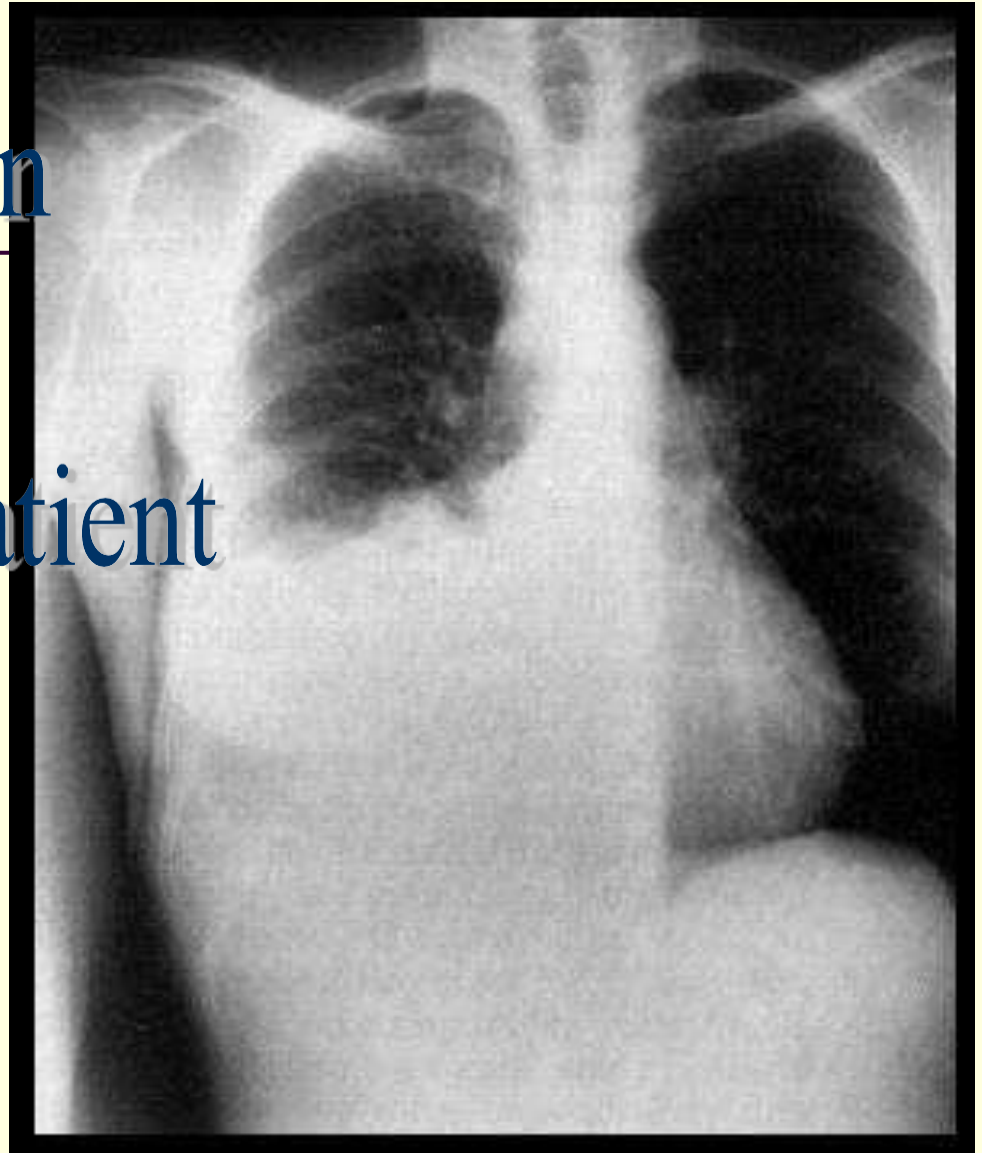


Pleural Effusion

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Approach to the patient




Definition

- Pleural effusion is the accumulation of fluid in the pleural space.
- The pleural space lies between the lung and chest wall and normally contains a very thin layer of fluid, which serves as a coupling system.
- A pleural effusion is present when there is an excess quantity of fluid in the pleural space.

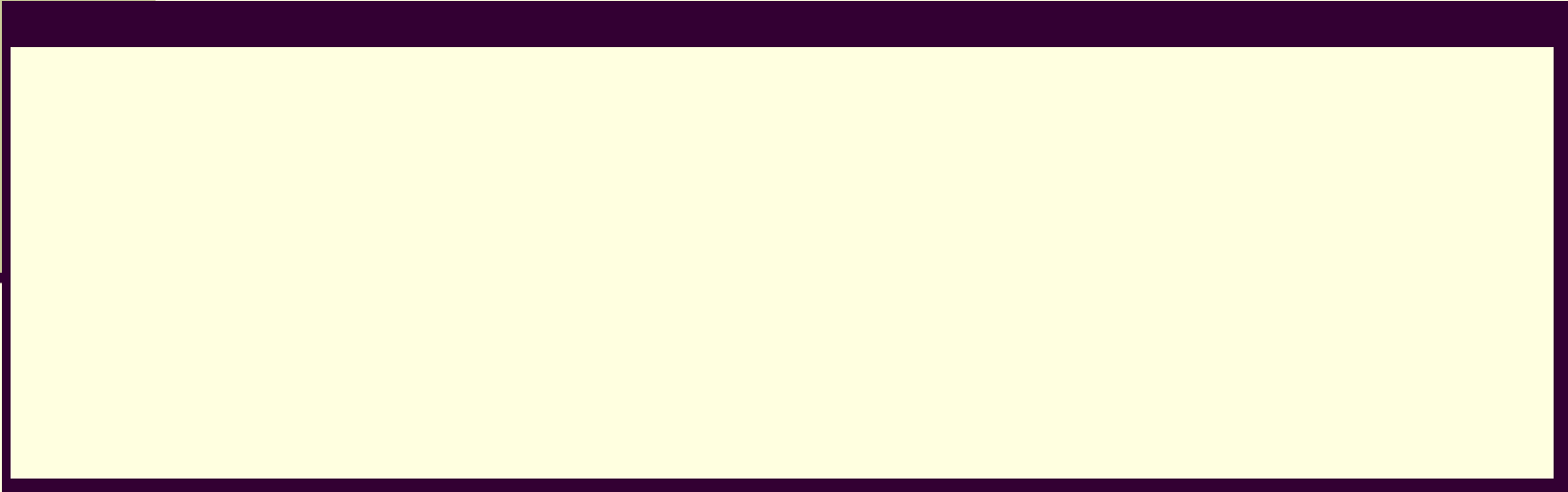
Etiology

- Normally, fluid enters the pleural space from the capillaries in the parietal pleura and is removed via the lymphatics situated in the parietal pleura.
- Fluid can also enter the pleural space from the interstitial spaces of the lung via the visceral pleura or from the peritoneal cavity via small holes in the diaphragm.

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- Pleural fluid accumulates when pleural fluid formation exceeds pleural fluid absorption.
 - The lymphatics have the capacity to absorb 20 times more fluid than is normally formed. Accordingly, a pleural effusion may develop when there is excess pleural fluid formation (from the interstitial spaces of the lung, the parietal pleura, or the peritoneal cavity) or when there is decreased fluid removal by the lymphatics.



Types of pleural effusion



Transudative pleural effusions

result from alteration of hydrostatic and oncotic factors that increase the formation or decrease the absorption of pleural fluid (e.g., increased mean capillary pressure [heart failure] or decreased oncotic pressure [cirrhosis or nephrotic syndrome]).

Exudative pleural effusions

occur when damage or disruption of the normal pleural membranes or vasculature (e.g., tumor involvement of the pleural space, infection, inflammatory conditions, or trauma) leads to increased capillary permeability or decreased lymphatic drainage.



Diagnostic Approach



Clinical Presentation

- The underlying cause of the effusion usually dictates the symptoms, although patients may be asymptomatic.
- Pleural inflammation, abnormal pulmonary mechanics, and worsened alveolar gas exchange produce symptoms and signs of disease.

symptoms and signs

- Inflammation of the parietal pleura leads to **pain** in local (intercostal) involved areas or referred (phrenic) distributions (shoulder).
- **Dyspnea** is frequent and may be present and out of proportion to the size of the effusion.
- **Cough** can occur.

Chest examination is notable for

- ***dullness to percussion, decreased or absent tactile fremitus, and decreased breath sounds.***
- ***Tracheal shift to the contralateral side or an ipsilateral pleural rub may be present.***

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- The clinical setting is crucial to establishing a proper diagnosis. A definitive diagnosis based solely upon pleural fluid analysis is possible in the minority of pleural effusions.
 - History or physical examination findings suggestive of congestive heart failure, malignancy, pneumonia, pulmonary embolism, myocardial infarction, surgery, cirrhosis, or rheumatologic arthritis provide important clues to the underlying diagnosis.



Laboratory and Imaging Studies



Chest Roentginogram

- Pleural effusions are typically detected by chest radiography as blunting of the costophrenic angle or opacification of the base of the hemithorax without loss of volume of the hemithorax (which would suggest atelectasis), and may be accompanied by air bronchograms (which would suggest an alveolar filling process such as pneumonia).

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- Prior to invasive diagnostic or therapeutic procedures, the patient should undergo imaging to confirm the presence and size of the effusion. Preferred modalities include:

Decubitus chest radiography

- Showing layering fluid will confirm the presence of pleural effusion and demonstrates that at least a portion of the fluid is not loculated.

Thoracic ultrasonography

- Is one of the best modalities to assess for pleural fluid loculations.
- Ultrasonography can also provide real-time guidance for pleural procedures and can reduce both the complication and failure rate of thoracentesis.

Computed tomography of the chest

- With contrast helps differentiate pleural fluid from lung masses and atelectatic lung, and
- helps define the extent of pleural thickening, pleural nodularity, and other associated findings.

Pleural fluid analysis

- Thoracentesis can be performed safely at the bedside, in the absence of disorders of hemostasis, on effusions that extend >10 mm from the inner chest wall on a lateral decubitus film.
- Loculated effusions can be localized with ultrasonography or CT scan.
- Proper technique and sonographic guidance minimize the risk of pneumothorax and other complications.

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- The first step is to determine whether the effusion is a transudate or an exudate.

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- A *transudative pleural effusion* occurs when *systemic factors* that influence the formation and absorption of pleural fluid are altered. The leading causes of transudative pleural effusions are left ventricular failure and cirrhosis.

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- An *exudative pleural effusion* occurs when *local factors* that influence the formation and absorption of pleural fluid are altered. The leading causes of exudative pleural effusions are bacterial pneumonia, malignancy, viral infection, and pulmonary embolism.

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- The primary reason to make this differentiation is that additional diagnostic procedures are indicated with exudative effusions to define the cause of the local disease.

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- While pleural effusion occurs in a vast array of disease states, 90% of pleural effusions are the result of only five diseases.
 - Congestive heart failure (36%)
 - Pneumonia (22%)
 - Malignancy (14%)
 - Pulmonary embolism (11%)
 - Viral disease (7%)

Check pleural fluid for

- Appearance,
- lactate dehydrogenase (LDH),
- protein,
- pH,
- glucose and
- albumin

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- Serum lactate dehydrogenase (LDH), protein, pH, glucose and albumin should be measured within hour of the thoracentesis to allow appropriate comparison.

Pleural fluid appearance

- Most transudates are clear, straw colored, nonviscid, and without odor
- Red-tinged pleural effusions indicate the presence of blood.
- In exudative pleural effusions, serosanguineous fluid is usually not helpful in narrowing the diagnosis.

Bloody pleural fluid

- If the blood is due to thoracentesis, the degree of discoloration should clear during the aspiration.
- Bloody pleural fluid usually indicates the presence of malignancy, pulmonary embolism (PE), or trauma.

Hemothorax

- The presence of gross blood should lead to the measurement of a pleural fluid hematocrit.
- Hemothorax is defined as a pleural fluid to blood hematocrit ratio of >0.5 , and chest tube drainage should be considered.

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- Exudative pleural effusions meet at least one of the Light's criteria , whereas transudative pleural effusions meet none:

Light's criteria

- (a) a pleural fluid-to-serum protein ratio of >0.5 ,
- (b) a pleural fluid-to-serum LDH ratio of >0.6 ,
- (c) a pleural fluid LDH of more than two-thirds of the upper limit of normal for serum LDH

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- The above criteria misidentify ~25% of transudates as exudates.
 - If one or more of the exudative criteria are met and the patient is clinically thought to have a condition producing a transudative effusion, like in whom clinical suspicion for heart, liver, or kidney disease is high what should be done?

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- The difference between the protein levels in the serum and the pleural fluid should be measured.
 - If this gradient is greater than 31 g/L (3.1 g/dL), the exudative categorization by the above criteria can be ignored because almost all such patients have a transudative pleural effusion.
 - In some texts a gradient of >1.2 g/dL suggests that the pleural fluid is transudate.

If a patient has an exudative pleural effusion

- Description of the fluid,
- Glucose level,
- Differential cell count,
- Microbiologic studies,
- Cytology.
- Cultures,
- Triglycerides,
- Amylase, and
- pH

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- Exudative effusions with normal protein but high LDH are likely to be parapneumonic or secondary to malignancy.
 - LDH is an indicator of the degree of pleural inflammation.

Glucose concentration

- A glucose concentration of <60 mg/dL is probably due to
- tuberculosis,
- malignancy,
- rheumatoid arthritis, or
- parapneumonic effusion.
- For parapneumonic pleural effusions with a glucose of <60 mg/dL, tube thoracostomy should be considered.

Pleural fluid with a low pH

- A pH of <7.3 is seen with
- empyema,
- tuberculosis,
- malignancy,
- collagen vascular disease, or
- esophageal rupture.

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- For parapneumonic pleural effusions with a pH of <7.20, tube thoracostomy should be considered.
 - Pleural fluid for pH testing should be collected anaerobically in a heparinized syringe and placed on ice.
 - Pleural fluid with a low pH usually has a low glucose and a high LDH; otherwise, the low pH may be due to poor sample collection technique.

Amylase

- An elevation of amylase suggests that the patient has pancreatic disease, malignancy, or esophageal rupture.
- Malignancy and esophageal rupture have salivary amylase elevations and not pancreatic amylase elevations.

Turbid or milky fluid

- should be centrifuged.
- If the supernatant clears, the cloudiness is likely due to cells and debris.
- If the supernatant remains turbid, pleural lipids should be measured. Elevation of triglycerides (>110 mg/dL) suggests that a chylothorax is present, usually due to disruption of the thoracic duct from trauma, surgery, or malignancy (i.e., lymphoma).

Cytology

- Cytology is positive in approximately 60% of malignant effusions.
- Priming the fluid collection bag with unfractionated heparin (UFH; e.g., 1,000 International Units) may increase the yield.
- The volume of pleural fluid analyzed does not impact the yield of cytologic diagnosis.
- Repeat thoracentesis increases the diagnostic yield.

Pleural effusion

Perform diagnostic thoracentesis
Measure pleural fluid protein and LDH

Any of following met?
PF/serum protein > 0.5
PF/serum LDH > 0.6
PF LDH > 2/3 upper normal serum limit

Yes

Exudate

Further diagnostic procedures

No

Transudate

Treat CHF, cirrhosis, nephrosis

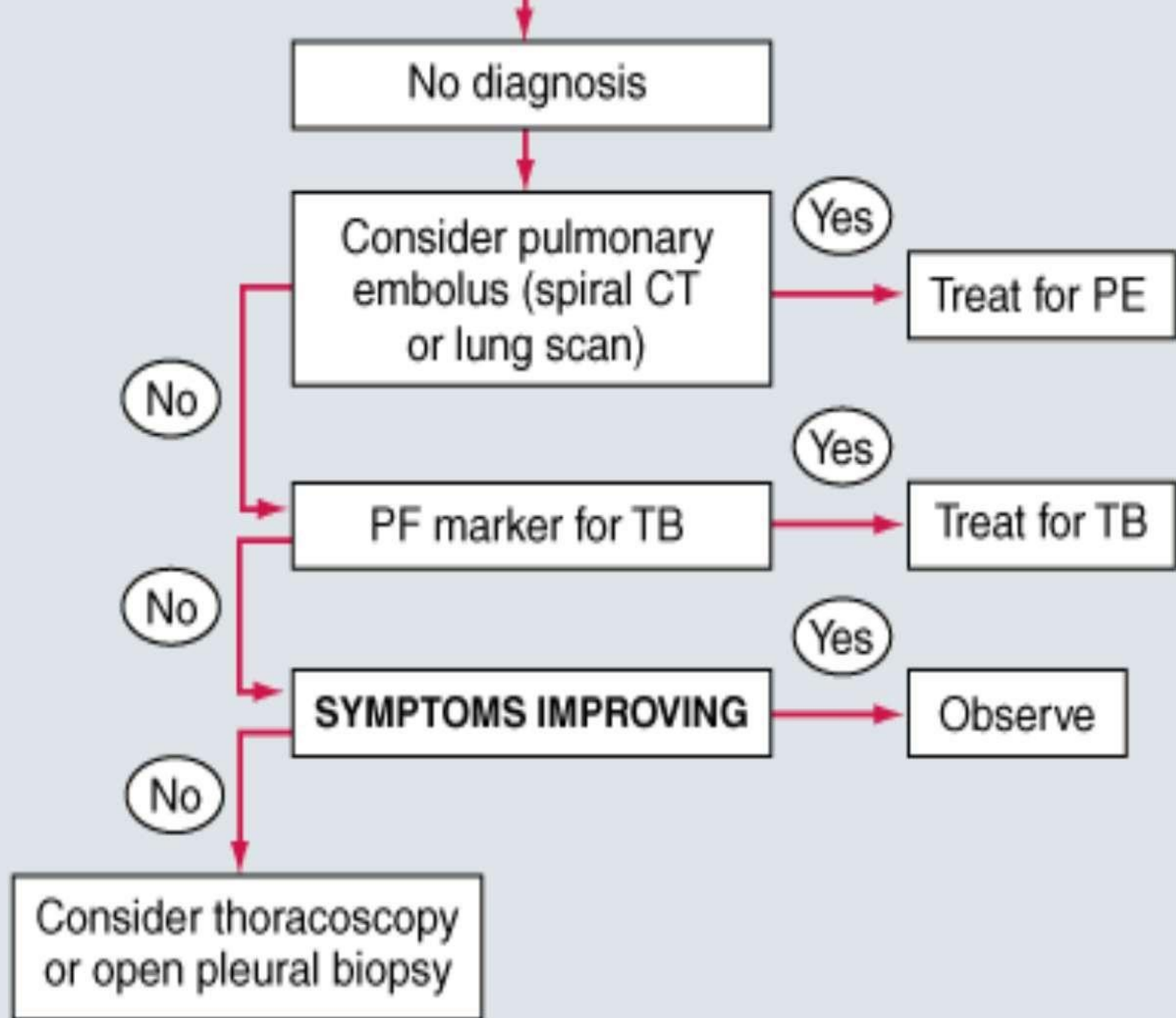
Measure PF glucose, amylase
Obtain PF cytology
Obtain differential cell count
Culture, stain PF
PF marker for TB

Amylase elevated

Consider: Esophageal rupture
Pancreatic pleural
effusion
Malignancy

Glucose < 60 mg/dL

Consider: Malignancy
Bacterial infections
Rheumatoid
pleuritis





Differential Diagnoses of Pleural Effusions



Transudative Pleural Effusions

1. Congestive heart failure
2. Cirrhosis
3. Pulmonary embolization
4. Nephrotic syndrome
5. Peritoneal dialysis
6. Superior vena cava obstruction
7. Myxedema
8. Urinothorax

Exudative Pleural Effusions

- **1. Neoplastic diseases**
 - a. Metastatic disease
 - b. Mesothelioma

■ **2. Infectious diseases**

- a. Bacterial infections
- b. Tuberculosis
- c. Fungal infections
- d. Viral infections
- e. Parasitic infections

- **3. Pulmonary embolization**

- **4. Gastrointestinal disease**

- a. Esophageal perforation
- b. Pancreatic disease
- c. Intraabdominal abscesses
- d. Diaphragmatic hernia
- e. After abdominal surgery
- f. Endoscopic variceal sclerotherapy
- g. After liver transplant

■ **5. Collagen-vascular diseases**

- a. Rheumatoid pleuritis
- b. Systemic lupus erythematosus
- c. Drug-induced lupus
- d. Immunoblastic lymphadenopathy
- e. Sjögren's syndrome
- f. Wegener's granulomatosis
- g. Churg-Strauss syndrome


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- 6. Post-coronary artery bypass surgery
 - 7. Asbestos exposure
 - 8. Sarcoidosis
 - 9. Uremia
 - 10. Meigs' syndrome
 - 11. Yellow nail syndrome

■ **12. Drug-induced pleural disease**

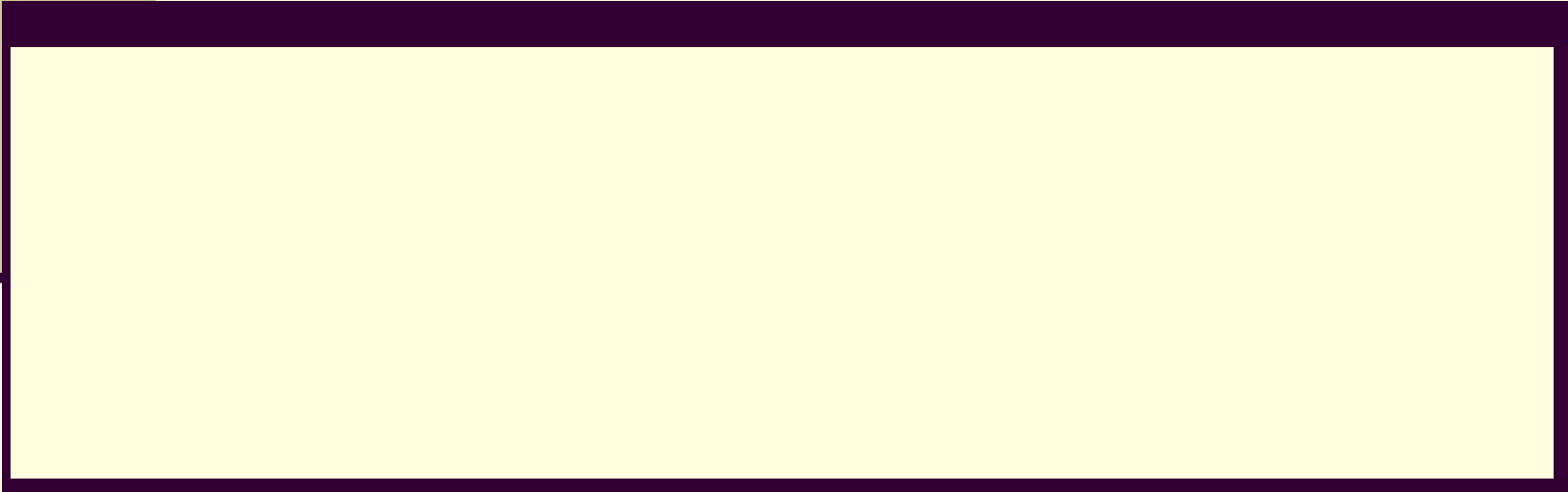
- a. Nitrofurantoin
- b. Dantrolene
- c. Methysergide
- d. Bromocriptine
- e. Procarbazine
- f. Amiodarone

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- 13. Trapped lung
 - 14. Radiation therapy
 - 15. Post-cardiac injury syndrome
 - 16. Hemothorax

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- 17. Iatrogenic injury
 - 18. Ovarian hyperstimulation syndrome
 - 19. Pericardial disease
 - 20. Chylothorax



Indications for Tube Thoracostomy in Parapneumonic Effusions



Radiographic criteria

Pleural fluid loculations

Effusion filling more than half the hemithorax

Air fluid level

Microbiologic criteria

Pus in the pleural space

Positive stain for microorganisms

Positive pleural fluid cultures

Chemical criteria

Pleural fluid pH <7.2

Pleural fluid glucose <60 mg/dL



Thank you very much

