

Haematological system

Anaemia

Introduction / Epidemiology

- Anaemia is defined as a decrease in the total amount of red blood cells (RBCs) or haemoglobin in the blood, leading to a reduced oxygen-carrying capacity. According to the World Health Organization (WHO), anaemia is defined as:
 - Haemoglobin <13 g/dL in men
 - Haemoglobin <12 g/dL in non-pregnant women
 - Haemoglobin <11 g/dL in pregnant women

Epidemiology:

- Anaemia affects about 25% of the global population.
- It is particularly prevalent in:
 - Women of reproductive age (due to menstruation and pregnancy)
 - Children under 5 years (due to nutritional deficiencies)
 - Elderly (due to chronic diseases or nutritional issues)
 - Low-income countries (due to malnutrition and infections)
- Iron deficiency anaemia (IDA) is the most common type, accounting for approximately 50% of all cases.

Etiopathogenesis (Causes and Pathophysiology)

Anaemia is broadly classified based on:

1. Mechanism:

1. Decreased RBC production
2. Increased RBC destruction (haemolysis)
3. Blood loss

2. Red cell indices (MCV):

- Microcytic (MCV <80 fL): Iron deficiency, thalassaemia
- Normocytic (MCV 80–100 fL): Anaemia of chronic disease, acute blood loss
- Macrocytic (MCV >100 fL): Vitamin B12 or folate deficiency

Common causes:

- **Iron deficiency anaemia:** Poor intake, blood loss (e.g., gastrointestinal bleeding, menstruation), malabsorption (e.g., celiac disease)

- **Megaloblastic anaemia:** Vitamin B12 or folate deficiency, due to poor intake or malabsorption (e.g., pernicious anaemia)
- **Anaemia of chronic disease:** Chronic infections (TB, HIV), autoimmune diseases (RA), CKD
- **Haemolytic anaemia:** Autoimmune haemolytic anaemia, hereditary spherocytosis, sickle cell anaemia
- **Aplastic anaemia:** Bone marrow failure due to toxins, radiation, drugs (e.g., chloramphenicol)

Pathophysiology:

- ↓ RBCs → ↓ oxygen delivery to tissues → compensatory mechanisms (e.g., ↑ cardiac output, ↑ 2,3-BPG, shunting of blood) → symptoms like fatigue and dyspnoea.

Clinical Features / Symptoms

General symptoms (due to hypoxia):

- Fatigue
- Weakness
- Dyspnoea on exertion
- Palpitations
- Dizziness or light-headedness
- Headache

Signs:

- Pallor (especially conjunctival, palmar)
- Tachycardia
- Systolic flow murmur
- Postural hypotension (if acute blood loss)

Specific features depending on type:

1. Iron deficiency anaemia:

- Pica (craving for non-food items like clay)
- Koilonychia (spoon-shaped nails)
- Glossitis, angular stomatitis

2. Vitamin B12 deficiency:

- Neurological signs: paresthesia, ataxia, memory impairment

3. Haemolytic anaemia:

- Jaundice

- Dark urine
- Splenomegaly

Diagnosis & Investigations

1. Basic blood tests:

CBC (Complete Blood Count):

- Haemoglobin
- MCV (microcytic, normocytic, macrocytic)
- MCH, MCHC
- Reticulocyte count

2. Peripheral blood smear:

- Microcytic, hypochromic: Iron deficiency
- Macrocytic with hypersegmented neutrophils: B12/folate deficiency
- Spherocytes, schistocytes: Haemolysis

3. Iron studies:

- Serum iron: ↓ in IDA
- Ferritin: ↓ in IDA (acute phase reactant, can be ↑ in inflammation)
- TIBC (Total Iron Binding Capacity): ↑ in IDA
- Transferrin saturation: ↓

4. Vitamin B12 and folate levels:

- ↓ in respective deficiencies

5. Other tests:

- LDH, haptoglobin, bilirubin: For haemolysis
- Coombs test: Autoimmune haemolytic anaemia
- Bone marrow biopsy: For aplastic anaemia or unexplained cases
- Stool occult blood test, endoscopy: To detect chronic GI bleeding

Treatment Goals / Therapeutic Objectives

- Identify and treat the underlying cause of anaemia
- Correct haemoglobin levels and restore oxygen-carrying capacity
- Alleviate symptoms
- Prevent complications (cardiac failure, cognitive decline, etc.)
- Prevent recurrence

Non-Pharmacological Therapy

1. Dietary changes:

- Iron-rich foods: red meat, spinach, legumes, fortified cereals
- Vitamin C-rich foods: enhance iron absorption
- B12: meat, dairy (for vegetarians, supplements may be necessary)
- Folate: green leafy vegetables, beans

2. Management of bleeding:

- Menorrhagia: consider hormonal therapy
- GI bleeding: endoscopic management, surgery if needed
- **Avoidance of causative drugs:** if drug-induced anaemia is suspected

Pharmacological Therapy

Iron Deficiency Anaemia

First-line: Oral iron therapy

- **Drug:** Ferrous sulfate
- **Dose:** 100–200 mg elemental iron/day (usually 325 mg tablet TID)
- **Duration:** 3–6 months (until Hb normalizes + 3 months to replenish stores)
- **Mechanism:** Provides iron for haemoglobin synthesis
- **Rationale:** Oral route preferred due to efficacy, safety, and cost

Alternative: Intravenous iron

- Indications:
 - Intolerance to oral iron
 - Malabsorption (e.g., IBD, post-gastrectomy)
 - Need for rapid correction (e.g., pre-op, CKD)
- **Preparations:** Iron sucrose, ferric carboxymaltose
- **Monitoring:** Risk of hypersensitivity

Megaloblastic Anaemia

Vitamin B12 deficiency:

- **Cyanocobalamin IM:** 1000 mcg/day for 1 week → weekly for 1 month → monthly
- **Oral B12:** For non-neurological cases or maintenance
- **Mechanism:** Coenzyme for DNA synthesis

Folate deficiency:

- **Folic acid 1–5 mg/day PO** for 4 months or more
- **Note:** Always rule out B12 deficiency before giving folate (folate can worsen neuro symptoms in B12 deficiency)

Anaemia of Chronic Disease

- Treat underlying disease (e.g., infection, autoimmune)
- **Erythropoiesis-stimulating agents (ESAs):** e.g., Epoetin alfa in CKD
- **Iron supplementation:** Often IV
- Monitor haemoglobin response and iron status

Haemolytic Anaemia

- **Autoimmune:** Steroids (prednisone), immunosuppressants, splenectomy
- **Inherited:** Supportive care, folic acid, transfusions, bone marrow transplant in some cases

Individualized Patient-Specific Therapeutic Plan

- **Age:** Elderly may have multiple causes, poor oral absorption
- **Comorbidities:**
 - CKD: Use ESAs + IV iron
 - Malignancy: Avoid ESAs unless symptomatic
- **Pregnancy:** Increased iron & folate requirements; avoid certain parenteral preparations
- **Renal/hepatic function:** Adjust iron dose; monitor for toxicity
- **Allergies:** Avoid specific iron salts; use alternatives
- **Dietary habits (e.g., vegetarian):** May predispose to B12 deficiency

Controversies / Special Considerations

- **Oral vs IV iron:** Some argue IV is superior in certain chronic diseases (e.g., CKD), but cost and safety must be weighed
- **ESAs in cancer patients:** Risk of thrombosis vs benefit
- **Transfusions:** Thresholds debated; generally avoid unless Hb <7–8 g/dL or symptomatic
- **Latest Guidelines:**
 - WHO 2020 Anaemia recommendations
 - KDIGO 2021 (for CKD-related anaemia)
 - NICE, AABB guidelines on transfusion thresholds

Monitoring Therapy

1. Clinical:

- Resolution of symptoms (fatigue, dyspnoea)



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