Pneumonia in the Adult

Pneumonia is a heterogeneous disease with a host response that ranges from mild symptoms (fever, cough, and chest pain) to septic shock with multisystem organ failure. Nurses have an important role in the management of the patient being treated for pneumonia in both the inpatient and outpatient settings. This guide provides basic information on the different classifications and treatment of pneumonia in adults.

Pathophysiology Review

- Infection of the pulmonary parenchyma leads to alveolar inflammation, which produces an exudate that interferes with the diffusion of oxygen and carbon dioxide.
- Secretions and mucosal edema cause areas of the lung to be inadequately ventilated.
- Hypoventilation can result in arterial hypoxia.
- Complications of pneumonia may include acute hypoxic respiratory failure, sepsis, pleural effusion, and empyema.

DEFINITIONS	
Pneumonia	• An acute infection of the lower respiratory tract due to microorganism invasion of the pulmonary parenchyma • Caused by a wide variety of bacteria, viruses, or fungi • Risk factors for developing pneumonia include age over 65 or under 2, immunosuppressed state, underlying lung disease such as chronic obstructive pulmonary disease (COPD), cigarette smoking, and neurologic or mechanical conditions that interfere with swallowing function or suppress the cough reflex • Pneumonia may present as the primary disease process or as a secondary disorder in an already debilitated patient
Community-acquired pneumonia (CAP)	• Pneumonia diagnosed in non-hospitalized patients or a previously ambulatory patient within 48 hours after admission to the hospital • *Streptococcus pneumoniae* is the most commonly identified bacterial cause of CAP. • Common causes of viral pneumonia are influenza, respiratory syncytial virus (RSV), and SARS-CoV-2 (the virus that causes COVID-19). • Includes all pneumonia acquired in the setting of assisted-living facilities, rehabilitation facilities, dialysis centers and nursing homes
Hospital-acquired pneumonia (HAP)	• Pneumonia that occurs 48 hours or more after hospital admission that did not appear to be incubating at time of admission • May be caused by exposure to large volumes of pathogens in inspired air, increasingly virulent pathogen exposure, aspiration or impaired host defenses
Ventilator-associated pneumonia (VAP)	• Pneumonia that develops after 48 hours of exposure to mechanical ventilation • May be caused by aspiration of oropharyngeal pathogens or leakage of

	bacteria around cuff of endotracheal tube • Usual gram-negative microorganisms involved in both HAP and VAP are *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Acinetobacter species*; *Staphylococcus aureus* is the major gram-positive microorganism

Assessment and Diagnosis

Clinical Features

General

- Cough, fever, pleuritic chest pain, dyspnea, tachypnea, hypoxia, purulent sputum production, leukocytosis/leukopenia, confusion, and rarely, hemoptysis
- Crackles, rhonchi, tubular breath sounds, diminished breath sounds or dullness to percussion

CAP

- Typical: Sudden-onset fever, productive cough, shortness of breath, signs of pulmonary consolidation (dullness, increased fremitus, bronchial breath sounds, crackles), and occasionally, pleuritic chest pain
- Atypical: Gradual onset, dry cough, shortness of breath, crackles, general myalgias, fatigue

HAP

- New or progressive pulmonary infiltrate on chest imaging and two of the three following clinical features: fever greater than 38°C, leukocytosis or leukopenia, or purulent secretions

VAP

- New or progressive pulmonary infiltrate on chest imaging and one or more of the following findings: fever, purulent tracheobronchial secretions, leukocytosis, tachypnea, decreased tidal volume, increased minute ventilation, and decreased oxygenation.
- Signs and symptoms may develop gradually or suddenly.

Radiographic features

- Infiltrate on chest x-ray, or CT scan of the chest/thorax may include lobar consolidation, interstitial infiltrates, and/or cavitation

Diagnostic criteria

- Clinical symptoms plus radiological evidence of infiltrate on chest imaging
- Pathogen identification by microbiologic evaluation of lower respiratory secretions supports diagnosis.

Microbiologic evaluation

- Sputum culture and gram stain: expectorated sputum, induced sputum, tracheal secretions, or alveolar lavage via bronchoscopy
- Collection in non-intubated patients: Obtain specimen prior to antibiotic initiation, rinse mouth prior to expectoration, ensure no food intake one to two hours prior to expectoration, and transport specimen promptly to lab.
- Test for influenza and RSV during the winter months.
- Urine testing for legionella or pneumococcal antigens
- A specific pathogen may not be identifiable.

Care Essentials for Patients with Pneumonia

- Perform a detailed history to identify patients at risk for multi-drug resistant (MDR) pathogens. Risk factors for MDR include (Kalil et al., 2016):
    - Prior intravenous antibiotic use within 90 days
    - Five or more days of hospitalization prior to the occurrence of diagnosis
    - Septic shock at time of diagnosis
    - Acute renal replacement therapy prior to VAP onset
- If patient is admitted to the hospital, first dose of antibiotic should be administered in the emergency department.
- In hospitalized patient:
    - Closely monitor vital signs.
    - Observe for progression of symptoms, such as hypoxemia,tachypnea, tachycardia, and fever.
    - Use general infection control strategies, including strict handwashing and useof alcohol-based hand sanitizers.
    - Follow policies to encourage antimicrobial stewardship and reduce or alter antibiotic prescribing practices.
    - If the patient is intubated, use ventilator bundle strategies to prevent VAP:
        - Elevate the head of bed 30 to 45 degrees per policy, unless contraindicated.
        - Perform oral hygiene with 2% oral chlorhexidine solution.
        - Assess daily for weaning readiness and extubation.
        - Use sedation reduction strategies, as ordered.
        - Maintain endotracheal cuff pressures of 20 to 25 mm Hg.
        - Ensure aspiration precautions; enteral feedings preferred over parenteral.
        - Administer stress ulcer and deep vein thrombosis prophylaxis, as ordered.
- Administer antibiotics, antivirals and/or supplemental oxygen, as prescribed.
    - For patients with HAP or VAP, a 7-day course of antibiotics is recommended; this antibiotic therapy should be de-escalated if cultures identify a specific organism and sensitivities (narrow the antibiotic regimen and change from combination therapy

to monotherapy).
    - For patients with CAP, treat for a minimum of five days; however longer treatment may be necessary.
    - Before stopping therapy, the patient should be afebrile for 48 to 72 hours, breathing without supplemental oxygen (unless required for preexisting disease), and have no more than one clinical instability factor (defined as HR > 100 beats/min, RR > 24 breaths/min, and SBP ≤ 90 mmHg).
    - Procalcitonin, along with clinical criteria, may be used to guide discontinuationof antibiotic therapy; procalcitonin levels have been shown to correlate with bacterial infection.
- In hospitalized patients with COVID-19, antiviral therapy within 5-7 days of symptom onset may help prevent progression to pneumonia.
- Monitor for drug reactions.
- Maintain adequate hydration to thin pulmonary secretions and compensate for insensible losses due to fever.
- Perform respiratory/pulmonary hygiene, including incentive spirometry, chest percussion, coughing exercises, and frequent repositioning.
- Observe isolation precautions, as indicated.
- Assist with early mobility.
- Encourage smoking cessation or refer, when applicable.
- Provide nutritional support.
- Immunize prior to discharge from hospital and educate patient on immunization recommendations, including vaccines for COVID-19, influenza and pneumococcus according to age and previous immunization status.

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