

Anemia

by Donald Beam, M.D.

One of the most common reasons for referral to a hematologist is due to anemia. While the diagnosis is frequently surprising, the cause is usually not. Ordinarily, the diagnosis can be suggested by examining the red blood cell (RBC) indices provided on the CBC.

Definition:

Anemia is defined by low hemoglobin, not hematocrit. Hemoglobin is a reflection of oxygen carrying capacity, while the hematocrit is more an index of RBC loss. To a surgeon, the hematocrit is a means of determining the blood loss from an event; whereas the hemoglobin is more important to the function of the blood, to carry oxygen.

- Mild anemia is hemoglobin 10-11.5 gm/dL
- Moderate anemia is hemoglobin above 7-10 gm/dL
- Severe anemia is hemoglobin less than 7 gm/dL

Anemia can be life threatening, but both the acuity and severity must be considered. Frequently, we see children with hemoglobins less than 4 gm/dL without obvious problems; these children will be both active and interactive, but they lack the reserve should they become sick or require sudden increases in cardiac output. Children with rapid drops in hemoglobin, due to blood loss or hemolysis, may be symptomatic with hemoglobin as high as 8 gm/dL.

MCV Index: When determining the reason for decreased hemoglobin, mean corpuscular volume (MCV) should draw first attention. The MCV is an average of RBC size and may reflect what is occurring in the bone marrow. As hemoglobin concentration is a “quality control” for the production of RBCs, defects in hemoglobin synthesis frequently cause decreases in MCV. If the body cannot make hemoglobin properly, the bone marrow produces smaller RBCs to get adequate hemoglobin concentration. Low MCV conditions include:

- Iron deficiency
- Thalassemia
- Lead toxicity
- Metabolic disorders including iron metabolism and mitochondrial deficits



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Defects in the production of cells, such as DNA synthesis problems (B₁₂ deficiency or folate deficiency) or bone marrow problems (aplastic anemia and myelodysplasia) cause macrocytosis. This can be confusing, as rapid production of RBCs cause cells to be released sooner than expected and these early RBCs are larger than typical mature RBCs.

RDW Index: Differentiating the causes of anemia can be difficult. Therefore, we turn to a third important measure of RBCs in the peripheral blood, the red cell distribution width (RDW). RDW is a statistical measure of the variation in size of the RBCs from the mean size of a RBC. In cases of stressed hematopoiesis, the RDW will be elevated. For example, in iron deficiency, the supply of iron is low, but does fluctuate with daily intake; RBCs of differing sizes are produced due to the availability of iron at the time of hemoglobin production, resulting in a high RDW.

In thalassemic diseases, the defective hemoglobin production is relatively constant and the RDW reflect this by being normal, as all cells produced are uniform in the normal state. Attempts to compensate for low hemoglobin result in increased production of RBCs and an elevated RBC count.

These three red cell measurements can be extremely helpful determining the cause for anemia. If questions remain, feel free to contact our center so we can be of further assistance.

BASIC LABORATORY EVALUATION FOR ANEMIA:

- **CBC**
- **Retic count**
- **Direct Coombs**
- **Peripheral smear**
- **Consider stool guaiac cards for occult blood**

Cook Children's Hematology and Oncology Center

901 Seventh Ave., Ste. 220
Fort Worth, TX 76104
682-885-4007

1600 W. Northwest Hwy., Ste. 500
Grapevine, TX 76051
817-310-0024

