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# CBC - Complete Blood Count

*(Includes hematocrit)*

The CBC panel is an inventory of the different cellular components of the blood:

**White Blood Cells, Red Blood Cells, and Platelets**



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### Ordered Items

CBC With Differential/Platelet; Comp. Metabolic Panel (14); Lipid Panel w/ Chol/HDL Ratio; Testosterone,Free and Total; DHEA-Sulfate; TSH; Luteinizing Hormone(LH), S; FSH, Serum; Prostate-Specific Ag, Serum; Estradiol, Sensitive; Progesterone; Triiodothyronine,Free,Serum; Venipuncture

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
<b>CBC With Differential/Platelet</b>					
WBC	9.4		x10E3/uL	3.4 - 10.8	01
RBC	4.97		x10E6/uL	4.14 - 5.80	01
Hemoglobin	16.1		g/dL	12.6 - 17.7	01
Hematocrit	48.0		%	37.5 - 51.0	01
MCV	97		fL	79 - 97	01
MCH	32.4		pg	26.6 - 33.0	01
MCHC	33.5		g/dL	31.5 - 35.7	01
RDW	14.0		%	12.3 - 15.4	01
Platelets	257		x10E3/uL	150 - 379	01
Neutrophils	90		%		01
Lymphs	6		%		01
Monocytes	4		%		01
Eos	0		%		01
Basos	0		%		01
<b>Neutrophils (Absolute)</b>	<b>8.4</b>	<b>High</b>	x10E3/uL	1.4 - 7.0	01
<b>Lymphs (Absolute)</b>	<b>0.5</b>	<b>Low</b>	x10E3/uL	0.7 - 3.1	01
Monocytes (Absolute)	0.4		x10E3/uL	0.1 - 0.9	01
Eos (Absolute)	0.0		x10E3/uL	0.0 - 0.4	01
Baso (Absolute)	0.0		x10E3/uL	0.0 - 0.2	01



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# Complete Blood Count (CBC)- Tests Included Part 1

## White Blood Cells

White blood cells (leukocytes) carry out the body's immune responses. The CBC looks at numbers of various different types of white blood cells.

**White Blood Cell Count (WBC):** the total number of white blood cells in a quantity of blood. A healthy adult normally has 4,000-11,000 white blood cells/mm<sup>3</sup>. A WBC increase often indicates that a person is actively fighting an infection or has recently received a vaccine. Decreased WBC (leukopenia) can leave a person vulnerable to various pathogens and cancers.

**Neutrophils:** a type of cell that fights bacterial infections. Neutrophils normally make up about 50-70% of all white blood cells. The risk of bacterial infection increases when the absolute neutrophil count falls below about 500-750 cells/mm<sup>3</sup>.

**Lymphocytes:** there are two main types of lymphocytes. B cells produce antibodies that fight foreign invaders in the body, while T cells target infected or cancerous cells and help coordinate the overall immune response. A normal lymphocyte count is about 20-40% of all white blood cells.

**Monocytes:** a type of cell that fights pathogens by engulfing and destroying them. Monocytes circulate in the blood for about 24 hours; when they leave the bloodstream and migrate into the tissues, they mature into macrophages. Monocytes and macrophages normally account for 2-10% of all white blood cells.

**Eosinophils:** cells that play a role in defense against parasites and in allergic reactions. They normally make up 0-6% of all white blood cells.

**Basophils:** another type of cell involved in allergic reactions, in particular the release of histamine. They normally account for 1% or less of all white blood cells.

# WBC Evaluation

WBC

Neu, PMN, polys

FULL NAME	EXAMPLES OF CAUSES OF A LOW COUNT	EXAMPLES OF CAUSES OF A HIGH COUNT
<div>White Blood Cell Count</div> <div>4500-11000 per microliter</div> <div><math>4.5-11 \times 10^9</math> per liter</div>	<div>Known as leukopenia</div> <div>Bone marrow disorders or damage</div> <div>Autoimmune conditions</div> <div>Severe infections (sepsis)</div> <div>Lymphoma or other cancer that spread to the bone marrow</div> <div>Dietary deficiencies</div> <div>Diseases of immune system (e.g., HIV/AIDS)</div>	<div>Known as leukocytosis</div> <div>Infection, most commonly bacterial or viral</div> <div>Inflammation</div> <div>Leukemia, myeloproliferative disorders</div> <div>Allergies, asthma</div> <div>Tissue death (trauma, burns, heart attack)</div> <div>Intense exercise or severe stress</div>
<div>Absolute neutrophil count, % neutrophils</div> <div>1800-7800 per microliter</div> <div><math>1.8-7.8 \times 10^9</math> per liter</div>	<div>Known as neutropenia</div> <div>Severe, overwhelming infection (sepsis)</div> <div>Autoimmune disorders</div> <div>Dietary deficiencies</div> <div>Reaction to drugs, chemotherapy</div> <div>Immunodeficiency</div> <div>Myelodysplasia</div> <div>Bone marrow damage (e.g., chemotherapy, radiation therapy)</div> <div>Cancer that spreads to the bone marrow</div>	<div>Known as neutrophilia</div> <div>Acute bacterial infections</div> <div>Inflammation</div> <div>Trauma, heart attack, or burns</div> <div>Stress, rigorous exercise</div> <div>Certain leukemias (e.g., chronic myeloid leukemia)</div> <div>Cushing syndrome</div>



## Low

## High

Lymph

Absolute lymphocyte count,  
% lymphocytes

34%

1000-4800 per microliter

$1-4.8 \times 10^9$  per liter

Known as lymphocytopenia

Autoimmune disorders (e.g.,  
lupus, rheumatoid arthritis)

Infections (e.g., HIV, viral  
hepatitis, typhoid fever, influenza)

Bone marrow damage (e.g.,  
chemotherapy, radiation therapy)

Corticosteroids

Known as lymphocytosis

Acute viral infections (e.g., chicken pox,  
cytomegalovirus (CMV), Epstein-Barr  
virus (EBV), herpes, rubella)

Certain bacterial infections (e.g.,  
pertussis (whooping cough),  
tuberculosis (TB))

Toxoplasmosis

Chronic inflammatory disorder  
(e.g., ulcerative colitis)

Lymphocytic leukemia,  
lymphoma

Stress (acute)

Mono

Absolute monocyte count, %  
monocytes

4%

0-80 per microliter

$0-0.8 \times 10^9$  per liter

Usually, one low count is not medically  
significant. Repeated low counts can  
indicate:

Bone marrow damage or failure

Bone marrow damage or failure

Aplastic anemia

Bone marrow damage or failure

Bone marrow damage or failure

Collagen vascular diseases (e.g.,  
lupus, scleroderma, rheumatoid  
arthritis, vasculitis)

Aplastic anemia

# Complete Blood Count (CBC)- Tests Included Part 2

## Red Blood Cells

Red blood cells (erythrocytes) carry oxygen from the lungs to the body's cells, bound to a molecule called hemoglobin.

- **Red Blood Cell Count (RBC):** the total number of red blood cells in a quantity of blood. Normal ranges are 4.5-6.0 million cells/mm<sup>3</sup> for men and 4.0-5.5 million cells/mm<sup>3</sup> for women. (Women typically have lower counts than men due to the loss of blood through menstruation.)
- **Hematocrit (HCT):** the proportion of red blood cells as a percentage of total blood volume. A normal hematocrit is 40-52% for men and 35-45% for women.
- **Hemoglobin (HGB):** the number of grams of hemoglobin in a deciliter of blood (g/dL). Normal levels in healthy adults are 14-18 g/dL for men and 12-16 g/dL for women. As a rough guideline, hemoglobin should be about one-third the hematocrit.
- **Mean Corpuscular Hemoglobin (MCH) and MCH Concentration (MCHC):** the amount or concentration, respectively, of hemoglobin in an average red blood cell.
- **Mean Corpuscular Volume (MCV):** the average size, or volume, of individual red blood cells. Conditions such as iron deficiency can lead to smaller than normal red blood cells, while certain vitamin deficiencies and some drugs can produce larger than normal cells.
- **Red Blood Cell Distribution Width (RDW):** a measure of the size and uniformity of red blood cells.

# RBC Evaluation

	FULL NAME	EXAMPLES OF CAUSES OF A LOW RESULT	EXAMPLES OF CAUSES OF A HIGH RESULT
RBC	<div>Red Blood Cell Count</div> <div>Male: 4.5-5.5*10<sup>6</sup> per microliter 4.5-5.5*10<sup>12</sup> per liter</div> <div>Female: 4.5-5.1*10<sup>6</sup> per microliter 4.5-5.1*10<sup>12</sup> per liter</div>	<div>Known as anemia</div> <div>Acute or chronic bleeding</div> <div>RBC destruction (e.g., hemolytic anemia, etc.)</div> <div>Nutritional deficiency (e.g., iron deficiency, vitamin B12 or folate deficiency)</div> <div>Bone marrow disorders or damage</div> <div>Chronic inflammatory disease</div> <div>Chronic kidney disease</div> <div>Frequent blood donations</div>	<div>Known as polycythemia</div> <div>Dehydration</div> <div>Lung (pulmonary) disease</div> <div>Kidney or other tumor that produces excess erythropoietin</div> <div>Smoking and sleep apnea</div> <div>Living at high altitude</div> <div>Genetic causes (altered oxygen sensing, abnormality in hemoglobin oxygen release)</div> <div>Polycythemia vera or testosterone replacement erythrocytosis</div>
Hb	<div>Hemoglobin</div> <div>Male: 14-17.5 g/dL</div> <div>Female: 12.3-15.3 g/dL</div>	<div>Usually mirrors RBC results, provides added information</div>	<div>Usually mirrors RBC results</div>
Hct	<div>Hematocrit</div> <div>Male: 41.5-50.4%</div> <div>Female: 36.9-44.6%</div>	<div>Usually mirrors RBC results</div>	<div>Usually mirrors RBC results; most common cause is dehydration</div>



		Low	High
MCV	<p>Mean Corpuscular Volume</p> <p>80-96 micrometer 80-96 fL</p>	Indicates RBCs are smaller than normal (microcytic); caused by iron deficiency anemia or thalassemias, for example.	Indicates RBCs are larger than normal (macrocytic), for example in anemia caused by vitamin B12 or folate deficiency, myelodysplasia, liver disease, hypothyroidism
MCH	<p>Mean Corpuscular Hemoglobin</p> <p>27.5-33.2 pg</p> <p>27.5-33.2 pg</p>	Mirrors MCV results; small red cells would have a lower value	Mirrors MCV results; macrocytic RBCs are large so tend to have a higher MCH.
MCHC	<p>Mean Corpuscular Hemoglobin Concentration</p> <p>33.4-35.5 g/dL</p> <p>334-355 g/L</p>	May be low when MCV is low; decreased MCHC values (hypochromia) are seen in conditions such as iron deficiency anemia and thalassemia.	Increased MCHC values (hyperchromia) are seen in conditions where the hemoglobin is more concentrated inside the red cells, such as autoimmune hemolytic anemia, in burn patients, and hereditary spherocytosis, a rare congenital disorder.
RDW	<p>RBC Distribution Width</p> <p>Low/High</p>	Low value indicates uniformity in size of RBCs.	Indicates mixed population of small and large RBCs; young RBCs tend to be larger. For example, in iron deficiency anemia or pernicious anemia, there is high variation (anisocytosis) in RBC size (along with variation in shape – poikilocytosis), causing an increase in the RDW.
Reticulocyte Count	<p>Reticulocytes (absolute count or %)</p> <p>0.5-1.5%</p> <p>25-75*10<sup>3</sup> microliter</p> <p>25-75*10<sup>9</sup> liter</p>	In the setting of anemia, a low reticulocyte count indicates a condition is affecting the production of red blood cells, such as bone marrow disorder or damage, or a nutritional deficiency (iron, B12 or folate).	In the setting of anemia, a high reticulocyte count generally indicates peripheral cause, such as bleeding or hemolysis, or response to treatment (e.g., iron supplementation for iron deficiency anemia).

Low

High

Eos

Absolute eosinophil count, % eosinophils

Numbers are normally low in the blood. One or an occasional low number is usually not medically significant

2.7%

0-450 per microliter

0-0.45\*10<sup>9</sup> per liter

Asthma, allergies such as hay fever

Drug reactions

Parasitic infections

Inflammatory disorders (celiac disease, inflammatory bowel disease)

Some cancers, leukemias or lymphomas

Addison disease

Baso

Absolute basophil count, % basophils

As with eosinophils, numbers are normally low in the blood; usually not medically significant

0.3%

0-200 per microliter

0-0.2\*10<sup>9</sup> per liter

Rare allergic reactions (hives, food allergy)

Inflammation (rheumatoid arthritis, ulcerative colitis)

Some leukemias

Uremia

# Complete Blood Count (CBC)- Tests Included Part 3

## Platelets

Platelets (thrombocytes) are necessary for blood clotting. A normal platelet count is about 130,000-440,000 cells/mm<sup>3</sup>. Low platelet counts (thrombocytopenia) -- which can lead to easy bruising and excessive bleeding -- may be caused by certain drugs, autoimmune reactions, accelerated destruction by the spleen, or certain immune diseases.

# Platelet Evaluation

Plt

FULL NAME	EXAMPLES OF CAUSES OF A LOW RESULT	EXAMPLES OF CAUSES OF A HIGH RESULT
<div>Platelet Count</div>	<div>Known as thrombocytopenia:</div> <div><div>Viral infection (mononucleosis, measles, hepatitis)</div><div>Rocky mountain spotted fever</div><div>Platelet autoantibody</div><div>Drugs (acetaminophen, quinidine, sulfa drugs)</div><div>Cirrhosis</div><div>Autoimmune disorders</div><div>Sepsis</div><div>Leukemia, lymphoma</div><div>Myelodysplasia</div><div>Chemo or radiation therapy</div></div>	<div>Know as thrombocytosis:</div> <div><div>Cancer (lung, gastrointestinal, breast, ovarian, lymphoma)</div><div>Rheumatoid arthritis, inflammatory bowel disease, lupus</div><div>Iron deficiency anemia</div><div>Hemolytic anemia</div><div>Myeloproliferative disorder (e.g., essential thrombocythemia)</div></div>

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