

L11: Pleural Effusion

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MEDICINE 433

objectives

1. Define Pleural Effusion.
2. Recognize and diagnose Pleural Effusion.
3. Understand courses of Pleural Effusion.
4. Management of Pleural Effusion.

Definition of Pleural Effusions

Pleural effusion: presence of **large amount** of fluid in the pleural space irrespective of the underlying causes

Normally the pleural space contains:

- **3.5 to 7.0 ml** of clear liquid
- **low** protein content
- **small number** of mononuclear cells

PLEURAL FLUID FORMATION AND ABSORTION:

- The rate of fluid **formation** is **0.02 ml/kg/hour**.
- The rate of fluid **clearance** is **0.2 ml/kg/hour**.



-Normal pleural fluid: straw colored, clear and odorless.
-For effusion to occur the fluid > clearance



If the patient has minimal lung compromise, pleural effusions are well tolerated, whereas pleural effusion in the presence of lung disease may lead to respiratory failure.

Pathophysiology of Pleural Effusions

Transudative effusions “usually bilateral”: (seen in cardiac, liver, or renal failure)

1. Increase capillary pressure in visceral or parietal pleura
2. Decreased plasma oncotic pressure

“ increased hydrostatic pressure or decreased osmotic pressure “

Exudative effusions “usually unilateral”: (seen in diseases of the pleura or injury to the adjacent lung)

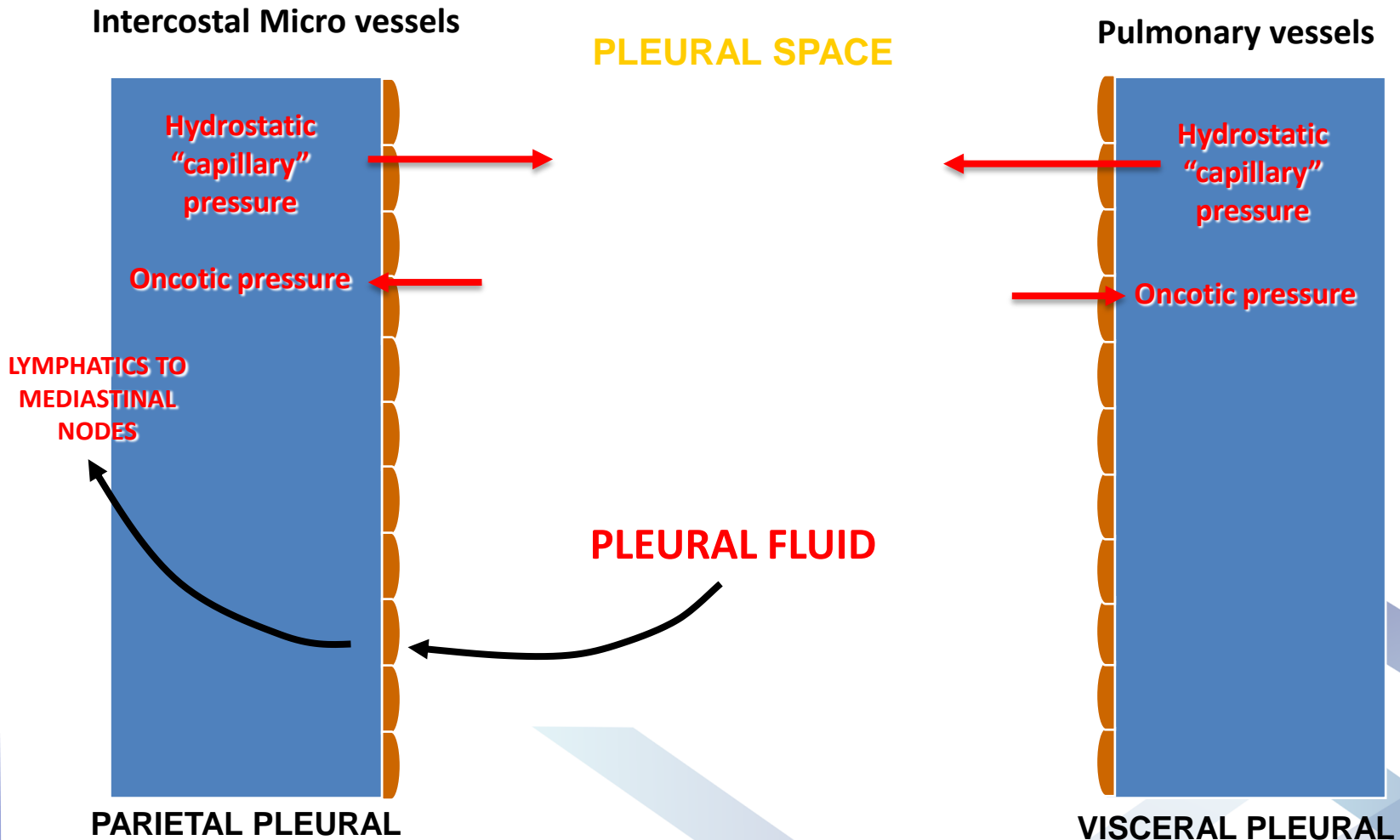
1. Increased permeability of pleural surfaces
2. Decreased lymphatic flow from pleural surface because of damage to pleural membranes or vasculature



Transudate: passive process (pressure related)

Exudate: active process.

Pathophysiology of Pleural Effusions



Differences between Transudative and Exudative Pleural Effusions

Transudate	Exudate
<ul style="list-style-type: none"> • Increase pulmonary capillary pressure: CHF • Decrease Intrapleural pressure: atelectasis • Decreased plasma oncotic pressure: Hypoalbuminemia, Cirrhosis, Nephrotic syndrome • Other causes: Pulmonary embolism - Peritoneal dialysis <p>*80% of bilateral pleural effusion is caused by congestive heart failure. <u>BUT</u> 50% of pleural effusion in congestive heart failure is unilateral.</p>	<ul style="list-style-type: none"> • Increase capillary permeability: pneumonia, tuberculosis • Increase pleural permeability: Malignancy, metastatic disease • Lymphatic obstruction: Malignancy • Thoracic duct rupture: Chylothorax • Other causes: Viral infection - Collagen vascular diseases - Pulmonary embolism

432 team

Transudate Vs Exudate (For REVIEW only)	Features	Transudate	Exudate
	Process	Passive (related to pressures)	Active (related to inflammation)
	Vascular permeability	Normal	Increased
	Plasma protein leak	Absent	Present
	Vessels	Normal	Dilated



-Thoracic surgery, lobectomy and lung collapse all lead to ↓intrapleural pressure.
 -Liver disease and nephrotic syndrome both lead to ↓plasma oncotic pressure.
 -SLE leads to ↑pleural membrane permeability.

Causes of Transudative and Exudative Pleural Effusions

Transudative	Exudative
<ul style="list-style-type: none"> • CHF • Cirrhosis • Pulmonary embolism (PE) • Nephrotic syndrome • Peritoneal dialysis • Hypoalbuminemia 	<ul style="list-style-type: none"> • Bacterial pneumonia, tuberculosis (TB) • Malignancy, metastatic disease • Viral infection • PE • Collagen vascular diseases

Signs & Symptoms

Symptoms	Signs
<ol style="list-style-type: none"> Often asymptomatic Dyspnea on exertion “Key symptom” Peripheral edema Orthopnea, paroxysmal nocturnal dyspnea pain on inspiration and coughing * 	<ol style="list-style-type: none"> Dullness to percussion (stony dull) Decreased breath sounds over the effusion Decreased tactile fremitus Signs of pleurisy (a pleural rub) *

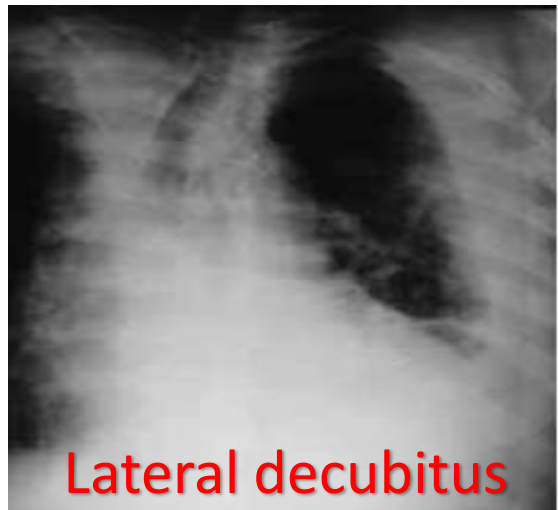
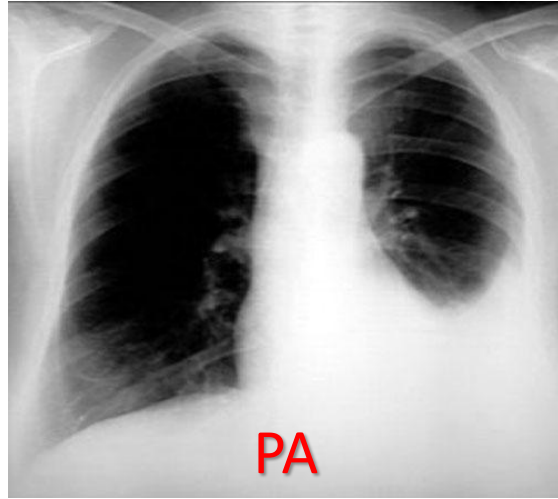
*especially in patients with pneumonia, pulmonary infarction and connective tissue diseases.

Investigations

1. Chest X-ray:

CXR (PA and lateral)—look for the following:

- A. **Blunting of costophrenic angle** (curved shadow at the lung bases ascending towards the axilla)
- B. **About 250 mL** of pleural fluid must accumulate before an effusion can be detected.
- C. **Lateral decubitus films (with the patient lying on his side):** more reliable than PA and lateral CXRs for detecting small pleural effusions; can also determine whether fluid is **free flowing or loculated**. (previous scarring or adhesions in the pleural space can cause localized effusions)



2. Ultrasound : more accurate than CXR.

Show hypoechoic space with transudate, and the presence of moving floating densities suggest an exudate.

3. CT-Scan: more reliable than CXR for detecting effusions (indicated where malignancy is suspected)

Investigations

4. Thoracentesis:

A. Thoracentesis is useful if etiology is **unknown**. It provides a diagnosis in 75% of patients, and even when it is not diagnostic it provides important clinical information. **No need for thoracentesis for patient with obvious cause (CHF with bilateral effusions). However: In heart failure: febrile/pleuritic pain, unilateral, no cardiomegaly, no response to diuresis indicate Thoracentesis**

B. **Therapeutic:** drainage provides relief for large effusions.

C. First check the color and texture of fluid (presence of blood suggest pulmonary infarction, malignancy or may result from a traumatic tap) then Send fluid for CBC, differential, protein, LDH, pH, glucose, Gram stain, and cytology.

Remember the four Cs: Chemistry (glucose, protein), **Cytology**, **Cell count** (CBC with differential), and **Culture**.

5. Ultrasound or CT-guided pleural biopsy.

6. Video-assessed thoracoscopy for visualization of the pleura and direct guidance of a biopsy.



If pleural fluid glucose level is <60, rule out rheumatoid arthritis. However, glucose in pleural fluid can be low with other causes of pleural effusion: TB, esophageal rupture, malignancy, lupus

How to diagnose



The first thing to assess is whether pleural effusion is transudate or exudate.

Patient's serum protein is normal then:

- Pleural protein is less than 25 g/l = **Transudate**
- Pleural Protein more than 35 g/l. = **Exudate**
- If not, Light's criteria

Table 9-5. Light Criteria for Exudative Pleural Effusion

	Transudative	Exudative
LDH effusion	<200 IU/mL	>200 IU/mL
LDH effusion/serum ratio	<0.6	>0.6
Protein effusion/serum ratio	<0.5	>0.5

LDH greater than 2/3 upper limit of normal for serum

Now, you know that the patient has exudative effusion and suspect of:

- **Pancreatitis:** Elevated pleural fluid amylase.
 - **chylothorax (lymph in the pleural space):** Milky, opalescent fluid
 - **Empyema (pus in the pleural space):** Frankly purulent fluid
 - **Malignancy:** Bloody effusion and low glucose
- a) **Confirm by thoracoscopy**
- b) most common Lung > breast > lymphoma/leukemia
- c) metastatic adenocarcinoma positive cytology 70%
- d) more than 50% hemocrit = Hemothorax
- **Tuberculosis:** Exudative effusions that are primarily lymphocytic then **AFB, PCR must be positive** and **confirm by pleural biopsy**)
 - **Parapneumonic effusion:** pH < 7.2 and low glucose



- Empyema: pus-like (w/ infection)
- Chylous/Chyliform effusion: milky appearance (w/ rheumatoid arthritis)
- 40% of community acquired pneumonia have some level of pleural effusion.
- Pleural effusion with pancreatitis + with ruptured esophagus: typically, on the left side.

Management

1. Transudative effusions:

- A. Diuretics and sodium restriction
- B. Therapeutic thoracentesis (only if massive effusion is causing dyspnea)

2. Exudative effusions: Treat underlying disease

A. Parapneumonic effusions

- 1. Uncomplicated effusions: **antibiotics** alone (in most cases)
- 2. Complicated effusions or empyema or Hemothorax:

- I. Chest tube drainage*
- II. VATS “Video-assisted thoracoscopic surgery”
- III. Surgical lysis of adhesions may be required.



*We drain blood in hemothorax -instead of letting it reabsorb on its own- to prevent sepsis and inflammation which will then lead to thickening of the pleura → trapped lung (lung unable to expand)

B. Malignant effusion:

- I. Chest tube drainage
- II. **pleurodesis** “pleura with adhesion” by initiating an inflammatory response to cause fibrosis then adhesion by injecting tetracyclines, talcum powder or blood sometimes.

Indication of chest tube:

- Empyema
- Complicated parapneumonic effusion
- Hemothorax
- Malignant effusion- chest tube +/- pleurodesis (sclerosants)

Complications

1-Pneumothorax is a complication seen in **10% to 15% of thoracenteses**, but it requires treatment with a chest tube in **<5%** of cases. Do not perform thoracentesis if effusion is **<10 mm** thick on lateral internal decubitus CXR.

2- Adhesions or thickening of the visceral pleura preventing lung expansion and require surgical intervention. (in case of empyema or **hemothorax**)

3- Surgery also necessary if a **Bronchopleural fistula** develops.

MCQs

1. A 64-year-old woman is found to have a right-sided pleural effusion on chest x-ray. Analysis of the pleural fluid reveals pleural fluid to serum protein ratio of 0.38, a lactate dehydrogenase (LDH) level of 110 IU (normal 100-190), and pleural fluid to serum LDH ratio of 0.46. Which of the following disorders is most likely in this patient?

- a. Bronchogenic carcinoma
- b. Congestive heart failure
- c. Pulmonary embolism
- d. Sarcoidosis
- e. Systemic lupus erythematosus

2. A 76-year-old woman presents with worsening dyspnea for the past 4 weeks. She has noticed fatigue, 10-lb weight loss, and occasional night sweats. On examination, she is in mild respiratory distress. Her RR is 22, and her BP is 134/76. She has mild generalized lymphadenopathy, with the largest node measuring 1.5 cm. Lung examination reveals bibasilar dullness without rales or wheezes. Her neck veins are not distended. CXR shows moderate left-sided pleural effusion. A thoracentesis is performed, revealing milky fluid. Pleural fluid protein and LDH demonstrate an exudative effusion. The pleural fluid cell count is 4800/mm³ with 14% neutrophils, 12% mesothelial cells, and 74% lymphocytes. Pleural fluid triglyceride is 170 mg/dL. What is the likely cause of this patient's illness?

- a. Tuberculosis
- b. Lung cancer
- c. Lymphoma
- d. Congestive heart failure
- e. Pneumonia with parapneumonic effusion

MCQs

3. Which of the following a classic exudate that can present as transudate?

- a.malignancy
- b.CHF
- c.Infection
- d.Nephrotic syndrome

4. First line of management in patient with CHF presents to the emergency with bilateral pleural effusion:

- a.chest tube
- b.diuretics
- c.Beta blockers
- d.Nitrates

5. A sample drained from a patient with pleural effusion taken to the cytology lab revealed dominance of lymphocytes is indicated of

- a.acute infection
- b.cirrhosis
- c.TB
- d.Hemorrhagic pleural effusion

MCQs

6. A Hemothorax is said to be present when the Hematocrit of the pleural fluid is at least what percentage of the Peripheral Blood?

- a.<1%
- b.10%
- c.20%
- d.50%

7. Pleural effusions that occur secondarily to ----- are most often treated with pleurodesis.

- a.Ascites
- b.Congestive heart failure
- c.Nephrotic syndrome
- d.Malignancy

Answers : 1-B 2-C 3-a 4-b 5-c 6-d 7-d



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*Medicine is a science of uncertainty
and an art of probability*



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