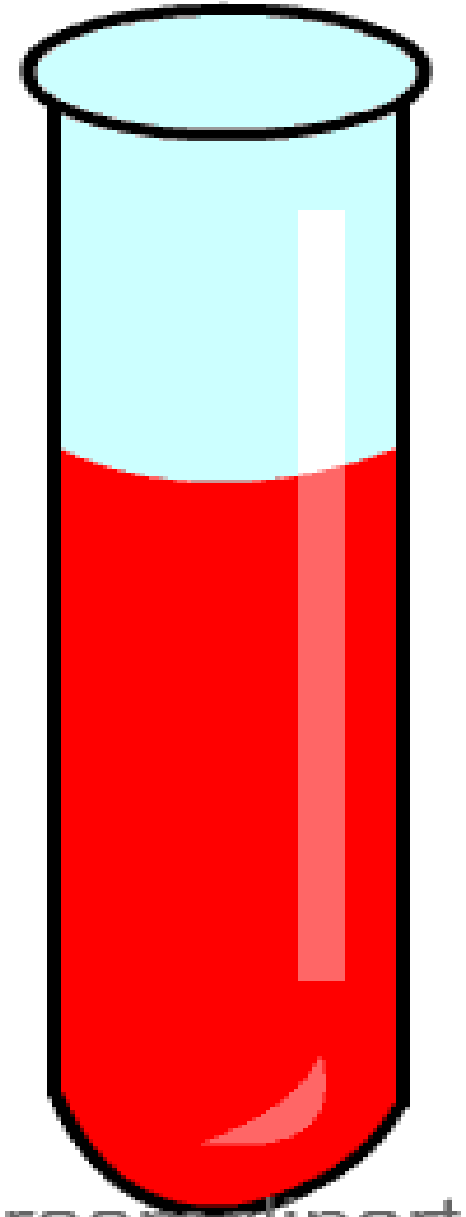
Screening for Hematologic Disease

Dr. Muhammad Mustafa Qamar

Assistant Professor, SMC



Human Blood

BLOOD

Blood is the circulating tissue of the body; the fluid and its formed elements circulate through the heart, arteries, capillaries, and veins

- Plasma
- Formed elements
- Erythrocytes , leukocytes and Thrombocytes

SYMPTOMS OF BLOOD DISORDERS ARE

- Most common in relation to the use of drugs (NSAIDs) for inflammatory conditions
- Neurologic complications associated with pernicious anemia
- Complications of chemotherapy or radiation.

SIGNS AND SYMPTOMS OF HEMATOLOGIC DISORDERS

- Exertion
- Dyspnea
- chest pain
- Palpitations
- severe weakness
- Fatigue

- Neurological symptoms such as headache, dizziness, syncope, or polyneuropathy
- Significant skin and fingernail bed changes that can occur with hematologic problems might include pallor of the face, hands, nail beds, and lips; cyanosis or clubbing of the fingernail beds and wounds or easy bruising or bleeding in skin, gums, or mucous membranes, often with no reported trauma to the area. The presence of blood in the stool or emesis or severe pain and swelling in joints and muscles

CLASSIFICATION OF BLOOD DISORDERS

- **Erythrocyte Disorders**

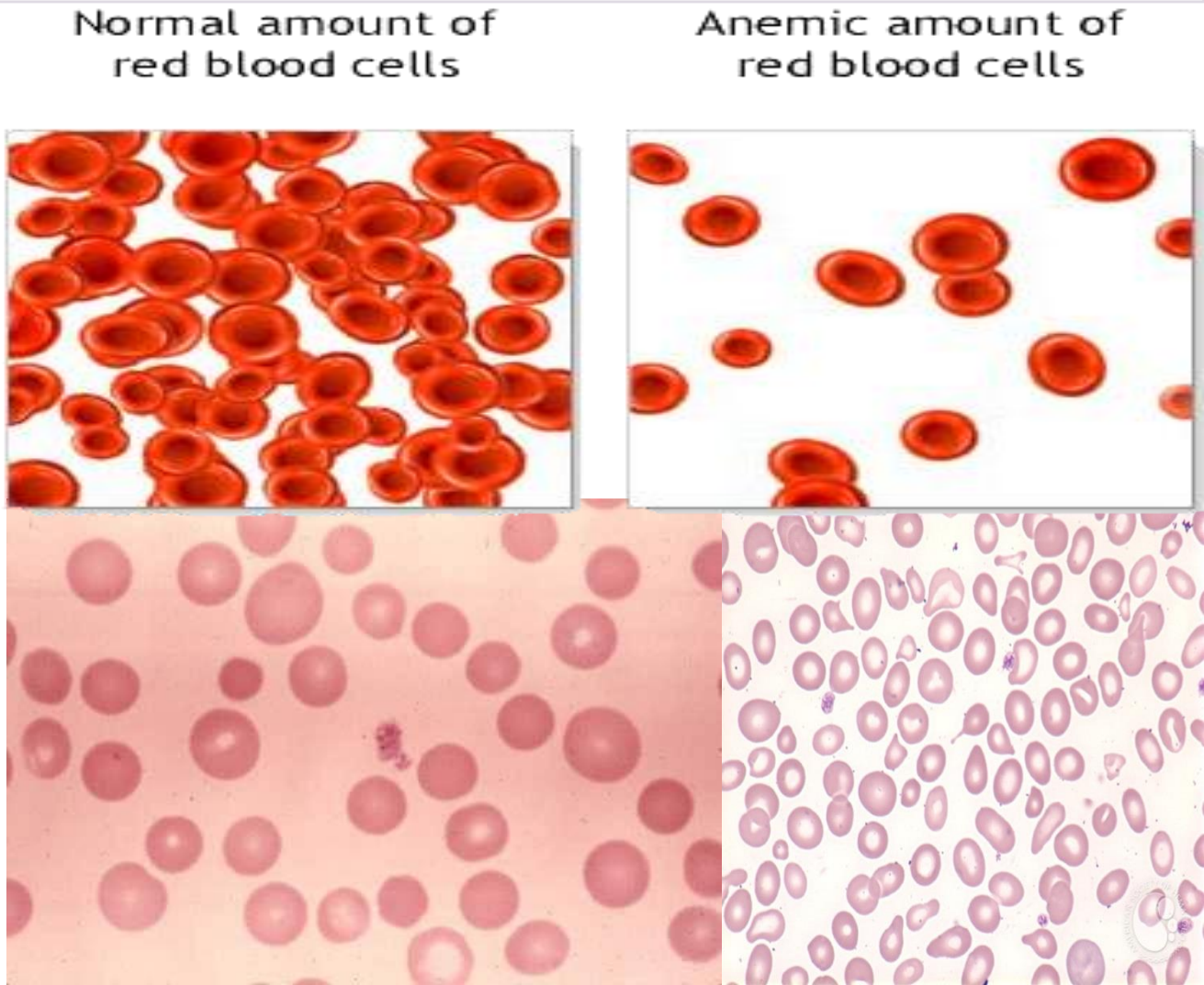
- Erythrocytes consist mainly of hemoglobin and a supporting framework. Erythrocytes transport oxygen and carbon dioxide; they are important in maintaining normal acid-base balance.

- There are many more erythrocytes than leukocytes (600 to 1). The total number is determined by gender, altitude and physical activity

(sedentary people have fewer erythrocytes, athletes have more). Disorders of erythrocytes are classified as follows

Disorders of erythrocytes

- Anemia
- Polycythemia
- Poikilocytosis
- Anisocytosis
- Hypochromia



Anemia

- Anemia is a reduction in the oxygen-carrying capacity of the blood as a result of an abnormality in the quantity or quality of erythrocytes.
- Anemia is not a disease but is a symptom of any number of different blood disorders.
- Excessive blood loss, increased destruction of erythrocytes, and decreased production of erythrocytes are the most common causes of anemia.

- In the PT practice, anemia-related disorders categorized into:
- Iron deficiency associated with chronic gastrointestinal (GI) blood loss secondary to NSAID use; Chronic diseases or inflammatory diseases, such as rheumatoid arthritis or SLE.
- Neurologic conditions (pernicious anemia)
- Infectious diseases, such as tuberculosis or AIDS, and neo-plastic disease or cancer (bone marrow failure).
- Anemia with neoplasia may be a common complication of chemotherapy or develop as a consequence of bone marrow metastasis.

- Deficiency in the oxygen-carrying capacity of blood may result in disturbances in the function of many organs and tissues leading to various symptoms .
- Rapid onset result in symptoms of dyspnea, weakness and fatigue, and palpitations.
- Many people can have moderate to severe anemia without these symptoms. Although there is no difference in normal blood volume associated with severe anemia, there is a redistribution of blood so that organs most sensitive to oxygen deprivation (e.g., brain, heart, muscles) receive more blood than, for example, the hands and kidneys.

- The physical therapist should look for pale palms with normal colored creases (severe anemia causes pale creases as well).
- Observation of the hands should be done at the level of the client's heart. In addition, the anemic client's hands should be warm; if they are cold, the paleness is due to vasoconstriction.

- Pallor in dark-skinned people may be observed by the absence of the underlying red tones that normally give brown or black skin .
- Resting cardiac output is usually normal in people with anemia, but cardiac output increases with exercise more than it does in people without anemia.
- As the anemia becomes more severe, resting cardiac output increases and exercise tolerance progressively decreases until dyspnea, tachycardia, and palpitations occur at rest.

POLYCYTHEMIA

is characterized by increases in both the number of red blood cells and the concentration of hemoglobin.

- There are two distinct forms of polycythemia:
- *Primary polycythemia is a relatively uncommon* neoplastic disease of the bone marrow of unknown etiology.
- *Secondary polycythemia is a physiologic* condition resulting from a decreased oxygen supply to the tissues. It is associated with high altitudes, heavy tobacco smoking, radiation exposure, and chronic heart and lung disorders, especially congenital heart defects

SIGN & SYMPTOMS

- General malaise and fatigue
- Shortness of breath
- Intolerable pruritus (skin itching) **(polycythemia vera)***
- Headache
- Dizziness
- Irritability
- Blurred vision
- Fainting

- Decreased mental acuity
- Feeling of fullness in the head
- Disturbances of sensation in the hands and feet
- Weight loss
- Easy bruising
- Cyanosis
- Clubbing of the fingers
- Splenomegaly
- Gout & Hypertension

Sickle Cell Anemia

- Sickle cell disease is a generic term for a group of inherited, autosomal recessive disorders characterized by the presence of an abnormal form of hemoglobin.
- A genetic mutation alters the shape of the cell.
- This sickled or curved shape causes the cell to lose its ability to deform and squeeze through tiny blood vessels, thereby depriving tissue of an adequate blood supply.
- e, g. chronic hemolytic anemia and vaso-occlusion

Leukocyte Disorders

- The blood contains three major groups of leukocytes including:
- Lymphoid cells (lymphocytes)
- Monocytes
- Granulocytes (neutrophils, eosinophils, and basophils).

- *Lymphocytes produce antibodies and react* with antigens, thus initiating the immune response to fight infection.
- *Monocytes are the* largest circulating blood cells and represent an immature cell until they leave the blood and travel to the tissues where they form macrophages in response to foreign substances such as bacteria.
- *Granulocytes contain lysing agents* capable of digesting various foreign materials and defend the body against infectious agents by phagocytosing bacteria and other infectious substances.

- The leukocyte count also may be elevated in women who are pregnant, in clients with bacterial infections, appendicitis, leukemia, uremia, or ulcers, in newborns with hemolytic disease and normally at birth.

- The leukocyte count may drop below normal values *(leukopenia) in clients with viral diseases* (e.g., measles), infectious hepatitis, rheumatoid arthritis, cirrhosis of the liver and also after treatment with radiation or chemotherapy.

LEUKOCYTOSIS

- Leukocytosis characterizes many infectious diseases and is recognized by a count of more than 10,000 leukocytes/mm3. It can be associated with an increase in circulating neutrophils which are recruited in large numbers early in the course of most bacterial infections.
- Leukocytosis is a common finding and is helpful in aiding the body's response to any of the following:

- Bacterial infections
- Inflammation or tissue necrosis (e.g., infarction, myositis, vasculitis)
- Metabolic intoxications (e.g., uremia, acidosis, gout) & Neoplasms

- Acute hemorrhage
- Splenectomy
- Acute appendicitis
- Pneumonia
- Intoxication by chemicals
- Acute rheumatic fever

LEUKOPENIA

- Leukopenia, or reduction of the number of leukocytes in the blood below 5000 per microliter, can be caused by a variety of factors.
- Unlike leukocytosis, leukopenia is never beneficial.
- Leukopenia can occur in many forms of bone marrow failure such as that following anti-neoplastic chemotherapy or radiation therapy, in dietary deficiencies, and in autoimmune diseases.

- It is important for the physical therapist to be aware of the client's most recent white blood cell count prior to and during the course of physical therapy.
- If the client is immuno-suppressed, infection is a major problem.
- Constitutional symptoms such as fever, chills, or sweats warrant immediate medical referral.
- *Lowest point the white blood* count reaches, usually 7 to 14 days after chemotherapy or radiation therapy.

Platelet Disorders

Thrombocytes function primarily in homeostasis and in maintaining capillary integrity . They function in the coagulation mechanism by forming hemostatic plugs in small ruptured blood vessels or by adhering to any injured lining of larger blood vessels.

- A number of substances derived from the platelets that function in blood coagulation have been labeled "platelet factors." Platelets survive approximately 8 to 10 days in circulation and are then removed by the reticuloendothelial cells.

THROMBOCYTOSIS

refers to a condition in which the number of platelets is abnormally high, whereas *thrombocytopenia refers to a condition in which the* number of platelets is abnormally low.

- Platelets are affected most often by anticoagulant drugs, including aspirin, heparin, warfarin and other newer antithrombotic drugs
- Platelet levels can also be affected by diet (vitamin K from promoting coagulation), by exercise that boosts the production of chemical activators that destroy unwanted clots, and by liver disease that affects the supply of vitamin K.
- Platelets are also easily suppressed by radiation and chemotherapy.

THROMBOCYTOSIS

- Thrombocytosis is an increase in platelet count that is usually temporary. It may occur as a compensatory mechanism after severe hemorrhage, surgery, and splenectomy; in iron deficiency and polycythemia vera; and as a manifestation of an occult (hidden) neoplasm (e.g., lung cancer).
- Thrombocytosis remains asymptomatic until the platelet count exceeds 1 million/mm3.
- Other symptoms may include splenomegaly and easy bruising.

THROMBOCYTOPENIA

- Thrombocytopenia, a decrease in the number of platelets (less than 150,000/mm3) in circulating blood, can result from decreased or defective platelet production or from accelerated platelet destruction.
- There are many causes of thrombocytopenia
- In PT practice the most common causes are bone marrow failure from radiation treatment, leukemia, or metastatic cancer; cytotoxic agents used in chemotherapy; and drug-induced platelet reduction, especially among adults with rheumatoid arthritis treated with gold or inflammatory conditions treated with aspirin or other NSAIDs.

Primary bleeding sites include bone marrow or spleen; secondary bleeding occurs from small blood vessels in the skin, mucosa and brain. (intracranial hemorrhage).

CLINICAL SIGNS AND SYMPTOMS

- Severe thrombocytopenia results in the appearance of multiple petechiae (small, purple, pinpoint hemorrhages into the skin), most often observed on the lower legs.
- Gastrointestinal bleeding and bleeding into the central nervous system associated with severe thrombocytopenia may be life threatening manifestations of thrombocytopenic bleeding.

- The physical therapist must be alert for obvious skin, joint, or mucous membrane symptoms of thrombocytopenia, which include severe bruising, external hematomas, joint swelling, and the presence of multiple petechiae observed on the skin or gums.
- These symptoms usually indicate a platelet count well below 100,000/mm3. Strenuous exercise could precipitate a hemorrhage, particularly used with caution and any mechanical compression, visceral manipulation, or soft tissue mobilization is contraindicated without a physician's approval.
- People with undiagnosed thrombocytopenia need immediate physician referral.

Coagulation Disorders

- *Hemophilia* is a hereditary blood-clotting disorder caused by an abnormality of functional plasma clotting proteins known as factors VIII and IX. In most cases, the person with hemophilia has normal amounts of the deficient factor circulating, but it is in a functionally inadequate state. Persons with hemophilia bleed longer than those with normal levels of functioning factors VIII or IX, but the bleeding is not any faster than would occur in a normal person with the same injury.

CLINICAL SIGNS AND SYMPTOMS

- Bleeding into the joint spaces (hemarthrosis) is one of the most common clinical manifestations of hemophilia.
- It may result from an identifiable trauma or stress or may be spontaneous, most often affecting the knee, elbow, ankle, hip, and shoulder (in order of most common appearance).

- Recurrent hemarthrosis results in hemophiliac arthropathy (joint disease)
- Bleeding episodes must be treated early with factor replacement and joint immobilization during the period of pain. This type of affected joint is particularly susceptible to being injured again.

- Hemarthrosis are not common in the first year of life but increase in frequency as the child begins to walk. The severity of the hemarthrosis may vary (depending on the degree of injury) from mild pain and swelling, which resolves without treatment within 1 to 3 days, to severe pain with swollen joint that persists for several weeks and resolves slowly with treatment.

- Bleeding into the muscles is the second most common site of bleeding in persons with hemophilia. Muscle hemorrhages can be more insidious and massive than joint hemorrhages. They may occur anywhere but are common in the flexor muscle groups, predominantly the iliopsoas, gastrocnemius, and flexor surface of the forearm, and they result in deformities such as hip flexion contractures, equinus position of the foot, or Volkmann's deformity of the forearm.

- When bleeding into the psoas or iliacus muscle puts pressure on the branch of the femoral nerve, loss of sensation occurs.
- Distention of the muscles with blood causes pain that can be felt in the lower abdomen, possibly even mimicking appendicitis when bleeding occurs on the right side.
- In an attempt to relieve the distention and reduce the pain, a position with hip flexion is preferred.

- Two tests are used to distinguish an iliopsoas bleed from a hip bleed:

1. When the client flexes the trunk, severe pain is produced in the presence of *iliopsoas bleeding,* whereas only mild pain is found with a hip hemorrhage.

2. When the hip is gently rotated in either direction, severe pain is experienced with a *hip hemorrhage,* but is absent or mild with iliopsoas bleeding.

CAUTIONS:

Over time, the following complications may occur:

- Vascular compression causing localized ischemia and necrosis
- Replacement of muscle fibers by non elastic fibrotic tissue causing shortened muscles and thus producing joint contractures .
- Peripheral nerve lesions from compression of a nerve that travels in the same compartment as the hematoma, most commonly affecting the femoral, ulnar, and median nerves.

Exercise for *anemic clients must be* instituted with extreme caution and should first be approved by the client's physician.

Clients with undiagnosed thrombocytopenia need immediate medical referral.

The physical therapist must be alert for obvious skin or mucous membrane symptoms of *thrombocytopenia.*

With clients who have been diagnosed with *hemophilia, medical referral should be* made when any painful episode develops in the muscle(s) or joint(s).

Guidelines for Physician Referral

- Consultation with the physician may be necessary when an exercise program for a client with known anemia
- New episodes of muscle or joint pain in a client with hemophilia; Any unexplained symptom(s) may be a signal of bleeding; coughing up blood in this population group must be reported to the physician

Clues to Screening for Hematologic Disease

- These clues will help the therapist in the decision making process: Previous history (delayed effects) or current administration of chemotherapy or radiation therapy
- Chronic or long-term use of aspirin or other NSAIDs (drug-induced platelet reduction)
- Spontaneous bleeding of any kind (e.g., nosebleed, vaginal/menstrual bleeding, blood in the urine or stool, bleeding gums, easy bruising, hemarthrosis), especially with a previous history of hemophilia

- Recent major surgery or previous transplantation
- Rapid onset of dyspnea, chest pain, weakness and fatigue with palpitations associated with recent significant change in altitude
- Observed changes in the hands and fingernail beds