Anemia

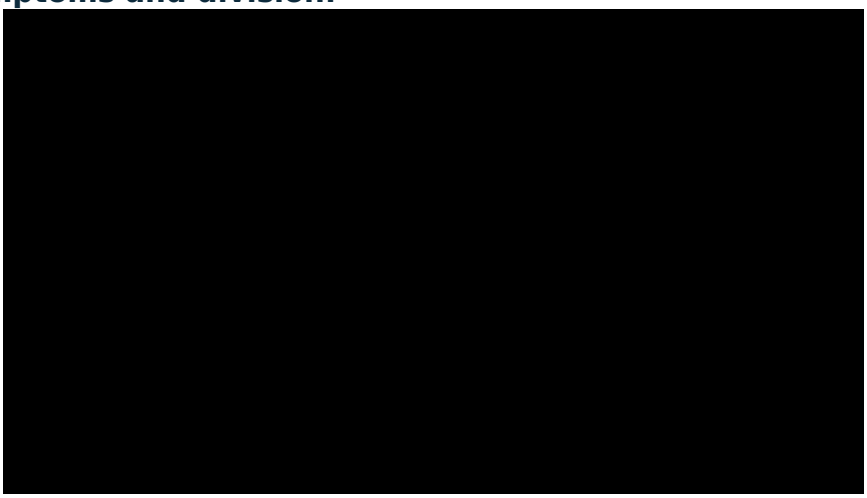
Anemia (Flight Plan):

Anemia is a condition in which the blood has either a **low number of red blood cells**, or **red blood cells that don't have enough hemoglobin** to carry oxygen. Anemia is caused by blood loss, lower-than-normal production of red blood cells, or higher-than-normal destruction of the cells. The main symptoms of anemia are weakness and fatigue, because of the lack of oxygen. Serious cases can lead to organ damage. Women, the elderly, and people with chronic diseases are at the greatest risk for developing anemia. Anemia is diagnosed based on medical history, physical exams, and laboratory tests. Treatments are available that prevent or reverse the condition, but some forms of anemia are chronic.

Anemia definition:

Anemia definition 2:

Anemia signs/symptoms and division:



MAHA:

Red Blood Cells

Anemia is a condition that affects the **red blood cells (RBCs)**, or erythrocytes.
Red blood cells are shaped like biconcave discs. They look like doughnuts with a dent instead of a hole in the center. The main role of RBCs is to carry oxygen, but they also remove carbon dioxide (a waste product) from cells and carry it to the lungs to be exhaled. In anemia, either the blood contains fewer than the normal number of RBCs, or the RBCs do not have enough hemoglobin. Hemoglobin is an iron-containing protein that binds to oxygen. The RBCs carry oxygen-containing blood from the lungs into the rest of the body. In anemia, the blood doesn't carry enough oxygen in the body. In some forms of anemia, white blood cells (leukocytes) and platelets are deficient as well. White blood cells help fight infections, whereas platelets help blood to clot.

Types

There are many different types of anemia because there are so many different causes. The causes can be divided into three main groups: increased red cell destruction, decreased red cell formation, and blood loss. (See Causes below.)

Types include:

- Aplastic anemia
- Anemia due to blood loss
- Anemia of chronic disease
- Folate (folic acid) deficiency anemia
- Diamond-Blackfan anemia
- Hemolytic anemia
- Iron-deficiency anemia
- Fanconi anemia
- Thalassemia
- Anemia due to glucose-6-phosphate-dehydrogenase deficiency
- Hereditary spherocytosis

- Autoimmune hemolytic anemi
- Microangiopathic hemolytic anemia
- Pernicious anemia

- Sickle cell anemia

Some types of anemia are mild, short-lived, and easily treated, while others are severe, long-lasting, and life-threatening if not diagnosed and treated. Some forms can be prevented with a healthy diet, and other forms require treatment with supplements or transfusions.

Causes

Anemia has three main causes: (1) **blood loss**, (2) **not enough production of RBCs**, and (3) **too much destruction of RBCs**. More than one of these causes can combine to produce anemia.

Blood loss

Blood loss is the most common cause of anemia, especially iron-deficiency anemia. It can be brief or it can last a long time. Heavy menstrual periods; bleeding in the intestine, kidneys, or bladder; surgery; trauma (injury); and cancer are some of the causes of blood loss. If bleeding is significant, the body can lose enough RBCs to cause anemia

Low rates of RBC production

Lower-than-normal rates of RBC production can result from a poor diet that lacks folic acid, iron, or vitamin B12. It also can be caused by conditions that make it hard for the body to absorb nutrients into the blood. Chronic diseases like kidney disease and cancer sometimes reduce RBC production. Other factors, like infections, medicines, or radiation therapy, may make the bone marrow unable to produce RBCs fast enough to replace the ones that die or are destroyed. During pregnancy, the fetus receives extra RBCs from the mother. These additional blood cells help proper development. In some anemias, the mother cannot produce enough RBCs for both her and her fetus.

High rates of RBC destruction

Inherited disorders such as sickle cell anemia, thalassemia, and some enzyme deficiencies are caused by higher-than-normal rates of RBC destruction. In these disorders, the RBCs are abnormal, and they die faster than healthy cells do. In hemolytic anemia, the immune system mistakenly attacks RBCs. This destroys the RBCs faster than the body can replace them.

Diagnosis

Anemia is diagnosed using medical histories, physical exams, and laboratory tests. In a medical history, a doctor or nurse talks to the patient and finds out the patient's symptoms and risk factors, as well as any family history of anemia. Physical exams usually consist of examining the heart, lungs, liver, and spleen. Laboratory tests are used to determine the complete blood count **(CBC)**. The CBC is used to determine the total number of cells in the blood, the hemoglobin level, and the hematocrit, which is the concentration of RBCs in the blood. Hemoglobin levels in the general population are 11–15 grams per deciliter (g/dL), whereas the hematocrit range is 32%–43% in the general population. Hemoglobin or hematocrit levels lower than these may indicate anemia.
Because the CBC collects all the blood cells, it is used to make many other measurements, such as the total number of RBCs, white blood cells, and platelets. Collection of RBCs allows the determination of RBC size, which is the average cell volume. In iron-deficiency anemia, the RBCs are usually smaller than normal, which is called microcytosis.
Follow-up tests can be performed to determine the cause, severity, and correct treatment of the anemia. **Hemoglobin electrophoresis** evaluates the different types of hemoglobin in the blood. The hemoglobin electrophoresis test is used to diagnose types of anemia caused by abnormal hemoglobin. The reticulocyte (new RBCs) count measures the number of new RBCs in the blood and is used to determine the amount of RBC production in the bone marrow. A high count usually means there has been either blood loss or destruction of RBCs earlier than their normal lifespan. A low count means a decreased production of RBCs. For example, in pernicious anemia, reticulocyte levels are low.
Several other tests are used to measure iron levels in the blood, since iron in hemoglobin is needed to carry oxygen. These tests include **serum iron**, **serum ferritin**, **transferrin level**, and **total iron-binding capacity**. To search for the cause of anemia, tests for kidney damage, lead poisoning (in children), deficiencies of vitamins (B12, folate), and internal bleeding in the stomach or intestines are performed. The source of bleeding is often detected by endoscopy. Finally, a small number of cells from the bone marrow may be removed by a needle in a procedure called bone marrow aspiration.

Treatment

The goal of treating anemia is to increase the blood's ability to carry oxygen. This is achieved by either increasing the number of RBCs, increasing the hemoglobin levels in RBCs, or both. The underlying cause of the anemia is also treated. Treatment depends on the type, cause, and severity of the anemia. Treatment includes dietary supplements, changes in diet, medicines, and/or medical procedures such as blood transfusions or surgery. With

treatment, acute anemia may last only a few days. If anemia is due to a chronic or inherited disease, the effects can be ongoing or lifelong despite treatment. Severe anemia or ongoing anemia that is untreated can be life-threatening.

Nutrition and dietary supplements

Some types of anemia are caused by low levels of vitamins or iron in the body. Treatment of deficiencies usually consists of dietary changes and vitamin or iron supplements. The vitamin supplements most frequently used are **folate** and **vitamin B12**. **Vitamin C** (ascorbic acid) is sometimes given because it helps the body absorb iron. **Iron** is used to produce hemoglobin. Iron in meats is more easily absorbed into the blood than the iron in vegetables and other foods. Good sources of dietary iron include meat (including fish), fortified foods (e.g. cereals, bread, and pasta), dark green leafy vegetables, peanuts, eggs, beans, and dried fruits. Sometimes iron supplements are needed to elevate iron levels. Iron absorption is increased by vitamin C. Vegetables and fruits, especially citrus, are good sources of vitamin C. Low levels of vitamin B12 can lead to pernicious anemia. Often pernicious anemia results when the body is unable to absorb vitamin B12. It can be treated with supplementation and diet. Good sources of vitamin B12 include fortified cereals, meat, and dairy products. Folate is a form of vitamin B that is found in foods. It is used to produce and maintain new cells. Folate is very important for pregnant women to avoid anemia and ensure the healthy development of the fetus. Good sources of folate include fortified foods (e.g., bread, pasta, and rice), dark green leafy vegetables, fruits, beef, liver, black-eyed peas or dried beans, and eggs.

Medication

Medications are used to treat the cause of the anemia as well as the symptoms. The drugs used depend on the type of anemia a person has. Antibiotics are used to treat infections and hormones are used in adult and teenaged women who have heavy menstrual bleeding. Sometimes a drug called epoetin is used to stimulate RBC production. This drug is a synthetic form of the hormone erythropoietin, which is released by the kidneys. Some drugs are given to prevent the body’s immune system from mistakenly attacking its own RBCs.

Medical procedures

Some types of serious anemia may require medical procedures. These procedures include blood transfusions and transplants of bone marrow or stem cells. Transfusions are given through a vein and require matching of donor and recipient blood. This matching involves blood groups (A, B, AB, or O) as well as many other factors. Regular blood transfusions can cause iron overload (hemochromatosis), or too much iron in the body. An iron overload is harmful, and chelation therapy is often used to help eliminate excess iron. Serious anemia, such as aplastic anemia, which results from the failure of bone marrow to make RBCs, is sometimes treated with marrow or stem cell transplants. Donor marrow is usually taken from a large bone, such as the pelvis. Marrow is given by transfusion through a vein. Stem cells for a transplant can be from matched umbilical cord blood, from bone marrow donated by a family member, or from a matched but unrelated donor. Stem cells in bone marrow develop into mature blood cells. Surgery is used to treat anemia caused by serious or life-threatening bleeding. For example, surgery may control chronic bleeding from a stomach ulcer or colon cancer. The spleen may be removed to prevent excessive RBC destruction. The spleen removes worn-out RBCs from the blood. An enlarged or diseased spleen may remove RBCs too quickly and cause anemia.

Cures

Some forms of anemia are curable with treatment, and others may require chronic treatment. This depends on the type of anemia a person has.

Prevention

Healthy diets and, if necessary, vitamin and mineral supplements can prevent anemia. Some anemias can be prevented by treating the cause of the anemia. For instance, treatment of internal bleeding will prevent anemia from recurring. Some forms of hereditary anemia, such as sickle cell anemia, cannot be prevented. However, not all anemias are preventable, especially those that are inherited like sickle cell anemia. In many cases, anemia can be prevented from becoming serious if the symptoms are caught early.

Chances of Developing Anemia

Anemia is common. More than 3 million people in the United States have anemia, and it occurs in all age groups as well as in all racial and ethnic groups.

Risk factors

Childbearing

Women of childbearing age are more at risk than are other women or men because of blood loss through menstruation and childbirth. During pregnancy, anemia can develop due to deficiencies of iron and folate and from a change in RBC concentration. During the first six months of pregnancy, the fluid portion (plasma) of the woman’s blood increases faster than does the number of RBCs. This imbalance dilutes the blood and reduces the hematocrit (concentration of RBCs). A certain amount of this anemia is normal and is referred to as "physiologic anemia of

pregnancy," but excessive anemia during pregnancy increases the risk that the baby will be premature or have a low birth weight. Women are also at risk of anemia after giving birth if it continued during the third trimester of pregnancy; if an excessive loss of blood occurred during the pregnancy, childbirth, or after childbirth; or if the woman carried and delivered more than one baby.

Age extremes

Also at an increased risk of anemia are children (especially under two years of age), adolescents, and the elderly. Children and adolescents are at risk because they are growing and developing. In the elderly, anemia is often caused by chronic disease, iron deficiency, and/or generally poor nutrition.

Others

Several other factors increase the risk of anemia:

- Poor or inadequate diets that are low in iron, vitamins, and minerals
- Chronic or serious illnesses (e.g., kidney or liver disease, cancer, diabetes, rheumatoid arthritis, HIV/AIDS, inflammatory bowel disease, thyroid disease)
- Chronic infections
- Blood loss from surgery or injury
- Family history of inherited anemia, such as sickle cell anemia or thalassemia

Clinical Trials

For a list of government-sponsored clinical trials studying anemia, click here (https://web.archive.org/web/20100207085655/http://www.medpedia.com/clinical-trials?q=anemia&entry=open), or visit the search page and type in a specific type of anemia.

Research

Laboratory research has helped scientists understand anemia and find more ways of treating it. Much attention has been focused on the hormone **hepcidin**. Hepcidin is involved in fighting bacteria by limiting the supply of iron. The hormone is over-activated in many chronic diseases that cause anemia. One study in mice has shown that suppressing the protein that regulates hepcidin, called HFE, helps maintain iron levels.[1]
The protein Gas6 has been identified as a possible future drug. In mice, Gas6 is released after treatment with epoetin (the synthetic form of erythropoietin) and is involved in the response to epoetin. One study found that mice deficient in Gas6 do not respond well to epoetin and do not recover from anemia.[2] In addition, both chronic and acute anemia in the mice were successfully treated with Gas6.
This type of basic research is needed because current approaches, which are not always effective, are sometimes impractical to apply. Epoetin needs frequent dose adjustments, requires careful monitoring of hemoglobin levels, and may be given as often as several times a week. New approaches to anemia are also under clinical investigation. A variant of the drug, called methoxy polyethylene glycol-epoetin beta, has been developed and shows promise for treatment of patients receiving dialysis with anemia. One clinical trial found that the new drug given every four weeks maintained hemoglobin levels as effectively as did more frequent doses of epoetin.[3]

History

Professor George Whipple conducted experiments of anemia related to acute blood loss and foods that could treat this condition. Building on his experiments, Professor George Minot and Dr. William Murphy of Harvard Medical School found that patients with pernicious anemia could be cured with diet alone, and that the food most helpful was liver. Patients had to eat as much as a pound of uncooked liver each day. Later, an extract was developed that produced the same results, but the key ingredient of this extract, vitamin B12, was not at the time recognized. These three men were awarded the Nobel Prize "for their discoveries concerning liver therapy in cases of anaemia."[4]

References

1. Roy CN, Custodio AO, de Graaf J, et al. An Hfe-dependent pathway mediates hyposideremia in response to lipopolysaccharide-induced inflammation in mice. Nat Genet. 2004;36:481-5.
2. Angelillo-Scherrer A, Burnier L, Lambrechts D, et al. Role of Gas6 in erythropoiesis and anemia in mice. J Clin Invest. 2008;118:583-96.
3. Levin NW, Fishbane S, Cañedo FV, et al. Intravenous methoxy polyethylene glycol-epoetin beta for haemoglobin control in patients with chronic kidney disease who are on dialysis: a randomised non-inferiority trial (MAXIMA). Lancet. 2007;370:1415-21.
4. Nobelprize.org: The Nobel Prize in Medicine or Physiology 1934: Presentation Speech.

External links

-