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 **EDEMA**

**What Causes Pitting Edema?**

Edema is caused by either systemic disease, that is, diseases that affect the various organ systems of the body, or by local conditions involving just the affected extremities. The most common systemic diseases associated with edema involve the heart, liver, and kidneys. In these diseases, edema occurs primarily because of the body's retention of too much salt (sodium chloride). The excess salt causes the body to retain water. This water then leaks into the interstitial tissue spaces, where it appears as edema. The most common local conditions that causes edema are varicose veins and thrombophlebitis (inflammation of the veins) of the deep veins of the legs.

### What is edema?

Edema is observable swelling from fluid accumulation in body tissues. Edema most commonly occurs in the feet and legs, where it is referred to as peripheral edema. The swelling is the result of the accumulation of excess fluid under the skin in the spaces within the tissues. All tissues of the body are made up of cells and connective tissues that hold the cells together. This connective tissue around the cells and blood vessels is known as the interstitium. Most of the body's fluids that are found outside of the cells are normally stored in two spaces; the blood vessels (as the "liquid" or serum portion of your blood) and the interstitial spaces (not within the cells). In various diseases, excess fluid can accumulate in either one or both of these compartments.

### What is pitting edema and how does it differ from non-pitting edema?

Pitting edema can be demonstrated by applying pressure to the swollen area by depressing the skin with a finger. If the pressing causes an indentation that persists for some time after the release of the pressure, the edema is referred to as pitting edema. Any form of pressure, such as from the elastic in socks, can induce pitting with this type of edema. This type of edema may be normal depending on the severity. Almost everyone wears socks all day will have mild pitting edema by the end of the day.

In non-pitting edema, which usually affects the legs or arms, pressure that is applied to the skin does not result in a persistent indentation. Non-pitting edema can occur in certain disorders of the lymphatic system such as lymphedema, which is a disturbance of the lymphatic circulation that may occur after a mastectomy, lymph node surgery, or congenitally. Another cause of non-pitting edema of the legs is called pretibial myxedema, which is a swelling over the shin that occurs in some patients with hypothyroidism. Non-pitting edema of the legs is difficult to treat. Diuretic medications are generally not effective, although elevation of the legs periodically during the day and compressive devices may reduce the swelling.

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The most common local condition that causes edema are varicose veins and thrombophlebitis (inflammation of the veins) of the deep veins of the legs. These conditions can cause inadequate pumping of the blood by the veins (venous insufficiency). The resulting increased back pressure in the veins forces fluid stay in the extremities (especially the ankles and feet). The excess fluid then leaks into the interstitial tissue spaces, causing edema.

### How does salt intake affect edema?

The body's balance of salt is usually well regulated. A normal person can consume small or large quantities of salt in the diet without concern for developing salt depletion or retention. The intake of salt is determined by dietary patterns. The removal of salt from the body is accomplished by the kidneys. The kidneys have a great capacity to control the amount of salt in the body by changing the amount of salt eliminated (excreted) in the urine. The amount of salt excreted by the kidneys is regulated by hormonal and physical factors that signal whether retention or removal of salt by the kidneys is necessary.

If the blood flow to the kidneys is decreased by an underlying condition such as heart failure, the kidneys react by retaining salt. This salt retention occurs because the kidneys perceive that the body needs more fluid to compensate for the decreased blood flow. If the patient has kidney disease that impairs the function of the kidneys, the ability to excrete salt in the urine is limited. In both conditions, the amount of salt in the body increases, which causes the patient to retain water and develop edema.

Patients experiencing a disturbance in their ability to normally excrete salt may need to either be placed on a diet limited in salt and/or given diuretic medications (water pills). In the past, patients with diseases associated with edema were placed on diets very restricted in salt intake. With the development of new and very potent diuretic agents, this marked restriction in dietary salt intake is generally no longer necessary. These diuretics work by blocking the reabsorption and retention of salt by the kidneys, thereby increasing the amount of salt and water that is eliminated in the urine.

### Why does a patient with heart disease retain fluid?

Heart failure is the result of poor cardiac function and is reflected by a decreased volume of blood pumped out by the heart, called cardiac output. Heart failure can be caused by weakness of the heart muscle, which pumps blood out through the arteries to the entire body, or by dysfunction of the heart valves, which regulate the flow of blood between the chambers of the heart. The diminished volume of blood pumped out by the heart (decreased cardiac output) is responsible for a decreased flow of blood to the kidneys. As a result, the kidneys sense that there is a reduction of the blood volume in the body. To counter the seeming loss of fluid, the kidneys retain salt and water. In this instance, the kidneys are fooled into thinking that the body needs to retain more fluid volume when, in fact, the body already is holding too much fluid.

This fluid increase ultimately results in the buildup of fluid within the lungs, which causes shortness of breath. Because of the decreased volume of blood pumped out by the heart (decreased cardiac output), the volume of blood in the arteries is also decreased, despite the actual increase in the body's total fluid volume. An associated increase in the amount of fluid in the blood vessels of the lungs causes shortness of breath because the excess fluid from the lungs' blood vessels leaks into the airspaces (alveoli) and interstitium in the lungs. This accumulation of fluid in the lung is called pulmonary edema. At the same time, accumulation of fluid in the legs causes pitting edema. This edema occurs because the build-up of blood in the veins of the legs causes leakage of fluid from the legs' capillaries (tiny blood vessels) into the interstitial spaces.

An understanding of how the heart and lungs interact will help you to better comprehend how fluid retention works in heart failure. The heart has four chambers; an atrium and a ventricle on the left side of the heart and an atrium and ventricle on the right. The left atrium receives oxygenated blood from the lungs and transfers it to the left ventricle, which then pumps it through the arteries to the entire body. The blood then is transported back to the heart by veins into the right ventricle and transferred to the right ventricle, which then pumps it to the lungs for re-oxygenation.

Left-sided heart failure, which is due primarily to a weak left ventricle, usually is caused by coronary artery disease, hypertension, or disease of the heart valves. Typically, when these patients initially come to the doctor they are troubled by shortness of breath with exertion and when lying down at night (orthopnea). These symptoms are due to pulmonary edema that is caused by pooling of the blood in the vessels of the lungs.

In contrast, right-sided heart failure, which often is due to obstructive sleep apnea or chronic lung diseases such as emphysema, initially causes salt retention and edema. Persistent salt retention in these patients, however, may lead to an expanded blood volume in the blood vessels, thereby causing fluid accumulation in the lungs (pulmonary congestion) and shortness of breath.

In patients with heart failure due to weak heart muscle (cardiomyopathy), both the right and left ventricles of the heart are usually affected. These patients, therefore, can initially suffer from swelling both in the lungs (pulmonary edema) and in the legs and feet (peripheral edema).

### Why does edema occur in patients with kidney disease?

Edema forms in patients with kidney disease for two reasons:

1. A heavy loss of protein in the urine
2. Impaired kidney (renal) function

### What is idiopathic edema?

Idiopathic edema is a pitting edema of unknown cause that occurs primarily in pre-menopausal women who do not have evidence of heart, liver, or kidney disease. In this condition, the fluid retention at first may be seen primarily pre-menstrually (just prior to menstruation), which is why it sometimes is called "cyclical" edema. However, it can become a more constant and severe problem.

Patients with idiopathic edema often take diuretics to decrease the edema in order to lessen the discomfort of bloating and swelling. Paradoxically, however, the edema in this condition can become more of a problem after the use of diuretics. The patients can develop fluid retention as a rebound phenomenon each time they discontinue diuretics. It is important to talk to your doctor before using any diuretics.

Patients with idiopathic edema appear to have a leak in the capillaries (tiny peripheral blood vessels that connect the arteries with the veins) so that fluid passes from the blood vessels into the surrounding interstitial space. Thus, a patient with idiopathic edema has a decreased blood volume, which leads to the typical reaction of salt retention by the kidneys.

* The leg edema in these patients is exaggerated in the standing position, since edema tends to accumulate in those parts of the body that are close to the ground at the time.
* These patients often have edema around the eyes (peri-orbital edema) in the morning because the edema fluid accumulates during the night around their eyes as they lay sleeping flat.

In contrast, edema around the eyes does not tend to develop in cardiac patients who keep their heads elevated at night because of shortness of breath when they lie flat. These patients characteristically experience varying amounts of edema in different parts of the body at different times of the day.

Patients with idiopathic edema often become dependent on diuretics, and this dependence is often difficult to interrupt. A period as long as three weeks off diuretics may be required to break the dependency cycle. The withdrawal from diuretics may lead to fluid retention that produces major discomfort and swelling. Furthermore, there are definite risks associated with the prolonged use of diuretics in these individuals, which are compounded by the tendency to increase the doses of the diuretics.

As a result of chronic diuretic use and abuse, patients may develop:

* A deficiency of potassium
* Depletion of blood volume in the blood vessels
* Kidney insufficiency or failure

### How does venous insufficiency cause edema?

The veins in the legs are responsible for transporting blood up to the veins of the torso, where it is then returned to the heart. The veins of the legs have valves that prevent the backward flow of blood within them. Venous insufficiency is incompetence of the veins that occurs because of dilation, or enlargement, of the veins and dysfunction of their valves. This happens, for example, in patients with varicose veins. Venous insufficiency leads to a backup of blood and increased pressure in the veins, thereby resulting in edema of the legs and feet. Edema of the legs also can occur with an episode of deep vein thrombosis, which is a blood clot within an inflamed vein. In this situation, the clot in the deep vein blocks the return of blood, and consequently causes increased back-pressure in the leg veins.

Venous insufficiency is a problem that is localized to the legs, ankles, and feet. One leg may be more affected than the other (asymmetrical edema). In contrast, systemic diseases that are associated with fluid retention generally cause the same amount of edema in both legs and can also cause edema and swelling elsewhere in the body. The response to therapy with diuretic drugs in patients with venous insufficiency tends to be unsatisfactory. This is because the continued pooling of fluid in the lower extremities makes it difficult for the diuretics to mobilize the edema fluid. Elevation of the legs periodically during the day and the use of compression stockings may alleviate the edema. Some patients require surgical treatment to relieve chronic edema that is caused by venous insufficiency.

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