

Table 15-7 Pneumonia Syndromes

Community-Acquired Acute Pneumonia
<i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Staphylococcus aureus</i> <i>Legionella pneumophila</i> Enterobacteriaceae (<i>Klebsiella pneumoniae</i>) and <i>Pseudomonas</i> spp. <i>Mycoplasma pneumoniae</i> <i>Chlamydia</i> spp. (<i>C. pneumoniae</i> , <i>C. psittaci</i> , <i>C. trachomatis</i>) <i>Coxiella burnetii</i> (Q fever) Viruses: respiratory syncytial virus, parainfluenza virus and human metapneumovirus (children); influenza A and B (adults); adenovirus (military recruits);
Health Care-Associated Pneumonia
<i>Staphylococcus aureus</i> , methicillin-sensitive <i>Staphylococcus aureus</i> , methicillin-resistant <i>Pseudomonas aeruginosa</i> <i>Streptococcus pneumoniae</i>
Hospital-Acquired Pneumonia
Gram-negative rods, Enterobacteriaceae (<i>Klebsiella</i> spp., <i>Serratia marcescens</i> , <i>Escherichia coli</i>) and <i>Pseudomonas</i> spp. <i>Staphylococcus aureus</i> (usually methicillin-resistant)
Aspiration Pneumonia
Anaerobic oral flora (<i>Bacteroides</i> , <i>Prevotella</i> , <i>Fusobacterium</i> , <i>Peptostreptococcus</i>), admixed with aerobic bacteria (<i>Streptococcus pneumoniae</i> , <i>Staphylococcus aureus</i> , <i>Haemophilus influenzae</i> , <i>Pseudomonas aeruginosa</i>)
Chronic Pneumonia
<i>Nocardia</i> <i>Actinomyces</i> Granulomatous: <i>Mycobacterium tuberculosis</i> and atypical mycobacteria, <i>Histoplasma capsulatum</i> , <i>Coccidioides immitis</i> , <i>Blastomyces dermatitidis</i>
Necrotizing Pneumonia and Lung Abscess
Anaerobic bacteria (extremely common), with or without mixed aerobic infection <i>Staphylococcus aureus</i> , <i>Klebsiella pneumoniae</i> , <i>Streptococcus pyogenes</i> , and type 3 pneumococcus (uncommon)
Pneumonia in the Immunocompromised Host
Cytomegalovirus <i>Pneumocystis jiroveci</i> <i>Mycobacterium avium-intracellulare</i> Invasive aspergillosis Invasive candidiasis "Usual" bacterial, viral, and fungal organisms (listed herein)

Pneumococcal vaccines containing capsular polysaccharides from the common serotypes are used in individuals at high risk for pneumococcal sepsis.

Haemophilus influenzae

Haemophilus influenzae is a pleomorphic, gram-negative organism that occurs in encapsulated and nonencapsulated forms. There are six serotypes of the encapsulated form (types a to f), of which type b is the most virulent. Antibodies against the capsule protect the host from *H. influenzae* infection; hence the capsular polysaccharide b is incorporated in the widely used vaccine against *H. influenzae*. With routine use of *H. influenzae* conjugate vaccines, the incidence of disease caused by the b serotype has declined significantly. By contrast, infections with nonencapsulated forms, also called *nontypeable forms*, are

increasing. They are less virulent, spread along the surface of the upper respiratory tract, and produce otitis media (infection of the middle ear), sinusitis, and bronchopneumonia. Neonates and children with comorbidities such as prematurity, malignancy, and immunodeficiency are at high risk for development of invasive infection.

H. influenzae pneumonia, which may follow a viral respiratory infection, is a pediatric emergency and has a high mortality rate. Descending laryngotracheobronchitis results in airway obstruction as the smaller bronchi are plugged by dense, fibrin-rich exudates containing neutrophils, similar to that seen in pneumococcal pneumonias. Pulmonary consolidation is usually lobular and patchy but may be confluent and involve the entire lung lobe. Before a vaccine became widely available, *H. influenzae* was a common cause of suppurative meningitis in children up to 5 years of age. *H. influenzae* also causes an acute, purulent conjunctivitis (pink eye) in children and, in predisposed older patients, may cause septicemia, endocarditis, pyelonephritis, cholecystitis, and suppurative arthritis. *H. influenzae* is the most common bacterial cause of acute exacerbation of COPD.

Moraxella catarrhalis

Moraxella catarrhalis is being increasingly recognized as a cause of bacterial pneumonia, especially in the elderly. It is the second most common bacterial cause of acute exacerbation of COPD. Along with *S. pneumoniae* and *H. influenzae*, *M. catarrhalis* constitutes one of the three most common causes of otitis media in children.

Staphylococcus aureus

Staphylococcus aureus is an important cause of secondary bacterial pneumonia in children and healthy adults following viral respiratory illnesses (e.g., measles in children and influenza in both children and adults). Staphylococcal pneumonia is associated with a high incidence of complications, such as lung abscess and empyema. *Intravenous drug users* are at high risk for development of staphylococcal pneumonia in association with endocarditis. It is also an important cause of hospital-acquired pneumonia.

Klebsiella pneumoniae

Klebsiella pneumoniae is the most frequent cause of gram-negative bacterial pneumonia. It commonly afflicts debilitated and malnourished people, particularly *chronic alcoholics*. Thick, mucoid, (often blood-tinged) sputum is characteristic, because the organism produces an abundant viscid capsular polysaccharide, which the patient may have difficulty expectorating.

Pseudomonas aeruginosa

Although *Pseudomonas aeruginosa* most commonly causes hospital-acquired infections, it is mentioned here because of its occurrence in cystic fibrosis and immunocompromised patients. It is common in patients who are neutropenic and it has a propensity to invade blood vessels with consequent extrapulmonary spread. *Pseudomonas* septicemia is a very fulminant disease.

Legionella pneumophila

Legionella pneumophila is the agent of Legionnaires' disease, an eponym for the epidemic and sporadic forms