

## How Your Doctor Diagnoses Disorders of the Blood and Lymphatic Systems

Although some diseases of the blood and lymphatic systems produce symptoms such as fatigue with anemia that may bring a patient to the doctor, most are uncovered by a standard blood test during a routine examination. Blood drawn from a vein in your arm (a procedure called a venipuncture) is sent to a laboratory for a complete blood count (CBC), where it is analyzed for factors such as the red blood cell count (RBC); white blood cell count (WBC); the hematocrit (HCT), which is the ratio of red blood cells to plasma; and the amount of hemoglobin (HGB) in the red blood cells. Women generally have fewer red blood cells than men and thus a lower hematocrit and hemoglobin level as well.

The first sign of a disease such as anemia is a drop in the red blood cell count, hematocrit, or hemoglobin. An increase in white blood cells often indicates that your body is fighting an infection. Your platelet count determines a problem in your clotting process. If there is any abnormality in complete blood count, your doctor may recommend additional tests (see table 16.1), usually done on the same blood sample. In many cases, however, your medical history, a review of your symptoms, and CBC results give all the information necessary to make a diagnosis and begin treatment.

### Red Blood Cell Disorders

A physician examining a woman who has excessive menstrual bleeding and a low red blood cell count would suspect iron-deficiency anemia. A simple measurement of the iron level in her blood would confirm the diagnosis. Other types of anemia are differentiated with a variety of tests. For instance, the symptoms of pernicious anemia and folic acid deficiency anemia are similar but can be distinguished by checking the levels of B<sub>12</sub> and folic acid in the blood.

An abnormal increase in the red blood cell count and hemoglobin concentration is called erythrocytosis. It may be due to a number of causes—including congenital heart disease, high altitude sickness, and some tumors, for instance—which must be considered in making a diagnosis.

### White Blood Cell Disorders

White blood cell disorders must also be distinguished from each other. Infectious mononucleosis is sometimes confused with leukemia, but in acute leukemia, anemia and decreased platelets commonly accompany a high white blood cell count. A bone marrow aspiration may be done to diagnose leukemia or blood may be drawn to look for atypical lymphocytes, which characterize infectious mononucleosis.

Often the complete blood count gives an accurate picture that leads to a diagnosis. For example, leukemia and leukocytosis are both characterized by a high white blood cell count, but in leukemia there is also a simultaneous reduction in red blood cell and platelet counts in addition to the presence of immature leukemic cells.

A bone marrow aspiration may be performed if your physician suspects leukemia. In the case of acute leukemia, there may be an increased number of immature, abnormal white blood cells called blast cells. Tests for certain enzymes in the blood also help to differentiate between leukemias.

If you are experiencing recurrent, prolonged swelling of the lymph nodes in your neck, chest, and armpits—the first signs of Hodgkin's disease—and your blood tests pointed to that diagnosis, you might have to undergo a bone marrow and lymph node biopsy. Non-Hodgkin's lymphoma may have the same symptoms, and would require a biopsy for proper diagnosis.

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**Table 16.1****Tests Most Commonly Done on Blood Samples \***

Test	Use
Activated partial thromboplastin time (APTT)	Measures the time it takes plasma to clot. Used to detect deficiencies in many clotting factors. Results will be abnormal in most hemophiliacs. The test is also used to monitor heparin therapy.
Antibody test	Identifies antibodies that, due to a malfunctioning immune system, attack cells of the patient's own body. Presence of these antibodies may indicate disorders such as collagen vascular disease (lupus, rheumatoid arthritis), thyroid disorders, and adrenal disorders.
Carboxyhemoglobin (carbon monoxide measurement)	Measures levels of carbon monoxide. A toxic level can be one cause of erythrocytosis. (This measurement is sometimes included in a blood gas test.)
Coagulation factors screening	Identifies congenital and acquired coagulation factor deficiencies. (Some factors may be increased in patients taking oral contraceptives.)
Coombs' test (antiglobulin test)	Detects immune antibodies that may cause anemia. (Drugs such as penicillin, cephalosporins, methyldopa, quinidine, and mefenamic acid may cause a positive result.)
Erythropoietin (EPO) measurement	Tests for some types of anemia and erythrocytosis. As the hematocrit (ratio of red blood cells to plasma) falls, EPO is released by the kidney to stimulate the marrow to produce more cells.
Ferritin level	Indicates iron stores in the body, used to diagnose iron deficiency anemia and iron overload states. High levels may also be associated with other types of anemia, inflammation, liver disease, leukemia, and lymphoma. Also used to monitor adequacy of iron replacement in iron-deficiency anemia and iron removal in hemochromatosis.
Fibrinogen test	Diagnoses blood disorders involving too much or too little fibrinogen, a key component in the clotting process.
Immunoelectrophoresis (IEP)	Diagnoses myeloma and serum protein disorders. Low levels of antibody proteins suggest immunodeficiency states, while elevated homogenous antibody protein suggests myeloma. About 3% of elderly people have elevated antibody protein levels that turn out to be benign.
Leukocyte alkaline phosphatase	Measures the degree of activity of this enzyme in white blood cells, which helps differentiate between chronic myelocytic leukemia (CML) and a leukemoid reaction. The latter is characterized by a marked elevation in the white blood cell count (usually as a result of infection, drugs, or tumors) that leads to confusion with leukemia.
Philadelphia chromosome	Helps diagnose chronic myelocytic leukemia by identifying this chromosome

screen	abnormality, which occurs in 90% of people with this disorder.
Prothrombin time (PT)	Measures the time it takes plasma to clot under selected conditions. Used to detect deficiencies in certain clotting factors produced by the liver. It monitors the effects of the anticoagulant drug coumarin. Results are frequently abnormal in patients with liver disease.
Reticulocyte count	Measures young or not quite mature red blood cells as an indication of production of red blood cells from the bone marrow. Evaluates ability of bone marrow to produce new red blood cells. Helps to distinguish between different types of anemia.
Serum viscosity	Measures the flow rate of plasma relative to water. An increased plasma viscosity is associated with macroglobulinemia and other blood protein content disorders (dysproteinemias).

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\*In addition to routine red blood, white blood, and platelet counts.

### **Platelet Disorders**

A drop in platelet count may lead to black and blue spots (ecchymosis) or frecklelike tiny red spots (petechiae) on your skin. If these symptoms occur with a normal platelet count, your physician may recommend a bleeding time test.

### **Coagulation/Clotting Disorders**

Coagulation factor deficiencies are detected by measuring their level in the blood. Disseminated intravascular coagulation (DIC) is characterized by a decreased level of coagulation factors and platelets, which have been consumed in the abnormal clotting process.

### **Blood Protein Content Disorders**

A combination of anemia, susceptibility to infections, and bone pain or easily occurring fractures, especially of the vertebrae, might indicate further tests, such as immunoelectrophoresis, which identifies abnormal proteins produced by the malignant cells.

### **Myeloproliferative Disorders**

Symptoms vary according to the specific type of disorder but may include weakness, visual disturbances, an enlarged spleen and perhaps enlarged liver, abnormal bleeding, headache, dizziness, and general malaise. Blood tests will show abnormal numbers of the affected blood cells; additional tests, such as chromosome studies and various other laboratory tests, are needed to identify the specific myeloproliferative disorder.

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