



431

Radiology Team

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Lecture 7: Radiology of Cardiorespiratory Diseases (Interactive Lecture)



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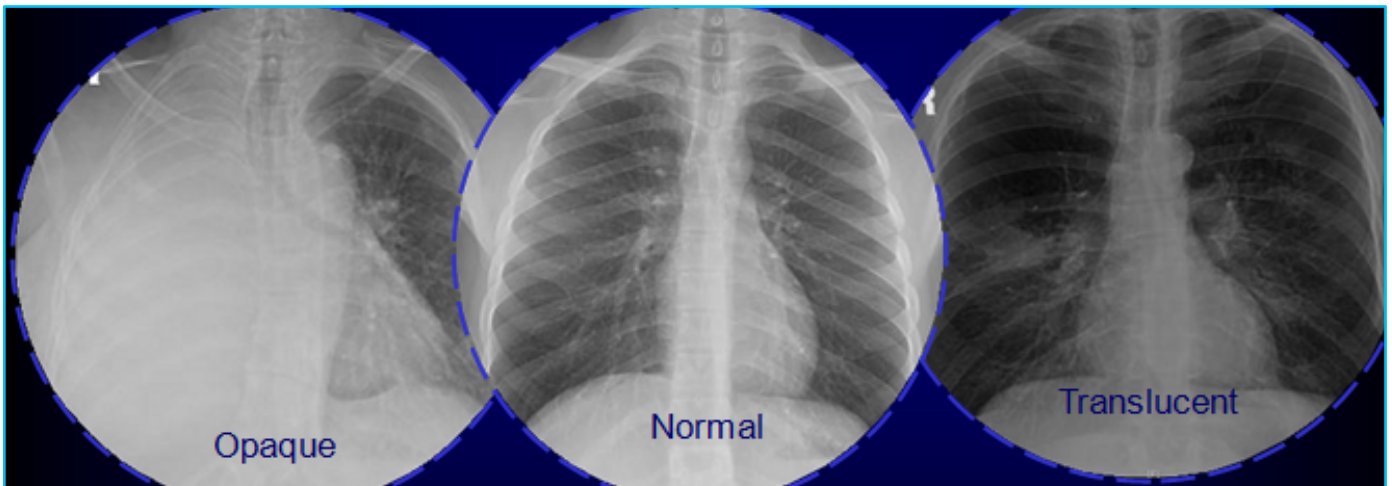
◆ Important ◆ Doctor's notes ◆ Team's notes

We thank 430 Team for their helpful notes

Important terms:

- ❖ Opaque Vs. Translucent (transparent). (White vs. Black)
- ❖ Alveolar Vs. Interstitial.
- ❖ Silhouette Sign.
- ❖ Airbronchogram. (Alveolar)
- ❖ Adequate Exposure.

❖ Opaque Vs. Translucent (transparent)



DDx:

- Consolidation / Collapse.
- Pleural effusion.
- Diaphragmatic hernia.
- Agenesis / Pneumectomy.
- Congenital (total) abscess.

DDx:

- Technique.
- Chest wall (Mastectomy).
- Pneumothorax.
- Emphysema.
- Hyperinflation of lung tissue.
- Absent of soft tissue muscles.

❖ Opaque →

- Condensed structured (thick structured) → e.g. bone
- The x-ray beam will hit that structure and will reflux back → won't pass through that structure → It will appear as **white**

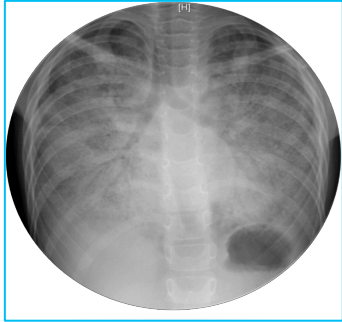
❖ Translucent (transparent) →

- Structure that contain air → e.g. lungs, bronchial tree, colon or bubbles within the abdomen
- X-ray beam will transfer through that structure easily because of the presence of the air → Therefore, it will appear as **black**.
- Normal Lungs are always translucent (because they are filled with air)
- The more amount of x-ray interacting with the film, the darker it will appear.

❖ Gray →

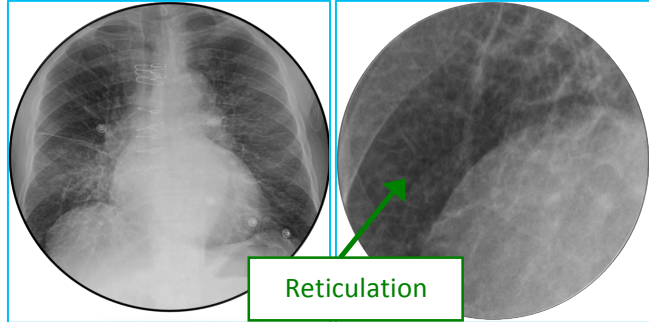
- Soft tissue → e.g. breast, muscles and heart
- Have different thickness → therefore, you will see different densities gradients in between white and black (gray)

❖ Alveolar Vs. Interstitial shadows



Alveolar

- Pneumonia.
- Pulmonary edema.
- Pulmonary hemorrhage.
- Alveolar cell carcinoma.



Interstitial

- Interstitial pulmonary edema.
- Interstitial pneumonitis IPF.
- Lymphangitis carcinomatosa. (Lymphatic spread of malignancy within the lung)

Pathology:

Alveolar: obliterate → white (opaque) lung.

Called air space or alveolar sac diseases.

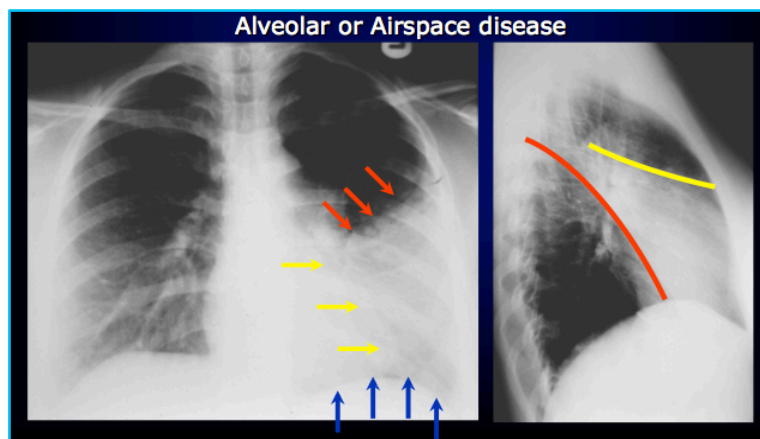
Examples: pneumonia, pulmonary edema, presence of blood in the lungs and presence of malignant cells.

If fluids entered the alveoli in cases such as CHF or the alveoli are filled with transudative or exudative fluids due to infections.

Interstitial: thickening of the interstitial septa in between the alveolar sacs. (Lung appears black, with exaggerated interlacing reticular shadows)

Examples: early stage of pulmonary edema, interstitial edema, interstitial pulmonary fibrosis, lymphangitis carcinomatosa, idiopathic pulmonary fibrosis (IPF).

❖ Silhouette Sign



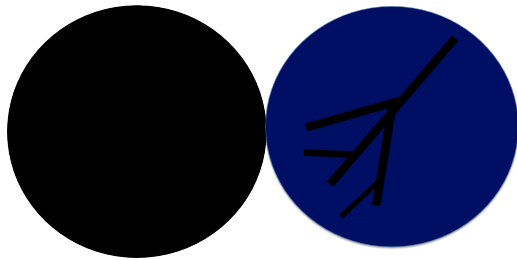
Silhouette Sign: If two objects of the same radiographic density touch each other, the edge or the margin between them disappears.

In the radiograph: left lung 1- obliterated heart line 2- diaphragm line is clear. So it's consolidation, not pleural effusion (In case of pleural effusion, fluid will be in the base of the lung so it will also obliterate the diaphragm)

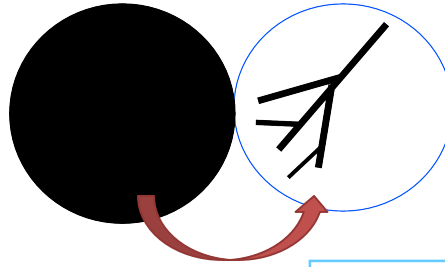
If the white shadow obliterates the cardiac border, it's adjacent to the heart. If it obliterates the hemidiaphragm, it's adjacent to the hemidiaphragm.

This helps in: localizing the pathology.

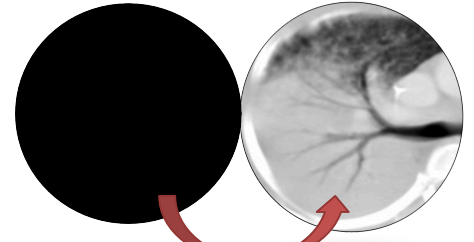
❖ Airbronchogram (Alveolar)



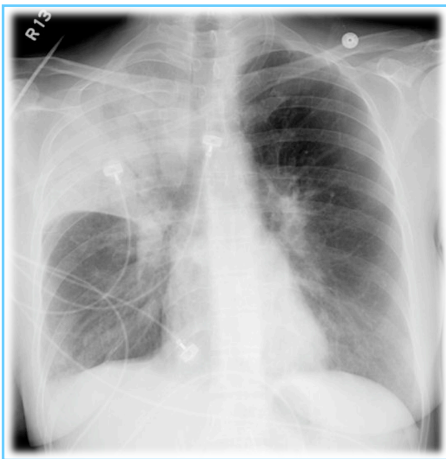
Normal lung parenchymal



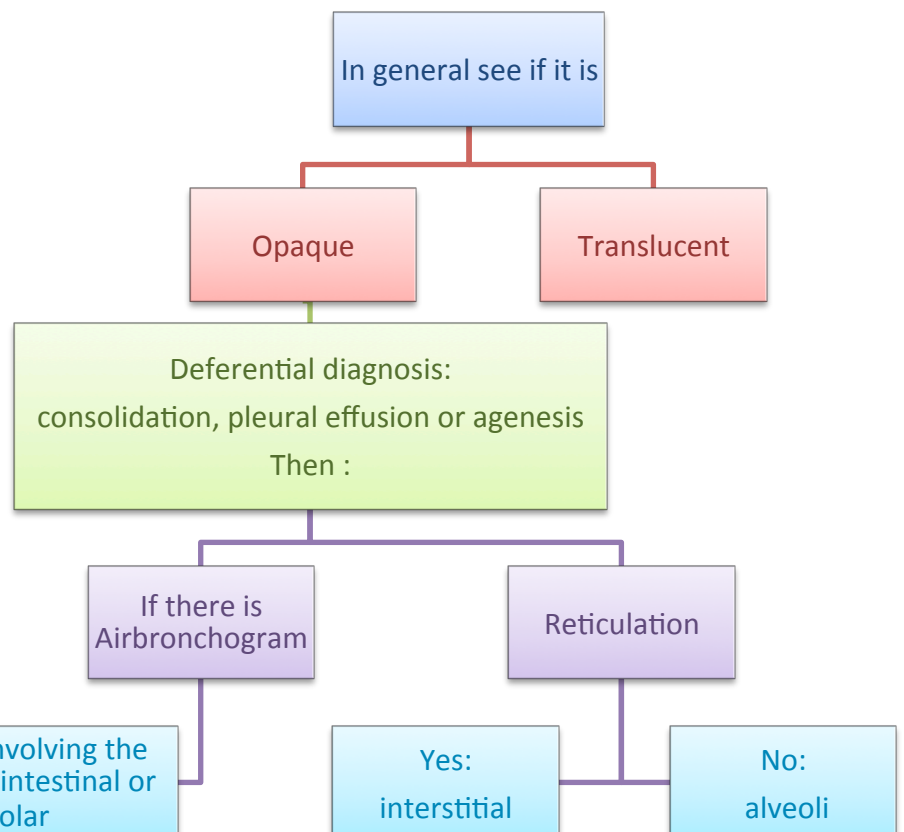
Airbronchogram



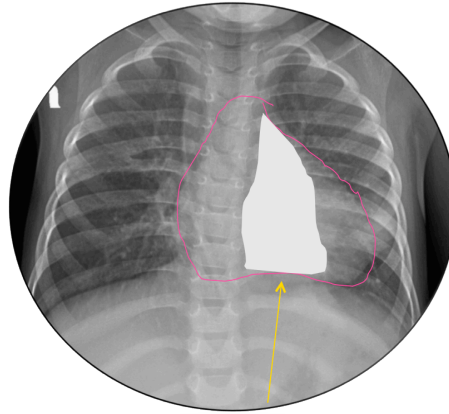
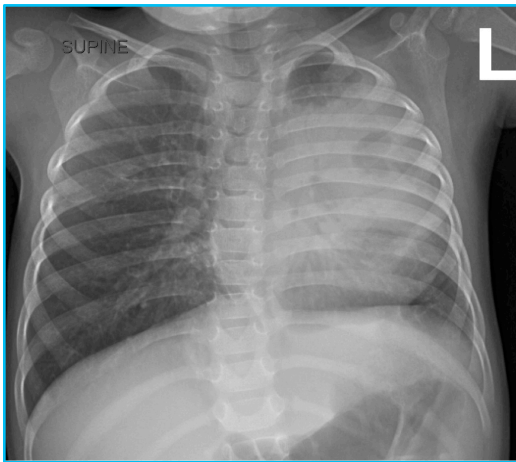
- Airway (bronchi) normally appears black (because they contain air).
- Alveolar sac filled with blood or fluid will appear **white** (opaque), but the airway **will remain black**.
- **Airbronchogram within a white shadow**: obliteration of the alveolar sac itself, consolidation (lung itself not pleura or chest wall) whether it is related to pneumonia, blood (trauma) or fluid in case of pulmonary edema.
- **Whenever you see airbronchogram → it is lung parenchymal pathology with edema, hemorrhage or infection.**
- **Note that the absence of airbronchogram indicates that the disease could be chest wall.**



Both lungs: White shadow that is not homogenous. Black lines are seen (airbronchogram). If the lungs are infiltrated diffusely (bilaterally) → systemic manifestation, not focal lesion.
E.g. pulmonary edema.

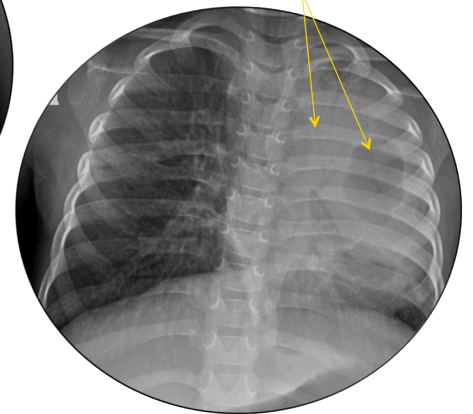


Case 1: A child presenting with cough and fever.



Consolidation become more obvious in retro-cardiac region

Air bronchogram is clearer here with development of cavitation



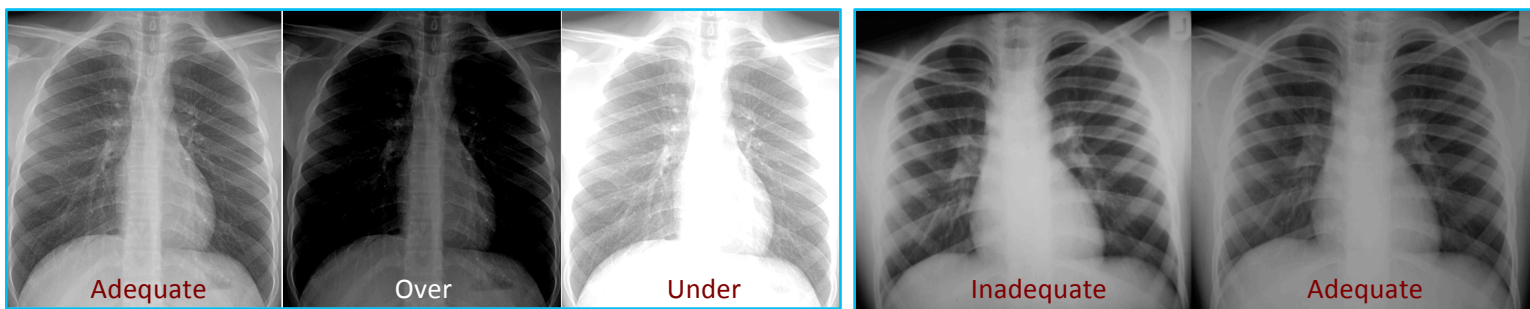
We see: white shadow, not homogenous, black lines = airbronchogram

Alveolar obliterated by fluid or blood, bronchial tree are outstanding with air as oppose to the obassification of the lung tissue itself = airbroncogram

When lung infiltrated diffusely, bilateral = systemic disorder (e.g. pulmonary edema, pulmonary hemorrhage and diffuse viral infection) rather than focal lesion

There is a black lines (airbroncogram) so means **consolidation** not pleural space or chest wall

❖ Adequate exposure



Depends on: dense variation and white vascular structure.

Adequate exposure: we can see the spine through cardiac shadow.

Example case: A child presented to the ER with acute respiratory distress. The image is under-exposed. No apparent abnormality. After adjusting the exposure, a foreign body mid part of the esophagus is seen.

How to know if the patient was exposed adequately or not?

If you CAN'T see the vascular structures of the lungs → over exposure. Repeat the x-ray and ask the patient to take hypo-inspiration → if it still black, this x-ray is called burned x-ray.

If you CAN'T see spines of vertebra → it is under exposure.

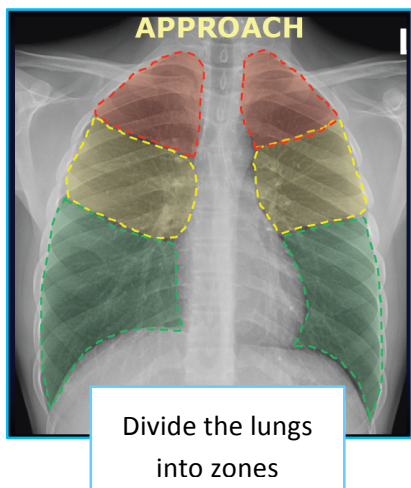
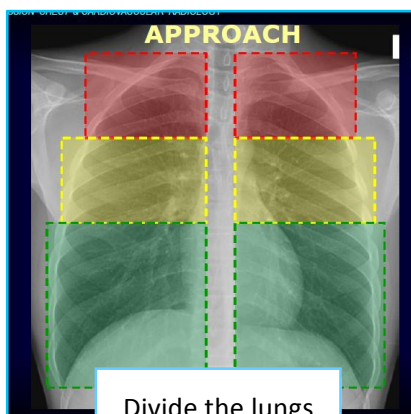
How can you differentiate if it is burned x-ray or a mastectomy? Usually, in a case of mastectomy, it will be one breast + you will be able to see the details of the lungs (vascular structures) unlike burned x-ray.

❖ Interpretation:

- In radiology, the original normal image is not given for comparison. Also, no one will tell you the number of abnormalities in each radiograph.
- The original or normal radiograph of a person of a certain age and sex is a mental image that must be developed.
- The best way to build up this mental picture is to understand the anatomy of that region and its variations.
- The best way to interpret the findings is to use a consistent system in analyzing the radiograph.

❖ The Chest Patterns:

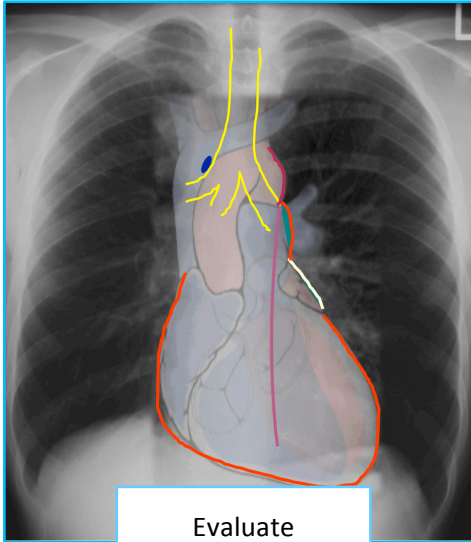
- Define the chest pattern of abnormality seen on the X-ray.
- Develop appropriate differential for such pattern recognized.
- Compare the two lung.
- Decrease your differential by:
 - 1- Careful analysis of the findings.
 - 2- Consider evaluation of previous exams.
 - 3- Correlate with clinical and laboratory data.
- Decide what the next step will be.



To interpret the lung you should divide the lungs into 3 zones:

- 1) Upper zone: first 2 ribs.
- 2) Middle zone: between 2nd and 4th rib.
- 3) Lower zone: the rest of the chest.

- Compare upper right with upper left, middle right with lower left and so on.
- This division is only to simplify the interpretation, it's not anatomical.

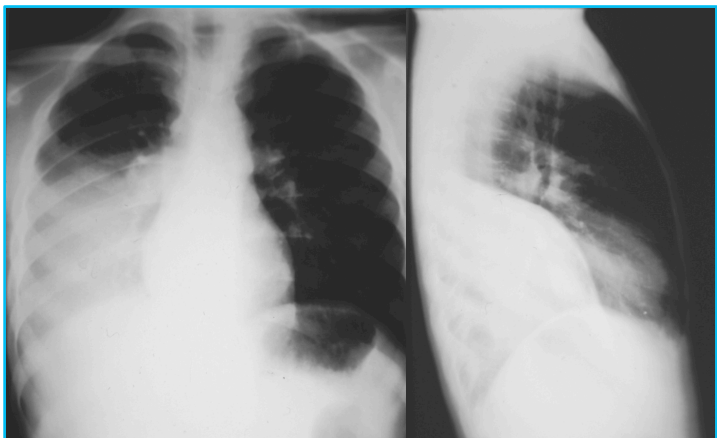
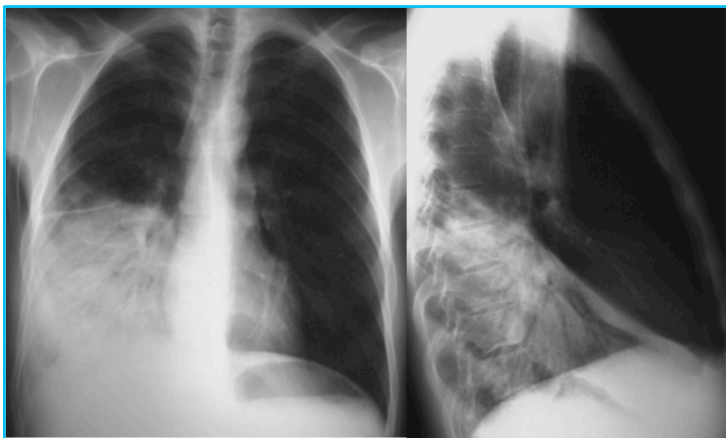


Evaluate mediastinum

- Aortic knob, superior left side.
- Pulmonary trunk
- Left ventricle forms the left border of the Mediastinum.
- Right atrium forms the right border of the Mediastinum.
- Mediastinum: central frontal chest x-ray, 2\3 on the left while 1\3 on the right
- Outline of the heart: two major curvature on the left side: aortic arch, pulmonary artery, left ventricle while only one curvature on the right: right atrium
- After that look at density of the heart (homogenous? lung? chest wall?)

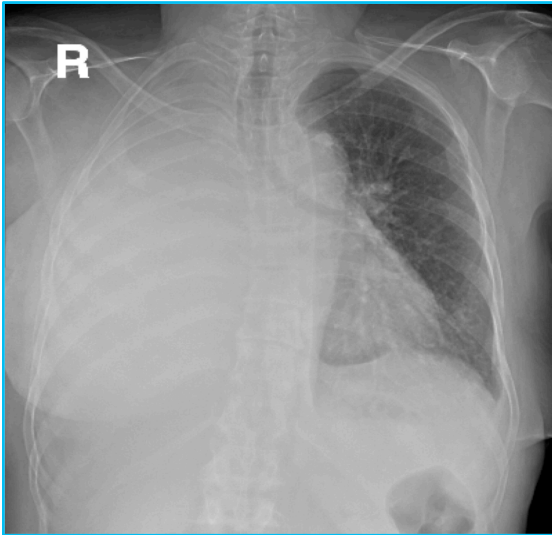
❖ Increased Pulmonary Densities (opaque):

Case 2: Adult patient presents with cough and fever for the last 3 days. His blood workup shows: WBC of $18 \times 10^9/L$ (High, mainly neutrophils). Chest X-ray was done. What is the most likely increased density pattern seen on this X-ray?



Diaphragm line is clear, so it's not pleural.
 Airbronchogram indicates alveolar pathology.
Answer: Lung parenchyma lesion.

- Most likely collapse.
 Loss of volume → the case is collapse (alveolar collapse) rather than consolidation (alveolar will only be filled with fluid, pus or blood)



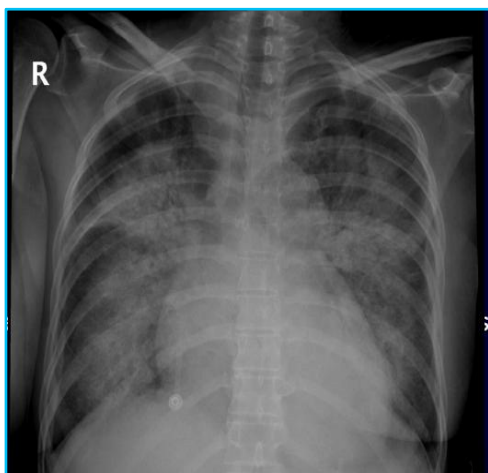
This is pleural effusion.

- Finding that support pleural effusion:
- The heart is not shifted (It's in the normal location)
- Complete opacification of right hemithorax.
- Homogenous
- No volume loss,
- No airbronchogram.
- If there's loss of volume: the heart will be shifted.
- If there's total collapse: loss of volume + mediastinum shifted to the collapsed side.

Case 3: An elderly patient presenting with dyspnea, cough and edema of both lower limbs.

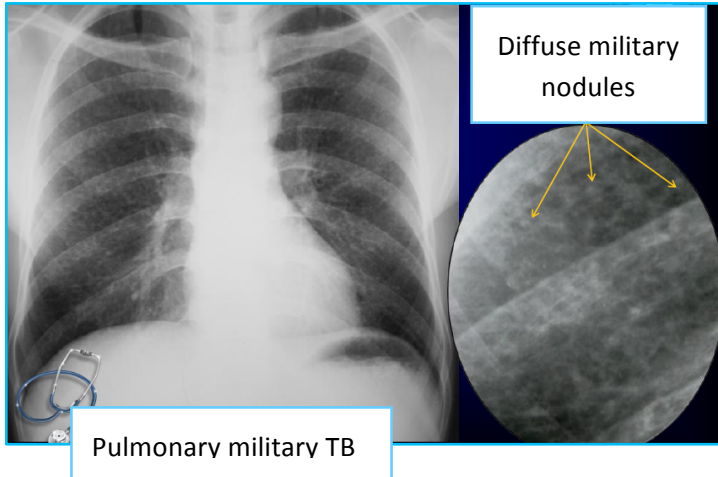
What is the most likely cause of the findings seen on this X-ray?

- A) Pneumonia.
- B) Interstitial pneumonitis.
- C) Pulmonary edema. (Wide spared air space shadow in both lungs. Heart is enlarged) ✓
- D) Pleural lesion.



Bat wing pattern.

❖ Increased Nodular Pulmonary Densities:

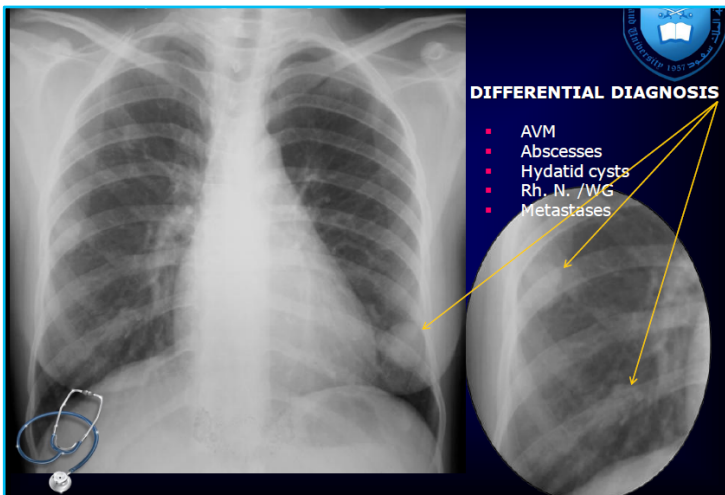


Case 4: An adult patient presenting with cough, fever and weight loss.

Nodular density: white tinny spot. (miliary shadow)

DDx:

- Arteriovenous malformation. (Usually larger nodules)
- Presence of microabscesses. (Not uniform)
- Hydatid cyst. (Larger nodules)
- Rheumatoid nodules.
- Pulmonary metastasis. (E.g. from thyroid cancer)

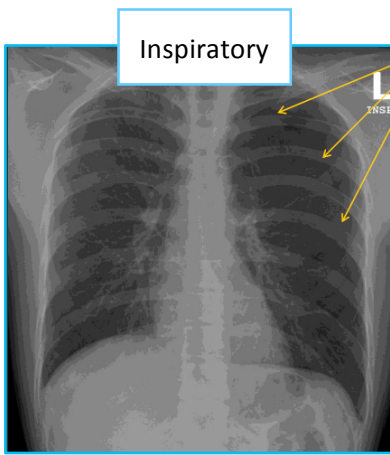


Case 5: Adult female presenting with cough and weight loss.

DDx:

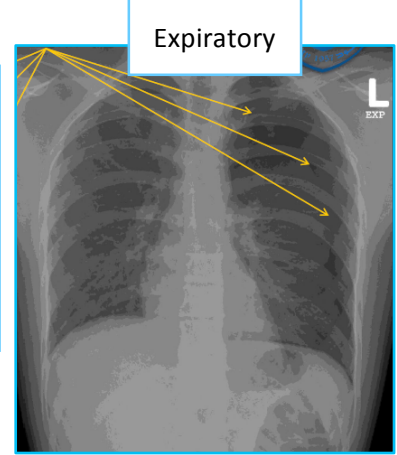
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❖ Decreased Pulmonary Densities (translucent):



Inspiratory

Pneumothorax on the left side
Evident by increased density of
the periphery of the lung. No
vascular marking in that
region. Thin visceral pleural
line seen outlining the lung.



Expiratory

Case 6: Young adult presenting with acute chest pain. Known to have bronchial asthma.

Pneumothorax. (Note: Pneumothorax is more clearly seen on the expiratory film than inspiratory one)

DDx of acute chest pain:

Lung: Pneumothorax – Pneumonia.

Cardio: Myocardial infarction - Pulmonary embolism (Most cases with normal x-ray) - Aortic dissection. (Expect the mediastinum to be wider)

GI: Esophageal rupture - Peptic ulcer.

Chest wall and muscles: Rib fracture.

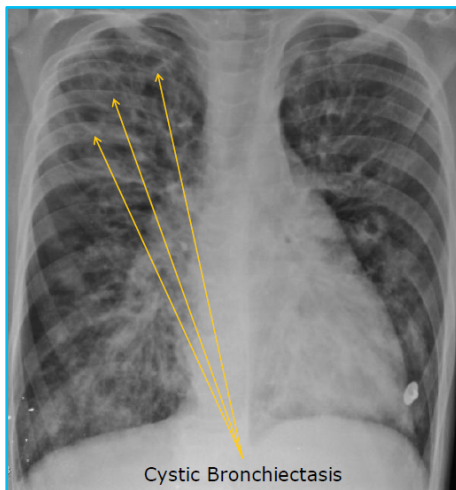
Foreign body. (Usually in younger age group)

Pneumothorax: We expect to see lung retraction with area of translucency within the region of pneumothorax.

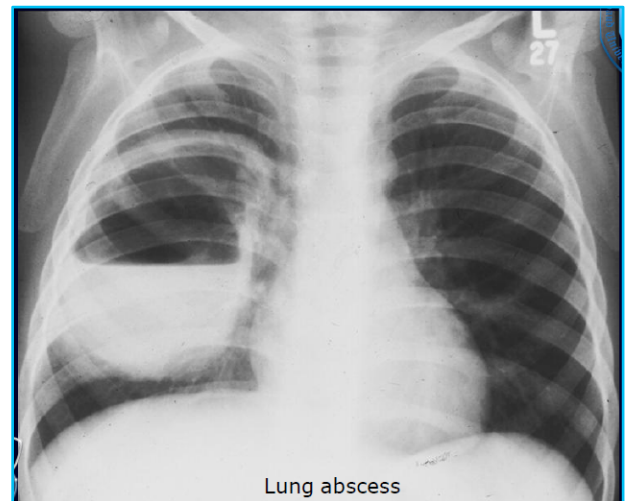
To confirm this:

- 1- we need to visualize plural reflection of the retracted lung, medially to the mediastinum. It's the most important sign.
- 2- In the periphery: Devoid lung marking.

❖ Cavitory/Cystic pulmonic lesions:



Cystic Bronchiectasis



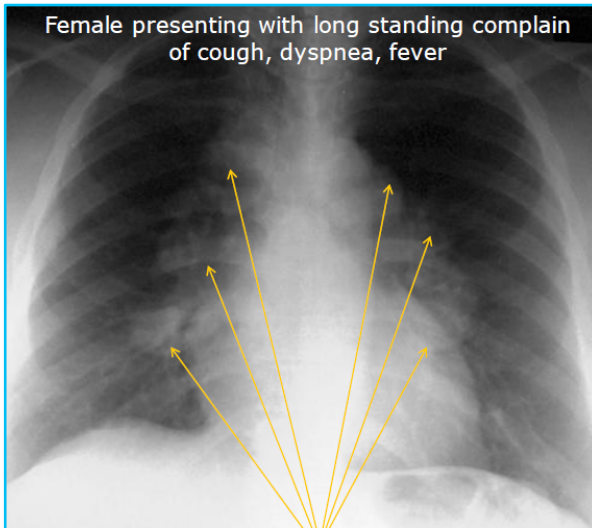
Lung abscess

Case 7: A 12 year-old child presenting with recurrent chest infection

Cystic bronchiectasis. (It's an important differential)

Large cystic area: air inside the cavity with fluid in the dependent portion, thick wall (inflammatory process)

❖ Mediastinal Masses:



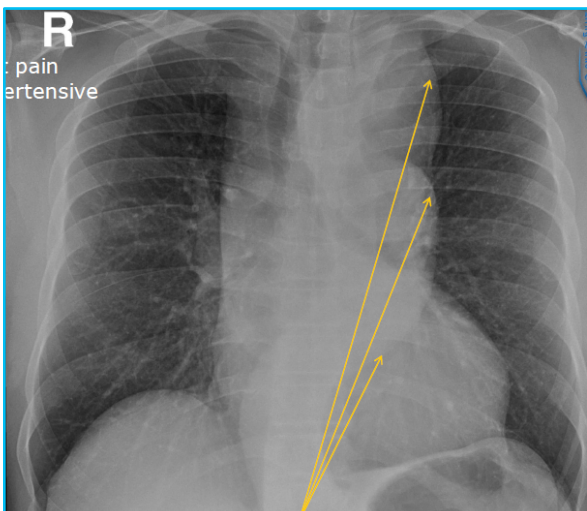
Sarcoidosis - Bilateral hilar lymphadenopathy

Case 8: Female presenting with long standing complain of cough, dyspnea and fever.

- Widening of mediastinum
- Lobulation bilaterally = enlarged mediastinum lymph nodes.

DDx:

- Sarcoidosis. (Bilateral + symmetrical hilar adenopathy)
- Lymphoma.
- Pulmonary TB.



Aortic dissecting aneurysm – tortuous aorta

Case 9: A young patient presenting with acute chest pain. Known case of hypertension.

- Young + acute chest pain + known hypertensive + widening of mediastinum = aortic dissection \ aneurysm.
- It can appear lobulated, unilateral but not bilateral)

<http://www.med-ed.virginia.edu/courses/rad/cxr/>
<http://www.radiologyanatomy.com/index.php>
<http://eradiology.bidmc.harvard.edu/LearningLab/>

**Good
Luck!**

