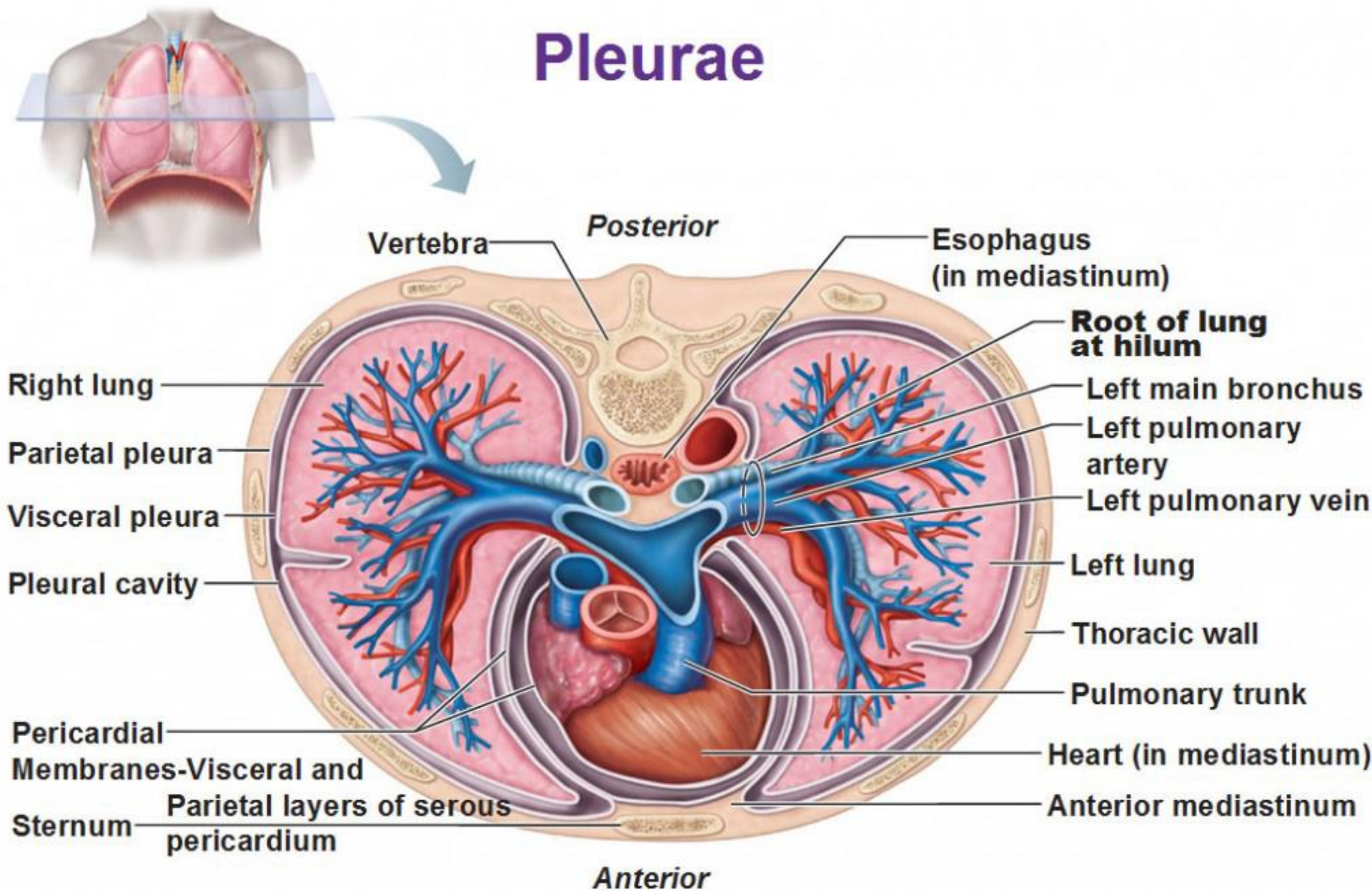


Pleural Effusion

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Pleurae



Transverse section through the thorax, viewed from above.

Lungs, pleural membranes, and major organs in the mediastinum are shown.



A 47-year-old man with a medical history of hypertension, diabetes, hyperlipidemia, and OSA

presented with a 7- to 10-day history of progressively worsening dyspnea on exertion, with a walking distance of 60 feet. He had bilateral lower-extremity swelling and was prescribed furosemide without clinical improvement.

At baseline, he used three pillows for sleeping. The patient was noncompliant with his CPAP treatment.

He had no smoking history and was retired from working in technology sales.

On review of systems, he denied cough, chest pain, hemoptysis, fevers, chills, or weight loss.



Examination revealed an obese man in no acute distress. ,

Vital signs included a heart rate of 104 beats/min, BP of 128/92, temperature of 37, and oxygen saturation of 96% on room air.

The chest physical examination was notable for decreased breath sounds over the lower three quarters of the left lung,

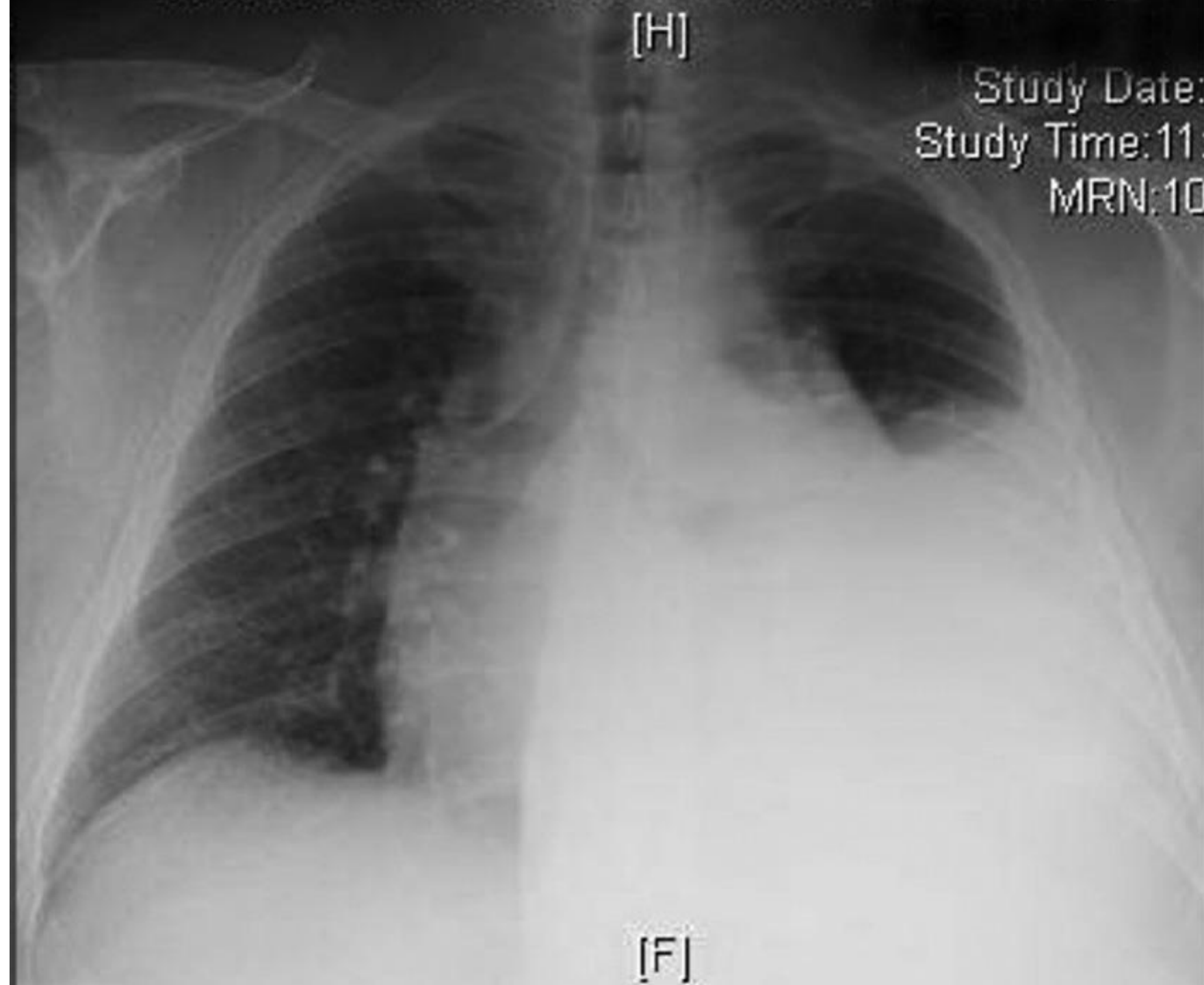
The cardiac examination showed regular rhythm with no murmurs, rubs, or gallops on auscultation, and no jugular venous distention was appreciated, Examination of the extremities revealed pitting edema of the lower extremities bilaterally.

The rest of the physical examination was unremarkable.

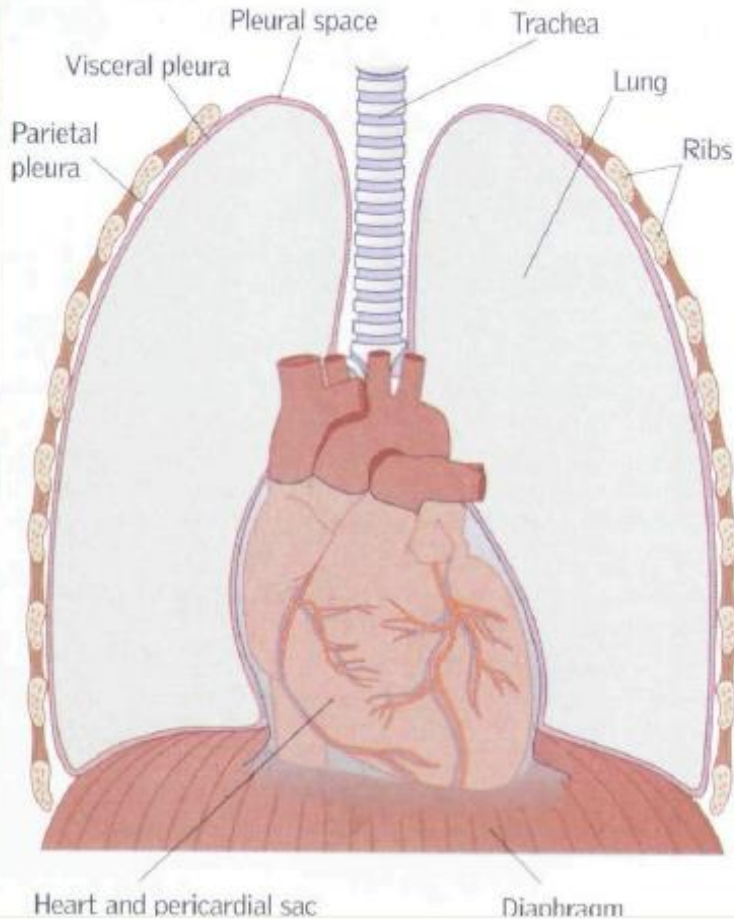
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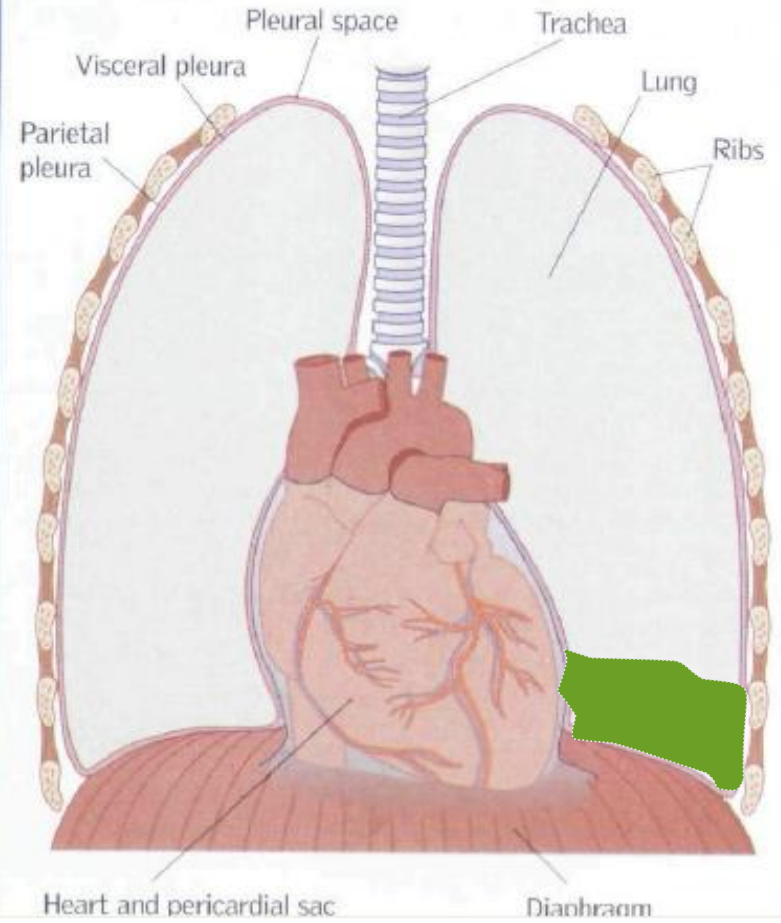
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The thorax, lungs and pleura



The thorax, lungs and pleura



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PLEURA

Serous fluid that allows for the parietal pleura (outer lining) and visceral pleura (inner lining) to glide over each other without separation

contains about 5-15ml of fluid at one time

Pleural fluid is produced by the parietal pleura and absorbed by the visceral pleura as a continuous process.

The visceral pleura absorbs fluid, which then drains into the lymphatic system and returns to the blood

about 100-200ml of fluid circulates through the pleural space within a 24-hour period

CLINICAL PRESENTATION

History

- Dyspnea
- Pleuritic chest pain
- Cough
- Other symptoms related to underlying cause

Physical exam (Findings usually present for effusions > 300 mL)

- Dullness to percussion, decreased tactile fremitus
- Asymmetric chest expansion
- Decreased breath sounds
- **Tracheal shift away from** the affected side

DEVELOPMENT OF PLEURAL EFFUSION

- ↑ **PULMONARY CAPILLARY PRESSURE** (CHF)
- ↑ **CAPILLARY PERMEABILITY** (Pneumonia)
- ↓ **INTRAPLEURAL PRESSURE** (atelectasis)
- ↓ **PLASMA ONCOTIC PRESSURE** (hypoalbuminemia)
- ↑ **PLEURAL MEMBRANE PERMEABILITY** (malignancy)
- LYMPHATIC OBSTRUCTION** (malignancy)
- DIAPHRAGMATIC DEFECT** (hepatic hydrothorax)
- THORACIC DUCT RUPTURE** (chylothorax)

IMAGING STUDIES-CHEST RADIOGRAPHS



PA - usually around 250-500 mL needed before visible



Lateral Decubitus – very sensitive, can detect effusions as small as 50 mL

IMAGING STUDIES

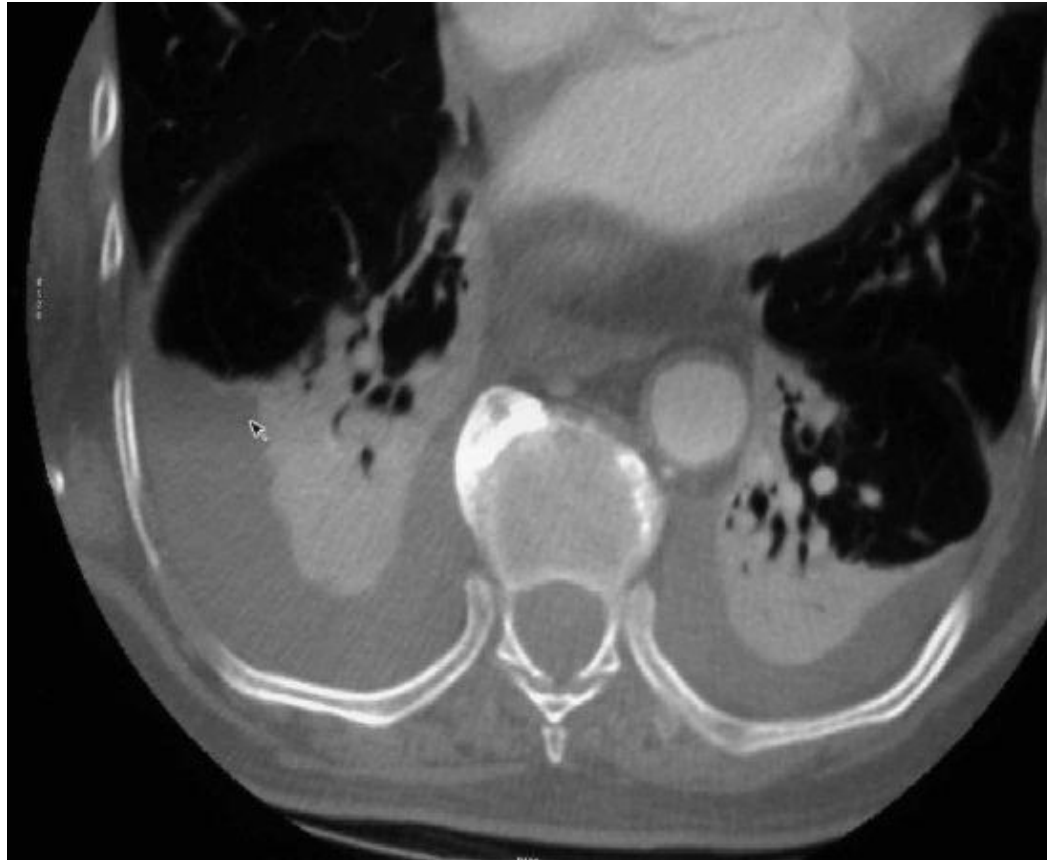
CT Scan

- Better characterization of underlying lung parenchyma and certain processes that may be obscured on radiographs by large pleural effusions

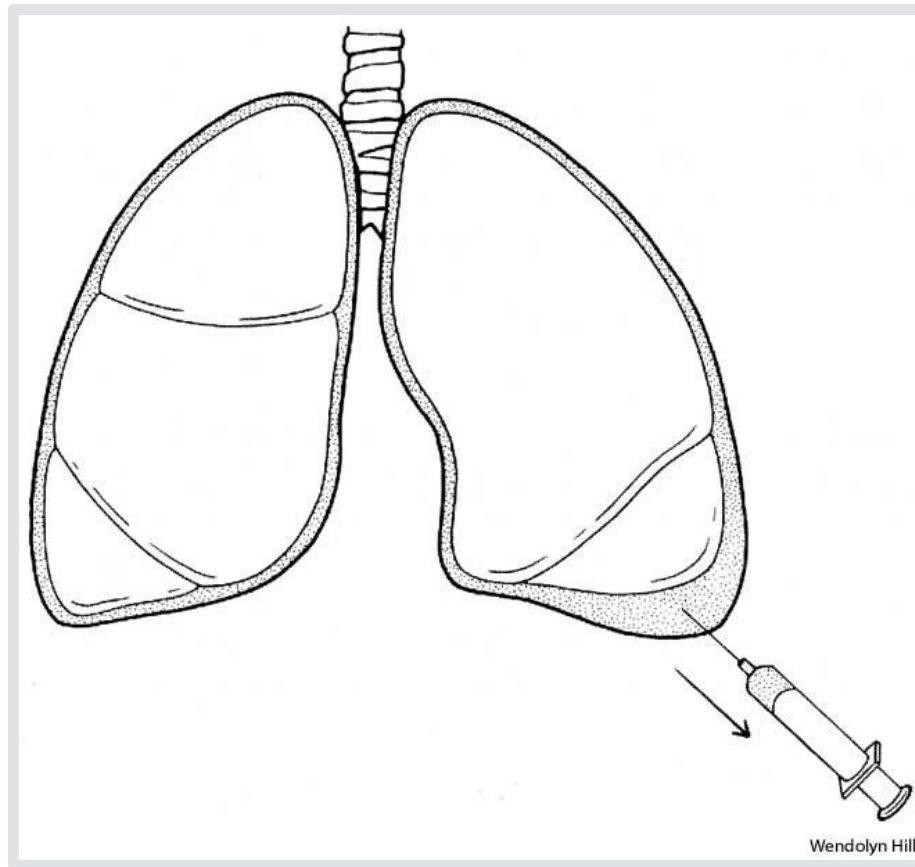
Ultrasound

- Cheap and available at bedside
- Can help identify free vs. loculated effusions
- Thoracentesis is facilitated by ultrasound guidance

CT Scan



THORACOCENTESIS



INDICATIONS FOR THORACENTESIS



Pleural effusion of unknown etiology, with >10 mm depth on lateral decubitus CXR or Ultrasound

Therapeutically for symptomatic relief

Concern for empyema

Air fluid level in pleural space

PLEURAL FLUID EVALUATION

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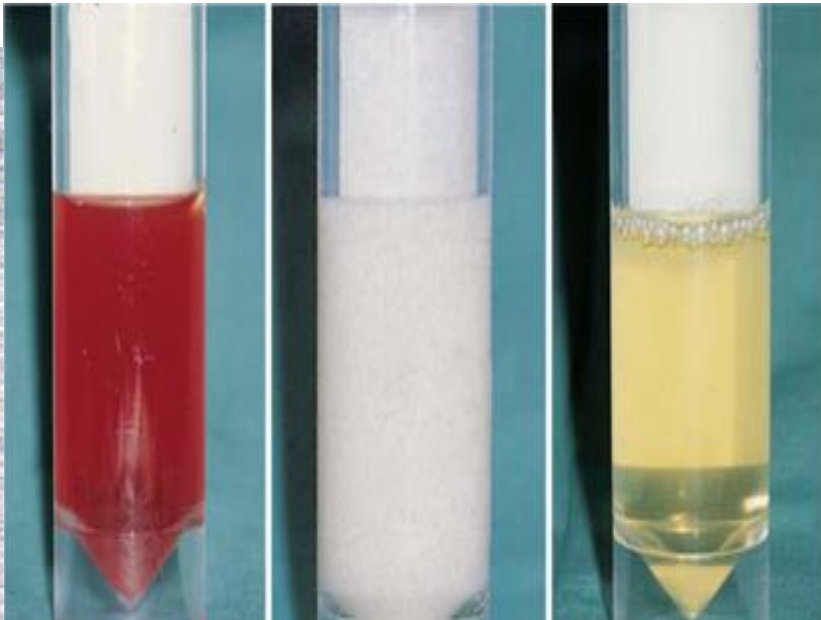
Color

Cytology

Culture

Cell count

Chemistry



B



LIGHTS CRITERIA

Pleural effusion is exudative if one or more of the following:

- Ratio of pleural fluid protein level to serum protein level > 0.5
- Ratio of pleural fluid LDH level to serum LDH level > 0.6
- Pleural fluid LDH level $> 2/3$ the upper limit of normal for serum LDH level.

98% sensitive and 83% specific for exudative effusion using Lights criteria.

Absence of all 3 criteria = transudative

TRANSUDATIVE VS EXUDATIVE

Transudative

- CHF
- Nephrotic syndrome
- Hypoalbuminemia
- Hepatic hydrothorax
- Atelectasis
- Hypothyroidism

• Exudative

- Pneumonia
- Malignancy
- PE
- Inflammatory (pancreatitis, ARDS, uremic pleurisy etc)
- Connective tissue disease

Routine Pleural Fluid Tests for Pleural Effusion

<i>Test</i>	<i>Test value</i>	<i>Suggested diagnosis</i>	<i>Comments</i>
Adenosine deaminase (ADA)	> 40 U per L (667 nkat per L)	Tuberculosis (> 90 percent), empyema (60 percent), complicated parapneumonic effusion (30 percent), malignancy (5 percent), rheumatoid arthritis ⁵	In the United States, ADA is not routinely requested because of the low prevalence of tuberculous pleurisy.
Cytology	Present	Malignancy	Actively dividing mesothelial cells can mimic an adenocarcinoma.
Glucose	< 60 mg per dL (3.3 mmol per L)	Complicated parapneumonic effusion or empyema, tuberculosis (20 percent), malignancy (< 10 percent), rheumatoid arthritis ⁵	In general, pleural fluids with a low glucose level also have low pH and high LDH levels.
Lactate dehydrogenase (LDH)	> Two thirds of upper limits of normal for serum LDH	Any condition causing an exudate	Very high levels of pleural fluid LDH (> 1,000 U per L) typically are found in patients with complicated parapneumonic pleural effusion and in about 40 percent of those with tuberculous pleurisy. ⁵
LDH fluid to serum ratio	> 0.6	Any condition causing an exudate	Most patients who meet the criteria for an exudative effusion with LDH but not with protein levels have either parapneumonic effusions or malignancy. ³
Protein fluid to serum ratio	> 0.5	Any condition causing an exudate	A pleural fluid protein level > 3 mg per dL suggests an exudate, but when taken alone this parameter misclassifies more than 10 percent of exudates

Optional Pleural Fluid Tests for Pleural Effusion

<i>Test</i>	<i>Test value</i>	<i>Suggested diagnosis</i>	<i>Comments</i>
Amylase	>Upper limit of normal	Malignancy (<20 percent), pancreatic disease, esophageal rupture ^{5,16}	Obtain when esophageal rupture or pancreatic disease is suspected. The amylase in malignancy and esophageal rupture is of the salivary type.
Cholesterol	>45 to 60 mg per dL (1.16 to 1.55 mmol per L)	Any condition causing an exudate	Measure if chylothorax or pseudochylothorax is suspected. This parameter taken alone misclassifies 10 percent of exudates and 20 percent of transudates. ¹³
Culture	Positive	Infection	Obtain in all parapneumonic pleural effusions because a positive Gram stain or culture should lead to prompt chest tube drainage. ^{14,15}
Hematocrit fluid to blood ratio	≥0.5	Hemothorax	Obtain when pleural fluid is bloody. Hemothorax most often originates from blunt or penetrating chest trauma.
Interferon*	Different cutoff points	Tuberculosis ¹⁷	Consider when ADA is unavailable or nondiagnostic and tuberculosis is suspected.
NT-proBNP	> 1,500 pg per mL	Heart failure ¹⁸	If available, consider testing when heart failure is suspected and exudate criteria are met. ¹⁹

pH	<7.20	Complicated parapneumonic effusion or empyema, malignancy (< 10 percent), tuberculosis (< 10 percent), esophageal rupture ⁵	Obtain in all nonpurulent effusions if infection is suspected. A low pleural fluid pH indicates the need for tube drainage only for parapneumonic pleural effusions.
Polymerase chain reaction†	Positive	Infection ^{20,21}	Consider when infection is suspected. Sensitivity of polymerase chain reaction to detect <i>Mycobacterium tuberculosis</i> in pleural fluid varies from 40 to 80 percent and is lower in patients with negative mycobacterial cultures.
Triglycerides	> 110 mg per dL (1.24 mmol per L)	Chylothorax	Obtain when pleural fluid is cloudy or milky. Chylothorax is caused by lymphoma or trauma. Not all chylous pleural effusions appear milky white or whitish.
Tumor markers‡	Different cutoff points	Malignancy	Consider when malignancy is suspected and thoracoscopy is being considered. Except for telomerase activity, ²² individual tests tend to have low sensitivity (< 30 percent) when looking for the utmost specificity. ^{23,24}

CELL COUNT

Lymphocytic (> 50%)

- CA (30-35%)
- TB (15-20%)
- Sarcoidosis

PMNs

- Empyema
- Parapneumonic
- Rheumatoid
- Pulmonary infarction

PMN or Lymphocytic

- PE
- Conn tissue disease
- Post-cardiac injury

Eosinophilic (> 10%)

- Trauma
- PTX
- CA
- Asbestos, parasites
- Pneumonia

RBC > 100,000/mm

- CA
- Trauma
- Pulmonary infarction

TREATMENT

Thoracentesis – then treat underlying disease

- Uncomplicated pneumonia – antibiotics

Hemothorax involved/empyema – tube thoracostomy +/- VATS

Malignant effusion- chest tube +/- pleurodesis (sclerosants)

VATS

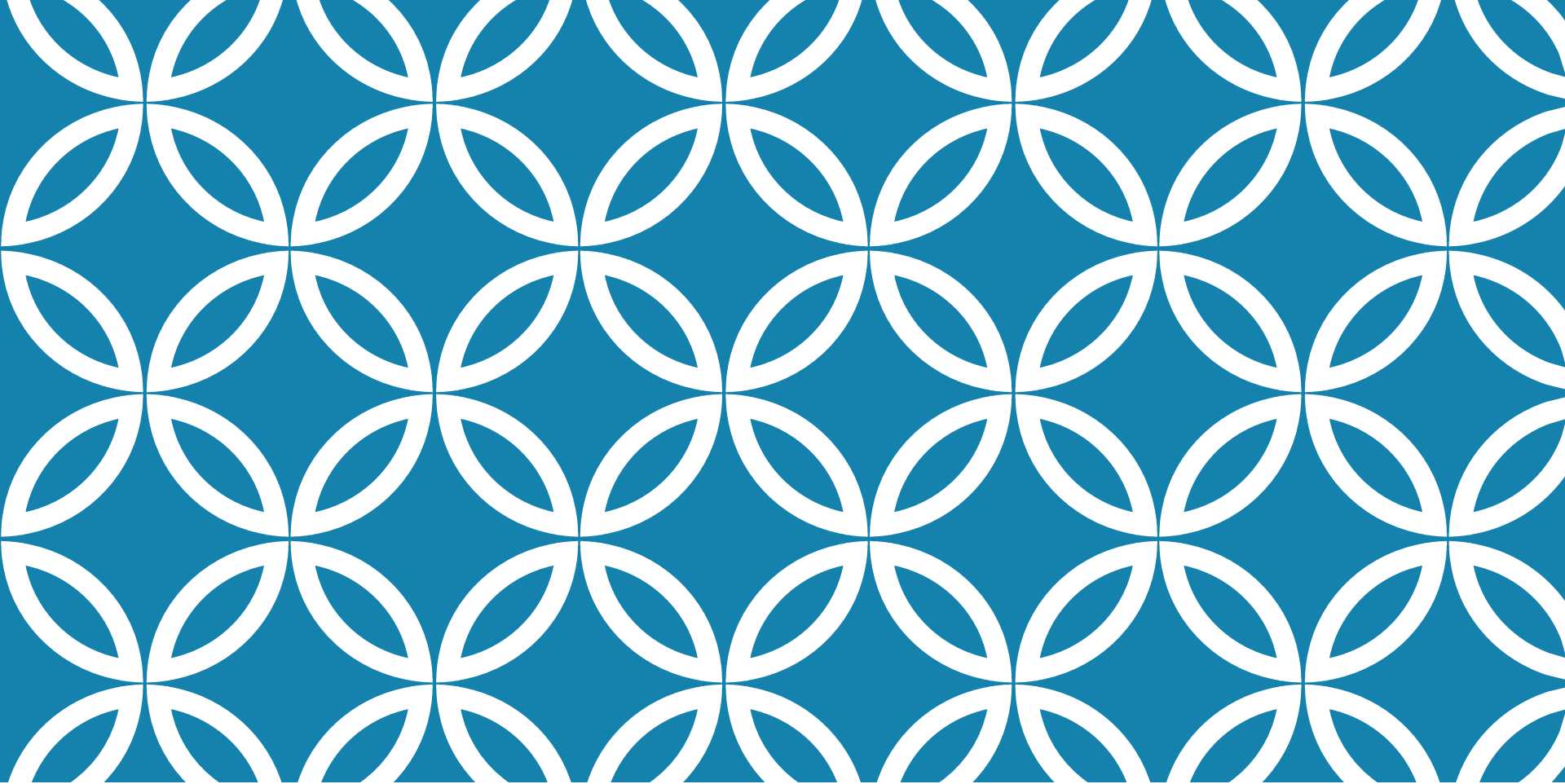
SUMMARY

Pleural effusions are commonly encountered on wards

Thoracentesis is not immediately indicated if there is a obvious explanation for pleural effusion without atypical features

Pleural effusions are classified as transudative vs exudative.

CHF, pneumonia, malignancy and PE comprise the vast majority of causes for pleural effusions.



THE END

