White Blood Cell (WBC) Differential

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Also Known As: Leukocyte Differential Count, Penpheral Differential, WBC Count Differential, Diff, Blood Differential, Differential Blood Count

Formal Name: White Blood Cell Differential

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At a Glance

Why Get Tested?

To help determine the cause of abnormal results on a white blood cell (WBC) count; to help diagnose and/or monitor an illness affecting your immune system, such as an infection or inflammatory condition, or cancers that affect your white blood cells, such as leukemia

When To Get Tested?

As part of a complete blood count (CBC), when you have a routine health examination; when results of a CBC fall outside the reference range; when you have any number of signs and symptoms that may be related to a condition affecting white blood cells, such as infection, inflammation, or cancer; when you are receiving treatment that is known to affect WBCs, such as chemotherapy

Sample Required?

A blood sample drawn from a vein in your arm or by a fingerstick (children and adults) or heelstick (infants)

Test Preparation Needed?

None

What is being tested?

White blood cells (WBCs), also called leukocytes, are cells that circulate in the blood and the lymphatic system that help protect the body against infections. They are an important part of the body's immune system and also have a role in inflammation, allergic responses, and protection against cancer. A WBC differential totals the number of each of the different types of WBCs in a person's sample of blood.

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How is it used?

The white blood cell differential is often used as part of a complete blood count (CBC) as a general health check. It may be used to help diagnose the cause of a high or low white blood cell (WBC) count, as determined with a CBC. It may also be used to help diagnose and/or monitor other diseases and conditions that affect one or more different types of WBCs.

The five types include: neutrophils, lymphocytes, monocytes, eosinophils and basophils. (For more details on these, see the "What is being tested?" section.)

The differential totals the number of each type and determines if the cells are present in normal proportion to one another, if one cell type is increased or decreased, or if immature cells are present. This information is useful in helping to diagnose the specific cause of an illness, such as:

- Infections caused by bacteria, viruses, fungi or parasites
- Inflammation
- Allergies, asthma
- Immune disorders (e g., autoimmune disorders, immune deficiency)
- Leukemia (e.g., chronic myeloid leukemia, chronic lymphocytic leukemia)
- Myelodysplastic syndrome
- Myeloproliferative neoplasms (e.g , myelofibrosis)

Some diseases trigger a response by the immune system that causes an increase in certain types of WBCs. A differential may give clues to the specific cause of that immune response. For example, it may help determine whether an infection is caused by bacteria or by viruses.

Other conditions affect the production of certain WBCs by the bone marrow or their survival in the circulation, resulting in either an increase or decrease in their number. A differential informs the healthcare provider as to which type of WBC is low or high

An abnormal differential result may be followed by other tests such as a blood smear, bone marrow biopsy, chromosome analysis, or immunophenotyping (e.g., flow cytometry). These tests can reveal the presence of abnormal and/or immature populations of WBCs.

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How is it used? +

When is it ordered? −

The differential is often performed as part of the complete blood count (CBC), which may be ordered at the time of a routine health exam.

A differential may be included as part of the CBC when someone has general signs and symptoms of an infection and/or inflammation, such as:

- Fever, chills
- Body aches, pain
- Headache
- A variety of other signs and symptoms, depending on the site of suspected infection or inflammation

Testing may be performed when there are signs and symptoms that the healthcare provider thinks may be related to a blood and/or bone marrow disorder, autoimmune disease or other immune disorder.

If a differential is not done at the same time as a CBC, it may be ordered when results from the CBC are not within the reference ranges.

What does the test result mean? +

Is there anything else I should know? +

Can a white blood cell (WBC) differential be performed on samples other than blood? +

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When is it ordered? +

What does the test result mean? −

The results indicate the number and/or the percentage of each type of white blood cell that is present in a person's sample of blood.

Results of a differential are usually reported as absolute values of the five types of WBCs and/or may be reported as a percent of the total number of WBCs. Absolute values are calculated by multiplying the total number of WBCs by the percentage of each type of white cell. This information can aid in diagnosing illness and monitoring therapy. Neutrophils typically make up the highest number of WBC, followed by lymphocytes, then monocytes, eosinophils and basophils.

Care must be taken when interpreting the results of a differential. A healthcare provider will consider an individual's signs and symptoms and medical history as well as the degree to which the cells are increased or decreased. A number of factors can cause a transient rise or drop in the number of any one type of cell. A persistent increase or decrease will usually prompt further testing to determine the cause.

The following table gives some examples as to what the results of a differential may indicate:

Possible Causes of High and Low WBC Differential Results

Type of WBC	Abbreviations	Examples of causes of a high count	Examples of causes of a low count
Neutrophils (Absolute neutrophil count, percent neutrophils)	Neu, Polys, PMNs, ANC, % Neu	Known as neutrophilia • Acute bacterial infections and also some infections caused by viruses and fungi • Inflammation (e.g., inflammatory bowel disease, rheumatoid arthritis) • Tissue death (necrosis) caused by trauma, major surgery, heart attack, burns • Physiological (stress, rigorous exercise) • Smoking • Pregnancy—last trimester or during labor • Chronic leukemia (e.g., myelogenous leukemia)	Known as neutropenia • Myelodysplastic syndrome • Severe, overwhelming infection (e.g., sepsis--neutrophils are used up) • Reaction to drugs (e.g., penicillin, ibuprofen, phenytoin, etc.) • Autoimmune disorder • Chemotherapy • Cancer that spreads to the bone marrow • Aplastic anemia

Lymphocytes (Absolute lymphocyte count, percent lymphocytes)	Lymphs, lym, ly, ALC, % lymphs	Known as lymphocytosis • Acute viral infections (e.g., hepatitis, chicken pox, cytomegalovirus (CMV), Epstein-Barr virus (EBV), herpes, rubella) • Certain bacterial infections (e.g., pertussis (whooping cough), tuberculosis (TB)) • Lymphocytic leukemia • Lymphoma	Known as lymphopenia or lymphocytopenia • Autoimmune disorders (e.g., lupus, rheumatoid arthritis) • Infections (e.g., HIV, TB, hepatitis, influenza) • Bone marrow damage (e.g., chemotherapy, radiation therapy) • Immune deficiency
Monocytes (Absolute monocyte count, percent monocytes)	Monos, AMC, % monos	Known as monocytosis • Chronic infections (e.g., tuberculosis, fungal infection) • Infection within the heart (bacterial endocarditis) • Collagen vascular diseases (e.g., lupus, scleroderma, rheumatoid arthritis, vasculitis) • Inflammatory bowel disease • Monocytic leukemia • Chronic myelomonocytic leukemia • Juvenile myelomonocytic leukemia	Known as monocytopenia Usually, one low count is not medically significant. Repeated low counts can indicate: • Bone marrow damage or failure • Hairy-cell leukemia
Eosinophils (Absolute eosinophil count, percent eosinophils)	Eos, AEC, % eos	Known as eosinophilia • Asthma, allergies such as hay fever • Drug reactions • Inflammation of the skin (e.g., eczema, dermatitis) • Parasitic infections • Inflammatory disorders (e.g., celiac disease, inflammatory bowel disease) • Certain malignancies/cancers • Hypereosinophilic myeloid neoplasms	Known as eosinopenia This is often difficult to determine because numbers are normally low in the blood. One or an occasional low number is usually not medically significant.
Basophils (Absolute		Known as basophilia • Rare allergic reactions (e.g., hives, food allergy)	Known as basopenia

		• Certain malignancies/cancers • Hypereosinophilic myeloid neoplasms	
Basophils (Absolute basophil count, percent basophils)	Baso, ABC, % baso	Known as basophilia • Rare allergic reactions (e.g., hives, food allergy) • Inflammation (rheumatoid arthritis, ulcerative colitis) • Some leukemias (e.g., chronic myeloid leukemia)	Known as basopenia As with eosinophils, numbers are normally low in the blood; usually not medically significant.

In certain cases, immature and/or abnormal forms of the cells may be present in the blood and may be detected with a differential. Immature forms include metamyelocytes, myelocytes, promyelocytes, and/or blasts. Further work-up (e.g., bone marrow biopsy) may be necessary

Is there anything else I should know? +

Can a white blood cell (WBC) differential be performed on samples other than blood? +

If I have an abnormal result on my WBC differential, what other tests might my healthcare provider order? +

My report mentions a "left shift." What does this mean? +

My complete blood count (CBC) report includes a result for immature granulocytes (IG). What are they? +

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My report mentions a "left shift." What does this mean? −

A "left shift" is a phrase used to note that there are a high number of young, immature white blood cells present. Most commonly, this means that there is an infection or inflammation present and the bone marrow is producing more WBCs and releasing them into the blood before they are fully mature. This is a natural immune response to infection and inflammation.

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Some automated hematology analyzers report the total number of immature granulocytes (IG) present in a person's blood sample. Immature granulocytes are white blood cells that have not fully developed before being released from the bone marrow into the blood. They may include metamyelocytes, myelocytes, and promyelocytes. These cells are normally only present in the bone marrow because they are precursors of neutrophils, the predominant type of white cells in blood. The presence of immature granulocytes in the blood may occur in various diseases, such as infection or a blood cancer, and thus will often prompt further investigation, which may include additional laboratory testing.

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