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## Medical Encyclopedia: Blood differential

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### Alternative names

Differential; White blood cell differential count

### Definition

The blood differential test measures the relative numbers of white blood cells (WBCs) in the blood. It also includes information about abnormal cell structure and the presence of immature cells. (See also CBC, peripheral smear, and eosinophil count - absolute.)

### How the test is performed

Blood will be drawn from a vein on the inside of the elbow or the back of the hand. The puncture site is cleaned with antiseptic, and an elastic band is placed around the upper arm to apply pressure and restrict blood flow through the vein. This causes veins below the band to fill with blood.

A needle is inserted into the vein, and the blood is collected in an airtight vial or a syringe. During the procedure, the band is removed to restore circulation. Once the blood has been collected, the needle is removed, and the puncture site is covered to stop any bleeding.

For infants or young children, the area is cleansed with antiseptic and punctured with a sharp needle or a lancet. The blood may be collected in a pipette (small glass tube), on a slide, onto a test strip, or into a small container. Cotton or a bandage may be applied to the puncture site if there is any continued bleeding.

After the specimen is collected from an adult or child, a drop of blood is placed on a glass slide. A smear is made and stained to differentiate the various types of WBCs for a manual differential (the cells are counted by a technician, hematologist, or pathologist rather than a computer).

### How to prepare for the test

No special preparation is necessary for adults.

### How the test will feel

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

### Why the test is performed

The differential count can be used to help detect infection, anemia, and leukemia or to follow the progress of treatment.

There are various types of WBCs (also called leukocytes) that normally appear in the blood. The differential determines the relative percentages of the different types of cells in the blood, notes any abnormal appearance of the cells, and the presence of any abnormal immature cells.

- **Neutrophils** are mainly phagocytic cells (that is, they engulf and destroy invading organisms). They also release some enzymes and substances that affect the function of other cells called cytokines.
- **B lymphocytes** (B cells) synthesize and secrete antibodies.
- **T lymphocytes** (T cells) -- one type of T cell is called a helper cell; it secretes proteins that increase B cell function and the functions of cytotoxic T lymphocytes. Cytotoxic T lymphocytes recognize and destroy virus-infected and other abnormal cells.
- **Monocytes** recognize a variety of microorganisms, especially gram-negative bacteria. Activated monocytes turn into macrophages that can engulf and destroy microorganisms and secrete a variety of cytokines that modulate the activity of other leukocytes.
- **Eosinophils** and **basophils** release substances that cause vasoconstriction, smooth muscle contraction, and an increased permeability of small blood vessels. Eosinophils are stimulated by parasites and some bacteria. Basophils are stimulated by allergens.

### Normal Values

- Neutrophils: 40% to 60%
- Lymphocytes: 20% to 40%
- Monocytes: 2% to 8%
- Eosinophils: 1% to 4%
- Basophils: 0.5% to 1%
- Band: 0% to 3%

### What abnormal results mean

Any infection or acute stress results in increased production of WBCs. This usually entails an increased numbers of cells and an increase in the percent of immature cells (mainly band cells) in the blood. High WBC counts may indicate the presence of an inflammatory and immune response, or it may result from other conditions such as leukemia.

It is important to realize that an abnormal increase in one type of leukocyte can produce an apparent decrease in the percentage of other types.

An increased percentage of neutrophils may indicate:

- Acute infection
- Eclampsia
- Gout
- Myelocytic leukemia
- Rheumatoid arthritis
- Rheumatic fever
- Acute stress
- Thyroiditis
- Trauma

A decreased percentage of neutrophils may indicate:

- Aplastic anemia
- Chemotherapy
- Influenza

- Overwhelming bacterial infection
- Radiation therapy

An increased percentage of lymphocytes (lymphocytosis) may indicate:

- Chronic bacterial infection
- Infectious hepatitis
- Infectious mononucleosis
- Lymphocytic leukemia
- Multiple myeloma
- Viral infection (such as infectious mononucleosis, mumps, measles)
- Recovery from a bacterial infection

A decreased percentage of lymphocytes may indicate:

- Chemotherapy
- HIV infection
- Leukemia
- Radiation therapy
- Sepsis

An increased percentage of monocytes may indicate:

- Chronic inflammatory disease
- Parasitic infection
- Tuberculosis
- Viral infection (for example, infectious mononucleosis, mumps, measles)

An increased percentage of eosinophils may indicate:

- Allergic reaction
- Parasitic infection
- Hodgkin's disease

A decreased percentage of basophils may indicate an acute allergic reaction.

This test may be performed under many other conditions as well.

### **What the risks are**

- Excessive bleeding
- Fainting or feeling light-headed
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)
- Multiple punctures to locate veins

### **Special considerations**

Veins and arteries vary in size from one patient to another, and from one side of the body to the other. Obtaining a blood sample from some people may be more difficult than from others.

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