
- Tuberculosis
- Histoplasmosis
- Pnemuconiosis: silicosis

Unilateral hilar lymphadenopathy

- Lymphoma
- Carcinoma
- Tuberculosis
- Histoplasmosis

Pulmonary Edema





Radiographic feature	Cardiogenic pulmonary edema (LVF)	Noncardiogenic pulmonary edema (ARDS)
Heart size	Enlarged	Nornal
Vascular distribution	Balanced or inverted	Normal or balanced
Distribution of edema	Even or central	Patchy or diffuse
Pleural effusion	Present	Not usually present
Peribronchila cuffing	Present	Not usually present
Septal lines	Present	Not usually present
Air bronchograms	Not usually present	Usually present

Hemithorax

Mediastinum pushed away from the opacified side

- Pleural effusion
- Large lung mass
- Diaphragmatic hernia

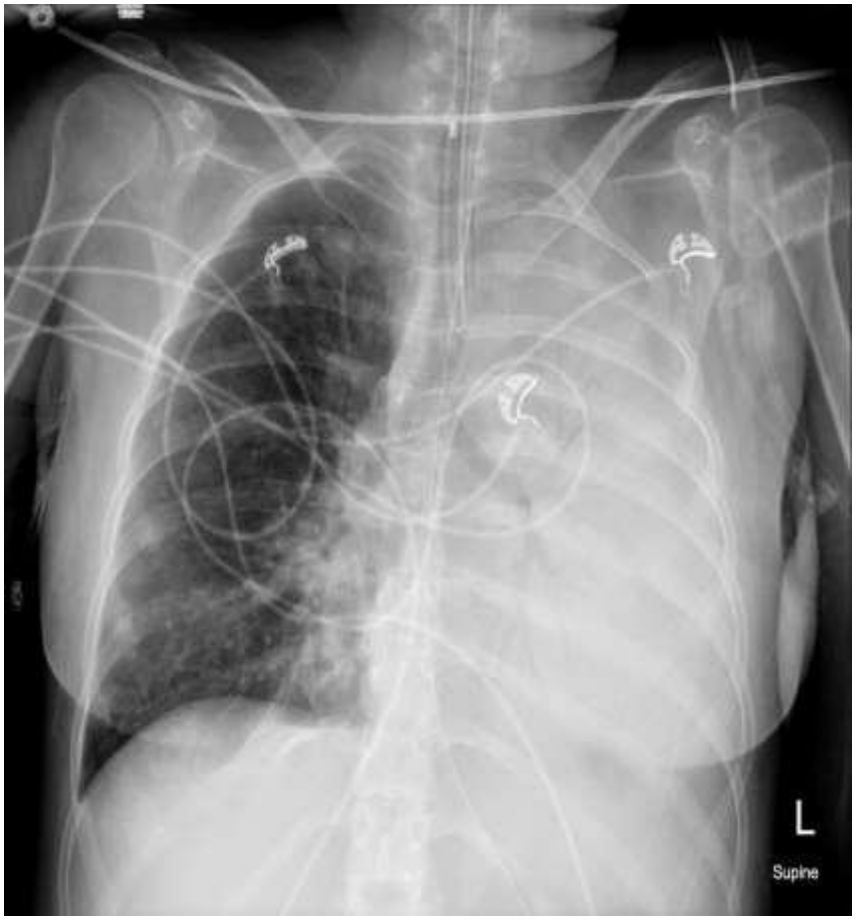
Mediastinum pulled toward the opacified side

- Total lung collapse
- Pneumonectomy
- Pulmonary hypoplasia/agenesis

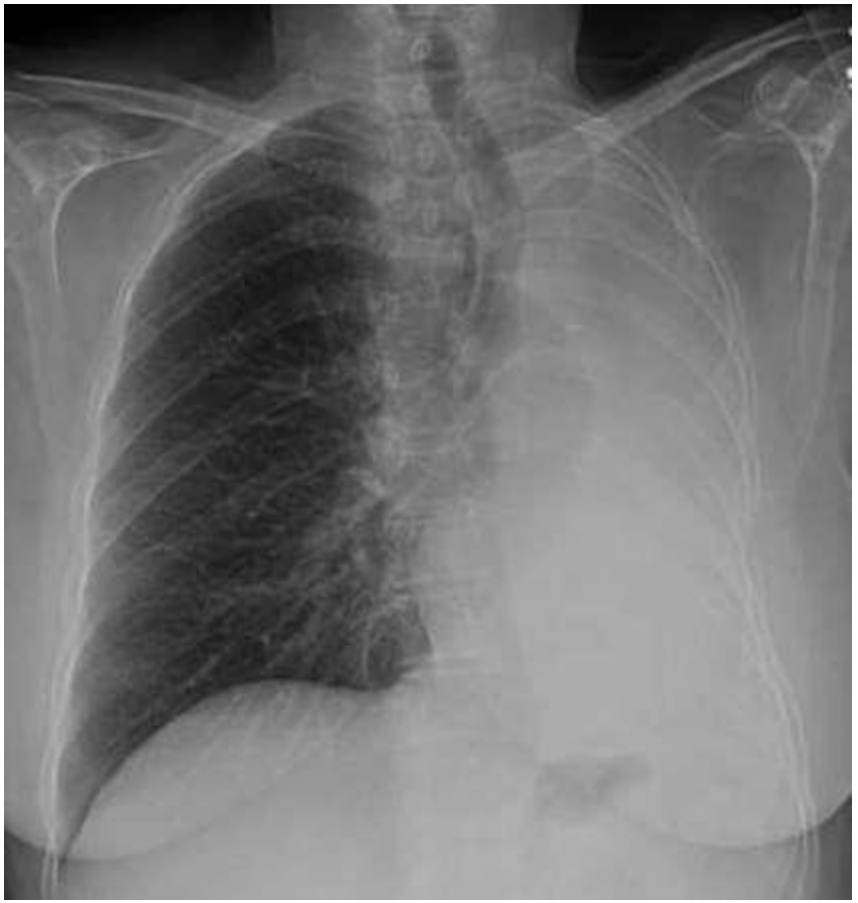
Mediastinum remains central in position

- Consolidation
- Pleural/chest wall mass
- Combination of pathologies

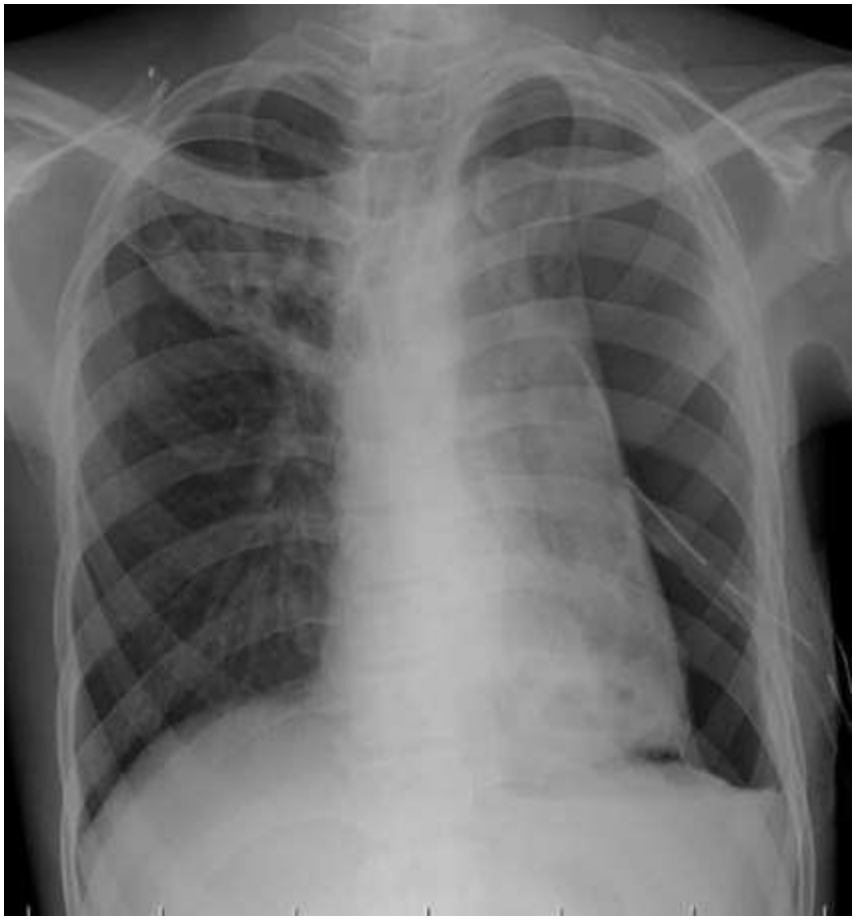
Hemithorax



Hemithorax

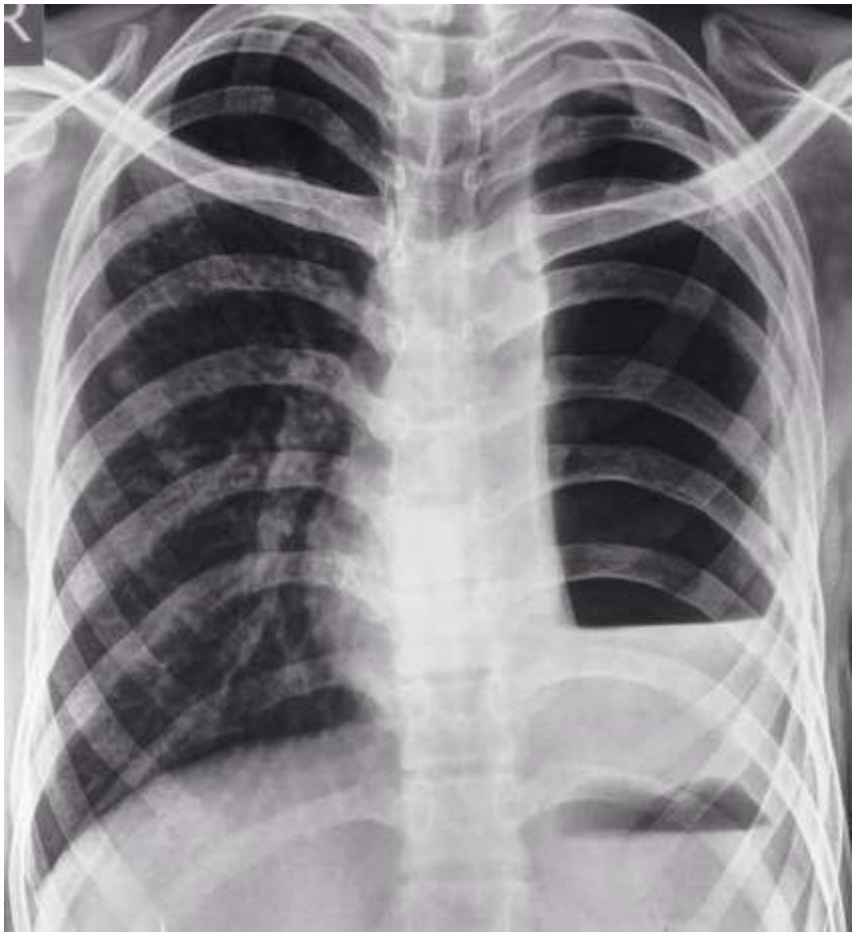


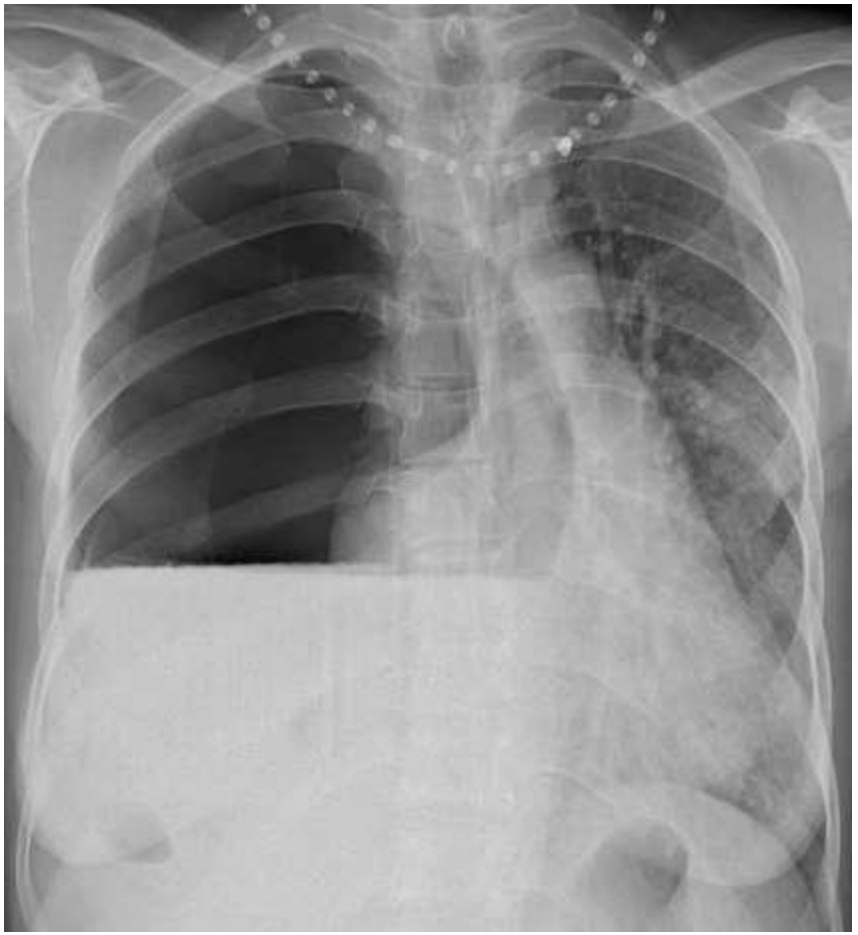
Pneumothorax



Which film preferred ???

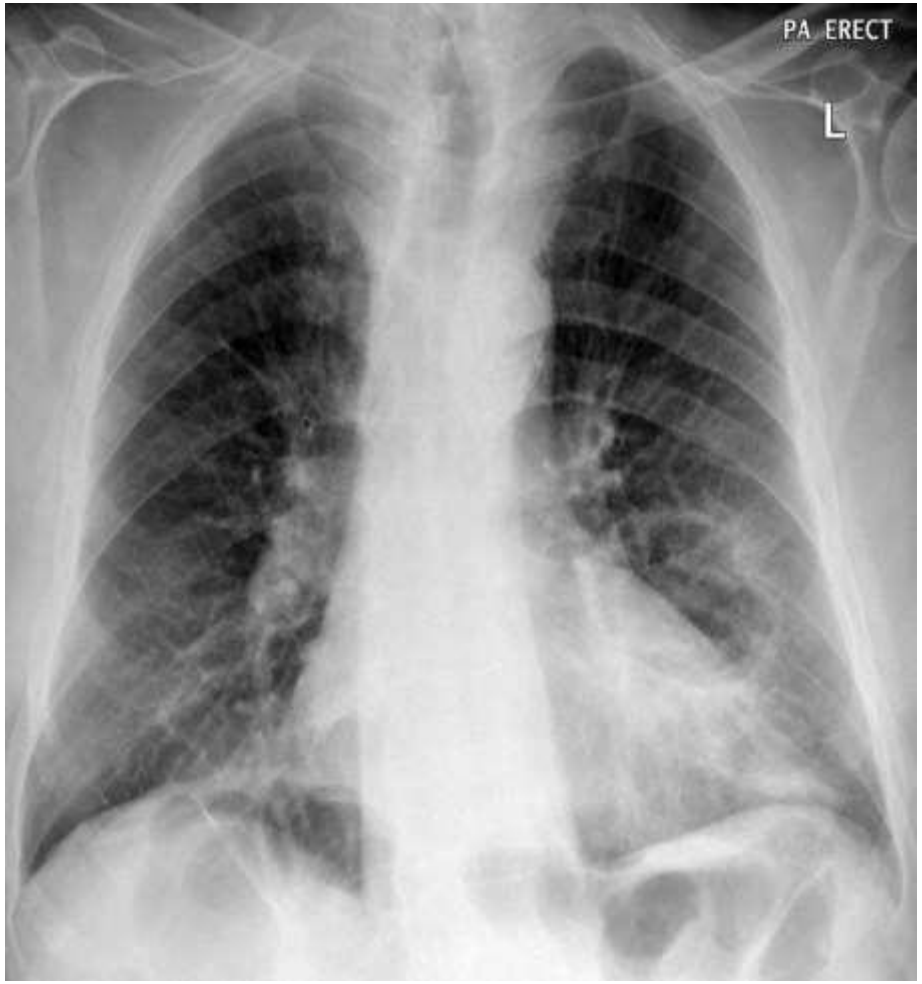
Hydropneumothorax



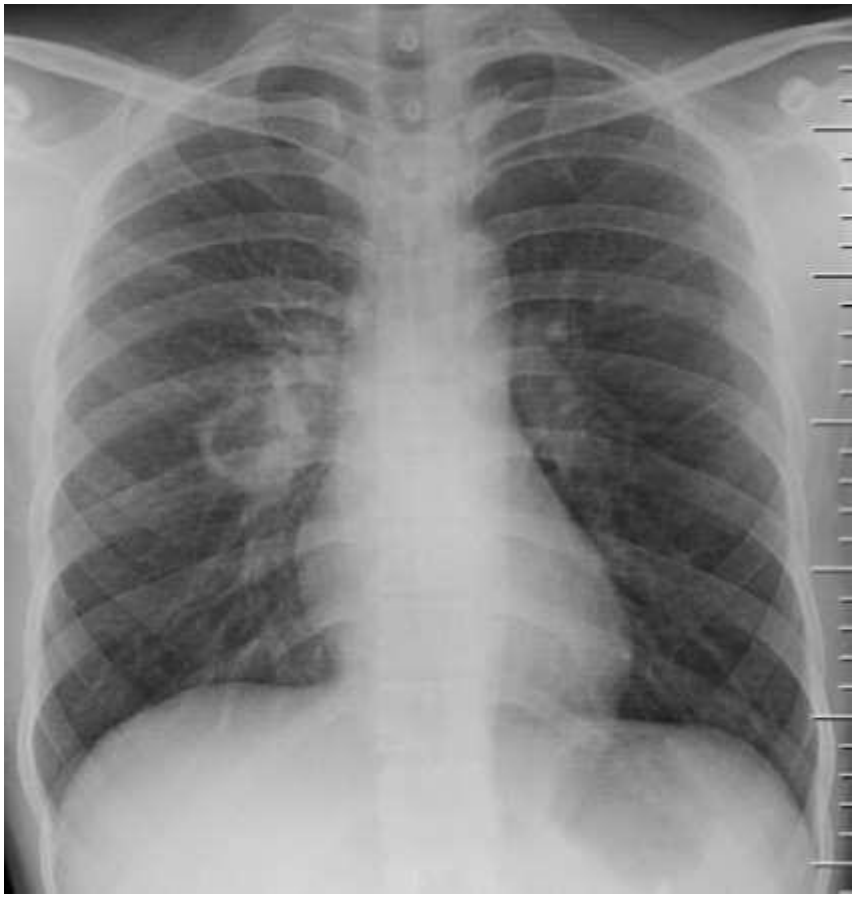


Pulmonary Cavity

- **C**arcinoma
- **A**utoimmune: Wegner granulomatosis and rheumatoid nodule
- **V**ascular: emboli (septic/bland)
- **I**nfection/abscess: bacterial (Klebsiella, Staphalococcus, anareobic infections), fungal (histoplasmosis), amebic, hydatid cyst
- **T**rauma: pnematocele
- **Y**oung: congenital, bronchogenic cyst



Pulmonary Cavity



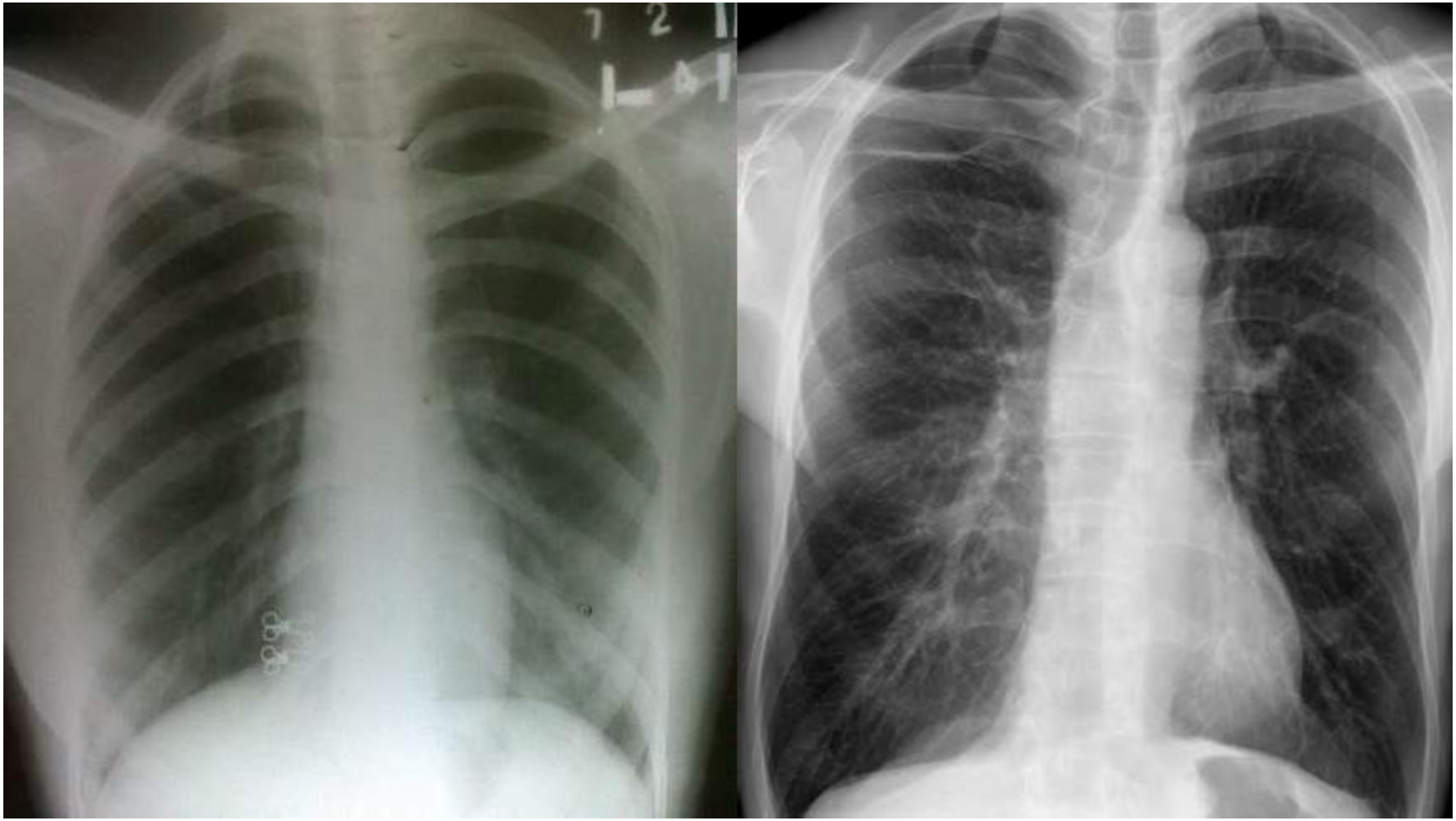
Pulmonary Tuberculosis

- Apical or posterior segment of upper lobes or superior segments of lower lobes mostly involved
- **Active tuberculosis**:

  Infiltrates, consolidations, cavities, mediastinal or hilar lymphadenopathy
- **Healed tuberculosis**:

  Pulmonary nodules, fibrotic scars, bronchiectasis and pleural scarring

Emphysema



Pathognomic sign ???