INVESTIGATIONS OF LUNG DISEASE

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Objectives

- Type of pulmonary diagnostic procedures
- Role of various specialized pulmonary procedures in diagnosing lung diseases
- When to apply specific tests

Pulmonary Diagnostic Procedures

- Thoracentesis
- Chest tube
- Pleural biopsy
- Bronchoscopy
- Pulmonary function tests
- Computed tomography
- Lung Scans: V/Q

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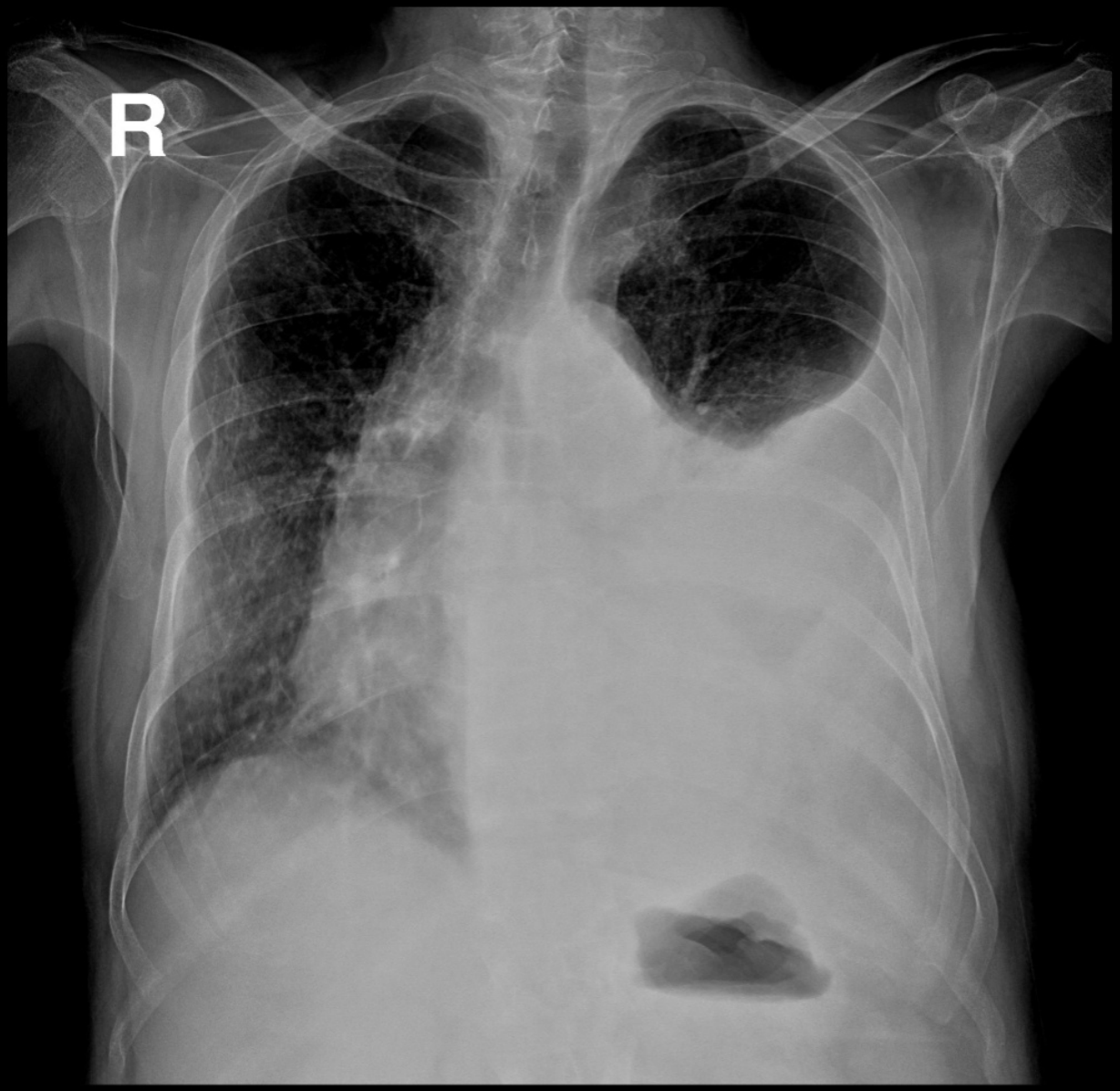

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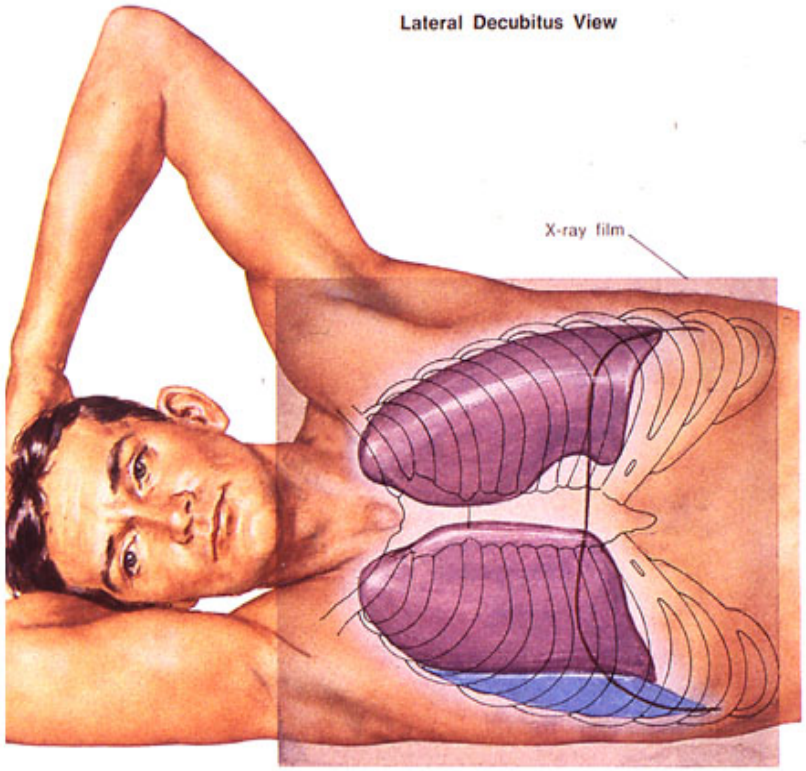
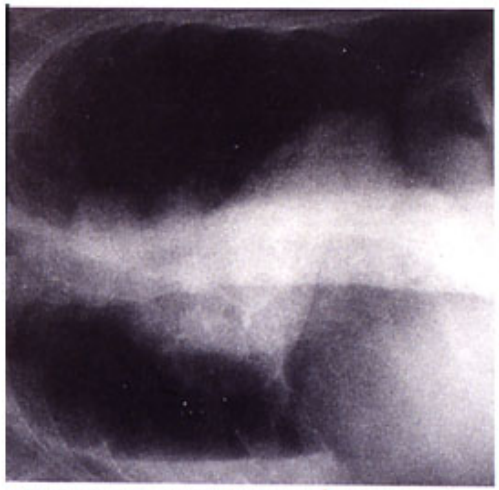
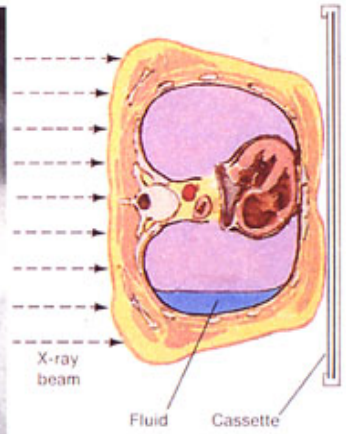
Lateral Decubitus View





lateral decubitus x-ray film: fluid in r. pleural space



Sectional view

Thoracentesis

- Appearance
- Gram stain, and cultures
- pH
- Chemistry (glucose, amylase, LDH, protein)
- Cytology

Separation of Transudates from Exudates

- Pleural fluid protein divided by the serum protein greater than 0.5
- Pleural fluid LDH divided by the serum LDH greater than 0.6
- Pleural fluid LDH greater than two-thirds of the upper limit of normal for the serum LDH

- Gross appearance is pus

or

- Gram stain positive

or

- pH below 7.20

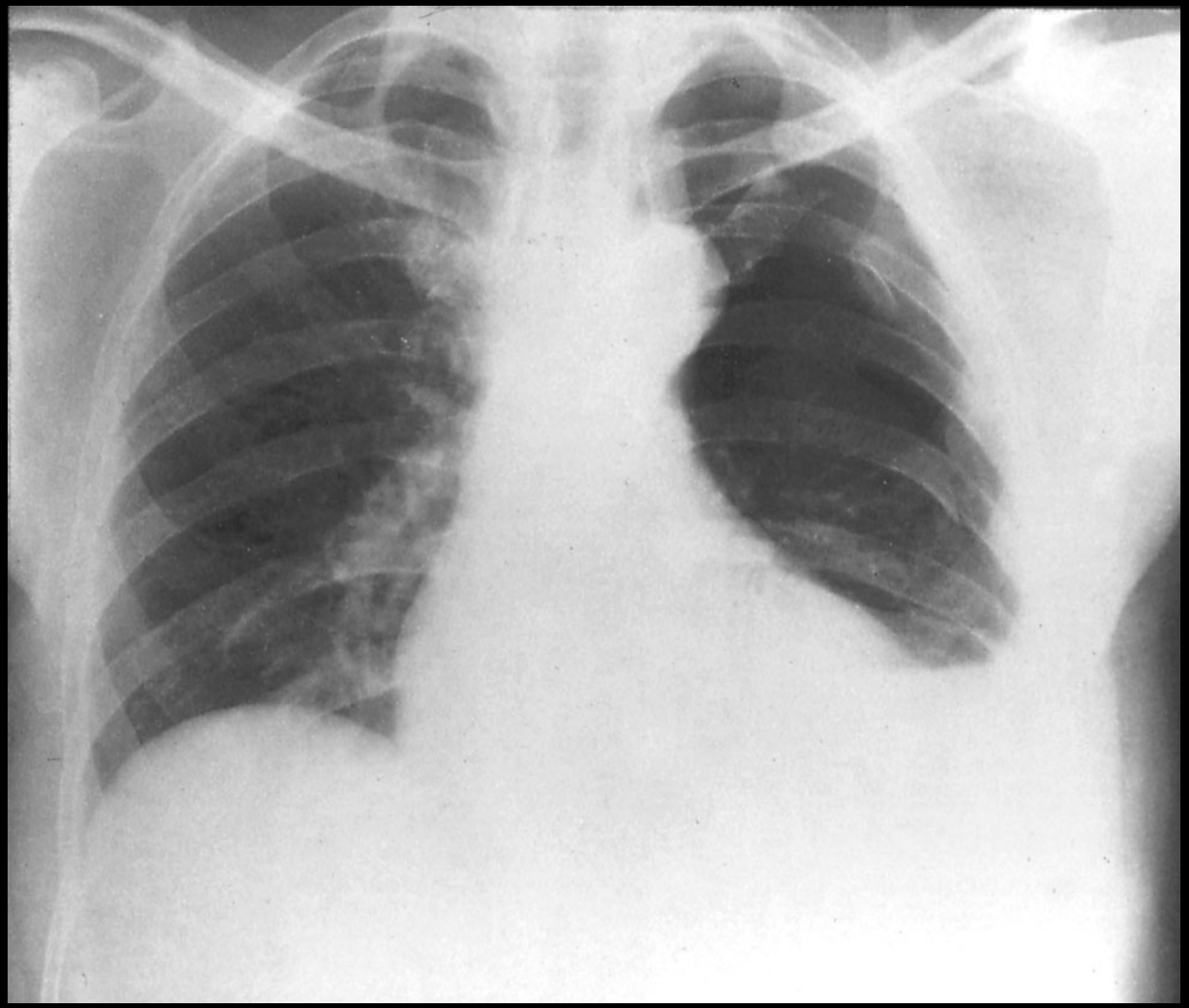
Chest tube

Indication for chest tube insertion

- Empyema
- Complicated parapneumonic effusion
- Symptomatic pleural effusion
- Hemothorax
- Pneumothorax

Complication of Thoracentesis

- Pneumothorax
- Bleeding
- Infection
- Hypotension
- Hypoxemia
- Air embolism
- Splenic laceration



Pleural biopsy

- Granulomatous disease
- Malignanancy

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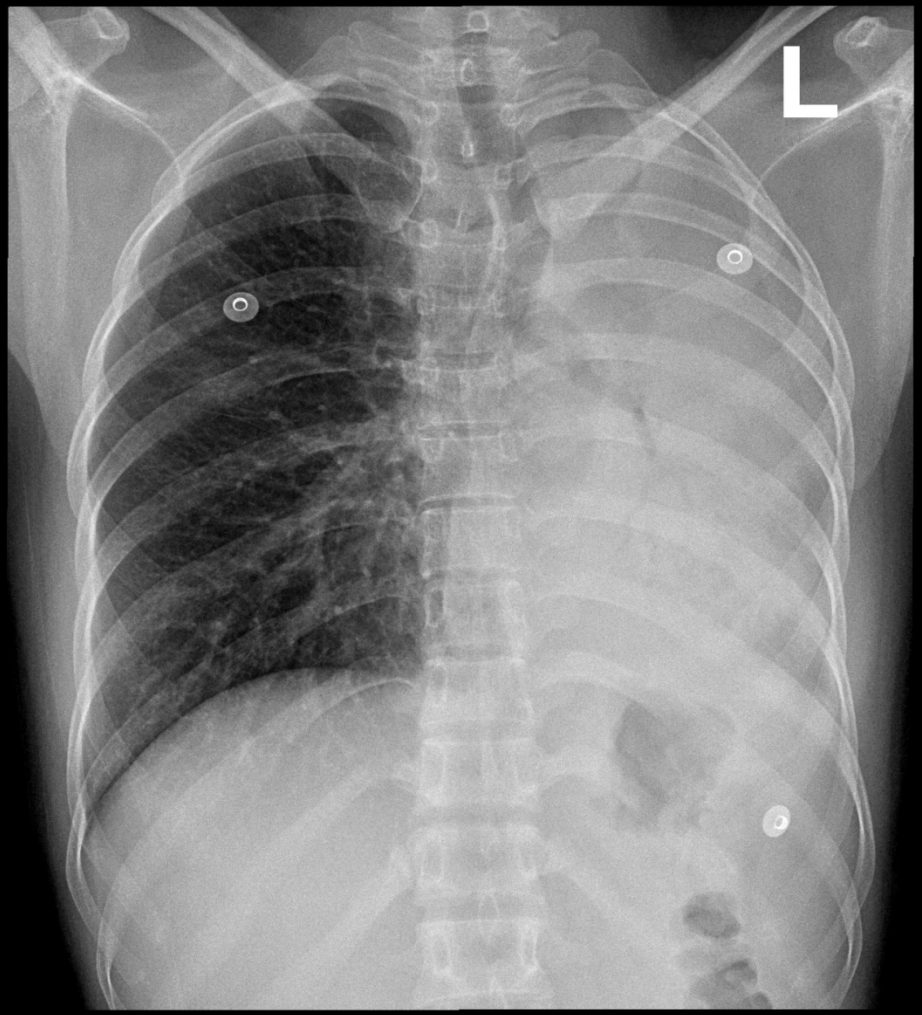

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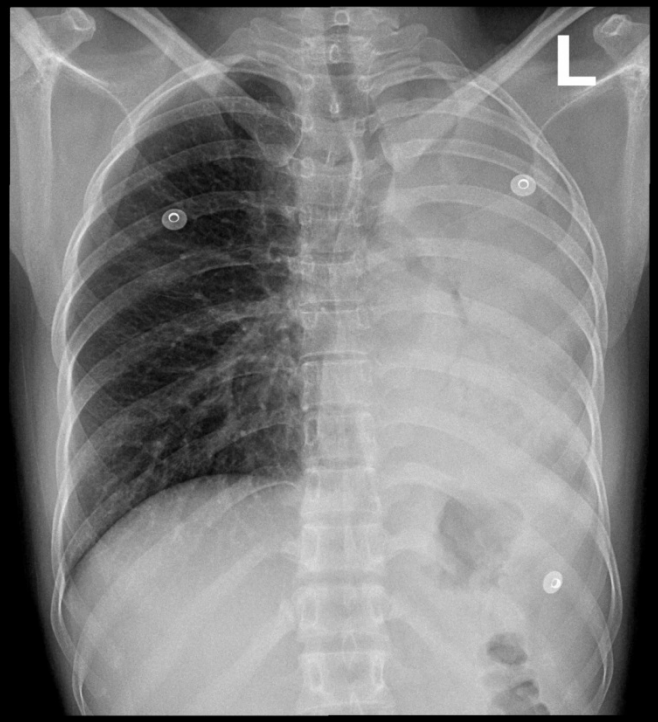

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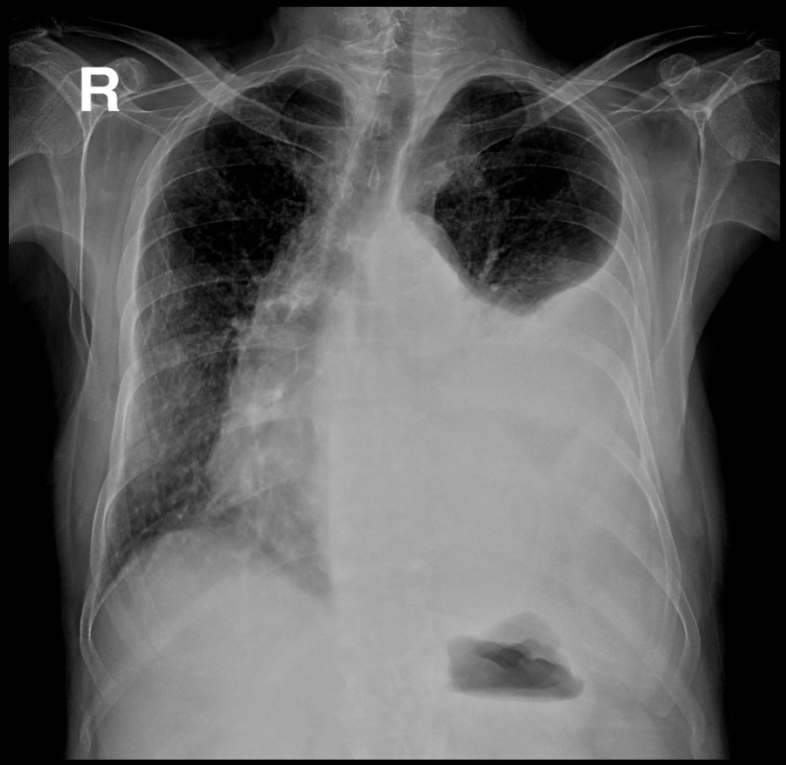


Bronchoscopy

Suspected lung cancer

Abnormal CXR

Hemoptysis

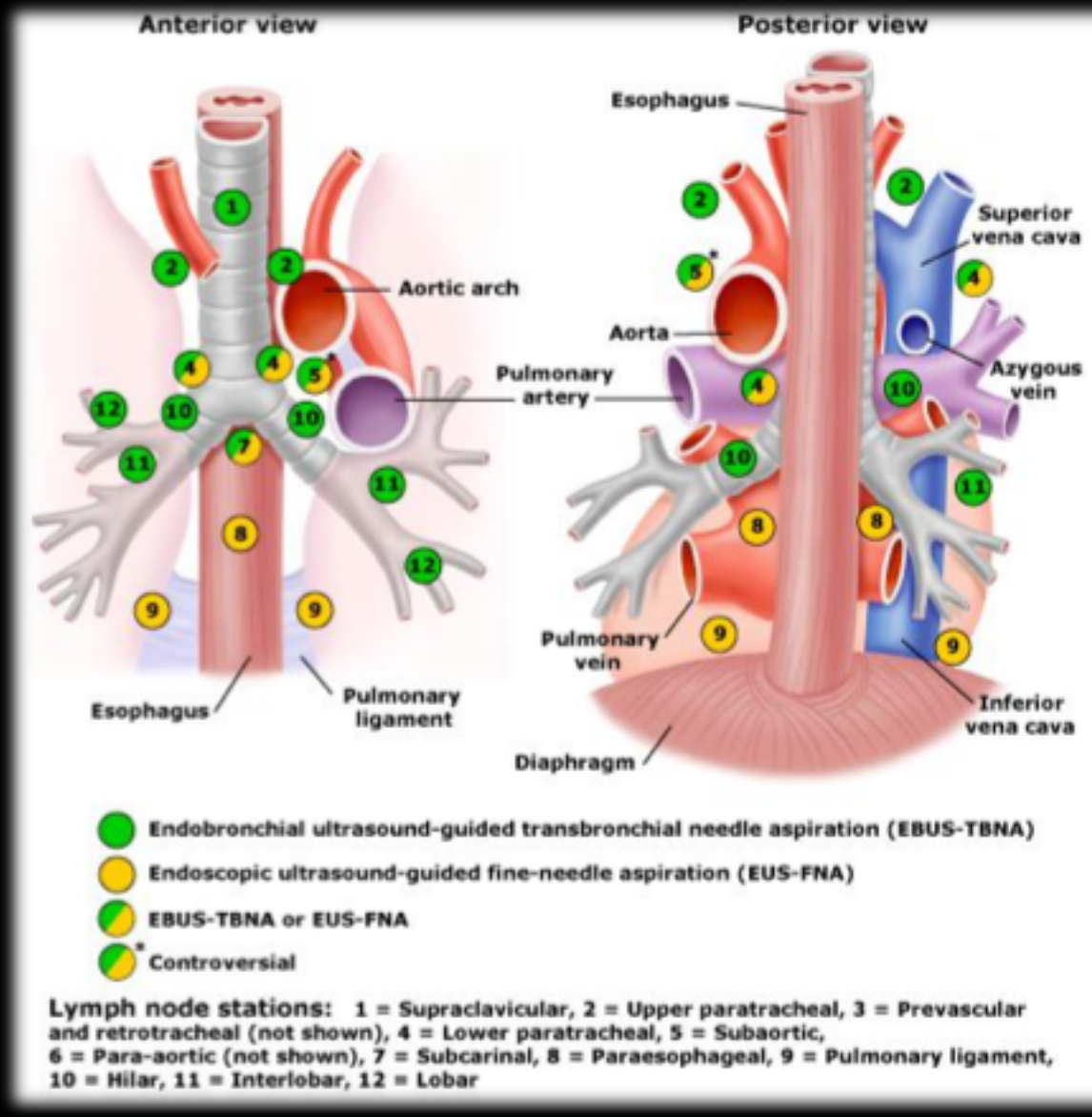
Unexplained cough

Localized wheeze

Positive sputum cytology

Bronchoscopy

- Mediastinal lymph nodes
- Hemoptysis
- Refractory cough
- Unexplained pleural effusion
- Lung abscess
- Staging of lung cancer
- Obtain culture material
- Airway trauma
- Tracheoesophageal fistula
- Diffuse lung disease


Anterior view
Posterior view
Esophagus
Superior vena cava
Aortic arch
Aorta
Pulmonary artery
Azygous vein
Pulmonary vein
Inferior vena cava
Diaphragm
Esophagus
Pulmonary ligament
Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA)
Endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA)
EBUS-TBNA or EUS-FNA
Controversial
Lymph node stations: 1 = Supraclavicular, 2 = Upper paratracheal, 3 = Prevascular and retrotracheal (not shown), 4 = Lower paratracheal, 5 = Subaortic, 6 = Para-aortic (not shown), 7 = Subcarinal, 8 = Paraesophageal, 9 = Pulmonary ligament, 10 = Hilar, 11 = Interlobar, 12 = Lobar

Bronchoscopy

Therapeutic

- Remove foreign bodies
- Remove abnormal endobronchial tissue
- Difficult endotracheal tube intubation
- Endobronchial stent placement

Pulmonary function tests

- Spirometry
- Lung volumes
- Diffusion capacity
- Respiratory muscle strength

Spirometry

- FVC (L) predicted >90%
- FEV1 (L) predicted >90%
- FEV1/FVC > 70

- Diagnose obstructive lung disease
- Suggest restrictive lung disease

Lung volumes

- TLC (L) >90% predicted
- RV (L) > 90% predicted

- Diagnose restrictive lung disease
- Diagnose air trapping

Diffusing capacity (DL)

- Measure the ability of gases to diffuse from the alveoli into the pulmonary capillary blood
- CO not normally present in lungs or blood
- More soluble in blood than lung tissues
- Dlco

↓DLco

- Reflect loss or damage to the gas exchanging surface of the lung
- Emphysema
- Distinguish emphysema from chronic bronchitis or chronic asthma
- Interstitial lung disease
- Pulmonary vascular disease

Respiratory muscle strength

- PImax, Pemax
- Measured by pressure transducer at the mouth when subject make a maximal inspiratory effort from full expiration or maximal expiratory effort from full inspiration
- PI reflect inspiratory muscles (diaphragm)
- PE expiratory muscles including abdominal
- Motor neuron disease, Guillian Barre syndrom

DIAGNOSIS

[redacted]

	Baseline		
Date and Time	03/02/2010	08:41	
SPIROMETRY	Pred	Pre	%Pred/P
FVC (L)	5.04	3.13	62.1
FEV 1 (L)	4.25	2.53	59.5
FEV 1 FVC		80.91	
MMEF 75/25 (L/s)	4.93	2.46	49.9
PEF (L/s)	9.73	7.88	81
FIF (50 (L/s)		4.09	
FEF 50 (L/s)	5.45	4.23	77.6
BODY PLETHYSMOGRAPH			
VC (L)	5.27	3.13	59.4
TLC (L)	6.9	4.51	65.4
ITGV (L)	3.25	3.58	110.2
ERV (L)	1.59	2.2	138.4
RV (L)	1.66	1.38	83.1
RV % TLC	24.49	30.58	124.9
PI MAX (kPa)	10.96	7.11	64.9
PE MAX (kPa)	14.51	11.55	79.6
DIFFUSING CAPACITY			
TLCO SB (mmol/min/kPa)	11.63	5.27	45.3
Hb (g/100ml)		16.2	
TLCOc SB (mmol/min/kPa)	11.63	5.06	43.5
KCO (mmol/min/kPa)	1.68	1.54	91.7
TLC-He (L)	6.75	3.42	50.7

- 50 yr old male with SOB and cough >3yrs
- Exam: clubbing and bilat insp crackles
- CXR: reticulation bilateral
- ABG: hypoxic respiratory failure
- PFT: restrictive defect with significant impairment in DLco

HRCT

- Designed for detailed evaluation of interstitial structures of the lung

- Use narrow slice thickness (1-2 mm) compared with 5-10 mm for routine scans

HRCT

Principle indications

- Suspected interstitial lung disease
- Characterization of interstitial lung disease
- Characterization of solitary pulmonary nodules
- Diagnosis of bronchiectasis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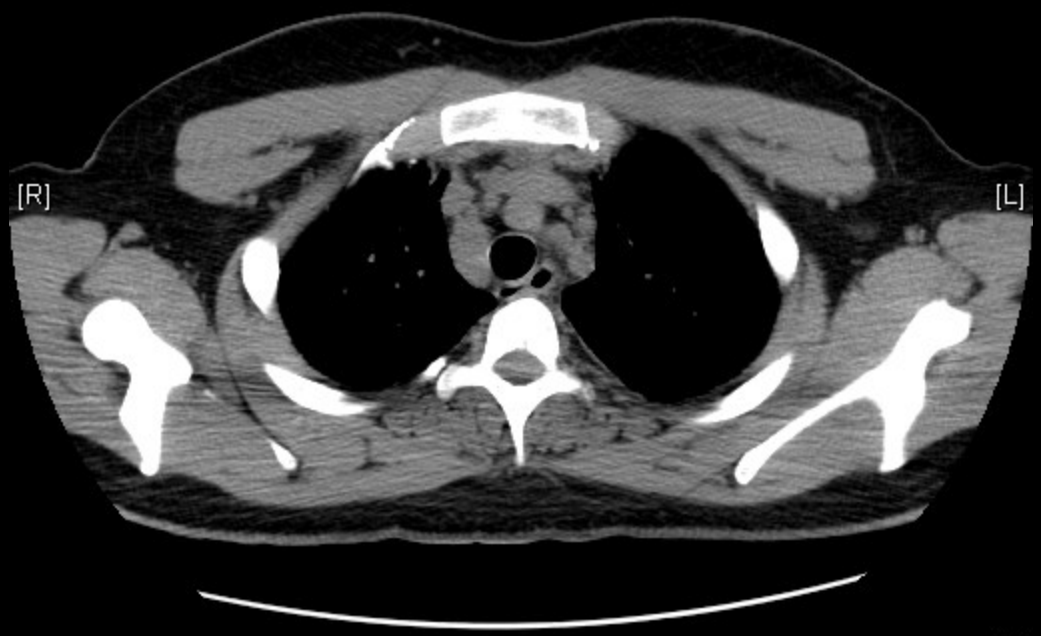
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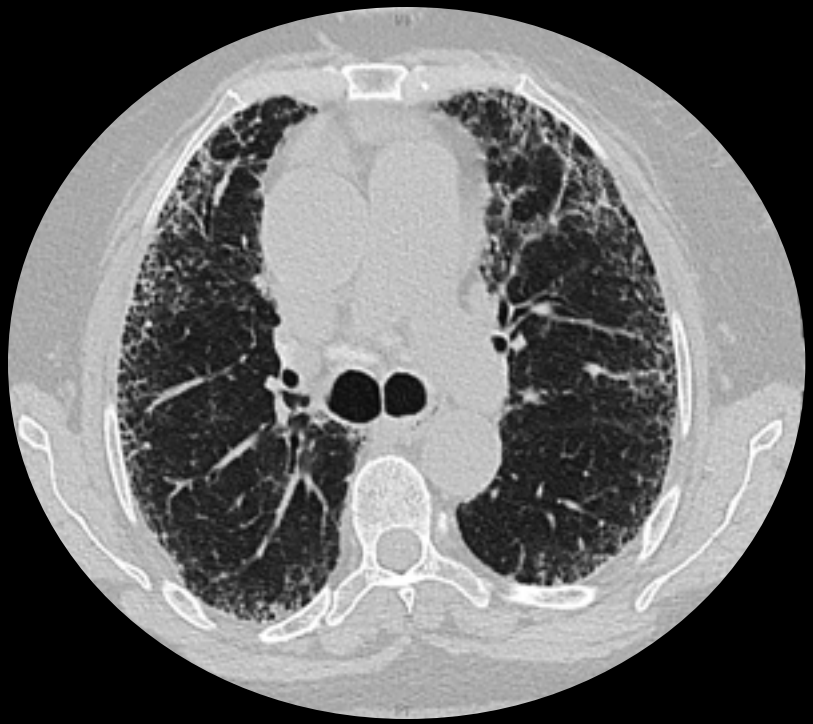
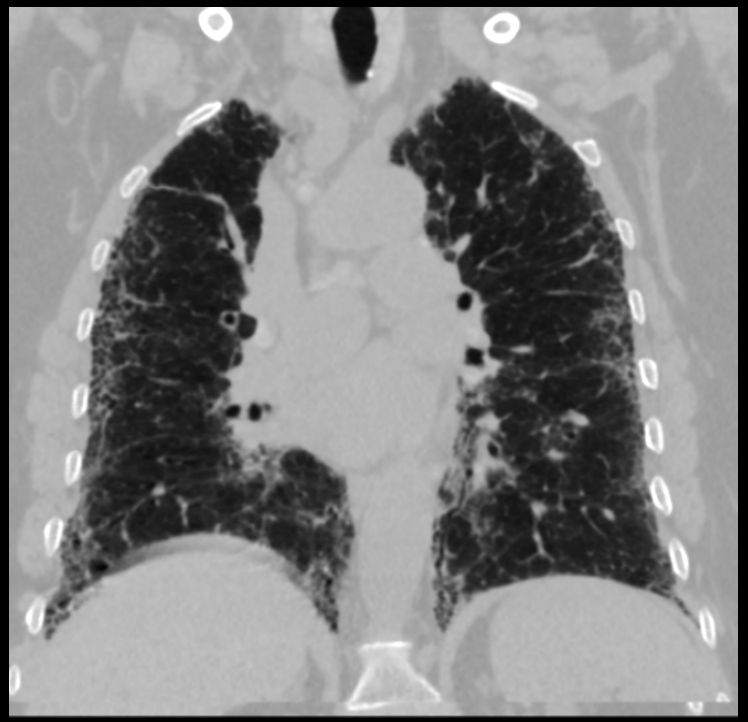
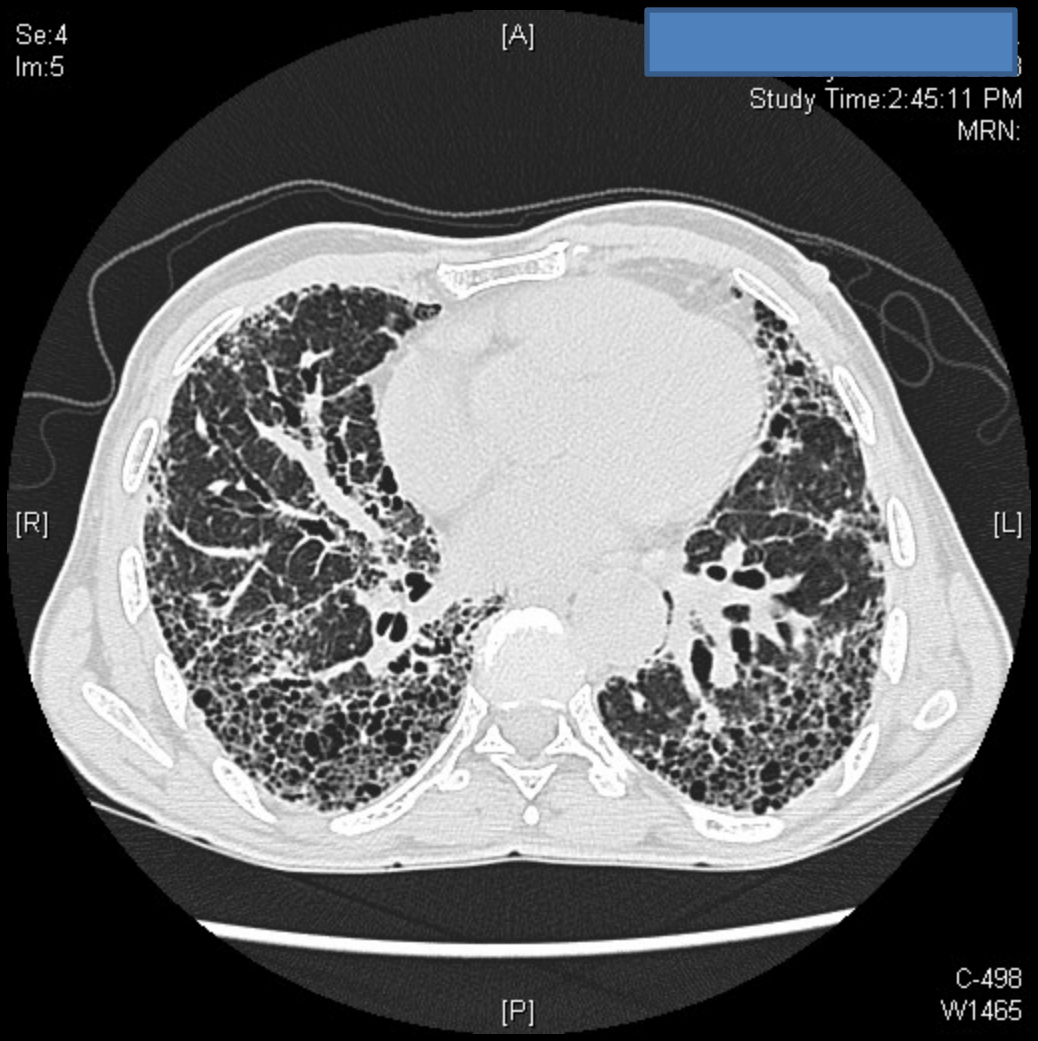
C56
W342



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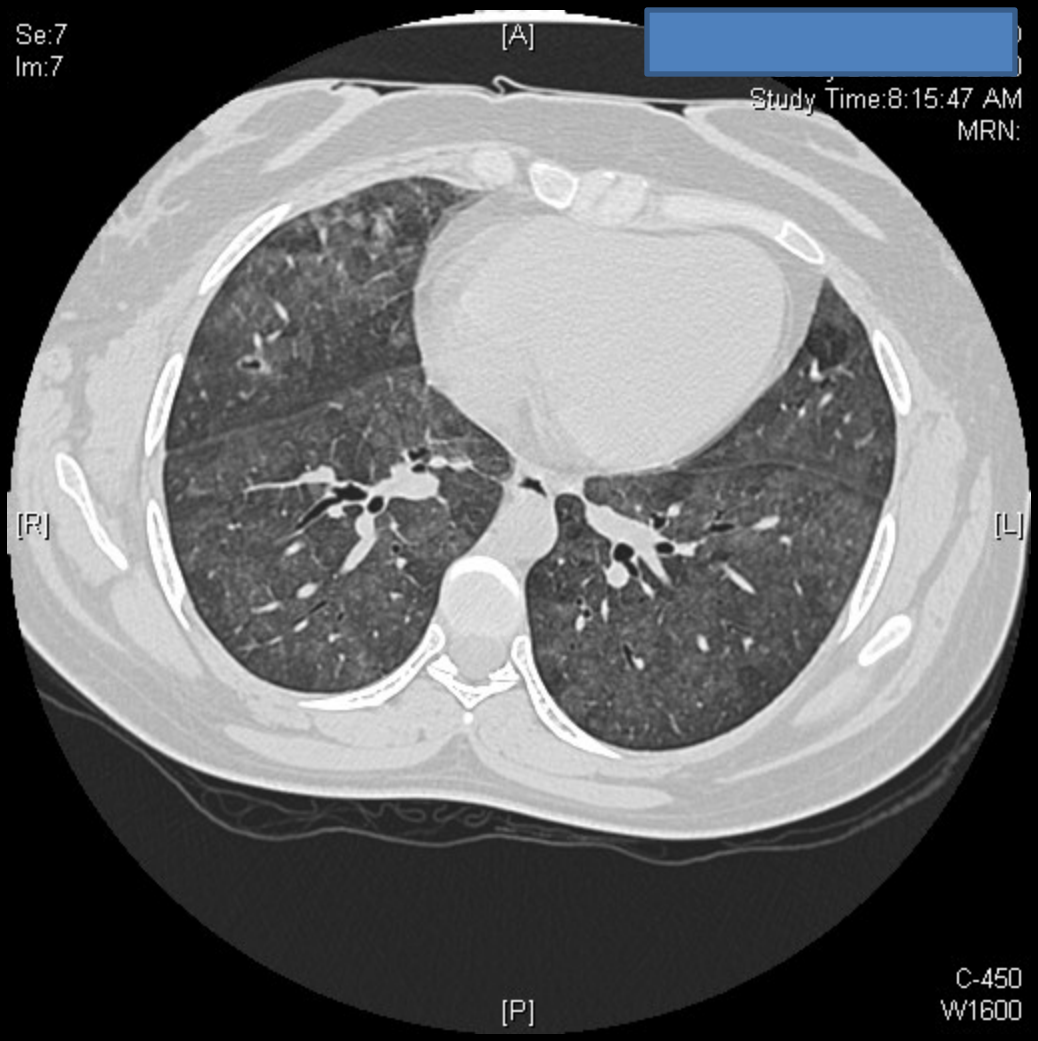
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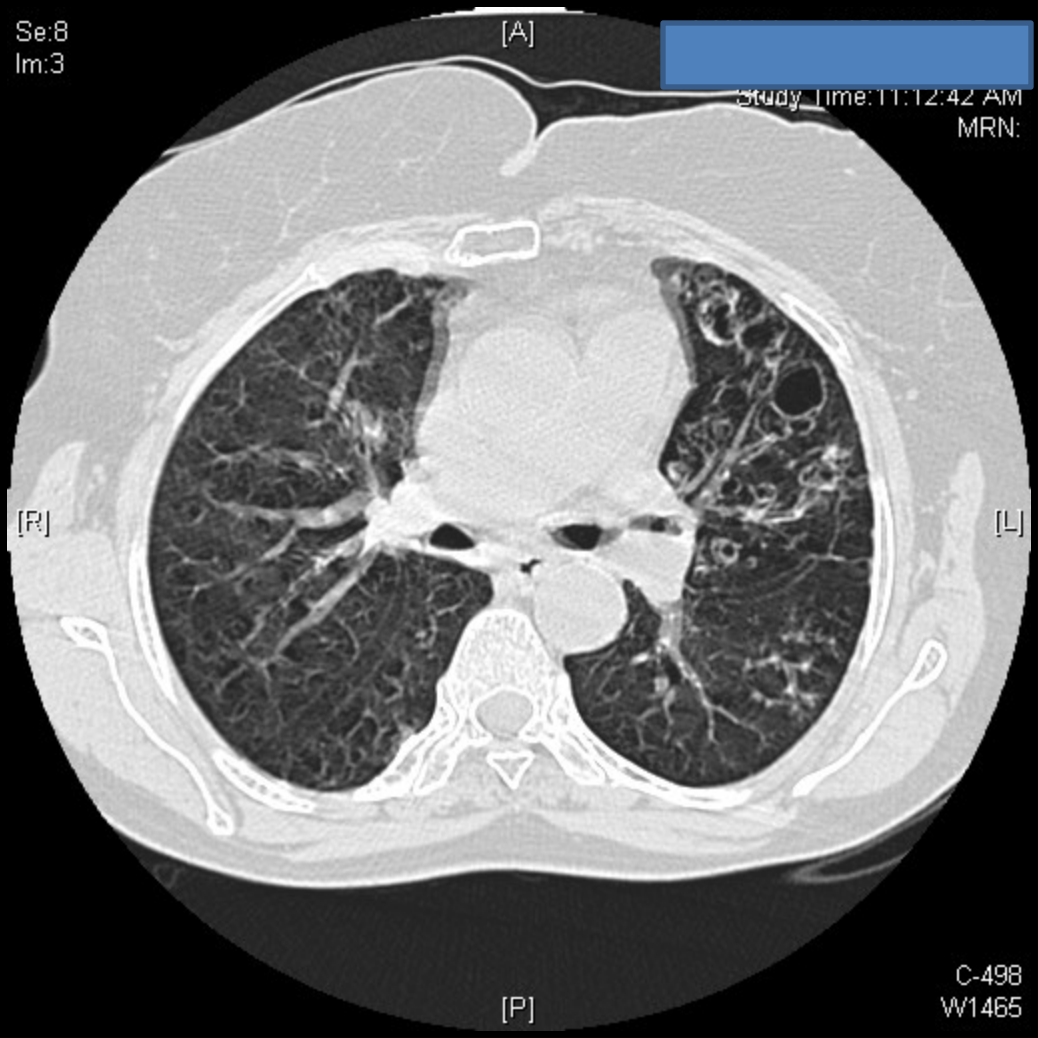
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- 45 yrs old female with RT sided chest pain for 1 day

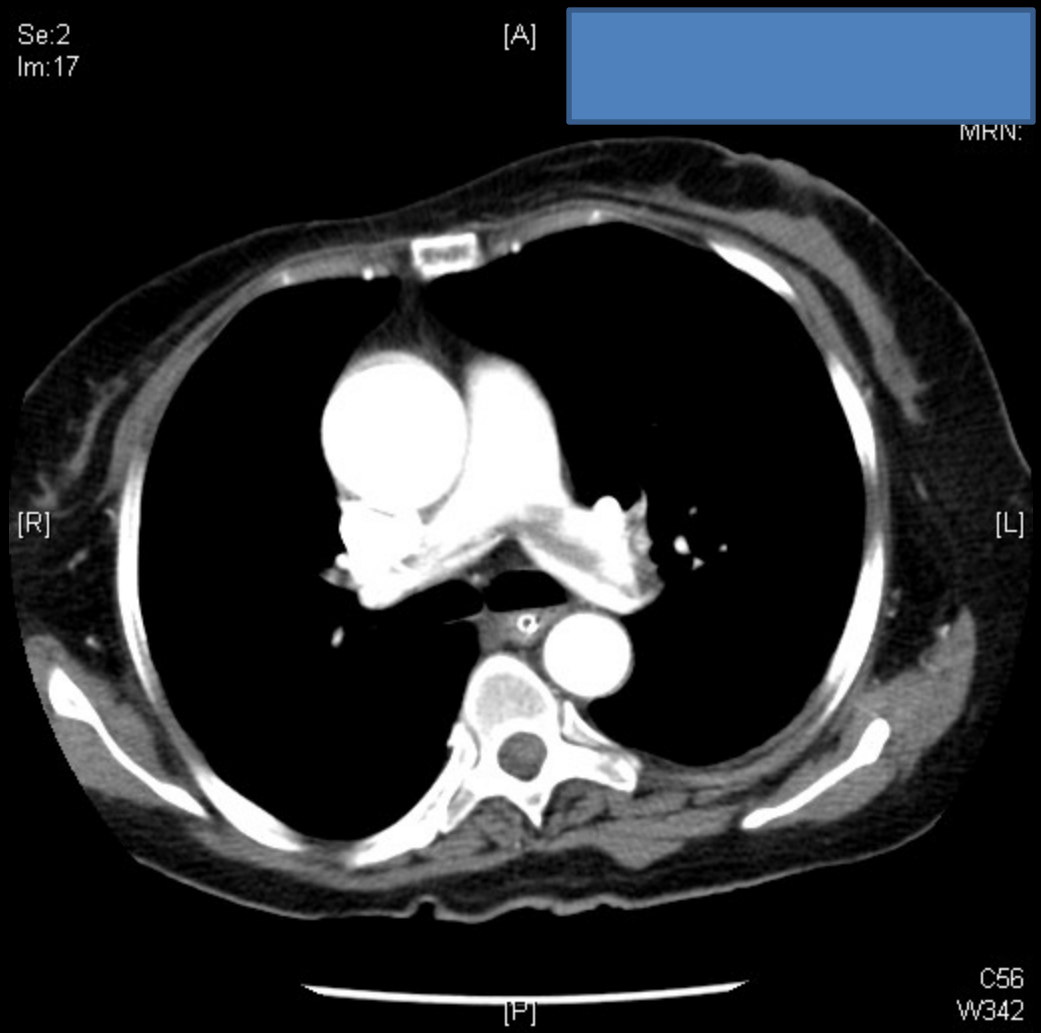
- ABG pH 7.32, $PaCO_2$ 28, PaO_2 50, O_2sat 88%
- EKG sinus tachycardia
- CXR normal
- Spiral CT
- V/Q scan

CT Angiography

- Image data are acquired continuously as the tube and detector rotate within the gantry and the patient moves continuously through the gantry

Advantages

- Critically ill patients
- Children
- Less volume of intravenous contrast
- Permits greater processing of the raw data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Lung Scans: V/Q

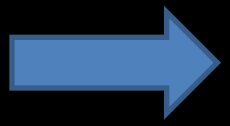
- Technetium (Tc) 99 m radionuclide is tagged to macroaggregated albumin to make small radioactive particles
- When Tc decays, it emits a gamma ray detected by the nuclear medicine gamma camera: a nuclear medicine image is formed by detection of many gamma rays

Lung scan: normal perfusion Q

- When injected via periphral venous site, the first capillaries encountered are the pulmonary capillaries
- If perfusion is present at the capillary level of the lungs, nuclear medicine perfusion image demonstrate activity in the periphery of the lungs

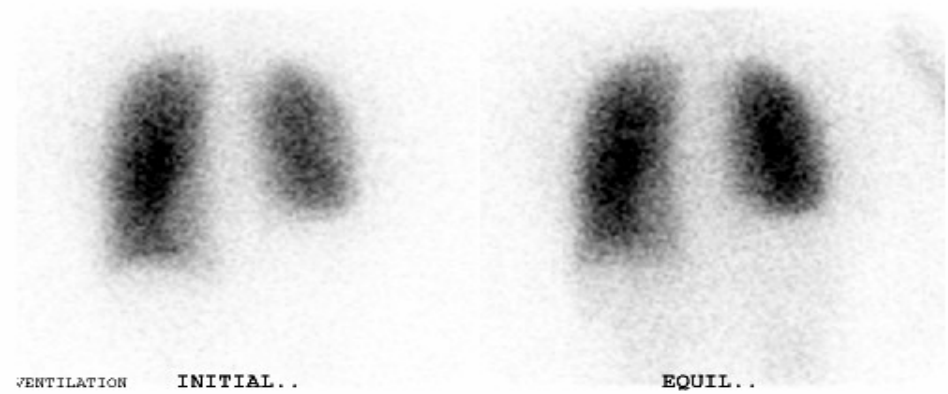
Lung scan: perfusion defect Q

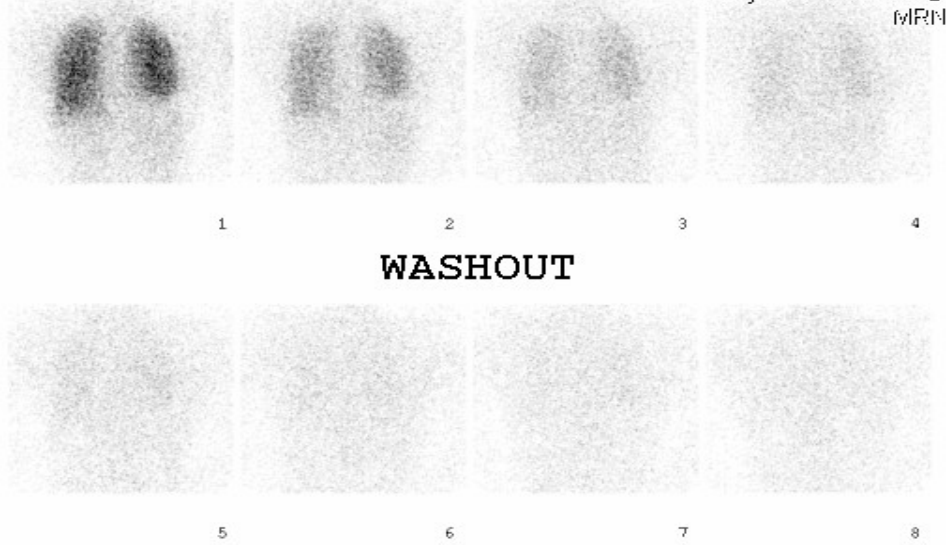
If there is an obstructing vascular lesion in the pulmonary arterial circulation



blocked perfusion to the distal capillary level

nuclear medicine perfusion image demonstrate no activity in the periphery of the lungs





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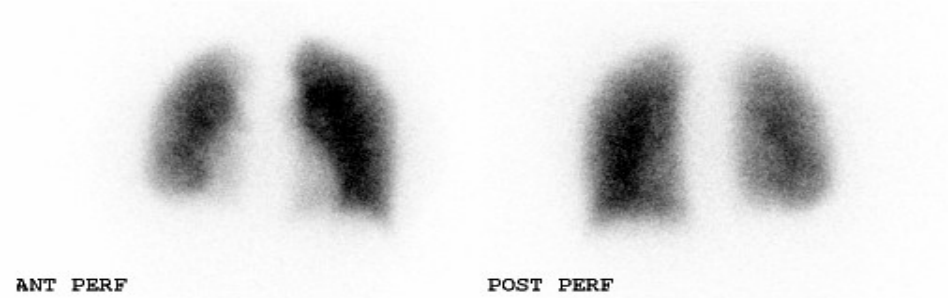

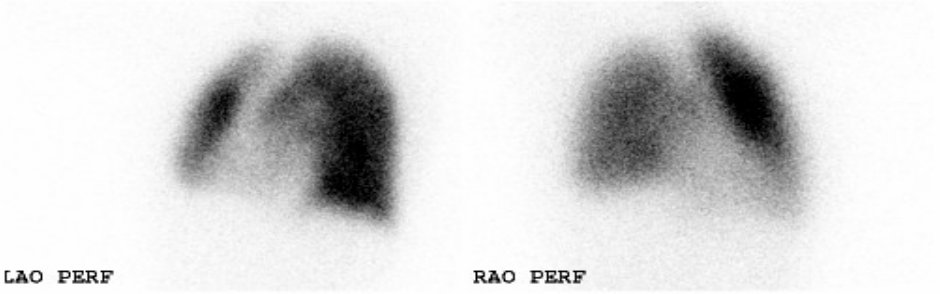

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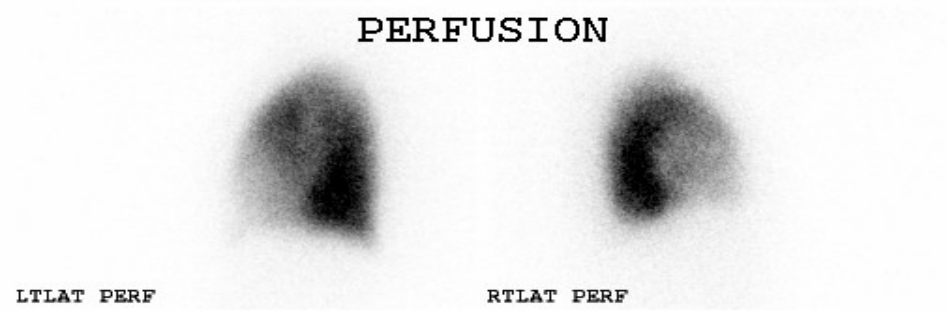

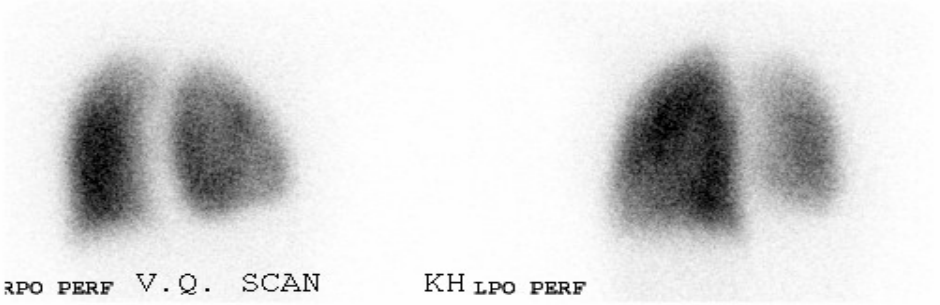

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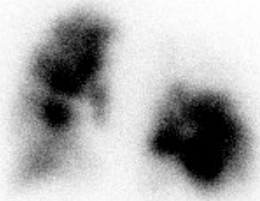

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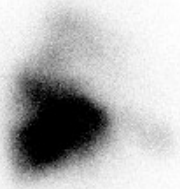

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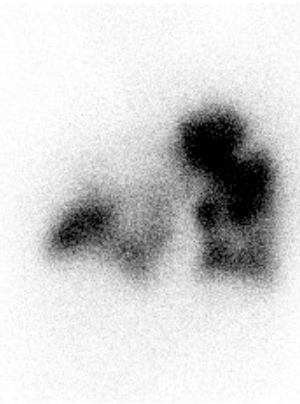

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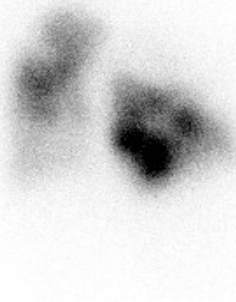

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