Acute Myeloid Leukemia

Chapter 1 Hematopoietic Stem Cell

Blood cell production comes from self-renewing stem cells.[1] Self-renewal ensures that stem cell reserves are not exhausted.[2] Acute Myeloid Leukemia (AML) begins in the bone marrow where these new blood cells are made, but it usually moves into the blood very quickly. A small portion of the blood-forming cells are blood stem cells. These stem cells can sometimes become abnormal in individuals who have AML.[3]

Hematopoietic stem cells are at the top of hematopoietic hierarchy and produce nine different types of functional effector cells. Most effector cells have a short life span, so mature blood cell production is an ongoing process. The high turnover rate requires homeostatic control mechanisms which resides primarily with the hematopoietic stem cells. Progenitor cells within the hematopoietic hierarchy take on significant homeostatic control, as well. Progenitor cells are incapable of prolonged self-renewal, so a branching design takes place in the hematopoietic hierarchy where progenitors give rise to more progenitors that have more restricted developmental potential.[2]

The hematopoietic stem cell is the only stem cell in the body that is clinically applied in the treatment of diseases like breast cancer, leukemias, and congenital immunodeficiencies.[4] Studies suggest that normal primitive cells are the target for leukemic transformation instead of committed progenitor cells.[5] Hematopoietic stem cells maintain stem cell function after transplantations or chemotherapy.[2]

Chapter 2 Myeloid Cells

Blood stem cells can develop into either lymphocytes or myeloid cells. Myeloid cells eventually become either red blood cells, white blood cells, or platelets. These myeloid cells are abnormal in individuals with AML.[3] Acute Myeloid Leukemia develops because of an increase in the number of myeloid cells in the marrow and an arrest in their maturation. This often results in hematopoietic insufficiency (granulocytopenia, thrombocytopenia, or anemia), with or without leukocytosis.[6] Poorly differentiated myeloid cells are a result of chromosomal translocations and mutations in the genes responsible for hematopoietic proliferation and differentiation.[7] The clonal expansion of undifferentiated myeloid precursors can impair hematopoiesis and cause bone marrow failture.[8]

Chapter 3 Acute Myeloid Leukemia Classifications

AML is a heterogeneous disease with favorable, intermediate, and adverse risk groups. Prognosis varies greatly between these groups. It is important to identify recurrent genetic mutations to help determine prognosis and decide on a treatment plan.[7]

AML with recurrent genetic abnormalities

These cases can include AML with:

- Translocation between chromosomes 8 and 21
- Translocation or inversion in chromosome 16
- Acute Promyelocytic Leukemia with the PML-RARA fusion gene
- Translocation between chromosomes 9 and 11