

# 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

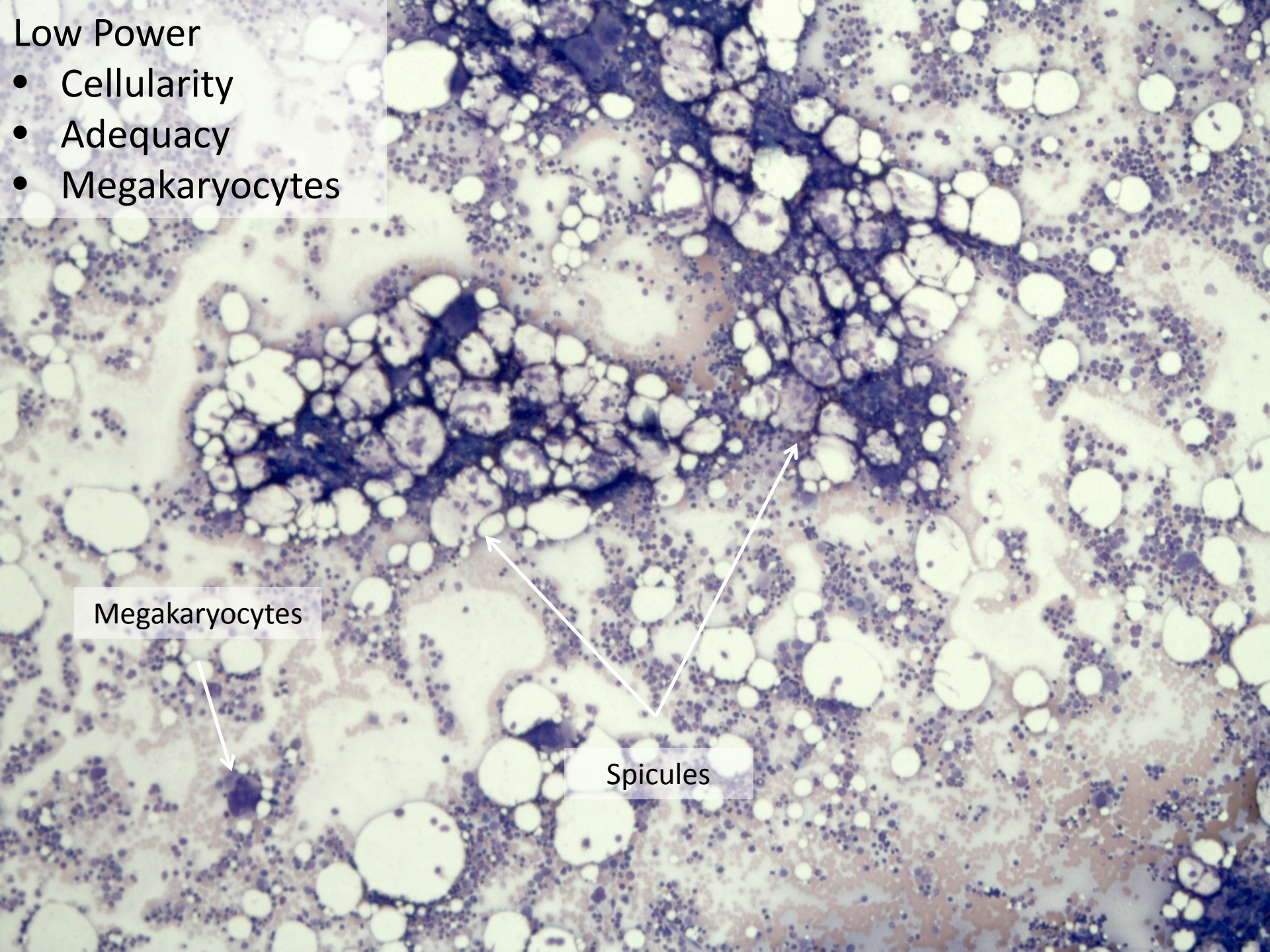
- Wright-stained slides
- Used for the assessment of:
  - Cytopenias or cytoses
  - Distribution of leukocytes
  - Circulating blasts or other atypical cells

# 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, erythroids, lymphocytes, plasma cells, blasts
    - Myeloid to erythroid ratio

Low Power

- Cellularity
- Adequacy
- Megakaryocytes

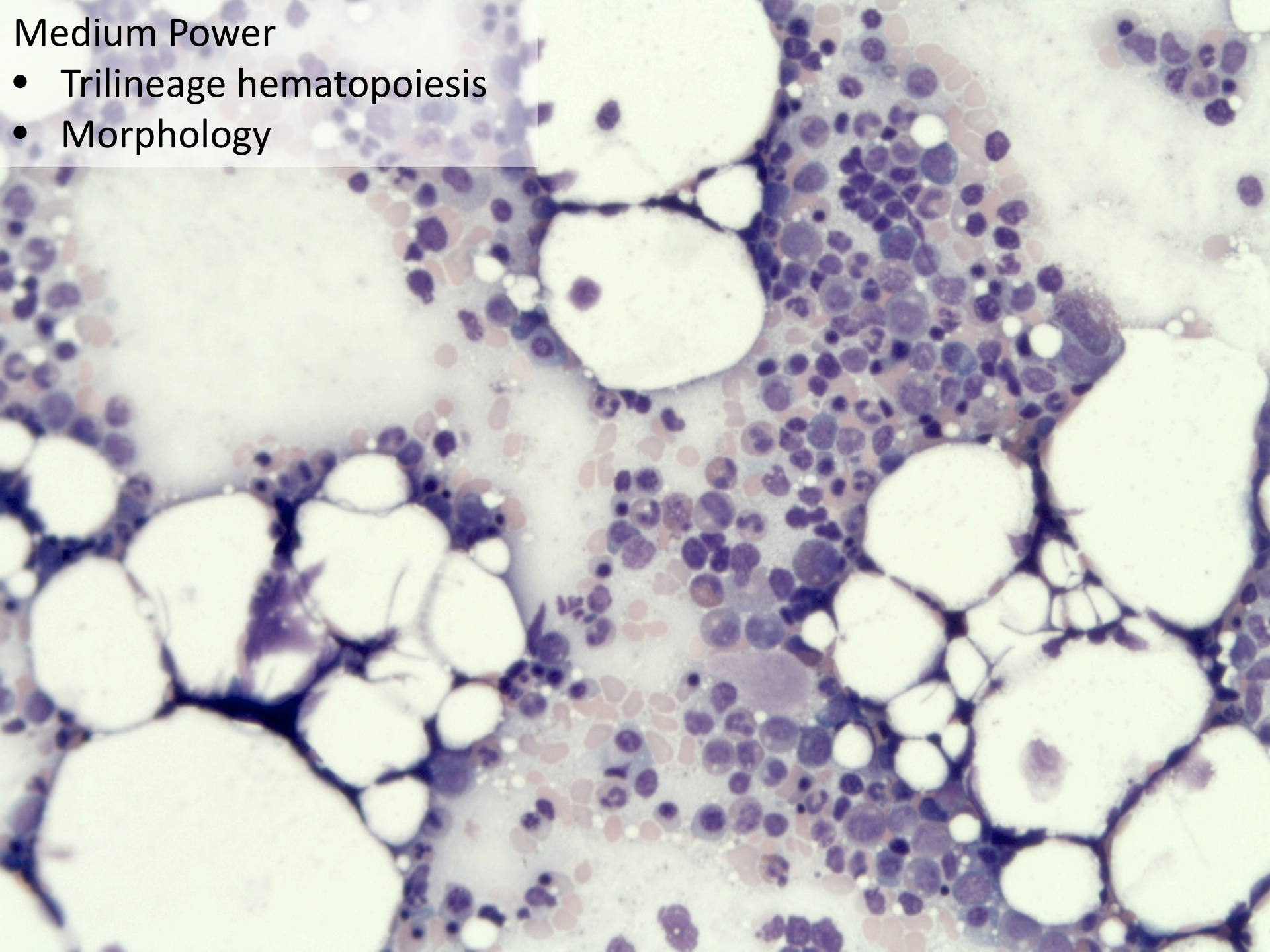


Megakaryocytes

Spicules

## Medium Power

- Trilineage hematopoiesis
- Morphology



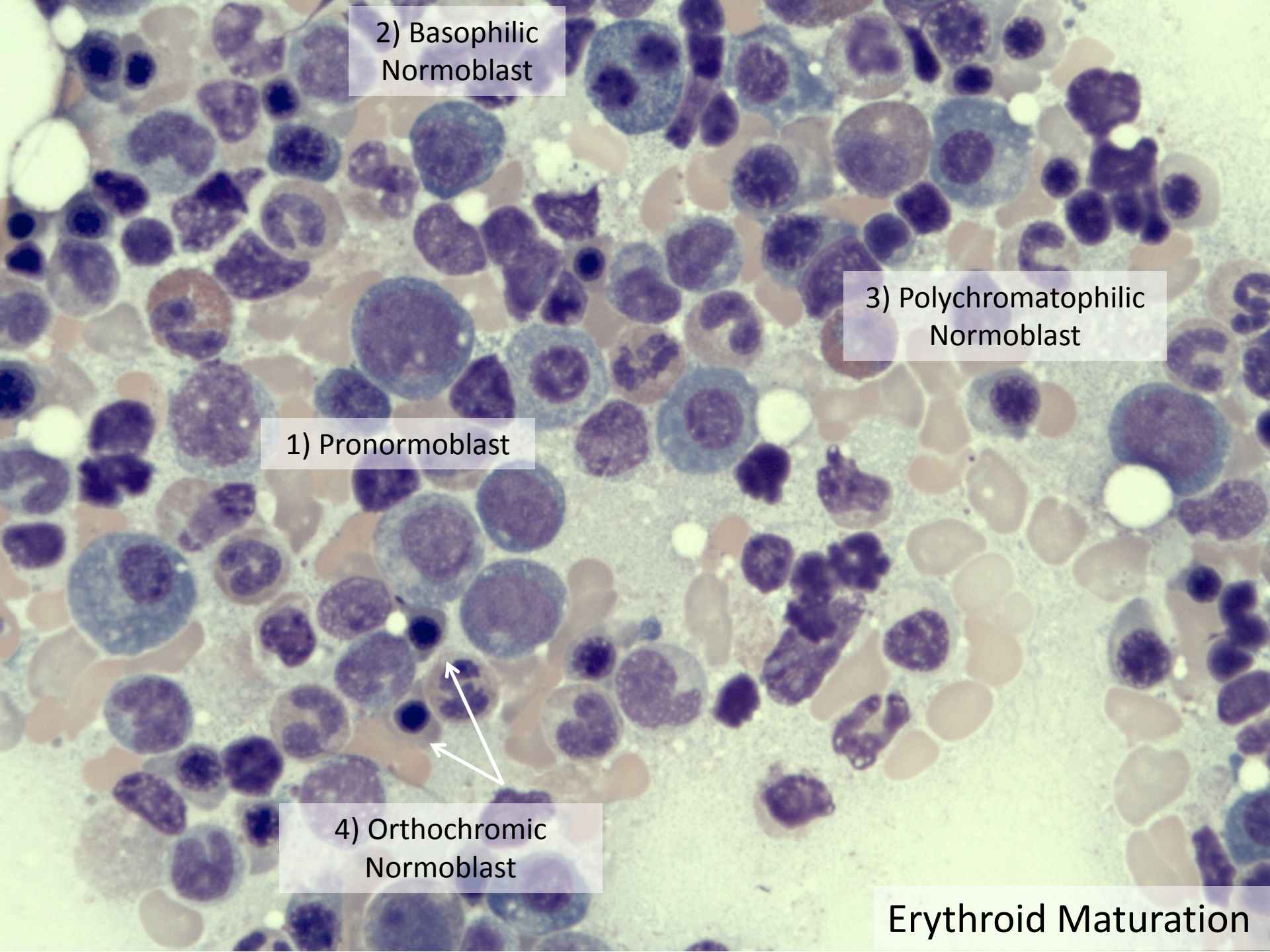
2) Basophilic Normoblast

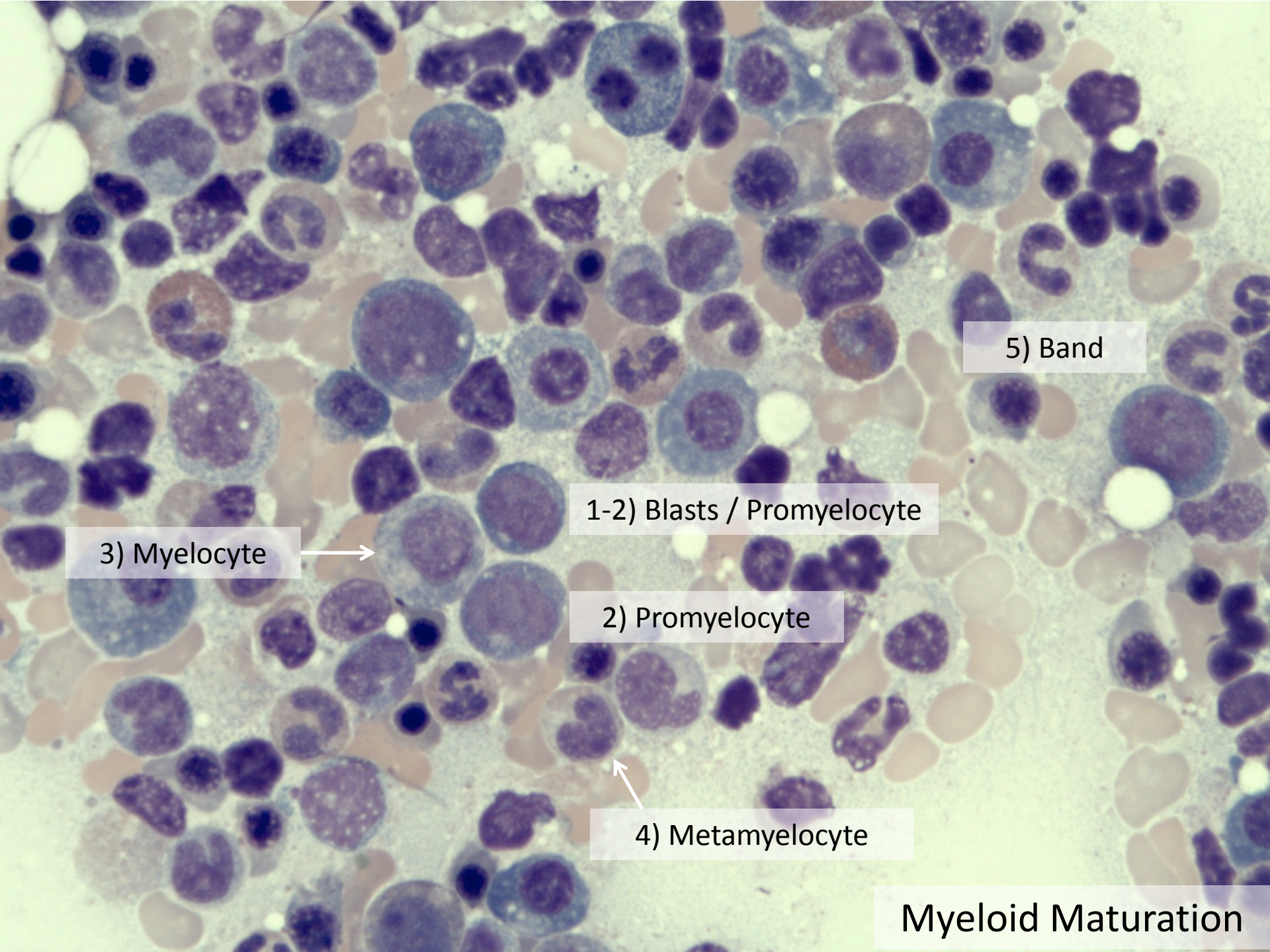
3) Polychromatophilic Normoblast

1) Pronormoblast

4) Orthochromic Normoblast

Erythroid Maturation

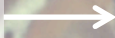




5) Band

1-2) Blasts / Promyelocyte

3) Myelocyte



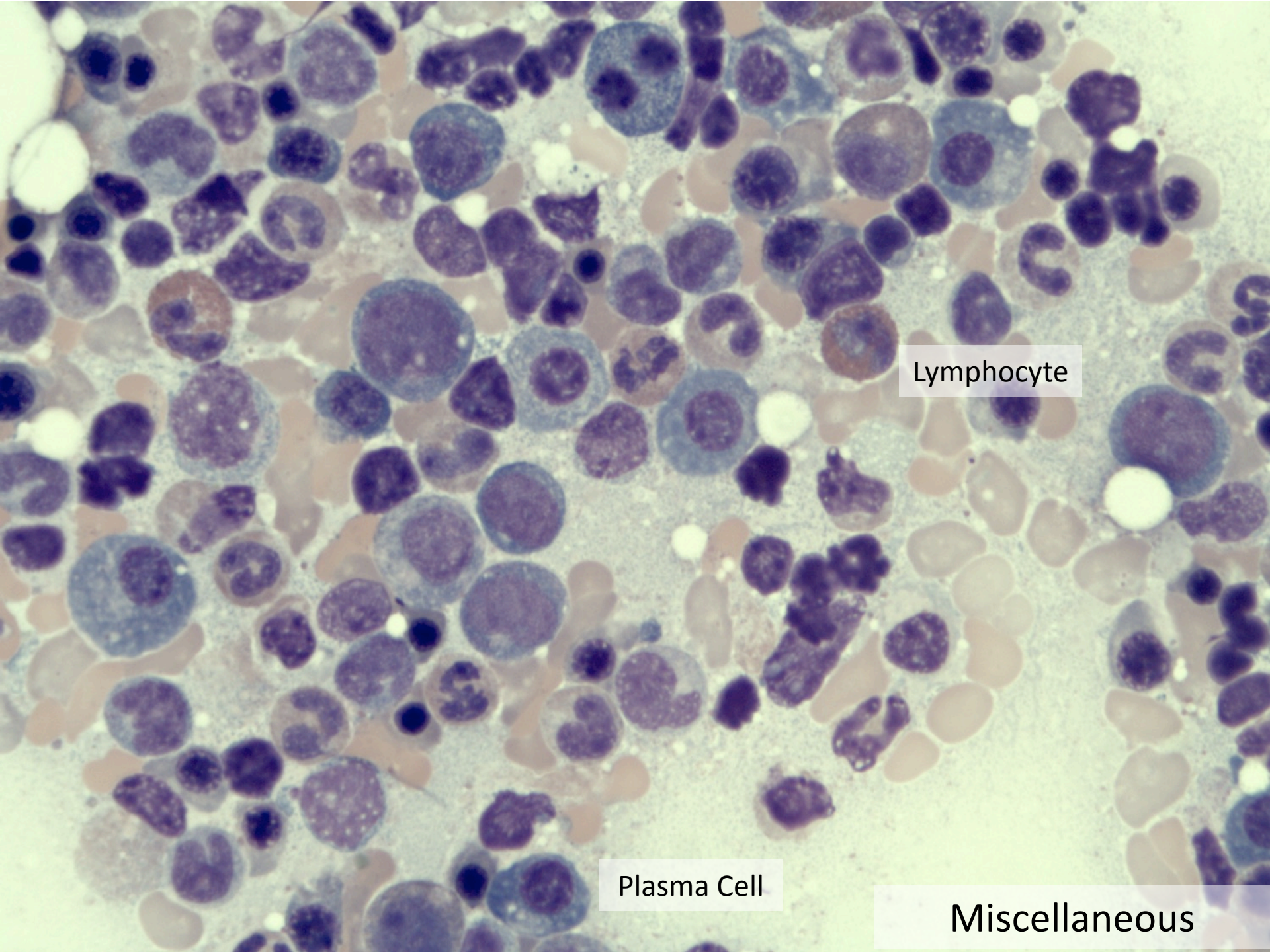
2) Promyelocyte

4) Metamyelocyte



Myeloid Maturation





Lymphocyte

Plasma Cell

Miscellaneous

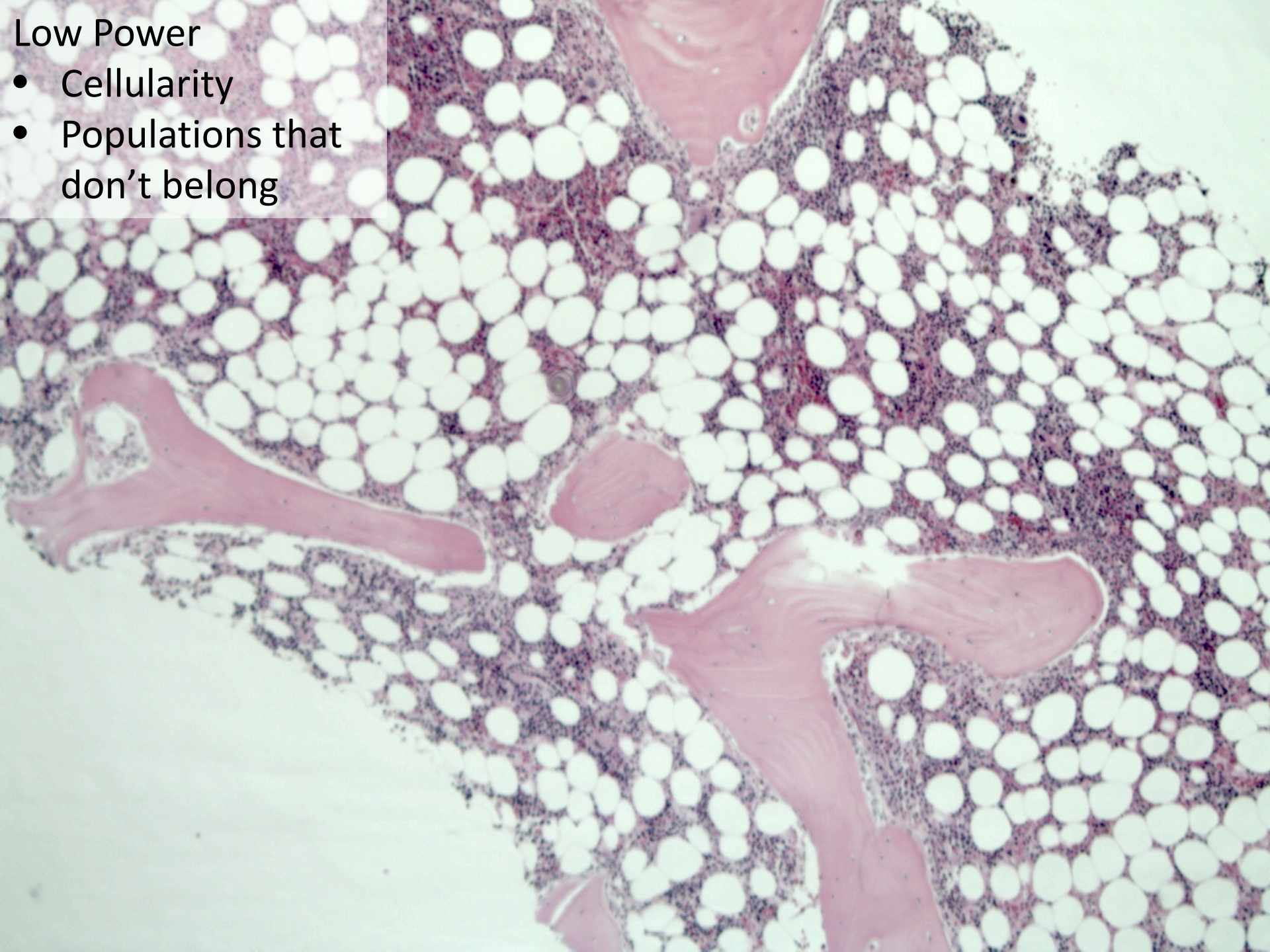
# 3 – Core Biopsy

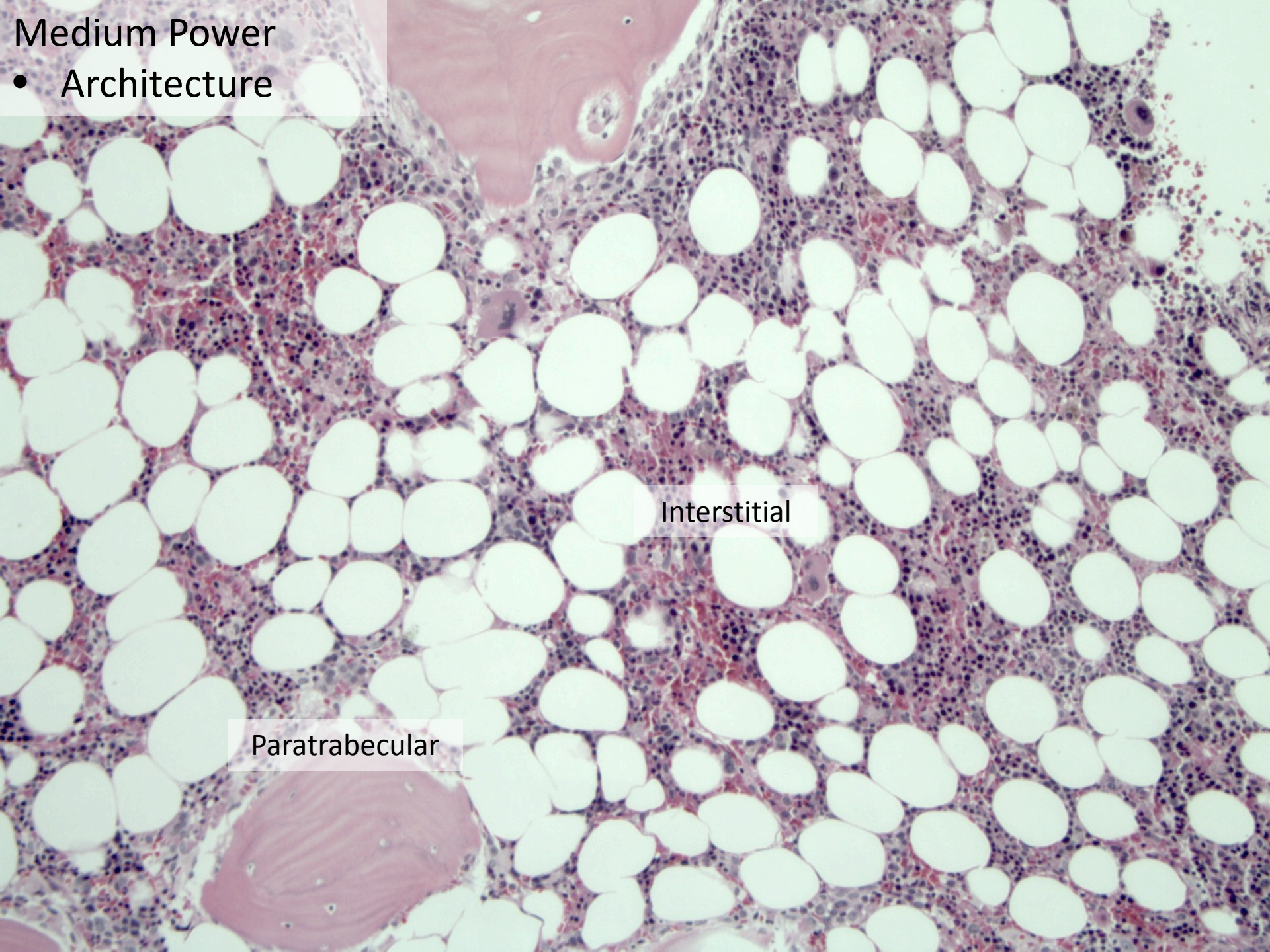
Used for the assessment of:

- More precise estimate of cellularity
- Marrow architecture
- Populations that don't belong

## Low Power

- Cellularity
- Populations that don't belong

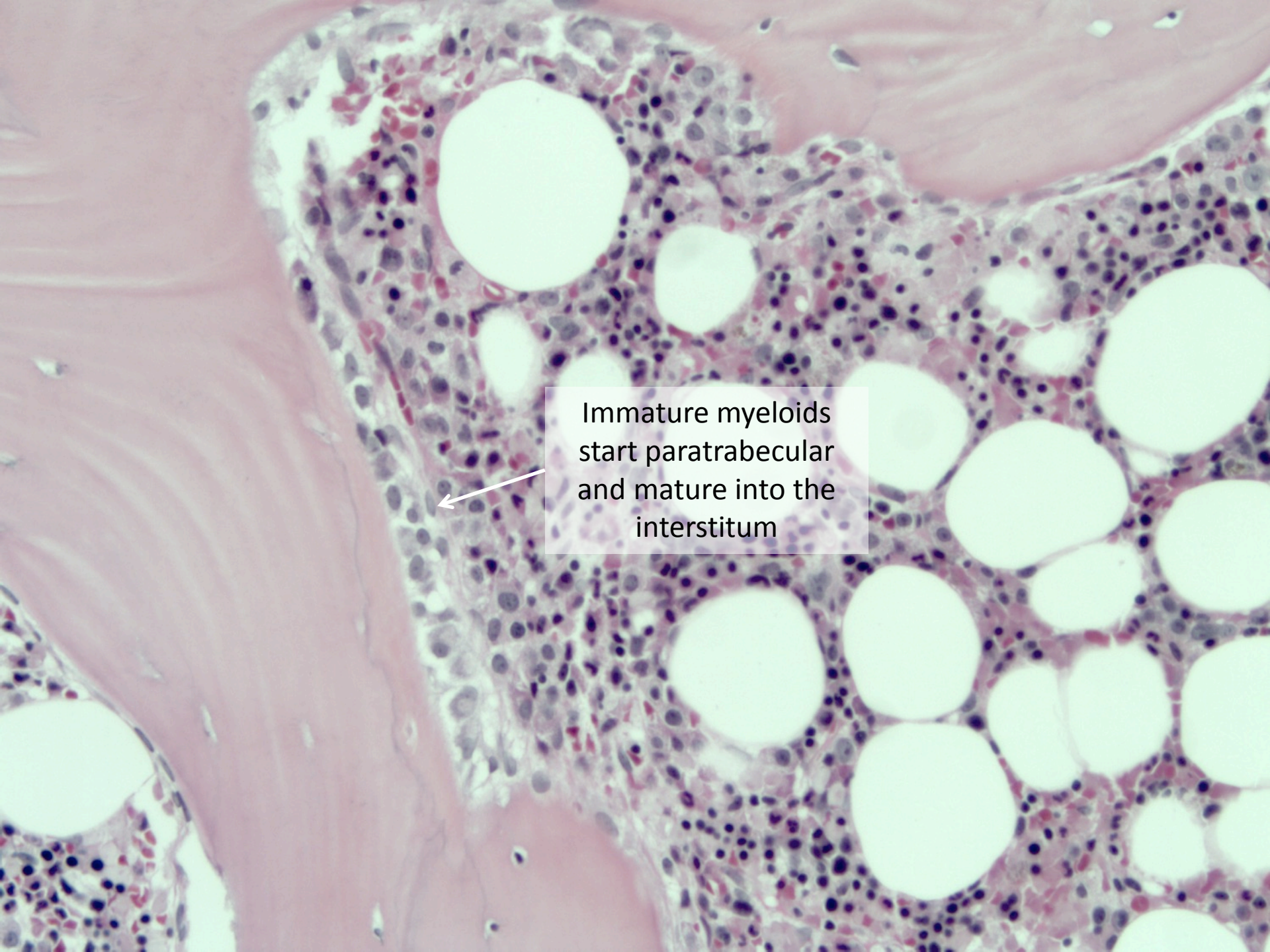




Medium Power  
• Architecture

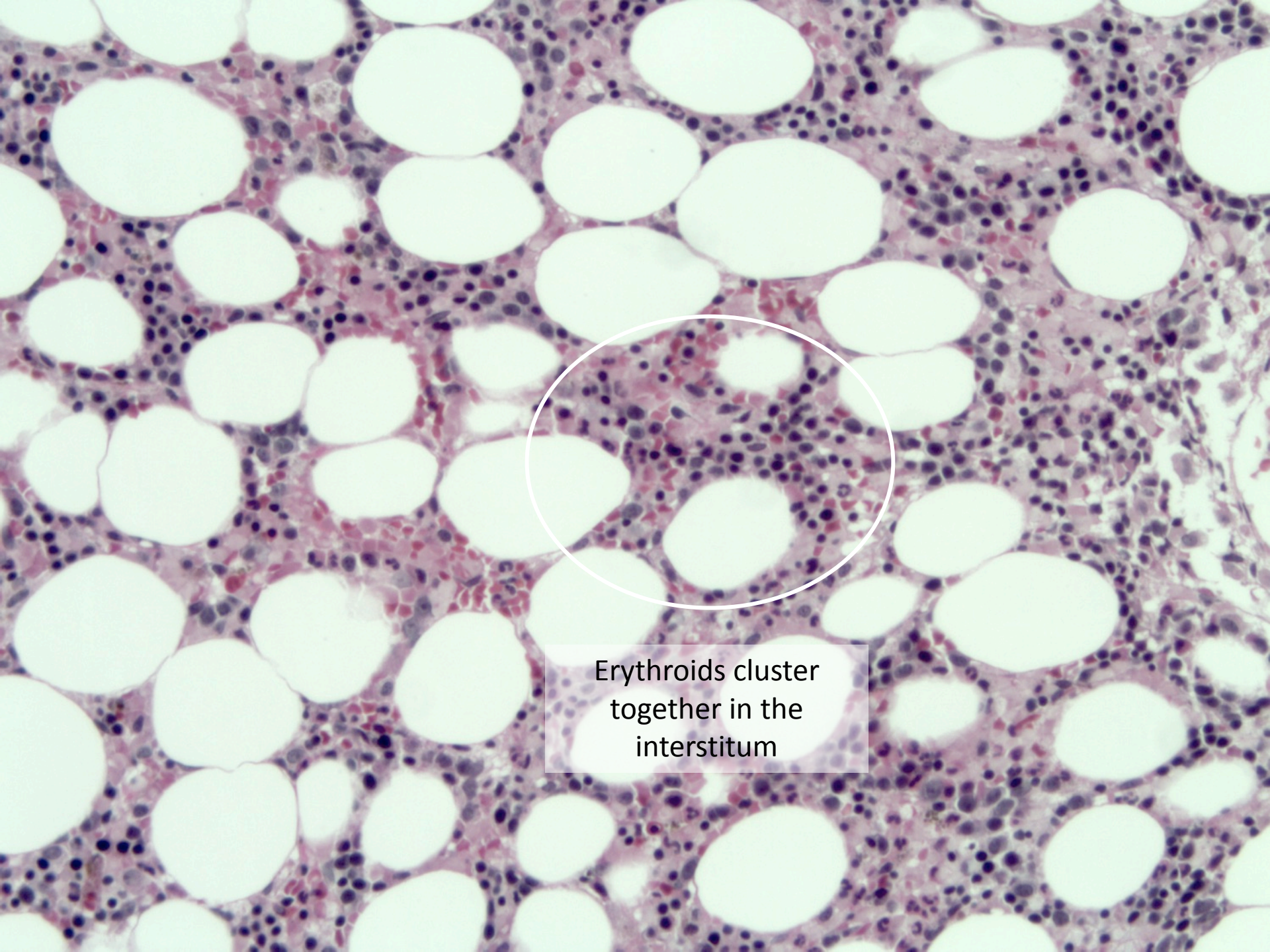
Interstitial

Paratrabeular



Immature myeloids  
start paratrabecular  
and mature into the  
interstitium

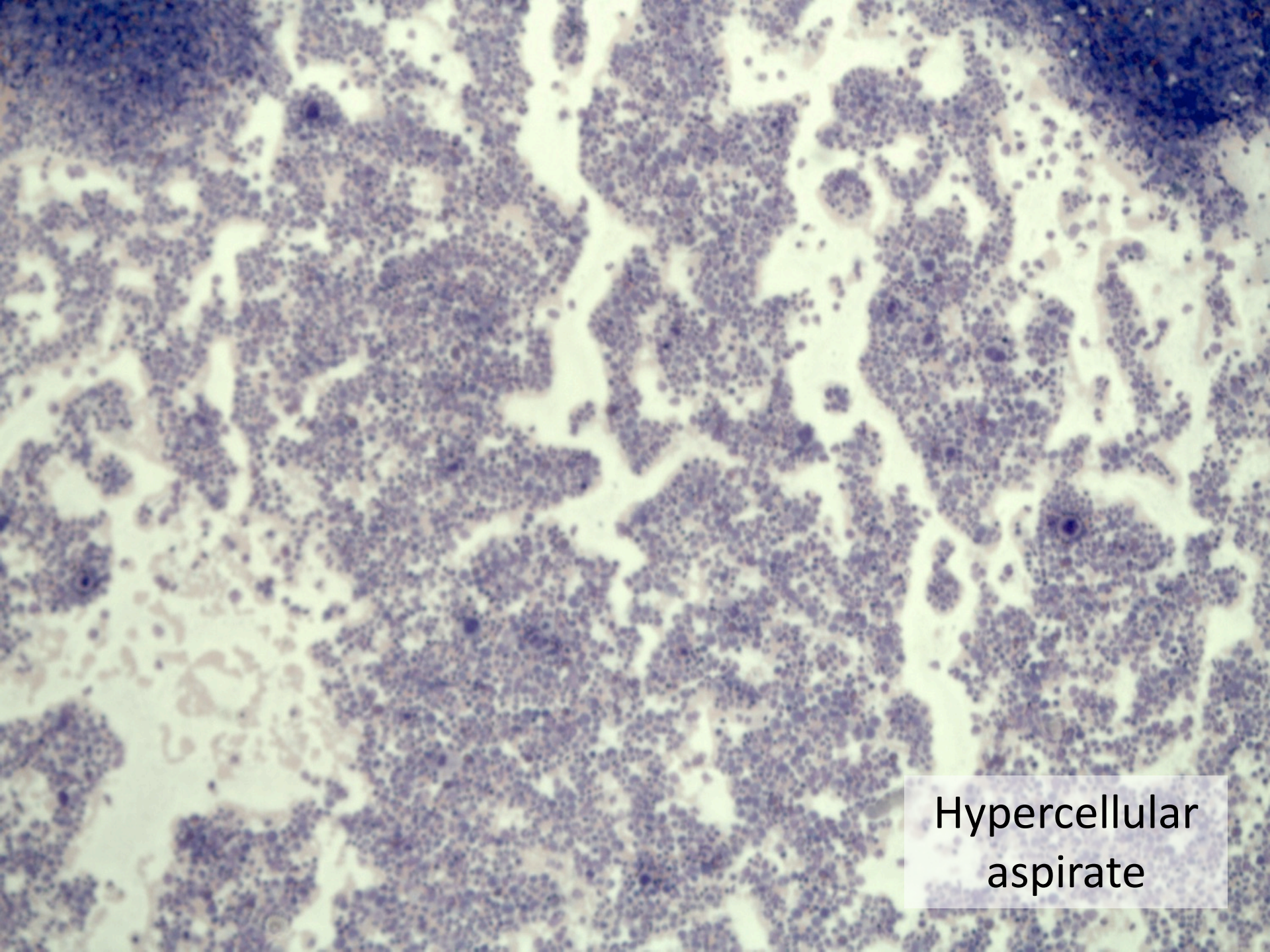




Erythroids cluster  
together in the  
interstitium

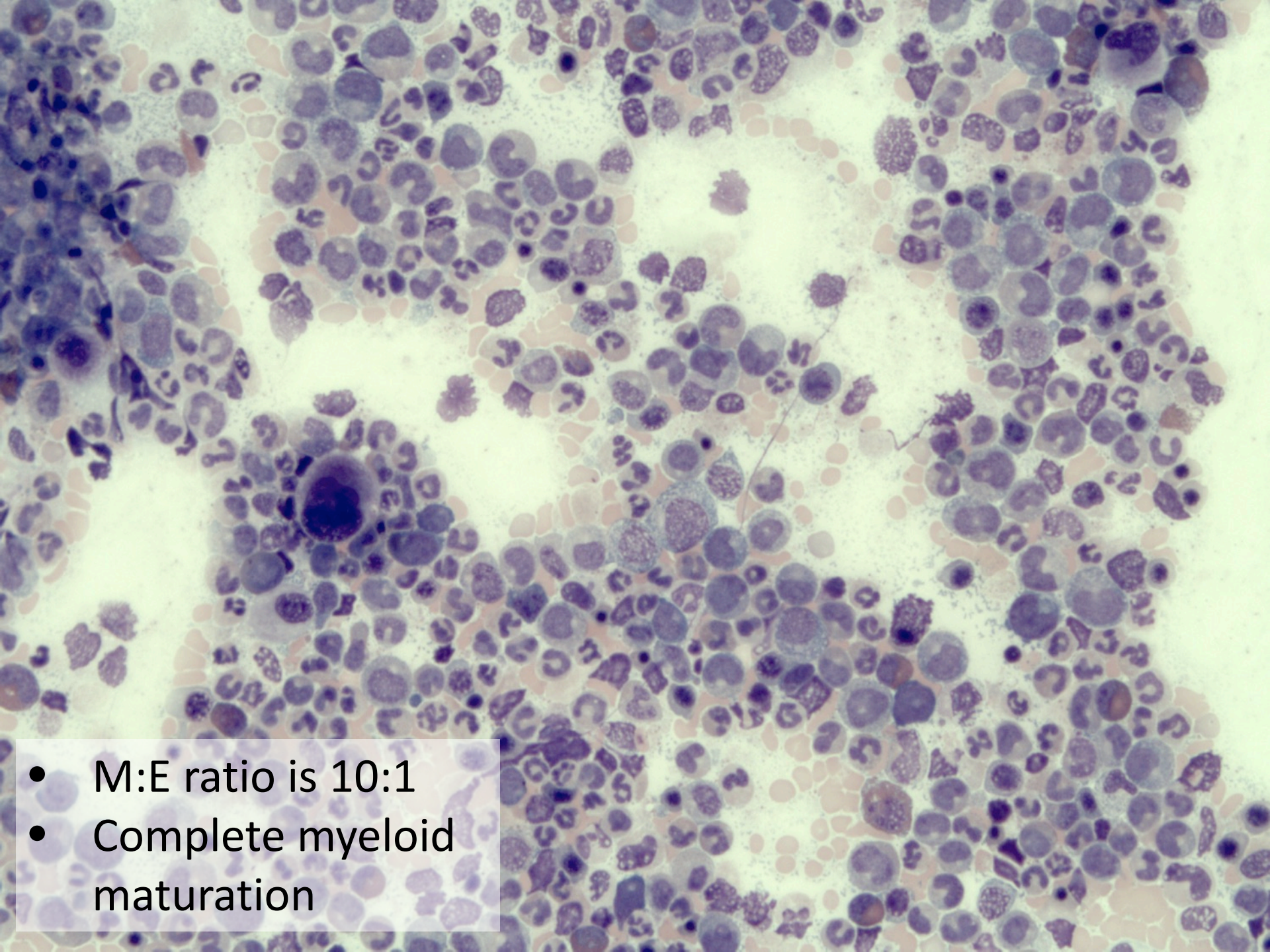
# Case 1

40-year-old man who presents with  
marked leukocytosis and  
splenomegaly

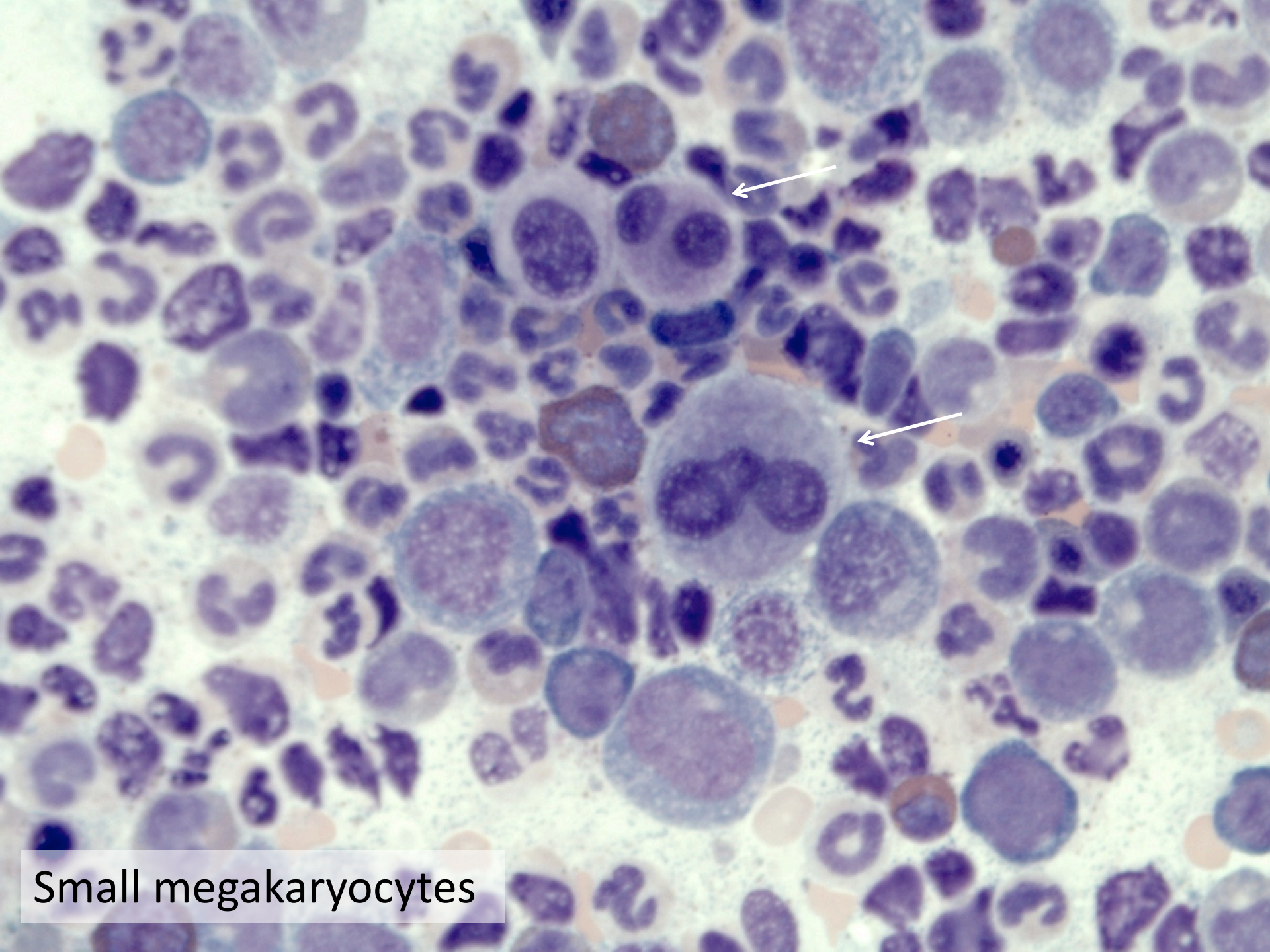


Hypercellular  
aspirate

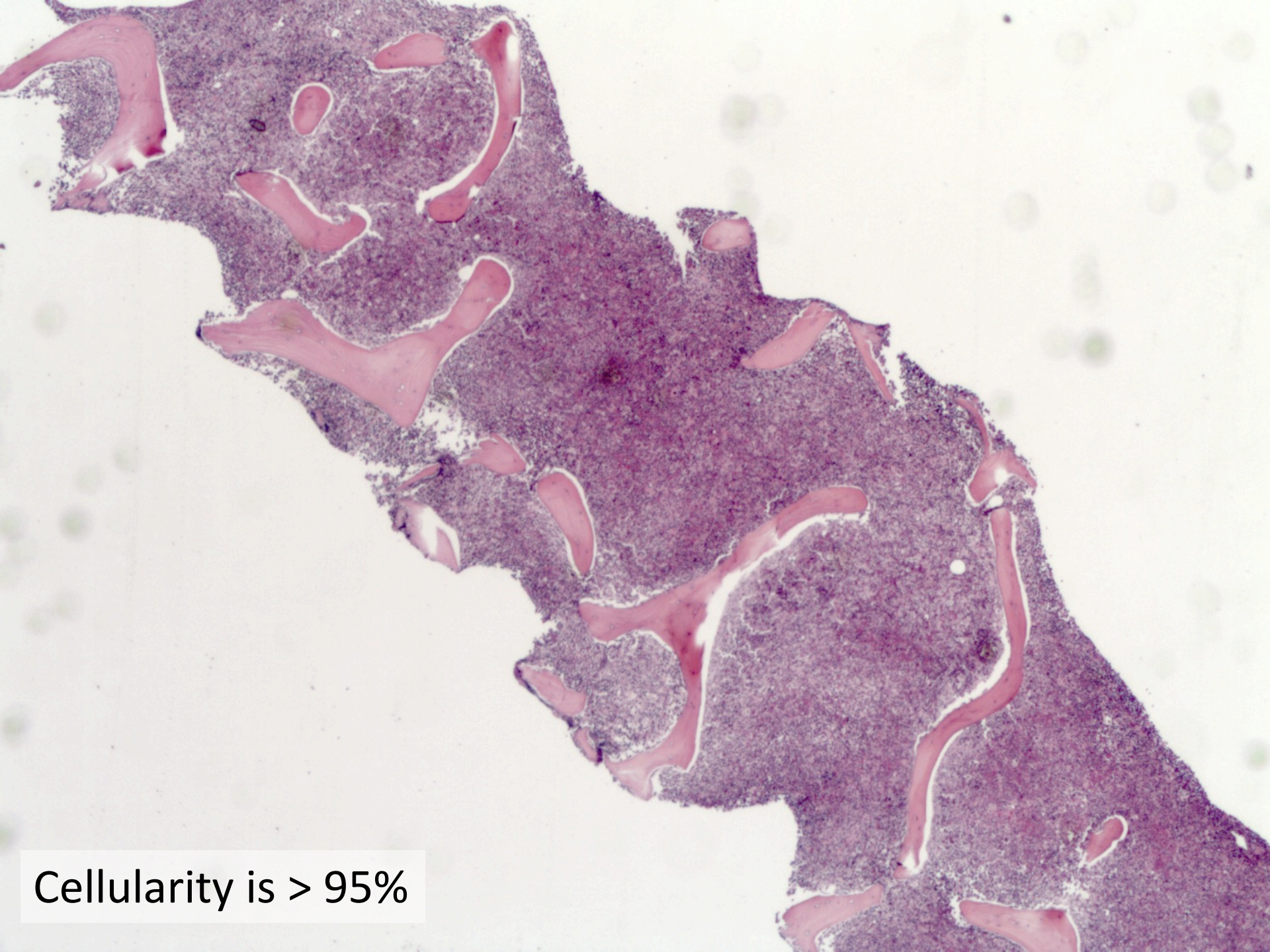




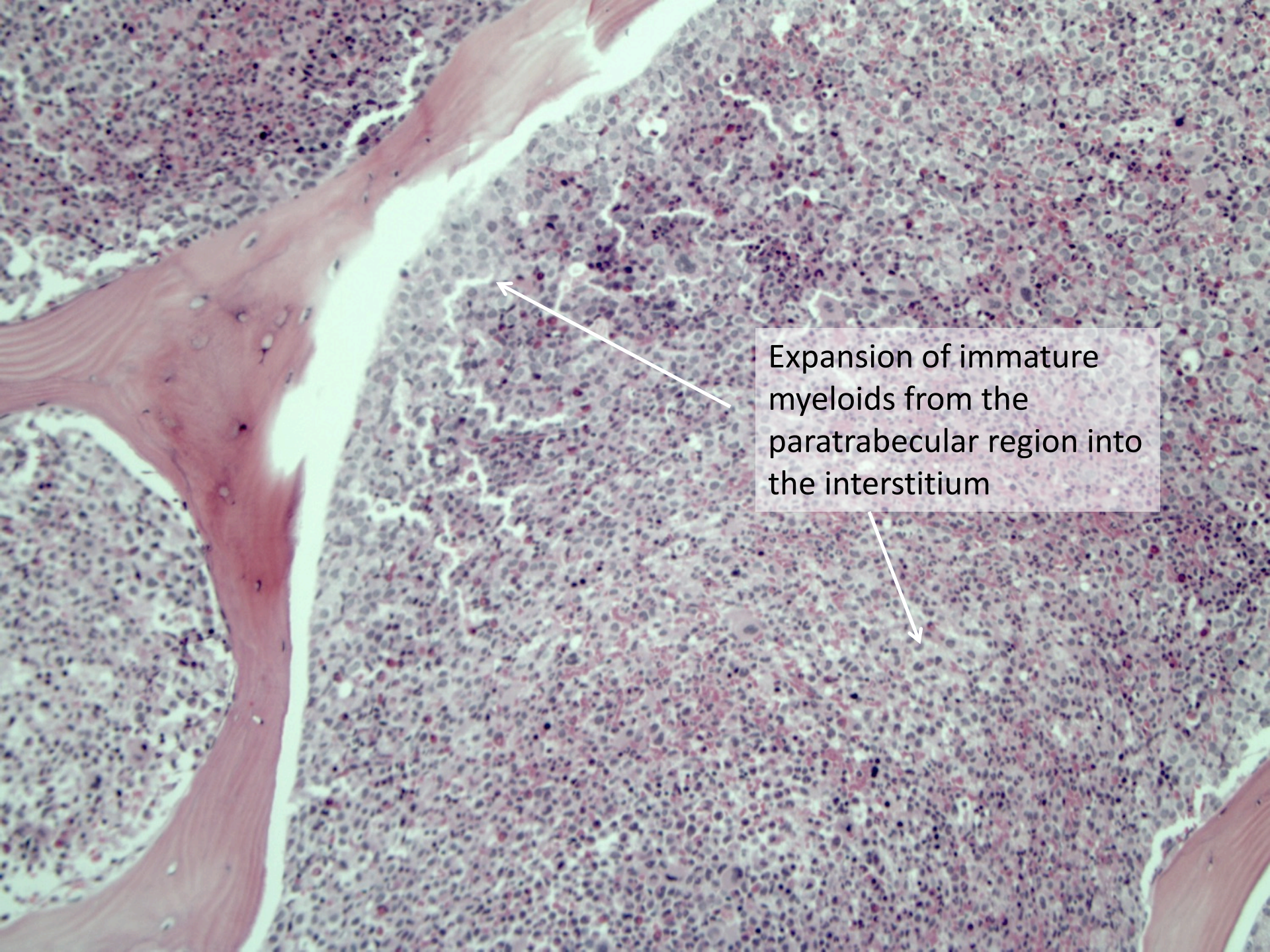
- M:E ratio is 10:1
- Complete myeloid maturation



Small megakaryocytes



Cellularity is > 95%



Expansion of immature myeloids from the paratrabecular region into the interstitium

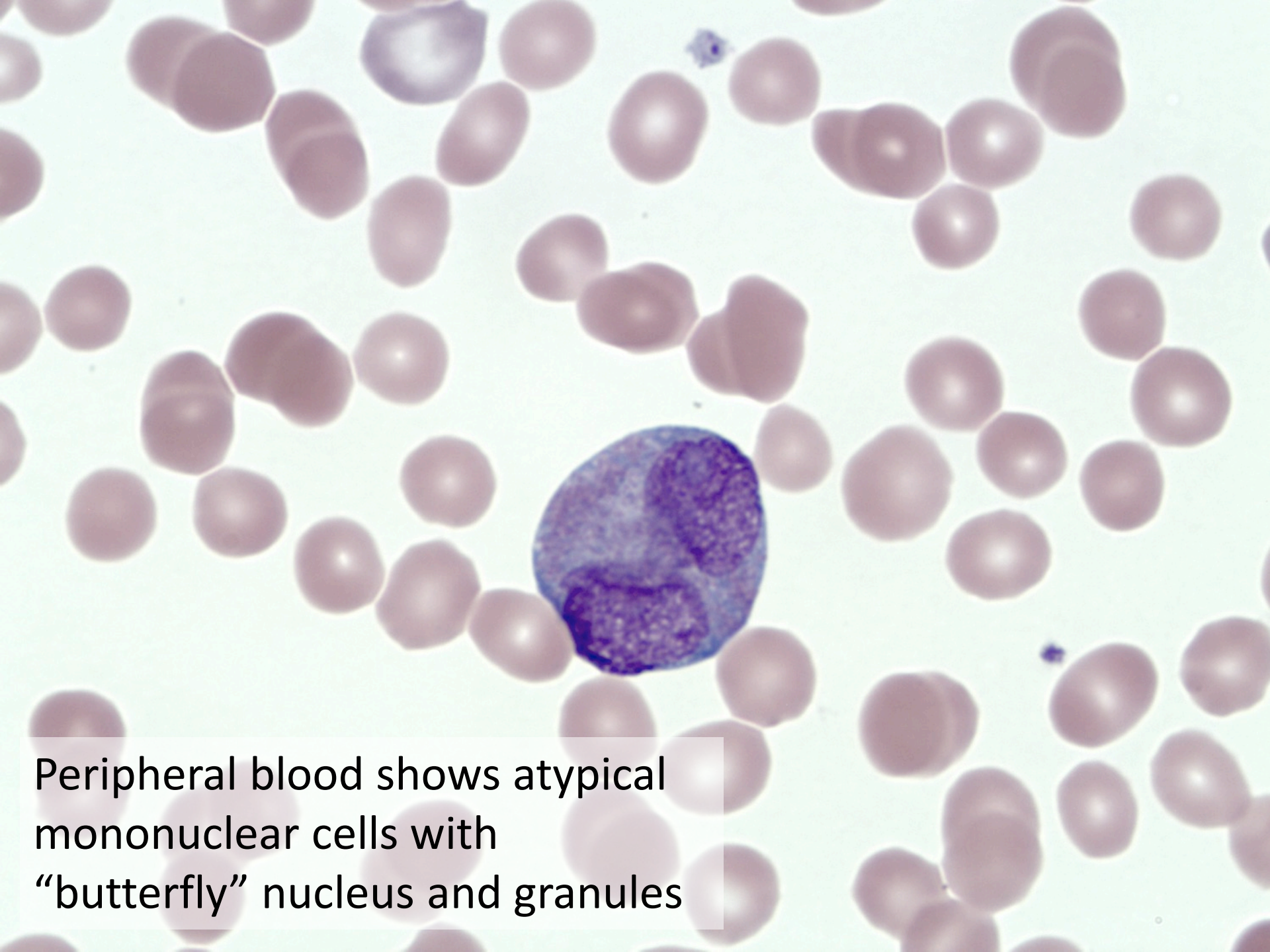
# Case 1

## Diagnosis?

# Chronic Myelogenous Leukemia (CML)

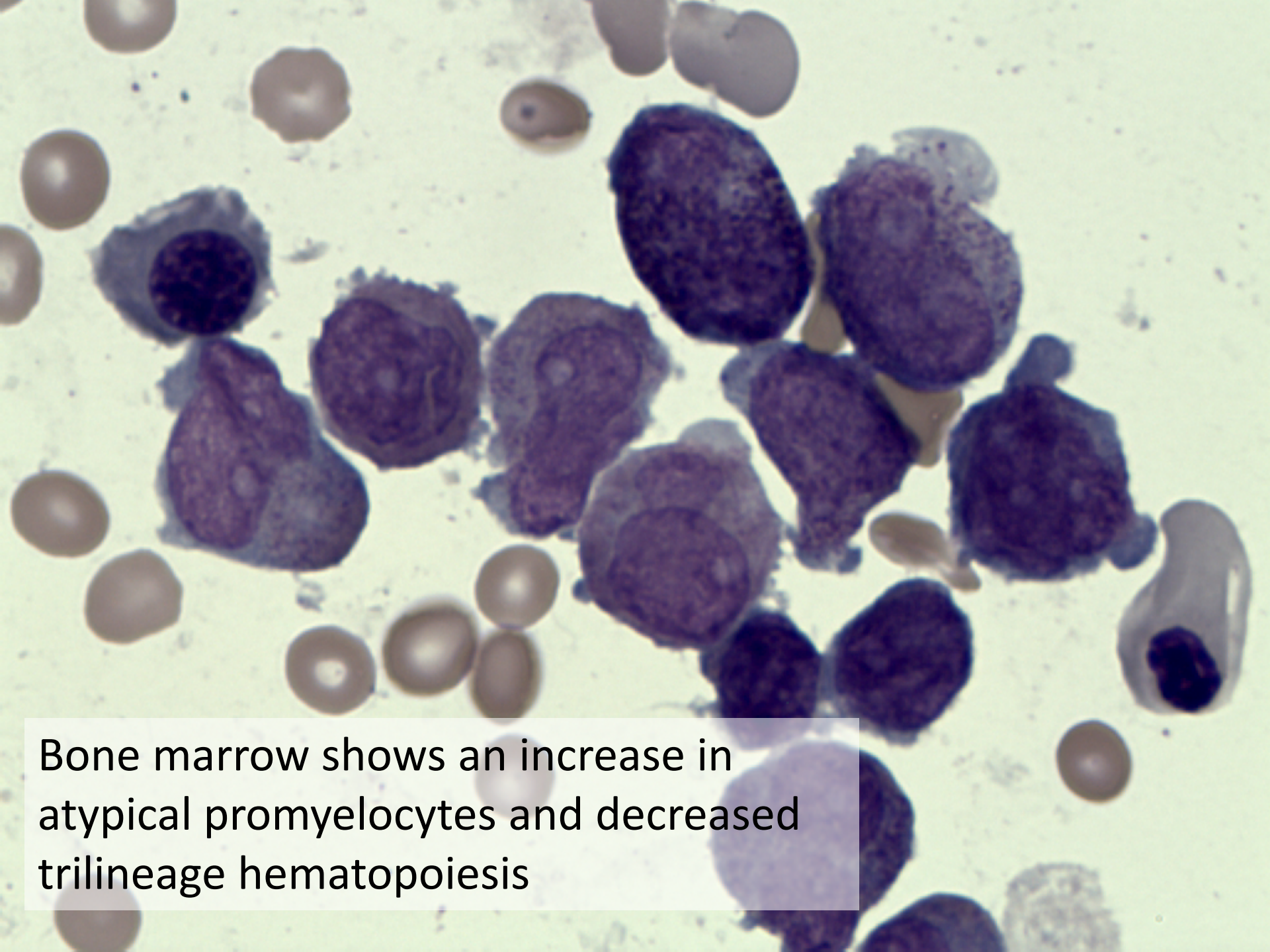
# Case 2

40-year-old woman with  
disseminated intravascular  
coagulation

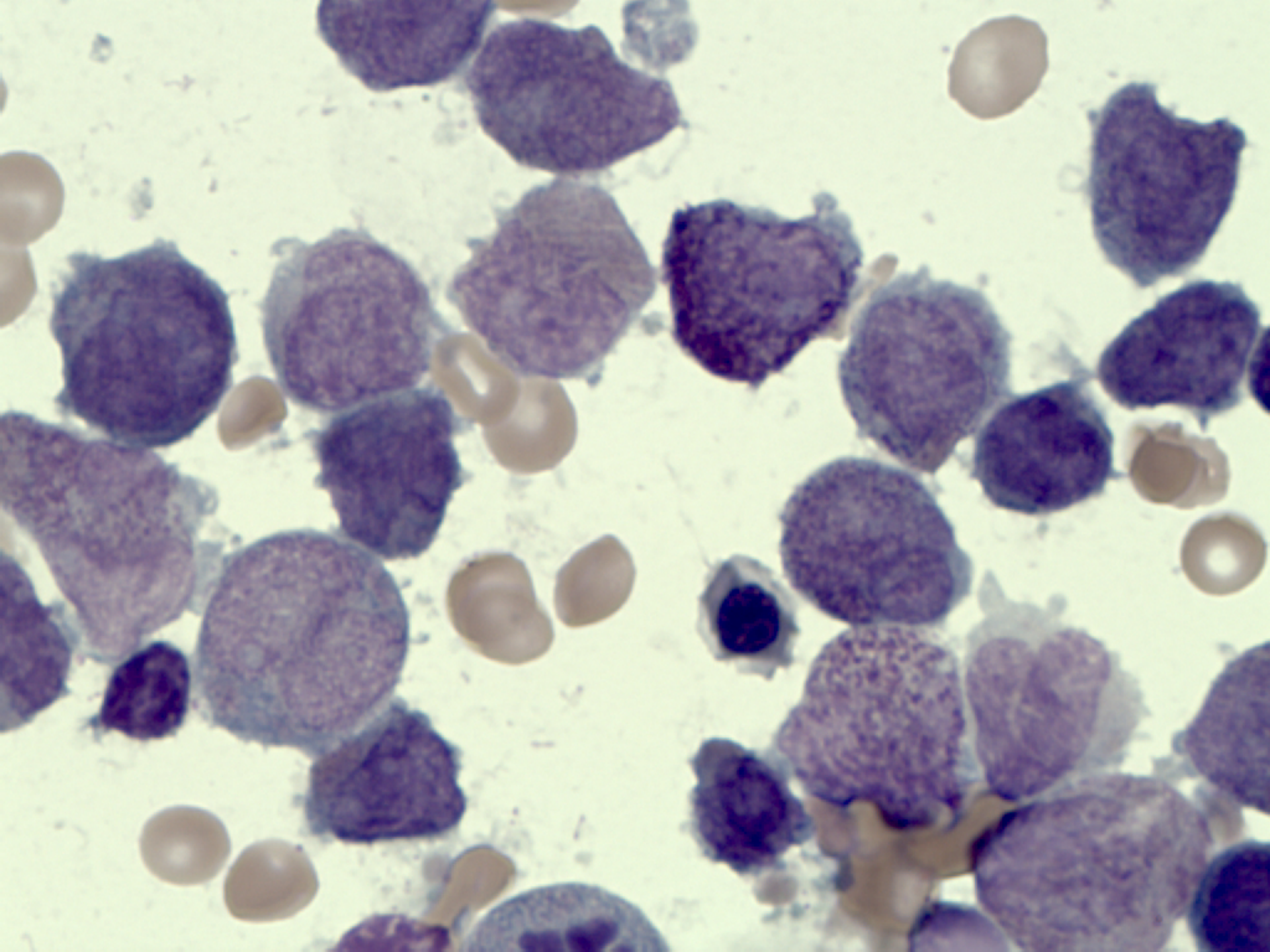


Peripheral blood shows atypical mononuclear cells with “butterfly” nucleus and granules





Bone marrow shows an increase in atypical promyelocytes and decreased trilineage hematopoiesis



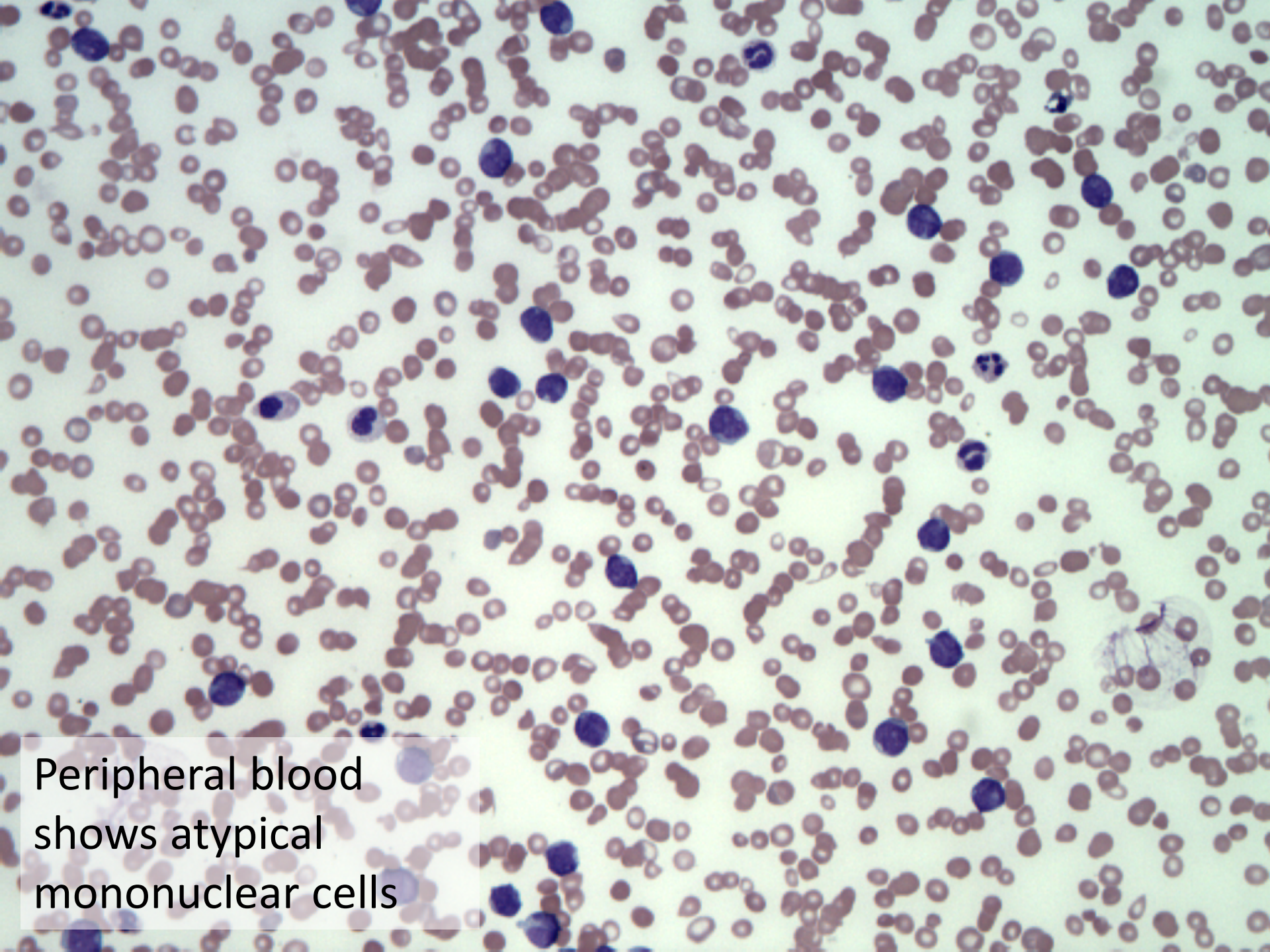
# Case 2

## Diagnosis?

# Acute Promyelocytic Leukemia (APL)

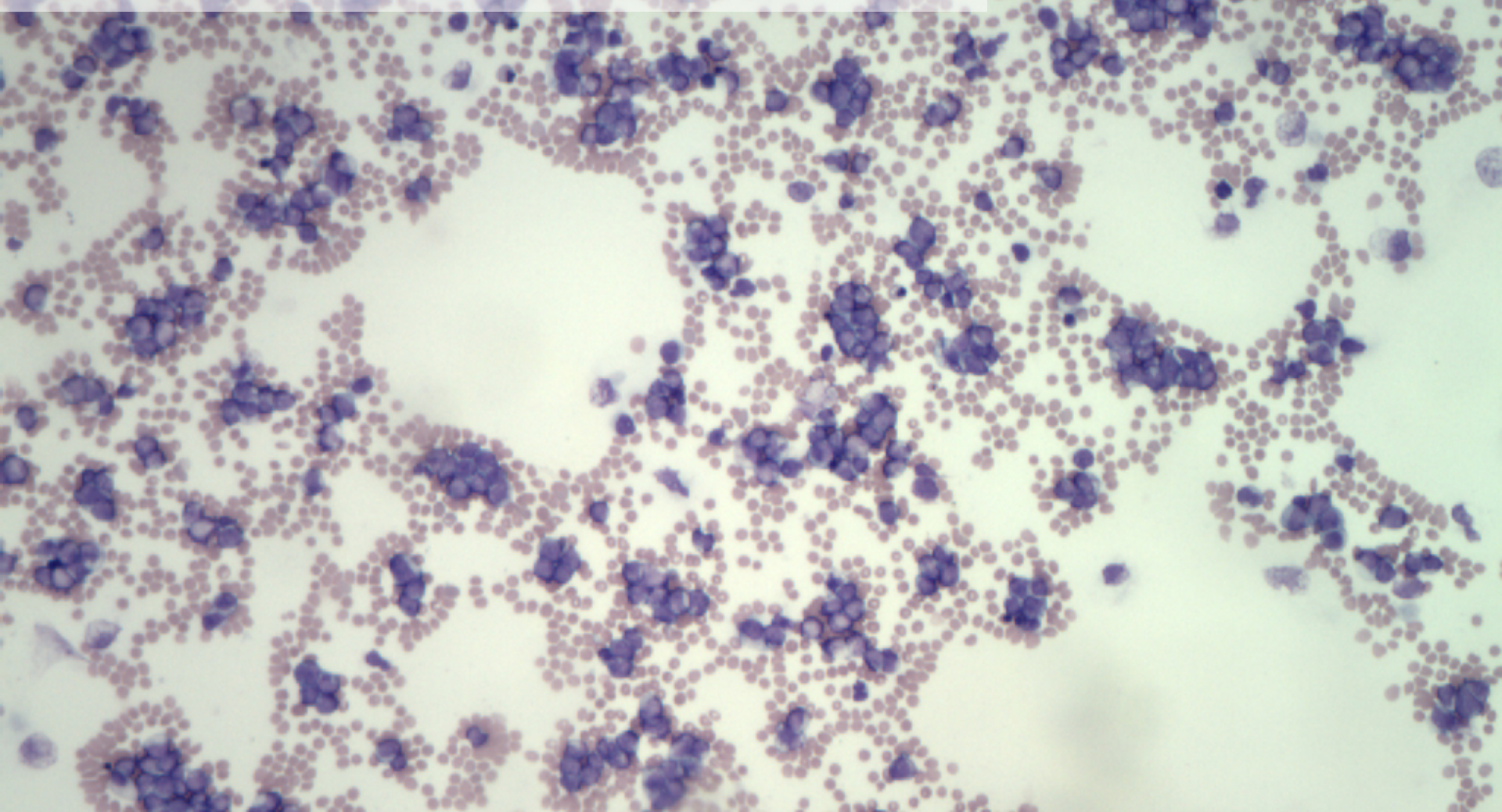
# Case 3

60-year-old woman with  
leukocytosis, anemia, and  
thrombocytopenia

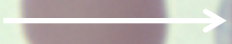
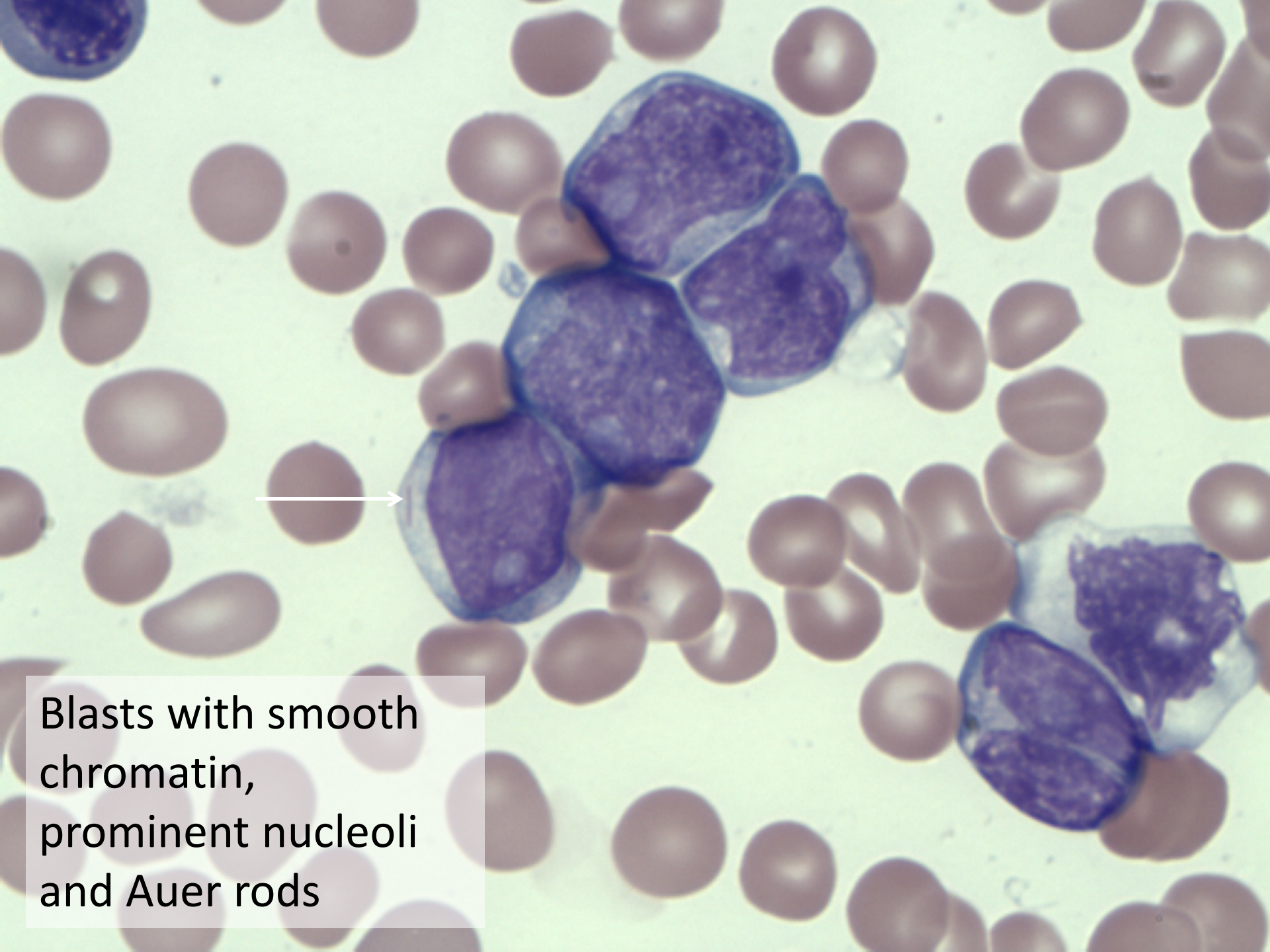


Peripheral blood shows atypical mononuclear cells

Bone marrow was inaspirable, so touch preparations were made....

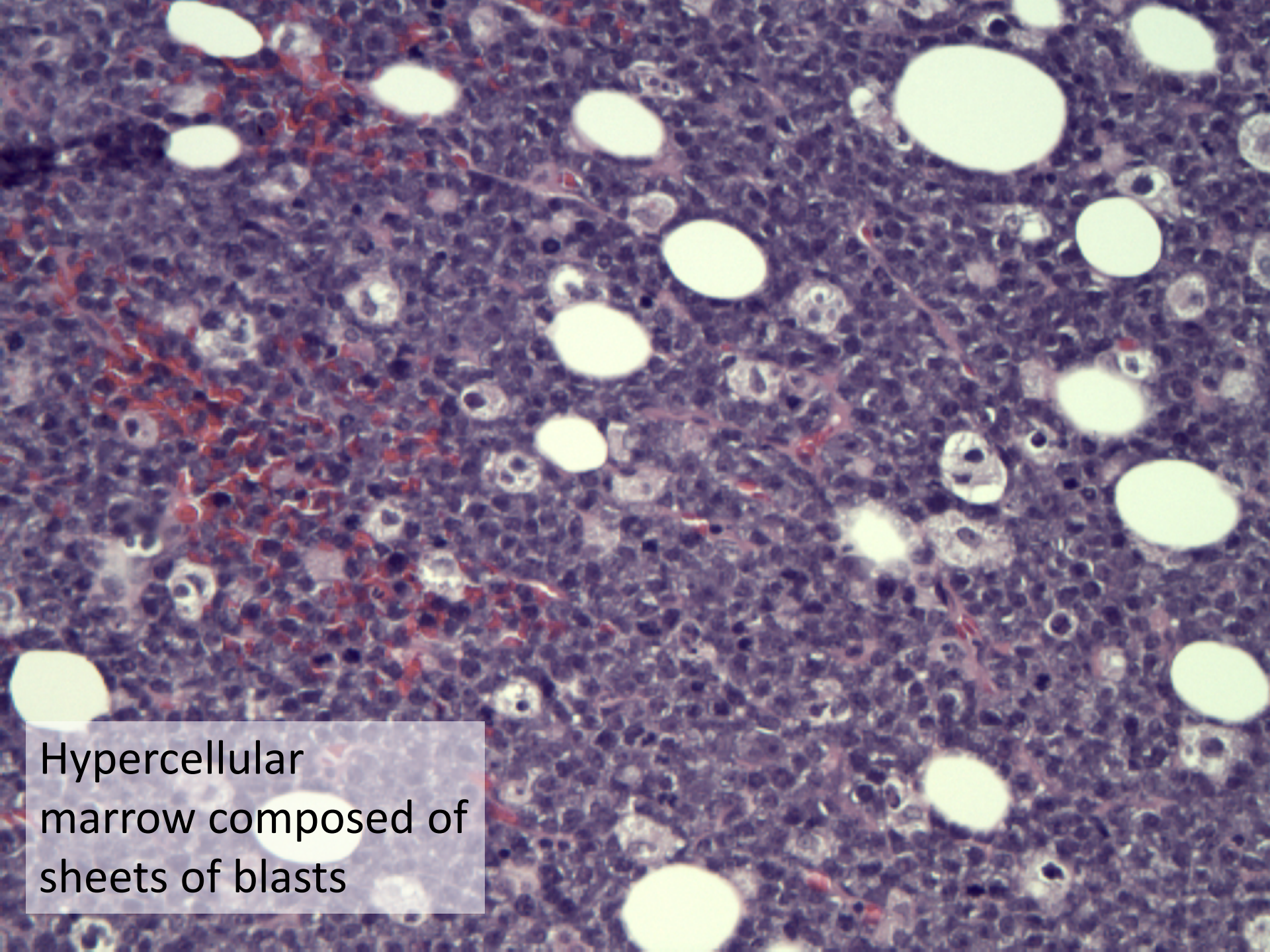


- Monotonous population of mononuclear cells
- Absence of trilineage hematopoiesis



Blasts with smooth chromatin, prominent nucleoli and Auer rods





Hypercellular  
marrow composed of  
sheets of blasts

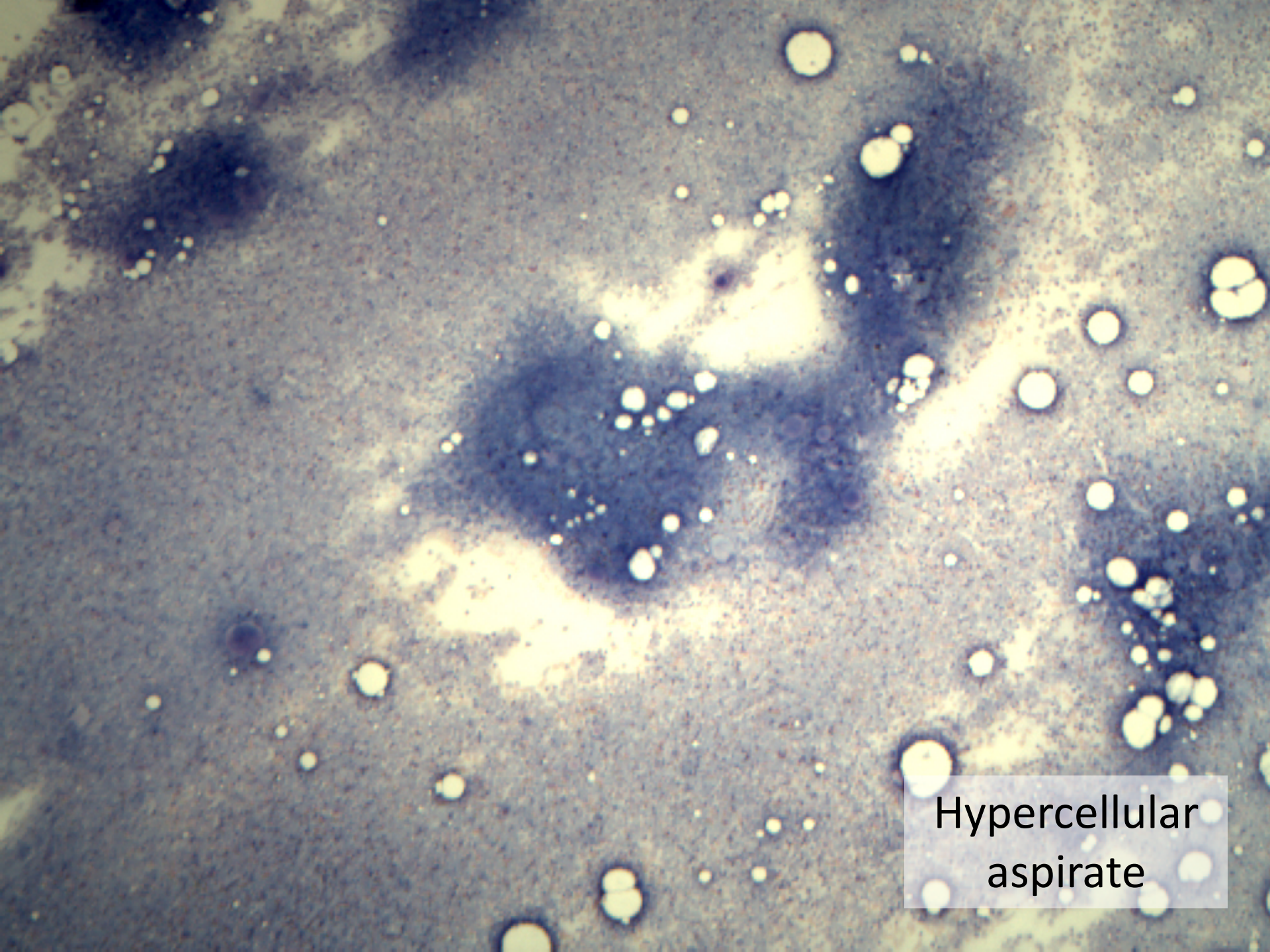
# Case 3

## Diagnosis?

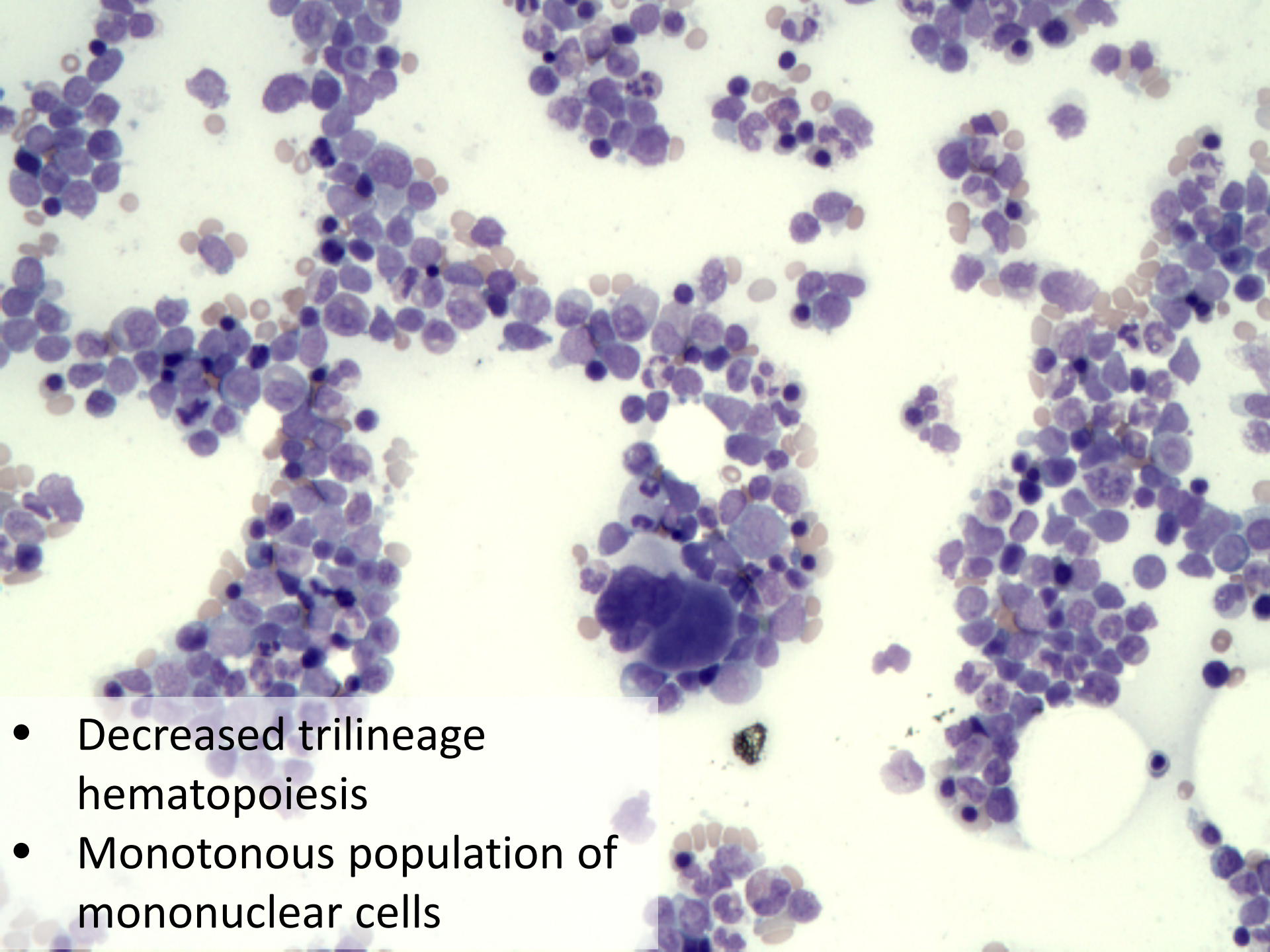
# Acute Myeloid Leukemia

# Case 4

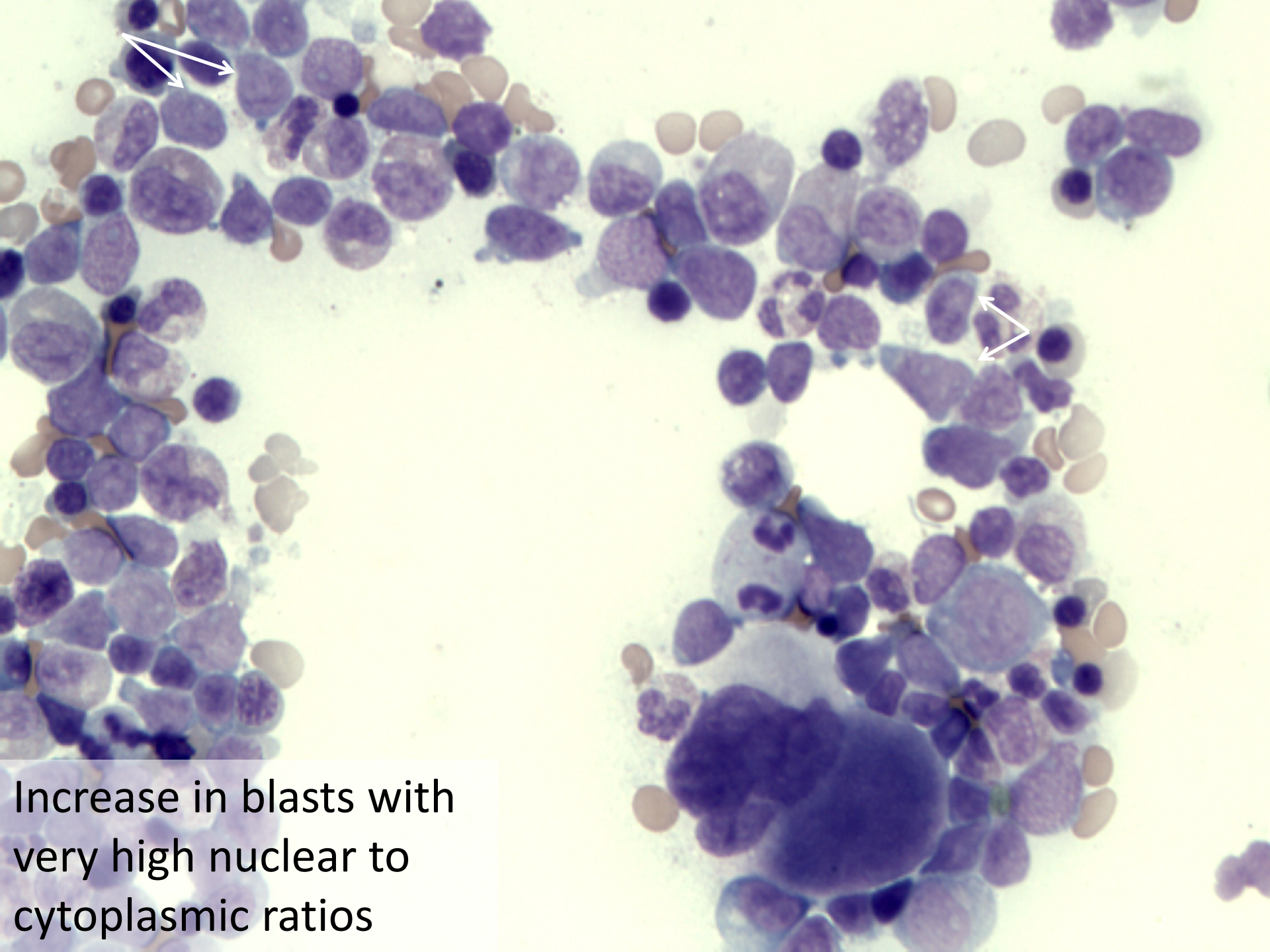
5-year-old boy with shortness of  
breath and eosinophilia



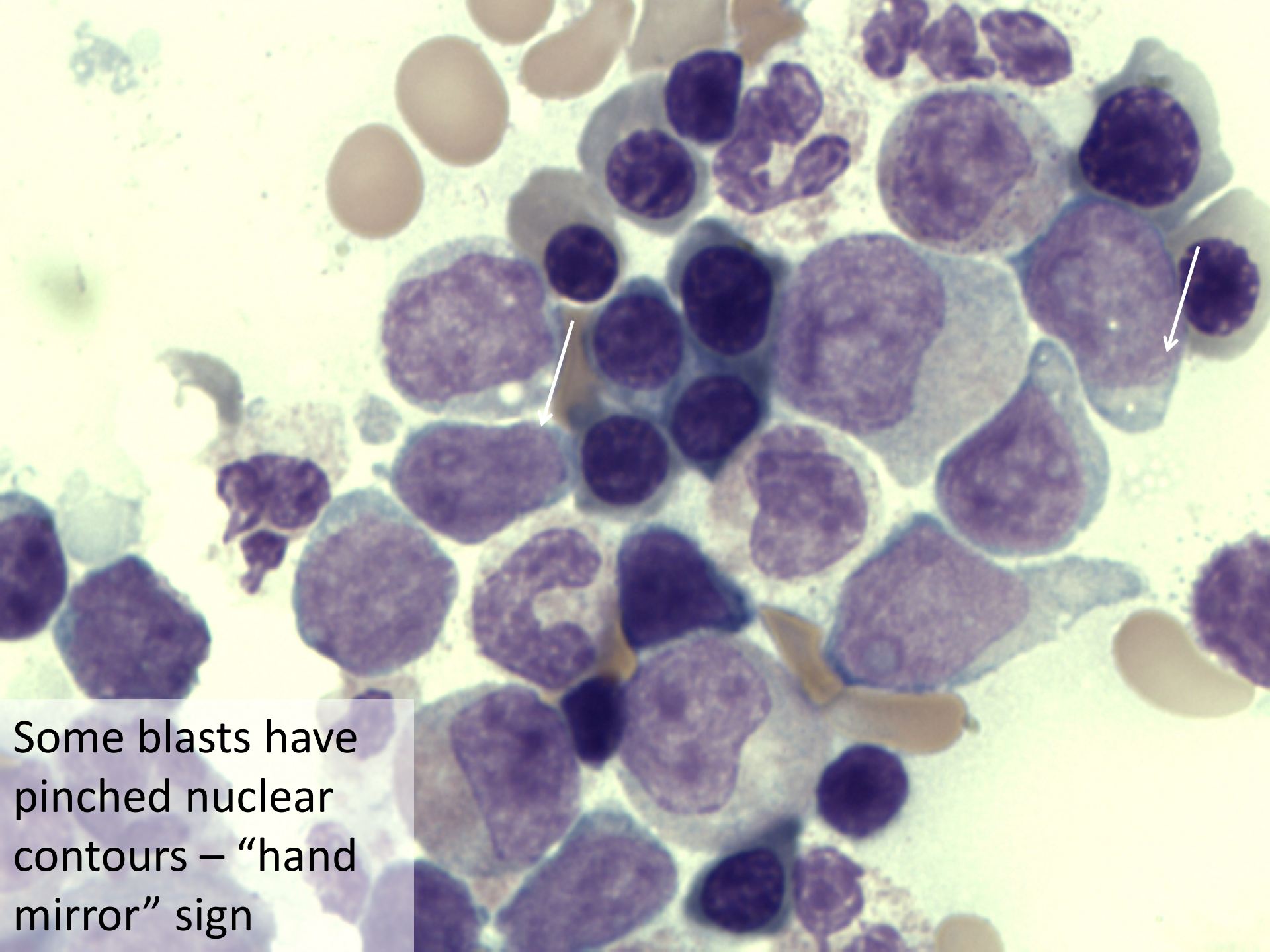
Hypercellular  
aspirate



- Decreased trilineage hematopoiesis
- Monotonous population of mononuclear cells

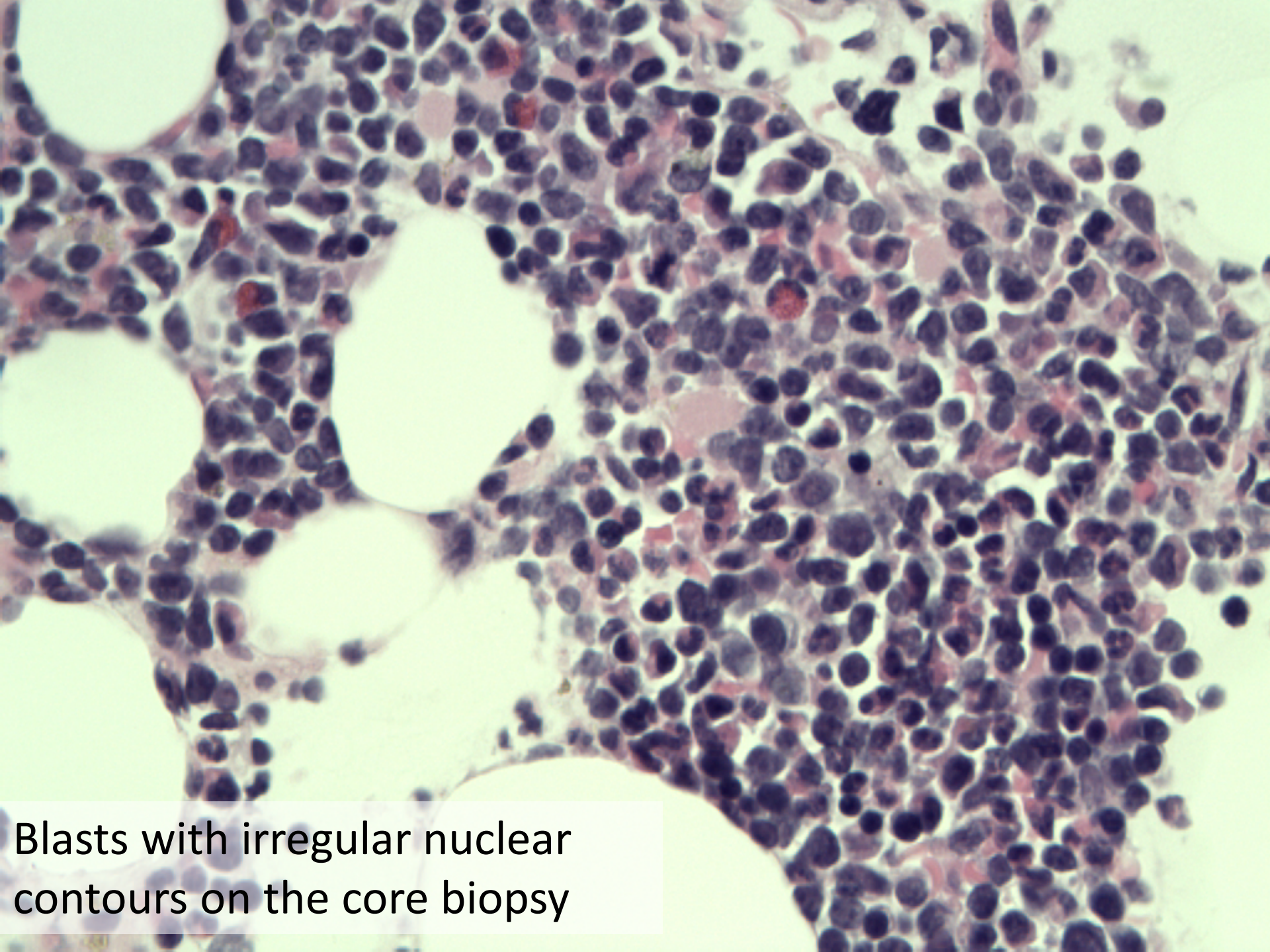


Increase in blasts with very high nuclear to cytoplasmic ratios



Some blasts have pinched nuclear contours – “hand mirror” sign





Blasts with irregular nuclear contours on the core biopsy

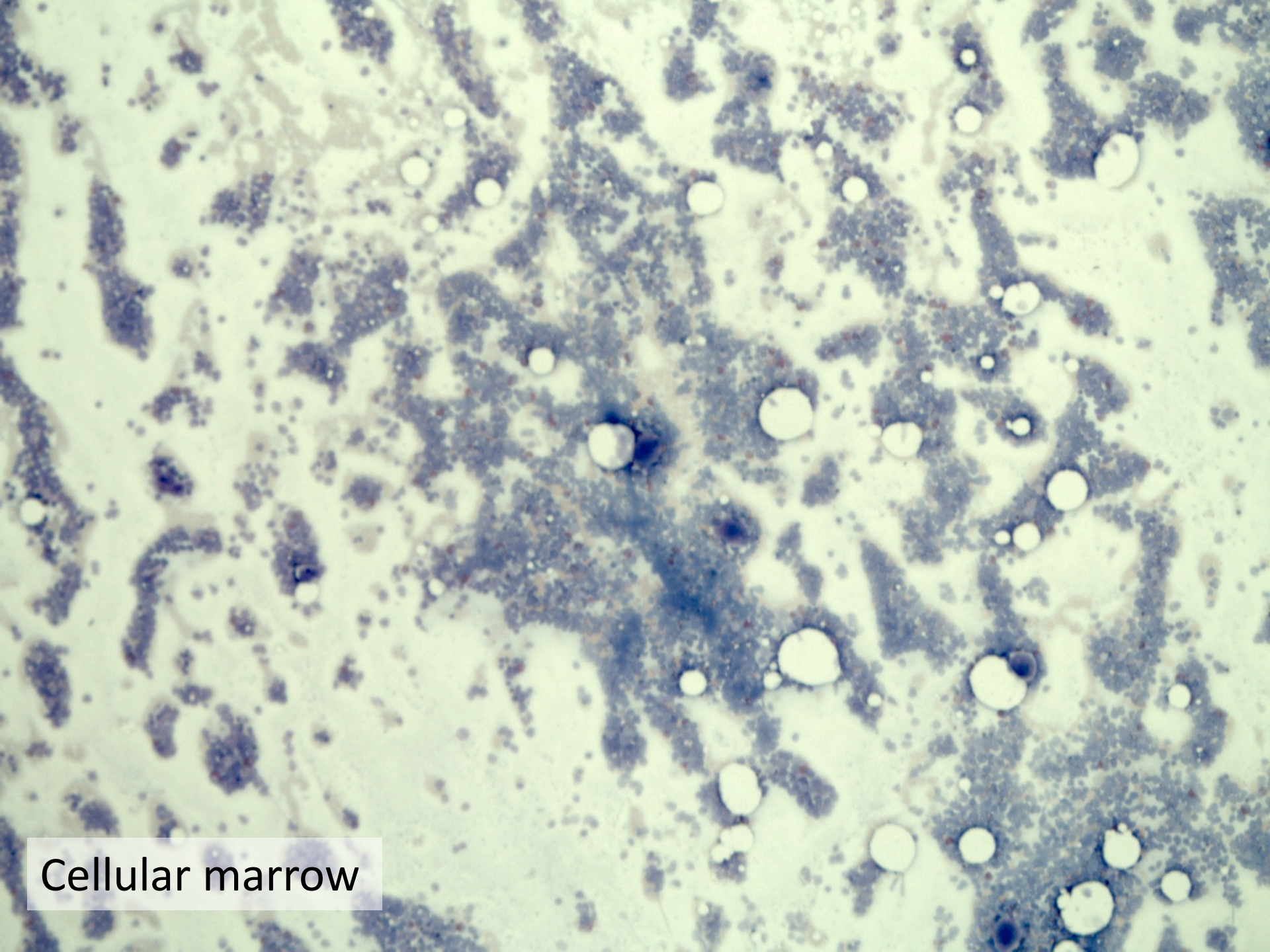
# Case 4

## Diagnosis?

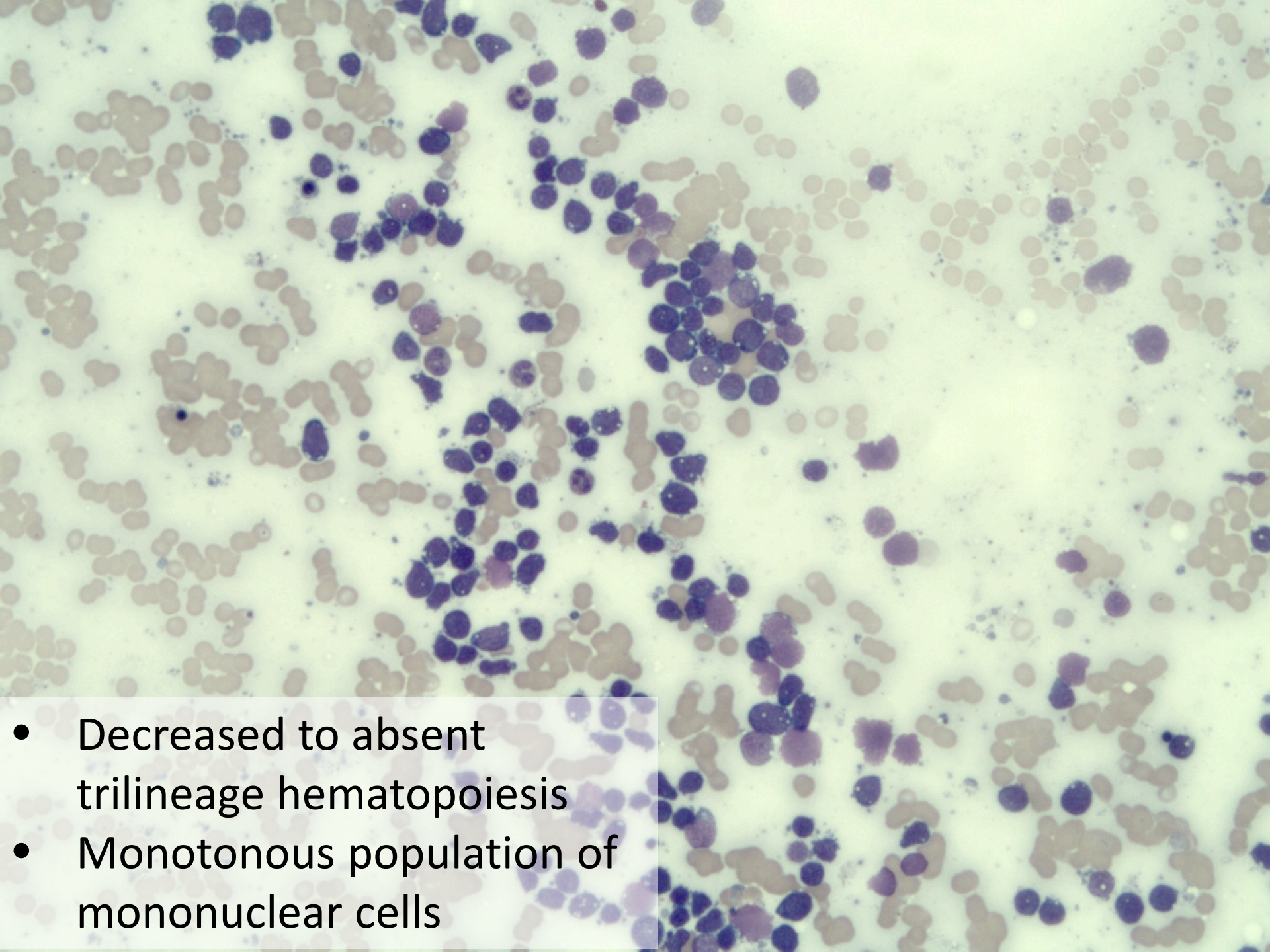
T Lymphoblastic  
Leukemia/Lymphoma  
(T-ALL)

# Case 5

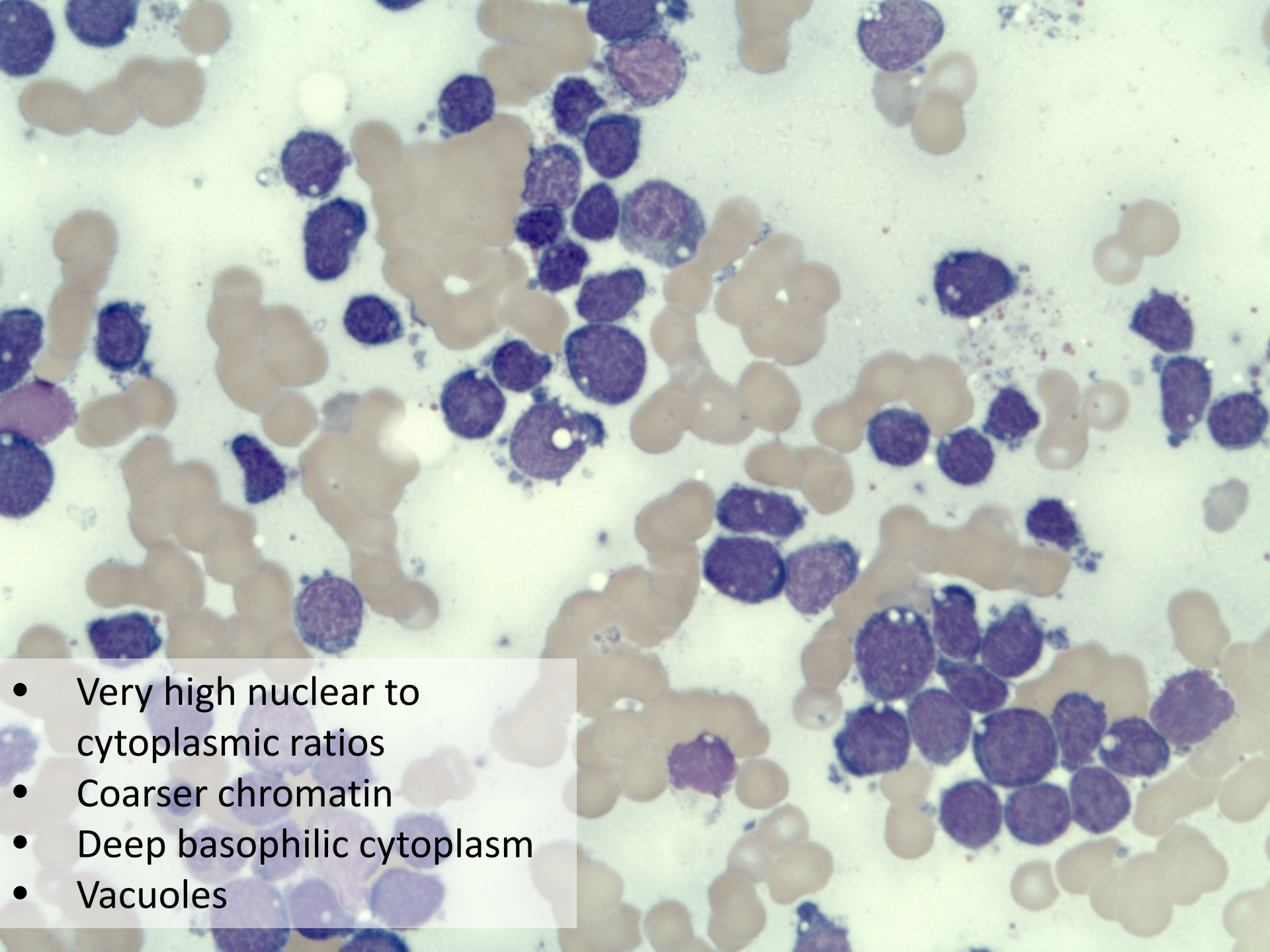
5-year-old boy with shortness of  
breath and jaw mass



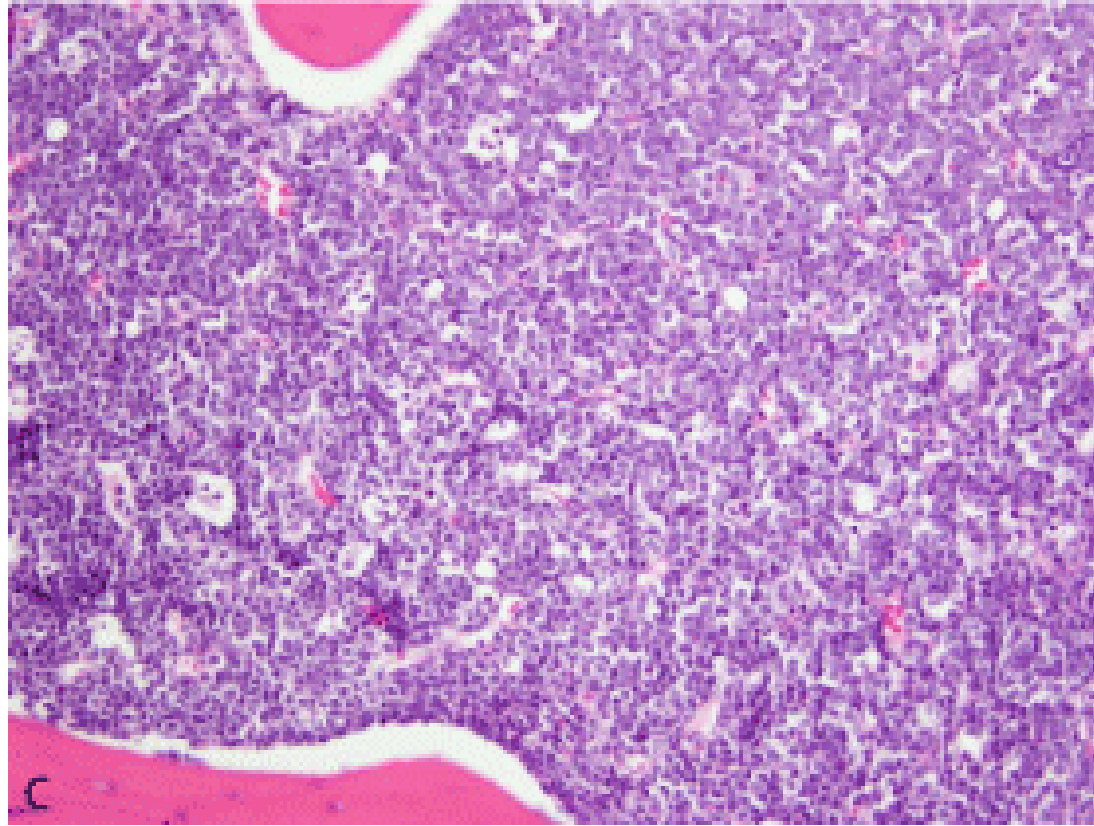
Cellular marrow



- 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.