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Anemia: An Advanced Over Review on a Health Problem

Sharma AD*, Sharma S, Joshi Y, Ahmad K

A.V.I.P.S, Gangoh 241347, Saharanpur, Uttar Pradesh, India

ABSTRACT

Anemia is a major public health problem in developing countries, particularly for pregnant women and young children. Approximately 47% of children younger than 5 years of age in developing countries experience anemia, defined as a hemoglobin (Hb) level less than 11 g/dL. Anemia has been linked to serious health consequences, including impairments in cognitive function, physical development, psychomotor development, and language development. Severe anemia is associated with an increased risk of mortality. Following article provides a review on brief introduction, types, etiology, diagonosis and prevention of anemia.

Key words: anemia, haemoglobin, deficiency of iron, iron, iron supplements

Corresponding author
Email: anshuldutt79@rediffmail.com

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INTRODUCTION

Over 2 billion people are affected by Anemia and the World Health Organization (WHO) estimates that half of these cases are anemic because of iron deficiency [1–3]. A disproportionate percentage of anemia and iron deficiency cases occur in developing countries [4, 5], accompanied by adverse pregnancy outcomes such as premature birth, low birth weight, and increased maternal mortality [6].

Anemia is a decrease in the total hemoglobin levels caused by a lack of sufficient iron. It is the most common cause of anemia worldwide. Iron is needed to form hemoglobin and is mostly stored in the body in the form of ferritin and hemosiderin. About 30% of iron is stored as ferritin and hemosiderin in the bone marrow, spleen, and liver [7].
The World Health Organization (WHO) has suggested levels of Hb below which anaemia is said to be present (Table 1). [8]

Table 1: WHO's Hemoglobin thresholds

Age or gender group	Hb threshold (g/dl)	Hb threshold (mmol/l)
Children (0.5–5.0 yrs)	11.0	6.8
Children (5–12 yrs)	11.5	7.1
Teens (12–15 yrs)	12.0	7.4
Women, non-pregnant (>15yrs)	12	7.4
Women, pregnant	11	6.8
Men (>15yrs)	13	8.1

WHO's Hemoglobin thresholds used to define anemia (1 g/dL = 0.6206 mmol/L)

AETIOLOGY [9-11]

1. Blood losses
   - Phlebotomy
   - Trauma
   - Surgery
   - Stress-related GI bleeding

2. Diminished erythropoiesis
   - Myelosuppressive drugs or toxins
   - Nutritional deficiencies
     - Iron
     - Folate
     - Vitamin B12
   - Bone marrow fibrosis or tumor infiltration
   - Certain endocrine disorders (e.g., hyperparathyroidism)

3. Relative or absolute deficiency of erythropoietin

- Renal insufficiency or failure
- Inflammation or infection/anemia of chronic disease
- Certain endocrine disorders (e.g., hypothyroidism, diabetes)

4. Hemolysis
   - Certain drugs
   - Certain toxins
   - Certain disease

CLASSIFICATION OF ANEMIA [12, 13]

Several types of classification of anemias have been proposed. Two of the widely accepted classifications are based on the pathophysiology and morphology.

A. PATHOPHYSIOLOGIC

1. Anemia due to increased blood loss.
   a) Acute post-hemorrhagic anemia
   b) Chronic blood loss

2. Anemia due to impaired red cell production

   a) Cytoplasmic maturation defects
      1. Deficient haem synthesis
         Iron deficiency anemia
      2. Deficient globin synthesis:
         Thalassaemic syndrome
   b) Nuclear maturation defect
      Vitamin B12 and/or folic acid deficiency:
      Megaloblastic anemia
   c) Defects in stem cell proliferation and differentiation
      1. Aplastic anemia
      2. Pure red cell aplasia
   d) Anemia of chronic disorders
   e) Bone marrow infiltration
   f) Congenital anemia

3. Anemias due to increased red cell destruction (Haemolytic anemias)
   a) Extrinsic (extracorpuscular) red cell abnormalities
   b) Intrinsic (intracorpuscular) red cell abnormalities

B. MORPHOLOGIC

1. Microlytic, hypochromic
2. Normocytic, normochromic
3. Macrocytic, normochromic

SIGNS AND SYMPTOMS [4]

Anemia goes undetermined in many people, and symptoms can be minor or vague.

Most common symptoms are as:-

- Blue-tinged or very pale whites of eyes
- Blood in the stools
- Brittle nails
- Decreased appetite (especially in children)
- Fatigue
- Headache
- Irritability
- Pale skin color (pallor)
- Shortness of breath
- Sore tongue
- Unusual food cravings (called pica) ,Weakness

INVESTIGATION OF ANEMIC SUBJECT [14, 15]

After obtaining a thorough investigation about the sign and symptoms, the patient is examined for evidence of anaemia. In order to confirm or deny the presence of anemia, its type and its cause, the following plan of investigations is generally followed-

Technology For Anemia Detection

Two methods are used

- **Non Dilutional**
- **Dilutional**

Non Dilutional This is a method in which there is no premixing of blood with chemicals. This method may use nonlyzed and lyzed blood cells The methods that use nonlysed whole blood are as under:

- Filter paper
- Copper sulphate

- Hematocrit or centrifuge
- Lovibond(also used in dilutional technique)

Method using Lysed Blood Cells In such method soap like product is used to break the cell. These are as under

- BMS Hemoglobinometer
- HemoCue (Lysis is automatic in this method)

Dilutional method In this method blood is mixed with chemicals that produce a new compound. Color intensity of new compound gives information about the haemoglobin concentration.

This color intensity can be measured b following ways:

a) Visual Colour Match
   - Sahli
   - Lovibond

b) Photoelectric Colour Match
   - Photometry/ colorimetry
   - Spectrophotometry

Other Tests for Hb Estimation

When the cause is not obvious, clinicians use other tests: ESR, ferritin, serum iron, transferrin, RBC folate level, serum vitamin B_{12}, hemoglobin electrophoresis, renal function tests (e.g. serum creatinine).

TREATMENTS [11, 12, 16]

Medical Care

Medical care consists of establishing the diagnosis and reason for the iron deficiency. In most patients, the iron deficiency should be treated with oral iron therapy, and the underlying etiology should be corrected so the deficiency does not recur.

Surgical Care

Surgical treatment consists of stopping hemorrhage and correcting the underlying defect so that it does not recur. This may involve surgery for treatment of either neoplastic or non neoplastic disease of the gastrointestinal tract, the genitourinary tract, the uterus, and the lungs.

Consultations

Surgical consultation often is needed for the control of hemorrhage and treatment of the underlying disorder. In the investigation of a source of bleeding, consultation with certain medical specialties may be useful to identify the source of bleeding and to provide control.

Gastroenterology consultation is the most frequently sought consult among the medical specialties. Endoscopy has become a highly effective tool in identifying and controlling gastrointestinal bleeding. If bleeding is brisk, angiographic techniques may be useful in identifying the bleeding site and controlling the hemorrhage. Radioactive technetium labeling of autologous erythrocytes also is used to identify the site of bleeding. Unfortunately, these radiographic techniques do not detect bleeding at rates less than 1 ml/min and may miss lesions with intermittent bleeding.

Diet

On a worldwide basis, diet is the major cause of iron deficiency. To suggest that iron-deficient populations correct the problem by the addition of significant quantities of meat to their diet is unrealistic. The addition of nonheme iron to national diets is initiated in some areas of the world. Problems encountered in these enterprises include changes in taste and appearance of food after the addition of iron and the need to supplement foodstuffs that are consumed by most of the population in predictable quantities. In addition, many dietary staples, such as bread, contain iron chelators that markedly diminish the absorption of the iron supplement (phosphates, phytates, carbonates, oxalates, tannates).

Medication

The most economical and effective medication in the treatment of iron deficiency anemia is the oral administration of ferrous iron salts. Among the various iron salts, ferrous sulfate most commonly is used. Claims are made that other iron salts are absorbed better and have less morbidity. Generally, the toxicity is proportional to the amount of iron available for absorption. There are advocates for the use of carbonyl iron because of the greater safety with children who ingest their mothers' medication. Decreased gastric toxicity is claimed but not clearly demonstrated in human trials. Bioavailability is approximately 70% of a similar dose of ferrous sulfate. Reserve parenteral iron for patients who are either unable to absorb oral iron or who have increasing anemia despite adequate doses of oral iron. It is expensive and has greater morbidity than oral preparations of iron. Reserve transfusion of packed RBC for patients with either significant acute bleeding or patients in danger of hypoxia and/or coronary insufficiency.

Mineral supplementations [17]

These agents are used to provide adequate iron for hemoglobin synthesis and to replenish body stores of iron. Iron is administered prophylactic ally during pregnancy because of anticipated requirements of the fetus and losses that occur during delivery.

Ferrous Sulphate (Fera- tab, Fer- iron, Slow - FE)

Mainstay treatment for treating patients with iron deficiency anemia. They should be continued for about 2 months after correction of the anemia and its etiological cause in order to replenish body stores of iron. Ferrous sulfate is the most common and cheapest form of iron utilized. Tablets contain 50-60 mg of iron salt. Other ferrous salts are used and may cause less intestinal discomfort because they contain a smaller dose of iron (25-50 mg). Oral solutions of ferrous iron salts are available for use in pediatric population.

Carbonyl Iron (Feosol)

Used as a substitute for ferrous sulfate. Has a slower release of iron and is more expensive than ferrous sulfate. Slower release affords the agent greater safety if ingested by children. On an mg basis, it is 70% as efficacious as ferrous sulfate. Claims are made that there is less gastrointestinal toxicity, prompting use when ferrous salts are producing intestinal symptoms and in patients with peptic ulcers and gastritis. Tablets are available containing 45 mg and 60 mg of iron.

Dextran-iron (IN Fed)

Replenishes depleted iron stores in the bone marrow where it is incorporated into hemoglobin. Parenteral use of iron-carbohydrate complexes has caused anaphylactic reactions, and its use should be restricted to patients with an established diagnosis of iron deficiency anemia whose anemia is not corrected with oral therapy. Fed may be diluted in 0.9% sterile saline. Do not add to solutions containing medications or parenteral nutrition solutions.

PREVENTION OF ANEMIA [18, 19]

1. Diet

Eating a diet with iron-rich foods can help treat iron-deficiency anemia. Good sources of iron include the following

- Meats - beef, lamb, liver, and other organ meats
- Poultry - chicken, duck, turkey, liver (especially dark meat)
- Fish - shellfish, including clams, mussels, sardines and anchovies
- Leafy greens of the cabbage family and collards
- Legumes and Yeast-leavened whole-wheat bread and rolls
- Iron-enriched white bread, pasta, rice, and cereals.

2. Patient education

Public health officials in geographic regions where iron deficiency is prevalent need to be aware of the significance of iron deficiency, its effect on work performance, and the importance of providing iron during pregnancy and childhood. Addition of iron to basic foodstuffs usually employed to solve this problem.

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