

LEC 14: Chronic Leukemia : Definition, Classification & Diagnosis

Definition: Chronic leukemia is a slowly progressing hematologic malignancy characterized by the uncontrolled proliferation of mature but dysfunctional white blood cells. Unlike acute leukemia, chronic leukemias progress gradually and allow for some normal hematopoiesis.

Classification of Chronic Leukemia

Chronic leukemia is classified into two major types based on the affected cell lineage:

A. Chronic Lymphocytic Leukemia (CLL)

- **Origin:** Mature B-lymphocytes, **age:** Common in: Elderly (>60 years old).
- **Features:** Most common adult leukemia in Western countries.
 - Small, mature-appearing lymphocytes accumulate in the blood, bone marrow, and lymphoid tissues.
 - Often asymptomatic at diagnosis and detected incidentally on CBC.
- **Key Markers (Flow Cytometry):**
 - CD19+, CD20+, CD5+, CD23+ (abnormal co-expression of CD5 on B-cells).
 - Smudge cells on peripheral smear (fragile lymphocytes).

B. Chronic Myeloid Leukemia (CML)

- **Origin:** Myeloid stem cells., **age:** Common in: Middle-aged adults (40–60 years old).
- **Features:** Marked leukocytosis (\uparrow WBC count, often $>100,000/\text{mm}^3$).
 - Increased granulocytes at all stages of maturation (neutrophils, myelocytes, basophils, eosinophils).
 - Massive splenomegaly (abdominal discomfort, early satiety).
- **Key Marker** • Low Leukocyte Alkaline Phosphatase (LAP) score (distinguishes from leukemoid reaction).

Diagnosis of Chronic Leukemia

A. Complete Blood Count (CBC)

- **CLL:** Lymphocytosis ($>5,000/\text{mm}^3$ mature-appearing lymphocytes).
- Mild anemia and thrombocytopenia in advanced disease.
- **CML:** Marked leukocytosis ($>100,000/\text{mm}^3$).
- Increased granulocytes at all stages of maturation.
- Basophilia and eosinophilia.

B. Peripheral Blood Smear

- **CLL :** Small, mature lymphocytes.
- Smudge cells (fragile lymphocytes that rupture during smear preparation)
- **CML:**
Leukocytosis with myeloid precursors (promyelocytes, myelocytes, metamyelocytes)

C. Flow Cytometry (Immunophenotyping)

- **CLL:** Confirms diagnosis with CD19+, CD5+, CD23+.
- **CML:** Not required (diagnosed via CBC, smear, and bone marrow biopsy.)

D. Bone Marrow Aspiration & Biopsy

- **CLL:** Hypercellular marrow with lymphocytic infiltration.
- **CML:** Granulocytic hyperplasia with increased myeloid precursors.

E. Leukocyte Alkaline Phosphatase (LAP) Score

- Low in CML (distinguishes from leukemoid reaction, which has a high LAP score.)

Summary Table – Chronic Leukemia Classification & Diagnosis

Features	CLL	CML
Cell of Origin	Mature B-lymphocytes	Myeloid stem cells
Common Age Group	Elderly (>60 years)	Middle-aged (40–60 years)
Peripheral Smear	Small lymphocytes, smudge cells	Myeloid precursors

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