East African Regional External Quality Assessment Scheme (EA-REQAS)

Learning Sheet Number Three

IRON DEFICIENCY ANAEMIA

DEFINITION OF ANAEMIA

Anaemia occurs when the amount of red pigment (haemoglobin) in the blood falls below the normal level for the age and sex of the individual. Defined lower limits of haemoglobin levels (WHO) are:

Infants, full term	13.0 g/dl
Children, 6 months – <6 years:	11.0 g/dl
Children, 6 – 14 years	12.0 g/dl
Adult males	13.0 g/dl
Adult females, non-pregnant	12.0 g/dl
Adult females, pregnant	11.0 g/dl

IMPORTANCE OF IRON DEFICIENCY

Iron deficiency anaemia is the most common type of anaemia in developing countries, and is the most common cause of a hypochromic, microcytic blood picture. It is estimated that about 20% of the world's population has iron deficiency. Iron deficiency has been shown to lead to altered mental and motor development in children, which may be irreversible despite iron therapy. Infants of anaemic mothers may show significantly delayed development.

Iron requirements

An average "western-type" diet contains about 10 – 20 mg iron, but only 10% of dietary iron is absorbed (1 – 2 mg per day). Iron absorption increases in iron deficiency, but rarely to > 6 mg/day unless supplemental iron is added. Iron absorption takes place mainly in the duodenum. Ferrous iron compounds are better absorbed than ferric compounds; haem iron (in food substances, such as meat) is better absorbed than iron from other sources. Certain food substances inhibit iron absorption such as vegetable phytates, tea tannins, bran; ascorbic acid (vitamin C) enhances iron absorption.

Iron is stored is stored in the liver, bone marrow and spleen. 60 – 70% if iron is found in the red cell pool. In healthy individuals, iron stores are about 3.5 g in men and 2.5 g in women. The body conserves iron very effectively and 97% of iron from aging red blood cells is reutilised. Daily losses of iron are about 1 mg per day, mainly from desquamation of cells in the intestinal tract into the faeces, from exfoliation of the skin, and small losses in urine, sweat, hair and nails. However, females of childbearing age, especially if pregnant or lactating, are often in a state of negative iron balance, unless supplemental iron is given.

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CAUSES OF IRON DEFICIENCY ANAEMIA

Iron deficiency anaemia occurs when the dietary intake or absorption of iron is insufficient to balance the iron lost from the body or increasing demand for iron, such as in pregnancy or lactation. The main cause of iron-deficiency in East Africa is inadequate intake from a poor diet, especially in infants at the time of weaning. Iron is also lost in parasitic infections, such as hookworm that attach to the intestinal mucosa and feed on blood; or schistosomiasis which causes intestinal bleeding. In men and post-menopausal women, iron deficiency anaemia may be a sign of serious chronic underlying disease, such as peptic (gastric or duodenal) ulcer, or gastric or colon cancer, which cause loss of blood into the bowel. Other less common causes of iron deficiency include malabsorption or haemoglobinuria (loss of blood into the urine).

CLINICAL FEATURES OF IRON DEFICIENCY ANAEMIA

Symptoms

Symptoms of anaemia include weakness, tiredness, dizziness, fainting or feeling faint, and shortness of breath, especially on exertion. Unusual obsessive food cravings, known as pica, may occur in iron deficiency anaemia, such as pica for soil (geophagia). Hair loss, sore tongue and mouth (glossitis), koilonychia (spoon-shaped nails), and rarely difficulty in swallowing (dysphagia) are features of severe iron deficiency anaemia.

Signs

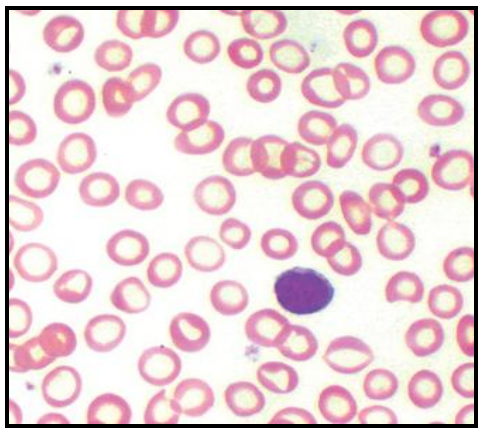
The cardinal sign of anaemia is **pallor** (paleness) best seen by examining the conjunctivae, tongue, gums and nail beds. However, pallor is **not a sensitive** sign for mild and moderate anaemia and may be completely absent. Only about one third of patients with haemoglobin levels between 8 – 10 g/dl have pallor. In moderate to severe anaemia, heart and respiratory rates may be increased to compensate for anaemia. When pallor is noted, the next step is to identify the cause. This includes examining the abdomen for masses, enlarged liver and spleen, or performing a pelvic or rectal examination to search for sites of internal bleeding.

LABORATORY DIAGNOSIS

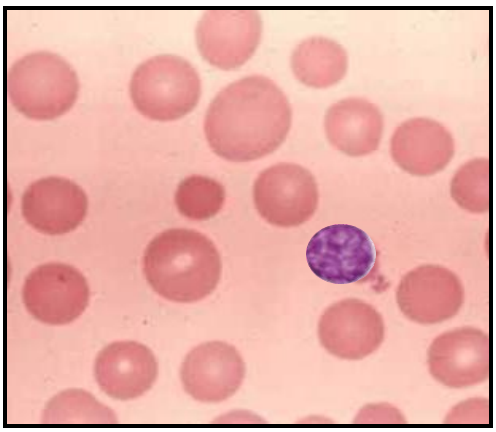
Laboratory tests are performed for two purposes: 1) to confirm the presence and level of anaemia; 2) to investigate the cause.

- *Haemoglobin estimation:* this documents the severity of the anaemia.
    - If an automatic blood cell anaylser is available, the mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) are below the normal reference ranges (MCV 83-97 fL; MCHC 32-36 g/dL).
    - Often, the platelet count is elevated (>450,000/µL). This normalises following iron therapy.
    - The white blood cell count (WBC) count is usually normal (4,500-11,000/µL).

- *Peripheral blood film:* examination of the peripheral blood film is an important part of the workup of patients with anaemia. Erythrocytes appear microcytic (small) and hypochromic (central pallor). Microcytosis may be apparent in the film before the MCV is decreased. Target cells, anisocytosis (variation in size) and poikilocytosis (variation in shape) may also be present. Combined folic acid and iron deficiency are commonplace in areas of the world where dietary intake is poor. The peripheral film reveals a dual red cell population of macrocytes together with microcytic hypochromic cells. This combination can normalize the MCV and is only recognised by examining the peripheral blood film.



Microcytic, hypochromic picture



Mixed microcytic, macrocytic picture

- *Other laboratory tests:* these may be useful to establish the cause of iron deficiency anaemia:
  - Examination of stool for parasites, especially hookworm.
  - Testing stool for the presence of hemoglobin to establish gastrointestinal bleeding (occult blood). Test kits are available that detect 10 mL of daily blood loss; however, these tests also detect blood from other sources such as ingested meat, and therefore do not reliably indicate gastrointestinal bleeding. Any suspicion of gastrointestinal bleeding requires a confirmatory procedure such as endoscopy.
  - Haemoglobinuria and haemosiderinuria are detected using urine dipsticks. These indicate renal loss of iron and suggest intravascular haemolysis as the cause.

Differential diagnosis of a microcytic, hypochromic blood picture

Other conditions that cause a microcytic, hypochromic blood picture include:

- Anaemia of chronic disorders, such as chronic infection (for example, tuberculosis, HIV infection), malignant neoplasm, inflammatory disorders such as rheumatoid arthritis.
- Thalassaemias (inherited abnormalities of haemoglobin)
- Sideroblastic anaemias, that may be hereditary or acquired. These are uncommon.

- Chronic lead poisoning. The incidence of lead poisoning is greater in individuals who are iron deficient because increased absorption of lead occurs in individuals with iron deficiency. Paint in old houses is a source of lead poisoning in children and painters.

TREATMENT

Treatment involves providing iron supplements and treating the underlying cause. Iron supplements must always be given in addition to advice on improving the diet. The most common forms of iron are ferrous sulphate or ferrous gluconate, at doses of 3 – 6 mg elemental iron /kg/day. Commonly available iron tablets (200 mg) contain 60 mg elemental iron. Iron syrups are not recommended as ferrous sulphate is unstable in solution. Parenteral therapy does not result in more rapid recovery, as long as oral iron is taken and tolerated. Folic acid is usually given at the same time, to address dietary insufficiency, at doses of 5 mg per day in adults; 2.5 mg per day in children.

The chief dietary sources of iron are meat, liver, kidney, egg yolk, green vegetable and fruit. Milk, particularly cow's milk, has a low iron content. Iron may be added to food by cooking in iron utensils.

Haemoglobin testing must be repeated every 2 – 4 weeks to ensure the level is rising. Iron therapy should be continued for up to 3 months after the haemoglobin has stabilised at normal levels, to replenish iron stores. The complete treatment may take several months.

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