Bone Marrow Morphology

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Bone Marrow Components

1. (Peripheral Blood)
2. Aspirate smears or touch preparations
3. Core/Trephine biopsy
1 - Peripheral Blood

• Wright-stained slides
• Used for the assessment of:
  – Cytopenias or cytoses
  – Distribution of leukocytes
  – Circulating blasts or other atypical cells
2 – Aspirate Smears

- Wright Stained cover slips or slides
- Used for assessment of:
  - Adequacy
  - Rough estimate of cellularity
  - Presence of trilineage hematopoiesis and maturation
  - Morphology
  - Populations that don’t belong
  - Enumeration
    - Myeloids, erythroblasts, lymphocytes, plasma cells, blasts
    - Myeloid to erythroid ratio
Low Power
- Cellularity
- Adequacy
- Megakaryocytes
Medium Power
• Trilineage hematopoiesis
• Morphology
1) Pronormoblast
2) Basophilic Normoblast
3) Polychromatophilic Normoblast
4) Orthochromic Normoblast

Erythroid Maturation
1-2) Blasts / Promyelocyte

2) Promyelocyte

3) Myelocyte

4) Metamyelocyte

5) Band

Myeloid Maturation
Miscellaneous

Plasma Cell

Lymphocyte
3 – Core Biopsy

Used for the assessment of:

• More precise estimate of cellularity
• Marrow architecture
• Populations that don’t belong
Low Power
- Cellularity
- Populations that don’t belong
Medium Power
- Architecture

Interstitial

Paratrabecular
Immature myeloids start paratrabecular and mature into the interstitium.
Erythroids cluster together in the interstitum
Case 1

40-year-old man who presents with marked leukocytosis and splenomegaly
Hypercellular aspirate
• M:E ratio is 10:1
• Complete myeloid maturation
Small megakaryocytes
Cellularity is > 95%
Expansion of immature myeloids from the paratrabecular region into the interstitium.
Case 1
Diagnosis?
Chronic Myelogenous Leukemia (CML)
Case 2

40-year-old woman with disseminated intravascular coagulation
Peripheral blood shows atypical mononuclear cells with “butterfly” nucleus and granules.
Bone marrow shows an increase in atypical promyelocytes and decreased trilineage hematopoiesis.
Case 2
Diagnosis?
Acute Promyelocytic Leukemia (APL)
Case 3

60-year-old woman with leukocytosis, anemia, and thrombocytopenia
Peripheral blood shows atypical mononuclear cells
Bone marrow was inaspirable, so touch preparations were made.

- Monotonous population of mononuclear cells
- Absence of trilineage hematopoiesis
Blasts with smooth chromatin, prominent nucleoli and Auer rods
Hypercellular marrow composed of sheets of blasts
Case 3
Diagnosis?
Acute Myeloid Leukemia
Case 4

5-year-old boy with shortness of breath and eosinophilia
Hypercellular aspirate
• Decreased trilineage hematopoiesis
• Monotonous population of mononuclear cells
Increase in blasts with very high nuclear to cytoplasmic ratios
Some blasts have pinched nuclear contours – “hand mirror” sign
Blasts with irregular nuclear contours on the core biopsy
Case 4
Diagnosis?
T Lymphoblastic Leukemia/Lymphoma (T-ALL)
Case 5

5-year-old boy with shortness of breath and jaw mass
Cellular marrow
• Decreased to absent trilineage hematopoiesis
• Monotonous population of mononuclear cells
• Very high nuclear to cytoplasmic ratios
• Coarser chromatin
• Deep basophilic cytoplasm
• Vacuoles
• Hypercellular marrow
• Monotonous infiltrate
• “Starry Sky” Appearance

Case 5
Diagnosis?
Burkitt Lymphoma
Summary

• Bone marrow studies are composed of 3 components
  – Peripheral smear, aspirate or touch preparations, core biopsy

• An understanding of normal marrow can help you spot abnormalities

• Morphologic features, although not always specific, can guide you to the right diagnosis.