What type of tissue is blood?

Blood is considered liquid connective tissue.

Define and describe the components of plasma?

Plasma is the liquid portion of blood. It makes up 55 – 60% of the blood volume. It contains about 92% water, urea, glucose, some dissolved gasses such as CO2 and O2, and proteins including immunoglobulins (antibodies), albumin (a main carrier protein and also one responsible for water concentration in the blood). Fibrinogen is also found in plasma and is responsible for blood clotting.

Formed elements (blood cells and platelets) are produced in the red marrow found in spongy bone.

This type of bone is found in flat bones such as the sternum, pelvis, and vertebrae and at the epiphyses of long bones. Some white blood cells are produced in the yellow marrow in the diaphysis of long bones.

List the formed elements, where they are produced, and a brief description of their function.

1. Erythrocytes (RBCs) – red marrow – gas transport to and from tissues. 95% of all formed elements are RBC.
2. Leukocytes (WBCs) – red and yellow marrow – infection / protection.
3. Thrombocytes (Platelets) – red marrow, spleen – clotting.
4. Lymphocytes (T cells, B cells) – infection / protection.

5. Fibrinogen - responsible for blood-clotting process.

Spleen - stores massive quantities of blood.

Describe the life cycle of a typical erythrocyte.

Formed in red marrow from hemopoietic stem cell. Stem cell divides into erythroblasts which divide and continue to specialize into RBCs. The RBC manufactures hemoglobin molecules and when that process is complete, the RBC expels its nucleus and then enters the circulation as a mature erythrocyte. The erythrocyte has a life span of 120 days. As it ages, it becomes stiff. Eventually, it is unable to make it through the capillaries of the spleen and is attacked and destroyed by macrophages in the spleen. Compoments are recycled by the liver. Hemoglobin is broken down into heme and globin. Heme contains iron which is sent back to the bone to form new hemoglobin molecules. Bilirubin is the other component of heme which is sent to the liver where it is converted to bile and excreted with the feces. The globin is the protein portion of the molecule and contains valuable amino acids which are reused to form new proteins by the liver. About 2 million RBCs are destroyed by the spleen each second. New ones must be produced by the red marrow at the same rate.

Describe hemoglobin.

Hemoglobin is an iron containing protein on the surface of red blood cells. Each hemoglobin molecule can carry 4 molecules of oxygen. Each red blood cell has about 270 million hemoglobin molecules on its surface. There are roughly 4.2 – 6.2 million red blood cells per mm3 of blood. That's about 15g of hemoglobin per 100 ml of blood. That means that the blood has the capacity to carry about 5,400,000,000 oxygen molecules per mm3 of blood.

List the various forms in which hemoglobin can exist.

1. Oxyhemoglobin – hemoglobin bound to oxygen.

2. Carboxyhemoglobin – hemoglobin bound to carbon monoxide.

3. Carbaminohemoglobin – hemoglobin bound to carbon dioxide.

4. Methemoglobin – hemoglobin bound to metabolic products.

What is considered a normal hemoglobin level (Hgb)?

15 g /dl (15 g per 100 ml).

List some factors which can decrease Hgb levels?

- Blood loss.
- Fluid replacement with non-blood products.
- Anemias.

Describe the hematocrit (Hct) and give normal values.

Hct is the percentage of RBCs in a sample of whole blood. It is normally 40 – 45% in males and somewhat lower in females. A sample of blood is spun down in a centrifuge. The red blood cells, being more dense, settle to the bottom of the sample. A middle layer, known as the buffy coat, contains platelets and WBCs. The top layer of the sample contains plasma.

Under what circumstances might you expect to see an elevated Hct?

- Post blood transfusion.
- High altitude acclimation.
- Polycythemia due to emphysema.
- Blood doping for sports.
- Dehydration.

Under what circumstances might you expect to see a decreased Hct? Supports anemic.

- Hemolytic anemia is a result of premature destruction of RBC leaking iron.
- Hemorrhage
- Erythrocytopenia
- Bone marrow disease
- Vitamin deficiency
- Sickle cell disease

Describe the role of thrombocytes.

- Thrombocytes aid in clotting.

Describe a CBC with differential.

- A CBC is a complete blood count. The number of RBCs, WBCs, and platelets are counted in a given sample of blood. Differential involves looking at the different types of white blood cells.

  Do not confuse hematocrit with Differential Blood Count. One is looking at volume of RBC the other is looking at WBC. A differential blood count identifies the different types of leukocytes present in blood. So like with HIV you would also do a Differential Blood Count.

List the different types of white blood cells and their function.

List the causes, signs, symptoms, and treatment for the various forms of anemia.

Anemia can be caused by iron deficiency (pernicious) or by premature hemolysis of red blood cells. The former can occur when there is significant bleeding or an iron deficiency in the diet. Hemolytic anemias can occur as a result of autoimmune dysfunction or abnormal hemoglobin or red blood cell structure such as

thalasemia or sickle cell. In these cases, the abnormal blood cells are destroyed by the spleen reducing RBC count.

Signs and symptoms:

- Fatigue
- Headache
- Chest pain
- Exertional dyspnea

Treatment:

- High flow oxygen
- Whole blood replacement or packed RBCs

Describe the signs, symptoms, and treatment for leukemia.

- Leukemia is a cancer of the blood in which large numbers of abnormal, non-functioning leukocytes are produced. The cancer usually originates in the bone marrow where the cells are produced. As the abnormal cells are produced, the normal cells are crowded out. The lymphatic system becomes clogged with large, non-functioning cells resulting in lymph node enlargement and spleen enlargement. Immunity drops since there are fewer normal cells to fight infection. RBCs and platelet counts may also drop. Leukemias may be caused by a number of factors including chromosomal abnormalities, viruses, exposure to radiation, and chemicals
- Leukemia may be either chronic or acute. Forms of acute leukemia include acute lymphoblastic leukemia which occur more often in children, and acute myoblastic leukemia which occurs in adulthood and is highly fatal.

Signs and symptoms

- Enlargement of abdominal organs (liver, spleen, testes)
- Lymph node enlargement in neck, axilla, and groin.
- Bone pain
- Fatigue and malaise
- Bleeding and bruising
- Night sweats
- Heat intolerance
- Priapism

Treatment:

- Treat crisis with high flow oxygen
- IV TKO

- Definitive care may include bone marrow transplants, chemotherapy, antibiotics to ward off infection, and whole blood transfusions.

List signs, symptoms, and treatment for Hodgkin's and non-Hodgkins lymphoma.

- Hodgkin's Disease is a lymph tissue cancer (Lymphoma). It is distinguished by the presence of Reed – Sternberg cells. Hodgkin's
- lymphoma has a high cure rate if diagnosed early. Non-Hodgkins lymphoma encompasses a host of other cancers of the lymph system which respond less effectively to treatment than Hodgkin's. One type, Burkitt's lymphoma, is associated with the Epstein- Barr virus. HIV patients are also at a high risk for the development of

lymphoma. It should be noted that many types of cancers may originate elsewhere and end up in the lymphatic system. Most cancers spread via the lymph.

- Remember this: Hodgkin's has a high cure rate. Non-Hodgkin is not so high. Do not insult a Non-Hodgkin patient and tell them that it is highly curable. Do not put Hodgkin's in the same category as Non-Hodgkin's.

Signs and symptoms

- Painless enlargement of lymph nodes in neck, axilla, and groin
- Spleen enlargement
- Fatigue
- Chills
- Night sweats
- Dyspnea
- Cough
- Weight loss
- Itching

Treatment

- Treat symptoms

Describe the pathophysiology, signs, symptoms, and treatment for DIC.

- Disseminated Intravascular Coagulopathy is a complication of serious illness. Frequently, the patient is septic or has started to go into Multi-Organ Dysfunction Syndrome (MODS). Ultimately, clotting factors are inhibited and essentially removed from the circulating blood. The result is vascular leakage and inability of the blood to clot.

Signs and symptoms:

- Dyspnea
- Edema
- Easy bruising
- Spontaneous bleeding
- Hypotension
- Shock

Describe the pathophysiology and treatment for hemophilia.

Hemophilia is a genetic disorder occurring almost exclusively in males. Females carry the recessive gene on the X chromosome but it is not dominant if there is a normal X chromosome. The genetic disorder causes an absence of Factor 8 in the clotting cascade making blood clotting essentially impossible. Relatively minor trauma can result in significant bleeding.

Treatment for a hemophiliac with trauma centers on controlling bleeding and treating for shock. Extra pressure, dressings, and time may be required to stabilize blood loss. Internal bleeding may be impossible to stop in the field. Rapid transport is always warranted. In the hospital treatment is factor VIII - blood donors blood is separated and the factor VIII is given on a routine basis to

Hemophiliacs

- Normal clotting time is 7 to 10 minutes.
- Christmas disease is a term for hemophilia. In 1952 the first pt was diagnosed with hemophilia and was named Christmas.

Describe the pathophysicology, signs, symptoms, and treatment for Sickle Cell Crisis.

Sickle cell disease is a genetic disorder that results in the production of abnormal hemoglobin (hemoglobins). Hemoglobin changes shape when low oxygen levels exist in the blood. This change causes less oxygen to be carried by the red blood cell. In addition, the sickle-shaped red blood cell clogs capillaries in tissues and organs starving them for nutrients and setting up a state of anaerobic metabolism and lactic acidosis. It is a disease

almost exclusively of African-Americans. A similar disease, called thalassemia occurs in people of Mediterranean decent.

Signs and symptoms

- Excruciating pain (abdomen and joints)
- Chest pain
- Weakness
- Jaundice
- Splenomegaly
- Priapism
- Stroke
- Pulmonary Embolus
- MI

Presence of triggers

- Dehydration
- Temperature extremes
- Infection
- Low oxygen environment

Treatment

- Oxygen 100 %
- IV NS fluid challenge (20ml/kg for dehydration, then 500ml/hour)
- Morphine for pain