Leukemia

By Mayo Clinic staff

Definition

Leukemia is cancer of the body's blood-forming tissues, including the bone marrow and the lymphatic system.

Many types of leukemia exist. Some forms of leukemia are most common in children. Other forms of leukemia occur mostly in adults.

Leukemia usually starts in the white blood cells. Your white blood cells are potent infection fighters — they normally grow and divide in an orderly way, as your body needs them. But in people with leukemia, the bone marrow produces a large number of abnormal white blood cells, which don't function properly.

Treatment for leukemia can be complex — depending on the type of leukemia and other factors. But there are strategies and resources that can help to make your treatment successful.
Symptoms

Leukemia symptoms vary, depending on the type of leukemia. Common leukemia signs and symptoms include:

- Fever or chills
- Persistent fatigue, weakness
- Frequent infections
- Losing weight without trying
- Swollen lymph nodes, enlarged liver or spleen
- Easy bleeding or bruising
- Tiny red spots in your skin (petechiae)
- Excessive sweating, especially at night
- Bone pain or tenderness

When to see a doctor
Make an appointment with your doctor if you have any persistent signs or symptoms that worry you.

Leukemia symptoms are often vague and not specific to the disease. You may overlook early leukemia symptoms because they may resemble symptoms of the flu and other common illnesses.

Causes

Scientists don't understand the exact causes of leukemia. It seems to develop from a combination of genetic and environmental factors.

How leukemia forms
In general, leukemia occurs when some blood cells acquire mutations in their DNA — the instructions inside each cell that guide its action. The mutations cause the cell to grow and divide more rapidly and to continue living when normal cells would die. Over time, these abnormal cells can crowd out healthy blood cells, causing the
signs and symptoms of leukemia.

**How leukemia is classified**

Doctors classify leukemia based on its speed of progression and the type of cells involved.

The first type of classification is by how fast the leukemia progresses:

- **Acute leukemia.** In acute leukemia, the abnormal blood cells are immature blood cells (blasts). They can't carry out their normal work, and they multiply rapidly, so the disease worsens quickly. Acute leukemia requires aggressive, timely treatment.

- **Chronic leukemia.** This type of leukemia involves more mature blood cells. These blood cells replicate or accumulate more slowly and can function normally for a period of time. Some forms of chronic leukemia initially produce no symptoms and can go unnoticed or undiagnosed for years.

The second type of classification is by type of white blood cell affected:

- **Lymphocytic leukemia.** This type of leukemia affects the lymphoid cells or lymphocytes, which form lymphoid or lymphatic tissue. Lymphatic tissue makes up your immune system.

- **Myelogenous (MI-uh-loj-uh-nus) leukemia.** This type of leukemia affects the myeloid cells. Myeloid cells give rise to red blood cells, white blood cells and platelet-producing cells.

**Types of leukemia**

The major types of leukemia are:

- **Acute lymphocytic leukemia (ALL).** This is the most common type of leukemia in young children. ALL can also occur in adults.

- **Acute myelogenous leukemia (AML).** AML is a common type of leukemia. It occurs in children and adults.

- **Chronic lymphocytic leukemia (CLL).** With CLL, the most common adult leukemia, you may feel well for years without treatment. CLL is very rare in children.
• **Chronic myelogenous leukemia (CML).** This type of leukemia mainly affects adults. A person with CML may have few or no symptoms for months or years before entering a phase in which the leukemia cells grow more quickly.

Other, rarer types of leukemia exist, including hairy cell leukemia.

**Risk factors**

Factors that may increase your risk of developing some types of leukemia include:

• **Previous cancer treatment.** People who've had certain types of chemotherapy and radiation therapy for other cancers have an increased risk of developing certain types of leukemia.

• **Genetic diseases.** Genetic abnormalities seem to play a role in the development of leukemia. Certain genetic diseases, such as Down syndrome, are associated with increased risk of leukemia.

• **Certain blood disorders.** People who have been diagnosed with certain blood disorders, such as myelodysplastic syndromes, may have an increased risk of leukemia.

• **Exposure to high levels of radiation.** People exposed to very high levels of radiation, such as survivors of a nuclear reactor accident, have an increased risk of developing leukemia.

• **Exposure to certain chemicals.** Exposure to certain chemicals, such as benzene — which is found in gasoline and is used by the chemical industry — also is linked to increased risk of some kinds of leukemia.

• **Smoking.** Smoking cigarettes increases the risk of acute myelogenous leukemia.

• **Family history of leukemia.** If members of your family have been diagnosed with leukemia, your risk of the disease may be increased.

However, most people with known risk factors don't get leukemia. And many people with leukemia have none of these risk factors.

**Preparing for your appointment**

Start by seeing your family doctor or a general practitioner if you have any signs or
symptoms that worry you. If your doctor suspects you may have leukemia, you may be referred to a doctor who treats diseases of the blood and bone marrow (hematologist).

Because appointments can be brief, and because there's often a lot of ground to cover, it's a good idea to be well prepared. Here's some information to help you get ready, and what to expect from your doctor.

What you can do

- **Be aware of any pre-appointment restrictions.** At the time you make the appointment, be sure to ask if there's anything you need to do in advance, such as restrict your diet.

- **Write down any symptoms you're experiencing,** including any that may seem unrelated to the reason for which you scheduled the appointment.

- **Write down key personal information,** including any major stresses or recent life changes.

- **Make a list of all medications,** as well as any vitamins or supplements, that you're taking.

- **Take a family member or friend along.** Sometimes it can be difficult to absorb all the information provided during an appointment. Someone who accompanies you may remember something that you missed or forgot.

- **Write down questions to ask** your doctor.

Your time with your doctor is limited, so preparing a list of questions can help you make the most of your time together. List your questions from most important to least important in case time runs out. For leukemia, some basic questions to ask your doctor include:

- Do I have leukemia?

- What type of leukemia do I have?

- Do I need more tests?

- Does my leukemia need immediate treatment?

- What are the treatment options for my leukemia?
• Can any treatments cure my leukemia?
• What are the potential side effects of each treatment option?
• Is there one treatment you feel is best for me?
• How will treatment affect my daily life? Can I continue working or going to school?
• Should I see a specialist? What will that cost, and will my insurance cover it?
• Are there any brochures or other printed material that I can take with me? What Web sites do you recommend?

In addition to the questions that you've prepared, don't hesitate to ask questions during your appointment at any time that you don't understand something.

Tests and diagnosis

Doctors often find chronic leukemia in a routine blood test, before symptoms begin. If this happens, or if you have signs or symptoms that suggest leukemia, you may undergo the following diagnostic exams:

• **Physical exam.** Your doctor will look for physical signs of leukemia, such as pale skin from anemia and swelling of your lymph nodes, liver and spleen.

• **Blood tests.** By looking at a sample of your blood, your doctor can determine if you have abnormal levels of white blood cells or platelets — which may suggest leukemia.

• **Bone marrow test.** Your doctor may recommend a procedure to remove a sample of bone marrow from your hipbone. The bone marrow is removed using a long, thin needle. The sample is sent to a laboratory to look for leukemia cells. Specialized tests of your leukemia cells may reveal certain characteristics that are used to determine your treatment options.

You may undergo additional tests to confirm the diagnosis and to determine the type of leukemia and its extent in your body. Certain types of leukemia are classified into stages, indicating the severity of the disease. Your leukemia's stage helps your doctor determine a treatment plan.
Treatments and drugs

Treatment for your leukemia depends on many factors. Your doctor determines your leukemia treatment options based on your age and overall health, the type of leukemia you have, and whether it has spread to other parts of your body.

Common treatments used to fight leukemia include:

- **Chemotherapy.** Chemotherapy is the major form of treatment for leukemia. This drug treatment uses chemicals to kill leukemia cells. Depending on the type of leukemia you have, you may receive a single drug or a combination of drugs. These drugs may come in a pill form, or they may be injected directly into a vein.

- **Biological therapy.** Biological therapy works by helping your immune system recognize and attack leukemia cells.

- **Targeted therapy.** Targeted therapy uses drugs that attack specific vulnerabilities within your cancer cells. For example, the drug imatinib (Gleevec) stops the action of a protein within the leukemia cells of people with chronic myelogenous leukemia. This can help control the disease.

- **Radiation therapy.** Radiation therapy uses X-rays or other high-energy beams to damage leukemia cells and stop their growth. During radiation therapy, you lie on a table while a large machine moves around you, directing the radiation to precise points on your body. You may receive radiation in one specific area of your body where there is a collection of leukemia cells, or you may receive radiation over your whole body.

- **Stem cell transplant.** A stem cell transplant is a procedure to replace your diseased bone marrow with healthy bone marrow. Before a stem cell transplant, you receive high doses of chemotherapy or radiation therapy to destroy your diseased bone marrow. Then you receive an infusion of blood-forming stem cells that help to rebuild your bone marrow. You may receive stem cells from a donor, or in some cases you may be able to use your own stem cells. A stem cell transplant is very similar to a bone marrow transplant.

Coping and support

A diagnosis of leukemia may be devastating — especially for the family of a newly
diagnosed child. Remember that no matter what your concerns or prognosis, you're not alone. The road ahead may not be easy, but these strategies and resources may make it easier:

- **Know what to expect.** If you or your child is diagnosed with leukemia, find out everything you can about the type, the stage, the treatment options and their side effects. The more you know, the more confidence you'll have when making treatment decisions. In addition to talking with your doctor, seek out information from reliable sources such as the National Cancer Institute and the Leukemia & Lymphoma Society.

- **Be proactive.** Although you may feel tired and discouraged, don't let others — including your family or your doctor — make important decisions for you. Take an active role in your treatment.

- **Maintain a strong support system.** Having a support system can help you cope with the issues, pain and anxieties that might occur. The concern and understanding of a formal support group or others coping with cancer can be especially helpful. Although support groups aren't for everyone, they can be a good source for practical information. You may also find you develop deep and lasting bonds with people who are going through the same things you are.

- **Set reasonable goals.** Having goals helps you feel in control and can give you a sense of purpose. But don't choose goals you can't possibly reach. You may not be able to work a 40-hour week, for example, but you may be able to work at least part time. In fact, many people find that continuing to work can be helpful.

- **Take time for yourself.** Eating well, relaxing and getting enough rest can help combat the stress and fatigue of cancer. Also, plan ahead for the downtimes when you may need to rest more or limit what you do.

- **Stay active.** Having cancer doesn't mean you have to stop doing the things you enjoy or normally do. For the most part, if you feel well enough to do something, go ahead and do it. It's important to stay involved as much as you can.