Pneumonia:
Emerging Trends in
Diagnosis & Care

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....Nadine Salmon, RN, BSN, *IBCLC,* is the Clinical content Specialist for RN.com. Nadine earned her BSN from the University of the Witwatersrand, Johannesburg, South Africa. She worked as a midwife in Labor and Delivery, an RN in Postpartum units and Antenatal units, before moving to the United Kingdom, where she worked as a Medical Surgical Nurse. After coming to the US in 1997, Nadine worked in obstetrics and became a Board Certified Lactation Consultant. Nadine was the Clinical Pre Placement Manager for the International Nurse Staffing division before joining RN.com. When not writing courses and other educational materials, Nadine is currently pursuing her master's degree in Nursing Leadership.

…Susan Herzberger, RN, MSN, is the original author of this course.

Purpose and Objectives

The purpose of this course on pneumonia is to update nurses on current guidelines and clinical issues surrounding care of patients with pneumonia.

After successful completion of this course, you will be able to:
1. Identify risk factors for pneumonia.
2. List signs and symptoms of pneumonia.
3. Differentiate between different kinds of commonly occurring pneumonias.
4. Identify pathogens associated with community-acquired and hospital-acquired pneumonias.
5. State why treatment is usually started after a presumptive diagnosis is made.
6. Explain the controversies about sputum specimens.
7. Recognize current treatment protocols for pneumonia.
8. Match commonly used drugs with their usages for pneumonia.
9. Describe how to do an assessment on a pneumonia patient.
10. Identify actions that fulfill nursing care objectives for pneumonia patients.
11. State signs and expectations associated with recovery from pneumonia.

Introduction

Pneumonia is an infection of the small air sacs of the lungs (alveoli) and the tissues around them, and is one of the most common causes of death worldwide. Often, pneumonia is the final illness in people who have other serious, chronic diseases.

The setting in which pneumonia develops is one of the most important features. Pneumonia may develop in people living in the community (community-acquired pneumonia or CAP), or in the hospital (hospital-acquired pneumonia or HAP). The setting often helps determine what infecting organism is responsible for the pneumonia. For example, community-acquired pneumonia is more likely to stem from infection with the bacterium Streptococcus pneumoniae. Hospital-acquired pneumonia is more likely to be caused by Staphylococcus aureus or a gram-negative bacterium, such as Klebsiella pneumoniae or Pseudomonas aeruginosa.

Another critical feature is whether the pneumonia occurs in a healthy person or in someone who has an impaired immune system. Certain drugs and diseases can impair the immune system, predisposing the patient to pneumonia caused by unusual organisms.

Statistics

Despite the advent of antibiotics, pneumonia remains a global problem and presents an enormous burden on healthcare systems throughout the world. According to the World Health Organization (WHO), 1.4 million people die each year as a result of pneumonia (Driver, 2012). Pneumonia is the sixth most common cause of death overall, and the most common fatal infection acquired in hospitals. In developing countries, pneumonia is either the leading cause of death or second only to dehydration from severe diarrhea (Driver, 2012).

Classification of Pneumonia By Setting

Pneumonia is defined as an acute infection of lung parenchyma. It can be classified in three different ways: by the setting where it develops, by the parts of the lung affected, and by the causative agent.

By setting:

- **Community-acquired pneumonia (CAP):**
  Occurring in patients who have not been hospitalized or living in a nursing home within the past two weeks.
- **Hospital-acquired pneumonia (HAP) / Nosocomial pneumonia:**
  Occurring in patients 48 hours or more after their admission.
- **Ventilator-associated pneumonia (VAP):**
  Occurring more than 48 to 72 hours after endotracheal intubation.
- **Healthcare-associated pneumonia (HCAP):**
  Occurring in a mixed group of patients including those hospitalized within the past 90 days, nursing home residents, dialysis and chemotherapy patients.

Classification of Pneumonia By Physiological Location

- Lobar pneumonia: Affecting an entire lobe
- Broncho pneumonia: Affecting bronchi, bronchioles and alveoli in a patchy pattern
- Interstitial pneumonia: Affecting tissue that surrounds the air passages

Classification of Pneumonia By Pathogen

Bacterial Pneumonia:
Is commonly caused by organisms that are normal commensals of the upper respiratory tract, that are transmitted to susceptible individuals via airborne droplets, followed by migration of the pathogen to the lower respiratory tract (Driver, 2012). Defective cough reflex or damage to the lining of the airways can facilitate aspiration of infectious organisms to the lower airways (Nair and Neiderman, 2011 in Driver, 2012).

The most common causes of bacterial pneumonia are:
Streptococcus pneumoniae (pneumococcus)
Haemophilus influenzae type b (Hib)
Moraxella catarrhalis

Viral Pneumonia:
May be caused by organisms that originate in the upper respiratory tract and migrate to the terminal bronchioles (e.g. influenza or respiratory syncytial virus) or organisms that enter the upper airways but disseminate to the lower respiratory tract as happens in measles infection. Some infections may originate elsewhere but find their way systemically to the lower respiratory tract, e.g. cytomegalovirus (Figueiredo, 2009 in Driver, 2012).

The most common viral causes are:

Influenza A, B and C

Respiratory syncytial virus (the most common viral cause in children)

Rhinovirus

Parainfluenza viruses

Coronavirus

Adenovirus

Fungal Pneumonia:

Can be caused by a fungal infestation in the lungs. Fungal pneumonia is more common in patients with a suppressed immune system, such as AIDS patients.

The most common fungal organisms are:

Pneumocystis jiroveci (most commonly in those with HIV)

Histoplasma capsulatum

Cryptococcus

The Respiratory Tract

The upper respiratory tract is designed to prevent pathogens entering the lower airways and alveoli. The body has several defense mechanisms in place to achieve this, including:

- Cilia action and mucus production that trap and propel pathogens out of the respiratory tract.
- A cough reflex that clears airways of mucus and foreign particles.
- Alveolar macrophages that remove pathogens.
- Inflammatory mediators (such as neutrophils) that launch an immune response.

The majority of healthy people carry potential pneumonia-causing bacteria and viruses in their noses and throats (National Institute of Allergy and Infectious Diseases, 2012). However, when immunity is compromised, an imbalance between the pathogen and host factors occurs. The virulence and size of the pathogen is matched against the physique, robustness and immune competence of the host (Driver, 2012).

Pathophysiology of Pneumonia

Any infectious organisms that reach the alveoli are likely to be highly virulent, as they have already evaded the host's physical defense mechanisms. Consequently, they may overwhelm the macrophages, resulting in production of a fibrin-rich exudate that fills the infected and neighbouring alveolar spaces, causing them to stick together, rendering them airless (Driver, 2012). The inflammatory response also results in a proliferation of neutrophils. This can damage lung tissue, leading to fibrosis and pulmonary oedema, which also impairs lung expansion.

The inflammatory response can also lead to the development of a pleural effusion which is thought to complicate up to 40% of cases of pneumonia (Koegelenberg et al, 2008 in Driver, 2012). These changes result in reduced gaseous exchange. As a result, vital organs become oxygen deprived and the respiratory effort required with each breath will be increased as a result of the disturbance in

normal physiology. Respiratory and heart rate will increase in response to falling oxygen and rising carbon dioxide levels.

Pneumonia is often preceded by an upper respiratory viral infection, aspiration of phlegm or gastric contents, asthma, or exposure to allergens or irritants.

Risk Factors

- Age: The very young and the very old are at increased risk for the development of pneumonia. The very young have immature immune systems, lack of previous antibody-building exposures to pathogens, and narrow airways. The very old have weaker immune systems and more problems with cough and gag reflexes.

- Compromised immunity due to underlying chronic disease, such as AIDS, sickle cell anemia, chronic renal failure, diabetes, stroke, congestive heart failure and chronic obstructive pulmonary disease (COPD). Recipients of chemotherapy or organ transplantation are also at increased risk for developing pneumonia.

- Smokers, asthmatics, and alcoholics.

- Recent history of upper respiratory tract infection or thoracic or abdominal surgery.

- Residents of elderly care facilities are also at increased risk (Buckley & Schub, 2012).

People in hospitals and nursing homes are also at high risk for acquiring pneumonia. The sheer size of a healthcare facility makes sanitation challenging. Bacteria is known to survive by colonizing for decades inside plumbing systems (Todd, 2005). Viruses and bacteria can be cultured from hospital walls, equipment, and even the air. Also, there are many people coming in and out, inadvertently spreading germs.

Hospitalized patients are further at risk for pneumonia from the care they receive. Improper positioning is a set-up for pneumonia, with the supine position putting the patient at greater risk (Pruitt & Jacobs, 2006). Intubation and improper handling of ventilator circuits greatly increases the chance of introducing bacteria into the airways (Adis Data Information, 2011). Lack of hydration, malnutrition, poor oral hygiene, and invasive nasogastric or endotracheal tubing all support bacterial growth.

Stress ulcer medication may alter the normal gastric pH, allowing certain bacteria to flourish and colonize in the respiratory tract when regurgitated and aspirated. Sedation and debilitation increase the likelihood of this scenario, especially if the patient is lying in a supine position.

The Clinical Picture

The presentation of the patient with pneumonia varies, based on the causative agent. However, there are classic symptoms generally present with all pneumonias. The most common symptom of pneumonia is a cough that produces sputum. Other common symptoms include chest pain, chills, fever, and shortness of breath. There may also be tachypnea, intercostal retractions, crackles and cyanosis.

These symptoms may vary, however, depending on how extensive the disease is and which organism is causing it.

Symptoms vary even more in infants and older people. Fever may not occur. Chest pain may not occur, or people may not be able to communicate that they have chest pain. Sometimes the only symptom is rapid breathing or a sudden refusal to eat. An older person may suddenly become confused.

Complications: A severe pneumonia can prevent oxygen from getting to the bloodstream, causing people to feel short of breath. Low levels of oxygen can be life-threatening.

Viral Pneumonia

Viral pneumonia is most commonly seen in infants (Respiratory Syncitial Virus or RSV) and the elderly (American Lung Association, 2012).

Influenza A and B and parainfluenza virus can create pneumonia in healthy people at any point along the lifespan.

Viral pneumonia is usually seasonal, starting with rhinorrhea, cough, and a low grade fever three to five days after exposure to contagious droplets. It spreads to the lower respiratory tract, creating symptoms of pneumonia. This condition predisposes patients to secondary infection – bacterial pneumonia.

Diagnosis is based on clinical presentation, laboratory testing & imaging studies.

Treatment is primarily preventative and may include prophylactic antiviral medications and vaccination.

Uncomplicated viral pneumonia is usually self-limiting with a good prognosis (Buckley & Schub, 2012).

Bacterial Pneumonia

The types of bacterial pneumonia that you are most likely to encounter are:

- *Streptococcus pneumonia (pneumococcal pneumonia)* accounts for the majority of bacterial pneumonia (Grose & Schub, 2011). This is a gram positive anaerobe, carried by up to 70% of the population (NIAID, 2009). It infects the very old and the very young, often following an upper respiratory infection. The onset is sudden, marked by a single shaking chill. Fever, productive coughing, dyspnea, and pleurisy follow.

- *Staphylococcus pneumonia* is caused by a Gram-positive bacterium staphylococcus aureus (S. Aureus) and occurs mostly in those with pre-existing viral pneumonia, diabetics and head trauma patients, IV drug abusers and ICU patients. The source of S. aureus is generally through inhalation or spread from an infected site such as valvular endocarditis or an infected intravenous access. Clinically patients develop fever, productive cough, pleuritic pain and leukocytosis. Staphylococcus pneumonia is one of the most common multi-drug resistant (MDR) strains of bacterial pneumonia and can be extremely difficult to treat.

Mycoplasmal Pneumonia

This mild, self-limiting pneumonia is the most common type of pneumonia among people 5 to 35 years old. It may also be referred to as atypical pneumonia as the causative organism is uncommon (Driver, 2012).

Symptoms develop after a two to three week incubation period. They progress gradually from dry cough with pharyngitis, flu-like complaints, and diarrhea to paroxysms of productive coughing. Two out of ten people also have maculopapular rashes. The disease usually subsides after a few weeks, although cough symptoms may linger for up to six weeks.

Fungal Pneumonia

Fungal pneumonia is usually an opportunistic disease. It is associated with either long-term exposure to endemic or occupationally-related fungi, or with immune system impairment.

Most people with fungal pneumonia due to environmental exposure are chronically ill and slow to seek medical treatment. You are most apt to encounter fungal pneumonia in the hospital while caring for immunocompromised patients.

Pneumocystis carinii is common in HIV and AIDS patients. These patients are susceptible to the fungus when their CD4 helper cell count falls.

Classic pneumonia symptoms of fever, dyspnea, and cough evolve slowly.

Differential Diagnosis

Pneumonia resembles several other conditions:

- Atelectasis
- Pulmonary edema
- Congestive heart failure
- Acute respiratory distress syndrome
- Pulmonary embolism
- Tuberculosis
- Lung cancer
- Chronic obstructive pulmonary disease

Also, pneumonia may extend from a common cold, influenza, bronchitis, and sinusitis. This makes the onset of pneumonia less clear to recognize.

Diagnosis

The diagnosis of pneumonia can be difficult, as it is a progressive illness often complicated by underlying diseases. Classic pneumonia symptoms, such as fever, may be diminished in patients who are elderly or immunocompromised. Clinical symptoms and x-ray findings do not always coincide. In 20 to 30% of pneumocystis carinii cases the x-rays are normal (Merck & Company, 2006). Often patients have been on antibiotics prior to developing pneumonia, which alters the validity of cultures.

Furthermore, there is controversy over the value of sputum cultures. The guidelines of the American Thoracic Society and the Infectious Diseases Society of America recommend that sputum specimens be taken if there is an out-of-the-ordinary agent or drug-resistant bacteria suspected. However, at least half of sputum cultures are falsely negative (Merck & Company, 2006). Some patients are too debilitated to produce a useful sputum specimen.

A presumptive diagnosis of pneumonia is often made to allow treatment to start in a timely manner. A critical decision about collecting a sputum specimen for culture is made prior to starting antibiotics. The guidelines state that treatment should not be delayed in the critically ill for the reason of specimen collection (Barclay & Vega, 2006).

Diagnosis is made based on history, clinical presentation, diagnostic tests and laboratory investigations.

X-rays are the most cost effective diagnostic tool, as a standard chest x-ray can identify infiltrates, hyperinflation, and areas of consolidation.

Anatomical location and pattern of findings is significant because they may align with characteristics typical of specific kinds of pneumonia. For instance:

- Multiple small abscesses occur in staphylococcal pneumonia.
- Interstitial airspace infiltrates are linked to moraxella.
- Patchy lower lobe infiltrates are characteristic of mycoplasmal pneumonia.
- A funnel-shaped interstitial pattern in one lower lobe is a trait of chlamydial pneumonia.
- Multiple lobar involvement is typical of Legionnaire's disease.

Practitioners match laboratory tests and x-ray findings to clinical symptoms. This enables them to sort out pneumonia from other conditions and identify specific types of pneumonia. Key characteristics may be enough to make a presumptive or suspected diagnosis. However, a definitive diagnosis requires proof of the causative agent in a laboratory finding.

Laboratory Investigations

Laboratory tests commonly used to diagnose pneumonia are:

- WBC count (Normal range: 4,500-10,000 WBC/mcL)
    - Normal or slightly elevated in viral pneumonias
    - Increased in bacterial pneumonias
- Sputum Gram's stain and culture
    Gram's stains differentiate between gram-positive and gram-negative bacteria, guiding treatment until a culture and sensitivity report is available.

- Blood, pleural fluid, transtracheal or transthoracic aspirate, and/or tissue cultures
- Arterial blood gases analysis
- Serologic assays of antibody titers

Some tests are done to obtain a definitive diagnosis of a specific kind of pneumonia for epidemiological reasons.

At other times, knowing the specific pathogen is necessary to make a treatment decision.

SARS
(Severe Acute Respiratory Syndrome) is a highly contagious type of pneumonia first seen in 2002 in China. Patients exposed to SARS should start droplet, contact and airborne isolation immediately.

Laboratory Investigations

Examples of agent-specific tests are:

- Legionnaire's disease: A rapid urinary antigen test can be performed to detect Legionella bacteria within the body. If the patient has pneumonia and the test is positive, then the patient is considered to have Legionnaire's disease (CDC, 2011).
- Chlamydial pneumonia: Fluorescent antibody test showing a specific IgG or IgM titer.
- Pneumococcal pneumonia: Urinary antigen test that supports but does not replace other tests. Can also isolate streptococcus in blood, tissue, pleural fluid or transtracheal aspirate.
- SARS: Reverse transcription polymerase chain reaction test (RT-PCR) detects the coronavirus in cultured blood, stool or nasal secretion samples. Findings not available until 28 days after onset of symptoms.
- Mycoplasmal pneumonia: Serologic assay showing ↑ IgM 2-4 weeks after onset.
- Pneumocystis carinii: Histopathologic demonstration of organism.
- Pneumonia caused by gram-negative bacteria: Gram's stain of sputum and cultures from blood, pleural fluid, or transtracheal aspirate.
- Staphylococcal pneumonia: Culture from blood, empyema fluid or transtracheal or transthoracic aspirate.

Other Diagnostic Investigations

Expectorated specimens:
Sputum must be coughed up from the lungs. The mouth should be as clean as possible. The best time to produce a specimen is upon arising, stimulating a cough after several deep breaths.

Bronchoscopy:
Patients should be nil by mouth for 4 to 8 hours and the mouth should be as clean as possible. Using local anesthesia, a thin, flexible fiberoptic tube is passed into the trachea. Deep sputum is aspirated, washings are taken, or a biopsy is done.

Thoracentesis:
Pleural effusions are aspirated through a needle inserted into the chest cavity while the patient sits. The procedure is both diagnostic and therapeutic. Chest x-ray and ultrasound may be used for

monitoring. Inform your patient to minimize movement and coughing during the procedure. Turn the patient on the unaffected side for an hour afterwards, monitoring coughing, and lung sounds (Pagana & Pagana, 2005).

Treatment

The decision about whether to treat a patient at home or in the hospital is often made in the ED.

The factors that affect the decision are:
- Severity of pneumonia
- Ability to maintain hydration
- Home care support
- Pre-existing conditions

Treatment of pneumonia is both supportive and pharmacological. See the following page for common drugs used to treat pneumonia.

Class	Drugs	Use	Notes
Macrolides	Clarithromycin (Biaxin) Azithromycin (Zithromax) Erythromycin (E-Mycin)	CAP: Bacterial Mycoplasmal Chlamydial Legionnaire's	
Tetracyclines	Doxycycline (Vibramycin)	Bacterial CAP or HAP	
Fluoroquinolones	Moxifloxacin (Avelox) Levofloxacin (Levoquin) Ciprofloxacin (Cipro) Gatifloxacin (Tequin) Gemifloxacin (Factive)	CAP or HAP: Bacterial Mycoplasmal Chlamydial Legionnaire's	Especially used in drug-resistant pneumonias
Penicillins	Penicillin G (Permapen) Ampicillin (Ampicin) Ticarcillin (Ticar) Piperacillin (Pipril) Amoxicillin/Clavulanate (Augmentin) Nafcillin	Bacterial CAP or HAP	
Cephalosporines	Cefaclor (Ceclor) Cefuroxime (Ceftin) Cefotaxime (Claforam)	Bacterial CAP or HAP	
Aminoglycosides	Gentamicin (Garamycin) Amikacin (Amikin)	Bacterial HAP	Used only in combination with drugs from other classes.
Sulfonamides	Co-trimoxazole/TMP-SMX (Sulfamethoxazole and trimethoprim)	Pneumocystis carinii	Used for prevention and treatment.
Miscellaneous	Aztreonam (Azactam) Vancomycin (Vancocin) Linezolid (Zyvox) Imipenem (Primaxin) Clindamycin (Cleocin)	Bacterial CAP or HAP Pneumocystis carinii Bacterial CAP or HAP	
Ketolides	Telithromycin (Ketek)	Bacterial CAP	Severe hepatoxicity risk
Amebicides/ Antiprotozoals	Pentamidine (NebuPent) Atovaquone (Mepron)	Pneumocystis carinii	Used for prevention and treatment.
Antivirals	Amantadine (Symmetrel) Rimantadine (Flumadine)	Influenza type A	Not recommended for flu season 2005-2006.
	Oseltamivir (Tamiflu) Zanamivir (Relenza)	Influenza types A + B	Prophylactic use in first 12-48 hours after onset of symptoms.
	Acycylovir	Pneumonia associated with herpes or varicella viruses.	
	Ganciclovir (Cytovene)	Pneumonia associated with cytomegalovirus.	

Treatment Guidelines & Recommendations

Guidelines for treating pneumonia come from the American Thoracic Society (ATS), the Infectious Diseases Society of America (IDSA), and the Centers for Disease Control and Prevention (CDC).

The specific recommendations often refer to empirical therapy (commencement of therapy prior to a definitive diagnosis), and effective pharmaceutical treatment based on ever-changing clinical evidence.

New guidelines are issued frequently to keep up with the emergence of new strains of pathogens and drug-resistance patterns. Some general recommendations relevant to your practice are:

- Start antibiotics within four hours of hospital admission.
- Tailor antibiotics from broad-spectrum to narrow-spectrum as soon as a causative agent is identified.
- Use a combination of drugs if multi-drug resistant pathogens are involved.
- Start all patients with IV administration, and later switch to oral or parenteral administration if appropriate. Aerosolized antibiotics may be an added therapy.
- Favor shorter duration of antibiotic use, seven days instead of 14 to 21 days.
- Monitor symptoms with an awareness of the time expected for improvement.

Treatment of Multi-Drug Resistant Pathogens

Multi-drug-resistant pathogens are more likely to be involved when:

- HAP is late-onset (5+ days on mechanical ventilation).
- There is a history of recent hospitalization or dialysis care.
- The patient lives in a nursing home (ATS, 2005).

Acinetobacter bacterium is a MDR pathogen associated with intensive care unit (ICU)–acquired pneumonia (Derricott, 2011).

Multi-drug resistant strains of Acinetobacter are often only susceptible to polymyxins (colistin and polymyxin B), a class of antimicrobial drugs that can be more toxic than most antimicrobial drugs (Sunenshine et al., 2007 in Derricott, 2011). However, treatment decisions for infections caused by the Acinetobacter bacterium are made on an individual basis.

The most common multi-drug-resistant bacteria are:

- **Pseudomonas**
- **Acinetobacter**
- **Staphylococcus**

Nursing Assessments

When making assessments your primary tools will be observation, auscultation, and palpation.

What to look for:
- Fluctuations in pulse oximetry and/or ABGs
- Cyanosis
- Changes in respiratory rate or depth
- Asymmetry of lung expansion
- Intercostal retractions and use of accessory muscles
- Nasal flaring
- New or change in coughing pattern
- Changes in quality or quantity of sputum
- Body temperature of more than two degrees above patient's baseline
- Tachycardia
- New or change in pleuritic chest pain
- Deterioration in functional ability
- Cognitive decline

Nursing Assessments

What to listen for:
- Rales (crackles)
- Wheezes (whistles)
- Rhonchi (snoring sounds)

What to feel for:
- Changes in fremitus (chest wall vibrations created when the patient speaks a repetitive phrase)

Nursing clinicians no longer consider percussion to be generally useful (Pruitt & Jacobs, 2005).

Nursing Care Objectives

Of paramount importance for patients with bacterial pneumonia is the timely start of antibiotics. The administration of antivirals within the first few days of certain kinds of viral pneumonia is also important for some patients. The aim may be to reduce the severity of an individual case or to diminish viral shedding within a facility where the patient is located. However, care for most patients with viral pneumonia is supportive, not pharmacological. Nursing care objectives relevant to all pneumonia patients are:

- Provide respiratory support
- Prevent the spread of infectious agents
- Maintain hydration
- Relieve pain and fever
- Facilitate laboratory and diagnostic testing
- Monitor for expected improvements
- Structure progressive mobilization and ambulation
- Take preventive measures against HAP or VAP
- Monitor for complications

Nursing Care

Provide respiratory support through oxygenation and airway clearance. Deliver oxygen to your patients with the beds elevated to 45 degrees. Use a nasal cannula, Venturi mask or re-breather mask, depending on the oxygen volume needed.

Patients who need short-term (less than a day) ventilatory assistance may use non-invasive positive pressure ventilation (NPPV) delivered with a mask (Pruit & Jacobs, 2006).

Patients that require mechanical ventilation are those whose hypoxemia is not relieved by oxygen therapy alone or who have respiratory failure.

Infection Control Alert

Almost all hospitalized pneumonia patients are placed under droplet, contact and airborne precautions, except for those with Legionnaire's disease (Nursing Spectrum, 2006).

Nursing Care

Nurse the patient in a semi (45 degree angle) or high (90 degree angle) fowler's position with the head of the bed elevated to promote postural drainage. Keep the patient's airways clear by thinning secretions with adequate hydration and possibly humidification. Change position frequently to promote lung expansion.

Unless your patient is intubated and suctioned routinely, you will have to facilitate coughing to clear out secretions. Prior to this event ensure that the patient receives any needed analgesic. Position your patient in high Fowler's or a standing position. Use pillows for splinting or physically assist the cough with your hands around the diaphragm.

Ask your patient to breathe deeply a few times before coughing. Patients with COPD may use a "huff" cough in which a few breaths taken with less than a full inspiration precede the cough (Pruitt & Jacobs, 2005).

Note that postural drainage with percussion, known as "Chest PT," is a controversial practice and may be harmful to some patients (Pruitt, 2005).
The huff cough uses a series of several mini- coughs to loosen and dislodge phlegm. This technique produces a soft exhalation sound like the word "huff." As the Huff Cough is produced, phlegm is dislodged and can be expectorated.

Preventing Hospital Acquired Pneumonia (HAP)

Aside from infection control measures, other ways to prevent HAP are to minimize the risk of aspiration and to install evidence-based measures for ventilator acquired pneumonia (VAP) reduction.

Two medical practices aimed at minimizing aspiration include:

- Nutritional feeding through a post-pyloric opening that bypasses the possibility of regurgitation.
- Decontamination of the digestive tract with oral antibiotics (ATS, 2005).

Additional measures you can use routinely are:

- Keep patients sitting up for at least 30 to 60 minutes after meals to avoid regurgitation.
- Ensure that meticulous oral hygiene is done twice a day to lower the bacterial count in saliva.
- Keep patients hydrated to help liquefy secretions.

Reducing Ventilator Assisted Pneumonia (VAP)

The best way to stop VAP is to avoid intubation. There are times that this is unavoidable.

Intubation raises the risk of VAP in three ways:
- Giving bacteria a direct entry into the lungs by passing through the oropharangeal area.
- Interfering with the normal defenses against aspiration by keeping the epiglottis open and dismantling the cough reflex.
- Providing a reservoir for pathogens, a biofilm that forms around the tube.

Protect your patients on mechanical ventilation by:
- Elevating the head of the bed at a 30 to 45 degree angle & repositioning the patient frequently.
- Avoiding the routine use of normal saline lavages when suctioning.
- Being vigilant about managing ventilator circuitry and ensuring that circuitry condensation doesn't inadvertently enter the patient's airway.
- Ensuring proper endotracheal tube cuff pressure (between 20 and 30).
- Ventilator Care Bundling (VCB) is a group of four evidence-based procedures, which when clustered together and implemented as an 'all or nothing' strategy, may result in substantial clinical outcome improvement.

Ventilated patients should receive meticulous oral care every 12 hours to minimize the risk of acquiring VAP.

Reducing Ventilator Assisted Pneumonia (VAP)

In addition to these practices, medical decisions aimed at reducing risk of VAP are:
- The use of an orotracheal tube instead of a nasotracheal tube to bypass nasal and sinus contamination.
- The use of a continuous suctioning endotracheal tube to prevent accumulation of subglottic secretions.
- The choice of sucralfate (Carafate) instead of H2-anatagonists for preventing stress ulcers.
- The growth of certain bacteria in the stomach increases when gastric acidity is reduced but medicine that lowers acidity also prevents GI bleeding. Both factors are considered when a drug is chosen to prevent stress ulcers.
- Limitation of sedation and paralytic agents that depress coughing.
- Daily withdrawal of sedation to assess patient readiness for weaning off mechanical ventilation.
- Modification of quantity and type of an enteral feeding diet.

Prognosis

Prognosis depends on both pathogen and patient. Recovery does not always proceed in a linear fashion.

Uncomplicated viral pneumonia generally resolves with supportive care in a few weeks. Particularly virulent influenzas and advanced age will extend the recovery time (Buckley & Schub, 2011).

Most patients with bacterial pneumonia show some response to antibiotics within 12 to 48 hours (Grose & Schub, 2011). However, seriously ill patients may require three to six days to become afebrile.

Mycoplasmal pneumonia usually subsides after a few weeks, although cough symptoms may linger for up to six weeks.

Fungal pneumonia is more difficult to manage, because of the immunocompromized status of the patient.

Signs of Improvement

Improvement is demonstrated by:
- Normalization of vital signs, particularly a lowering of fever.
- Arterial blood gases showing improved oxygenation.
- Laboratory values showing a normalized WBC count.
- Decreased bacterial growth in cultures.

Although your patient's clinical symptoms may improve within the first week, don't expect to see

resolution of the pneumonia on x-ray for several weeks, as infiltrates are re-absorbed slowly.

Hospitalized pneumonia patients are discharged when they show clinical improvement and are medically stable.

Complications

There are many reasons why some patients do not recover from pneumonia as expected:

- Pre-existing vulnerabilities:
    - Age extremes.
    - Underlying chronic diseases.
    - Immune suppression.
- Asthma: Many asthmatics harbor chronic infections.
- Extreme severity of pneumonia, for example: multilobar involvement.
- Wrong diagnosis or misidentified pathogen.
- Inadequate drug treatment.
- Drug-resistant pathogen(s) involved.

Complications may include:
- Adverse drug reaction
- Superinfections
- Occult infections
- Bacteremia
- Systemic Inflammatory Response Syndrome (SIRS)
- Empyema (accumulation of pus in the pleural space)
- Lung abscess
- Pneumothorax
- Pleural effusion
- Acute Respiratory Distress Syndrome (ARDS)
- Respiratory failure
- Cardiovascular events
- Arrhythmias
- Endocarditis
- Meningitis
- Otitis media
- Clostridium difficile colitis

Prevention

Pneumonia is best prevented through vaccines:

- Pneumococcal conjugate vaccine for young children and Pneumococcal polysaccharide vaccine for vulnerable groups. Pneumococcal pneumonia, caused by Streptococcus pneumonia, can sometimes be prevented with this vaccine. Vaccination is recommended for people at high risk, such as those older than 65 and younger adults who have lung or heart disease, a weakened immune system, or diabetes or who have had their spleen removed. The protection from vaccination may last a lifetime, although it is recommended that people at highest risk be revaccinated after 5 years. Although temporary soreness at the site of injection is common, only 1% of people develop a fever and muscle pain after vaccination. Even fewer people have a severe allergic reaction. Pregnant women should not receive this vaccine. The Pneumococcal conjugate vaccine is also given to children younger than 2 years old.

- Haemophilus influenzae type b vaccine: Offers protection against pneumonia caused by Haemophilus influenzae type b strain. This vaccine is recommended for all children to prevent pneumonia as well as other infections caused by this organism. The vaccine is given in two or three doses—at ages 2 months, 4 months and sometimes 6 months.

- Influenza vaccine: Annual influenza vaccinations are recommended for health care workers, older people, and people with chronic medical conditions. Some experts recommend vaccination for all people if enough vaccine is available. Vaccination should take place every year during the fall (September through November), so that levels of antibodies will be highest during the peak influenza months—November through March. A different vaccine is introduced every year based on predictions of which strains are most likely to cause influenza.

- Varicella vaccine: Pneumonia caused by this virus is very rare. One dose of the vaccine is given between ages 12 and 15 months of age and another between ages 4 and 6 years. Children between 6 and 12 years who have not already received the vaccine should be vaccinated, unless testing indicates a natural immunity from a previous infection. Vaccination without testing is acceptable, because vaccination appears to be safe even if a person has had chickenpox. In people 13 years and older, the vaccine should be given only if testing does not indicate natural immunity. For these people, two doses are given 4 to 8 weeks apart.

Conclusion

Caring for pneumonia patients will always be a part of nursing. Many end-stage disease processes in the elderly culminate in pneumonia. However, constitutional vulnerability and exposure to pathogenic agents put even the young at risk. This makes public health recommendations for immunization important.

Updated guidelines on management of pneumonia are issued to address new and mutating pathogens. Keep current with these changes.

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Statistics on Pneumonia

- Pneumonia is the 6th leading cause of death in the U.S. (Merck & Company, 2006).
- Twenty percent of people with pneumonia need to be hospitalized (Kleinpell & Elpern, 2004).
- The average length of hospitalization for pneumonia is three days in those under 18 years of age and six days in adults (National Center for Health Statistics, 2005).
- Pneumonia is the 2nd most common hospital acquired infection (American Thoracic Society and the Infectious Diseases Society of America, 2005; Goldrick, 2005).
- The risk of developing pneumonia from being in a hospital is 0.5 to 1% but increases to over 20% if the patient is intubated for mechanical ventilation (ATS, 2005; Pruitt & Jacobs, 2006).
- The incidence of ventilator-associated pneumonia increases with the length of ICU stay (Myrianthefs, Kalafati, Samara, & Baltopoulos, 2004).
- The risk of developing pneumonia from a nursing home is comparable to that for the hospital. Pneumonia patients often transfer to the hospital for acute care (Goldrick, 2005).
- The mortality rate for hospital-acquired pneumonia is 30 to 70%. However, many pneumonia patients die of underlying diseases (ATS, 2005).