Components of the CBC

WBC Evaluation

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF A LOW COUNT	
White Blood Cell Count (WBC)	*Conventional Units*[1] 4,500-11,000 white blood cells per microliter (mcL) *SI Units*[1] 4.5-11.0 x 10^9 per liter (L)	Known as leukopenia • Bone marrow disorders or damage • Autoimmune conditions • Severe infections (sepsis) • Lymphoma or other cancer that spread to the bone marrow • Dietary deficiencies • Diseases of immune system (e.g.,HIV/AIDS)	Known as leukocytosis • Infection, most commonly bacterial or viral • Inflammation • Leukemia, myeloproliferative neoplasms • Allergies, asthma • Tissue death (trauma, burns, heart attack) • Intense exercise or severe stress
White Blood Cell Differential (Diff)	(Not always performed; may be done as part of or in follow up to CBC)		
Absolute neutrophilcount, % neutrophils (Neu, PMN, polys)	*Conventional Units* Percent (mean): 56% Absolute count (per microliter): 1800-7800 *SI Units*	Known as neutropenia • Severe, overwhelming infection (sepsis) • Autoimmune disorders • Dietary deficiencies • Reaction to drugs • Immunodeficiency • Myelodysplasia • Bone marrow damage (e.g., chemotherapy, radiation therapy)	Known as neutrophilia • Acute bacterial infections • Inflammation • Trauma, heart attack, or burns • Stress, rigorous exercise • Certain leukemias (e.g., chronic myeloid leukemia) • Cushing syndrome

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF A LOW COUNT	
	Mean number fraction: 0.56 Absolute count X 10^9 per liter: 1.8-7.8	• Cancer that spreads to the bone marrow	
Absolute lymphocytecount, % lymphocytes (Lymph)	*Conventional Units* Percent (mean) 34% Absolute count (per microliter): 1000-4800 *SI Units* Mean number fraction: 0.34 Absolute count X 10^9 per liter: 1.0-4.8	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)
Absolute monocytecount, % monocytes (Mono)	*Conventional Units* Percent (mean) 4% Absolute count (per microliter) 0-800 *SI Units* Mean number	Usually, one low count is not medically significant. Repeated low counts can indicate: • Bone marrow damage or failure • Hairy cell leukemia • Aplastic anemia	• Chronic infections (e.g., tuberculosis, fungal infection) • Infection within the heart (bacterial endocarditis) • Collagen vascular diseases (e.g., lupus, scleroderma, rheumatoid arthritis, vasculitis) • Monocytic or myelomonocytic leukemia (acute or chronic)

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF A LOW COUNT	
	fraction 0.04 Absolute count X 10^9 per liter 0-0.80		
Absolute eosinophilcount, % eosinophils (Eos)	*Conventional Units* Percent (mean) 2.7% Absolute count (per microliter) 0-450 *SI Units* Mean number fraction 0.027 Absolute count X 10^9 per liter 0-0.45	Numbers are normally low in the blood. One or an occasional low number is usually not medically significant	• Asthma, allergies such as hay fever • Drug reactions • Parasitic infections • Inflammatory disorders (celiac disease, inflammatory bowel disease) • Some cancers, leukemias or lymphomas • Addison disease
Absolute basophil count, % basophils (Baso)	*Conventional Units* Percent (mean) 0.3% Absolute count (per microliter) 0-200 *SI Units* Mean number fraction 0.030	As with eosinophils, numbers are normally low in the blood; usually not medically significant	• Rare allergic reactions (hives, food allergy) • Inflammation (rheumatoid arthritis, ulcerative colitis) • Some leukemias • Uremia

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF A LOW COUNT
	Absolute count X 10^9 per liter 0-0.20	

RBC Evaluation

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF LOW RESULT	
Red Blood Cell Count (RBC)	*Conventional Units* Men: 4.5-5.9 x 10^6/microliter Women: 4.5-5.1 x 10^6 microliter *SI Units* Men: 4.5-5.9 x 10^{12}/L Women: 4.1-5.1 x 10^{12}/L	Known as anemia • Acute or chronic bleeding • RBC destruction (e.g., hemolytic anemia, etc.) • Nutritional deficiency (e.g., iron deficiency, vitamin B12 or folate deficiency) • Bone marrow disorders or damage • Chronic inflammatory disease • Chronic kidney disease	Known as polycythemia • Dehydration • Lung (pulmonary) disease • Kidney or other tumor that produces excess erythropoietin • Smoking • Living at high altitude • Genetic causes (altered oxygen sensing, abnormality in hemoglobin oxygen release) • Polycythemia vera—a rare disease
Hemoglobin (Hb)	*Conventional Units* Men: 14-17.5	Usually mirrors RBC results, provides added information	Usually mirrors RBC results

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF LOW RESULT	
	g/dL Women: 12.3-15.3 g/dL *SI Units* Men: 140-175 g/L Women: 123-153 g/L		
Hematocrit (Hct)	*Conventional Units* Men: 41.5-50.4% Women: 36.9-44.6% *SI Units* Men: 0.415-0.504 volume fraction Women: 0.369-0.446 volume fraction	Usually mirrors RBC results	Usually mirrors RBC results; most common cause is dehydration
RBC indices			
MCV	*Conventional*	Indicates RBCs are smaller than normal (microcytic); caused by iron deficiency	Indicates RBCs are larger than normal (macrocytic), for example in anemia

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF LOW RESULT	
	Units 80-96 micrometer^3 *SI Units* 80-96 fL	anemia or thalassemias, for example.	caused by vitamin B12 or folate deficiency, myelodysplasia, liver disease, hypothyroidism
MCH	*Conventional Units* 27.5-33.2 pg *SI Units* 27.5-33.2 pg	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	*Conventional Units* 33.4-35.5 g/dL *SI Units* 334-355 g/L	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 (Not always reported)	RBC Distribution Width	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),

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			causing an increase in the RDW.
Reticulocyte Count (Not always done)	*Conventional Units* 0.5-1.5% or 25-75 x 10^3/microliter *SI Units* 0.005-0.015 number fraction or 25-75 x 10^9/L	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).

Platelet Evaluation

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF LOW RESULT	
Platelet Count (Plt)	*Conventional Units* 150-450 x 10^3/microliter *SI Units* 150-450 x 10^9/L	Known as thrombocytopenia: • Viral infection (mononucleosis, measles, hepatitis) • Rocky mountain spotted fever • Platelet autoantibody • Drugs (acetaminophen, quinidine, sulfa drugs) • Cirrhosis • Autoimmune disorders • Sepsis • Leukemia, lymphoma • Myelodysplasia	Know as thrombocytosis: • Cancer (lung, gastrointestinal, breast, ovarian, lymphoma) • Rheumatoid arthritis, inflammatory bowel disease, lupus • Iron deficiency anemia • Hemolytic anemia • Myeloproliferative disorder (e.g., essential thrombocythemia)

TEST	REFERENCE RANGE[2]	EXAMPLES OF CAUSES OF LOW RESULT	
		• Chemo or radiation therapy	
MPV (Not always reported)	Mean Platelet Volume	Indicates average size of platelets is small; older platelets are generally smaller than younger ones and a low MPV may mean that a condition is affecting the production of platelets by the bone marrow.	Indicates a high number of larger, younger platelets in the blood; this may be due to the bone marrow producing and releasing platelets rapidly into circulation.
PDW (Not always reported)	Platelet Distribution Width	Indicates uniformity in size of platelets	Indicates increased variation in the size of the platelets, which may mean that a condition is present that is affecting platelets