Review Article

EPIDEMIOLOGY AND PREVENTION OF PNEUMONIA

Kumar Raja Jayavarapu*, D. Praveen Kumar, Ishrath Sulthana, J. Madhavi, S. Uma Murali and S. Vineetha

Mother Teresa Pharmacy College, Kothuru, Sathupally-507303.

*Corresponding Author: Kumar Raja Jayavarapu

Mother Teresa Pharmacy College, Kothuru, Sathupally-507303.

ABSTRACT

A prevalent acute respiratory infection that affects the distal airways and alveoli, pneumonia is a serious health issue that is linked to high rates of morbidity and both short and long-term mortality in all age groups globally. Community-acquired pneumonia and hospital-acquired pneumonia are the two main categories of pneumonia. Pneumonia can be caused by a wide range of microorganisms, including fungi, respiratory viruses, and bacteria, and their prevalence varies greatly across different geographic regions. Pneumonia is more common in susceptible people, such as older adults with a history of chronic conditions and children under the age of five. Pathogen features play a less significant effect in the development of the disease than the host immune response. Pneumonia is diagnosed based on both clinical presentation and radiological findings. Patients with pneumonia frequently present with respiratory and systemic symptoms. Finding the bacteria causing the problem is essential since ineffective or delayed antimicrobial therapy can have negative effects. Pneumonia will be better managed with new antibiotic and non-antibiotic medicines, as well as quick and precise diagnostic tests that can identify infections and drug resistance.

KEYWORDS: Bacterial pneumonia, Community-acquired pneumonia, Hospital acquired pneumonia, Pneumonia, Antibiotic resistance, Microbial pathogens.

INTRODUCTION

The alveoli and distal bronchial tree of the lungs are affected by pneumonia, a common acute respiratory illness. Community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP, which includes ventilation-associated pneumonia (VAP)) are the two main categories into which the illness falls. Aspiration pneumonia represents 5–15% of all cases of CAP; however, its prevalence amongst patients with HAP is not known1. The lack of robust diagnostic criteria for aspiration pneumonia may explain why the true burden of this type of pneumonia remains unknown.

Community-acquired pneumonia (CAP): infection acquired outside of the hospital setting.

Hospital-acquired pneumonia (HAP): infection acquired after at least 48 hours of hospitalization.
The microbes that cause CAP and HAP are very different from one another. Streptococcus pneumoniae, respiratory viruses, Haemophilus influenzae, and other bacteria like Mycoplasma pneumoniae and Legionella pneumophila are the most frequent causative pathogens in community-acquired pneumonia (CAP). The most frequent microorganisms in HAP are Staphylococcus aureus (including both methicillin-susceptible. However, the

idea of HCAP appears to have limited utility due to challenges in standardizing risk variables for this population and the variability of post-hospital health care globally; in fact, HCAP was left out of the most current guidelines.

Epidemiology

Pneumonia remains a leading cause of hospitalization and death worldwide. In 2015, Pneumonia was the eighth leading cause of death in the United States,1 the fourth leading cause of death worldwide, and leading cause of death in low-income countries. However, the true incidence of CAP is likely underestimated. Patients with mild infections are less likely to seek medical attention and diagnosis may therefore go unrecognized.

Pneumonia is a disease that affects all populations heavily and is fairly common. After adjusting for various gender and age differences, CAP was found to be the eighth leading cause of death in the United States and the seventh leading cause of death in Canada in a study conducted by the US Centre's for Disease Control and Prevention (CDC) with the goal of estimating its burden in North America.[8] The annual age-adjusted incidence of CAP was 649 patients hospitalized per 100,000 adults (95% confidence interval, 628.2 to 669.8), corresponding

to 1,591,825 annual adult CAP hospitalizations in the United States, according to one of the largest studies conducted over a 2-year period in a Louisville population of 587,499 adults from 2014 to 2016.

Furthermore, the study discovered that the hospitalized mortality rate was 6.5%, translating to 102,821 fatalities annually in the US. 30 days mortality was 13.0%, six-month mortality was 23.4%, and one-year mortality was 30.6%. Populations with a higher proportion of African Americans or Hispanics as well as economically disadvantaged groups have higher scores on these indices. According to the Community-Acquired Pneumonia Organization (CAPO) database, the death rates in the United States/Canada, Europe, and Latin America were 7.3%, 9.1%, and 13.3%, respectively, based on incidence in 16 nations concentrated in these three geographical areas.

Pathophysiology
The upper airway typically provides protection against pathogenic germs. When the host's defences are weakened due to an underlying reason, microorganisms can enter the lower respiratory tract or aspirate the normal oropharyngeal flora into the lungs. If blood-borne bacteria get stuck in the pulmonary capillary beds and enter the circulation, they can result in pneumonia.
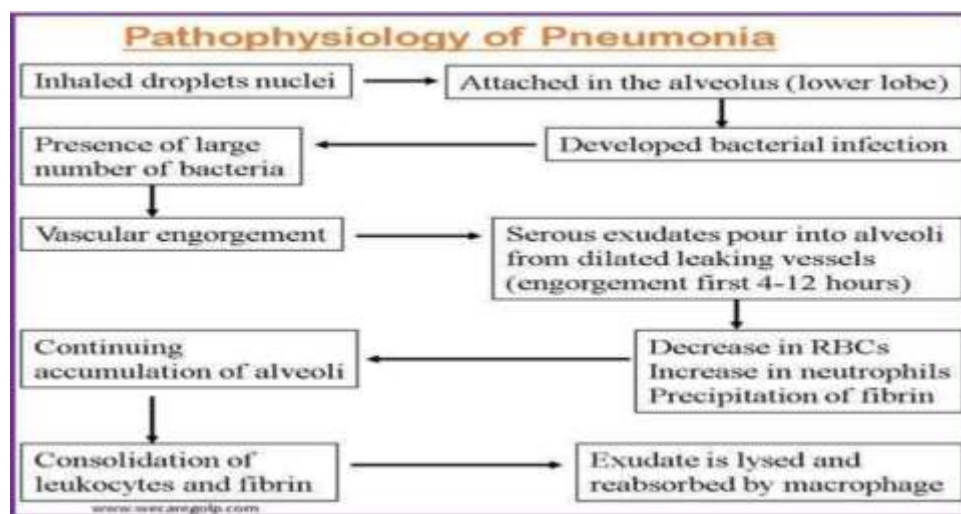
To initiate the inflammatory process, WBC and neutrophils enter the alveoli and fill the region that is typically air-containing. White blood cells and neutrophils occupy places that are previously filled with air during inflammatory reactions, obstructing the alveoli and causing them to become airless.

This obstructs the carbon dioxide and oxygen exchange, which impacts diffusion and ventilation. A sufficient ventilation of the lungs is also compromised by obstruction brought on by secretions and mucosal edema. Blood with low oxygen content is delivered to the lungs through the pulmonary artery. Partially oxygenated blood travels to the left heart, a factor in hypoxemia.

Risk factors
Although pneumonia can affect anyone, certain groups are at higher risk of acquiring pneumonia:
Young children: Due to the development of their immune systems, children under the age of five are more at risk for pneumonia and other illnesses.

Older adults: Due to weakening immune systems, adults 60 years of age and older—especially those with other comorbidities—are also more likely to develop pneumonia.

People with underlying health conditions: Because these diseases harm the lungs and make it harder for the body to rid itself of germs, people with cystic fibrosis, asthma, chronic obstructive pulmonary disease (COPD), and illnesses affecting the kidneys, heart, or liver are more likely to have infections like pneumonia.

Smokers and heavy drinkers: Smoking and heavy alcohol drinking can weaken the lungs and increase the risk of infection.

Signs and Symptoms
Pneumonia can present with a variety of signs and symptoms, which may vary based on the type (Bacterial, Viral, Fungal) and severity. Common signs and symptoms include:
1. **Cough:** Often productive, with mucus that may be green, yellow, or even bloody.
2. **Fever:** Typically high, but may be mild in some cases.
3. **Chills:** Accompanied by shaking.
4. **Shortness of breath:** Difficulty breathing or rapid breathing.
5. **Chest pain:** Often sharp or stabbing, especially when coughing or breathing deeply.
6. **Fatigue:** General weakness and tiredness.
7. **Nausea or vomiting:** Sometimes present, especially in children.

8. **Confusion:** Particularly in older adults.

The mildest cases, called walking pneumonia, feel like a bad cold or flu. More moderate cases may feel like a bad flu accompanied with breathing difficulties. People may find it hard or painful to take a deep breath or, they breathe faster than normal. In the most severe cases, people feel like they can't get enough air and start breathing very fast. You can see their nostrils flare with each breath. Additionally, the heart rate increases, blood pressure goes down, and the skin starts turning blue or pale because of the lack of oxygen. The decrease in oxygen in the blood causes brain stops working well causing confusion or disorientation. All in all, it becomes very hard to do anything. About 1 in 5 people who get pneumonia have severe enough symptoms to require intensive care

Etiology
Community-Acquired Pneumonia.

Bacterial causes
They have been classically studied under the subheadings "typical" and "atypical" organisms in terms of ease of culture positivity. Common typical organisms include Pneumococcus, Haemophilus influenzae, Moraxella catarrhalis, Group A Streptococcus, and other aerobic and anaerobic gram-negative organisms. Atypical organisms commonly seen in clinical practice include Legionella, Mycoplasma, Chlamydia, among others.In the United States, the most common bacterial causes of CAP include Streptococcus pneumoniae, Staphylococcus aureus, Mycoplasma pneumoniae, and gram-negative enteric bacilli.

Viral causes
It is often observed that viral species colonize nasopharynx of patients with CAP. Whether they are the primary cause or contribute to the pathogenesis by secondary bacterial causes is still being investigated. However, some of the most frequent viral agents implicated in CAP in the United States include influenza virus followed by respiratory syncytial virus, parainfluenza virus, and adenoviruses.

Fungal causes
Fungal infections are usually implicated in patients with certain predisposing immunocompromised states like HIV and organ transplant recipients, among others. However, often overlooked, some fungal species can cause pneumonia in immunocompetent individuals which results in a delay in diagnosis and leads to unfavourable outcomes. The 3 commonest ones in North America include Histoplasma, Blastomyces, and Coccidioides.

Diagnosis of pneumonia
Pneumonia is an inflammatory condition of the lung primarily caused by infections. The diagnosis of pneumonia involves a combination of clinical assessment, imaging studies, and laboratory tests. Here's a comprehensive overview of the diagnostic process.

1. **Clinical assessment**
•   **Recording history**
Symptoms: Common signs and symptoms include fever, chills, chest pain, coughing up sputum, and shortness of breath.
Risk factors: Considered age, smoking history, associated conditions (Such diabetes or COPD), and recent hospital stays.

•   **Physical examination**
Vital Signs: Check for low oxygen saturation, tachycardia, fever, and tachypnea.
Auscultation: Pay attention for reduced breath sounds or crackles (rales), which could be signs of lung involvement.
Percussion: A dull percussion sound may indicate an infection or pleural effusion.

2. **Imaging studies**
Chest X-ray: The initial imaging examination for pneumonia. It can show pleural effusion and other abnormalities, such as patches of opacity (Consolidation).
CT Scan: If the results of the chest X-ray are unclear or if problems like empyema or abscess formation are suspected, a CT scan may be recommended.

3. **Laboratory tests**
•   **Sputum culture**
Obtain a sample for culture and sensitivity to identify the causative organism. This is particularly useful for bacterial pneumonia.

•   **Blood tests**
Complete Blood Count (CBC): May show leukocytosis (increased white blood cells).
Blood cultures: Recommended in severe cases to detect bacteremia.

•   **C-reactive Protein (CRP) and Procalcitonin**
These markers can help differentiate bacterial pneumonia from viral infections and assess severity.

4. **Additional tests**
•   **Pulse oximetry**
To assess oxygen saturation and need for supplemental oxygen.

•   **Bronchoscopy**
Considered in cases where the diagnosis is unclear, or if there is suspicion of atypical pathogens, especially in immunocompromised patients.

•   **Pleural fluid analysis**
If pleural effusion is present, thoracentesis may be performed to analyze the fluid for infection.

5. Differential diagnosis
- Consider other conditions that may present similarly, such as:
  - Chronic obstructive pulmonary disease (COPD) exacerbation
  - Pulmonary embolism
  - Lung cancer
  - Tuberculosis

Prevention
All will agree that prevention is better than cure. The following activities are part of preventive measures against pneumonia:

Vaccination
Vaccines to prevent pneumococcal disease are available in the community setting and in government or private hospitals and clinics. There are many kinds of vaccines depending on the strain causing pneumonia.

Good hygiene
Practicing good hygiene, such as washing hands regularly, can help prevent the spread of infection.

Avoiding Smoking and Heavy drinking
Quitting smoking and reducing alcohol consumption can help reduce the risk of developing pneumonia because putting a stop to these habits aids in strengthening the immune system.

Maintaining a healthy Diet and Lifestyle
Eating a balanced diet and staying physically active can help boost the immune system, thus lowering the chance of being infected with pneumonia.

Keep yourself hydrated
Consume lots of water to help keep mucus light and easy to pass.

Minimize exposure
Especially during flu season, try to avoid busy areas and avoid close contact with sick people.

Handle chronic conditions
To lower your risk of pneumonia, take good care of any chronic conditions you may have, such as diabetes or asthma.

Maintain good respiratory hygiene
To stop the spread of germs, cover your mouth and nose when you cough or sneeze with a tissue or your elbow.

Routine checkups
Routine medical examinations can aid in the early detection of any respiratory problems.

Treatment
The newly available drugs for the treatment of pneumonia are:
Xacduro (cefiderocol), Ceftobiprole, Ceftazidime, Avibactam, Lefamulin, Amoxicillin, Cefiderocol:

While natural remedies can support recovery from pneumonia, they should not replace medical treatment, especially for serious cases. Here are some supportive natural approaches:

Honey: Known for its antibacterial properties, honey can soothe the throat and help with coughing. Mix it with warm water or herbal tea.

Garlic: Garlic has antimicrobial properties. Adding fresh garlic to meals or consuming it raw may help boost immunity.

Ginger: Ginger can help reduce inflammation and support the immune system. Try ginger tea or adding fresh ginger to meals.

Turmeric: Curcumin, the active compound in turmeric, has anti-inflammatory properties. You can mix it with warm milk or water.

Eucalyptus oil: Inhalation of eucalyptus oil can help relieve congestion. Add a few drops to hot water and inhale the steam.

Steam inhalation: Inhaling steam from hot water can help clear mucus and improve breathing.

CONCLUSION
Pneumonia is still a major worldwide health concern because it causes high rates of morbidity and mortality in people of all ages. Effective management of community-acquired pneumonia and hospital-acquired pneumonia, two different kinds of the illness, depends on an accurate diagnosis and adequate therapy. The importance of host variables and the immune system's reaction frequently exceeds that of particular infections. New therapy alternatives and the development of diagnostic tools are critical to improving patient outcomes as antibiotic resistance rises. The incidence of pneumonia can be significantly decreased by taking preventive measures, such as vaccination and maintaining proper cleanliness. In order to reduce the burden of this preventable disease, further research and public health activities are essential.

REFERENCE
1. Basic pathology, kumar abbas, 8: 497-500.
2. Medical physiology, Eleventh addition, C. guyton, 527-528.
3. Human anatomy and physiology, Deepa k. Ingawale, Satish k. mandlik, Page, 228.
4. Mackenzie G. The definition and classification of pneumonia. Pneumonia (Nathan), 2016; 8: 14.
5. Mandell, L. A. & Niederman, M. S. Aspiration pneumonia. N. Engl. J. Med. A review article about aspiration pneumonia, including new insights about microbial aetiology and antibiotic treatment, 2019; **380**: 651–663.
6. Bartlett JG. Diagnostic tests for agents of community-acquired pneumonia. Clin Infect Dis, 2011.
7. Hage CA, Knox KS, Wheat LJ. Endemic mycoses: overlooked causes of community acquired pneumonia.

8. Jones RN. Microbial etiologies of hospital-acquired bacterial pneumonia and ventilator-associated bacterial pneumonia. Clin Infect Dis, 2010; 01.
9. Barbier F, Andremont A, Wolff M, Bouadma L. Hospital-acquired pneumonia and ventilator-associated pneumonia: recent advances in epidemiology and management.
10. Shorr AF, Zilberberg MD, Reichley R, Kan J, Hoban A, Hoffman J, Micek ST, Kollef MH. Validation of a clinical score for assessing the risk of resistant pathogens in patients with pneumonia presenting to the emergency department.