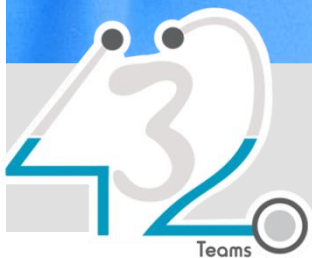


MEDICINE

432 Team

12 Pleural Effusion



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COLOR GUIDE: • Females' Notes • Males' Notes • Important • Additional

Objectives

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

Pleural Effusion

Normally the pleural space contains:

- 3.5 to 7.0 ml of clear liquid
- Low protein content
- Small number of mononuclear cells

Pleural effusion: Presence of large amount of fluid in the pleural space irrespective of the underlying causes.

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.

Starling's Law:

$$L \cdot A [(P_{CAP} - P_{PI}) - (\sigma_{CAP} - \sigma_{PI})]$$

L: Filtration coefficient

A: Surface area

Cap: Capillary

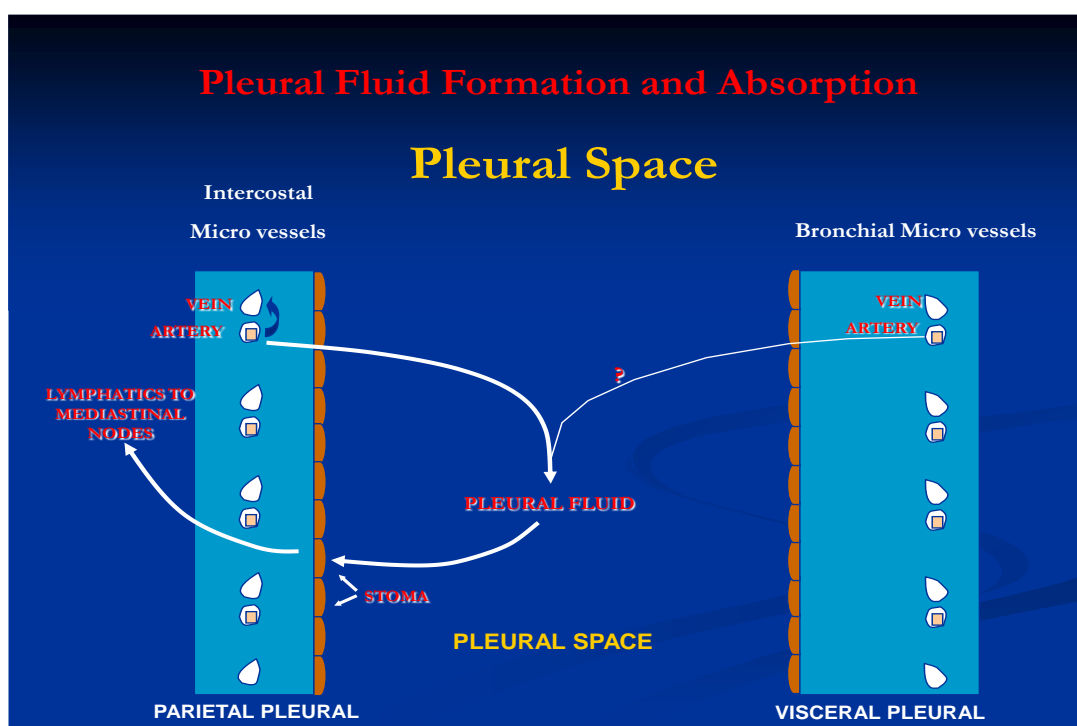
Pl: Pleural

P_{CAP} : Capillary hydrostatic pressure

P_{PI} : Pleural hydrostatic pressure

σ_{CAP} : Capillary oncotic pressure

σ_{PI} : Pleural oncotic pressure



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) **(results from the passage of fluid from the peritoneal cavity into the pleural cavity through small diaphragmatic defects or holes)**
- Thoracic duct rupture (chylothorax)

TABLE 1. LEADING CAUSES OF PLEURAL EFFUSION IN THE UNITED STATES, ACCORDING TO ANALYSIS OF PATIENTS SUBJECTED TO THORACENTESIS. *

CAUSE	ANNUAL INCIDENCE	TRANSUDATE	EXUDATE
Congestive heart failure	500,000	Yes	No
Pneumonia	300,000	No	Yes
Cancer	200,000	No	Yes
Pulmonary embolus	150,000	Sometimes	Sometimes
Viral disease	100,000	No	Yes
Coronary-artery bypass surgery	60,000	No	Yes
Cirrhosis with ascites	50,000	Yes	No

*Adapted from Light.¹

Other causes of pleural effusion: nephrotic syndrome, TB, collagen vascular disease, urinothorax, SVC syndrome, Meigs syndrome, rheumatoid arthritis, pancreatitis, yellow-nail syndrome, drugs

Symptoms:

- Key symptom **shortness of breath**: Fluid filling the pleural space makes it hard for the lungs to fully expand, causing the patient to take many breaths so as to get enough oxygen.
- If parietal pleura is irritated **mild pain** or a **sharp stabbing pleuritic type of pain**.
- Some patients will have a **dry cough**.
- Occasionally **no symptoms** at all (This is more likely when the effusion collects gradually)
- Chest examination will reveal stony dullness, and decrease/absent breath sounds

The 5 major types of pleural effusion are:

- Transudate,
- Exudate,
- Empyema,
- Hemorrhagic pleural effusion or hemothorax and
- Chylous or chyliform effusion.
- **Urinothorax (Rare)**

Evaluation:

History:

- Pleuritic chest pain
- Cough
- Fever
- Hemoptysis
- Weight loss
- Trauma
- Hx cancer
- Cardiac surgery

Physical:

- Dullness to percussion
- Decreased breath sounds
- Absent tactile fremitus

Chest X-Ray:

PA view

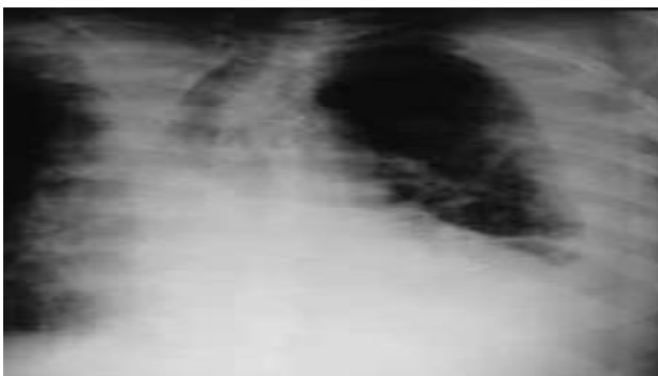


Fluid gathers in the lowest part of the chest, according to the patient's position. If the patient is upright when the x-ray is taken, a pleural effusion will obscure the costophrenic angle and hemidiaphragm.

- The left lower zone is uniformly white
- at the top of this white area there is a concave surface - meniscus sign
- the left heart border, costophrenic angle and hemidiaphragm are obscured

At least 300 ml of fluid must be present before upright chest films can pick up signs of pleural effusion (e.g., blunted [costophrenic angles](#)).

Lateral decubitus



Chest radiographs acquired in the lateral [decubitus](#) position (with the patient lying on his side) are more sensitive and can pick up as little as 50 ml of fluid.



80% of bilateral effusion is caused by heart failure

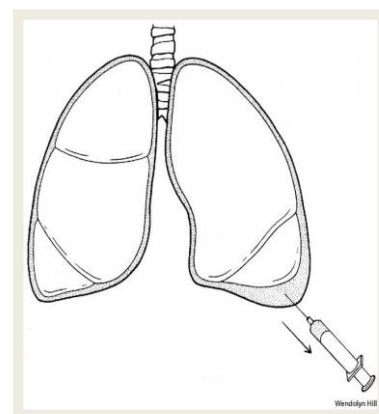
Note(s):

.....
 If a patient is supine a pleural effusion layers along the posterior aspect of the chest cavity and becomes difficult to see on a chest x-ray. With large volume effusions, mediastinal shift occurs away from the effusion

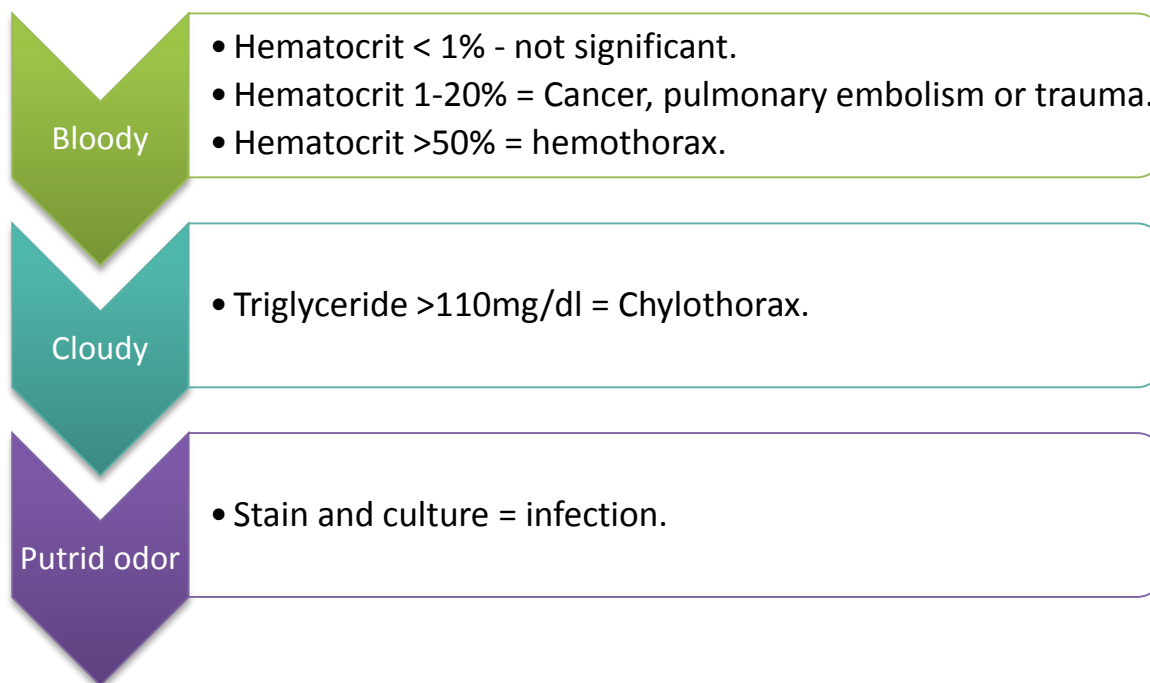
Thoracentesis

Indications for thoracentesis:

- Effusions larger than 1cm height of unknown origin.
- 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.



Pleural fluid analysis



Transudate or Exudate?

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

If the patient's pleural protein is **less than 25 g/l it will be transudate**, and if it is **more than 35g/l it will be exudate**, or we could use **Light's Criteria if between 25-35g/l**

Light's Criteria: Pleural fluid is exudate if one or more of these criteria is applied:

Pleural fluid protein:serum protein ratio >0.5

Pleural fluid LDH:serum LDH ratio >0.6

Pleural fluid LDH is two-thirds more than the upper normal limit of serum LDH.

LDH: Lactate dehydrogenase.

Conditions with transudative effusion: Congestive Heart Failure (bilateral), Cirrhosis and Nephrotic syndrome.

Conditions with exudative effusion: Pneumonia, TB, Malignancy and Pulmonary Embolism.

Exudative Effusion

- Cell count: **Neutrophil predominance: acute pleural process (Pneumonia, pulmonary embolism).**
Lymphocytic predominance: chronic process (Cancer, tuberculosis or Coronary Artery Bypass Grafting "CABG").
- Culture/strain: **infected fluid.**
- Glucose-low level "**<60 mg/dl**": **(pneumonia or cancer).**
- **The lower glucose in the sample = the more number of bacteria consuming the glucose.**
- Cytology: to see if there is any evidence of malignancy **(no diagnosis = thoracoscopy).**
- pH **(less pH indicates that there is a lot of infection in the space which led to anaerobic glycolysis)**
< 7,2 = parapneumonic "empyema" must be drained.
< 7,2 "very low" = malignant – poor prognosis due to the presence of large number of malignant cells.

Other tests:

- **Suspected TB:** send the sample to PCR or AFB **"Acid Fast Bacilli".**
- **Suspected Rheumatoid arthritis:** pleural rheumatoid factor.
- **Suspected SLE "Systemic Lupus Erythromatosus":** serum complement, pleural antinuclear antibody testing **"ANA"** and lupus Erythromatosus cells. **"SLE cause pleural effusion because of the pleural inflammation, and one of the common symptoms of SLE is pleuritis and pleuritic pain".**
- **Suspected pancreatitis:** pleural amylase.
- **Suspected Raptured esophagus:** check for pH(gastric content), food within pleural fluid

Malignant Effusion

The pleura may look abnormal or we might see a mass in the lung. Commonly lung and breast malignancies lead to effusions.

Symptoms: absence of fever, **blood-tinged fluid** or chest CT suggesting malignancy.

Most common Malignancies: Lung >breast > lymphoma/leukemia.

Metastatic Adenocarcinoma positive cytology will give the diagnosis in 70% of the cases.

Treatment:

Sample the fluid “thoracentesis” + treat the underlying disease.

- ✓ **Uncomplicated pneumonia:** antibiotics.
- ✓ **Hemothorax involved/empyema:** drain the fluid because it could cause inflammation, fibrosis or constrict the lungs.
- ✓ **Malignant effusion:** drain the fluid because it might get bigger and cause more symptoms, then we should think about how could we prevent the re-accumulation, **so we could do pleurodesis “pleura with adhesion” by initiating an inflammatory response to cause fibrosis then adhesion by injecting tetracyclines, talcum powder or blood sometimes.**
- ✓ **VATS “Video-assisted thoracoscopic surgery”:** a thoracic surgery used to clear the fluid from the pleural cavity by inserting a small camera into the patient’s chest by a scope.

Undiagnosed Pleural Effusions

Count for 15-20% of effusions. We should carefully review the patient's history, physical examination, medications and other risk factors like smoking.

Consider occult abdominal process and pulmonary embolism.

Why pulmonary embolism causes effusion? The obstruction will increase the pleural permeability, which will cause eventually transudative of exudative effusion.

Risk factors for TB or malignant effusion: If any factor present evaluate for TB or cancer.

1. Weight lost > 4.5 kg (10 pounds).
2. Fever > 38 C.
3. Large effusion
4. > 95% lymph in pleural fluid.

Pleural Biopsy: For undiagnosed pleural effusions, helpful in evaluating for TB but limited utility for malignancy.

Thoracoscopy: Helpful in evaluating for malignancy.

Indications for chest tube:

1. Empyema
2. Complicated parapneumonic effusion with pH < 7,2
3. Hemothorax.
4. Malignant effusion +/- pleurodesis.

Q1/ which of the following most likely to cause bilateral pleural effusion?

- A) Congestive Heart Failure
- B) Malignant disease
- C) Pneumonia
- D) Rheumatoid Arthritis

Q2/ All of the following are one of Light's Criteria (for the diagnosis of pleural exudative effusions) EXCEPT:

- A) Pleural proteins/serum proteins greater than 0.5 ratio
- B) Pleural LDH/serum LDH greater than 0.6 ratio
- C) LDH greater than 2/3 upper limit of normal for serum
- D) Total proteins greater than 2/3 upper limit of normal for serum

Q3/ Pleural effusions that occur secondarily to ----- are most often treated with pleurodesis.

- A) Ascites
- B) Congestive heart failure
- C) Nephrotic syndrome
- D) Malignancy

Q4/ which of the following conditions is most closely associated with exudative pleural effusion?

- A) Tuberculosis
- B) Congestive heart failure
- C) Cirrhosis of the liver
- D) Nephrotic syndrome

Q5/ 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%

Answers:

- 1st Questions: A
- 2nd Questions: D
- 3rd Questions: D
- 4th Questions: A
- 5th Questions: D

432 Medicine Team Leaders

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