

Pulmonary Procedures: Review Questions

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QUESTIONS

Choose the single best answer for each question.

Questions 1 and 2 refer to the following case study.

A 50-year-old man with a history of lymphoma and rib cage trauma from a motor vehicle accident presents to the clinic with dyspnea and chest pain. A large pleural effusion fills the right hemithorax, and 2000 mL of turbid, milky-white fluid is obtained during thoracentesis. Lactic dehydrogenase and protein studies indicate that the pleural fluid is an exudate, but possible empyema is a concern.

- Which of the following statements regarding pleural effusions is true?**
 - The presence of 10,000 leukocytes/mm³ in the pleural fluid is diagnostic for empyema.
 - The turbid fluid may indicate a chylothorax, which is diagnosed by the presence of increased lipids (ie, chylomicrons, triglycerides, and cholesterol) in the pleural fluid.
 - A pseudochyloous effusion is characterized by the presence of large amounts of triglyceride in the pleural fluid.
 - The presence of a chylothorax mandates that a chest tube be placed and the pleural space completely drained of all fluid.
 - Rheumatoid arthritis is a common cause of a pseudochyloous effusion.
- After the 2000 mL of fluid is removed from the pleural space, the patient experiences a sudden increase in dyspnea and a decrease in oxygen saturation. The physical examination shows dullness to percussion, but now crackles are audible on auscultation over the right hemithorax. The most likely explanation for this patient's sudden status change includes which one of the following?**
 - Re-expansion pulmonary edema
 - Iatrogenic puncture of the lung with a complete pneumothorax
 - Large pulmonary embolism
 - Air embolism
 - Large hemothorax from laceration of an intercostal vein
- A 75-year-old woman with a history of severe emphysema demonstrates a solitary pulmonary nodule located in the peripheral aspect of the right upper lobe on a routine chest radiograph. The nodule is 1 cm in diameter, and a chest computed tomography scan shows only the single pulmonary nodule. The nodule is free of calcium and has a low Hounsfield number. The hilar and mediastinal lymph nodes are normal in appearance and size. The patient's forced expiratory volume in 1 second (FEV₁) is 1.2L. Which of the following choices of diagnostic and treatment procedures is appropriate for this patient?**
 - Immediate open-lung biopsy and resection of the nodule
 - Transthoracic needle lung aspiration/biopsy, and, if the results are positive for cancer, a pneumonectomy should be performed
 - Fiberoptic bronchoscopy and transbronchial biopsy to define the origin of the nodule
 - Ventilation-perfusion lung scan to rule out a pulmonary infarction
 - Previous chest radiographs should be obtained to determine whether the lesion is new or old and whether the size has changed
- A 25-year-old man begins mechanical ventilatory support to treat severe pneumonia. On the fourth hospital day, he is found to have a pneumothorax on the right side. A chest tube is inserted and connected to a three-chamber closed evacuation system. Continuous air is seen bubbling through the underwater seal, and it appears that approximately half of the inspiratory tidal volume is diverted through the chest tube. Attempts to reduce the peak inspiratory pressure and positive end-expiratory pressure are unsuccessful in reducing the flow through the chest tube. The chest tube is connected to 10-cm H₂O negative-pressure suction. A chest radiograph is obtained and shows that the lung has**

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been fully inflated; however, it appears that the chest tube is not fully contained within the pleural space. Which of the following procedures should now be performed?

- A) Advance the chest tube until it is fully inserted up to the connecting tubing at the chest wall.
- B) Advance the chest tube until the airflow in the underwater seal chamber is seen to stop.
- C) Replace the chest tube with a new tube and ensure that it is properly positioned within the pleural space, and then assess the flow through the underwater seal chamber.
- D) Discontinue the suction because it is responsible for the increased flow through the bronchopleural fistula.
- E) Discontinue mechanical ventilatory support because positive pressure is known to increase flow through a bronchopleural fistula.

EXPLANATION OF ANSWERS

1. **(E) Rheumatoid arthritis is a common cause of a pseudochyloous effusion.** A turbid, milky-appearing pleural effusion requires the differentiation of a chylous effusion from a pseudochyloous effusion and from an empyema. An empyema is "pus" in the pleural space and is manifested by an increased number of leukocytes per mm³. Typically more than 100,000 leukocytes/mm³ are present in an empyema. Distinction between a chylous effusion and a pseudochyloous effusion is based on the presence of chylomicrons (confirmed by Sudan stain) and elevated levels of triglycerides (> 110 mg/dL) in the chylous effusion and an elevated level of cholesterol (without chylomicrons) in the pseudochyloous effusion. The cholesterol reportedly originates from the breakdown of the cell membranes of the inflammatory cells or other cells that are present with a chronic effusion. Although the treatment of choice for an empyema is a closed-tube thoracostomy, this treatment is not performed for a chylothorax because it may result in profound nutritional and vitamin deficiencies.
2. **(A) Re-expansion pulmonary edema.** Re-expansion pulmonary edema can occur after the rapid drainage of the pleural space (typically removal of fluid), especially after long-standing atelectasis of the

underlying lung. The rapidly re-expanding lung may then become edematous and stiff. This clinical condition, though not frequently encountered, can have devastating impact on patient survival. The other choices also represent possible causes of respiratory difficulty after drainage of a large pleural effusion. However, the physical examination with dullness to percussion and crackles is not consistent with a tension pneumothorax after lung puncture. A large hemothorax from laceration of an intercostal vein would take more time for significant hemodynamic alterations and dyspnea to occur. An acute air embolism is rarely encountered and is typically manifested by rapid hemodynamic collapse. The large pulmonary embolism could certainly occur at any time, but would not be expected to produce dullness to percussion over the hemithorax.

3. **(E) Previous chest radiographs should be obtained to determine whether the lesion is new or old and whether the size has changed.** The most important information in the management of a patient with a lung nodule is the demonstration of the nodule on old chest radiographs. A nodule that has not changed in size in over 2 years is typically benign and would thus spare the patient a diagnostic procedure or open resection.
4. **(C) Replace the chest tube with a new tube and ensure that it is properly positioned within the pleural space, and then assess the flow through the underwater seal chamber.** The chest tube cannot be advanced to correct the problem because of the possibility of infection. Discontinuation of the suction may help the amount of air leak but will not correct the problem of improper placement and may allow ambient air to enter the pleural space or not effectively evacuate the pleural space. If the patient no longer needed positive-pressure ventilatory support, the need for a chest tube to maintain lung inflation and prevent a tension pneumothorax from ensuing would not be as great. However, in this situation, the most prudent step is to reinsert a chest tube into the proper position within the pleural space and to ensure that the lung remains inflated and the bronchopleural fistula is resolved.

Adapted from Balk BA: Pulmonary procedures. Hospital Physician Pulmonary Disease Board Review Manual 1998:4(3).