11
Pitfalls in the Diagnosis of Pneumonia

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As the diagnosis of pneumonia depends on a careful analysis of historical information, the physical examination, the chest roentgenogram, and selective laboratory values, the "pitfalls in the diagnosis of pneumonia" are concerned with noninfectious entities that may mimic bacterial pneumonia. There are two major areas of diagnostic difficulty facing the clinician who approaches the patient with presumed pneumonia. First, it must be determined if the patient in fact has an infectious explanation for the pulmonary symptomatology and findings, or if the process is noninfectious but has features that mimic an infectious pneumonia (Table 11.1). Second, if the process is infectious, the presentation may be atypical and mimic a noninfectious disorder in certain subpopulations (e.g., compromised hosts, the elderly, children). The essential diagnostic task is to differentiate infectious from noninfectious processes. The most common diagnostic confusion is caused by malignant diseases and, to a lesser extent, collagen-vascular diseases, drug reactions, and radiation pneumonitis.[1–6] The clue to diagnostic pitfalls exists among the historical clues, physical findings, chest film abnormalities, and key laboratory tests. Such pitfalls should be kept in mind to avoid over- or underdiagnosing the infectious pneumonias.

History

When obtaining a history, keep in mind the noninfectious conditions that can mimic an infection so additional information may be found to corroborate the diagnostic impression during the physical examination and subsequent laboratory tests. For example, hemoptysis is a cardinal sign of many diseases but most frequently suggests bronchitis, bronchiectasis, bronchogenic carcinoma, or pulmonary embolus. It is important not to forget that these noninfectious etiologies may mimic an infectious pneumonia presenting with hemoptysis (e.g., *Klebsiella*, *Streptococcus pneu-*

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TABLE 11.1. Noninfectious mimics of pneumonia.

Common	Uncommon
Acute	
Left ventricular failure	Eosinophilic pneumonias
Adult respiratory distress syndrome	Leukoagglutinin reactions
Hypersensitivity pneumonitis	Noncardiogenic pulmonary edema
Systemic lupus erythematosus	
Pulmonary emboli/infarction	
Chronic	
Bronchogenic carcinomas	Eosinophilic pneumonias
Sarcoidosis	Rheumatoid lung
Wegener's granulomatosis	Radiation pneumonitis

moniae, viral influenza, or *Mycobacterium tuberculosis*). Mitral stenosis is an often forgotten cause of hemoptysis, and its presence is suggested by characteristic findings on auscultation of the heart during the physical examination. Similarly, pleuritic chest pain may be infectious or noninfectious. Without an associated pulmonary infiltrate, one should always think of costochondritis due to coxsackie B viruses, pulmonary embolism, or metastatic carcinoma to a rib before considering the diagnosis of a bacterial pneumonia.[2]

Usually there are historical features that suggest the diagnosis before the chest film or other tests confirm it. It is important to obtain a careful history in terms of previous radiation therapy or medications that may result in a variety of pulmonary reactions that mimic pneumonia. Cough may be an early symptom of pneumonia, but do not forget to consider bronchitis, congestive heart failure, asthma, or bronchogenic carcinoma in such patients before a chest film is ordered. Careful inquiries should be made in terms of a travel history and contact with sick individuals. A history of animal or bird contact is also important especially with respect to the atypical pneumonias (e.g., tularemia, Q fever, psittacosis). The age of the patient suggests age-related diagnostic possibilities.[3,4] For example, malignancy is common in the elderly population but is an unusual cause of pulmonary infiltrates in those under age 40. Using the same line of reasoning, it would be unusual to have the first manifestation of systemic lupus erythematosus (SLE), pneumonitis, in an elderly individual, whereas that is an appropriate diagnostic consideration in a younger patient with the appropriate clinical presentation.[2] Age should not be used to exclude certain diagnoses solely on the basis of low probability, however. Viral influenza and legionnaires' disease are common in elderly patients, but one cannot exclude *Chlamydia pneumoniae* or *Mycoplasma pneumoniae* solely on the basis of advanced age. There are many pitfalls when obtaining a history of conditions that may mimic infectious disorders or vice versa. Such information is best presented in aphoristic form.

Pitfalls

1. Do not forget to inquire about animal contact in a patient with an atypical pneumonia. For example, it is easy to miss the significance of a cat next door having kittens, with airborne *Coxiella* being transmitted via the airborne route to individuals nearby.

2. Histoplasmosis is commonly associated with hilar lymph node calcifications without lymph node enlargement.

3. A coin lesion in a patient with dog contact suggests *Dirofilaria immitis*.

4. In children with a sore throat and pneumonia, be careful not to diagnose bacterial pneumonia, as this picture is a common presentation of adenoviral pneumonitis.

5. Do not overlook the seasonal importance of certain infections; for example, legionnaires' pneumonitis is most common during early fall, whereas viral influenza is most common during late winter or early spring. Influenza in the fall is considered legionnaires' disease until proved otherwise.

6. Alcoholics with cirrhosis suggests *M. tuberculosis* or malignancy.

7. In elderly populations, do not exclude *Mycoplasma* pneumonia or *Chlamydia* pneumoniae (TWAR agent) pneumonia solely on the basis of advanced age. These pneumonias are less common than *Hemophilus influenzae*, *Klebsiella*, or legionnaires' pneumonia in this age group but nevertheless do occur.

8. Be careful not to overlook a history of mild, transient pulmonary hemorrhage in a patient with gastroenteritis and guaiac-positive stool; it suggests *Strongyloides*.

9. Cytomegalovirus (CMV) pneumonitis occurs within the first 6 months after renal transplantation but is uncommon after this time.

10. Radiation pneumonitis develops 2 months after the course of radiation therapy in the fields of irradiated lung.

11. If there is a history of travel to Southeast Asia, one should not overlook the possibility of tuberculosis, melioidosis, or paragonamiasis. Hemoptysis is an important clue to each of these disorders.

12. Do not forget that a history of sinusitis does not necessarily suggest a bacterial process and may be the clue to Wegener's granulomatosis.

13. A nonproductive cough suggests bronchogenic carcinoma, heart failure, or infectious etiologies.

14. Hemoptysis may occur with bronchiectasis, bronchitis, lung abscess, necrotizing bacterial pneumonias, fungal pneumonias,, and neoplasms. In addition, Goodpasture syndrome, Wegener's granulomatosis, and idiopathic hemosiderosis should be considered in the differential diagnosis of hemoptysis. Mitral stenosis is often forgotten as a cause of mild hemoptysis.

15. Acute hoarseness is usually caused by viruses rather than bacteria. However, be careful not to miss *Candida*, which may present with hoarseness and dysphasia.

16. Hoarseness may be the presenting symptom of a pancoast lesion (superior sulcus tumor/squamous cell carcinoma) or a dissecting aortic aneurysm.

17. Community-acquired pneumonia in normal hosts does not present with septic shock.

18. A patient with pneumonia and a sore throat is not likely to have *H. influenzae* or *S. pneumoniae* pneumonia.

19. Hoarseness in a patient with pneumonia suggests *C. pneumoniae* acutely and *M. tuberculosis* if the hoarseness is chronic.

20. Someone who develops shortness of breath acutely may have developed a spontaneous pneumothorax. If pneumothorax is not due to bullous disease, consider legionnaires' disease, eosinophilic granuloma, or osteogenic sarcoma.

21. A history of nightsweats suggests not only *M. tuberculosis* or histoplasmosis but lymphoma as well.

22. Mental confusion may be present with a severe systemic infection, but it may also be the clue to *Legionella* pneumonia. Pneumonia and abdominal pain points to a diagnosis of legionnaires' disease.

23. Do not forget that *Neisseria meningitidis* is a cause of pneumonia in asplenic individuals in addition to the pneumococcus and *H. influenzae*.

24. A drug history is all-important when sorting out pulmonary drug reactions. Acute pulmonary drug reactions may present as pulmonary hemorrhage or noncardiac pulmonary edema. Subacute pulmonary drug reactions manifest as drug-induced lupus or hypersensitivity pneumonitis, whereas chronic pulmonary infiltrates are characteristic of illicit drug abuse and certain drug reactions (e.g., gold or nitrofurantoin).

25. Hemoptysis may occur with tuberculous, *Klebsiella*, pneumococcal, or viral influenza, but do not overlook the more common noninfectious etiologies of hemoptysis (i.e., mitral stenosis, pulmonary embolism, bronchogenic carcinoma, bronchiectasis).

26. Dyspnea out of proportion to clinical findings or the chest film appearance suggests an interstitial disease such as sarcoidosis or interstitial fibrosis. Only relatively few infections present with disproportionate dyspnea (e.g., viral influenza or *Pneumocystis carinii* in a compromised host).

27. Obscure chest pain may be due to a preeruptive phase of herpes zoster, costochondritis (Tietze syndrome), or postpericardiotomy syndrome (Dressler syndrome), but these disease entities are not usually associated with pulmonary infiltrates.

28. Pleuritic chest pain argues against the diagnosis of atypical pneumonia (except *Legionella*) and viral pneumonia (except viral influenza).

29. Be careful not to miss a history of medications (e.g., nitrofurantoin, sulfonamides, bleomycin, gold salts, nitrosoureas, chlorthiazide, busulfan,

methotrexate) or radiation therapy, which may suggest a drug-induced injury or radiation pneumonitis mimicking pneumonia.

30. Always inquire about environmental exposure to inhaled fumes/dusts (e.g., silica, asbestos, talc, sugar cane, beryllium, chlorine, sulfur dioxide), which could explain an undiagnosed pulmonary infiltrate.

31. A history of cough with a negative chest film suggests congestive heart failure, asthma, bronchitis, bronchogenic carcinoma, or bronchial adenoma.

32. The absence of fever in a patient with pneumonia is unusual in the nonelderly, immunocompetent adult.

33. Wheezing by an adult patient with a pulmonary infiltrate almost never indicates an infectious process; the exceptions include endobronchial tuberculosis and postobstructive bacterial pneumonia. Multiple small pulmonary emboli and congestive heart failure are common causes and may be the clue to Churg-Strauss granulomatosis.

Physical Diagnosis

Avoiding pitfalls during the physical examination involves correct interpretation of physical findings and their association with the appropriate clinical entity. A good example is found in the case of clubbing, which is usually associated with cyanotic heart disease, suppurative lung disease, tuberculosis, or bronchogenic carcinoma. Although clubbing occurs with primary biliary cirrhosis and inflammatory bowel disease, these entities are not associated with pulmonary infiltrates and therefore cause no diagnostic difficulty. Painful clubbing immediately suggests bronchogenic carcinoma as the etiology, and a careful search for unidigital clubbing would point to the diagnosis of sarcoidosis.[2,3] The physical findings are best interpreted in light of the history, and when these date or considered together certain diseases are immediately eliminated as diagnostic possibilities (e.g., cyanotic heart disease).

The finding of a pleural effusion on physical examination is of great diagnostic importance because it suggests a wide variety of infectious and noninfectious etiologies. It also provides an analyzable fluid that assists in determining the cause of the pleural effusion. The commonest pitfall associated with pleural effusions and bilateral diffuse infiltrates is to ascribe an infectious explanation to this common clinical problem. Bilateral pleural effusions are never due to infection, with or without associated pulmonary infiltrates. Keeping this aphorism in mind, one can eliminate needlessly treating patients with congestive heart failure (CHF) or adult respiratory distress syndrome (ARDS) with antibiotics for nonexistent but presumed pneumonia. Another example is a positive d'Espine's sign, which is usually due to the bilateral hilar adenopathy associated with sarcoidosis. However, a mass lesion strategically placed between the trachea and the spine would also result in d'Espine's sign being positive,

but it would be due to malignancy rather than sarcoidosis.[7] In terms of misinterpreting information, it is a common clinical pitfall to fail to consider the diagnosis of *Mycoplasma* pneumonia in a patient with pharyngitis or otitis, especially if the characteristic but uncommon bullous myringitis is absent. The pitfalls possible with physical findings are presented in aphoristic form here.

Pitfalls

1. A patient with pneumonia and perforated nasal septum suggests Wegener's granulomatosis or disseminated histoplasmosis.
2. In a patient with pneumonitis and mouth ulcers, do not forget SLE or disseminated histoplasmosis.
3. Pneumonitis and conjunctivitis in a neonate suggests *C. trachomatis* pneumonia. An important clue is peripheral eosinophilia and low-grade fevers accompanied by diffuse perihilar interstitial markings on the chest film.
4. With *Mycoplasma* pneumonia, otitis is more common than bullous meningitis.
5. Splenomegaly in a patient with pneumonia suggests Q fever, disseminated tuberculosis, histoplasmosis, or lymphoma.
6. A pulse-temperature deficit (relative bradycardia) is an uncommon finding with pneumonias. If present, however, it suggests legionnaires' disease or pisttacosis.
7. Noninfectious causes of pulmonary infiltrates usually produce temperatures of 102°F or less (e.g., pulmonary embolism, CHF, ARDS). Pulmonary drug reactions are acutely associated with temperature elevations (e.g., nitrofurantoin), but chronic drug reactions are characteristically associated with little or no fever.
8. Clubbing argues against the diagnosis of pulmonary tuberculosis, and unidigital clubbing suggests sarcoidosis.
9. Bronchogenic carcinoma is the usual cause of painful clubbing.
10. Pulmonary edema without signs of heart failure may be due to drug-induced changes in pulmonary capillary permeability (noncardiopulmonary edema), including aspirin, heroin, nitrofurantoin, thiazides, phenylbutazone, and propoxyphene.

Chest Film

The greatest area for diagnostic error lies in misinterpreting the chest film. Many diseases present with similar findings that suggest a bacterial process, and therein lies the diagnostic dilemma. Because the chest film is key to diagnosing an infectious pneumonia, there are many roentgenographic findings that must be clarified before arriving at the diagnosis of a pneumonia or an infectious process in the chest or lungs. For example,

an air bronchogram is correctly considered a sign of consolidation, usually indicative of a bacterial pneumonia; however, one must be wary not to overlook a bronchoalveolar carcinoma or a lymphoma, which occasionally presents in this fashion. Similarly, the bulging fissure sign is usually associated with *Klebsiella* pneumonia but may be found in volume-expanding bacterial pneumonias.[8] Once again, the "great imitator," bronchoalveolar carcinoma, may also present with this finding.[5] Pulmonary infiltrates should be analyzed in terms of their focality, speed of progression and regression, and associated findings (i.e., pulmonary effusions, hilar adenopathy, pulmonary nodules).

Pulmonary infiltrates are usually regarded as the sine qua non for the diagnosis of pneumonia. However, pneumonia without pulmonary infiltrates does occur in specific situations (e.g., very early pneumonia, in patients with endobroncheal tuberculosis, in leukopenic compromised hosts, and in patients with pulmonary emphysema).[8] However, the converse—pulmonary infiltrates without pneumonia—is the more common clinical dilemma. Nodules usually represent granulomatous disease or neoplasia and are rarely associated with pneumonias per se.[9]

In terms of the distribution of pulmonary infiltrates, much has been written with respect to central versus peripheral, upper lobe versus lower lobe, predisposition. This information is presented in asphoristic form below and is useful in a general sense when arriving at a differential diagnosis. For example, peripheral infiltrates except for *Nocardia* and actinomycosis are usually formed on a noninfectious basis. Perihilar infiltrates are characteristic of interstitial diseases (e.g., viral influenza), but one must be careful not to fail to consider radiation pneumonitis or bronchogenic carcinomas.

The rapidity of resolution of a pulmonary infiltrate is most helpful, albeit retrospectively, when determining the cause of the transient evanescent pulmonary infiltrate. Rapidly resolving lesions are virtually never infectious and are most commonly due to CHF, hypersensitivity, or pulmonary drug reactions.[10,11] Slowly resolving pulmonary infiltrates present a much more difficult problem, as many infectious and noninfectious conditions present in this fashion.[12,13] Once again, use of the aphoristic approach and analyzing the chest roentgenogram, in concert with the history and physical examination findings, solve most of the problems without resorting to additional invasive procedures. If there is clinical urgency or if malignancy is a consideration, however, clearly an invasive diagnostic procedure is indicated to arrive at a definitive diagnosis.

Pitfalls

1. In a patient with a "bulging fissure" sign, which usually suggests *Kelbsiella*, *S. pneumoniae*, or *H. influenzae*, do not forget bronchogenic carcinoma, especially bronchoalveolar carcinoma.

2. Solitary nodules are not commonly associated with pulmonary infiltrates. Therefore solitary nodules due to granulomatous diseases (tuberculosis, histoplasmosis), arteriovenous malformations (AVMs), mucoid plugs, *Dirofilaria*, or bronchial adenomas are not usually in cluded in the differential diagnosis of pneumonias.

3. Coccidioidomycosis and sporotrichosis may present with unilateral or bilateral hilar adenopathy.

4. Large bilateral effusions are not usually associated with an infectious etiology. Group A streptococci and primary tuberculosis are the only infectious diseases commonly associated with a large pleural effusion. Bilateral effusions argue strongly against an infectious etiology except in patients with PCP.

5. Consolidation is usually associated with the classic bacterial pneumonias but may be an uncommon feature of legionnaires' disease. The clinician should not forget that bronchoalveolar carcinoma and Wegener's granulomatosis frequently present with consolidative changes.

6. Pneumonia without infiltrates occurs in a few situations: leukopenic compromised host, chronic obstructive pulmonary disease (COPD), endobronchial tuberculosis, or very early pneumonias. Usually, some degree of pulmonary infiltrate is visible on the chest film within 24–48 hours of admission.

7. Minimal pulmonary infiltrates are characteristic of interstitial infection. Characteristically, *Pneumocystis carinii*, *Mycoplasma*, or viral pneumonias may have relatively unimpressive chest film findings.

8. Pulmonary edema is almost always bilateral and symmetric, but be wary of the unilateral pulmonary edema secondary to abnormal lung architecture mimicking pneumonia.

9. In an afebrile patient, peripheral infiltrates, except for actinomycosis and *Nocardia*, usually point to a noninfectious etiology (e.g., drug reaction, adenocarcinoma, large-cell carcinoma, vasculitis, Leoffler syndrome, SLE, or fat emboli).

10. It is unwise to ascribe pulmonary parenchymal involvement to lymphoma unless there is associated hilar adenopathy, which is nearly always bilateral and asymmetric.

11. The resolution of pulmonary infiltrates occurs at varying rates, but rapid resolution/diminution of an infiltrate strongly suggests interstitial fluid shifts (i.e., congestive heart failure).

12. It is unwise to consider sarcoidosis or lymphoma as the diagnosis in a patient with unilateral hilar adenopathy.

13. Be careful not to make the diagnosis of advanced sarcoidosis unless there is typical sparing of the apices.

14. "Eggshell calcification" of the hilar nodes is characteristic of silicosis but rarely is also seen in lymphomas (postradiation therapy) and sarcoidosis.

15. Be careful not to exclude a diagnosis of bronchogenic carcinoma in a patient with unilateral pleural effusion and a pulmonary infiltrate.

Although unilateral effusions are uncommon with most bronchogenic carcinomas, they are commonly found with bronchoalveolar cell carcinoma.

16. Small pleural effusions are common with rheumatoid lungs and SLE but are rare with sarcoidosis.

17. All causes of pulmonary fibrosis affect predominantly the lower lung fields except sarcoidosis, which most often affects the midzones and spares the apices.

18. Single or multiple pulmonary nodules peripherally located are usually neoplastic in origin, whereas centrally located nodes are usually benign (e.g., granulomas).

19. Pulmonary infarction with a pleural effusion is suggested by an elevated hemidiaphragm on the affected side.

Laboratory Tests

Laboratory tests should never be interpreted in a vacuum: They must always be considered in the clinical context of the history, physical examination, and chest film.

Sputum is the most readily available material that can provide either a diagnosis or misleading information for the unwary. First, the sputum must be properly collected and represent a lower respiratory tract specimen. Hence one should guard against overinterpretation of a specimen highly contaminated with epithelial cells, suggesting contamination by oropharyngeal flora. Sputum is not available or is uninterpretable in certain patients. For example, if patients are leukopenic compromised hosts, there are an insufficient number of white blood cells to produce a proper sputum specimen. Conversely, patients with chronic bronchitis produce copious amounts of sputum that is virtually always colonized with multiple organisms; sputum cultures from these patients almost invariably are reported as "normal flora." Sputum is also uninterpretable in the intensive care setting from patients who are intubated or have tracheostomy tubes. The sputum represents the ambient flora in the intensive care setting and does not necessarily represent the pulmonic process deep in the lung parenchyma. In contrast, with community-acquired pneumonias, a properly collected sputum specimen may provide the earliest clue to a definitive diagnosis of bacterial pneumonia, pulmonary tuberculosis, or malignancy.[14,15]

Other helpful laboratory tests are the complete blood count (CBC), platelet count, and erythrocyte sedimentation rate (ESR). The CBC may provide clues to the etiology of the pulmonary infiltrate. For example, typical lymphocytosis suggests a viral etiology, whereas eosinophilia may be the clue to a pulmonary hypersensitivity reaction. Basophilia immediately suggests malignancy, as do nucleated red blood cells. Thrombocytopenia suggests a drug reaction of a viral etiology, whereas thrombocytosis

suggests tuberculosis or malignancy. Analogously, the ESR may be useful when properly combined with other clinical information. For example, if a patient presents with a pulmonary infiltrate, weight loss, fever, and night sweats, the differential diagnosis should include tuberculosis versus malignancy. Because the ESR does not usually exceed 70 mm/hour in uncomplicated pulmonary tuberculosis, finding an ESR of 100 mm/hour in such a patient favors the diagnosis of malignancy.[1,2]

Serum serologies provide another possible diagnostic pitfall for clinicians, especially in the diagnosis of viral pneumonias and atypical pneumonias. It is not commonly appreciated that a serologic response to viral infection takes weeks or months to fully develop. Therefore it is a common error to disregard a diagnosis because the initial acute titers are negative or positive or are minimally elevated. This result is to be expected initially, and the diagnosis is confirmed by a fourfold or greater titer rise with a subsequent sample abtained 6–8 weeks later. The convalescent titer is often forgotten and is not obtained after the patient has left the hospital or is well at home. In contrast, the initial positive titers are the problem in patients presenting with *Mycoplasma* pneumonia. If a patient has a pulmonary infiltrate or *Mycoplasma* is considered, usually an enzyme-linked immunosorbent assay (ELISA) is obtained. When the titer is moderately to highly elevated, the pulmonary infiltrate is ascribed to *Mycoplasma*. This diagnostic pitfall can be avoided if one remembers that the ELISA titer measures predominantly the immunoglobulin G (IgG) antibody response, indicating past exposure to the organism. Acute infection requires either a fourfold increase in IgG titers with paired specimens or, more usefully, a positive IgM *Mycoplasma* titer and a positive cold agglutinin titer at 1:64 or more. Obviously, serologic tests are useful for the diagnosis of collagen-vascular diseases as well as some of the fungal pneumonias.

Positive blood cultures rarely cause diagnostic confusion, as there are rarely false positive blood cultures found in association with a pulmonary infiltrate. Organisms that are common denizens of the skin (e.g., *S. aureus*, *S. epidermidis*, enterococcus, *S. viridans*) are uncommon causes of pulmonary infections. When *S. aureus* pneumonia is present, the patient is clinically ill with a readily recognizable syndrome complex, and the diagnosis does not depend on blood culture positivity.[3,4] The aphorisms associated with laboratory tests are presented here.

Pitfalls

1. Do not forget to obtain blood for cultures (×3) in all patients with pneumonia, as it may provide the only retrospective clue to the diagnosis of the patient who cannot produce sputum.

2. Urinary antigen tests for selected pathogens (e.g., pneumococcus, *H. influenzae*, *Legionella*) may be useful for patients unable to produce

sputum. Remember that these tests may not be positive initially, but they remain positive for a long time after the initial infection.

3. A transtracheal aspirate does not necessarily guarantee a lower respiratory tract specimen, as the catheter is often misdirected into the oropharynx.

4. Bronchoalveolar lavage (BAL), if positive, can confirm the diagnosis of *Pneumocytis carinii* pneumonia (PCP) in a human immunodeficiency virus (HIV)-infected patient; however, because PCP is an interstitial disease, a negative BAL does not rule out PCP.

5. Do not rely on sputum in the intensive care unit to diagnose nosocomial pneumonia, as it reflects the flora in the intensive care setting and not that of the lower respiratory tract. Therapy should not be based on sputum samples from endotracheal or tracheostomy site specimens).

6. Positive *Legionella* direct fluorescent antibody (DFA) sputum smears quickly become negative as appropriate antibiotic therapy is begun.

7. Negative *Legionella* titers in a patient presenting with possible *Legionella*, argues for rather than against the diagnosis. Remember, it takes 2–3 weeks for titers to begin to rise and 6–8 weeks for the titers to peak. Also remember that early therapy may delay, blunt, or eliminate the titer rise and eliminate proof of the diagnosis.

8. Be careful not to overinterpret an elevated *Mycoplasma* ELISA titer in a patient with an acute pulmonary infiltrate. *Mycoplasma* ELISA titers measure both IgM, and IgG (predominantly) antibodies and usually reflect prior exposure rather than acute disease. IgM *Mycoplasma* titers detect acute disease, as do elevated cold agglutinin titers of 1:64 or more.

9. The "agglutination association test" readily differentiates cold agglutinins on a viral or *Mycoplasma* basis if the cold agglutinin titer is 1:64 or more.

10. A sputum sample containing squamous epithelial cells suggests upper respiratory contamination and should not be processed or its results overinterpreted.

11. *Candida* does not cause pneumonia. Be careful not to diagnose *Candida* pneumonia on the basis of BAL or protected brush biopsy specimens, where oropharyngeal contamination is common with *Candida* and unavoidable when doing the procedure.

12. An elevated white blood cell (WBC) count or "shift to the left" does not always signify infection. Such shifts of the peripheral WBC count most commonly reflect stress rather than infection.

13. Certain organisms are frequent "colonizers" of sputum in the intensive care setting but are rarely pathogens. Be careful not to "chase" endotracheal aspirates that grow *Achromobacter*, *Enterobacter*, *Flavimonas*, non-*aeruginosa Pseudomonas*, or *Xanthomonas*.

14. Sputum samples from patients with aspiration pneumonia or COPD are notoriously misleading and should not be used to guide therapy. Coverage should be directed against the usual pathogens (e.g., *S. pneu-*

moniae, group A streptococci, *H. influenzae*) rather than relying on sputum data in COPD patients.

15. No polymorphonuclear neutrophils (PMNs) in the sputum in a patient with atypical pneumonia suggests Q fever.

16. Eosinophils in sputum suggest bronchopulmonary aspergillosis in a chronic asthmatic rather than a drug reaction.

17. Sputum assessment is usually misleading in nosocomial pneumonia or leukopenic patients. Empiric therapy should be based on the usual pathogen patterns rather than relying on sputum data.

Mimics

The most common "mimics" of an infectious pulmonary process are malignancies, collagen-vascular diseases, drug reactions, and radiation pneumonitis.[16–18] Therefore utilizing a history, physical examination, chest film, and selected laboratory tests, the clinician should analyze all the diagnostic data to arrive at a working differential diagnosis.

Patients with carcinoma usually present with a subacute course and on chest film show a mass lesion, pleural effusion, or some degree of nodal involvement.[2] The patients with collagen-vascular diseases (e.g., sarcoidosis) usually have extrapulmonary manifestations of these systemic illnesses. Rarely, pulmonary manifestations are the sole or initial finding in rheumatoid arthritis, sarcoidosis, or SLE.[18] This situation is the exception rather than the rule, however, and one must be careful to avoid ascribing these abnormalities to other disease processes. Pulmonary drug reactions depend largely on an adequate history of appropriate drug exposure and may present acutely with pulmonary hemorrhage or pulmonary edema, subacutely or chronically with chronic pulmonary infiltrates and fibrosis. Acute pulmonary reactions are associated with migratory pulmonary infiltrates and peripheral eosinophilia with variable degrees of fever, whereas, in general, chronic pulmonary reactions are characterized by a lack of peripheral eosinophilia, little or no fever, but chronic progressive bilateral and symmetric changes on the chest film[16] (Tables 11.2 and 11.3). The distribution of the lesions is not as important as the appropriate history and evolution in time of the infiltrates for arriving at a proper diagnosis. One should be familiar with the entities associated with noncardiac pulmonary edema, as well as drug-induced SLE. Radiation pneumonitis is suggested by the distribution on the chest film over the irradiated lung fields, as well as a history of irradiation of the chest.[2]

Once again, a diagnostic impression is gained from the "flavor" of the patient's presentation, taking into account all aspects of the history and physical and the proper interpretation of laboratory tests weighed against the appearance of the chest film. In some cases the diagnosis can

TABLE 11.2. Pneumonia: pulmonary drug reactions.

Acute pulmonary infiltrates		Subacute pulmonary infiltrates		Chronic pulmonary infiltrates
Noncardiac pulmonary edema	Pulmonary hemorrhage	Hypersensitivity pneumonitis	Drug-induced pneumonitis	Hypersensitivity: pneumonitis/ pulmonary fibrosis
Nitrofurantoin	Nitrofurantoin	Nitrofurantoin	Procainamide	Nitrofurantoin
Amphotericin B	Anticoagulants	Sulfasalzine	Hydralazine	Sulfasalazine
Acetylsalicylic acid		Isoniazid	Isoniazid	Gold
Opiates		*p*-Aminosalicylic acid	Diphenylhydantoin	Penicillamine
β-Sympathomimetics		Penicillin	Methydopa	Amiodarone
Hydrochlorothiazide			Penicillin	Tocainide
		Gold	Sulfonamides	Methysergide
		Diphenylhydantoin		Intravenous drug abuse
		Carbamazepine		
		Imipramine		
		Sulfonamides		
		Naproxen		
		Penicillamine		
		Hydrazaline		
		Chlorpropramide		
		Dantrolene		

TABLE 11.3. Pneumonias: cancer chemotherapy and drug-induced pulmonary infiltrates.

Drug	Clinical examination	Chest film	Course/outcome
Cyclophosphamide	Period between institution of drug and onset of symptoms variable: 2 weeks to 13 years; toxicity possible after drug is discontinued	Diffuse interstitial infiltrates; acute pulmonary edema pattern	Recovery may follow if drug stopped
Methothrexate	Fever, headache, malasie, dyspnea; peripheral eosinophilia 50%; skin rash 15%	Bibasilar infiltrates; pleural effusion rare	Recovery 1–6 weeks if drug stopped
Chlorambucil	Fever, anorexia, cough month to years after drug	Bibasilar interstitial infiltrates	Response to glucocorticoids variable; recovery may follow if drug stopped
Cytosine arabinoside	Noncardiogenic pulmonary edema within 4 weeks of taking drug or discontinuing it	Diffuse interstitial infiltrates	Fatal noncardiogenic pulmonary edema
Busulfan	Subacute onset of symptoms occurs during drug therapy	Diffuse pattern, intersitital or acinar; pleural effusion rare	Usually no recovery even if drug stopped
Azathioprine	Fever, dyspnea	Diffuse intersitital infiltrates	Recover may follow if drug stopped

be determined noninvasively; for example, serologic tests for fungi or *Dirofilaria* can help rule in infectious etiologies, and anti-native DNA, antinuclear antibody (ANA) titers, and the rheumatoid factor test can help point to a collagen-vascular disease.[17–20] The presence of a pleural effusion is of great importance for the diagnosis of collagen-vascular diseases and malignancy and to a lesser extent for pulmonary embolic disease or pulmonary drug reactions. Once again, rarely is a single finding pathognomonic; rather, all findings must be considered together in the proper clinical context, which goes far for determining a definitive diagnosis[1] (Table 11.4). The aphorisms for malignant disease, collagen-vascular disease, drug reactions, radiation pneumonitis, and miscellaneous conditions are presented below.

Neoplastic Pitfalls

1. Hilar enlargement is frequently associated with middle mediastinal adenopathy. The most common causes of unilateral hilar adenopathy are bronchogenic carcinomas, particularly squamous cell or small-cell anaplastic carcinomas, primary tuberculosis, fungal infections, lymphomas, and metastatic carcinomas.

2. A fine reticular pattern on chest film in association with hilar adenopathy never indicates an infectious process. The differential diagnosis includes sarcoidosis, lymphoma, leukemia, small-cell carcinoma, metastases, or silicosis.

3. Unilateral hilar adenopathy secondary to lymphoma is unusual. Involvement is usually asymmetric but bilateral with lymphomas.

4. Lymphangitic spread of a carcinoma may also rarely lead to bilateral hilar adenopathy.

5. Viruses may cause bilateral hilar adenopathy in children but not commonly in adults. Bilateral hilar adenopathy secondary to malignancy is more common in children.

6. Leukemias occasionally are associated with bilateral hilar adenopathy in concert with bronchopulmonary adenopathy. Pleural effusion and parenchymal lung involvement with leukemia occurs in 25% of patients.

7. Lymphoma is associated with hilar adenopathy where it is calcified following radiation therapy.

8. Bilateral hilar adenopathy in acquired immunodeficiency syndrome (AIDS) patients may be due to pneumonia or AIDS-related lymphomas.

9. With sarcoidosis hilar nodes decrease as the disease progresses; and with lymphoma the nodes increase as the disease progresses.

10. Pseudolymphoma involving the hilar nodes in the absence of a pulmonary infiltrate suggests phenytoin (Dilantin).

11. Ten percent of bronchogenic carcinomas cavitate. Cavitation is most common with squamous cell carcinomas and never occurs in small-cell anaplastic (oat cell) carcinomas.

TABLE 11.4. Pneumonia: eosinophilic pulmonary infiltrates.

Disorder	History of asthma	Signs and symptoms	Laboratory tests	Diagnosis
Drug-induced eosinophilic pneumonias		Dry cough, fever, chills, dyspnea	Chest film: patchy infiltrates, eosinophic pleural effusions in some Blood eosinophilia	Withdrawal of causative drug results in rapid improvement
Chronic eosinophilic pneumonia	±	High fevers, night sweats, chills, dyspnea, weight loss, sometimes coexisting bronchial asthma	Chest film: peripheral infiltrates Blood eosinophilia	Lung biopsy: eosinophils with mononuclear cell
Bronchopulmonary aspergillosis		Chronic asthmatics with brownish sputum, wheezing	Fleeting infiltrates on chest film Blood and sputum eosinophilia	↑ Serum *Aspergillus* precipitins; eosinophils and *A. fumigatus* in sputum
Loeffler syndrome	–	Low-grade fever, myalgias, dry cough, not "sick"	Chest film: peripheral densities or fleeting infiltrates Blood and tissue eosinophilia	Benign, acute, self-limiting; diagnosis of exclusion
Churg-Strauss allergic granulomatosis	+	Skin, renal, and CNS involvement with fever, wheezing; mimics CHF	Chest film: nodular densities Blood eosinophilia	Lung biopsy: granulomatous eosinophilia; vessels of different size involved (i.e., vasculitis)
Parasitic infestations	–	Dry cough, not "sick"	Migratory pulmonary infiltrates Blood eosinophilia	*Wuchereria* or *Toxocara* serologies; *Ascaris*, *Ancylostoma*, *Strongyloides* in stools
Hypereosinophilic syndrome	–	Fever, weight loss, hepatosplenomegaly, adenopathy	Migratory pulmonary infiltrates Blood and tissue eosinophilia	Bone marrow: eosinophilic preleukemia

12. Metastases cavitate less commonly than bronchogenic carcinomas and usually have thick-walled cavities. Thin-walled cavities in metastatic lesions suggest a primary cancer of the head or neck. A cavitating lesion with an air-fluid level suggests an abscess or a lymphoma.

13. Air-fluid levels may be found with lymphomas and *S. aureus*, *Klebsiella*, or *Proteus* oat cell lesions. A single thick-walled upper lobe cavity suggests *Klebsiella*.

14. Bronchial adenomas are most common in women 30–50 years of age; they are centrally located and may be associated with an obstructive pneumonia. Hemoptysis occurs in 50%. They have a predilection for the upper and middle lobes; and calcification and cavitation are rare. Twenty percent are solitary peripheral nodules, well circumscribed, and lobulated.

15. Linear stranding is characteristic of carcinoma extending from the lesion toward the pleura. Alveolar cell carcinoma tends to be peripheral and may be associated with an air bronchogram or bulging fissure sign, but cavitation rarely occurs.

16. Calcifications argue against the diagnosis of bronchogenic carcinoma except when carcinoma develops in a calcified scar. Which is usually an adenocarcinoma.

17. Hematogenous metastases are multiple in 75% of cases and solitary in 25%. Pulmonary metastatic lesions rarely cause clinical symptoms.

18. Calcification in a metastatic lesion occurs only with osteogenic sarcomas, mucinous adenocarcinomas, and bone-forming sarcomas.

19. Lymphomas rarely obstruct bronchi and may be associated with air bronchograms. Cavitation is rare. Most cases are associated with hilar or mediastinal adenopathy.

20. Metastatic calcifications due to secondary hyperparathyroidism or multiple myeloma occur predominatly in upper zone lung fields.

21. Solitary nodules that may calcify but are malignant include chondrosarcomas, mucinous adenocarcinomas of the colon or breast, papillary carcinoma of the thyroid, carcinoids, and cystadenomas of the ovary.

22. AVMs are well defined and usually lobulated. Calcification is rare. A feeder vessel is usually present.

23. Commonest metastases to the lungs are from breast, thyroid, kidney, gastrointestinal tract, and tests. In children one sees Wilms' tumor, Ewing's sarcoma, neuroblastoma, or osteogenic sarcoma.

24. Metastatic lesions tend to be peripheral on the lower lobe. Hilar adenopathy and effusions are uncommon. III-defined lesions suggest a primary lesion in the prostate, breast, stomach, or testes. Central nervous system (CNS) tumors rarely metastasize to the lungs.

25. A right pleural effusion is found 65% of the time and a left pleural effusion 10% of the time. Bilateral pleural effusion is seen 20% of the time with Meigs' tumor.

26. The mediastinum shifts away from the hilum if there is a pleural effusion; but if the effusion is due to bronchogenic carcinoma, the

mediastinum deviates toward the tumor. Bilateral effusions are never due to bronchogenic carcinoma.

27. Bilateral effusions are usually due to heart failure, nonbronchogenic carcinomas, metastatic carcinomas, lymphomas, and SLE.

28. Carcinomatous effusions are usually due to bronchogenic carcinomas when associated with cough or chest pain.

29. Malignant effusion is uncommon in individuals under age 40. Malignant pleural effusion is likely if there is splenomegaly, superior vena cava syndrome, hepatomegaly, pelvic mass, clubbing, tibial periostitis, or superclavicular adenopathy.

30. Pleural effusion associated with a fine or reticular parenchymal pattern does not suggest an infectious etiology. Other causes include congestive heart failure, rheumatoid nodules, lymphangitic spread, and leukemias and lymphomas.

31. Bloody pleural effusions suggest a malignant process, thromboembolism, or trauma. Red blood cells (RBCs) are needed to give pleural fluid a red color. More than 100,000 RBCs produce a grossly red pleural fluid.

32. Carcinomatous effusions are usually bloody with a lymphocytic predominance (2000–4000), a normal though slightly depressed glucose level, and pH over 7.3.

33. Among the malignant causes of pleural effusion, only mesotheliomas commonly produce pH less than 7.3. A clue to a mesothelioma is a bloody pleural effusion fluid that is highly viscous.

34. Rapidly occurring pleural effusion suggests hemorrhage or group A streptococcal pneumonia, whereas rapid recurrent accumulation of pleural fluid suggests malignancy.

35. The commonest malignancies with a pleural effusion are lymphomas and alveolar cell carcinoma.

36. Pleural effusion without hilar adenopathy suggests an occult retroperitoneal lymphoma.

37. Diffuse pulmonary nodules with pleural effusions and a normal heart size suggest metastatic carcinoma.

38. The only chest finding with carcinoma of the pancreas is isolated pleural effusion.

39. Pleural effusion with an otherwise normal chest film suggests peripheral carcinogenic carcinoma, metastases, mesothelioma, SLE, rheumatoid arthritis, or primary tuberculosis.

Collagen-Vascular Disease Pitfalls

1. Recurrent pleural effusion with subsequent pleural thickening suggests rheumatoid arthritis or tuberculosis.

2. Patients with sarcoidosis and a pleural effusion should be considered to have tuberculosis or metastatic carcinoma until proved otherwise.

3. Bilateral pleural effusion in SLE patients with cardiomegaly suggests pericardial effusion.

4. Pleural effusion may be a presenting sign of rheumatoid arthritis.

5. Bilateral hilar adenopathy associated with a pleural effusion suggests lymphoma or tuberculosis and argues against the diagnosis of sarcoidosis.

6. "Lobulated" bilateral hilar adenopathy suggests the diagnosis of sarcoidosis. A clear channel between the cardiac shadow and the hilum suggests sarcoidosis versus lymphoma. An enlarged azygos node also suggests sarcoidosis.

7. Five percent of patients with sarcoidosis have eggshell calcifications of the symmetric bilateral hilar adenopathy. Calcifications take more than 6 years to appear and are associated with advanced pulmonary disease.

8. Unilateral or bilateral paratracheal adenopathy suggests sarcoidosis with bilateral or hilar adenopathy.

9. Lymphomas, when associated with paratracheal lymphadenopathy, are usually asymmetric, in contrast to sarcoidosis.

10. The most common cause of bilateral hilar adenopathy is sarcoidosis, which may be mimicked by lymphoma or metastatic carcinoma.

11. Sarcoid presents as unilateral hilar adenopathy in fewer than 1–5% of cases.

12. Rheumatoid nodules may be thick- or thin-walled and have a smooth inner surface; they are most common in the lower lobes.

13. Rheumatoid nodules cavitate commonly but do not calcify. Caplan syndrome nodules occur in crops, and both calcification and cavitation occur.

14. Dressler syndrome usually occurs 1 week after cardiothoracic surgery. Pain is usually pleuritic and may involve the shoulder. Pain after myocardial infarction lasts 1 day only.

15. A miliary pattern on the chest film may be caused by tuberculosis, histoplasmosis, or coccidiodomycosis. There are many noninfectious diseases that may mimic these disorders as well, including eosinophilic granuloma, sarcoidosis, hypersensitivity pneumonitis, carcinoma with lymphangitis spread, lymphoma, or alveolar cell carcinoma.

16. The best way to diagnose miliary tuberculosis is by liver or bone marrow biopsy. The chest film is often negative in miliary tuberculosis patients.

17. In SLE patients recurrences with pleural effusions are the rule; and pleural effusions may be the only sign of lupus pneumonitis.

18. Lupus effusions are never bloody, never large, never full of PMNs; and they never have a low glucose level.

19. Only rheumatoid arthritis and SLE among the collagen-vascular diseases are commonly associated with pleural effusions.

20. Increased pleural fluid protein suggests tuberculosis or rheumatoid arthritis.

21. Rheumatoid arthritis may be associated with a negative chest film.

22. Rheumatoid arthritis is associated with chronic pleural effusions that vary in size, as do the subcutaneous nodules.

23. One-third of rheumatoid effusions are bilateral and are prone to empyema.

24. Rheumatoid effusions are characterized by "debris" and "tadpole-shaped" epithelial cells, as well as by extracellular material.

25. Undetectably low pleural fluid glucose suggests rheumatoid arthritis.

26. A low pleural fluid pH and low glucose level suggest rheumatoid arthritis or tuberculosis, rarely carcinoma.

27. Transudates are due to cirrhosis, congestive heart failure, or nephrosis. Transudates are occasionally seen with pulmonary emboli or sarcoidosis.

Miscellaneous Pitfalls

1. Acute pulmonary drug reactions are frequently associated with pleural effusions, whereas with chronic pulmonary drug reactions effusion is rare.

2. The pleural effusion from a pulmonary embolus takes a few days to develop. PMNs are characteristic, but they are present in low numbers.

3. Ten to fifteen percent of patients with cirrhosis have an effusion, more commonly on the right than on the left.

4. The "shaggy heart" sign may be found with asbestosis or pertussis.

5. Honeycomb lung, which is a generalized reticular nodular pattern, never appears with an infectious process.

6. Empyema can be distinguished from chylothorax by centrifugation, after which, if due to empyema, a clear supernatant results.

7. Abdominal hydatid cysts are multiseptate and usually calcified; calcification does not occur in lung lesions.

8. A regular inner surface of a right lower lobe cavity with pleural effusion suggests amebiasis. A thin-walled cavitary lesion with a "hump" on the inner surface suggests paragonamiasis.

9. Do not confuse pulmonary artery enlargement for unilateral hilar adenopathy. Pulmonary artery enlargement may be due to poststenotic dilatation on the left side, massive pulmonary embolus to one lung, or aortic aneurysm.

10. Silicosis is always symmetric, as is extrinsic allergic alveolitis and chronic berylliosis.

11. Calcification of the hilar lymph nodes is seen in about 5% of patients with silicosis. The anterior and posterior mediastinal, cervical, or intraperitoneal nodes may be calcified as well. Only 1% of patients with coalminers' pneumoconiosis have eggshell calcifications of the hilar nodes.

12. "Eggshell calcifications" of the hilar nodes should not be confused with aortic calcifications and the wall of a saccular aneurysm.

13. Be wary of fibromas and dermoid cysts of the anterior mediastinum with "rim calcifications" mimicking the eggshell calcifications of the hilar nodes.

14. Other causes of symmetric hilar adenopathy include the eosinophilic granuloma, idiopathic pulmonary hemosiderosis, Goodpasture syndrome, and drug-induced pulmonary reactions.

15. Air-fluid levels argue against the diagnosis of Wegener's granulomatosis. Multiple thick-walled cavities bilaterally with an irregular inner surface are characteristic, as the irregular inner surface is due to hemorrhage.

16. Cavitation in a pulmonary infarct suggests septic pulmonary emboli rather than bland pulmonary emboli, as cavitation of bland emboli in infarcts is unusual.

17. Pancreatitis usually produces a left-sided pleural effusion, but it may be on the right or bilateral.

18. "Yellow nail syndrome" is the association of pleural effusion with lymphedema and yellow nails. It is benign and requires no further workup.

19. A chylous pleural effusions is milky in appearance and usually accompanied by an elevated triglyceride level without cholesterol crystals.

20. Peripneumonic effusions may be differentiated from chylous effusions by the cholesterol crystals and normal triglyceride levels in the pleural fluid.

21. One-third of patients with nephrotic syndrome have associated thromboembolism.

22. Most transudates have WBC counts under 1500 cells/mm^3.

23. In the absence of a positive Gram stain, PMNs in low number in the pleural fluid suggest CHF or pulmonary embolism.

24. Pneumothorax may be associated with eosinophilic pleural fluid and
suggests pulmonary thromboembolism or asbestosis.

25. Transudates usually have a normal pH, few WBCs with a lymphocytic predominance, and a normal glucose level.

26. A pleural effusion with ascites suggests Meigs syndrome, nephrosis, cirrhosis, or CHF.

Tuberculosis Pitfalls

1. Pleural calcification indicates empyema, tuberculosis, hemothorax, talc, or asbestos exposure.

2. The only atypical pneumonia with a bloody pleural effusion is tularemia.

3. Pleural effusion argues against the diagnosis of viral pneumonia and is uncommon with *Mycoplasma* pneumonia.

4. Eosinophils argue against the diagnosis of tuberculous pleural effusion.

5. Pleural fluid in tuberculosis may be serosanguineous but is rarely grossly bloody.

6. The higher the lymphocyte count in the pleural fluid, the more likely is tuberculosis.

7. One-third of patients with tuberculosis eventually develop a tuberculous pleural effusion. Axillary pleural pain is a clue to tuberculous effusion.

8. Tuberculosis is not associated with clubbing, eosinophilia, or gross blood in the pleural fluid. A count of more than 3000 WBCs goes against the diagnosis of tuberculous pleural effusion.

9. Tuberculous pleural effusions characteristically have low glucose and elevated protein levels and are prone to spontaneous resolution.

10. Atypical tuberculosis produces smaller effusion than that caused by *M. tuberculosis*.

11. Sixty-five percent of idiopathic pleural effusions in PPD-positive individuals develop tuberculosis within 5 years. The protein in tuberculosis-related pleural effusions is characteristically more than 4 g/dl.

12. Nocardiosis and actinomycosis are associated with empyema and rib involvement. Thick-walled large solitary cavitary lesions, especially of the upper lobes, favor a diagnosis of actinomycosis or nocardiosis.

13. Tuberculosis and coccidioidomycosis may have air-fluid levels.

14. Primary tuberculosis is unilateral 60% of the time. Bilateral node enlargement is rare, and ipsilateral paratracheal node enlargement is present in 40% of cases. There is no hilar adenopathy with reactivation tuberculosis.

15. Tuberculous cavities have a predilection for the apical and posterior segments of the upper lobes and superior segment of the lower lobes.

16. Air-fluid levels argue against the diagnosis of tuberculosis, as does an irregular wall cavity because tuberculous cavities tend to have a smooth inner surface.

17. Pneumatoceles are found in children with staphylococcal pneumonia; less commonly they are seen in adults with PCP and group A streptococcus pneumonia in AIDS patients.

18. Cavitation argues against the diagnosis of *S. pneumoniae* and legionnaires' disease.

19. Most thick-walled cavities become thin-walled over time.

20. The larger the lung cavity, the more likely it is due to anaerobic bacteria.

21. Upper lobe cavitary lesions due to bacteria include chronic *Klebsiella* and *Proteus* lesions, of both which cause upper lobe abscesses. A clue to a *Klebsiella* lesion is the "shaggy border" within the thick-walled cavity.

22. Tropical eosinophilia is occasionally associated with bilateral node involvement when caused by filariasis.

23. Tularemia is characterized by unitaleral hilar node involvement, with "ovoid" parenchymal densities and bloody pleural effusion. Unilateral hilar adenopathy occurs in 25–50% of tularemic pneumonias.

24. Mediastinal widening and hemorrhagic mediastinitis associated with pleural effusion suggest anthrax.

25. Lymph node enlargement is rare in adults with *Mycoplasma* pneumonia but is not uncommon in children. Unilateral ill-defined lower lobe infiltrates are the rule with *Mycoplasma* pneumonia.

Fungal Pitfalls

1. Patients with leukopenia do not usually develop fungal pneumonias until after at least 2 weeks of profound leukopenia.

2. "Satellite calcifications" suggest tuberculosis or histoplasmosis.

3. Leukopenic compromised hosts, when infected with *Mucor*, do not get rhinocerebral mucormycosis; rather, pulmonary mucormycosis develops.

4. A cavitary lesion of the lower lobe is not blastomycosis or cryptococcosis. *Cryptococcus* is characteristically pleura-based, but effusions are uncommon.

5. Calcifications and cavitation are uncommon with coccidioidomycosis.

6. A large lower lobe peripheral lesion without rib involvement favors the diagnosis of cryptococcosis or carcinoma. Cavitation and hilar adenopathy are not features of cryptococcosis.

7. Unlike tuberculosis, coccidioidomycosis has a predilection for the anterior segment of the upper lobes.

8. Histoplasmosis may mimic tuberculosis by having a similar upper lobe location, and it may coexist as a coinfection in the same patient.

9. Hilar adenopathy is a common feature of all fungal pneumonias except blastomycosis.

10. Enlargement of the paratracheal lymph nodes in a patient with coccidioidomycosis may indicate imminent dissemination, as may the disappearance of erythema nodosum.

11. The presence of an ipsilateral paratracheal node in a fungal pneumonia with unilateral hilar adenopathy favors the diagnosis of coccidioidomycosis.

Summary

Noninfectious diseases mimicking the infectious pneumonias usually present with little or no fever. Their presentation is subacute or chronic, and there are associated extrapulmonary laboratory or physical findings. When obtaining the history, doing a physical examination, interpreting the chest film, and interpreting laboratory data, the physician should be

on the lookout for clues to a noninfectious explanation for the pulmonary symptomatology or the roentgengraphic findings. Almost always it is possible, by combining various diagnostic parameters and using the aphoristic approach, to differentiate between infectious and noninfectious processes as well as to arrive at a working diagnosis within each of the broad diagnostic categories (e.g., malignancies, collagen-vascular diseases, drug hypersensitivy reactions). The definitive diagnosis usually requires an invasive diagnostic procedure in the case of malignancies, but the diagnosis may be made by noninvasive means for a variety of other disorders (e.g., angiotensin-converting enzyme in sarcoidosis, ANA and SLE, eggs or parasites in the stools of a patient with pulmonary infiltrates and eosinophilia).

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