Chapter 35 Hematology

Hematology
• The study of blood and blood-forming ________________
• Includes the study of the following blood disorders:
  - Red blood cell disorders
  - ______________________blood cell disorders
  - Platelet disorders
  - ______________________problems

Blood Components
• Plasma
  - sticky yellowish
  - carries blood cells and ______________________
• Erythrocytes (red blood cells)
  - contain ______________________
  - gives blood it’s color
  - carries ______________________

Blood Components
• ______________________:
  - Iron containing oxygen-transport malloprotein in the red blood cells
• ______________________(white blood cells)
  - fights infection
• ______________________
  - clot formation
  - usually clots in 4 to 6 minutes

Lab Values

Hemoglobin Levels
• The amount of ______________________ carrying protein within the red blood cells
• Normal Adult Female 12-16g/dL
• Normal Adult Male: 14-18g/dL
• Low hemoglobin suggests ______________________
• High hemoglobin can suggest lung disease, living at high altitudes, or excessive bone marrow production

Hematocrit
• A measure of how much space red blood cells take up in the blood
• The proportion of blood volume that is occupied by red blood cells
• Normal adult male: _________%
• Normal adult female: _________%
• Elevated hematocrit indicates ______________________
• Low levels indicate ______________________

White Blood Cell Levels
• Number of white blood cells
• Normal adult range: 3.8-10.8 thousand/mcL
• Optimal reading: 7.3
High readings could indicate ___________________________ or leukemia
Low readings can indicate bone marrow disease or enlarged

Red Blood Cell Levels
- Number of red blood cells
- Normal adult female: 3.9-5.2 mill/mcl
- Normal adult male: 4.2-5.6 mill/mcl
- High readings could indicate ___________________________ disease, cor pulmonale, or dehydration
- Low readings could indicate anemia, leukemia, malnutrition, bone marrow failure, multiple myeloma, blood loss, or ___________________________

Platelet Values
- Number of platelet cells
- Normal adult range: 150-450 thousand/mcl
- Optimal range: 265 thousand
- High readings could indicate ___________________________, cigarette smoking, or excessive production by the bone marrow
- Low readings could indicate acute blood loss, drug effects (_________________________), infections, enlarged spleen

Troponin
- Troponin is a muscle ____________________________, that helps muscles contract
- When the ____________________________, muscle is damaged, troponins leak out of cells and into the bloodstream
- Normal reading is <_________ng/mL
- Elevated readings could indicate an __________________
- Troponin levels can remain high for 1-2 weeks after an MI

Blood Products and Blood Typing
- ___________________________
  - A, B, AB, O
  - Type A blood
    - Has the A antigen
    - _________% of population
  - Type B blood
    - Has the B antigen
    - _________% of the population
- ___________________________
  - Type O blood
    - Has ___________________________ antigens
    - Universal ___________________________
    - _________% of the population
  - Type AB blood
    - Has both A and B antigens
    - Can receive any type of blood (universal ___________________________
    - _________% of the population
  - Rh factor: + or -
### Rh Factor
- Consists of 50 blood group antigens
- Rh factor is based on the ______________ antigen
  - Positive or Negative
- Used to determine the risk of hemolytic disease of the ______________ as well as transfusion compatibility

### Types of Transfusions
- ______________ blood
  - Contains all cells, platelets, clotting factors, and plasma
  - Replaces blood loss from hemorrhage
- Packed Red Blood Cells (PRBC)
  - Red blood cells with some ______________________________
  - Replaces RBC in anemic patients
- ________________________________
  - Platelets with some plasma
  - Replaces platelets in a patient with thrombocytopenia

### Types of Transfusions
- Fresh Frozen Plasma (FFP)
  - Plasma, a combination of fluids, ______________________________ factors, and proteins
  - Replaces volume in a ______________________________ patient
- Clotting Factors
  - Specific clotting factors needed for ______________________________
  - Replaces factors missing due to inadequate production as in ______________

### Transfusion Reactions
#### Hemolytic Reactions
- Occurs when a donor’s and ______________________________ blood are not compatible
- Signs & Symptoms
  - Facial flushing, hyperventilation, tachycardia, hives, chest pain, wheezing, rales, fever, chills, and ______________________________
- Treatment
  - Stop transfusion, change all IV tubing, and initiate IV therapy with NS or LR
  - Consider ______________________________ , Dopamine, and Diphenhydramine.

#### Febrile Nonhemolytic Reactions
Febrile Nonhemolytic Reactions
- Caused by ______________________________ to antigens on the white blood cells, platelets, or plasma proteins
- Signs & Symptoms
- Headache, fever, and chills
- Treatment:
  - Stop ______________________________ , change all IV tubing, and initiate IV
therapy with NS or LR

- Consider ______________________________________ and an antipyretic.
- Observe closely to ensure reaction is nonhemolytic.

20 General Assessment and Management of Hematologic Patients

Scene Size-up
Primary Assessment
Focused History and Physical Exam

- SAMPLE history
  - Hematological disorders are rarely the chief complaint.
  - “Weak and Dizzy” is a ______________________________________ complaint
- Physical exam
  - Evaluate ______________________________________ system function.

21 Physical Exam of Hematologic Patients

- Skin signs
  - Jaundice
  - Pallor
    - ________________________________: tiny red dots
    - ________________________________: large purplish blotches
- Gastrointestinal signs
  - ________________________________
  - Bleeding gums
  - Abdominal pain, N/V

22 Physical Exam of Hematologic Patients

- Musculoskeletal signs
  - Pain and swelling of the ________________________________
- Cardiorespiratory signs
  - Dyspnea, tachycardia, chest pain
  - Pulmonary edema
- Genitourinary signs
  - ________________________________
  - Blood in scrotal sac on males
  - ________________________________ (later stages of sickle cell anemia)

23 General Management of Hematologic Patients

- Maintain ABCs.
  - Provide high-flow oxygen or assist ________________________________ as indicated.
  - Consider ________________________________ replacement.
- Monitor cardiac rhythm and vital signs.
  - Treat rhythm ________________________________.
- Provide reassurance, comfort care, and transport.

24 Managing Specific Patient Problems

- Diseases of the ________________________________ Blood Cells
- Diseases of the White Blood Cells
- Diseases of the ________________________________/Blood Clotting Abnormalities
Other Hematopoietic Disorders

Anemia
- Number of red blood cells
- Anemia is a sign, not a separate process.
- Signs and symptoms may not be present until the body is stressed.
- S/S include: mild dyspnea, fatigue, and syncope. Possible S/S of shock.
- Differentiate chronic anemia from episode.

Prehospital Treatment of Anemia
- Treat signs and symptoms
- Maximize
- Limit loss.
- Establish IV therapy if indicated.

Types of Anemias
3 causes of Anemias:
- Inadequate of red blood cells
- Increased red blood cell
- Blood cell loss or

Anemias Caused by Inadequate Production of Red Blood Cells
- Failure to produce red blood cells
- Deficiency
  - Iron is primary component of hemoglobin

Anemias Caused by Inadequate Production of Red Blood Cells
- Vitamin B12 is necessary for correct rbc division during it's development
  - Decreased levels of B12
- Cell Anemia
  - Genetic alteration changes the shape of red blood cells to a C, or sickle, in low oxygen states

Anemias Caused by Increased Red Blood Cell Destruction
- Body destroys RBCs at greater rate than production

Anemias Caused by Blood Cell Loss or Dilution
- Hemorrhage leads to cell loss while excessive fluid leads to a dilution of RBC concentration

Diseases of the Red Blood Cells

Sickle Cell Disease
- Inherited disorder of red blood cell production, so named because the RBCs become sickle shaped when levels are low
- Patients with sickle cell disease has chronic anemia
- Average life span of a RBC is days as compared to 120 days for normal RBC
Primarily affects __________________________ - Americans

Sickle Cell Disease

Sickle Cell Crises

- ________________________________ Crises: causes musculoskeletal pain, abdominal pain, priapisms, pulmonary problems, renal infarctions, and CNS problems
- ________________________________ Crises: fall in the hemoglobin level and problems with bone marrow function
- ________________________________ Crises: vulnerable to infections

Management
- Supportive measures
- Fluid replacement as indicated
- Consider analgesics.

Polycythemia

- Overproduction of RBCs.
  - Occurs in patients > 50 years old or with secondary dehydration.
  - Increases risk of ________________________________
- Results in bleeding abnormalities:
  - ________________________________, spontaneous bruising, GI bleeding.
- Management:
  - Follow general treatment guidelines.

Diseases of the White Blood Cells

Leukopenia/Neutropenia

- Too few white blood cells or ________________________________
- Person is very susceptible to ________________________________
- Follow general treatment guidelines and provide supportive care.

Leukocytosis

- An ________________________________ in the number of circulating white blood cells, often due to infection or stress
- Causes include bacterial infections, ________________________________ , rheumatoid arthritis, leukemia
- Follow general treatment guidelines and provide supportive care.

Leukemia

- ________________________________ of hematopoietic cells

Common types of Leukemia
- Acute lymphocytic leukemia (ALL)
- Acute myelogenous leukemia (AML)
- Chronic lymphocytic leukemia (CLL)
- Chronic myelogenous leukemia (CML)
- Hairy cell leukemia

Leukemia

- Initial presentation
  - Acutely ill, fatigued, febrile and weak, anemic,
  - Often have a secondary ________________________________.
Management
- Follow general treatment guidelines.
- Utilize isolation techniques to limit risk of __________________________.
- IV therapy
- __________________________

**Lymphomas**
- Cancers of the __________________________ system
- Presentation
  - Swelling of the lymph nodes
  - Fever, night sweats, __________________________, weight loss, fatigue, and pruritis (itching)
- Management
  - Follow general treatment guidelines.
  - Utilize __________________________ techniques to limit risk of infection.

**Diseases of the Platelets and Blood Clotting Abnormalities**

**Thrombocytosis**
- An abnormal increase in the number of __________________________
- Often complicates chronic myelegogenous leukemia
- May be secondary to other disorders such as autoimmune diseases, acute hemorrhage, and malignant diseases
- Most persons are __________________________
- Prehospital care is __________________________

**Thrombocytopenia**
- An abnormal __________________________ in the number of platelets
- Due to decreased platelet production, sequestration of platelets in the spleen, destruction of platelets, or a combination of the three
- Characterized by easy __________________________, bleeding, and a falling plate count
- Prehospital care is supportive

**Hemophilia**
- Deficiency or absence of a blood clotting factor
- Deficiency of factor __________ causes hemophilia A.
- Deficiency of factor __________ causes hemophilia B.
- Delays or prevents the stoppage of __________________________
- __________________________ injuries can be life threatening

**Hemophilia**
- Deficiency is a sex-linked, inherited disorder.
- Defective gene is carried on the __________ chromosome.
- Females have 2 X chromosomes and __________________________ must have the defective gene for the female to develop hemophilia
  - Females with only 1 X chromosome with defective gene are __________________________
- Males have 1 X (from mother) and 1 Y chromosome (from father)
  - If that X chromosome has the defective gene, then that person will have hemophilia
Signs & Symptoms:
- Numerous bruises, deep muscle bleeding, and __________________________ bleeding.
- Often use Medic Alert __________________________
- Most will know of their condition

Management of Hemophilia
- Administer supplemental oxygen
- Establish IV access with great __________________________
- Be alert for recurrent or prolonged bleeding
- Prevent additional __________________________
- Consider __________________________ if needed

Multiple Myeloma
- A __________________________ disorder of plasma cells
- Mutation in a plasma cell in the bone marrow leading to decreased reduced red blood cell production
- Signs/Symptoms
  - Pain in back or ribs
  - __________________________ fractures
  - Fatigue
  - Elevated calcium levels which lead to __________________________ failure

Multiple Myeloma
- Normally treated with chemotherapy, bone marrow transplants, and radiation
- Prehospital care is supportive
  - IV if s/s of __________________________
  - Administer analgesics if needed
  - Protect from __________________________