

**MINISTRY OF HEALTHCARE OF UKRAINE
HSEEU "Ukrainian Medical Stomatological Academy"**

"Approved"
at the meeting of internal
medicine №1 department
Head of Department
Prof. Skrypnyk I.M.

Protocol № 4 from 13.10.2016

**GUIDELINES
FOR STUDENTS
INDEPENDENT WORK
IN THE PRACTICAL CLASSES PREPARING**

<i>Academic discipline</i>	Internal medicine
<i>Module</i>	Current practice of internal medicine
<i>Content module</i>	Management of the patients with main symptoms and syndromes in pulmonology clinic
<i>Study subject</i>	Management of the patients with pleural effusion
<i>Course</i>	VI
<i>Faculty</i>	of foreign students training

1. The aims of the training course:

To Know:

1. Differential diagnosis the conditions that accompanied with the presence of pleural effusion (tuberculosis, bronchial tumors, branches of pulmonary artery thromboembolism, heart failure, acute pancreatitis, liver cirrhosis, trauma,).
2. Existing algorithms for diagnosis.
3. Test plan, the role of radiological, instrumental and laboratory methods of examination (radiography, bronhohrafy, CT, bronchoscopy, ultrasound, EhoCG, general and biochemical analysis).
4. The relative and absolute indications for pleural puncture.
5. Drug and non-medicamentous treatment.

To be able to:

Conduct surveys and examination of patients with major Pulmonological syndromes

- draft examination of patients with major Pulmonological syndromes
- justify the use of basic diagnostic methods in pulmonology, identify indications and contraindications for their conduct, possible complications
- prescribe treatment, determine prognosis and to conduct primary and secondary prevention in the major respiratory diseases
- diagnose and assist in respiratory distress
- justify the need of pleural puncture
- Perform pikfluometry

Demonstrate knowledge of moral principles

The contents of topic:

Text

Merck Manual Professional Version <http://www.merckmanuals.com/professional>

Last full review/revision September 2014 by Richard W. Light, MD

Pleural effusions are accumulations of fluid within the pleural space. They have multiple causes and usually are classified as transudates or exudates. Detection is by physical examination and chest x-ray; thoracentesis and pleural fluid analysis are often required to determine cause. Asymptomatic transudates require no treatment. Symptomatic transudates and almost all exudates require thoracentesis, chest tube drainage, pleurodesis, pleurectomy, or a combination.

Normally, 10 to 20 mL of pleural fluid, similar in composition to plasma but lower in protein (< 1.5 g/dL), is spread thinly over visceral and parietal pleurae, facilitating movement between the lungs and chest wall. The fluid enters the pleural space from systemic capillaries in the parietal pleurae and exits via parietal pleural stomas and lymphatics. Pleural fluid accumulates when too much fluid enters or too little exits the pleural space.

Etiology

Pleural effusions are usually categorized as transudates or exudates based on laboratory characteristics of the fluid. Whether unilateral or bilateral, a transudate can usually be treated without extensive evaluation, whereas the cause of an exudate requires investigation. There are numerous causes.

Transudative effusions are caused by some combination of increased hydrostatic pressure and decreased plasma oncotic pressure. Heart failure is the most common cause, followed by cirrhosis with ascites and by hypoalbuminemia, usually due to the nephrotic syndrome.

Exudative effusions are caused by local processes leading to increased capillary permeability resulting in exudation of fluid, protein, cells, and other serum constituents. Causes are numerous; the most common are pneumonia, cancer, pulmonary embolism, viral infection, and TB. Yellow nail syndrome is a rare disorder causing chronic exudative pleural effusions, lymphedema, and dystrophic yellow nails—all thought to be the result of impaired lymphatic drainage.

Chylous effusion (chylothorax) is a milky white effusion high in triglycerides caused by traumatic or neoplastic (most often lymphomatous) damage to the thoracic duct. Chylous effusion also occurs with the superior vena cava syndrome.

Chyliform (cholesterol or pseudochylous) effusions resemble chylous effusions but are low in triglycerides and high in cholesterol. Chyliform effusions are thought to be due to release of cholesterol from lysed RBCs and neutrophils in long-standing effusions when absorption is blocked by the thickened pleura.

Hemothorax is bloody fluid (pleural fluid Hct > 50% peripheral Hct) in the pleural space due to trauma or, rarely, as a result of coagulopathy or after rupture of a major blood vessel, such as the aorta or pulmonary artery.

Empyema is pus in the pleural space. It can occur as a complication of pneumonia, thoracotomy, abscesses (lung, hepatic, or subdiaphragmatic), or penetrating trauma with secondary infection. Empyema necessitatis is soft-tissue extension of empyema leading to chest wall infection and external drainage.

Trapped lung is a lung encased by a fibrous peel caused by empyema or tumor. Because the lung cannot expand, the pleural pressure becomes more negative than normal, increasing transudation of fluid from parietal pleural capillaries. The fluid characteristically is borderline between a transudate and an exudate; ie, the biochemical values are within 15% of the cutoff levels for Light's criteria.

Iatrogenic effusions can be caused by migration or misplacement of a feeding tube into the trachea or perforation of the superior vena cava by a central venous catheter, leading to infusion of tube feedings or IV solution into the pleural space.

Effusions with no obvious cause are often due to occult pulmonary emboli, TB, or cancer. Etiology is unknown for about 15% of effusions even after extensive study; many of these effusions are thought to be due to viral infection.

Symptoms and Signs

Some pleural effusions are asymptomatic and are discovered incidentally during physical examination or on chest x-ray. Many cause dyspnea, pleuritic chest pain, or both. Pleuritic chest pain, a vague discomfort or sharp pain that worsens during inspiration, indicates inflammation of the parietal pleura. Pain is usually felt over the inflamed site, but referred pain is possible. The posterior and peripheral portions of the diaphragmatic pleura are supplied by the lower 6 intercostal nerves, and irritation there may cause pain in the lower chest wall or abdomen that may simulate intra-abdominal disease. Irritation of the central portion of the diaphragmatic pleura, innervated by the phrenic nerves, causes pain referred to the neck and shoulder.

Physical examination reveals absent tactile fremitus, dullness to percussion, and decreased breath sounds on the side of the effusion. These findings can also be caused by pleural thickening. With large-volume effusions, respiration is usually rapid and shallow. A pleural friction rub, although infrequent, is the classic physical sign. The friction rub varies from a few intermittent sounds that may simulate crackles to a fully developed harsh grating, creaking, or leathery sound synchronous with respiration, heard during inspiration and expiration. Friction sounds adjacent to the heart (pleuropericardial rub) may vary with the heartbeat and may be confused with the friction rub of pericarditis. Pericardial rub is best heard over the left border of the sternum in the 3rd and 4th intercostal spaces, is characteristically a to-and-fro sound synchronous with the heartbeat, and is not influenced significantly by respiration. Sensitivity and specificity of the physical examination for detecting effusion are probably low.

Diagnosis

- Chest x-ray
- Pleural fluid analysis
- Sometimes CT angiography or other tests

Pleural effusion is suspected in patients with pleuritic pain, unexplained dyspnea, or suggestive signs. Diagnostic tests are indicated to document the presence of pleural fluid and to determine its cause.

Presence of effusion

Chest x-ray is the first test done to confirm the presence of pleural fluid. The lateral upright chest x-ray should be examined when a pleural effusion is suspected. In an upright x-ray, 75 mL of fluid blunts the posterior costophrenic angle. Blunting of the lateral costophrenic angle usually requires about 175 mL but may take as much as 500 mL. Larger pleural effusions opacify portions of the hemithorax and may cause mediastinal shift; effusions > 4 L may cause complete opacification of the hemithorax and mediastinal shift to the contralateral side.

Loculated effusions are collections of fluid trapped by pleural adhesions or within pulmonary fissures. Lateral decubitus x-rays, chest CT, or ultrasonography should be done if it is unclear whether an x-ray density represents fluid or parenchymal infiltrates or whether suspected fluid is

loculated or free-flowing; these tests are more sensitive than upright x-rays and can detect fluid volumes < 10 mL. Loculated effusions, particularly those in the horizontal or oblique fissure, can be confused with a solid pulmonary mass (pseudotumor). They may change shape and size with changes in the patient's position and amount of pleural fluid.

CT is not routinely indicated but is valuable for evaluating the underlying lung parenchyma for infiltrates or masses when the lung is obscured by the effusion or when the detail on chest x-rays is insufficient for distinguishing loculated fluid from a solid mass.

Cause of effusion

Thoracentesis should be done in almost all patients who have pleural fluid that is ≥ 10 mm in thickness on CT, ultrasonography, or lateral decubitus x-ray and that is new or of uncertain etiology. In general, the only patients who do not require thoracentesis are those who have heart failure with symmetric pleural effusions and no chest pain or fever; in these patients, diuresis can be tried, and thoracentesis avoided unless effusions persist for ≥ 3 days.

Thoracentesis and subsequent pleural fluid analysis often are not necessary for pleural effusions that are chronic, have a known cause, and cause no symptoms.

Whenever possible, thoracentesis is done using ultrasonographic guidance, which increases the yield of fluid and decreases risk of complications such as pneumothorax or puncture of an intra-abdominal organ.

Pleural fluid analysis is done to diagnose the cause of pleural effusion. Analysis begins with visual inspection, which can

- Distinguish bloody and chylous (or chyloform) from other effusions
- Identify purulent effusions strongly suggestive of empyema
- Identify viscous fluid, which is characteristic of some mesotheliomas

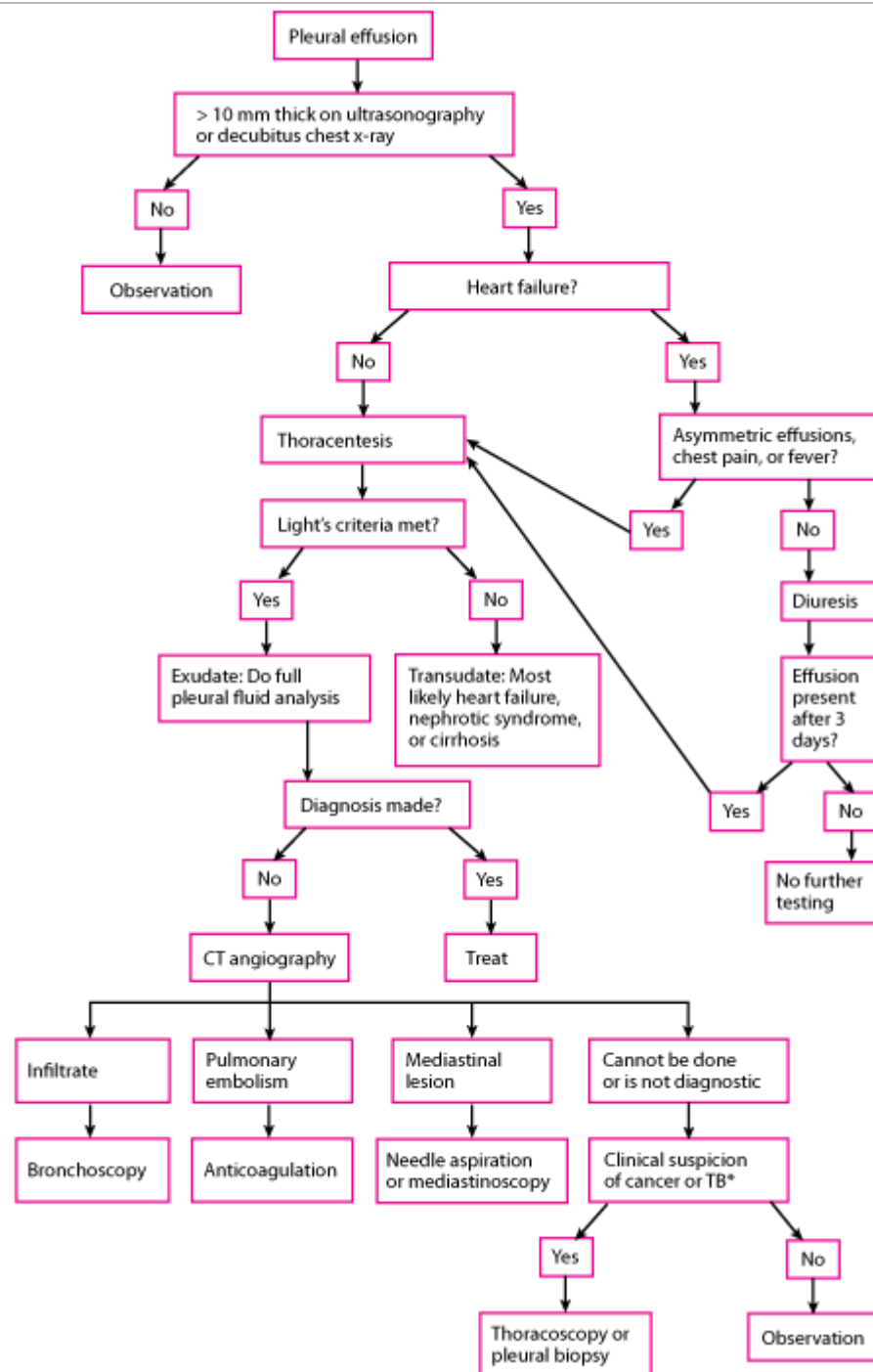
Fluid should always be sent for total protein, LDH, cell count and cell differential, Gram stain, and aerobic and anaerobic bacterial cultures. Other tests (glucose, cytology, TB fluid markers [adenosine deaminase or interferon- γ], amylase, mycobacterial and fungal stains and cultures) are used in appropriate clinical settings.

Fluid chemistries help distinguish transudates from exudates; multiple criteria exist, but not one perfectly discriminates between the 2 types. When Light's criteria are used, serum LDH and total protein levels should be measured as close as possible to the time of thoracentesis for comparison with those in pleural fluid. Light's criteria correctly identify almost all exudates but misidentify about 20% of transudates as exudates. If transudative effusion is suspected (eg, due to heart failure or cirrhosis) and none of the biochemical measurements are > 15% above the cutoff levels for Light's

criteria, the difference between serum and the pleural fluid protein is measured. If the difference is > 3.1 g/dL, the patient probably has a transudative effusion.

If the diagnosis remains unclear after pleural fluid analysis, CT angiography is indicated to look for pulmonary emboli, pulmonary infiltrates, or mediastinal lesions. Findings of pulmonary emboli indicate the need for long-term anticoagulation; parenchymal infiltrates, the need for bronchoscopy; and mediastinal lesions, the need for transthoracic needle aspiration or mediastinoscopy. However, CT angiography requires patients to hold their breath for ≥ 24 sec, and not all patients can comply. If CT angiography is unrevealing, observation is the best course unless the patient has a history of cancer, weight loss, persistent fever, or other findings suggestive of cancer or TB, in which case thoracoscopy may be indicated. Needle biopsy of the pleura can be done when thoracoscopy is unavailable. When tuberculous pleuritis is suspected, the level of adenosine deaminase in the pleural fluid is measured. A level > 40 U/L has a 95% sensitivity and specificity for the diagnosis of tuberculous pleuritis.

Diagnosis of pleural effusion



*Based on presence of fever, weight loss, history of cancer, or other suggestive symptoms.

Treatment

- Treatment of symptoms and underlying disorder
- Drainage of some symptomatic effusions
- Other treatments for parapneumonic and malignant effusions

The effusion itself generally does not require treatment if it is asymptomatic because many effusions resorb spontaneously when the underlying disorder is treated, especially effusions due to

uncomplicated pneumonias, pulmonary embolism, or surgery. Pleuritic pain can usually be managed with NSAIDs or other oral analgesics. At times, a short course of oral opioids is required.

Thoracentesis is sufficient treatment for many symptomatic effusions and can be repeated for effusions that reaccumulate. There are no arbitrary limits on the amount of fluid that can be removed. Removal of fluid can be continued until the effusion is drained or the patient develops chest tightness, chest pain, or severe coughing.

Effusions that are chronic, recurrent, and causing symptoms can be treated with pleurodesis or by intermittent drainage with an indwelling catheter. Effusions caused by pneumonia and cancer may require additional specific measures.

Parapneumonic effusion and empyema

In patients with adverse prognostic factors (pH < 7.20, glucose < 60 mg/dL, positive Gram stain or culture, loculations), the effusion should be completely drained via thoracentesis or tube thoracostomy. If complete drainage is impossible, a thrombolytic (fibrinolytic) drug (eg, a tissue plasminogen activator 10 mg) plus a DNase (eg, dornase alfa 5 mg) in 100 mL saline solution can be administered intrapleurally twice a day for 3 days. If attempts at drainage are unsuccessful, thoracoscopy should be done to lyse adhesions and remove fibrous tissue coating the lung to allow the lung to expand. If thoracoscopy is unsuccessful, thoracotomy with surgical decortication (eg, removal of scar, clot, or fibrous membrane surrounding the lung) is necessary.

Malignant pleural effusion

If dyspnea caused by malignant pleural effusion is relieved by thoracentesis but fluid and dyspnea redevelop, chronic (intermittent) drainage or pleurodesis is indicated. Asymptomatic effusions and effusions causing dyspnea unrelieved by thoracentesis do not require additional procedures.

Indwelling catheter drainage is the preferred approach for ambulatory patients because hospitalization is not necessary for catheter insertion and the pleural fluid can be drained intermittently into vacuum bottles. Pleurodesis is done by instilling a sclerosing agent into the pleural space to fuse the visceral and parietal pleura and eliminate the space. The most effective and commonly used sclerosing agents are talc, doxycycline, and bleomycin delivered via chest tube or thoracoscopy. Pleurodesis is contraindicated if the mediastinum has shifted toward the side of the effusion or if the lung does not expand after a chest tube is inserted.

Shunting of pleural fluid to the peritoneum (pleuroperitoneal shunt) is useful for patients with malignant effusion in whom pleurodesis is unsuccessful and in patients who have trapped lung.

Key Points

- Exudative effusions result from increased capillary permeability, leading to leakage of protein, cells, and other serum constituents.

- The most common causes of transudative effusions are heart failure, cirrhosis with ascites, and hypoalbuminemia (usually due to the nephrotic syndrome).
- The most common causes of exudative effusions are pneumonia, cancer, pulmonary embolism, and TB.
- Evaluation requires imaging (usually chest x-ray) to confirm presence of fluid and pleural fluid analysis to help determine cause.
- Lateral decubitus x-rays, chest CT, or ultrasonography should be done if it is unclear whether an x-ray density represents fluid or parenchymal infiltrates or whether suspected fluid is loculated or free-flowing.
- Effusions that are chronic or recurrent and causing symptoms can be treated with pleurodesis or by intermittent drainage with an indwelling catheter.

Last full review/revision September 2014 by Richard W. Light, MD

Causes of Pleural Effusions: History, Signs, and Symptoms

<i>Condition</i>	<i>Potential causes of the pleural effusion</i>
History	
Abdominal surgical procedures	Postoperative pleural effusion, subphrenic abscess, pulmonary embolism
Alcohol abuse or pancreatic disease	Pancreatic effusion
Artificial pneumothorax therapy	Tuberculous empyema, pyothorax-associated lymphoma, trapped lung
Asbestos exposure	Mesothelioma, benign asbestos pleural effusion
Cancer	Malignancy
Cardiac surgery or myocardial injury	Pleural effusion secondary to coronary artery bypass graft surgery or Dressler's syndrome
Chronic hemodialysis	Heart failure, uremic pleuritis
Cirrhosis	Hepatic hydrothorax, spontaneous bacterial empyema
Childbirth	Postpartum pleural effusion
Esophageal dilatation or endoscopy	Pleural effusion secondary to esophageal perforation
Human immunodeficiency virus infection	Pneumonia, tuberculosis, primary effusion lymphoma, Kaposi sarcoma
Medication use	Medication-induced pleural disease
Remote inflammatory pleural process	Trapped lung
Rheumatoid arthritis	Rheumatoid pleuritis, pseudochylothorax
Superovulation with gonadotrophins	Pleural effusion secondary to ovarian hyperstimulation syndrome
Systemic lupus erythematosus	Lupus pleuritis, pneumonia, pulmonary embolism
Trauma	Hemothorax, chylothorax, diaphragmatic fistula

<i>Condition</i>	<i>Potential causes of the pleural effusion</i>
Signs	
Ascites	Hepatic hydrothorax, ovarian cancer, Meigs' syndrome
Dyspnea on exertion, orthopnea, peripheral edema, elevated jugular venous pressure	Heart failure, constrictive pericarditis
Pericardial friction rub	Pericarditis
Unilateral lower extremity swelling	Pulmonary embolism
Yellowish nails, lymphedema	Pleural effusion secondary to yellow nail syndrome*
Symptoms	
Fever	Pneumonia, empyema, tuberculosis
Hemoptysis	Lung cancer, pulmonary embolism, tuberculosis
Weight loss	Malignancy, tuberculosis, anaerobic bacterial pneumonia

*—*Yellow nail syndrome results from an abnormality of lymphatics and consists of the triad of yellow nails, lymphedema, and pleural effusion.*

TABLE
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

<i>Test</i>	<i>Test value</i>	<i>Suggested diagnosis</i>	<i>Comments</i>
Protein fluid to serum ratio	> 0.5	Any condition causing an exudate	either parapneumonic effusions or malignancy. ³ 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 and 15 percent of transudates. ¹³
Red blood cell count	> 100,000 per mm ³ (100 10 ⁶ per L)	Malignancy, trauma, parapneumonic effusion, pulmonary embolism	A fluid hematocrit < 1 percent is nonsignificant. ¹³
White blood cell count and differential	> 10,000 per mm ³ (10 3 10 ⁹ per L)	Empyema, other exudates (uncommon)	In purulent fluids, leukocyte count is commonly much lower than expected because dead cells or other debris account for much of the turbidity.
Eosinophils	> 10 percent	Not diagnostic	The presence of air or blood in the pleural space is a common cause. No diagnosis is ever obtained in as many as one third of patients with eosinophilic pleural effusion. ³
Lymphocytes	> 50 percent	Malignancy, tuberculosis, pulmonary embolism, coronary artery bypass surgery	Pleural fluid lymphocytosis > 90 percent suggests tuberculosis or lymphoma.
Neutrophils	> 50 percent	Parapneumonic effusion, pulmonary embolism, abdominal diseases	In about 7 percent of acute tuberculous pleurisy and 20 percent of malignant pleural effusions, a neutrophilic fluid predominance can be seen. ⁵

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}

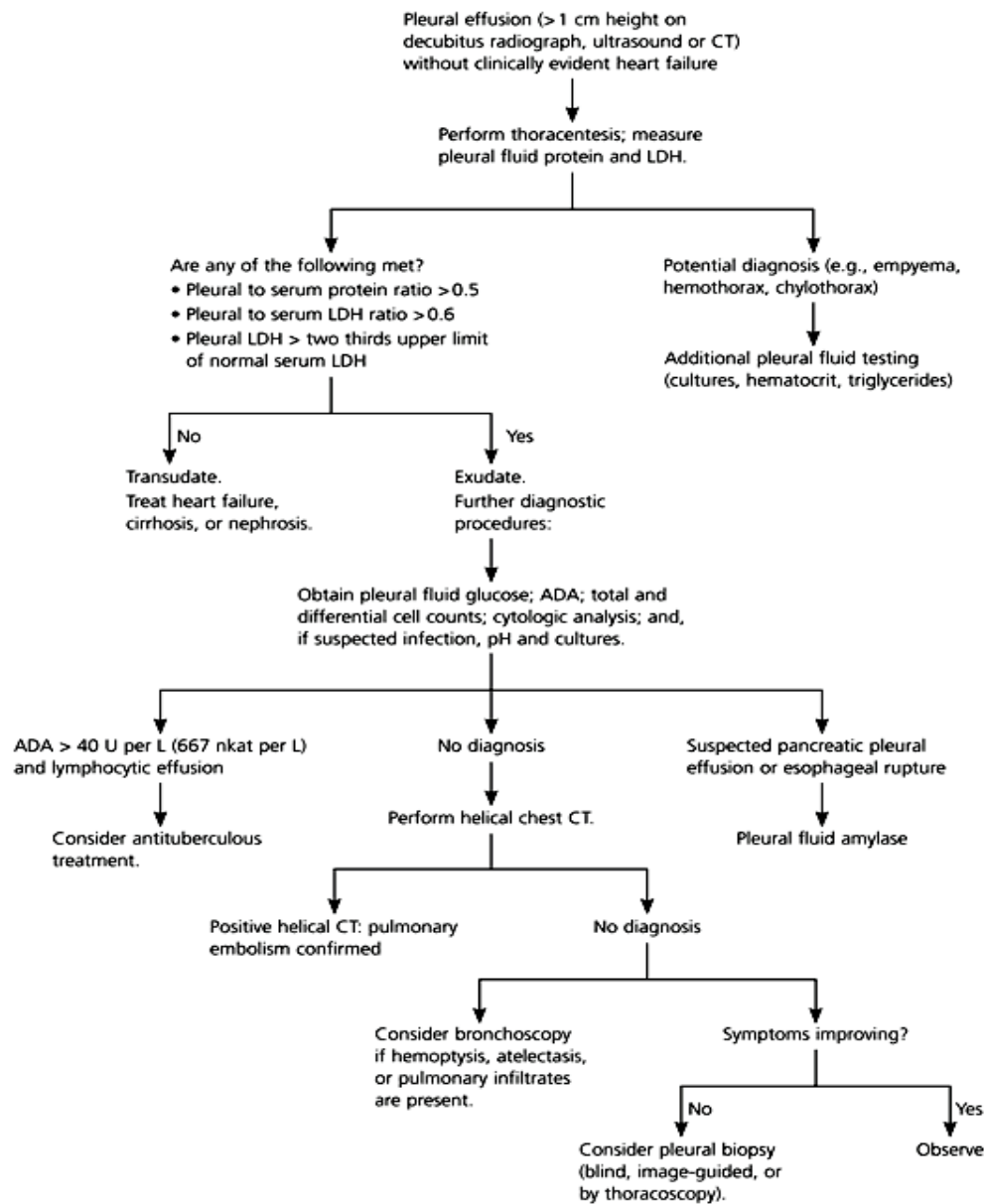
<i>Test</i>	<i>Test value</i>	<i>Suggested diagnosis</i>	<i>Comments</i>
Hematocrit fluid to blood ratio	≥ 0.5	Hemothorax	Obtain when pleural fluid is bloody. Hemothorax most often originates from blunt or penetrating chest trauma.
Interferon*	Different cutoff points	Tuberculosis ¹⁷	Consider when ADA 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}

ADA = adenosine deaminase; NT-proBNP = N-terminal pro-b-type natriuretic peptide.

*—ADA measurement is cheaper, easier, and quicker to perform than interferon for diagnosing tuberculosis.

†—For example, *Streptococcus pneumoniae* and *Mycobacterium tuberculosis*.

‡—For example, carcinoembryonic antigen (CEA), CA 15.3 and CA 549 (markers for breast carcinoma), CYFRA 21–1 (marker for lung carcinoma), CA 125 (marker for ovarian and endometrial carcinoma), human epidermal growth factor receptor (HER-2/neu) gene amplification, telomerase.



Self preparation at class:

Listen information;

Work with patients (with cardiac pathology);

Ask about the problems that have not been found in information given.

Self preparation at home:

Compose the plan of your answer;

Answer the questions to the topic;

Do the test given above.

1. Which one of the listed abnormalities is an example of a type of pleural effusion that is better classified as an exudate (inflammatory edema) rather than a transudate?

- Chylothorax
- Empyema
- Hemothorax
- Hydrothorax
- Pneumothorax

Recommended literature:

A. Main:

1. "Harrison's principles of internal medicine", Editors: Anthony S. Fauci, Dennis L. Kasper, Stephen L. Hauser, Dan L. Longo, Joseph Loscalzo, McGraw-Hill Education / Medical; 19 edition (April 8, 2015), 1-2 volumes, 3000 p.
2. CURRENT Medical Diagnosis and Treatment 2012, Fifty-First Edition (LANGE CURRENT Series) by Stephen McPhee, Maxine Papadakis and Michael W. Rabow (Paperback - Sep 12, 2011)
3. Davidson's Principles and Practice of Medicine: With STUDENT CONSULT Online Access, 21e (Principles & Practice of Medicine (Davidson's)) by Nicki R. Colledge BSc FRCP(Ed), Brian R. Walker BSc MD FRCP(Ed) and Stuart H. Ralston MB ChB MD FRCP FMedSci FRSE (Paperback - Mar 11, 2010) Kumar and Clark's Clinical Medicine, 7e (Kumar, Kumar and Clark's Clinical Medicine) by Parveen J. Kumar (Paperback - Jul 2, 2009)
4. CURRENT Diagnosis and Treatment Emergency Medicine, Seventh Edition (LANGE CURRENT Series) by C. Keith Stone (May 23, 2011)
5. Goldman's Cecil medicine / [edited by] Lee Goldman, Andrew I. Schafer.—24th ed. Elsevier Sanders. Rev. ed. of: Cecil medicine. 23rd ed. – 2012. p.
6. Sonographer's Handbook of Diagnostic Ultrasound by Jason R. Young M.D. (Feb 23, 2011)

Additional literature:

1. Kovalyova O.M., Asheulova T.V. Propedeutics to internal medicine. Part 1, Diagnostics. Vinnytsya, Nova Knyha, 2006, 424 p

1. The answer is b. The causes of pleural effusions may be classified as being inflammatory or noninflammatory. The formation of noninflammatory edema is related to abnormalities involving the Starling forces and may result in the formation of noninflammatory pleural effusions. Increased hydrostatic pressure, such as is seen with congestive heart failure, causes hydrothorax, which is a transudate. Decreased oncotic pressure, such as is seen with renal disease associated with albuminuria, also causes hydrothorax. Increased intrapleural negative pressure produced by atelectasis causes hydrothorax, while decreased lymphatic drainage, which can be caused by a tumor obstructing lymphatics, produces chylothorax. Chylothorax is characterized by milky fluid that contains finely emulsified fats. An additional type of noninflammatory pleural effusion is hemothorax, which may be caused by trauma or ruptured aortic aneurysm. Inflammatory edema may be caused by increased vascular permeability. Inflammation in the adjacent lung, such as with collagen vascular diseases, produces a serofibrinous exudate. Suppurative inflammation in the adjacent lung may produce a suppurative pleuritis, which is called an empyema.

Methodical recommendations consisted by

Kulishov S.K.