

INVESTIGATIONS OF LUNG DISEASE

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Professor of Medicine

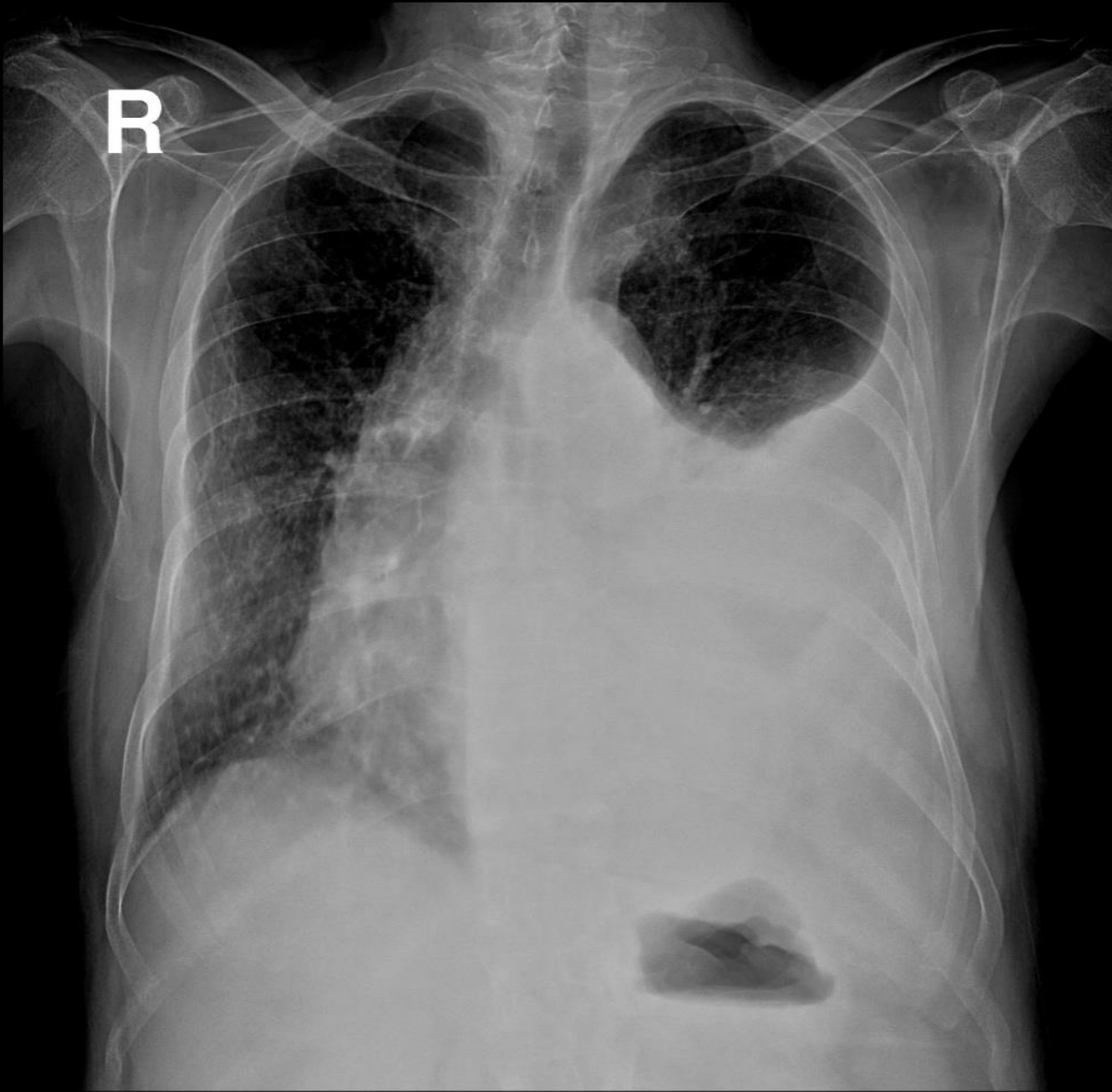
Division of Pulmonary Medicine

Objectives

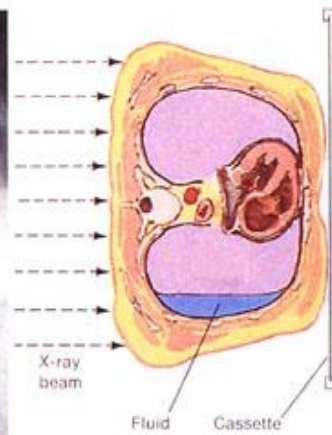
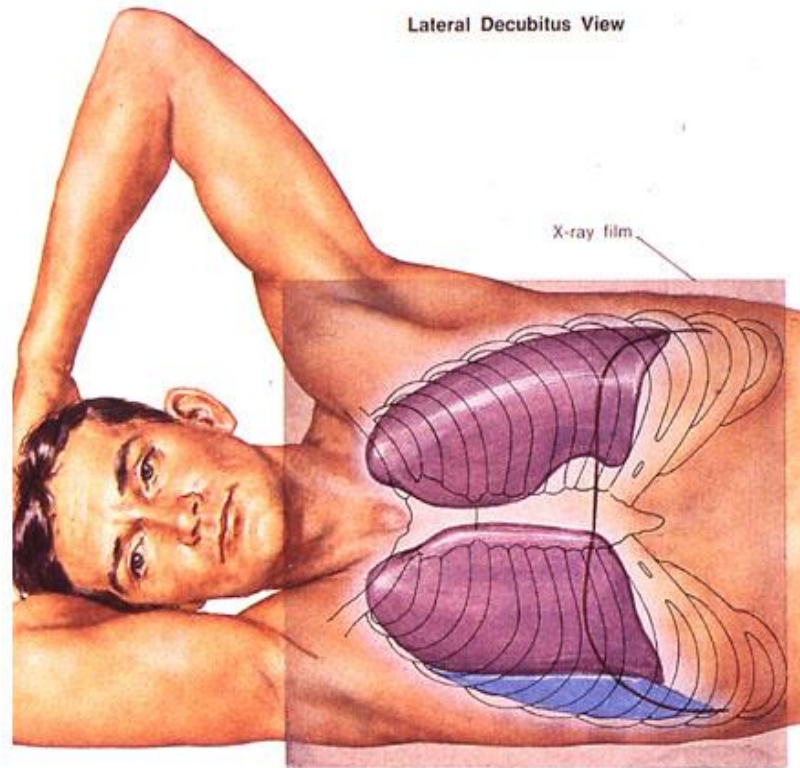
- Type of pulmonary diagnostic procedures
- Role of various specialized pulmonary procedures in diagnosing lung diseases
- When to apply specific tests

Pulmonary Diagnostic Procedures

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



Lateral Decubitus View



Sectional view

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

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

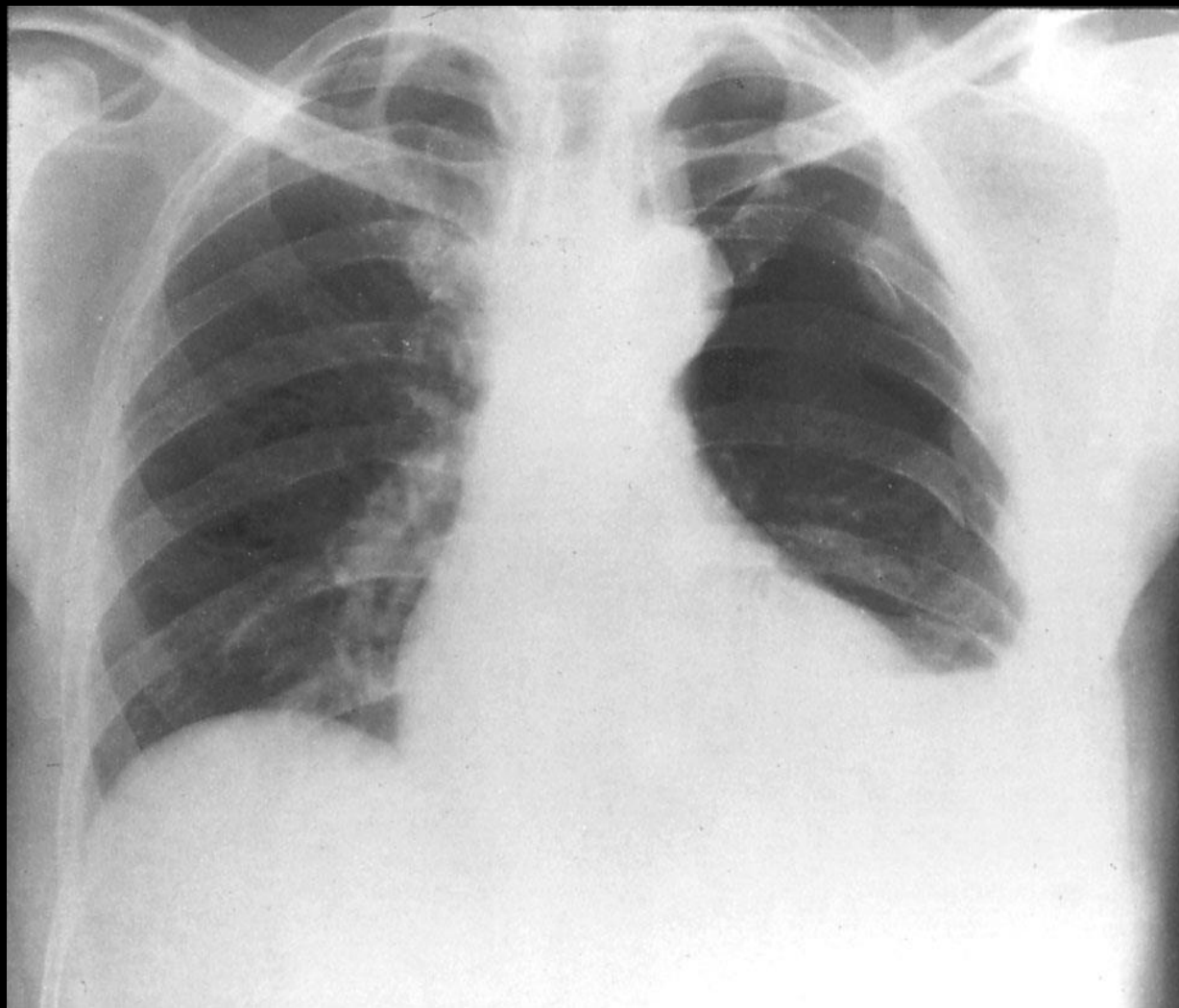
Chest tube

Indication for chest tube insertion

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

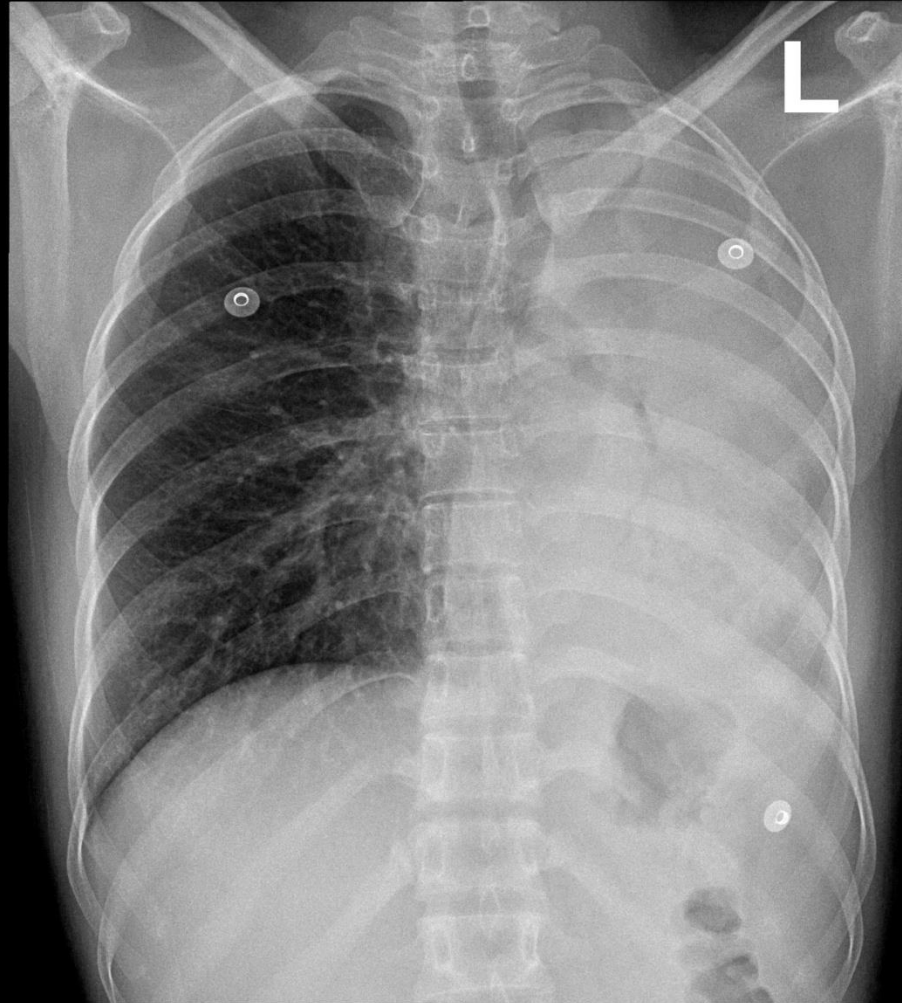
Complication of Thoracentesis

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

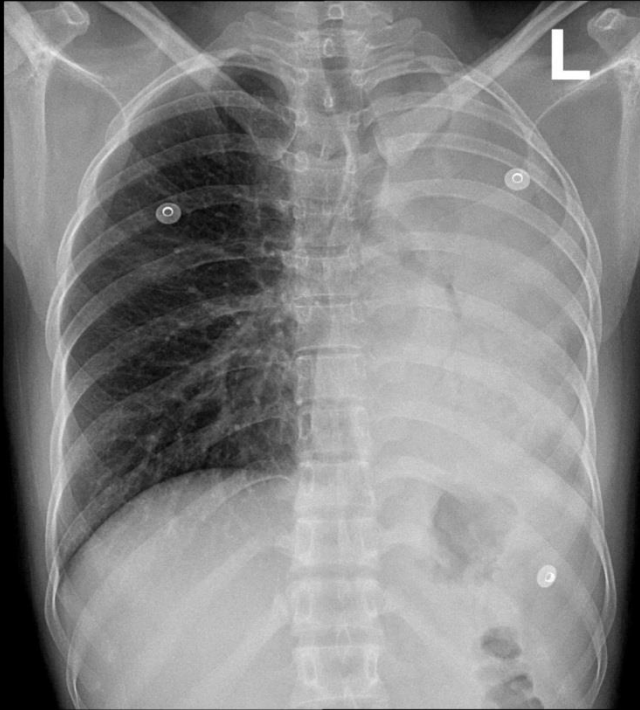


Pleural biopsy

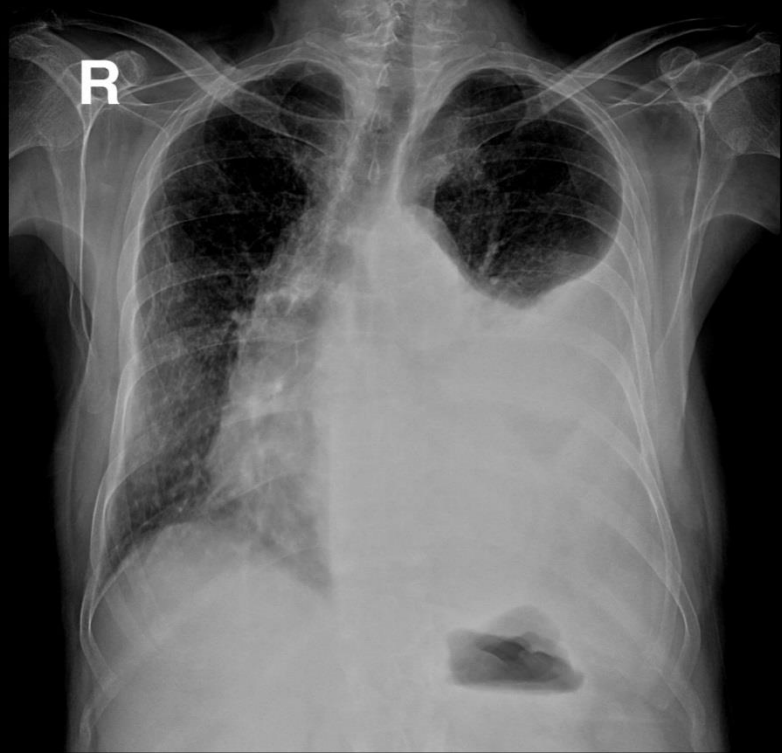
- Granulomatous disease
- Malignancy



A



B



Bronchoscopy

Suspected lung cancer

Abnormal CXR

Hemoptysis

Unexplained cough

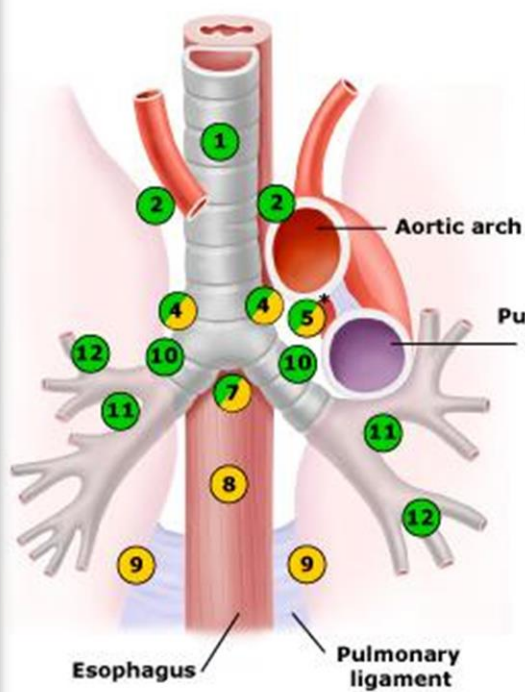
Localized wheeze

Positive sputum cytology

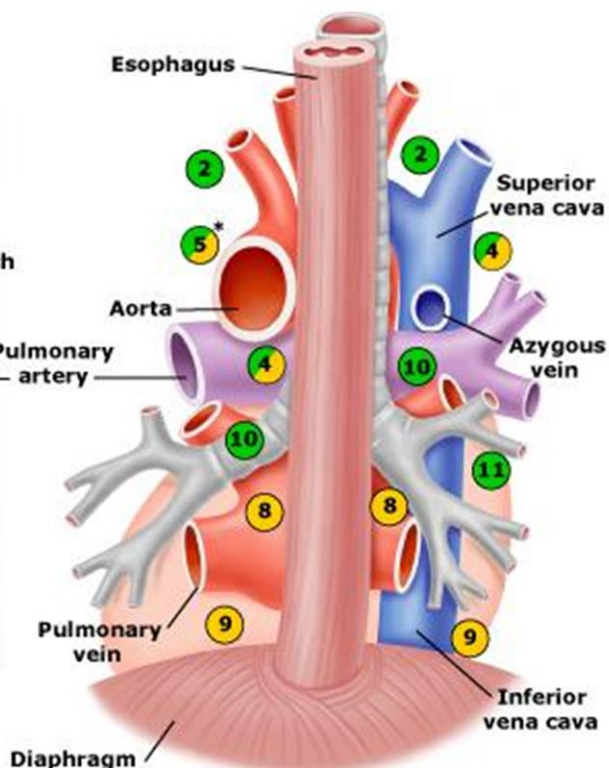
Bronchoscopy

- 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



- 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
- D_{lco}

↓ 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

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

DIAGNOSIS

	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

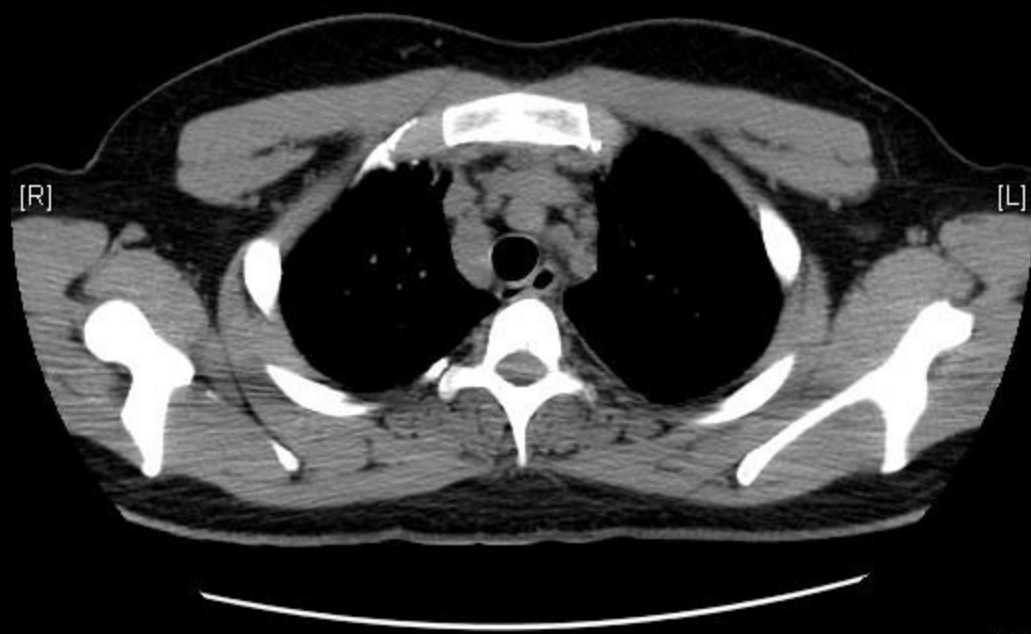


Se:2
Im:11

[A]



Study Time:4:00:04 PM
MRN:

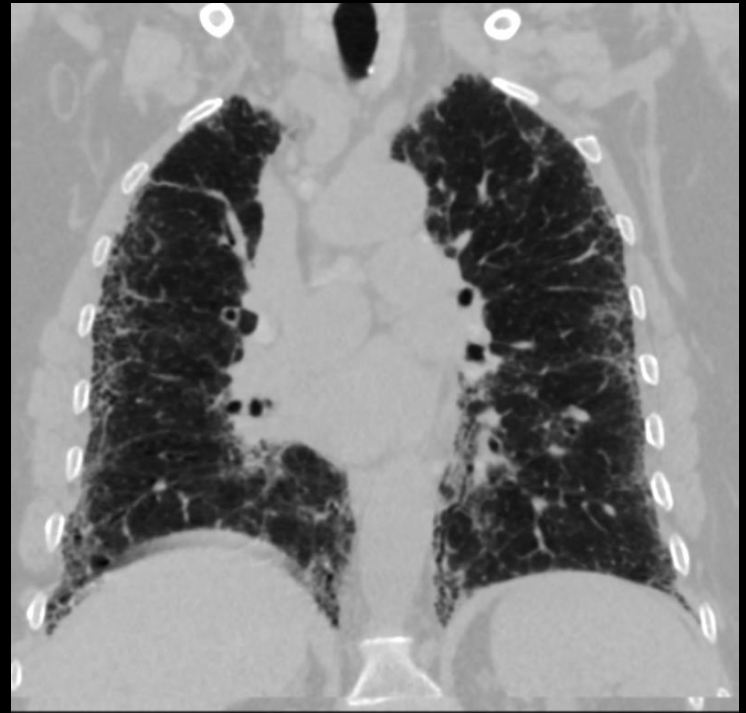
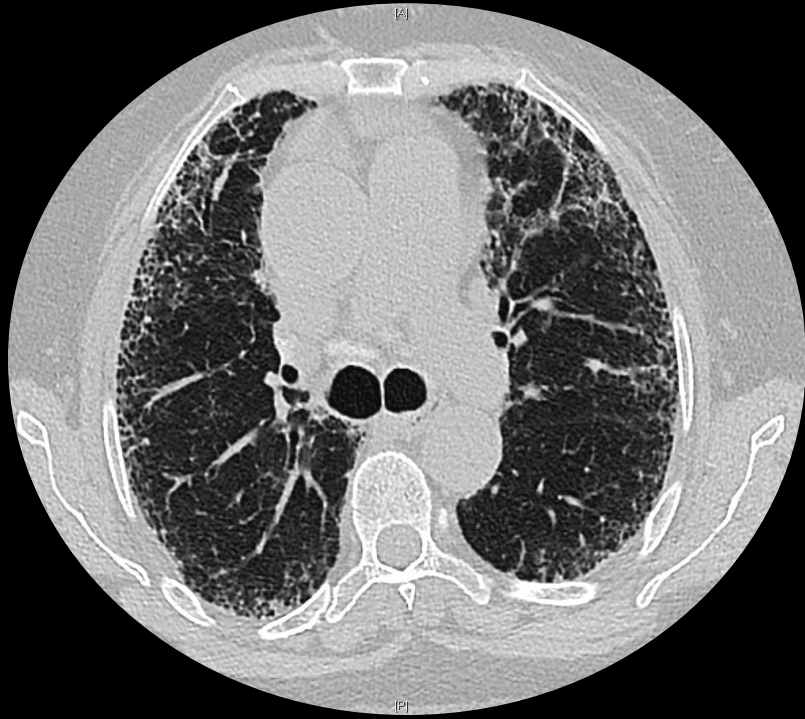


[R]

[L]

[P]

C56
W342



Se:4
Im:5

[A]



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MRN:



[R]

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C-498
W1465

[R]



[A]

[L]

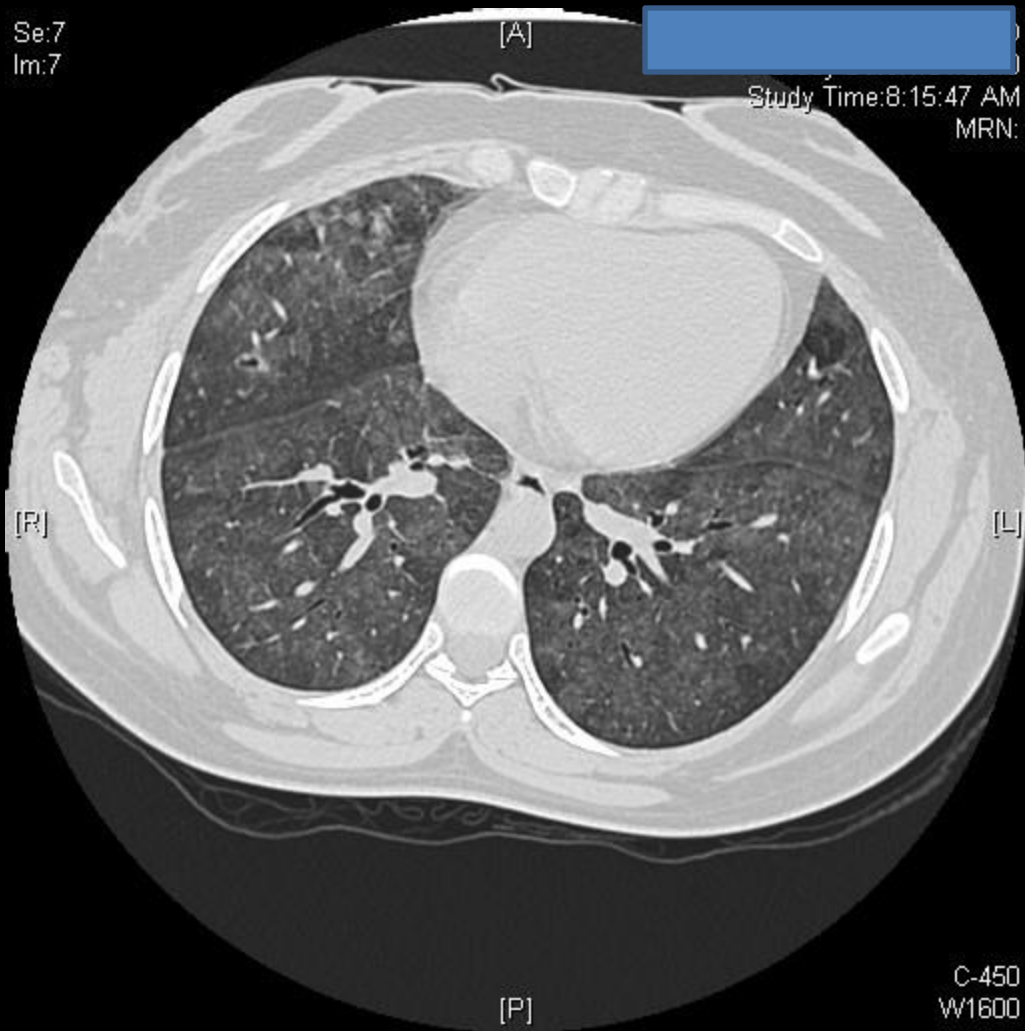
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C-450
W1600

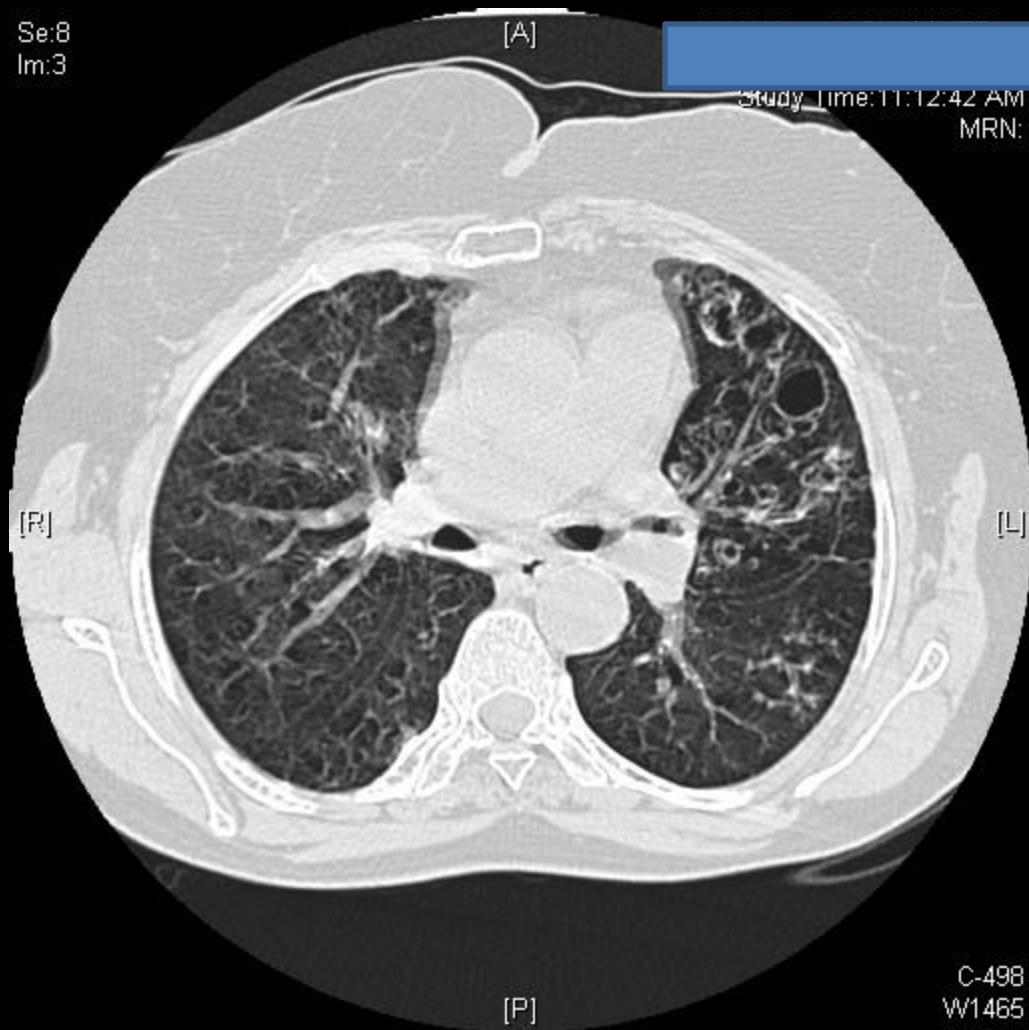
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[A]



Study Time: 11:12:42 AM
MRN:

[R]



[L]

[P]

C-498
W1465

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

- ABG pH 7.32, PaCO₂ 28, PaO₂ 50, O₂sat 88%
- EKG sinus tachycardia
- CXR normal
- Spiral CT
- V/Q scan

CT Angiography

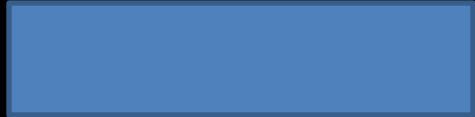
- Image data are acquired continuously as the tube and detector rotate within the gantry and the patient moves continuously through the gantry

Advantages

- Critically ill patients
- Children
- Less volume of intravenous contrast
- Permits greater processing of the raw data

Se:2
Im:17

[A]



MRN:



C56
W342

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 peripheral 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

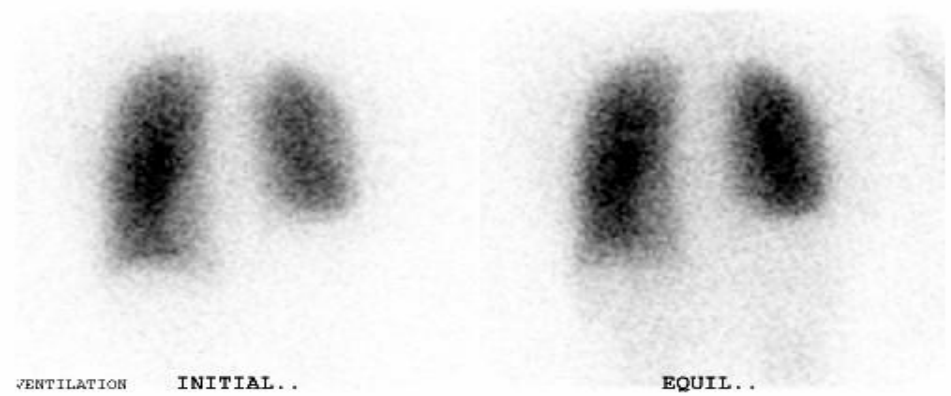


nuclear medicine perfusion image demonstrate no activity in the periphery of the lungs

S:
Im



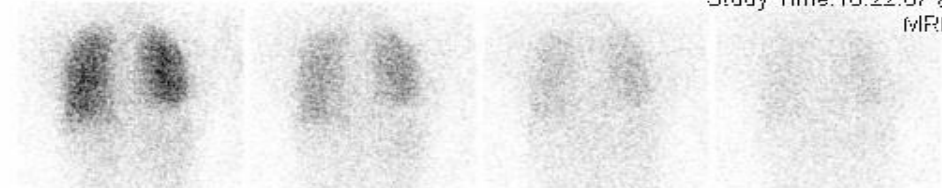
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VENTILATION INITIAL..

EQUIL..

VENTILATION



1

2

3

4

WASHOUT

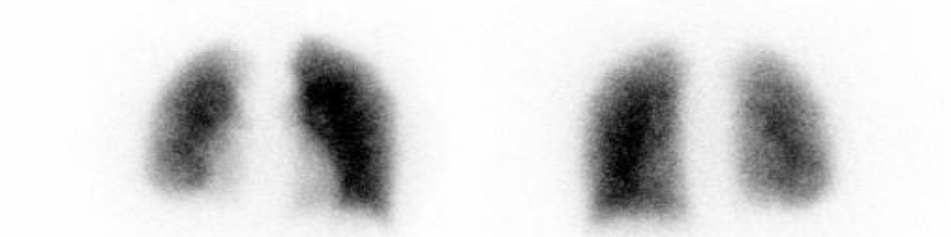


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6

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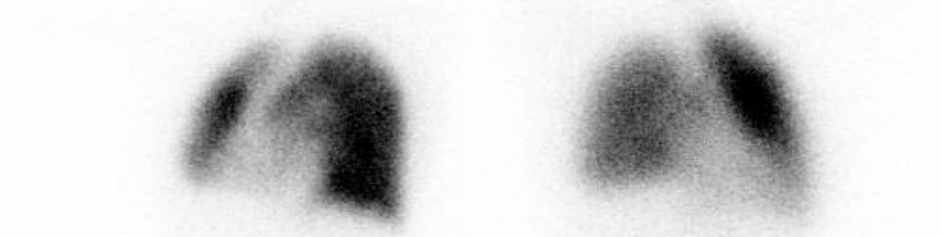
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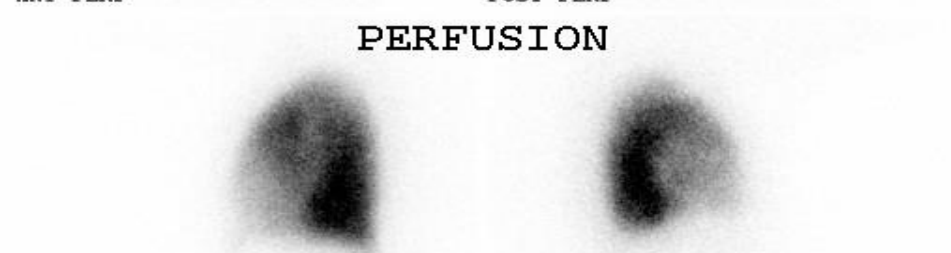
POST PERF

PERFUSION



LAO PERF

RAO PERF



LTLAT PERF

RTLAT PERF



RPO PERF V.Q. SCAN

KH LPO PERF



MRF:



ANT PERF

POST PERF

RTLAT PERF



LTLAT PERF

LAO PERF

RPO PERF

LUNG PERFUSION

17Aug2006

KKUH

RM3

RSM

