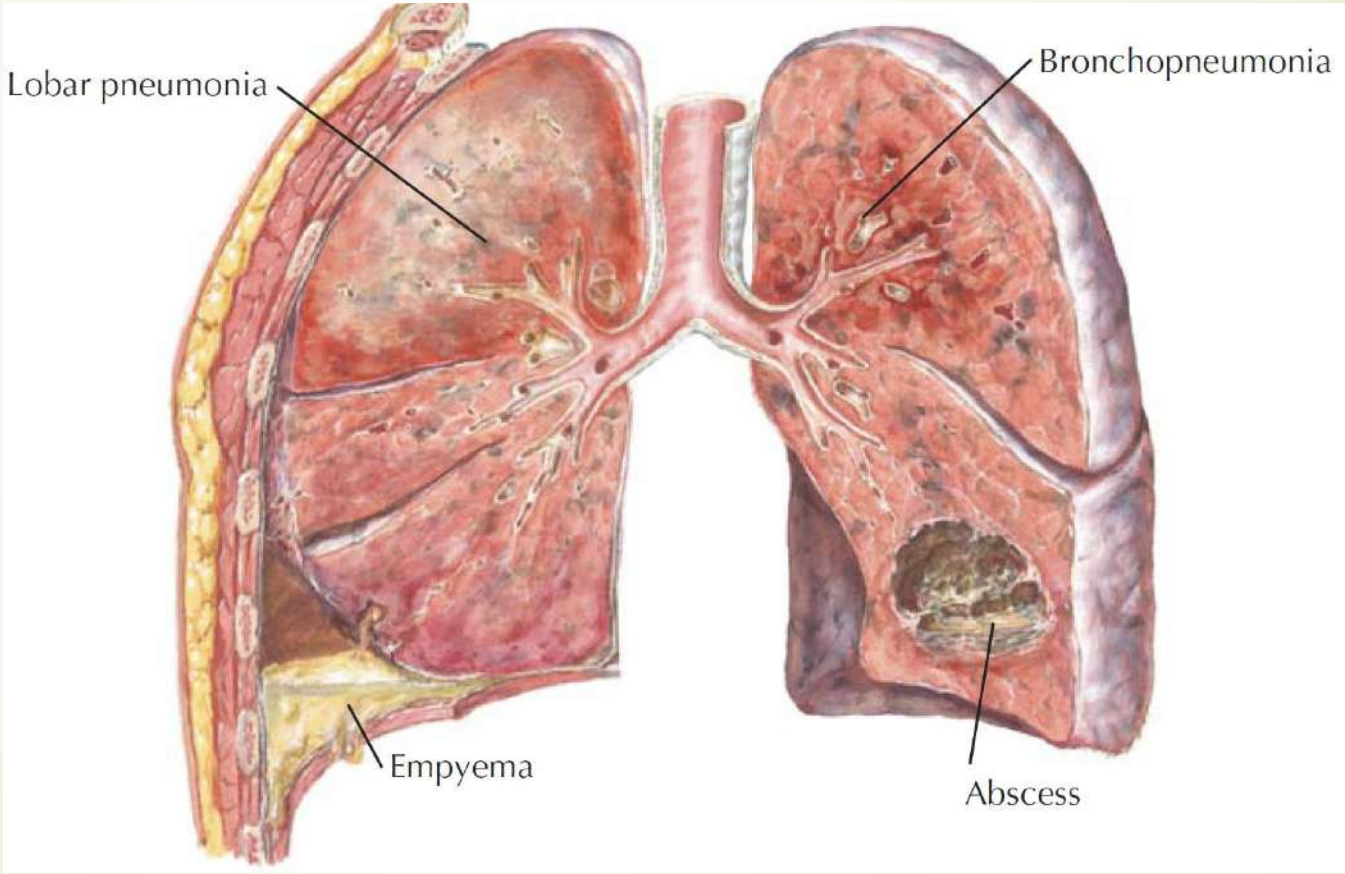
Community-acquired pneumonia diagnosis and treatment

Presented By: Dr.Fakhrmousavi.MD.Pulmonologist

Assistant Professor of Pulmonary Diseases

Guilan University of Medical Sciences

- Community-acquired pneumonia (CAP) is one of the most commonly diagnosed illnesses worldwide. The clinical presentation of CAP varies, ranging from mild disease characterized by limited shortness of breath and productive cough to severe disease characterized by fever, respiratory distress, and sepsis.

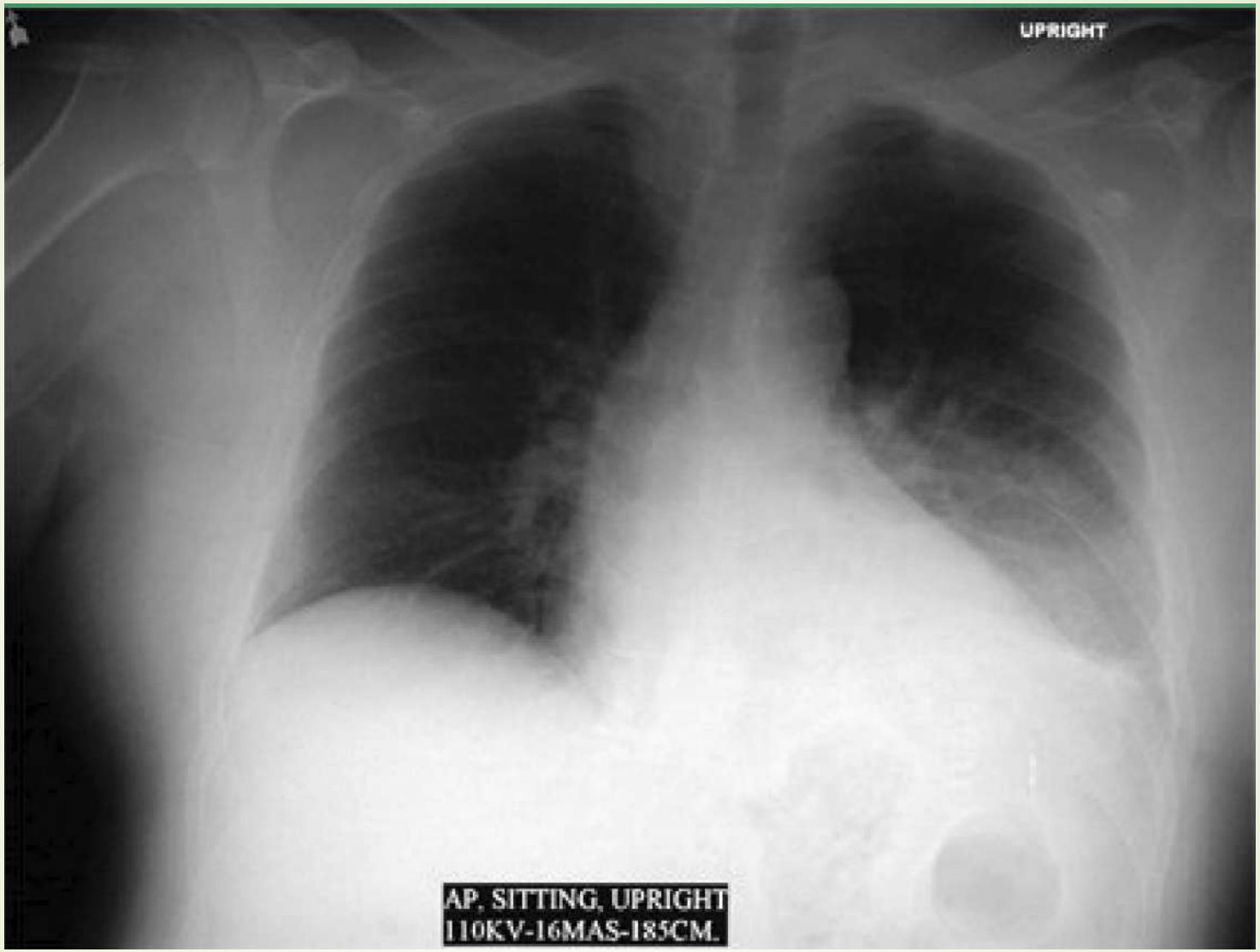


- In patients with a clinically compatible syndrome, the demonstration of an infiltrate on chest imaging is generally sufficient to establish an initial working diagnosis and start empiric therapy.

- However, this combination of findings is ultimately nonspecific and is shared among many cardiopulmonary disorders. Thus, it is important to remain attentive to the possibility of an alternate diagnosis as a patient's course evolves

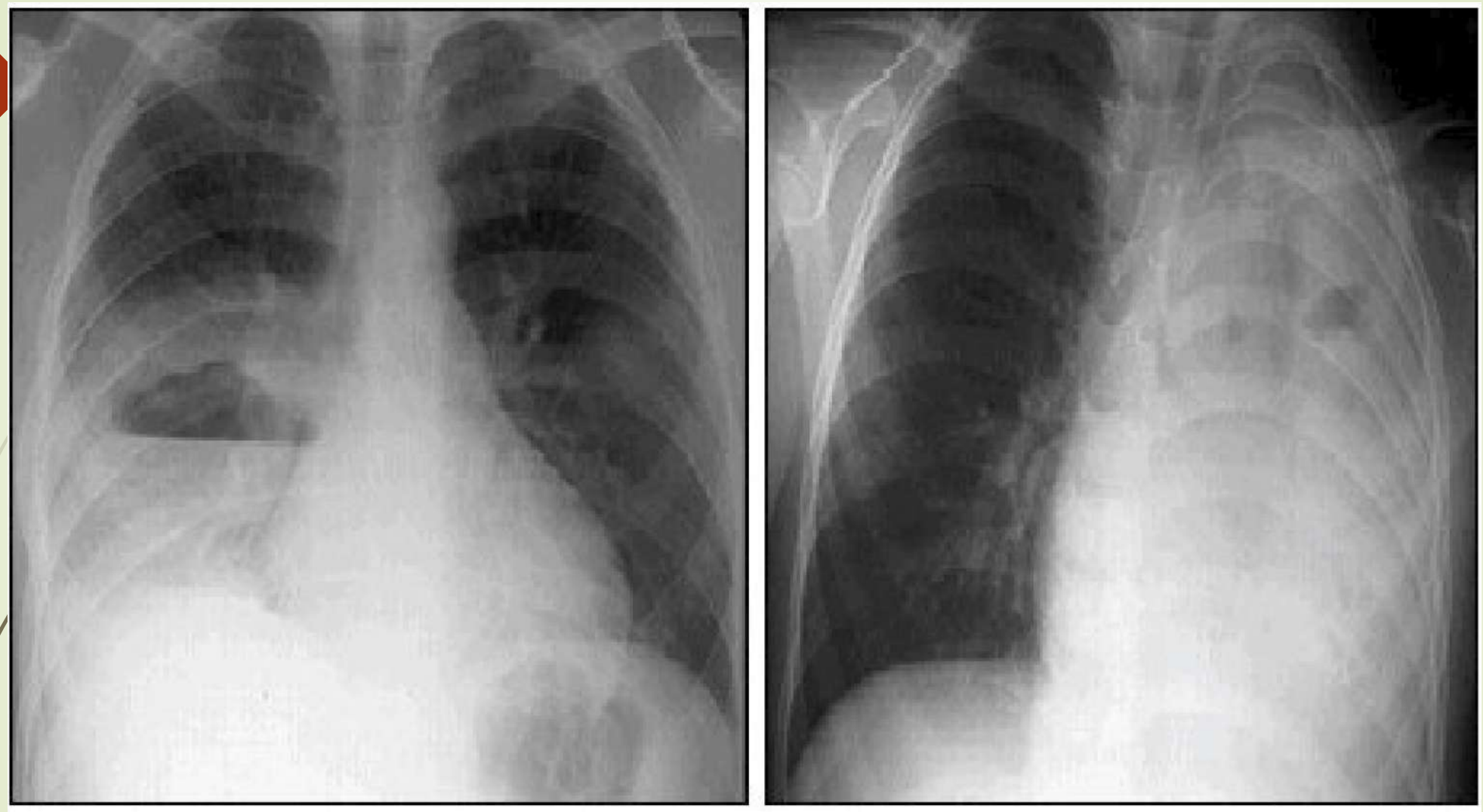
For most patients with suspected CAP, we obtain posteroanterior and lateral chest radiographs. Radiographic findings consistent with the diagnosis of CAP include lobar consolidations ,interstitial infiltrates, and/or cavitations.

Pneumococcal pneumonia chest radiograph



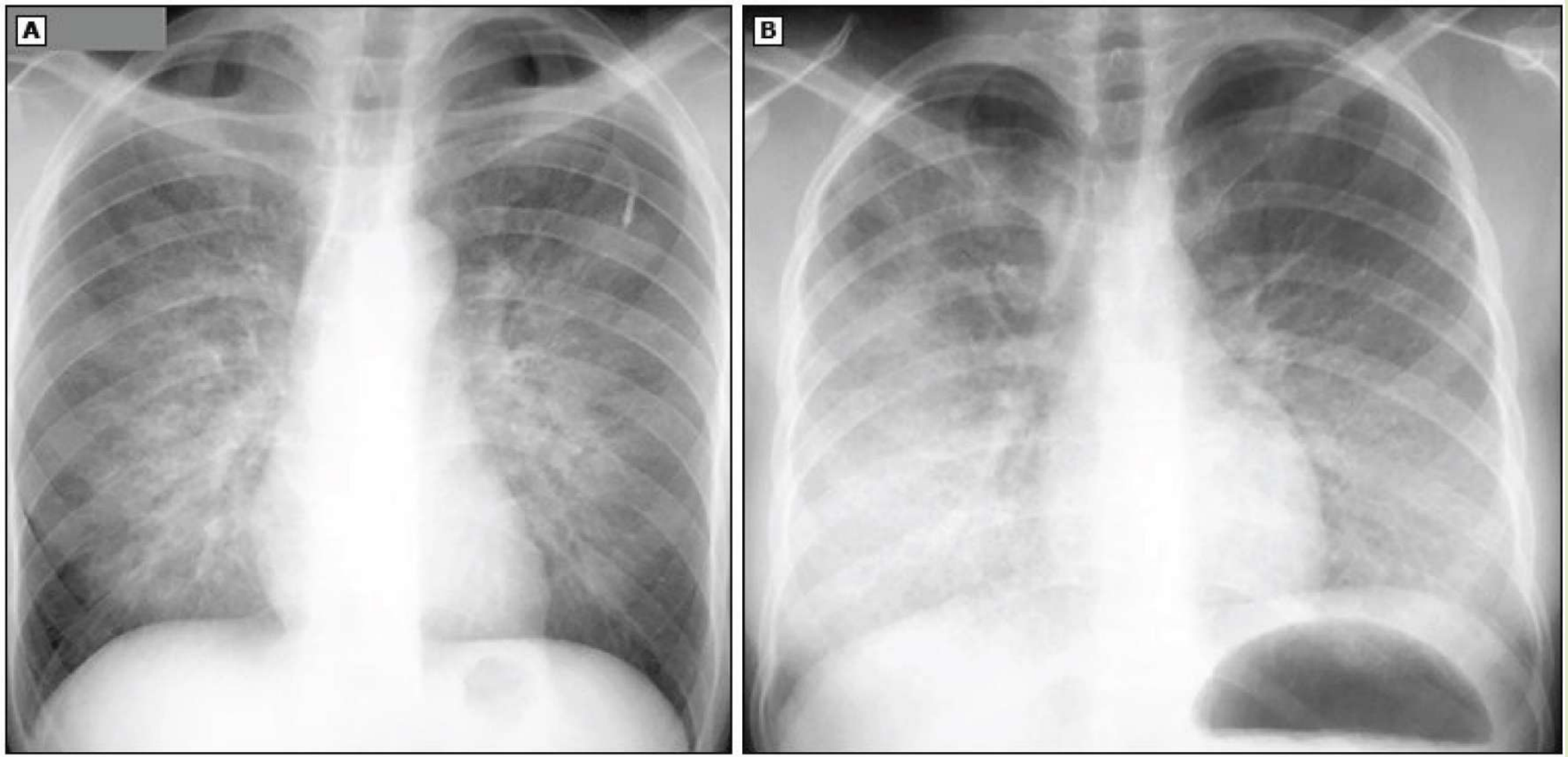
64-year-old male with insulin-dependent diabetes mellitus. He was admitted with bacteremic pneumococcal pneumonia. Note the left lower lobe opacity

Complications of *Streptococcus pneumoniae* pneumonia



Radiographic images of the complications of pneumococcal pneumonia.
(Left panel) Lung abscess with an air-fluid level in the right lung. Abscess cavity material is nearly always culture positive, and patients commonly defervesce within 48 hours of interventional drainage.
(Right panel) Radiograph of necrotizing pneumonia in the left lung.

Chest radiograph of *Pneumocystis jirovecii* pneumonia with ground-glass opacification



Chest radiograph in patients with *Pneumocystis jirovecii* pneumonia, one that shows perihilar ground-glass opacification with early consolidation (A) and the other that shows left-sided ground-glass opacification and right-sided early consolidation (B).

- Although certain radiographic features suggest specific causes of pneumonia (eg, lobar consolidations suggest infection with typical bacterial pathogens), radiographic appearance alone cannot reliably differentiate among etiologies.

- In selected cases, it is reasonable to make a clinical diagnosis without chest imaging in otherwise healthy patients with highly compatible syndromes (eg, acute onset, fever, cough, and signs of consolidation on physical examination) and lack of concern for other causes

- However, clinical features alone have limited diagnostic accuracy, thus, we typically reserve this option for circumstances in which chest radiography cannot be easily obtained and the patient can be closely followed.

- Obtaining a CT scan is also reasonable when CAP is suspected but the clinical presentation is atypical or the patient has possible alternative explanations for their syndrome (eg, chronic obstructive pulmonary disease exacerbation, pulmonary edema, atelectasis, etc).

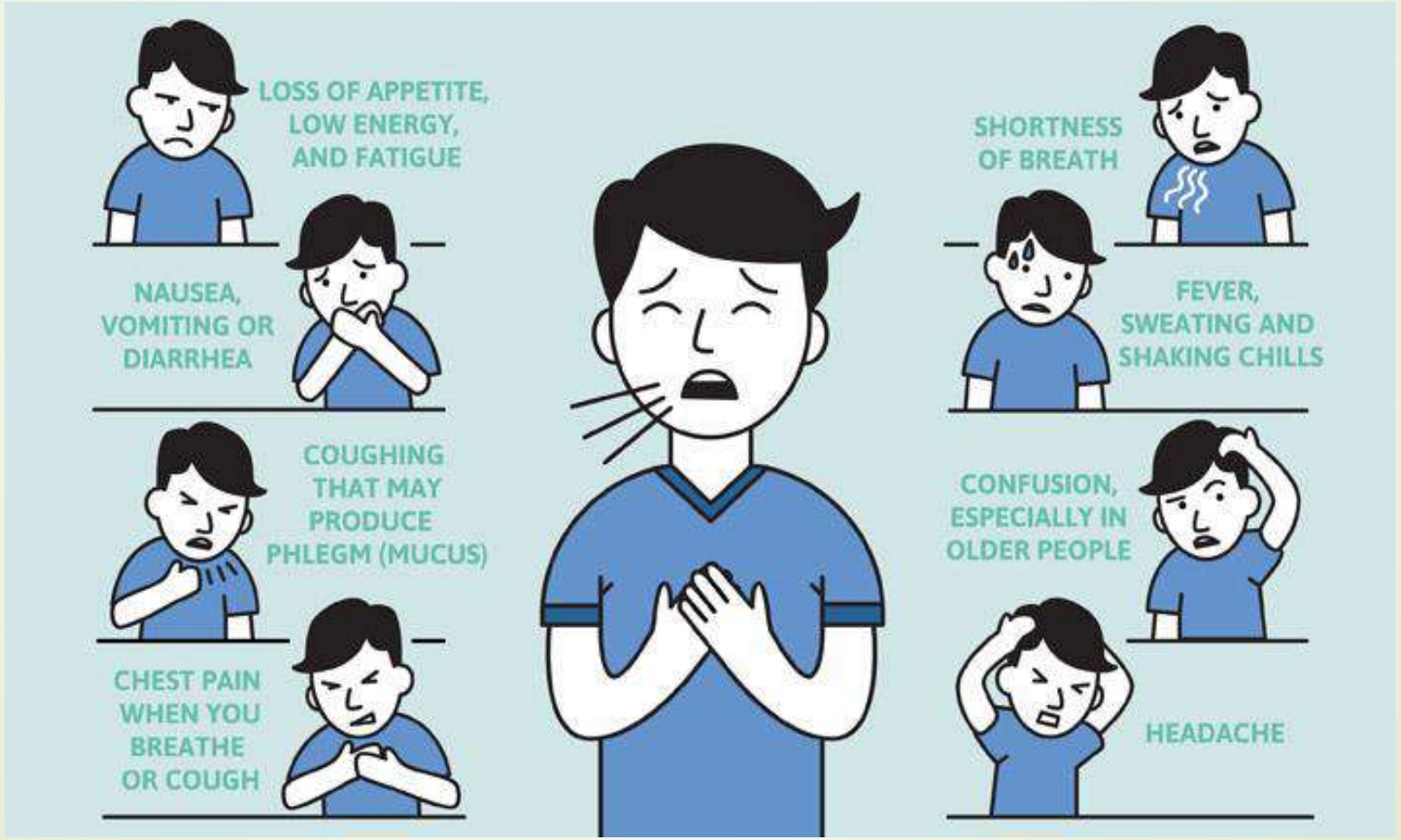
Ct scan role

- In such cases, CT scanning can help confirm or exclude the diagnosis of pneumonia. Because there is no direct evidence to suggest that CT scanning improves outcomes for most patients and cost is high, we do not routinely obtain CT scans when evaluating patients for CAP.

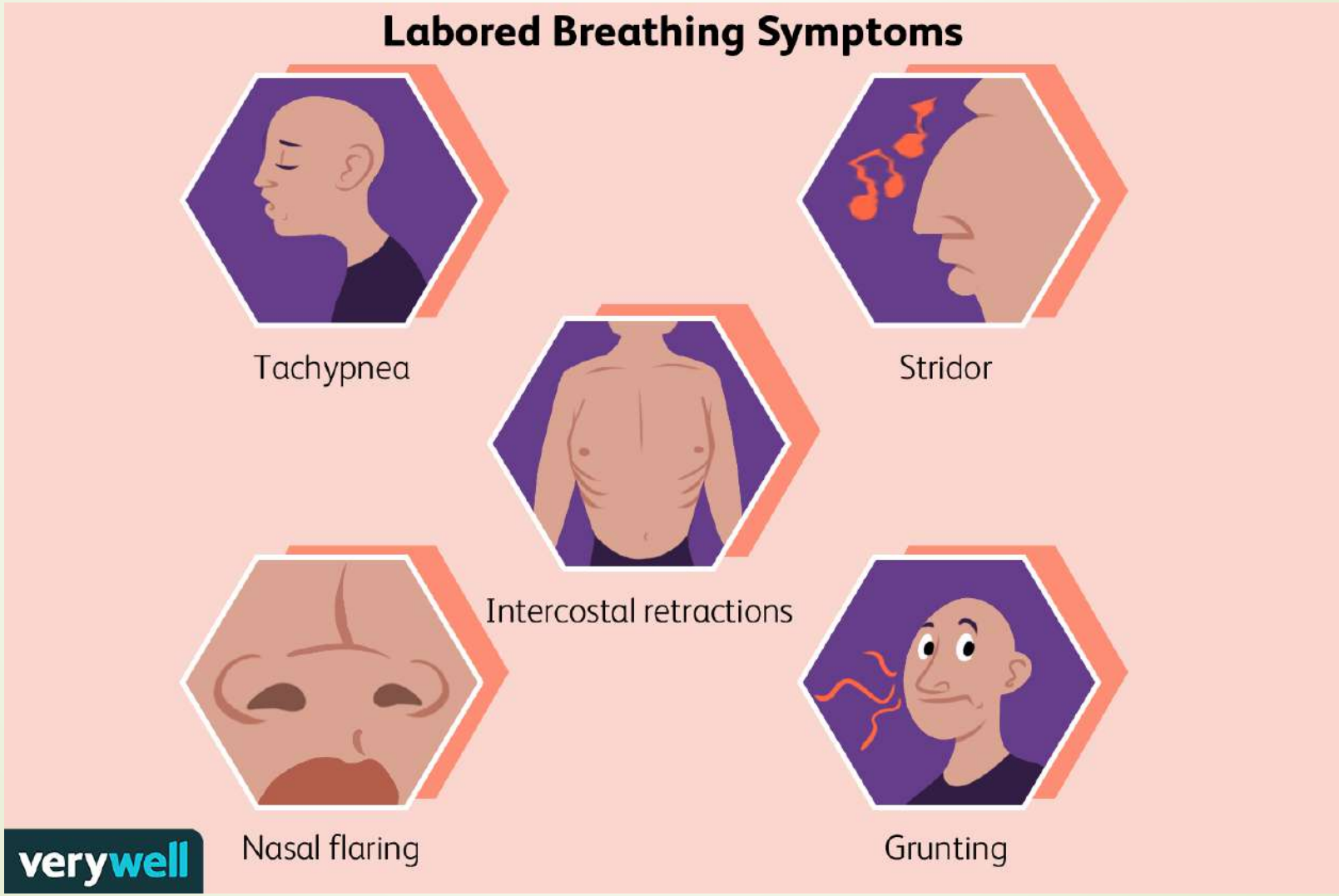
- Classically, CAP is characterized by acute onset fever, cough (with or without sputum production), and shortness of breath. In some cases, pleuritic chest pain may also be present

- Less common symptoms include gastrointestinal complaints (eg, nausea, vomiting, diarrhea, abdominal pain), loss of appetite, and mental status changes.

- In patients with advanced age or impaired immune systems, presenting symptoms can be subtle. For example, fever may be absent in older patients and mental status changes may be the sole presenting symptom



- Tachycardia, tachypnea, hypoxemia, or increased work of breathing may be present on physical examination. Crackles (rales) and rhonchi may be heard on chest auscultation, along with other signs of consolidation (eg, tactile fremitus, egophony, dullness to percussion)



- As infection progresses, the dominant clinical picture may be of sepsis and/or respiratory distress.

Viral versus bacterial

- Similarly, there are no signs or symptoms that reliably distinguish among the many infectious causes of pneumonia (eg, viral versus bacterial or between different bacterial causes). However, the presence of certain features may raise the index of suspicion for particular pathogens.

- Leukocytosis is the most common blood test abnormality with a leftward shift. Leukopenia (<4000 cells per mm3) is less common but generally connotes poorer prognosis . Similarly, thrombocytopenia (platelet count <100,000 cells per mm3) is an uncommon finding but one that suggests poorer outcome.

- New elevations in creatinine and blood urea nitrogen also connote poor prognosis and often indicate need for hospitalization. These values along with abnormal liver function tests can be also be signs of sepsis, which mandates immediate additional evaluation and care.

- While there is much interest in using C-reactive protein (CRP) and procalcitonin to aid in the diagnosis of pneumonia and to help distinguish bacterial from viral causes of CAP, we do not find that these tests reliably add value to the initial clinical and radiographic evaluation

- procalcitonin, in conjunction with clinical judgement, can help guide the decision to discontinue antibiotic treatment

- Because CAP is common and its symptoms overlap with many other cardiopulmonary disorders, it is frequently overdiagnosed. In one cohort study, approximately 17 percent of patients hospitalized with CAP were ultimately found to have a different diagnosis. The most common alternate diagnoses included heart failure,malignancy, and pulmonary infarct or fibrosis

- **Acute bronchitis** – Acute bronchitis is an infection that primarily involves the large airways (bronchi) but not the alveoli or pulmonary parenchyma. Prolonged cough, typically following an upper respiratory tract infection, is the most common symptom of acute bronchitis. In contrast to pneumonia, acute bronchitis is less likely to present with abnormal vital signs (pulse >100/minute, respiratory rate >24 breaths/minute, temperature >38°C [100.4°F], or oxygen saturation <95 percent). Mental status changes and/or other signs of systemic infection are typically absent. Signs of consolidation (rales, egophony, or tactile fremitus) should be absent on chest auscultation

- **Influenza** – Influenza is characterized by acute onset fever and cough, often accompanied by pronounced systemic symptoms including chills, rigors, myalgias, and/or arthralgias. Pneumonia complicates a minority of cases and may be primary (caused by influenza virus itself) or secondary, caused by bacterial respiratory pathogens (most often streptococci or *Staphylococcus aureus*).

- **Upper respiratory tract infection (URI)** – URIs are commonly characterized by fever and cough, but in contrast to pneumonia lack signs of consolidation on chest auscultation. While the presence of rhinorrhea and pharyngitis favor the diagnosis URI over pneumonia, URIs sometimes precede or co-occur with CAP

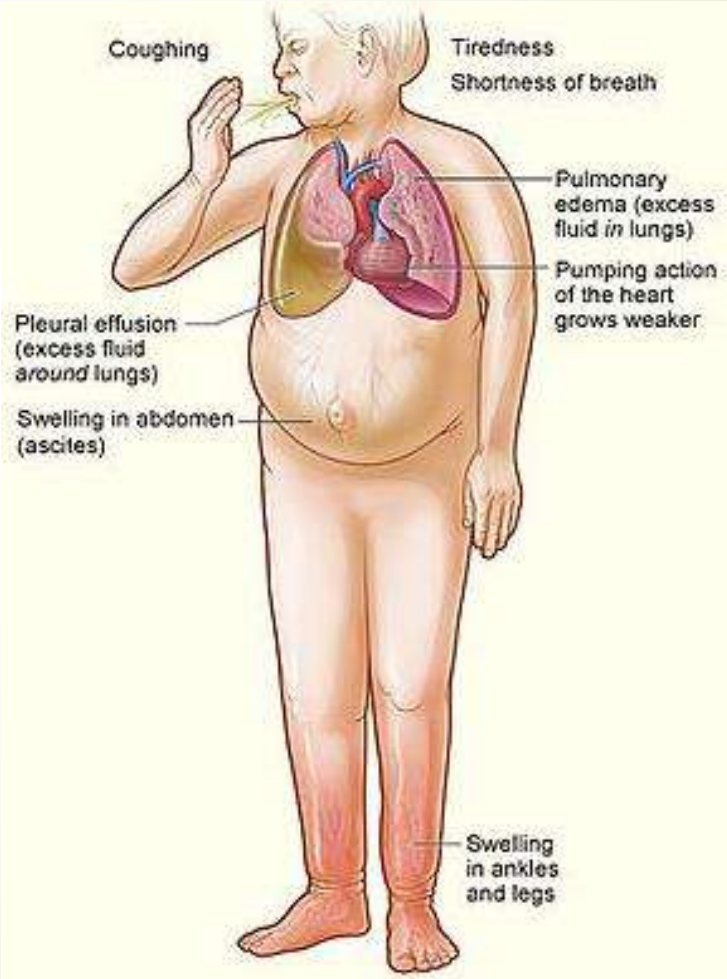
- **Acute exacerbations of chronic obstructive pulmonary disease** (AECOPD) – AECOPD is defined as an acute increase in COPD symptoms that go beyond day-to-day variation, typically characterized by increases in dyspnea, sputum volume/viscosity, and/or sputum purulence.

- **Acute asthma exacerbations** – Cough (often worse at night), wheezing, and shortness of breath are characteristics symptoms of asthma exacerbations. In contrast to AECOPD, infectious triggers are less common.

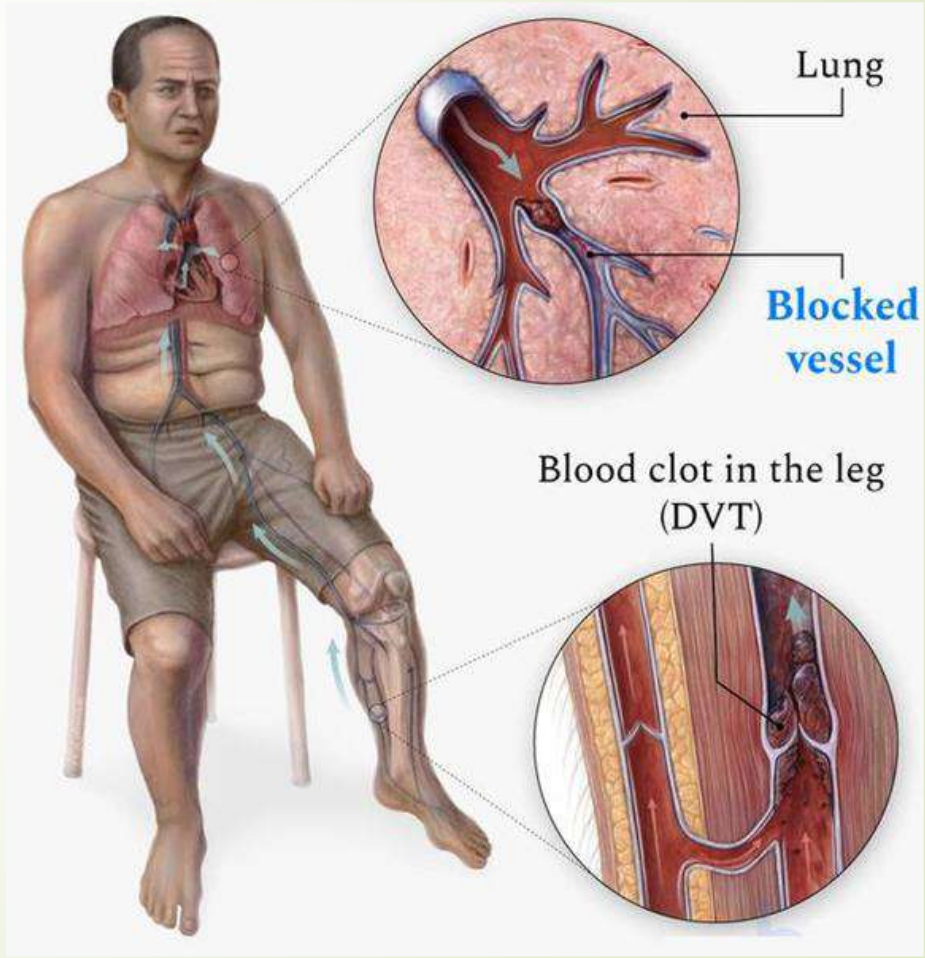
- **Acute exacerbations of bronchiectasis** – Worsening cough, sputum production, and shortness of breath also characterize bronchiectasis exacerbations. Focal crackles may also be present on physical examination.
- Distinguishing features from CAP include known history of bronchiectasis, chronic baseline respiratory symptoms, and/or thickened airways on chest imaging.

- Noninfectious illnesses that mimic or co-occur with CAP and present with pulmonary opacities and cough include:

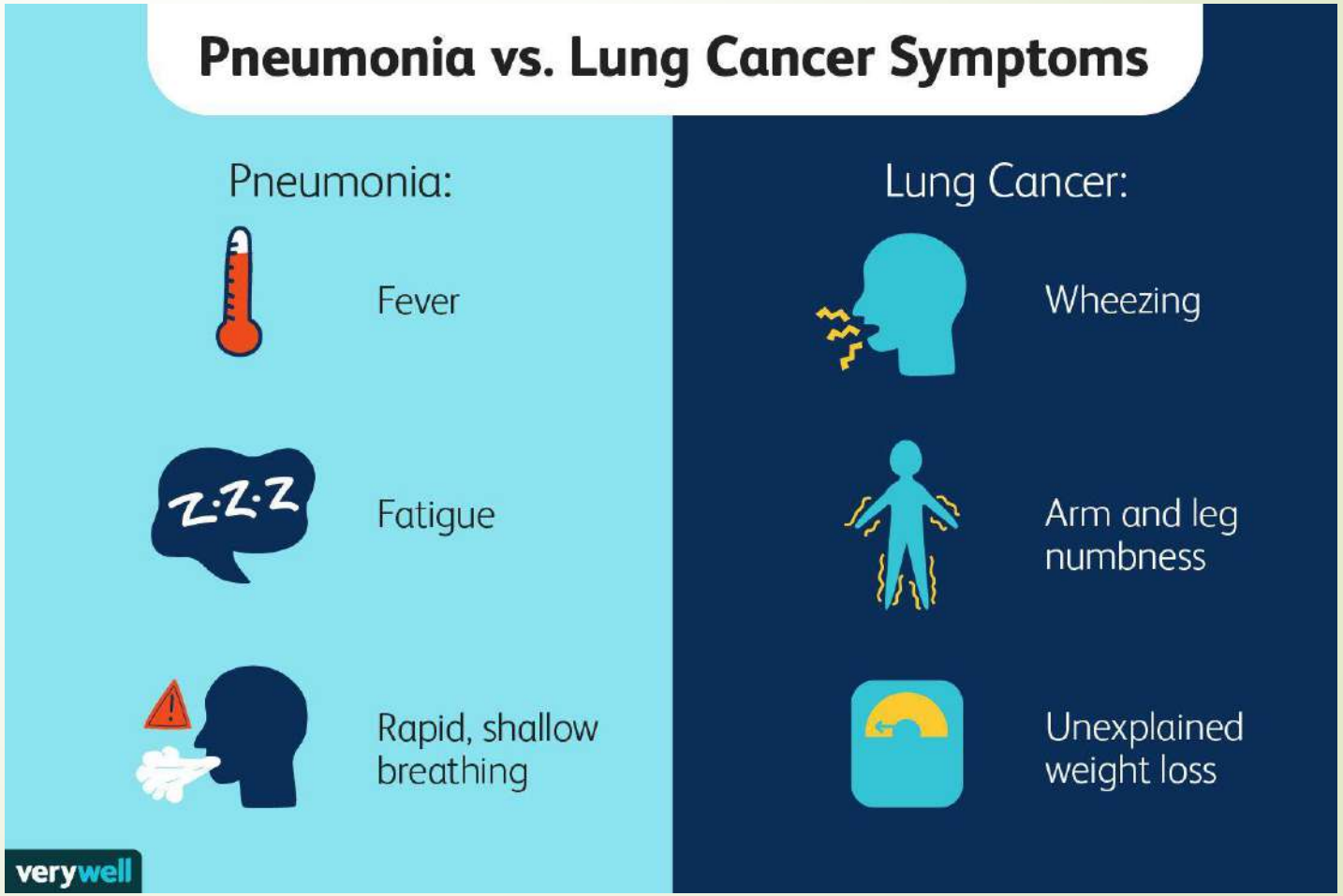
- **Heart failure with pulmonary edema** – Cough accompanied by shortness of breath, particularly with exertion or when lying flat, should raise suspicion for heart failure. Physical examination findings such as an elevated jugular venous pressure, bilateral basilar crackles with resonance to percussion, S3 heart sound, displaced apical impulse, and peripheral edema should further heighten suspicion.



- **Pulmonary embolism (PE)** – Dyspnea, pleuritic chest pain, and hemoptysis in addition to cough are classic symptoms associated with PE. However, presenting symptoms vary and can be mild and nonspecific. History may be notable for malignancy, recent surgery, or prolonged immobilization. Physical examination findings also vary but those that support this diagnosis include tachypnea, tachycardia, and unilateral lower extremity swelling. Any suspicion for PE warrants further evaluation.

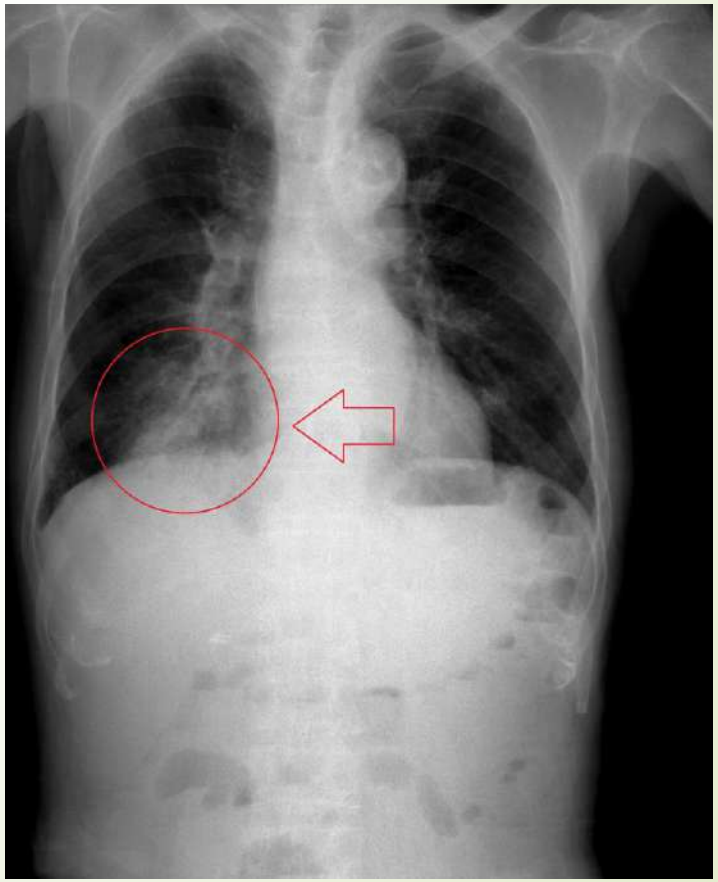


- **Lung cancer** – Lung cancer is an uncommon cause of acute shortness of breath and cough but should be considered in any current or prior smoker. Features that should raise suspicion for this diagnosis include a recent change in a chronic "smoker's cough," hemoptysis, and signs of focal airway obstruction on physical examination such as a unilateral wheeze or decreased breath sounds.

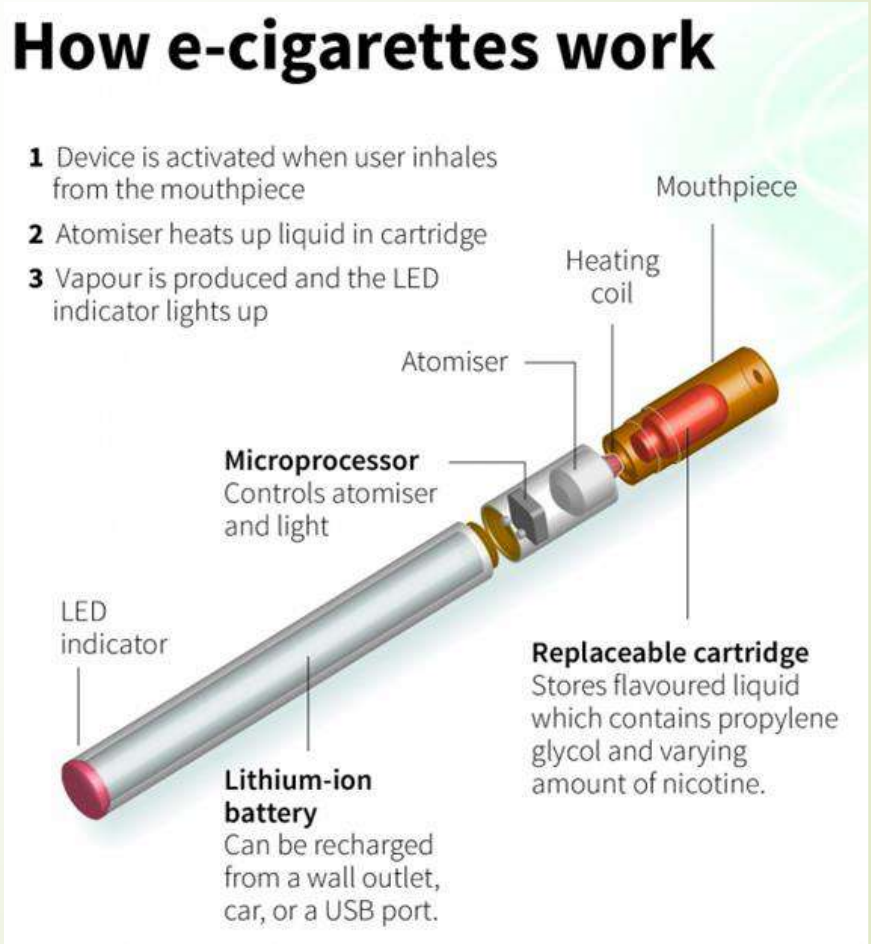


- **Atelectasis** – Atelectasis refers to collapse of a portion of the pulmonary parenchyma and can appear similar to pneumonia on chest imaging.

- **Aspiration or chemical pneumonitis –** Aspiration of substances that are toxic to the lower airways (eg, gastric acid, stomach contents) can lead to inflammation and opacities on chest imaging. Imaging abnormalities are typically seen in the gravity-dependent areas of the lung (eg, bases of lower lobes if upright, posterior segments of lower lobes if supine). In contrast to aspiration pneumonia, clinical improvement is often rapid following aspiration or chemical pneumonitis



- **E-cigarette or vaping product use associated lung injury (EVALI)** – EVALI should be considered in patients with respiratory complains and recent e-cigarette use. Respiratory symptoms are similar to CAP and include fever, cough, shortness of breath, and chest pain. Concurrent gastrointestinal symptoms (eg,nausea, vomiting, diarrhea, and abdominal pain) are also common.



- **Drug reactions** – Exposure to certain drugs can cause hypersensitivity reactions or direct pulmonary toxicity. Symptoms are often similar to CAP, but the acuity of onset, pathogenesis, and radiographic appearance vary by agent. Common culprits include nitrofurantoin, amiodarone, daptomycin,methotrexate, bleomycin, and gemcitabine.

- **Interstitial lung diseases (ILD)** – A wide variety of ILD can present similarly to CAP early in their evolution and include sarcoidosis, asbestosis, hypersensitivity pneumonitis, cryptogenic organizing pneumonia, and systemic rheumatic diseases (eg, granulomatosis with polyangiitis, rheumatoid arthritis, systemic lupus erythematosus, dermatomyositis).

Chest imaging

- Chest imaging is indicated for the majority of patients with suspected CAP to confirm the diagnosis, assess for complications (eg, parapneumonic effusion, empyema, abscess), and evaluate for alternate or concurrent diagnosis (eg, heart failure, malignancy). The presence of an opacity on chest imaging in a patient with a compatible clinical syndrome is the gold standard for diagnosis and recommended for diagnosis in the American Thoracic Society/Infectious Disease Society of America guidelines

- The presence of an infiltrate on plain chest radiograph is considered the gold standard for diagnosing pneumonia when clinical and microbiologic features are supportive. For most patients with suspected CAP,obtaining posteroanterior and lateral chest radiographs is sufficient for diagnosis. Rarely, we forgo imaging in outpatients with highly compatible syndromes (eg, acute onset, fever, cough, shortness of breath, and signs of consolidation on physical examination) and lack of concern for other causes. Imaging is a necessity for hospitalized patients.

- Radiographic findings consistent with the diagnosis of CAP include lobar consolidations, interstitial infiltrates , and/or cavitations . Although certain radiographic features suggest specific causes of pneumonia (eg, lobar consolidations suggest infection with typical bacterial pathogens),radiographic appearance alone cannot reliably differentiate among etiologies

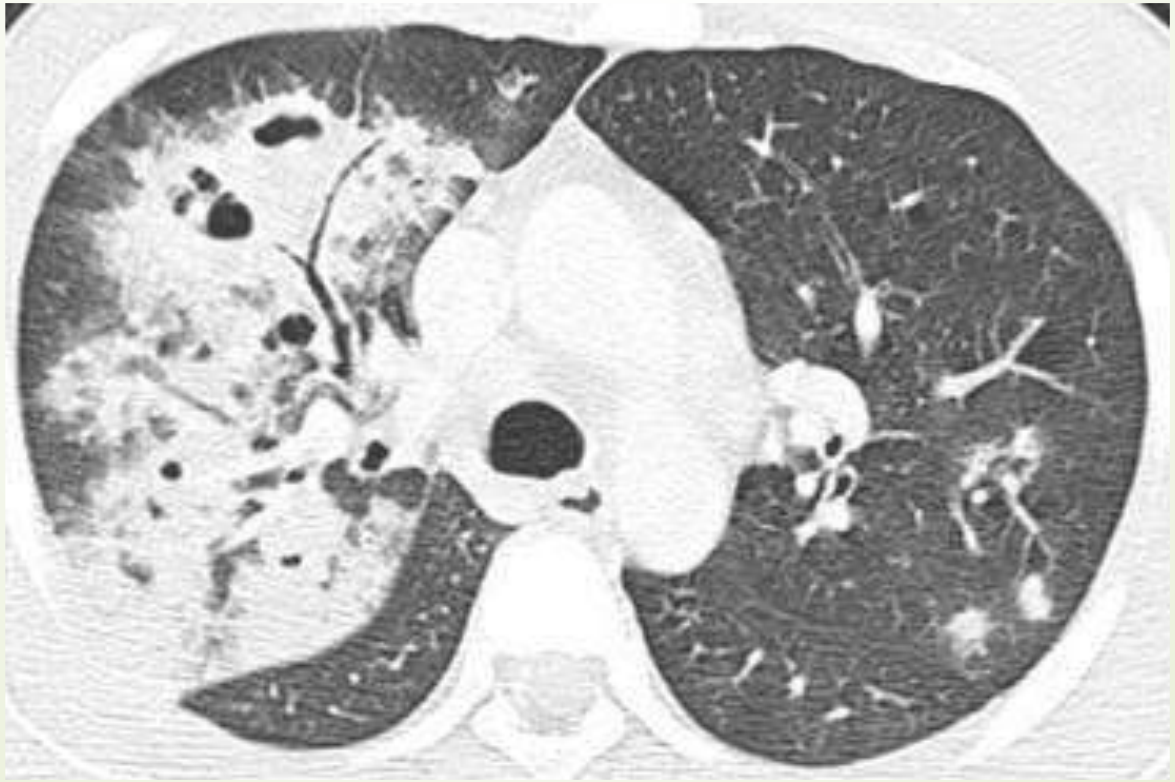
- There is also substantial interobserver variation in the interpretation of chest radiographs in patients with possible pneumonia between different radiologists and between emergency department physicians and radiologists

- In some cases, chest radiographs may not be sufficiently sensitive for the detection of pneumonia. There are case reports and animal experiments favoring the hypothesis that volume depletion may produce an initially negative radiograph, which "blossoms" into infiltrates following rehydration. In support of this hypothesis, one population-based cohort study of suspected CAP found that 7 percent of patients with negative initial radiographs developed changes consistent with CAP on repeat chest radiograph

- Thus, when clinical suspicion is high despite a negative chest radiograph, we decide to either treat empirically and/or perform a chest computed tomography (CT) depending on the patient’s severity of illness, immune status, and/or the suspected pathogen

Role of ct scan

- High-resolution CT is more sensitive for the detection of pneumonia than chest radiograph. CT scanning can be helpful to better characterize pneumonia and identify complications. This is particularly true for immunocompromised patients who are at risk for infection with broad array of pathogens. The enhanced sensitivity and specificity of CT scan can help distinguish among causes (eg, invasive fungal infections, pneumocystis pneumonia, bacterial pathogens)



- There are increasing data on the use of lung ultrasound to diagnose pneumonia, particularly in unstable patients in the emergency department or intensive care unit in whom it is difficult to obtain good-quality chest radiographs. In three large meta-analyses, the sensitivity of lung ultrasound was approximately 80 to 90 percent and the specificity approximately 70 to 90 percent

- For patients with a working diagnosis of CAP, the next steps in management are defining the severity of illness and determining the most appropriate site of care. Determining the severity of illness is based on clinical judgement and can be supplemented by use of severity scores

- **Determining the site of care** – Determining whether a patient with CAP can be safely treated as an outpatient or requires hospital admission is an essential first step in management, which informs downstream diagnostic and therapeutic decisions

- While severity of illness is the key determinant, other factors should also be taken into account. These include the ability to maintain oral intake, likelihood of medication adherence, history of active substance abuse, mental illness, cognitive or functional impairment, and living or social circumstances (eg, homelessness, residence far enough from a health care facility that precludes timely return to care in the event of clinical worsening).

- **Microbiologic testing** – For most patients with mild CAP being treated in the ambulatory setting, microbiologic testing is not needed. Empiric antibiotic therapy is generally successful, and knowledge of the infecting pathogen does not usually improve outcomes. However, when clinical suspicion for a specific pathogen is high based on clinical and/or epidemiologic features (eg, high activity of influenza in the community, during outbreaks), microbiologic testing can be helpful, particularly when treatment of the suspect pathogen differs from standard empiric therapy or when there are public health implications

- Important pathogens to bear in mind when considering the need to test include *Legionella* species, *Mycobacterium tuberculosis*, influenza A and B, avian influenza, Middle East respiratory syndrome coronavirus, community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA), or agents of bioterrorism. Advances in molecular testing for etiology may allow for earlier pathogen-directed therapy than was previously possible.

- **Timing of treatment** – Since patients who do not require admission are often not given the first dose of antibiotics when they present for care, they should be counseled to fill their prescription without delay in order to achieve the best outcome. Specific treatment regimens are discussed below.

- **General approach**
- Empiric regimens are designed to cover the most common bacterial causes of CAP encountered in the outpatient setting.

- For all patients, these include *Streptococcus pneumoniae*, *Haemophilus influenzae,* and atypical pathogens (ie, *Mycoplasma pneumoniae, Legionella pneumophila*, and *Chlamydia pneumoniae*).
- Coverage is expanded to include or better treat certain gram-negative pathogens (eg, beta-lactamase producing *H. influenzae*, *Moraxella catarrhalis,* and methicillin-susceptible *S. aureus* for older patients,smokers, and those with comorbidities (eg, chronic heart, lung, liver, or kidney disease, diabetes mellitus, alcohol use disorder) and/or recent antibiotic use.

- For patients with structural lung disease (eg, advanced chronic obstructive pulmonary disease [COPD]), we also select a regimen that includes coverage for Enterobacteriaceae (eg, *Escherichia coli* and *Klebsiella* spp).

- The backbone of therapy is the beta-lactam, which primarily targets *S. pneumoniae*. Among beta-lactams, highdose amoxicillin and amoxicillin-clavulanate are preferred because they remain active against most strains of *S.pneumoniae*, despite rising resistance rates among macrolides, tetracyclines, and other antibiotic classes. We generally use amoxicillin-clavulanate rather than amoxicillin in older patients, smokers, and those with comorbidities because of its extended spectrum.

- Generally, we add either a macrolide or doxycycline to the beta-lactam to target atypical pathogens. However,
- the value of treating atypical pathogens in otherwise healthy patients is debated.

- Respiratory viruses (eg, influenza, parainfluenza, respiratory syncytial virus) are also among the most frequently detected causes of CAP and may occur concurrently or independently from bacterial infection. When influenza virus is a confirmed or suspected cause of CAP, antiviral treatment is typically warranted.

- Although a wide variety of other pathogens can cause CAP, these few described above are responsible for the majority of cases with a known cause in the outpatient setting. Other bacterial causes of CAP, such as MRSA, Enterobacteriaceae, and *Pseudomonas aeruginosa*, tend to be associated with greater illness severity and are detected more frequently in hospitalized patients and those with specific risk factors.

- No first-line empiric antibiotic regimen has been clearly shown to be superior to another for the empiric treatment of CAP in outpatients in clinical trials. Thus, antibiotic selection depends on the likelihood of antibiotic resistance, patient comorbidities, and the potential for adverse medication effects (including drug hypersensitivity reactions).

- Specific regimens are outlined below. Modifications to these regimens may be needed based on patient travel and exposure history, local epidemiology (eg, outbreaks, family clusters), or when specific pathogens are suspected (eg, influenza viruses, CA-MRSA, *M. tuberculosis*). The doses given below are intended for patients with normal renal and hepatic function; the doses of certain agents should be reduced in patients with organ dysfunction.

- For otherwise healthy patients aged <65 years who have not recently used antibiotics, we typically use an empiric regimen that targets *S. pneumoniae*, *H. influenzae*, and atypical pathogens (ie, *M. pneumoniae*, *L. pneumophila*, and *C. pneumoniae*).

- For most patients in this category, we treat with high-dose amoxicillin (1 g orally three times daily) plus either a macrolide (ie, azithromycin, clarithromycin) or doxycycline. Macrolides are generally preferred over doxycycline, unless there are contraindications.

- For patients with mild non-immunoglobulin (Ig)E-mediated reactions to penicillin (eg maculopapular rash)
- or known tolerance to cephalosporins, a third-generation cephalosporin (eg , cefpodoxime) is the preferred alternative to amoxicillin. Like amoxicillin, we give the cephalosporin in combination with an agent that targets atypical pathogens. For patients with IgE-mediated reactions (eg, urticaria, angioedema, anaphylaxis) or severe delayed reactions, empiric use of cephalosporins should generally be avoided.

- When the above regimens cannot be used, we generally treat with a respiratory fluoroquinolone (ie , levofloxacin, moxifloxacin, gemifloxacin).
  We have begun to adopt lefamulin monotherapy into practice,
- particularly for patients who cannot tolerate beta-lactams and wish to avoid the potential adverse effects associated with fluoroqinolones.

- However, clinical experience with lefamulin is limited and use may be limited by cost and/or availability. Lefamulin has a more targeted spectrum for standard CAP patients than the fluoroquinolones but does not cover Enterobacteriaceae. Use should be avoided in patients with moderate to severe hepatic dysfunction, known long QT syndrome, or in those taking Qt prolonging agents, pregnant and breastfeeding women, and women with reproductive potential not using contraception.

- For patients with major comorbidities (ie , chronic pulmonary, liver, heart, or renal disease, cancer, diabetes , congestive heart failure, alcohol dependence, immunosuppression), smokers, or those who have used antibiotics within the prior three months, we expand coverage to better treat beta-lactamase-producing *H. influenzae, M. catarrhalis,* and methicillin-susceptible *S. aureus* in addition to *S. pneumoniae* and atypical pathogens. For those with structural lung disease, we further expand coverage to treat Enterobacteriaceae (eg, *E. coli, Klebsiella* spp)

- For most patients in this category, we treat with extended-release amoxicillin-clavulanate (2 g orally twice daily) plus a macrolide (ie, azithromycin, clarithromycin) or doxycycline. In general, we prefer macrolides over doxycycline because their use has been associated with improved outcomes in patients with more severe CAP (possibly due to their immunomodulatory effect). However, for patients who have contraindications to macrolides (eg, risk for or known prolonged QTc, allergy), doxycycline is an appropriate alternative.

- Despite its greater convenience, we reserve monotherapy with respiratory fluoroquinolone (levofloxacin, moxifloxacin, gemifloxacin) for patients who cannot tolerate either of the above regimens (eg, due to IgEmediated or severe, delayed hypersensitivity reactions to penicillin) because of its adverse effect profile and the potential of promoting fluoroquinolone resistance.

- We have also begun to adopt lefamulin monotherapy into practice, particularly for patients without structural lung disease (eg, advanced COPD) who cannot tolerate beta-lactams and wish to avoid the potential adverse effects associated with fluoroquinolones. However, clinical experience with lefamulin is limited, use may be limited by cost and/or availability, and it does not cover Enterobacteriaceae.

- Although fluoroquinolones are frequently used for treatment of CAP, their use is discouraged in ambulatory patients with CAP without comorbid conditions or recent antimicrobial use unless use of other regimens is not feasible.
- There is concern that widespread use of fluoroquinolones in outpatients will promote the development of fluoroquinolone resistance among respiratory pathogens (as well as other colonizing pathogens) and may lead to an increased incidence of *Clostridioides* (formerly *Clostridium*) *difficile* colitis

Tuberculosis warning

- In addition, empiric use of fluoroquinolones should not be used for patients at risk for *M. tuberculosis* without an appropriate assessment for tuberculosis infection. The administration of a fluoroquinolone in patients with tuberculosis has been associated with a delay in diagnosis, increase in resistance, and poor outcomes.

- Macrolides, lefamulin, and fluoroquinolones can cause a prolonged QT interval, which can result in torsades de pointes.

- For outpatients with known QT interval prolongation and for those considered to be at high risk of QT interval prolongation, we favor doxycycline since it is not associated with QT interval prolongation. However, doxycycline should be avoided during pregnancy. It should also be noted that doxycycline has been less well studied for the treatment of CAP than the macrolides or fluoroquinolones. Risk factors for QT interval prolongation include advanced age, hypokalemia, hypomagnesemia, clinically significant bradycardia, and the use of other agents that prolong the QT interval, including class IA (quinidine, procainamide) and class III (dofetilide, amiodarone, sotalol) antiarrhythmic agents and certain azoles (eg, voriconazole, posaconazole).

Duration of therapy

- We treat most ambulatory patients with CAP for five days. Because of its long half-life, receiving azithromycin at a dose of 500 mg daily can usually be treated for three days. Patients should be afebrile for ≥48 hours and clinically stable before therapy is discontinued. When this is achieved, the persistence of other symptoms (eg, dyspnea, cough) is not an indication to extend the course of antibiotic therapy.

Follow up

- All patients who are treated for CAP at home should have a follow-up visit or communication with a health care provider within 24 to 48 hours after being diagnosed to determine whether they are feeling better and to assess whether any complications of pneumonia have developed. Patients who have not responded to therapy after 48 to 72 hours should be reevaluated. In addition, a later visit (eg, in one to four weeks) is often appropriate to ensure that symptoms continue to resolve and comorbid conditions (eg, heart failure, chronic obstructive pulmonary disease) have not worsened or newly developed.

- The median time to resolution ranged from 3 days for fever to 14 days for both cough and fatigue. At least one symptom (eg, cough, fatigue, dyspnea) was still present at 28 days in one-third of patients. In another report, 76 percent had at least one symptom at 30 days, most commonly fatigue, compared with 45 percent by history in the one month prior to the onset of CAP

- We do not routinely obtain a follow-up chest radiograph in patients with CAP who have responded to therapy, as radiographic findings tend to lag behind clinical response . This approach is similar to that outlined by the American Thoracic Society (ATS)/Infectious Diseases Society of America (IDSA), which recommends not obtaining a follow-up chest radiograph in patients whose symptoms have resolved within five to seven days

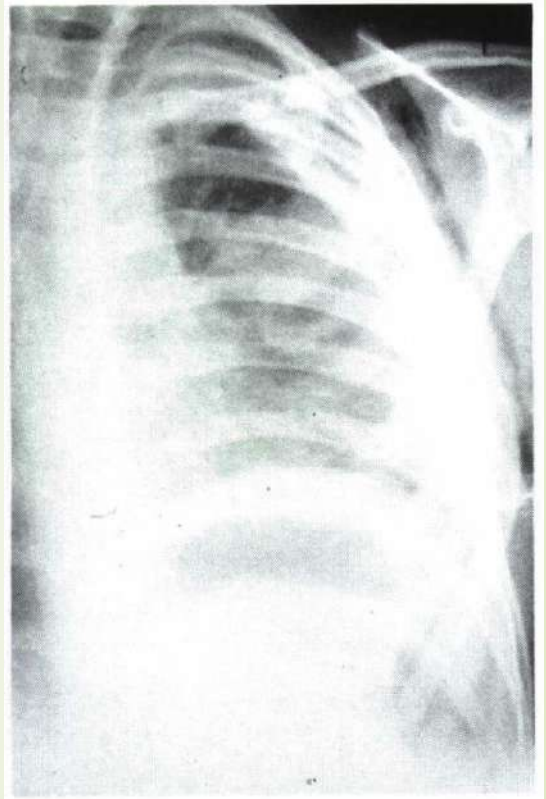
Nonresolving cap

- In a small minority of patients treated in the outpatient setting, initial symptoms will neither progress nor improve following empiric antibiotic treatment. We generally characterize these patients as having nonresolving pneumonia. Potential causes of nonresolving CAP include

Delayed clinical response

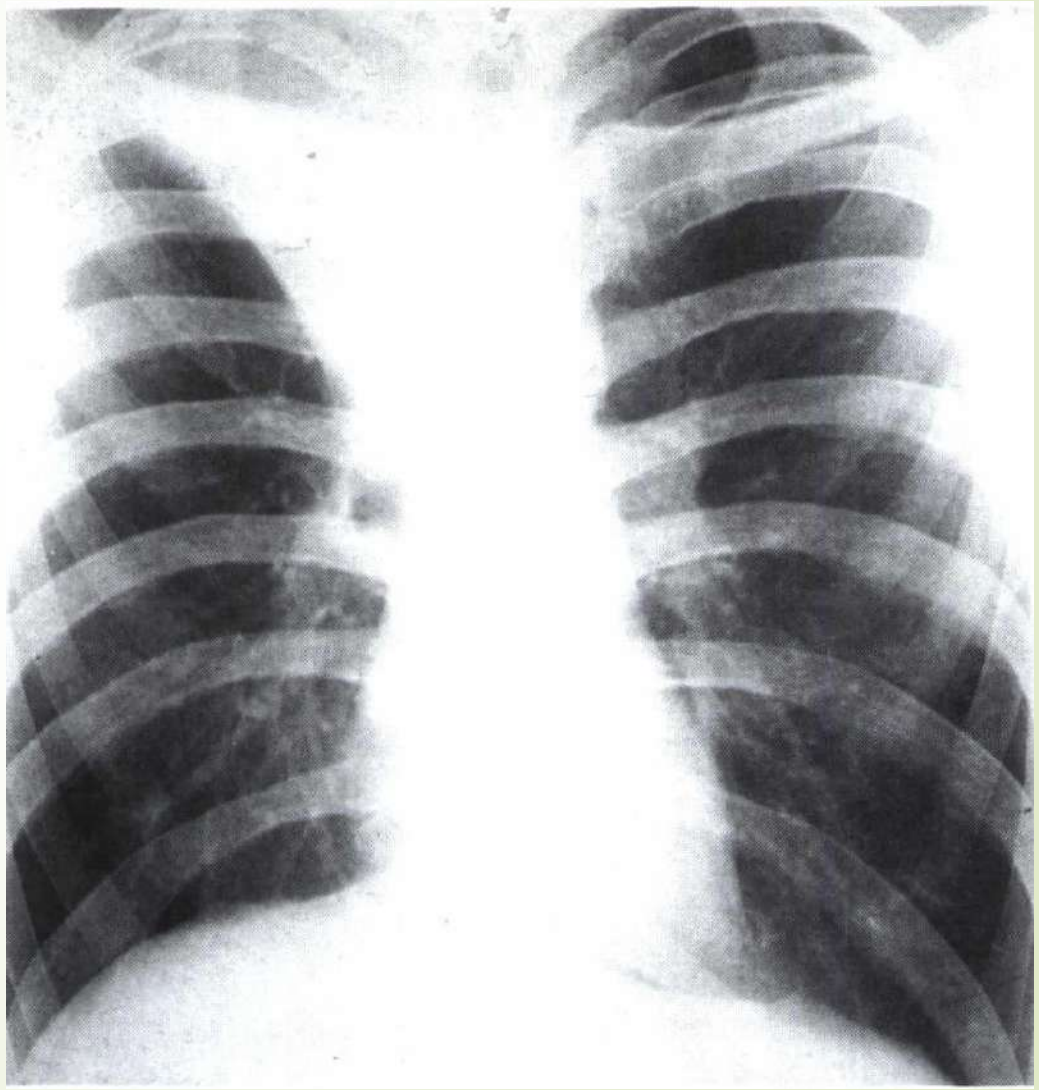
For some patients, particularly those with multiple comorbidities, more severe pneumonia, and infection with certain pathogens (eg, *S. pneumoniae)*, treatment response may be slow.

- **Loculated infection** – Patients with complications such as lung abscess, empyema, or other closed-space infections may fail to improve clinically despite appropriate antibiotic selection. Such infections may require drainage and/or prolonged antibiotic treatment.

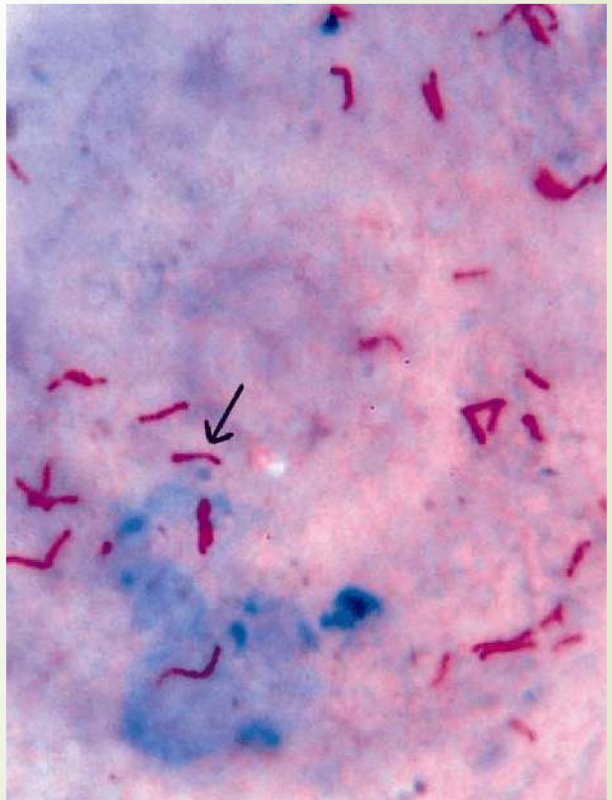


Empyema may complicate pneumococcal pneumonia, especially if treatment is delayed. Its presence is indicated by continued fever, persistent leucocytosis and pleural effusion.

- **Bronchial obstruction** – Bronchial obstruction (eg, by a tumor) can cause a postobstructive pneumonia that may fail to respond or may slowly respond to standard empiric antibiotic regimens for CAP.



- **Pathogens that cause subacute/chronic CAP** – *M. tuberculosis*, nontuberculous mycobacteria (eg, *Mycobacterium kansasii*), fungi (eg, *Histoplasma capsulatum*, *Blastomyces dermatitidis*), or less common bacteria (eg, *Nocardia* spp, *Actinomyces israelii*) can cause subacute or chronic pneumonia that may fail to respond or may incompletely respond to standard empiric antibiotic regimens for CAP



- **Incorrect initial diagnosis** – Failure to improve also raises the possibility of an alternate diagnosis (eg, malignancy or inflammatory lung disease).

- Vaccination is an effective and important component of pneumonia prevention.
- Recommendations for other routine vaccinations are provided separately. Annual vaccination against seasonal influenza viruses is indicated for all patients (without contraindications).
- Pneumococcal vaccination is indicated for all patients ≥65 years old and others with specific risk factors (eg, certain comorbidities including chronic heart, lung, and liver disease, immunocompromising conditions, and impaired splenic function).

- Smoking cessation should be a goal for patients with CAP who smoke, and we discuss this at the time of diagnosis and when providing follow-up care.

Thanks for your attention