

An 8-month-old boy is brought to the physician for evaluation of pale mucous membranes, irritability, and listlessness. The stool examination is negative for blood, ova, and parasites. Serum laboratory studies are as follows:

Hemoglobin	6 g/L
Mean corpuscular hemoglobin concentration	25%
Mean corpuscular hemoglobin	16.5 pg
Mean corpuscular volume	68 fl
Red cell distribution width	22% (normal: 11.5-14.5%)
Reticulocytes	0.6%
Platelets	230,000/ $\mu$ L
Leukocytes	5,500/ $\mu$ L
Iron	40 $\mu$ g/dL
Total iron binding capacity	460 $\mu$ g/dL (normal: 300-350 $\mu$ g/dL)
Transferrin saturation	8.7% (normal 15-50 %)
Total bilirubin	0.9 mg/dL

The peripheral blood smear shows marked anisocytosis, microcytosis, and hypochromia. Which of the following is the most likely cause of this patient's anemia?

- ☐ A. Alpha thalassemia
- ☐ B. Anemia of chronic disease
- ☐ C. Autoimmune hemolysis
- ☐ D. Beta thalassemia
- ☐ E. Folate deficiency
- ☐ F. Iron deficiency
- ☐ G. Sideroblastic anemia
- ☐ H. Vitamin B<sub>12</sub> deficiency



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The peripheral blood smear shows marked anisocytosis, microcytosis, and hypochromia. Which of the following is the most likely cause of this patient's anemia?

- ☐ A. Alpha thalassemia [3%]
- ☐ B. Anemia of chronic disease [1%]
- ☐ C. Autoimmune hemolysis [1%]
- ☐ D. Beta thalassemia [6%]
- ☐ E. Folate deficiency [0%]
- ☒ F. Iron deficiency [86%]
- ☐ G. Sideroblastic anemia [3%]
- ☐ H. Vitamin B<sub>12</sub> deficiency [0%]



Explanation:

User Id: [REDACTED]

Iron studies in microcytic anemia					
Cause	MCV	Iron	TIBC	Ferritin	Transferrin saturation (Iron/TIBC)
Iron deficiency	↓	↓	↑	↓	↓
Thalassemia	↓↓	↑	↓	↑	↑↑
Anemia of chronic disease (inflammation)	Normal/↓	↓	↓	Normal/↑	Normal/↓

MCV = mean corpuscular volume; TIBC = total iron binding capacity.

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This patient's history and laboratory results are most likely due to **iron deficiency**, the most common nutritional deficiency in infants. Iron deficiency is typically due to the introduction of cow, goat, or soy milk before age 1 and inadequate consumption of iron-rich foods. In older children and adults, the cause is usually chronic blood loss from the gastrointestinal tract.

The characteristic laboratory findings of iron deficiency anemia are shown in the table. Anisocytosis (red blood cells of unequal size) is often the first finding on peripheral smear, and the **increased red blood cell distribution width (RDW)** is a quantification of this abnormality. Gradually, the **mean corpuscular volume (MCV)** and **mean corpuscular hemoglobin (MCH)** decline, correlating with **microcytosis** and **hypochromia** on peripheral smear. The iron stores become depleted, resulting in a low reticulocyte count, decreased transferrin saturation (serum iron/total iron binding capacity [TIBC]), and increased TIBC.

**(Choices A and D)** Thalassemia is associated with normal or elevated iron and ferritin levels due to high red blood cell turnover. Reticulocyte count and total bilirubin are increased as a result of hemolysis.

**(Choice B)** Anemia of chronic disease is associated with decreased TIBC. Serum ferritin is often increased due to ongoing inflammation.



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**(Choices A and D)** Thalassemia is associated with normal or elevated iron and ferritin levels due to high red blood cell turnover. Reticulocyte count and total bilirubin are increased as a result of hemolysis.

**(Choice B)** Anemia of chronic disease is associated with decreased TIBC. Serum ferritin is often increased due to ongoing inflammation.

**(Choice C)** Autoimmune hemolysis typically causes an increased reticulocyte count due to the bone marrow response in an attempt to compensate for red blood cell destruction. The breakdown of red blood cells also causes indirect hyperbilirubinemia, which is not seen in this patient.

**(Choices E and H)** Folate and vitamin B<sub>12</sub> deficiency cause megaloblastic anemia, which is characterized by an elevated MCV, elevated MCH, and normal mean corpuscular hemoglobin concentration.

**(Choice G)** Sideroblastic anemia is characterized by increased serum iron levels and normal TIBC.

#### Educational objective:

The characteristic laboratory findings of iron deficiency anemia are decreased mean corpuscular volume (MCV), increased red blood cell distribution width (RDW), decreased serum iron, decreased transferrin saturation, and increased total iron binding capacity (TIBC). The peripheral smear will show small, hypochromic red blood cells.

#### References:

1. [Evaluation of anemia in children.](#)
2. [Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children \(0-3 years of age\).](#)