

A 2-year-old boy is brought to the pediatrician for a routine well-child visit. He has no chronic medical conditions and is growing and developing appropriately. He is starting to put words together into short sentences. His mother says that he eats less than his older sister did at this age but has a varied diet. The boy drinks approximately 30 ounces (900 mL) of whole milk each day. His mother has no concerns at this visit. Physical examination is notable for mild pallor. Laboratory results are as follows:

Complete blood count

Hemoglobin	9.6 g/dL
Hematocrit	29%
Mean corpuscular volume	70 fL
Platelets	260,000/ μ L
Leukocytes	8,200/ μ L

Which of the following additional findings is most likely to be present in this patient?

- ☐ A. Abnormal hemoglobin electrophoresis
- ☐ B. Circulating nucleated red blood cells
- ☐ C. Elevated mean corpuscular hemoglobin concentration
- ☐ D. Elevated red cell distribution width
- ☐ E. High indirect bilirubin
- ☐ F. Low serum total iron-binding capacity
- ☐

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Which of the following additional findings is most likely to be present in this patient?

- ☐ A. Abnormal hemoglobin electrophoresis [6%]
- ☐ B. Circulating nucleated red blood cells [7%]
- ☐ C. Elevated mean corpuscular hemoglobin concentration [5%]
- ☒ D. Elevated red cell distribution width [70%]
- ☐ E. High indirect bilirubin [2%]
- ☐ F. Low serum total iron-binding capacity [10%]

Proceed to Next Item

Explanation:

User Id: [REDACTED]

Parameter	Iron deficiency anemia	α -thalassemia minor	β -thalassemia minor
MCV	↓	↓	↓

Explanation:

User Id:

Parameter	Iron deficiency anemia	α -thalassemia minor	β -thalassemia minor
MCV	↓	↓	↓
RDW	↑	Normal	Normal
RBCs	↓	Normal	Normal
Peripheral smear	Microcytosis, hypochromia	Target cells	Target cells
Serum iron studies	↓ Iron & ferritin ↑ TIBC	Normal/ ↑ iron & ferritin (RBC turnover)	Normal/ ↑ iron & ferritin (RBC turnover)
Response to iron supplementation	↑ Hemoglobin	No improvement	No improvement
Hemoglobin electrophoresis	Normal	Normal	↑ Hemoglobin A2

MCV = mean corpuscular volume; RBC = red blood cell; RDW = red cell distribution width; TIBC = total iron-binding capacity.

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The most common causes of microcytic anemia in children are iron deficiency and thalassemia. Iron deficiency, the most common nutritional deficiency in children, is often caused by **excessive consumption of cow's milk (>24 ounces [700 mL] per day)**. The anemia is secondary to the low iron content of milk, the poor bioavailability of iron from milk, and increased intestinal blood loss from cow's milk protein-induced colitis.

Although historical features may be helpful in distinguishing iron deficiency from thalassemia, additional laboratory studies beyond hemoglobin and mean corpuscular volume may be used to confirm the diagnosis. Red cell distribution width (RDW), a measure of how variable the red blood cells are in size, is one of the most useful studies to distinguish between the types of anemia. It is the earliest laboratory finding in iron deficiency anemia. Elevated RDW commonly occurs in nutritional deficiencies as nutrient

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(Choice A) Beta thalassemia minor and major are forms of microcytic anemia associated with an abnormal hemoglobin electrophoresis. Given this patient's dietary history, iron deficiency is more likely.

(Choice B) **Nucleated red blood cells** are immature red blood cells typically found only in the bone marrow and not in the peripheral bloodstreams of healthy patients. The presence of nucleated red blood cells in the peripheral bloodstream is indicative of significant bone marrow stress and is seen in conditions such as severe hemolysis or myelofibrosis.

(Choice C) Mean corpuscular hemoglobin concentration is a value calculated by dividing the hemoglobin by the hematocrit and is a measure of the hemoglobin concentration of each erythrocyte. It is decreased in conditions such as iron deficiency and thalassemia and elevated in patients with hereditary spherocytosis secondary to loss of red blood cell surface area.

(Choice E) Increased indirect bilirubin levels are seen in the hemolytic anemias; patients with iron deficiency anemia have normal bilirubin levels.

(Choice F) Total iron-binding capacity (TIBC) is a direct measure of the amount of iron that can be bound by transferrin and is an indirect measure of transferrin levels. In iron deficiency anemia, transferrin production is upregulated and serum iron is low, resulting in increased rather than decreased TIBC.

Educational objective:

Iron deficiency, the most common nutritional deficiency in children, is often caused by excessive intake of cow's milk (>24 ounces [700 mL] per day) and results in a microcytic

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Educational objective:

Iron deficiency, the most common nutritional deficiency in children, is often caused by excessive intake of cow's milk (>24 ounces [700 mL] per day) and results in a microcytic anemia. Iron deficiency anemia can be differentiated from thalassemia by an elevated red cell distribution width, which is typically >20% in iron deficiency.

References:

1. **Use of diet history in the screening of iron deficiency.**
2. **Prevention of iron deficiency in infants and toddlers.**

Media Exhibit

emia

