

---

### **A complete blood count (CBC)**

A complete blood count may be done to: Why it is done :

1. Find the cause of symptoms such as fatigue, weakness, fever, bruising, or weight loss.
2. Check for anemia.
3. See how much blood has been lost if there is bleeding.
4. Diagnose polycythemia.
5. Check for an infection.
6. Diagnose diseases of the blood, such as leukemia.
7. Check how the body is dealing with some types of drug or radiation treatment.
8. Screen for high and low values before a surgery.
9. See if there are too many or too few of certain types of cells. This may help find other conditions, such as too many eosinophils may mean an allergy or asthma is present.
10. A blood count can give valuable information about the general state of your health.

Counting chambers to identify the numbers of different white cells, a blood film is made, and a large number of white blood cells (at least 100) are counted. This gives the percentage of cells that are of each type.

**manual counting** is useful in cases where automated analyzers cannot reliably count abnormal cells, such as those cells that are **not present in normal patients and are only seen in peripheral blood with certain haematological conditions**. Manual counting is **subject to sampling error because so few cells are counted compared with automated analysis**.

Medical technologists examine blood film via a microscope for some CBCs, not only to find abnormal white cells, **but also because**

1-variation in the shape of red cells is an important diagnostic tool.

2-Although automated analyzers give fast, reliable results regarding the number, average size, and variation in size of red blood cells, they do not detect cells' shapes.

3-some normal patients' platelets will clump in EDTA anticoagulated blood, which causes automatic analyses to give a falsely low platelet count. The person viewing the slide in these cases will see clumps of platelets and can estimate if there are low, normal, or high numbers of platelets.

### **A complete blood count will normally include:**

#### **White blood cells :**

White blood cells (or leukocytes) are divided into two main groups: **granulocytes and agranulocytes**. The granulocytes receive their name from the distinctive granules that are present in the cytoplasm of neutrophils, basophils, and eosinophils. The total count of circulating white blood cells is differentiated according to the five types of leukocytes, each of which performs a specific function. The differential count is expressed as a percentage of the total number of leukocytes (WBC).

The distribution (number and type) of cells and the degree of increase or decrease are diagnostically significant. The percentages indicate the relative number of each type of leukocyte in the blood. The absolute count of each type of leukocyte is obtained mathematically by multiplying its relative percentage by the total leukocyte count.

#### **Red blood cells:**

The main function of the red blood cell (RBC or erythrocyte) is to carry oxygen from the lungs to the body tissues and to transfer carbon dioxide from the tissues to the lungs. This process is achieved by means of the Hb in the RBCs, which combines easily with oxygen and carbon dioxide and gives arterial blood a bright red appearance. The RBC test, an important

measurement in the evaluation of anemia or polycythemia, determines the total number of erythrocytes in a microliter (cubic millimeter) of blood.

**Hemoglobin: Hb**

The main component of erythrocytes, serves as the vehicle for the transportation of oxygen and carbon dioxide. The oxygen-combining capacity of the blood is directly proportional to the Hb concentration rather than to the RBC because some RBCs contain more Hb than others.

The Hb determination is part of a CBC. It is used to screen for disease associated with anemia, to determine the severity of anemia, to monitor the response to treatment for anemia, and to evaluate polycythemia.

**Hematocrit :**

The Hct test is part of the CBC. This test indirectly measures the RBC mass. The results are expressed as the percentage by volume of packed RBCs in whole blood (PCV). It is an important measurement in the determination of anemia or polycythemia.

The hematocrit also known as packed cell volume (PCV) or erythrocyte volume fraction (EVF), is the volume percentage (%) of red blood cells in blood. It is normally about 45% for men and 40% for women.

**Red Blood Cell Indices:**

The red cell indices define the size and Hb content of the RBC and consist of the mean corpuscular volume (MCV), the mean corpuscular hemoglobin concentration (MCHC), and the mean corpuscular hemoglobin (MCH).

The RBC indices are used in differentiating anemia. When they are used together with an examination of the erythrocytes on the stained smear, a clear picture of RBC morphology may be ascertained.

On the basis of the RBC indices, the erythrocytes can be characterized as normal in every respect or as abnormal in volume or Hb content. In

deficient states, the anemia can be classified by cell size as macrocytic, normocytic, or microcytic, or by cell size and color as microcytic hypochromic.

### **Red Cell Size Distribution Width (RDW):**

This automated method of measurement is helpful in the investigation of some hematologic disorders and in monitoring response to therapy.

Type 1 (Absolute deficiency of insulin due to destruction of  $\beta$  cells of pancreas) – Immune mediated – Idiopathic

- Type 2 (Insulin resistance along with relative deficiency of insulin secretion)
- Other specific types • Gestational DM (onset or first recognition of glucose intolerance during pregnancy).

Normal RBCs have a slight degree of variation.

### **Stained Red Cell Examination (blood film).**

The stained film examination determines variations and abnormalities in erythrocyte size, shape, structure, Hb content, and staining properties. It is useful in diagnosing blood disorders such as anemia, thalassemia, and other hemoglobinopathies. This examination also serves as a guide to therapy and as an indicator of harmful effects of chemotherapy and radiation therapy. The leukocytes are also examined at this time.

### **Platelet Count**

Mean Platelet Volume (MPV): Platelets (thrombocytes) are the smallest of the formed elements in the blood. Platelet activity is necessary for blood clotting, vascular integrity and vasoconstriction, and the adhesion and aggregation activity that occurs during the formation of platelet plugs that occlude (plug) breaks in small vessels.

The platelet count is of value for assessing bleeding disorders that occur with thrombocytopenia, uremia, liver disease, or malignancies and for monitoring

the course of disease associated with bone marrow failure. It is also part of a coagulation profile or workup.

**The mean platelet volume (MPV)** is sometimes ordered in conjunction with a platelet count. The MPV indicates the uniformity of size of the platelet population. It is used for the differential diagnosis of thrombocytopenia.

### **Reticulocyte Count**

A Reticulocyte young, immature, nonnucleated RBC contains reticular material (RNA) that stains gray-blue. Reticulum is present in newly released blood cells for 1 to 2 days before the cell reaches its full mature state. Normally, a small number of these cells are found in circulating blood. The reticulocyte count is used to differentiate anemia caused by bone marrow failure from those caused by hemorrhage or hemolysis (destruction of RBCs), to check the effectiveness of treatment in pernicious anemia and folate and iron deficiency, to assess the recovery of bone marrow function in aplastic anemia, and to determine the effects of radioactive substances on exposed workers.