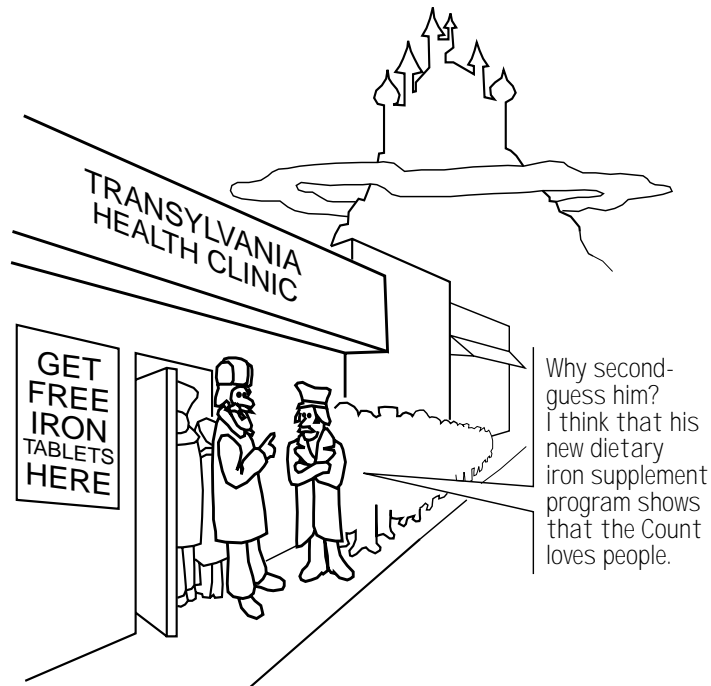


# THE BLOOD



The average healthy person has approximately 6 to 10 pints of blood that circulates through the body. The blood is a liquid that is pumped by the heart through all of the arteries, veins, and capillaries. It is made up of a clear yellow fluid, called plasma, and many cells that are called formed elements. These formed elements consist of red blood cells (erythrocytes), white blood cells, (leukocytes), and platelets (thrombocytes).





## BLOOD ELEMENT FUNCTIONS

- ◆ The red blood cells carry oxygen to the cells and also remove carbon dioxide and other waste from these cells.
- ◆ The white blood cells defend the body against foreign matter, including infection caused by bacteria, viruses, and fungi.
- ◆ The platelets (thrombocytes) function is in blood clotting and repairing injured blood vessels.
- ◆ The plasma (also called serum) contains hormones, proteins, enzymes, vitamins, and minerals.
- ◆ The bone marrow is a soft tissue that fills the spaces in the bones and produces red blood cells, platelets, and most of the white blood cells.
- ◆ The lymph system is another circulatory system in the body and helps to return water and protein (from tissues) to the blood. Lymph is a liquid that is filtered as it travels through circulatory ducts and lymph nodes en route to the heart by lowering the heat produced in the muscles and by metabolism.

To be sure blood can conduct its many important functions, proper nutritional building blocks are necessary to produce healthy blood. Avoidance of toxins and other substances which may harm blood is also important. A diet rich in iron, vitamin B12 and folic acid helps to prevent anemia (See Nutrition chapter). To add to the white blood cell's power to fight infection, immunization is desirable. For instance, vaccines against tetanus, measles, and flu cause the body to produce antibodies that fight these diseases.

## BLOOD TESTS

Samples of blood can be collected by drawing blood from a vein in the arm or a capillary in the finger. The most common tests are:

**Complete blood count (CBC)** A measure of the number of red and white blood cells in each cubic millimeter of blood.

**Hematocrit** This is often used to screen for anemia and measures the number of red blood cells in a given volume of blood. The normal value is 42 percent in women and 47 percent in men.

**Hemoglobin** This reflects the iron available in the red cells.

Other blood tests measure the number of platelets circulating in the blood.



# DISORDERS OF THE BLOOD

## ANEMIA

Anemia is a decrease of red cells in the blood. The anemias are the most common blood disorders. Early, the signs and symptoms are often mild and may go unnoticed, but if not corrected, the symptoms become progressively noticeable (eg, skin paleness and pallor of the nail beds). The palms of the hands, which are usually redder than the surrounding skin, may also be pale. When exercising, stamina will be decreased and in advanced cases, shortness of breath may occur.

### ■ IRON DEFICIENCY ANEMIA

This is the most common anemia. Without enough iron, the body cannot produce adequate hemoglobin. The main causes are insufficient consumption of iron-rich food (nutritional deficiency), poor absorption of iron from the gastrointestinal tract (diarrhea states), and loss of blood (excessive menstruation) or hemorrhage into the digestive tract. In pregnancy, the fetus absorbs most of the nutrients from the mother causing iron deficiency anemia. Iron supplementation is usually necessary during pregnancy.

#### SIGNS AND SYMPTOMS

Gradual onset of pallor; fatigue; occasional craving for substances that are not food (eg, ice, clay, soil).

#### DRUG TREATMENT

Supplemental iron salts, such as ferrous sulfate, are required; rarely are intramuscular injections needed.

#### SURGICAL TREATMENT

Surgery is done only to treat a cause, such as an ulcer or cancer of the colon. Packed red blood cells are sometimes used to alleviate symptoms, such as shortness of breath and chest pain and also to prevent shock.

### ■ PERNICIOUS ANEMIA

This is often hereditary and is caused by a deficiency of Vitamin B12 that is needed in producing normal red blood cells. Pernicious anemia does not result in insufficient B12 in the diet, but rather is a failure of the digestive tract to absorb the vitamin. The condition is unusual and occurs most often in elderly people, more often in men.

#### SIGNS AND SYMPTOMS

Similar to all anemia; sore tongue, loss of appetite, weight loss; disturbed walking gait and balance; mental changes, including memory loss, depression, and dementia; numbness of hands and feet (peripheral neuropathy).

#### TREATMENT

Vitamin B12 is injected. The injections may start daily to stabilize the condition, after which the maintenance doses are given monthly.



## ■ FOLIC ACID ANEMIA

Folic acid (a vitamin B) deficiency decreases the production of red blood cells and usually results from lack of sufficient folic acid in the diet. The anemia may also be caused by lack of absorption of folic acid from the intestines. The anemia can usually be prevented by eating a balanced diet rich in fresh citrus fruits, green leafy vegetables, liver, and kidney. Cooking tends to destroy the vitamin. Folic acid supplements are advised during pregnancy. Alcohol affects folic acid absorption and should be limited. This is an inherited disorder.

**SIGNS AND SYMPTOMS** Similar to other anemia; weight loss; diarrhea.

**DRUG TREATMENT** Supplemental folic acid may be given orally. Injection is only used when a severe gastrointestinal disorder prevents absorption. Folic acid is advised as a supplement in pregnancy.

## ■ SICKLE CELL ANEMIA

The red blood cells become rigid and are shaped like crescents or sickles rather than being flexible and round. It is caused by the abnormal type of hemoglobin known as hemoglobin S and it deforms the red blood cells.

**SIGNS AND SYMPTOMS** Joint pain; blood clots; fever; enlargement of the spleen; vision disorders; lack of energy; weakness.

**DRUG TREATMENT** During an emergency, medications are given to relieve pain and prevent dehydration. Oxygen may be administered due to the lack of hemoglobin. Occasionally, blood transfusions are necessary.

## ■ HEMOLYTIC ANEMIA

This is a condition where the red blood cells are prematurely destroyed. This anemia may be slight or completely absent if the bone marrow is able to increase red blood cell production. There are two types of hemolytic anemia: inherited and acquired. The red cells are small, rounded, and fragile. Hemolytic anemia can also be caused from medications, infections, or poisoning. Sometimes, it results as an immune response against the body's own blood cells (autoimmunity).

**SIGNS AND SYMPTOMS** Fatigue; paleness; breathlessness and rapid heartbeat; yellow-tinged skin (jaundice); dark urine; enlarged spleen. Emergency occurs with an acute pain in the upper abdomen.

**DRUG TREATMENT** Withdrawal from any drug causing the symptoms. Corticosteroids, usually prednisone, are given to block the immune response.

**SURGICAL TREATMENT** It is sometimes necessary to surgically remove the enlarged spleen.



## LESS COMMON ANEMIAS

### ■ GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY

This is caused by an inherited defect in an enzyme in the red blood cells. It is a form of hemolytic anemia. It occurs more commonly in those with black or Mediterranean ancestry. The gene is sex-linked and carried on the X chromosome, therefore, only males are affected. (Males carry one X chromosome and females have two X chromosomes.)

### ■ THALASSEMIA

There are two types of this unusual anemia: alpha-thalassemia, where the alpha-hemoglobin is lacking, and beta-thalassemia, where the beta-globulin is lacking. The genes are recessive, so it has to be inherited from both parents. The disease causes chronic anemia with poor growth, enlarged spleen and sometimes heart failure. Without treatment, death can occur in early childhood. The treatment requires repeated transfusions of packed red blood cells. Since the cells contain a lot of iron, excessive iron can overload the body's vital organs at which time medication is given to excrete iron from the kidneys. The most common variety, beta-thalassemia, is often without symptoms and can be mistaken for iron deficiency anemia.

### ■ ANEMIA OF CHRONIC DISEASE

Anemia can develop as a result of a chronic disease, such as rheumatoid arthritis, kidney failure (with uremia), endocrine failure (hypothyroidism), and chronic liver disease (cirrhosis). The anemia will not improve unless the primary disorder is effectively treated.

### ■ APLASTIC ANEMIA

This occurs when the bone marrow can no longer produce red blood cells. This could be caused by cancer of the bone marrow, or by a contact with poisonous chemicals, radiation, antibiotics, or other drugs. Because the platelets are low, spontaneous bleeding and bruising may occur. The treatment starts by eliminating the causing agent. Prophylactic antibiotics are used to ward off infection. Transfusion of red blood cells, white cells, and platelets may be necessary. If severe, the patient may require a bone marrow transplant.

### ■ SIDEROBLASTIC ANEMIA

Sideroblasts are young red blood cells. This is a rare disorder in which the red blood cells contain an abnormally high concentration of iron. In some cases, no cause can be found and transfusion with healthy red blood cells may be given, along with medication, to excrete the excessive iron from the kidneys.



# MALIGNANCIES OF THE BLOOD SYSTEM

## LEUKEMIA

Leukemia are cancers of the body's blood-forming tissues, including the bone marrow and the lymph system. These cancers form large numbers of abnormal white blood cells in the bone marrow, lymph system, and blood stream. This accumulation can interfere with the function of vital organs as they overwhelm the production of healthy white blood cells, red blood cells, and platelets. This causes a deficiency of healthy cells. The body's ability to fight infection is decreased, and with the oxygen-carrying capacity reduced, the body's organs are oxygen-deprived. Spontaneous bruising and bleeding (as from the mucous membranes of the mouth) may occur. The cause of leukemia is unknown but it is suspected that certain drugs and viruses are implicated. The susceptibility to leukemia may be inherited, as it runs in families. The different types of leukemia are: lymphocytic (lymph cells), myelogenous (a cell produced in bone marrow), and monocytic (a white cell of the bone marrow). Leukemia are divided into categories characterized by how quickly the cells progress and the maturity of the cells involved. Acute leukemia progresses quickly with the production of immature cells. Chronic leukemia usually progresses slowly and causes an overproduction of mature red blood cells as well as immature white blood cells. Both types occur more often in men than women.

### ■ CHRONIC MYELOGENOUS LEUKEMIA

An overproduction of cancerous versions of a type of white cells are formed in the bone marrow. It is also called myeloid, myelocytic or granulocytic. It occurs most often in middle-aged adults.

#### SIGNS AND SYMPTOMS

Symptoms of anemia; bone pain; fever and infections; swollen lymph nodes; weight loss; bleeding and bruising; pressure under left ribs from swollen spleen.

#### DRUG TREATMENT

Treatment is immunotherapy with a bone marrow transplant. If a crisis occurs in immature white cells, high dose chemotherapy and total body irradiation are followed with a bone marrow transplant.



## ■ ACUTE NONLYMPHOCYTIC LEUKEMIA

This cancer causes overproduction of immature white cells known as blasts. This form of leukemia is also called myelogenous, monocytic, myelogenic or myelocytic. It is the most common leukemia in adults.

**SIGNS AND SYMPTOMS** Symptoms of anemia; fever; bruising; weight loss; overgrowth of the gums; blurred or loss of vision; headache or seizures; swollen lymph glands.

**DRUG TREATMENT** Combinations of chemotherapy drugs are used. Because of the risk of infections, antibiotics are often given to prevent or treat infections.

## ■ CHRONIC LYMPHOCYTIC LEUKEMIA

This is a cancerous production of white blood cells known as lymphocytes. It is common among older adults (over 50 years of age) and occurs two to three times more often in men.

**SIGNS AND SYMPTOMS** Symptoms of anemia with swollen lymph nodes; fatigue; progressive malaise; weight loss; night sweats; infection; bleeding from mucous membranes; pressure under ribs from enlarging spleen.

**TREATMENT** If the disease is not advanced, episodic blood counts are done to monitor the lymphocytes.

**DRUG TREATMENT** Progressive states are treated with chemotherapy and corticosteroids.

**SURGICAL TREATMENT** Rarely, surgical removal of an enlarged spleen is done.

## ■ ACUTE LYMPHOCYTIC LEUKEMIA

This is a cancer that causes overproduction of immature blood cells (lymphoblasts) and the number of normal blood cells is reduced. It is called a childhood leukemia because it most frequently affects children. Treatment is more successful in children than adults.

**SIGNS AND SYMPTOMS** Symptoms of anemia with abnormal bruising and hemorrhages into the skin; bleeding from the mucous membranes; fatigue; weakness; fever; enlarged liver and spleen; bone pain.

**DRUG TREATMENT** The treatment is divided into phases. First, chemotherapy for stabilizing the disease. Second, once remission is achieved, additional chemotherapy and radiation to the brain may be recommended. These treatments are designed to kill the cancer cells that may linger in the central nervous system and beyond the reach of chemotherapy. A bone marrow transplant may be performed after a relapse, or if the patient is considered at high risk for relapse.



## LYMPHOMAS

Lymphomas are cancers of the lymph system. The lymph system includes the lymph nodes, or lymph glands, which are located throughout the body and are connected by small vessels called lymphatics. The spleen is part of the lymph system. Often, the first symptom of a lymphoma is an enlargement of a lymph node. The diseases of the lymph system vary in type and behavior.

### ■ HODGKIN'S DISEASE

There are four major types of Hodgkin's disease on the basis of appearances under the microscope. The disease usually affects people between 15 and 35 years of age but it can occur in persons over 50 years of age. Hodgkin's disease is often suspected by enlarging lymph nodes.

#### SIGNS AND SYMPTOMS

Painless swelling of lymph nodes in the neck, armpits and groin; fatigue; fever and chills; night sweats; weight loss; severe itching. Emergency symptoms (crisis) are sudden onset of high fever; loss of bladder and bowel control; and numbness or loss of strength in the arms and legs.

#### DRUG TREATMENT

Chemotherapy is the primary treatment. Radiation therapy is used when the spread of disease is limited, and is sometimes used with chemotherapy. If there is a relapse after chemotherapy, treatment may be repeated at higher doses and a bone marrow transplant may be suggested.

#### SURGICAL TREATMENT

Surgery is occasionally done to explore the abdomen for determining the stage of the disease.



## ■ NON-HODGKIN'S LYMPHOMA

These are tumors that arise from the lymphocytes (white blood cells) and are classified as low, intermediate, and high grade. This is more common than Hodgkin's disease. It occurs more frequently among people who have received organ transplants and whose immune mechanisms are restrained by immunosuppressive therapy. It occurs most frequently in the mid-forties but can occur in younger and older persons.

### SIGNS AND SYMPTOMS

Painless enlargement of lymph nodes with or without swelling of the abdomen; fatigue; fever and chills; night sweats; loss of appetite. Emergency symptoms (crisis) or sudden onset of high fever; mental confusion and drowsiness; loss of bladder and bowel control; numbness of the arms and legs.

### DRUG TREATMENT

Chemotherapy combined with anticancer drugs are usually used.

### SURGICAL TREATMENT

Surgery is done to decrease the size of the tumor (debulking). This has been used to prevent obstruction in the stomach and make the tumor more sensitive to the medication and irradiation. Radiation therapy is used in low grade and intermediate grade tumors.



## BONE MARROW DISORDERS

Bone marrow deficiencies occur when the production of cells is no longer orderly, leading to anemia, bleeding disorders, and infections.

### ■ POLYCYTHEMIA VERA

When the bone marrow produces too many cells, it is termed polycythemia vera. In this disorder, there is a high concentration of red blood cells in the circulating blood. The cause is unknown and usually appears in late middle age and is more common in men than women.

<b>SIGNS AND SYMPTOMS</b>	Weakness; itching, especially in a warm bath; dizziness; sense of fullness in the head; fullness in the upper abdomen. Emergency symptoms are blood in the vomit or stool; stroke.
<b>DRUG TREATMENT</b>	Radioactive phosphorus treatment is used to cut down blood cell production.
<b>SURGICAL TREATMENT</b>	Splenectomy is used (removal of spleen) if the spleen becomes enlarged.

### ■ AGNOGENIC MYELOID METAPLASIA (IDIOPATHIC MYELOFIBROSIS)

The bone marrow becomes scarred for unknown reasons, and is less able to produce blood cells. The liver and spleen overcompensate and become enlarged. There is no cure for this disease and most patients become dependent on blood transfusions.

### ■ MULTIPLE MYELOMA

This is a cancer that produces uncontrolled multiplication of a plasma cell (white cell in the marrow). As these cells fill the marrow space, the bones may weaken and break more easily, causing pain, particularly in the back or ribs. Eventually, the growth of the plasma cells interferes with the bone marrow production of normal red blood cells, white blood cells, and platelets.

<b>SIGNS AND SYMPTOMS</b>	Symptoms of anemia; fatigue; back and rib cage pain; vulnerability to infection; bleeding problems, such as nose bleeds and bleeding gums; spontaneous bone fracture. Emergency symptoms are changes in consciousness; decreased urine flow; incontinence; numbness of the arms and legs.
<b>DRUG TREATMENT</b>	Chemotherapy, corticosteroids, and radiation therapy are often prescribed. A bone marrow transplant, following high doses of radiation and/or chemotherapy, is also done.



## ■ AMYLOIDOSIS

In this condition, a protein (amyloid) is deposited in sites throughout the body. The disease is rare. As in multiple myeloma, the plasma cells may produce abnormal proteins. No effective treatment has been found. The condition is chronic, progressing slowly, and can be fatal after a number of years.

## ■ GRANULOCYTOPENIA

The blood contains less than the normal amount of a grainy type of white blood cell (granulocyte). Either the bone marrow is not producing enough of the cells or a destructive process is occurring. It is sometimes seen with leukemia or as a result of chemotherapy. Antibiotics are used to ward off an increased susceptibility to infections.

## ■ AGRANULOCYTOSIS

This is a very rare condition with a drastic decrease in the granulocyte of the blood. Most often, the disorder is a response to exposure to certain chemicals, solvents, hydrocarbons, or to certain medications, such as penicillin, phenothiazine, and anti-inflammatory medications. The treatment is removing the patient from additional exposure and protecting against serious infection until the bone marrow can recover.



## BLEEDING DISORDERS

Bleeding disorders result from disruption of the body's blood-clotting process. The coagulation process involves platelets and plasma proteins called clotting factors.

### ■ HEMOPHILIA

An inherited disorder of specific clotting factors (proteins in the plasma that cause the blood to clot). There are two types: Hemophilia A, or classic hemophilia, and hemophilia B. Although hemophilia is the most commonly inherited bleeding disorder, it is still quite rare. Both types are caused by genes that are recessive and sex-linked (carried on the X chromosome), so the disorder occurs in males, not females. Girls who carry the genes are carriers with no symptoms.

#### SIGNS AND SYMPTOMS

Many large or deep bruises; pain and swelling of the joints caused by internal bleeding; blood in the urine or stool; prolonged bleeding from cuts, injuries, after surgery, or a tooth extraction. Emergency symptoms occur with bleeding into the head, neck, or digestive tract; inability to stop bleeding with an injury.

#### DRUG TREATMENT

Desmopressin (DDAVP) helps stop bleeding by making blood vessels contract. A hemophilia patient should never use aspirin or other anticoagulants that may cause more bleeding.

#### SURGICAL TREATMENT

If severe osteoarthritis occurs from bleeding into the large dependent joints, joint replacement may be considered.

### ■ VON WILLEBRAND'S DISEASE (PSEUDO HEMOPHILIA)

This chronic bleeding disorder is caused by a defect in a clotting factor. These factors are necessary to cause platelets to gather at the site of a blood vessel injury. The severity of symptoms varies from person to person. Since this is a nonpreventable inherited disorder, siblings and children should be screened and couples should seek counseling regarding reproduction.

#### SIGNS AND SYMPTOMS

Nosebleeds; excessive menstrual periods; easy bruising; blood in stool.

#### DRUG TREATMENT

Desmopressin (DDAVP) and cryoprecipitate, derived from donated human blood, is used to control symptoms. Avoiding the use of aspirin is important.



## ■ DISSEMINATED INTRAVASCULAR COAGULATION (DIC)

This is a nonhereditary, potentially fatal bleeding disorder that results from coagulation at times of excessive bleeding, usually from trauma or bleeding in pregnancy. It occurs when activated clotting factors are present throughout the bloodstream instead of only at the site of an injury or trauma. These factors cause circulating platelets to clot (coagulate) in small blood vessels all over the body. The body's clotting factors are used up and become insufficient for the site of the injury. The body reacts by stepping up the system to dissolve clots.

### SIGNS AND SYMPTOMS

Severe bleeding from many sites in the body. Emergency symptom is severe bleeding with trauma or at a surgical incision site.

### DRUG TREATMENT

The condition that caused the DIC must be treated and, if necessary, replacement of the collapsed clotting factors by transfusion of various blood products. Rarely, treatment with heparin (a drug that prevents clotting) is needed to dissolve the small clots.

## ■ THROMBOCYTOPENIA

Thrombocytopenia is a common bleeding disorder resulting from a shortage of platelets. There are two types, idiopathic and secondary. Most often it is an acquired condition rather than a hereditary one. It often arises from the breakdown of tissues in the bone marrow caused from a type of cancer or an immune reaction to a drug. It occurs most often in children and young adults, but can occur at any age.

### SIGNS AND SYMPTOMS

Easy or excessive bruising; measles-like rash, usually on the lower legs; nosebleeds; blood in vomit or stools; heavy menstrual flow; excessive bleeding during surgery. Emergency symptoms are widespread bleeding and bleeding into the brain and digestive system.

### DRUG TREATMENT

Medications that suppress or alter the immune system, including prednisone (a corticosteroid), are used. Never use aspirin as it impairs the function of the platelets. Transfusion of blood products (packed red blood cells) is sometimes performed.

### SURGICAL TREATMENT

Surgery is occasionally used to remove the spleen.



## BLOOD TRANSFUSIONS

Blood transfusions are necessary to save the life of a person who has a blood disorder, disease, accident, or surgery. The success of a safe and available bank of blood is based on healthy individuals donating their blood (only 5 percent of Americans volunteer to donate blood). In order to transfuse safely, the blood groups must be known. There are four major blood groups: A, B, AB, and O. Each of these groups is divided into two Rh types — positive and negative.

Donated blood is screened carefully for infectious disease and separated into groups. The blood may also be used for concentrations of blood products. Occasionally, only the serum is collected and the red blood cells are returned to the donor. The types of transfusions are:

### WHOLE BLOOD

A whole blood transfusion is given if a large amount of blood has been lost through hemorrhage from the gastrointestinal tract, major surgery, or trauma. Whole blood can be safely stored for about five weeks.

### RED BLOOD CELLS

If you are deficient in red blood cells but not in other components, a packed red blood cell transfusion is best. This provides only the red blood cells you need without any extra blood volume. The primary use of red blood cells is to correct anemia when the red blood cells are singularly affected. This blood product can be stored for seven weeks.

### FRESH FROZEN PLASMA

This is used to treat clotting disorders, including mild forms of hemophilia and serious burns. This blood product can be stored for one year.



## ON THE HORIZON

Anemia can develop as a result of a chronic disease, such as rheumatoid arthritis, kidney failure, endocrine failure, and chronic liver disease. Erythropoietin, the hormone that spurs the body to make red blood cells,



may soon allow most people with anemia from chronic disease to elevate red blood cells without the use of a transfusion.

## ADVERSE REACTIONS TO TRANSFUSIONS

The recipient of a blood transfusion is given donor blood that has been matched to the receiver's blood. Sometimes adverse reactions do occur. These reactions are:

**Antibody Reactions** Despite precautions, sometimes a transfusion recipient will be carrying undetected antibodies against the donor's red blood cells, white cells, or platelets, and an immune reaction results. Common symptoms are fever, shaking, chills, chest pain, low back pain, pain in the vein used for the blood access, shortness of breath, pink urine, hives, and nausea.

**Communicable Diseases** Blood transfusions can spread diseases such as hepatitis, cytomegalovirus infection, syphilis, malaria, toxoplasmosis, and AIDS; however, various tests are performed on donated blood to prevent this from occurring. Blood supplies are considered to be safe.

**Other Reactions** There are other adverse reactions to transfusion. For instance, if a patient has heart trouble, the increased blood volume may result in iron toxicity.

The safest blood you receive is your own. Giving one's own blood, known as autologous



transfusion, is becoming more popular, particularly in elective surgery where there will be a predictable blood loss. Usually, the patient donates and stores blood over a period of several weeks before the elective surgery and receives iron supplements to reproduce blood cells rapidly before surgery. In an emergency, however, a donor bank may have to be relied upon.

## BONE MARROW TRANSPLANTS

Bone marrow transplant and stem cell rescue are relatively new techniques that permit the use of high doses of chemotherapy or irradiation for anticancer treatment. Following the treatment, either bone marrow or stem cell transfusion follows to restore bone marrow function. The types of transplants are:

**Syngeneic** The donor is an identical twin. Severe reactions are not expected to occur.

**Allogenic** The donor is a sibling or parent of the recipient.



**Autologous** Bone marrow is taken from the person with the cancer. This person is subjected to high doses of chemotherapy and perhaps irradiation. After this treatment has been completed, the marrow is returned to the cancer patient.

**Unrelated Donors** This type uses unrelated donors for bone marrow transplants. The donors are selected on the basis of their HLA system (human leukocyte antigens, the body's built-in commandos), being identical or nearly identical to that of the recipient. A National Bone Marrow Registry has been set up to help locate HLA-matched bone marrow donors.

The transplant process is more complicated, expensive, and riskier than blood transfusions. The bone marrow or stem cells are given through the recipient's veins, and from there, it travels to the bone marrow space and produces new cells. The best results have been in the treatment of aplastic anemia and a variety of cancers.



## WHAT TO DO

SEVERITY LEVEL	SYMPTOM	POSSIBLE DIAGNOSIS
 <p data-bbox="311 305 462 396">Seek Medical Help Immediately!</p>	<p data-bbox="522 305 916 396">Acute pain in upper abdomen with fatigue, paleness, breathlessness, and rapid heartbeat</p> <p data-bbox="522 418 916 509">Sudden onset of high fever, loss of bladder and bowel control, numbness or loss of strength in arms and legs</p> <p data-bbox="522 531 916 658">Sudden onset of high fever, mental confusion and drowsiness, loss of bladder and bowel control, numbness of arms and legs</p> <p data-bbox="522 680 916 771">Changes in consciousness, decreased urine flow, incontinence, numbness of arms and legs</p> <p data-bbox="522 793 916 884">Bleeding into head, neck or digestive tract, inability to stop bleeding after injury</p> <p data-bbox="522 906 916 971">Severe bleeding from many sites or after trauma or surgical incision</p> <p data-bbox="522 1022 916 1088">Widespread bleeding and bleeding into brain and digestive tract</p>	<p data-bbox="1045 367 1236 396">Hemolytic anemia</p> <p data-bbox="1045 484 1236 513">Hodgkin's disease</p> <p data-bbox="1045 600 1208 666">Non-Hodgkin's lymphoma</p> <p data-bbox="1045 753 1236 782">Multiple myeloma</p> <p data-bbox="1045 869 1168 899">Hemophilia</p> <p data-bbox="1045 913 1279 1004">(DIC) Disseminated intravascular coagulation</p> <p data-bbox="1045 1059 1245 1088">Thrombocytopenia</p>
 <p data-bbox="311 1124 462 1241">Make an appointment to see your doctor</p>	<p data-bbox="522 1139 916 1295">Sore tongue, loss of appetite, weight loss; disturbed balance and walking; mental changes (memory loss, depression, "dementia), numbness of hands and feet</p> <p data-bbox="522 1321 916 1386">Fatigue, disturbed balance, weight loss, and diarrhea</p> <p data-bbox="522 1408 916 1499">Joint pain, blood clots, and fever; spleen enlargement, vision disorders, lack of energy, weakness</p> <p data-bbox="522 1521 916 1550">Spontaneous bleeding and bruising</p> <p data-bbox="522 1572 916 1627">Yellow-tinged skin, dark urine, enlarged spleen</p>	<p data-bbox="1045 1277 1236 1306">Pernicious anemia</p> <p data-bbox="1045 1357 1236 1386">Folic acid anemia</p> <p data-bbox="1045 1466 1236 1496">Sickle cell anemia</p> <p data-bbox="1045 1521 1216 1550">Aplastic anemia</p> <p data-bbox="1045 1605 1236 1634">Hemolytic anemia</p>



Make an appointment to see your doctor

Bone pain, fever, and infections, swollen lymph nodes, weight loss; bleeding and bruising, pressure under left ribs from swollen spleen

Chronic myelogenous leukemia

Fever, bruising, weight loss, overgrowth of gums, blurred vision, headache or seizures, swollen lymph glands

Acute nonlymphocytic leukemia

Abnormal bruising and hemorrhages into skin, bleeding from mucous membranes, fatigue, weakness, fever, bone pain

Acute lymphocytic leukemia

Painless swelling of lymph nodes in neck, armpits, and groin, fatigue, fever and chills, night sweats, severe itching

Hodgkin's disease

Painless enlargement of lymph nodes, abdominal swelling, fatigue, fever and chills, night sweats, loss of appetite

Non-Hodgkin's lymphoma

Weakness and itching (especially in warm bath, dizziness, sense of fullness in head, fullness in upper abdomen

Polycythemia vera

Anemia, fatigue, back and ribcage pain, constant infections, nose bleeds and bleeding gums, spontaneous bone fracture

Multiple myeloma

Large or deep bruises, pain and swelling of joints, blood in urine/ stool, prolonged bleeding from cuts or injuries

Hemophilia

Nosebleeds, excessive menstruation, easy bruising, blood in stool

Von Willebrand's Disease (pseudohemophilia)

Easy bruising, measles-like rash, nosebleeds, blood in vomit or stools

Thrombocytopenia



Try the home treatment outlined in this chapter

Gradual onset of pallor and fatigue, craving for substances, eg, ice, clay, soil

Iron deficiency anemia