

Pneumonia is an infection of the lungs that causes the tiny air sacs inside the lungs to fill with fluid or pus. The lungs are the organs responsible for breathing and exchanging gases with the blood. When you breathe in, oxygen from the air enters the lungs and moves into the bloodstream. At the same time, carbon dioxide—a waste gas produced by the body—moves from the blood into the lungs and is exhaled. This exchange happens in millions of microscopic air sacs called alveoli. Alveoli are extremely small balloon-like structures at the ends of the lung's airways where oxygen passes into the blood and carbon dioxide leaves the body.

When a person develops pneumonia, these alveoli become inflamed and fill with fluid, mucus, or pus. Inflammation is the body's immune response to infection or injury, and it causes swelling, redness, and increased blood flow to the affected area. Because the alveoli fill with fluid during pneumonia, oxygen cannot move into the bloodstream as efficiently. This is why pneumonia often causes breathing problems, fatigue, and sometimes low oxygen levels in the body.

Pneumonia can be caused by several types of microorganisms. A microorganism is a microscopic organism such as a bacterium, virus, or fungus. The most common cause of pneumonia worldwide is bacteria, especially a species called *Streptococcus pneumoniae*. Bacteria are single-celled organisms that can multiply rapidly in the body and cause infections. Viral pneumonia is also common and may be caused by viruses such as influenza (the flu virus), respiratory syncytial virus (RSV), or coronaviruses. Viral pneumonia often develops after or during a respiratory infection like the flu. Fungal pneumonia is less common but can occur in people with weakened immune systems or those exposed to certain environmental fungi.

The immune system normally protects the lungs from infection. The immune system is the body's defense network made up of cells, tissues, and organs that recognize and destroy harmful microbes. The lungs have several protective mechanisms. The nose and throat filter incoming air. Tiny hair-like structures called cilia line the airways and help move mucus and trapped particles out of the lungs. Mucus itself helps trap bacteria and viruses before they reach deeper lung tissue. When these defenses are overwhelmed or weakened, microorganisms can enter the lungs and begin multiplying.

Certain groups of people are more vulnerable to pneumonia than others. Infants and very young children have immune systems that are still developing, which makes it harder for them to fight infections. Older adults are also at higher risk because immune function often weakens with age. People with chronic illnesses such as asthma, diabetes, heart disease, or chronic obstructive pulmonary disease (COPD) may also have increased risk. A weakened immune system—caused by conditions like cancer, HIV infection, or medications that suppress immunity—can also make pneumonia more likely.

The symptoms of pneumonia often begin with signs similar to other respiratory infections. These may include cough, fever, chills, and fatigue. As the infection

progresses, additional symptoms may appear such as shortness of breath, chest pain when breathing or coughing, rapid breathing, and thick mucus produced by coughing. In severe cases, a person may experience confusion, bluish lips or fingertips due to low oxygen levels, or severe difficulty breathing.

The cough associated with pneumonia often produces mucus called sputum. Sputum is the mixture of mucus, immune cells, and microorganisms that the lungs expel during infection. The color of sputum may vary from clear to yellow, green, or sometimes rust-colored depending on the type of infection and the presence of blood or inflammatory cells.

Doctors diagnose pneumonia using several tools. One of the most common is a chest X-ray. An X-ray is an imaging technique that uses radiation to create pictures of structures inside the body. In pneumonia, areas of the lung that contain fluid appear as cloudy or white patches on the image. Doctors may also listen to the lungs with a stethoscope to detect abnormal sounds such as crackling or wheezing. Blood tests or sputum samples may be used to identify the microorganism responsible for the infection.

Treatment for pneumonia depends on its cause. If the infection is bacterial, antibiotics are typically prescribed. Antibiotics are medications designed to kill bacteria or stop them from multiplying. If pneumonia is caused by a virus, antibiotics will not work because antibiotics do not affect viruses. In viral pneumonia, treatment often focuses on supportive care such as rest, hydration, and medications to reduce fever or relieve symptoms. In severe cases, antiviral medications may be used if the virus is known.

Some people with pneumonia can recover at home with proper treatment and rest. Others may require hospitalization, especially if breathing becomes difficult or oxygen levels fall dangerously low. In hospitals, patients may receive oxygen therapy, intravenous fluids, and stronger medications. Oxygen therapy provides additional oxygen to the lungs to help maintain normal blood oxygen levels while the lungs heal.

Complications can occur if pneumonia becomes severe or is not treated promptly. One possible complication is pleurisy, which is inflammation of the pleura. The pleura are the thin membranes surrounding the lungs and lining the chest cavity. Pleurisy can cause sharp chest pain that worsens when breathing deeply or coughing. Another complication is a lung abscess, which is a pocket of pus that forms inside lung tissue. In very severe cases, pneumonia can lead to sepsis. Sepsis is a life-threatening condition in which the body's response to infection causes widespread inflammation and organ damage.

Prevention plays an important role in reducing the risk of pneumonia. Vaccines are available to protect against some of the most common causes. The pneumococcal vaccine protects against *Streptococcus pneumoniae*, the bacterium responsible for many cases of bacterial pneumonia. Influenza vaccines also help prevent flu infections that can lead to viral or secondary bacterial pneumonia. Good hygiene practices such as frequent handwashing and covering coughs can help reduce the spread of respiratory infections.

Lifestyle factors can also influence pneumonia risk. Smoking damages the cilia and other protective mechanisms in the lungs, making it easier for microorganisms to enter and infect lung tissue. Maintaining a healthy immune system through balanced nutrition, adequate sleep, and regular exercise helps the body resist infections.

Although pneumonia can be serious, many people recover completely with proper treatment. The severity of the illness varies widely depending on the cause of the infection, the person's age, overall health, and how quickly treatment begins. Understanding how pneumonia affects the lungs helps explain why symptoms like coughing, fever, and difficulty breathing occur and why early medical care can make a significant difference in recovery.