UNIT 3 ANAEMIA IN PREGNANCY

Structure

3.0 OBJECTIVES

After reading this unit, you should be able to:

- define anaemia and grade for degrees of anaemia;
- describe the various causes of anaemia;
- diagnose various types of anaemia clinically and investigate for the cause and type of anaemia;
- describe the effects of anaemia on the mother, foetus and newborn;
- provide prophylaxis against anaemia to pregnant and lactating women;
- prescribe treatment for anaemia and provide emergency treatment for CCF due to anaemia; and
- describe the national programmes of Government of India for prevention and control of anaemia during pregnancy.

3.1 INTRODUCTION

In the year 2002, the WHO day was observed as “World Anaemia Day”. In our country, anaemia during pregnancy is one of the major causes of maternal mortality and morbidity. FOGSI-WHO study on maternal deaths showed that 64.4% of women had Hb less than 8 gm% and 21.6% who died had Hb less than 5 gms%. Anaemia was the direct cause of death in 10-15% cases but was an associated cause in many maternal deaths due to haemorrhage,

sepsis and cardiac failure. Pregnancy anaemia is a major public health problem in many other developing countries. Many women start their pregnancy in an anaemic state. NFHS-2 (1998-99) has shown anaemia in 54% of rural women and 46% of urban women in childbearing age.

Anaemia during pregnancy is associated with adverse obstetric outcome such as preterm labour, low birth of newborn, IUGR and predisposes to infection. You can well appreciate inspite of RCH programme under which all pregnant women are provided iron prophylaxis, and where anaemia present treatment doses are given, anaemia is still a common problem. In this unit, you will be reading about the causes of anaemia, investigation for causes, degree and type of anaemia and treatment of anaemia.

3.2 DEFINITION, DEGREES AND PREVALENCE OF ANAEMIA OF PREGNANCY

Definition

As per WHO, "Anaemia in Pregnancy" is defined as the condition when the haemoglobin concentration of a pregnant woman is less than 110 g/l i.e. 11g%.

Haemoglobin level varies in childhood and adult, men and women and in women during non-pregnant and pregnant stage. Table 3.1 shows the level of haemoglobin below which anaemia is judged to be present in each group/age/physiologic status.

Table 3.1: Diagnosis of anaemia in relation to level of haemoglobin in various stages of life

Group/Age/Physiologic Status	Haemoglobin (g/dl)
Children (6 months – 5 years)	11.0
Children (5 years – 11 years)	11.5
Children (12 years – 13 years)	12.0
Non pregnant women	12.0
Pregnant women	11.0
Men	13.0

Source: WHO/UNICEF/UNU (1996)

As per WHO, anaemias can be divided into three degrees as shown in Table 3.2.

Table 3.2: Degree of Anaemia

Degree of Anaemia	Haemoglobin (Hb) (g/100 ml)	Haematocrit (PCV) (%)
moderate	7-10.9	24-37
severe	4.0-6.9	13-23
very severe	< 4.0	< 13

Reference: WHO Report Consultation on control of Anaemia in pregnancy, Congo, 1989.

Anaemia is a major public health problem. Being a medical person, you must know the prevalence of Anaemia in your community, in non pregnant women and in pregnant women.

In India alone, prevalence of anaemia among pregnant women, shown by ICMR was as high as 88%

The prevalence of Iron Deficiency (ID), which precedes Iron Deficiency Anaemia (IDA) is much higher.

3.2 CLASSIFICATION OF ANAEMIAS

Anaemia during pregnancy may be physiological or/and pathological.

Physiological Anaemia during pregnancy

Physiological anaemia of pregnancy is due to disproportionate increase in plasma volume with respect to the red cell mass. Process is known as physiological haemodilution. This process mainly occurs in the second and third trimester. As a result there is fall in haemoglobin concentration. It is not pathologic but it could aggravate any anaemia present in woman. Physiological anaemia has no untoward consequences on mother or fetus.

Pathological Anaemia during pregnancy:

A) **Clinical classification**:

1) Iron deficiency anaemia
2) Megaloblastic anaemia
3) Haemolytic anaemia
4) Secondary anaemia due to
   - Repeated bleeding
   - Chronic infection
   - Hodgkin's disease
5) Aplastic varities of anaemia

B) **Common Etiological Classification**

One common etiological classification of anaemias identifies 3 main causative groups of anaemia:

1) Nutritional
2) Marrow disease
3) Haemolytic

Nutritional anaemias are the most common type of anaemia worldwide. Mainly they are due to iron, folate and B12 deficiencies. Iron Deficiency anaemia itself is caused by insufficient dietary intake of iron, chronic gastro-intestinal tract bleeding especially from hookworm infestation, mal absorption conditions and infection. In India, you will find three common etiology i.e. iron deficiency, hookworm infestation and malaria.

Check Your Progress 1

1) Define anaemia of pregnancy.

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2) Which test helps to detect anaemia?

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3) Write down degrees of anaemia.

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4) Write down three common causes of anaemia in India.

i) .....

ii) .....

iii) .....

3.4 NUTRITIONAL ANAEMIA

3.4.1 What is Nutritional Anaemia?

WHO has defined Nutritional Anaemia as follows:

Nutritional Anaemia is a condition in which the haemoglobin content of the blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency.

Haemoglobin is the red pigment present in solution in the red corpuscles of the blood. Its primary function is to transport oxygen to all parts of the body. Iron, folic acid, other vitamins and trace elements are all required for the formation of haemoglobin. These substances are ingested from food. We can call them haemopoetic factors. Deficiency of these haemopoetic factors, e.g. iron, folic acid, vitamin B12 can lead to nutritional anaemia.

Green vegetables, cereals, and meat contain iron. The process of formation of haemoglobin takes place in the bone marrow. Iron ingested and daily absorbed from the small intestines is not needed immediately. Excess of iron is stored in the bone marrow. During the need, it is used to increase the rate of formation of haemoglobin to satisfy increased bodily demand e.g. pregnancy.

Severe nutrient deficiency of one or more haemopoetic factors, more commonly iron, less commonly folate or vitamin B12 can result in anaemia. Because, haemoglobin content of blood is more easily detected, rather than deficiency of individual haemopoetic factor, usually, anaemia is diagnosed by haemoglobin concentration. But it is an insensitive index of milder degree of nutrient depletion. By the time an individual becomes anaemic (low haemoglobin value), she is already suffering from a marked degree of nutrient deficiency.

Usually nutritional anaemia is a result of an imbalance between intake, absorption and body's need of different nutrient factors. Such imbalance can occur in following ways:

1) By low nutrient intake

   Low intake may be due to lack of knowledge, diet habits, poverty, and non-availability.

2) By poor absorption or utilization

   Nutrient absorbed by the body depends on amount ingested, in form it is ingested and factors enhancing or inhibiting absorption.

3) By increased nutrient losses and/or demands

   Increased losses or increased demands depend on various physiological and pathological conditions.

3.4.2 Iron Deficiency Anaemia

1) **Iron Metabolism**

In this section, iron absorption, iron loss, iron balance and iron requirement during pregnancy is described.

Dietary Iron

There are two types of dietary iron, Haem iron & Non Haem Iron. Haem iron is found in foods of animal origin, e.g. meat, fish, poultry. Its bioavailability is high with absorption being 20 to 30 %. Non-haem iron is found in foods of plant origin like green leafy vegetables whole grain cereals, tubers, and pulses. Its bio-availability is lower and is determined by presence of enhancing and inhibiting factors consumed in the same meal.

Iron Absorption

Enhancers of non-haem iron absorption include meat, poultry, fish, vitamin C (Ascorbic acid). So meat, poultry, fish are of double value. They provide a rich source of bioavailable iron i.e. haem iron and also enhance absorption of non-haem iron contained in rest of the meal. For vegetarians, vitamin C is the most important enhancer for iron absorption.

Inhibitors are phylates, polyphenols (which include tannins), calcium etc. Phylates are present in wheat and other cereals. Tannins are present in tea and coffee. Other polyphenols are found in nuts and pulses. Adding Vitamin C to a meal can counteract inhibitory effects of phylates and polyphenols.

From total quantity of iron available in the food, only $1/10^{th}$ is absorbed. For daily need of haemoglobin formation 95% iron is available from breakdown of RBCs, deficiency is filled up by iron from diet.

First of all food iron present in complex form gets converted into simpler compounds. To begin with colloidal ferric compounds get converted in to monomolecular ferric irons and then acid pH of stomach converts it into ferrous form. Iron gets absorbed only in ferrous form.

Though iron gets absorbed throughout gut, mainly it gets absorbed from the duodenum. The absorption of iron through mucosa of intestine is well controlled as per need of iron by body.

Iron Loss

Iron loss may be physiological e.g. basal loss, menstruation, and childbirth. It may be pathological e.g. intestinal helminthes (Hook worm), gut disease.

Iron Balance

Iron balance is determined by the body's iron stores, iron absorption and iron loss.

In body, one-third iron remains as storage iron and two third as functioning iron. Functioning iron is found mostly in haemoglobin within circulating RBCs, and some as myoglobin in muscle cells and some in iron containing enzymes. Storage iron is in forms of ferritin and haemosiderin, and stored in reticuloendothelial system. Storage iron serves as a deposit and to be mobilized when needed.

Compared to adult male, non-pregnant woman has lower iron due to menstrual loss. Pregnant woman has also lower iron status because of requirements for fetus and maternal tissue development. Since requirement for the foetus is greatest during third trimester, anaemia become evident or aggravated during this period.

Human body contains total 3.0 grams (3000 mg.) of iron. Out of this 2.0 grams (2000 mg) are in haemoglobin, 0.5 grams (500 mg) in liver, spleen and bone marrow as reserve store (mobile iron) and available for haemopoesis, and 0.5 grams (500 mg) distributed in body tissues for cellular respiration as parenchymal iron (fixed iron).

2) **Iron Requirement**

Iron requirement varies from childhood to adulthood, men to women and in women during non-pregnant and pregnant stage as shown in Table 3.3.

Table 3.3: Iron Requirement During Various Stages of Life

Stages of Life	Iron Requirement per day
Children	0.5 mg per Kg.
Adult Male	5-10 mg
Women (Up to menopausal age)	15.0 mg
Pregnant & Lactating Women	20.0 mg

Iron requirement also increases during infection due to

- Reduced absorption in the gut
- Diminished plasma iron
- Diminished capacity for synthesis

During pregnancy there is increased iron requirement due to demands of the fetus and increase in blood volume in last two trimesters.

Total iron requirement during whole pregnancy is about 1000 mg.

300 mg. actively transferred to the fetus and placenta

200 mg. lost through various normal routes of excretion

500 mg. average increase in the total volume of circulating erythrocytes of about 450 ml.

Requirement during first trimester are relatively small (0.8 mg/ day). During second and third trimester requirement is high (6.3mg/day). In later months of pregnancy demand of iron by fetus is heavy because for all these purposes the iron is utilized during the latter half of pregnancy. So iron requirements are large during the second half of pregnancy. After delivery and during lactation, again requirement is less (1.5 mg/day).

3) **Iron deficiency**

There are three stages in reduction of body iron. You must understand these three stages of reduction in body iron.

***Stage I*: Stage of Iron depletion**

Depleted iron stores but no effect on erythropoesis and haemoglobin (Mild iron deficiency). This is also known as tissue depletion of iron without anaemia or latent iron deficiency. In this stage, the saturation of total iron binding capacity is below 16%, there is no stainable iron in bone marrow. Erythropoesis and Hb are normal. Many women start pregnancy in this stage and deteriorate as pregnancy advances.

***Stage II*: Stage of iron deficient erythropoesis**

When iron storage is depleted and iron absorption is insufficient to counteract the amount lost from the body through faeces, desquamated mucosal and skin cells, and menstrual blood loss, erythropoesis gets affected and shows beginning of changes of hypochromia and microcytosis (moderate iron deficiency). Depletion of iron stores (SF, SI, TS) results in fall in haemoglobin and hypochromia..

***Stage III*: Stage of Iron deficiency anaemia**

When there is severe degree of iron deficiency, further fall in haemoglobin and microcytosis of red blood cells, stage is known as iron deficiency anaemia.(IDA).

3.4.3 Folate Deficiency Anaemia

Folates are water-soluble vitamins. They are heat labile and light sensitive. They are essential for red cell maturation. Folate deficiency is characterized by unusually large red blood cells. Such anaemia is known as Megaloblastic anaemia or macrocytic anaemia.

Folates are present in all foods. They are present more plentiful in liver, dark green vegetable leaves, yams, sweet potatoes, egg yolk, fish, pulses, nuts, fruits like banana, mangoes. Maize, rice, millets are poor sources of folates. Folate deficiency can be due to:

a) Folate deficient diet

b) Malabsorption following systemic infections or tropical sprue

c) High demand for folate during pregnancy and lactation

As folates are heat labile, prolonged cooking and repeated heating can destroy folates from food. Folate deficient diet can make an individual folate depleted. When absorbed, folate does not meet requirements over time, it may lead to anaemia. Pregnancy and lactation exert a particularly high demand for folate. Tissue folate stores may be depleted in up to one-third of pregnant women. Folate requirement is also increased by disease process associated with haemolysis such as Malaria, Sickle cell disease. Normal nonpregnant woman's daily folate requirement is from 50 to 100µg. During pregnancy the requirement s for metabolically active forms of folic acid are increased.

3.4.4 Vitamin B_{12} Deficiency (Addisonian Pernicious Anaemia)

Megaloblastic anaemia can also be a result of lack of vitamin B12. It is rare. There is a failure to absorb B_{12} due to lack of intrinsic factor.

Both folic acid and vitamin B_{12} have important roles in the formation of nucleic acid. Deficiencies of both result in abnormal nucleoprotein synthesis. Many of the body cells and particularly the cells of the bone marrow are unable to form new cells at the usual rate. Defect in nucleic acid formation is responsible for the inhibition of normoblastic erythropoesis. Consequently they grow large. These are seen as megaloblasts, macrocytes, metamyelocytes and megakaryocytes.

Deficiency of both iron and folic acid results in dimorphic anaemic. There are macrocytes as well as hypochromia due to less Hb. This type of anaemia indicates nutritional deficiency to a severe degree.

3.5 ANAEMIA DUE TO PARASITIC INFESTATION

Malaria in Pregnancy and Anaemia we will discuse two important conditions i.e.anaemia due to malaria parasite and interstinal parasites.

During malaria, the haemoglobin of the infected erythrocytes is consumed and degraded by the growing malarial parasites. The red cell membrane becomes sticky due to an adhesive protein. This phenomenon of cyto-adherence and resetting is significant to P. Falciparum infection. This results in sequestration of red cells in vital organs that interferes with the microcirculation and metabolism. Immunity is impaired during second and third trimester of pregnancy. Complications involve both the mother and the fetus. Maternal morbidity and mortality are directly related to the degree of vital organs dysfunction and the proportion of infected erythrocytes. Mortality rises significantly when 3% or more erythrocytes are infected. With P. Falciparum malaria, placental parasitaemia, is common (20-60%). Congenital malaria occurs in less than 5% of newborns.

Worm Infestation

Hookworm infestations can contribute to anaemia. Hookworms cause intestinal blood loss by feeding on blood through the intestinal mucosa. It results in chronic fecal blood loss.

3.6 ANAEMIA DUE TO HAEMOGLOBINOPATHIES

Three commonly seen sickle cell haemoglobinopathies are

1) Sickle cell anaemia (SS disease)

2) Sickle cell – Haemoglobin C disease (SC disease)

3) Sickle cell - β- thalassemia disease (S-thalassemia disease)

Presence of such diseases is found in certain areas and in some populations.

These diseases are due to inheritance of the gene for production of respective types of haemoglobin from each parent. Maternal morbidity and mortality, abortion and perinatal mortality are high in these diseases. Pregnancy is a serious burden to a woman with SS disease. In this disease, anaemia often becomes more intense and there are attacks of pains (Pain crisis). Frequency of pain crisis increases. Also there are chances of developing infections and pulmonary dysfunctions. Large number of pregnancy gets aborted or results in stillbirth or neonatal death.

Other types of haemoglobinopathies are:

1) Sickle cell trait

2) Haemoglobin C, C-Thalassemia disease and C-trait

3) Haemoglobin E

Check Your Progress 2

1) Fill in the blanks:

   a) Total iron requirement during pregnancy is ..... .

   b) Pregnant woman needs iron for..... , ... , and ..... .

   c) Pregnant woman needs more iron during ..... trimester.

   d) Dose of iron in iron deficiency anaemia depends on.....of .....

2) Write down difference between iron deficiency (ID) and iron deficiency anaemia (IDA).

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3) Enumerate enhancers and inhibitors of iron absorption.

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4) Mark the sentences as true or false:

   a) Deficiency of iron decreases the size of red blood cells. (True/ False)

   b) Deficiency of iron increases the size of red blood cells. (True/ False)

   c) Deficiency of folates decreases the size of red blood cells. (True/ False)

d) Deficiency of folates increases the size of red blood cells. (True/ False)

e) From duodenum, iron gets absorbed in ferrous form. (True / False)

3.7 CONCEQUENCSES OF ANAEMIA

Anaemia is associated with adverse obstetric consequences which depend on:

– rapidity of fall of Hb

– severity of anaemia

– presence of other obstetric/systemic problems

Factors responsible for adverse obstetric outcome include:

i) direct effect of anaemia

ii) indirect effect due to risk factors in anaemic women

iii) immnosuppression leading to morbidity due to infections

iv) cereal and pulse based habitual diet

v) poverty, ignorance and inaccessibility of available health services.

Stages of Anaemia

The three distinct stages of anaemia are:

i) Compensated (adapted to low Hb levels) — She may go through pregnancy and labour without consequences.

ii) Decompensated (moderate anaemia) — She cannot do household work, cannot look after children and unable to work outside home.

iii) Associated with circulatory failure (severe anaemia) — She has palpitation at rest, compensatory mechanism inadequate to deal with low Hb, lack of oxygen leading to cardiac failure and if untreated to pulmonary oedema and death.

Consequences of anaemia for mother

Anaemic mother face high morbidity and mortality compared to nonanaenic mothers. This is because:

1) She is more susceptible to develop infection due to fall in T and B cells count if Hb levels fall below 8.0 G. Sepsis is an important cause for morbidity and mortality.

2) She is not in a position to tolerate blood loss of APH and PPH. She goes into shock easily and face all complications of haemorrhagic shock.

3) Fall in oxygen carrying capacity due to anaemia affects tissue perfusion of vital organs like heart, brain, kidney, liver, lungs etc. Hypoxic heart muscle for long time leads to anerobic metabolism and lactic acid accumulation. Heart muscles succumb resulting into cardiac failure and death.

4) Anaemic woman is at poor anaesthetic risk, if needed.

5) Anaemic woman can go for preterm delivery.

6) For pregnant women, anaemia can result in severe morbidity and reduces the resistance to blood loss with the result that death may result from the blood loss associated with normal delivery.

Consequences of anaemia for fetus

Anaemia is directly related to risk of

1) Preterm delivery
2) Inadequate gestational weight gain
3) Intra uterine growth retardation.
4) Low Birth weight
5) High perinatal morbidity and mortality

Folate deficiency in mother can lead to anaemia and increased susceptibility to infections in mother. In fetus it can lead to neural tube defect. Also it can lead to delayed growth in early childhood and adolescent and delayed sexual development.

3.8 DIAGNOSIS AND ASSESSMENT OF ANAEMIA IN PREGNANCY

The diagnosis of anaemia is not difficult. Anaemia can affect psychological and physical behavior. Even very mild forms influence the sense of well being, lessen resistance to fatigue, aggravate other disorders and affect work capacity. Anaemic pregnant woman complains of easy fatigue. Clinically pallor is visible in skin, tongue, conjunctiva and nails.

Confirmation of anaemia is easy as the level of Haemoglobin will give the diagnosis. But this is not enough. For correct management of anaemia it is important to detect:

- Anaemia
- Severity of anaemia
- Etiology of anaemia
- Type of anaemia

Minimum essential tests are:

I) Measuring Hb concentration (at least 3 times during pregnancy at 1st visit, 28-30 weeks and 34-36 weeks)

- Haematocrit / Packed cell Volume (HCT / PCV) wherever possible

II) Peripheral Smear

By peripheral smear examination of blood, you can know the cause of anaemia. This tests is available to you at the PHC. You find:

i) Iron deficiency anaemia—Hypochromic microcytic red cells with anisocytosis and poikilocytosis

ii) Folate deficiency—Macrocytic cells

iii) Both Iron and Folic Acid deficiency—Dimorphic cells (Macrocytic and hypochromic)

iv) Haemolytic—target cells, sickle cells, reticueocytes

v) Malaria—Parasites

vi) Leukaemia—abnormal cells

vii) Infection—multilobed polymorphs, toxic granules

III) Stool for ova, cysts and occult blood

IV) Urine microscopic examination for pus cells, RBCs and casts

Screening tests for anaemia are described below:

a) **Clinical Screening for Anaemia (Noninvasive and Qualitative)**

- Paleness of conjunctiva
- Paleness of tongue
- Paleness of skin
- Paleness of nail beds

Non-invasive instruments (Colour cards) are available to compare pallor of conjunctiva, tongue. Clinical screening and colour card comparison have low sensitivity (38% and 24%) but reasonable specificity (90% and 68%). Colour card test can be taught to paramedical workers also to screen pregnant women looked after by them and will help them to decide dose of iron tablets or refer to higher level.

b) **The Tallqvist Technique (Invasive method)**

It is simplest and cheapest to use. It is based on direct visualization of a drop of blood on a filter paper against a standard scale of colours equivalent to Hb concentrations ranging from 30 % to 100 %. Test is to be done in daylight, and interpreted after the blood sample on filter paper has dried up.

This method is in use by some ANMs in villages of India.

c) **Hb Concentration by Any Specific Acceptable Method**

i) ***Tests for Assessing Degree of Anaemia***

1) **Haemoglobin Assessment** with Haemoglobinometer (Digital), Haemoglobinometer (Comparators), or with Dilution Techniques.

2) **Haematocrit / PCV**

It is a simple test and can be done at site or sample collected in heparinised capillary tubes for later estimation. It requires haematocrite centrifuge and source of electricity.

These two tests help us to know the degree of anaemia.

Following laboratory measures help us to know etiology of anaemia.

ii) ***Tests to Know Etiology of Anaemia***

1) **Measures for Iron Deficiency:**

- Serum iron (SI)
- Serum ferritin (SF)
- Iron binding capacity (IBC)
- Transferrin saturation (TS)
- Bone marrow aspiration for the presence of stainable iron.

Serum Ferritin is the most specific biochemical test indicating total iron body stores. It is more reliable in first trimester of pregnancy but becomes less reliable after 20^{th} week of pregnancy due to physiological dilution of the plasma leading to concurrent fall in Haemoglobin and serum ferritin. Inspite of this effect of physiological changes, if SF concentration is below 15µg/l, it indicates iron deficiency in all stages of pregnancy.

Further, there is also general acceptance that it would be better to use at least 1 or 2 other indicators to access iron deficiency (ID). Suggested ones are transferrin saturation < 16%, Erythrocyte protoporphyrin >70 µg/dl RBC.

You should also advise other related investigations as shown below if possible:

- **P.C.V. (Packed red cell volume):** Number of cubic centimeters of packed red cells per 100 ml. of blood
- **M.C.V. (Mean corpuscular volume):** Average volume of one red cell in cubic microns M.C.V.=P.C.V. ÷ T.R.B.C.
- **M.C.H. (Mean corpuscular haemoglobin):** Average haemoglobin content of one red cell in pieogrammes. It is measured in weight

  M.C.H.= Hb. in G. ÷T. R.B.C.
- **M.C.H.C. (Mean corpuscular haemoglobin concentration):** Mean or average haemoglobin concentration in percentage per unit volume of cells.

  M.C.H.C. = Hb in gm. ÷P.C.V.

In most types of anaemia, increase or decrease in MCV , are associated with increase or decrease in MCH. Ratio of these to one another is indicated by MCHC.

In IDA, (Hypochromic, microcytic), there is marked reduction in red cell volume and reduction in Hb, compared to number of red cells. As a result, MCHC is reduced.

In megaloblastic anaemia, (macrocytic), red cells are increased in volume, MCH is proportionately increased. Increase in size and haemoglobin content of red cell are roughly inversely proportional to the number of red cells. MCHC remains fairly normal or slightly reduced.

In normocytic anaemia, number of red cells is reduced without any or at most a slight increase in MCV, and the MCH and MCHC are normal through out.

Normal Values

R.B.C.: 5 millions/c.mxm.

Hb. : 14.8gm../100 ml.

Reticulocytes 0.2 per cent

P.C.V. (Haematocrit) 39-42 per cent

M.C.V. 78-94 c μ

M.C.H. 27-32π g.

M.C.H.C. 30 % (28 to 34 %)

(Note: For normocytic, normochromic red cells, the haematocrit is almost three times the haemoglobin concentration.)

2) **Tests for Folate Deficiency**

Folate deficiency causes macrocytosis of the red blood cells and hyper segmentation of neutrophils. Investigations required to confirm folate deficiency are:

- Thin blood film
- Bone marrow aspiration
- Serum Folate level
- Red cell folate level

Combined iron and folate deficiency

This can mask the typical changes of either deficiency on thin blood film, through double population of hypochromic/microcytic and macrocytic cells may be seen.

Note that if you have limited laboratory facilities, most useful and simplest diagnostic tool is to examine thin blood film under microscope.

3) **Tests for Malaria and Worm Infestation**

A: Peripheral blood smear:

Demonstrating parasites in Giemsa stained thick and thin blood films can diagnose malaria. Thick films have many cells and hence suited for rapid diagnosis of parasitaemias, which cannot be seen in thin film. Thin films are useful for studying the details of the parasites and species of parasite. If you are suspecting malaria and initial films are negative, take fresh samples of blood at six-hour interval and examine for three consecutive days.

B: Stool for ova, cyst, occult blood:

This will help us to know hook worm infestation as etiology of anaemia.

4) **Tests for Sickle Cell Disease:**

A: Thin blood film will detect sickle cells, target cells and reticulocytes.

B: Haemoglobin electrophoresis will determine the type of haemoglobin present.

3.9 TREATMENT

This section deals with treatment of anaemia.

3.9.1 Treatment of Nutritional Deficiency Anaemia

Prophylaxis Treatment

Prophylaxis treatment of iron deficiency anaemia is for adolescent girls, non-pregnant women and all pregnant women having normal haemoglobin value.

Adolescent Girls

i) Encourage screening for anaemia through school health checkup or as family physician

ii) Counseling for getting ready for future safe motherhood by guiding for good diet, correction of anaemia in adolescent period, age of marriage, age of first pregnancy, interval between two pregnancies, and correct use of available family planning measures.

iii) Guidance to parents of adolescent girls

iv) Provision of iron tablet (100 mg.) once a week.

Non Pregnant Woman

i) Dietary advice and counseling

ii) Provide iron tablets if anaemic

Pregnant Mothers

i) Screen them for haemoglobin value on first visit

ii) provide her one tablet of iron of 100 mg. daily

iii) Dietary advice and counseling

Therapeutic Treatment

1) ***Dietary Modification***

- Through Counseling: Though important it is difficult to follow due to limited purchasing power and long established dietary habits. At least one can suggest modification from locally available foods, and removing wrong beliefs about certain food by counseling. This will help to modify diet. Also one can ask to consume more food for more energy.
- Enhancing the bioavailability of ingested iron by promoting iron absorption enhancers like meat, vitamin C and avoiding tea and coffee with iron reach food.
- Advice for correct cooking habits to avoid destruction of vitamin C and folic acid.
- Advice to take pulses and vegetables with vitamin C

2) **Treatment of Iron Deficiency Anaemia**

a) Iron Therapy

Objectives of the treatment of iron deficiency anaemia are

1) Correction of the severe deficit in haemoglobin mass

2) Restitution of iron stores.

Both these objectives can be achieved by oral or parenteral iron administration.

Choosing of route will depend upon the time available before delivery and tolerance of iron by oral route.

Oral Iron

Oral preparations are preferred, if she is explained and understood the importance of regular medication and follows it. Because of the problem of compliance with regular oral iron supplementation, parenteral iron therapy may be considered. It guarantees that pregnant mother has received the iron.

For oral administration iron compounds preferred are ferrous compounds (Ferrous sulphate, fumerate or gluconate). Dosage depends on the degree of anaemia. National anaemia control programme in India has recommended need for 100 mg of elemental iron daily, as prophylaxis treatment to all pregnant women without fall of Hb. Those having moderate anemia should take 100 mg of iron twice daily and severe degree cases should take 100mg of elemental iron three times a day. To replenish iron stores, oral therapy should be continued for three months or so after the anaemia has been corrected.

Table 3.4 will help you to select the iron compound for percentage of iron element and availability of iron from the compound.

Table 3.4: Proportion of iron absorbed orally for various ferrous salts

Ferrous salt	Unit dose	% of iron element	Total available iron
Ferrous Fumerate	200 mg	33 %	66 mg
Ferrous Gluconate	300 mg	12 %	36 mg
Hydrated Ferrous Sulphate	300 mg	20 %	60 mg
Exsiccated ferrous Sulphate	200 mg	30 %	60 mg
Anhydrous ferrous sulphate	200 mg	37 %	74 mg

Pitfalls of oral iron therapy are:

- No absolute way of knowing patient's compliance, except frequent Hb %, PCV and serum ferritin level
- Gastrointestinal tract irritation (epigastric discomfort, nausea, vomiting, constipation, diarrhoea)

Parenteral Iron

Major benefit of parenteral iron therapy is rapid and complete correction of iron deficiency., including replacement of the iron stores. Parenteral therapy can be given as a series of intramuscular injections or a single dose as an intravenous infusion (Total dose Infusion of Iron – TDI). Method of calculation of total iron dose for parenteral therapy is by the following formula:

$0.3 \times$ wt in lbs $\times$ % Hb deficit. Add 500 mg. for iron storage

Test dose is given before starting parental iron therapy.

Severe iron deficiency in late pregnancy is one of the good indication for injectable iron. It may decrease the need of blood transfusion for severe anaemia prior to delivery or in postnatal period.

Parenteral preparations of iron have shown adverse and some times severe reactions. Intramuscular iron injections may be painful and associated with staining of the skin, fever and arthralgia. TDI has been associated with severe anaphylactic reactions especially in those with a history of allergy. This can be taken care by premedicating client with an antihistamine, slow infusion for first 10 minutes and monitoring and not giving intravenous iron to clients with allergic history. Local thrombophlebitic reactions can be decreased by using normal saline as the diluents and by not putting more than 30ml. of iron dextran in one liter of solution.

Preparations available for parenteral iron therapy are Iron Dextran complex (Imferon)and iron sorbitol. (Jectofer). Iron Dextran gives local irritation at the site of an injection and sarcoma has been noticed at the site of injections in the rat. Iron sorbitol is available in 2ml. ampoule, having 100 mg. elemental iron. Drug is well tolerated. Dosage duration is to be calculated as is available in 2ml. ampoule, having 100 mg. elemental iron. 100mg is given Im daily till total calculated dose is injected.

Response to Therapy

Response to therapy is first seen in reticulocyte count. It begins to rise in 3 days and reaches a maximum in 7-12 days. Rise in Hb is seen in 2-3 weeks and the patient starts feeling better. Hb rise up 0.8 – 1g % per week. In 8 – 10 weeks, Hb level reaches the normal level of 11 g%.

If the woman is not responding to iron therapy (inspite of good compliance), investigate for thalassemia minor (foetal Hb i.e. HbA_2).

B. Folic acid It should be given along with iron as a safeguard against folate deficiency. 5 mg folic acid tablets are given daily. It may be given as 30 mg I/m injection for 3 days followed by oral tablets in macrocytic/dimorphic anaemia.

3.9.2 Treatment of Intestinal Helminthes Treatment Aneamina due to Parasitic Infertation

Where hookworms are prevalent, hookworm control is a feasible and essential component of anaemia control.

Albendazole is more effective than mebendazole. Dewormimg should be carried out among pregnant women after first trimester when there is no risk of teratogenecity.

3.9.3 Treatment of Malaria

Chemoprophylaxis has shown to abolish parasitaemias and prevent anaemia. It also reduces the risk of megaloblastic anaemia resulting from the increased folate requirements with malaria induced haemolysis. You will be reading more about in unit 4.

3.9.4 Treatment of CCF Treatment of complications

CCF is one of the important condition responsible for maternal death. On an average it can kill mother in two hours. Intravenous injection of lasix, oxygen and sitting position will help a lot before you refer pregnant woman to referral hospital. One should take care, not to overload her cardio vascular system.

Sickle Cell Disease and Haemoglobinopathies

It is better to refer such cases to tertiary level hospitals. Pain of crisis can be treated by

Hydration, oxygenation and narcotic analgesics. Prompt diagnosis and treatment of infection is important. Acidosis should be avoided during labour.

3.9.5 Efforts by Government of India to Control Anaemia

National Nutrition Anaemia Control Programme (NNACP)

National natritimal Anamia paragramme (NNAPP) which was exsitent form 1970, was renamed as NNACP

in 1990. In NNACP beneficiary groups were redefined to include both anaemic as well non-anaemic pregnant and lactating mothers and children 1 to 5 years old for iron folic supplementation. Highest priority was given to “Universal Coverage of pregnant women”. Iron tablet dose was revised from 60mg. to 100 mg. per tablet.

Reproductive and Child Health (RCH) Programme

On 15th October 1997, was launched nationwide RCH programme wherein nutritional anaemia control was further prioritized.

- Beneficiary group include both anaemic and non anaemic pregnan and lactating mothers and children 1-5 years for iron folic acid suplementation. Iron dose was revised to 100 mg. per tablet. Anaemic woman are given 2 tablets (200 mg/day)
- Nutrition education to promote consumption of iron rich food
- Establishment of
    - i) An appropriate system for calculating quantity of IFA tablets required and ensuring adequate supply of tablets
    - ii) Streamlining of logistics.
    - iii) Improving training of health and ICDS functionaries
    - iv) Increase in community awareness
    - v) Effective monitoring and reporting system

Specific Recommendations in Ninth Five Year Plan (1997-2002)

The planning commission has made following specific recommendations for the prevention and control of anaemia in pregnant women in the ninth five year plan (1997-2002).

- Fortification of common foods with iron to increase dietary intake of iron and improve Hb status of entire population including girls and women prior to pregnancy.
- Screening of pregnant women using reliable method of haemoglobin estimation for detection of anaemia.

- Oral iron folate prophylactic iron therapy for a non anemic pregnant woman (Hb > 11g/dl)
- Iron folate oral medication of maximum tolerable dose throughout pregnancy for women with Hb between 8 and 11g/dl.
- Parenteral iron therapy for women with Hb between 5 and 8 g/dl, if they do not have any obstetric or systemic complication.
- Hospital admission and intensive personalized care for women with Hb < 5 g/dl.
- Screening and effective management of obstetric and systemic problems in all anaemic pregnant women.
- Improvement in health care delivery system and health education to the community to promote utilization of available facilities for antenatal, intrapartum and postnatal care.

Check Your Progress 3

1) What are the consequences of iron deficiency anaemia on mother during pregnancy, labour and puerperium ?

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2) What are the effects of iron deficiency anaemia on fetus.

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3) Write down the drug, timing and dosage of de worming treatment.

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4) Fill in the blanks:

a) Iron therapy should be continued for..... months after haemoglobin comes to normal value.

b) Drug ..... is life saving in the treatment of CCF resulting due to anaemia. It should be given by ..... route preferably.

c) Beneficial effect of oral iron therapy can be judged by repeating ..... after ..... months.

3.11 LET US SUM UP

In this chapter you are made aware of Anaemia of pregnancy, it's magnitude and it's role in maternal morbidity, mortality and perinatal morbidity and mortality. Also it is made clear that though anaemia is diagnosed by haemoglobin estimation, it does not throw light on underlying etiology. Various degrees, types of classifications and prevalence of anaemia

are included to understand the condition. Iron metabolism, iron requirement, haemopoesis are included to understand iron deficiency and it's effect. Various investigations and their interpretations are given to find out underlying etiology and provide better management. Treatment is also discussed according to etiology and during emergency. At the end, different efforts made till 2002, by GOI to control this public health hazard are mentioned to convince you it's magnitude, severity and to inspire you to play important role to prevent, and control it.

3.12 KEY WORDS

FOGSI	**:**	Federation of Obstetrics and Gynaecology Societies of India
GOI	**:**	Government of India
G/dl	**:**	Gram per deciliter
Hb	**:**	Haemoglobin
IBC	**:**	Iron Binding Capacity
ICMR	**:**	Indian Council of Medical Research
ID	**:**	Iron Deficiency
IDA	**:**	Iron Deficiency Anaemia
IFA	**:**	Iron Folic Acid
IUD	**:**	Intra Uterine Device
IUGR	**:**	Intra Uterine Growth Retardation.
MOHFW	**:**	Ministry of Health and Family Welfare
NHFS	**:**	National Family Health Survey
NNACP	**:**	National Nutritional Anaemia Control Programme
NNAPP	**:**	National Nutritional Anaemia Prophylaxis Programme
RBC	**:**	Red Blood Cell
SEA	**:**	South East Asia
SF	**:**	Serum Ferritin
SI	**:**	Serum Iron
TDI	**:**	Total Dose Infusion
TRBC	**:**	Total Red Blord Cells
TS	**:**	Transferrin Saturation
UNICEF	**:**	United Nations Children's Fund
UNU	**:**	United Nations University
WHO	**:**	World Health Organisation

3.13 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) As per WHO, "Anaemia in Pregnancy" means haemoglobin concentration of less than 11gm %.

2) Blood for Haemoglobin

3) Write down degrees of anaemia.

Degree of Anaemia	Haemoglobin (Hb) (g/l)	Haematocrit (PCV) (%)
Moderate	7-10.9	24-37
Severe	4-6.9	13-23
Very severe	< 4	< 13

4) i) Nutritional Deficiency Anaemia (Iron Deficiency Anaemia)

ii) Malaria

iii) Hookworm Infestation

Check Your Progress 2

1) a) 1000mg

b) fetus, placente; increase in red cell mass

c) second & third

d) level; harmoglobin

2) **Iron deficiency:** Depleted iron stores but no effect on erythropoesis and haemoglobin (Mild iron deficiency). In this stage, the saturation of total iron binding capacity is below 16%, there is no stainable iron in bone marrow. Erythropoesis and Hb are normal.

Iron deficiency anaemia: When there is severe degree of iron deficiency it results into fall in haemoglobin and microcytosis of red blood cells. This is known as iron deficiency anaemia.(IDA).

3) Enhancers of non haem iron absorption: Meat, Poultry, Fish, Vitamin C (Ascorbic acid). Inhibitors: Phytates, Polythenols (which include tannins), Calcium etc.

4) a) (True)

b) (False)

c) (False)

d) (True)

e) (True)

High morbidity and mortality compared to nonanaemic mothers due to:

- more susceptible to develop infection due to fall in T and B cells count if Hb levels fall below 8.0 G. Sepsis is an important cause for morbidity and mortality.
- Can not tolerate blood loss of APH, PPH. She goes into shock easily and face, all complications of haemorrhagic shock.
- Cardiac failure.
- Poor anaesthetic risk, if anaesthesia needed.
- Preterm delivery.

2) Anaemia is directly related to risk of :

- Preterm delivery

- Inadequate gestational weight gain
- Intra uterine growth retardation
- Low birth weight
- High perinatal morbidity and mortality

3) Timings: Second or Third Trimester

Dosage: Mebendazole 200 mg twice a day for 3 days.

4) a) 3

b) Lasix; intravemous

c) haemoglobin; one

3.14 FURTHER READING

FOGSI FOCUS : *Conquering Anaemia Project 2002*

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