

# PNEUMONIA

## **Abstract**

Pneumonia involves inflammation and consolidation of the lungs, and most cases of pneumonia are caused by an infection from bacteria or viruses. In most individuals, pneumonia is a relatively serious condition however recovery can be quick if the condition is detected and treated early. Individuals who are very young, elderly, and that have chronic diseases or a compromised immune system are at higher risk of complications, will require close monitoring, and may need hospitalization. The treatment for patients with pneumonia includes antibiotics, fluids, rest, and supportive care. Supplemental oxygen in very severe cases, intubation and mechanical ventilation, and admission to intensive care may be necessary in some cases.

## **Learning Objectives**

1. Identify the correct definition of pneumonia.
2. Identify the causes of pneumonia.
3. Identify the signs and symptoms of pneumonia.
4. Identify risk factors for developing pneumonia.
5. Identify how pneumonia is treated.

## **Introduction**

Pneumonia is an inflammatory process that is caused by an infection with a microorganism. It is a common respiratory problem. Millions of people each year get pneumonia, and many of them are hospitalized because of the condition. For most people, pneumonia is a relatively serious condition but if the infection is quickly detected and the proper treatments are done, the patient will recover completely. Pneumonia can be dangerous for some people who are at greater risk for the illness. The treatment of pneumonia provides most people with an excellent chance of recovery but it is worth knowing that it is still a significant cause of illness, and in vulnerable patients it can be a potentially dangerous disease.

## **Pathophysiology of Pneumonia**

Pneumonia is defined as an *inflammation* and *consolidation* of the lungs. The majority of pneumonia cases are caused by an infection from bacteria or viruses but there are other microorganisms that can cause pneumonia such as fungi and parasites. Pneumonia is also classified by how and where it was contracted. It is important for healthcare workers to know that pneumonia may be community-acquired or hospital-acquired.

## **Statistics of Pneumonia**

Precise statistics are not available, but every year approximately 4 million Americans develop pneumonia and many of them need to be hospitalized. Pneumonia is more common in men than women, and men are more likely to die from the disease. The very young are more susceptible to pneumonia, compared to older adolescents and adults, however the incidence of pneumonia increases with advancing age.

The older the person, the more likely the person is to develop pneumonia or to die from pneumonia.

The mortality rate from pneumonia in people 80 years or older has been reported to be > 37%. The risk of developing pneumonia is strongly associated with someone's state of health. Certain diseases, chronic medical conditions, compromised immune system, and lifestyle issues are factors that increase the likelihood that a person will get pneumonia.

### **Risk Factors for Pneumonia**

Before reviewing the risk factors for pneumonia, it's important to understand the normal *gag reflex* and its function. The gag reflex is a protective mechanism that prevents something from entering the throat except during voluntary swallowing. If certain parts of the oral cavity such as roof of the mouth or the back of the tongue are touched, there is a reflex action that causes gagging and expels foreign objects. The gag reflex protects the lungs from fluids or solids being aspirated.

#### **Age:**

The very young and the elderly are very susceptible to pneumonia.

#### **Aspiration:**

Aspiration is defined as the inhalation of a foreign substance into the lungs. The relationship between aspiration and pneumonia relates to the fact that gastric contents entering the lungs can cause an infection. People who are likely to aspirate are those who have had a

stroke, seizure, syncopal (fainting) episode, or a nasogastric tube or an endotracheal tube in place.

Someone who has had a stroke may have permanent damage to the gag reflex, and for people who have had a seizure or a syncopal episode there is a temporary disruption of the gag reflex that develops. In someone with a nasogastric or endotracheal tube, the gag reflex is mechanically blocked.

#### Chronic Diseases:

Chronic respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD) increase the risk of developing pneumonia. Cancers, diabetes, liver disease, and renal disease also increase the risk.

#### Immunocompromised Patients:

People who have a compromised immune system cannot fight off infections and are at risk for pneumonia. People who have acquired immune deficiency syndrome (AIDS), who have certain cancers, who are receiving chemotherapy, who are malnourished, and who have had an organ transplant are likely to have a compromised immune system.

#### Intravascular Devices:

Patients who have indwelling intravascular devices such as a percutaneous indwelling central catheter (commonly called a PICC line) can develop pneumonia because the PICC line allows microorganisms access to the bloodstream.

#### Lifestyle Factors:

Chronic alcohol or drug use and cigarette smoking increase the risk of developing pneumonia.

### **Pathophysiology of Pneumonia**

Pneumonia is an inflammatory process that is caused by an infection with a microorganism. As mentioned above, most cases of pneumonia are caused by bacteria or viruses, and many of those microorganisms are found everywhere. Some of the microorganisms that typically cause pneumonia are listed in Table I. A microorganism that can cause an infection is called a pathogen.

**Table I: Microorganisms Causing Pneumonia**

<p><b>Streptococcus</b> <b>Haemophilus influenzae</b> <b>Rhinoviruses</b> <b>Coronaviruses</b> <b>Influenza viruses</b></p>
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All of these are common microorganisms. They are found on the skin, in the nasal passages, in the throat and other parts of the body, and they are also in the environment.

If these microorganisms are a natural and normal part of the body and they are commonly found in the environment, why do they cause pneumonia? The answer has three parts: 1) the microorganism causing the infection may be particularly strong and can overcome the normal immune defenses, 2) the host's immune defenses are compromised or deficient, and 3) a combination of the two. Some strains of the bacteria or viruses that cause pneumonia can be more virulent, and if someone is unlucky enough to be exposed to one of

these, the risk of pneumonia is relatively high. In many cases, the host's immune defenses are not strong enough to eliminate these microorganisms, and pneumonia can develop. Many of the risk factors that were listed in Table I are risk factors because they negatively affect the immune system, which will be discussed in more detail.

### **Natural Defenses of the Lungs**

Pneumonia is a disease of the lungs, and like many organs of the body the respiratory system and the lungs have defense mechanisms that protect them from infections. The nasal hairs and the mucous membranes of the nasal cavity and the bronchial passages all work to trap bacteria and viruses, and they are so effective that the great majority of microorganism never reach the lungs.

Coughing and the gag reflex also help expel these pathogens. If a microorganism does escape these initial defenses and reaches the lungs, cells called *macrophages* literally engulf or "swallow" them and the pathogens are destroyed. If there is a particularly strong bacteria or virus, or if the defense mechanisms are weak, the microorganism grows and multiplies and an infection begins.

In pneumonia the infection happens in the alveoli, the tiny air sacs where oxygen leaves the lung and enters the bloodstream. The infection prompts the body to initiate an inflammation. The inflammation causes consolidation, and the inflammation and consolidation are the changes that cause the signs and symptoms of pneumonia.

Inflammation is a normal response of the body to injury or infection. Inflammation increases blood flow to the injured or infected area, it increases the production of mucus, and it stimulates the production of pus (white blood cells that fight infections). The increased blood flow, the excess mucus, and the production of pus help promote healing but in an infection in the lungs, they also block air and oxygen from moving through the alveoli. Inflammation is one of the ways the body heals itself, but if the infection is strong and it cannot be quickly resolved, inflammation can cause harm.

### **Signs and Symptoms of Pneumonia**

Pneumonia causes inflammation in the alveoli, and as previously mentioned the inflammation causes consolidation with increased blood flow, excess mucus, and the production of pus; the consolidation fills the alveoli. This prevents oxygen from reaching the bloodstream because the alveoli are essentially plugged, or consolidated.

Pneumonia prevents oxygen from being delivered to the bloodstream and reaching the organs and tissues. This is the most important effect that pneumonia has on the body. The inflammation and consolidation prevent oxygen from reaching the bloodstream, and these effects produce the two primary signs of pneumonia: 1) a productive cough and 2) dyspnea (difficulty breathing). Dyspnea may be present only when the patient exerts physically but it may be present at rest too. The other common signs and symptoms of pneumonia are cough, chills, diarrhea, fatigue, headache, increased respiratory rate, muscle pain, nausea, tachycardia (rapid heart rate), sweating, vomiting, and weakness. Some of the common symptoms of pneumonia are further elaborated on below.

## **Cough**

The respiratory passages are inflamed and filled with excess mucus and pus, and the body's natural response to these fluids that are blocking the passage of air is a cough. Some patients who have pneumonia will have a dry cough, but most patients will have a productive cough, expectorating a lot of secretions and sputum.

## **Fatigue**

The body expends energy trying to fight the infection so fatigue is a common symptom.

## **Fever**

A high body temperature can help destroy microorganisms.

## **Increased Respiratory Rate**

Pneumonia prevents oxygen from reaching the bloodstream. Someone who has pneumonia will breathe faster and deeper.

## **Tachycardia (rapid heart rate)**

The body needs oxygen so the heart beats faster (tachycardia) and pumps more blood.

Pneumonia decreases the amount of oxygen that is delivered to the body. The brain needs a high amount of oxygen to function, and some people cannot tolerate a drop in oxygen delivery. In those people, pneumonia can cause confusion and disorientation.

Someone who has pneumonia typically feels very ill. Most people have cough, fever, headache, and some degree of dyspnea, and approximately 20% may have gastrointestinal signs and symptoms. Hospitalization may not be necessary, but the person may not be able to work a usual level of activity and be significantly compromised. Basically, a person with pneumonia who is comprised in daily activity will feel terrible and may not be able to get out of bed. In most cases, the infection is localized to the lungs, it is treatable with antibiotics and supportive care, and the patient recovers.

Approximately 80% of cases of community-acquired pneumonia can be managed at home. However, pneumonia can be a serious and even fatal disease. The risk factors listed earlier in Table I that increase the chances of developing pneumonia will also make pneumonia more dangerous once it develops. In addition, some of the chronic diseases can be made worse by pneumonia; for example, a person with chronic obstructive pulmonary disease (COPD) is chronically oxygen deprived and cannot tolerate a decrease in oxygen supply. There are special populations that are more likely to be seriously affected by pneumonia.

### **Diseases and Lifestyle Issues**

Pneumonia is affected by multiple other disease states and lifestyles that could weaken a person's physical constitution and impact the progression and outcome of pneumonia. People with an alcohol use disorder, a tobacco use disorder, COPD, heart disease, diabetes, the elderly, infants, and those with chronic diseases are at higher risk of developing pneumonia and suffering from complications.

### **Alcohol Use Disorder**

People who chronically use alcohol are often malnourished, and often have compromised immune systems. They are more likely to smoke cigarettes, and they are more likely to have chronic diseases such as COPD, diabetes, and liver disease that will make a condition of pneumonia more serious.

### **Tobacco Use Disorder**

Tobacco use in the form of smoking can injure the lungs and because of that the lung tissue is more easily affected by an infection. Tobacco smoking also damages the local defense mechanisms in the lung, so an infection is more likely to develop and to remain.

### **Chronic Obstructive Pulmonary Disease and Heart Disease**

The issue of chronic obstructive pulmonary disease and pneumonia was previously discussed. Patients who have cardiovascular disease are less able to tolerate pneumonia because the lack of oxygen demands extra work from the heart and the vascular system. Also, COPD, like tobacco use, injures the lungs and affects the local defense mechanisms in the lungs.

### **Diabetes**

Diabetics are four times more likely to develop pneumonia than people who do not have diabetes and they are two to three times more likely to die from pneumonia.

### **Elderly**

As people age, their immune system becomes less effective. Elderly people are also more likely to have chronic diseases.

## **Infants**

Children who are three months old or younger do not have a fully developed immune system. They are more likely to get an infection than an older child or an adult, and once an infection has started, they cannot protect themselves from it very well.

## **Chronic Diseases**

People with chronic diseases and pre-existing depression in their immune system are at higher risk of developing pneumonia. For example, a person with human immunodeficiency virus (HIV) infection or AIDS often has a compromised immune system. These people are also more likely to develop complications from pneumonia.

These special populations need close monitoring and may need hospitalization if pneumonia develops. The treatment for these patients would be the same as for a patient managed at home. They will need antibiotics, fluids, rest, and supportive care. Some patients may need supplemental oxygen and in very severe cases, the patient will need intubation and mechanical ventilation and admission to intensive care.

The biggest risk in a severe case of pneumonia, or for a patient who has pneumonia and who an alcohol use disorder, diabetic, elderly, *etc.*, is *sepsis*. Sepsis is defined as an infection that has entered the bloodstream and has caused a massive, widespread inflammation. Sepsis is a very serious condition. The mortality rate of severe sepsis is almost 30%. Patients who have pneumonia and have sepsis are usually cyanotic, and they have a very high fever, are hypotensive (low blood pressure) and tachycardic (rapid heart rate).

## **Types of Pneumonia**

Pneumonia can be classified by the microorganism that is causing the inflammation. Bacterial and viral microorganisms are the most common types that cause pneumonia, and fungi and protozoa are relatively unusual. Pneumonia can also be classified by where it was acquired. The classification of pneumonia recognizes three different types of the disease: 1) community-acquired, 2) hospital-acquired, and 3) ventilator-acquired.

### **Community-Acquired Pneumonia**

Community-acquired pneumonia is the most common form of pneumonia. This form of pneumonia can affect anyone, although some people are obviously more at risk. Approximately 80% of all people with community-acquired pneumonia have a bacterial pneumonia. Community-acquired pneumonia can affect anyone, but it is more likely to occur in people who have the risk factors listed in Table I.

### **Hospital-Acquired Pneumonia**

Hospital-acquired pneumonia is similar to community-acquired pneumonia in many ways. The patient will have a fever, chills, fatigue, and most cases are caused by bacteria; however, hospital-acquired pneumonia is usually more severe for several reasons. The microorganisms that cause the pneumonia are usually stronger than the ones that cause community-acquired pneumonia, and hospitalized patients are more likely to be elderly, are more likely to be at risk for aspiration, and are more likely to have risk factors that can increase the seriousness of the disease.

### **Ventilator-Acquired Pneumonia**

Ventilator-acquired pneumonia is simply a hospital-acquired pneumonia that has occurred to a patient who is being mechanically ventilated. The primary difference between these two forms of the diseases is that the mortality rate is much higher for ventilator-acquired pneumonia.

### **Is it a Cold, the Flu, or Pneumonia?**

Someone who has pneumonia typically experiences chills, headache, fever, fatigue, and sweating. The common cold and influenza (the flu) are common respiratory illnesses that share many of the same signs and symptoms as pneumonia. Whether this clinical picture is caused by a case of the flu, a cold, or pneumonia is important to distinguish.

Distinguishing between a cold and the flu, or a cold and pneumonia is relatively simple. The common cold does not cause a fever, most people do not have a cough, and the signs and symptoms are much less severe. Determining if someone has the flu or pneumonia is more difficult.

Influenza and pneumonia can cause a high fever, and the signs and symptoms of influenza are basically the same. However, pneumonia will cause a productive cough, but influenza will not. Also, the signs and symptoms of pneumonia are typically more severe than a case of influenza. It is not always possible to decide if someone has influenza or pneumonia by examining the patient and taking vital signs. Sometimes the only way to be sure is by obtaining a chest x-ray.

### **Prevention of Pneumonia**

The microorganisms that cause pneumonia are everywhere, and the risk factors that increase someone's chances of developing pneumonia are common. Most young, healthy people do not develop pneumonia but there are many people who can be in danger of developing pneumonia. Preventing pneumonia in the higher risk population is obviously much better than treating it. Fortunately, there are steps that can be taken to prevent pneumonia.

The first step is to get vaccinated. The pneumonia vaccine, the pneumococcal polysaccharide vaccine (PPSV), can be effective protection against pneumonia. The vaccine is injected and typically has minimal side effects. It should be given to people ages 2 to 64 that have risk factors such as cancer, cigarette smoking, diabetes, heart disease, HIV/AIDS, or an organ transplant. The influenza vaccine should also be given to vulnerable people. This will help prevent someone from developing the flu. Influenza itself may predispose someone to pneumonia, and the influenza virus itself can cause pneumonia.

The second step is to avoid situations in which contracting pneumonia may be likely. If someone has risk factors for developing pneumonia, that person should try to avoid day care centers, hospitals, and crowded public places where close contact with other people is unavoidable. One example would be a subway or a bus.

The third step is to practice good hygiene, and good hygiene when dealing with a person who has pneumonia includes proper handwashing. Handwashing is the most important infection control technique. Pneumonia and other illnesses such as the flu can be

transmitted by infected droplets that are coughed out or exhaled from someone who has pneumonia. These droplets settle on surfaces such as computer keyboards, doorknobs, and telephone receivers. Hand-to-mouth contact can then transmit the infected droplets to anyone who has touched the surface.

### **Pneumonia Risk Factors**

The level of risk and danger of pneumonia varies and depends upon individual case factors. The age and physical health of the individual diagnosed with pneumonia will influence disease progression and outcomes.

Young, healthy people who do not have risk factors can stay at home and with the proper care they will recover in an approximate two weeks. Antibiotics and supportive care will be given, the patient's own immune system will be mobilized and help fight the infection, and the patient will recover. Elderly people or people who will have difficulty fighting the infection may take a month or more to recover, and some may need to be hospitalized. The mortality rate for people who are treated as outpatients is less than 1%; for people who are hospitalized the mortality rate is approximately 10%.

The mortality rates for pneumonia reflect the rates for all people who have pneumonia, and that fact can make those figures misleading. For example, the mortality rate for people who have pneumonia but stay home is less than 1% but for people who are age 75 or older, it is much higher. For people who are age 25 or younger the mortality rate is much lower than the less than 1% mentioned above.

## **Therapies for Pneumonia**

There are two basic goals for treating someone who has pneumonia: 1) treat the infection, and 2) treat the signs and symptoms. Treating the infection will destroy the microorganism that is causing the pneumonia. Treating the signs and symptoms will make the patient more comfortable, it will prevent complications, and it will allow the patient's natural defense mechanisms to operate.

### **Treatment of Pneumonia**

Antibiotics are used to treat pneumonia that is caused by bacteria. Antibiotics can be given orally or intravenously (IV). Oral antibiotics take a little longer to act than IV, and the blood levels of oral antibiotics take a little longer to reach their peak than IV. Therefore, people who are hospitalized will usually receive IV antibiotics.

The choice of antibiotics will depend on what microorganism is responsible for the pneumonia. Often the physician will not know this or it would be impractical to discover the offending organism. In those cases, antibiotics will be used that are effective against the bacteria that is the likely cause; this is called *empirical therapy*.

Antibiotics will not be effective if the pneumonia is caused by a virus; antibiotics are only effective against bacteria. However, if the physician suspects that a pneumonia is caused by the influenza virus, antiviral drugs such as Amantadine or Tamiflu® may be prescribed.

### **Choice of Treatment**

Treating the signs and symptoms of pneumonia is commonly called symptomatic-supportive-care. Symptomatic-supportive care consists

of rest, nutrition, fluids, oxygen, antipyretics, and over-the-counter medications.

#### Rest:

Rest is often overlooked as a therapy, and patients and healthcare professionals may not appreciate how helpful rest can be but the more active people are, the more oxygen their bodies need. Pneumonia decreases the amount of oxygen that is delivered to the body. The body works hard to fight an infection and the need for oxygen is high, so any unneeded activity will not be helpful.

Rest allows oxygen to be delivered to the tissues and organs. Oxygen is essential for healing, and oxygen helps the immune system control and eliminate the infection.

#### Nutrition:

Nutrition is another aspect of symptomatic-supportive care that may be overlooked. Fighting an infection takes energy, and good nutrition is also essential for proper functioning of the immune system.

#### Fluid Intake:

Adequate fluid intake is very important for someone who has pneumonia. Fever causes sweating and loss of fluids. Diarrhea and vomiting are less common than fever, but they do occur and are another source of fluid loss. Maintaining normal fluid levels allows for the immune system to function and it helps the patient feel comfortable.

Good hydration also helps loosen secretions so that the patient is better able to cough them up. If a CNA is caring for a patient who has pneumonia, it's important to ensure the affected person stays well hydrated and an accurate record of the patient's intake and output should be maintained.

### Antipyretics

Antipyretics are medications that are used to lower fever.

Acetaminophen and ibuprofen are very effective for temperature control. Either one can be used, but acetaminophen is preferred because it has fewer potential side effects than ibuprofen and it is better tolerated for most patients than ibuprofen. It is very important to stay within the dosing guidelines for acetaminophen; excess doses can cause liver damage.

Fever is often the most dramatic sign of pneumonia or any infection but fever itself is not dangerous. A fever is the body's natural response to infection. A fever is uncomfortable for the patient, but it is possible that a fever may help fight the microorganisms that are causing the pneumonia, and there is no evidence that lowering a fever helps patients recover more quickly from an illness. Fever control is helpful, but antibiotics are far more important.

### Oxygen Therapy:

People who have pneumonia and are managed at home will seldom need oxygen but supplemental oxygen is often prescribed for hospitalized patients who have pneumonia. Oxygen delivery is decreased by pneumonia, and some patients cannot tolerate this.

There are many ways oxygen can be delivered. One of the most common ways that is relatively comfortable is nasal cannula delivered oxygen. It should always be remembered that oxygen is, essentially, a drug. Oxygen can only be given if it is ordered by a physician, and the amount of oxygen the patient receives should never be decreased or increased unless a physician has given specific directions for this.

#### Over-the-counter Medication:

There are literally hundreds of over-the-counter cold and cough products. They can contain acetaminophen, an antihistamine, a cough suppressant, or a decongestant, and there are many combinations of these four ingredients that are available.

The over-the-counter cold and cough medications can relieve some symptoms of pneumonia. However, the symptom relief is usually brief and these products will not decrease the length of time someone is sick; they are not a cure.

The cough and cold medications can be overused. Because they are available without a prescription, many people have the impression that they are harmless; however, excess doses of these ingredients - the acetaminophen, the antihistamines, the decongestants, *etc.* - can cause serious harm, and they can have dangerous interactions with prescription medications. If over-the-counter medications are used correctly they might make someone feel a little bit better for a short period of time but it is worth noting that the American Academy of Pediatrics has officially recommended against their use for children. Rest, good nutrition, and lots of fluids are safer and probably more effective for providing symptom relief.

## **Pneumonia and Isolation Precautions**

Pneumonia is caused by an infection, and the infection is typically from common microorganisms that are found everywhere. Pneumonia should be treated as a contagious disease, and someone who has pneumonia needs to be placed in isolation and the healthcare worker caring for a patient diagnosed with pneumonia will need to practice standard precautions to prevent cross infection.

Pneumonia is not spread through the air. Pneumonia can be contracted by hand-to-mouth contact of infected droplets that are in the environment, but transmission of pneumonia through the air is not the normal way of cross infection. Generally, isolation is not needed when caring for a patient with pneumonia. Unless a physician or an infection control specialist has ordered otherwise, face masks or respirators are not needed.

Standard precautions are always needed and especially when the healthcare worker is caring for a patient who has an infection. Standard precautions are the basic infection control techniques that are mandatory when providing patient care. The critical points to remember about standard precautions include handwashing and the proper disposal of contaminated articles.

### **Handwashing**

Handwashing is the most effective way of preventing the infections from spreading patient to patient. Handwashing should always be done before and after performing patient care, even if wearing gloves. Handwashing should also be done if there has been contact with any

body fluid or secretion, and can be done with soap and water or an alcohol-based hand sanitizer.

### **Proper Disposal of Contaminated Articles**

All body fluids and secretions should be considered contaminated and must be handled and disposed of properly.

### **Personal Protective Equipment**

Personal Protective Equipment (PPE) should be worn if there is a risk, or there might be a risk of contact with body fluids. Personal protective equipment includes disposable gloves, gowns, foot covers, face masks, and hair covers, and which of these to wear depends on the situation. All PPE is single-use and disposable.

### **Respiratory Hygiene/Cough Etiquette**

Healthcare personnel, visitors, and other patients who have contact with someone who has pneumonia should practice cough etiquette. The mouth should be covered when coughing or sneezing, and handwashing should be done after coughing or sneezing if the hands were used to cover the mouth. Disposable tissues should be readily available, and most health sites have these in convenient locations for for both patients and staff. Anyone, visitor or healthcare worker, who is coughing and must have contact with a patient who has pneumonia should be wearing a disposable face mask.

## **Emergency Complications of Pneumonia**

Most patients who have pneumonia will recover. However, if someone who is particularly vulnerable has a severe case of pneumonia, a fatality is possible. When caring for a patient who has pneumonia, there are warning signs that indicate that the patient is seriously ill. If

any of these signs are present, a physician or a supervisor should be notified immediately.

### **Warning Signs of Pneumonia**

The warning signs of pneumonia complications are shown in Table II.

**TABLE II: WARNING SIGNS OF PNEUMONIA**

<ul style="list-style-type: none"><li>• <b>Very high fever</b></li><li>• <b>Pulse greater than 100 beats a minute</b></li><li>• <b>Respiratory rate greater than 20 breaths a minute</b></li><li>• <b>Hypotension: Systolic blood pressure less than 100 mm Hg</b></li><li>• <b>Cyanosis: The best places to look for cyanosis are the nail beds, the tips of the fingers and toes, and the patient's face and lips</b></li><li>• <b>Confusion or disorientation</b></li></ul>
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### **Case Study: Pediatric Pneumonia**

The following case study was obtained from a PubMed search and discusses the management of severe childhood pneumonia in low resource settings. The authors reported on a twenty-seven months old male from rural Bangladesh who had a history of breathing difficulty, cough and fever for two days.

The child received a physical examination and was found to be grunting, very severe chest indrawing and low oxygen (pulse oximetry of 82% without oxygen) and head nodding, gasping for air. The diagnosis was severe pneumonia. During evaluation he was found to have a temperature of 37.4° C, respirations 74 breaths/min, pulse rate 176 beats/min, and pulse oximetry (oxygen saturation reading) of 82% without oxygen. He was very short of breath and irritable. His chest sounds were abnormal with rattling heard using the stethoscope.

The health team treated him as a severe pneumonia patient and he was admitted to an observation health unit immediately. Treatment and diet were started according to the child's body weight. The child was breastfed and required oxygen 2L/min. The antibiotic selected was ceftriaxone 1 gm intramuscularly once daily for 5 days. He also received a bronchodilator every 12 hours for 7 days and acetaminophen every 8 hours for fever more than or equal to 38° C.

The health team treatment goals included patient improvement with no fever, no low oxygen level, no fast breathing and no rapid heart rate by day 5 of treatment.

On day 1, there was age specific fast breathing, fast heart rate and chest wall indrawing. Temperature was 36.8° C, pulse rate was 157 beats/min, respiratory rate was 44 breaths/min, oxygen saturation was 97% without oxygen therapy, however oxygen was provided while the child slept at night.

On day 2, there was mild chest indrawing but no age specific fast breathing, no fever and no low blood oxygen. Temperature was 36.2° C, respiratory rate was 36 breaths/min, oxygen saturation was 95% without oxygen and pulse rate was 136 beats/min.

On day 3, the patient started improving clinically but there was age specific fast breathing but no chest indrawing, no fever, no rapid heart rate and no low blood oxygen. Temperature was 36.3° C, pulse rate was 132 beats/minute, respiratory rate was 41 breaths/min, oxygen saturation reading was 98% without oxygen.

On day 4, the patient was clinically improved and there was no hypoxemia, no fever, no age specific fast breathing and no rapid heart rate. Temperature was 36.5° C, pulse rate was 134 beats/min, respiratory rate was 36 breaths/min and oxygen saturation reading was 99% without oxygen.

On day 5, the child was clinically stable. His temperature was 36.4° C, pulse rate 118 beats/min, respiratory rate was 34 breaths/min, oxygen saturation reading was 100% without oxygen. As the child was clinically improved and there was no fever, no rapid heart rate, no hypoxemia, no fast breathing, he was discharged to home.

### **Discussion**

Severe childhood pneumonia that is managed in low resource settings can often involve difficult or impossible referral. While this case was located in Bangladesh, there are also areas in developed countries such as the U.S., where health resources are fewer than in larger urban centers or cities. Remote and rural areas may be lacking in the needed accommodations and treatments needed for a severe case of pneumonia. Healthcare resources tend to be available in cities and towns in developing countries as well than in rural areas. Children with severe pneumonia are at high risk of life-threatening complications, however when proper treatment is available for children receiving care at the community levels there may be improvement from actual treatment outcomes at home rather than being referred out.

The authors stated that the World Health Organization (WHO) develops the treatment guidelines for children age 2–59 months with a cough and/or difficult breathing, such as fast breathing and/or chest

indrawing, and the WHO states that pneumonia should be treated with oral amoxicillin and home advice. However, a child age 2–59 months with cough and/or difficult breathing, general danger signs (symptoms of not being able to drink, persistent vomiting, convulsions, lethargic or unconscious, stridor in a calm child or severe malnutrition) of severe pneumonia should be treated with an antibiotic and referred to a facility for injectable antibiotic and supportive therapy.

Children with severe pneumonia can be treated at a community clinic as effectively as in the hospital. Severe childhood pneumonia requires a thorough initial emergency assessment and treatment and of the appropriate placement of the child for treatment. The referral of a sick child from a rural health facility to an urban based hospital can often lead to hold ups in care and clinicians should attempt to manage children in the community.

This case report may have a significant impact on the treatment of severe childhood pneumonia, particularly in geographic locations with poor resources and limited hospital beds. The approach documented in this case is a practical, effective way for both developing and other developed countries with similar health resources in poorer or remote settings. Health clinicians should be familiar with the clinical manifestations of pneumonia in children to recognize the danger signs of life-threatening low blood oxygen. Existing day care facilities in poorer or remote settings should train existing health staff and providers to develop and manage a cost-effective, successful treatment for pneumonia cases in outpatient clinics that are community based.

## Summary

Pneumonia is a very common respiratory illness. It is defined as an inflammation and consolidation of the lungs. As the pneumonia develops and progresses, the alveoli fill with fluid, mucous, and pus, leading to consolidation of the lungs, and this interferes with oxygen moving through the lungs and into the bloodstream. The great majority of pneumonias are caused by common microorganisms, bacteria and viruses, that are found everywhere in the environment and on people's bodies. Infections with these microorganisms are common, but if the bacteria are very virulent and the person is vulnerable, pneumonia can develop. Most pneumonias are caused by bacteria.

Anyone can develop pneumonia, but some people are especially susceptible because of risk factors. A pneumonia vaccine is available, and good hygiene can help prevent someone from getting pneumonia. The signs and symptoms of pneumonia include chills, dyspnea, fever, a productive cough, and shortness of breath. Many of the signs and symptoms of pneumonia are also present in people who have influenza or a cold. Colds are usually much less severe, but at times a chest xray is needed to distinguish a bad case of the flu from pneumonia. Most people who have pneumonia will recover, but pneumonia can be dangerous in vulnerable populations.

Pneumonia is treated with antibiotics and symptomatic-supportive care. Symptomatic-supportive care consists of rest, fluids, nutrition, supplemental oxygen, antipyretics, and over-the-counter cough and cold preparations. Most patients who have pneumonia do not need to be in isolation, and a face mask or a respirator is not needed.

Standard precautions and cough etiquette however should always be used in cases of pneumonia.

People living in low resource geographic areas, away from available health resources such as exist in larger cities and developed countries, may benefit from a community based approach to treat pneumonia. Children and other vulnerable groups with severe pneumonia may have a better chance to recover through the implementation of a community-based treatment approach that includes antibiotic therapy and supportive care.