Patients may have an antecedent upper respiratory tract infection followed by the sudden onset of fever, shaking chills, dyspnea, and pleurisy. Cough productive of purulent, rust-colored sputum is common. Imaging studies show lobar consolidation. Sputum is gram positive in only 45% of bacteremic cases. The diagnosis is confirmed by culture of the organism from a normally sterile site, such as blood, pleural fluid, or cerebrospinal fluid. In many cases, the diagnosis is presumptive, and recommended antibiotic coverage for community-acquired pneumonia is designed to cover this organism (discussed later).

M. pneumoniae is a slow-growing, facultative anaerobic organism that accounts for 25% to 60% of all atypical pneumonias. *M. pneumoniae* is a common cause of pneumonia in patients between the ages of 5 and 35 years who may initially exhibit upper respiratory tract symptoms, pharyngitis, and bullous myringitis. The clinical presentation includes dry cough and gastrointestinal symptoms in addition to fever, headache, and myalgias. Uncommon complications include cold agglutinin–induced hemolysis, hepatitis, erythema multiforme, hyponatremia caused by the syndrome of inappropriate antidiuretic hormone, pericarditis, myocarditis, and neurologic abnormalities. The chest radiograph may show fine interstitial reticulonodular infiltrates in patients. The diagnosis is based on clinical and epidemiologic features. Acute and convalescent serologic findings are required to confirm the diagnosis, but they are not helpful during the acute illness.

Other common causes of community-acquired pneumonia are *C. pneumoniae* and *Haemophilus influenzae*. Patients with comorbid conditions and those older than 65 years are also at risk for pneumonia from *Legionella* species, *Staphylococcus aureus*, and gram-negative organisms. Anaerobic infection should be considered when large amounts of oropharyngeal secretions are aspirated and in patients with chronic gingivitis.

Viral causes may encompass up to 65% of cases of community-acquired pneumonia in infants and preschool-age children (<5 years). The most common causes include rhinovirus, parainfluenza virus, adenovirus, enterovirus, coronavirus, human metapneumovirus (hMPV), and respiratory syncytial virus (RSV), the most commonly identified pathogen. HMPV is a recent addition to the long list of viral causes that mostly affect the upper and lower respiratory tracts in young children and older adults. It is common in late winter and early spring, when RSV is common, and co-infection with RSV causes severe bronchiolitis in children younger than 2 years of age.

In September 2012, a novel betacoronavirus was isolated from a man in Saudi Arabia. This Middle East respiratory syndrome coronavirus (MERS-CoV) causes severe acute pneumonia, acute respiratory distress syndrome (ARDS), and acute kidney injury. It has since been identified in Europe and other parts of the Middle East. Patients also may have gastrointestinal symptoms, pericarditis, and disseminated intravascular coagulation (DIC). Diagnosis is made by polymerase chain reaction (PCR) assay, and its infectivity is based on antagonizing endogenous interferon (IFN) production in cells. Treatment is supportive with mechanical ventilation or extracorporeal membrane oxygenation (ECMO), but exogenous interferon alfa-2b administration has reduced viral replication in vitro. MERS-CoV has a high mortality rate of 48%, with a median time of survival from clinical presentation of 14 days.

Diagnostic tests for community-acquired pneumonia include a chest radiograph and complete blood count. The role of routine sputum and blood cultures in this setting is controversial. Studies have advocated the use of C-reactive protein and procalcitonin as markers of the inflammatory response to bacterial infection. However, further studies are needed.

The recommended treatment for community-acquired pneumonia is a 7- to 10-day course of a macrolide antibiotic (i.e., erythromycin, clarithromycin, or azithromycin). Azithromycin has been linked to increased risk of cardiovascular death, especially in patients with a high baseline risk of cardiovascular disease. If there are comorbidities such as chronic heart or lung disease, an extended-spectrum fluoroquinolone (i.e., levofloxacin, moxifloxacin, or gemifloxacin) or a β-lactam (e.g., amoxicillin) plus a macrolide should be used. The choice of treatment should be influenced by local antibiotic resistance patterns.

An important decision in the care of community-acquired pneumonia is whether the patient requires hospital admission. This decision should take into consideration the known risk factors of increased mortality from pneumonia, including age 65 years or older; the presence of comorbidities such as diabetes mellitus, renal, or congestive heart failure; altered mental status; tachycardia (>125 beats per minute); tachypnea (>30 breaths per minute); high fever (>38.3° to 40° C); hypotension (systolic blood pressure <90 mm Hg); hypoxia (Sao_2 <90% or Pao_2 <60 mm Hg); multilobar involvement seen on the chest radiograph; and identification of high-risk pathogens such as gram-negative organisms and *S. aureus*.

For hospitalized patients, initial therapy for community-acquired pneumonia usually includes a cephalosporin such as ceftriaxone or cefuroxime with or without a macrolide. Antibiotic treatment should be given as soon as possible because the likelihood of death can increase even after a short delay (>8 hours) in receiving appropriate antibiotics. Sputum and blood cultures should be obtained before instituting antibiotic therapy.

For a deeper discussion on this topic, please see Chapter 289, "Streptococcus Pneumoniae Infections," and Chapter 317, "Mycoplasma Infection," in Goldman-Cecil Medicine, *25th Edition.*

Nosocomial Pneumonia

Nosocomial pneumonia is categorized as hospital-acquired pneumonia (HAP), ventilator-associated pneumonia (VAP), and health care–associated pneumonia (HCAP). HAP is pneumonia that occurs 48 hours or more after admission. VAP is a type of HAP that develops more than 48 to 72 hours after endotracheal intubation. HCAP is pneumonia that occurs in a nonhospitalized patient with extensive health care contact. This includes recent hospitalization, residence in a nursing home or other long-term care facility, and recent intravenous therapy. These patients should be considered at high risk for resistant organisms and therefore inappropriate for routine, empirical therapy for community-acquired pneumonia.

Nosocomial pneumonia is the second most common infection among hospitalized patients and the most common infection in the intensive care unit. The pathogenesis of nosocomial pneumonia is based on colonization of the oropharynx and stomach with