REVIEW ARTICLE

Nursing Management of Patients with Pneumonia: A Nursing Process Approach

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Abstract

Although "Pneumonia" was regarded by William Osler in the 19th century as "the captain of the men of death", the advent of antibiotic therapy and vaccines in the 20th century has seen improvements in survival. Nevertheless, in developing countries, and among all age groups, it remains a leading cause of death. Yet, little attention is paid to this disease. Pneumonia is an inflammation of the lung parenchyma caused by various microorganisms. Sudden onset; shaking chill; rapidly rising fever and pleuritic chest pain aggravated by respiration or coughing are its vital clinical manifestations. The key goals of management of Pneumonia are maintaining adequate gas exchange, clearing the infection and promoting the airway clearance through skilled effective nursing interventions. Monitoring the sputum production, respiratory pattern and characteristics, ABGs and SaO_2 to determine oxygen needs; Providing chest physical therapy and postural drainage and therapeutic Positioning; Administering Oxygen, Bronchodilators, NSAID's, Antibiotics and timely suctioning are the goal directed nursing interventions in effective management of Pneumonia. The best way to prevent pneumococcal disease is by getting vaccinated. The pneumococcal vaccines like Pneumococcal Conjugate Vaccine (PCV13) and Pneumococcal Polysaccharide Vaccine (PPSV23) are helpful to protect against some of the more than 90 types of pneumococcal bacteria.

Keywords: Pneumonia; Pnuemonitis; Pneumococcal infections; Bronchopneumonia; Nursing management; Pneumonia vaccination.

Introduction

Pneumonia kills more children than any other illness – more than AIDS, malaria and measles combined. Over 2 million children die from pneumonia each year, accounting for almost 1 in 5 under five deaths worldwide. Yet, little attention is paid to this disease.[1]

Pneumonia is an inflammatory condition of the lung, affecting primarily the microscopic air sacs known as alveoli. It is usually caused by infection with viruses or bacteria and less commonly other microorganisms, certain drugs and other conditions such as autoimmune diseases.

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Although pneumonia was regarded by William Osler in the 19th century as "the captain of the men of death", the advent of antibiotic therapy and vaccines in the 20th century has seen improvements in survival. Nevertheless, in developing countries, and among the very old, the very young, and the chronically ill, pneumonia remains a leading cause of death.[2]

Definition

Pneumonia is an inflammation of the lung parenchyma[3,4,5,6] caused by various microorganisms, including bacteria, mycobacteria, chlamydiae, mycoplasma, fungi, parasites, and viruses. "Pneumonitis" is a more general term that describes an inflammatory process in the lung tissue that may predispose or place the patient at risk for microbial invasion.[3]

According to the author of this article

"Pneumonia" can be defined based on the multiple references as, "the inflammation of lung parenchyma involving the terminal airways and alveoli of the lung, caused by infectious agents, resulting in edema of the interstitial lung tissue and extravasation of fluid into the alveoli, with consolidation and exudation, thus causing hypoxemia".[4,5,6,7,8]

Epidemiology

1. Pneumonia affects approximately 450 million people globally per year, seven percent of population, and results in about 4 million deaths, mostly in third-world countries.[2]
2. Pneumonia remains a leading cause of death for all age groups,[2,3] resulting in 4 million deaths (7% of the world's total death) yearly.
3. Rates are greatest in children less than five, and adults older than 75 years.
4. In the United States, as of 2009, pneumonia is the 8th leading cause of death.
5. It occurs about five times more frequently in the developing world than in the developed world.
6. In 2010, it resulted in 1.3 million deaths, or 18% of all deaths in those under five years, of which 95% occurred in the developing world.
7. Countries with the greatest burden of disease include: India (43 million), China (21 million) and Pakistan (10 million).
8. It is the second most common nosocomial infection and accounts for about 15 - 20% of total nosocomial infections.[2]
9. Leading cause of death for the clients older than 85 years.[8]

WHO response

In 2013, WHO and UNICEF launched the integrated Global Action Plan for Pneumonia and Diarrhoea (GAPPD). The aim is to accelerate pneumonia control with a combination of interventions to protect, prevent, and treat pneumonia in children with actions.[9] The goal is to see a drop in deaths from pneumonia to fewer than 3 children in 1000 live births, and from diarrhoea to less than 1 in 1000 by 2025.[10]

Risk factors

1. Chronic illness.
2. Viral respiratory infections.
3. Immunosuppression / Neutropenia
4. Age > 65 years.
5. Impaired gag, cough or swallow reflex.
6. Depressed cerebral function (altered level of consciousness)
7. Tracheotomy or endotracheal tube
8. Organ transplants
9. AIDS
10. Exposure to noxious gas (eg: cigarette smoke, air pollution)
11. Abdominal or thoracic surgery
12. Aspiration of upper airway organisms
13. Crowded living conditions
14. Prolonged bed rest or immobility
15. Malnutrition.[8]

Predisposing factors in elderly

1. Chronic airflow limitation.
2. Congestive Heart Failure
3. Influenza
4. Alcoholism
5. Immobility
6. Reduced cellular immunity
7. Loss of ciliary action
8. Decreased chest wall compliance
9. Decreased muscle strength
10. Poor nutritional status.[8]

Etiology/ classification / the pneumonia syndromes

1. *Community Acquired Acute Pneumonia:*
   - Streptococcus Pneumoniae
   - Haemophilus Influenzae
   - Moraxella Catarrhalis

- Staphylococcus Aureus
- Legionella Pneumophila
- Enterobacteriaceae (Klebseilla Pneumoniae) and Pseudomonas spp.

2. *Community acquired a typical pneumonia:*
   - Mycoplasma Pneumoniae
   - Chlamydia spp. (C. Pneumoniae, C. Psittaci, C Trachomatis)
   - Coxiella Burnetti (Q fever)
   - Viruses : Respiratory Syncytial Virus, Parainfluenza Virus(Children); Influenza A and B (Adults); Adenovirus (military recruits); SARS virus
3. *Nosocomial pneumonia:*
   - Gram–negative rods belonging to Enterobacteriaceae (Klebsiella spp., Serratia Marcescens, E Coli) and Pseudomonas spp.
   - Staphylococcus Aureus (usually Penicillin – resistant)
4. *Aspiration pneumonia:*
   - Anaerobic oral flora (Bacteroides, Prevotella, Fusobacterium, Peptostreptococcus), admixed with aerobic bacteria (Streptococcus Pneumoniae, Staphylococcus Aureus, Hemophilas Influenza, and Pseudomonas Aeruginosa)
5. *Chronic pneumonia:*
   - Nocardia
   - Actinomyces
   - Granulomatous: Mycobacterium Tuberculosis and atypical Mycobacteria, Histoplasma Capsulatum, Coccidiodes Immitis, Blastomyces Dermatitidis
6. *Necrotizing pneumonia and lung abscess:*
   - Anaerobic bacteria (extremely common) with or without mixed aerobic infection.
   - Staphylococcus Aureus, Klebsiella Pneumoniae, Streptococcus Pyogenes, and type 3 Pneumococcus (uncommon)
7. *Pneumonia in the immunocompromised host*:
   - Cytomegalovirus
   - Pneumocystis Carinii
   - Mycobacterium Avium Intracellulare
   - Invasive Aspergillosis
   - Invasive Candidiasis
   - Usual bacterial, viral, and fungal organisms (listed above).[11]

Pathophysiology

Pneumonia results from an infection of the pulmonary tissue, including the interstitial spaces, the alveoli, and often the bronchioles. The pneumonic process begins when pathogens successfully penetrate the airway mucus and multiply in the alveolar spaces. To do this, they must survive the lung's many defenses against microbial invasion. As the pathogenic organisms multiply, edematous fluid forms, and other evidence of inflammation becomes apparent. White blood cells migrate into the alveoli and cause thickening of the alveolar wall. Fluid fills the alveoli, which protects the organisms from phagocytosis and facilitates the movement of organisms to other alveoli. In this way the infection spreads. If the invading organisms obtain access to the blood stream, septicemia results.

The edema of inflammation stiffens the lung, thus causing decreased lung compliance and a decline in the vital capacity (VC) of the lung. Decreased production of surfactant further reduces compliance and leads to atelectasis. Some of the venous blood coming into the lung passes through the under ventilated area. This unoxygenated blood then travels to the left side of the heart. As a result, arterial oxygen tension falls, causing hypoxemia (insufficient oxygen in the blood).

Fever is the systemic response to the infection. The client may develop shaking chills in an attempt to increase heat production and raise the metabolic rate. An increase in metabolic demand causes secondary tachypnea with tachycardia. Blood pressure may fall because of peripheral vasodilation and decreased circulating blood volume secondary to dehydration. Cardiac function may be compromised by hypoxemia and enhanced metabolism. Congestive heart failure or shock may result; cardiac irritability may be enhanced because of inadequate tissue oxygenation, thus causing dysrhythmias.

The extent of pulmonary involvement after the

microbial invasion depends on the defenses of the host. In an immunocompromised host, bacteria can multiply. Tissue necrosis results when multiplying anaerobic organisms form an abscess that perforates the bronchial wall. Pneumonia may occur as diffuse patches throughout both lungs (bronchopneumonia), or it may cause consolidation (solidification, lack of air spaces) in one lobe.[8]

Clinical Manifestations

1. Fever, chills, or both : Sudden onset; shaking chill; rapidly rising fever of 39.5° C to 40.5° C (101° F to 105° F).
2. Cough nonproductive to very productive or purulent.
3. Dyspnea accompanied by respiratory grunting, nasal flaring, use of accessory muscles of respiratory, fatigue.
4. Tachypnea.
5. Tachycardia.
6. Rapid bounding pulse.
7. Pleuritic chest pain aggravated by respiration / coughing.
8. Diaphoresis.
9. Headache.
10. Fatigue.[7]

Dignostic evaluation

1. *History:* Assess for risk factors.
2. *Physical examination findings (in addition to clinical manifestations)*
   - Bronchial breath sounds over the affected area.
   - Whispered pectoriloguy present.
   - Tactile fremitus increased over the affected area.
   - Percussion note dull over the affected area.
   - Unequal lung expansion over the affected area.
3. *Diagnostic studies:*
   - Tests to identify organism responsible: sputum culture and sensitivity, arterial blood gases, blood cultures, (WBC increased).
   - Chest radiograph to define location and extent of pneumonia (affected areas appear white or opaque)
   - Immunologic test for detecting microbial antigens in serum, sputum, and urine.
   - Skin test or tuberculosis.
   - Transtracheal aspiration
   - Bronchoscopy
   - Needle aspiration
   - Open lung biopsy[6]

Management

Goals of treatment:

1. Maintain adequate gas exchange.
2. Clear infection
3. Promote airway clearance.

Pharmacological interventions

1. *Antibiotics therapy:* depends on laboratory identification of causative organism and sensitivity to specific antimicrobials.
2. *Oxygen therapy:* If the patient has inadequate gas exchange oxygen therapy is provided to prevent or treat hypoxemia.[6]

Non-pharmacological interventions

1. Turn, cough, and deep breathing exercises to remove secretions.
2. Aerosols and Humidification: to reduce sputum viscosity and promote mucociliary clearance
3. Perform postural drainage and chest physiotherapy.
4. Ensure proper nutrition to keep immune system functioning properly.
5. Promote activity such as walking as tolerated.
6. Isolate immunocompromised patients to prevent continued exposure to infective organism.

Special Medical Surgical Procedures:

Bronchoscopy to directly visualize the affected areas, to remove sputum by lavage, and to obtain

Drug therapy for various types of Pneumonia

Type of Pneumonia	Drug therapy
Community Acquired Pneumonias:	
• Streptococcus Pneumoniae (Gram +ve)	• Penicillins
• Haemophilus Influenzae (Gram -ve)	• First and second generation Cephalosporins • Tetracyclines • Quinolones • Trimethoprim / Sulfamethoxazole
• Mycoplasma Pneumoniae	Macrolide antibiotics (such as Erythromycin)
• Legionella Pneumophila (Gram –ve)	
Viruses	• No specific drug for viruses
Nosocomial pneumonias	
• Staphylococcus Aureus (Gram +ve)	• Broad spectrum Penicillins
• Klebsiella Pneumoniae (Gram -ve)	
• Pseudomonas Aeruginosa (Gram –ve)	• Penicillin with a beta-lactamse – inhibitor added • Second and third generation Cephalosporins • Aminoglycosides • Quinolones • Macrolide antibiotics • Trimethoprim / Sulfamethaxazole • Vancomycin
Fungi	• Antifungals (such as Amphotericin B or Flucanazole [Diflucan])
Other pneumonias	
• Pneumocystis Carinii Pneumonia	• Trimethoprim / sulfamethoxazole • Pentamidine
• Aspiration Pneumonia (usually anaerobes such as Bacteroides)	• Clindamycin (Cleocin, Dalacin) • Second generation Cephalosporins[8]

tissue biopsies.[6]

Complications

1. Hypoxemia
2. Respiratory failure
3. Abscess formation
4. Empyema
5. Pleural effusion
6. Pleurisy
7. Bacteremia
8. Septicemia
9. Pulmonary edema
10. Atelectasis
11. Arthritis.[6]

Nursing Management

Nursing Assessment

Subjective data

Important health information:

Past health history: Lung cancer, COPD, cigarette smoking, alcoholism, diabetes, chronic debilitating disease, AIDS, exposure to chemical toxins, dust or allergen.

Medications: Use of antibiotics, corticosteroids, chemotherapy, or any other immunosuppressants.

Surgeries and other treatment: Recent abdominal or thoracic surgery, splenectomy, any surgery with general anesthesia.

Functional health patterns:

Health perception – health management: Recent URI, fatigue, malaise.

Nutritional metabolic: Anorexia, nausea, vomiting, fever, chills.

Activity exercise: Prolonged bed rest or immobility, weakness, dyspnea, cough (productive or dry).

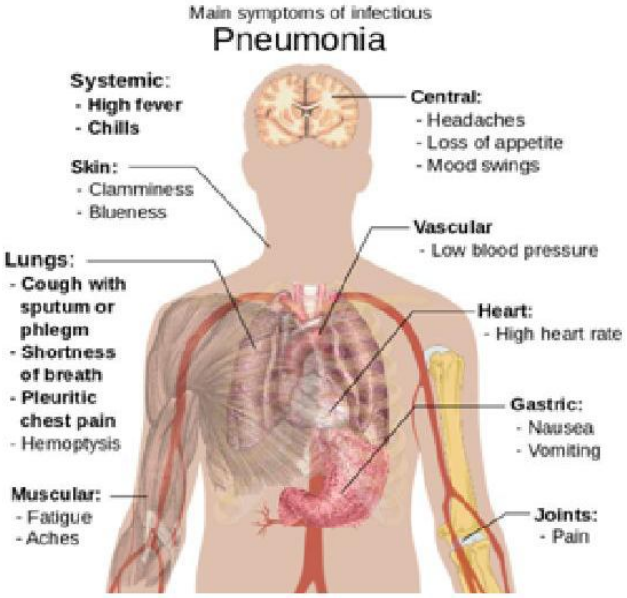
Cognitive perceptual: Pain with breathing, chest pain, headache, myalgia.

Subjective data

General: Restlessness or lethargy; splinting of affected area.

Integumentory: Diaphoresis or dry skin with poor turgor; pallor, flushing, or circumoral and nail bed

Figure 1: Main symptoms of infectious pneumonia



Reference: Pneumonia. Wikipedia: The free encyclopedia. [online] 2013 Aug 28 [cited 2013 Sep 2]; Available from URL: http://en.wikipedia.org/wiki/File:Symptoms_of_pneumonia.svg

cyanosis.

Respiratory: Tachypnea; pharyngitis; asymmetric chest movements or retraction; decreased excursion; nasal flaring; use of accessory muscles (neck abdomen); grunting; crackles, ronchi, bronchial or absent breath sounds, pleural friction rub on auscultation; dull over consolidated areas, tactile fremitus; pink, rusty, purulent, green, yellow, or white sputum (amount may be sent to copious) on percussion.

Cardiovascular: Tachycardia

Neurologic: Changes in mental status; confusion to delirium

Possible findings: Leukocytosis; abnormal ABG's with decreased or normal PaO_2, increased $PaCO_2$, and decreased $p^{H;}$ positive sputum gram stain and culture; nonsegmental consolidation with air bronchograms and patchy or diffuse infiltrates on chest X- ray.[5]

List of nursing diagnosis

1. Ineffective airway clearance related to copious sputum production.
2. Ineffective breathing pattern related to chest pain, tachypnea and hypoxia.
3. Impaired gas exchange related to ventilation perfusion mismatch.
4. Pain related to effects of inflammation of the parietal pleura and frequent coughing.
5. Hyperthermia related to increased metabolic rate, dehydration.
6. Impaired nutritional status, less than body requirements related to inflammatory and infectious condition.
7. Activity intolerance related to decreased oxygen levels for metabolic demands.
8. Fluid volume deficit related to fever, diaphoresis, and mouth breathing.
9. Impaired oral mucous membrane related to mouth breathing and frequent coughing.
10. Sleeping pattern disturbance related to pain, dyspnea, unfamiliar environment.
11. Knowledge deficit related to treatment regimen and preventive health measures.
12. High risk for potential complications of super infections related to pleural effusion, lung abscess, bacteremia.

Vaccination

Vaccination prevents against certain bacterial and viral pneumonias both in children and adults. Influenza vaccines are modestly effective against influenza A and B. The Center for Disease Control and

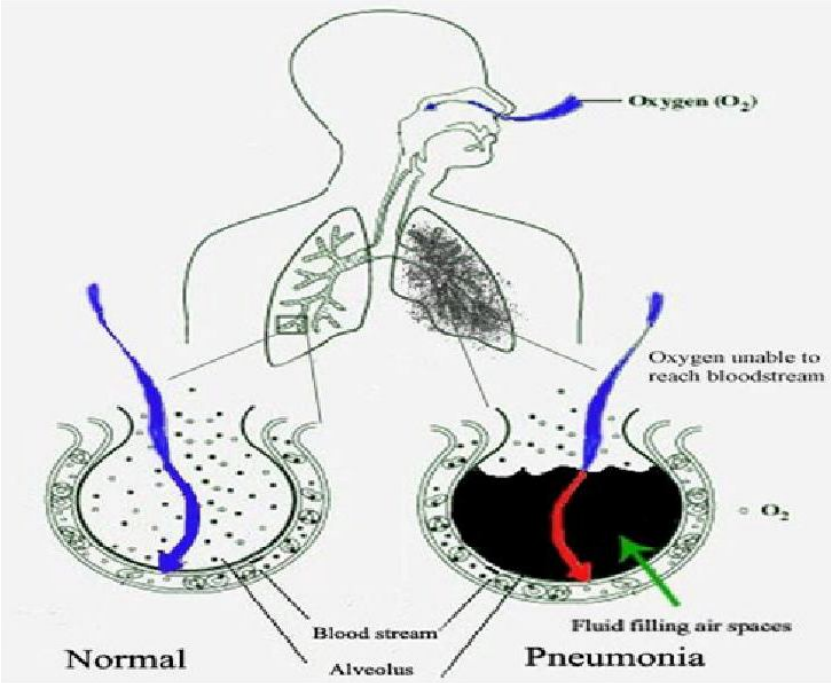
Nursing care plan based on priority nursing diagnosis

Nursing Diagnosis	Objective	Nursing Interventions	Evaluation
1. Ineffective airway clearance related to copious sputum production.	Client maintains patent airway clearance as manifested by adequate coughing reflex, clearing secretions and clear lung sounds.	1. Monitor sputum production, noting color, consistency, amount, and odor. 2. Provide adequate humidification and hydration to loosen secretions. 3. Stress the importance of activity and exercise. 4. Teach the patient to turn, cough, and deep breathe. 5. Provide chest physical therapy and postural drainage, if indicated. 6. Administer nasotracheal suction, if indicated. 7. Administer bronchodilators, if indicated. 8. Administer antibiotics, if indicated.[6]	Client maintain patent airway clearance
2. Ineffective breathing pattern related to chest pain, tachypnea and hypoxia.	Client maintains normal breathing pattern as manifested by lack of dyspnea, respiratory rate of 12 to 20 breaths per minute, lung sounds equal bilaterally and bilaterally equal chest expansion.	1. Monitor ABGs as indicated. 2. Monitor respiratory rate, rhythm, and depth and use of accessory muscles. 3. Position for comfort with head of bed elevated to facilitate efficient use of diaphragm. 4. Administer pain medication as needed. 5. Administer oxygen as indicated.[6]	Client maintain normal breathing pattern
3. Impaired gas exchange related to ventilation perfusion mismatch.	Client attains balanced gas exchange as manifested by reduced cyanosis, dyspnea, improved ABGs gradually leading to normal findings.	1. Observe for cyanosis, dyspnea, hypoxia, and confusion, indicating worsening condition. 2. Follow ABGs / SaO_2 to determine oxygen need and response to oxygen therapy. 3. Administer oxygen at concentration to maintain PaO_2 at acceptable level. Hypoxemia may be encountered because of abnormal ventilation- perfusion ratios in affected lung segments. 4. Avoid high concentrations of oxygen in patients with COPD, particularly with evidence of CO_2 retention; use of high oxygen concentrations may worsen alveolar ventilation by removing the patients only remaining ventilatory drive 5. Place patient in an upright position to obtain greater lung expansion and improve aeration. Frequent turning and increased activity (up in chair, ambulate as tolerated) should be employed.[7]	Client attain balanced gas exchange
4. Pain related to effects of inflammation of the parietal pleura and frequent coughing.	Client verbalizes maximum reduction of pain as manifested by appears comfortable.	1. Place in a comfortable position (Semi-Fowler's) for resting and breathing; encourage frequent change of position to prevent pooling of secretions in lungs. 2. Demonstrate how to splint the chest while coughing. 3. Avoid suppressing a productive cough. 4. Administer prescribed analgesic agent to relive pain. Avoid narcotics in patients with a history of COPD and use very cautiously in elderly. 5. Apply heat and / or cold to chest as prescribed. 6. Assist with intercostal nerve block for pain relief. 7. Encourage modified bed rest during febrile period. 8. Watch for abdominal distention or ileus, which may be due to swallowing of air during intervals of severe dyspnea. Insert a nasogastric or rectal tube as directed.[7]	Client verbalize maximum reduction of pain.

Prevention (CDC) recommends yearly vaccination for every person 6 months and older. Immunizing health care workers decreases the risk of viral pneumonia among their patients. When influenza outbreaks occur, medications such as amantadine or rimantadine may help prevent the condition.[2]

The best way to prevent pneumococcal disease is by getting vaccinated. The pneumococcal vaccine is a shot that helps protect against some of the more

Figure 2: Pneumonia fills the lung's alveoli with fluid, hindering oxygenation. The alveolus on the left is normal, whereas the one on the right is full of fluid from pneumonia



Reference: Pneumonia. Wikipedia: The free encyclopedia. [online] 2013 Aug 28 [cited 2013 Sep 2]; Available from URL: http://en.wikipedia.org/wiki/File:Symptoms_of_pneumonia.svg

than 90 types of pneumococcal bacteria. Following are the Vaccines for available against Pneumococcal infections:

1. *Pneumococcal Conjugate Vaccine (PCV13 or Prevnar 13®):* For Children protects against the 13 types of pneumococcal bacteria. PCV13 is also recommended to help prevent pneumococcal disease in adults with certain medical conditions.
2. *Pneumococcal Polysaccharide Vaccine (PPSV23 or Pneumovax 23®):* Protects against 23 types of pneumococcal bacteria. It is recommended for all adults 65 years and older and for anyone who is 2 years and older at high risk for disease.[12]

Conclusion

Prevention is best rather than treatment as pneumonia is considered comparatively to other disease as such. The patient needs to be assured that complete recovery from pneumonia is possible. It is extremely important to emphasize the need to take all of the prescribed medication and to return for follow – up medical care and evaluation. Adequate rest is needed to maintain progress and to prevent relapse. The patient considered to be at high risk to pneumonia should be told about available vaccines and should discuss with the health care provider.

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