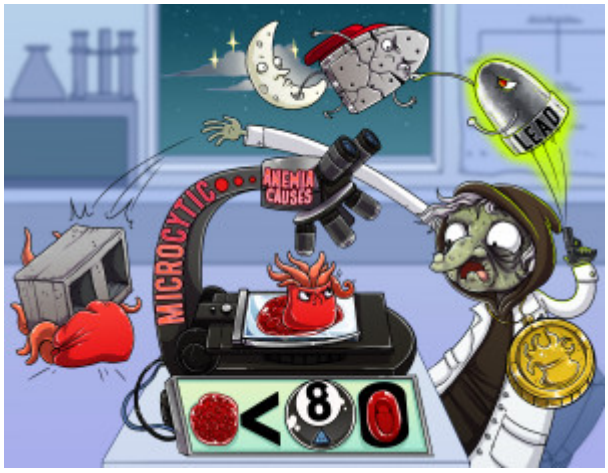
Microcytic Anemia Causes

Microcytic anemia is defined as an anemic state with a red blood cell MCV < 80 fL and is caused by a decrease in hemoglobin synthesis. Hemoglobin is composed of both heme, which contains iron and protoporphyrin, and globin chains, so anything that affects the synthesis of these precursors can cause a microcytic anemia. The most commonly tested causes of microcytic anemia include late-stage iron deficiency, anemia of chronic disease, thalassemias, lead poisoning, and sideroblastic anemia.



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MCV < 80

Red Blood Cells Less-than (80)

Mean corpuscular volume (MCV) is the average volume of a red blood cell. A mean corpuscular volume less than 80 fL (femtoliters) indicates a microcytic anemia.

Causes

Thalassemias

Talisman

Alpha-thalassemia and beta-thalassemia are autosomal recessive diseases that lead to the abnormal production of either the alpha or beta globin chains that are a key constituent of hemoglobin. In both of these types of thalassemias, lack of globin chains leads to insufficient hemoglobin production, and thus microcytic anemia.

Chronic Disease or Illness

Crone Diseased

The body’s response to a chronic disease state is to store iron outside of the blood with a protein called ferritin. Although the body may have iron stored away, it is unavailable for hemoglobin synthesis, leading to a normocytic anemia. Eventually, as iron stores deplete further, a microcytic anemia occurs. Although serum iron is low in these patients, total iron binding capacity is also low, because stored iron and ferritin levels are high.

Lead Toxicity

Lead-bullet with Toxic-green-glow

Lead inhibits two key enzymatic steps in the porphyrin synthesis pathway: aminolevulinic acid dehydratase and ferrochelatase. Without protoporphyrin, hemoglobin is not synthesized, leading to a microcytic anemia. In children, lead poisoning can cause developmental delay and cognitive disabilities. In adults, lead poisoning may lead to abdominal pain and GI symptoms, or long-term problems like hypertension and nephropathy.

Late Iron Deficiency

Late-moon Iron Broken

Iron deficiency usually occurs via inadequate dietary intake or through chronic blood loss. Sources of blood loss include parasites, GI bleeds, colon cancer, and menorrhagia. Because iron is a key component of heme, iron deficiency prevents the synthesis of hemoglobin. Early iron deficiency is normocytic, but as hemoglobin is depleted, the MCV decreases below 80 fL. In these patients, serum iron is low and total iron binding capacity is high.

Sideroblastic Anemia

Cinder-block Anemone

Sideroblastic anemia occurs with defects in the enzymes that regulate the porphyrin synthesis pathway, typically aminolevulinic acid synthase. In these patients, protoporphyrin cannot be created, so heme is not synthesized. Unused iron accumulates within mitochondria, which then make a ring around the RBC precursor nucleus, forming what are known as ringed sideroblasts. The most common cause of sideroblastic anemia is chronic alcoholism, but other causes include vitamin B6 deficiency, lead poisoning, and inherited enzymatic defects.

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