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Pulmonary edema

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Overview

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Pulmonary edema is a condition caused by excess fluid in the lungs. This fluid collects in the numerous air sacs in the lungs, making it difficult to breathe.

In most cases, heart problems cause pulmonary edema. But fluid can accumulate for other reasons, including pneumonia, exposure to certain toxins and medications, trauma to the chest wall, and visiting or exercising at high elevations.

Pulmonary edema that develops suddenly (acute pulmonary edema) is a medical emergency requiring immediate care. Pulmonary edema can sometimes be fatal, but the outlook improves if you get treated quickly. Treatment for pulmonary edema varies depending on the cause but generally includes supplemental oxygen and medications.

Symptoms

Depending on the cause, pulmonary edema signs and symptoms may appear suddenly or develop over time.

Sudden (acute) pulmonary edema signs and symptoms

- Extreme shortness of breath or difficulty breathing (dyspnea) that worsens with activity or when lying down

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- A feeling of suffocating or drowning that worsens when lying down
- Wheezing or gasping for breath
- Cold, clammy skin
- Anxiety, restlessness or a sense of apprehension
- A cough that produces frothy sputum that may be tinged with blood
- Blue-tinged lips
- A rapid, irregular heartbeat (palpitations)

Long-term (chronic) pulmonary edema signs and symptoms

- More shortness of breath than normal when you're physically active
- Difficulty breathing with exertion
- Difficulty breathing when you're lying flat
- Wheezing
- Awakening at night with a cough or breathless feeling that may be relieved by sitting up
- Rapid weight gain
- Swelling in your lower extremities
- Fatigue

High-altitude pulmonary edema (HAPE) signs and symptoms

HAPE can occur when people travel to or exercise at very high altitudes. Signs and symptoms are similar to those that occur with acute pulmonary edema and include:

- Shortness of breath after exertion, which progresses to shortness of breath at rest
- Cough
- Difficulty walking uphill, which progresses to difficulty walking on flat surfaces
- Fever

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- Fatigue
- A cough that produces frothy sputum that may be tinged with blood
- A rapid, irregular heartbeat (palpitations)
- Chest discomfort
- Headaches, which may be the first symptom

When to see a doctor

Pulmonary edema that comes on suddenly (acute pulmonary edema) is life-threatening. Call 911 or emergency medical assistance if you have any of the following acute signs and symptoms:

- Shortness of breath, especially if it comes on suddenly
- Trouble breathing or a feeling of suffocating (dyspnea)
- A bubbly, wheezing or gasping sound when you breathe
- Pink, frothy sputum when you cough
- Breathing difficulty along with profuse sweating
- A blue or gray tone to your skin
- Confusion
- A significant drop in blood pressure resulting in lightheadedness, dizziness, weakness or sweating
- A sudden worsening of any of the symptoms associated with chronic pulmonary edema or high-altitude pulmonary edema

Don't attempt to drive yourself to the hospital. Instead, call 911 or emergency medical care and wait for help.

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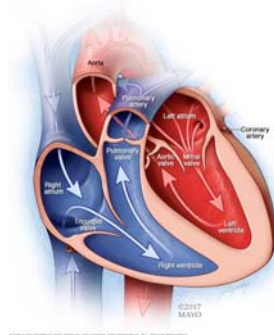
Causes

Your lungs contain numerous small, elastic air sacs called alveoli. With each breath, these air sacs take in oxygen and release carbon dioxide. Normally, the exchange of gases takes place without problems.

But in certain circumstances, the alveoli fill with fluid instead of air, preventing oxygen from being absorbed into your bloodstream. A number of things can cause fluid to accumulate in your lungs, but most have to do with your heart (cardiogenic pulmonary edema). Understanding the relationship between your heart and lungs can help explain why.

How your heart works

Your heart is composed of two upper and two lower chambers. The upper chambers (the right and left atria) receive incoming blood and pump it into the lower chambers. The lower chambers (the more muscular right and left ventricles) pump blood out of your heart. The heart valves — which keep blood flowing in the correct direction — are gates at the chamber openings.



Chambers and valves of the heart

A normal heart has two upper and two lower chambers. The upper chambers, the right and left atria, receive incoming blood. The lower chambers, the more muscular right and left ventricles, pump blood out of your heart. The heart valves, which keep blood flowing in the right direction, are gates at the chamber openings.

Normally, deoxygenated blood from all over your body enters the right atrium and flows into the right ventricle, where it's pumped through large blood vessels (pulmonary arteries) to your lungs. There, the blood releases carbon dioxide and picks up oxygen.

The oxygen-rich blood then returns to the left atrium through the pulmonary veins, flows through the mitral valve into the left ventricle and finally leaves your heart through another large artery, the aorta.

The aortic valve at the base of the aorta keeps the blood from flowing backward into your heart. From the aorta, the blood travels to the rest of your body.

Heart-related (cardiogenic) pulmonary edema

Cardiogenic pulmonary edema is a type of pulmonary edema caused by increased pressures in the heart.

This condition usually occurs when the diseased or overworked left ventricle isn't able to pump out enough of the blood it receives from your

lungs (congestive heart failure). As a result, pressure increases inside the left atrium and then in the veins and capillaries in your lungs, causing fluid to be pushed through the capillary walls into the air sacs.

Medical conditions that can cause the left ventricle to become weak and eventually fail include:

- **Coronary artery disease.** Over time, the arteries that supply blood to your heart muscle can become narrow from fatty deposits (plaques). A heart attack occurs when a blood clot forms in one of these narrowed arteries, blocking blood flow and damaging the portion of your heart muscle supplied by that artery. The result is that the damaged heart muscle can no longer pump as well as it should.

Sometimes, a clot isn't the cause of the problem. Instead, gradual narrowing of the coronary arteries can lead to weakness of the left ventricular muscle. Although the rest of your heart tries to compensate for this loss, there are times when it's unable to do so effectively. The heart can also be weakened by the extra workload.

When the pumping action of your heart is weakened, blood gradually backs up into your lungs, forcing fluid in your blood to pass through the capillary walls into the air sacs. This is chronic congestive heart failure.

- **Cardiomyopathy.** When your heart muscle is damaged, the condition is called cardiomyopathy. Because cardiomyopathy affects the function of the ventricles — your heart's main pump — your heart may not be able to respond to conditions that require it to work harder, such as a surge in blood pressure, a faster heartbeat with exertion, or consuming too much salt in the diet that causes water retention or infections. When the left ventricle can't keep up with the demands that are placed on it, fluid backs up into your lungs.
- **Heart valve problems.** In mitral valve disease or aortic valve disease, the valves that regulate blood flow in the left side of your heart may not open wide enough (stenosis). Or, they don't close completely, allowing blood to flow backward through the valve (insufficiency or regurgitation).

When the valves are narrowed, blood can't flow freely into your heart and pressure in the left ventricle builds up, causing the left ventricle to work harder and harder with each contraction. The left ventricle also dilates to allow greater blood flow, but this makes the left ventricle's pumping action less efficient.

The increased pressure extends into the left atrium and then to the pulmonary veins, causing fluid to accumulate in your lungs. On the other hand, if the mitral valve leaks, some blood is backwashed toward your lung each time your heart pumps. If the leakage develops suddenly, you may develop sudden and severe pulmonary edema.

- **High blood pressure (hypertension).** Untreated or uncontrolled high blood pressure can enlarge the heart.

Other conditions may lead to cardiogenic pulmonary edema, such as high blood pressure due to narrowed kidney arteries (renal artery stenosis) and fluid buildup due to kidney disease or heart problems.

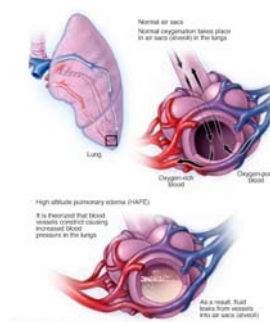
Non-heart-related (noncardiogenic) pulmonary edema

Pulmonary edema that isn't caused by increased pressures in your heart is called noncardiogenic pulmonary edema.

In this condition, fluid may leak from the capillaries in your lungs' air sacs because the capillaries themselves become more permeable or leaky, even without the buildup of back pressure from your heart. Some factors that can cause noncardiogenic pulmonary edema include:

- **Acute respiratory distress syndrome (ARDS).** This serious disorder occurs when your lungs suddenly fill with fluid and inflammatory white blood cells. Many conditions can cause ARDS, including severe injuries (trauma), systemic infection (sepsis), pneumonia and severe bleeding.
- **High altitudes.** Mountain climbers and people who travel to high-altitude locations run the risk of developing high-altitude pulmonary edema (HAPE).

This condition — which generally occurs at elevations above 8,000 feet (about 2,400 meters) — can also affect hikers or skiers who



High-altitude pulmonary edema

In normal lungs, air sacs (alveoli) take in oxygen and release carbon dioxide. In high-altitude pulmonary edema (HAPE), it's theorized that vessels in the lungs constrict, causing increased pressure. This causes fluid to leak from the blood vessels to the lung tissues and eventually into the air sacs.

start exercising at higher altitudes without first becoming acclimated, which can take from a few days to a week or so. But even people who have hiked or skied at high altitudes in the past aren't immune.

Although the exact cause isn't completely understood, HAPE seems to develop as a result of increased pressure from constriction of the pulmonary capillaries. Without appropriate care, HAPE can be fatal, but this risk can be minimized.

- **Nervous system conditions.** A type of pulmonary edema called neurogenic pulmonary edema can occur after some nervous system conditions or procedures — such as after a head injury or seizure — or after brain surgery.
- **Adverse drug reaction.** Many drugs — ranging from illegal drugs such as heroin and cocaine to aspirin — are known to cause noncardiogenic pulmonary edema.
- **Negative pressure pulmonary edema.** Pulmonary edema can develop after a blockage in the upper airway causes negative pressure in the lungs from intense efforts to breathe despite the blockage.
- **Pulmonary embolism.** Pulmonary embolism, a condition that occurs when blood clots travel from blood vessels in your legs to your lungs, can lead to pulmonary edema.
- **Viral infections.** Pulmonary edema can be caused by viral infections such as the hantavirus and dengue virus.
- **Exposure to certain toxins.** These include toxins you inhale as well as those that may circulate within your own body, for example, if you inhale (aspirate) some of your stomach contents when you vomit. Inhaling toxins causes intense irritation of the small airways and alveoli, resulting in fluid accumulation.
- **Smoke inhalation.** Smoke from a fire contains chemicals that damage the membrane between the air sacs and the capillaries, allowing fluid to enter your lungs.
- **Near drowning.** Inhaling water causes noncardiogenic pulmonary edema that is reversible with immediate attention.

Complications

If pulmonary edema continues, it can raise pressure in the pulmonary artery (pulmonary hypertension), and eventually the right ventricle in your heart becomes weak and begins to fail. The right ventricle has a

much thinner wall of muscle than does the left side of your heart because it is under less pressure to pump blood into the lungs. The increased pressure backs up into the right atrium and then into various parts of your body, where it can cause:

- Lower extremity and abdominal swelling
- Buildup of fluid in the membranes that surround your lungs (pleural effusion)
- Congestion and swelling of the liver

Left untreated, acute pulmonary edema can be deadly. In some instances, it may be fatal even if you receive treatment.

Prevention

Preventing conditions and situations that cause pulmonary edema can help keep pulmonary edema from developing. These measures can help reduce your risk.

Preventing cardiovascular disease

Cardiovascular disease is the leading cause of pulmonary edema. You can reduce your risk of many kinds of heart problems by following these suggestions:

- **Control your blood pressure.** High blood pressure (hypertension) can lead to serious conditions such as a stroke, cardiovascular disease and kidney failure. In many cases, you can lower your blood pressure or maintain a healthy level by getting regular exercise; maintaining a healthy weight; eating a diet rich in fresh fruits, vegetables and low-fat dairy products; and limiting salt and alcohol.
- **Watch your blood cholesterol.** Cholesterol is one of several types of fats essential to good health. But too much cholesterol can be too much of a good thing. Higher than normal cholesterol levels can cause fatty deposits to form in your arteries, impeding blood flow and increasing your risk of vascular disease.

But lifestyle changes can often keep your cholesterol levels low. Lifestyle changes may include limiting fats (especially saturated fats); eating more fiber, fish, and fresh fruits and vegetables; exercising regularly; stopping smoking; and drinking in moderation.

- **Don't smoke.** If you smoke and can't quit on your own, talk to your doctor about strategies or programs to help you break a smoking habit. Smoking can increase your risk of cardiovascular disease. Also avoid secondhand smoke.
- **Eat a heart-healthy diet.** Eat a healthy diet that's low in salt, sugars and solid fats and rich in fruits, vegetables and whole grains.
- **Limit salt.** It's especially important to use less salt (sodium) if you have heart disease or high blood pressure. In some people with severely damaged left ventricular function, excess salt may be enough to trigger congestive heart failure.

If you're having a hard time cutting back on salt, it may help to talk to a dietitian. He or she can help point out low-sodium foods as well as offer tips for making a low-salt diet interesting and good tasting.

- **Exercise regularly.** Exercise is vital for a healthy heart. Regular aerobic exercise, about 30 minutes a day, helps you control blood pressure and cholesterol levels and maintain a healthy weight. If you're not used to exercise, start out slowly and build up gradually. Be sure to get your doctor's OK before starting an exercise program.
- **Maintain a healthy weight.** Being even slightly overweight increases your risk of cardiovascular disease. On the other hand, even losing small amounts of weight can lower your blood pressure and cholesterol and reduce your risk of diabetes.
- **Manage stress.** To reduce your risk of heart problems, try to reduce your stress levels. Find healthy ways to minimize or deal with stressful events in your life.

Preventing high-altitude pulmonary edema (HAPE)

If you travel or climb at high altitudes, acclimate yourself slowly. Although recommendations vary, most experts advise ascending no more than 1,000 to 1,200 feet (about 305 to 366 meters) a day once you reach 8,200 feet (about 2,500 meters).

Some climbers take prescription medications such as acetazolamide or nifedipine (Procardia) to help prevent signs and symptoms of HAPE. To prevent HAPE, start taking the medication at least one day before ascent. Continue taking the medication for about five days after you've arrived at your high-altitude destination.

By Mayo Clinic Staff

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