

Mycobacteria and buffered charcoal yeast extract (BCYE) for *Legionella*.

Blood cultures can be helpful. However, the ratio of bacteremic to nonbacteremic pneumococcal pneumonia is approximately 1 : 4. A positive blood culture is very helpful because the etiologic agent is definitely identified and susceptibility data are available to determine appropriate therapy.

Other diagnostic studies used to identify the causative organism include *Legionella* urinary antigen, *Histoplasma* urinary antigen, polymerase chain reaction (PCR) for respiratory viruses, and serologic testing for *Mycoplasma* and *C. immitis*.

Chest radiography of patients with pneumococcal pneumonia can show a consolidative lobar infiltrate or a bronchopneumonic (patchy) pattern; less commonly, it causes an interstitial pattern. A definitive etiologic diagnosis cannot be made based on the chest radiographic appearance.

Not all patients with a new pulmonary infiltrate have pneumonia. Congestive heart failure is commonly confused with pneumonia. Noninfectious causes of pulmonary infiltrates and fever include pulmonary infarction, granulomatosis with polyangiitis (i.e., Wegener's granulomatosis), drug reactions, tumor, cryptogenic organizing pneumonia, hypersensitivity pneumonitis, collagen vascular disease, and acute respiratory distress syndrome (ARDS).

TREATMENT

The definitive treatment for pneumonia is to eradicate the infecting microorganism. Antibiotics are used to kill bacteria and decrease or stop the spread of infection in the lungs. Normal host responses are needed to repair the inflammatory damage in the lungs.

Penicillin therapy has reduced the mortality rate of bacteremic pneumococcal pneumonia from 84% to 17%. However, antibiotics have little to no effect on the mortality rate during the first 5 days of illness.

After the etiologic agent has been identified, the appropriate antibiotic can be given (Table 92-1). If a specific etiologic diagnosis is not made, empirical treatment with one of many antimicrobial agents is recommended. Guidelines are available at

http://www.idsociety.org/IDSA_Practice_Guidelines (accessed November 1, 2014).

The decision to admit a patient with pneumonia is based on clinical prediction rules. The pneumonia severity index (PSI) stratifies patients into one of five risk groups. Those in a low-risk group are treated as outpatients, whereas those in a higher-risk group are admitted to the hospital for treatment. The CURB-65 score (confusion, urea, respiratory rate, blood pressure, and age ≥ 65 years) developed by Lim and colleagues is easier to calculate but has not been as rigorously validated as the PSI. Psychosocial and other factors that affect the decision to admit a patient are not included in the PSI or CURB-65.

For a deeper discussion of these topics, please see Chapter 9, "Overview of Pneumonia," in Goldman-Cecil Medicine, 25th Edition.

PROGNOSIS AND PREVENTION

Patients with bacteremic pneumococcal pneumonia have a higher mortality rate (21%) compared with those who have nonbacteremic pneumococcal pneumonia (13%). Among patients with bacteremic pneumococcal pneumonia, the mortality rate increases with advancing age (Fig. 92-3), number of lobes involved (i.e., one lobe, 12%; two lobes, 24%; and three lobes, 63%), and white blood cell (WBC) count (i.e., leukopenia, 35%; normal peripheral WBC count, 24%; and leukocytosis, 14%). Mortality rates are different for each capsular type of pneumococcus. For example the mortality rate for patients infected with capsular type I is 3%, compared with 22% for patients infected with capsular type III. Patients who survive usually recover without sequelae.

The influenza vaccine protects against not only influenza but also bacterial pneumonia, because patients who do not have influenza are not at risk for secondary bacterial pneumonia. The 13-valent pneumococcal conjugate vaccine followed 6 to 12 months later by the 23-valent pneumococcal polysaccharide vaccine is recommended for those 65 years of age and older who have not been previously vaccinated. Adults less than 65 years with certain immunocompromising conditions or

TABLE 92-1 TREATMENT OF PNEUMONIA BY SPECIFIC ETIOLOGIC AGENT

ETIOLOGIC AGENT	PREFERRED ANTIMICROBIAL	ALTERNATIVE ANTIMICROBIAL
<i>Streptococcus pneumoniae</i>	Penicillin	Cephalosporin, moxifloxacin, levofloxacin
<i>Haemophilus influenzae</i>	Cefuroxime, ceftriaxone	
<i>Mycoplasma pneumoniae</i>	Macrolide	Moxifloxacin, levofloxacin
<i>Legionella</i> species	Macrolide or quinolone	
Methicillin-susceptible <i>Staphylococcus aureus</i>	Nafcillin	Cephalosporin
Methicillin-resistant <i>Staphylococcus aureus</i>	Vancomycin (intravenous)	Sulfamethoxazole-trimethoprim (oral) or doxycycline
<i>Moraxella catarrhalis</i>	Amoxicillin/clavulanate, cefuroxime, ceftriaxone, sulfamethoxazole-trimethoprim	

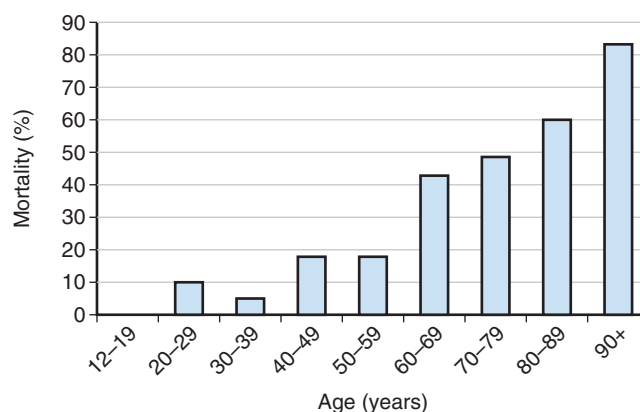


FIGURE 92-3 Mortality rates for bacteremic pneumococcal pneumonia by age group. (Data from Austrian R, Gold J: Pneumococcal bacteremia with especial reference to bacteremic pneumococcal pneumonia, *Ann Intern Med* 60:759-776, 1964.)