Leukaemia – Laboratory diagnosis

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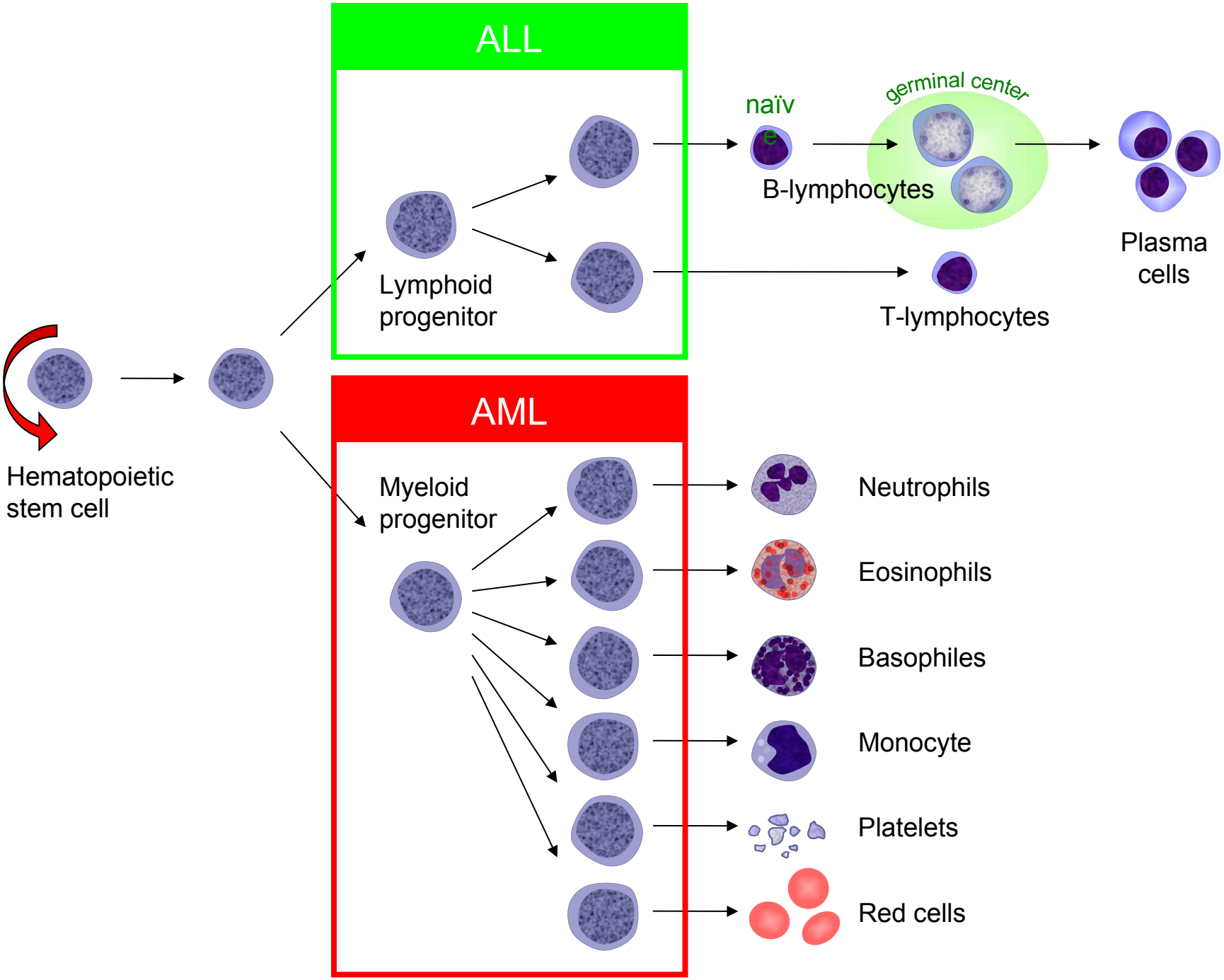
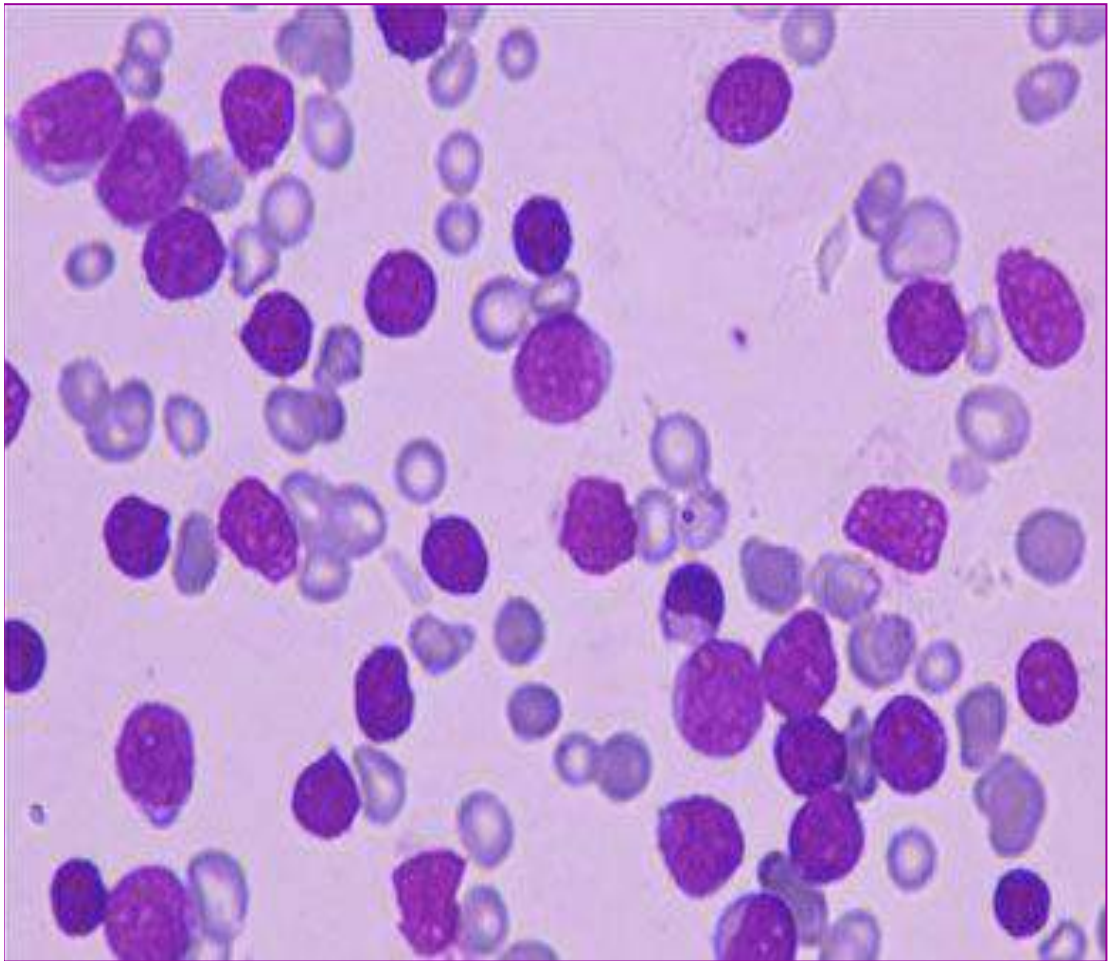
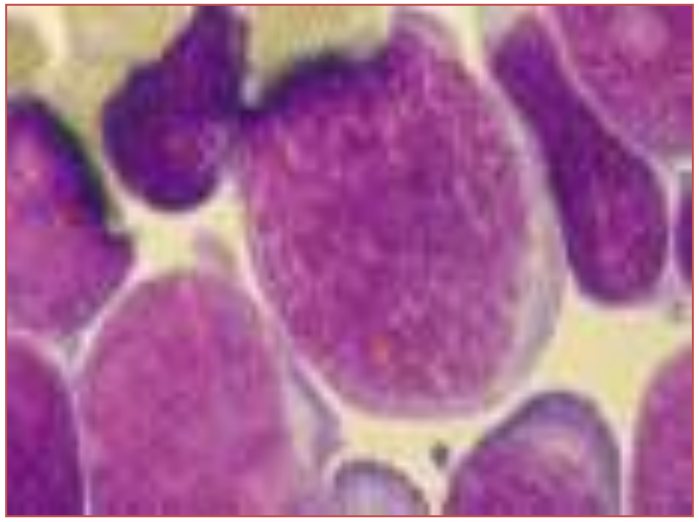
Leukemia

“ Stem cell disorder characterized by a malignant neoplastic proliferation and accumulation of immature hematopoietic cells in the bone marrow”


ALL
naïv
e
germinal center
B-lymphocytes
Plasma
cells
Lymphoid
progenitor
T-lymphocytes
Hematopoietic
stem cell
AML
Myeloid
progenitor
Neutrophils
Eosinophils
Basophiles
Monocyte
Platelets
Red cells

When to suspect leukaemia





Reactive vs. leukaemic

- Normocytic normochromic blood picture
- Mature cells or reactive cells
- Platelets- normal
- Symptoms of underlying infection or disease
- Abnormality in counts comes to normal as the underlying condition is treated

- Normocytic normochromic anemia
- Immature precursor cells
- Platelet counts – increased/ decreased
- Symptoms due to leukaemic process
- Abnormality in Counts worsen with time

CRITERIA FOR CLASSIFICATION

- **MORPHOLOGICAL**
- **CYTOCHEMICAL**
- **IMMUNOPHENOTYPING**
- **CYTOGENETIC**
- **MOLECULAR GENETICS**

CLASSIFICATION OF LEUKEMIAS (FAB)

	MYELOID		LYMPHOID
ACUTE LEUKEMIA	MYELOBLASTIC	M0	L 1
		M1	L 2
		M2	L 3
	PROMYELOCYTIC	M3	
	MYELOMONOCYTIC	M4	
	MONOCYTIC	M5	
	ERYTHROCYTIC	M6	
	MEGAKARYOCYTIC	M7	
CHRONIC LEUKEMIA	MYELOCYTIC (CML)		LYMPHOCYTIC
	MYELOMONOCYTIC (CMML)		PLASMACYTIC
			HAIRY CELL
			PROLYMPHOCYTIC
			LARGE GRANULAR

BLAST COUNT & AGGRESSIVENESS

MICM

Lab investigations

1. **Blood count and blood film**
2. **Bone marrow aspirate**
3. **Bone marrow trephine biopsy**
4. **Cytochemistry**
5. **Flow cytometric immunophenotyping**
6. **Immunohistochemistry**
7. **Cytogenetic analysis**
8. **Fluorescence *in situ hybridization***
9. **Molecular genetic analysis**

CYTOCHEMICAL ANALYSIS

- **MYELOPERAXIDASE**
- **SUDAN BLACK**
- **ESTERASES : SPECIFIC**

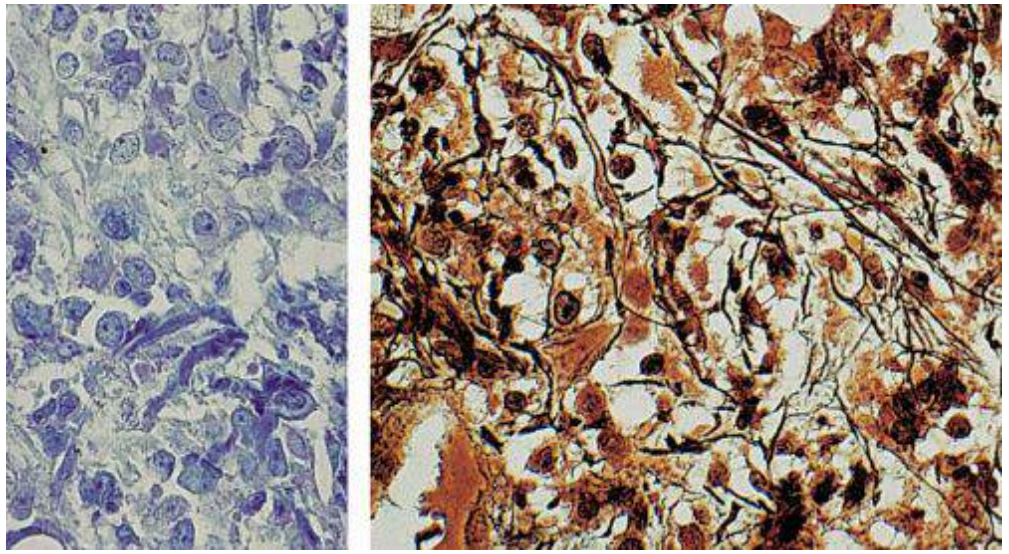
  NON - SPECIFIC
- **PERIODIC ACID-SCHIFF (PAS)**
- **LEUKOCYTE ALKALINE PHOSPHATASE**
- **ACID PHOSPHATESE**
- **TOLUDINE BLUE**
- **TERMINAL DEOXYNUCLEOTIDYL TRANSFERASE (TdT)**
- **RETICULIN STAIN**
- **METHYL GREEN - PYRONINE**

CYTOCHEMISTRY IN ACUTE LEUKEMIA

STAINS	AML	ALL
MYELOPERAXIDASE	+	--
SUDAN BLACK	+	--
PAS	+ (fine)	+ (course)
NON- SPECIFIC ESTERASE	+ (M4 , M5)	--
ACID PHOSPHATASE	--	-- (+ve T-ALL)
TdT	--	+

Trephine biopsy

- In cases of dry tap
- Equivocal data/insufficient cell yield in aspirate
- AML M7



blast cells (left) and
increased reticulin deposition (right).

FLOW CYTOMETRY – Immunophenotyping

- Done on a peripheral blood sample / bone marrow aspirate / on a cell suspension from any infiltrated tissue.
- *Indications*:

1. Lineage determination-myeloid/lymphoid

   B cell / T cell.

2. Aberrant expression of antigens – role in prognosis and evaluation for MRD—LAIP detects MRD.

3. Confirmation of a diagnosis of FAB M0 and acute undifferentiated leukaemias;

   M7 AML(CD 61/41)

4. Identification of mixed - lineage acute leukaemia & biphenotypic leukaemias.

5. Taregetted therapy – CD20- rituximab

6. ALL (TdT+)over NHL spillover

7. CSF and FNAC samples for leukaemic cells.

Precursor-B ALL	CD19, CD10, CD79a, TdT, cCD22*, HLA-DR, cCD79a*
Precursor-T ALL	CD1, CD2, CD3, CD4, CD5, CD7 CD8, TdT, cCD3*
AML	CD33, CD13, CD117, $CD4^{+}CD2^{-}$, HLA-DR, cMPO*
With monoblastic differentiation	CD11b, CD16, CD14, CD64
True erythroleukemia	Glycophorin A
Acute megakaryocytic leukemia	CD41, CD61, cCD41*, cCD61*
Lineage-independent antigens	HLA-DR, CD45, CD34. CD10

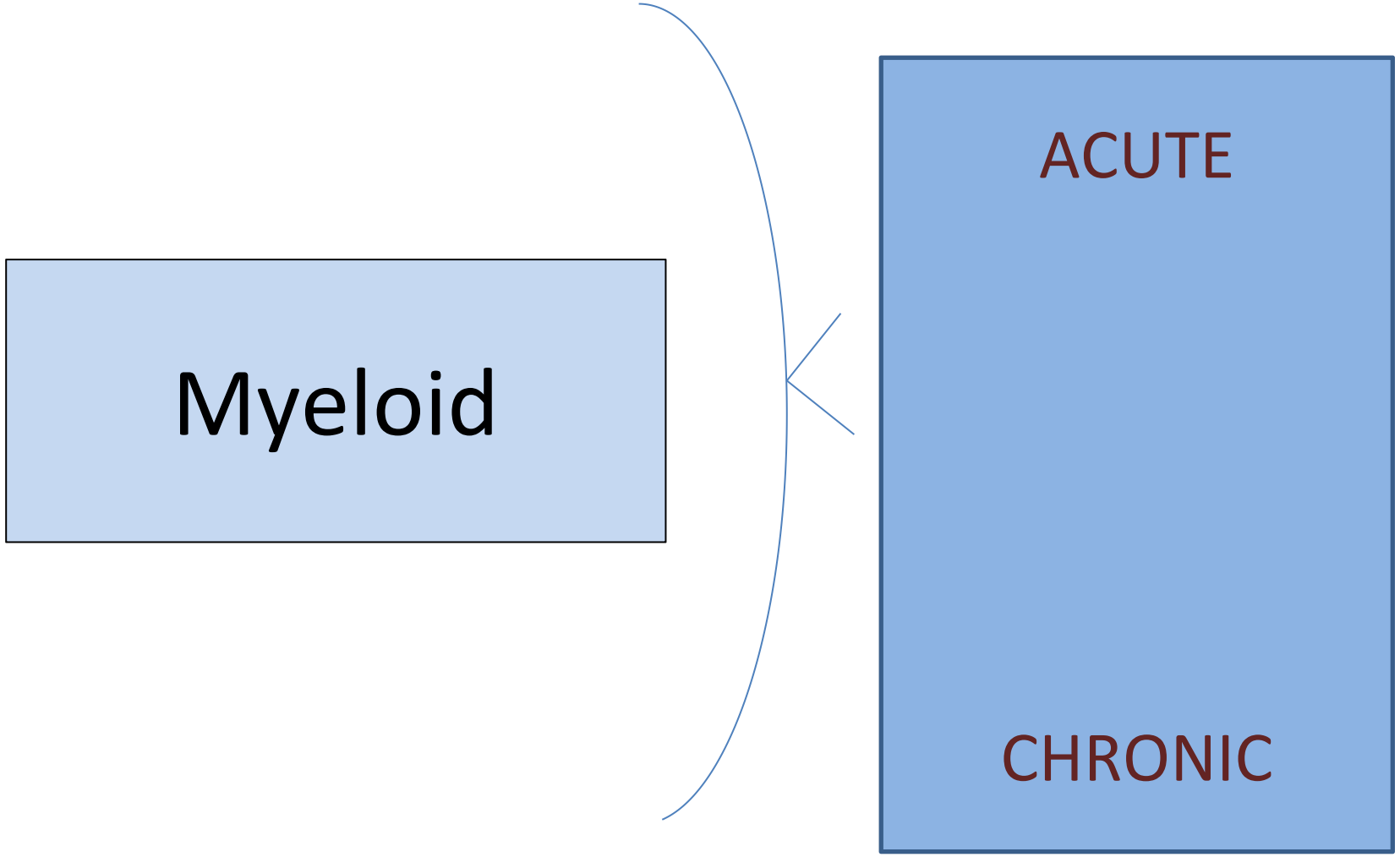
- **CYTOGENETIC-** WHO classifications for acute leukemias , prognostic value in some cases

- **MOLECULAR GENETICS:**

  SOUTHERN BLOT TECHNIQUE

  PCR

  RTPCR


Myeloid
ACUTE
CHRONIC

ACUTE MYELOBLASTIC LEUKEMIA

FAB CLASSIFICATION : AML

- **MO ACUTE MYELOBLASTIC LEUKEMIA WITH minimal differentiation**
- **M1 ACUTE MYELOBLASTIC LEUKEMIA without maturation**
- **M2 ACUTE MYELOBLASTIC LEUKEMIA with maturation**
- **M3 PROMYELOCYTIC LEUKEMIA , hypergranular**
  M3v, hypogranular
- **M4 ACUTE MYELOMONOCYTIC LEUKEMIA**
  M4eo with eosinophilia
- **M5a ACUTE MONOBLASTIC LEUKEMIA without differentiation**
  M5b with differentiation
- **M6 ACUTE ERYTHROLEUKEMIA**
- **M7 ACUTE MEGAKARYOCYTIC LEUKEMIA**

LABORATORY FINDINGS

- **PERIPHERAL BLOOD**

  NORMOCYTIC NORMOCHROMIC ANEMIA

  NUCLEATED ERYTHROCYTES

  ANISOPOIKILOCYTOSIS (VARIABLE)

  THROMBOCYTOPENIA

  LEUKOCYTOSIS (may be normal / decreased)

  BLASTS (> 20%)

  MONOCYTOSIS

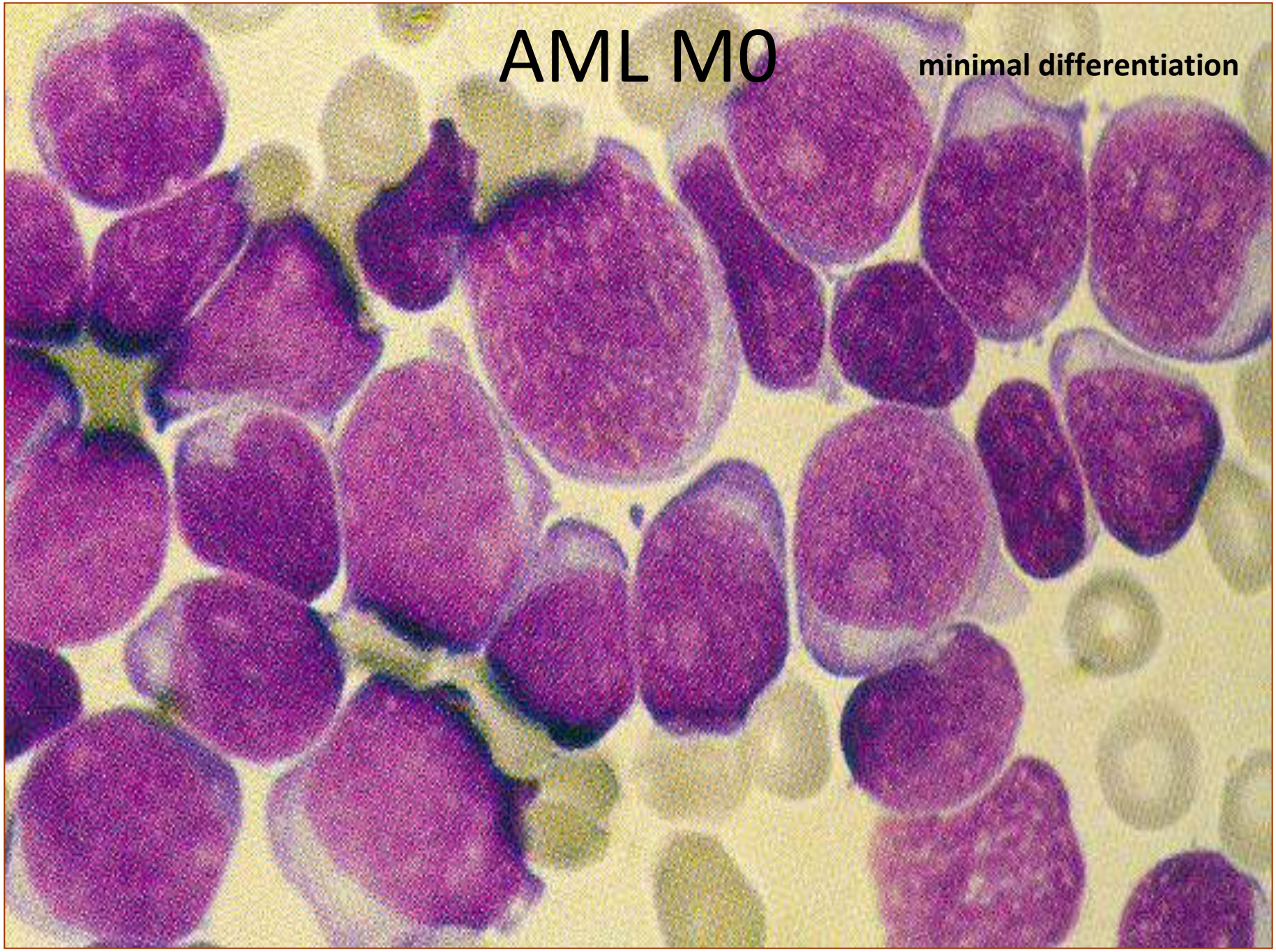
  NEUTROPENIA

  EOSINOPHILIA & BASOPHILIA (VARIABLE)

- ***HEMOSTATIC FUNCTION TESTS :***
  - ***Coagulation studies***
    - ***Clotting time***
    - ***PT, APTT, Fibrinogen levels***
    - ***FDP estimation***
  - ***Platelet studies***
    - ***Bleeding time***
    - ***Platelet count***
- ***PLASMA LDH***
- **BONE MARROW**
  - **HYPERCELLULAR ; > 30% BLASTS**

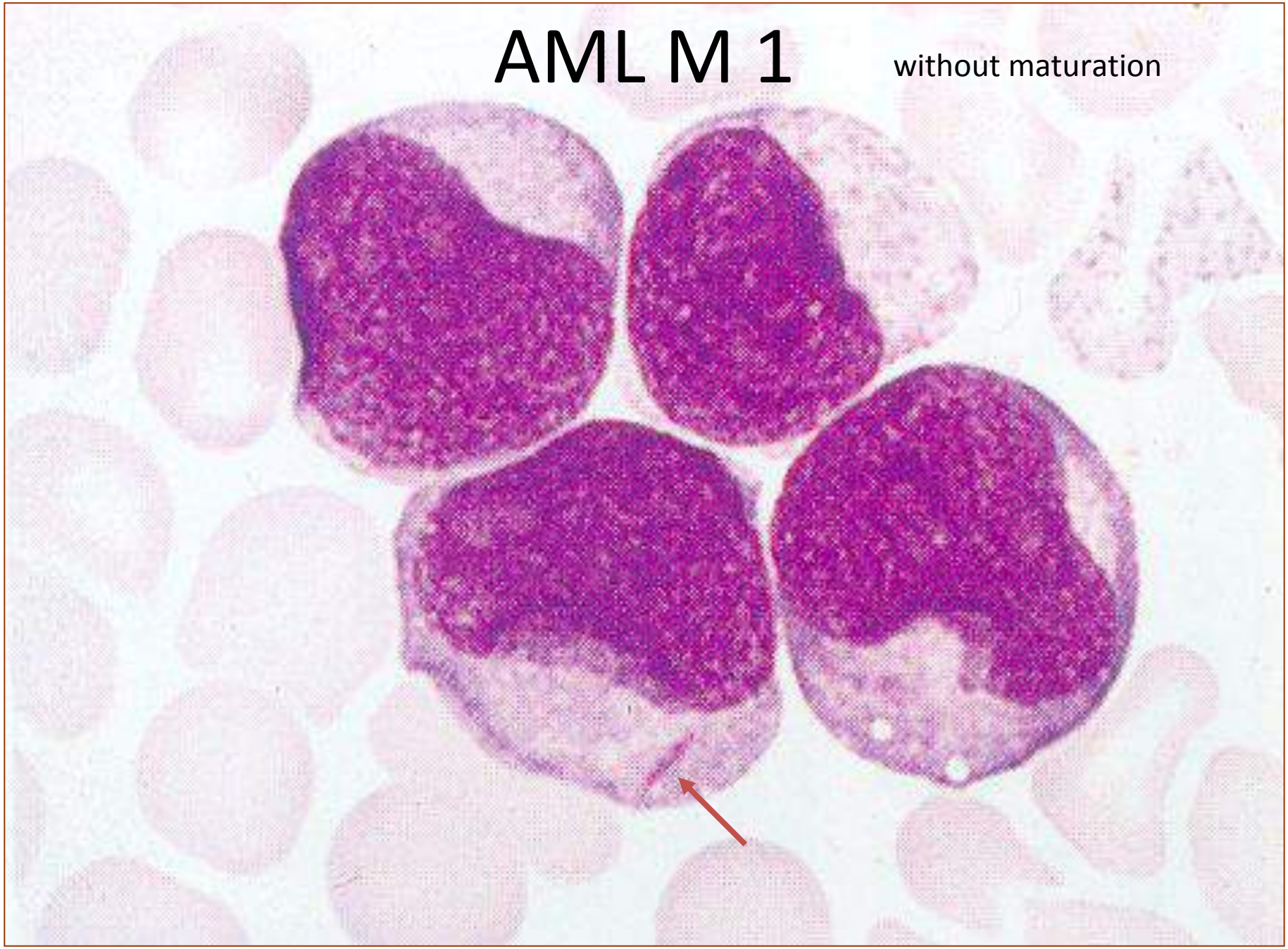
CLINICAL FINDINGS

- **SYMPTOMS RELATED TO**
  - **ANEMIA**
  - **NEUTROPENIA (recurrent U.Resp.T Infections)**
  - **THROMBOCYTOPENIA**
- **BONE TENDERNESS and SOFT TISSUE NODULES**
- **SPLENOMEGALY (Mild to moderate)**
- **HEPATOMEGALY (Mild to moderate)**
- **LYMPHADENOPATHY (May or may not)**
- **DIC (AML M3)**
- **GINGIVAL HYPERPLASIA (AML M4)**
- **DIFFUSE ERYTHEMATOUS SKIN RASH (AML M5)**


AML M0
minimal differentiation

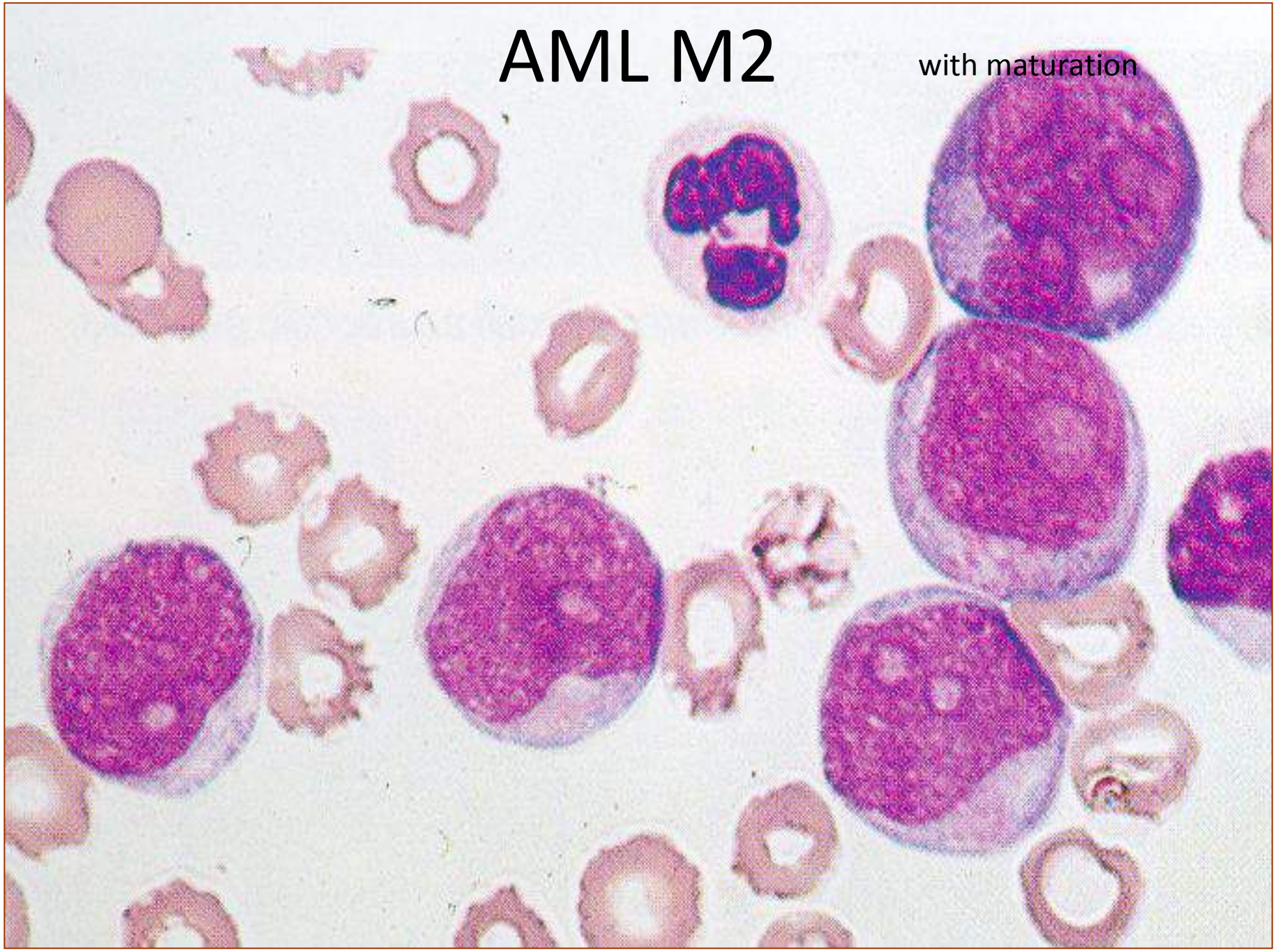
AML M 1

without maturation



AML M2

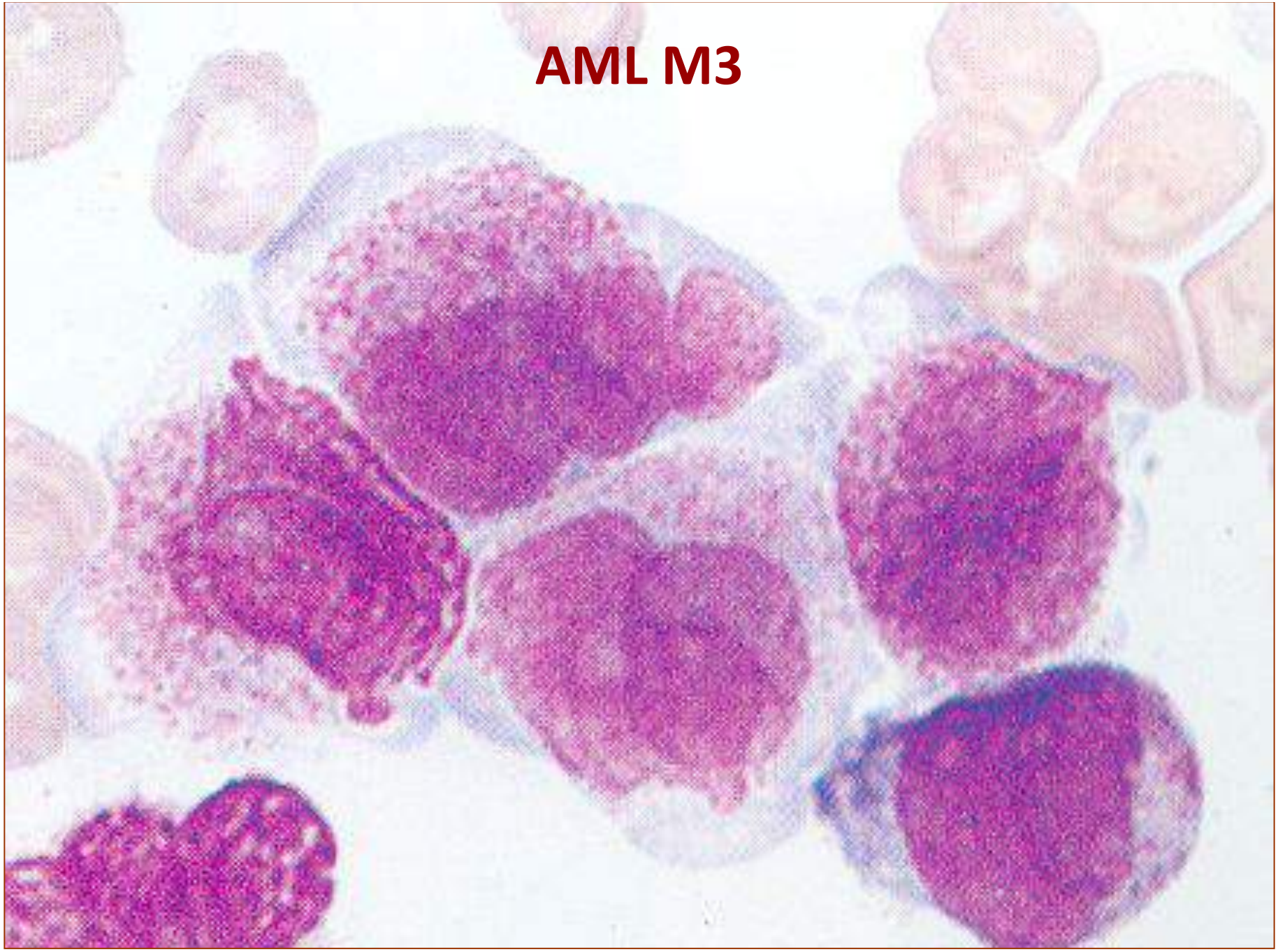
with maturation



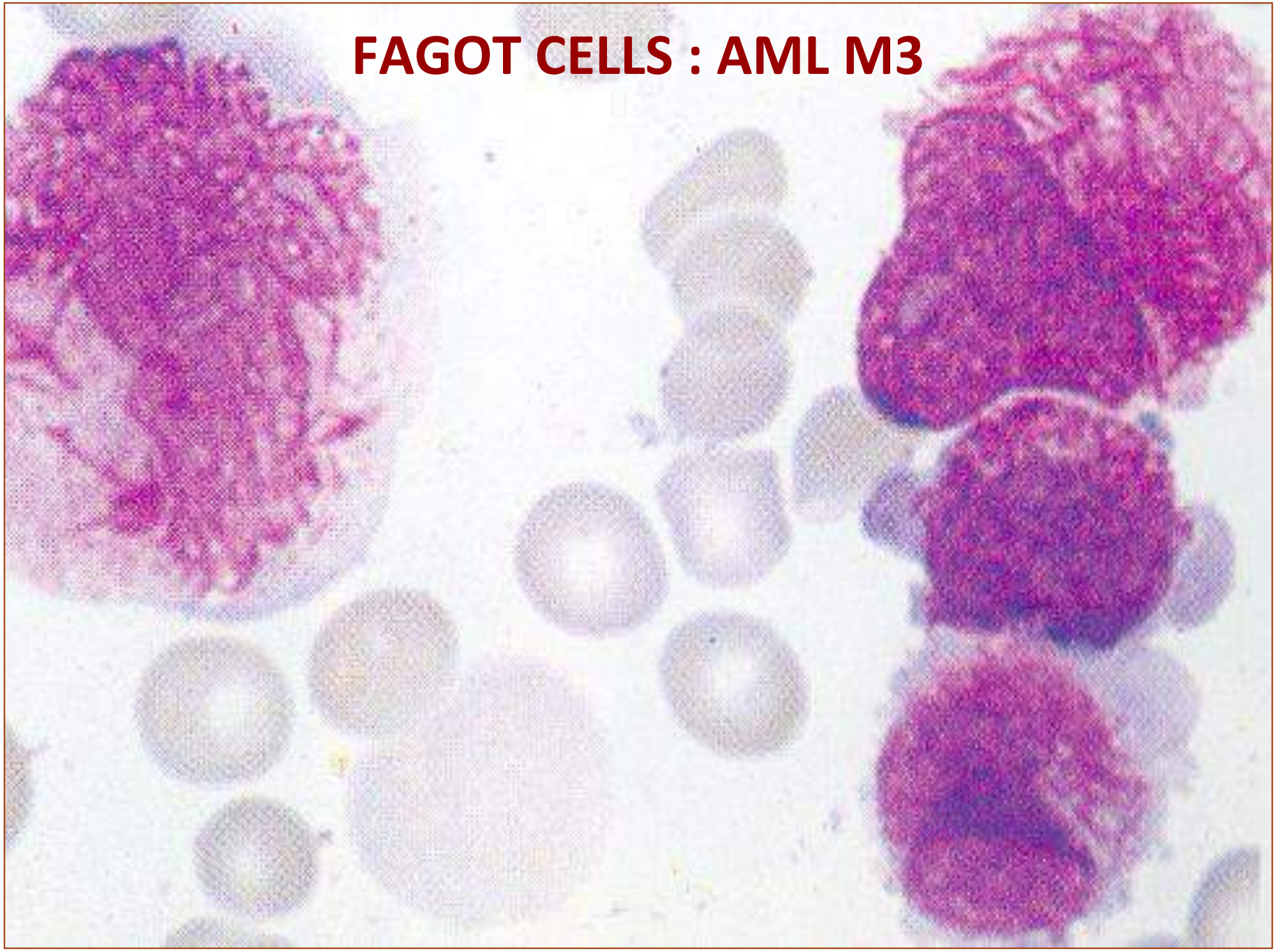
PROMYELOCYTIC LEUKEMIA

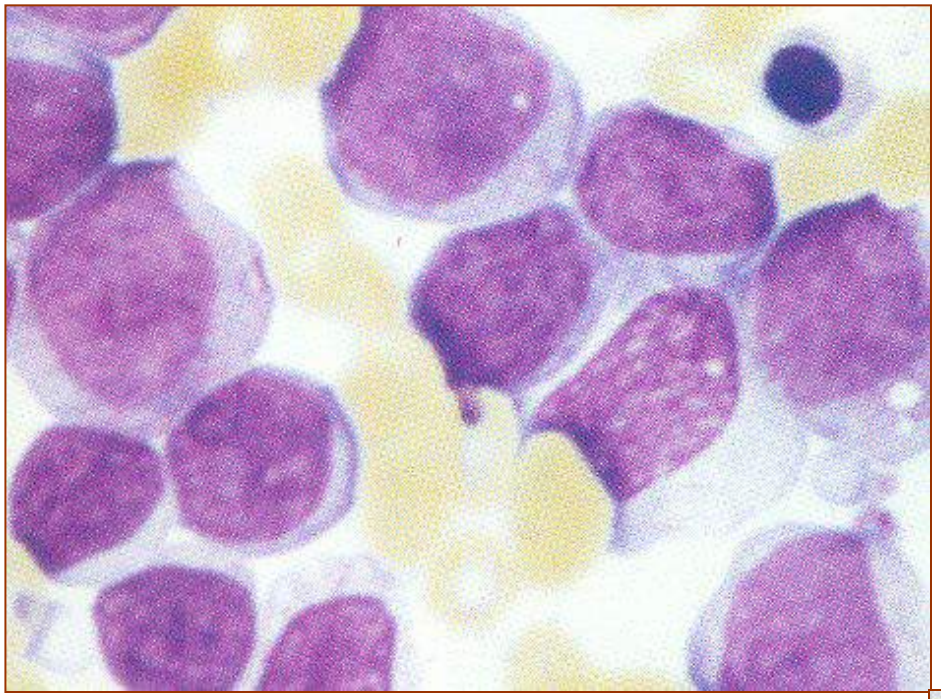
- **ACCORDING TO FAB CLASSIFICATION PML - AS M3**
- **TWO FORMS OF M3 (Hyper and hypogranular variants)**
- **ACCOUNTS FOR 5 to 10%**
- **OCCURS IN YOUNGER AGE GROUP (median age 39 yrs)**
- **MORE VIRULENT**
- **COMMON CLINICAL FINDING – BLEEDING**
- **GRANULES CONTAIN PROCOAGULANT**
- **MOST SERIOUS COMPLICATION IS DIC**
- **POTENTIATES DIC DURING THERAPY**
- **ADJUVENT HEPARIN THERAPY TO PREVENT DIC**

AML M3



FAGOT CELLS : AML M3



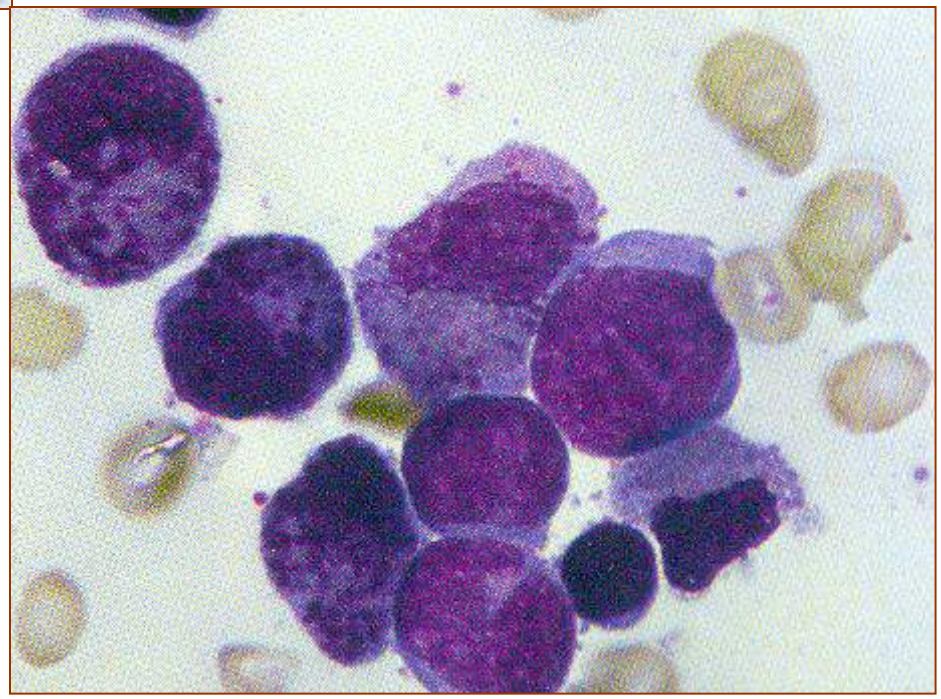


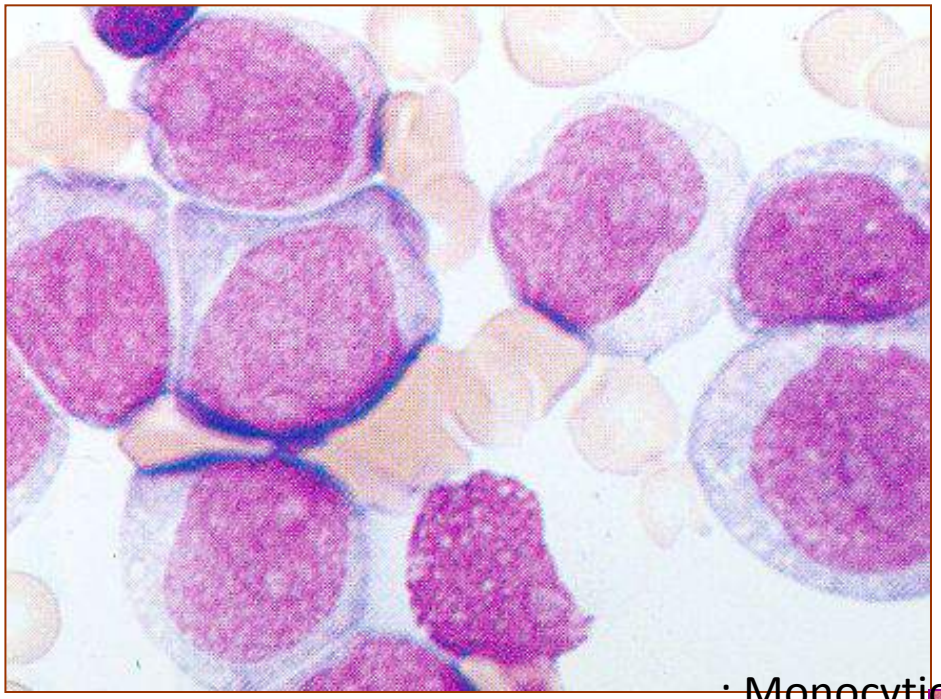
AML M 4

Myelomonocytic leukemia

AML – M4Eo

Increase in abnormal marrow eosinophils

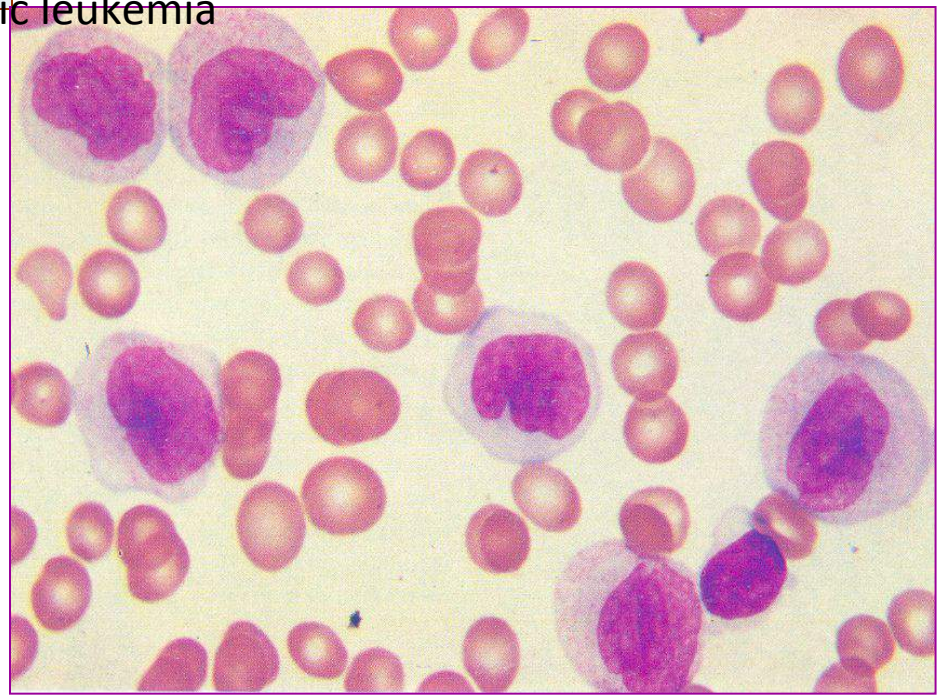




AML - M5a

>80% MONOBLASTS
<20% PROMONOCYTES AND MONOCYTES

: Monocytic leukemia

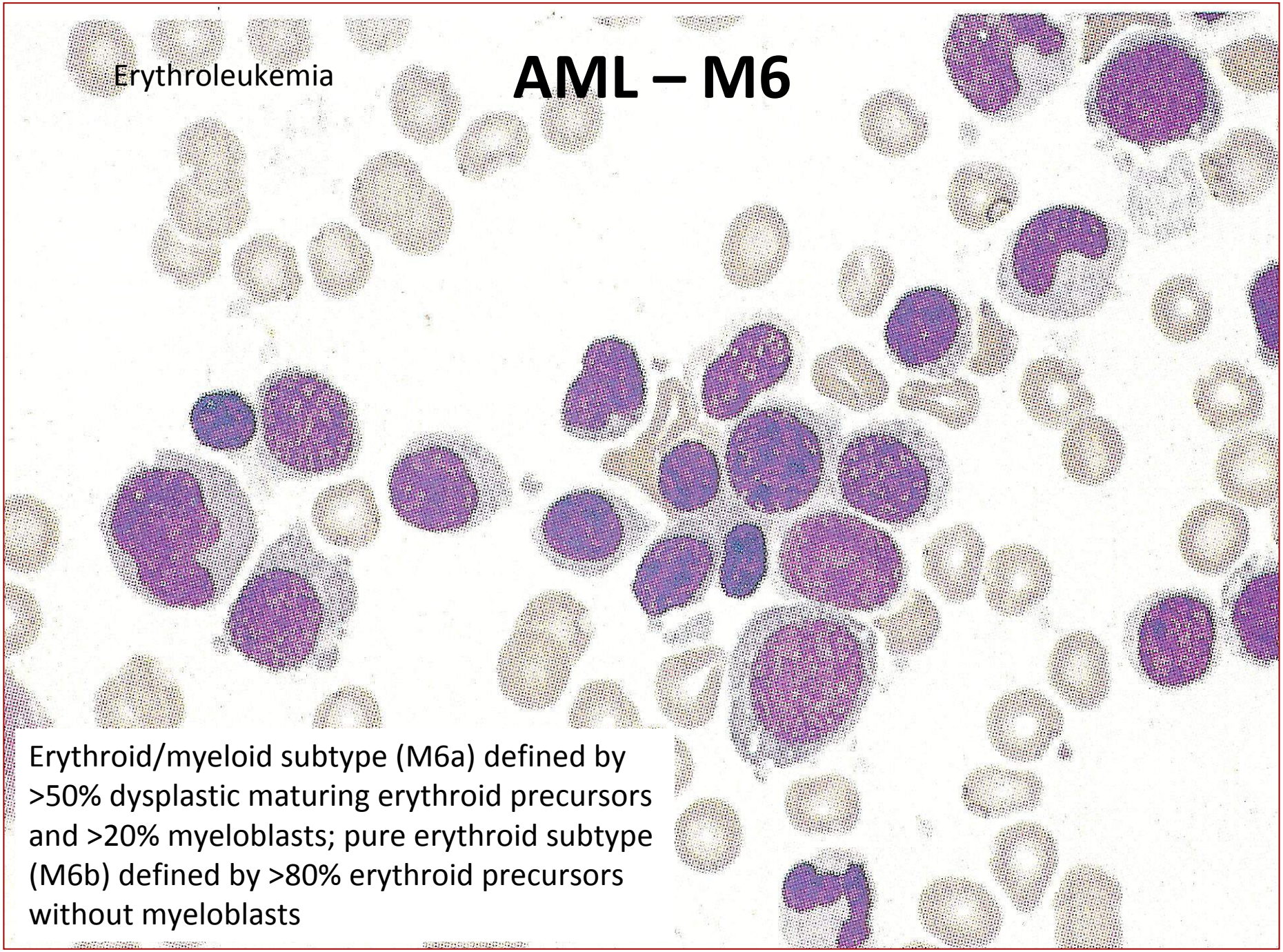


AML - M5b

<80% MONOBLASTS
>20% PROMONOCYTES AND BLASTS

Erythroleukemia

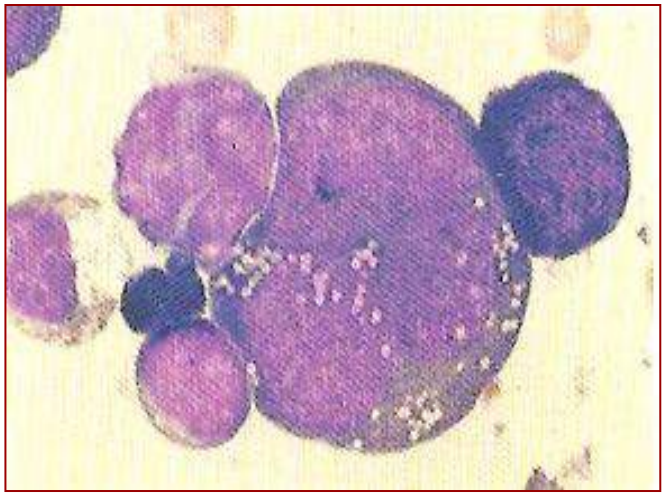
AML – M6

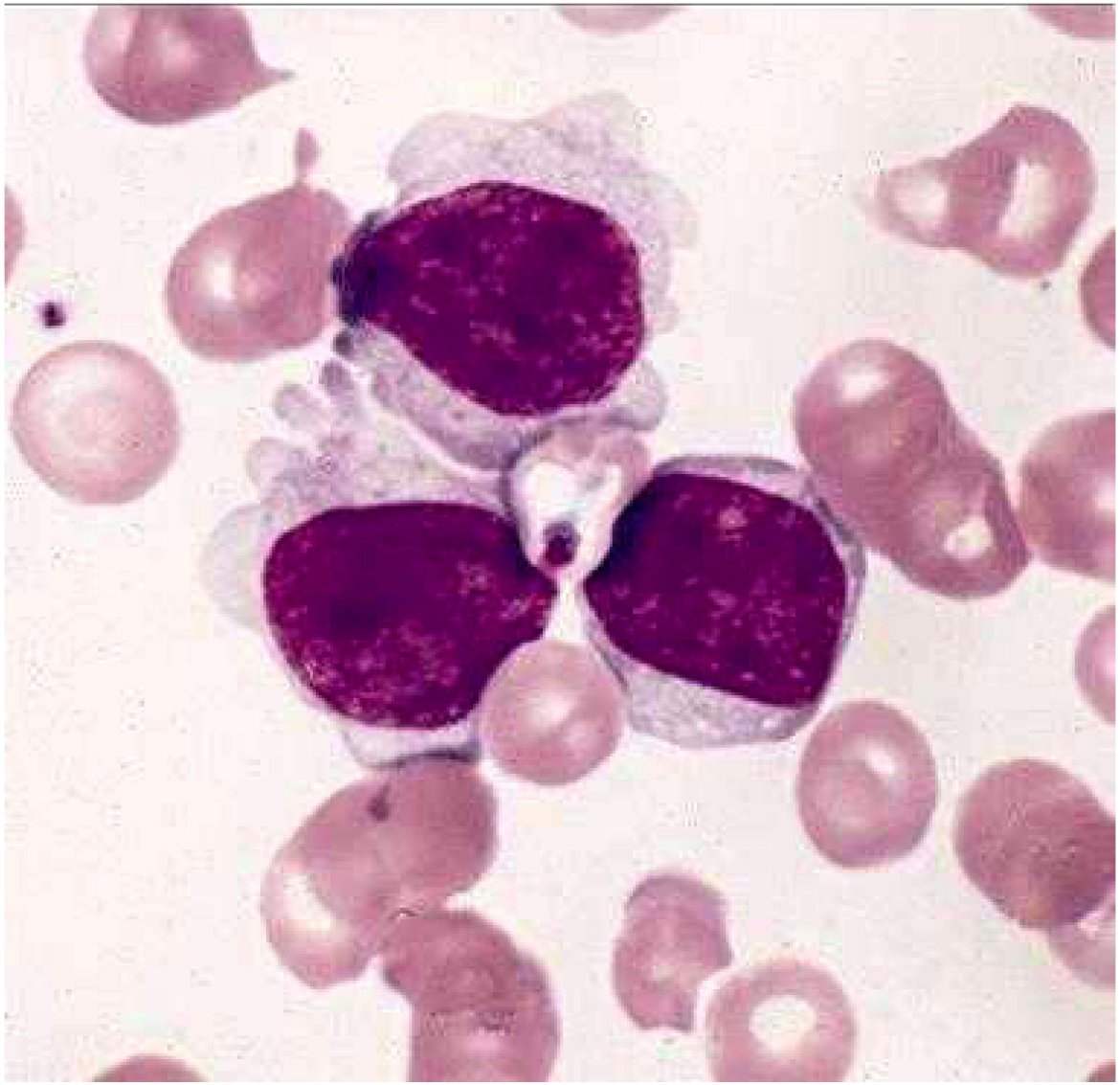


Erythroid/myeloid subtype (M6a) defined by >50% dysplastic maturing erythroid precursors and >20% myeloblasts; pure erythroid subtype (M6b) defined by >80% erythroid precursors without myeloblasts

AML-M7

: Megakaryoblastic leukemia





CYTOCHEMISTRY IN ACUTE LEUKEMIA

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MYELOPEROXIDASE	+	--
SUDAN BLACK	+	--
PAS	+ (fine)	+ (course)
NON- SPECIFIC ESTERASE	+ (M4 , M5)	--
ACID PHOSPHATASE	--	-- (+ve T-ALL)
TdT	--	+

Immunophenotyping

Precursor-B ALL	CD19, CD10, CD79a, TdT, cCD22*, HLA-DR, cCD79a*
Precursor-T ALL	CD1, CD2, CD3, CD4, CD5, CD7 CD8, TdT, cCD3*
AML	CD33, CD13, CD117, $CD4^{+}CD2^{-}$, HLA-DR, cMPO*
With monoblastic differentiation	CD11b, CD16, CD14, CD64
True erythroleukemia	Glycophorin A
Acute megakaryocytic leukemia	CD41, CD61, cCD41*, cCD61*
Lineage-independent antigens	HLA-DR, CD45, CD34. CD10

CYTOGENETICS

M 1	**monosomy 5, Del (5q) , t (6;9) , t(9;22)**
M 2	**t(6;9) , t(8;21) , monosomy 7**
M 3	**t(15;17)**
M 4	**t(6;9) ,t(8;21) , t(9;11) ,del (11) , monosomy 7**
M 4eo	**del(16q) ,inv(16)**
M 5	**del(16q) ,inv(16) ,monosomy 7 ,del(11) ,t(9;11)**
M 6	**abnormalities ch 5 & 7**
M 7	**t(21;8)**

The WHO classification of acute myeloid leukaemia (AML)-2008

1. *AML with recurrent genetic abnormalities*

AML with t(8;21)(q22;q22); *RUNX1 – RUNX1T1*
AML with inv(16)(p13.1q22) or t(16;16)(p13.1;q22); *CBFB – MYH11*
AML with t(15;17)(q22;q12); *PML – RARA*
AML with 11q23(MLL) abnormalities

2. *AML with multilineage dysplasia*

MDS related
denovo

3. *AML and MDS therapy related-* +

alkylating agent related
topoisomerase II inhibitor related ,
others

4. *AML,NOS*

with minimal differentiation
without maturation
with maturation
myelomonocytic
monoblastic and monocytic
erythroid
megakaryoblastic
basophilic
panmyelosis with myelofibrosis
myeloid sarcoma

CHRONIC MYELOID LEUKEMIA

DISEASE PROGRESSION

- **CHRONIC PHASE**
- **ACCALERATED PHASE**
- **BLAST CRISIS**

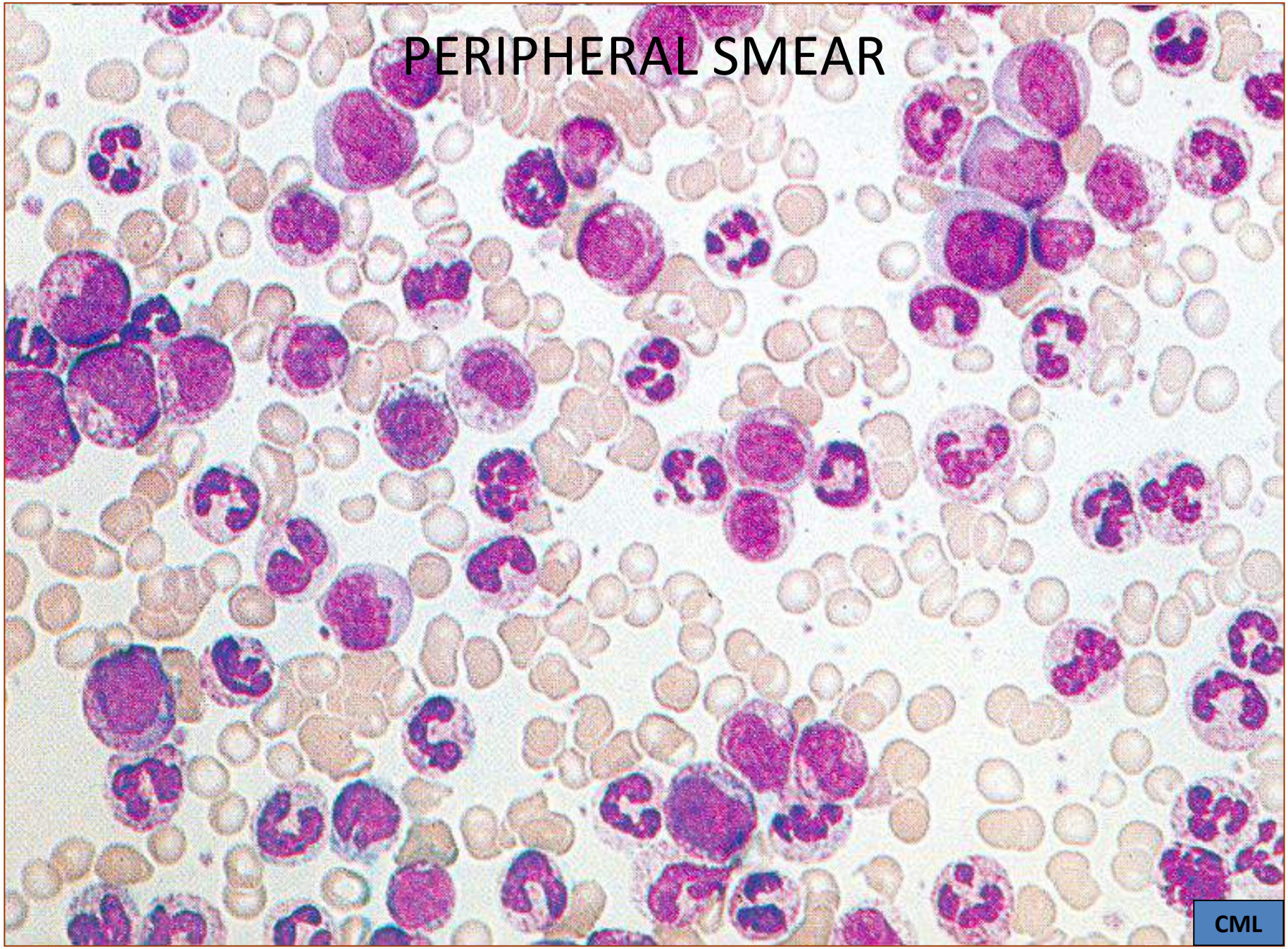
CLINICAL FINDINGS

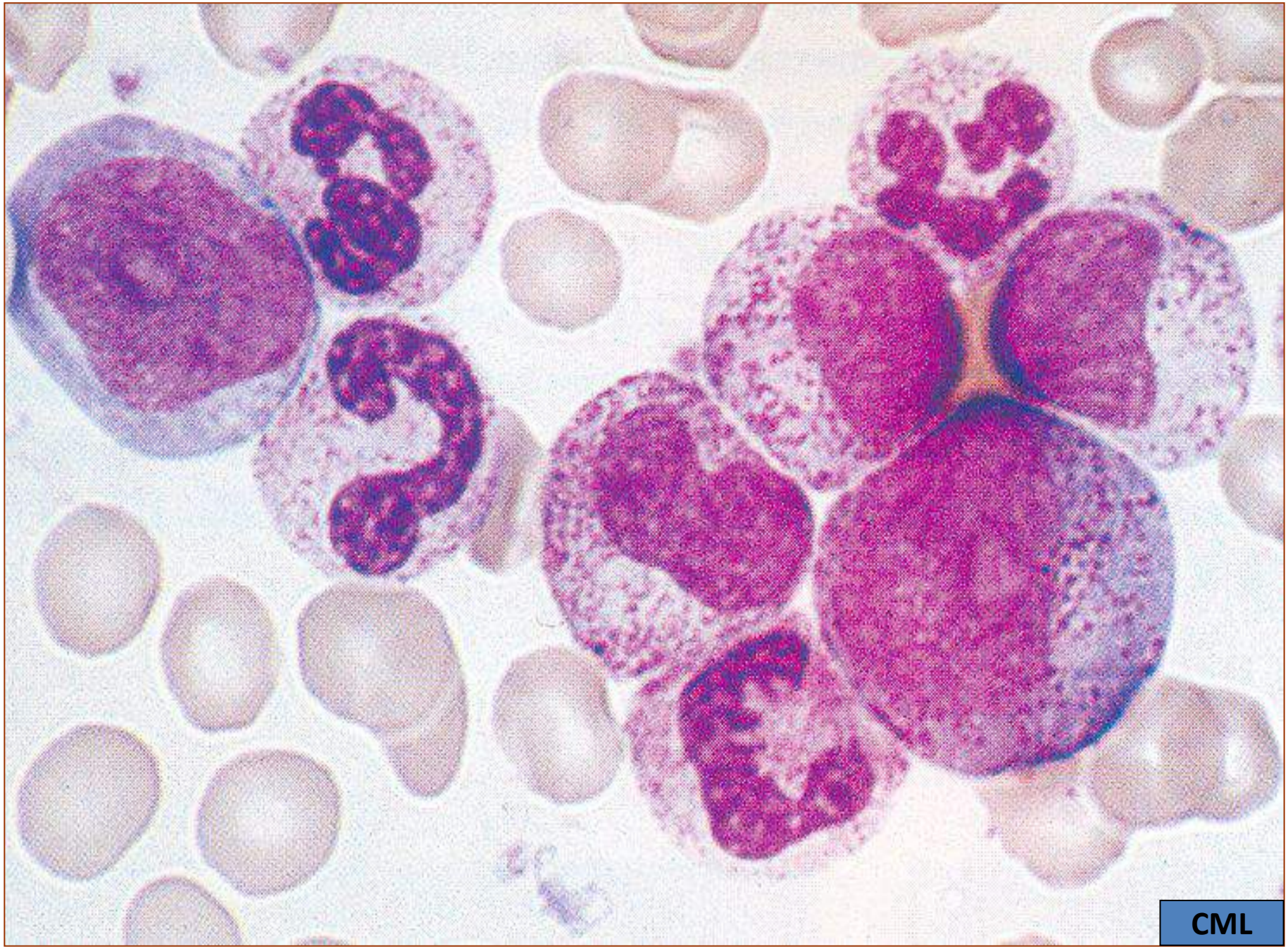
- ***MIDDLE AGE***
- ***INSIDIOUS ONSET***
- ***ANEMIA SYMPTOMS***
- ***UNEXPLAINED FEVER***
- ***WEIGHT LOSS***
- ***FULLNESS IN ABDOMEN (Dragging sensation in the left hypochondrial region)***
- ***BLEEDING MANIFESTATIONS***
- ***MASSIVE SPLENOMEGALY***
- ***LYMPHADENOPATHY (DISEASE PROGRESSION)***
- ***EXTRAMYELOID MASSES***

PERIPHERAL BLOOD FEATURES

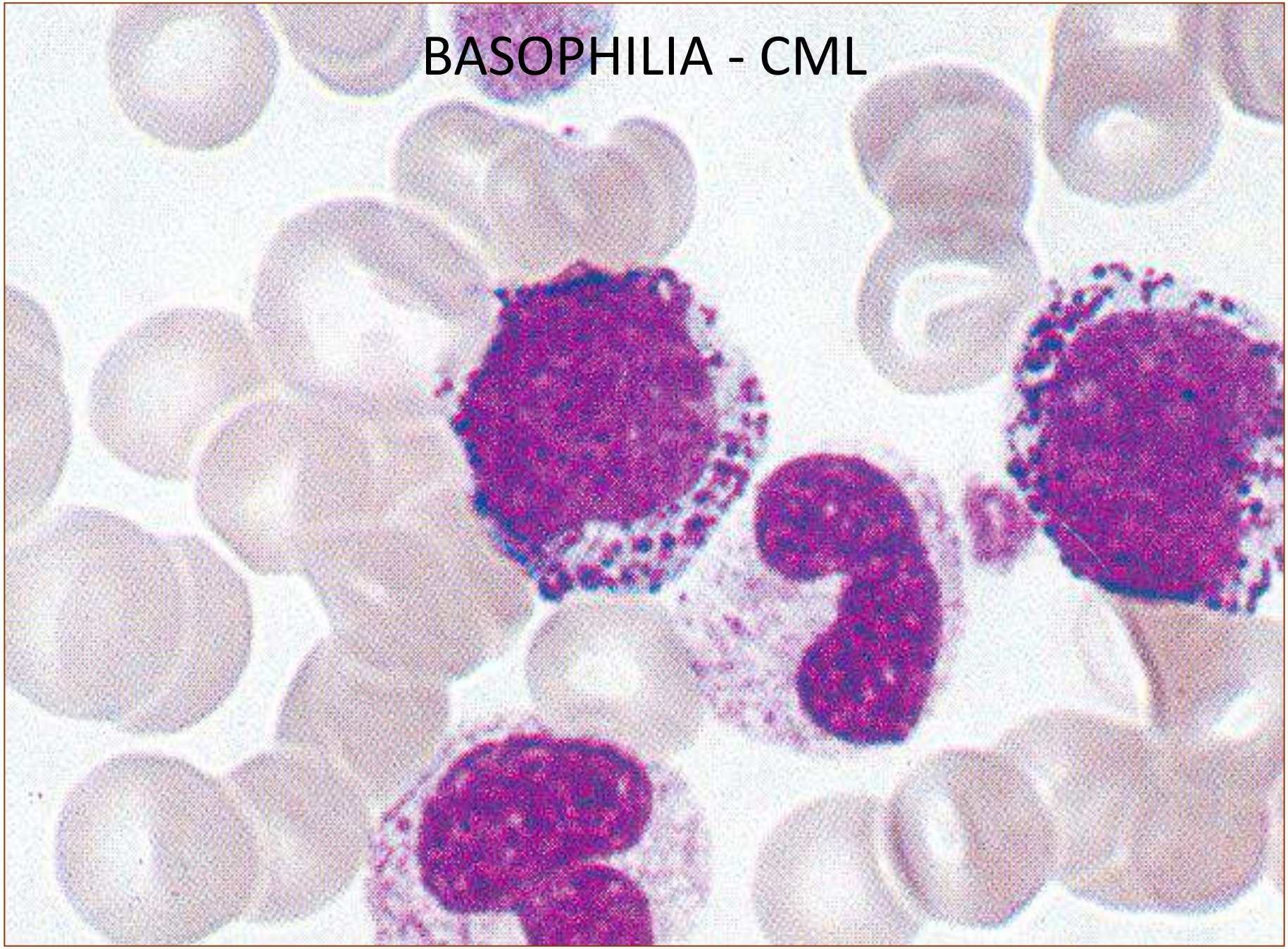
- **LEUKOCYTOSIS (1.0 – 5.0 laks/cu mm)**
- **THROMBOCYTOSIS**
- **NORMOCYTIC NORMOCHROMIC ANEMIA**
- **SHIFT TO LEFT (BLAST COUNT < 20%)**
- **BASOPHILIA**
- **EOSINOPHILIA**
- **MONOCYTOSIS**
- **OCCASIONAL NRBC**
- **DECREASED LAP SCORE**

PERIPHERAL SMEAR




CML

BASOPHILIA - CML



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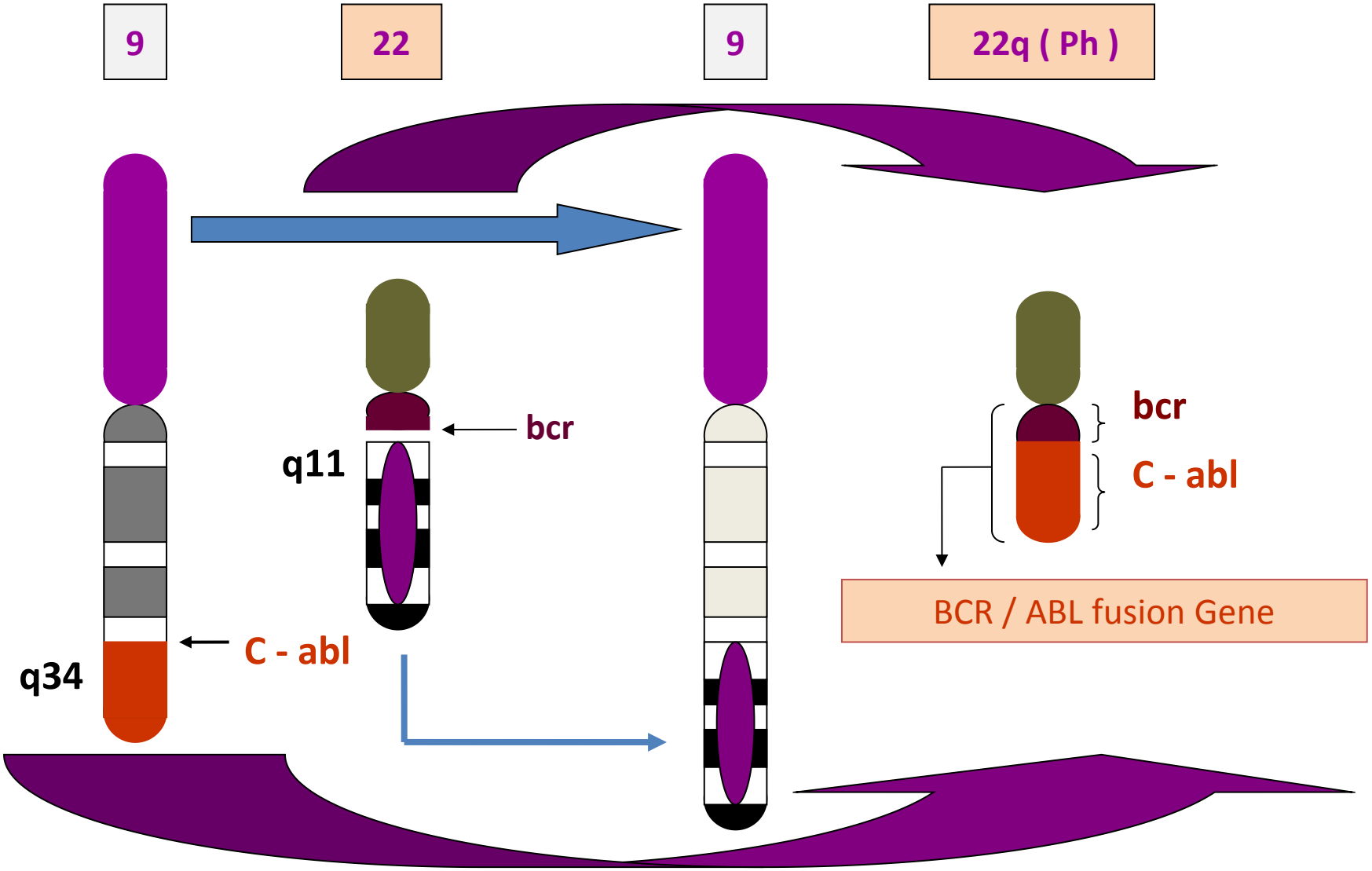


VARIANTS OF CML

VARIANT	AGE	LAP score	Ph chromosome
▪ TYPICAL CML	Middle age	↓	Present
▪ ATYPICAL CML	Older adults	↓	Absent
▪ JUVENILE CML			
INFANTILE VARIANT	< 5 yrs	↓	Absent
ADULT VARIANT	> 5 yrs	↓	Present
▪ CHRONIC EOSINOPHILIC			
LEUKEMIA	Middle age	N	Present / Absent
▪ CHRONIC BASOPHILIC			
LEUKEMIA	Middle age	N / ↓	Present / Absent
▪ CHRONIC NEUTROPHILIC			
LEUKEMIA	Over 50 yrs	↑	Absent

B) Accelerated phase

Criteria of accelerated phase

- Blasts in blood or bone marrow-10-19%
- Basophilia $\geq$ 20%
- Thrombocytopenia <1,00,000/cmm
- Thrombocytosis >10,00,000/cmm
- Additional chromosomal aberrations
- Refractory splenomegaly or refractory leucocytosis

When to suspect progression

- Decreasing platelet counts
- Increasing basophil count
- Increasing total counts
- Lymphadenopathy

c)Blast phase (blast crisis) of CML

- Criteria of blast phase

1. Blasts ≥20%
2. Extramedullary blast proliferation
3. Large foci of blasts in bonemarrow

- Phenotype of blasts

1. Myeloblasts – 60-70%
2. Lymphoblasts -10-30%
3. MPAL– 25%
4. Acute myelofibrosis

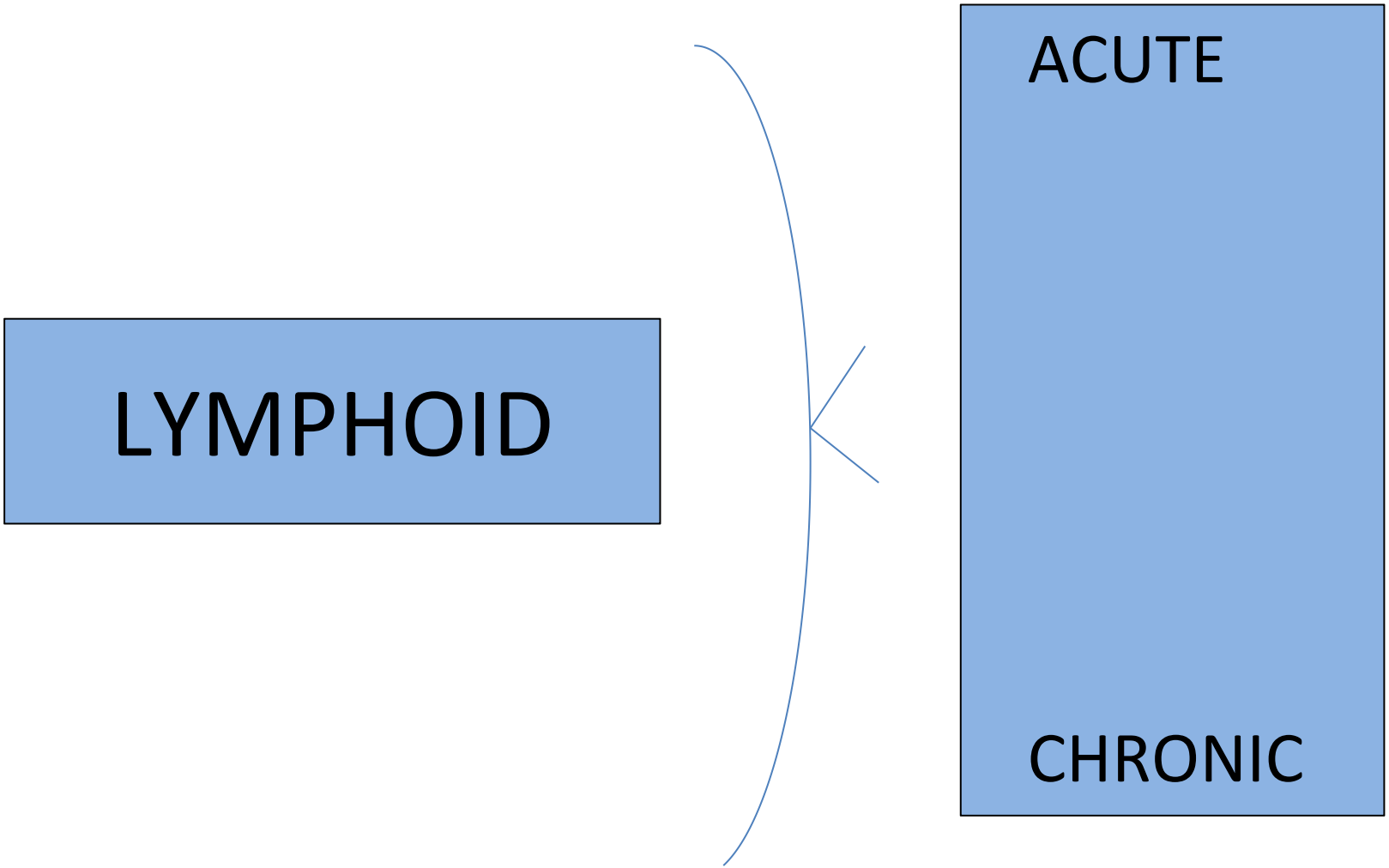
DIFFERENTIAL DIAGNOSIS

- **LEUKEMOID REACTION**

- **MYELOFIBROSIS WITH MYELOID METAPLASIA**

DIFFERENTIAL DIAGNOSIS

	LEUKEMOID REACTION	CML
▪ LEUKOCYTE COUNT	INCREASED	INCREASED
▪ DIFFERENTIAL	SHIFT TO LEFT	SHIFT TO LEFT
▪ ERYTHROCYTE COUNT	NORMAL	DECREASED
▪ PLATELETS	NORMAL	INCREASED / DECREASED
▪ *LAP SCORE*	*INCREASED*	*DECREASED*
▪ *BASOPHELIA*	*NOT SEEN*	*PRESENT*
▪ *PHILADELPHIA CHROMOSOME*	*ABSENT*	*PRESENT*
▪ *COURSE*	*TRANSIENT*	*PROGRESSIVE*


LYMPHOID
ACUTE
CHRONIC

ACUTE LYMPHOBLASTIC LEUKEMIA

CLINICAL FINDINGS

- **ABRUPT ONSET**
- **SYMPTOMS RELATED TO**
  - **ANEMIA**
  - **NEUTROPENIA**
  - **THROMBOCYTOPENIA**
- **BONE PAIN & TENDERNESS**
- **SYMPTOMS RELATED TO CNS involvement**
- **LYMPHADENOPATHY** ****
- **HEPATOSPLENOMEGALY** **

COMMON

FAB CLASSIFICATION : ALL

ALL – L1	ALL – L2	ALL – L3

BASED ON :

MORPHOLOGY

CELL SIZE

NUCLEAR CHROMATIN

NUCLEAR SHAPE

NUCLEOLI

AMOUNT OF CYTOPLASM

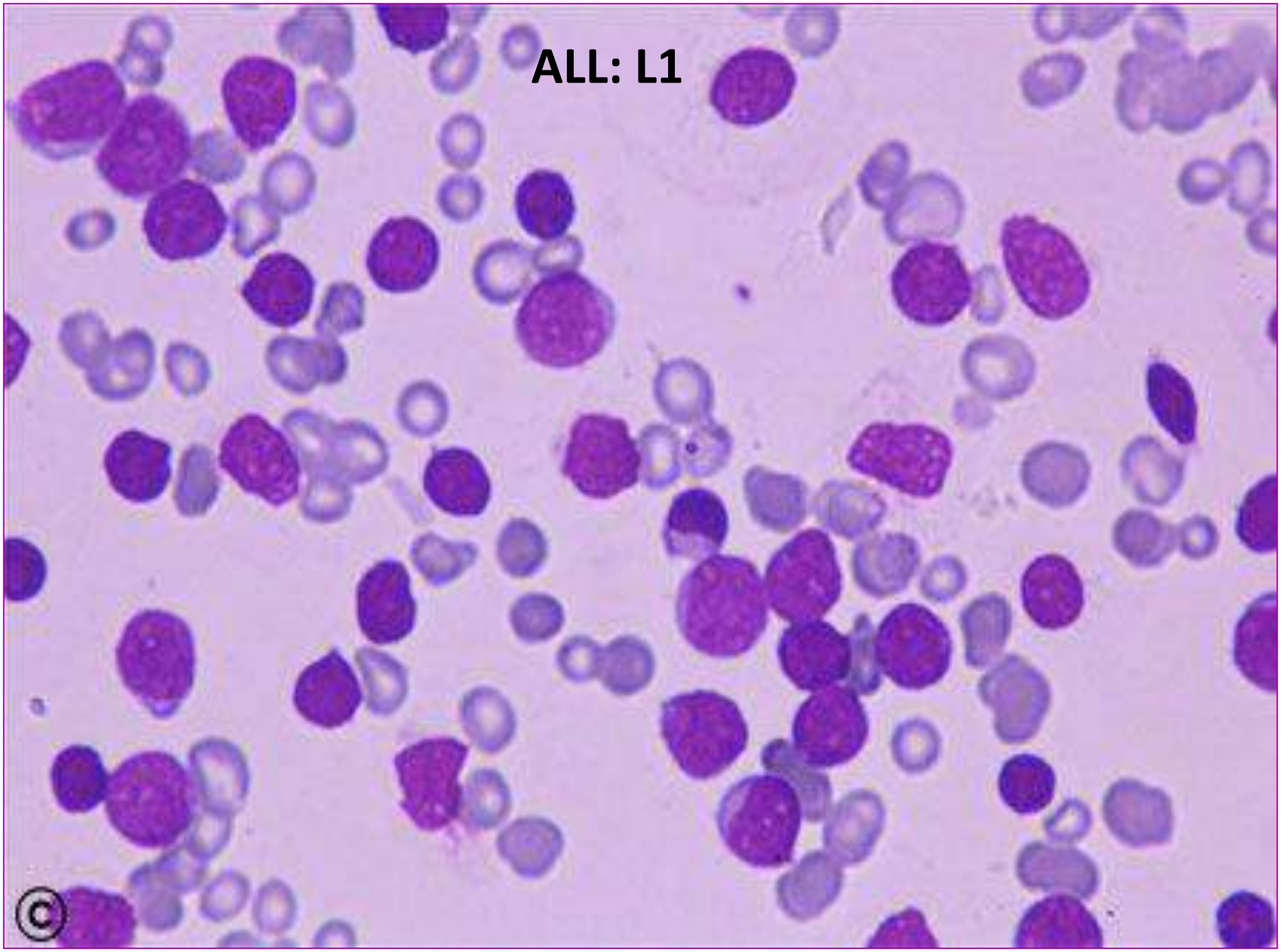
CYTOPLASMIC BASOPHILIA

CYTOPLASMIC VACUOLATION

HETEROGENECITY

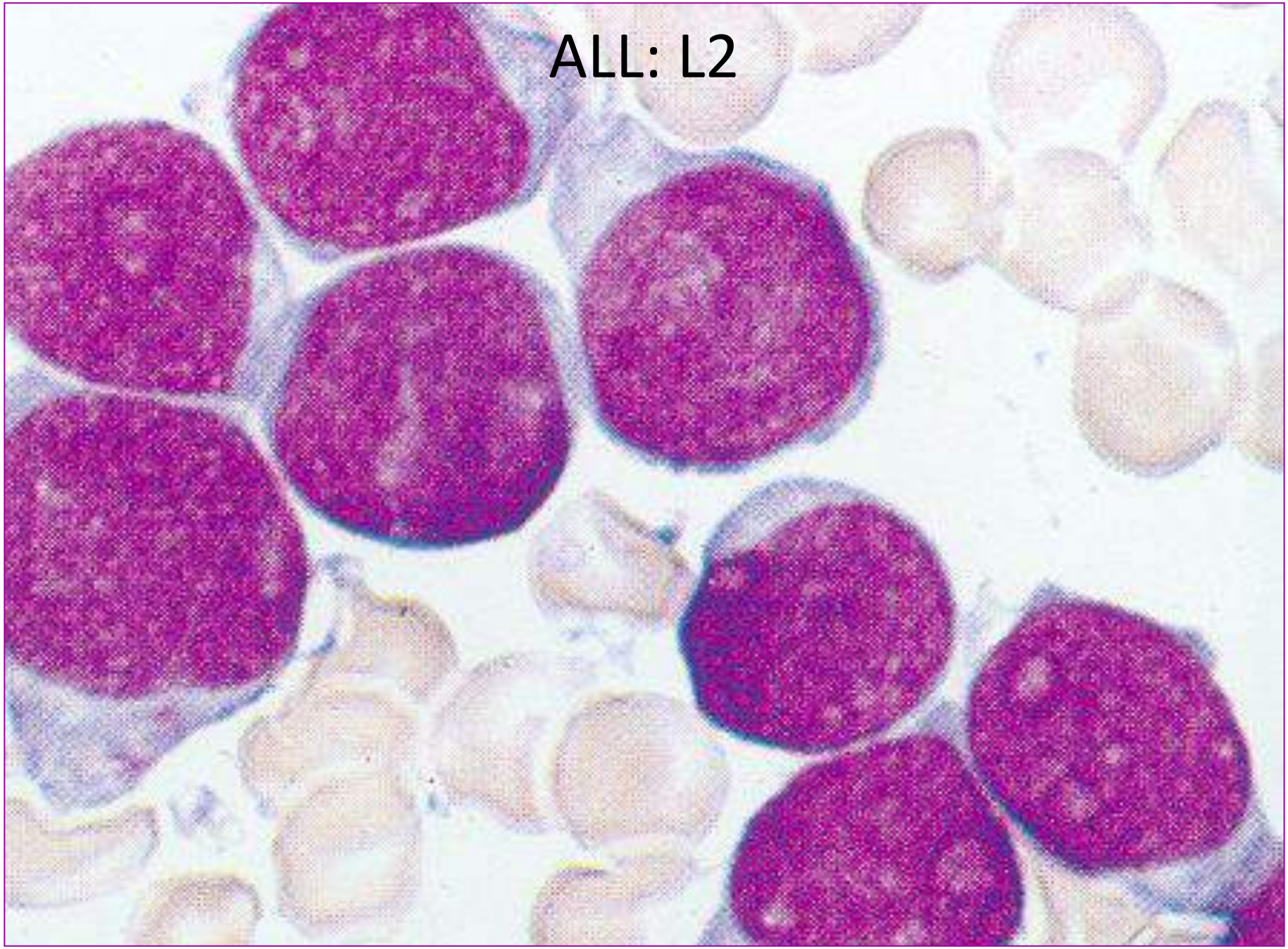
ALL : L1

- **CELL SIZE : SMALL CELLS PREDOMINATE**
- **NUCLEAR CHROMATIN : HOMOGENEOUS IN ANY ONE**
- **NUCLEAR SHAPE : REGULAR, OCCASIONAL CLEFTING or INDENTATION**
- **NUCLEOLI : SMALL or INCONSPICUOUS**
- **AMOUNT OF CYTOPLASM : SCANTY**
- **CYTOPLASMIC BASOPHILIA : SLIGHT or MODERATE**
- **CYTOPLASMIC VACUOLATION : VARIABLE**


ALL: L1
©

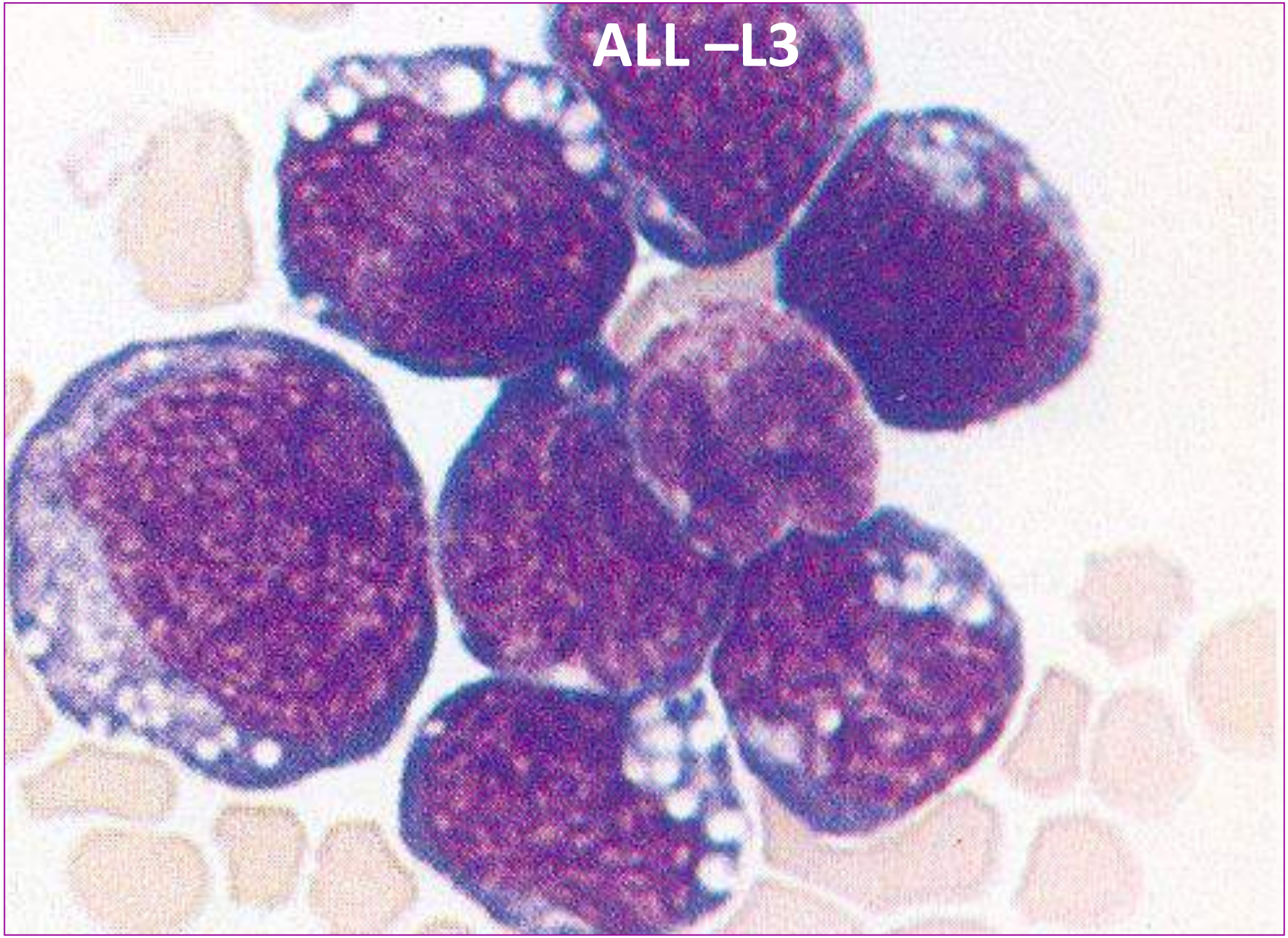
ALL : L2

- **CELL SIZE : LARGE, HETEROGENEOUS**
- **NUCLEAR CHROMATIN : HETEROGENEOUS IN ANY ONE**
- **NUCLEAR SHAPE : IRREGULAR, CLEFTING and INDENTATION COMMON**
- **NUCLEOLI : ONE or MORE PROMINENT**
- **AMOUNT OF CYTOPLASM : MODERATE**
- **CYTOPLASMIC BASOPHILIA : VARIABLE**
- **CYTOPLASMIC VACUOLATION : VARIABLE**


ALL: L2

ALL : L3

- **CELL SIZE : LARGE and HOMOGENEOUS**
- **NUCLEAR CHROMATIN : FINELY STIPPLED and HOMOGENEOUS**
- **NUCLEAR SHAPE : REGULAR, OVAL to ROUND**
- **NUCLEOLI : PROMINENT ONE or MORE**
- **AMOUNT OF CYTOPLASM : MODERATLY ABUNDANT**
- **CYTOPLASMIC BASOPHILIA : VERY DEEP**
- **CYTOPLASMIC VACUOLATION : PROMINENT**


ALL –L3

LABORATORY FINDINGS : ALL

- **PERIPHERAL BLOOD**
  - **LEUKOCYTE COUNT** ↑ / N / ↓
  - **NEUTROPENIA**
  - **LYMPHOBLASTS**
  - **NORMOCYTIC, NORMOCHROMIC ANEMIA**
  - **THROMBOCYTOPENIA**
- **BONE MARROW**
  - **HYPERCELLULAR**
  - **> 30% BLASTS**

CYTOCHEMISTRY IN ACUTE LEUKEMIA

STAINS	AML	ALL
MYELOPERAXIDASE	+	--
SUDAN BLACK	+	--
PAS	+ (fine)	+ (course)
NON-SPECIFIC ESTERASE	+ (M4 , M5)	--
ACID PHOSPHATASE	--	-- (+ve T-ALL)
TdT	--	+

Immunophenotyping

Precursor-B ALL	CD19, CD10, CD79a, TdT, cCD22*, HLA-DR, cCD79a*
Precursor-T ALL	CD1, CD2, CD3, CD4, CD5, CD7 CD8, TdT, cCD3*
AML	*
	* *

CYTOGENETICS

Immunophenotype	*Chromosomal Abnormality*
B-Lineage ALL	t(4;11)(q21;q23) t(5;14)(q31;q32)
Pre-B cell ALL	t(1;19)(q23;p13)
B cell ALL	t(8;14)(q24;q32) t(2;8)(p11;q24) t(8;22)(q24;q11)
T cell ALL	t(11;14)(p13;q11) t(1;14)(p34;q11) t(8;14)(q24;q11) t(10;14)(q24;q11) t(1;14)(p32;q11) t(14;14)(q11;q32) t(7;9)(q35–36;q34) t(7;14)(q35–36;q11) t(7;7)(p15;q11) t(7;14)(p15;q11) inv(14)(q11;q32) inv(14)(q11;q32)
Variable	t(9;22)(q34;q11) del 9(p21–22)

The **WHO** classification of acute lymphoblastic leukaemia, 2008

1. **B lymphoblastic leukaemia/lymphoma**
2. **B lymphoblastic leukaemia/lymphoma, not otherwise specified**

B lymphoblastic leukaemia/lymphoma with recurrent genetic abnormalities++

- With t(9;22)(q34;q11.2) and *BCR – ABL1*
- With t(4;11)(q21;q23) and *MLL – MLLT2 or other 11q23 and*
- *MLL rearrangement*
- W ith t(12;21)(p13;q22) and *ETV6 – RUNX1 **
- With hyperdiploidy (> 50 chromosomes)
- With hypodiploidy (< 46 chromosomes)
- With t(5;14)(q31;q32) and *IL3 – IGH*
- With t(1;19)(q23;p13.3) and *TCF3 – PBX1*

3. **T lymphoblastic leukaemia/lymphoma**

PROGNOSTIC FACTORS

Favorable factors :	*Unfavorable factors :*
★ *1. L 1 subtype of ALL*	*1. L 2 , L3 subtype of ALL*
★ *2. B Precursor ALL*	*2. Mature B & T cell phenotype*
★ *3. Leucocyte count < 10,000/ μl*	*3. Leucocyte count >50,000/ μl*
4. Age between 1 – 10years	*4. Age < 1 year*
5. Female child	*5. Male child*
★ *6. Absent or minimal extramedullary involvement*	*6. Extensive extramedullay involvement*
★ *7. Chromosomal translocations other than t(4;11)*	*7. Chromosomal translocation* ★ *t(4;11), t(9;22)*
★ *8. Hyperdiploid cases - t(12;21)*	

ALL Phenotype	Chromosome Aberration	Known Gene Loci	Prognosis
Early B cell CALLA +	★Hyperdiploid >50		good
	Hyperdiploid 47–50		intermediate
	Hypodiploid		poor
	del(6q)		intermediate
	del/t 9p	IFNA/IFNB	intermediate
	del/t 12p		intermediate
	★t(9;22)(q34;q11)	ABL/BCR	poor
eosinophilia	t(5;14)(q31;q32)	IL3/IGH	intermediate
CIg +	t(1;19)(q23;p13)	PBL1/E2A	poor
Biphenotypic & CALLA-	★t(4;11)(q21;q23)		poor
B cell SIg +	★t(8;14)(q24;q32)	MYC/IGH	poor
	t(2;8)(p12;q24)	IGK/MYC	poor
	t(8;22)(q24;q11)	MYC/IGL	poor
T cell	t(11;14)(p13;q11)	TCL2/TCRα-δ	poor
	t(8;14)(q24;q11)	C-MYC/TCRα	poor
	inv(14)(q11q32)	TCRα/IGH/TCL1	poor
	t(v;14)(v;q11)	TCRα	poor
	t(7;v)(q34–36;v)	TCRβ	poor
	t(7;v)(p15;v)	TCRγ	poor

CHRONIC LYMPHOCYTIC LEUKEMIA

CLASSIFICATION : CHRONIC LYMPHOID LEUKEMIAS

- **B-CELL**

  CHRONIC LYMPHOCYTIC LEUKEMIA → **Peripheral B cell neoplasm**

  PROLYMPHOCYTIC LEUKEMIA

  HAIRY CELL LEUKEMIA

  PLASMA CELL LEUKEMIA

  LEUKEMIA – LYMPHOMA SYNDROMES

- **T-CELL**

  LARGE GRANULAR LYMPHOCYTIC LEUKEMIA

  T-PROLYMPHOCYTIC LEUKEMIA

  ADULT T-CELL LEUKEMIA-LYMPHOMA

  SEZARY SYNDROME

CLINICAL FEATURES

- **LYMPHADENOPATHY**
- **ANEMIA**
- **INFECTIONS**
- **HEMORRHAGIC DIATHESIS**
- **AIHA**
- **SPLENOMEGALY**
- **SKIN INFILTRATION**

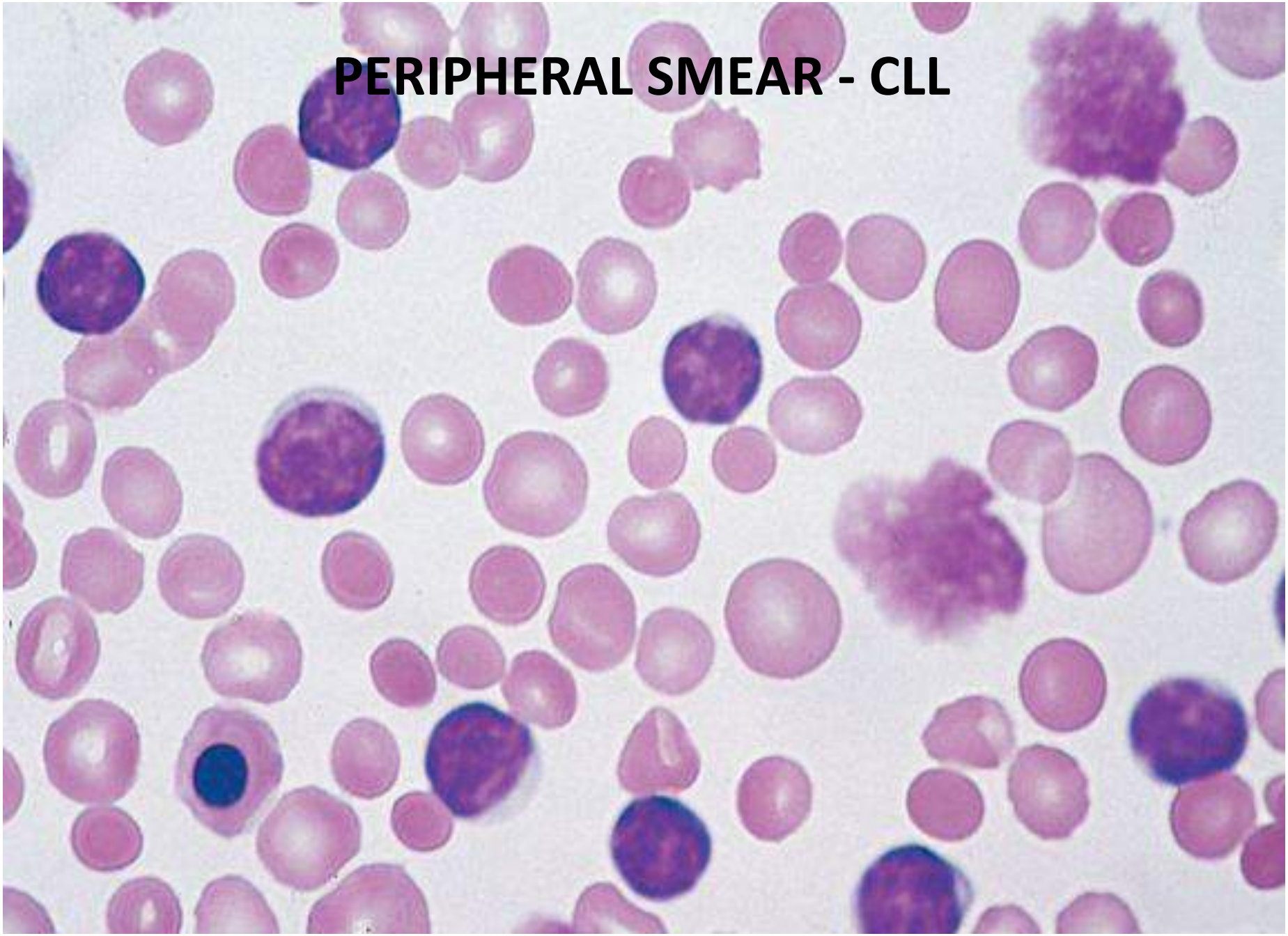
LAB DIAGNOSIS

- **PERIPHERAL SMEAR**
  - **NORMOCYTIC NORMOCHROMIC ANEMIA**
  - **LYMPHOCYTIC LEUKOCYTOSIS**
  - **PRESENCE OF SMUDGE CELLS**
  - **NEUTROPENIA**
  - **THROMBOCYTOPENIA**
  - **AHA BLOOD PICTURE**
- **BONE MARROW**

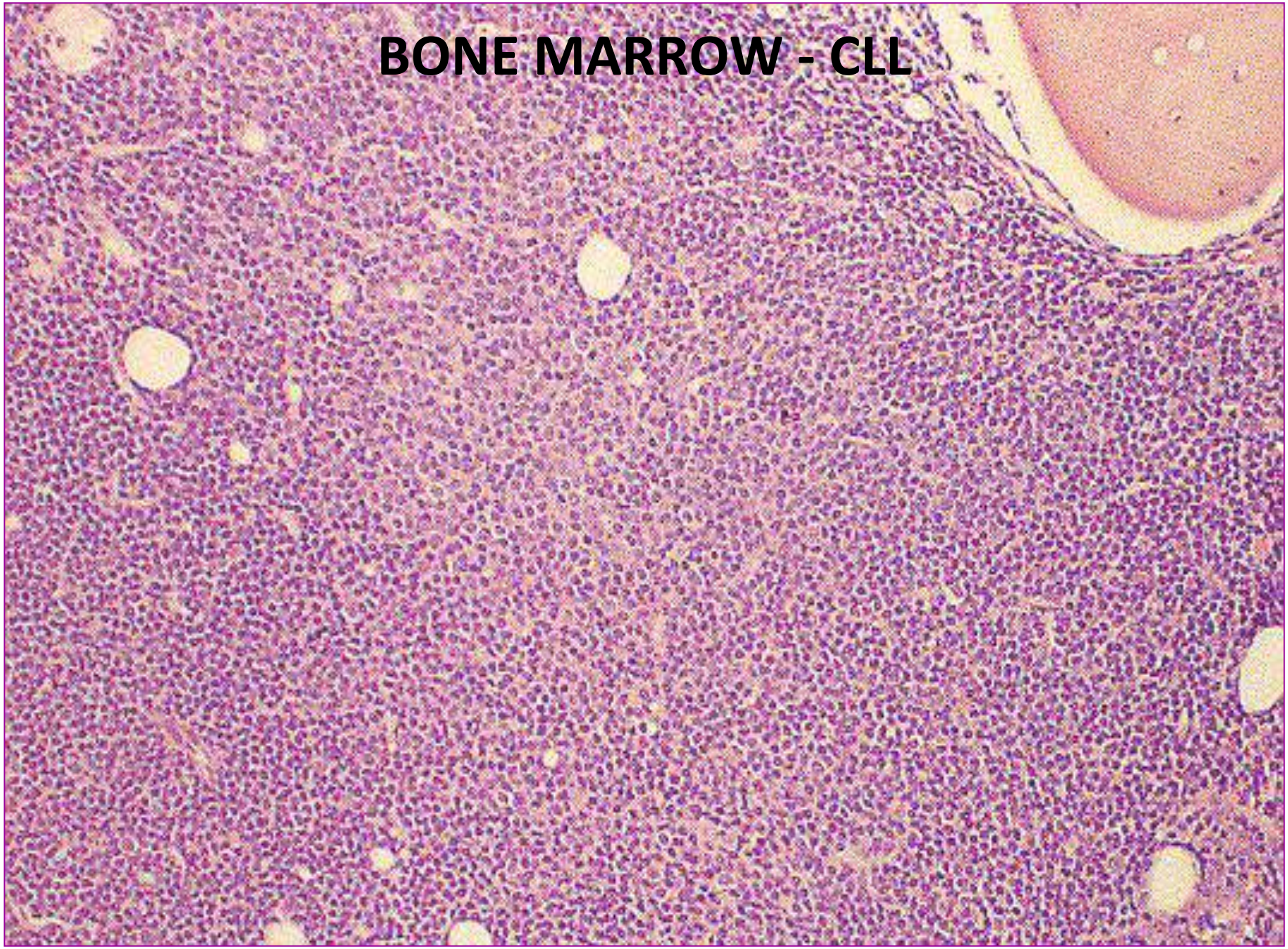
CLL - Diagnostic Criteria

- Persistent lymphocytosis.
- Absolute lymphocyte count more than 5000.
- Mature appearing B-cells with <10% of prolymphocytes
- 30% lymphoid cells in bonemarrow
- Low density of surface Ig
- CD 19,20, 23*
- CD 5
- Lack of pan B cell markers other than CD5

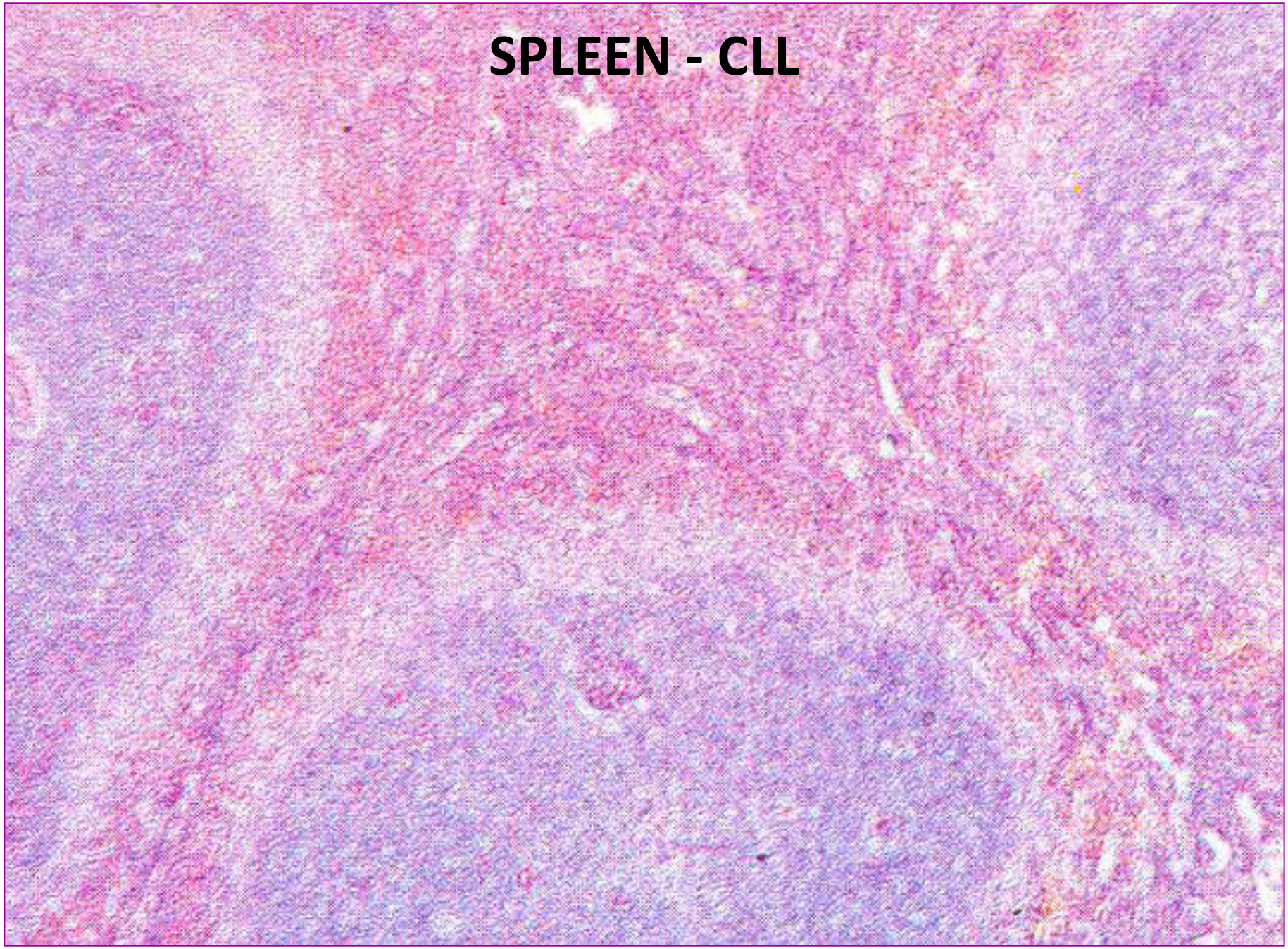
PERIPHERAL SMEAR - CLL



BONE MARROW - CLL



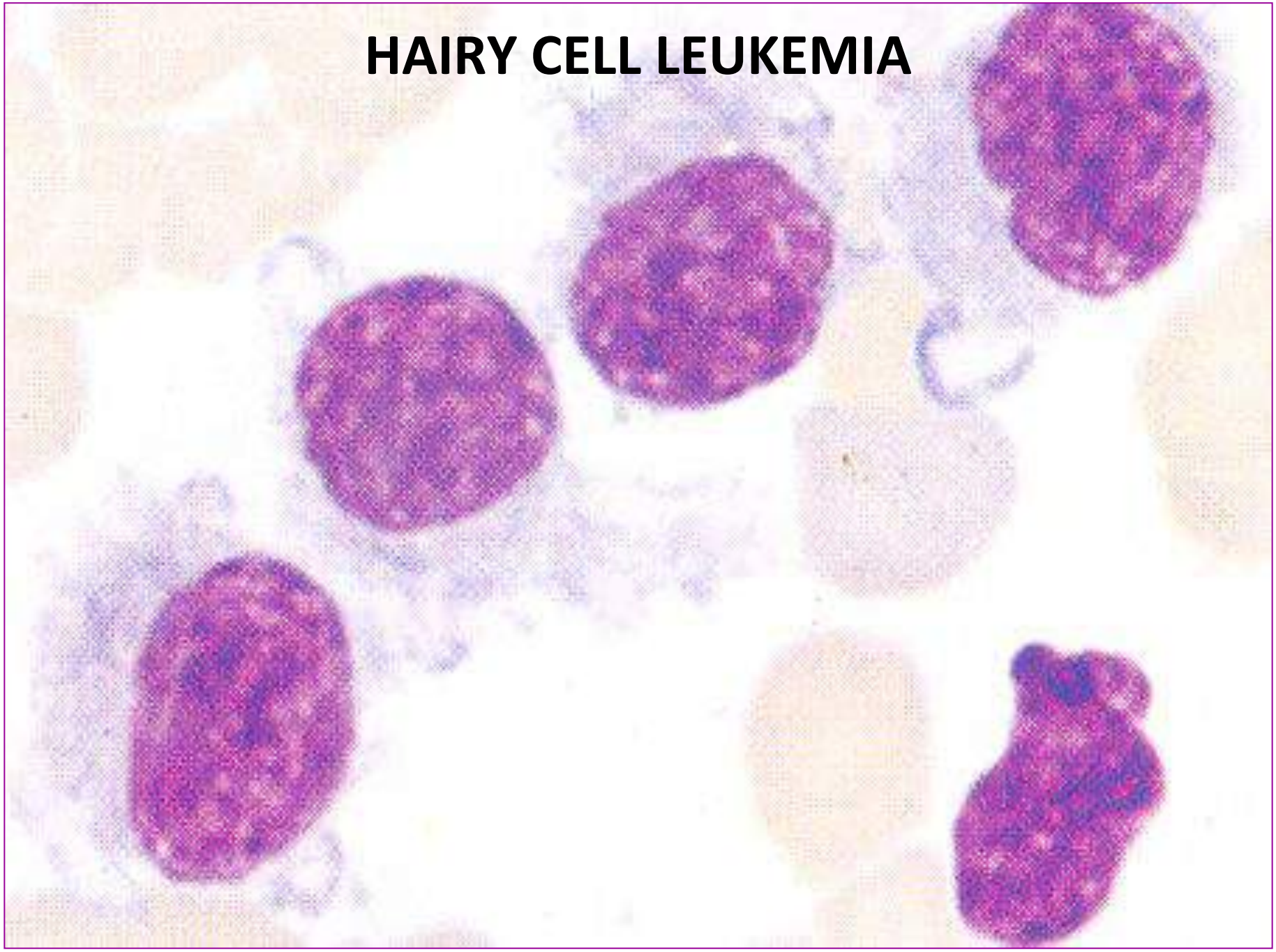
SPLEEN - CLL



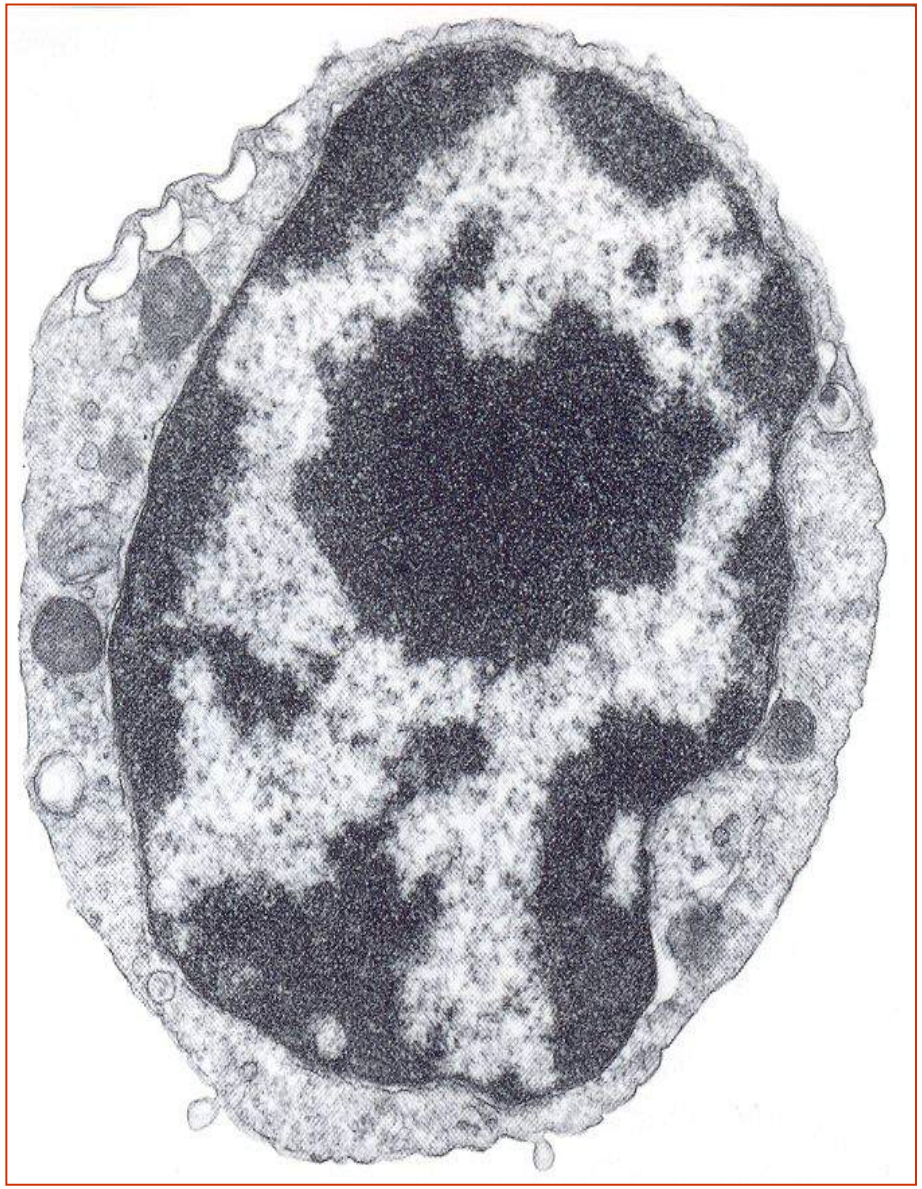
DIFFERENTIAL DIAGNOSIS

- **INFECTIOUS MONONUCLEOSIS**
- **WHOOPING COUGH**

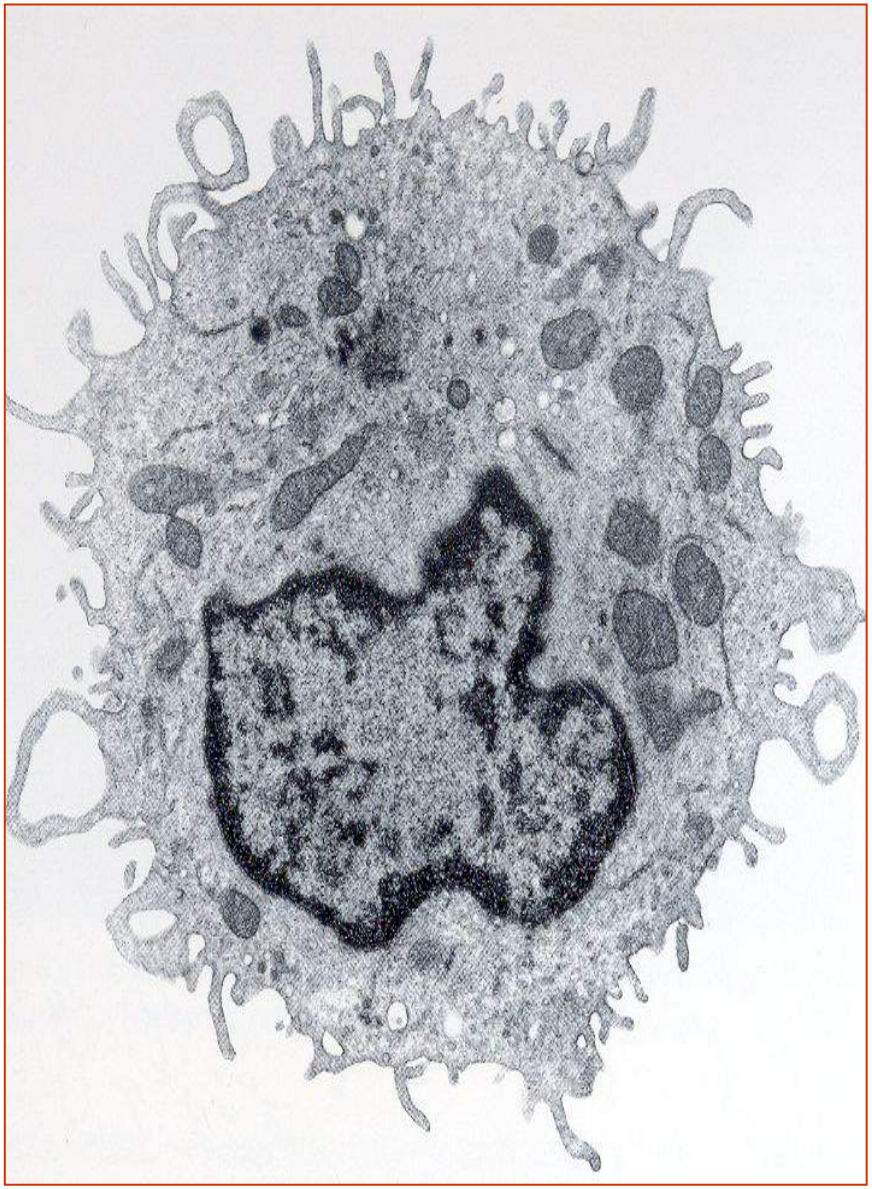
HAIRY CELL LEUKEMIA



CLL : CELL



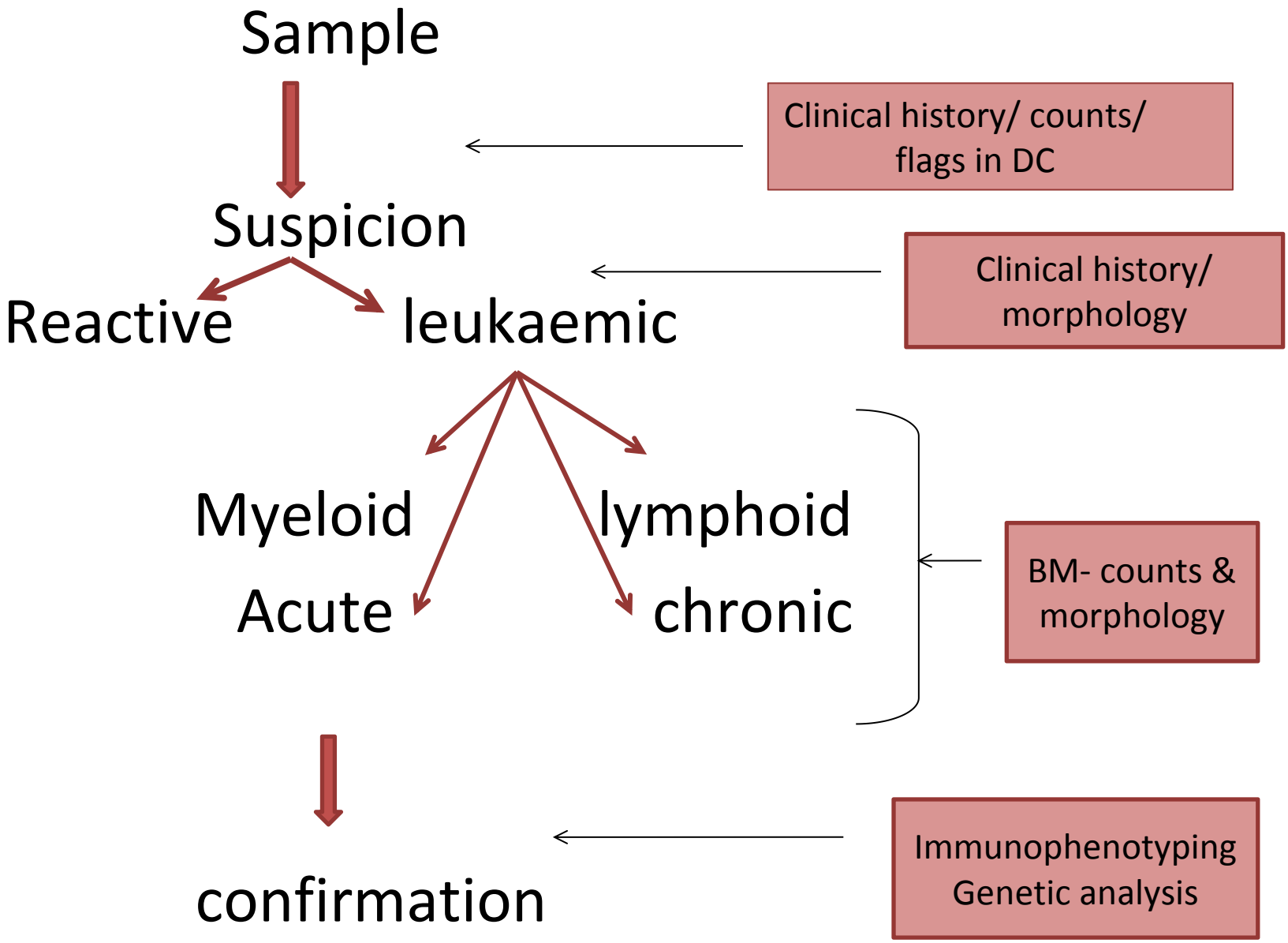
HCL : CELL



Cytogenetics

- Deletions in chromosome 13 at q 14
- Chromosome 11 at q22 or q23.
- Trisomy-12.
- Less common are deletions in chromosome 17 & 6.

TO SUMMARISE …


Sample
Clinical history/ counts/ flags in DC
Suspicion
Clinical history/ morphology
Reactive
leukaemic
Myeloid
lymphoid
Acute
chronic
BM- counts & morphology
confirmation
Immunophenotyping
Genetic analysis

Conclusion

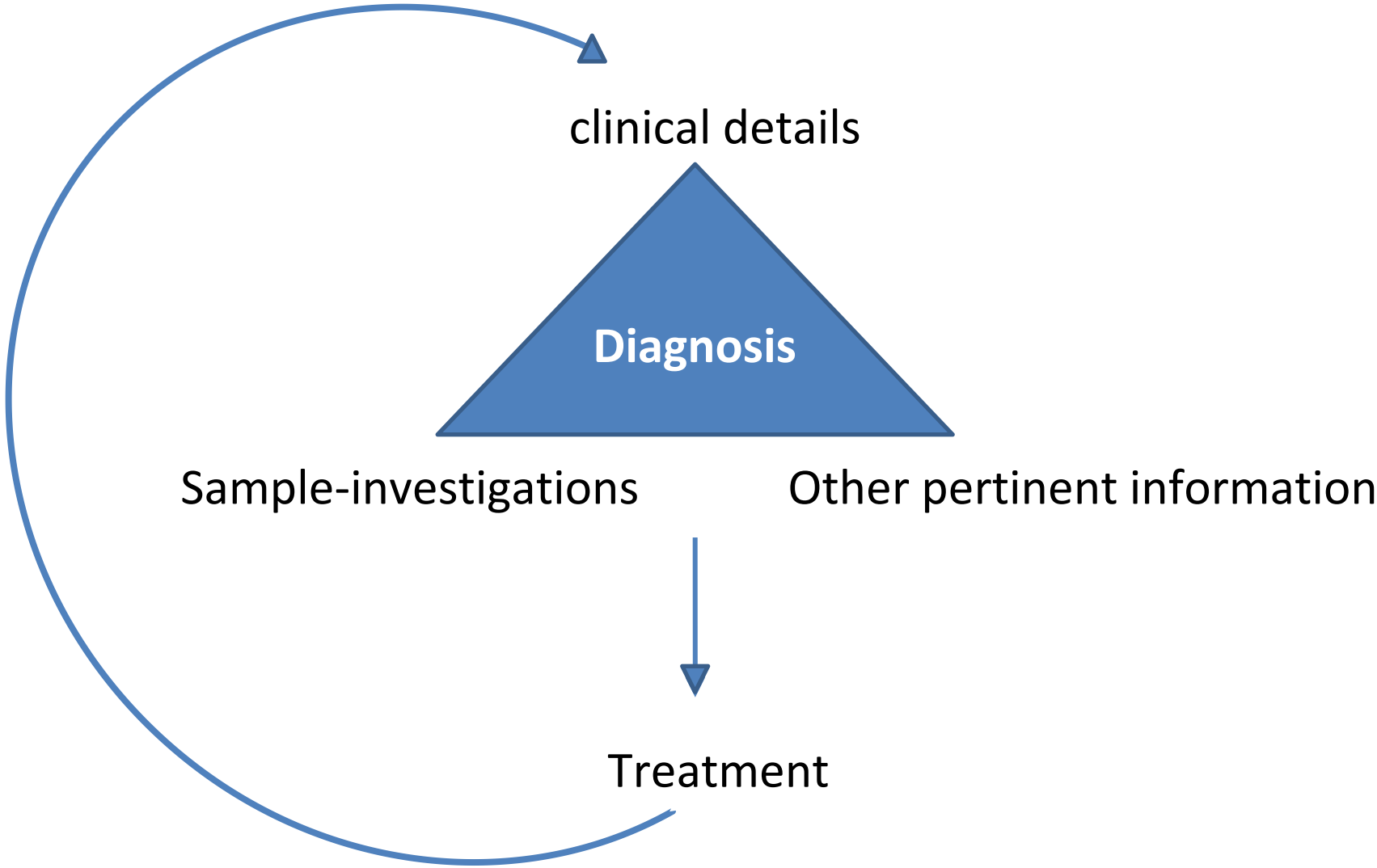
Three important factors contribute to accurate diagnosis:

1. The provision of clinical information;

2. The correct sample- type and time

3 .The integration of information across different sites dealing with diagnostic samples from a single patient.

Conclusion


clinical details
Diagnosis
Sample-investigations
Other pertinent information
Treatment

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Thank yo