Chapter 12

The Respiratory System

QUESTIONS

Select the single best answer.

1 A 63-year-old man with small cell carcinoma of the left mainstem bronchus begins chemotherapy. During the treatment period, he becomes febrile and develops a productive cough. The temperature is 38.7°C (103°F), respirations are 32 per minute, and blood pressure is 125/85 mm Hg. A CBC shows leukocytosis (WBC = 18,500/μL). The patient's cough worsens, and he begins expectorating large amounts of foul-smelling sputum. A chest X-ray shows a distinct cavity with an air/fluid level distal to the tumor area. Which of the following is the most likely diagnosis?

(A) Atelectasis
(B) Bronchiectasis
(C) Ghon complex
(D) Lobar pneumonia
(E) Pulmonary abscess

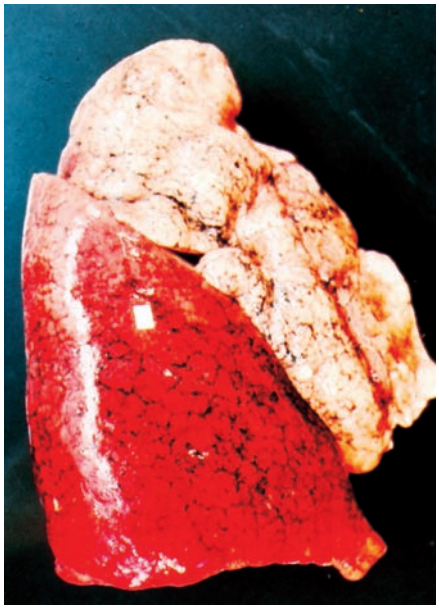
2 A 64-year-old man presents with fever, chills, and increasing shortness of breath. The patient appears in acute respiratory distress and complains of pleuritic chest pain. Physical examination shows crackles and decreased breath sounds over both lung fields. The patient exhibits tachypnea, with flaring of the nares. The sputum is rusty-yellow and displays numerous neutrophils and erythrocytes. Which of the following pathogens is the most common cause of this patient's pulmonary infection?

(A) *Legionella pneumophila*
(B) *Mycoplasma pneumoniae*
(C) *Pseudomonas aeruginosa*
(D) *Staphylococcus aureus*
(E) *Streptococcus pneumoniae*

3 If the patient described in Question 2 is appropriately treated with antibiotics, which of the following is the most likely outcome?

(A) Abscess formation
(B) Bronchopleural fistula
(C) Bullous emphysema
(D) Resolution
(E) Scar formation

4 A 40-year-old alcoholic man is admitted to the hospital in severe respiratory distress. The temperature is 38.7°C (103°F), respirations are 32 per minute, and blood pressure is 130/90 mm Hg. He coughs constantly and expectorates "currant-jelly" sputum. A chest X-ray reveals bilateral diffuse pulmonary consolidation. Physical examination shows bilateral crackles, dullness to percussion over both pulmonary fields, and use of accessory muscles. The patient subsequently dies from complications of bacterial sepsis. The left lung at autopsy (shown in the image) shows a red, engorged lower lobe. What is the appropriate diagnosis?



(A) Atypical pneumonia
(B) Bronchopneumonia
(C) Interstitial pneumonia
(D) Lobar pneumonia
(E) Pulmonary abscess

5 A 28-year-old woman with cystic fibrosis presents with increasing shortness of breath and production of abundant foul-smelling sputum. The sputum in this patient is most likely associated with which of the following pulmonary conditions?

(A) Atelectasis
(B) Bronchiectasis
(C) Empyema
(D) Pneumothorax
(E) Pyothorax

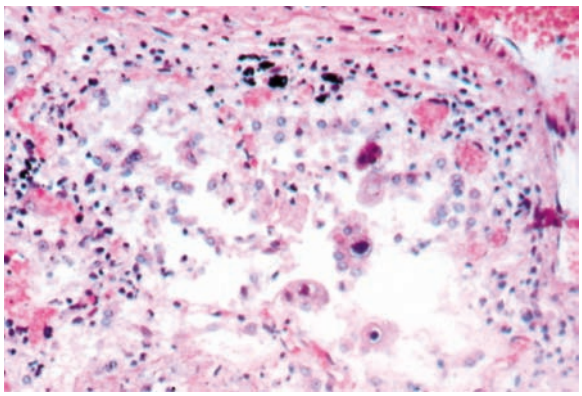
6 A 60-year-old alcoholic woman presents to the emergency room with fever, chills, and shortness of breath. The sputum is rusty-yellow and contains numerous neutrophils, red blood cells, and Gram-positive cocci. A chest X-ray shows diffuse haziness over both lungs. One week following admission, the patient develops empyema. This pulmonary condition is associated with the spread of bacterial infection to which of the following anatomic locations?
(A) Blood
(B) Bronchi
(C) Interstitial space
(D) Pericardium
(E) Pleural space

7 A 10-year-old boy suffers head trauma and lies unconscious for 2 weeks. He is now intubated. His temperature rises to 38.7°C (103°F), and oxygenation becomes more difficult. A chest X-ray reveals a pleural effusion and multiple abscesses in the lung parenchyma. Which of the following microorganisms is the most likely cause of this pulmonary infection?
(A) *Legionella pneumophila*
(B) *Mycoplasma pneumoniae*
(C) *Pneumocystis carinii*
(D) *Staphylococcus aureus*
(E) *Streptococcus pneumoniae*

8 A 22-year-old man with AIDS complains of persistent cough, night sweats, low-grade fever, and general malaise. A chest X-ray reveals an area of consolidation in the periphery of the left upper lobe, as well as hilar lymphadenopathy. Sputum cultures show acid-fast bacilli. Which of the following is the most likely diagnosis?
(A) Bronchopneumonia
(B) Pulmonary abscess
(C) Sarcoidosis
(D) Tuberculosis
(E) Wegener granulomatosis

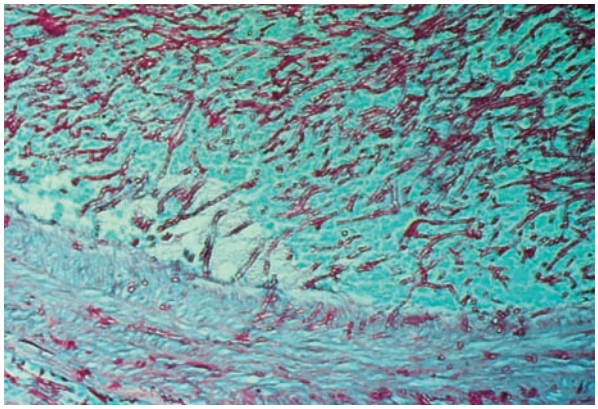
9 A 53-year-old man develops weakness, malaise, cough with bloody sputum, and night sweats. A chest X-ray reveals numerous apical densities bilaterally, some of which are cavitary. Exposure to *Mycobacterium tuberculosis* was documented 20 years ago, and *M. tuberculosis* is identified in his sputum. Which of the following describes the expected lung pathology in this patient?
(A) Dense fibrosis
(B) Eosinophilic infiltration
(C) Granulomas
(D) Interstitial pneumonia
(E) Plasma cell infiltration

10 A 3-day-old girl shows signs of cyanosis and respiratory distress. Her temperature is 38.7°C (103°F), pulse rate is 140 per minute, respirations are 60 per minute, and blood pressure is 90/58 mm Hg. Laboratory studies indicate that the baby is positive for HIV. The infant does not respond to conventional antibiotic therapy and expires. Histologic examination of the lungs at autopsy is shown in the image. The alveolar cells are very large and display single basophilic nuclear inclusions, with a peripheral halo and multiple cytoplasmic basophilic inclusions. Which of the following is the most likely etiologic agent in this child's pulmonary infection?



(A) Adenovirus
(B) Cytomegalovirus (CMV)
(C) Herpesvirus
(D) *Pneumocystis carinii*
(E) Rubellavirus

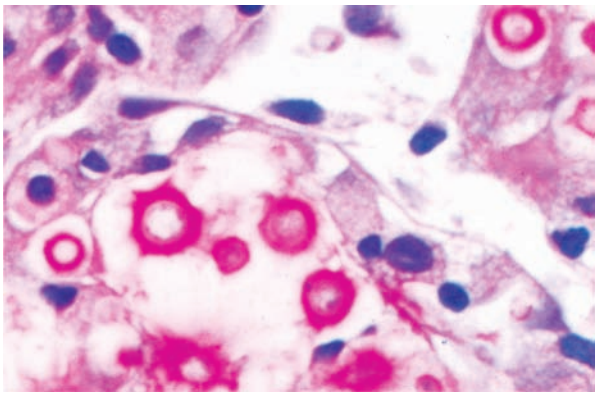
11 A 56-year-old woman with disseminated breast cancer undergoes multidrug chemotherapy. Ten days later, she develops cough and a fever of 38.7°C (103°F). A chest X-ray shows multiple areas of consolidation and a large cavity in the right upper lobe. Multiple pulmonary infarcts are also identified. The patient subsequently dies of multisystem organ failure. Histologic examination of the lungs at autopsy is shown in the image. Which of the following is the most likely diagnosis?



(A) Actinomycosis
(B) Blastomycosis
(C) Coccidioidomycosis
(D) Cryptococcosis
(E) Invasive aspergillosis

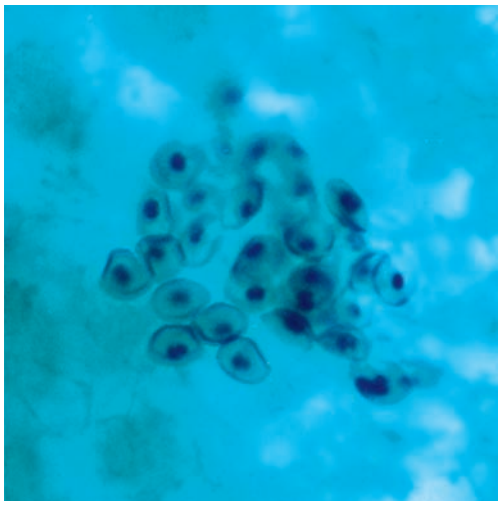
12 A 40-year-old woman with leukemia is treated with chemotherapy. During treatment she develops increasing cough and shortness of breath. A chest X-ray shows diffuse lung infiltrates. Sputum cultures are negative, and the patient does not respond to routine antibiotic therapy. An open lung biopsy is diagnosed by the pathologist as viral pneumonia. Which of the following histopathologic findings would be expected in the lungs of this patient?
(A) Clusters of epithelioid macrophages
(B) Confluent areas of caseous necrosis
(C) Fibrous scarring of lung parenchyma
(D) Hyaline membranes and interstitial inflammation
(E) Sheets of bacilli-filled macrophages

13 A 38-year-old woman, who is being treated with corticosteroids for systemic lupus erythematosus, presents with chronic nonproductive cough. She breeds pigeons for avian hobbyists. A chest X-ray reveals a 2-cm nodule in the upper lobe of the right lung. The lung nodule is resected. Histologic examination reveals granulomas and budding yeast forms, which stain positively for polysaccharides (mucicarmine stain, shown in the image). What is the appropriate diagnosis?



(A) Actinomycosis
(B) Coccidioidomycosis
(C) Cryptococcosis
(D) Histoplasmosis
(E) Mycoplasma pneumonia

14 A 36-year-old man with AIDS presents with fever, dry cough, and dyspnea. A chest X-ray shows bilateral and diffuse infiltrates. Laboratory studies reveal a $CD4^+$ cell count of less than 50/μL. A lung biopsy discloses a chronic interstitial pneumonitis and an intra-alveolar foamy exudate. A silver stain of a bronchoalveolar lavage is shown in the image. Which of the following organisms is the most likely pathogen responsible for these pulmonary findings?



(A) *Cryptococcus neoformans*
(B) Cytomegalovirus
(C) *Histoplasma capsulatum*
(D) *Mycoplasma pneumoniae*
(E) *Pneumocystis jiroveci*

15 A 48-year-old man with AIDS is admitted to the hospital with a fever of 38.7°C (103°F). The patient has a 2-week history of persistent cough and diarrhea. Laboratory studies show that the $CD4^+$ cell count is less than 500/μL. A sputum culture reveals acid-fast organisms, which are further identified as *Mycobacterium avium-intracellulare*. This patient's pneumonia is characterized by extensive pulmonary infiltrates of which of the following cell types?
(A) $CD4^+$ helper T cells
(B) Eosinophils
(C) Macrophages
(D) Mast cells
(E) Neutrophils

16 A 65-year-old man who is a heavy smoker complains of sudden onset of malaise, fever, productive cough, abdominal pain, and muscle aches. A chest X-ray shows bilateral, diffuse, patchy, alveolar infiltrates. Laboratory studies reveal that the patient is infected with *Legionella pneumophila*. This patient's pneumonia is characterized by extensive pulmonary infiltrates of which of the following cell types?
(A) $CD4^+$ helper T cells
(B) $CD8^+$ killer T cells
(C) Eosinophils
(D) Macrophages
(E) Mast cells

17 A 16-year-old boy is rushed to the emergency room after sustaining a stab wound to the chest during a fight. Physical examination reveals a 1-cm entry wound at the right 5th intercostal space in the midclavicular line. His temperature is 37°C (98.6°F), respirations are 35 per minute, and blood pressure is 90/50 mm Hg. A chest X-ray shows air in the right pleural space. Which of the following pulmonary conditions

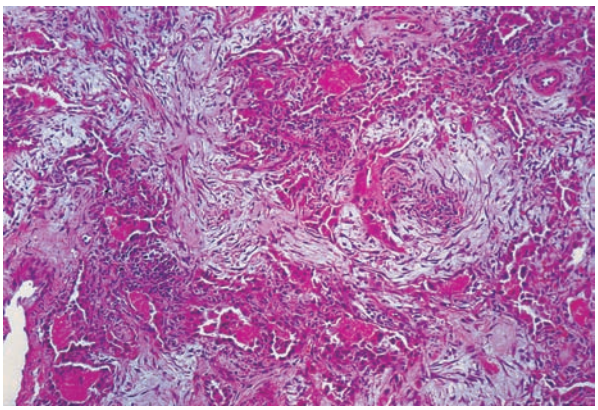
is the expected complication of pneumothorax arising in this patient?

(A) Atelectasis
(B) Chylothorax
(C) Diffuse alveolar damage
(D) Empyema
(E) Pyothorax

18 A 62-year-old woman is rushed to the emergency room following an automobile accident. She has suffered internal injuries and massive bleeding and appears to be in a state of profound shock. Her temperature is 37°C (98.6°F), respirations are 42 per minute, and blood pressure is 80/40 mm Hg. Physical examination shows cyanosis and the use of accessory respiratory muscles. A CT scan of the chest is normal on arrival. Her condition is complicated by fever, leukocytosis, and a positive blood culture for staphylococci (sepsis). Two days later, the patient develops rapidly progressive respiratory distress, and a pattern of "interstitial pneumonia" can be seen on a chest X-ray. Which of the following is the most likely diagnosis?

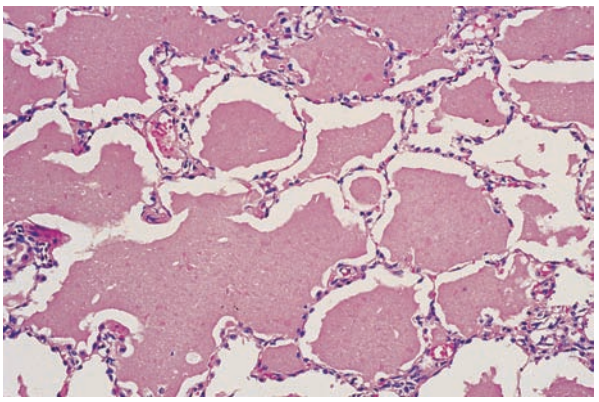
(A) Acute bronchiolitis
(B) Alveolar proteinosis
(C) Atelectasis
(D) Desquamative interstitial pneumonitis
(E) Diffuse alveolar damage

19 A 64-year-old woman who has suffered shock and sepsis experiences declining respiratory function and is placed on a ventilator. Despite intensive therapy, the patient dies 3 weeks later in respiratory failure. Histologic examination of the lungs at autopsy is shown in the image. Which of the following best describes the pathologic findings in this autopsy specimen?



(A) Atelectasis
(B) Bronchiectasis
(C) Bronchopneumonia
(D) Lobar pneumonia
(E) Pulmonary fibrosis

20 A 22-year-old man who is being treated for leukemia complains of shortness of breath on exertion, pleuritic chest pain, and a low-grade fever. Physical examination reveals crackles in both lung bases and clubbing of the fingers. Bronchoalveolar lavage demonstrates PAS-positive material and elevated levels of surfactant proteins. An open-lung biopsy is shown in the image. Which of the following is the most likely diagnosis?



(A) Alveolar proteinosis
(B) Eosinophilic pneumonia
(C) Goodpasture syndrome
(D) Hyaline membrane disease
(E) Radiation pneumonitis

21 A 50-year-old woman presents with a 4-week history of fever, shortness of breath, and dry cough. She reports that her chest feels "tight." The patient is a pigeon fancier. Blood tests show leukocytosis and neutrophilia, an elevated erythrocyte sedimentation rate, and increased levels of immunoglobulins and C-reactive protein. A lung biopsy reveals poorly formed granulomas composed of epithelioid macrophages and multinucleated giant cells. Which of the following is the appropriate diagnosis?

(A) Actinomycosis
(B) Goodpasture syndrome
(C) Hypersensitivity pneumonitis
(D) Nocardiosis
(E) Wegener granulomatosis

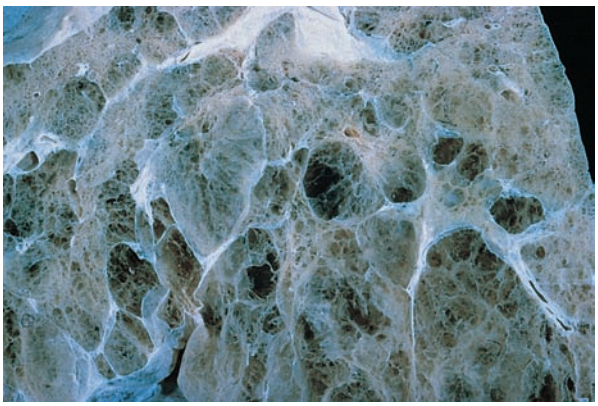
22 A 55-year-old man is admitted to the hospital with increasing shortness of breath and dry cough for the past few years. He smokes 1.5 packs of cigarettes and drinks about four bottles of beer a day. He is constantly "gasping for air" and now walks with difficulty because he becomes breathless after only a few steps. Prolonged expiration with wheezing is noted. Physical examination shows a barrel chest, hyperresonance on percussion, and clubbing of the digits. The patient's face is puffy and red, and he has pitting edema of the legs. A chest X-ray discloses hyperinflation, flattening of the diaphragm, and increased retrosternal air space. Which of the following is the appropriate diagnosis?

(A) Asthma
(B) Chronic bronchitis
(C) Emphysema
(D) Hypersensitivity pneumonitis
(E) Usual interstitial pneumonia

23 Which of the following best describes the expected histopathology of the lungs in the patient described in Question 22?

(A) Destruction of the walls of airspaces without fibrosis
(B) Interstitial fibrosis of the lung parenchyma
(C) Lymphocytes restricted to the interstitium
(D) Prominent bronchial smooth muscle cell hyperplasia
(E) Thickening of the epithelial basement membrane

24 A 35-year-old woman with a long history of dyspnea, chronic cough, sputum production, and wheezing dies of respiratory failure following a bout of lobar pneumonia. She was a nonsmoker and did not drink alcoholic beverages. The lung at autopsy is shown in the image. Which of the following underlying conditions was most likely associated with the pathologic changes shown here?



(A) α_1-Antitrypsin deficiency
(B) Cystic fibrosis
(C) Goodpasture syndrome
(D) Hypersensitivity pneumonitis
(E) Kartagener syndrome

25 A 55-year-old man was admitted to the hospital with a chief complaint of increasing shortness of breath over the past several years. The patient was a heavy smoker over the past 40 years. Physical examination reveals cyanosis, elevated jugular venous pressure, and peripheral edema. A high-resolution CT scan shows bullae over both lungs. Chronic intra-alveolar exposure to which of the following proteins is most likely associated with the pathogenesis of chronic obstructive pulmonary disease in this patient?

(A) Alkaline phosphatase
(B) α_1-Antitrypsin
(C) Collagenase
(D) Elastase
(E) α_2-Macroglobulin

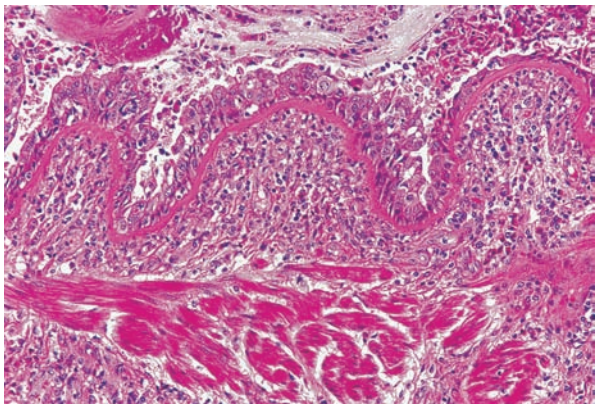
26 A 48-year-old man with a history of heavy smoking presents with a 3-year history of persistent cough and frequent upper respiratory infections, associated with sputum production. Physical examination reveals prominent expiratory wheezes and peripheral edema. Analysis of arterial blood gases reveals hypoxia and CO_2 retention. Which of the following is the appropriate diagnosis?

(A) Atelectasis
(B) Chronic obstructive pulmonary disease
(C) Goodpasture syndrome
(D) Hypersensitivity pneumonitis
(E) Usual interstitial pneumonia

27 An 8-year-old girl is brought into the physician's office in mild respiratory distress. She has a history of allergies to cats and wool, and her parents state that she has recurrent episodes of upper respiratory tract infections. Physical examination shows expiratory wheezes, use of accessory respiratory muscles, and a hyperresonant chest to percussion. Analysis of arterial blood gases discloses respiratory alkalosis, and the peripheral eosinophil count is increased. What is the appropriate diagnosis?

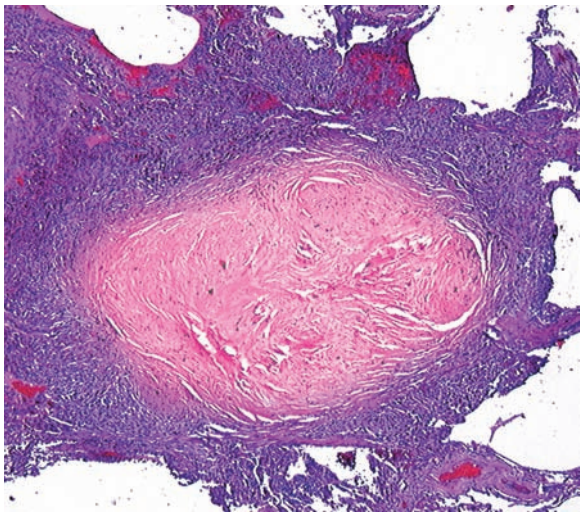
(A) Acute bronchiolitis
(B) Asthma
(C) Cystic fibrosis
(D) Kartagener syndrome
(E) Usual interstitial pneumonia

28 A 10-year-old boy dies following a severe episode of status asthmaticus. Histologic examination of the lung at autopsy is shown in the image. Which of the following best describes the pathologic features evident in this autopsy specimen?



(A) Destruction of the walls of airspaces without fibrosis
(B) Hyaline membranes and interstitial edema
(C) Interstitial fibrosis of the lung parenchyma
(D) Intra-alveolar hemorrhage and exudates containing neutrophils
(E) Smooth muscle hyperplasia and basement membrane thickening

29 A 60-year-old mason complains of shortness of breath, which has become progressively worse during the past year. A chest X-ray shows small nodular shadows in both lungs. Pulmonary function studies reveal a pattern consistent with restrictive lung disease. The patient subsequently develops congestive heart failure and expires. Autopsy discloses numerous small, fibrotic nodules in both lungs. Histologic examination of these nodules is shown in the image. Which of the following is the most likely diagnosis?

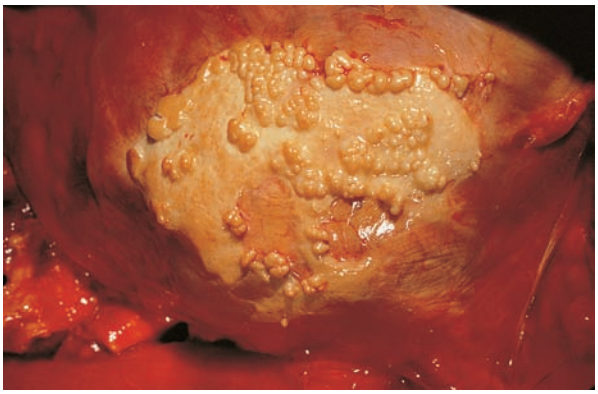


(A) Anthracosis
(B) Asbestosis
(C) Sarcoidosis
(D) Silicosis
(E) Wegener granulomatosis

30 A 65-year-old coal miner is admitted for evaluation of chronic lung disease. The patient admits to smoking one pack of cigarettes a day for 40 years. On physical examination, he is noticed to have a barrel chest and use accessory muscles for inspiration. His face is puffy and red. He has 2+ pitting edema of the lower extremities. A chest X-ray is compatible with diffuse fibrosis, with some nodularity in central areas. Which of the following is the most likely diagnosis?

(A) Anthracosilicosis
(B) Asbestosis
(C) Diffuse alveolar damage
(D) Psittacosis
(E) Sarcoidosis

31 A 75-year-old man who had worked in a shipyard dies of a chronic lung disease. Autopsy reveals extensive pulmonary fibrosis, and iron stains of lung tissue show numerous ferruginous bodies. The dome of the diaphragm is shown in the image. What is the appropriate diagnosis?

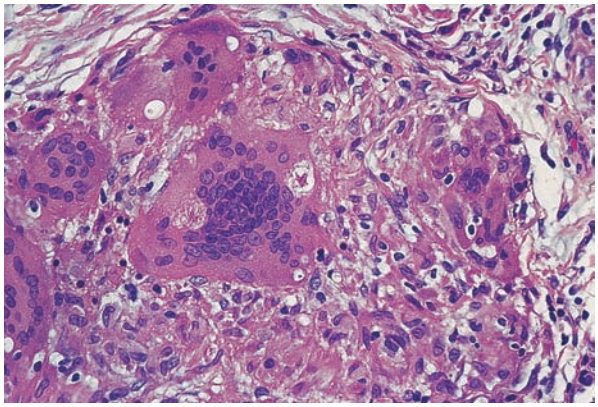


(A) Anthracosis
(B) Asbestosis
(C) Berylliosis
(D) Sarcoidosis
(E) Silicosis

32 A 69-year-old retired man is brought to the emergency department because he experienced sudden onset of left-sided chest pain, which is exacerbated upon inspiration. He is taking no medications and has been in good health. Physical examination reveals dyspnea and hemoptysis. Temperature is 38°C (101°F), pulse rate is 98 per minute, respirations are 35 per minute, and blood pressure is 158/100 mm Hg. A pleural friction rub is present on auscultation. The left leg is markedly edematous, with a positive Homans' sign. An ECG shows a normal sinus rhythm. A chest X-ray reveals a left pleural effusion. What is the most likely cause of this patient's pulmonary condition?

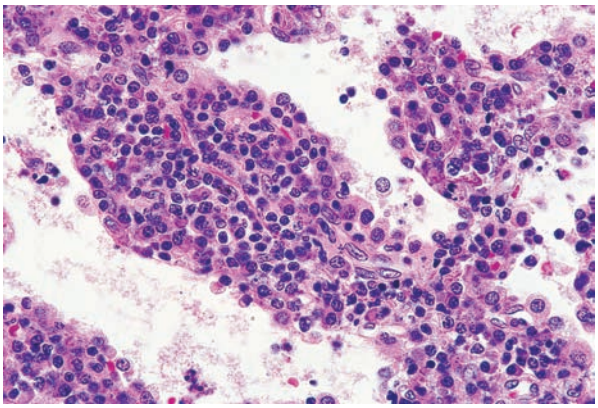
(A) Congestive heart failure
(B) Cor pulmonale
(C) Mitral stenosis
(D) Subacute endocarditis
(E) Thromboembolism

33 A 25-year-old black woman presents with a 3-month history of cough and shortness of breath on exertion. A chest X-ray reveals enlargement of hilar and mediastinal lymph nodes. Laboratory studies show elevated serum levels of angiotensin-converting enzyme and an increase in 24-hour urine calcium excretion. An open-lung biopsy is shown in the image. Stains for microorganisms in the tissue are negative. Which of the following is the most likely diagnosis?



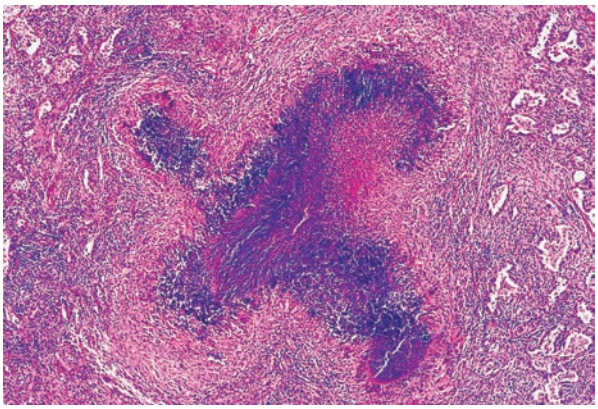
(A) Goodpasture syndrome
(B) Sarcoidosis
(C) Silicosis
(D) Tuberculosis
(E) Wegener granulomatosis

34 A 43-year-old woman with Sjögren syndrome and a 5-year history of cough and shortness of breath develops end-stage lung disease and dies of respiratory failure. Histologic examination of the lung at autopsy is shown in the image. Which of the following is the most likely diagnosis?



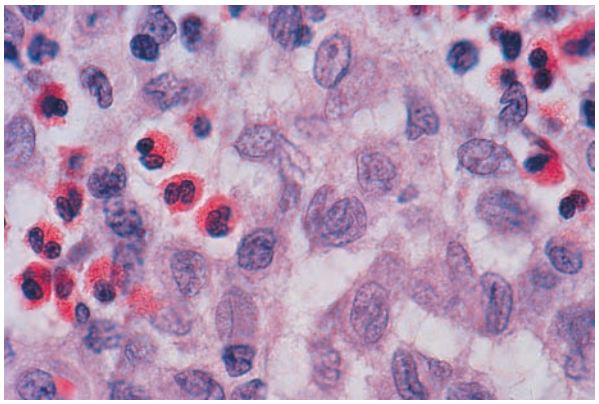
(A) Alveolar proteinosis
(B) Churg-Strauss syndrome
(C) Langerhans cell histiocytosis
(D) Lymphangioleiomyomatosis
(E) Lymphocytic interstitial pneumonia

35 A 23-year-old man complains of nasal obstruction, serosanguinous discharge, cough, and bloody sputum. A chest X-ray shows cavitated lesions and multiple nodules over both lung fields. A CT scan discloses obliteration of several maxillary sinuses. Urinalysis reveals hematuria and RBC casts. Laboratory studies demonstrate anemia and elevated serum levels of C-ANCA. An open-lung biopsy is shown in the image. Which of the following is the most likely diagnosis?



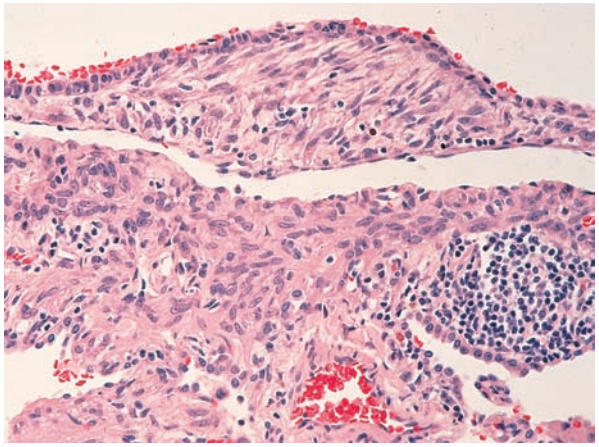
(A) Adenocarcinoma of lung
(B) Churg-Strauss syndrome
(C) Necrotizing sarcoid granulomatosis
(D) Tuberculosis
(E) Wegener granulomatosis

36 A 31-year-old woman smoker complains of nonproductive cough, chest pain, shortness of breath on exertion, and fatigue. A CBC is normal. A chest X-ray shows ill-defined nodules, reticulonodular infiltrates, a small cavitary lesion in the right middle lobe, and mediastinal adenopathy. A transbronchial biopsy is shown in the image. Which of the following is the most likely diagnosis?



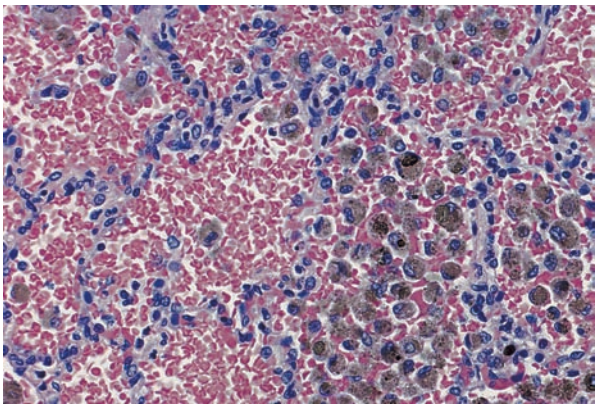
(A) Goodpasture syndrome
(B) Langerhans cell histiocytosis
(C) Lymphangioleiomyomatosis
(D) Pulmonary interstitial fibrosis
(E) Wegener granulomatosis

37 A 30-year-old woman presents with shortness of breath and bloody sputum. Physical examination reveals pulmonary crackles and abdominal ascites. A chest X-ray shows bilateral pleural effusions and marked hyperinflation of the lungs. A CT scan of the chest discloses thin-walled, air-containing cysts in a diffuse symmetric pattern. A lung biopsy is shown in the image. The patient responds favorably to antiestrogen and antiprogesterone therapy. Which of the following is the most likely diagnosis?



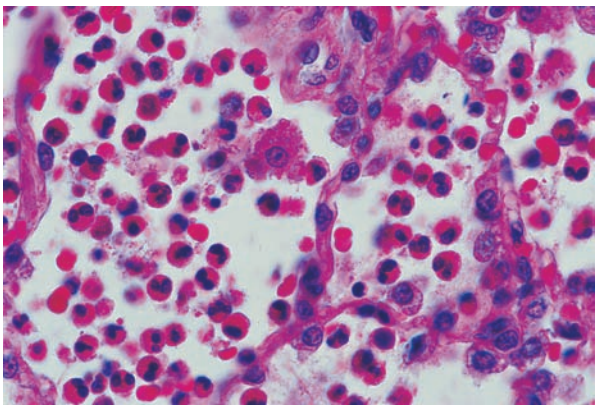
(A) Bronchiectasis
(B) Histiocytosis X
(C) Lymphangioleiomyomatosis
(D) Tuberculosis
(E) Wegener granulomatosis

38 A 22-year-old man presents with a 6-month history of increasing shortness of breath and persistent cough with rusty sputum. A chest X-ray shows diffuse bilateral alveolar infiltrates. Urine dipstick analysis reveals 2+ hematuria. A transbronchial lung biopsy is shown in the image. Linear deposits of IgG and complement C3 are detected in the alveolar basement membrane by immunofluorescence. Which of the following is the most likely diagnosis?



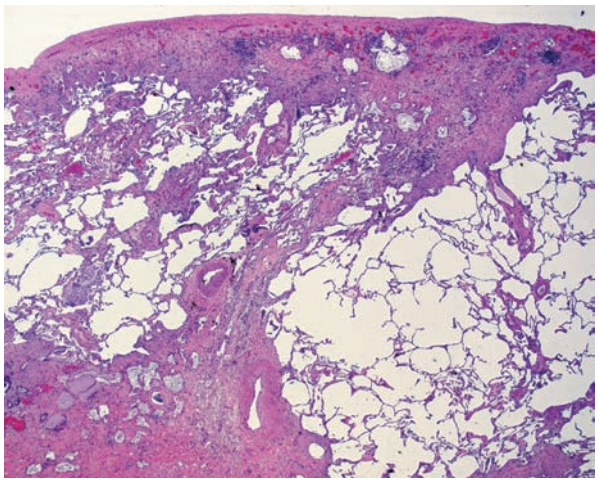
(A) Churg-Strauss syndrome
(B) Goodpasture syndrome
(C) Hypersensitivity pneumonitis
(D) Loeffler syndrome
(E) Wegener granulomatosis

39 A 28-year-old man presents with 6 days of fever and shortness of breath. His temperature is 38.7°C (103°F), respirations are 30 per minute, and blood pressure is 120/80 mm Hg. A chest X-ray reveals diffuse interstitial and alveolar infiltrates. Sputum cultures are negative, and the patient does not respond to standard antibiotic therapy. A transbronchial lung biopsy is shown in the image. Which of the following is the appropriate diagnosis?



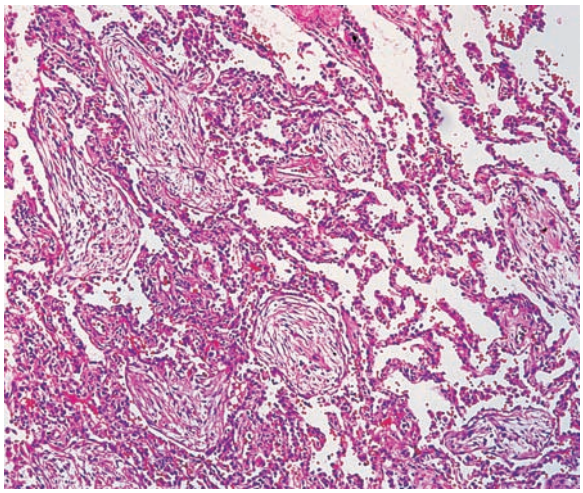
(A) Eosinophilic pneumonia
(B) Lipid pneumonia
(C) Pneumococcal pneumonia
(D) Pneumocystis pneumonia
(E) Usual interstitial pneumonia

40 A 53-year-old man presents with increasing shortness of breath on exertion and dry cough that has developed over a period of a few years. Physical examination shows clubbing of the fingers. A chest X-ray discloses diffuse bilateral infiltrates, predominantly in the lower lobes, in a reticular pattern. Two years later, the patient suffers a massive stroke and expires. Histologic examination of the lung at autopsy is shown in the image. Patchy scarring with extensive areas of honeycomb cystic change predominantly affects the lower lobes. Which of the following is the most likely diagnosis?



(A) Churg-Strauss syndrome
(B) Desquamative interstitial pneumonia
(C) Goodpasture syndrome
(D) Usual interstitial pneumonia
(E) Wegener granulomatosis

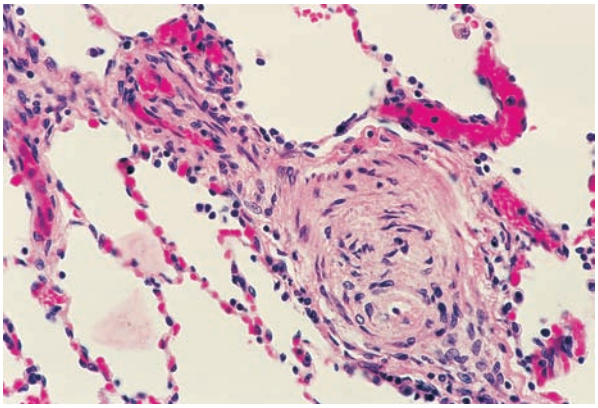
41 A 55-year-old woman complains of sudden onset of fever, dry cough, and shortness of breath. She was seen for flu-like symptoms 6 weeks ago. A chest X-ray shows bilateral patchy alveolar consolidations. An open-lung biopsy reveals narrow inflamed airways containing plugs of fibrous tissue (shown in the image). Which of the following is the most likely diagnosis?



(A) AIDS-related pneumonia
(B) Alveolar proteinosis
(C) Cryptogenic organizing pneumonia
(D) Diffuse alveolar damage
(E) Wegener granulomatosis

42 A 45-year-old woman with severe kyphoscoliosis presents with fatigue, shortness of breath on exertion, fainting spells, and bloody sputum. A CBC is normal. Physical examination shows splitting of the second heart sound with accentuation of the pulmonic component, distended neck veins with a

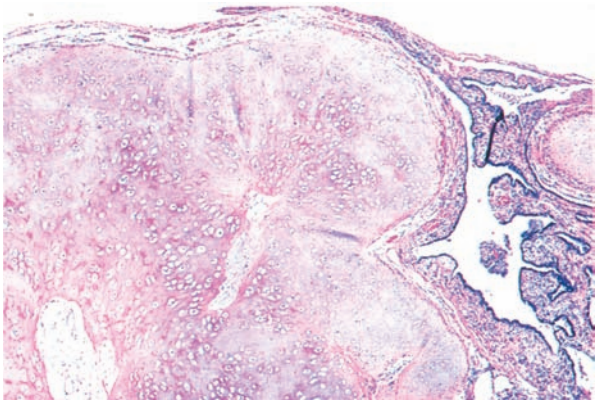
prominent V wave, a right ventricular third heart sound, and peripheral edema. A chest X-ray film shows enlargement of the central pulmonary arteries. A transbronchial lung biopsy is shown in the image. Which of the following is the most likely diagnosis?



(A) Churg-Strauss syndrome
(B) Diffuse alveolar damage
(C) Eosinophilic granuloma
(D) Pulmonary hypertension
(E) Wegener granulomatosis

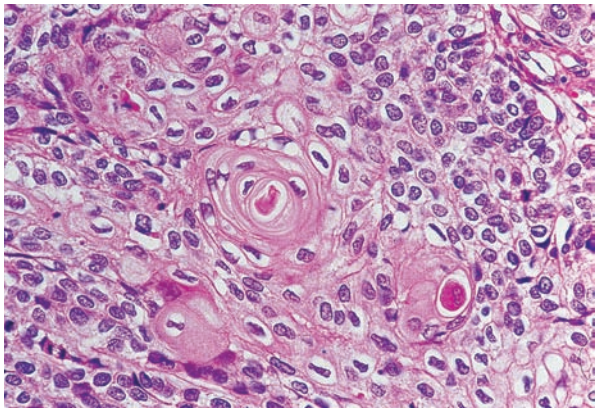
43 A 56-year-old man with a history of cigarette smoking presents with difficulty swallowing and a muffled voice. Laryngoscopy reveals a 2-cm laryngeal mass. If this mass is a malignant neoplasm, which of the following is the most likely histologic diagnosis?
(A) Adenocarcinoma
(B) Leiomyosarcoma
(C) Small cell carcinoma
(D) Squamous cell carcinoma
(E) Transitional cell carcinoma

44 A 56-year-old man undergoes a routine chest radiograph as part of a comprehensive physical examination. The X-ray film of the chest shows a solitary, centrally located coin lesion, with a "popcorn" pattern of calcification. A lung biopsy is performed and reveals nodules of benign mature cartilage and respiratory epithelium (shown in the image). What is the most likely diagnosis?



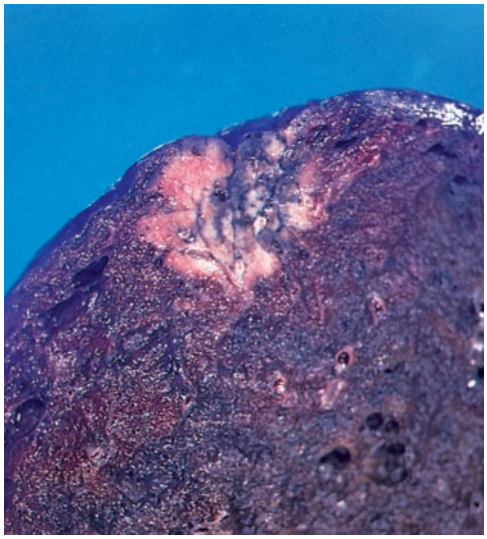
(A) Carcinoid tumor
(B) Extralobar sequestration
(C) Leiomyoma
(D) Pulmonary fibroma
(E) Pulmonary hamartoma

45 A 68-year-old man complains of shortness of breath, hoarseness, productive cough, and bloody sputum of 2 weeks in duration. He admits to smoking two packs a day for 45 years and drinks occasionally. Recently, he has experienced a significant loss of appetite and weight loss. Physical examination shows pallor, cachexia, clubbing of the fingers, and barrel-shaped chest. A chest X-ray reveals a mass at the right lung apex. Histologic examination of a transbronchial biopsy is shown in the image. What is the appropriate histologic diagnosis?



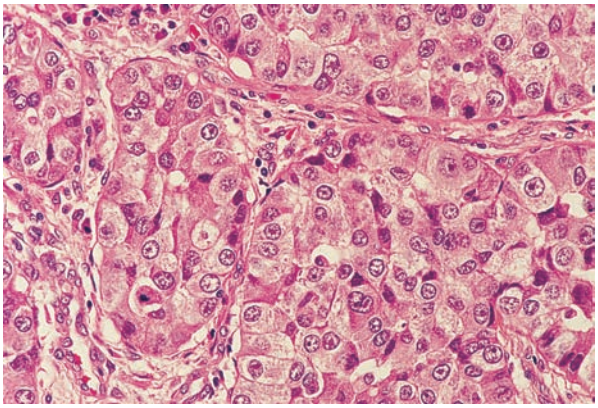
(A) Adenocarcinoma
(B) Mesothelioma
(C) Metastatic adenocarcinoma
(D) Small cell carcinoma
(E) Squamous cell carcinoma

46 A 53-year-old woman with a history of cigarette smoking presents with a 3-month history of chest pain, cough, and mild fever. A chest X-ray reveals a peripheral mass in the left upper lobe. The surgical specimen is shown in the image. What is the most likely diagnosis?



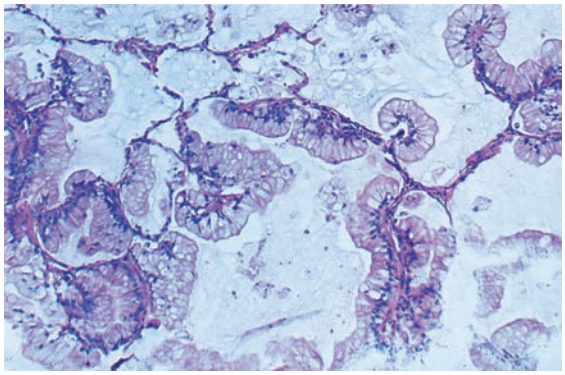
(A) Adenocarcinoma
(B) Large cell carcinoma
(C) Mesothelioma
(D) Small cell carcinoma
(E) Squamous cell carcinoma

47 A 67-year-old woman with a history of smoking presents with a 3-week history of chest pain and bloody sputum. A chest X-ray reveals a bulky mass within the pulmonary parenchyma. An open-lung biopsy is shown in the image. Immunohistochemical stains for keratin and chromogranin are negative. What is the appropriate diagnosis?



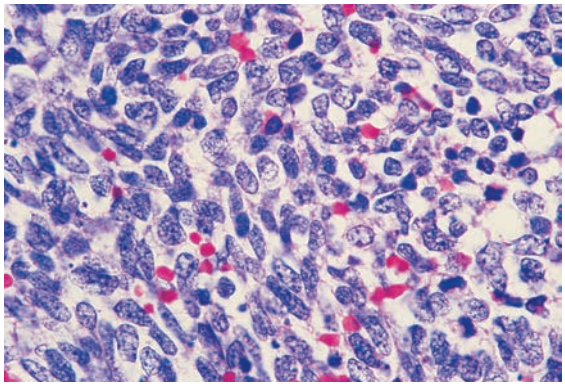
(A) Adenocarcinoma
(B) Carcinoid tumor
(C) Large cell carcinoma
(D) Metastatic adenocarcinoma
(E) Small cell carcinoma

48 A 58-year-old man presents with a long history of persistent cough, chest pain, and recurrent pneumonia. He denies smoking or consuming alcohol. The patient subsequently dies of sepsis. Autopsy reveals malignant cells that diffusely infiltrate the lung parenchyma. Histopathologic examination of the lung shows well-differentiated, mucus-producing, columnar neoplastic cells lining the alveolar spaces (shown in the image). Neoplastic cells are not found in any other organ. What is the most likely diagnosis?



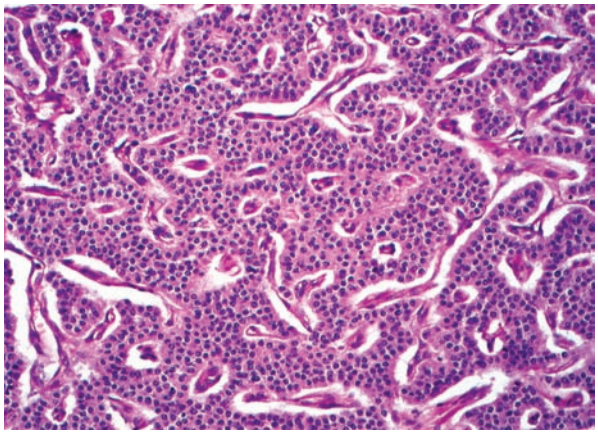
(A) Bronchioloalveolar carcinoma
(B) Carcinoid tumor
(C) Large cell carcinoma
(D) Mesothelioma
(E) Small cell carcinoma

49 A 52-year-old woman presents with a 1-year history of upper truncal obesity and moderate depression. Physical examination shows hirsutism and moon facies. Endocrinologic studies reveal hypokalemia, high plasma corticotropin levels, and increased concentrations of serum and urine cortisol. CT scan of the thorax demonstrates a hilar mass. A transbronchial lung biopsy is shown in the image. Electron microscopy discloses neuroendocrine granules within the cytoplasm of some tumor cells. What is the appropriate diagnosis?



(A) Adenocarcinoma
(B) Bronchioloalveolar carcinoma
(C) Carcinoid tumor
(D) Metastatic carcinoma
(E) Small cell carcinoma

50 A 55-year-old man presents with increasing chest pain, bloody sputum, and weight loss over the past 3 months. A high-resolution CT scan reveals a mass circumscribing the right main bronchus, extending into its lumen. Histologic examination of an open-lung biopsy is shown in the image. Electron microscopy shows numerous neuroendocrine granules within tumor cells. What is the appropriate diagnosis?



(A) Adenocarcinoma
(B) Bronchioloalveolar carcinoma
(C) Carcinoid tumor
(D) Large cell carcinoma
(E) Squamous cell carcinoma

51 A 64-year-old man who has worked in a manufacturing plant all his life complains of an 8-month history of chest discomfort, malaise, fever, night sweats, and weight loss. A chest X-ray reveals a pleural effusion and pleural mass encasing the lung. The patient subsequently dies of cardiorespiratory failure. Histologic examination of the pleural mass at autopsy shows a biphasic pattern of epithelial and sarcomatous elements. What is the most likely diagnosis?
(A) Carcinoid tumor
(B) Large cell carcinoma
(C) Malignant melanoma
(D) Malignant mesothelioma
(E) Metastatic carcinoma

52 A 48-year-old woman with a long-standing history of ulcerative colitis presents with anemia and shortness of breath. Laboratory studies show increased serum levels of carcinoembryonic antigen. A chest X-ray reveals multiple, round masses in both lungs. Histologic examination of an open-lung biopsy discloses nodules that are composed of gland-like structures. What is the most likely diagnosis?
(A) Adenocarcinoma
(B) Bronchioloalveolar carcinoma
(C) Eosinophilic granuloma
(D) Large cell undifferentiated carcinoma
(E) Metastatic carcinoma

53 A 72-year-old woman complains of shortness of breath upon exertion. She states that she also becomes short of breath at night unless she uses three pillows. Physical examination reveals mild obesity, bilateral pitting leg edema, an enlarged liver and spleen, and fine crackling sounds on inspiration. A chest X-ray is consistent with pulmonary edema and cardiomegaly. Which of the following is the most likely pulmonary complication in this patient?
(A) Chylothorax
(B) Hemothorax
(C) Hydrothorax
(D) Pneumothorax
(E) Pyothorax

54 A 27-year-old man with history of alcoholism and repeated bouts of aspiration pneumonia comes to the emergency room with a high fever and pleuritic chest pain. Physical examination reveals dullness on percussion and absence of breath sounds in the right lower lung field. A chest X-ray demonstrates pleural fluid on the right side. Thoracentesis returns a thick, foul-smelling fluid. Which of the following is the most likely diagnosis?
(A) Chylothorax
(B) Empyema
(C) Hemothorax
(D) Hydrothorax
(E) Pneumothorax

55 A 22-year-old man has been treated for lymphoma and comes to the emergency room complaining of severe shortness of breath. Physical examination reveals decreased breath sounds and shifting dullness. Cervical adenopathy is prominent. Thoracocentesis yields a milky-white fluid with a high lipid content. Which of the following is the most likely diagnosis?
(A) Chylothorax
(B) Empyema
(C) Hemothorax
(D) Hydrothorax
(E) Pyothorax

ANSWERS

1 **The answer is E: Pulmonary abscess.** Lung abscess is a localized accumulation of pus accompanied by the destruction of pulmonary parenchyma, including alveoli, airways, and blood vessels. The most common cause of pulmonary abscess is aspiration, often in the setting of depressed consciousness. Pulmonary abscess is also a common complication of lung cancer. A cystic abscess contains purulent exudates and is contained by a fibrous wall. Abscess cavities are often partially filled with pus and air, which accounts for the X-ray finding of an "air/fluid level." Inflammation is usually present in the surrounding pulmonary parenchyma. Foul-smelling sputum may be expectorated if an abscess is connected to a bronchus. None of the other choices present as cavitary lesions.
Diagnosis: Pulmonary abscess, small cell carcinoma of lung

2 **The answer is E: *Streptococcus pneumoniae*.** All of the choices cause pneumonia. However, despite the impact of antibiotic therapy, pneumonia caused by *Streptococcus pneumoniae* (pneumococcus) remains the most significant problem. The onset of pneumococcal pneumonia is acute with fever and chills.
Diagnosis: Pneumonia, *Streptococcus pneumoniae*

3 **The answer is D: Resolution.** Although abscesses and fistulas may occur (choices A and B), the most common outcome of acute bacterial pneumonia is resolution, particularly with appropriate antibiotic treatment.
Diagnosis: Pneumonia, *Streptococcus pneumoniae*

4 **The answer is D: Lobar pneumonia.** The term lobar pneumonia refers to consolidation of an entire lobe; bronchopneumonia (choice B) signifies scattered solid foci in the same or several lobes. Lobar pneumonia presents with a diffuse consolidation of one or more pulmonary lobes. In contrast to lobar pneumonia, interstitial pneumonia (choice C) primarily involves the alveolar septa. Atypical pneumonia (choice A) is most often encountered in mycoplasma pneumonia. Pulmonary abscess (choice E) may be a complication of lobar pneumonia or bronchopneumonia.
Diagnosis: Lobar pneumonia

5 **The answer is B: Bronchiectasis.** Bronchiectasis refers to the irreversible dilation of bronchi, which is caused by the destruction of the muscular and elastic elements of bronchial walls. Bronchiectasis is often localized to a segment of the lung distal to mechanical obstruction of a bronchus by a variety of lesions, including tumors, inhaled foreign bodies, mucous plugs (e.g., cystic fibrosis and asthma), and compressive lymphadenopathy. Nonobstructive bronchiectasis is usually a

complication of chronic pulmonary infections. Patients with bronchiectasis present with chronic productive cough, often with copious mucopurulent sputum. Pyothorax (choice E) is infection of pleural effusion.

Diagnosis: Bronchiectasis, cystic fibrosis

6 **The answer is E: Pleural space.** Complications of bacterial pneumonia include pleuritis (extension of inflammation to the pleural surface), pleural effusion, pyothorax (infection of pleural effusion), pulmonary abscess, and pulmonary fibrosis. Empyema is a loculated collection of pus with fibrous walls that follows the spread of bacterial infection to the pleural space. All of the other choices are possible routes of spread, but do not describe empyema.

Diagnosis: Bacterial pneumonia, empyema

7 **The answer is D: *Staphylococcus aureus*.** Staphylococcal pneumonia is an uncommon community-acquired disease, accounting for only 1% of bacterial pneumonias. However, pulmonary infection with *Staphylococcus aureus* is common as a superinfection after influenza and other viral respiratory tract infections. Nosocomial (hospital acquired) staphylococcal pneumonia typically occurs in chronically ill patients who are prone to aspiration or who are intubated. Although lung abscess can conceivably follow any respiratory infection, the other choices do not usually do so.

Diagnosis: Bacterial pneumonia

8 **The answer is D: Tuberculosis.** Tuberculosis represents infection with *Mycobacterium tuberculosis*, although atypical mycobacterial infections may mimic it. The Ghon complex includes parenchymal consolidation and enlargement of ipsilateral hilar lymph nodes and is often accompanied by a pleural effusion. The sputum contains *M. tuberculosis*, which is acid-fast in smears stained by the Ziehl-Neelsen technique. After resolution of primary tuberculosis, reemergence may occur (secondary tuberculosis). None of the other choices feature acid-fast organisms.

Diagnosis: Tuberculosis, *Mycobacterium tuberculosis*

9 **The answer is C: Granulomas.** Secondary (reactivation) tuberculosis is characterized by the formation of granulomas and extensive tissue destruction (caseous necrosis). Mycobacteria typically spread to the apices of the lungs and produce large cavities, which are associated with hemoptysis. Miliary tuberculosis refers to widespread seeding of bacteria in the lungs and distant organs. Granulomatous inflammation may induce fibrosis (choice A) as a secondary feature.

Diagnosis: Tuberculosis, *Mycobacterium tuberculosis*

10 **The answer is B: Cytomegalovirus (CMV).** CMV produces a characteristic interstitial pneumonia. Initially described in infants, it is now well recognized in immunocompromised persons. The virus may be transmitted from mother to child transplacentally (a feature of TORCH syndrome). Although infected children are usually asymptomatic, in symptomatic infants and children, central nervous symptoms predominate. As implied by its name, CMV causes marked enlargement of infected cells, which contain typical intranuclear and often cytoplasmic inclusions. The other TORCH agents may cause pneumonia, but only CMV exhibits this cellular morphology.

Diagnosis: Cytomegalovirus, viral pneumonia

11 **The answer is E: Invasive aspergillosis.** Invasive aspergillosis is the most serious manifestation of *Aspergillus* infection, occurring almost exclusively as an opportunistic infection in immunocompromised persons (e.g., undergoing cytotoxic therapy or diagnosed with AIDS). Invasion of blood vessels and tissue infarcts are common. *Aspergillus* species may also grow in preexisting cavities caused by tuberculosis or bronchiectasis. They proliferate to form fungus balls, which are also referred to as aspergillomas or mycetomas. Vascular invasion is not a feature of the other choices.

Diagnosis: Pulmonary aspergillosis

12 **The answer is D: Hyaline membranes and interstitial inflammation.** Viral infections of the pulmonary parenchyma produce diffuse alveolar damage (DAD) and interstitial pneumonia. Necrosis of type I pneumocytes and the formation of hyaline membranes result in an appearance that is indistinguishable from DAD in other settings. Choices A, B, and D are not characteristic of interstitial pneumonia. Choice C (fibrous scarring) may be a late complication of some forms of this disorder.

Diagnosis: Diffuse alveolar damage, viral pneumonia

13 **The answer is C: Cryptococcosis.** Cryptococcosis results from the inhalation of spores of *Cryptococcus neoformans*, an organism frequently encountered in pigeon droppings. Most serious cases occur in immunocompromised persons. Other examples of fungal infections of the lungs are histoplasmosis (choice D), coccidioidomycosis (choice B), and aspergillosis. However, cryptococcus stains positively with a mucicarmine stain for capsular polysaccharides. These diseases are also acquired by inhaling spores.

Diagnosis: Cryptococcal pneumonia, pigeon breeder lung disease

14 **The answer is E: *Pneumocystis jiroveci*.** *P. jiroveci* (formerly *P. carinii*) is the most frequent cause of infectious pneumonia in patients with AIDS. Once considered a protozoan, the organism has been reclassified as a fungus. The classic lesion of *Pneumocystis* pneumonia comprises an interstitial infiltrate of plasma cells and lymphocytes, diffuse alveolar damage, and hyperplasia of type II pneumocytes. The alveoli are filled with a characteristic foamy exudate. The organisms appear as small bubbles in a background of proteinaceous exudates. In this case, a centrifuged bronchoalveolar lavage specimen impregnated with silver shows a cluster of cysts. The cysts appear as round or indented ("crescent moon") bodies, which are approximately 5 μm in diameter. *Cryptococcus neoformans* (choice A) and *Histoplasma capsulatum* (choice C) do not typically cause interstitial pneumonia.

Diagnosis: *Pneumocystis* pneumonia, AIDS

15 **The answer is C: Macrophages.** *Mycobacterium avium-intracellulare* (MAI) complex is a progressive systemic disorder, often occurring in patients who have AIDS. One third of all patients with AIDS develop overt MAI infec-

tions because depletion of $CD4^+$ helper T cells cripples the immune response. This pneumonia is characterized by an extensive infiltrate of macrophages. The proliferation of MAI and the recruitment of macrophages produce expanding lesions, ranging from epithelioid granulomas containing few organisms to loose aggregates of foamy macrophages. Symptoms associated with MAI resemble those of tuberculosis. The other inflammatory cells listed are not characteristic of infection with MAI.

Diagnosis: *Mycobacterium avium-intracellulare,* AIDS

16 **The answer is D: Macrophages.** *Legionella* pneumonia begins when microorganisms enter the alveoli, where they are phagocytozed by macrophages. Bacteria multiply within macrophages and are released to infect new macrophages. Smoking, alcoholism, and chronic pulmonary diseases interfere with normal host defenses thereby increasing the risk of developing *Legionella* pneumonia. Patients typically present with an acute bronchopneumonia. One third of cases of *Legionella* pneumonia are complicated by subsequent emphysema. The other inflammatory cells listed are scarce or absent in the alveolar exudate.

Diagnosis: Legionnaire disease

17 **The answer is A: Atelectasis.** Pneumothorax, which is defined as the presence of air in the pleural cavity, may be due to traumatic perforation of the pleura or may be spontaneous. Traumatic causes include penetrating wounds of the chest wall (e.g., stab wound or a rib fracture). Traumatic pneumothorax is most commonly iatrogenic and is seen after aspiration of fluid from the pleura (thoracentesis), pleural or lung biopsies, transbronchial biopsies, and positive pressure-assisted ventilation. Pneumothorax causes collapse of a previously expanded lung, a condition that is termed atelectasis. Additional causes of atelectasis include deficiency of surfactant, compression of the lungs, and bronchial obstruction. Chylothorax (choice B) is the accumulation of lymphatic fluid within the pleural space and is a rare complication of trauma.

Diagnosis: Atelectasis

18 **The answer is E: Diffuse alveolar damage (DAD).** DAD refers to a nonspecific pattern of reaction to injury of alveolar epithelial and endothelial cells from a variety of acute insults. The clinical counterpart of severe DAD is acute respiratory distress syndrome. In this disorder, a patient with apparently normal lungs sustains pulmonary damage and then develops rapid progressive respiratory failure. DAD is a final common pathway of pathologic changes caused by a variety of insults, including respiratory infections, sepsis, shock, aspiration of gastric contents, inhalation of toxic gases, near-drowning, radiation pneumonitis, and a large assortment of drugs and other chemicals. Desquamative interstitial pneumonia (choice D) is a chronic, fibrosing, interstitial pneumonitis of unknown etiology.

Diagnosis: Diffuse alveolar damage

19 **The answer is E: Pulmonary fibrosis.** The photomicrograph shows hyaline membranes, thickening of the alveolar walls, and loose connective tissue. This organizing phase of diffuse alveolar damage begins about 1 week after the initial injury. This phase is marked by the proliferation of fibroblasts within the alveolar walls. Alveolar macrophages digest the remnants of hyaline membranes and other cellular debris. Loose fibrosis then thickens the alveolar septa. This fibrosis resolves in mild cases, but in severe cases, it may progress to restructuring of the pulmonary parenchyma and cyst formation. The photograph does not display features of the other choices.

Diagnosis: Diffuse alveolar damage

20 **The answer is A: Alveolar proteinosis.** Alveolar proteinosis (also termed lipoproteinosis) is a rare condition in which the alveoli are filled with a granular, proteinaceous, eosinophilic material, which is PAS-positive, diastase resistant, and rich in lipids. The disease was initially described as idiopathic, but recent studies have associated alveolar proteinosis with compromised immunity, leukemia and lymphoma, respiratory infections, and exposure to environmental inorganic dusts. Repeated bronchoalveolar lavage is used to remove the alveolar material, and repeated lavage may halt progression of the disease. None of the other choices exhibit an acellular eosinophilic material that fills the alveoli.

Diagnosis: Alveolar proteinosis

21 **The answer is C: Hypersensitivity pneumonitis.** Hypersensitivity pneumonitis (extrinsic allergic alveolitis) is a response to inhaled antigens. The inhalation of a variety of antigens leads to acute or chronic interstitial inflammation in the lung. Hypersensitivity pneumonitis may develop in response to repeated exposure to a variety of organic materials (e.g., bird droppings, feathers, mushrooms, and tree bark). Histologically, the lung contains poorly formed granulomas, which differ from the compact (solid) noncaseating granulomas of sarcoidosis and the caseating granulomas of tuberculosis or histoplasmosis. Actinomycosis and nocardiosis (choices A and D) do not induce granulomas. Wegener granulomatosis (choice E) is not known to be associated with environmental exposure.

Diagnosis: Hypersensitivity pneumonitis, pigeon breeder lung disease

22 **The answer is C: Emphysema.** Chronic obstructive pulmonary disease is a nonspecific term that describes patients with chronic bronchitis or emphysema who evidence a decrease in forced expiratory volume. Emphysema is characterized principally by hyperinflated lungs. Chronic bronchitis (choice B) occurs after recurrent infections and, like asthma (choice A), is not generally associated with hyperinflated lungs. The major cause of emphysema is cigarette smoking, and moderate-to-severe emphysema is rare in nonsmokers.

Diagnosis: Emphysema

23 **The answer is A: Destruction of the walls of airspaces without fibrosis.** Emphysema is a chronic lung disease characterized by enlargement of the airspaces distal to the terminal bronchioles, with destruction of their walls, but without fibrosis or inflammation.

Diagnosis: Emphysema

24 **The answer is A: α_1-Antitrypsin deficiency.** Hereditary deficiency of α_1-antitrypsin accounts for about 1% of all patients with a clinical diagnosis of chronic obstructive pulmonary disease and is considerably more common in young persons with

severe emphysema. Emphysema in patients with this genetic disease is diffuse and is classified as panacinar. In the lung, the most important action of α_1-antitrypsin is its inhibition of neutrophil elastase, an enzyme that digests elastin and other structural components of the alveolar septa. Most patients with clinically-diagnosed emphysema who are younger than 40 years of age have α_1-antitrypsin (PiZZ phenotype) deficiency. Emphysema is not a feature of the other choices.

Diagnosis: α_1-Antitrypsin deficiency, emphysema

25 **The answer is D: Elastase.** The dominant hypothesis concerning the pathogenesis of emphysema is the proteolysis-antiproteolysis theory. In most patients with emphysema, it is thought that tobacco smoke induces an inflammatory reaction. Serine elastase in neutrophils is a particularly potent elastolytic agent, which injures the elastic tissue of the lung. Over time, an imbalance in elastin generation and catabolism in the lung leads to emphysema (i.e., emphysema results when elastolytic activity is increased or antielastolytic activity is reduced). α_1-Antitrypsin (choice B), a circulating glycoprotein produced in the liver, is a major inhibitor of a variety of proteases, including elastase, and accounts for 90% of antiproteinase activity in the blood.

Diagnosis: Emphysema

26 **The answer is B: Chronic obstructive pulmonary disease.** Chronic obstructive pulmonary disease is a nonspecific term that describes patients with chronic bronchitis, emphysema, or both who evidence obstruction to air flow in the lungs. It is often difficult to separate the relative contribution of each disease to the clinical presentation. Chronic bronchitis is defined clinically as the presence of a chronic productive cough without a discernible cause for more than half the time over a period of 2 years. It is primarily a disease of cigarette smoking, with 90% of all cases occurring in smokers. The frequency and severity of acute respiratory tract infections is increased in patients with chronic bronchitis. Exertional dyspnea and cyanosis supervene, and cor pulmonale may ensue. The combination of cyanosis and edema secondary to cor pulmonale has led to the label "blue bloater" for such patients. In contrast to patients with predominantly chronic bronchitis, those with emphysema are at lower risk of recurrent pulmonary infections and are not so prone to the development of cor pulmonale. The clinical course of emphysema is marked by an inexorable decline in respiratory function and progressive dyspnea, for which no treatment is adequate.

Diagnosis: Chronic obstructive pulmonary disease, chronic bronchitis, emphysema

27 **The answer is B: Asthma.** Asthma is a chronic lung disease caused by increased responsiveness of the airways to a variety of stimuli. Patients typically have paroxysms of wheezing, dyspnea, and cough. Acute episodes of asthma may alternate with asymptomatic periods or they may be superimposed on a background of chronic airway obstruction. The consensus hypothesis attributes bronchial hyperresponsiveness in asthma to an inflammatory reaction to diverse stimuli, either extrinsic (e.g., pollen) or intrinsic (e.g., exercise). Extrinsic asthma is typically a childhood disease, whereas intrinsic asthma usually begins in adults. The other choices do not lead to wheezing and eosinophilia.

Diagnosis: Asthma

28 **The answer is E: Smooth muscle hyperplasia and basement membrane thickening.** When severe acute asthma is unresponsive to therapy, it is referred to as status asthmaticus. Histological examination of lung from a patient who died in status asthmaticus often shows a bronchus containing a luminal mucous plug, submucosal gland hyperplasia, smooth muscle hyperplasia, basement membrane thickening, and increased numbers of eosinophils. All of the other choices concern alveolar damage, whereas the photograph demonstrates a section of bronchus.

Diagnosis: Asthma

29 **The answer is D: Silicosis.** Silicosis is caused by inhalation of small crystals of quartz (silicon dioxide), which are generated by stone cutting, sandblasting, and mining. The condition is marked by the insidious development of fibrotic pulmonary nodules containing quartz crystals. The disease may be asymptomatic for prolonged periods of time or may cause only mild to moderate dyspnea. Continued exposure may lead to progressive fibrosis and severe respiratory embarrassment. Anthracosis (choice A) by itself does not cause restrictive lung disease, whereas asbestosis (choice B) is characterized by interstitial fibrosis. The nodules of sarcoidosis (choice C) and Wegener granulomatosis (choice E) are not fibrotic.

Diagnosis: Silicosis

30 **The answer is A: Anthracosilicosis.** Coal dust is composed of amorphous carbon and other constituents of the earth's surface, including variable amounts of silica. Amorphous carbon by itself is not fibrogenic owing to its inability to kill alveolar macrophages. It is simply a nuisance dust that causes an innocuous anthracosis. By contrast, silica is highly fibrogenic, and the inhalation of rock particles may therefore lead to the lesions of anthracosilicosis. Coal workers' pneumoconiosis is also known as "black lung disease" due to massive deposits of carbon particles. The characteristic pulmonary lesions of complicated coal workers' pneumoconiosis include palpable coal-dust nodules scattered throughout the lung as 1- to 4-mm black foci. Nodules consist of dust-laden macrophages associated with a fibrotic stroma. Coal miners are not predisposed to the other choices.

Diagnosis: Coal workers' pneumoconiosis, anthracosilicosis

31 **The answer is B: Asbestosis.** Asbestosis refers to the diffuse interstitial fibrosis that results from the inhalation of asbestos fibers. The disease occurs as a result of the processing and handling of asbestos, rather than mining, which is a surface operation. Asbestosis is characterized by bilateral, diffuse interstitial fibrosis and asbestos bodies in the lung. These ferruginous bodies are golden brown and beaded, with a central colorless core fiber. Asbestos bodies are encrusted with protein and iron. In this patient, the dome of the diaphragm is covered by a smooth, pearly white, nodular fibrotic lesion (pleural plaque), a common feature of asbestos exposure. A clear-cut relationship between occupational asbestos exposure and malignant mesothelioma is established. None of the other choices display pleural plaques or ferruginous bodies.

Diagnosis: Asbestosis

32 **The answer is E: Thromboembolism.** Pulmonary arterial embolism is potentially fatal. Most pulmonary emboli arise

from the deep veins of the lower extremities. This patient had signs of deep venous thrombosis of the leg. However, only half of patients with pulmonary thromboembolism have deep vein thrombosis. In this patient, pulmonary embolism was associated with pulmonary infarction, pleuritic chest pain, hemoptysis, and pleural effusion. None of the other choices feature pleuritic signs and symptoms.
Diagnosis: Pulmonary thromboembolism

33 **The answer is B: Sarcoidosis.** Sarcoidosis is a granulomatous disease of unknown etiology. In sarcoidosis, the lung is the most frequently involved organ, but the lymph nodes, skin, and eyes are also common targets. Angiotensin-converting enzyme (ACE) is produced by epithelioid macrophages and is elevated in the blood. Spontaneous regression of lesions is common, but in some cases, the disease causes pulmonary fibrosis and respiratory failure. Symptoms of pulmonary disease include dyspnea, cough, and wheezing. None of the other choices are associated with increased serum levels of ACE.
Diagnosis: Sarcoidosis

34 **The answer is E: Lymphocytic interstitial pneumonia.** Lymphocytic interstitial pneumonia (LIP) is a rare pneumonitis in which lymphoid infiltrates are distributed diffusely in the interstitial spaces of the lung. In this case, the walls of the alveolar septa are diffusely infiltrated with chronic inflammatory cells. LIP often occurs in a variety of clinical settings, including Sjögren syndrome and HIV infection. The course of the disease varies from an indolent condition to one that progresses to end-stage lung disease and respiratory failure. Langerhans cell histiocytosis (choice C) features nodular infiltrates. Interstitial lymphocytic infiltrates are not characteristic of the other choices.
Diagnosis: Lymphocytic interstitial pneumonia

35 **The answer is E: Wegener granulomatosis (WG).** WG is a disease of unknown cause that is characterized by aseptic, necrotizing, granulomatous inflammation and vasculitis. This disease affects the upper and lower respiratory tract and kidneys. Pulmonary features of WG include necrotizing granulomatous inflammation, parenchymal necrosis, and vasculitis. In most cases, multiple nodules averaging 2 to 3 cm in diameter are seen in the lungs. WG most commonly affects the head and neck, followed by the lung, kidney, and eye. Respiratory manifestations include sinusitis, cough, hemoptysis, and pleuritis. Sinus involvement is not common in the incorrect choices. Churg-Strauss syndrome (choice B) shares some features with WG, but is characterized by asthma, peripheral eosinophilia and P-ANCA.
Diagnosis: Wegener granulomatosis

36 **The answer is B: Langerhans cell histiocytosis.** Different presentations of Langerhans cell histiocytosis have been called eosinophilic granuloma, Hand-Schuller-Christian disease, and Letterer-Siwe disease. In adults, the disorder occurs most often as an isolated form known as pulmonary eosinophilic granuloma. Virtually all of these patients are cigarette smokers. The pulmonary lesions consist of varying proportions of Langerhans cells admixed with lymphocytes, eosinophils, and macrophages. Eosinophils are not typical of the other choices.
Diagnosis: Langerhans histiocytosis

37 **The answer is C: Lymphangioleiomyomatosis.** Lymphangioleiomyomatosis is a rare interstitial lung disease that occurs in women of childbearing age. It is characterized by the widespread abnormal proliferation of smooth muscle in the lung (see photomicrograph), mediastinal and retroperitoneal lymph nodes, and the major lymphatic ducts. On gross examination, the lungs show bilateral, diffuse enlargement, with extensive cystic changes resembling those of emphysema. Hormonal ablation through oophorectomy and antiestrogen and progesterone therapy has shown some promise. None of the other choices exhibit this morphologic pattern.
Diagnosis: Lymphangioleiomyomatosis

38 **The answer is B: Goodpasture syndrome.** Goodpasture syndrome is an autoimmune disease in which autoantibodies bind to the noncollagenous domain of type IV collagen. This connective tissue protein is a major structural component of both pulmonary and glomerular basement membranes. Local complement activation results in the recruitment of neutrophils, tissue injury, pulmonary hemorrhage, and glomerulonephritis. Anti–type IV collagen antibodies are not encountered in the other choices.
Diagnosis: Goodpasture syndrome

39 **The answer is A: Eosinophilic pneumonia.** Eosinophilic pneumonia is principally an allergic disorder. It refers to the accumulation of eosinophils in alveolar spaces and is classified as either idiopathic or secondary to an underlying illness. In acute eosinophilic pneumonia, the alveolar spaces are filled with an inflammatory exudate composed of eosinophils and macrophages. The alveolar septa are thickened by the presence of numerous eosinophils and hyaline membranes are present. Patients respond dramatically to corticosteroids, and, in contrast to chronic eosinophilic pneumonia, acute eosinophilic pneumonia does not recur. Excess eosinophils are not encountered in the other choices.
Diagnosis: Eosinophilic pneumonia

40 **The answer is D: Usual interstitial pneumonia (UIP).** UIP is one of the most common types of interstitial pneumonia and demonstrates a histologic pattern that occurs in a variety of clinical settings, including collagen vascular disease, chronic hypersensitivity pneumonitis, and drug toxicity. Most commonly, it has no known cause, although viral, genetic, and immunologic factors may be implicated. A microscopic view of the lung in this case shows patchy, subpleural fibrosis with microscopic "honeycomb" cystic change. Diffuse fibrosis is not characteristic of the other choices.
Diagnosis: Usual interstitial pneumonia

41 **The answer is C: Cryptogenic organizing pneumonia.** Organizing pneumonia was previously referred to as bronchiolitis obliterans-organizing pneumonia. The histologic pattern is not specific for any particular etiologic agent and may be observed in many settings, including respiratory tract infections, inhalation of toxic materials, and collagen vascular diseases. In the absence of a specific etiology, the term cryptogenic organizing pneumonia is applied. Loose fibrous tissue in the alveoli and bronchioles is a typical finding in patients with cryptogenic organizing pneumonia. Diffuse alveolar damage (choice D) features intra-alveolar fibrin (hyaline membranes).
Diagnosis: Cryptogenic organizing pneumonia

42 **The answer is D: Pulmonary hypertension.** Pulmonary hypertension is characterized by thickening of the media of pulmonary muscular arteries. As pulmonary hypertension becomes more severe, there is extensive intimal fibrosis and muscle thickening within arteries and arterioles, which may be occlusive. Churg-Strauss syndrome (choice A) exhibits vasculitis and eosinophilia but is excluded in this case on the basis of a normal CBC. The other choices do not principally affect arteries.
Diagnosis: Pulmonary hypertension

43 **The answer is D: Squamous cell carcinoma.** The vast majority of laryngeal cancers are squamous cell carcinomas and occur principally in smokers. Adenocarcinoma (choice A), leiomyosarcoma (choice B), and small cell carcinoma (choice C) are rarely encountered in the larynx.
Diagnosis: Laryngeal cancer

44 **The answer is E: Pulmonary hamartoma.** Although the term hamartoma implies a malformation, hamartomas are true tumors. They are composed of cartilage, fibromyxoid connective tissue, fat, bone, and occasional smooth muscle. They typically occur in adults, with a peak in the sixth decade of life. Hamartomas are the cause of approximately 10% of "coin" lesions discovered incidentally on chest radiographs. A characteristic "popcorn" pattern of calcification is often seen by X-ray. Cartilage is not encountered in the other choices.
Diagnosis: Pulmonary hamartoma

45 **The answer is E: Squamous cell carcinoma.** Squamous cell carcinoma accounts for 30% of all invasive lung cancers in the United States. Well-differentiated squamous cell carcinoma displays keratin "pearls," which appear as a small round nest of brightly eosinophilic aggregates of keratin surrounded by concentric ("onion skin") layers of squamous cells. Gland formation is exhibited in adenocarcinoma (choices A and C).
Diagnosis: Squamous cell carcinoma of lung

46 **The answer is A: Adenocarcinoma.** Adenocarcinoma usually presents as a peripheral subpleural mass composed of neoplastic gland-like structures. Central (hilar) cancers of the lung can be of any of the histologic types (e.g., choices B, D, and E), whereas peripheral lung cancers are most commonly diagnosed as adenocarcinomas. They are often associated with pleural fibrosis and subpleural scars. At initial presentation, adenocarcinomas usually appear as irregular masses, although they may be so large that they completely replace the entire lobe of the lung. Mesothelioma (choice C) is pleural based.
Diagnosis: Adenocarcinoma of lung

47 **The answer is C: Large cell carcinoma.** Large cell undifferentiated carcinoma is composed of atypical neoplastic cells that do not resemble any normal cells in the lung. These cells do not form glands (like adenocarcinoma) and do not express cytokeratin (choices A and D). Chromogranin is expressed in carcinoid tumors (choice B) and often in small cell carcinomas (choice E).
Diagnosis: Large cell carcinoma of lung

48 **The answer is A: Bronchioloalveolar carcinoma.** Bronchioloalveolar carcinoma is a primary pulmonary adenocarcinoma originating from stem cells in the terminal bronchioles. The cells may be columnar and mucus producing or cuboidal and similar to type II pneumocytes. They tend to grow along the alveolar septa, as depicted in the photomicrograph. A similar growth pattern may be seen in metastatic adenocarcinomas. None of the other tumors produce alveolar mucus or display alveolar spaces lined by a columnar epithelium.
Diagnosis: Bronchioloalveolar carcinoma

49 **The answer is E: Small cell carcinoma.** Small cell carcinoma (previously referred to as "oat-cell" carcinoma) is a highly malignant epithelial tumor of the lung that exhibits neuroendocrine features. It accounts for 20% of all lung cancers and is strongly associated with cigarette smoking. Metastases occur early and are widespread. Carcinoid tumors (choice C) also contain neuroendocrine granules, but the tumor cells are arranged in a distinctive pattern. Moreover, Cushing syndrome is often encountered in patients with small cell carcinoma, but not carcinoid tumor (choice C).
Diagnosis: Small cell carcinoma of lung

50 **The answer is C: Carcinoid tumor.** Carcinoid tumors account for 2% of all primary lung cancers. They comprise a group of neuroendocrine neoplasms derived from the pluripotential basal layer of the respiratory epithelium. Carcinoid tumors occur most often in the wall of the major bronchus and may protrude into its lumen. The tumors are characterized by an organoid growth pattern and uniform cytologic features. Carcinoid tumors exhibit a neuroendocrine differentiation similar to that of resident Kulchitsky cells. The indolent nature of carcinoid tumors is reflected in the finding that half of the patients are asymptomatic at the time of presentation, but regional lymph node metastases occur in 20% of patients. Atypical carcinoids exhibit a more aggressive behavior. Neuroendocrine features are absent in the other tumors.
Diagnosis: Carcinoid tumor of lung

51 **The answer is D: Malignant mesothelioma.** Mesothelioma is a malignant neoplasm of mesothelial cells that is most common in the pleura, but also occurs in the peritoneum, pericardium, and the tunica vaginalis of the testis. The tumor is strongly linked to occupational inhalation of asbestos. Patients are often first seen with a pleural effusion or a pleural mass, chest pain, and nonspecific symptoms, such as weight loss and malaise. Pleural mesotheliomas tend to spread locally and extensively within the chest cavity, but do not typically invade the pulmonary parenchyma. Widespread metastases can occur. Mesothelioma is typically composed of both epithelial and sarcomatous elements (i.e., biphasic pattern). The other choices do not ordinarily encase the lung.
Diagnosis: Malignant mesothelioma

52 **The answer is E: Metastatic carcinoma.** Pulmonary metastases represent the most common neoplasm of the lung. In one third of all fatal cancers, pulmonary metastases are evident at autopsy. Metastatic carcinomas typically present as multiple,

round masses scattered at random throughout the parenchyma of lungs and liver. Although pulmonary adenocarcinoma (choice A) and bronchoalveolar carcinoma (choice B) cannot be excluded on histologic grounds, this patient with ulcerative colitis is predisposed to develop adenocarcinoma of the colon, which most likely accounts for the anemia and lung metastases.

Diagnosis: Metastatic carcinoma of lung

53 **The answer is C: Hydrothorax.** The elevation of hydrostatic pressure in patients with congestive heart failure causes transudation of edema fluid into the pleural cavity (i.e., hydrothorax). Chylothorax (choice A) and hemothorax (choice B) refer to lymph and blood in the pleural space, respectively. Pneumothorax (choice D) and pyothorax (choice E) refer to air and acute inflammatory cells in the pleural space, respectively.

Diagnosis: Congestive heart failure, hydrothorax

54 **The answer is B: Empyema.** Pleuritis (inflammation of the pleura) may result from the extension of any pulmonary infection to the visceral pleura. Causes of pleuritis include bacterial infections, viral infections, and pulmonary infarction involving the surface of the lung. Pyothorax refers to a turbid effusion containing many neutrophils. Empyema is a variant of pyothorax in which thick pus accumulates within the pleural cavity, often with loculation and fibrosis. Hydrothorax (choice D) refers to transudation of edema fluid into the pleural cavity.

Diagnosis: Empyema

55 **The answer is A: Chylothorax.** Chylothorax is defined as the accumulation in the pleural cavity of a milky, lipid-rich fluid as a result of lymphatic obstruction. It has an ominous portent because obstruction of the lymphatics suggests disease of the lymph nodes in the posterior mediastinum. Chylothorax is thus found as a rare complication of malignant tumors in the mediastinum, such as lymphoma. Empyema (choice B) is a loculated collection of pus with fibrous walls that follows the spread of bacterial infection to the pleural space.

Diagnosis: Chylothorax