Chapter 7
Blood and Blood-Forming Organs
Diseases and Disorders

Anatomy and Physiology

• Hematologic system
• Major functions of blood
  – Transport nutrients to cells
  – Aid removal of wastes
• Average adult has 5 to 6 liters of circulating blood

Anatomy and Physiology

• Normal erythrocyte count 4.2 to 6.3 million
• Erythrocytes life span - 120 days
• Erythrocytes form in the bone marrow and do not reproduce

Anatomy and Physiology

• Hemoglobin important in oxygen transport
• Normal hemoglobin - Male - 13.5 to 18 gm/female – 12 to 16 gm

Anatomy and Physiology

• Leukocytes protect individual from infection
• Normal leukocyte count is 4,500-11,000
• Platelets known as thrombocytes
• Important in blood clotting
• Normal platelet count is 150,000-350,000
Anatomy and Physiology

- Blood-forming organs include lymph nodes, bone marrow, spleen, liver
- Lymph system protects against pathogens
- Bone marrow is major blood cell producer

Anatomy and Physiology

- Spleen produces lymphocytes, plasma cells, and antibodies; filters microorganisms from the blood
- Responsible for producing prothrombin and fibrinogen for blood clotting

Common Signs and Symptoms

- Erythrocytopenia (decrease in RBCs) leads to anemia

Common Signs and Symptoms

- Common signs and symptoms of anemia
  - Fatigue
  - Headache
  - Low RBCs
  - Pallor
  - Shortness of breath

Common Signs and Symptoms

- Erythrocytosis (increased RBCs)
- Common signs and symptoms
  - High RBCs
  - Reddened skin tones
  - Bloodshot eyes
  - Increased blood volume and pressure
  - Increased blood volume of the heart

Common Signs and Symptoms

- Leukocytopenia (decreased white blood cells) weakens immune system
- Leukocytosis (increased white blood cells) is a normal response to acute infections
- Thrombocytopenia (decreased platelet count) leads to coagulation problem
Common Signs and Symptoms

- Signs and symptoms
  - Petechiae - small hemorrhages in the skin
  - Ecchymoses - large areas of bruising or hemorrhage
  - Epistaxis - nosebleeds
  - Bleeding in mouth, gums, and mucous membranes

Common Signs and Symptoms

- Thrombocytosis (increase in platelets)
- Condition is uncommon
- Usually no serious side effects

Diagnostic Tests

- Complete blood count with differential and indices
- Biopsy of blood-forming organs
- Hematocrit (hct) reflects amount of red cell mass as a proportion of whole blood
- Hemoglobin (hgb) reflects the blood’s oxygen-carrying potential

Diagnostic Tests

- Bleeding time determines platelet disorders such as hemophilia, thrombocytopenia, disseminated intravascular coagulation
- PT (prothrombin time) and PTT (partial prothrombin time) measure blood’s ability to clot

Disorders of Red Blood Cells

- Anemia
  - Decrease in oxygen-carrying ability of the RBC
- Symptoms
  - Pallor
  - Fatigue
  - Shortness of breath
Disorders of Red Blood Cells

• Anemia
  – Symptoms
    • Tachycardia
    • Headache
    • Irritability
    • Syncope

• Iron-Deficiency Anemia
  – Loss of iron or inadequate intake of iron
  – Causes: blood loss and low dietary intake
  – Treatment: increase dietary intake of iron

• Folic Acid Deficiency Anemia
  – Folic acid needed for maturation of RBCs
  – Poor diet, overcooking vegetables, or overconsumption of alcohol
  – Treatment: folic acid by eating green and yellow vegetables

• Pernicious Anemia
  – Lack of intrinsic factor leading to inadequate absorption of vitamin B₁₂
  – Treatment: monthly injections of vitamin B₁₂ for life

• Hemolytic Anemia
  – Destruction of RBCs related to antibody-antigen reaction
  – Disorder of immune system leading to destruction of erythrocytes
  – Treatment: exchange transfusion and/or a splenectomy

• Sickle Cell Anemia
  – Hereditary; no cure
  – Found in black race
  – Abnormal sickle shape of the erythrocyte
  – Sickle shape does not allow the cell to travel smoothly through vessels
  – Treatment is symptomatic
Disorders of Red Blood Cells

• Aplastic Anemia - failure of bone marrow to produce blood components
• Causes
  – Chemotherapy, radiation, viruses, and toxins
• Treatment: avoid causative agent, bone marrow transplantation, and transfusions

Disorders of Red Blood Cells

• Polycythemia - too many blood cells
• Spleen is enlarged, mucous membranes are reddened, bloodshot eyes, palms are deep red color
• Treatment: donate blood at regular intervals to reduce blood volume

Disorders of White Blood Cells

• Mononucleosis - "kissing disease"
• Symptoms
  – Fatigue, sore throat, and swollen glands
• Diagnosis - Increase monocytes in WBC
• Treatment: rest, analgesics, and throat gargles

Disorders of White Blood Cells

• Leukemia - malignant neoplasm of blood-forming organs
• Abnormal production of immature leukocytes
• Classified as acute or chronic
• Acute forms affect children, progress rapidly, and may be fatal

Disorders of White Blood Cells

• Chronic forms of leukemia occur in older adults, often asymptomatic, and may not be lethal
• Classified as
  – Myelogenous - affecting bone marrow
  – Lymphocytic - affecting lymph nodes

Disorders of White Blood Cells

• Bone marrow biopsy to confirm diagnosis
• Symptoms
  – Fatigue
  – Headache
  – Sore throat
Disorders of White Blood Cells

• Symptoms
  – Dyspnea, bleeding of mucous membranes of the mouth and GI system
  – Bone and joint pain
  – Enlargement of lymph nodes, liver, and spleen
• Infections are common

Disorders of White Blood Cells

• Treatment of Leukemia
  – Aggressive chemotherapy
  – Once in remission, a bone marrow transplant to replace neoplastic tissue with normal tissue
  – Remission: 50 percent

Disorders of White Blood Cells

• Hodgkin’s Disease
  – Most common lymphoma
  – Painless enlargement of lymph nodes in neck, weight loss, and fever
  – Primarily affects young adults with average age of 35

Disorders of White Blood Cells

• Hodgkin’s Disease
  – Cause thought to be viral
  – Diagnosis made by presence of Reed-Sternberg cell in lymphatic tissue

Disorders of White Blood Cells

• Non-Hodgkin’s
  – Lymphomas lacking Reed-Sternberg cell
  – Symptoms:
    • Painless enlargement of lymph nodes of neck
    • Axilla and inguinal areas
    • Fever, night sweats, and weight loss
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<th>Disorders of White Blood Cells</th>
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<tbody>
<tr>
<td>• Non-Hodgkin’s</td>
<td>• Multiple Myeloma</td>
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<tr>
<td>– Affects adults: average age of 50</td>
<td>– Malignant neoplasm of plasma cells or B-lymphocytes</td>
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<tr>
<td>– Treatment: radiation and chemotherapy</td>
<td>– Increases with age, peaking in seventies</td>
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<td>– Plasma cells multiply abnormally in bone marrow causing weakness and leading to fractures and bone pain</td>
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<tr>
<td>– Honeycombed bone pattern</td>
<td>– Treatment</td>
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<tr>
<td>– Hypercalcemia</td>
<td>• Chemotherapy</td>
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<tr>
<td>– Special protein called Bence Jones found in blood and urine</td>
<td>• Radiation</td>
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<tr>
<td>– Bone marrow biopsy</td>
<td>• Treatment is not effective and prognosis is poor</td>
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<td>• Hemophilia</td>
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<tr>
<td>– X-linked hereditary bleeding disorder</td>
<td>– Epistaxis, bruising, and prolonged bleeding</td>
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<td>– Several types of hemophilia – Type A is most common</td>
<td>– Diagnosis confirmed by blood test; no cure</td>
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<td>– Male children from asymptomatic mothers</td>
<td>– Treatment: prevention of injury and treat symptoms</td>
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<td>– Lack protein necessary for clot formation</td>
<td>– Blood transfusions and concentrated form of clotting protein</td>
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Disorders of Platelets

- Thrombocytopenia
  - Thrombocytopenia purpura
  - Decrease in platelets leading to inability to normally clot blood

Disorders of Platelets

- Thrombocytopenia
  - Characteristics:
    - Petechiae
    - Abnormal bleeding in skin, mucous membranes, and internal organs
    - Ecchymoses, GI hemorrhages, epistaxis, hematuria

Disorders of Platelets

- Diagnosis made by platelet count and bleeding time
- Treatment
  - Avoid tissue trauma to reduce bleeding
  - Vitamin K
  - Transfusions of platelets
  - Splenectomy

Disorders of Platelets

- Disseminated Intravascular Coagulation (DIC)
  - Abnormal clotting followed by abnormal bleeding
  - Usually follows major trauma such as complicated childbirth, surgery, tissue destruction, septicemia, snakebite, and shock

Disorders of Platelets

- Rare Diseases
  - Thalassemia
    - Affects primarily people of Mediterranean descent
    - RBCs are fragile and thin and form defective hemoglobin
Disorders of Platelets

• Rare Diseases
  – Von Willebrand’s Disease
    • Hereditary
    • Congenital
    • Deficiency in clotting factor and platelet function
    • Also called angiohemophilia
    • Affects females as well as males