# ANAEMIA
# A PRACTICAL APPROACH FOR NURSING AND PARAMEDICAL SPECIALITIES

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**KEY WORDS**
- Anaemia
- Symptom only
- Classification
- Diagnosis
- Treatment

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**OPSOMMING**

**Die kliniese aspekte van anemie word hier – met inagneming van die simptome en belangrikste fisiese tekens – aangebied. By 'n benadering wat die ontwikkeling van die simptoom wil verstaan, word die gelyktydige gebruik van morfologiese, etiologiese en kinetiese klassifikasies beklemtoon. 'n Praktiese metode van diagnose en 'n oorsig van die beginsels van behandeling word kortliks gegee.**

## INTRODUCTION

ANAEMIA is only a symptom and not, in itself, a diagnosis. Its importance lies in the fact that it signals underlying disease which is often correctable. By definiton anaemia is a reduction in red cell mass and this is reflected in reduced haemoglobin, packed cell volume, or red cell count in the peripheral blood. To understand the mechanisms of its development normal blood formation must be briefly reviewed.

## ERYTHROPOIESIS

During the early weeks of embryonic life primitive red blood cells are produced in the yolk sac of the foetus. In the middle trimester of gestation the liver is the main organ for production of red blood cells and additional production takes place in the spleen and lymph nodes. In the last trimester, and after birth, red blood cells are produced exclusively by the bone marrow.

**Genesis of the red blood cell or erythropoiesis**

Red blood cells are derived from precursors known as pronormoblasts and the latter are continually formed from stem cells located throughout the bone marrow. The pronormoblast differentiates to form the basophilic normoblast which begins the synthesis of haemoglobin and with maturation passes through the stage of polychromatic normoblast. The nucleus of the

erythrocyte shrinks in parallel with accelerated synthesis of haemoglobin resulting in the orthochromatic normoblast. (Figure 1).

The youngest red cell without a nucleus is called the reticulocyte, and is larger in volume and diameter than the mature red cell. The haemoglobin content is approximately the same as the mature cell, but because of its larger size the haemoglobin concentration is slightly lower. The maturation time of a reticulocyte to the erythrocyte is 1-2 days.

**Regulation of red blood cell production**

The major factor controlling the rate of red cell production is the oxygen content of arterial blood; a decrease stimulating erythropoiesis while an increase depresses it.

Although the tissue tension of oxygen controls the rate of the erthropoiesis, it does not do so by direct action on the marrow but rather through a plasma hormone, called erythropoietin. The site of formation of erythropoietin is in the kidney and acts on the bone marrow primarily by stimulating the differentiation of primitive stem cells to the pronormoblast stage of erythropoiesis. (Figure 2).

**Signs and symptoms of anaemia**

The majority of these reflect reduction in oxygen supply necessary to meet metabolic demands.

These signs and symptoms will be grouped, firstly, according to the effect on different organs; secondly, to contrast acute as opposed to chronic anaemia; and thirdly, the specific symptoms of different types of anaemia will be presented.

**I. Effects on different organs:**

General:
- fatigue
- lassitude
- muscular weakness
- mild pyrexia 37.2 - 38.2°C.

Central nervous system:
- dizziness and vertigo
- syncope and headaches
- irritability and euphoria
- lack of concentration
- clouding of consciousness

Ears:
- tinnitus
- roaring and "banging sensation" in head

Eyes:
- pale conjunctivae
- "spots in front of eyes"
- retinal exudates and haemorrhage

Naso-pharynx and oral cavity:
- pale mucosa
- smooth tongue
- glossitis

**II Acute opposed to chronic anaemia**

| Acute | Chronic |
|---|---|
| Pallor – "dead white" | Tiredness |
| Dyspnoea at rest | Lassitude |
| High output state" | Weakness |
| Raised JVP | Dyspnoea on exertion |
| C.C.F. | |
| – Hepatomegaly | Dysphagia with glossitis |
| – Pulmonary congestion | Loss of weight |
| – Peripheral oedema | Neuralgic pains |
| Oedema of extremities in ambulant patients | Delayed wound healing |
| Intermittent claudication | Pallor skin and mucosa |
| ECG changes | Numbness of extremities and tingling |
| – normal | Vaso-motor disturbances |
| – depressed S-T segment | |
| – flattening, or | |
| – inversion of T-Wave | |
| Faintness | |
| Giddiness | |
| Headaches | |
| Tinnitus | |
| Spots in front of eyes | |
| Lack of concentration | |
| Drowsiness – clouding of consciousness | |
| Numbness | |
| Coldness of hands and feet | |
| Tingling | |
| Mild pyrexia 37.2 - 38.2°C | |
| Heart murmurs | |

**III Specific signs and symptoms**

| | |
|---|---|
| Iron deficiency | – Koilonychia |
| B12 deficiency | – severe glossitis<br>subacute combined degeneration of spinal cord |
| Chronic congenital haemolytic syndromes (e.g. Thalassaemia major) | – bossing of skull, stunted growth<br>– vascular crises of sickle cell anaemia |

CLASSIFICATION

This can be done either according to the size of the cell, the aetiology, or based on the underlying pathophysiological mechanisms. These are not exclusive and are best combined in understanding the development or pathogenesis of anaemia.

**A. According to Cell Size**

| | |
|---|---|
| 1. Macrocytic (MCV 96) | B12 deficiency<br>Folate deficiency |
| 2. Normocytic (MCV 76-96) (MCHC 30-35) | Stromal disease (myelofibrosis)<br>Chronic inflammation<br>Endocrinopathy |
| 3. Microcytic | Non-sideroblastic, e.g. iron deficiency |
| MCV 76<br>MCH 27<br>MCHC 30 | Sideroblastic<br>– Globin abnormality<br>– Porphyrin abnormality |

**B. Aetiology**

1. Blood loss
   - Acute post haemorrhagic anaemia
   - Chronic blood loss anaemia
2. Impaired red cell formation.
   a) Disturbances of bone marrow function owing to deficiency of nutrients necessary for erythropoiesis.
      i) Iron deficiency anaemia
      ii) Folate or B12 deficiency
   b) Anaemia associated with:-
      i) Infection
      ii) Renal diseas
      iii) Liver disease
      iv) Bone marrow infiltration
         – leukaemia
         – myeloma
         – lymphoma

- myelofibrosis
- metastatic tumours

v) Aplastic anaemia
vi) Collagen diseases
vii) Myxoedema and hypopituitarism
viii) Sideroblastic anaemias

3. Haemolytic Anaemias
   a) Abnormalities of the Red Cell (Intrinsic)
      i) Congenital
         - membrance
         - metabolic
         - haemoglobinopathies
      ii) Acquired
         - paroxysmal nocturnal haemoglobinuria
   b) Abnormalities of red blood cell environment (Extrinsic)
      i) Plasma
         - immune disorders
         - lipid disorders
         - toxins and drugs
      ii) Abnormal phsyical environment
         - blood vessels (microangiopathic haemolytic anaemia)
         - burns
      iii) Infections

C. **Pathophysiological Classification**

1. Acute blood loss

If otherwise haematologically normal (e.g. normal iron, B12, folate, etc.) there will be signs of stimulated erythropoiesis 2-5 days following the loss of blood.

- Polychromasia on smear (occasional normoblasts may be seen).
- Increased reticulocyte index (maximal at 5-10 days following normal blood loss)
- Marrow : erythroid hyperplasia (E/G ratio 1 : 1 or greater).

2. Malproduction of Erythroid Precursors
   a) Hypoproliferative anaemias: Absence of appropriate marrow erythroid proliferation with consequent lack of reticulocytosis.
      - no polychromasia
      - reticulocyte index normal or decreased
      - marrow E/G ratio usually normal

      i) Decreased erythropoietin levels
         - renal failure
         - reduced $0_2$ requirements
         - increased $0_2$ release
      ii) Iron lack
         - chronic blood loss
         - inflammation
         - iron deficiency (dietary)
      iii) Marrow Damage
         - toxic
         - infiltrative
         - idiopathic (hypoplastic anaemia)
   b) Maturation Abnormality: Characterised by ineffective erythropoiesis.
      - near maximal marrow erythropoietic activity (E/G ratio 1 : 1 or more).
      - poor reticulocyte response, thus implying premature death of erythroid precursors in the marrow.

      i) Macrocytic
         - B12 deficiency
         - folate deficiency
         - disorders of DNA synthesis: Hereditary Acquired
      ii) Microcytic
         - globin abnormality: Thalassaemias
         - haem abnormality : Sideroblastic anaemias
         : Iron lack (severe)

3. Haemolytic Anaemias (Excessive destruction of mature red cells in the circulation).
   The features are those of:-
   - maximal erythropoietic stimulation in the marrow (E/G ratio 1 : 1 and often greater).
   - reticulocytosis
   - evidence of excessive red cell destruction:-
     Increased unconjugated bilirubin
     Increased urine and faecal urobilinogen

      i) Abnormalities of the Red Cell (Intracorpuscular)
         Congenital
         - membrane
         - metabolic
         - haemoglobinopathies

         Acquired
         - paroxysmal nocturnal haemoglobinuria
      ii) Abnormalities of Red Cell Environment (Extracorpuscular)
         Plasma
         - imune disorders
         - lipid disorders
         - toxins and drugs

         Abnormal physical environment
         - blood vessels (microangiopathic haemolytic anaemia)
         - burns

         Infections

INVESTIGATIONS

1. **History of patient**
   a) Age, sex.
   b) Rate of onset – a rapid onset may suggest acute anaemia, haemolysis or acute leukaemia.
   c) Blood loss – which may be haematemesis, malaena, bleeding haemorrhoids, menorrhagia, epistaxis, haematuria or haemoptysis.
      This is by far the commonest cause of anaemia, as chronic blood loss leads to iron deficiency.
   d) Alimentary tract – anorexia, nausea, flatulence, constipation may be symptoms of anaemia, but these symptoms are usually due to the cause of the anaemia.
   e) Reproductive system – menstrual history in detail. Number and interval of pregnancies and abortions.
   f) Central nervous system – although numbness, coldness and tingling of hands and feet can occur in severe anaemia irrespective of its aetiology, it usually is significant in pernicious anaemia and other megaloblastic anaemias due to B12 deficiency.
   g) Bleeding tendencies – history of easy bruisng or prolonged bleeding during trivial injuries may suggest anaemia due to disorders causing thrombocytopenia, other coagulation defects, or to renal insufficiency.
   h) Skeletal system – bone pain may occur in leukaemias, multiple myelomas due to bone marrow infiltration or replacement.
   i) Drug ingestion – persistent analgesic intake may cause GIT bleeding.
   j) Occupation – to enquire re possible exposure to radiation or toxic chemicals.
   k) Diet – an inadequate diet may lead to iron deficiency anaemia (unusual in adults, but may occur in infants).
   l) Social history – especially alcoholism, as this leads to nutritional folic acid deficiency causing a megaloblastic anaemia.
   m) Family history – it may be a hereditary anaemia and a

family history of jaundice and anaemia is common in congenital haemolytic anaemias.

n) Past history – if any previous anaemias – note diagnosis of anaemia and the response to treatment.

o) Temperature – rarely present, although night sweats are sometimes present in lymphomas and leukaemia. Mild pyrexia may be present in severe anaemia.

p) Weight loss.

q) Fatique, malaise, lassitude.

2. **Examination of patients**

a) Skin – note the colour, texture, and the presence of petechiae and ecchymoses.
Pernicious anaemia may give a lemon-yellow tint.
Petechiae may be present in anaemia associated with thrombocytopenia but may be due to increased capillary fragility.
Ecchymoses may also occur in anaemia associated with thrombocytopenia.

b) Nails – koilonychia (spoon-shaped nails), brittleness and longitudinal ridging are common in chronic iron deficiency anaemia.

c) Conjunctivae – must be examined for pallor, icterus or haemorrhage.
Pallor indicates anaemia whereas icterus may suggest haemolytic anaemia or liver disease.

d) Mouth –
i) mucous membranes – examine for pallor and petechiae.
ii) tongue – examine for acute glossitis with a raw-red tongue or a smooth shiny tongue.
iii) pharynx – examine for ulceration which may occur in acute leukaemia.
iv) gums – lead line at the tooth margin in the gums in lead poisoning.

e) Cardiovascular system – history of dyspnoea on exertion or at rest. Palpitation. Oedema of extremities. Raised jugular venous pressure. Murmurs, especially in anaemias due to bacterial endocarditis. Hypertension usually occurs in anaemia present with renal insufficiency.

f) Abdomen –
i) splenomegaly – if present is usually related to the cause of the anaemia.
ii) hepatomegaly – may also be due to the cause of the anaemia or, rarely, due to the anaemia itself, in which case the liver will be smooth, slightly to moderately enlarged and sometimes tender.
iii) abdominal mass – usually related to original cause for the anaemia.

g) Superficial lymph nodes may be palpable in leukaemia and in malignant lymphomas.

h) Bone tenderness often present due to marrow infiltration. Most easily demonstrated in the sternum.

i) Arthralgia and arthritis. Either due to an increased urate production in haemolytic anaemias or it may occur in diseases causing anaemia such as sickle cell disease, leukaemia and systemic lupus erythematosus.

j) Legs – ulcers occur commonly in sickle cell anaemia.

k) Rectal examination especially in patients with GIT symptoms. Haemorrhoids may be seen and polyps can be felt. A tarry appearance of faeces on the glove indicates internal bleeding except if the patient is taking iron orally.

l) Pelvic examination – indicated in females with complaints of menorrhagia or metrorrhagia.

m) Fundus oculi – examine for changes in the fundus, particularly haemorrhages may be seen in severe anaemias or leukaemia.
Macroglobulinaemia causes sausage-like veins.

n) Urine – mild proteinuria may be present in severe anaemia and urobilinogen where haemolysis is present. Check for haematuria.

o) Central nervous system – may reveal the signs of vitamin B12 deficiency.

BLOOD EXAMINATION

Once the clinical examination is done an initial screening is done which consists of the following tests:-

a) Full blood count
- Haemoglobin estimation
- White blood cell count
- Red blood cell count
- P.C.V. (Packed cell volume)
- M.C.V. (Mean cell volume)
- M.C.H. (Mean cell haemoglobin)
- M.C.H.C. (Mean cell haemoglobin concentration)

b) Smear
c) Reticulocyte Count
d) E.S.R.
e) Platelet count
f) Differential count
g) Bilirubin

a) **Full blood count**

i) **Haemoglobin estimation (Hb)**
Normal values differ according to sex and age. In pregnance the Hb. decreases due to an increase in plasma volume and also the Hb. is higher at higher altitudes.

| Mean | ± 2 S.D. (g/dl) at sea level |
|---|---|
| Men | 15.5 ± 2.5 g/dl. |
| Women | 14.0 ± 2.5 g/dl. |
| Infants (full term) | 16.5 ± 3.0 g/dl. |
| Children, 3 months | 11.0 ± 1.5 g/dl. |
| Children, 1 year | 12.0 ± 1.0 g/dl. |
| Children 3-6 years | 13.0 ± 1.0 g/dl. |
| Children 10-12 yrs. | 13.0 ± 1.5 g/dl. |

ii) **White blood cell count**
Normal values in adults 4-11 x $10^9$/1.

iii) **Red blood cell count** (erythrocyte count)
This is an important gauge of marrow activity. A decrease will indicate anaemia.

| Mean at sea level | (in millions/ul) ± 2 S.D. |
|---|---|
| Men | 5.5 ± 1.0 x $10^{12}$/1 |
| Women | 4.8 ± 1.0 x $10^{12}$/1 |
| Infants (full term, cord blood) | 5.0 ± 1.0 x $10^{12}$/1 |
| Children, 3 months | 4.0 ± 0.8 x $10^{12}$/1 |
| Children, 1 year | 4.4 ± 0.8 x $10^{12}$/1 |
| Children, 3-6 years | 4.8 ± 0.7 x $10^{12}$/1 |
| Children, 10-12 yrs | 4.7 ± 0.7 x $10^{12}$/1 |

iv) **Packed cell volume** (PVC) or haematocrit 1/1)
A decrease will indicate anaemia
Mean values ± 2 S.D. at sea level.

| Men | 0.47 ± 0.07 (1/1) |
|---|---|
| Women | 0.42 ± 9.05 (1/1) |
| Infants (full term, cord blood) | 0.54 ± 0.10 (1/1) |
| Children, 3 months | 0.38 ± 0.06 (1/1) |
| Children, 3-6 years | 0.40 ± 0.04 (1/1) |
| Children, 10-12 yrs | 0.41 ± 0.04 (1/1) |

v) **Mean cell volume** (MCV)
This represents the average volume of red cells. It is calculated from the red cell count and packed cell volume. In adults an MCV of less than 80 is termed

microcytic, and an MCV of greater than 100 is termed macrocytic.
Normal values (mean ± 2 S.D.) at sea level.
Measured in femtolitres (fl)

| | |
|---|---|
| Adults | 85 ± 8 fl. |
| Infants (full term, cord blood) | 106 fl (mean) |
| Children, 3 months | 95 fl (mean) |
| Children, 1 year | 78 ± 8 fl. |
| Children, 3-6 years | 81 ± 8 fl. |
| Children, 10-12 yrs | 84 ± 7 fl. |

vi) **Mean cell haemoglobin** (MCH)
This represents the average weight of haemoglobin contained in each cell.
Measured in picograms.
MCH of less than 27 = hypochromic
Normal means ± 2 S.D.

| | |
|---|---|
| Adults | 29.5 ± 2.5 pg. |
| Children, 3 months | 29 ± 5 pg. |
| Children, 1 year | 27 ± 4 pg. |
| Children, 3-6 years | 27 ± 3 pg. |
| Children, 10-12 yrs | 27 ± 3 pg. |

vii) **Mean cell haemoglobin Concentration** (MCHC)
Indicates the average concentration of haemoglobin in red cells.
Measured in g/dl.
Normal: Adults and children 33 ± 2g/dl.

b) **Smear**
1. **Appearance of the red cells**
A. **Size and shape**
1. **Anisocytosis**
– a term used to indicate variations in cell size.
i) Macrocytes
– megaloblastic anaemia
– aplastic anaemia
– leukaemia
ii) – iron deficiency anaemia
– thalassaemia

2. **Poikilocytosis** – abnormality of erythropoiesis used to describe varied cell shapes. Alterations include oval, pear, tear shaped poikilocytes. These shapes may give an indication of the type of anaemia present, e.g. elongated pencil-shaped cells – iron deficiency anaemia.

B. **Staining**
i) Normochromic – these are cells which stain normally and have a normal concentration of haemoglobin.
ii) Hypochromic – there is a decrease in the intensity of the staining and is normally associated with a decreased MCH and MCHC. Seen in iron deficiency anaemia, thalassaemia, sideroblastic anaemia.
iii) Hyperchromia – an increase in intensity of staining and usually associated with raised MCHC.
Seen in hereditary spherocytosis.
iv) Basophilia
a) Diffuse – represents reticulocytes
b) Punctate – in many diseases: e.g., lead poisoning, represents ineffective erythropoiesis.
v) Target cells – cells which are thinner than normal. Occurs in liver disease and thalassaemia.
vi) Howell-Jolly bodies – nuclear remnants – usually appear singly. Seen in:
a) Post-splenectomy
b) Megaloblastic anaemias

c) **Reticulocyte Count**
Normal uncorrected range in adults 0.2 - 2.0%
children 2.0 - 6.0%
An increased reticulocyte count usually indicates erythroid hyperplasia in marrow with effective red cell production.
Increased reticulocyte count found in haemolytic or haemorrhagic anaemias.
Decreased reticulocyte count found in dyshaemopoietic disorders (bone marrow failure), and where cells are destroyed in the marrow – ineffective production.

d) **Erythrocyte – sedimentation rate (ESR)**
This may give an indication of the underlying cause of the anaemia.
Indicates an increase in certain plasma proteins.
Generally raised in inflammatory disorders and markedly raised in myeloma.
ESR may rise slightly with age.
ESR may be raised in anaemia and correlates with cause rather than degree.
Normal values: Males 0-5 mm per hour (Westergren method)
Females 0-7 mm per hour (Westergren method)

e) **Platelet Count**
Normal values: Range 150 - 400 x $10^9$/1
Mean 250 x $10^9$/1

f) **Differential Count** – Adults

| | | |
|---|---|---|
| Neutrophils | 40 - 75% | (2.0 - 8.5 x $10^9$/1) |
| Lymphocytes | 20 - 50% | (1.5 - 4.0 x $10^9$/1) |
| Monocytes | 2 - 10% | (0.2 - 0.8 x $10^9$/1) |
| Eosinophis | 1 - 6% | (0.04 - 0.4 x $10^9$/1) |
| Basophils | 1% | ( 0.01 - 0.1 x $10^9$/1) |

g) **Bilirubin**
This gives an indication of the amount of haemolysis present, as bilirubin is a breakdown product of haemoglobin.

Following these tests, a provisional diagnosis is made, and to confirm this the following special investigations may be done:-

1. **Bone marrow aspirate and trephine biopsy**
The following information can be obtained:-
a) Cellularity
b) Type and activity of erythropoiesis
c) Number and type of developing white cells
d) Number and type of megakaryocytes
e) The myeloid erythroid ratio (M : E ratio)
f) Presence of foreign or tumour cells
g) Presence of parasites or organisms
h) Iron content
2. Fasting serum iron levels 8-30 umol/1.
Normally decreased in iron deficiency anaemia.
3. Total iron binding capacity (TIBC)
Normal levels 47-67 umol/1.
Usually increased in iron deficiency.
4. Serum B12 levels
Normal levels 200-925 ng/1.
In pernicious anaemia levels below 120 ng/1 are often found.
5. Serum folate level
Normal levels 4-20 ug/1.
Levels are low with folate deficiency and may be raised or normal with B12 deficiency. Reflects folate balance rather than body stores.
6. Red cell folate
This is useful in assessing the severity of folate deficiency at the tissue level in patients who have a low serum folate but are not yet in the stage of megaloblastic anaemia.
Normal values 160-700 ug/1.
7. Schillings Test
Tests whether B12 deficiency is due to malabsorption, or to lack of intrinsic factor (as in pernicious anaemia).

8. If a haemolytic anaemia is being considered, the following tests may be diagnostic.
   i) Coombs Test – if an immune haemolytic anaemia is suspected. Detects presence of antibodies on red cells.
   ii) Osmotic Fragility – assesses degree of spherocytosis of red cells. Increased in hereditary spherocytosis.
   iii) Haemoglobin Electrophoresis – for haemoglobinopathies and thalassaemia syndromes.
   iv) Tests for red cell enzyme deficiencies
   – Motulsky test (G6PD deficiency)
   – Specific assays
   v) Tests of intravascular haemolysis
   – serum haptoglobin decreased
   – presence of haemoglobinuria
   – presence of haemosiderinuria
   – Schumm's test for methaemalbuminaemia
   vi) Red cell survival studies.
9. In iron deficiency anaemia chronic blood loss is usually present. The source of the bleeding, when not clinically obvious, is almost invariably the gastro-intestinal tract. Bleeding from this site may be intermittent, thus stools for occult blood must be tested on several occasions. To determine the presence of carcinoma of stomach or colon, hiatus hernia, oesophageal varices, haemorrhoids and peptic ulcers which may be the cause of the chronic blood loss, the following tests are performed:-
   – Barium meal and enema
   – Gastroscopy and biopsy
   – Sigmoidoscopy
   – Colonoscopy
   – Absorption studies
   – Gastic acid studies
   – Stools are also to be examined for parasites as hookworm infestation is a common cause of blood loss.
10. Anaemia as a result of infection, renal disease, liver disease, malignancy, collagen disease, myxoedema, hypopituitarism and Addison's disease need investigations specific to their cause, including chest x-rays, urea, creatinine levels, liver function studies, T3 and T4 levels.

TREATMENT

Must be commenced following an accurate diagnosis of the cause of the anaemia.

1. Correct the cause.
2. Administration of specific haematinics as indicated. Will be able to assess need according to blood picture.
3. Treat the symptoms.

**Acute blood loss**

1. Arrest of blood loss when possible.

2. Restoration of the blood volume to normal. Immediately after blood loss there is an acute reduction of blood vlume, but little change in the haemoglobin, since the red cells and plasma are lost in exactly the same proportions as they are present in the body. However, fluid from the tissues soon enters the circulation as the blood volume becomes restored and thus there is a gradual fall in haemoglobin over the following hours.
   Circulatory failure may result owing to severe and sudden blood loss. This is restored with immediate infusion, e.g. saline solutions, Ringers lactate, and replacement of red cells by transfusion as soon as compatible blood is available. As iron is usually also lost it is advisable to give oral iron for 1-2 months following severe blood loss.

**Chronic blood loss** – is one of the commonest causes of iron deficiency. It is important to treat the cause of the blood loss and this may require surgical procedures.
Correction of the diet, and in females with menorrhagia with no obvious organic cause, hormonal therapy may be needed.
Iron therapy is given to restore the haemoglobin level and to replenish the depleted iron stores. This may be either orally or parenterally (IVI or IMI).
The **oral drug** of choice is ferrous sulphate 200mg three times a day. If gastrointestinal irritation occurs the tablets may be given with meals. Although this preparation contains a substantial amount of elemental iron and this is efficiently absorbed, it is wise to check this if response in haemoglobin levels is slow.
This iron therapy should continue for six months after anaemia has been relieved, to allow repletion of the iron stores.
An appropriate response to therapy is shown by:-
a) Increased reticulocyte count – maximum at 5-10 days.
b) Average increase of 0.2G/day after 3rd day.
c) Increase of more than 2G% of circulating Hb. during a three week period.

**Parenteral iron therapy** is indicated when:-
a) Intolerance to iron is present.
b) When a rapid iron loss is present.
c) When patient is uncooperative.
d) When there is failure of iron absorption.

The pattern of response is the same as to oral therapy.
**Intramuscular iron** – an iron-dextran complex available as "Imferon" is used. This injection must be given deeply into the muscle mass to avoid leakage into subcutaneous tissue, causing subsequent discolouration or abscess formation.
**Intravenous iron** – the same iron dextran may be administered as an intravenous infusion with a small test dose to avoid complications from hypersensitivity.
The total dose needed to replenish the iron stores is calculated according to the patient's weight and haemoglobin value. The calculated dose is then introduced into a litre of fluid. The rate of infusion is commenced at 15 drops per minute, and gradually increased if no reaction occurs.

**Side effects**

Major – Anaphylaxis. Always have necessary resuscitation equipment ready.
Minor – Nausea, vomiting, arthralgia, fever, venous thrombosis.

Occasionally iron therapy is not sufficient and blood transfusions are necessary. The amount of blood given should be only that necessary to allow a comfortable active life.
Patients with chronic anaemia are particularly prone to circulatory overload especially in the older age group. The risk can be lessened by:-

1. The use of concentrated red cells to keep the volume of the transfusion to the minimum.
2. A slow rate of administration.
3. Careful supervision of transfusion.
4. Use of oral or parenteral diuretics.

In chronic anaemia the estimated amount of blood to be transfused is an amount that will raise the haemoglobin sufficiently to allow the patient a symptom-free life, and in acute blood loss the volume transfused should reflect a conservative estimate of the actual loss.

Should any signs or symptoms of circulatory failure become present it must be treated with the standard measures:-
1. Bedrest
2. Diuretics
3. Digitalis
4. Salt restriction.

**Vitamin B12 and folate deficiency**

A. **Vitamin B12 administration**
   In pernicious anaemia vitamin B12 is administered for life.
   It is necessary to:-
   a) Correct the anaemia and to maintain a normal blood picture.
   b) Prevent or halt nervous system lesions when present.
   c) Replenish depleted tissue stores. Administer IMI

vitamin B12 1000ug/daily X1 weekly initially; thereafter as maintenance dose 1000ug every 3-4 weeks.

Response see within two to three days.

a) Symptoms improve
b) Reticulocyte count increases second to third day
c) Then increase in Hb. which usually rises to normal within five to six weeks.

B. **Supportive and Symptomatic Therapy**

a) Bedrest until the Hb level reaches 9-10g/dl.
b) If CCF present (1) diuretics, (2) digitalis, (3) salt restriction
c) Physiotherapy to improve muscular strength in patients with nervous system involvement. If paraplegia is present every effort must be made to avoid urinary tract infection and bedsores.
d) Blood transfusions only indicated if anaemia severe. Packed cells rather than whole blood is used.

**In folate deficiency** the oral administration of 5mg folic acid daily is used.

Associated deficiency such as iron and B12 may be present and will thus need replacement as previously described.

**Haemolytic anaemias** – a detailed discussion of treatment is not possible in this article. A short summary is given, as follows.

I. **Intrinsic**

a) Congenital Membrane Disorders – splenectomy is the treatment of choice in hereditary spherocytosis and severe elliptocytic haemolysis.
b) Haemoglobin Disorders – no specific treatment.
c) Metabolic Disorders – avoidance of precipitating causes with G6PD deficiency (drugs, fava beans).
d) Acquired – no specific treatment for paroxysmal nocturnal haemoglobinuria. Blood transfusions may be required. (use washed red cells) Iron deficiency should be corrected.

II. **Extrinsic**

1. Autoimmune haemolytic anaemia.
   Splenectomy
   Corticosteroids
   Other immunosuppressive therapy if the above measures fail.
   Transfusions – but compatibility problems are often experienced.
2. Non-immune – treatment specific to the cause.

Note: Folic acid is usually required as maintenance therapy in patients with haemolysis owing to secondary folate deficiency.

## SUMMARY AND CONCLUSION

The clinical aspects of anaemia are presented taking into account symptoms and the major physical signs. An approach to understanding the development of this symptom stresses the combined use of morphologic, aetiologic and kinetic classifications. A practical method is given for diagnosis and the principles of treatment briefly reviewed.

**ADDITIONAL READING**

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