Pediatrics - Topic 26 - Anemia and other Hemato-oncologic disorders in children

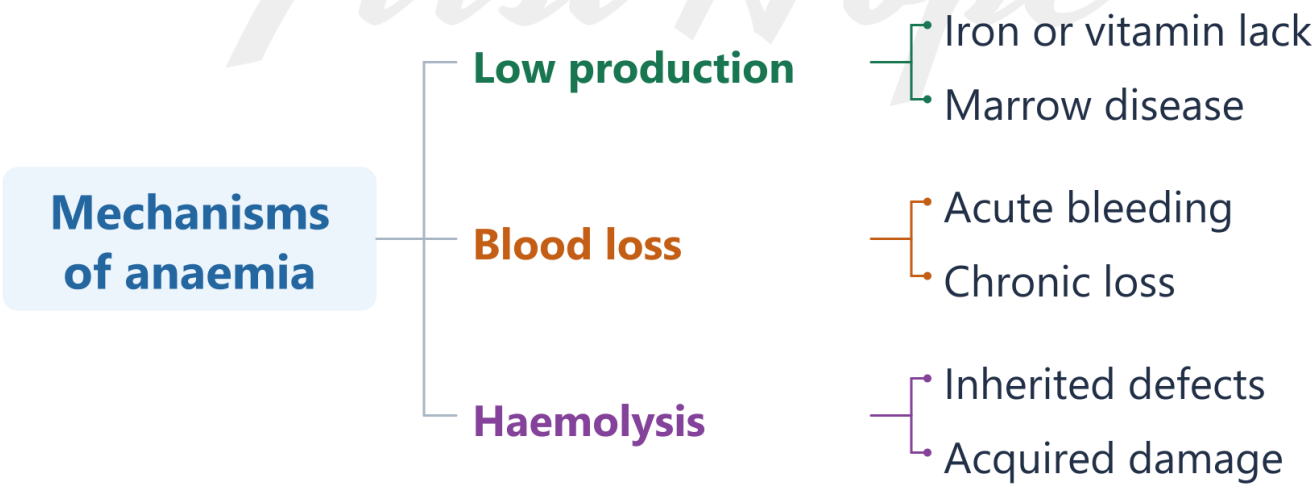
Approach to a Child with Anaemia

- Anaemia means that the haemoglobin concentration is below the appropriate threshold for the child's age and physiological context.

Age-appropriate Definition and Interpretation

- Interpret the result with the measurement method, altitude, clinical condition and the reference standard being used.
- A low haemoglobin value identifies a problem but does not establish its cause.

Age group	WHO haemoglobin threshold for anaemia
6–23 months	Below 10.5 g/dL.
24–59 months	Below 11.0 g/dL.
5–11 years	Below 11.5 g/dL.
12–14 years	Below 12.0 g/dL for boys and nonpregnant girls.



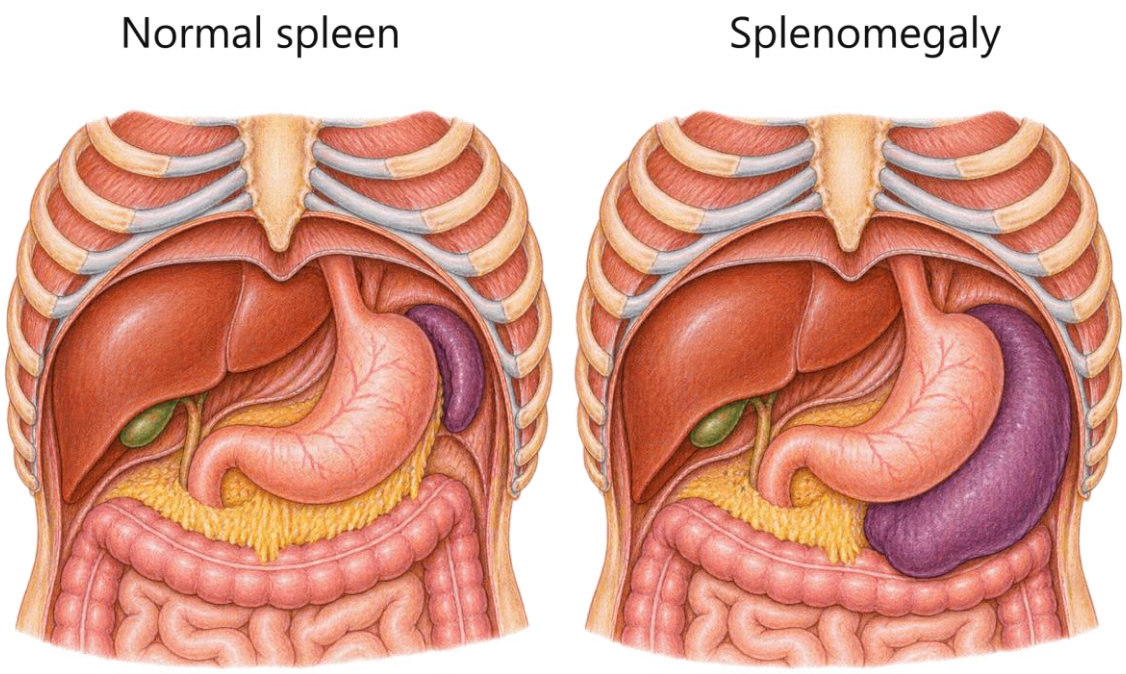
Mechanisms, Cell Size and Reticulocyte Response

- Anaemia can result from reduced red-cell production, excessive destruction or blood loss, and more than one mechanism may coexist.
- The mean corpuscular volume groups red cells as microcytic, normocytic or macrocytic using age-specific ranges.
- The reticulocyte response helps distinguish inadequate production from an appropriate marrow response to haemolysis or blood loss.

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- A low reticulocyte count in a severely anaemic child is an important clue to impaired production.

History and Examination



The spleen lies in the left upper abdomen and may enlarge downwards and medially

- Ask about diet, milk intake, pica, growth, fatigue, breathlessness, jaundice, dark urine, bleeding and previous transfusions.
- Review maternal health, prematurity, medicines, infections, chronic disease, family history and possible inherited blood disorders.
- Ask adolescents sensitively about menstrual blood loss and nutrition.
- Assess pallor, pulse, respiratory effort, cardiac signs, jaundice, bruising, lymph nodes, growth and liver or spleen enlargement.

Urgent Severity and Initial Investigations

- Severe pallor with respiratory distress, shock, heart failure, altered consciousness or active bleeding requires urgent treatment and referral.
- Initial tests usually include a complete blood count, red-cell indices, reticulocyte count and peripheral smear, with further tests guided by the pattern.
- Ferritin, inflammatory markers, bilirubin, renal function, vitamin levels and haemoglobin analysis may be useful in selected children.
- Do not assume that all anaemia in a child is caused by iron deficiency.

Iron Deficiency Anaemia

- Iron deficiency develops when available iron cannot meet the needs of haemoglobin production and growth.

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Iron Requirements and Causes of Deficiency

- Common contributors are low iron intake, prematurity, rapid growth, excessive milk intake, poor complementary feeding and chronic blood loss.
- Consider intestinal disease, parasites or heavy menstrual bleeding when the history suggests ongoing loss or impaired absorption.

Clinical and Laboratory Findings

- Children may have pallor, reduced activity, irritability, poor concentration, pica or impaired growth.
- The blood count commonly shows microcytosis and hypochromia, often with a raised red-cell distribution width.
- A low ferritin supports depleted stores, but inflammation can raise ferritin and conceal coexisting iron deficiency.
- Serum iron varies with recent intake and illness and should not be used alone to diagnose deficiency.

Treatment and Prevention

Oral Iron and Caregiver Advice

- Treat the cause, improve dietary iron and prescribe a preparation using its elemental iron content rather than its total salt weight.
- A usual therapeutic oral dose is 3–6 mg/kg/day of elemental iron, adjusted for severity and the local protocol.
- For example, 3 mg/kg/day gives 36 mg of elemental iron daily for a 12 kg child.
- Explain possible dark stools, constipation or tooth staining and demonstrate accurate measurement of the prescribed liquid.
- Give iron away from large milk feeds when practical, and include vitamin-C-containing foods to support absorption.

Response and Escalation

- Review adherence and the haemoglobin response, with earlier assessment in severe anaemia.
- Continue treatment for at least three months after haemoglobin correction to replenish stores, then reassess haemoglobin and ferritin as appropriate.
- Failure to improve requires review of the diagnosis, dose, adherence, continuing loss, malabsorption or another coexisting disease.
- IV iron is reserved for selected indications such as inability to use oral treatment or persistent deficiency despite an adequate supervised course.
- Transfusion is not routine treatment for a stable child with iron deficiency and requires careful clinical justification when severe compromise is present.

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Dietary Prevention

- Promote iron-rich complementary foods, fortified foods where appropriate and treatment of relevant infection or blood loss.
- Avoid cow's milk as the main drink before twelve months, and avoid excessive milk intake afterwards.

Vitamin B12 and Folate Deficiency

- Vitamin B12 and folate are needed for normal DNA synthesis, so deficiency impairs rapidly dividing marrow cells.

Mechanism and Blood-film Findings

- The result may be macrocytic megaloblastic anaemia, sometimes with neutropenia or thrombocytopenia.
- Macro-ovalocytes and hypersegmented neutrophils are important blood-film clues.
- Coexisting iron deficiency can conceal macrocytosis, so a normal MCV does not exclude vitamin B12 deficiency.

Risk Factors, Neurological Features and Confirmation

- A breastfed infant may become deficient when maternal vitamin B12 stores are low.
- Restricted diets, malabsorption, increased demand and selected medicines can contribute to either deficiency.
- B12 deficiency may cause developmental regression, hypotonia, unusual movements, neuropathy or poor feeding, sometimes before severe anaemia appears.
- Measure appropriate vitamin levels and consider methylmalonic acid or homocysteine when the result and clinical picture need clarification.

Management and Follow-up

Vitamin B12 Replacement

- Begin urgent specialist-guided B12 replacement in a symptomatic infant or a child with neurological involvement.
- Intramuscular replacement is commonly used in these higher-risk situations, while oral treatment may suit selected older children without malabsorption or neurological signs.
- A specialist paediatric regimen for an infant with clinical deficiency begins with 1,000 micrograms of intramuscular B12 daily for three doses, followed by reassessment and an individualized continuation plan.
- Screen and treat maternal deficiency when relevant, and arrange developmental follow-up for an affected infant.

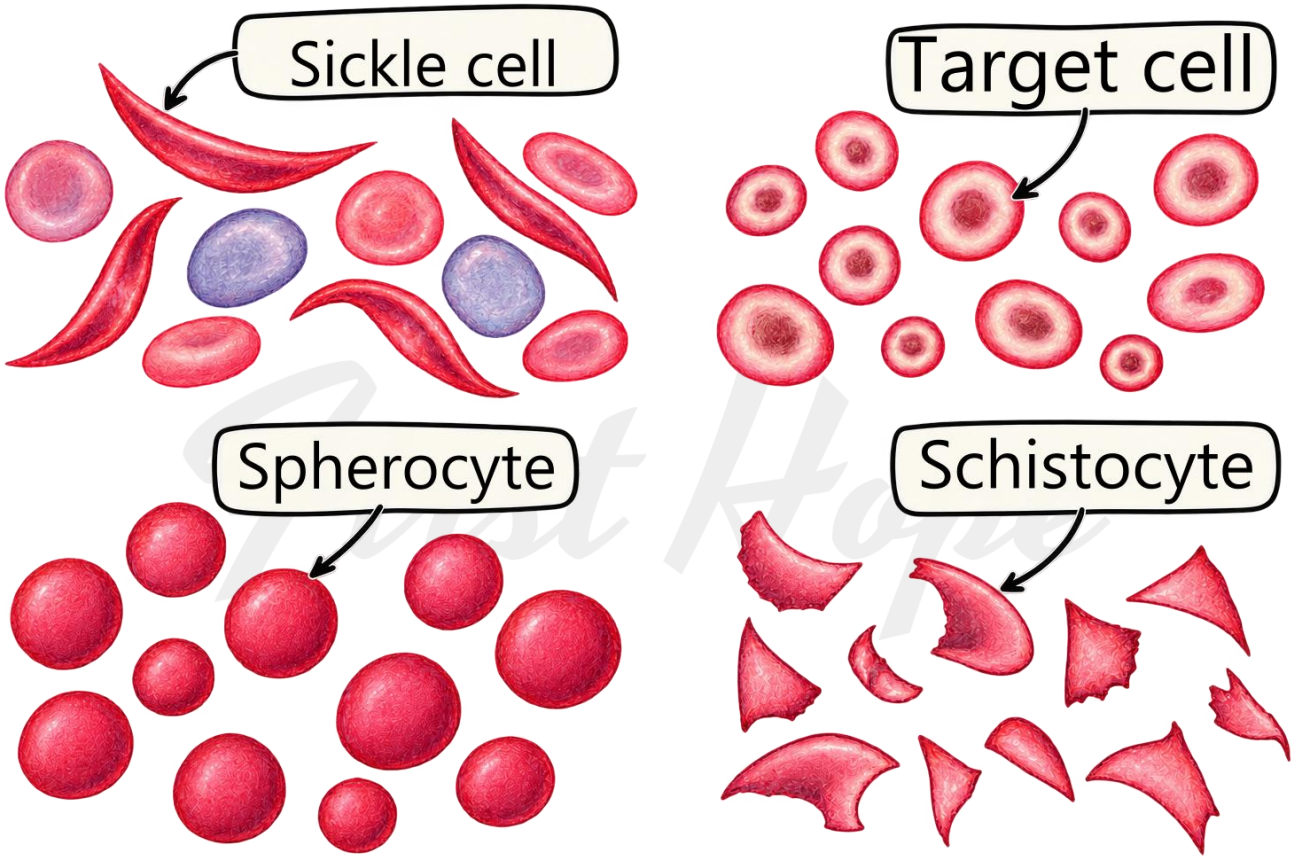
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Folate Replacement and Cause Correction

- Treat folate deficiency after B12 deficiency has been excluded or treated because folate alone may improve the blood count while neurological injury continues.
- Correct the dietary or absorptive cause and follow the blood count and clinical recovery rather than stopping at a single normal vitamin result.

Haemolytic Anaemia

- Haemolysis shortens red-cell survival and may occur within blood vessels or through removal by the spleen and liver.



Sickle cells, target cells, spherocytes and schistocytes provide different diagnostic clues on a blood film

Mechanism and Cause Groups

- Inherited causes include haemoglobin disorders, membrane defects and enzyme deficiencies, while acquired causes include immune destruction, infection and microangiopathy.

Clinical and Laboratory Findings

- Pallor, jaundice, splenomegaly, dark urine and pigment gallstones can occur, depending on the cause and duration.
- The usual laboratory pattern includes reticulocytosis, raised unconjugated bilirubin and LDH, with reduced haptoglobin in many cases.
- An unexpectedly low reticulocyte count may indicate marrow suppression, a nutrient deficiency or an aplastic crisis.

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