APPROCH TO THE DIAGNOSIS AND TREATMENT OF ANEMIA

Sachin V. Tembhurne*, Dinesh M Sakarkar,

Department of Pharmacology and physiology, Sudhakarrao Naik Institute of Pharmacy, Pusad. (M.S), India.

***Corresponding Author**

Email: stembhurne@gmail.com

ABSTRACT:

It is important to understand that anemia is not a disease by itself, but the result of a malfunction somewhere in the body. It is a quite common condition, particularly in female; estimates suggest that around one in five menstruating women and half of all pregnant women are anemic. A wide range of events, including certain diseases, specific conditions and modifications, can cause anemia.

Anemia means that either the level of red blood cells or the level of haemoglobin is lower than normal. This means the red blood cells have to work harder to get oxygen around the body.

Each red blood cell contains a complicated protein called haemoglobin. This protein gives red blood cell their characteristics color. It is state that when the value of haemoglobin fall 5 to 6 mg/dl the person immediately gets startled and anxious then it understands that the person is anemic.

Haemoglobin value is not providing sufficient information to understand the anemia because it is not a simple condition that can be merely defined by just one parameter. This article try to explain the various facets of anemia, its diagnosis, the approach, test involved, the treatment to be given and the prevention should to be taken.

Key words: anemia, RBC, haemoglobin, types, causes, symptoms, diagnosis, treatment, prevention.

INTRODUCTION

Anaemia is not a disease by itself but only a manifestation of disease which resulted to the reduction in the number of circulating red blood cells, or the hemoglobin concentration in the blood. Hemoglobin carries oxygen from the lungs to the rest of the body. In anemia, the blood does not carry enough oxygen to the rest of the body. As a result, people with anemia can face variety of complications, including fatigue and stress on bodily organs. In severe or prolonged cases of anemia, the lack of oxygen in the blood can cause serious and sometimes fatal damage to the heart and other organs of the body (1, 2).

World Health Organization (WHO) defined it as a hemoglobin (Hb) level <13 g/dl in men and <12 g/dl in women. Results from a number of studies have indicated that anemia has a substantial negative impact on both function and quality of life in the elderly. Even when "mild" anemia is present, it causes and/or is associated with both significant functional impairment and increased patient mortality [2, 3].

A recent review of studies of anemia in elderly patients confirms that, hemoglobin levels decline with age and anemia is considered to be an important health problem among older individuals. It affects 1 in every 7 or 8 person over 65 yrs living in the community. In older people admitted to hospital or nursing homes anemia is even more common, affecting almost 1 in 2[4].

Although there are over 400 different forms of anemia, this health profile will only address the three most common: iron-deficiency anemia, vitamin B12 anemia and folic acid deficiency. Anemia can also be caused by conditions such as external bleeding, chronic disease, pregnancy, alcoholism, bleeding disorders, infection and hereditary conditions [2].

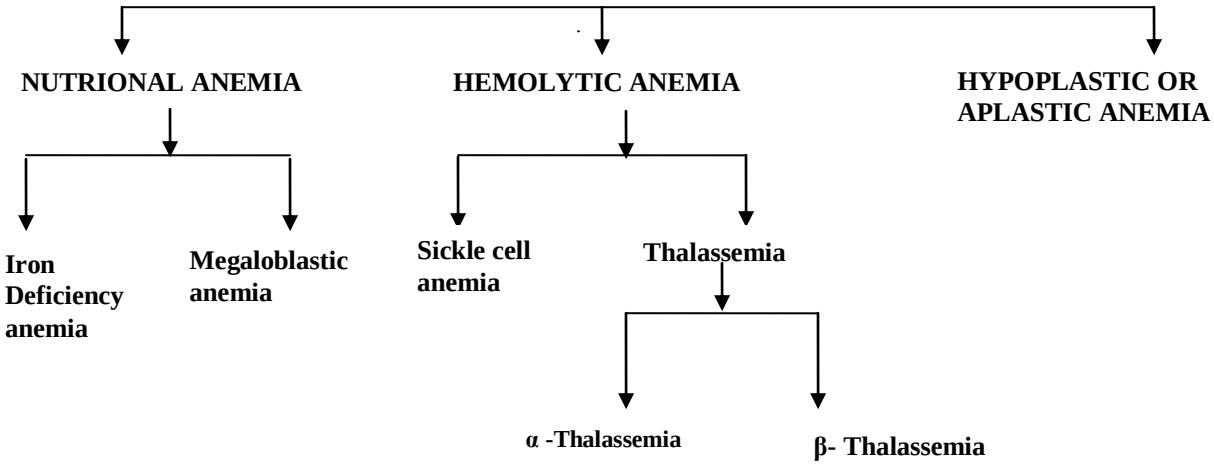
Clinical sign and symptoms of anemia[5, 6]

The following clinical signs (table 1) are helpful in a patient with anaemia. These patients often have a compensatory tachycardia, with a bounding pulse from high-volume circulation [5].

The symptoms of anemia will vary according to the type of anemia, the underlying cause, and the underlying health problems they are discuss in separate individual type anemia. Symptoms common to many types of anemia are included in table 2:

CLASSIFICATION OF ANEMIA

There are generally three main types of anemia they are classified as fallows [7].



NUTRITIONAL ANEMIA [7-11]

In the Third US National Health and Nutrition Examination Survey (NHANES III) study, nutrient deficiency was suspected in approximately one third of the cases of anemia in elderly persons. Most of these cases were attributed to iron deficiency, including chronic blood loss. However, folate deficiency (related to excessive alcohol use and malnutrition) and vitamin B12 deficiency (primarily related to atrophic gastritis) are also causes of nutritional anemia and warrant routine screening.

Iron deficiency anemia

Iron deficiency anemia arises from too little iron in the body to make sufficient hemoglobin. There are three causes of iron deficiency anemia [9]:

1**. Loss of iron at a greater rate than normal (blood loss).** Blood loss is usually the result of slow and persistent bleeding from inside the body, such as gastritis, peptic ulcers, ulcerative colitis, inflammatory bowel disease, gastrointestinal tumors (such as stomach or colon cancer), heavy menstrual periods, kidney tumors, bladder tumors, cystitis, prostatitis, and hemorrhoids. Additionally, the frequent use of aspirin, ibuprofen or other non-steroid anti-inflammatory drugs, as well as chronic alcohol abuse, can also cause iron deficiency anemia[10, 11].

2. **Poor absorption of iron from the diet.** Poor absorption of iron from the diet is usually as a result of surgical removal of part or all of the stomach or celiac sprue (a condition in which the

lining of the small intestine is damaged by a protein found in wheat or rye called gluten)[11, 12].

3**. Eating a diet low in iron.** This anemia can happen from not eating enough iron-rich foods, such as fruit, whole-grain bread, beans, lean meat and green vegetables. This is occurs mostly in pregnant women because their iron stores need to serve their own increased blood volume as well as be a source of haemoglobin for the growing fetus. A fetus needs iron to develop red blood cells, blood vessels and muscle [13].

Sign and symptoms [14]

There are some signs and symptoms that may suggest iron deficiency as the cause for anemia and these include-

- Koilonychias (spoon shaped nails)
- Pica-it can unusual craving for non-nutritive substances such as dirt, rice or starch.
- Inflammation or soreness of the tongue
- Poor appetite especially in infants and children can be an early sign of iron deficiency anemia.
- Some people with iron deficiency anemia may experience restless legs syndrome an uncomfortable tingling or crawing feeling in your legs that's generally relived by moving them.

3. Megaloblastic (or vitamin deficiency) anemia[15].

Megaloblastic anemia is a type of anemia characterized by very large red blood cells. In addition to the cells being large, the inner contents of each cell are not completely developed. This malformation causes the bone marrow to produce fewer cells and sometimes the cells die earlier than the 120 day life expectancy.

Causes of Megaloblastic anemia[15-18]

Digestive disease: Certain diseases of the lower digestive tract can lead to Megaloblastic anemia. These include celiac disease, chronic infectious enteritis, and enteroenteric fistulas. Pernicious anemia is a type of Megaloblastic anemia caused by an inability to absorb vitamin B-12 due to lack of intrinsic factor in gastric (stomach) secretions. Intrinsic factor enables the absorption of vitamin B-12. [15]

Malabsorption: Inherited congenital folate malabsorption is a genetic problem in which infants cannot absorb folic acid in their intestines can lead to megaloblastic anemia. This requires early intensive treatment to prevent long term problems such as mental retardation[15].

Medication-induced folic acid deficiency: Certain medication, especially ones that prevent seizures, such as phenytoin, primidone, and phenobarbital, can impair the absorption

of folic acid. The deficiency can usually be treated with a dietary supplement[17].

Folic acid and vitamin B12 dietary deficiency[15,16,18]

These vitamins are essential for the production of red blood cells, as well as the maintenance of the nervous system.

Folic acid deficiency is usually caused by an inadequate intake of folic acid, a vitamin mainly supplied by the fresh green leafy vegetables, mushrooms, lima beans and kidney beans. It also present in beans and legumes; citrus fruits and juices; wheat bran and other whole grains; and poultry, pork, shellfish, and liver. This disorder is most common in the poor and elderly (due to poor eating habits), in heavy alcohol drinkers, and in persons afflicted with intestinal disorders such as Crohn's disease or celiac sprue.

B-12 deficiency may also be more common in people with other autoimmune diseases, like Crohn's disease. Not getting enough B-12 can cause numbness in legs and feet, problems walking, memory loss, and problems seeing. Vitamin B-12 is mostly found in food of animal origin such as meat, fish and dairy products.

Sign and symptoms[15]

There are some sign and symptoms that may give a clue to the diagnosis of megaloblastic anemia and these include-

- Diarrhoea/constipation
- Numbness or tingling in hands and feet
- Smooth and tender tongue
- Weak muscles
- 'Megaloblastic madness' due to mental problems.

HAEMOLYTIC ANEMIA

Sickle cell anemia

Sickle cell anemia is an inherited form of anemia characterized by the presence of an abnormal form of haemoglobin, HbS. It is common in the vidharbh region of Maharastra. Under the normal circumstance, the red blood cells are flexible and round, and they move easily through the blood vessels to carry oxygen to all parts of the body. In people with sickle cell anemia, the red blood cells become rigid and sticky and are shaped like sickles. These irregular-shaped blood cells die prematurely, resulting in haemolysis and loss of blood. As these cells are not flexible they can get stuck when traveling through small blood vessel, which can slow or block blood flow and oxygen to certain parts of the body[19,20].

Sign and symptoms[19,20]

Sickle cells are fragile; they break apart easily and die leading to anemia.

Periodic episodes of pain: called pain crisis, are major symptoms of sickle cell anemia. Pain develops when sickle-shaped red cell block blood flow through tiny blood vessels.

Jaundice: jaundice is a yellowing of the skin and eyes that occurs because if liver damage or dysfunction. In patients of sickle cell anemia jaundice may be caused due to the inability of the liver to cope up with the haemolysis.

Frequent infection: sickle cells can damage spleen, an organ that fights infection. Therefore these patients are more vulnerable to infections. Doctors commonly give infant and children with sickle cell anemia vaccines and antibiotics to prevent potentially life threatening infections, such as pneumonia.

Stunted growth: A shortage of healthy red blood cells can slow growth in infants and children and delay puberty in teenagers as; it hampers the oxygen carrying and supply of nutrients.

THALASEMIA[7,21,22]

Haemoglobin has a complex structure. It is composed of heme and a protein called globin. Globin in turn is made of two alpha and two beta chains. Thalassemia is an inherited disorder of haemoglobin. The fundamental abnormality in thalassemia is impaired production of one of the globin chains and it is mainly classified into alpha or beta thalassemia depending on which hemoglobin chain production is impaired. The genes for each type of thalassemia are passed from parents to their children. Alpha and beta thalassemia have both mild and severe forms.

Alpha thalassemia occurs when one or more of the four gene needed for making the alpha globin chain of hemoglobin are variant or missing. Moderate to severe anemia results when more than two genes are affected. The most severe form of alpha thalassemia is known as alpha thalassemia major.

Beta thalassemia occurs when one or both of the genes needed for making the beta globin chain of haemoglobin are variant. The severity of illness depends on whether one or both are affected and the nature of the abnormality. If both genes are affected, anemia can range from moderate to severe. The severe form of beta thalassemia is also known as Cooley's anemia.

Alpha Thalassemia[7,21]

Alpha thalassemia occurs when one or more of the four chain genes fail to function.

1. The loss of one gene diminishes the production of the alpha protein only slightly. A person with this condition is called a silent carrier because of the difficulty in detection.
2. The loss of two genes produces condition with small red blood cells and at most a mild anemia.
3. The loss of three alpha genes produces a serious hematological problem. Patient with this condition have a severe anemia, and often require blood

transfusion to survive. The imbalance between the alpha chain production and beta chain production causes an accumulation of beta chain pair only with alpha chains. With three-gene deletion alpha thalassemia, however, beta chain begins to associate in groups of four, producing abnormal haemoglobin, called "haemoglobin-H". The condition is called "hemoglobin H disease". Haemoglobin H has two problems. First it does not carry oxygen properly, making it functionally useless to the cell. Second, hemoglobin H protein damages the membrane that surrounds the red cell, accelerating cell destruction. The combination of the very low production of red cells in hemoglobin H disease produces a severe, life-threatening anemia. These patients typically have enlarged spleens. Bony abnormality particularly involving the cheeks and forehead are often striking. The bone marrow works at an extraordinary pace in an attempt to compensate for the anemia. As a result, the marrow cavity within the bones stuffed with red cell precursors. Untreated, most patient die in childhood or early adolescence[21].

4. The loss of all four alpha genes produces a condition that is incompatible with life. The gamma chain produced during fetal life associate in groups of four to form abnormal hemoglobin called "hemoglobin Barts". Most people with four-gene deletion alpha thalassemia die in utero or shortly after birth (Hydrops fetalis)[21].

Beta Thalassemia[7,21]

The fact that there are only two genes for the beta chain of haemoglobin makes beta thalassemia a bit simpler to understand than alpha thalassemia. In some cases, the affected gene makes essentially no beta globin protein (beta-0-thalassemia). In other cases, the production of beta chain protein is lower than normal, but not zero (beta-(+)-thalassemia). The severity of beta thalassemia depends in part on the type of beta thalassemic genes that a person has inherited.

1. One-gene beta thalassemia has one beta globin that is normal, and a second, affected gene with a variably reduced production of beta globin. The degree of imbalance with the alpha globin depends on the residual production of beta globin. The degree of imbalance with the alpha globin depends on the residual production capacity of the defective beta globin gene. Even when the affected gene

produces no beta chain, the condition is mild since one beta gene functions normally. The red cells are small and a mild anemia may exist. People with the condition generally have no symptoms. The condition can be detected by electrophoresis.

2. Two gene beta thalassemia produces a severe anemia and a potentially life threatening condition. In this condition repeated blood transfusion are usually needed. In some people the anemia is so severe, that death occurs without transfusions. Blood transfusion ultimately produce iron overload. Chelation therapy with the iron-binding agent, desferrioxamine, is needed to prevent death from iron-mediated organ injury.

HYPOPLASTIC OR APLASTIC ANEMIA[23,24].

This rare problem happens when the body (bone marrow) doesn't make enough red blood cells for circulation. Since this affects the white blood cells too, there is a higher risk for infections and bleeding that can't be stopped. This can be caused by many things like cancer treatments (radiation or chemotherapy), exposure to toxic chemicals (like those used in some insecticides, paint, and household cleaners), some drugs (like those that treat rheumatoid arthritis), autoimmune diseases (like lupus), viral infection that affects bone marrow o bone marrow diseases.

Sign and symptoms

The person complaints of increasing tiredness, weakness and shortness of breath. Bleeding, bruising and blood spot may be noticed. Sore throat and other infection are noticeable. A high temperature with shivering attacks is an important symptom that demands immediate medical attention.

The treatment depends on how serious the anemia is. It can be treated with blood transfusions, medicines, or a bone marrow transplant.

CONSEQUENCES OF ANEMIA IN THE ELDERLY[25-27]

The potential negative impact of a low hemoglobin level on performance status, physiology, and functional independence appears to be highest in elderly patients. Among those older than 65 years, anemia has been associated with increased frailty, poorer exercise performance, diminished cognitive function, risk of developing dementia, decreased mobility, increased risk of recurrent falls, lower bone density and skeletal muscle density, and an increased rate of major depression. Anemia can be a marker for more severe disease or an indicator of lower likelihood to respond to current therapies. For instance, radiotherapy for cancer depends on adequate oxygen delivery by hemoglobin for optimal tumor cell killing.

CLINICAL EVALUATION OF ANEMIA[28-30]

The clinical examination is important in detecting anemia, but it is the laboratory examination that is most useful in formulating a diagnostics approach to identify an underlying cause of anemia. An anemia work-up should include a routine complete blood count (CBC) with reticulocyte count and three red cell indices: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

First, the MCV is used to classify the anemia as microcytic, normocytic, or macrocytic. A low MCV is strongly suggestive of iron deficiency anemia, especially if it is an acquired abnormality; a congenitally low MCV suggests thalassemia. The reticulocyte count estimates the rate of red cell production, is important as it indicates the response of the bone marrow to the anemia. An elevated reticulocyte count generally indicates that the marrow is responding to endogenous erythropoietin stimulation. The reticulocyte count is normal in anemia of chronic disease and is low in iron deficiency anemia (Table 3a). The reticulocyte count will increase with response to therapy (eg. iron, folate, vitamin B12).

The red cell indices reflect the state of red cell production. The red blood cell distribution width index (RDW) is also important in differentiating causes of anemia, being increased in iron deficiency and hemolytic anemias and normal in anemia of chronic disease (Table 3a).

An iron panel (serum iron, total iron binding capacity, transferrin, and ferritin) is useful in differentiating anemia of chronic disease from iron deficiency as both may be microcytic (Table 3b).

DIAGNOSIS AND MANAGEMENT OF ANEMIA[7,16,29-34]

Since anemia is a sign of a wide range of underlying disorders, and, in itself, is associated with morbidity and even an increased risk of mortality, it is critical that the underlying pathophysiologic mechanism be identified for any given patient.

Anemia is diagnosed from the patient's symptoms and by a blood test that measures the level of hemoglobin in the blood, as well as substances such as folic acid, bilirubin and vitamin B12. Additionally, the sizes of the red cells provide further clues to the type of anemia.

Other methods of diagnosis may include a bone marrow biopsy, which is the removal of bone marrow for further examination under a microscope. Bone marrow biopsy is helpful in diagnosing vitamin B12 anemia. Some dietitians suggest that the doctor also check for levels of ferritin in the blood of premenopausal women. Ferritin is a protein that stores iron before the mineral circulates in the bloodstream.

The diagnostic scheme for anemic patient is given in below

Ideally anaemia should be diagnosed when red cell mass (RBC mass) in the body decreases bellow the expected normal for a healthy population, which is a mean of 25ml/kg for women and 28ml/kg for men. However, measurement of RBC mass is difficult and not easily available. Hence a convenient and practical way to define anaemia is the measurement of Hb concentration in blood.

Anaemia is said to be present when Hb concentration falls below 13gm/dl in men, or <12gm/dl in women. A lower threshold <11gm/dl defines presence of anaemia in small children. This definition assumes a normal distribution of RBC mass and plasma volume. Problems may arise when this proportion is altered. For example, in normal pregnancy RBC mass increases by about 25% whereas the expansion in plasma volume is much greater, thereby bringing the Hb concentration down (Hb level 11gm/dl may consider the normal level in pregnancy). One should be vary of such spurious anaemia or masked anaemia situations. These are physiological variations. These days, electronic cell counters are widely available for estimating Hb concentration. These instruments automatically measure a lot many more parameters, apart from Hb concentration. Such parameters on RBC indices viz. the MCV, MCH, MCHC, RDW, RBC count, haematocrit and also the WBC and platelet counts are informative in patients with anaemia. Reticulocyte may be measured automatically, or manually. Specific diagnosis in anaemia is a function of clinical assessment and laboratory investigations. The two must be put together for a comprehensive diagnosis.

Investigations in a patient with anaemia[29,30,34]

Complete blood count is the single most important investigation in anaemia. It should include Hb, WBC, platelet count and RBC indices viz. RBC count, MCV, MCH, and RDW.

Peripheral blood smears examination, to look for abnormalities in RBC, WBC, platelets and reticulocyte count.

The above triad comprises the primary investigations in anaemia and can be performed on a single EDTA blood sample. Secondary investigations are guided by the results of the above tests in a given clinical context, and may include one or more from the serum ferritin, vitamin B12, and RBC folate levels; Hb electrophoresis and quantitation (Hb A2, Hb F etc), blood biochemistry for hepatic and renal functions, bone-marrow aspiration, trephine biopsy from bone marrow, Imaging studies may include X-ray chest/ skull/ other bones as warranted, ultrasound abdomen, radio-isotope studies, RBC survival & kinetic studies[29,30]

Other specialized tests include Coombs test, osmotic fragility, Hams test, erythropoietin level, immunocytochemistry, cytogenetics etc.

Another set of investigations may need be undertaken to unravel the primary causative disease. These would depend upon the clinical suspicion and the results of investigations as listed above. Thus, a patient with diagnosis of Iron deficiency anaemia (commonest type of anaemia in clinical practice) may warrant one or more investigations like dietary history, Stool for ova, cyst, and occult blood; if stool shows occult blood positive, do GI endoscopy or Barium meal studies; routine urine for microscopic haematuria, gynaecological assessment in women, X-ray chest, ENT assessment, tests for a bleeding disorders, tests of iron assimilation. Likewise, other types of anaemias may warrant a different set of investigations (30, 34).

Diagnostic paradigms[7,29,30,31, 34,35]

Diagnosis in a patient with anaemia can be approached from several angles. It is dictated by the available clinical and laboratory information. Accordingly, numerous classifications exist for the diseases causing anaemia.

Morphological examination of blood smear and RBC indices form the most important step in the diagnosis and classification of anemia. Morphologically anemia is classified depending on the size of RBC's on peripheral blood smear examination. Now a day it is usually done base on erythrocyte indices like MCV, MCH and MCHC that is performed on an automatic hematology analyzer. The following set of algorithms is helpful in diagnosis of anaemia in a given patient. Base on mean corpuscular volume it classified into three types are as fallows

Microcytic anemia: This type anemia includes the patients who have smaller RBC than normal size. The causes includes iron deficiency anemia, anemia of chronic disorder, thalassemia, sideroblastic anemia. The details are given in below diagram.

Normocytic anemia: In which the size of RBC's is normal in normocytic anemia. This condition may be caused due to variety of causes some of which include haemolytic anemia, aplastic anemia, leukemia, liver disease and hypothyrodism. Their further evaluation and management are discussed in below diagram.

Macrocytic anemia: It is characterized by RBC's of larger size. The most common cause of macrocytic anemia is megaloblastic anemia which is due to deficiency of vitamin B-12 or folic acid. Other causes can be hypothyrodism, liver disease and alcoholism. The only way of differtiating megaloblastic macrocytic anemia from nonmegaloblstic anemia is to do bone marrow examination. The marrow shows large blood cell precursor (megaloblast) and that is why the name. Other

diagnostic paradigms are given in below flow chart 1.

MANAGEMENT OF ANEMIA

Detailed clinical history, examination, and appropriate laboratory investigations should give a fair idea on the complete diagnosis in a patient with unexplained anaemia. This will facilitate specific therapy in a given case. Other measures include giving supportive medical care. This is true especially in emergency situations when blood (red blood cell) transfusion may be needed.

Parameters indicating need for blood (red cell) transfusion in a patient with anemia[31,36]

- Anaemia of acute onset.
- Anaemia of high severity (Hb <6gm/dl or even 8gm/dl in presence of co-morbid conditions).
- Anaemia with cardio-respiratory decompensation.
- Anaemia in presence of active bleeding.
- Anaemia of a potentially progressive nature e.g. leukaemias, other malignancies.
- Elective transfusions e.g. thalassaemias, or prior to surgery.

Steps in emergency care of anaemia requiring transfusion[31,36]

- Start an IV line, and take out blood for blood grouping and cross matching.
- Request for packed RBC for transfusion.
- Send for urgent reticulocyte count, blood smear, and blood biochemistry.
- Start O_2 by mask at 6-8L/minute.
- Restrict physical activities of the patient.
- Engage measures to stop out going active bleeding, if any.
- If anaemia is from acute or active bleeding (trauma or severe bleeding as haemoptysis, epistaxis, oromucosal bleed, haematuria, bleeding per rectum, bleeding per vaginum, or hereditary bleeding disorder etc.), start i.v. line with rapid normal saline infusion.
- Rate of infusion is governed by heart rate, blood pressure, urine output, and cardiac condition.
- Switch over to colloid volume expanders as soon as possible (until blood is available).
- Whole blood is not transfused these days.
- Transfuse packed RBC only for anaemia.
- Each unit of RBC is transfused promptly within 2-3 hours.
- Monitor and watch out for transfusion-reactions during period of transfusion.

- Number of units to be transfused is determined from clinical assessment and the response to transfusion.
- Expect a rise of 1gm/dl in Hb concentration from a single unit of transfusion of packed RBC.
- Unnecessary transfusion must be avoided. Also, apart from transfusion reactions, blood is a source of infection, volume overload, and iron overloaded.
- This management for stabilization of patient takes precedence over a detailed assessment of the anaemia and of any other co-morbid medical conditions.

Specific management would start as soon as the primary disease gets diagnosed[31,36-43].

- A patient having anaemia from Iron deficiency, give oral iron (ferrous sulphate) as tablets, equivalent to 200mg elemental iron per day (Tab Fersolate 1 tab TDS).
- Avoid sustained release or fancy or expensive preparation of iron.
- Administerd along with ascorbic acid which enhances iron absorption.
- Avoid giving antacids concomitantly.
- Oral iron is administered for at least 3 months beyond normalization of Hb so as to replenish body stores.
- Parenteral iron may be given if oral iron is not tolerated or oral iron therapy is ineffective.

Total Dose Iron / (T.D.I) in mg

= (15- Hb of patient) x body weight in kg x 3

This can be given as a slow intravenous infusion over 8-10 hours. Iron dextran or iron gluconate or hydroxide sucrose composition preparations are available (Imferon, Venofer). Iron sorbitol is for intramuscular route only while intramuscular route is painful and causes local discolorations. It is not a preferred route. If must, intramuscular injections must be administered deep[41-43].

- Primary disease is to be managed appropriately to prevent recurrence of bleeding, iron deficiency, or anaemia.

Treatment of iron-deficiency anemia[13,36,38,44]

Treatment will depend upon whether an individual is not getting enough iron in the diet (increase iron intake); not absorbing iron (surgery for celiac sprue, etc.); or losing small amounts over time due to anything from alcoholic gastritis to medication abuse to tumors. The doctor will often recommend iron-rich foods (such as liver, seafood, dried fruits, lima beans, whole grains, green leafy vegetables and blackstrap molasses) or iron pills. In the more severe cases of iron deficiency anemia caused by blood loss, surgery, blood transfusions or hormone injections may be recommended.

Iron Guidelines for anemic patient: Most people get enough iron through a regular healthy diet that has iron-rich

foods. But some groups of people don't get enough iron:

- Teenage girls/women of childbearing age (who have heavy menstrual losses, who have had more than one child, or use an intrauterine device [IUD]).
- Older infants and toddlers.
- Pregnant women.

These groups of people should be screened periodically for iron deficiency. If the tests show that the body isn't getting enough iron, iron supplements may be prescribed. Many health care providers prescribe iron supplements during pregnancy because many pregnant women don't get enough. They can help when diet alone can't restore the iron level back to normal. The following table provides the information of every day intake of iron in milligrams (mg). (Table 4)

Specific treatment in megaloblastic anemia[45-47]

Megaloblastic anaemia is common amongst vegetarians because vegetarian diet lacks in vitamin B-12. Folates are water-soluble vitamins with limited body stores, and sensitive to destruction during cooking or processing of food. An absorptive defect of either is seen in medical or surgical diseases. Blood levels identify the deficient vitamin.

If vitamin B12 deficiency is the cause of megaloblastic anaemia, give oral Vitamin B12 if absorption is not a problem. Else vitamin B12 is administered by intramuscular route.

A lifelong supplementation is mandatory in presence of defects of absorption or assimilation, and is advisable for vegans. If folic acid deficiency alone is responsible for megaloblastic anaemia, give oral folic acid as tablet, 1 mg daily. Folic acid is a water-soluble vitamin. Folic acid needs to be administered as long as the causative pathology persists.

Specific treatment in anaemia of chronic renal failure (CRF)

Appropriate management of chronic renal failure, including renal replacement therapy, and complications of CRF by treating any associated infections, deficiency states and bleeding diathesis.

In absence of adequate response, recombined erythropoietin (rhEPO) is very beneficial in anaemia of CRF. It is administered subcutaneously, 2000i.u. x 2-3 times in a week. Expect a rise in Hb, while watching for any rise in BP or fall in body iron. The latter mandates iron supplementation[48-50].

Specific treatment in Thalassaemias/ Haemoglobinopathies[22,38]

For thalassaemias and other Transfusion Dependent hereditary haemoglobinopathies, regular packed RBC transfusion (generally 2 units to an adult) is needed every 2- 3 weeks. Such regular transfusion is a source of iron overload. Hence, concomitant iron

chelation therapy (e.g. with Desferal) is required.

Folate supplementation is helpful in preventing anaemia. Therapeutic splenectomy is beneficial in selected cases. Curative gene transplant therapy is now possible for these genetic disorders.

Specific treatment in anaemia of chronic systemic disease[35]

- Management of primary disease and its complications
- Supportive care (RBC transfusion etc.) may be undertaken wherever warranted.

Specific treatment in anaemia secondary of chronic bleeding disorders[35,46]

- Can of primary disease to stop and prevent any further bleed.
- Treatment of secondary deficiency of iron, folic acid and at times vitamin B-12 using appropriate supplements.

Specific treatment in anaemia secondary to Leukaemia & Haematological malignances[35]

- Full supportive care including blood transfusions.
- Supplements for the expected deficiency states.
- Immunosuppressive agents if anaemia is immuno-haemolytic
- Treatment of the primary disease
- All efforts to be made to keep the patient free of nagging symptoms.

Specific treatment in Immune Haemolytic Anaemia[35]

- Blood transfusions are tricky in these situations. The antibodies against RBCs may destroy the transfused RBCs.
- Mainstay of treatment is use of immunosuppressive agents.
- Vitamin supplements are essential owing to increased requirements.

A common treatment for anemia - A deficiency in red blood cells caused by their insufficient production, excessive destruction, or excessive loss - is administration of recombinant erythropoietin, a hormone that stimulates the production of RBC precursors by the bone marrow. Unfortunately, many patients with anemia do not respond to treatment with Epo[49,51].

Overall treatment considerations[36]

Other therapies for anemia may include oxygen, fluids, fresh frozen plasma, platelet replacement and vasopressors (medication to elevate blood pressure). This will depend upon the underlying cause of the anemia.

PREVENTION OF ANEMIA [5,6,36,52]

Following are some of steps to help prevent some types of anemia:

- Eat foods high in iron e.g. red meat, fish, chicken, liver, eggs, dried fruits, like apricots, prunes,

and raisins, lentils and beans, green, leafy vegetables, like spinach and broccoli o tofu o cereal with iron in it (iron-fortified).

- Eat/drink foods that help the body to absorb iron, like orange juice, strawberries, broccoli, or other fruits and vegetables with vitamin C.
- Don't drink coffee or tea with meals because these drinks make it harder for body to absorb iron.
- Calcium can hurt the absorption of iron.
- Make sure to get enough folic acid and vitamin B-12 in daily diet.
- Do not take iron pills without talking to health care provider because these pills come in two forms: ferrous and ferric. The ferrous form is better absorbed by body. But taking iron pills can cause side effects, like nausea, vomiting, constipation, and diarrhea.

These side effects can be reducing by taking following steps:

- Start with half of the recommended dose. Gradually increase to the full dose.
- Take the pill in divided doses.
- Take the pill with food.

- In non-pregnant woman of childbearing age, get tested for anemia every 5 to 10 years. This can be done during a regular health exam. Testing should start in adolescence.
- If a non-pregnant woman of childbearing age with these risk factors for iron deficiency, get tested every year for heavy periods, low iron intake and previous diagnosis of anemia.

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