

WebPath questions:

1) An 8-year-old boy at birth appeared to be a normal term baby, but his neonatal course was complicated by the development of meconium ileus. His sweat chloride and immunoreactive trypsinogen are both found to be elevated. Throughout childhood he has experienced multiple increasingly severe bouts of pneumonia with a productive cough, often with *Pseudomonas aeruginosa*, and later *Burkholderia cepacea*, cultured from sputum. He is at greatest risk for development of which of the following pulmonary abnormalities?

- A) Adenocarcinoma
- B) Bronchiectasis
- C) Lymphangiectasis
- D) Pleural fibrous plaques
- E) *Pneumocystis jiroveci* pneumonia
- F) Pneumothorax

ANS: (B) CORRECT. The chronic lung disease of cystic fibrosis often includes bronchiectasis, a disease characterized by inflammation with obstruction and dilation and destruction of bronchi. This process is diffuse throughout the lungs. The loss of pulmonary vascular bed with progressive bronchiectasis can lead to pulmonary hypertension and cor pulmonale. The sweat chloride is a good screening test, and can be applied as well as immunoreactive trypsinogen, to select for additional genomic testing, but testing is confounded by hundreds of possible CFTR gene mutations.

2) On the 11th postoperative day following a radical prostatectomy for adenocarcinoma, a 70-year-old man is recovering uneventfully. He then ambulates to the bathroom, but upon returning to his bed he suddenly becomes extremely dyspneic and diaphoretic, with chest pain, palpitations, and a feeling of panic. Which of the following post-operative pulmonary complications has he most likely developed?

- A) Pulmonary edema
- B) Pleural effusion
- C) Atelectasis
- D) Thromboembolus
- E) Diffuse alveolar damage

ANS: (D) CORRECT. The activity of ambulation resulted in embolization of a thrombus that formed during his period of immobilization in leg or pelvic veins. The thrombus became an embolus and traveled up the vena cava, through the right heart, and to the pulmonary arterial tree of the lungs.

3) A 50-year-old woman has lived in Stockholm, Sweden all her life and worked as a seamstress. She is a non-smoker, but she has had increasing shortness of breath, fever, weight loss, and night sweats for the past 4 months. On physical examination her temperature is 37.6°C. There are fine rales auscultated in all lung fields. A chest radiograph reveals hilar lymphadenopathy and a reticulonodular pattern of small densities in all lung fields. She demonstrates anergy by skin testing to mumps and *Candida* antigens. A transbronchial biopsy

is performed that microscopically shows numerous small pulmonary interstitial non-caseating granulomas. Which of the following is the most likely diagnosis?

- A) Histoplasmosis
- B) Adenocarcinoma in situ
- C) Sarcoidosis
- D) Usual interstitial pneumonitis
- E) Berylliosis
- F) Tuberculosis
- G) Extrinsic allergic alveolitis

ANS: (C) CORRECT. Sarcoidosis is typified by non-caseating granulomas. However, culture of the tissue and a careful search histologically should be made for organisms before beginning therapy with corticosteroids. Extensive granulomatous disease can produce a restrictive pattern of pulmonary disease. Sweden has a higher prevalence than some other locations. However, the prevalence is 100% for the patient in front of you with this disease.

4) A 55-year-old man with a 50 pack year history of smoking cigarettes has recently experienced an episode of hemoptysis along with his usual cough. On physical examination he has no abnormal findings. A sputum for cytology on microscopic examination shows atypical cells with hyperchromatic nuclei and orange-pink cytoplasm. Laboratory studies show a serum calcium of 11.3 mg/dL, with phosphorus 2.1 mg/dL. Which of the following chest radiographic findings is this man most likely to have?

- A) Large hilar mass
- B) Pneumonia-like consolidation
- C) Peripheral nodule
- D) Carinal compression
- E) Left pleural thickening

ANS: (A) CORRECT. Both squamous cell and small cell carcinomas, most common in smokers, tend to be central in location. Squamous cell carcinomas of the lung are associated with hypercalcemia, though overall the small cell carcinomas are best known for paraneoplastic syndromes.

5) During a cardiac arrest, a 58-year-old man, a non-smoker, receives cardiopulmonary resuscitative measures and is brought to the hospital, where he is intubated. During the intubation procedure he suffers aspiration of gastric contents. Over the next 10 days he develops a non-productive cough along with a fever to 37.9°C. A chest radiograph reveals a 4 cm diameter mass with an air-fluid level in the right lung. A sputum gram stain reveals mixed flora. Which of the following conditions is he most likely to have?

- A) Squamous cell carcinoma
- B) Lung abscess
- C) Chronic bronchitis

D) Bronchiectasis

E) Bronchopulmonary sequestration

ANS: (B) CORRECT. Lung abscesses can result from aspiration of oropharyngeal or nasopharyngeal contents, where bacterial organisms as part of normal flora can be transported to the lungs. The straighter bronchus to the right lung is more likely to conduct aspirated material. With septicemia, multiple abscesses are more likely to be present. The infection is often polymicrobial and difficult to treat.

6) A 66-year-old woman has had a worsening non-productive cough with malaise for the past week. Her temperature increases to 37.4°C. A chest radiograph reveals diffuse bilateral pulmonary interstitial infiltrates in all lung fields. A sputum gram stain reveals normal flora and few neutrophils. She recovers over the next two weeks without sequelae. Infection with which of the following organisms most likely caused her illness?

A) Mycobacterium tuberculosis

B) Streptococcus pneumoniae

C) Influenza A virus

D) Cryptococcus neoformans

E) Mycobacterium avium-complex

ANS: (C) CORRECT. The typical appearance of a viral lung infection is interstitial inflammation. The inflammatory response is primarily T lymphocytes.

7) A 58-year-old man has developed a non-productive cough worsening over the past 2 months. Last week he noted the appearance of blood-streaked sputum. On physical examination there are some expiratory wheezes auscultated over the left lung. A chest radiograph reveals a 5 cm mass near the left lung hilum. A sputum cytology reveals the presence of small clusters of very hyperchromatic, pleomorphic cells with scant cytoplasm. Which of the following is the most likely predisposing factor to development of his pulmonary disease?

A) Silicosis

B) Radon gas exposure

C) Smoking

D) Asbestosis

E) Chronic bronchitis

ANS: (C) CORRECT. Smoking remains the most frequent cause of lung cancer. Lung cancer does, however, occur in nonsmokers. A small cell anaplastic carcinoma, as in this patient, is virtually always seen in smokers. Small cell cancers arise in the central portion of the lung but are aggressive neoplasms that spread quickly.

8) A 64-year-old man has a 90 pack year history of smoking. For the past 5 years, he has had a cough productive of copious amounts of mucoid sputum for over 3 months at a time. He has had episodes of pneumonia with *Streptococcus pneumoniae* and *Klebsiella pneumoniae* cultured. His last episode of pneumonia is complicated by septicemia and brain abscess and he dies. At autopsy, his bronchi microscopically demonstrate mucus gland hypertrophy. Which of the following conditions is most likely to explain his clinical course?

- A) Small cell carcinoma
- B) Congestive heart failure
- C) Chronic bronchitis
- D) Bronchial asthma
- E) Centrilobular emphysema
- F) Panlobular emphysema
- G) Bronchiectasis

ANS: (C) CORRECT. Chronic bronchitis is defined clinically as persistent cough with sputum production for at least 3 months in at least 2 consecutive years. Air pollution and smoking are key causes for chronic bronchitis. The alteration of lung parenchyma predisposes to superimposed infection, typically with bacterial organisms.

9) Following a vehicular accident with blood loss leading to prolonged, severe hypotension, a 30-year-old man is intubated and placed on a mechanical ventilator. He has progressively decreasing oxygen saturations despite increasing PEEP and FIO₂ content of 100%. He remains afebrile. He dies 3 days later. At autopsy, the distal lungs show pink hyaline membranes, thickened interstitium, and many macrophages but few neutrophils. Which of the following pulmonary diseases most likely complicated his course?

- A) Bronchopneumonia
- B) Chronic bronchitis
- C) Bronchiectasis
- D) Viral pneumonia
- E) Diffuse alveolar damage

ANS: (E) CORRECT. Diffuse alveolar damage (or ARDS as it is known clinically) is the final event following severe lung injury from a variety of serious illnesses or accidents. In this case, it was probably initiated by the hypotension ('shock lung') and potentiated by the 100% oxygen generating free radical damage.

10) A 61-year-old man has had a cough without production of much sputum for the past week. On physical examination he is afebrile. There are decreased breath sounds at the right lung base. A chest x-ray reveals an area of consolidation in the right lower lobe. He is given antibiotic therapy, but a month later the radiographic picture has not changed, and his cough continues. A bronchoalveolar lavage is performed and yields atypical cells along with scattered alveolar macrophages. Which of the following is the most likely diagnosis?

- A) Mycoplasma pneumonia
- B) Adenocarcinoma-in-situ
- C) Sarcoidosis
- D) Pulmonary infarction
- E) Silica inhalation

ANS: (B) CORRECT. Adenocarcinoma-in-situ can spread in a pneumonia-like pattern. The lack of a change over time and the absence of a response to antibiotics should suggest an underlying non-infectious process. Adenocarcinomas may occur in non-smokers.

11) A 54-year-old woman has had fever and dyspnea for a month along with a 2 kg weight loss. On physical examination her temperature is 37.7°C. A chest radiograph shows a reticulonodular pattern along with prominent hilar lymphadenopathy. A transbronchial lung biopsy is performed, and microscopic examination shows no viral inclusions, no fungi, no acid fast bacilli, and no atypical cells. Which of the following diseases is she most likely to have?

- A) Silicosis
- B) Sarcoidosis
- C) Asbestosis
- D) Tuberculosis
- E) Usual interstitial pneumonitis

ANS: (B) CORRECT. The symptoms and signs are classic for granulomatous disease. Sarcoidosis often involves the hilar lymph nodes as well. No organisms can be found.

12) A 44-year-old woman, a non-smoker, has had a fever and cough for the past 4 days. She does not have hemoptysis. She has not experienced weight loss, malaise, nausea, or vomiting. On physical examination her temperature is 37.6°C. There are decreased breath sounds over the right upper lung. A chest radiograph reveals a 6 cm area of infiltrates in the right upper lobe. She is given a course of antibiotic therapy, but her cough persists. A month later her chest x-ray now reveals a 3 cm peripheral mass in the right upper lobe. Which of the following neoplasms is most likely to be present in this woman?

- A) Squamous cell carcinoma
- B) Small cell anaplastic carcinoma
- C) Adenocarcinoma
- D) Mesothelioma
- E) Carcinoid tumor

ANS: (C) CORRECT. Peripheral lung cancers (adenocarcinoma and large cell carcinoma) show less of an association with smoking than central lung cancers (small cell and squamous cell carcinoma). The focal obstruction from the mass predisposed to infection.

13) A 70-year-old woman has been bedridden for 5 weeks following a cerebrovascular accident (CVA). She has the sudden onset of dyspnea, but has no further symptoms until two days later when she experiences left sided pleuritic chest pain. A radiologic imaging study show a wedge-shaped area consistent with hemorrhage based on the pleura of the left lower lobe. Which of the following pathologic findings in her pulmonary arterial branches is she most likely to have?

- A) Atherosclerosis
- B) Aspergillosis
- C) Metastatic carcinoma
- D) Vasculitis
- E) Thromboembolism

ANS: (E) CORRECT. An embolus to a medium-sized arterial branch may not be large enough to kill the patient, but large enough to cause an infarction. Her bedridden state predisposes her to deep venous thrombosis and thromboembolism--the CVAs are due to separate systemic arterial problems--or the systemic and pulmonary embolization can be tied together by a hypercoagulable state, or more remotely by a 'paradoxical' embolus through a patent foramen ovale once the right sided--pressures increased following the initial pulmonary thromboembolic event.

14) For the past 5 months, a 51-year-old woman has noted increased swelling of her lower legs as the day progresses. She has no fever and no cough. On physical examination, she has pitting edema to the knees. A chest radiograph reveals bilateral pleural effusions, and the right heart border is prominent. Laboratory studies show a serum AST of 238 U/L, ALT 263 U/L, LDH 710 U/L, and CK 127 U/L. Which of the following underlying diseases is most likely to cause these findings?

- A) Goodpasture syndrome
- B) Recurrent thromboembolism
- C) Renovascular hypertension
- D) Bronchial asthma
- E) Rheumatoid arthritis

ANS: (B) CORRECT. Pulmonary hypertension and subsequent right heart failure can occur in the small number of cases in which recurrent thromboembolism takes place. The right heart failure that occurs then leads to hepatic passive congestion with centrilobular necrosis that is the cause for the increased transaminases and LDH (but normal CK, since the heart is enlarged, but not ischemic).

15) A study is performed reviewing medical records of adults presenting with sudden onset of severe dyspnea. They were afebrile, with absent breath sounds over an entire lung, and chest x-ray showing pulmonary atelectasis of an entire lung. Which of the following conditions is most likely to produce these findings?

- A) Aspiration of a foreign body
- B) Pulmonary embolism
- C) Squamous cell carcinoma

D) Penetrating chest trauma

E) Bronchiectasis

ANS: (D) CORRECT. Penetrating chest trauma would lead to pneumothorax with lung collapse (atelectasis).

16) A 60-year-old woman develops multiple organ failure 3 weeks following a pneumonia complicated by septicemia. Antibiotic therapy has resulted in sputum and blood cultures that are now without growth of organisms. Nevertheless, she requires intubation with mechanical ventilation, but it becomes progressively more difficult to maintain her oxygen saturations. Ventilatory pressures must be increased. A portable chest radiograph shows increasing opacification of all lung fields. Which of the following pathologic processes is most likely now to be present in her lungs?

A) Pulmonary arterial vasculitis

B) Diffuse alveolar damage

C) Extensive neutrophilic alveolar exudates

D) Extensive intra-alveolar hemorrhage

E) Widespread bronchiectasis

ANS: (B) CORRECT. Diffuse alveolar damage (DAD) is the pathologic term for adult respiratory distress syndrome (ARDS) that is the final common pathway for many acute lung injuries. DAD produces increasing interstitial thickening with mixed inflammation and features of an acute restrictive lung disease.

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Good luck!