



Tests Your Pulmonologist Might Order



Lifespan Cardiovascular Institute

Rhode Island Hospital • The Miriam Hospital
Newport Hospital

Delivering health with care.®

Center For Cardiac Fitness

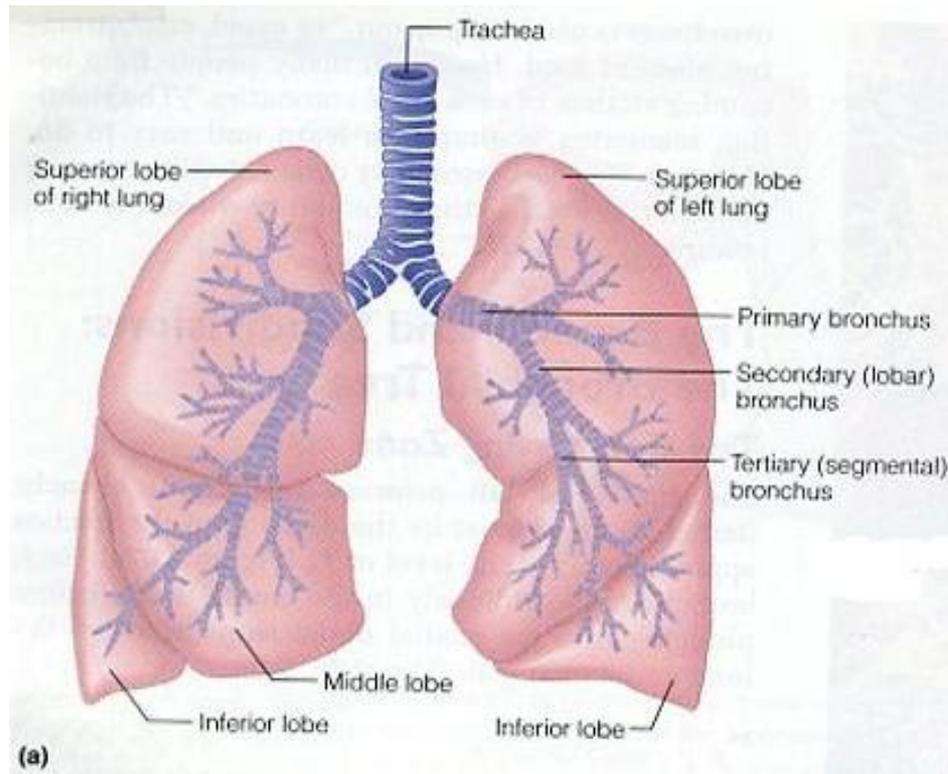
Pulmonary Rehab Program

The Miriam Hospital

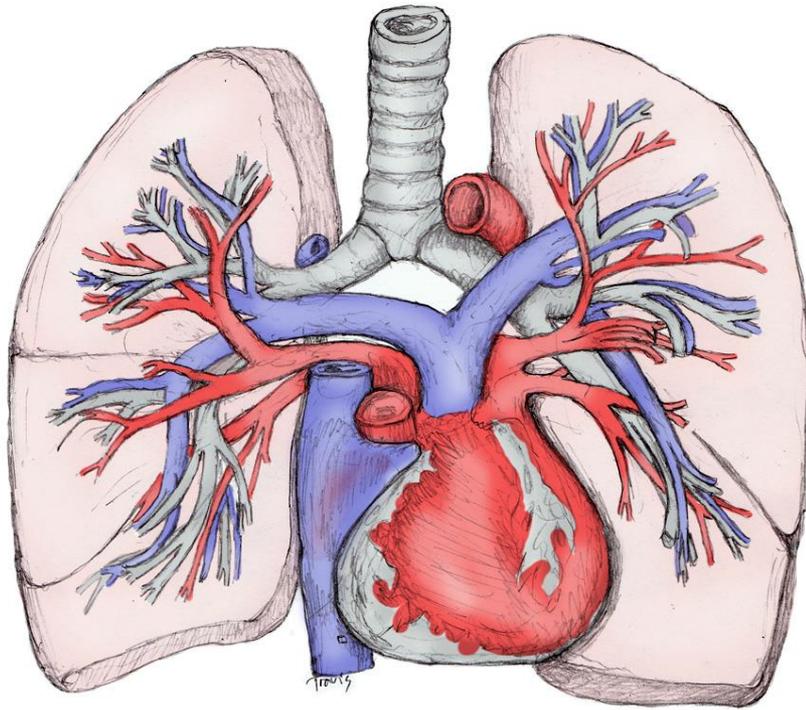
BASIC ANATOMY OF THE LUNGS

Lobes of Lung

- 3 lobes on the Right lung
- 2 lobes on the Left



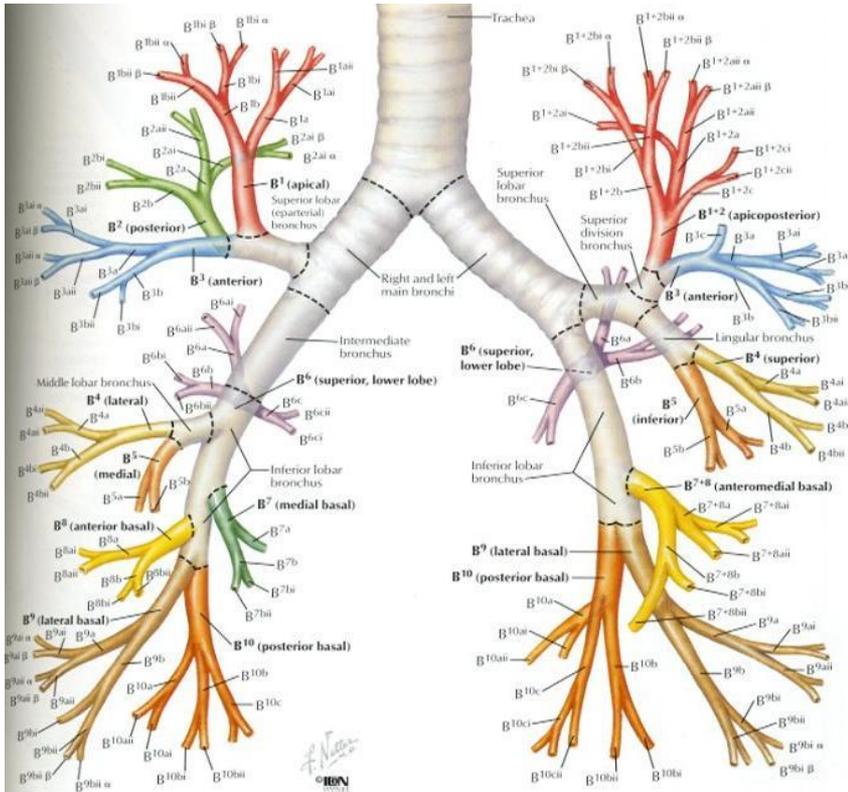
Blood Vessels



- Pulmonary arteries (red) carry blood from the heart to the lungs
- Pulmonary veins (blue) carry blood from the lungs back to the heart

Airways

- Carry air that we inhale and exhale

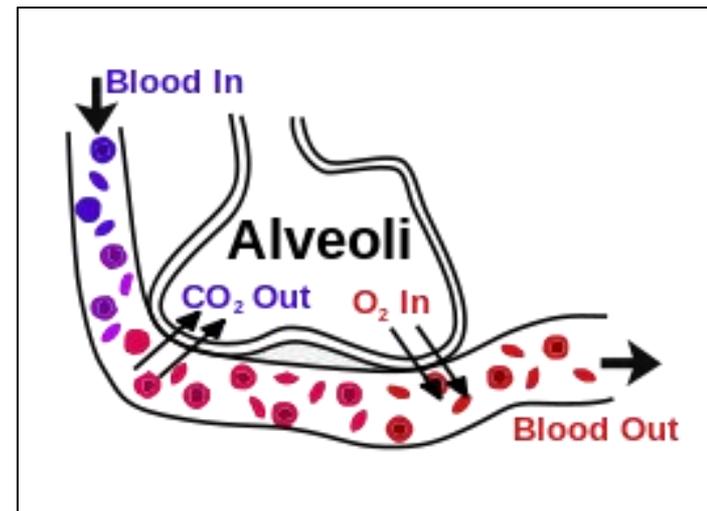
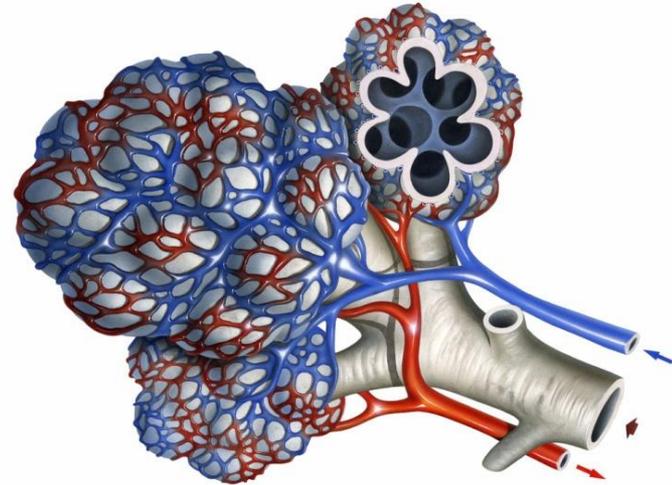


Trachea -> Bronchi -> Alveoli

Alveoli

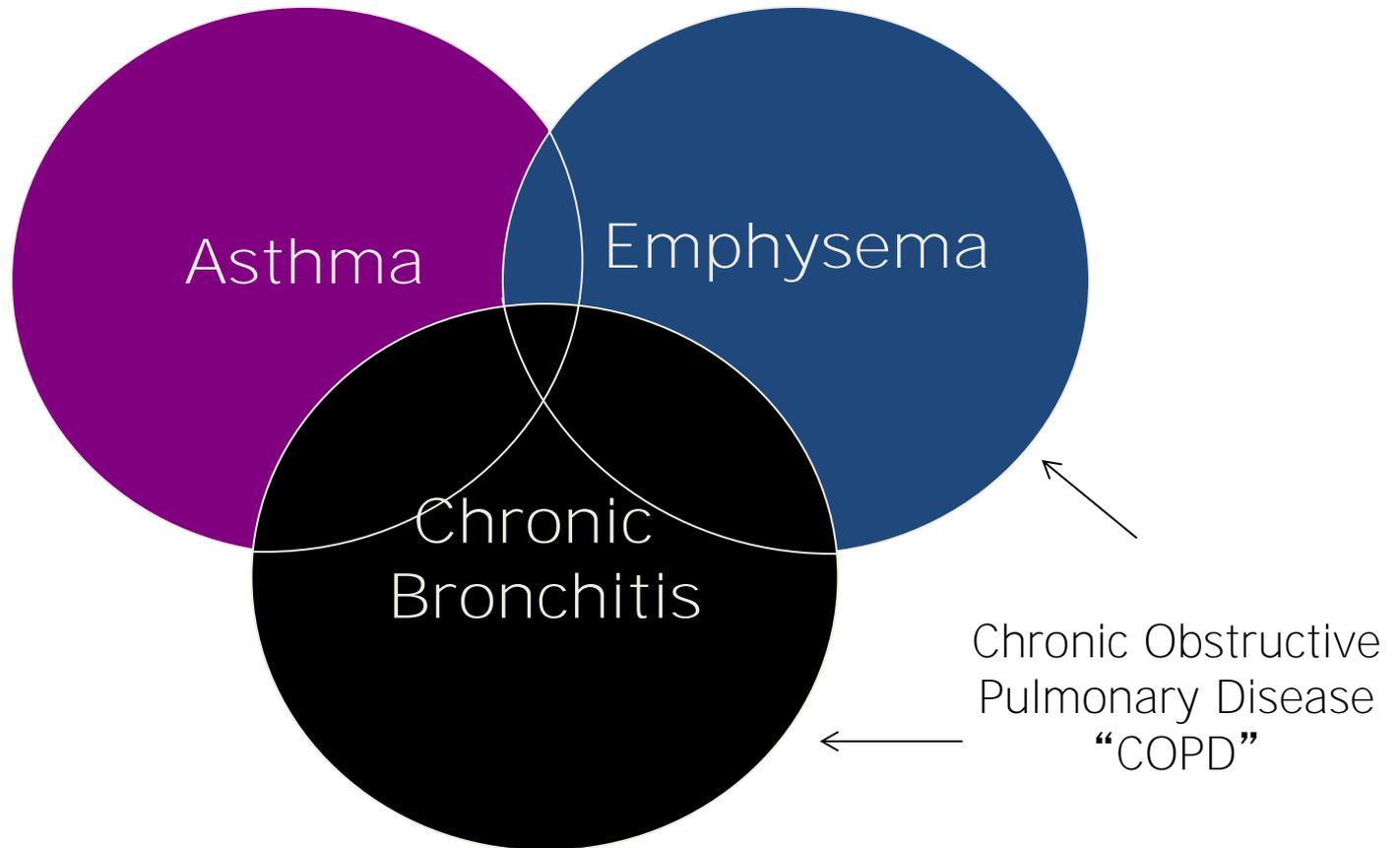
Functional Unit of Lungs

- 300 million tiny air sacs in the lungs
- Surface area of a tennis court
- Surrounded by capillaries
- Where gas exchange actually occurs
- Most chronic lung diseases affect the alveoli, the capillaries or both



COMMON DISEASE IN PULMONARY REHAB

Obstructive Lung Diseases



COPD: Chronic Bronchitis

Normal bronchi



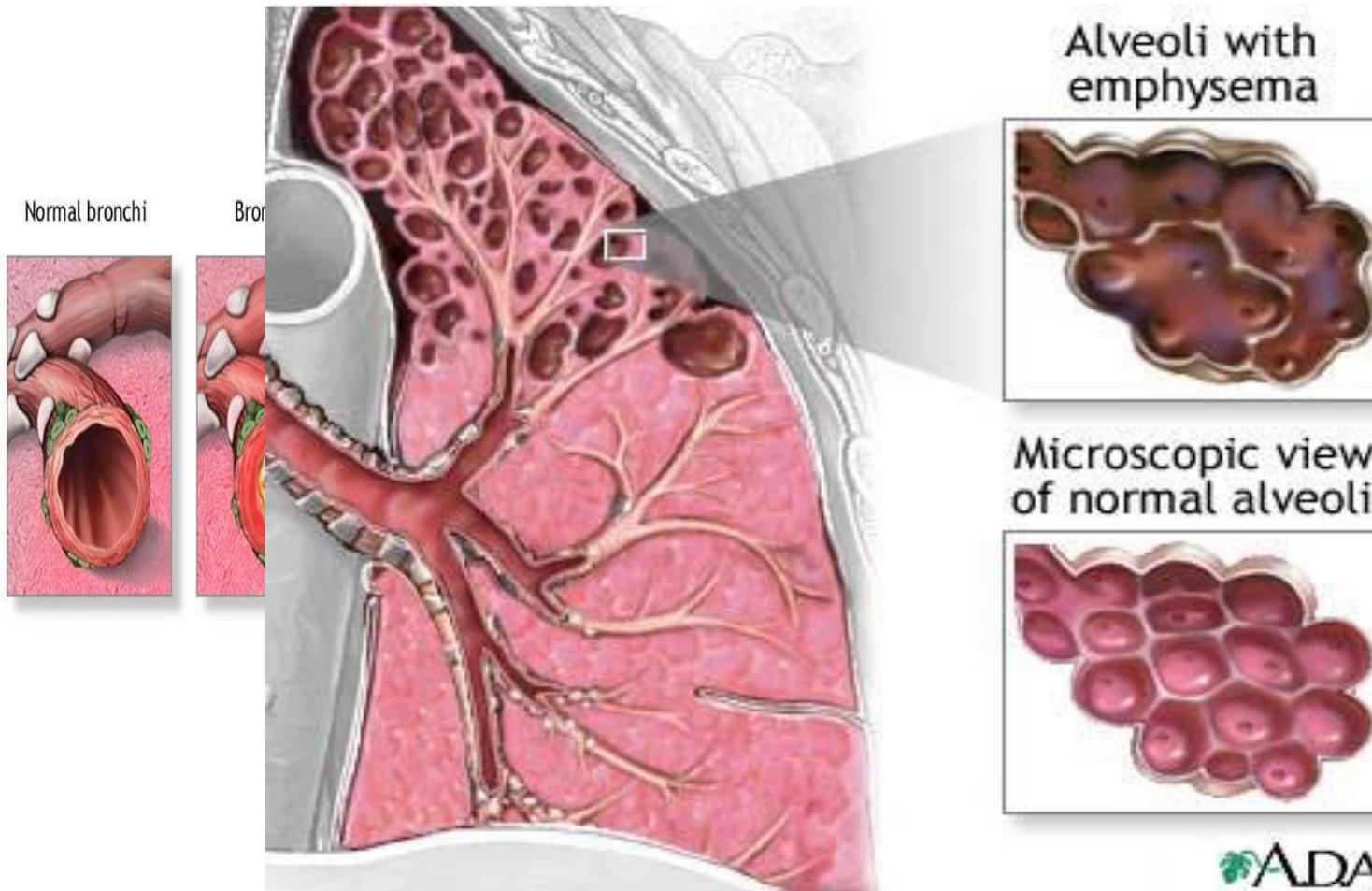
Bronchitis



Thickened
airway wall

Increased Mucus Production

COPD: Emphysema

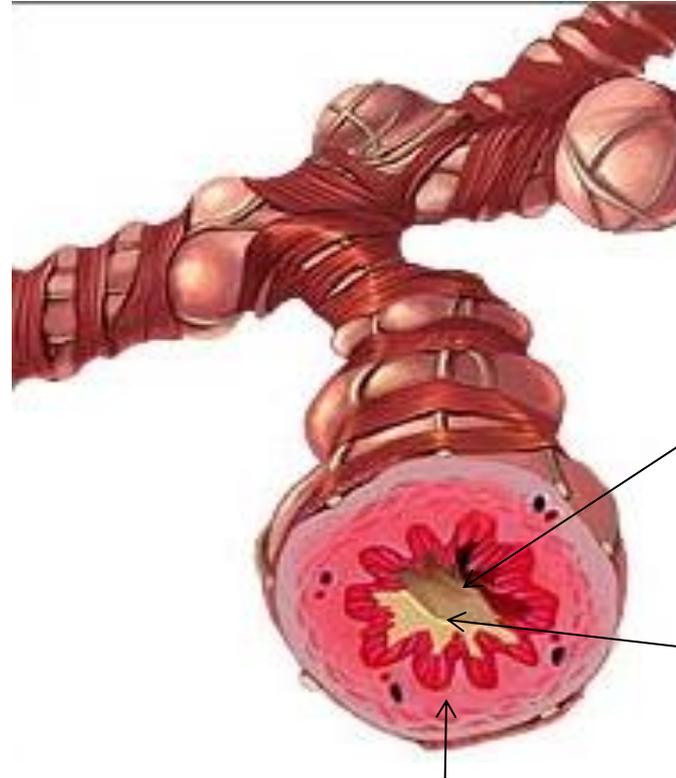


Asthma

Normal Airway



Asthmatic Airway



Constricted
airway lumen

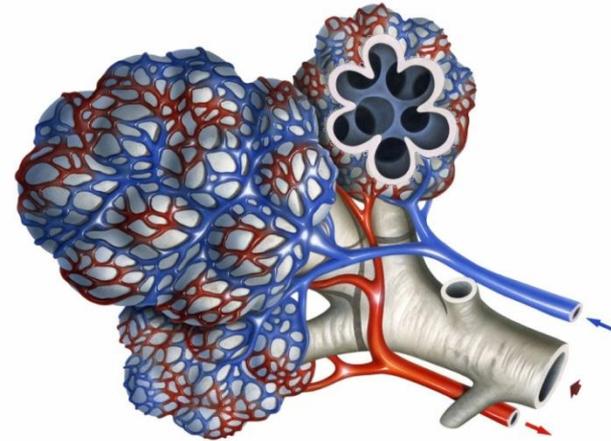
Increased
Mucus

Thickened airway wall

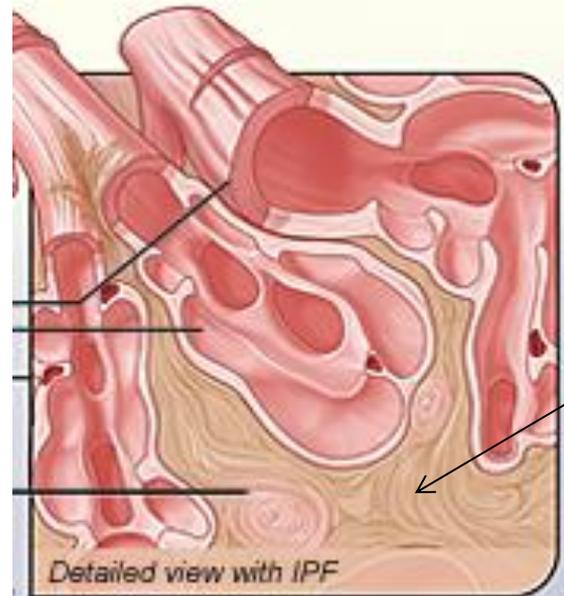
Compared to COPD, the changes in asthma are potentially reversible

Pulmonary Fibrosis

- In the normal lung the capillaries surround the alveoli allowing for gas exchange
- In fibrosis, scar forms between the alveoli and the capillaries



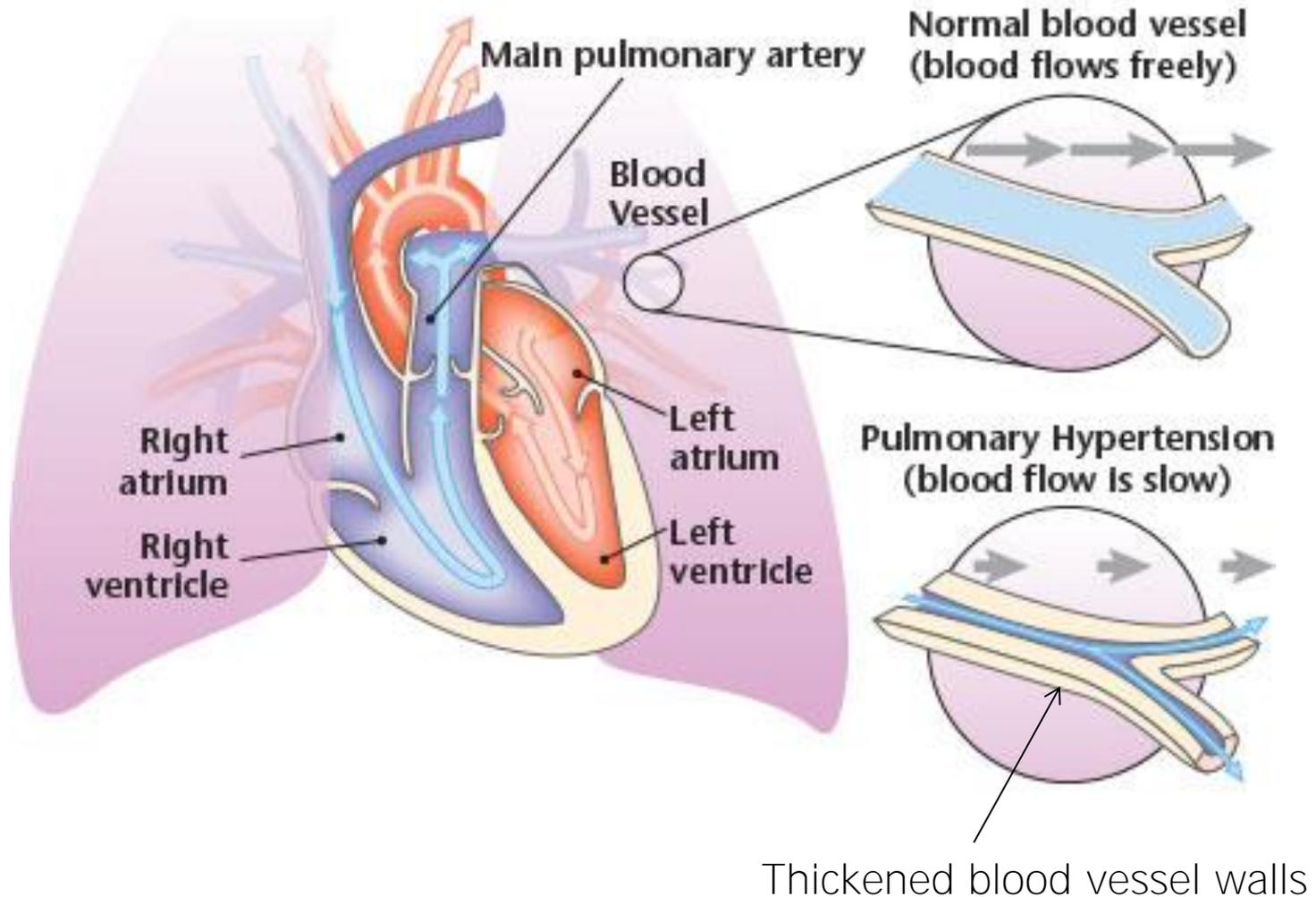
Normal



Fibrosis

Detailed view with IPF

Pulmonary Arterial Hypertension



COMMON TESTS YOUR DOCTOR MIGHT ORDER

The Chest XRAY

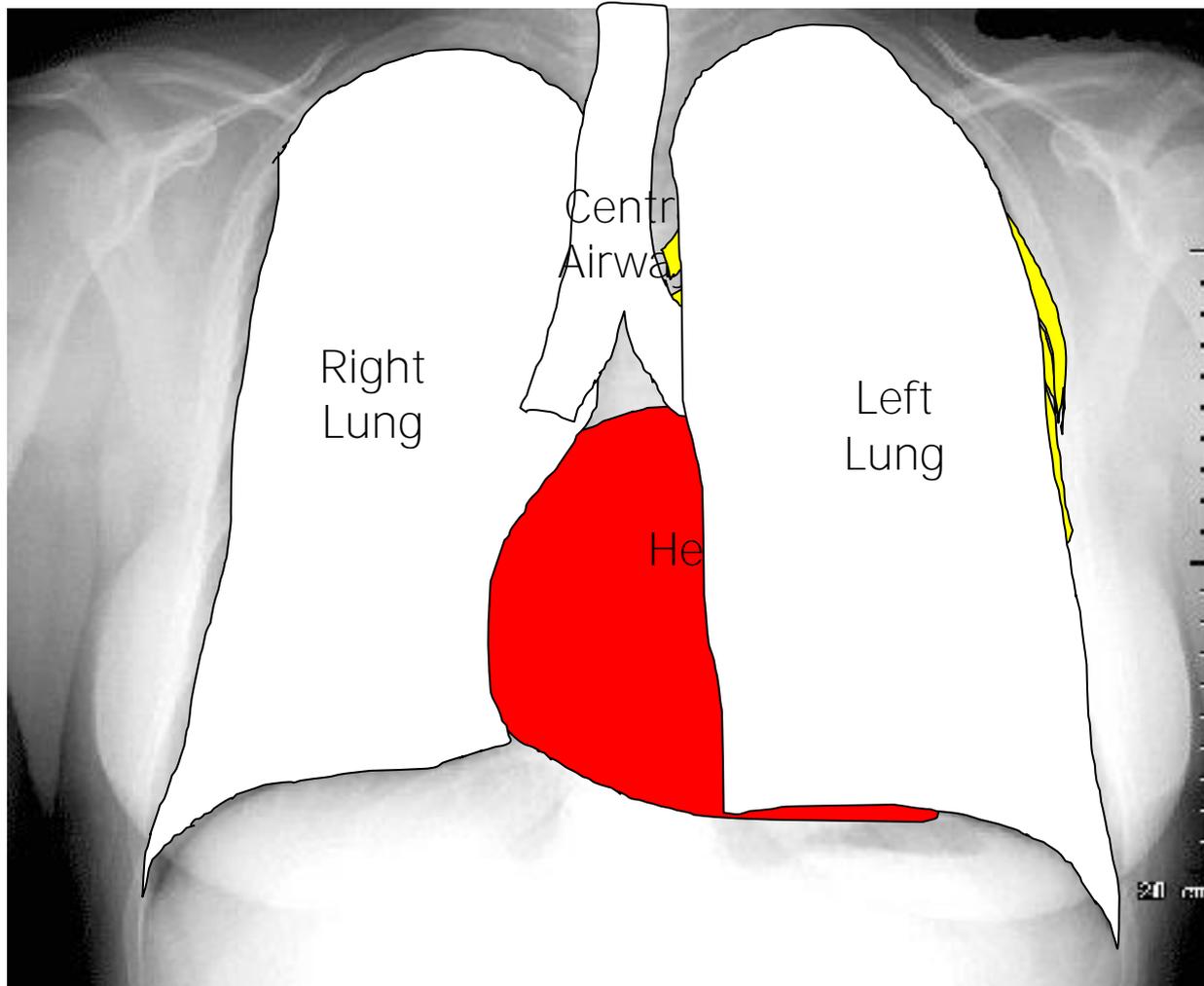
- X-rays use radiation to create pictures of the inside of the body
- Different tissues absorb different amounts of radiation
 - Bone and metal absorb x-rays well and appear white
 - Air in the lungs doesn't absorb x-rays and appears black
 - Tissues appear different shades of gray
- Diseases that change the way radiation is absorbed can be detected on x-ray



The Normal Chest XRAY



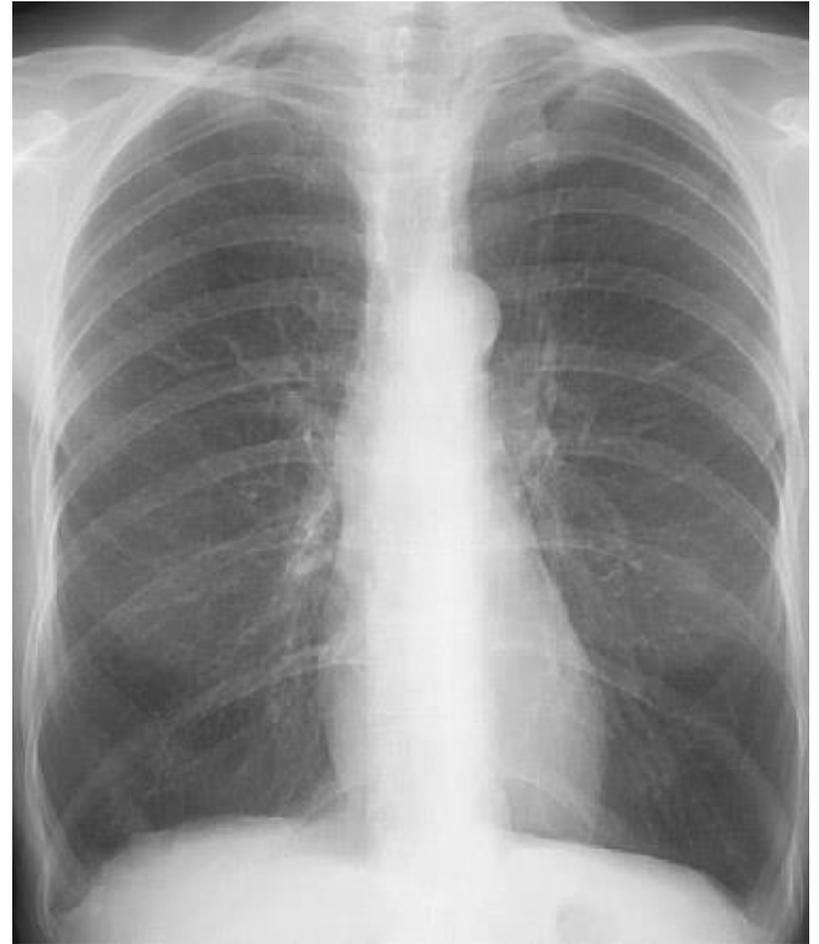
The Normal Chest XRAY



Emphysema

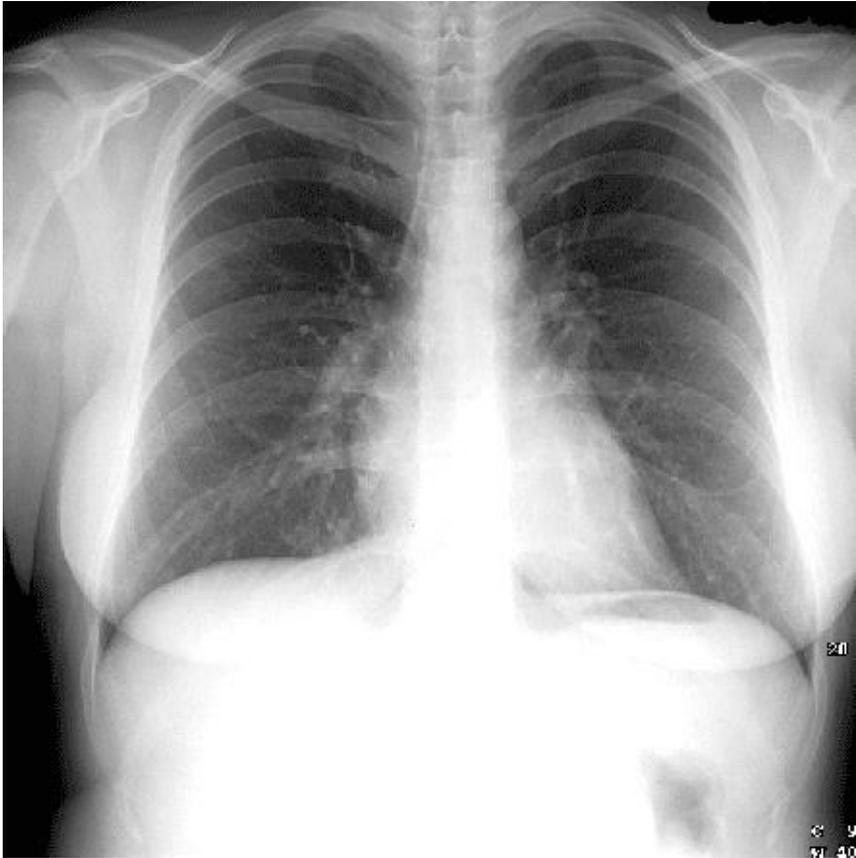


Normal



Emphysema

Pulmonary Fibrosis

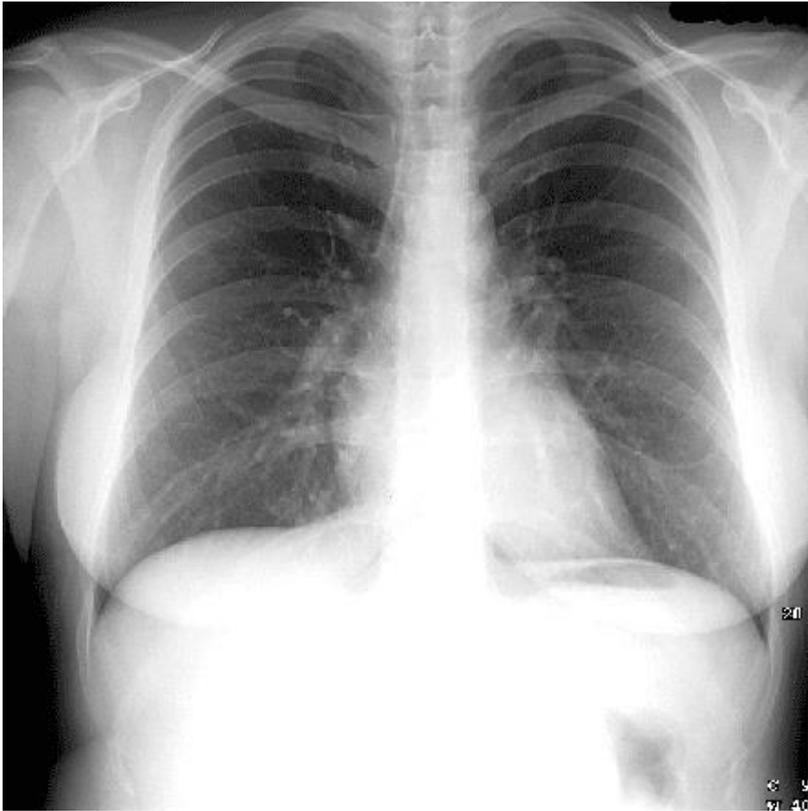


Normal

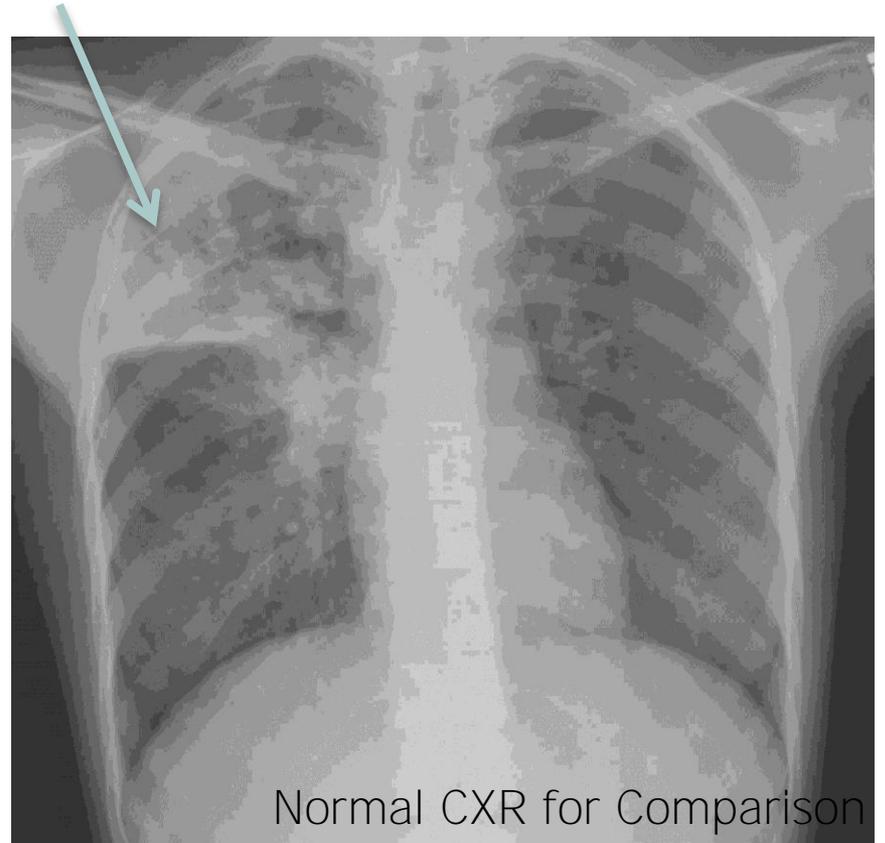


Pulmonary Fibrosis

Pneumonia



Normal



Normal CXR for Comparison

Pneumonia

Computed Tomography

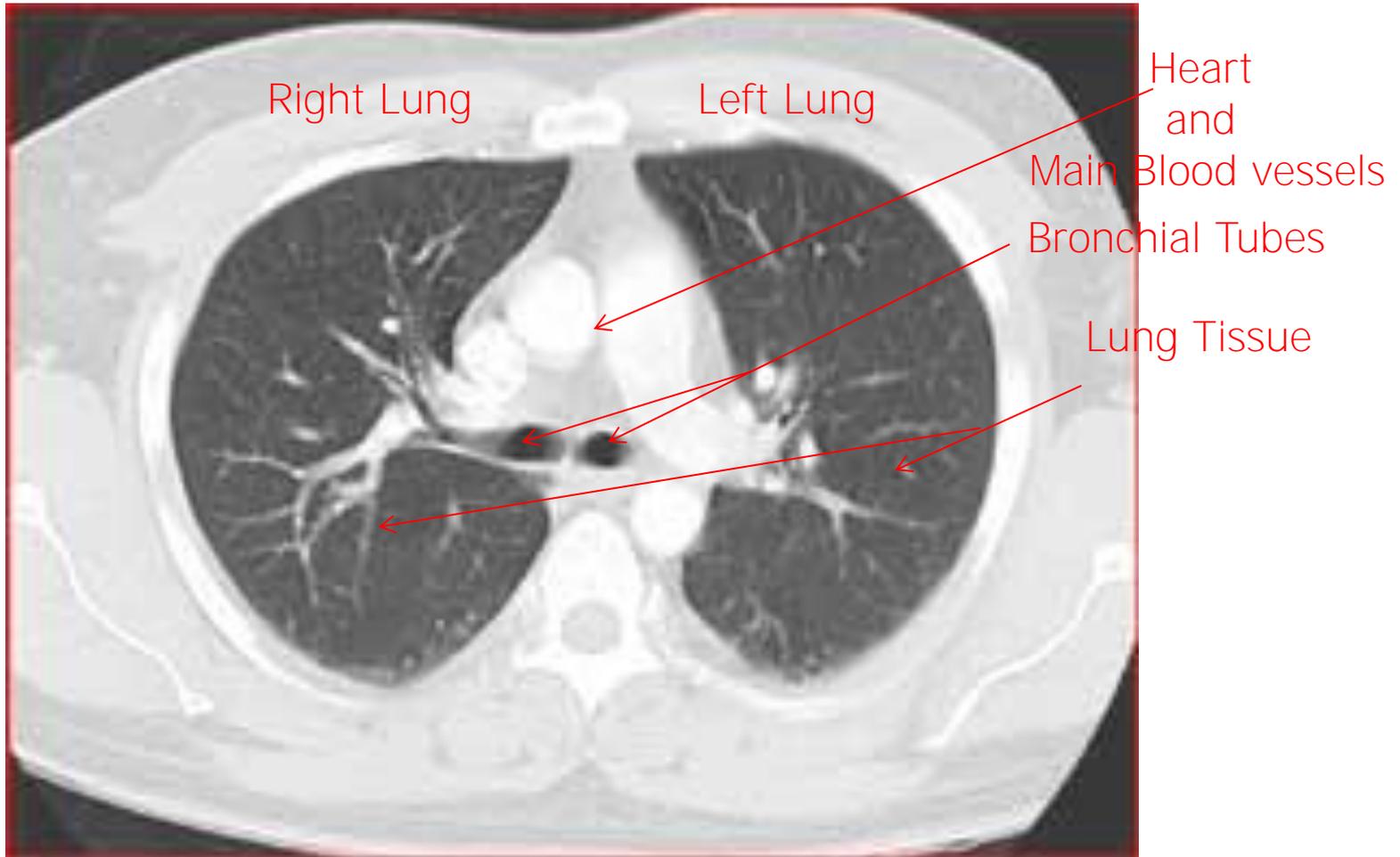
“The Cat Scan”

- Uses similar technology and concepts as XRAY
- Many more detectors allows creation of a 2D image of the patient's inside
- Provides much more detail than a chest XRAY
 - Risk is increased radiation exposure

CT Scan Machine

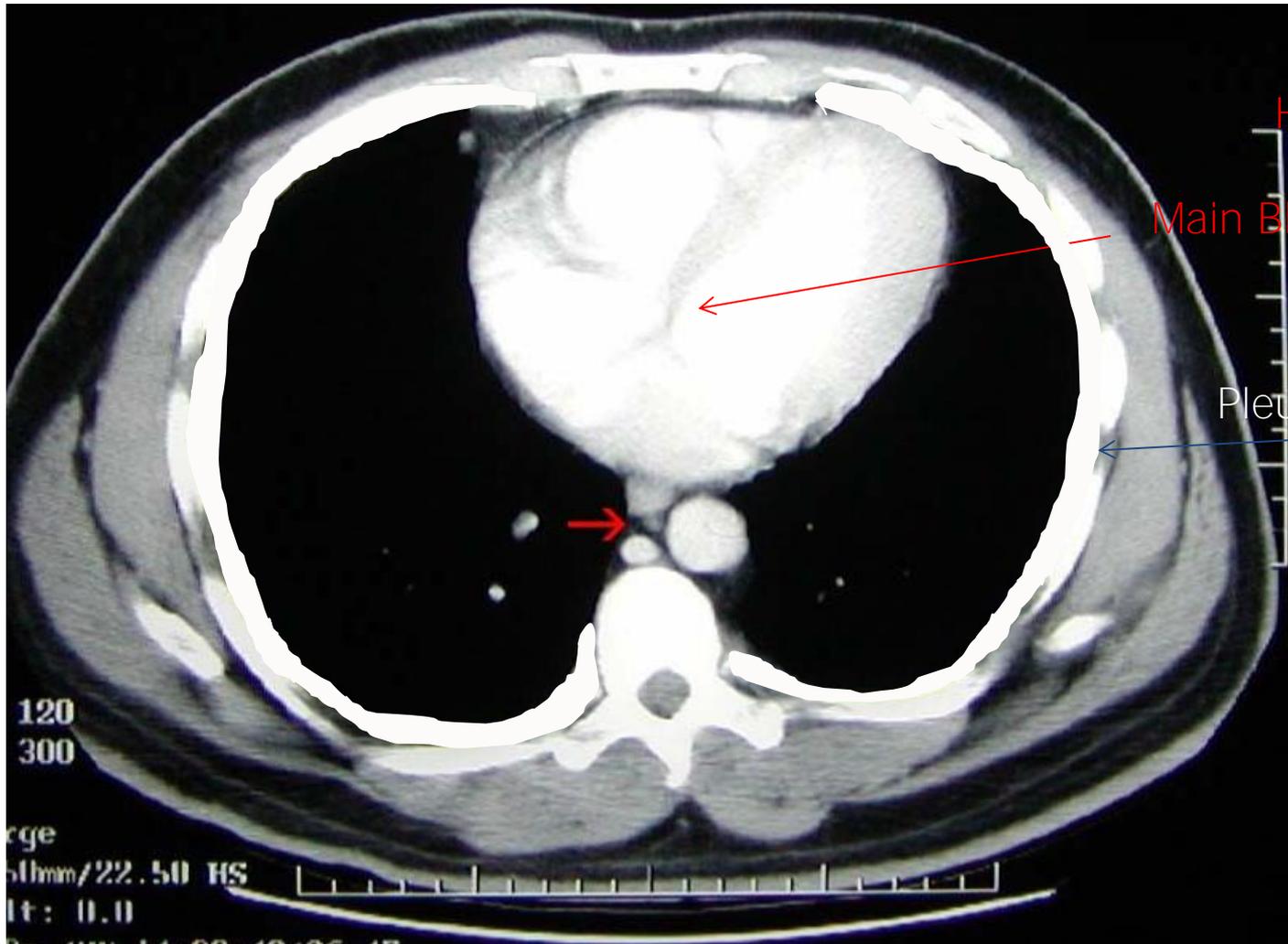


Normal CT Images



Slices are done as if lying with feet coming out of screen

Normal CT Images

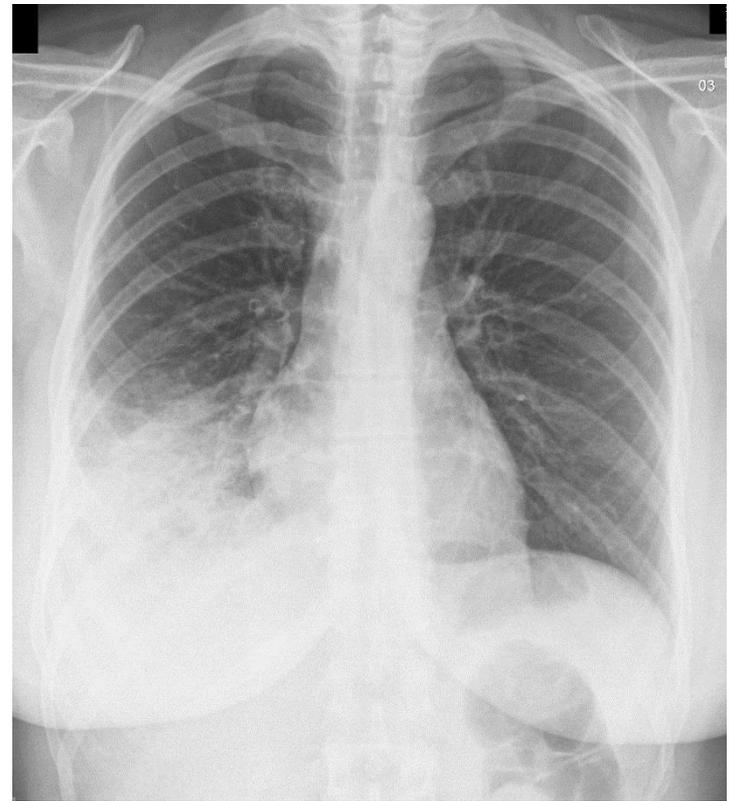
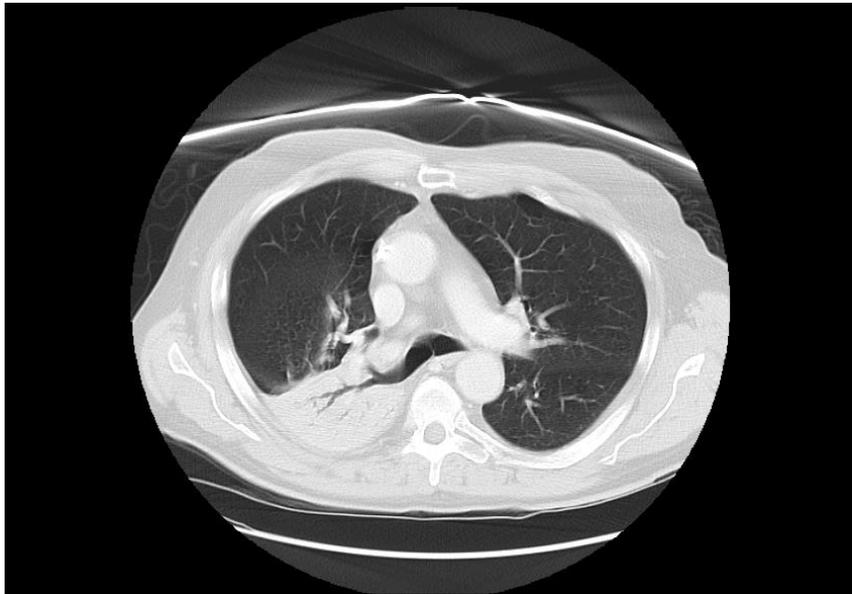


Heart
and
Main Blood vessels

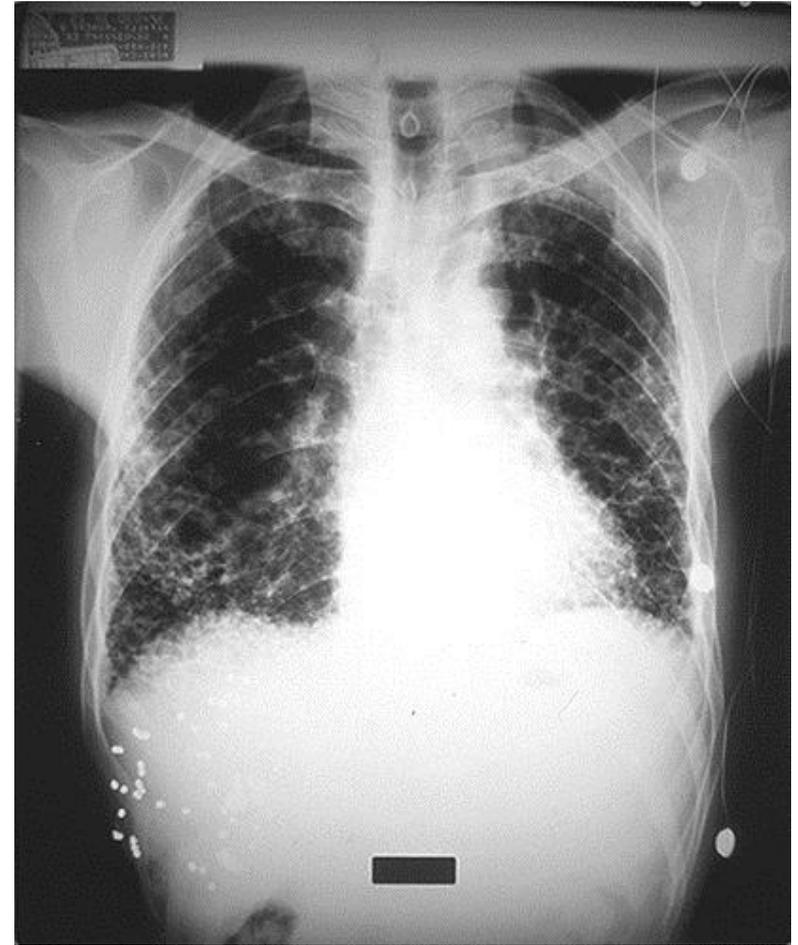
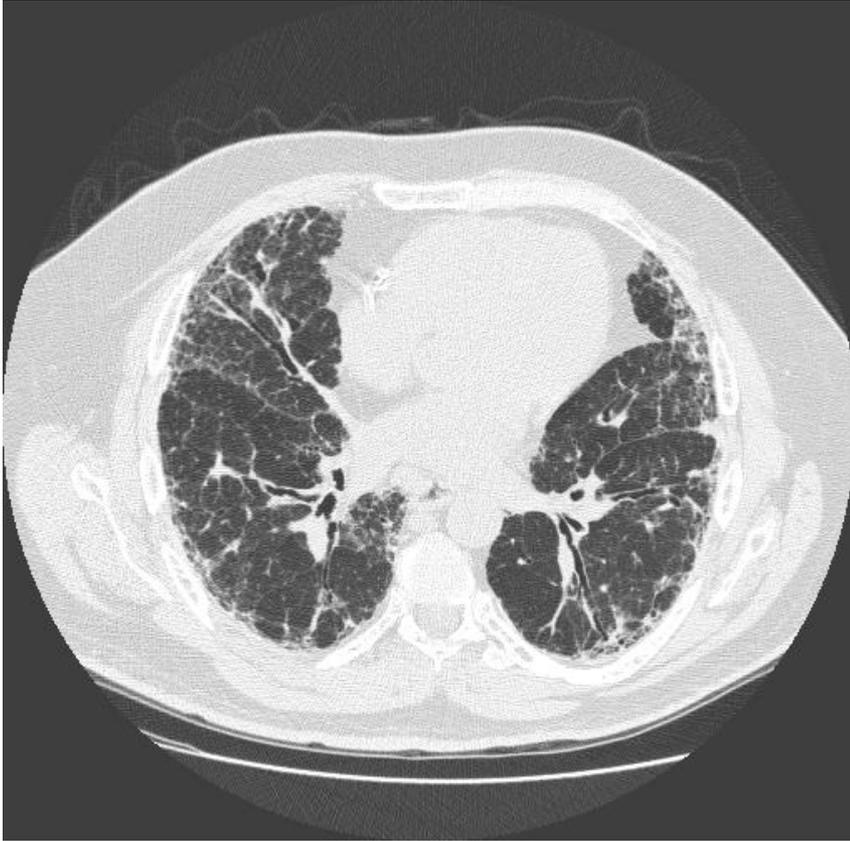
Pleural Space

Mediastinal Windows:
To See Heart Structures, Blood Vessels, Pleural space

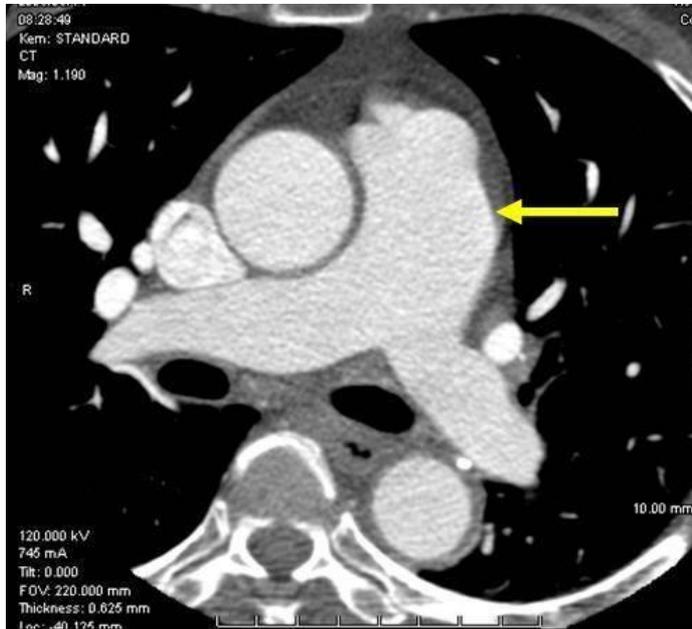
Right Lower Lobe Pneumonia



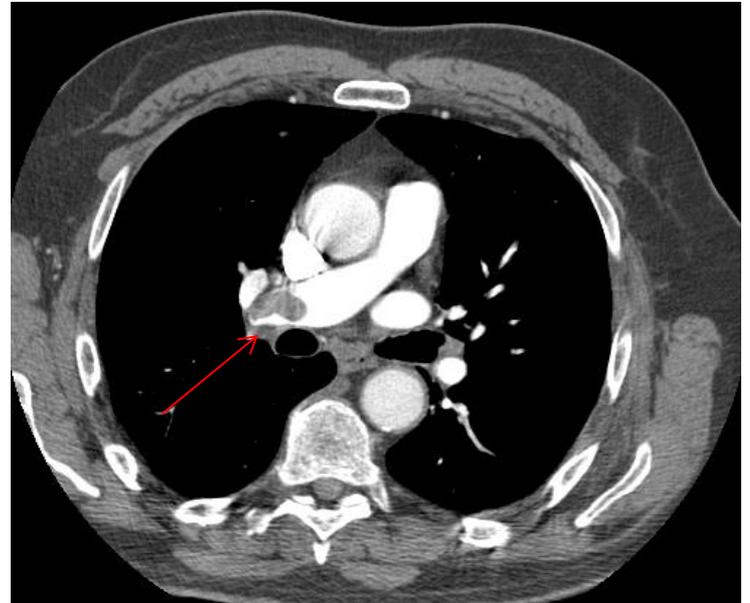
Pulmonary Fibrosis



Pulmonary Embolism

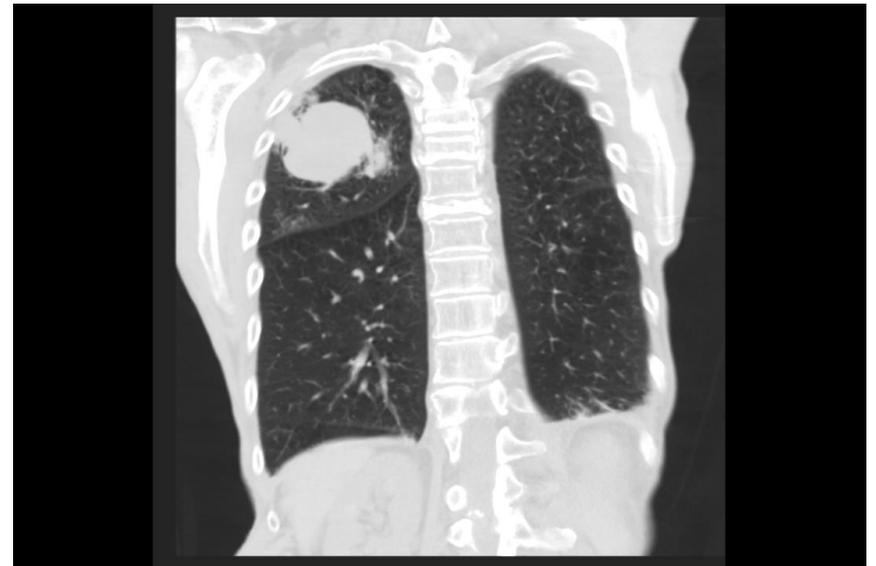
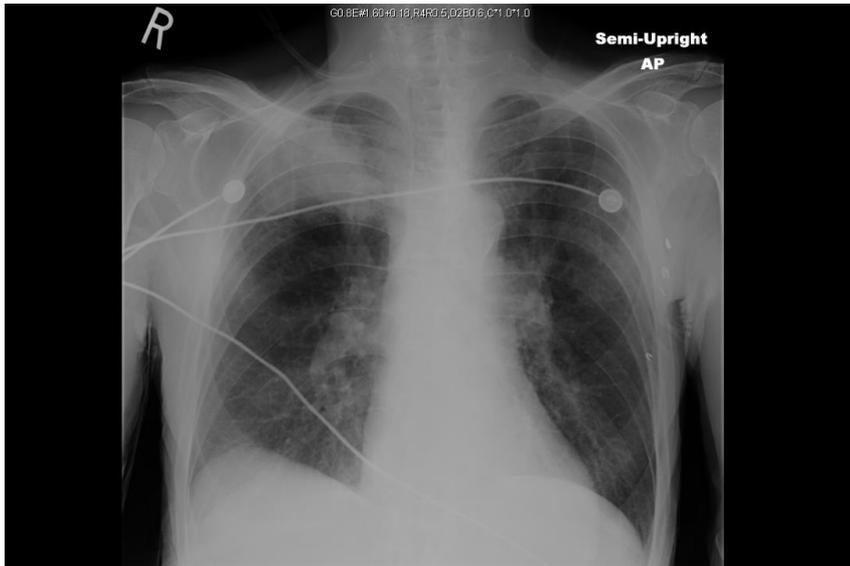


Normal
Pulmonary
Artery



Blood Clot in
Pulmonary
Artery

Lung Cancer



Bronchoscopy

Performed awake but
with Sedation

Flexible camera at end



A bronchoscopy is used to view the airway
to check for any abnormalities and perform
biopsies



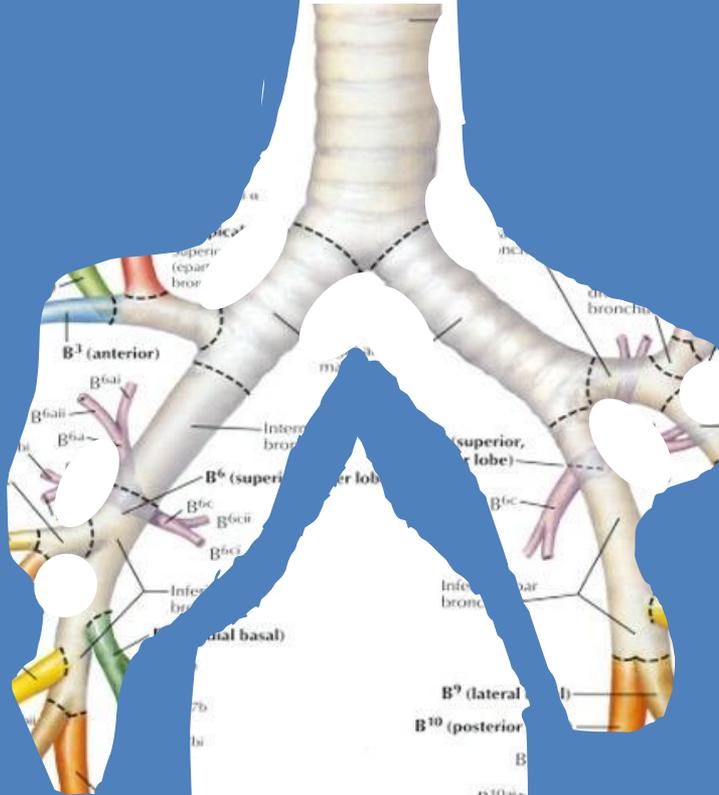
Bronchoscopy

Unexamined lung

Unexamined lung

Unexamined lung

Unexamined lung



Inspection of only airways larger than the camera

→ Bron

PET- CT Scan

- Used primarily to evaluate suspected or known cancer
- Tumor cells grow rapidly
- Cells that grow rapidly consume high amounts of sugar
 - Injection of radiolabeled glucose to see what cells are metabolically active
- Used to better define features of lung nodules
- Used in patients with known lung cancer to evaluate whether the cancer has spread

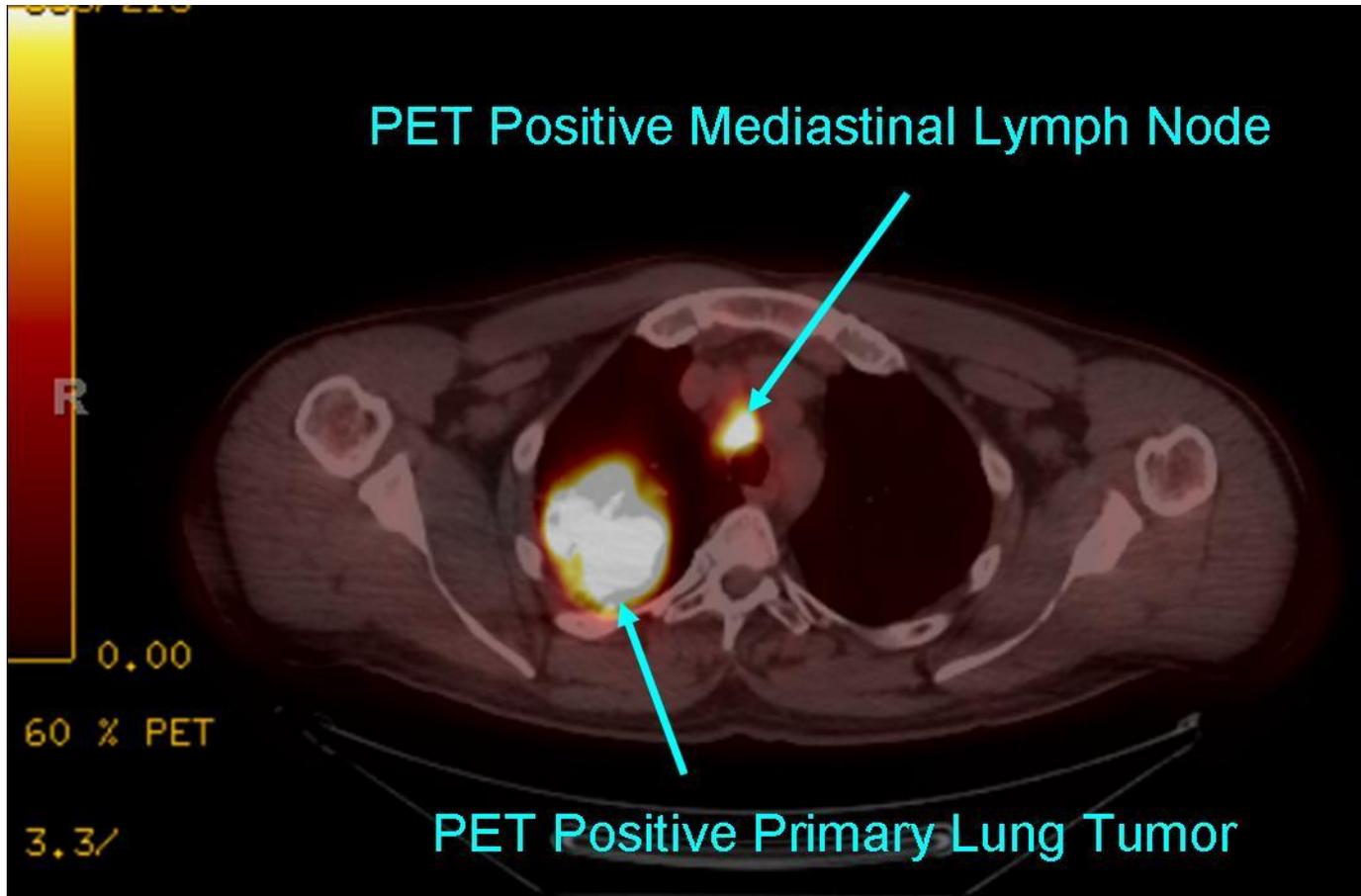
PET Scan

Left Sided Lung Mass



PET Scan

Right Sided Lung Mass



Pulmonary Function Tests (PFTs)

- Routine breathing tests to assess lung health
 - Important in the evaluation “shortness of breath” of unknown cause
 - Evaluation of other pulmonary complaints: cough
- Once diagnosis is known:
 - Allow for classification of severity of disease
 - Used to follow progress over time



Pulmonary Function Tests

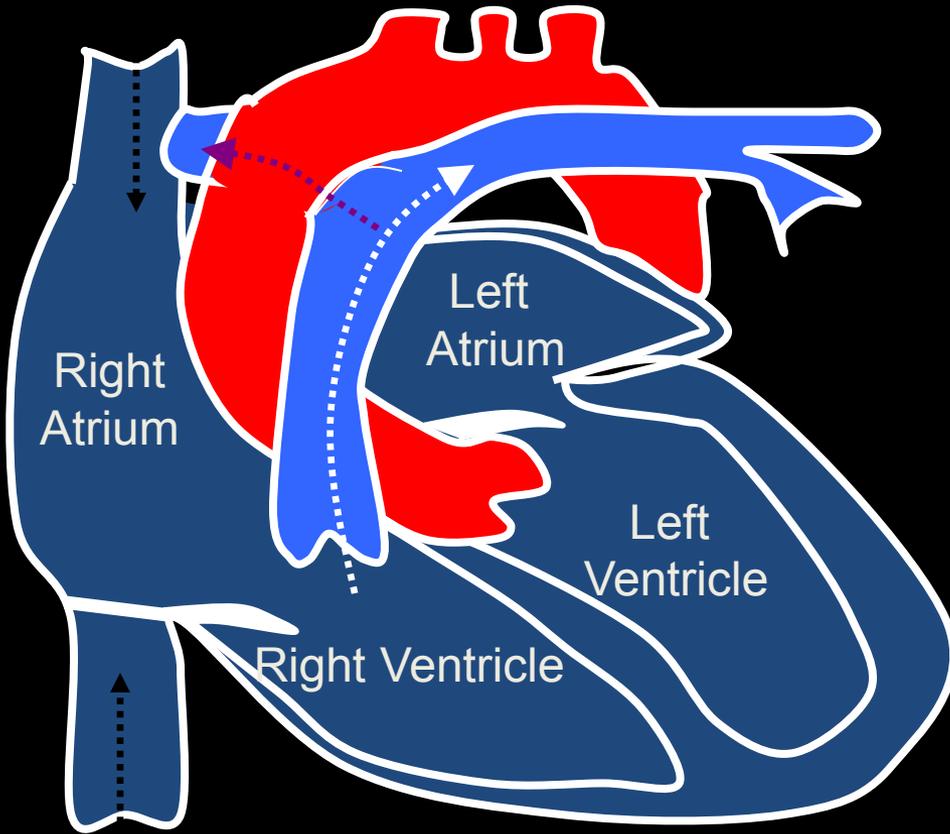
-



Echocardiography

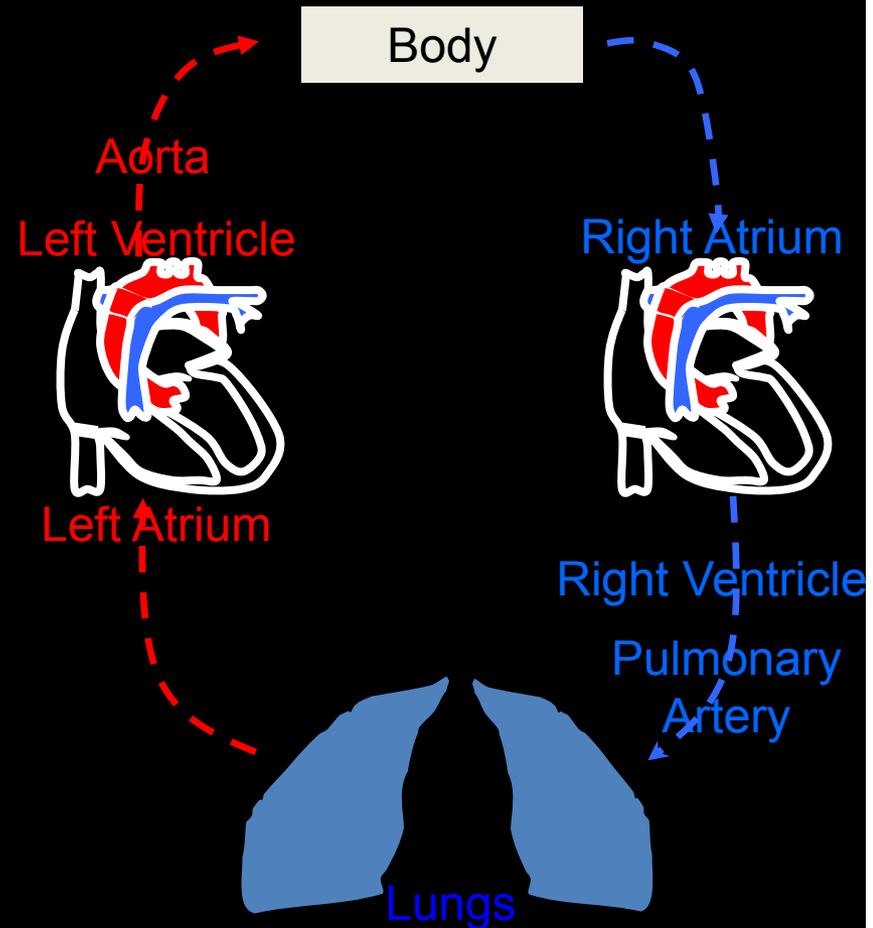
Normal Heart Structures

From Head/Arms



From Lower Body

Blood flow

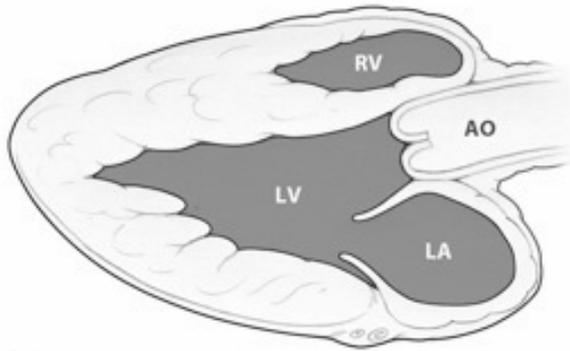


Echocardiography

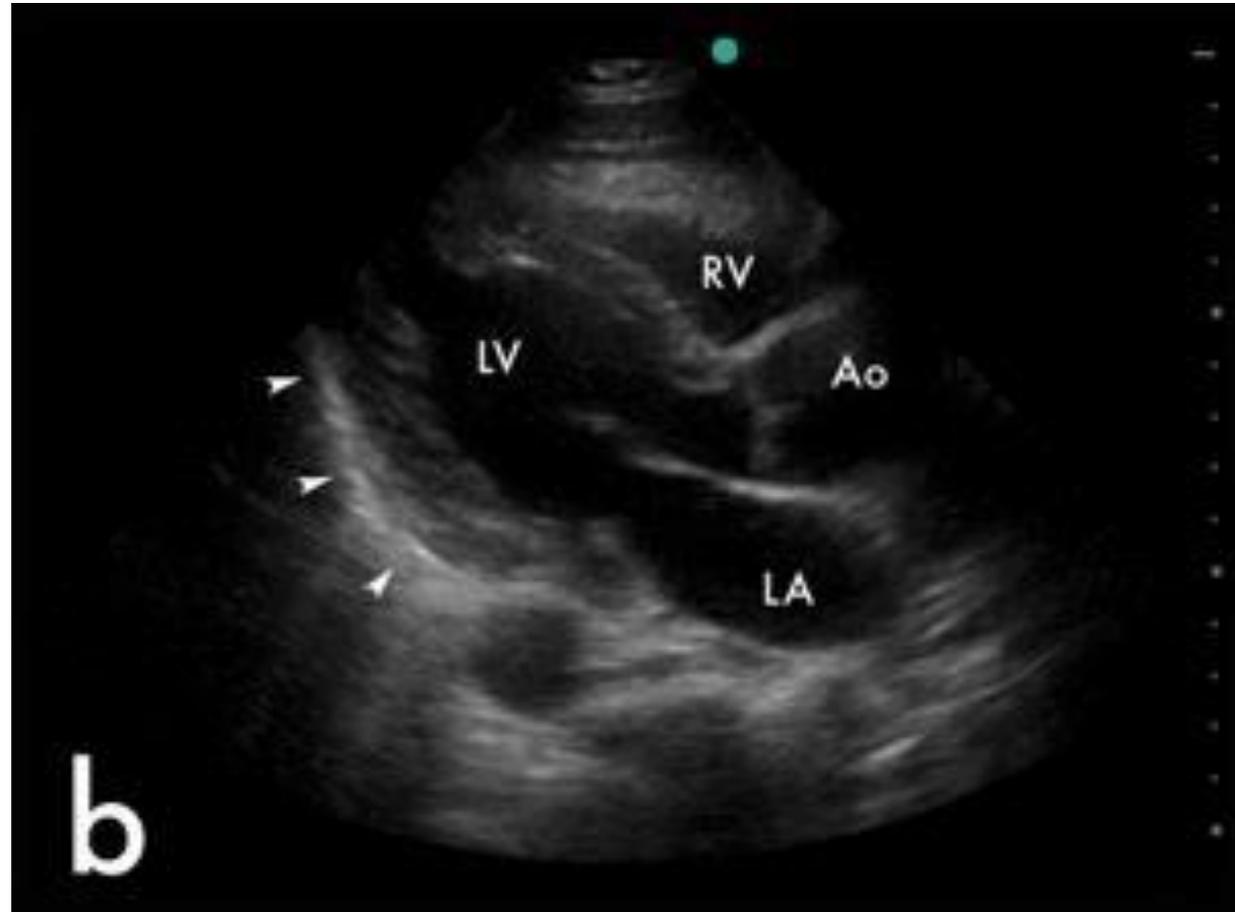
- Left heart evaluation
 - Function
 - Valves
- Right heart structures and function
 - Presence of pulmonary hypertension



Echocardiography



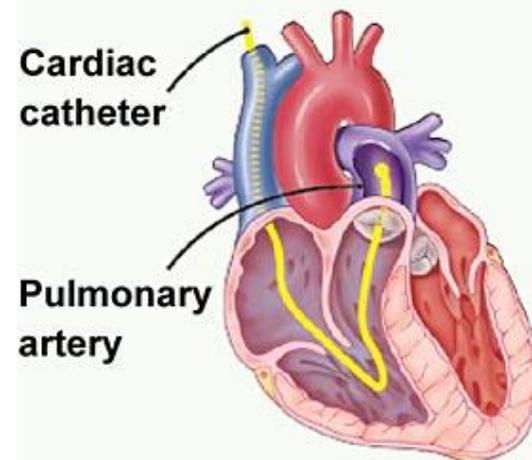
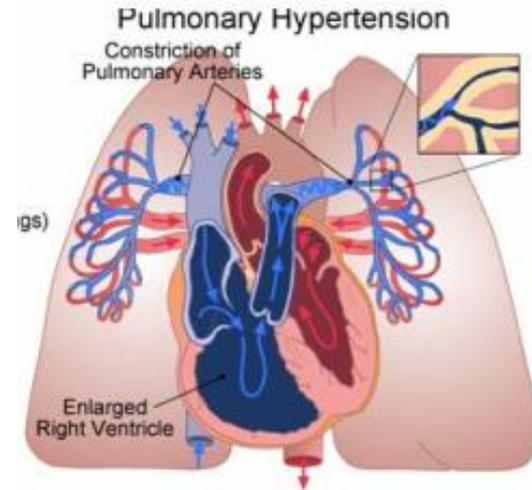
a



b

Right Heart Catheterization

- Used to measure pressures in the right side of the heart
- Primarily used to diagnosis and monitor pulmonary hypertension



Comments or Questions?