McCance: Pathophysiology, 6th Edition

Chapter 27: Alterations of Leukocyte, Lymphoid, and Hemostatic Function

Key Points – Print

SUMMARY REVIEW

Alterations of Leukocyte Function

1. Quantitative alterations of leukocytes (too many or too few) can be caused by bone marrow dysfunction or premature destruction of cells in the circulation. Many quantitative changes in leukocytes occur in response to invasion by microorganisms.
2. Leukocytosis is a condition in which the leukocyte count is higher than normal and is usually a response to stress and invasion of microorganisms.
3. Leukopenia is a condition in which the leukocyte count is lower than normal and is caused by pathologic conditions such as malignancies and hematologic disorders.
4. Granulocytosis (particularly as a result of an increase in neutrophils) occurs in response to infection. The marrow releases immature cells, causing a shift-to-the-left, when responding to an infection that has created a demand for neutrophils that exceeds the supply in the circulation.
5. Eosinophilia results most commonly from parasitic invasion and ingestion or inhalation of toxic foreign particles.
6. Basophilia is seen in hypersensitivity reactions because of the high content of histamine and subsequent release.
7. Monocytosis occurs during the late or recuperative phase of infection when macrophages (mature monocytes) phagocytose surviving microorganisms and debris.
8. Granulocytopenia, a significant decrease in neutrophils, can be a life-threatening condition if sepsis occurs; it is often caused by chemotherapeutic agents, severe infection, and radiation.
9. IM is an acute infection of B lymphocytes most commonly associated with EBV, a type of herpesvirus. Transmission of EBV is by personal contact, commonly through saliva, thus its nickname, the kissing disease.
10. Two of the earliest manifestations of IM are sore throat and fever caused by inflammation at the primary site of viral entry.
11. Most causes of EBV IM include fever lasting 7 to 10 days, sore throat, and enlargement and tenderness of the cervical lymph nodes. It is self-limiting and treatment consists of rest and symptomatic treatment.
12. The common pathologic feature of all forms of leukemia is an uncontrolled proliferation of leukocytes, overcrowding the bone marrow and resulting in decreased production and function of the other blood cell lines.

13. All leukemias are classified by the cell type involved, (a) lymphocytic or (b) myelogenous, and are differentiated by onset, acute or chronic. Thus there are four major types of leukemia: ALL, CLL, AML, and CML.
14. Although the exact cause of leukemia is unknown, it is considered a clonal disorder. A high incidence of acute leukemias and CLL is reported in certain families, suggesting a genetic predisposition.
15. The most common genetic abnormality in adult ALL is the Philadelphia chromosome. In about a third of clients with AML there is a mutation in the receptor tyrosine kinase FLT3.
16. In leukemia, blasts (precursor cells) “crowd out” the marrow and cause cellular proliferation of the other cell lines to cease.
17. The major clinical manifestation of leukemia includes fatigue caused by anemia, bleeding caused by thrombocytopenia, fever secondary to infection, anorexia, and weight loss.
18. Chemotherapy is the treatment of choice for leukemia. Acute leukemias are associated with an increasing survival rate of 80% to 90%, with long-term survival of 30% to 40%. Chronic leukemias are associated with a longer life expectancy than are acute leukemias.
19. Chronic leukemias progress differently than acute leukemias, advancing slowly and without warning. The presence of the Philadelphia chromosome is a diagnostic marker for CML.
20. The number of lymphocytes is decreased (lymphocytopenia) in most acute infections and in some immunodeficiency syndromes.
21. Lymphocytosis occurs in viral infections (IM and infectious hepatitis, in particular), leukemia, lymphomas, and some chronic infections.
22. Lymphomas are tumors of primary lymphoid tissue (thymus, bone marrow) or secondary lymphoid tissue (lymph nodes, spleen, tonsils, intestinal lymphoid tissue). The two major types of malignant lymphomas are HL and NHL.
23. HL is associated with a highly distinctive cell, the RS cell, in the lymph nodes. The RS cell is derived from a malignant B cell that usually becomes binucleate.
24. A virus might be involved in the pathogenesis of HL. Some familial clustering suggests an unknown genetic mechanism.
25. An enlarged painless mass or swelling, most commonly in the neck, is an initial sign of HL. Local symptoms are produced by lymphadenopathy, usually caused by pressure or obstruction.
26. Treatment of HL includes radiation therapy and chemotherapy. A cure is possible regardless of the stage of HL; however, individuals treated with chemotherapy who relapse in less than 2 years have a poor prognosis.
27. The cause of lymph node enlargement and cancerous transformation in NHL is unknown. Immunosuppressed persons have a higher incidence of NHL, suggesting an immune mechanism.
28. Generally, with NHL, the swelling of lymph nodes is painless, and the nodes enlarge and transform over months or years.
29. Individuals with NHL can survive for long periods. Treatment is chemotherapy.

30. Burkitt lymphoma involves the jaw and facial bones and occurs in children from east-central Africa and New Guinea.
31. MM is a neoplasm of B cells (immature plasma cells) and mature plasma cells. It is characterized by multiple malignant tumor masses of plasma cells scattered throughout the skeletal system and sometimes found in soft tissue.
32. Myeloma cells usually secrete monoclonal protein (M protein) that is an abnormal antibody molecule. The myeloma cell may also secrete free antibody light chain that is excreted in the urine (Bence Jones protein).
33. The exact cause of MM is unknown, but genetic factors and chronic stimulation of the mononuclear phagocyte system by bacteria, viral agents, and chemicals have been suggested.
34. The major clinical manifestations for MM include recurrent infections caused by suppression of the humoral immune response and renal disease as a result of Bence Jones proteinuria.
35. Chemotherapy is the treatment of choice for MM. Survival is still only 2 to 3 years with chemotherapy, however. Treatment with thalidomide is showing promise as an effective therapeutic agent in producing long-term remissions.
36. Waldenström macroglobulinemia is a rare type of slow-growing plasma cell tumor that secretes a monoclonal IgM molecule.

Alterations of Splenic Function

1. Splenomegaly (enlargement of the spleen) may be considered normal in certain individuals, but its presence should not be ignored.
2. Splenomegaly results from (a) acute inflammatory or infectious processes, (b) congestive disorders, (c) infiltrative processes, and (d) tumors or cysts.
3. Hypersplenism (overactivity of the spleen) results from splenomegaly. Hypersplenism results in sequestering of the blood cells, causing increased destruction of red blood cells, which leads to the development of anemia.

Alterations of Platelets and Coagulation

1. Thrombocytopenia is characterized by a platelet count less than 100,000 platelets/mm^3 of blood; a count less than 50,000/mm^3 increases the potential for hemorrhage associated with minor trauma.
2. Thrombocytopenia exists in primary or secondary forms and is commonly associated with autoimmune diseases and viral infections; bacterial sepsis with DIC also results in thrombocytopenia.
3. Heparin-induced thrombocytopenia develops in approximately 4% of individuals receiving unfractionated heparin.

4. ITP is a major cause of platelet destruction, often affecting females, and results in hemorrhaging that ranges from minor development of petechiae to major bleeding from mucosal sites.
5. TTP causes platelet aggregation leading to microcirculatory occlusion.
6. Thrombocythemia is characterized by a platelet count more than 400,000 platelets/mm^3 of blood and is symptomatic when the count exceeds 1 million/mm^3, at which time the risk for intravascular clotting (thrombosis) is high.
7. Thrombocythemia is caused by accelerated platelet production in the bone marrow.
8. Qualitative alterations in normal platelet adherence or aggregation prevent platelet plug formation and may result in prolonged bleeding times.
9. Prolonged bleeding can result from alterations in platelet function, including adhesion between platelets and the vessel wall, platelet-platelet adhesion, platelet granule secretion, arachidonic acid pathway activity, and membrane phospholipid regulation.
10. Disorders of coagulation are usually caused by defects or deficiencies of one or more clotting factors.
11. Coagulation is impaired when there is a deficiency of vitamin K because of insufficient production of prothrombin and synthesis of clotting factors II, VII, IX, and X, often associated with liver diseases.
12. DIC is a complex syndrome that results from a variety of clinical conditions that release tissue factor causing an increase in fibrin and thrombin activity in the blood and producing augmented clot formation and accelerated fibrinolysis. Sepsis is a condition that is often associated with DIC.
13. DIC is characterized by a cycle of intravascular clotting followed by active bleeding caused by the initial consumption of coagulation factors and platelets and diffuse fibrinolysis.
14. Diagnosis of DIC is based on measurement in the blood of end products characteristic of dysfunctional coagulation activity. Treatment is complex and nonstandardized and focused on removing the primary cause, restoring hemostasis, and preventing further organ damage.
15. Thromboembolic disease results from a fixed (thrombus) or moving (embolus) clot that blocks flow within a vessel, denying nutrients to tissues distal to the occlusion; death can result when clots obstruct blood flow to the heart, brain, or lungs.
16. Hypercoagulability is the result of deficient anticoagulation proteins. Secondary causes are conditions that promote venous stasis.
17. The term *Virchow triad* refers to three factors that can cause thrombus formation: (1) injury to the vessel wall, (2) abnormalities of blood flow, and (3) alterations in the blood constituents leading to hypercoagulability.
18. Autoantibodies against phospholipids result in a state of acquired hypercoagulability, an increased risk for venous or arterial thrombosis, and a high incidence of pregnancy complications.