CHAPTER: 4

LEUKEMIA

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Leukemia

- A group of malignant disorders affecting the blood and blood-forming tissues of
  - Bone marrow
  - Lymph system
  - Spleen
- Occurs in all age groups
Leukemia

- Results in an accumulation of dysfunctional cells because of a loss of regulation in cell division
- Fatal if untreated
  - Progressive
Leukemia

- Often thought of as a childhood disease
- The number of adults affected with leukemia is 10 times that of children
Leukemia

Etiology and Pathophysiology

- No single causative agent
- Most from a combination of factors
  - Genetic and environmental influences
- Associated with the development of leukemia
  - Chemical agents
  - Chemotherapeutic agents
  - Viruses
  - Radiation
  - Immunologic deficiencies
Leukemia

Classification

- **Acute versus chronic**
  - Cell maturity
    - Acute: clonal proliferation of immature hematopoietic cells (the formation of blood or blood cells)
    - Chronic: mature forms of WBC; onset is more gradual
  - Nature of disease onset
- **Type of white blood cell (WBC)**
  - Acute lymphocytic leukemia (ALL)
  - Acute myelogenous leukemia (AML)
    - Also called acute nonlymphoblastic leukemia (ANLL)
  - Chronic myelogenous leukemia (CML)
  - Chronic lymphocytic leukemia (CLL)
Myelogenous Leukemia

- Leukemia characterized by proliferation of myeloid tissue (as of the bone marrow and spleen) and an abnormal increase in the number of granulocytes, myelocytes, and myeloblasts in the circulating blood
• Myeloid tissue is a biologic tissue with the ability to perform hematopoiesis. It is mainly found as the red bone marrow in bones, and is often synonymous with this. However, myeloid can also be present in the liver and spleen.

• A myelocyte is a young cell of the granulocytic series, occurring normally in bone marrow, but not in circulating blood (except when caused by certain diseases).
Granulocytes are a category of white blood cells characterized by the presence of granules in their cytoplasm. They are also called polymorphonuclear leukocytes (PMN or PML) because of the varying shapes of the nucleus, which is usually lobed into three segments.

The myeloblast is a unipotent stem cell, which will differentiate into one of the actors of the granular series.
Acute Myelogenous Leukemia (AML)

- Leukemia characterized by proliferation of myeloid tissue (as of the bone marrow and spleen) and an abnormal increase in the number of granulocytes, myelocytes, and myeloblasts in the circulating blood
- One fourth of all leukemias
  - 85% of the acute leukemias in adults
- Abrupt, dramatic onset
  - Serious infections, abnormal bleeding
- Uncontrolled proliferation of myeloblasts
  - Hyperplasia of bone marrow and spleen
Acute Lymphocytic Leukemia (ALL)

- Most common type of leukemia in children
- 15% of acute leukemia in adults
- Immature lymphocytes proliferate in the bone marrow
Acute Lymphocytic Leukemia

- Signs and symptoms may appear abruptly
  - Fever, bleeding
- Insidious with progressive
  - Weakness, fatigue
- Central nervous system manifestations
Chronic Myelogenous Leukemia (CML)

- Excessive development of mature neoplastic granulocytes in the bone marrow
  - Move into the peripheral blood in massive numbers
  - Ultimately infiltrate the liver and spleen
Chronic Myelogenous Leukemia

- Philadelphia chromosome
  - The chromosome abnormality that causes chronic myeloid leukemia (CML) (9 & 22)
  - Genetic marker

- Chronic, stable phase followed by acute, aggressive (blastic) phase
Chronic Lymphocytic Leukemia (CLL)

- Production and accumulation of functionally inactive but long-lived, mature-appearing lymphocytes
- B cell involvement
- Lymph node enlargement is noticeable throughout the body
  - ↑ incidence of infection
Chronic Lymphocytic Leukemia

- Complications from early-stage CLL is rare
  - May develop as the disease advances
  - Pain, paralysis from enlarged lymph nodes causing pressure
Hairy Cell Leukemia

- 2% of all adult leukemias
- Usually in males > 40 years old
- Chronic disease of lymphoproliferation
  - B lymphocytes that infiltrate the bone marrow and liver
Hairy Cell Leukemia

- Cells have a “hairy” appearance
- Symptoms from
  - Splenomegaly, pancytopenia, infection, vasculitis
- Treatment
  - alpha-interferon, pentostatin, cladribine
Unclassified Leukemias

- Subtype cannot be identified
- Malignant leukemic cells may have
  - Lymphoid, myeloid, or mixed characteristics
- Frequently these patients do not respond well to treatment
  - Poor prognosis
Leukemia

Clinical Manifestations

- Relate to problems caused by
  - Bone marrow failure
    - Overcrowding by abnormal cells
    - Inadequate production of normal marrow elements
    - Anemia, thrombocytopenia, ↓ number and function of WBCs
  
  - Leukemic cells infiltrate patient’s organs
    - Splenomegaly
    - Hepatomegaly
    - Lymphadenopathy
    - Bone pain, meningeal irritation, oral lesions (chloromas)
Leukemia

Diagnostic Studies

- To diagnose and classify
  - Peripheral blood evaluation (CBC and blood smear)
  - Bone marrow evaluation
- To identify cell subtype and stage
  - Morphologic, histochemical, immunologic, and cytogenetic methods
Eradicates patient’s hematopoietic stem cells
Replaced with those of an HLA-matched (Human Leukocyte Antigen)
- Sibling (is a brother or a sister; that is, any person who shares at least one of the same parents)
- Volunteer
- Identical twin
- Patient’s own stem cells removed before