

Hematology Objectives Clinical Medicine II

A. Lab Studies

1. Discuss the following laboratory tests and the interpretation of normal and abnormal results. *The student will be expected to memorize normal lab values for select labs.*
 - a. Complete blood count (CBC)
 1. WBC (white blood count)
 2. WBC differential
 - Neutrophils (polymorphonuclears- PMNs)
 - Band neutrophils (bands)
 - Lymphocytes (lymphs)
 - Monocytes (monos)
 - Eosinophils (eos)
 - Basophils (basos)
 3. Platelets
 - Mean platelet volume
 4. Hemoglobin (Hgb)
 5. Hematocrit (HCT)
 6. Red cell count (RBC)
 - Mean corpuscular volume (MCV)
 - Mean corpuscular Hgb (MCH)
 - Mean corpuscular Hgb concentration (MCHC)
 - RDW
 - b. Serum iron
 - c. Serum transferrin
 - d. Total iron binding capacity (TIBC)
 - e. Iron saturation (% sat)
 - f. Serum ferritin
 - g. Serum vitamin B₁₂
 - h. Serum folate
 - i. Erythropoietin
 - j. Coagulation studies:
 - Bleeding Time
 - Prothrombin time (PT)
 - International normalized ratio (INR)
 - Partial thromboplastin time (PTT)
 - Thrombin time (TT)
 - Plasma fibrinogen
 - Fibrin split products (FSP)
 - k. Serum bilirubin
 - l. Total bilirubin
 - m. Conjugated bilirubin (direct)
 - n. Albumin
 - o. Total protein

B. Overview of Hematopoiesis

1. Describe the process of hematopoiesis including erythropoiesis, production and differentiation of white cells, platelet synthesis and their release from the normal bone marrow.
2. Define the normal life span of red blood cells (RBCs), white blood cells (WBCs), and platelets within the circulation.
3. Describe the structure/composition, metabolic activities, and functions of the various blood cell types:
 - erythrocytes
 - neutrophils
 - lymphocytes
 - monocytes
 - eosiniphils
 - basophils
4. Describe the plasma environment of blood cells, demonstrating knowledge of the plasma proteins required for normal clotting and host defense.
5. Identify common conditions associated with abnormalities in red cells, white cells, and platelets.
6. Describe the common laboratory tests for the evaluation of blood and bone marrow:
 - complete blood count –CBC
 - peripheral blood smear
 - bone marrow aspiration and biopsy
7. Describe common pathophysiological processes that result in disruption of bone marrow function.
8. Identify structural or metabolic abnormalities that may result in cellular dysfunction.
9. For the following conditions, discuss the pathophysiologic reason for the hematologic change (anemia, polycythemia, white cell changes, platelet, and blood coagulation abnormalities):
 - Malignant disease
 - Rheumatoid arthritis (connective tissue disorders)
 - Renal failure
 - Liver disease
 - Hypothyroidism
 - Bacterial infection
 - Viral infection
10. Explain the splenic reaction to systemic disease.
11. Explain the hematologic effects of splenomegaly, and the effects of splenectomy.

C. Blood Products

1. Identify the major blood groups characterized by ABO antigens and antibodies.
2. Describe the Rh system of blood group classification and risks associated with Rh incompatibility.
3. Identify standards for pretransfusion testing.
4. Define type and cross-match.
5. Describe transfusion complications associated with ABO incompatibilities.
6. Identify the composition of various blood products that may be given in a transfusion and common indications for use.
 - whole blood
 - white blood cells
 - fresh frozen plasma (FFP)
 - packed red blood cells (PRBCs)
 - cryoprecipitate
 - plasma derivatives
 - albumin
 - immunoglobulin
 - antithrombin
 - coagulation factors

D. Anemia

1. Describe the epidemiology, etiology, and pathophysiology for common specific anemias.
 - Iron deficiency anemia
 - Anemia of chronic disease (ACD)
 - Vitamin B12 and folic acid deficiency
 - Thalassemia
 - Sickle cell anemia
 - Hemolytic Anemias
2. Differentiate anemias resulting from decreased RBC production, increased RBC destruction, and abnormal hemoglobin synthesis.
 - Decreased production
 - Microcytic/hypochromic
 - iron deficiency
 - thalassemia
 - anemia of chronic disease
 - Normocytic/normochromic
 - renal failure
 - anemia of chronic disease
 - early mild iron deficiency
 - primary bone marrow failure (aplastic anemia)
 - Macrocytic/megaloblastic, normochromic
 - B12 deficiency
 - folic acid deficiency (use of folic acid antagonists)
 - liver disease
 - hypothyroidism

- Aplastic/dysplastic anemia
 - drug induced
 - toxin induced
 - secondary to radiation
 - idiopathic
 - Abnormal hemoglobin production
 - Thalassemia
 - sickle cell anemia
 - Increased destruction (hemolytic anemia)
 - Non-immune
 - fragmentation hemolysis
 - hypersplenism
 - infection
 - enzyme defects
 - glucose-6-phosphate dehydrogenase (G6PD) deficiency
 - abnormal Hgb
 - Immune
 - warm Ab AhA
 - cold Ab AhA
 - drug induced
 - paroxysmal cold hemoglobinuria
3. List the symptoms and physical findings for a patient presenting with iron deficiency anemia, ACD, Thalassemia, vitamin B12 deficiency, folic acid deficiency, sickle cell anemia, and hemolytic anemia.
 4. Formulate a diagnostic plan and differential diagnosis for patients presenting with iron deficiency anemia, ACD, Thalassemia, B12 deficiency, folic acid deficiency, sickle cell anemia, and hemolytic anemia.
 5. Correlate laboratory findings with the pathology of specific anemias.
 6. Identify treatment options for patients with Thalassemia, deficiency, sickle cell anemia, and hemolytic anemia.
(Treatment options for iron deficiency, ACD, B-12 and folic acid deficiency will be covered in Pharmacotherapy II.)
 7. Differentiate ethnic and genetic factors in the epidemiology of Thalassemia and sickle cell anemia.

E. Blood Coagulation and Coagulation Abnormalities

1. Describe the role of each of the following in the regulation of blood coagulation.
 - vascular endothelium
 - platelets
 - plasma coagulation factors
 - inhibitory factors

2. Describe the homeostatic process of blood coagulation and inhibition.
3. Recognize major characteristics of common bleeding disorders including:
 - Hemophilia
 - Factor VIII disorders
 - Factor IX disorders
 - Factors XI disorders
 - Von Willebrand's disease
4. Identify patterns of inheritance and genetic mutations in these common coagulation deficiencies.
5. Identify common acquired conditions associated with coagulation dysfunction and describe the factors that contribute to the deficiency.
 - liver disease
 - disseminated intravascular coagulation (DIC)
 - obstetric catastrophes
 - malignancy
 - multiple trauma
 - bacterial sepsis
 - anticoagulation therapy
6. Differentiate coagulation factor deficiencies from platelet abnormalities.
7. Recognize the characteristics of common hereditary thromboembolic disorders.
 - Factor V Leiden
 - Prothrombin gene mutation
 - Protein C deficiency
 - Protein S deficiency
 - Antithrombin-III deficiency
 - Dysfibrinogenemia
 - Hyperhomocysteinemia
8. Identify common acquired thrombophilic conditions.
9. Describe the pathophysiology of common triggers for acquired thrombosis.
 - Immobilization (stasis)
 - Antiphospholipid antibodies / lupus anti-coagulant
 - Surgery
 - Trauma
 - Pregnancy
 - Estrogen induced
 - Age

F. Platelets

1. Describe the process of platelet production.
2. Identify key features of platelet structure.
3. Describe the process of normal platelet function.
4. Identify common drugs, by classification, that impair platelet function and their mechanism of action.

5. Recognize the clinical features of common platelet abnormalities.
 - Thrombocytopenia
 - Thrombotic thrombocytopenic purpura (TTP)
 - Thrombocytosis
 - Congenital/inherited disorders
 - Acquired disorders

6. Distinguish thrombocytopenias resulting from decreased platelet production, increased platelet destruction or sequestration, and hypersplenism.
 - Decreased production
 - Nutritional deficiency
 - Bone marrow failure
 - Marrow replacement
 - Marrow toxins
 - Increased sequestration and/or destruction
 - Immunological
 - Idiopathic (immune) thrombocytopenic purpura (ITP)
 - Drug induced thrombocytopenia
 - Heparin induced thrombocytopenia (HIT)
 - Disseminated intravascular coagulation (DIC)
 - Hypersplenism

G. White Blood Cell Function and Abnormalities

1. Describe humoral and cell mediated immunity and define their role in host defense and autoimmune disorders.
2. Identify common conditions associated with leukocytosis and differentiate reactive (infectious) from neoplastic etiologies.
 - Reactive (benign)
 - Bacterial (neutrophilia)
 - Viral (lymphocytosis)
 - Parasitic (eosinophilia)
 - Neoplastic (malignant)
 - leukemias

3. Differentiate neutropenias resulting from decreased neutrophil production from those caused by increased neutrophil destruction.
 - Decreased production
 - Nutritional deficiency
 - Marrow aplasia/dysplasia
 - Marrow replacement
 - Marrow destruction
 - idiopathic
 - secondary to toxins, drugs or radiation

- Increased destruction
 - Hypersplenism
 - Overwhelming infections/sepsis
4. Identify common benign and malignant disorders associated with lymphadenopathy.
 5. Recognize common causes lymphadenopathy.
 - Localized lymphadenopathy
 - Local infection
 - Pyogenic infection (pharyngitis, dental abscess, otitis media)
 - Viral infection (cat scratch fever)
 - Tuberculosis
 - Lymphoma
 - Hodgkin's disease
 - Non-Hodgkin's lymphoma
 - Carcinoma (secondary)
 - Generalized lymphadenopathy
 - Infections
 - Viral (mononucleosis, measles, rubella, viral hepatitis, HIV)
 - Bacterial (syphilis, tuberculosis, Salmonella, bacterial endocarditis)
 - Fungal (histoplasmosis)
 - Non-infectious inflammatory diseases
 - Leukemias
 - Lymphoma
 - Reactions to drugs and chemicals
 - Hyperthyroidism

H. Malignant Disorders (Lymphoma, Leukemia, Multiple Myeloma)

1. Describe the etiology, pathophysiology clinical presentation, and physical and hematological findings of various lymphomas and leukemias.
 - Acute myelogenous leukemia (AML)
 - Chronic myelogenous leukemia (CML)
 - Acute lymphocytic leukemia (ALL)
 - Chronic lymphocytic leukemia (CLL)
 - Hodgkin's Disease
 - Non-Hodgkin Lymphoma
 - Multiple myeloma
2. Identify the diagnostic approaches for the various malignant disorders.
3. Recognize treatment options and prognostic factors for common lymphomas, leukemias, and multiple myeloma.

I. Human Immunodeficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS)

1. Discuss the state, national, and worldwide epidemiology of HIV/AIDS.
2. Describe the pathophysiology of HIV and the hematological/immunological derangements associated with HIV/AIDS.
3. Explain the progression of HIV to AIDS.
4. Correlate the clinical presentation of HIV/AIDS with the underlying pathophysiology of the disease.
5. Identify common infectious agents and presenting conditions that may indicate a positive HIV status.
6. List the diagnostic tests, criteria for screening and diagnosis of HIV/AIDS, and current guidelines for reporting.
7. Formulate a teaching plan for patient's with HIV/AIDS.
8. List the goals of treatment for an HIV vs. AIDS patient.
9. Identify public education guidelines regarding the prevention/transmission of HIV.