



Understanding Blood Cell Counts

No. 1 in a series providing the latest information on blood cancers.

What is a blood test?

Blood tests help a physician to diagnose and manage a disease. In addition to examining blood cells, there are many chemicals in the blood that give important information about the functioning of bodily systems. Important chemicals that may be measured include cholesterol, thyroid hormone, potassium, and numerous others. These various chemicals are dissolved in the plasma and circulate in the blood. For a chemical blood test, blood is drawn from a patient's vein and placed in an empty tube and usually allowed to clot; the fluid portion of the blood after clotting, called serum, is then used for the various chemical analyses.

What is a blood cell count?

Counting and examining blood cells are very important in the diagnosis of blood cell diseases. Blood cell counts are used during diagnosis, treatment and follow up to determine the health of the patient. Blood cell counts alone cannot determine if a patient has a blood cancer. However, blood cell counts can alert the physician if further testing is needed.

To count and/or examine blood cells, the blood must be collected in a tube that has an anticoagulant in it to prevent blood clotting. By so doing the cells are preserved, suspended in plasma, and can be stored for several hours without impairing the accuracy of the results.

To do a blood count, a sample of blood usually is taken from a vein in the crease of the forearm, placed in a tube containing an anticoagulant and transported to a hematology laboratory. In the laboratory, a sample of the blood is put in a machine that can count red and white cells and platelets and measure the blood hemoglobin. Also, a small drop of blood is spread into a thin film on a glass slide, dried, and dyes are applied.

The dyes color the different types of blood cells so that they are readily distinguishable from one another. The slide is examined under a microscope, the different types of white cells counted, and the cells examined to see if they are normal or, if abnormal, what the nature of the changes are.

Blood is composed of several different types of cells:

- Red blood cells, sometimes referred to as erythrocytes, pick up oxygen as blood passes through the lungs and release it to the cells in the body.
- White blood cells, sometimes referred to as leukocytes, help fight bacteria and viruses.
- Platelets are tiny cells produced by the bone marrow to help your blood clot in response to a cut or a wound. A decreased platelet count is called thrombocytopenia.

If all three of the blood cell types are examined, the test is referred to as a complete blood count or CBC. Some refer to the results as a hemogram.

A CBC also tests hemoglobin and hematocrit.

- Hemoglobin is a protein used by red blood cells to distribute oxygen to other tissues and cells in the body.
- Hematocrit refers to the amount of your blood that is occupied by red cells.

Why does my physician request blood cell counts?

There are several reasons why a physician may request blood cell counts. In a periodic health examination, blood counts, like other features of the examination, should be normal. Blood cell counts are a sensitive barometer of many illnesses; their measurement is an important part of a standard periodic health examination.

The blood cells may be altered as a result of a blood cell disease, or the counts may be altered as a reaction to another illness. For example, the white cell count may be elevated if a bacterial infection is present. The red cell count may be decreased as a result of a specific vitamin deficiency. The measurement of blood cells can contribute to the diagnosis of many disorders. If you have a blood cell disorder, measurement of the blood cell counts is an important index of the response of the disease to treatment. These counts are also important to learn the effects of drug treatment or radiation therapy. A blood count helps the physician to determine if a drug is working or not, whether the amount of drug a patient is receiving should be adjusted, or if another drug is needed.

What is a normal blood count?

Normal blood counts fall within the range that has been established by testing healthy men and women of all ages. The cell counts are compared to those of healthy individuals of similar age and sex. If a cell count is higher or lower than normal, the physician will try to determine the explanation for the abnormal results. The approximate normal ranges of blood cell counts for healthy adults are as follows:

1. Red blood cell (RBC) count:
 - 4.5 to 6.0 million red cells per microliter of blood in men
 - 4.0 to 5.0 million red cells per microliter of blood in women
2. White blood cell (WBC) count:
 - 4.5 to 11 thousand white cells per microliter of blood
3. Platelet count:
 - 150 to 450 thousand platelets per microliter of blood
4. Hematocrit is the percent of the blood that is composed of red cells:
 - 42% to 50% is normal in men
 - 36% to 45% is normal in women
5. Hemoglobin is the compound in the red blood cell that carries oxygen.
 - 14 to 17 grams per 100 milliliters of blood is normal for men
 - 12 to 15 grams per 100 milliliters of blood is normal for women

Differential count, sometimes referred to as a “diff,” is a breakdown of the different types of white blood cells, also called leukocytes. The observer can also tell if the white cells in the blood are normal in appearance.

The five types of white cells that are counted are neutrophils, lymphocytes, monocytes, eosinophils, and basophils. Blood contains about 60% neutrophils, 30% lymphocytes, 5% monocytes, 4% eosinophils and <1% basophils.

How do leukemia, lymphoma, and myeloma affect the blood count?**Leukemia**

Leukemia is the term used for certain diseases that affect the white blood cells or leukocytes. The different types of leukemia affect the blood count differently. Persons with acute leukemia may have a low, a normal, or a high white blood cell count. The white cell count may occasionally be many times higher than the normal average count of about 7,000 white cells per microliter of blood. In addition, the leukemic white blood cells in patients with acute leukemia do not function normally. Patients with chronic leukemia always have an increase in white blood cells.

Lymphoma

Patients with lymphoma often have disturbances in their blood cell counts as the lymphoma may suppress red blood cell production, or because the lymphoma has spread to the marrow and suppresses all blood cell types. The lymphoma cells may enter the blood and produce high white blood cell counts made up of lymphoma cells (abnormal lymphocytes).

Myeloma

Patients with myeloma usually have anemia because the myeloma cells in the marrow interfere with red blood cell production. Later, all blood cell types may be decreased by the effects of the myeloma cells in the marrow.

- Persons with a very low white blood cell count may have an increased risk of infection.
- Persons with a low red blood cell count, hematocrit, and hemoglobin are anemic. Depending on the severity of the anemia and the rate at which it develops, it may result in fatigue, shortness of breath with exertion, and other limitations.
- Persons with a very low platelet count can bruise or bleed more readily than normal.

Will treatment affect my blood count?

Chemotherapy and radiation therapy often affect a person's blood counts. To measure the effects, a complete blood count is usually done at appropriate intervals during therapy to monitor its effects. The effect depends on the drug used, the dose used, and the duration of the therapy. Red blood cells, white blood cells, and platelets originate in the bone marrow. If the type of therapy you are receiving can suppress blood cell production in the marrow, the red blood cell count, white blood count, and/or platelet count can decrease. By following your blood counts, your doctor can determine how the therapy is affecting your body and whether to continue therapy at the same dose or change the dose or timing of treatment. If the blood counts do not recover sufficiently between treatments, a transfusion may be necessary.

Your doctor may decide to administer cytokines to boost the amount of white blood cells and red blood cells you produce following chemotherapy treatments. Cytokines are drugs that resemble naturally occurring hormones that stimulate blood cell production. The following are some names of the drugs used to help increase specific types of blood cells:

- Erythropoietin (also called Procrit[®]), which helps stimulate red blood cell production;
- Darbepoetin Alfa (also called Aranesp[™]), a long-acting form of erythropoietin that also helps stimulate red blood production but requires less frequent injections;
- Granulocyte colony stimulating factor (also called G-CSF, filgrastim, or Neupogen[®]), which helps stimulate white blood cell production;

- Granulocyte-monocyte colony-stimulating factor (also called GM-CSF, sagramostim, Leukine[®], or Prokine[®]), which also helps stimulate white blood cell production.

Should patients keep track of their blood counts?

Some patients want to know the results of their blood counts and follow the changes that occur. If anemia develops, it may explain changes in your energy levels or an inability to carry out tasks that were easy to do before the anemia. If the white blood cell count drops to very low levels and fever develops, it is important to contact the physician promptly. If the platelet count is very low, you may bleed or bruise more easily, and it may be advisable to minimize activities that have a risk of injury. These matters should be discussed with your physician.

Resources

The Leukemia & Lymphoma Society

The Leukemia & Lymphoma Society is a national voluntary health agency with 63 chapters serving all 50 states. It provides education and support services for the public and for cancer treatment professionals. To find the Society chapter nearest you, visit our online chapter finder or contact:

The Leukemia & Lymphoma Society
1311 Mamaroneck Avenue
White Plains, NY 10605
(800) 955-4572 or www.LLS.org

Through the Society's Information Resource Center, callers may speak directly with an Information Specialist, Monday-Friday, 9 am- 6 pm, ET at (800) 955-4572. To contact an Information Specialist, click on Live Help (10 am- 5 pm) on the Society's Web site or email us at infocenter@LLS.org .

Information Specialists can answer general questions about diagnosis and treatment options, offer guidance and support, and assist with clinical trial searches for leukemia, lymphoma and myeloma.

The Society's Web site features a link to the clinical trial searching service of the National Cancer Institute. Clinical trials listings for blood cancers, including abstracts of clinical trial protocols and contact information, are available.

The Society provides fact sheets and booklets that can be ordered via the 800 number or through the Free Materials section on the Web site, www.LLS.org .

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