

Each year, nearly 27,000 adults and more than 2,000 children in the United States learn that they have leukemia.

What Is Leukemia?

Leukemia is a type of cancer. Cancer is a group of more than 100 diseases that have two important things in common. One is that certain cells in the body become abnormal. Another is that the body keeps producing large numbers of these abnormal cells.

When leukemia develops, the body produces large numbers of abnormal blood cells. In most types of leukemia, the abnormal cells are white blood cells. The leukemia cells usually look different from normal blood cells, and they do not function properly.

Types of Leukemia

There are several types of leukemia. They are grouped in two ways. One way is by how quickly the disease develops and gets worse. The other way is by the type of blood cell that is affected.

Leukemia is either acute or chronic. In acute leukemia, the abnormal blood cells are blasts that remain very immature and cannot carry out their normal functions. The number of blasts increases rapidly, and the disease gets worse quickly. In chronic leukemia, some blast cells are present, but in general, these cells are more mature and can carry out some of their normal functions. Also, the number of blasts increases less rapidly than in acute leukemia. As a result, chronic leukemia gets worse gradually.

Leukemia can arise in either of the two main types of white blood cells—lymphoid cells or myeloid cells. When leukemia affects lymphoid cells, it is called lymphocytic leukemia. When myeloid cells are affected, the disease is called myeloid or myelogenous leukemia.

These are the most common types of leukemia:

- **Acute lymphocytic leukemia (ALL)** is the most common type of leukemia in young children. This disease also affects adults, especially those age 65 and older.
- **Acute myeloid leukemia (AML)** occurs in both adults and children. This type of leukemia is sometimes called acute nonlymphocytic leukemia (ANLL).
- **Chronic lymphocytic leukemia (CLL)** most often affects adults over the age of 55. It sometimes occurs in younger adults, but it almost never affects children.
- **Chronic myeloid leukemia (CML)** occurs mainly in adults. A very small number of children also develop this disease.

Hairy cell leukemia is an uncommon type of chronic leukemia. This and other uncommon types of leukemia are not discussed in this booklet.

Symptoms

Leukemia cells are abnormal cells that cannot do what normal blood cells do. They cannot help the body fight infections. For this reason, people with leukemia often get infections and have fevers.

Also, people with leukemia often have less than the normal amount of healthy red blood cells and platelets. As a result, there are not enough red blood cells to carry oxygen through the body. With this condition, called anemia, patients may look pale and feel weak and tired. When there are not enough platelets, patients bleed and bruise easily.

Like all blood cells, leukemia cells travel through the body. Depending on the number of abnormal cells and where these cells collect, patients with leukemia may have a number of symptoms.

In acute leukemia, symptoms appear and get worse quickly. People with this disease go to their doctor because they feel sick. In chronic leukemia, symptoms may not appear for a long time; when symptoms do appear, they generally are mild at first and get worse gradually. Doctors often find chronic leukemia during a routine checkup—before there are any symptoms.

These are some of the common symptoms of leukemia:

- Fever, chills, and other flu-like symptoms;
- Weakness and fatigue;
- Frequent infections;
- Loss of appetite and/or weight;
- Swollen or tender lymph nodes, liver or spleen;
- Easy bleeding or bruising;
- Tiny red spots (called petechiae) under the skin;
- Swollen or bleeding gums;
- Sweating, especially at night; and/or
- Bone or joint pain.

In acute leukemia, the abnormal cells may collect in the brain or spinal cord (also called the central nervous system or CNS). The result may be headaches, vomiting, confusion, loss of muscle control, and seizures. Leukemia cells also can collect in the testicles and cause swelling. Also, some patients develop sores in the eyes or on the skin. Leukemia also can affect the digestive tract, kidneys, lungs, or other parts of the body.

In chronic leukemia, the abnormal blood cells may gradually collect in various parts of the body. Chronic leukemia may affect the skin, central nervous system, digestive tract, kidneys, and testicles.

Diagnosis

To find the cause of a person's symptoms, the doctor asks about the patient's medical history and does a physical exam. In addition to checking general signs of health, the doctor feels for swelling in the liver; the spleen; and the lymph nodes under the arms, in the groin, and in the neck.

Blood tests also help in the diagnosis. A sample of blood is examined under a microscope to see what the cells look like and to determine the number of mature cells and blasts. Although blood tests may reveal that a patient has leukemia, they may not show what type of leukemia it is.

To check further for leukemia cells or to tell what type of leukemia a patient has, a hematologist, oncologist, or pathologist examines a sample of bone marrow under a microscope. The doctor withdraws the sample by inserting a needle into a large bone (usually the hip) and removing a small amount of liquid bone marrow. This procedure is called bone marrow aspiration. A bone marrow biopsy is performed with a larger needle and removes a small piece of bone and bone marrow.

If leukemia cells are found in the bone marrow sample, the patient's doctor orders other tests to find out the extent of the disease. A spinal tap (lumbar puncture) checks for leukemia cells in the fluid that fills the spaces in and around the brain and spinal cord (cerebrospinal fluid). Chest x-rays can reveal signs of disease in the chest.

Possible Causes

At this time, we do not know what causes leukemia. Researchers are trying to solve this prob-

lem. Scientists know that leukemia occurs in males more often than in females and in white people more often than in black people. However, they cannot explain why one person gets leukemia and another does not.

By studying large numbers of people all over the world, researchers have found certain risk factors that increase a person's risk of getting leukemia. For example, exposure to large amounts of high-energy radiation increases the risk of getting leukemia. Such radiation was produced by the atomic bomb explosions in Japan during World War II. In nuclear power plants, strict safety rules protect workers and the public from exposure to harmful amounts of radiation.

Some research suggests that exposure to electromagnetic fields is a possible risk factor for leukemia. (Electromagnetic fields are a type of low-energy radiation that comes from power lines and electric appliances.) However, more studies are needed to prove this link. Certain genetic conditions can increase the risk for leukemia. One such condition is Down's syndrome; children born with this syndrome are more likely to get leukemia than other children.

Workers exposed to certain chemicals over a long period of time are at higher risk for leukemia. Benzene is one of these chemicals. Also, some of the drugs used to treat other types of cancer may increase a person's risk of getting leukemia. However, this risk is very small when compared with the benefits of chemotherapy.

Scientists have identified a virus that seems to increase the risk for one very uncommon type of leukemia. However, this virus has no known association with common forms of leukemia. Scientists throughout the world continue to study viruses and other possible risk factors for leukemia. By learning what causes this disease, researchers hope to better understand how to prevent and treat it.

What the Future Holds

Researchers are finding better ways to treat leukemia, and the chances of recovery keep improving. Still, it is natural for patients and their families to be concerned about the future.

Sometimes people use rates of survival and other statistics to try to figure out whether a patient will be cured or how long the patient will live. It is important to remember, however, that statistics are averages based on large numbers of patients. They cannot be used to predict what will happen to a certain patient because no two patients are alike; treatments and responses vary greatly. The doctor who takes care of the patient is in the best position to discuss the chance of recovery (prognosis). Patients and their families should feel free to ask the doctor about the prognosis, but they should keep in mind that not even the doctor knows exactly what will happen. Doctors often talk about surviving cancer, or they may use the term remission, rather than cure. Even though many leukemia patients are cured, doctors use these terms because the disease can recur.

Treatment

Treatment for leukemia is complex. It varies with the type of leukemia and is not the same for all patients. The doctor plans the treatment to fit each patient's needs. The treatment depends not only on the type of leukemia, but also on certain features of the leukemia cells, the extent of the disease, and whether the leukemia has been treated before. It also depends on the patient's age, symptoms, and general health.

Whenever possible, patients should be treated at a medical center that has doctors who have experience in treating leukemia. If this is not possible, the