

A 1-year-old boy is brought in for a routine visit. The patient has been growing and developing normally. He can say "mama," "dada," "go," and "ball." The boy drinks 10 ounces of whole milk and eats fruits and meats daily. He is "picky" about vegetables. Past medical history is unremarkable. He takes no medications or vitamins. Vital signs and physical examination are normal. Laboratory results are as follows:

Hematocrit	31%
Red blood cells	5 million/mm ³
Mean corpuscular volume	64 fL
Red cell distribution width	13% (normal 11.5%-14.5%)
Reticulocytes	3%
Platelets	240,000/mm ³
Leukocytes	7,500/mm ³

Which of the following is the most likely cause of this child's anemia?

- ☐ A. Abnormal utilization of iron
- ☐ B. Cobalamin deficiency
- ☐ C. Iron deficiency
- ☐ D. Red blood cell membrane instability
- ☐ E. Reduced production of globin chains

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Which of the following is the most likely cause of this child's anemia?

- ☐ A. Abnormal utilization of iron [6%]
- ☐ B. Cobalamin deficiency [2%]
- ☐ C. Iron deficiency [54%]
- ☐ D. Red blood cell membrane instability [5%]
- ☒ E. Reduced production of globin chains [33%]

Proceed to Next Item

Explanation:

User Id: [REDACTED]

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

Explanation:

User Id: [REDACTED]

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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Thalassemia occurs when there is absent or reduced production of ≥ 1 of the alpha- or beta-globin chains of hemoglobin. Clinical manifestations range from minor to severe depending on the number of globin chains affected. Alpha- and β -thalassemia minor (also known as thalassemia trait) are often asymptomatic and found incidentally on laboratory testing (eg, universal screening for anemia around age 1 year). These patients rarely require treatment, but the diagnosis is important for genetic counseling of future childbearing.

Both types of thalassemia minor are characterized by abnormally small red blood cells (RBCs) (as reflected by **low mean corpuscular volume [MCV]**). The red cell distribution width (RDW) is normal, and total RBC count is normal or elevated. This typically results in a **Mentzer index (MCV/RBC) <13**. The hematocrit is usually >30% in

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It is important to exclude iron deficiency in patients with thalassemia, as unnecessary iron therapy can lead to **hemochromatosis**. Increased RBC turnover in thalassemia minor may result in slightly increased serum iron and ferritin levels and reticulocyte count, although overt hemolysis is not typical.

(Choice A) Abnormal utilization of iron occurs in anemia of chronic disease from ongoing inflammation. RBCs can be normocytic or microcytic; laboratory studies show low serum iron and total iron binding capacity levels. Anemia of chronic disease is unlikely in this child, who has no medical problems.

(Choice B) Cobalamin, or vitamin B12, deficiency presents as a **macrocytic anemia** (MCV > 100 fL) and occurs in individuals with pernicious anemia or short-bowel syndrome or in those on a vegan diet.

(Choice C) Iron deficiency anemia is the most common cause of anemia in children and is often caused by excessive intake of cow's milk (> 24 ounces [700 mL] daily). It may present with pallor, pica, and fatigue. Distinguishing laboratory findings include a low MCV, an increased RDW, and a Mentzer index > 13 (due to a decline in the total RBC count). Significant microcytosis generally occurs only when the anemia becomes severe with a hematocrit $< 30\%$.

(Choice D) Hereditary spherocytosis, which is an autosomal dominant condition in 75% of cases, is caused by RBC membrane instability and typically presents with jaundice and anemia. Laboratory studies demonstrate reticulocytosis, an elevated mean corpuscular hemoglobin concentration, a normal or slightly low MCV, and **spherocytosis** on peripheral smear.

Educational objective:

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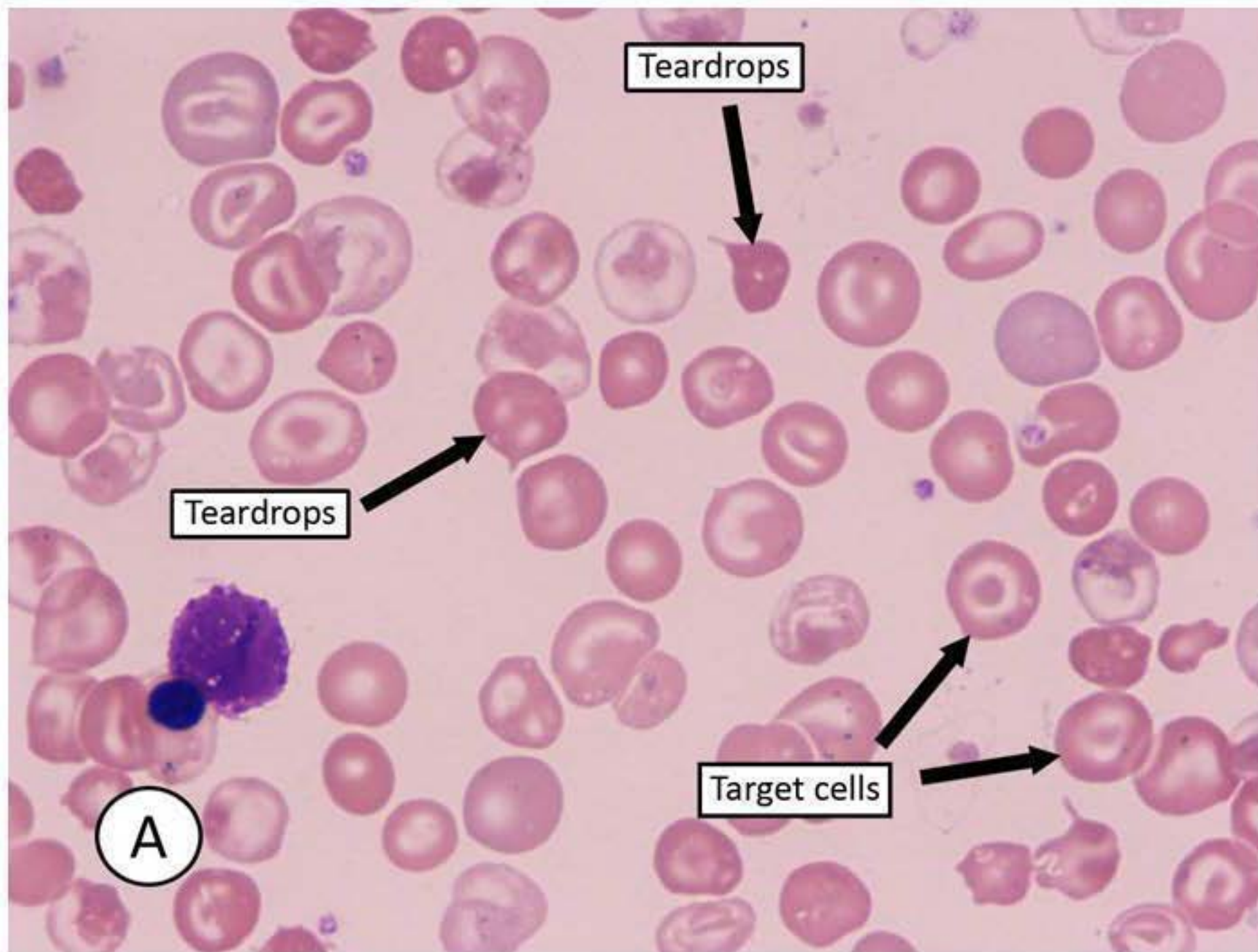
Thalassemia trait, also known as thalassemia minor, presents with microcytic anemia with target cells and teardrop cells on peripheral smear. The red cell distribution width and total red blood cell count are typically normal. Treatment is not usually needed.

References:

1. **Thalassaemia.**

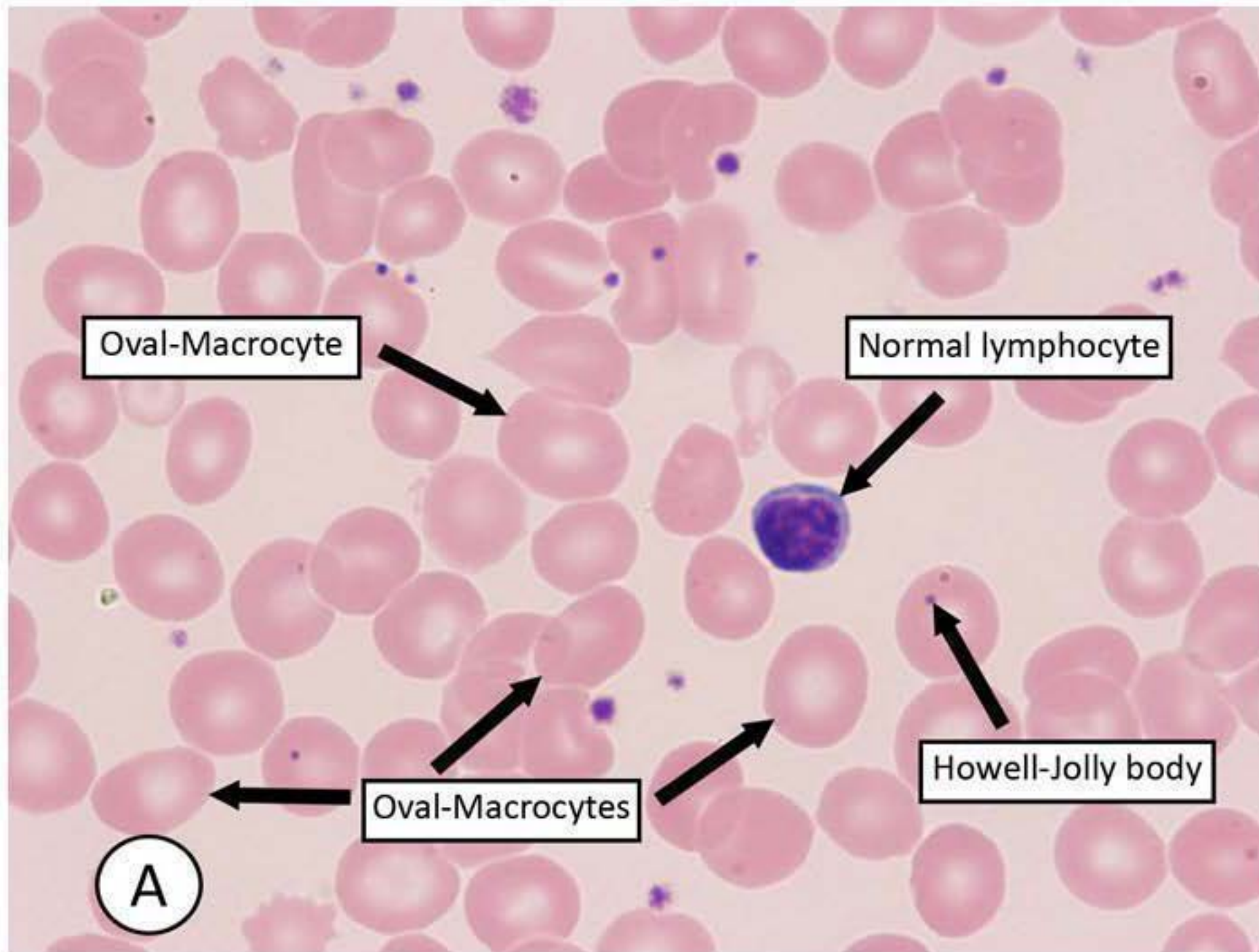
Media Exhibit

Thalassemia



Media Exhibit

plastic anemia: Macrocytic anemia



Media Exhibit

ary spherocytosis

