



# Complete Blood Count (CBC)

## THE COMPLETE BLOOD COUNT (CBC)

The most common laboratory test is the complete blood count (CBC). It examines the components of blood, including red and white blood cells and platelets. Most test results are reported as amounts in a sample of blood (for example, cells per milliliter) or as a percentage. Other laboratory tests are discussed in Fact Sheets 122 and 123.

All blood cells are made in the bone marrow, the center of large bones. Some medications or diseases can damage the bone marrow. This can reduce the numbers of different types of red or white blood cells.

Every laboratory has its own "reference range" or normal values for the results of each test. Most lab reports show the normal range and highlight any test results outside the normal range.

For more information on laboratory test results, see Fact Sheet 120 or **Lab tests online** at <http://www.labtestsonline.org/>

## RED BLOOD CELL TESTS

Red blood cells carry oxygen from the lungs to cells throughout the body. This is measured by three main tests. The **Red Blood Cell Count (RBC)** is the total number of red blood cells. **Hemoglobin (HGB)** is a protein in red blood cells that actually carries oxygen from the lungs to the rest of the body. **Hematocrit (HCT)** measures the percentage of blood volume taken up by red blood cells.

A high RBC is common for people who live at high altitude. It's a way the body adjusts to thinner oxygen.

Very low readings for RBC, hemoglobin and hematocrit can indicate anemia. With anemia, the cells do not get enough oxygen to function normally. People with anemia feel tired all the time and might look pale. See Fact Sheet 551 on fatigue and Fact Sheet 552 on anemia.

**Mean Corpuscular Volume (MCV)** measures the average volume (size) of individual red blood cells. A low MCV

means that the cells are smaller than normal. This is usually caused by an iron deficiency or chronic disease. A high MCV can be caused by HIV medications. This is not dangerous. However, a high MCV can indicate megaloblastic anemia, where red blood cells are large and pale. This is caused by a shortage of folic acid.

While the MCV measures the average size of red blood cells, the **RDW (Red Blood Cell Distribution Width)** measures the range of red blood cell sizes. RDW can help diagnose anemia or some vitamin deficiencies.

**Mean Corpuscular Hemoglobin (MCH)** and **Mean Corpuscular Hemoglobin Concentration (MCHC)** measure the amount and concentration of hemoglobin in the average cell. The MCH is calculated by dividing total hemoglobin by the total number of red blood cells.

**Platelets (PT)** help stop bleeding by forming clots and scabs. If you don't have enough platelets, you might get internal bleeding or you could bruise easily. People with HIV disease sometimes have a low platelet count, also called "thrombocytopenia." Taking HIV medications usually corrects this problem. Platelets are almost never so high that they cause health problems.

## WHITE BLOOD CELL TESTS

White blood cells (also called leukocytes) help fight infections in the body.

**White Blood Cell Count (WBC)** is the total number of white blood cells. A high WBC usually means that the body is fighting an infection. A very low WBC can be caused by problems with the bone marrow. This condition, called cytopenia or leukopenia, means that your body is less able to fight off infections.

The **Differential** counts five types of white blood cells: neutrophils, lymphocytes, monocytes, eosinophils and basophils. These are reported as a percentage of the WBC. The percentages are multiplied by the WBC to get "absolute" counts. For example, with 30% percent lymphocytes

and a WBC of 10,000, absolute lymphocytes are 30% of 10,000, or 3,000. **Neutrophils** or **polymorphonuclear cells (Polys)** fight bacterial infections. They normally account for 55% to 70% of WBCs. If you have a very low count, you could get a bacterial infection. This condition is called neutropenia. Advanced HIV disease can cause neutropenia. So can some medications including ganciclovir, a drug used to treat cytomegalovirus (see Fact Sheet 504) and the anti-HIV drug AZT.

There are two main types of **lymphocytes (lymphs)**. "T cells" attack and kill germs, and help regulate the immune system. "B cells" make antibodies, special proteins that attack germs. Lymphocytes are normally 20% to 40% of WBCs. A regular CBC does not give T-cell counts. Most people with HIV infection get special T-cell tests (see Fact Sheet 124). However, the results of a CBC are needed to calculate T-cell counts, so both tests are done at the same time.

**Monocytes** or **Macrophages (Monos)** make up 2% to 8% of WBCs. They fight infections by "eating" germs and telling the immune system what germs they have found. Monocytes circulate in the blood. When monocytes settle in various tissues they are called macrophages. A high count usually indicates a bacterial infection.

**Eosinophils (Eos)** are normally 1% to 4% of WBCs. They are involved with allergies and reactions to parasites. Sometimes, HIV disease can cause a high eosinophil count. A high count, especially if you have diarrhea, gas or stomach bloating, may indicate the presence of parasites.

**Basophils (Bas)** are not well understood, but they are involved in long-term allergic reactions such as asthma or skin allergies. They are usually less than 1% of WBCs.

Reviewed April 21, 2014