Pathology

World of Revision

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- The notes contain blank spaces primarily for labelling diagrams, completing cycles and more to promote active engagement and reinforce learning.
- Red icons, wherever present, serve as cues to faculty-emphasised sections, intended to guide focused learning.
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HAEMATOLOGY : WBC DISORDERS AND LEUKEMIAS

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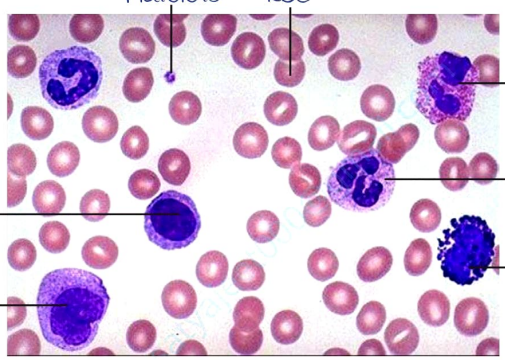
White Blood Cells

00:01:36

- TLC : 4000 – 11,000/mm³.
- Infection : > 11,000/mm³.

Peripheral Smear :



Eosinophil :
Bilobed nucleus, brick red granules

Neutrophil :
3 – 5 lobes in nucleus, bluish granules

Basophil :
Bluish granules obscuring cytoplasm

Lymphocyte (Smallest) :
No granules

Monocyte (Largest) :
Reniform/kidney-shaped nucleus

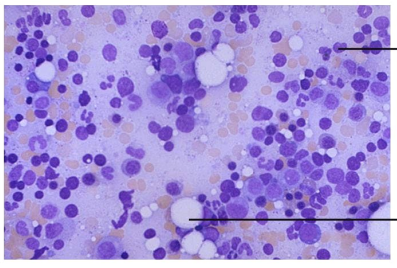
: Agranulocytes.

: Granulocytes → Granules ⊕ in cytoplasm.

Stain :

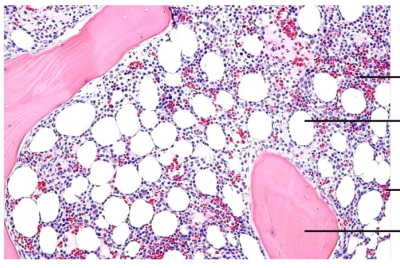
Romanowsky stain : Leishman, Giemsa.

Bone Marrow Aspirate (BMA) :



Normal myeloid : erythroid ratio = 3 : 1 – 15 : 1

Bone Marrow Biopsy :



% Cellularity : 100 – Age

BMA dry tap : Dry needle on attempted BMA → Requires BM biopsy.

Causes :

- Aplastic anemia : Fat >> Cells.
- Myelofibrosis :
  - Hairy cell leukemia.
  - AML-M_7.
- Myelophthisic anemia : Space occupying lesion.

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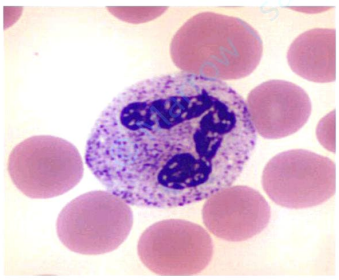
WBC Disorders

00:10:10

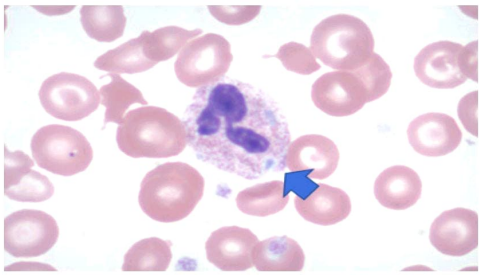
Non-Neoplastic Disorders :

Disorder	Causes
Neutrophilia (> 70%)	• Acute infection • Tissue necrosis : Burns, MI • Bacterial infections
Lymphocytosis (> 40%)	• Chronic infection • Viral infection
Eosinophilia (> 6%)	• Allergic reactions : Asthma, hay fever • Malignancy : Hodgkin's lymphoma • Parasitic infections (Helminthic)
Basophilia (> 1%)	• myeloproliferative disorders : CML
Monocytosis (> 1 – 8%)	• Chronic infections : TB • Rickettsia • IBD • Malaria

Abnormalities d/t infection :



Toxic granules :
Bluish, prominent

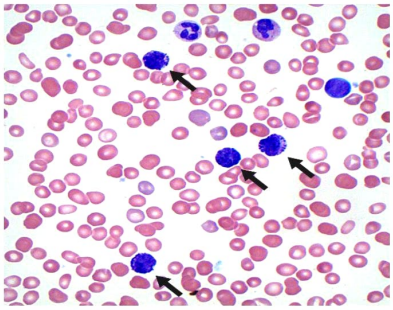


Dohle bodies :
Patches of dilated endoplasmic reticulum

Note :

Giant granules : Chediak Higashi syndrome (LYST gene mutation).

CML :



- massive splenomegaly
- ↓NAP score
- Basophilia

Neoplastic Disorders :

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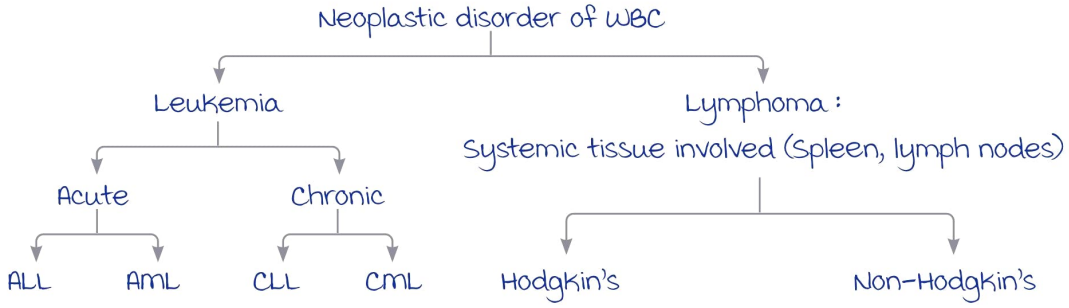


Acute Leukemias

00:18:08

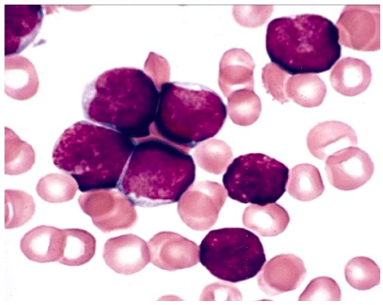
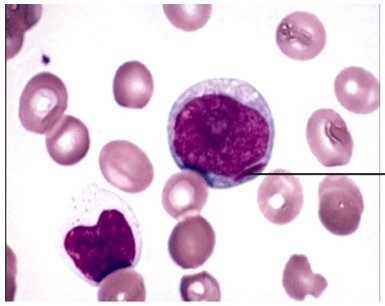
Diagnostic criteria :

WHO : Based on markers

- > 20% blasts (Immature precursors) in BM/PS OR
- < 20% blasts + t (15 ; 17)/t (8 ; 21)/inversion-16.

FAB : > 30% blasts in BM/PS → Based on morphology.

Types of blasts :

	Lymphoblast	myeloblast
Size	Small	Large
Cytoplasm	Scanty	Moderate amount
Granules	Absent	Present
Auer rods	Absent	Present (Clusters → Faggot cells)
Chromatin	Coarse, clumped	Homogenous, opened up, pink
Nucleoli	Inconspicuous	2 - 5, prominent
Special stain	PAS	myeloperoxidase (MPO), sudan black B (SBB), non-specific esterase (NSE)
Appearance		

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ALL

00:24:50

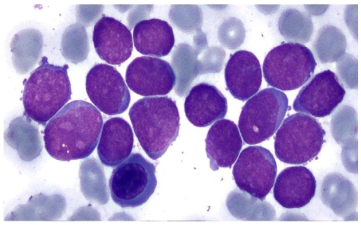
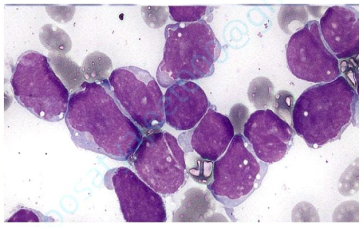
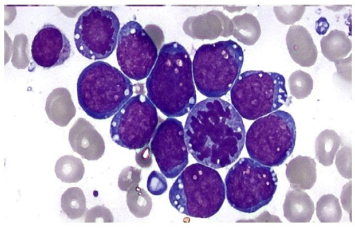
Age at presentation : 2 – 9 yrs (m/c leukemia in children).

Clinical features :

- D/t ↑blasts → ↓mature cells → ↓RBC → Pallor, fatigue.
  - ↓WBC → ↑Infections.
  - ↓Platelets → Bleeding manifestation.
  - Hepatosplenomegaly
- Involvement of CNS, testes & LN (Absent in AML).

Classification :

FAB classification (morphological) :

	L_1	L_2	L_3
			
Cell	Small	Larger (~ myeloblast)	• Vacuolated • Burkitt's lymphoma like • Oil red O : +ve
Cytoplasm	Scanty, no granules	more	
Chromatin	Coarse	Homogenous/Opened up	
Nucleoli	⊖	⊕	
Occurrence	m/c	-	L/c
Prognosis	Best prognosis	-	Worst prognosis

WHO classification (Based on flowcytometric markers) :

	B-ALL	T-ALL
Occurrence	m/c	L/c
Age group affected	Usually children	Usually adults & adolescent
Mediastinal involvement	Absent	Present
Associated mutation	LOF in PAX-5, E2A, RUN-X1, EBF gene or t (12 ; 21)	GOF in NOTCH-1 gene
Prognosis	Better	Poor

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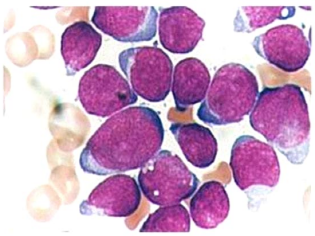
Investigations :

CBC : Pancytopenia.

PS :

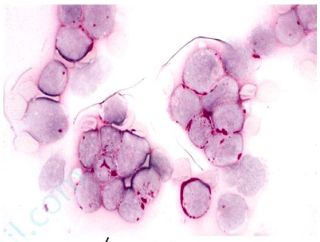
- > 20% lymphoblasts.
- Special stain : PAS +ve (Dot/Block)



Hand mirror cells

Markers :

- B-ALL : CD 19, CD 20, CD 22, PAX-5, TdT.
- T-ALL : CD 3, CD 1, CD 2, CD 5, CD 7.



Dot/block PAS +ve

Treatment :

- Stem cell transplant.
- VAPD regimen :
  - Vincristine.
  - Prednisolone.
  - L-asparaginase.
  - Daunorubicin.

Prognostic Factors :

		Good prognosis	Bad prognosis
Age		2 – 9	< 1, > 10
Sex		F	m
Race		Whites	Blacks
FAB type		L_1	L_2, L_3
WHO type		B-ALL	T-ALL
Organ involvement	CNS	⊖	⊕
	Testis	⊖	⊕
	Lymph node	⊖	⊕
Cytogenetics		• Hyperdiploidy • Trisomy 4, 7, 10 • t (12 ; 21)	• Hypodiploidy • t (9 ; 22)
Leucocyte count		< 1,00,000/mL	> 1,00,000/mL

Note :

- If t (9 ; 22) present in CML ⟶ Good prognosis.
- AML-M6 : Diffuse PAS +ve.

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AML

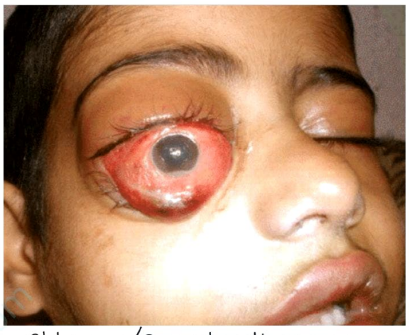
00:36:20

Age at presentation : 15 – 39 yrs (Same as CML).

Clinical features : Similar to ALL.

Additionally :

- Gum hypertrophy/bleeding.
- DIC (M_3).
- Chloroma : Soft tissue involvement.
  - AKA granulocytic sarcoma.
  - A/w AML-M_2.
  - m/c site : Orbit.
  - Arbitkov cells : Atypical cells.
  - Greenish d/t chlorophyll.



Chloroma/Granulocytic sarcoma

Classification :

FAB classification :

Class	Special features
M_2 : AML with maturation (m/c)	• t (8 ; 21) • Chloroma
M_3 : Acute promyelocytic leukemia	• Best prognosis • Max Auer rods → Faggot cells • t (15 ; 17) → PML – RARA • DIC • Rx : All trans retinoic acid, Arsenic trioxide
• M_4 • M_5 } Monoblastic	• Inversion 16 : M_4 • m/c a/w gum bleeding : M_4 > M_5 • Leukemia cutis • NSE +ve (D/t monoblasts) } Soft tissue involvement
M_6 – erythroblastic	• AKA Di Guglielmo disease • Diffusely PAS +ve
M_7 (L/c) – megakaryoblastic	• A/w Down's syndrome • myelofibrosis : BMA dry tap • markers : CD 41, CD 61