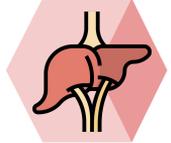


Pleural Effusion



Objectives :

- Describe the pathophysiology of a pleural effusion
- Describe the main causes of a pleural effusion
- Differentiate among the manifestations of fluid collections
- Describe the signs and symptoms of a pleural effusion
- Explain diagnostic methods
- Describe the various treatment options

Done by :

Leader: Hadeel Awartani
Members: Balqees Alrajhi, Aljohara Alshuneifi
Sultan Alaqil, Faisal Alqarni, Adnan Almogbel

Resources :

437 Slides, 436 team, Davidson, Kumar, Step up to medicine

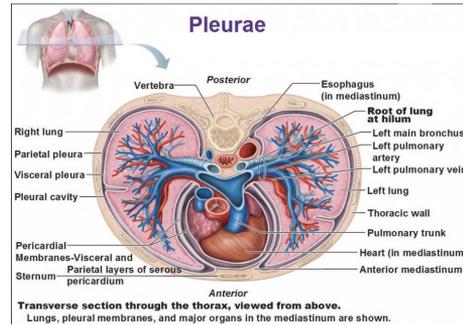
Revised by:

Yazeed Al-Dossare

Definition:

Pleura:

- Serous fluid [5-15 ml] that allows for the parietal pleura (**outer lining**) and visceral pleura (**inner lining**) to glide over each other without separation.
- **Produced** by the Parietal Pleura, **absorbed** and **drained** by Visceral Pleura.
- The visceral pleura absorbs fluid, which then drains into the lymphatic system and returns to the blood, about 100-200 ml of fluid circulates through the pleural space within a 24-hour period
- **Function:** Pleural fluid helps in lubrication and prevents atelectasis¹.
- of pleural fluid is pathological (below it is acceptable).
- Patients with pleural effusion will present with: Chest pain and SOB.
- What are the physical signs of pleural effusion?
 - 1- Dullness on percussion.
 - 2- Shifted trachea to the other side.
 - 3- Asymmetrical chest expansion.
 - 4- Decreased tactile fremitus.

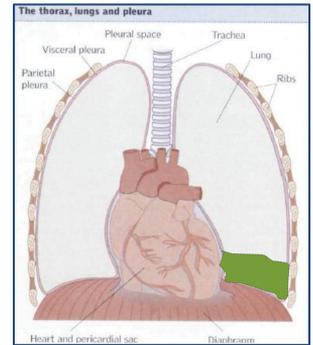
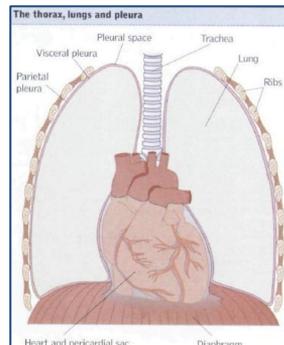


Pleural Effusion:

Pleural effusion is an excessive accumulation of **serous fluid** within the **pleural space**, which can be detected on:

- PA X-ray when 250-500 ml of fluid is present.
- Lateral view when 50-70 ml is present.
- Clinically when the findings usually present for effusions > 300 mL.

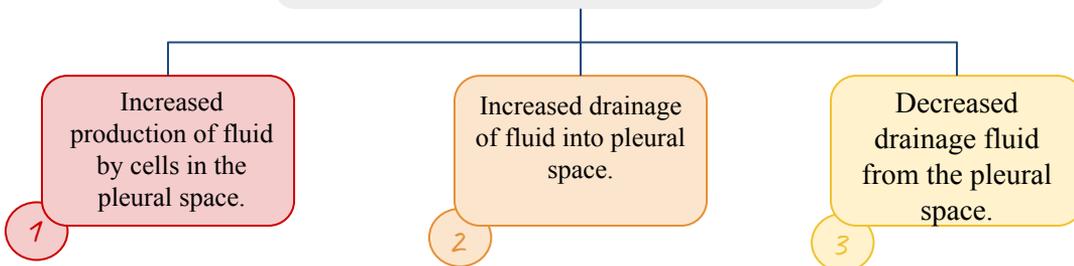
It is most commonly a unilateral effusion.



The Accumulation of:

- Frank **pus**² is termed **empyema**,
- **blood** is **haemothorax**,
- **chyle**³ is a chylothorax⁴

This accumulation can be caused by one of the following mechanisms



¹ the collapse or closure of a lung resulting in reduced or absent gas exchange

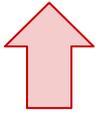
² unmistakable; obvious

³ A milky fluid containing fat droplets which drains from the lacteals of the small intestine into the lymphatic system during digestion.

⁴ It results from lymph formed in the digestive system called chyle accumulating in the pleural cavity due to either disruption or obstruction of the thoracic duct.

Development of Pleural Effusion

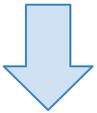
All possible causes of pleural effusion:



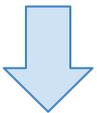
Pulmonary capillary pressure (CHF)



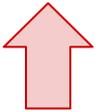
Capillary permeability (Pneumonia)



Intrapleural pressure (Atelectasis)



Plasma oncotic pressure (Hypoalbuminemia)



Pleural membrane permeability (Malignancy)



Lymphatic obstruction (Malignancy)



Diaphragmatic defect (Hepatic hydrothorax)



Thoracic duct rupture (Chylothorax)

Pleural Effusion Types

Transudative Pleural Effusion		Exudative Pleural Effusion
<p>(don't bother about it, just know that there are different mechanisms for pleural effusion)</p> <p>Pathophysiology</p>	<ul style="list-style-type: none"> → Due to elevated capillary hydrostatic pressure in visceral or parietal pleura (e.g., CHF) → Due to decreased plasma oncotic pressure (e.g., hypoalbuminemia) → Due to decreased intrapleural pressure (eg. atelectasis). 	<ul style="list-style-type: none"> → ↓ lymphatic flow from pleural surface due to a damage to pleural membranes or vasculature. → ↑ capillary permeability (eg. Pneumonia) → ↑ pleural membrane permeability (eg. malignancy) → Thoracic Duct rupture (eg. Chylothorax) → Lymphatic Obstruction (eg. malignancy)
<p>Main causes and types of fluid</p>	<p>The causes of the majority of pleural effusions are identified by a thorough history, examination and relevant investigations.</p>	
	<p>To make it easy transudate means big organ</p> <ol style="list-style-type: none"> 1-CHF Serous fluid, straw-coloured 2-Nephrotic syndrome 3-Hypoalbuminemia This can occur in both liver cirrhosis & nephrotic syndrome 4-Hepatic hydrothorax 5-Atelectasis 6-Hypothyroidism 7-Liver Cirrhosis Movement of ascitic fluid from the peritoneal cavity into the pleural space through diaphragmatic <p>Other: ovarian tumour producing right-sided pleural effusion - meigs syndrome</p>	<ol style="list-style-type: none"> 1. Bacterial Infections: <ol style="list-style-type: none"> A. Tuberculosis (chronic): <ul style="list-style-type: none"> - Fluid is serous, usually amber-coloured, - Fluid contains predominantly Lymphocytes (The diagnostic test for pleural TB is pleural biopsy) <ol style="list-style-type: none"> b. Pneumonia (acute): Parapneumonic effusion may lead to empyema 2. Malignancy: <ul style="list-style-type: none"> - Serous, often blood stained, - Serosal cells and lymphocytes, - Often clumps of malignant cells. - The most common malignancy cause pleural effusion is breast cancer for women and adrenal for men 3. Inflammatory Diseases: <ul style="list-style-type: none"> ● Pancreatitis, ARDS, uremic pleurisy ● Collagen Vascular Disease (also called connective tissue disease): <ul style="list-style-type: none"> - Rheumatoid Disease, - SLE and it's sisters. (Serous, Lymphocytes are the predominant cells) 4. Pulmonary Embolism: <ul style="list-style-type: none"> - Serous, or blood stained, - Fluid contains: Red blood cells and Eosinophils 5. Viral infection. <p>Others: idiopathic pleural effusion, drugs (hydralazine, cimetidine). Pregnancy</p>

★ Light's Criteria for Distinguishing Pleural Transudate From Exudate: (Important).

98% sensitive and 83% specific for **exudative** effusion using **Light's criteria**.

Exudative effusions have at least one of the following (*transudates have none of these*):

1-Protein (pleural)/protein (serum) >0.5¹ 2-LDH (pleural)/LDH (serum) >0.6 3-LDH > 2/3 upper limit of normal serum LDH

¹Eg:pleural fluid with protein 40, and serum protein 20, the total is 2.0 =it is **exudative** pleural effusion because it should exceed 0.5.



The most common causes are:

1. **CHF** is most common cause.
2. **Pneumonia** (bacterial)
3. **Malignancies**: lung (36%), breast (25%), lymphoma (10%)
4. **Pulmonary embolism** (PE)
5. Viral diseases
6. Cirrhosis with ascites

Manifestation of Fluid Collections

To differentiate between empyema and complicated parapneumonic effusion look at the color; empyema has pus (yellow) while parapneumonic effusion is (turbid) (when I have pleural effusion, I will get the fluid and look for the 5 C's)

THE 5 C's
(very important)

- 1-Cytology
- 2-Culture
- 3-Cell count
- 4-Color /Character
- 5-Chemistry

1-Cytology

To tell you if there's **malignancy** or not e.g. cells of **metastatic adenoma** from the breast.

2-Culture

for diagnosis of **Parapneumonic effusion, Empyema, TB**

3-Cell Count

look for the **DDx depending on the predominant cells** (not the total number of WBC):

Lymphocytes (chronic) >50%

Malignancy (30-35%), TB(15-20%), Connective tissue disease (e.g. sarcoidosis, **SLE**) & trauma or bleeding. (think about the causes for **red color**) **lymphocytes = red color**

Neutrophils (PMN) (acute)

Parapneumonic (Acute infection), Empyema, Rheumatoid or Pulmonary infarction

Eosinophils >10%

Lymphatic obstruction, Fungal Infection, Allergy, Drugs(e.g. hydralazine) Others: Trauma, pneumothorax, CA, Asbestos, parasites, Pneumonia
Predominant eosinophils = **Green color**

RBC > 100,000/mm

Malignancy, Trauma, Pulmonary infarction.

Lymphocytes or PMNs

Pulmonary infarction, Conn tissue disease, post-cardiac surgery.

4-Color/ Character

**Red
(important)**

Green

White/Milky

Yellow

Turbid

Black

**Brown/
Roasted**

pleural fluid is normally colorless
(transparent)

Exudative effusions that are primarily lymphocytic:

Blood (Hemorrhagic effusion/trauma), Malignancy, TB (chronic infection),
Connective tissue disease. How to know if this blood is hemothorax or iatrogenic? We divide the
hematocrit level in the pleura by the hematocrit level in the blood, if it is 50% = hemothorax (blunt)

Fungal infection.

Lymphatic obstruction as in Lymphoma, **Thoracic duct injury**,
Chylothorax (lymph in the pleural space)

Any of the mentioned causes above can cause yellow "it's the most
common color".

Acute infection = Pneumonia (**Parapneumonic effusion**)

Aspergillus niger and *Rhizopus oryzae*, metastatic melanoma, [Read more](#)

→ Pus → **Empyema**. **So how to differentiate between Empyema and
Parapneumonic effusion?** By appearance and color: Parapneumonic = **Turbid
empyema = PUS**

5-Chemistry

To minimize your DDX.

pH (<7.2)

Glucose

LDH

Protein

In general, pleural fluids with a **low glucose** level also have **low pH**
and **high LDH⁸** levels (**Exudate**), as in infections (**parapneumonic
effusion** or empyema), connective tissue disease, TB and
malignancies, esophageal rupture, pancreatitis.

Amylase

Elevated pleural fluid **amylase**: esophageal rupture, pancreatitis,
malignancy

⁸Lactate dehydrogenase

Pleural Fluid Pearls

Pleural fluid pearls	
Condition	Suggests
Elevated pleural fluid amylase	Esophageal rupture, pancreatitis, malignancy.
Milky, opalescent fluid	Chylothorax (lymph in the pleural space)
Frankly purulent fluid	Empyema (pus in the pleural space)
Bloody Effusion	Malignancy
Exudative effusions that are primarily lymphocytic	TB
pH < 7.2 (most important indication for inserting chest drain)	Parapneumonic effusion⁹ or empyema

Empyema

(pus within the pleural space) Exudative pleural effusions **-if left untreated-** can lead to empyema, which means the pleural effusion is **infected**.

- The Pus may be as thin as **serous fluid** or so **thick** that it is impossible to aspirate
- **Most cases** occur as a complication of bacterial pneumonia¹⁰ (parapneumonic effusion).
- Empyema may involve the whole pleural space or only part of it (“loculated” or „encysted“ empyema).
- **Clinical features:** The clinical features are those of the underlying disease (most commonly pneumonia).
- **Diagnosis:** CXR¹¹ and CT scan of the chest are the recommended tests.
- **Treatment:** aggressive drainage of the pleura (via thoracentesis) and antibiotic therapy. If the condition is not adequately treated, pus may rupture into a bronchus, causing a bronchopleural fistula and pyopneumothorax.

To differentiate empyema from complicated parapneumonic effusion we look at the color:

- If it is pus (usually very yellow, but not always) then it is empyema.
- If it is Turbid, then it is parapneumonic.

To differentiate empyema from complicated parapneumonic effusion and parapneumonic effusion:

- All 3 have low glucose
- **Empyema and complicated parapneumonic effusion have PH less than 7.2**

19.17 Clinical features of empyema	
Systemic features	
<ul style="list-style-type: none"> • Pyrexia, usually high and remittent • Rigors, sweating, malaise and weight loss • Polymorphonuclear leucocytosis, high CRP 	
Local features	
<ul style="list-style-type: none"> • Pleural pain; breathlessness; cough and sputum, usually because of underlying lung disease; copious purulent sputum if empyema ruptures into a bronchus (bronchopleural fistula) • Clinical signs of pleural effusion 	

⁹ A parapneumonic effusion is a non infected pleural effusion secondary to bacterial pneumonia.

¹⁰ Over 40% of patients with community- acquired pneumonia develop an associated pleural effusion („parapneumonic“ effusion)

¹¹ Chest X-ray appearances may be indistinguishable from those of pleural effusion.

Signs and Symptoms of Pleural Effusion

- **Clinical Features: (important)**

- **History / Symptoms: (Often asymptomatic)**

- 1.Symptoms of pleural effusion:**

- Pleuritic chest pain (on inspiration and coughing) (defined as pain in the lung)
- Cough
- Dyspnea (ALL patient with Pleural Effusion will present with pain and dyspnea)

- 2.Symptoms of the underlying cause, e.g. in CHF: Peripheral edema, orthopnea, paroxysmal nocturnal dyspnea. Or Sx related to malignancy.**

e.g. if related to pneumonia or aspiration then cough.

SLE patient: classical symptoms of SLE (rash, fatigue)

+

(musculoskeletal pain – joint pain) + chest pain, shortness of breath.

- **Physical examination / Signs: (very important)**

(Findings usually present for effusions > 300 mL)

- **Stony dullness to Percussion**
- **Reduced** tactile fremitus
- Asymmetrical **chest wall expansion** → **reduced** in affected side. The side containing the fluid moves slower.
- **Decreased vesicular breath sounds over the effusion.**
- Egophony above the effusion.
- **Trachea will shift away from the affected side.**
- Palpation of apex beat → if the effusion was on the left side apex beat will be displaced, or if it was on the right side but there was cardiomegaly.

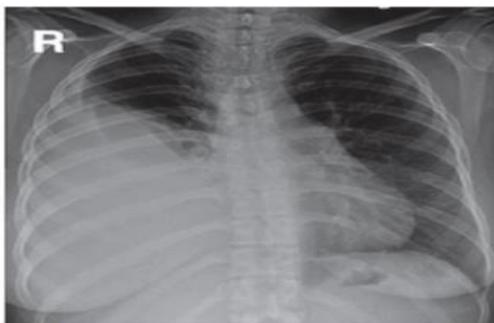
Rule 1,5,10

1: for trachea

5:apex beat, tactile fremitus

10:chest expansion

Large right pleural effusion



Inspection

Tachypnoea

Palpation

↓Expansion on R

Trachea and apex may be moved to L

Percussion

Stony dull

R mid- and lower zones

Auscultation

Absent breath sounds and

vocal resonance R base

Bronchial breathing or

crackles above effusion

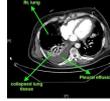
Diagnosis

1- History & 2- Physical examination → give 85% of diagnosis.

3- Chest x-ray: **Initial diagnostic test for pleural effusion. (Very simple and non-invasive)**

- **Postero-anterior:** Around 250-500 mL of pleural fluid must accumulate before an effusion can be detected. Look for: **blunting of costophrenic angle**

Lateral decubitus films (patient lying on one side): very sensitive, can detect effusions as small as 50 mL. (it is old, not used anymore)



4 CT scan: **What's the indication for CT in pleural effusion?**

- CT scanning is indicated where **malignant disease** is suspected.
- Better characterization of underlying lung parenchyma and certain processes that may be obscured on radiographs by large pleural effusions. E.g. consolidation or masses. More reliable than CXR for detecting effusions.
- To detect the underlying cause, PE, ovary masses could cause pleural effusion (meigs syndrome)¹⁶
- Gold standard for detecting loculated pleural effusion.
- Fluid is darker than solid. Solid can be pus (empyema), consolidation (pneumonia), Tumor, atelectasis (mucus bands that adhere to the lung tissue and appears like pus).

5 **Ultrasound: What are the advantages of ultrasound?**

- **More sensitive and specific** and it can detect minimal fluid.
- It will help you to rule out others like pneumothorax and fluid collection.
- A very important step in diagnosing the patient.
- Cheap and available at bedside
- Can help identify free vs. loculated effusions. Disadvantage: Operator dependent. Usually a pulmonologist will perform it and not a radiologist.

6 **Thoracentesis: It's aspiration of fluid facilitated by ultrasound guidance**

When I did thoracentesis I should look for 5C's

Has two aims: diagnostic & therapeutic

- Thoracentesis is not immediately indicated if there is an obvious explanation for pleural effusion without atypical features. E.g. a patient with CKD and on hemodialysis, we don't need to do thoracentesis as we already know the cause. Or a patient known for HF and regularly comes with pulmonary edema and pleural effusion.
- Indications for thoracentesis:
 - o **NEW** Pleural effusion of **unknown** etiology, with >10mm depth on lateral decubitus CXR or Ultrasound
 - o **Therapeutically for symptomatic relief**
 - o Concern for empyema
 - o Air fluid level in pleural space
- Pneumothorax is a complication seen in 10% to 15% of thoracenteses. - After you get the fluid send it for analysis.
- Pleural effusion on CT or CXR can't show the nature of the effusion whether it's blood, pus or any other type, so thoracentesis helps identifying the nature of the effusion.

Routine & Additional Fluid Tests for Pleural Effusion

Routine Pleural Fluid Tests for Pleural Effusion

Test	Test value	Suggested diagnosis	Comments
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 ⁶	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. ⁷
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

Test	Test value	Suggested diagnosis	Comments
Amylase	>Upper limit of normal	Malignancy (<20 percent), pancreatic disease, esophageal rupture ^{6,16}	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. ¹⁷
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 ²	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}

Treatment

Treatment: (one sentence: Treat the underlying cause)

Thoracentesis – then treat underlying disease

- **Uncomplicated pneumonia:** antibiotics.
- **Hemithorax involved/empyema:** tube thoracostomy²⁰ +/- VATS²¹
- **Malignant effusion:** chest tube +/- pleurodesis (sclerosants)²² / VATS

(Chest tube is the first step in treating empyema (drain))

Drain is optional for symptomatic relief, but its mandatory for empyema

1 - Transudative effusion:

- Diuretics and sodium restriction.
- Therapeutic thoracentesis (in massive effusion).

3 - Parapneumonic effusions:

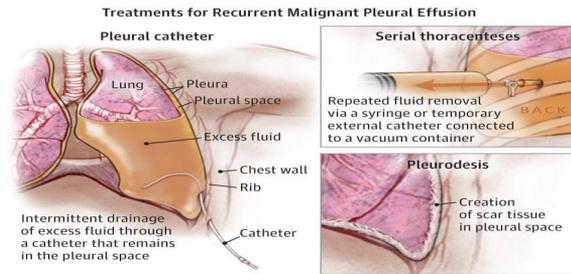
- Uncomplicated: antibiotics alone

2- Exudative effusion

treat underlying cause..

- Complicated or empyema:

- Chest tube drainage and antibiotics.
- Intrapleural injection of thrombolytic agents (streptokinase or urokinase); may accelerate the drainage.
- Surgical lysis of adhesions may be required



²⁰ Tube thoracostomy is the insertion of a tube (chest tube) into the pleural cavity to drain air, blood, bile, pus, or other fluids. [How is it different from thoracentesis?](#)

²¹ Video-assisted thoracoscopic surgery (VATS) is a type of thoracic surgery performed using a small video camera that is introduced into the patient's chest via small incisions.

²² Pleurodesis is a medical procedure in which the pleural space is artificially obliterated. It involves the adhesion of the two pleurae.

Summary

- **Pleural effusion** is an excessive **accumulation** of **serous fluid** within the **pleural space**.
If it is: - **Frank pus** > **empyema**, - **blood** > **haemothorax**, - chyle > chylothorax.
 - Types: 1) Exudative. 2) Transudative.
 - **Light's criteria:** Exudative effusions have at least one of the following:
 - 1- Protein (pleural)/protein (serum) > **0.5**
 - 2- LDH (pleural)/LDH (serum) > **0.6**
 - 3- LDH > 2/3 the upper limit of normal serum LDH
- **Clinical Features:** chest pain \ Cough \ Dyspnea \ Stony dullness \ Decreased vesicular breath sounds \ Trachea will shift **away** from the affected side \ Reduced tactile fremitus.
 - **Diagnosis:** Initial diagnostic test > Chest x-ray
 - **Treatment:** Thoracentesis – then treat underlying disease

Manifestations of Fluid Collections <u>THE</u> <u>5 C's:</u>		4. <u>Color/Character:</u>	
1. <u>Cytology:</u>	2. <u>Culture:</u>	Red	Blood (Hemorrhagic effusion), Malignancy, TB
3. <u>Cell count:</u>		Green	Fungal infection
Lymphocytes	<u>Malignancy, TB, Connective tissue disease</u>	White/Milky	Thoracic duct injury, Chylothorax
Neutrophils	<u>Parapneumonic (Acute infection), Empyema.</u>	Yellow	Any causes
Eosinophils	Lymphatic obstruction, <u>Fungal Infection, Allergy, Drugs</u>	Turbid	(Parapneumonic effusion)
RBC > 100,000/mm	Malignancy, Trauma, Pulmonary infarction	Brown/Roasted	→ Pus → Empyema.
5. <u>Chemistry:</u>	PH (< 7.2), Glucose, Protein & LDH (for li	(Light's criteria)	

19.15 Pleural effusion: main causes and features				
Cause	Appearance of fluid	Type of fluid	Predominant cells in fluid	Other diagnostic features
Tuberculosis	Serous, usually amber-coloured	Exudate	Lymphocytes (occasionally polymorphs)	Positive tuberculin test Isolation of <i>M. tuberculosis</i> from pleural fluid (20%) Positive pleural biopsy (80%) Raised adenosine deaminase
Malignant disease	Serous, often blood-stained	Exudate	Serosal cells and lymphocytes Often clumps of malignant cells	Positive pleural biopsy (40%) Evidence of malignancy elsewhere
Cardiac failure	Serous, straw-coloured	Transudate	Few serosal cells	Other signs of cardiac failure Response to diuretics
Pulmonary infarction	Serous or blood-stained	Exudate (rarely transudate)	Red blood cells Eosinophils	Evidence of pulmonary infarction Obvious source of embolism Factors predisposing to venous thrombosis
Rheumatoid disease	Serous Turbid if chronic	Exudate	Lymphocytes (occasionally polymorphs)	Rheumatoid arthritis: rheumatoid factor and anti-CCP antibodies Cholesterol in chronic effusion; very low glucose in pleural fluid
SLE	Serous	Exudate	Lymphocytes and serosal cells	Other signs of SLE Antinuclear factor or anti-DNA positive
Acute pancreatitis	Serous or blood-stained	Exudate	No cells predominate	Higher amylase in pleural fluid than in serum
Obstruction of thoracic duct	Milky	Chyle	None	Chylomicrons

(anti-CCP = anti-cyclic citrullinated peptide; SLE = systemic lupus erythematosus)

Examine Yourself !!

1) A 55-year-old man presents with progressive shortness of breath. Other than a history of heavy smoker, the patient has no significant past medical history. Breath sounds are absent two-thirds of the way up on the left side of the chest. Percussion of the left chest reveals stony dullness, the trachea appears to be deviated toward the right. Which of the following diagnoses is most likely? (From the doctor's lecture)

- A. Bacterial pneumonia
- B. Viral pneumonia
- C. Bronchial obstruction
- D. Pleural effusion
- E. Pneumothorax

The correct answer is **D**

2) A 59-year-old male presents with a community acquired pneumonia complicated by pleural effusion. A thoracentesis is performed, but the results are not currently available. Which characteristic of the pleural fluid is most suggestive complicated parapneumonic pleural effusion? (From the doctor's lecture)

- A. Presence of more than 30% polymorphonucleocytes (PMNs)
- B. Glucose less than 150 mg/dl
- C. Presence of more than 100 white blood cells
- D. pH less than 7.20
- E. Lactate dehydrogenase (LDH) more than two-thirds of the normal upper limit for serum

The correct answer is **D**

(In this question, which answer (feature) says that it is parapneumonic? (A) is wrong because neutrophils must be more than 60%. (B) is wrong because glucose is very high. (C) is wrong because the total number of WBC is not needed here. (D) is correct because of low pH. (E) is wrong because LDH levels are specifically used to indicate if the fluid is exudate or transudate.)

3) A 50 year old lady presents to the emergency department with increased shortness of breath on exertion over the past 3 months. She has a past history of breast cancer 10 years previously treated with mastectomy and no known recurrence. Oxygen saturations are 94% on air and PO₂ of 9 kPa on arterial blood sampling. Chest X-ray shows a large right-sided pleural effusion. The next appropriate investigation would be: (Kumar)

- A- Chest CT
- B- Chest drain insertion
- C- Pleural aspiration
- D- Peak expiratory flow rate
- E- Exercise test

The correct answer is : C

Examine Yourself !!

4) A 59 year old man with shortness of breath is brought to the emergency department for evaluation. He has a past medical history of hepatitis B, cirrhosis, and recurrent pulmonary infections. A chest x-ray is obtained and reveals a large, right-sided pleural effusion. Thoracentesis is undertaken, which reveals that the ratio of pleural protein to serum protein is >0.5 . What is the most likely explanation for these findings? (step-up)

- A. Pulmonary infarction
 - B. Atelectasis
 - C. Hypoalbuminemia
 - D. Cirrhosis
 - E. Pneumonia
- The correct answer is **E**

Explanation: This patient has an exudative pleural effusion as suggested by the pleural effusion found on chest x-ray. Thoracentesis reveals that the pleural protein/serum protein ratio is >0.5 , which is characteristic, based on Light's criteria rule, for an exudative effusion. The differential diagnosis of an exudative effusion includes bacterial pneumonia, TB, malignancy, viral infection, pulmonary embolism, and collagen vascular diseases. Atelectasis and cirrhosis are both common causes of transudative pleural effusion; in these patients, the pleural protein/serum protein ratio is <0.5 . Hypoalbuminemia is also common cause of a transudative pleural effusion with a pleural protein/serum protein ratio <0.5 ; further, the pleural LDH/serum LDH ratio is <0.6 . Pulmonary embolism, not pulmonary infarct, is associated with formation of transudative pleural effusion. In these patients, the pleural protein/serum protein ratio is <0.5 .

A 55 year old man presents to the emergency department with shortness of breath and chest pain. Physical examination suggested the presence of pleural effusion in the right side of the chest. A PA chest X-ray was taken. What is the most likely finding in the X-ray?

- A. Hyperinflation of the lungs.
 - B. Blunting of the right costophrenic angle
 - C. Flattening of the diaphragm
 - D. Normal chest X-ray.
- The correct answer is **B**

Thoracentesis was done to a patient who's physical exam and chest X-ray were positive for pleural effusion. Cell count showed predominant PMNs. What is the most likely cause for this patient's pleural effusion?

- A. Malignancy.
- B. Tuberculosis.
- C. Parapneumonic.
- D. Fungal infection.

The correct answer is **C**

7) A 57 year old man with bacterial pneumonia is hospitalized on the medical service. He has a left-sided pleural effusion and underwent thoracentesis. The pleural LDH/serum LDH is >0.6 . One week later, he reaccumulates the effusion, and chest X-ray shows a large left-sided pleural effusion. What is the most appropriate course of action to take? (Step-up)

- A. Antibiotics, oral.
 - B. Consideration for rib resection with open drainage.
 - C. Antibiotics, intravenous.
 - D. Lung lobectomy.
 - E. Corticosteroid infusion.
- The correct answer is **B**

Explanation: This patient has empyema. Most cases are a complication of bacterial pneumonia, but it can also occur with mediastinitis or abscess. This condition should be treated with open drainage since the patient has failed treatment with thoracentesis. Recurrent exudative pleural effusion is best treated more aggressively than simply with antibiotics. Corticosteroids may suppress the immune system and worsen the empyema. Lung lobectomy should not be required; once the exudative effusion is removed, the lung should heal.

Examine Yourself !!

8) A 38 years old female who has been smoking Shisha daily for 20 years, came to the ER with severe shortness of breath exacerbating with lying down. On history, the patient mentioned loss of 10 kg on the last 3 months. On clinical examination there was asymmetrical chest expansion. Chest X-Ray showed massive pleural effusion on the left lung. Thoracocentesis was performed and red colored effusion was shown. What is the first DDx comes to your mind?

- A. Fungal infection.
- B. Pneumonia.
- C. Tuberculosis.
- D. Trauma.
- E. Malignancy.

The correct answer is

E

Abnormality in which organ can affect the amount of the fluid in pleural space?

- A. Lungs.
- B. Brain.
- C. Ovaries.
- D. Testes.
- E. Liver.

The correct answer is **C**

Which procedure can relieve symptoms but can't treat the primary cause?

- A. CT angiogram.
- B. Thoracocentesis.
- C. Treating the underlying disease.
- D. B&C.
- E. None of the above.

The correct answer is **B**

Which one of the following is considered the most common cause of pleural effusion?

- A. Primary lung cancer.
- B. Congestive heart failure.
- C. Mesothelioma.
- D. Trauma.
- E. Pneumonia.

The correct answer is

B

Choose the clinical signs that matches a patient with severe pleural effusion.

- A. Chest inflation > 5cm, resonant on percussion.
- B. Infraclavicular dullness, sharp costophrenic angles on CXR.
- C. Stony dullness on percussion, asymmetrical chest expansion.
- D. B&C.
- E. None of the above.

The correct answer is **C**