

WELCOME!

RESPIRATORY

PATHOLOGY

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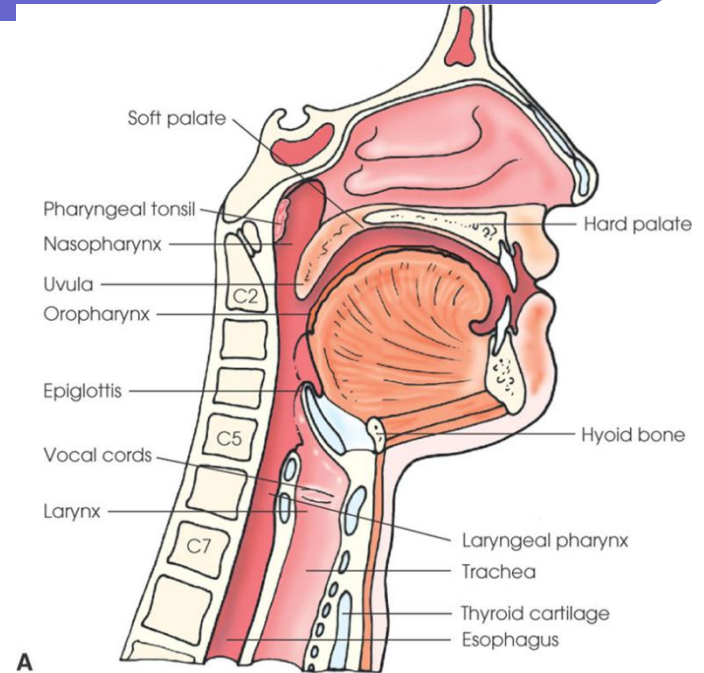
Respiratory

Oxygenation of blood and the removal of waste products of the body in the form of carbon dioxide.

Respiration controlled by medulla in the brain.

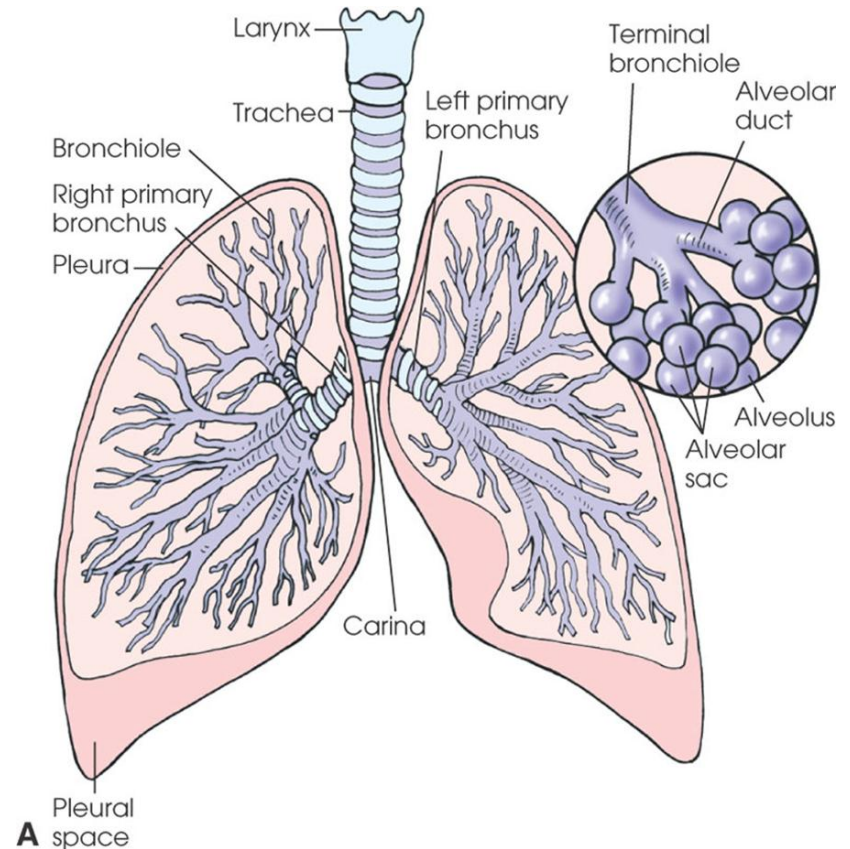
Upper respiratory tract

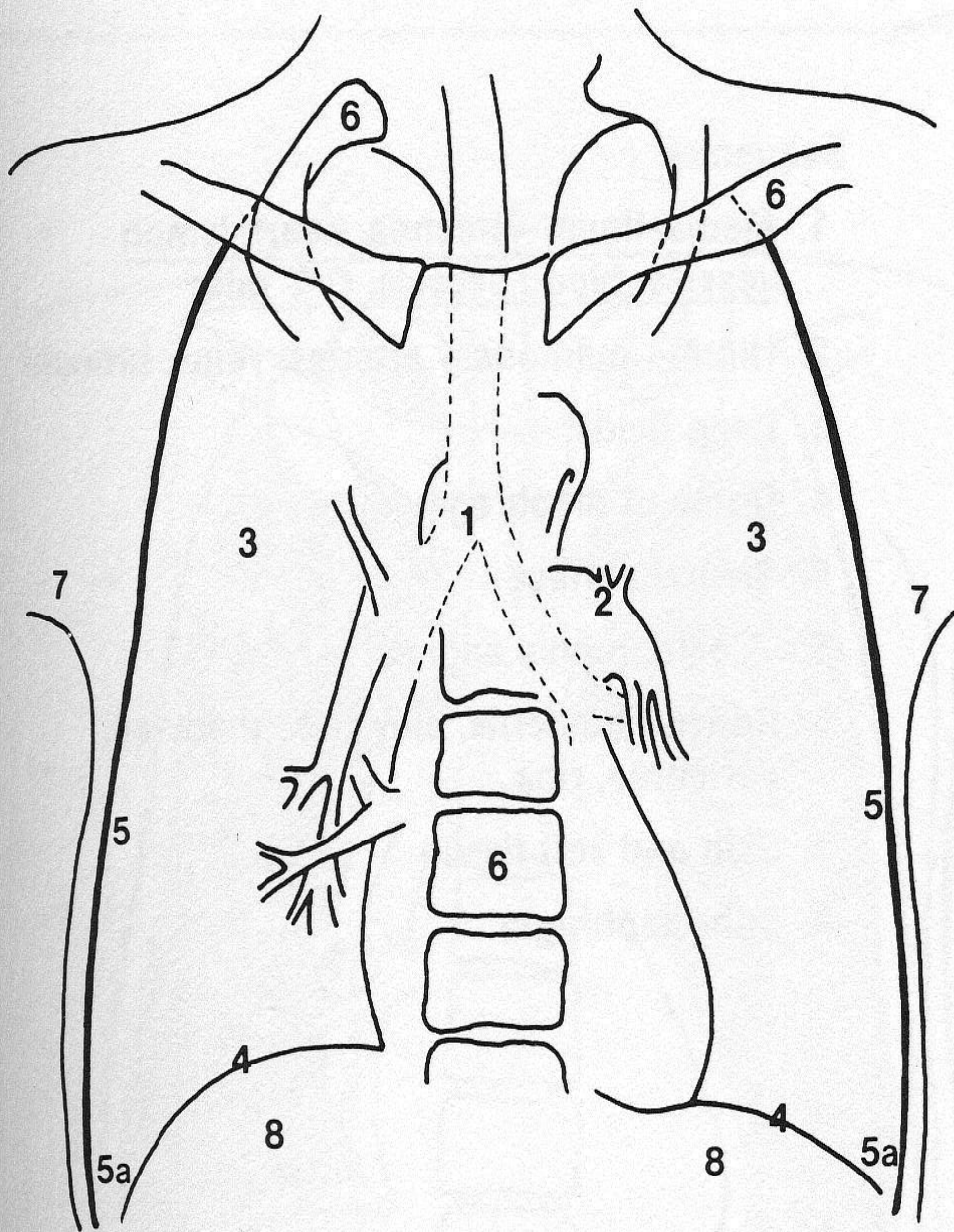
- Mouth
- Larynx
- Nasopharynx
- Oropharynx
- Laryngopharynx
- Last 3 make up the pharynx (throat)



Lower respiratory tract

- Trachea (windpipe)
- Bronchus
- Lungs
- Bronchioles
- Alveoli





Sequence:

1. Mediastinum—trachea, heart, lymph vessels, blood vessels, C/T ratio
2. Hilum—pulmonary arteries, veins, bronchi
3. Lung fields
4. Dome of diaphragm
5. Pleural surface
- 5a. Costophrenic angles
6. Bones—humerus, clavicles, scapulae, vertebrae, ribs
7. Skin and soft tissue
8. Sub-diaphragm

Lungs

- Rt. Lung has 3 lobes- shorter and wider than the Lt. lobe because of the liver.
- Has 10 segments
- Has 2 fissures
- Lt. Lung has 2 lobes- has less volume because of heart.
- Has 1 fissure

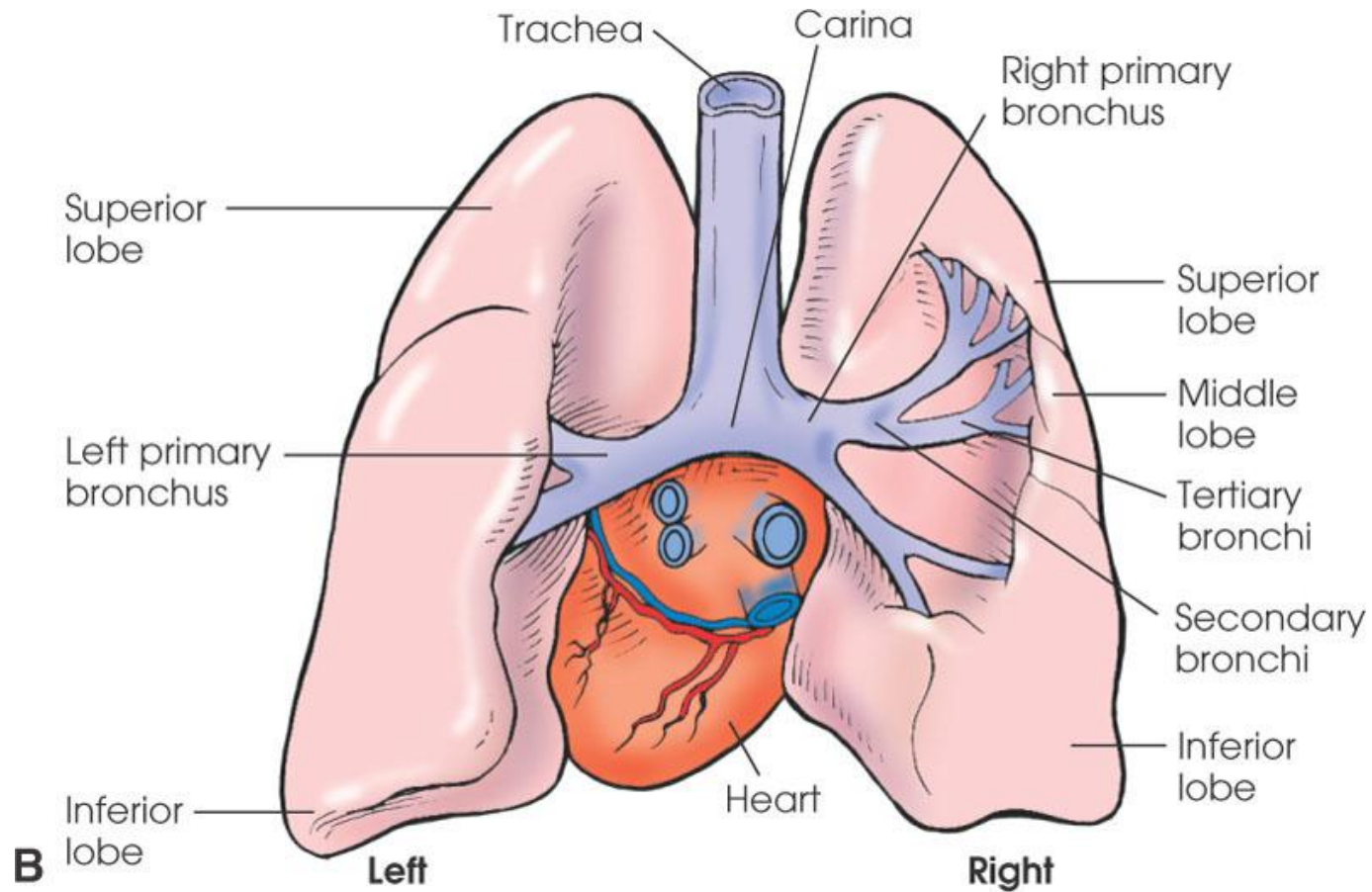
Lung Membrane

- Visceral pleura- covers the lung
- Parietal pleura- covers the inner chest wall or thoracic cavity
- Pleural cavity- contains small amount of fluid to lubricate surfaces. This prevents friction when the lungs expand and contract.

MEDIASTINUM

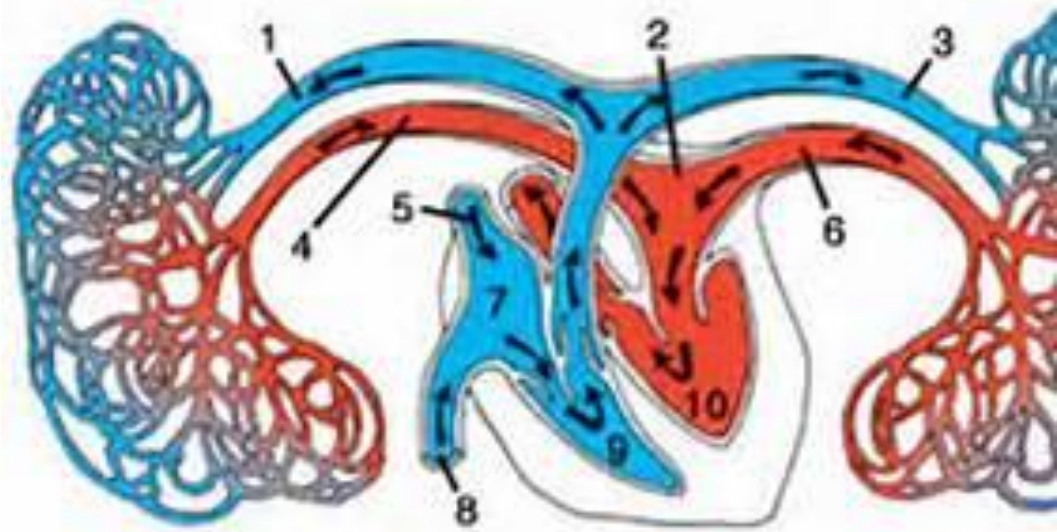
- Great vessels
 - Heart
 - Esophagus
 - Trachea
 - Thymus
- (GHETTO without the “O”)

HILUM- the area of an organ where everything enters and exits



Vessels

- Pulmonary artery- Deoxygenated blood (4 & 6)
- Pulmonary veins- Oxygenated blood (1 & 3)



X-ray of the Chest

- Lt lateral normally done because it best views the heart.
- Rt laterals are done to demonstrate any abnormalities of the right lung
- Done at 72" - even portables because they are done AP
- Try to do upright- fluid levels
- Decubs- affected side down to check for fluid; affected side up to check for air. The side that is down is the name of the decub.
- Lordotic view- visualizes apical region

CONGENITAL DISORDERS:

PATHOLOGY

Cystic Fibrosis

- Inherited (congenital) disease that involves the dysfunction of the exocrine glands. Caused by a defective gene.
- Mainly involves the respiratory and digestive system.
- Abnormal thick secretions of mucus.
- Sweat test – a test performed to diagnose cystic fibrosis; CF patients have an excess of chloride in their sweat

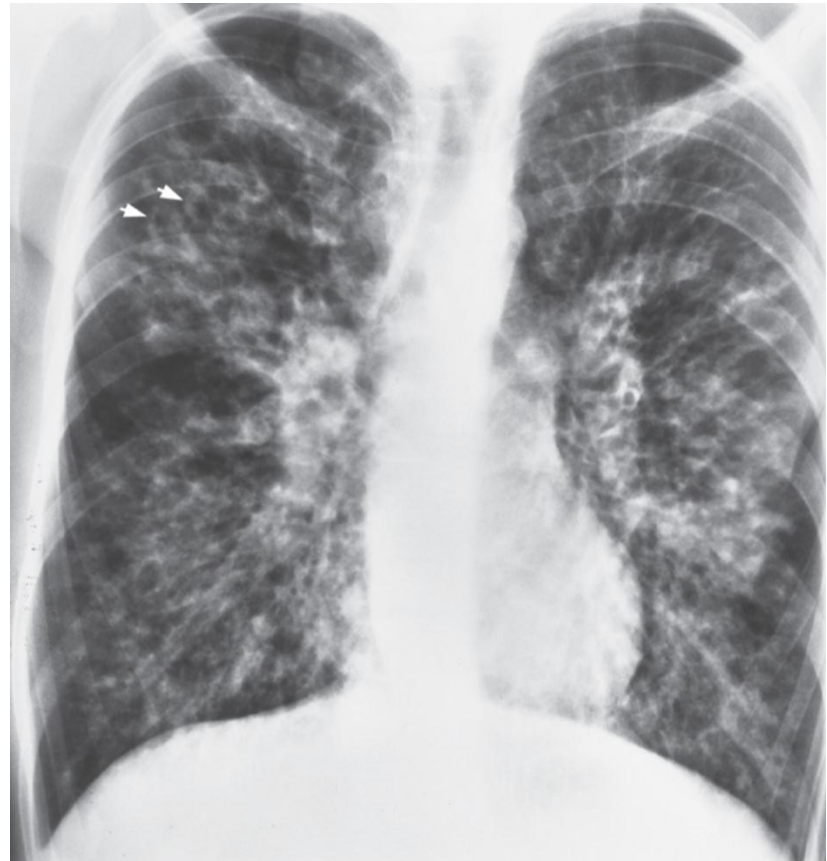
Worldwide it affects 70,000 people

Here are a few signs and symptoms to look for:

- Coughing
- Salty skin
- Poor weight gain
- Diarrhea or bulky, foul-smelling, greasy stools
- Constipation
- Wheezing
- Crackles

Radiographic Appearance:

- ✓ Thickening of linear markings
- ✓ Hyperinflation
- ✓ Resembles COPD in older patients



Respiratory Distress syndrome (RDS) or Hyaline Membrane Disease (HMD):

One of the most common problems of premature babies.

- Caused by loss of surfactant.
- Surfactant is normally released into the lung tissues where it helps lower surface tension in the airways. This helps keep the lung alveoli (air sacs) open.
- When there is not enough surfactant, the tiny alveoli collapse with each breath.

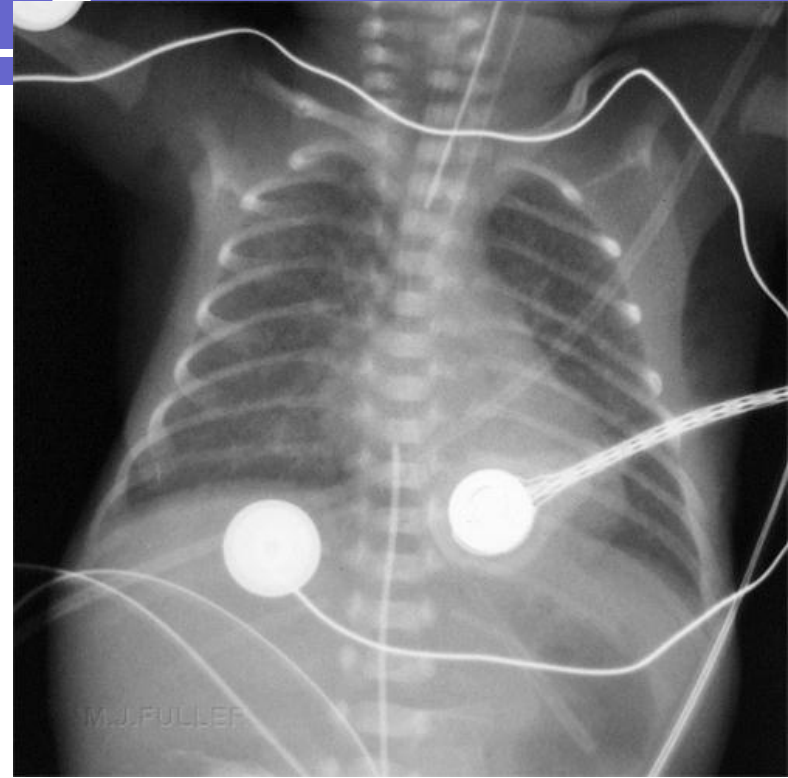
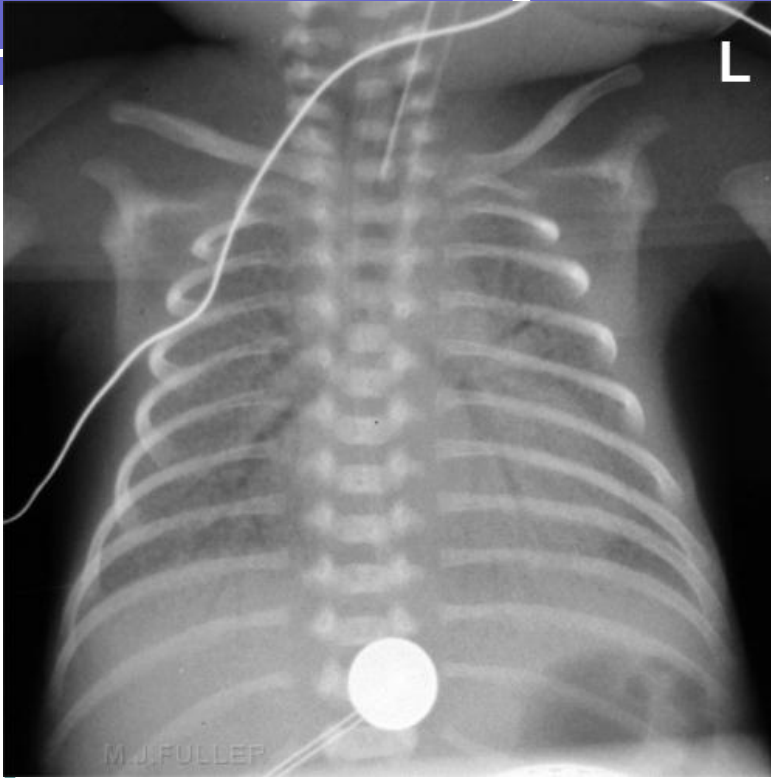
Symptoms/Treatment

- The symptoms of RDS usually peak by the third day, and may resolve quickly when the baby begins to excrete excess water in urine and begins to need less oxygen and mechanical help to breathe.

Signs

- cyanosis (blue coloring)
- flaring of the nostrils
- tachypnea (rapid breathing)
- grunting sounds with breathing
- chest retractions (pulling in at the ribs and sternum during breathing)

Chest x-rays of lungs



This is a typical RDS/HMD appearance on day 1. Note the following

- diffuse granuloreticular pattern
- airbronchogram lines

Compare this with the chest X-ray on the right which is 'near normal'

ACUTE DISORDERS

PATHOLOGY

Croup-

Viral infection that causes spasm and constriction of the airway.

- Occurs in very young children; 1-3 years old
- Rough, bark-like cough



Pulmonary Edema-

Excess accumulation of fluid within the lung.

There is fluid where air is suppose to be.

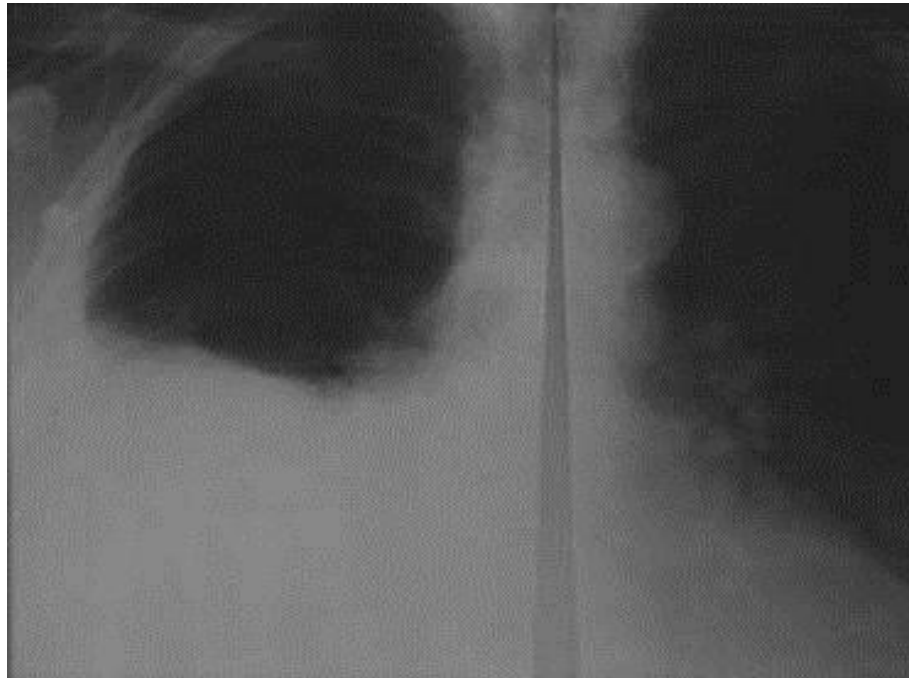
- Generally, divided into cardiogenic and non-cardiogenic categories.
- Congestive heart failure is the leading diagnosis in hospitalized patients older than 65

Cardiogenic Pulmonary Edema

- Heart failure
- Coronary artery disease with left ventricular failure.
- Cardiac arrhythmias
- Fluid overload -- for example, kidney failure.
- Cardiomyopathy
- Obstructing valvular lesions
- Myocarditis and infectious endocarditis

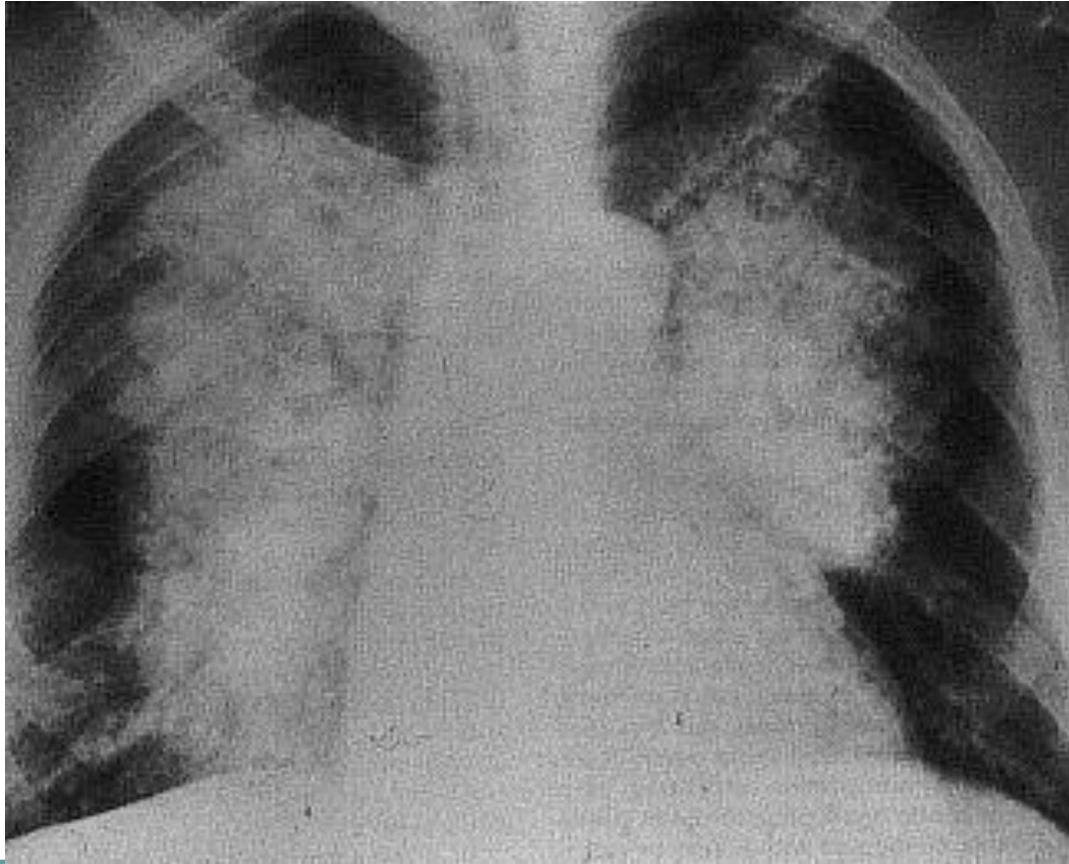
CHF

CHF is when the heart can't maintain sufficient arterial pressure and can't provide enough oxygenated blood to tissues



Cardiogenic Pulmonary Edema

- **CHRONIC RENAL FAILURE**



Non-cardiogenic Pulmonary

Edema- due to changes in capillary permeability

- Smoke inhalation.
- Head trauma
- Overwhelming sepsis.
- Hypovolemia shock
- Re-expansion
 - By drainage of a large pleural effusion with thoracentesis
 - Of the lung collapsed by a large pneumothorax
- High altitude pulmonary edema
- Disseminated intravascular coagulopathy (DIC)
- Near-drowning
- Overwhelming aspiration
- Heroin overdose

Non-cardiogenic Pulmonary Edema

- NEAR DROWNING



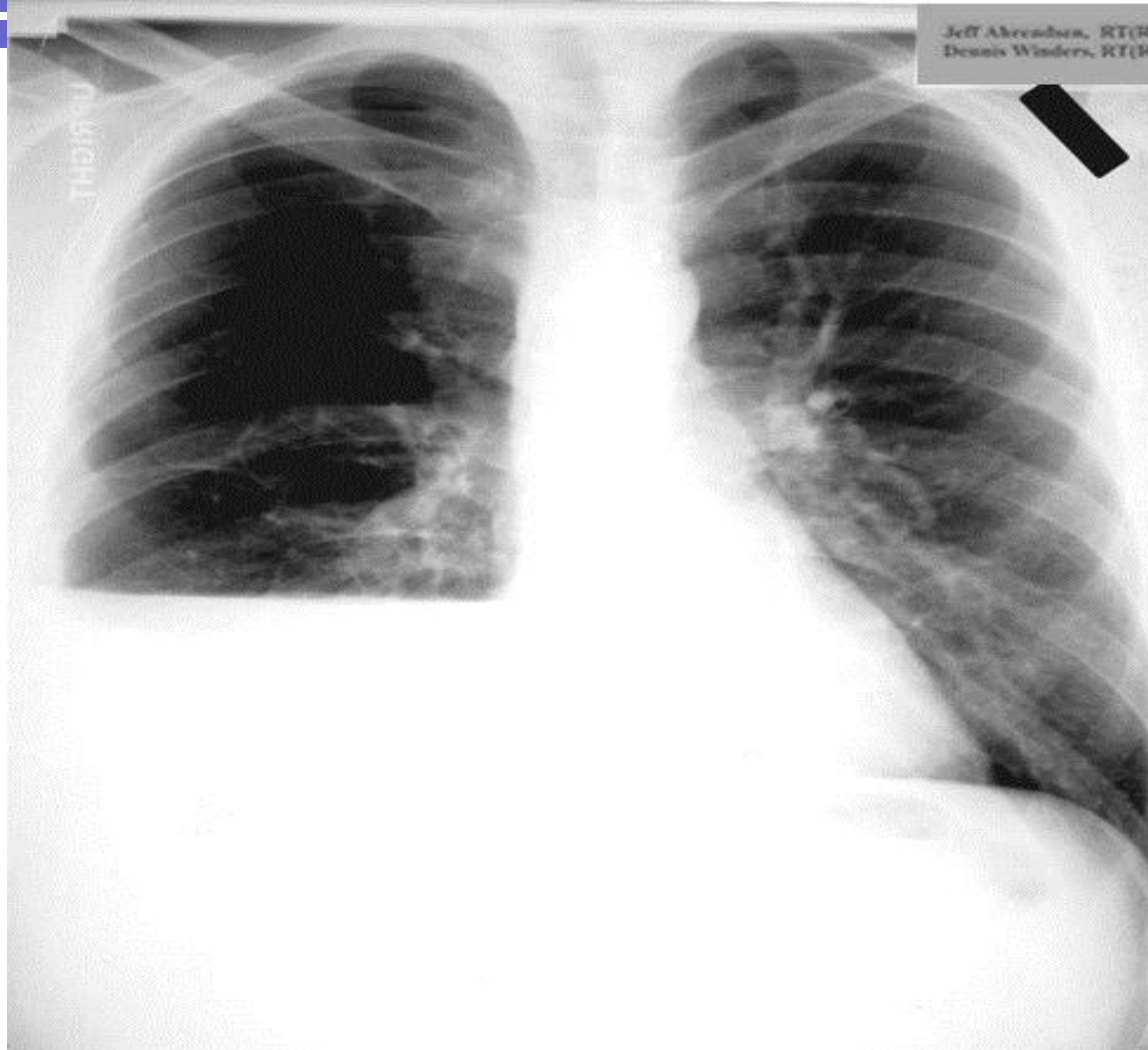
Pleural Effusion

- Accumulation of fluid in the pleural space
- Caused by:
 - Inflammation
 - Recent surgery
- Radiographic appearance:
 - Blunting of the costophrenic angle
 - Fluid level seen
 - Always do upright or decubitus (decub)
 - Decub – horizontal beam
 - Always try to do lateral chest x-ray
 - CT also useful in demonstration of pleural fluid

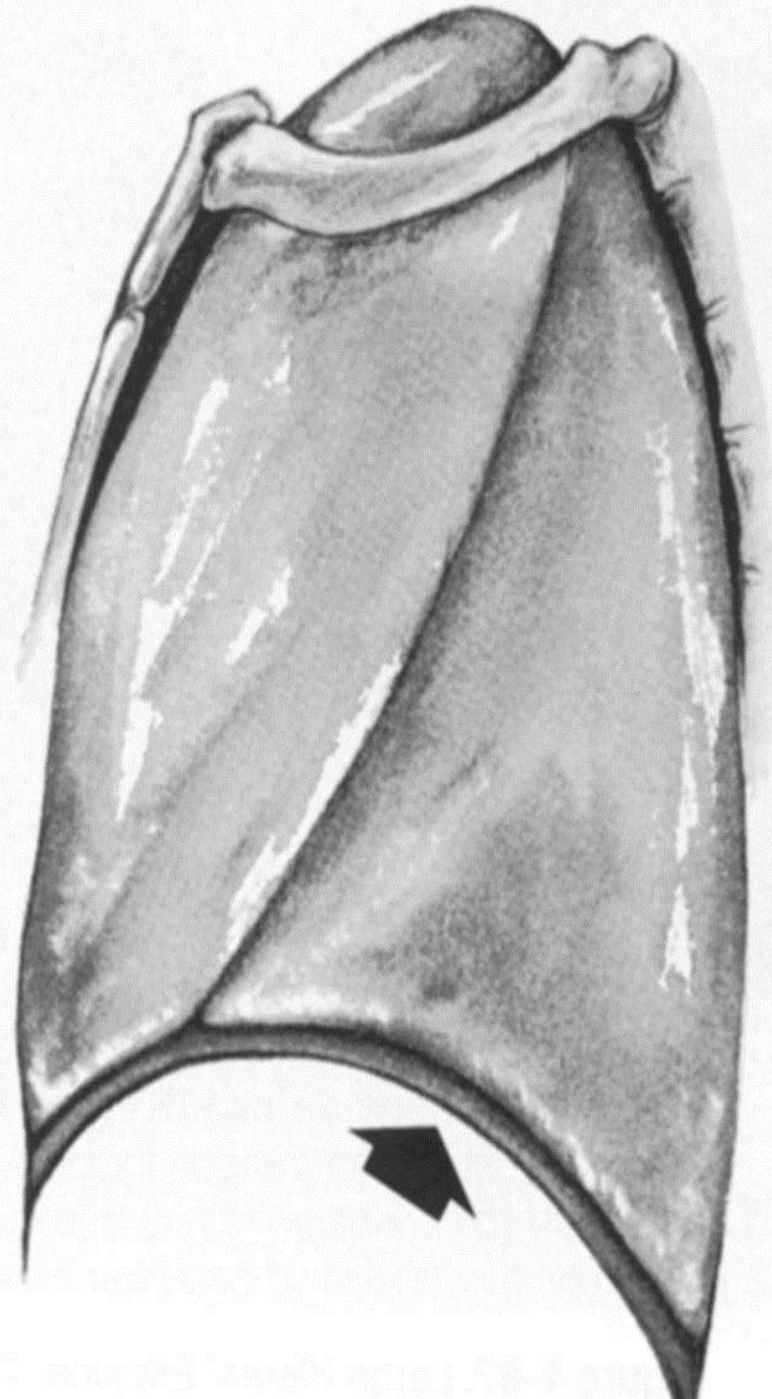
PLEURAL EFFUSION

- Effusion is one of most important pleural abnormalities observed in thoracic disease.
- Fluid accumulation will separate the visceral and parietal pleura and compress the lungs.
- Compression will cause lungs to collapse (atelectasis)
- Produces a restrictive lung disorder.

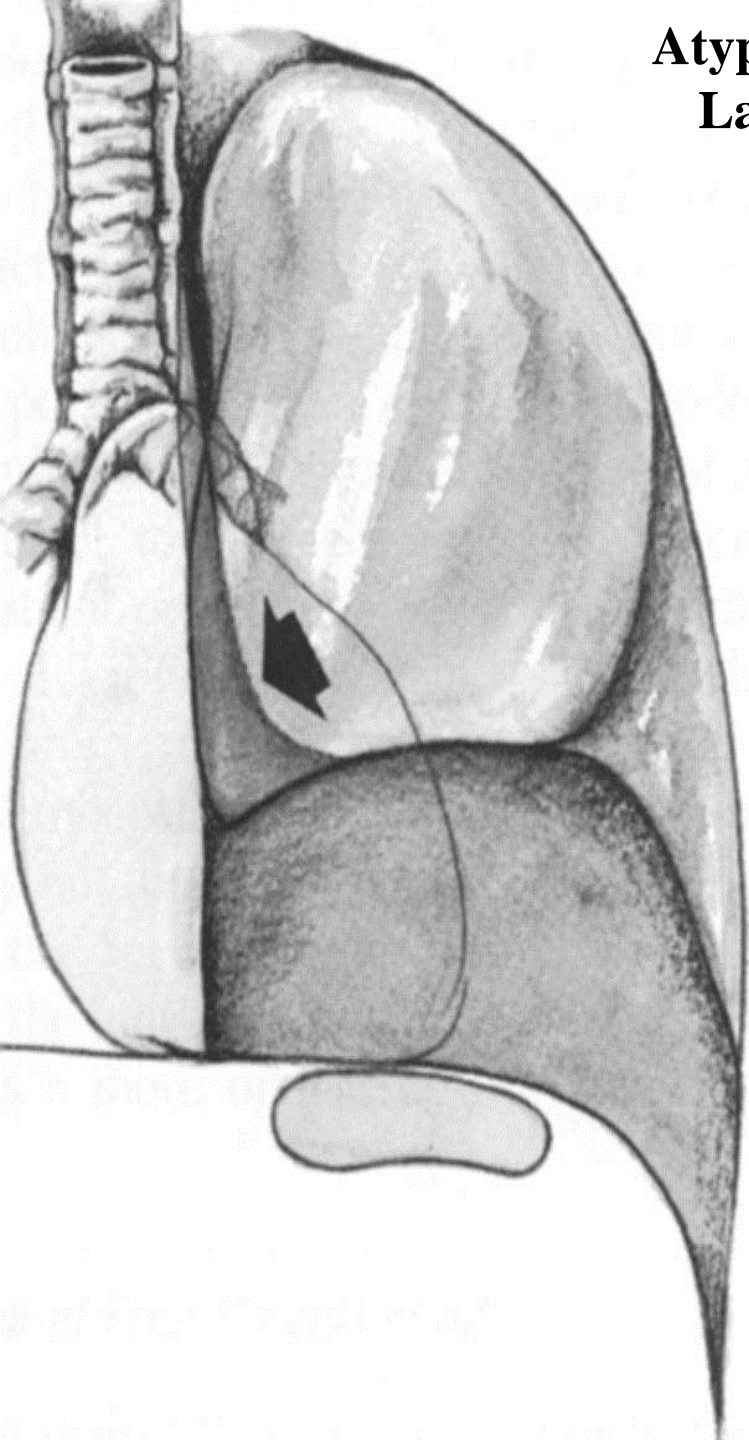
Pleural Effusion

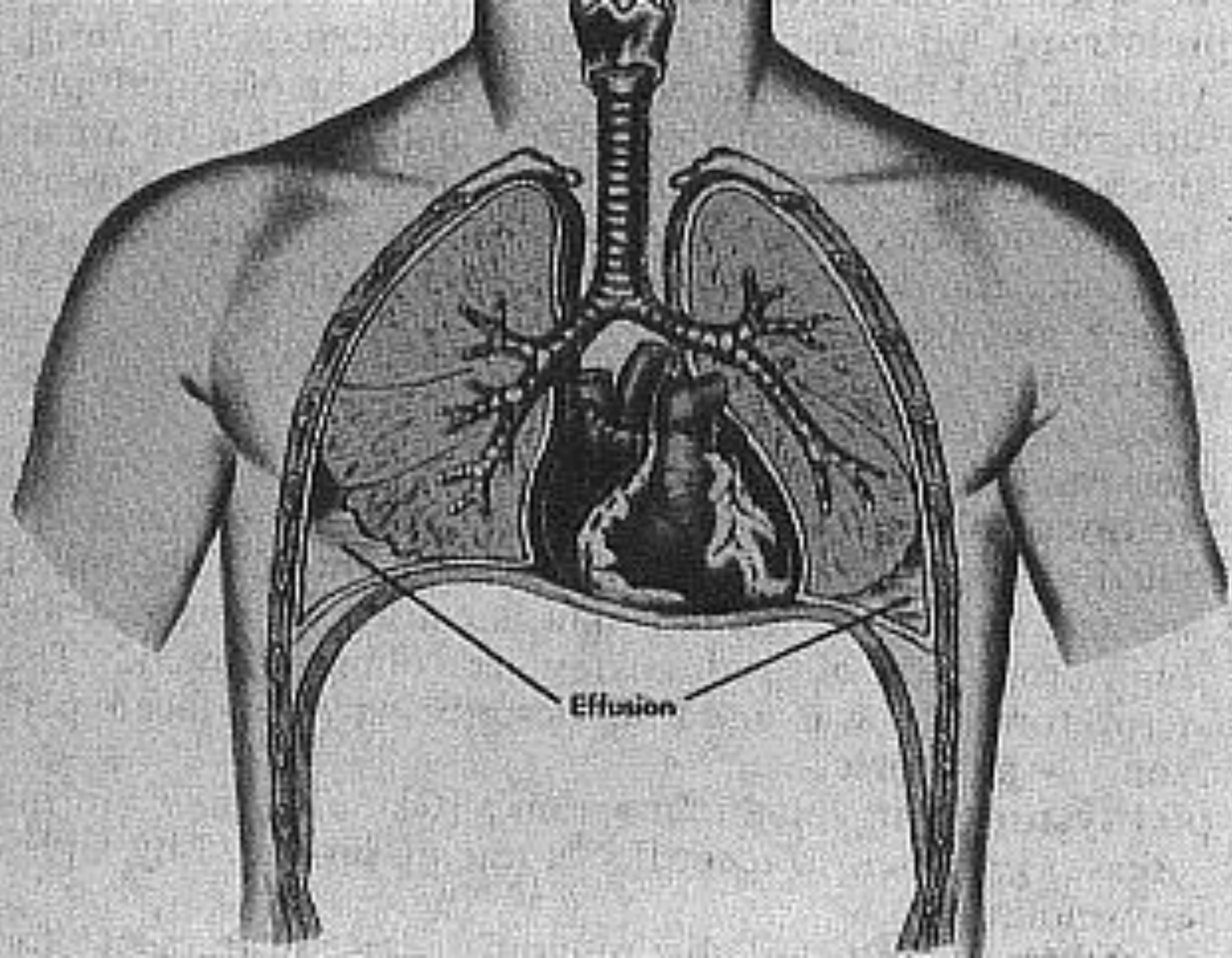


Typical quantity of pleural fluid
Up to 300 ml



Atypical pleural fluid
Large – 1500 ML





Effusion

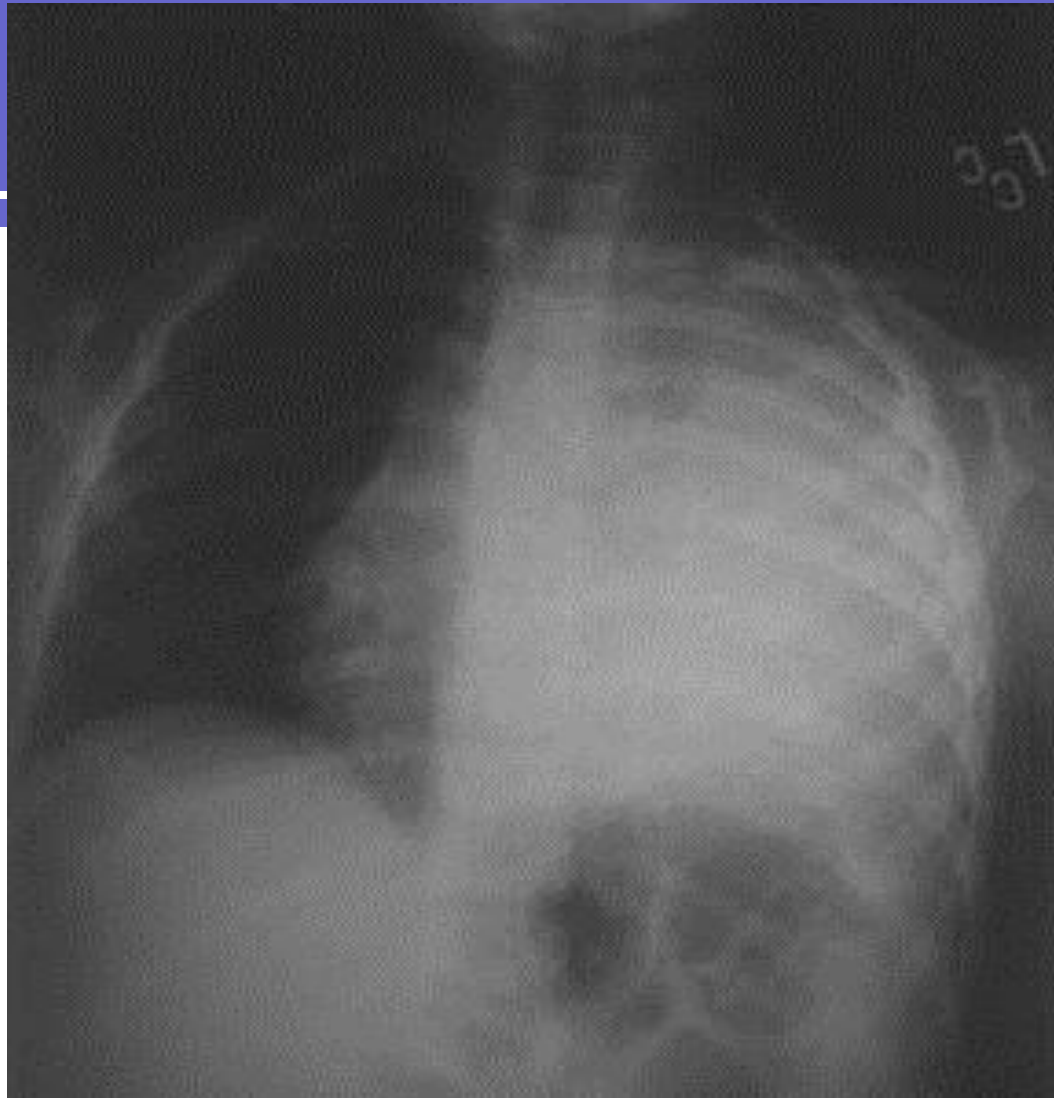
Atelectasis:

Collapse of all or part of the lung.

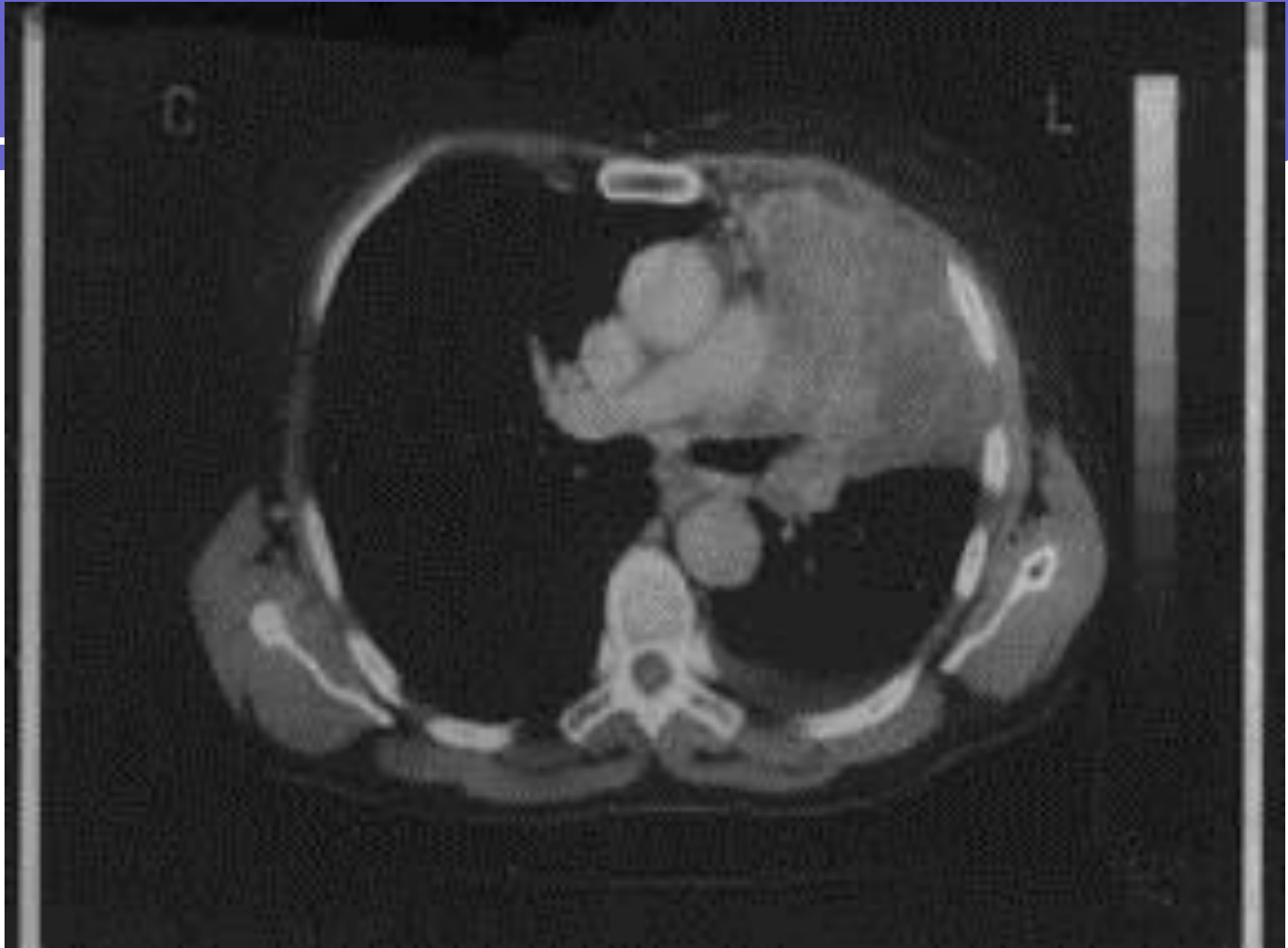
- Can be caused by obstruction of the bronchus due to foreign matter or mucous
- Pressure to lungs can cause atelectasis-tumors, aneurysms, enlarges lymph nodes

Atelectasis:

- Term “atelectasis” derived from Greek words *ateles* (incomplete) and *ektasis* (stretching)
- Is a state of incomplete expansion
- Is a loss or diminished air volume
- Air in the alveoli is decreased or absorbed



Shift in mediastinum with Atelectasis



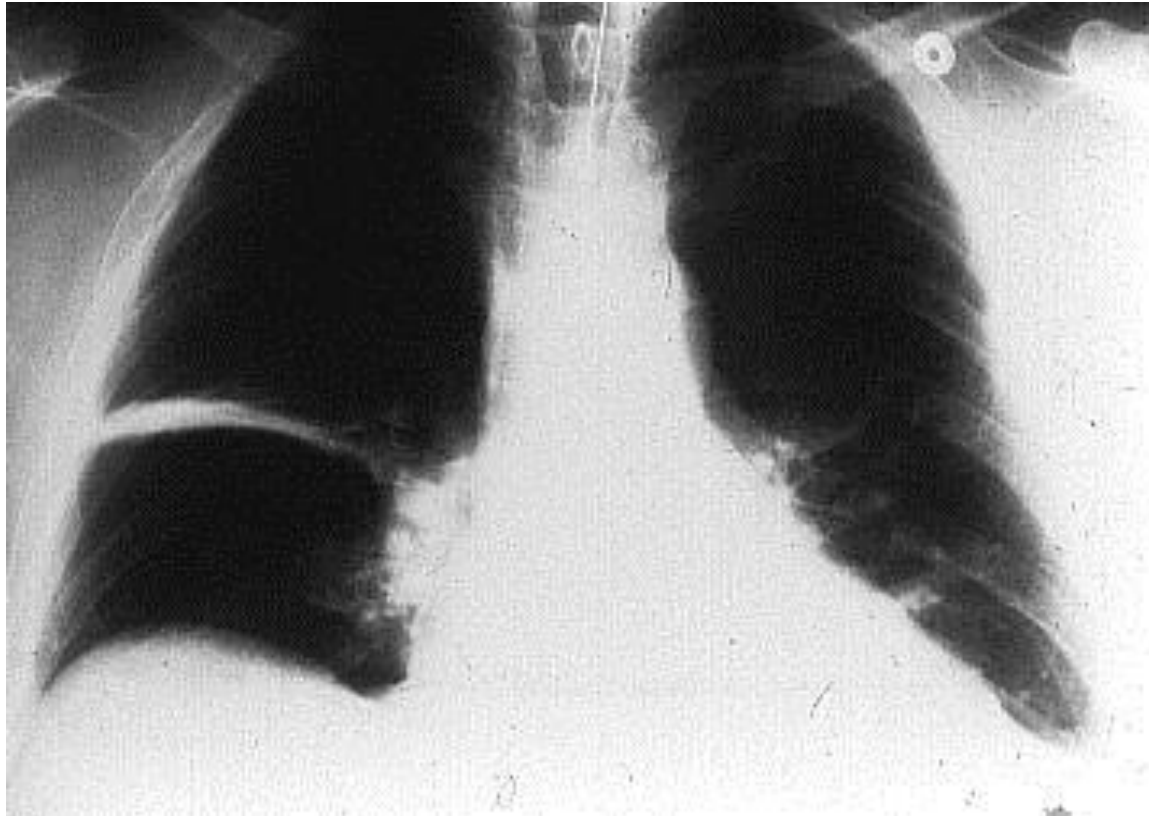
Mass

SIGNS

- **Obstruction of a small bronchus**
- **Produces a horizontal plate-like line often seen in the lung base**

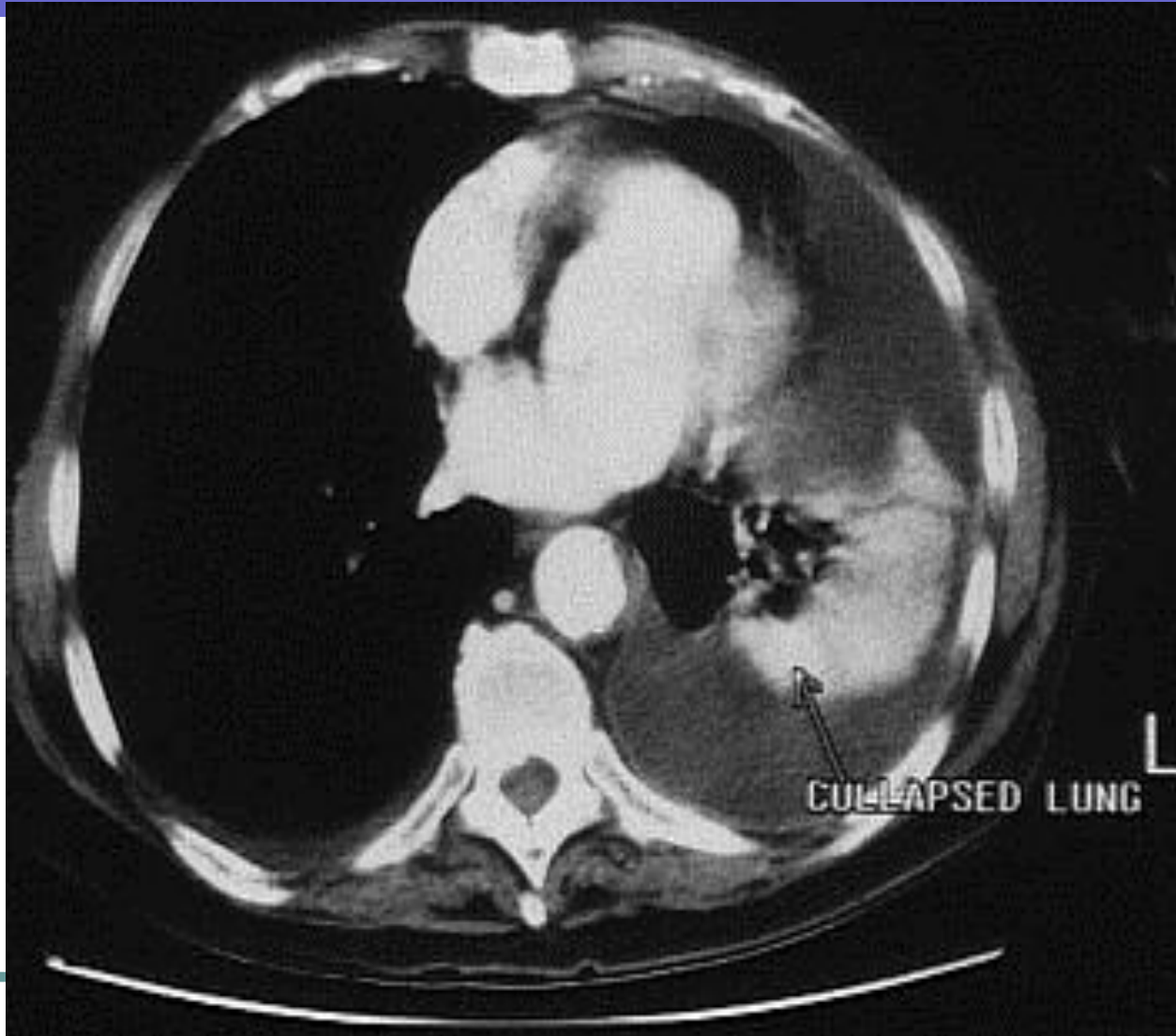
ATELECTASIS

- **SEGMENTAL ATELECTASIS**





ATELECTASIS



Pneumothorax:

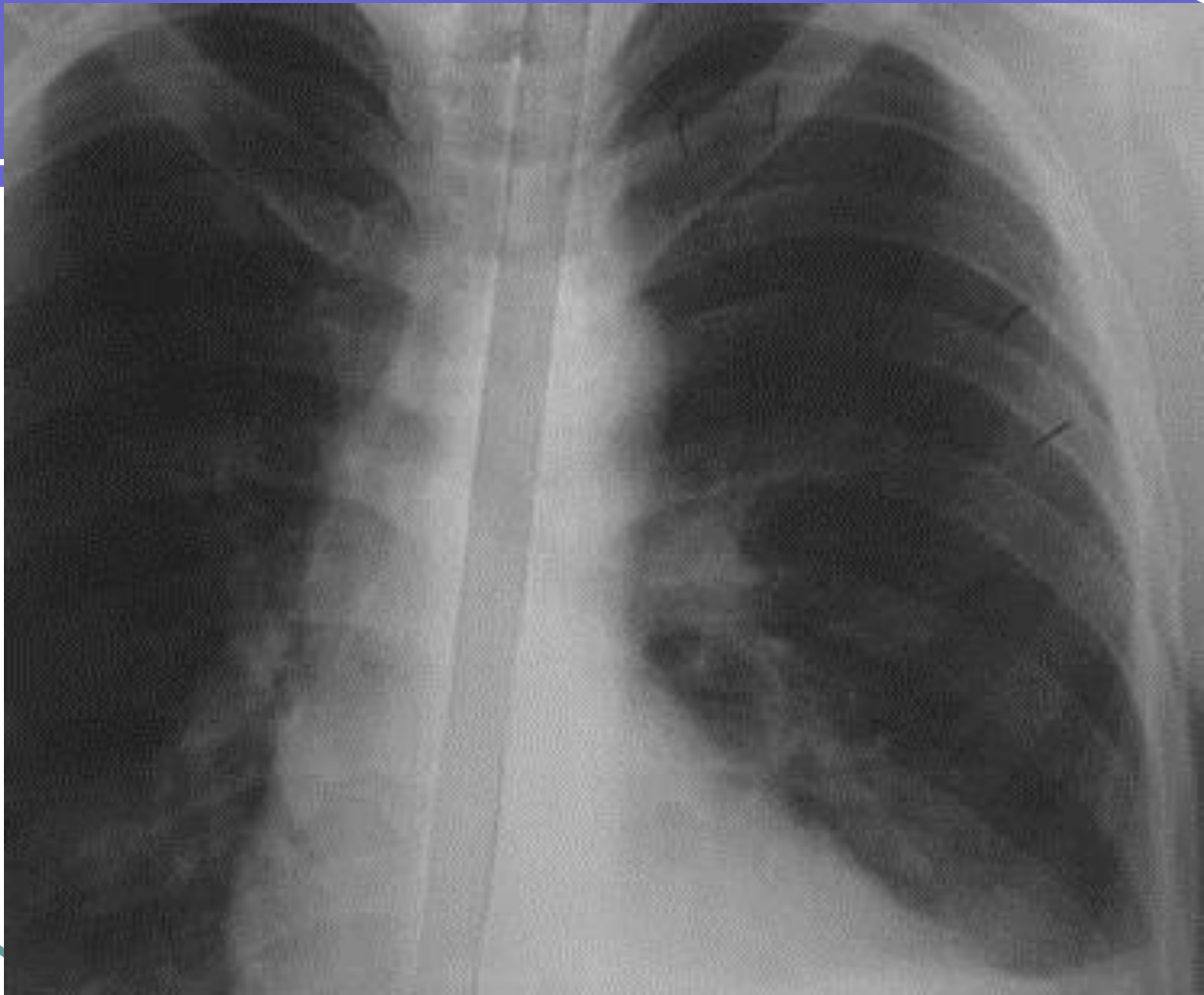
- Free air in the pleural space of the thorax
- Complete or partial collapse of lung
- Air causes separation of visceral and parietal pleura
- As lungs collapse, alveoli are compressed and atelectasis ensues
- Pulmonary veins may be compressed also
- Caused by trauma, lung disease, and other conditions
- Do CXR upright with **inspiration** and **expiration** views

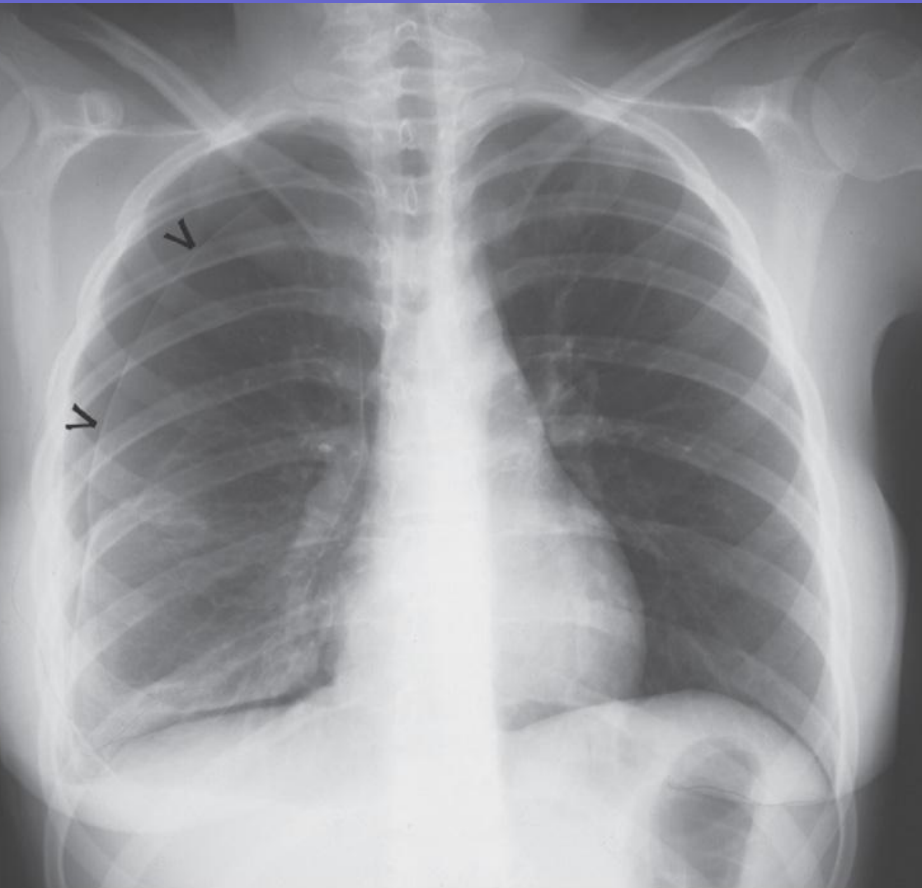
Pneumothorax continued:

- 1. **Tension pneumothorax**- when air enters cavity and does not leave during expiration. Causes shift of the mediastinal structures toward the collapsed lobe.
- 2. **Spontaneous pneumothorax**- Usually affects healthy adults between 20-40 yrs. of age & is associated with hyposthenic and asthenic patients. Rupture of “blebs” or blisters that form on the lung surface.

Pneumothorax continued:

- 3. **Open pneumothorax**- when air flows between the pleural space and the outside of the body (gunshot wound, stabbing)
- 4. **Closed pneumothorax**- air reaches the pleural space directly from the lung (spontaneous, lung disease, mets)





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Inspiration

B



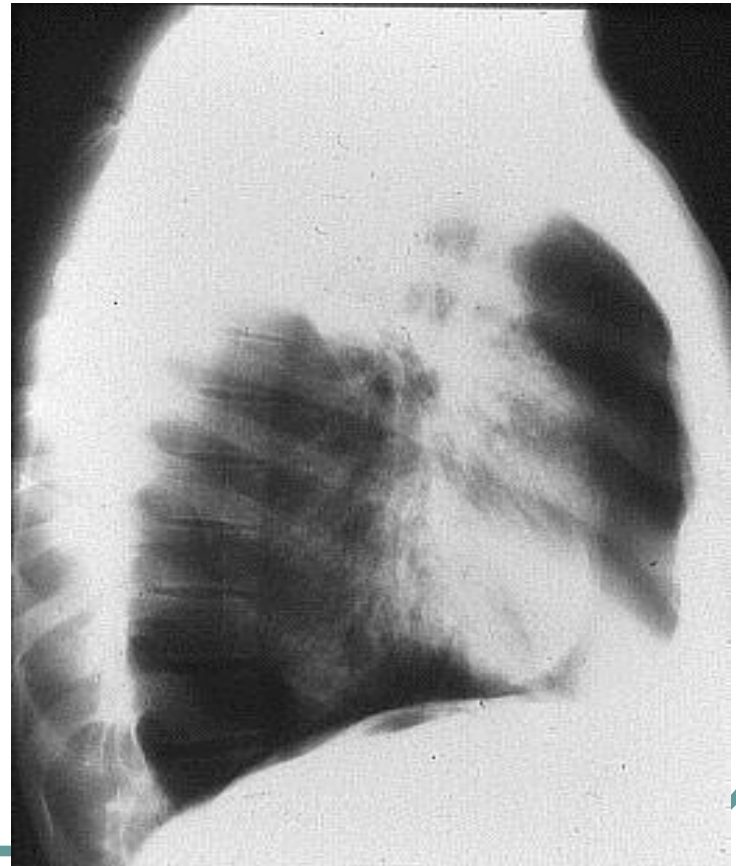
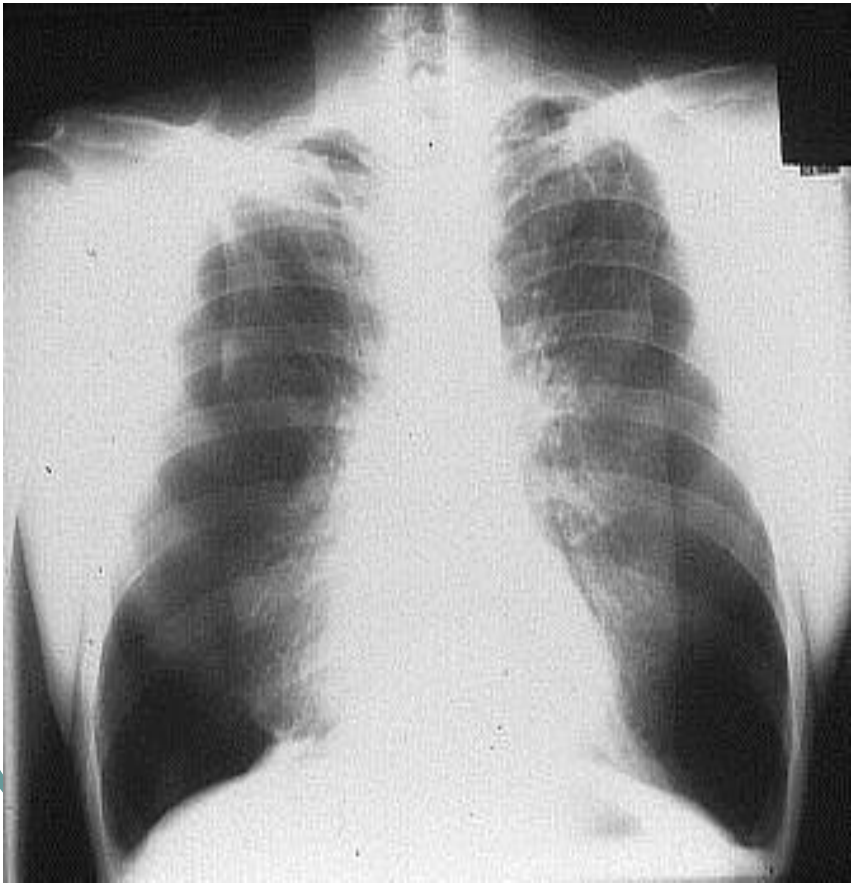
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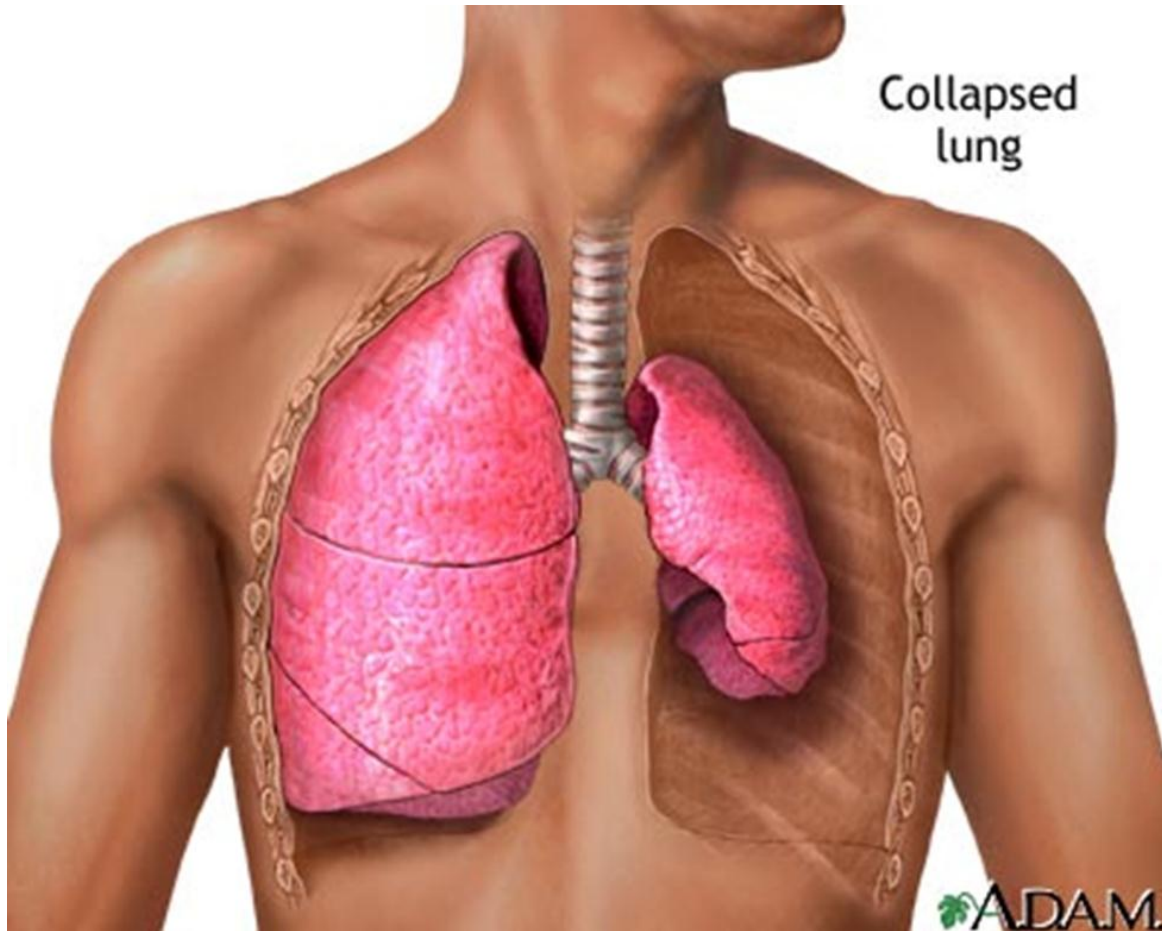
Expiration

Pneumothorax

PNEUMOTHORAX

- PLEURAL/LUNG EDGE/EDGE SIGN





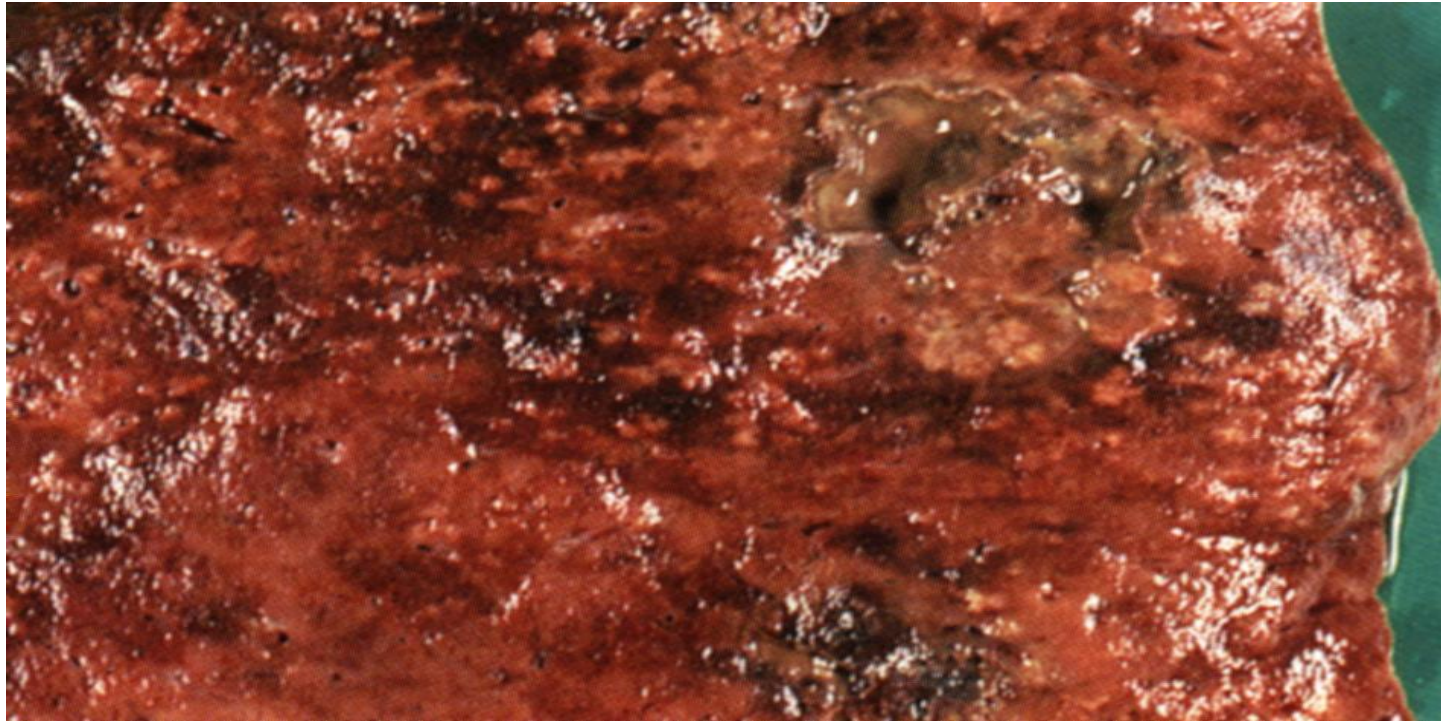
Collapsed
lung

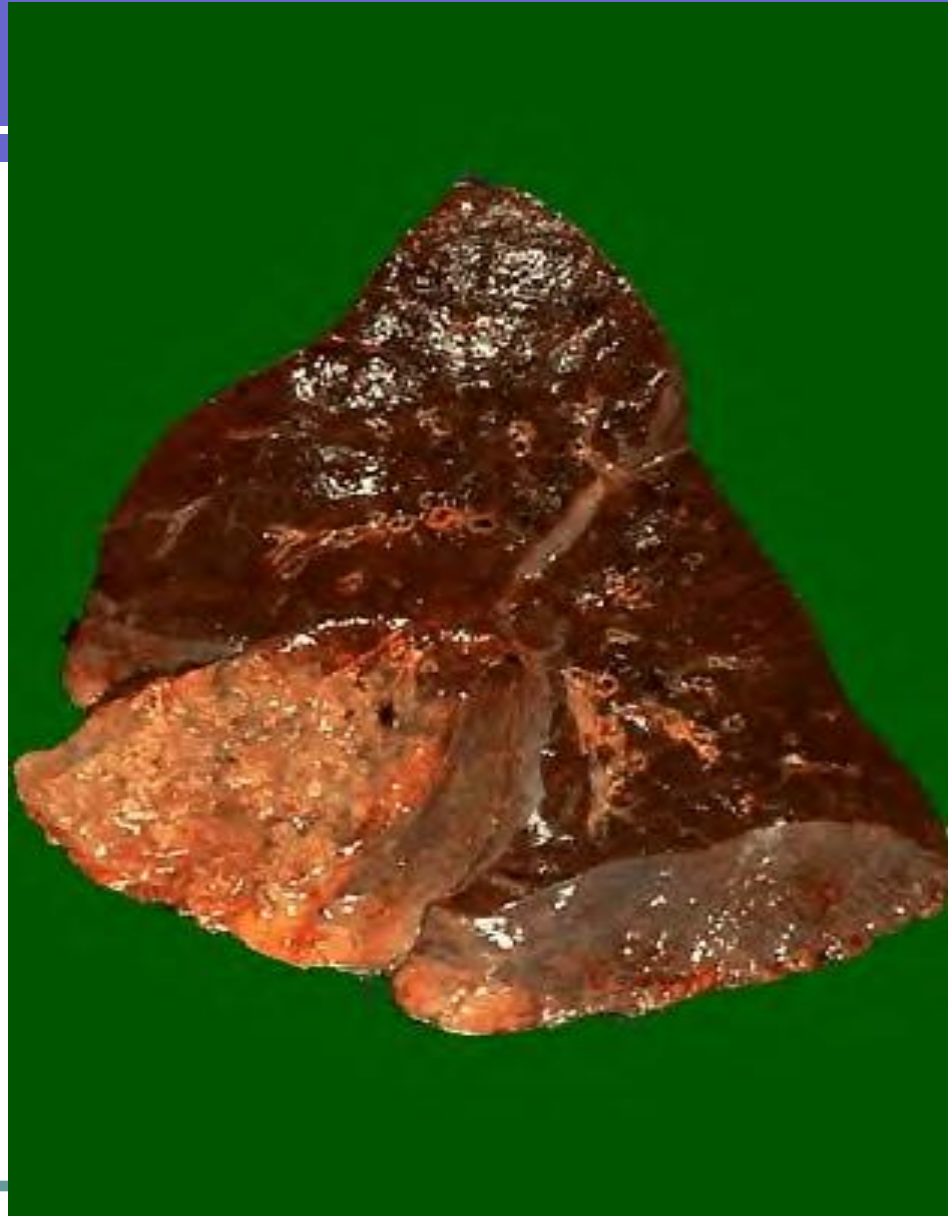
ADAM

EMPHYEMA

- **GENERAL INFORMATION**
 - **A localized spherical lesion consisting of a collection of pus in a cavity formed by the disintegration of tissue.**
 - **Usually a staphylococcal organism**
 - **Empyema is pus contained within a pleural cavity**
 - **Complicates bacterial pneumonia and tuberculosis**

LUNG ABSCESS/EMPYEMA





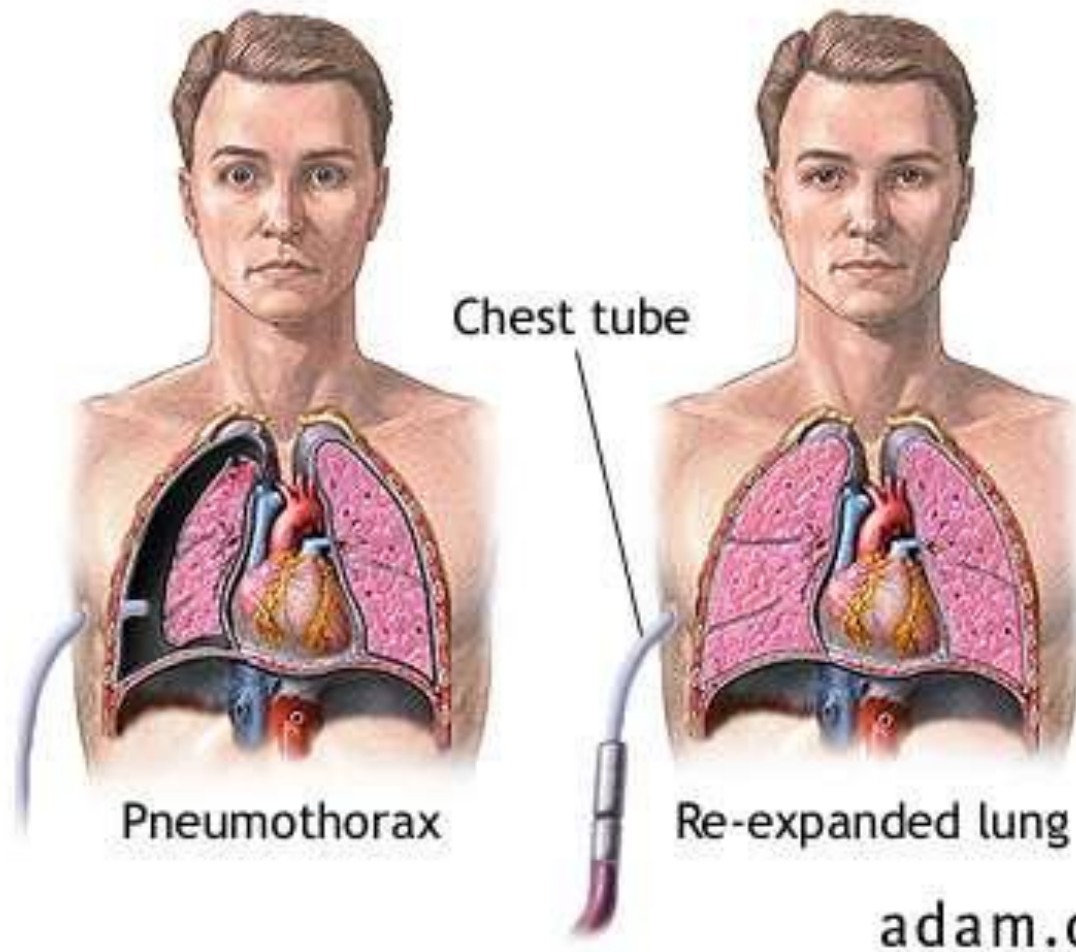
EMPYEMA



EMPYEMA

-TREATMENT

- *Focuses on prevention of disease advancement**
- *Warm compresses for draining wounds**
- *Antibiotics**



Chest Tube is a flexible plastic tube that is inserted through the chest wall and into the pleural space or mediastinum. It is used to remove air (*pneumothorax*) or fluid (*pleural effusion*) or pus (*empyema*) from the intra-thoracic space.

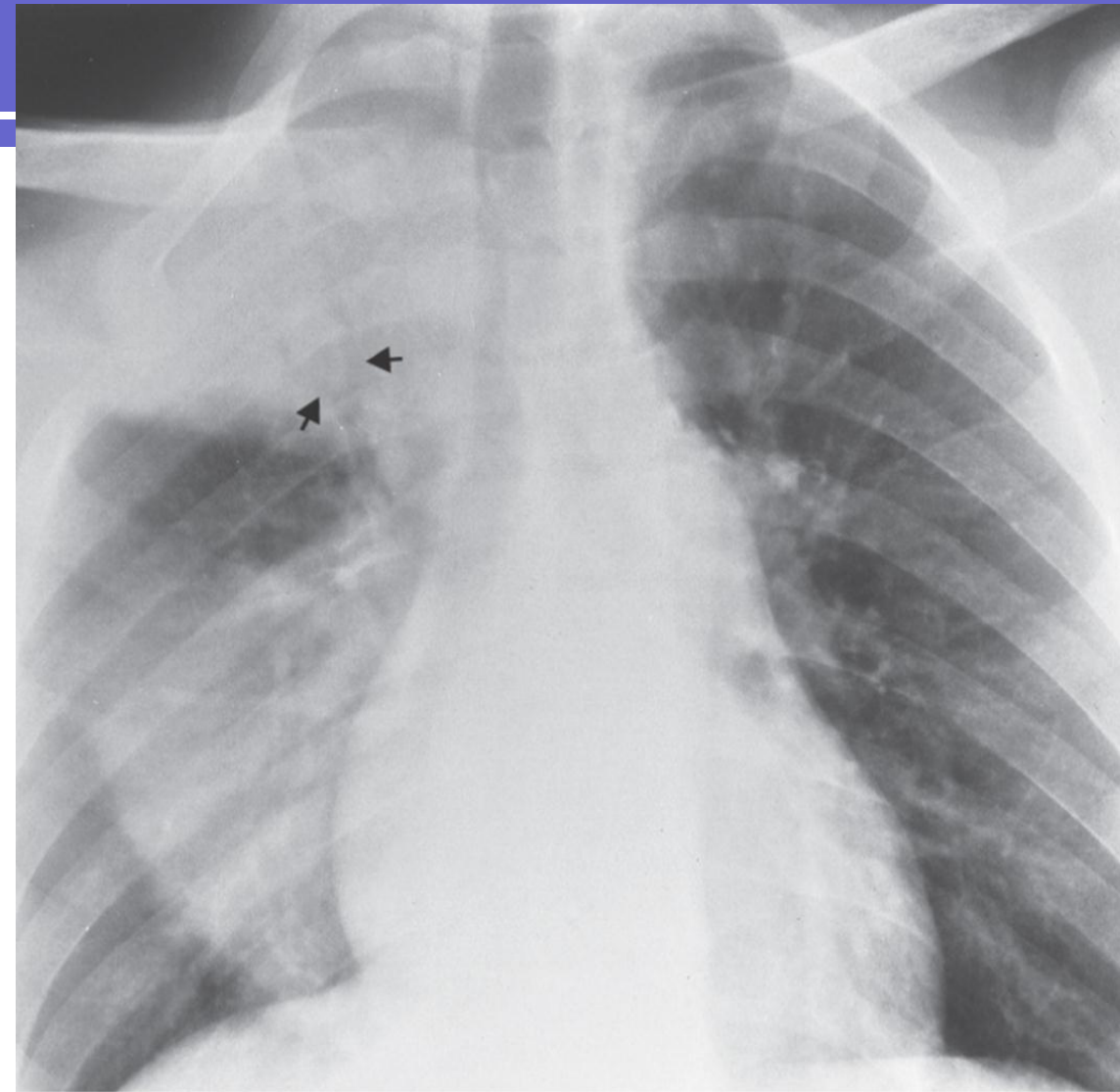
Pneumonia

Inflammation of the lung caused by bacteria and viruses

- Unilateral, bilateral, in all or portions of the lung.
- Increase technique to penetrate fluid filled lungs

Pneumonia continued:

1. **Alveolar Pneumonia**- inflammation of the alveoli
2. **Bronchopneumonia**- inflammation of the bronchi
3. **Interstitial Pneumonia**- interstitial dispersal of infection
4. **Aspiration Pneumonia**- the inhalation of gastric contents



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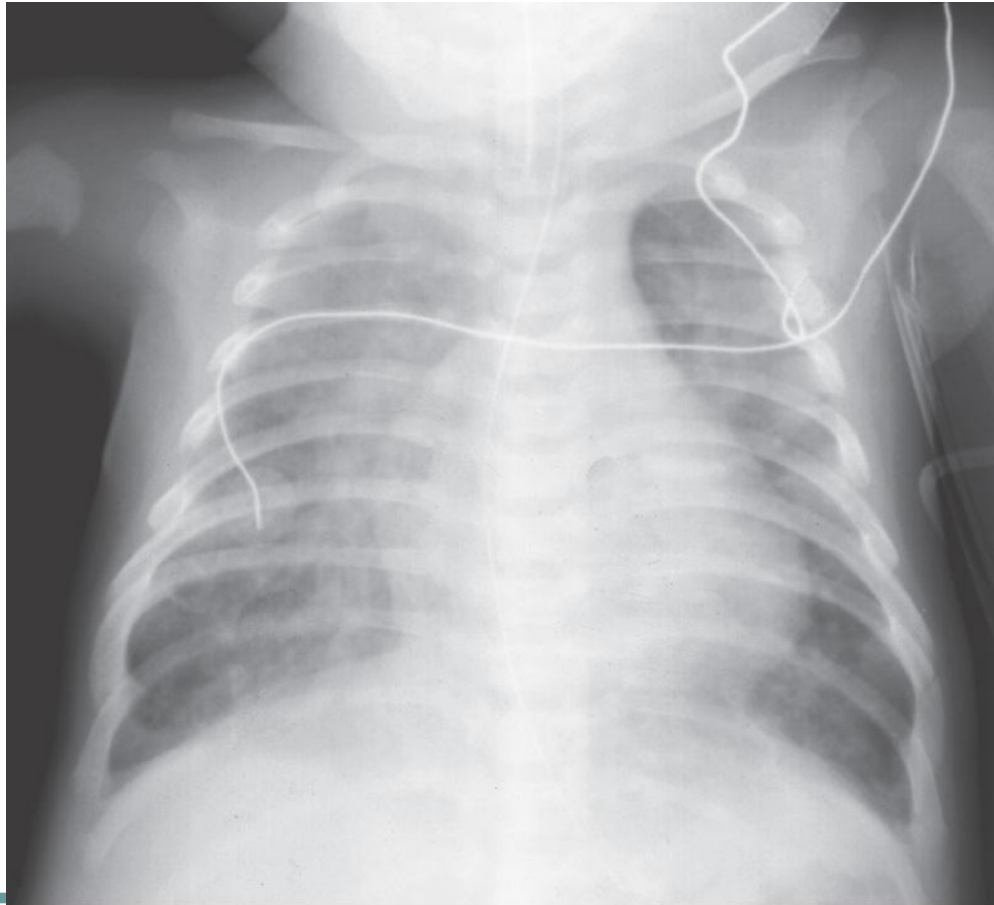


Respiratory syncytial virus (RSV)

- Respiratory system infection
- Caused by a virus
- Common in infants
- High rate of nosocomial (hospital acquired) infection
- Affects the bronchioles

RSV

- This virus causes pneumonia of the bronchioles.



(Courtesy Karen Brown, RT, (R)(M), St. Joseph's Hospital and Medical Center, Phoenix, AZ.)

Pleurisy

Inflammation of the pleura; usually caused by viral infection; thoracic pain; not seen on x-ray

Symptoms

- Dry cough
- Fever and chills
- Rapid, shallow breathing
- Shortness of breath
- Rapid pulse
- Sore throat followed by pain and swelling in the joints
- Ventricular tachycardia

CHRONIC DISORDERS

PATHOLOGY

COPD- :

Chronic Obstructive Pulmonary Disease

- This is a persistent obstruction of bronchial flow.

Chronic obstruction of the airways

Excessive mucus leads to obstruction of airways

Almost all cases caused by smoking

Other risk factors for COPD are:

- Exposure to certain gases or fumes in the workplace
- Exposure to heavy amounts of secondhand smoke and pollution
- Frequent use of cooking fire without proper ventilation

There are two main forms of COPD:

1. **Chronic bronchitis**, which involves a long-term cough with mucus
 2. **Emphysema**, which involves destruction of the lungs over time
- Most people with COPD have a combination of both conditions.

Emphysema:

- Permanent enlargement of the air spaces beyond the terminal bronchioles.
- “Leather lung disease” because the lungs become stiff and brittle. The alveoli lose their elasticity and remain filled with air during expiration.
- As condition progresses, less oxygen goes to the bloodstream, causes shortness of breath- dyspnea
- ***Adjust technique***
- Blunt edges of costophrenic angles on lateral

Symptoms

- Cough, with or without mucus
- Fatigue
- Many respiratory infections
- Shortness of breath (dyspnea) that gets worse with mild activity
- Trouble catching one's breath
- Wheezing

EMPHYSEMA

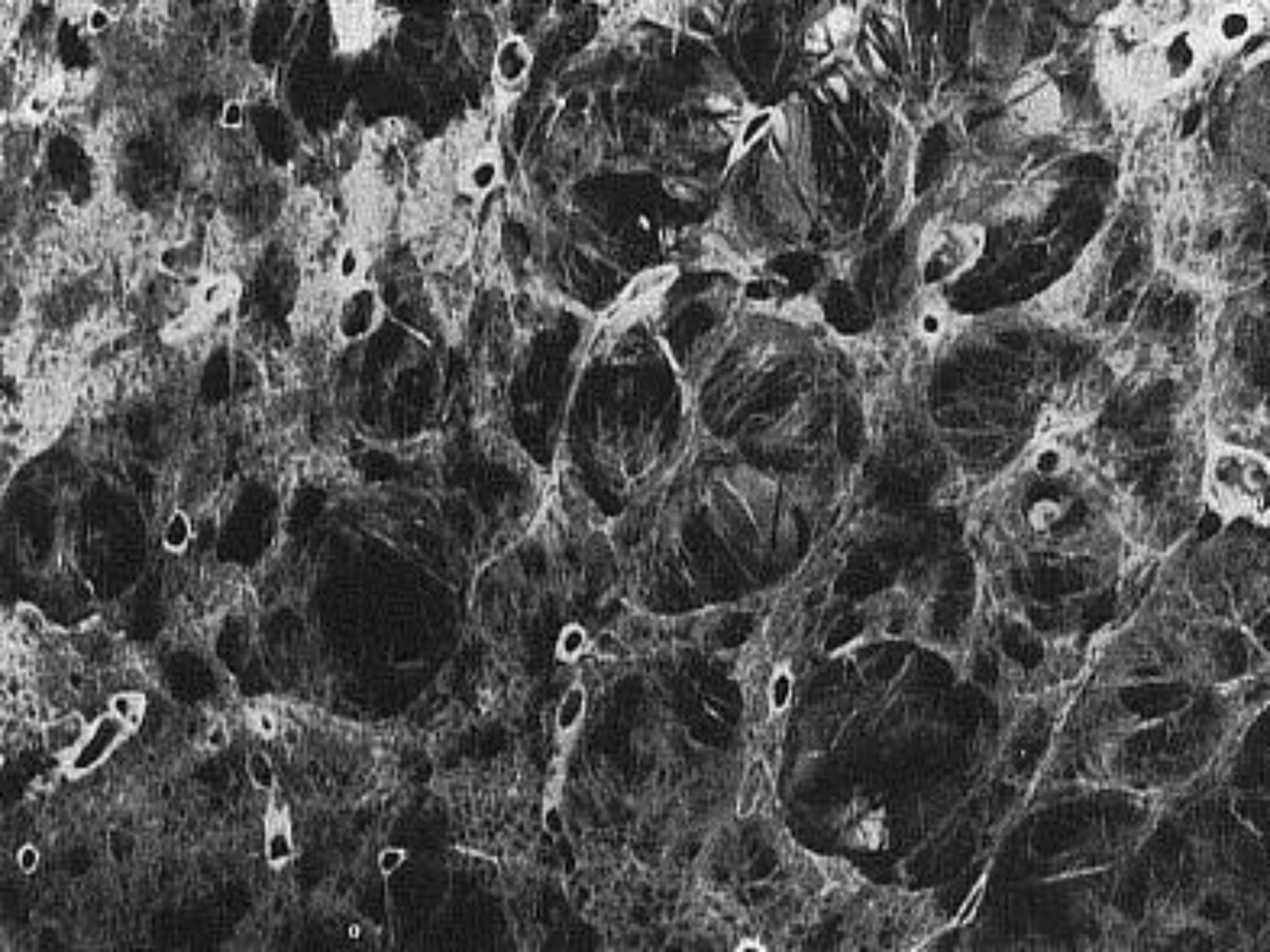


Alveoli with emphysema



Microscopic view of normal alveoli







EMPHYSEMA

- Chest radiographs:
 - Lungs are oversized, paper-thin, and compress with pressure
 - Areas of increased blackening or radiolucency, compatible with over inflation (***hyperinflation***) and destruction of distal bronchi & alveoli.
 - Progressive lung expansion & flattening of lung bases



Asthma:

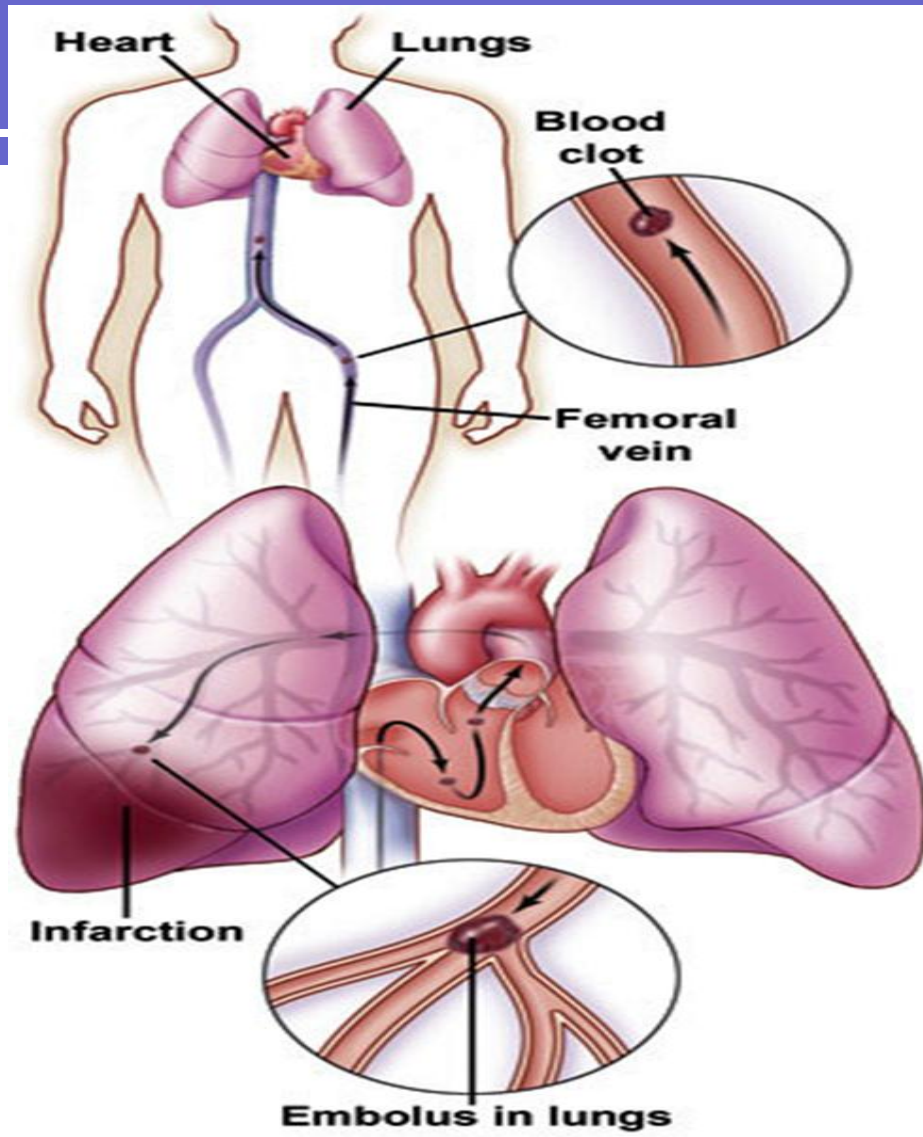
- Recurrent attacks of labored breathing.
- Wheezing, coughing, and tightness of chest are symptoms.
- In many cases of asthma, the chest x-ray is normal.

Pulmonary Embolism:

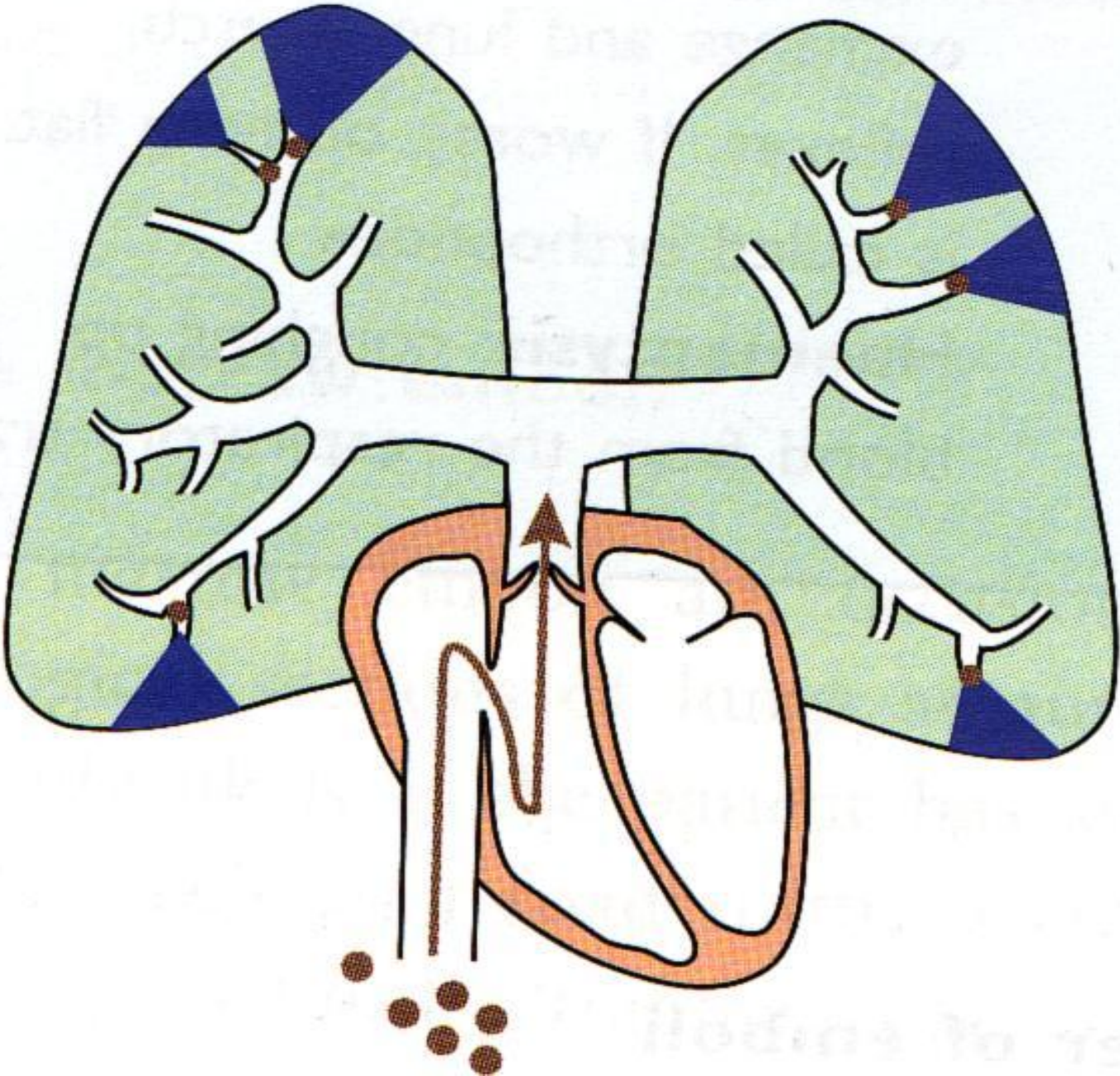
- Mass of undissolved matter in the pulmonary artery or one of its branches
- Common in post-operative pts., pts. with CHF, pregnant women, pts. with varicose veins, and women on oral contraceptives
- Difficult to note on an x-ray.

PULMONARY EMBOLISM

- OTHER FACTORS AND/OR CONDITIONS:
 - Heart disease
 - COPD
 - Extended bed rest
 - Surgery
 - Paralysis
 - Aging
 - Sickle cell disease



Showering of emboli



cm 1 2 3 4 5
Anatomical Path



PULMONARY EMBOLISM

- TREATMENT
- Directed toward the prevention of new thrombus formation.
- Thrombolytic therapy
- Vena Cava Filters
- Heparin (bleeding hazard)
 - Monitored by PTT and APTT blood tests

PULMONARY EMBOLISM

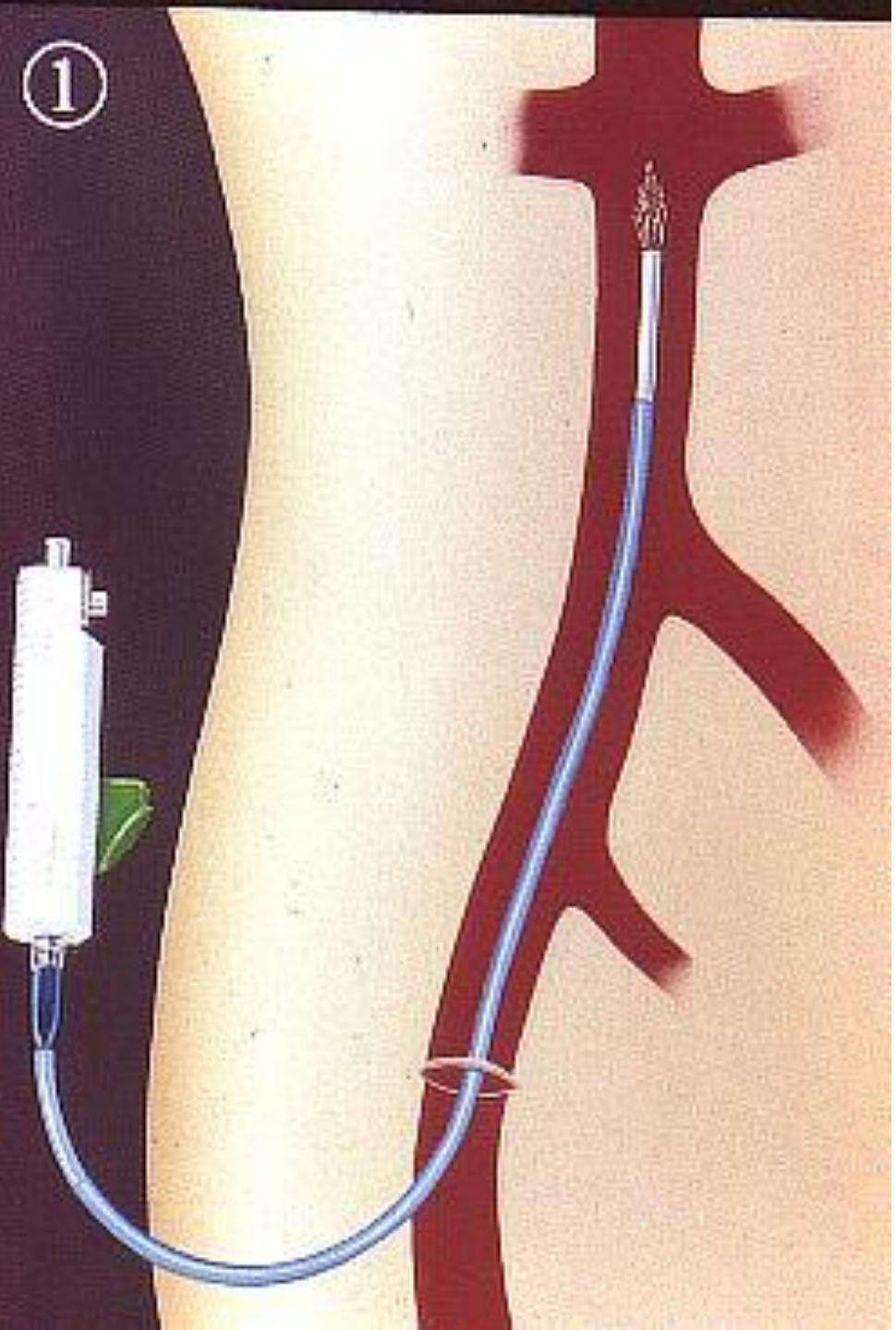
- **THROMBOLYTIC THERAPY**
 - Urokinase, Streptokinase, and Tissue Plasminogen activator t-Pa.
 - Material bring about dissolution of a thrombus
 - Administered via a catheter inserted into the vein leading to the thrombus.
 - Thrombolytic agent is then applied to thrombus.

PULMONARY EMBOLISM

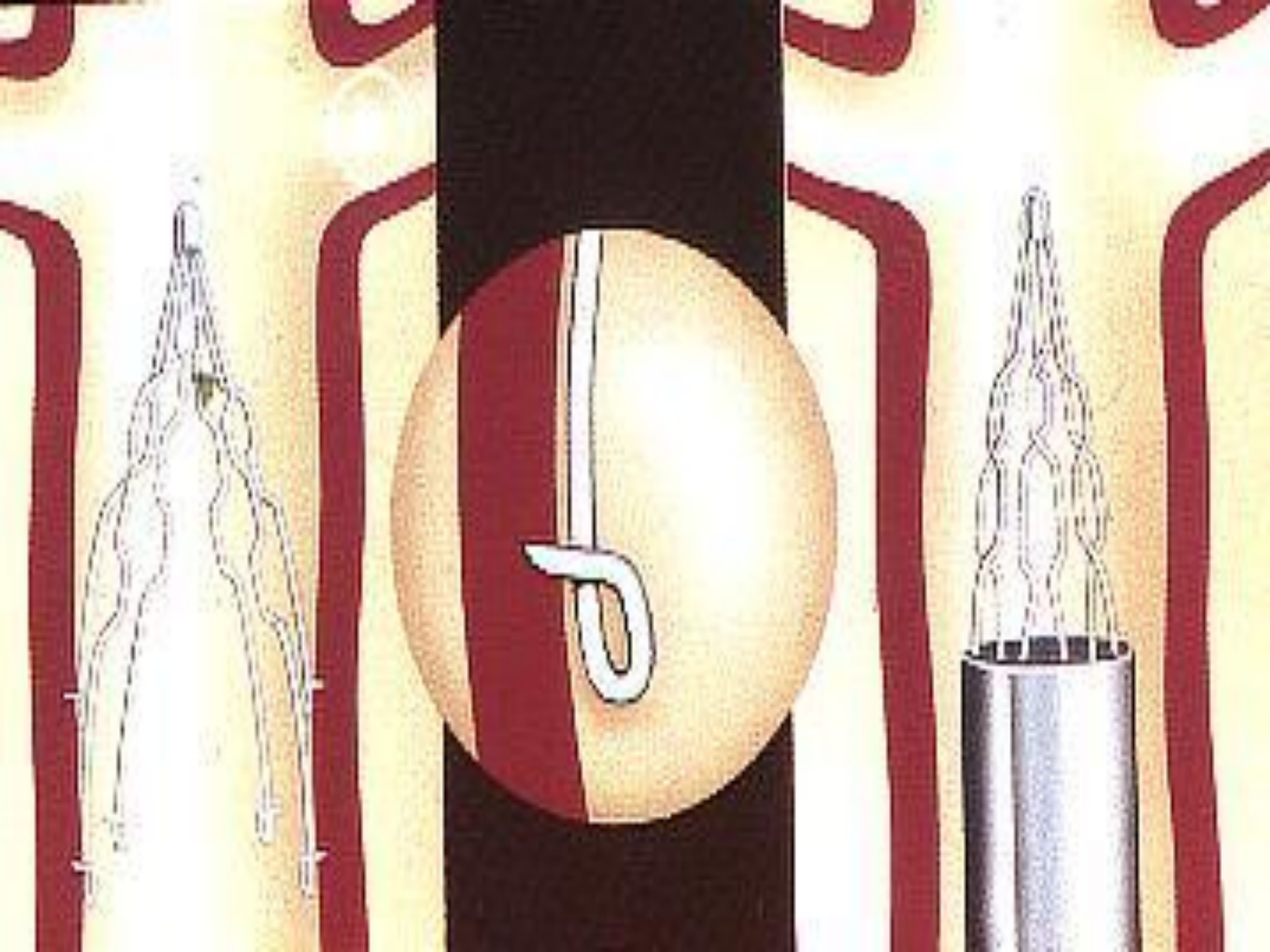
- **VENA CAVA FILTER PLACEMENT**
 - **Through catheterization of the inferior vena cava, a special filter is released from the catheter**
 - **This filter or (*umbrella*) physically sits within the vena cava and provides a physical barrier against the migration of large pulmonary emboli.**
 - **These devices are used where recurrent PEs occur despite anticoagulation.**

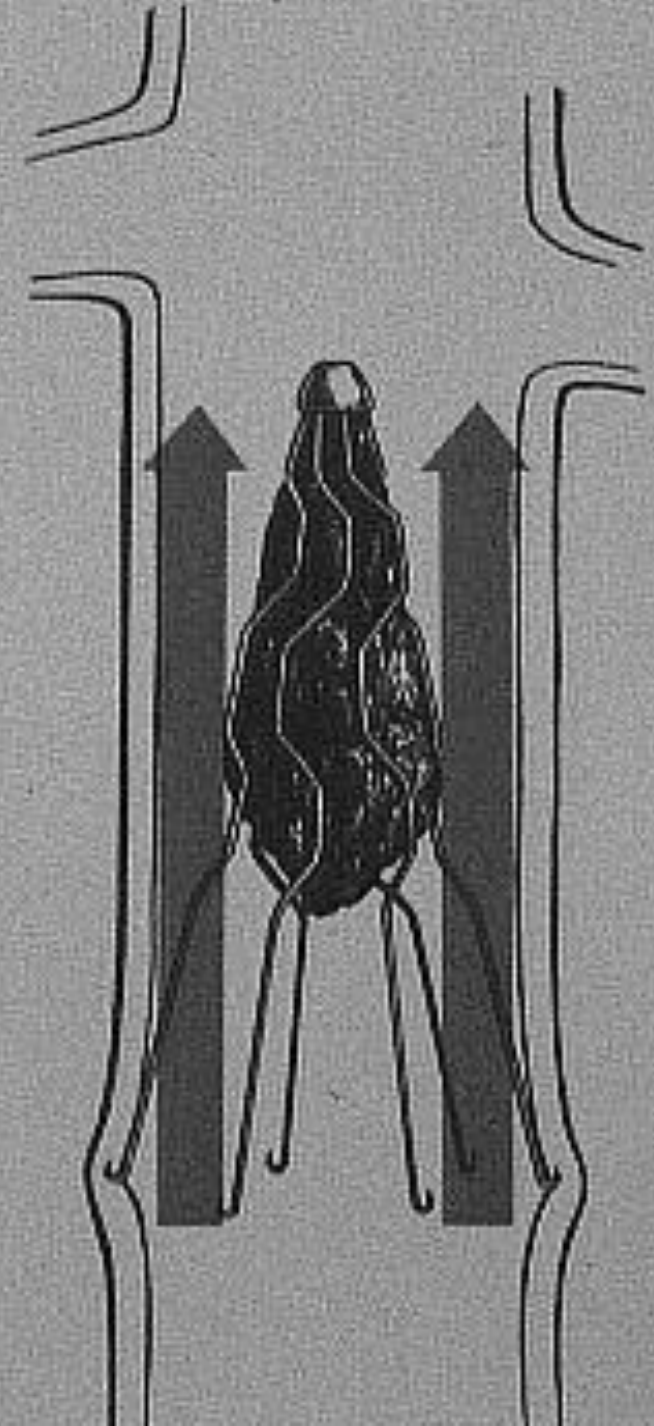
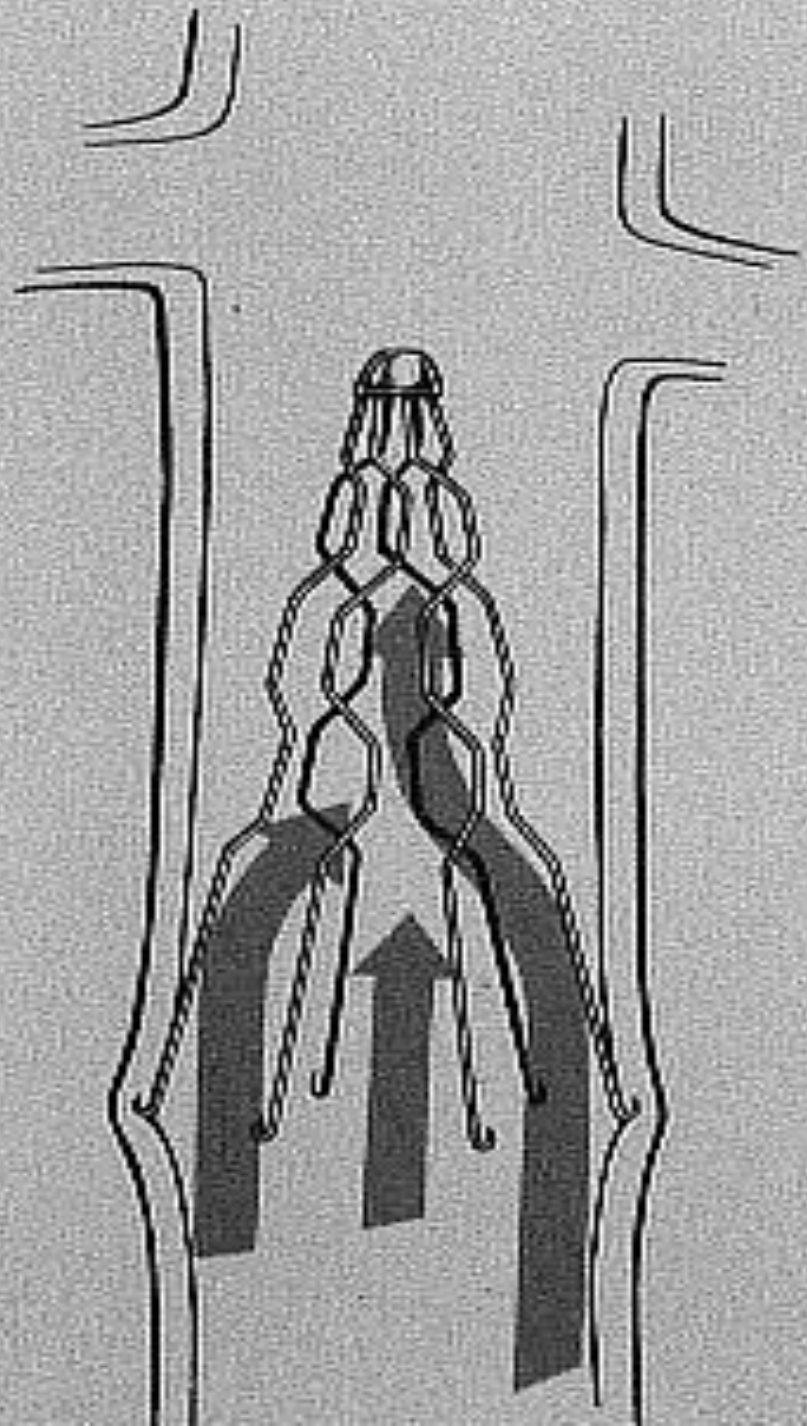


New, one-way, positive thumb release for control and precision of filter placement.



1





Pleural Effusion: We already talked about this as an acute disease but it can be also considered chronic

- Excess of fluid between the parietal and visceral pleural membranes around each lung
- Most common cause of pleural effusion is CHF
- Thoracentesis may be done

Tuberculosis:

- Transmitted by inhalation of infected droplets
- Slow developing bacterial infection that causes necrosis of lung tissue
- Infectious, inflammatory, chronic, fever, loss of weight, and weakness



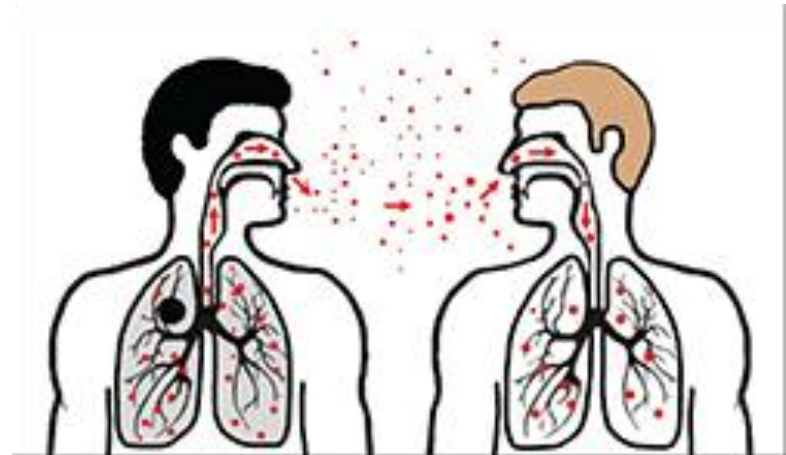
Tuberculosis (TB)

Caused by a bacterium called *Mycobacterium tuberculosis*. The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. If not treated properly, TB disease can be fatal.

How TB Spreads:

TB is spread through the air from one person to another. The TB bacteria are put into the air when a person with TB disease of the lungs or throat coughs, sneezes, speaks, or sings. People nearby may breathe in these bacteria and become infected.

TB is NOT spread by
shaking someone's hand
sharing food or drink
touching bed linens or toilet seats
sharing toothbrushes
kissing



Latent TB Infection

TB bacteria can live in the body without making you sick. This is called latent TB infection. In most people who breathe in TB bacteria and become infected, the body is able to fight the bacteria to stop them from growing. People with latent TB infection do not feel sick and do not have any symptoms. People with latent TB infection are not infectious and cannot spread TB bacteria to others. However, if TB bacteria become active in the body and multiply, the person will go from having latent TB infection to being sick with TB disease.

TB Disease

TB bacteria become active if the immune system can't stop them from growing. When TB bacteria are active (multiplying in your body), this is called TB disease. People with TB disease are sick. They may also be able to spread the bacteria to people they spend time with every day.

Many people who have latent TB infection never develop TB disease. Some people develop TB disease soon after becoming infected (within weeks) before their immune system can fight the TB bacteria. Other people may get sick years later when their immune system becomes weak for another reason.

For people whose immune systems are weak, especially those with HIV infection, the risk of developing TB disease is much higher than for people with normal immune systems.

- a bad cough that lasts 3 weeks or longer
- pain in the chest
- coughing up blood or sputum
- weakness or fatigue
- weight loss
- no appetite
- chills
- fever
- sweating at night



TB Risk Factors

Once a person is infected with TB bacteria, the chance of developing TB disease is higher if the person:

- Has HIV infection;
- Has been recently infected with TB bacteria (in the last 2 years);
- Has other health problems, like diabetes, that make it hard for the body to fight bacteria;
- Abuses alcohol or uses illegal drugs; or
- Was not treated correctly for TB infection in the past

Treatment for TB Disease

TB disease can be treated by taking several drugs, usually for 6 to 9 months. It is very important to finish the medicine, and take the drugs exactly as prescribed. If you stop taking the drugs too soon, you can become sick again. If you do not take the drugs correctly, the germs that are still alive may become resistant to those drugs. TB that is resistant to drugs is harder and more expensive to treat.

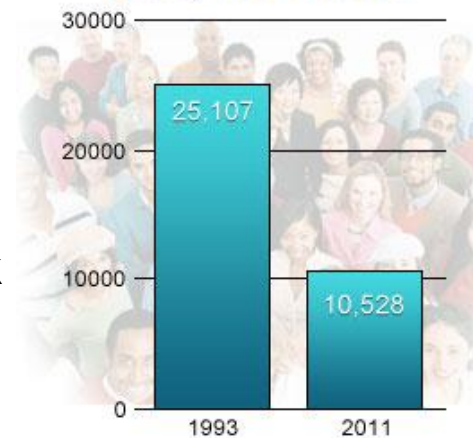
Tuberculosis (TB) is one of the world's deadliest diseases:

One third of the world's population are infected with TB. In 2011, nearly 9 million people around the world became sick with TB disease. There were around 1.4 million TB-related deaths worldwide.

TB is a leading killer of people who are HIV infected.

A total of 10,528 TB cases (a rate of 3.4 cases per 100,000 persons) were reported in the United States in 2011. Both the number of TB cases reported and the case rate decreased; this represents a 5.8% and 6.4% decline, respectively, compared to 2010

Reported TB Cases, United States, 1993 and 2011



http://www.cdc.gov/tb/topic/globaltb/strategy_video.htm



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Pneumonconiosis:

- Disease of the respiratory tract caused by inhaling inorganic dust particles over a prolonged period. 4 varieties:
 1. **Silicosis**- inhalation of crystalline forms of silica (quartz dust)
 - A. Oldest and most widespread occupational disease
 - B. Mining, sandblasters, and drilling

Continued pneumonconiosis:

2. **Asbestosis**- exposure to asbestos dust and fibers

- A. Causes pulmonary fibrosis and some lung malignancies
- B. Victims are those who manufacture and install asbestos

Continued pneumonconiosis:

3. **Berylliosis**- caused by inhalation of beryllium salt fumes

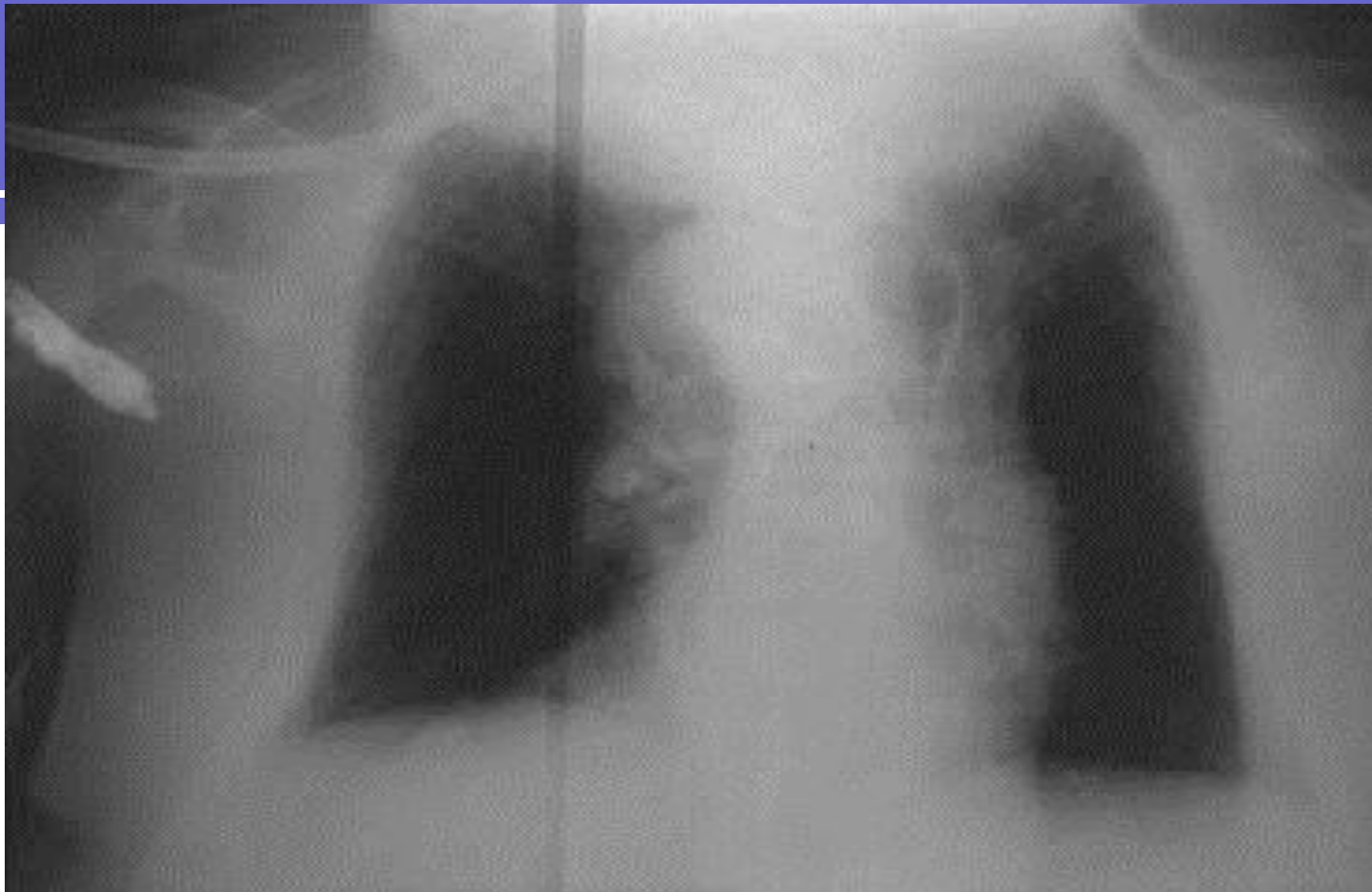
- A. Usually poisons lungs but can affect skin and other bodily organs
- B. People affected are those who work with specialty metals and ceramic industries

Continued Pneumonconiosis:

4. **Anthracosis**- caused by accumulation of carbon deposits in the lungs
- “Black lung or Miner’s asthma”
 - Inhaling smoke or coal dust
 - Coal mining is a high risk occupation

Fungal Diseases:

- 1. **Histoplasmosis**- caused by a yeast-like organisms
- 2. **Coccidioidomycosis**- fungus in dry desert soils



Chest x-ray is marked correctly and is hung correctly.

**What condition
is shown?**

Protocol for chest

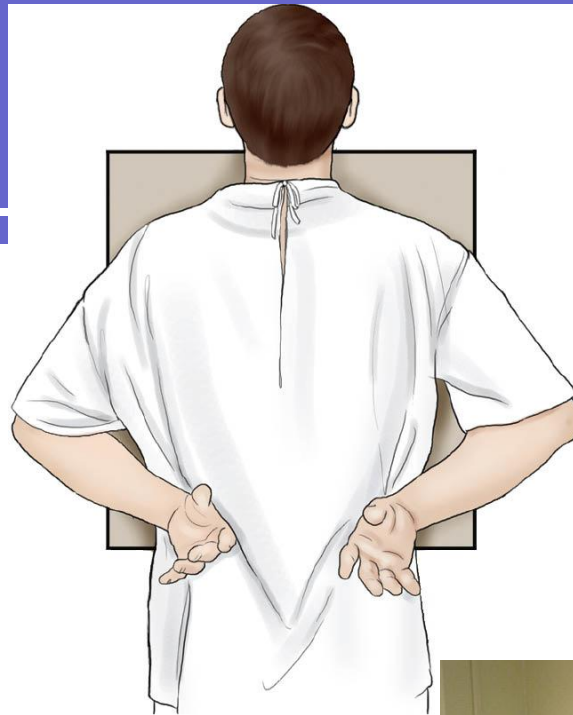
The two projections to visualize the lungs, and other soft tissue as well as the bony thorax. They include:

- ❑ PA or AP chest
- ❑ LAT chest (left side against the image receptor)

- On a PA chest, a slight rotation can distort the size and shape of the heart. Rotation of the chest can be determined by examining both sternal ends of the clavicle. On a true PA the sternal ends of the clavicles are at equal distance from the spine.
- On a LAT chest, the left side is against the image receptor to better demonstrate the heart regions since it is located primarily on the left side

Patient Position

- ❑ The Central Ray (CR) is centered in the middle of the chest at T-7 level
- ❑ Anatomical marker is to be placed on the Bucky, left side of patient
- ❑ Light or top of IR is 1 ½ inches above relaxed shoulder



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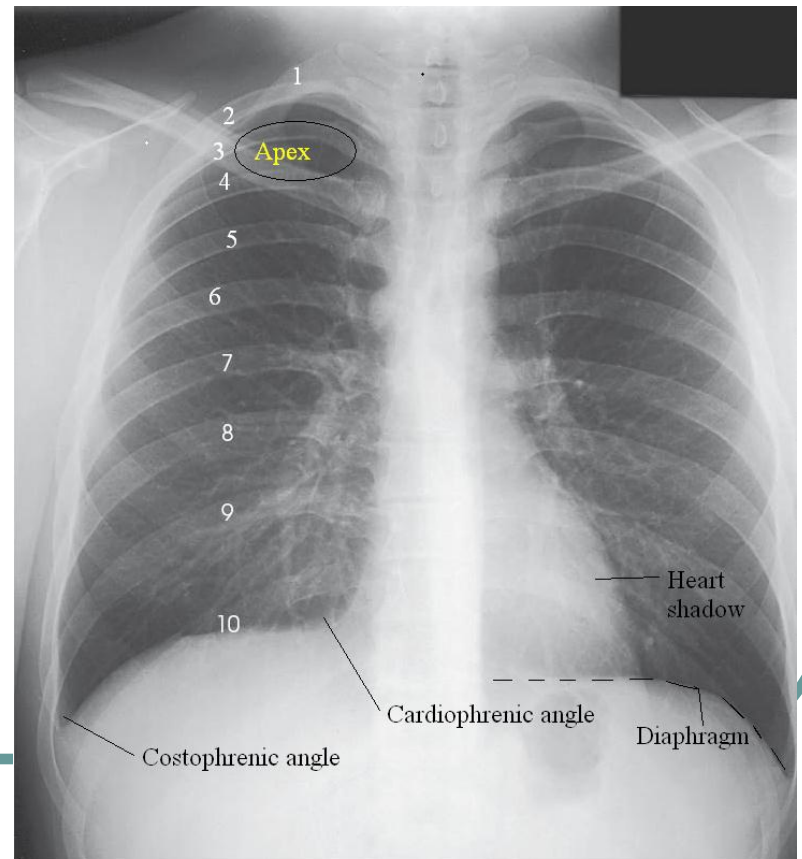
Patient Positioning

- ❑ The range of 110-125 KVP
- ❑ Film size is 14 X 17 inches (35 X 43 cm)
- ❑ The source to image (SID) distance is 72 inches or 180 cm
- ❑ Collimate to area of interest
- ❑ Shield patient around the waist
- ❑ Breathing instructions : two deep inspirations and hold breath



Structures to be visualized

- ❑ Entire lung, apex to angles
- ❑ With full inspiration, a minimum of 10 posterior ribs are to be visualized above the diaphragm
- ❑ Scapulae not in lung field
- ❑ Collimation



CHEST X-RAYS

- To demonstrate fluid levels, the patient should be in an erect position for a minimum of **5 minutes**
- Evaluation Criteria:
- See upper 10 ribs
- No rotation
- 72" SID – to minimize magnification (portables also)
- Scapulas rolled out of way

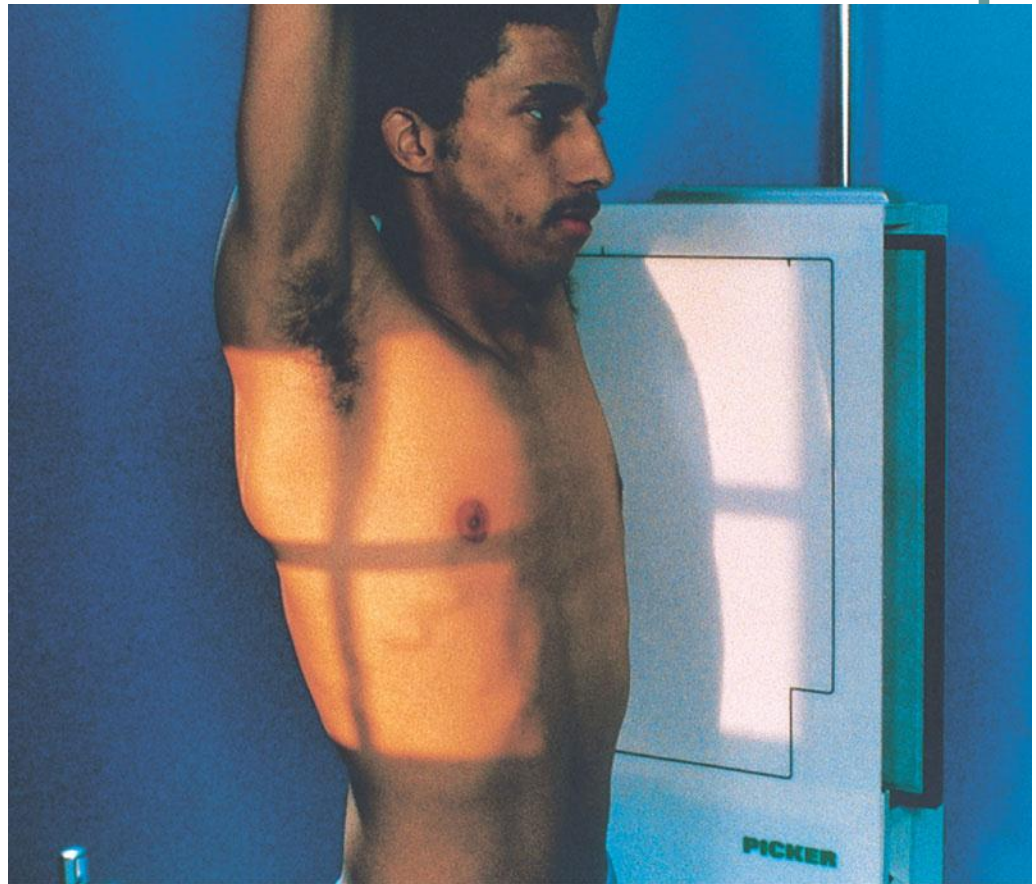
- What does decreasing the kVp do for chest radiography?
 - Enhances the bony thorax
- Why is it best to do a chest x-ray in the erect position?
 - Puts diaphragm in lowest position
 - Potential to see air levels or fluid levels

Lateral View

- ❑ Patient's left side is placed against the Bucky or cassette
- ❑ Minimize rotation
- ❑ Arms are raised above the head
- ❑ Anatomical Marker
- ❑ Patient is shielded

Patient Positioning

- ❑ The Central Ray (CR) is in the middle of the chest (T-7)
- ❑ Both arms are raised above the head
- ❑ Chin is raised



Positioning

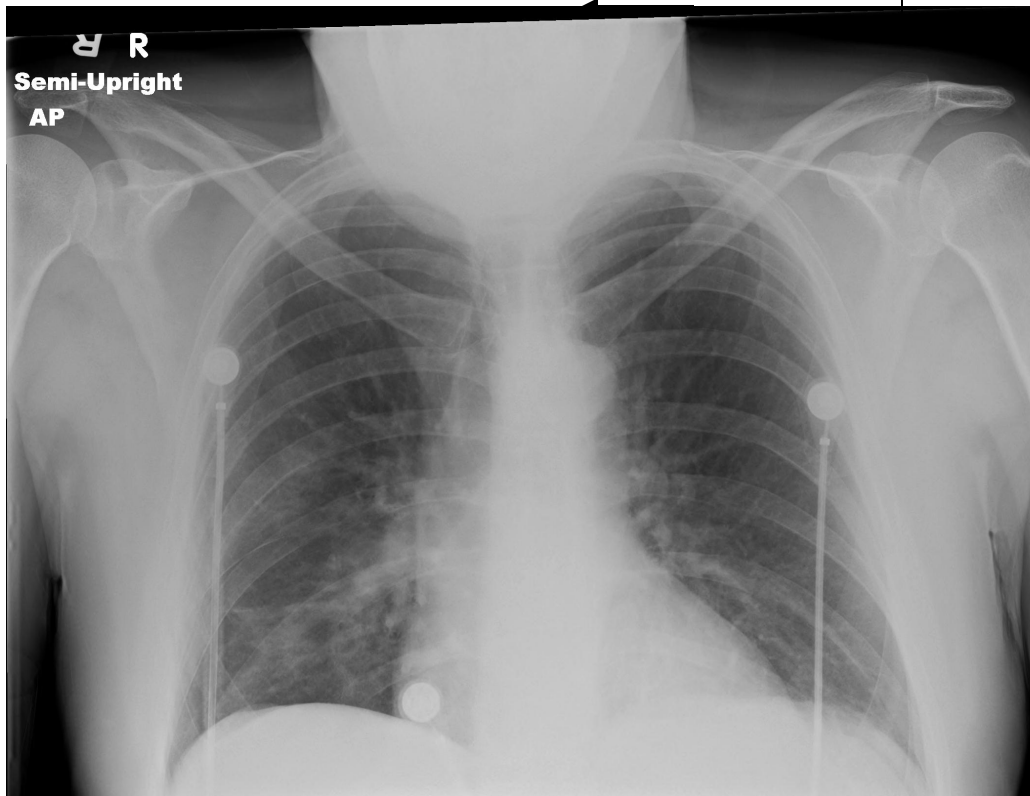
- ❑ The range of 110-125 KVP
- ❑ Film size is 14x17 lengthwise
- ❑ The source to image (SID) distance is 72 inches or 180 cm
- ❑ Collimate and patient is to be shielded
- ❑ Breathing instructions : 2 deep inspiration and hold breath

Structures visualized

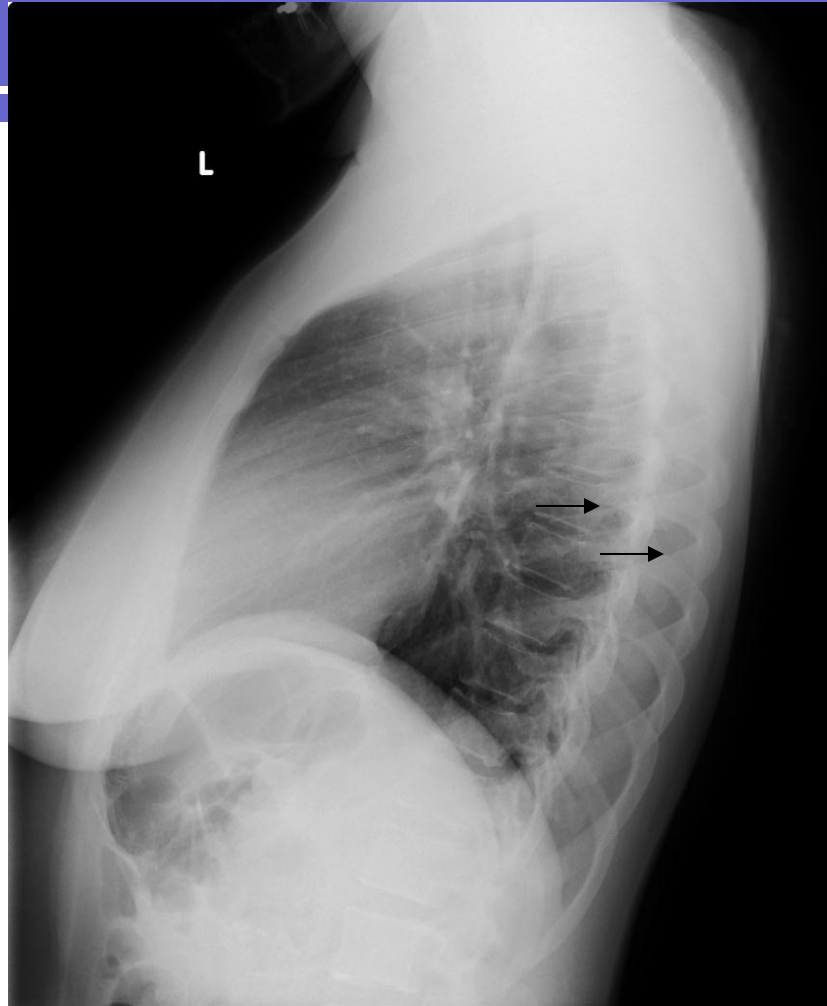
- ❑ Apices to be visualized on the top
- ❑ Costophrenic angles on the bottom
- ❑ Collimation margins should appear
- ❑ Sharp outlines of the diaphragm and lung markings
- ❑ Ribs markings and lung markings through the heart shadow and upper lung area



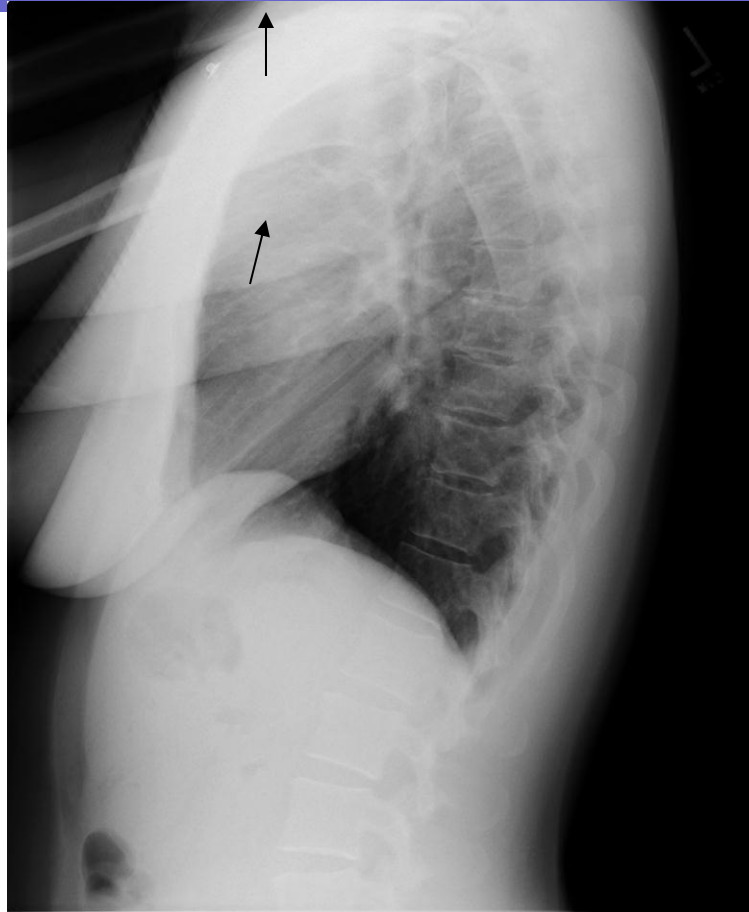
Over penetrated Chest x-ray



Chin is down, shoulders not relaxed



Over rotated LAT Chest



Arms not up high enough

QUESTIONS

1. Which of the following criteria are used to evaluate a PA projection of the chest?

- 1) Ten posterior ribs should be visualized
 - 2) Sternoclavicular joints should be symmetrical
 - 3) The scapulae should be outside the lung fields
- a) **1 and 2**
 - b) **1 and 3**
 - c) **2 and 3**
 - d) **All of the above**

2. During chest radiography, the act of inspiration

- 1) Elevates the Diaphragm
 - 2) Raises ribs
 - 3) Depresses the abdominal viscera
- a) **1 only**
 - b) **1 and 2**
 - c) **2 and 3**
 - d) **All of the above**

QUESTIONS

3. ___ Is a hereditary disease in which thick mucus is secreted by all the exocrine glands.
 - a. Cystic Fibrosis
 - b. Pneumonia
 - c. Tuberculosis
4. **What is the covering of the lung termed?**
5. **An increased volume of air in the lungs is seen in ____.**
6. **Reduced air volume within a lung leading to collapse is termed ____.**

References

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