بسم الله الرحمن الرحیم

هماتومورفولوژی مقدماتی

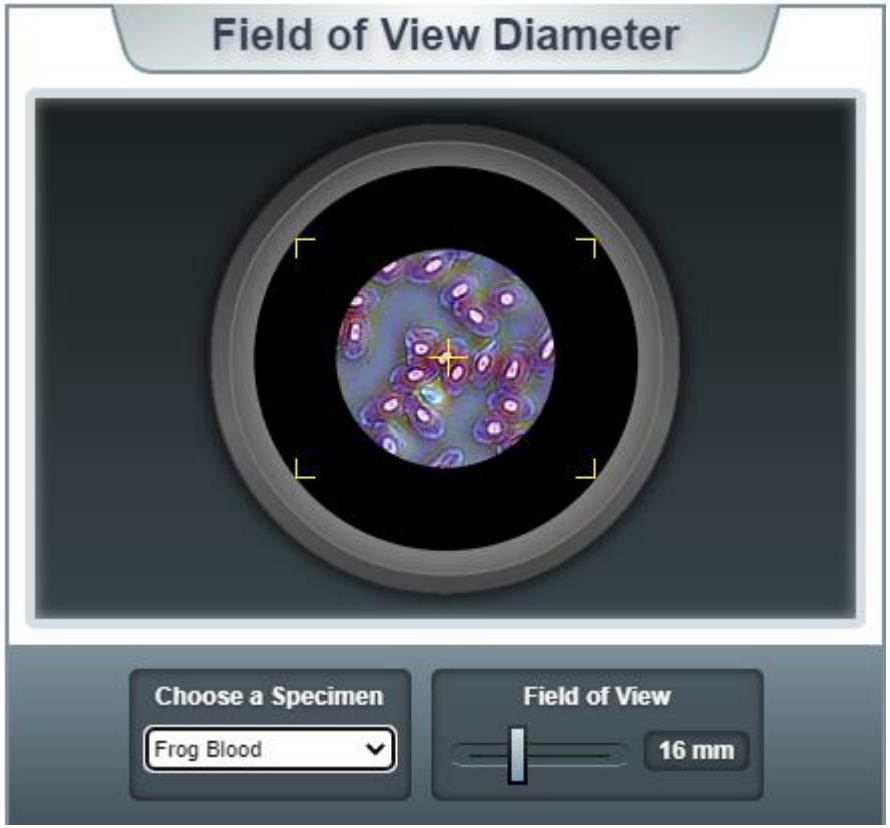
ناهنجاریهای خوش خیم گلبول های سفید و پلاکت

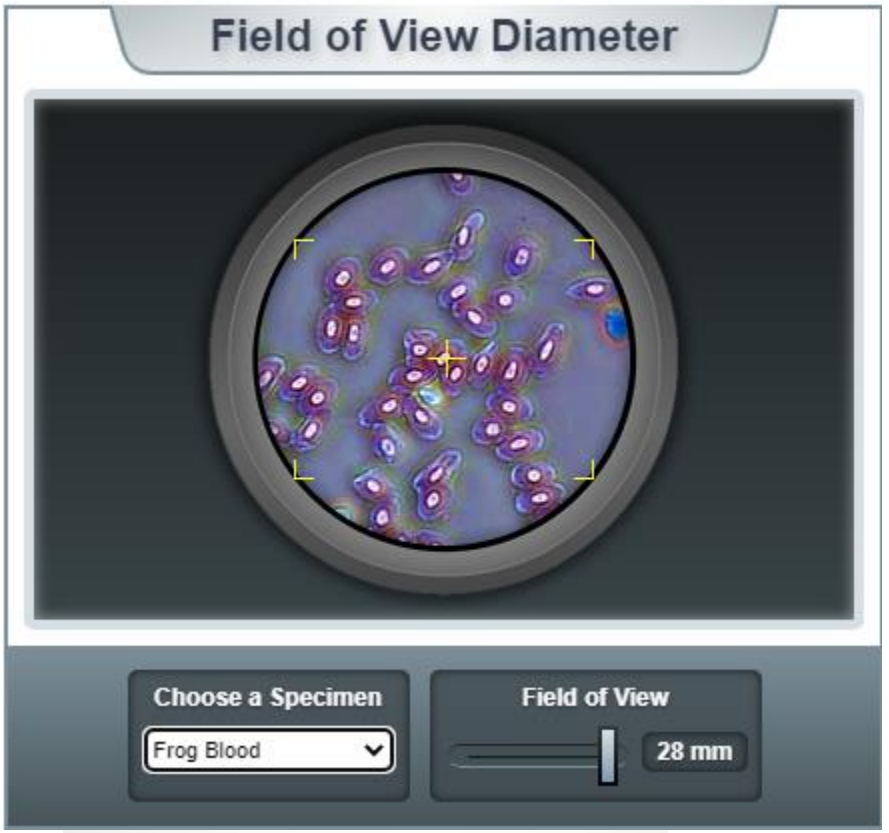
The grading of morphology elements should provide the **clinician**

with **useful information** regarding the status of

any abnormality

in the peripheral blood.


Field of View Diameter
Choose a Specimen
Frog Blood
Field of View
16 mm


Field of View Diameter
Choose a Specimen
Frog Blood
Field of View
28 mm


N-WF10X/20
magnification
field number


CFI 10X/22

Quantitative abnormalities

- In patients with normal cell populations in the absence of analyser flags or abnormal cell populations : It is recommended that the automated analyser WBC differential count be reported
- The automated differential may also be reported after viewing a blood film due to flags or other indicators where the automated values are found to be accurate.

Criteria for blood smear scan and/or blood smear examination at Thomas Jefferson University Hospital

		Adults	Infants
A. Based on CBC			
WBC ($\times 10^9$/L)	Initial*	< 2.0 or > 30.0	
		Or Delta failure of - 300% for WBC of 0.1 to 1.0	
		+ 300% for WBC of > 10	
PLT ($\times 10^9$/L)	Initial	< 100 or > 999 or > 30 with delta failure of -50% or greater	
B. Based on automated DIFF results			
Lymphocytes ($\times 10^9$/L)	Initial	> 7.0 (for > 14 yr old) > 10.0 (for1-14 yr old)	> 14.0 (for < 1 yr old)
Monocytes ($\times 10^9$/L)	Initial	> 3.0	
Eosinophils ($\times 10^9$/L)	Initial	> 2.0	
Basophils ($\times 10^9$/L)	Initial	> 0.5	
Qualitative Flags		WBC abnormal scattergram, Immature granulocytes, Left shift, Atypical lymphocytes, Blasts, NRBC	

*Initial: first smear on a new patient per admission or an infrequent outpatient visit.

Qualitative abnormalities

Each laboratory and laboratory system should have policies in place to ensure the consistent application of the grading criteria.

Table 1. Morphology Grading Table

	Grading System		
Cell Name	Few/1+	Mod/2+, %	Many/3+, %
WBC			
Döhle bodies	N/A	2–4	>4
Vacuolation (neutrophil)	N/A	4–8	>8
Hypogranulation (neutrophil)	N/A	4–8	>8
Hypergranulation (neutrophil)	N/A	4–8	>8
Platelets			
Giant Platelets	N/A	11–20	>20

Qualitative abnormalities

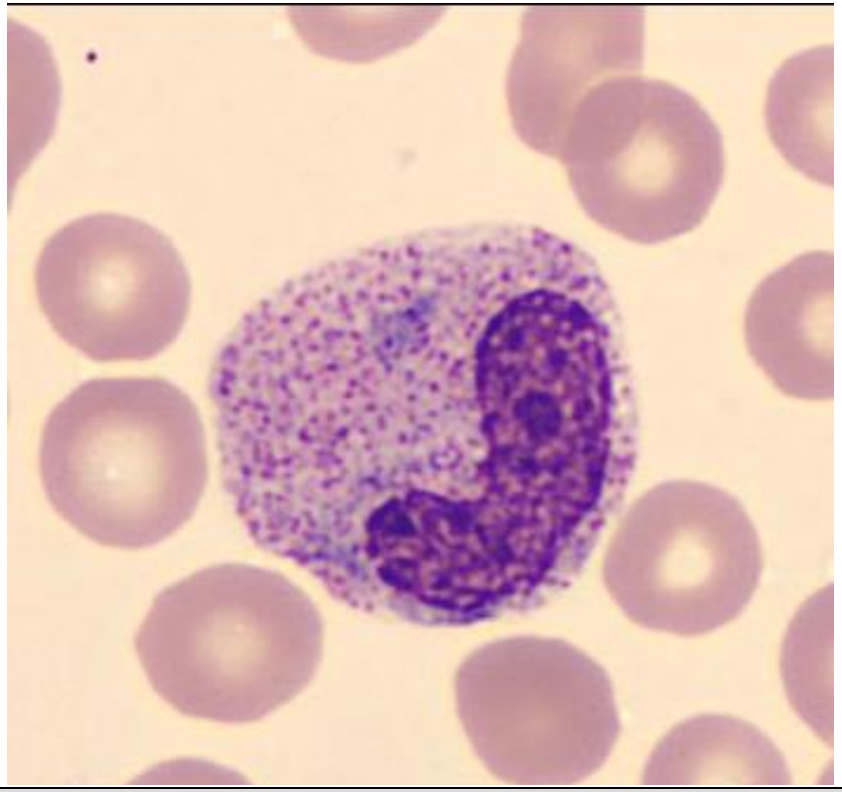
Cytoplasmic abnormalities

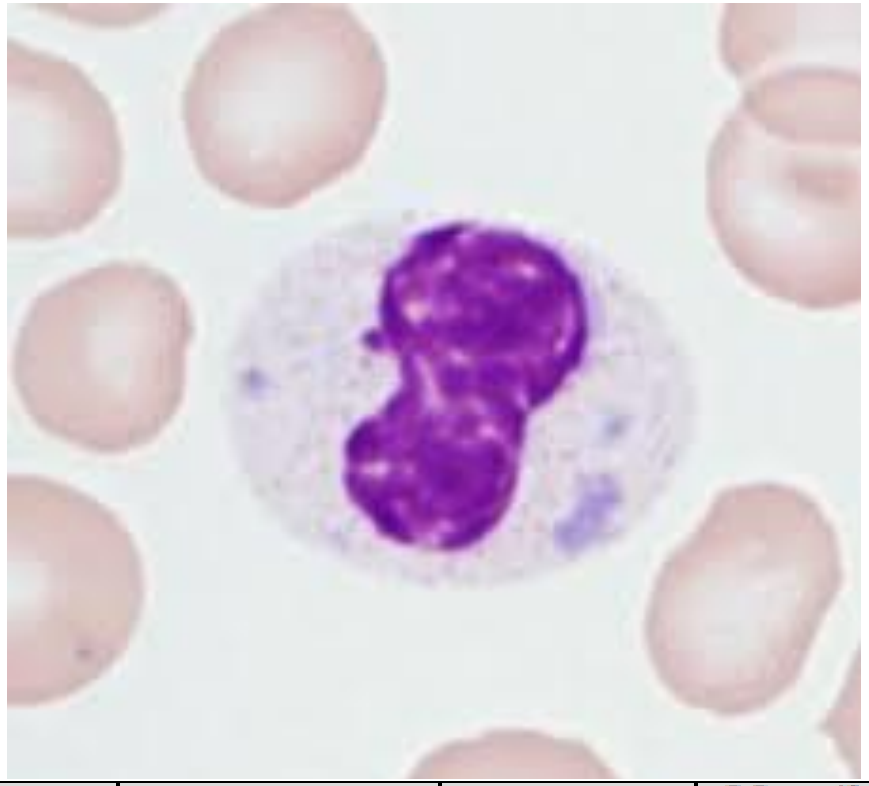
Dohle body:

- Pale light blue or grey
- Single or multiple
- Cytoplasmic inclusions found near the periphery of the neutrophil.
- Non-specific reactive change but may also indicate:
    - Infection: Toxic granulation, vacuolation, left shift
    - May-Hegglin anomaly: thrombocytopenia and giant platelets.
    - G-CSF administration
    - CML(infrequent)

Qualitative abnormalities

Cytoplasmic abnormalities CONT…





		Few/1+ %	Mod/2+ %	Many/3+ %
WBC	Dohle bodies			
	Vacuolation (neutrophil)			
	Hypogranulation(neutrophil)			
	Hypergranulation(neutrophil)			
	Hypersegmented(neutrophil)			
Platelets	Giant Platelets			

Qualitative abnormalities

Cytoplasmic abnormalities

Vacuolation – neutrophil:

I. Infection : 'pin-hole' vacuolation – small, discrete vacuoles, but the vacuoles may be larger

II. Alcohol toxicity

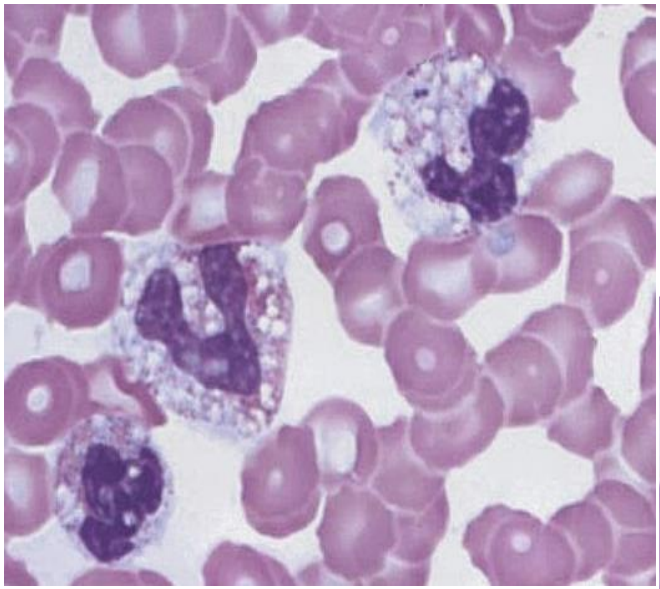
III. Storage Artefact : prolonged exposure to EDTA anticoagulant

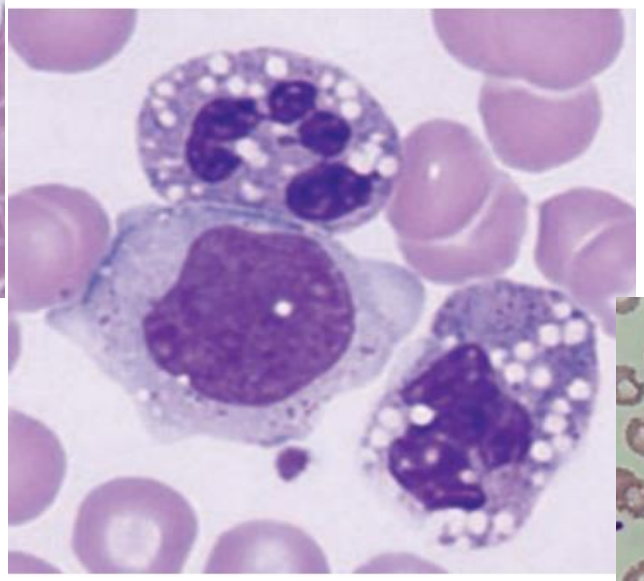
IV. liver failure

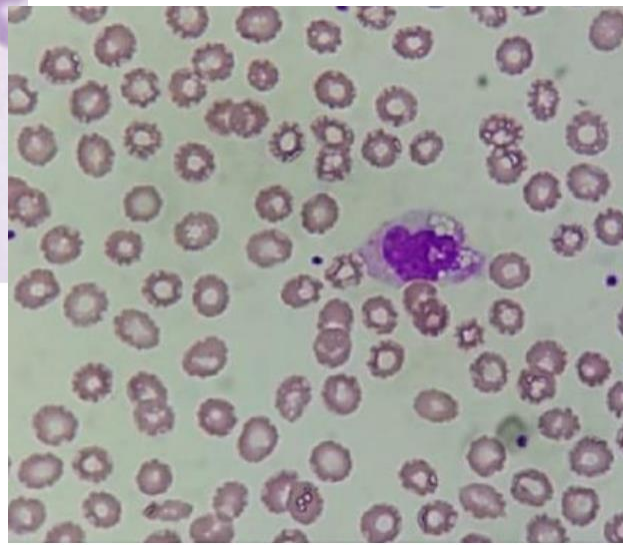
V. G-CSF

Qualitative abnormalities

Cytoplasmic abnormalities CONT…





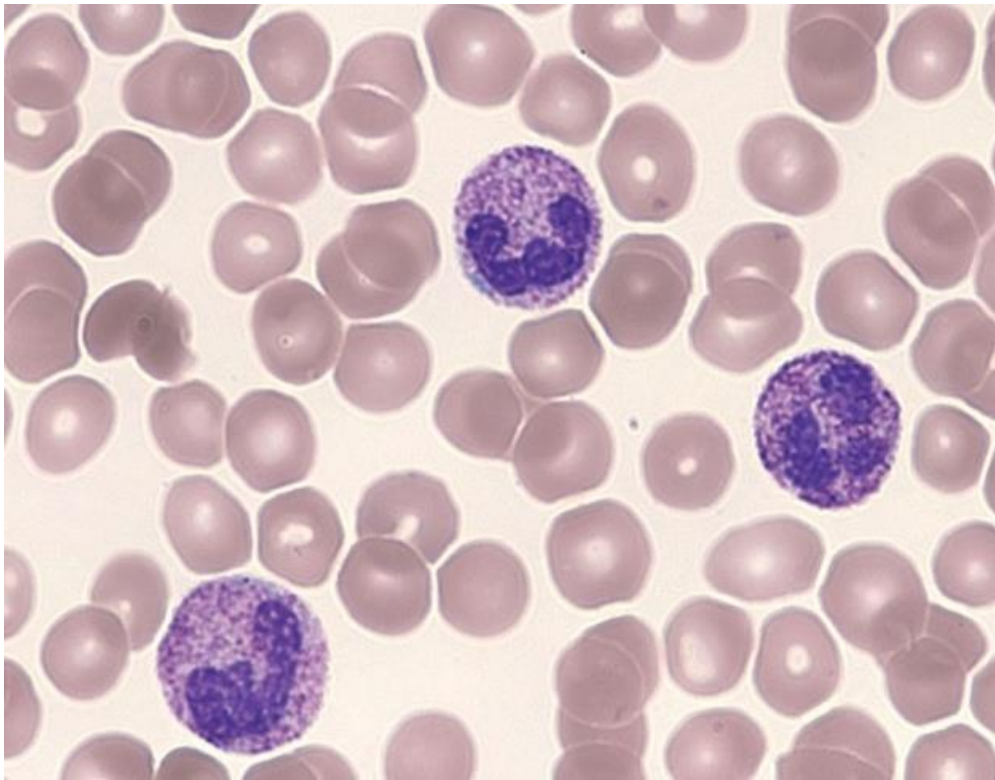


Qualitative abnormalities

Cytoplasmic abnormalities

Hypergranulation – neutrophil, (toxic granulation):

- Coarse, purple staining primary (azurophilic) neutrophil cytoplasmic granules
- Response to infection and inflammation.
- G-CSF
- Chemotherapy

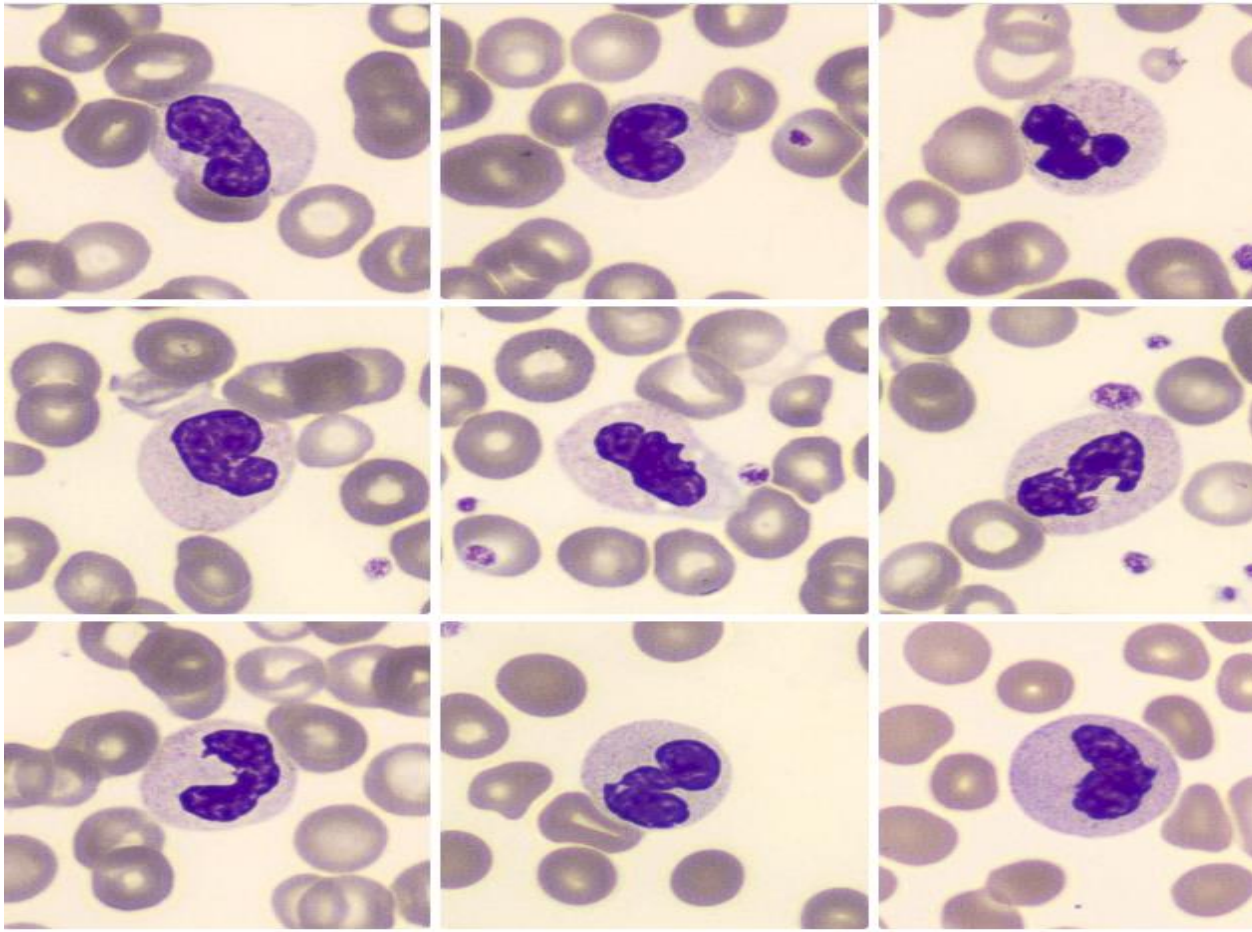


Qualitative abnormalities

Cytoplasmic abnormalities

Hypogranulation – neutrophil:

- Reduced presence of the normal granulation.
- All types of granulocytes➔ Dysgranulopoiesis and MDS

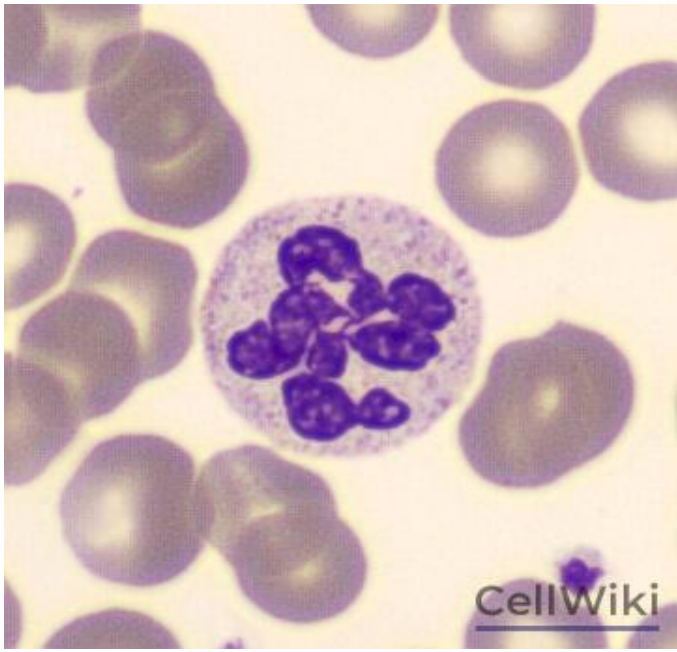


Qualitative abnormalities

Nuclear abnormalities

Hypersegmented neutrophils

- Any neutrophil having 6 more lobes
- 100 neutrophils are examined➔More than 3% of neutrophils having 5 lobes.



Associated with:

- Vitamin B12 / folate deficiency anemia
- MDS and MPD
- Cytotoxic chemotherapy
- long-term chronic infections.
- Hereditary hypersegmentation
- G-CSF administration
- Secondary to nitrous oxide anaesthesia
- Steroid therapy for immune thrombocytopenic purpura (ITP)

Qualitative abnormalities

Nuclear abnormalities

Pelger-Huet neutrophils

- Failure of normal nuclear lobe development during terminal differentiation and have coarse clumped nuclear chromatin.
- Dumbbell shaped, bi-lobed nuclei, 'pince-nez'

Importance:

Confused with: 1. Pseudo Pelger-Huet

2. Myelocytes, Metamyelocyte or Band neutrophils.

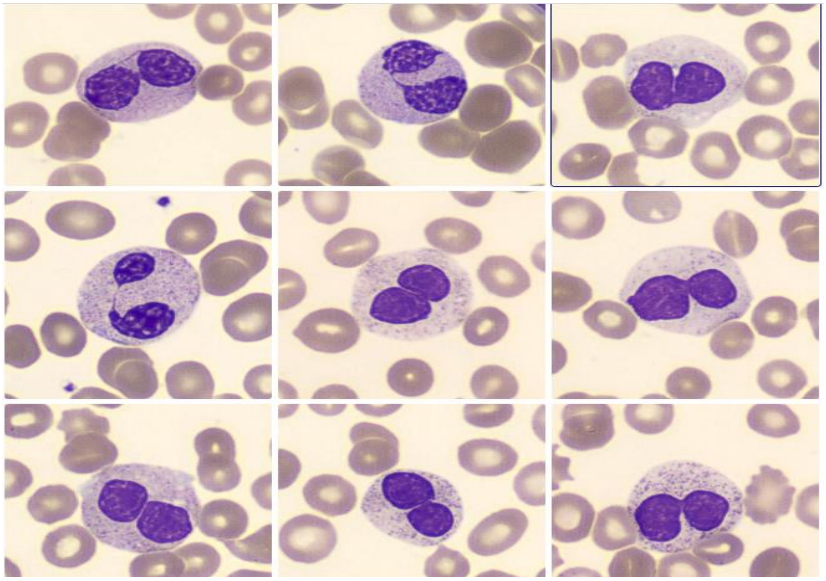
Recommendation:

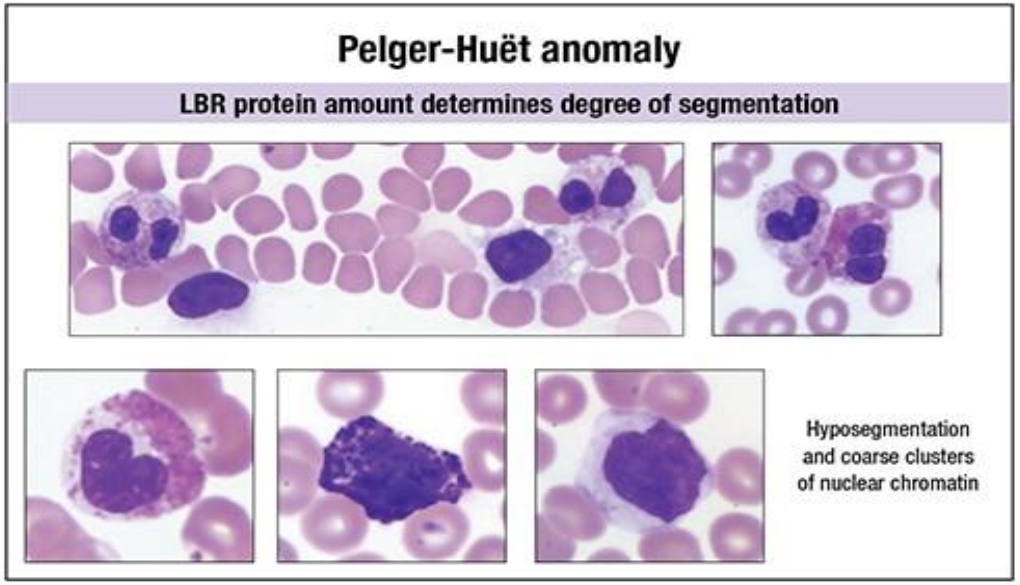
Counted and reported as mature segmented neutrophils but with a suitable interpretive comment.

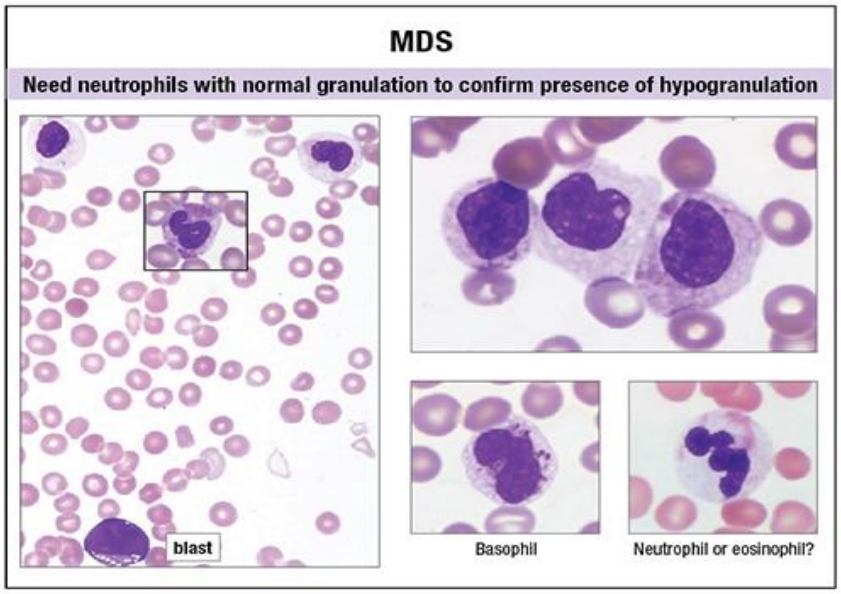
Pelgerhuet Anomally	**Seen**		**Not Seen**	
Pelgeroid morphology(Psudo Pelgerhuet)	**Seen**		**Not Seen**	
Chediak Higashii Anomally	**Seen**		**Not Seen**	

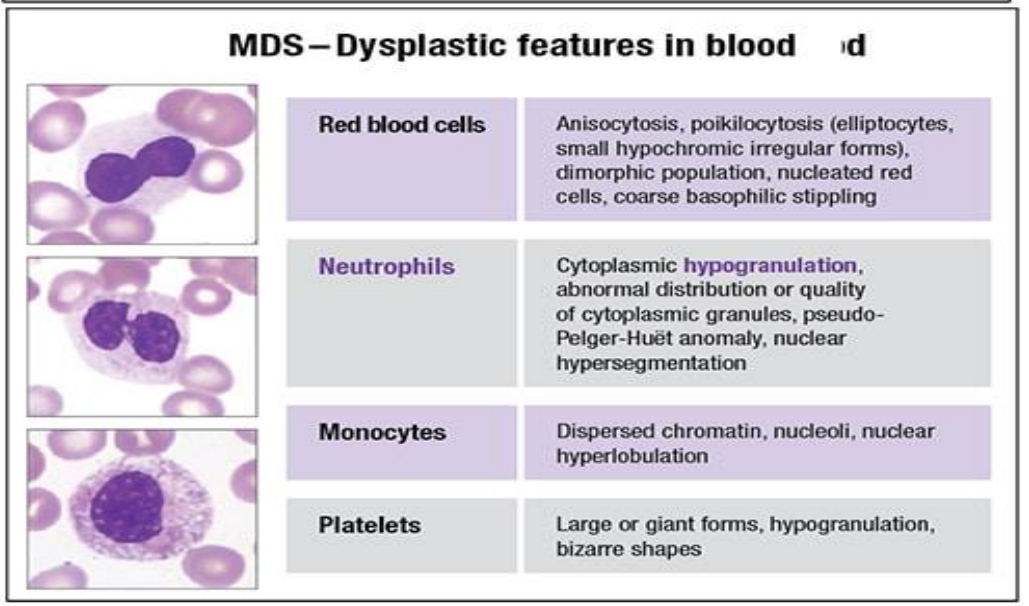
Qualitative abnormalities

Nuclear abnormalities CONT…









Qualitative abnormalities

PLATELETS

Platelets are small, blue-grey granular fragments derived from megakaryocytic cytoplasm, containing many small, reddish-purple granules.

Platelet size:

Diagnostic significance particularly when considered in relation to the platelet count.

- A normal platelet measures 1.5–3 µm in diameter.
- Large platelets measure 3–7 µm (roughly the diameterof a normal sized red cell),
- Giant platelets are larger than normal sized

Note: In a normal person, usually less than 5% of the platelets appear large.

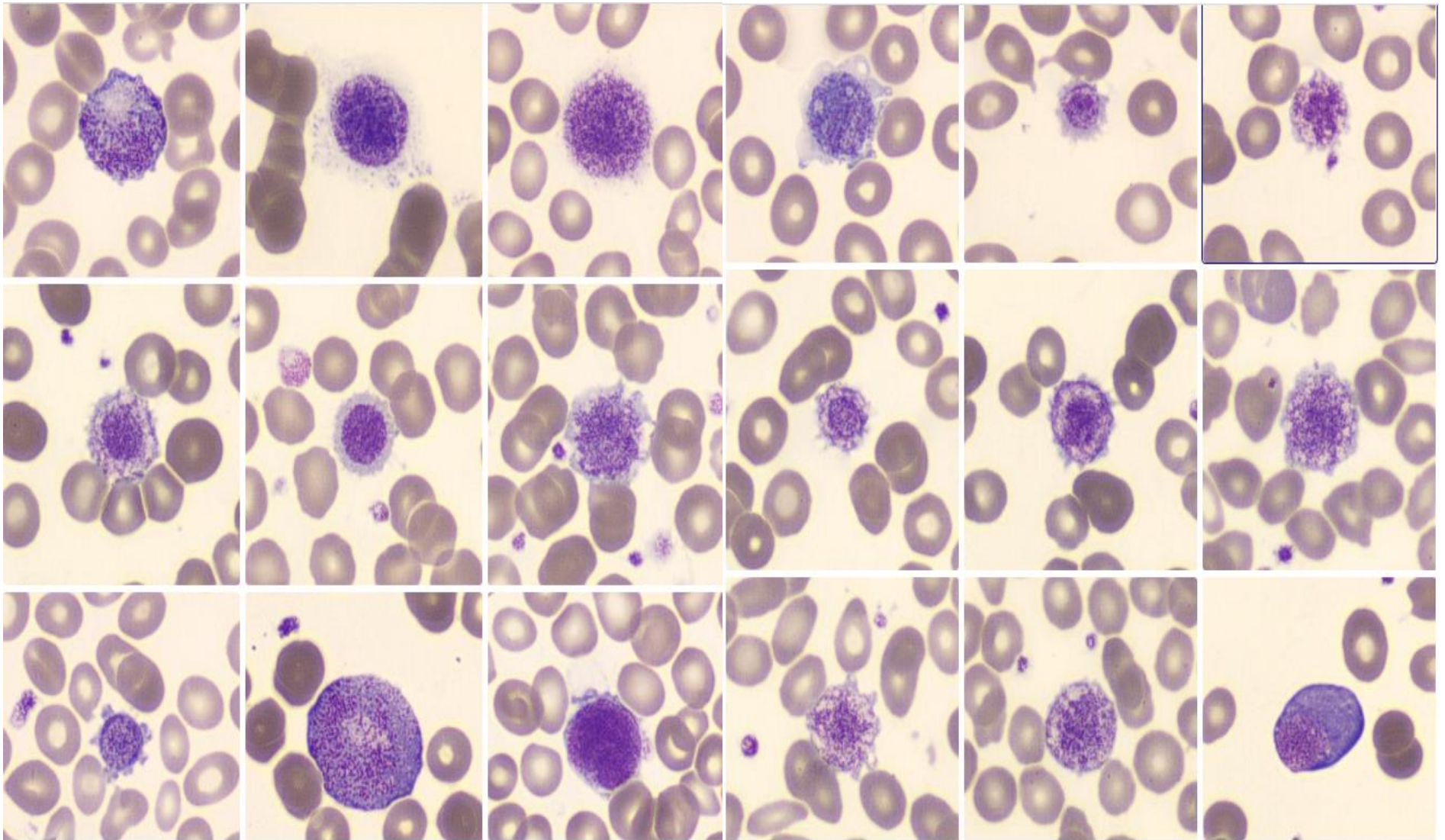
Recommendation:

Giant platelets be graded.

A comment about the platelet count and the presence of small, large and/or giant platelets can be made with an additional interpretive film comment if appropriate.

Qualitative abnormalities

PLATELETS CONT…



Qualitative abnormalities

PLATELETS CONT…

Acquired causes of large platelets :

Storage artefacts
Physiological platelets in neonates
Immune thrombocytopenia
Thrombotic microangiopathies
Disseminated intravascular coagulation
Myeloproliferative neoplasms (essential thrombocythaemia, polycythaemia vera, primary myelofibrosis, chronic myeloid leukaemia)
Myelodysplastic syndromes
Myelodysplastic/myeloproliferative neoplasms
Megakaryoblastic leukaemia
Postsplenectomy states and hyposplenism
Drug-induced (cholestyramine, erucic acid)

Inherited : Bernard–Soulier syndrome, gray platelet syndrome and May–Hegglin anomaly

Qualitative abnormalities

PLATELETS

PLATELETS granulation abnormality:

- Hypogranular
- Agranular platelets
- Presence of singular large granula

PLATELETS shape abnormality:

- Irregular to bizzare
- Cytoplasmatic blebs

Megakaryocytes and **megakaryoblasts** are rarely seen in normal peripheral blood.

- Small ***megakaryoblasts*** may be indistinguishable from lymphoblasts.
- ***Micromegakaryocyte***
  - Size of a promyelocyte or smaller with a nonlobated or a bilobed nucleus
  - Variable amount of weakly basophilic cytoplasm.
  - Nucleus may appear ‘bare’ but a small rim of cytoplasm

Qualitative abnormalities

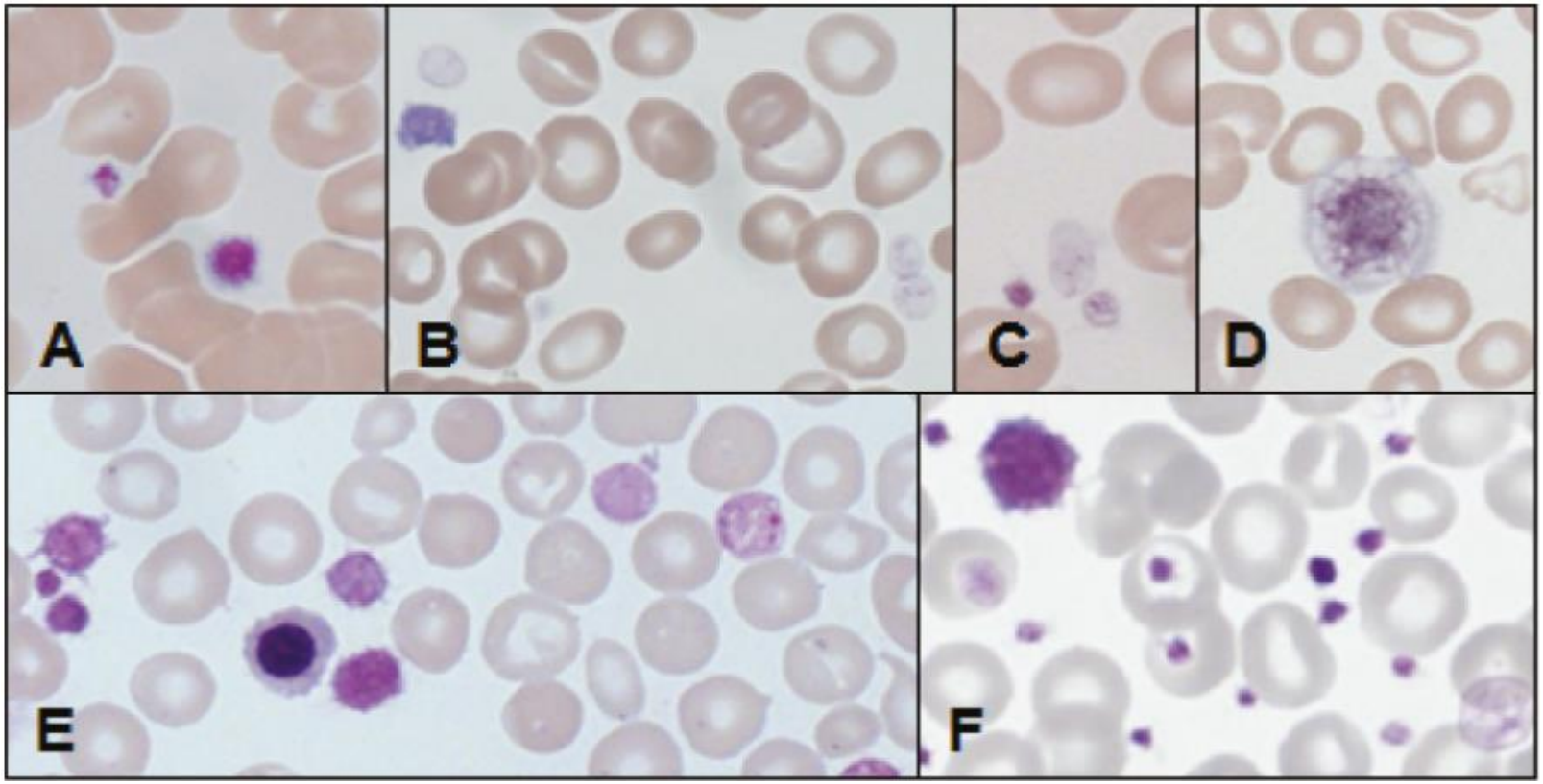
PLATELETS CONT…

Causes of hypogranular/agranular platelets

Inherited	Gene	Inheritance
Grey platelet syndrome	*NBEAL2*	AR
Chediak-Higashi syndrome	*LYST*	AR
Hermansky-Pudlak syndrome	*HPS*	AR
Griscelli syndrome	*MYO5A, RAB27A, MLPH*	AR
Wiskott-Aldrich syndrome	*WAS*	XL
Thrombopenia-absent radius syndrome	*RBM8A*	AR
GATA1-related disease	*GATA1*	XL
Arthrogryposis renal dysfunction and cholestasis syndrome	*VPS33B, VIPAR*	AR
Acquired		
In vitro degranulation (difficult venipuncture, platelet aggregation, EDTA-induced, cardiopulmonary bypass)		
In vivo degranulation (disseminated intravascular coagulation)		
Myelodysplastic syndromes		
Myeloproliferative neoplasms (essential thrombocythaemia, polycythemia vera, primary myelofibrosis)		

Qualitative abnormalities

PLATELETS CONT…



(A) Normal platelets;

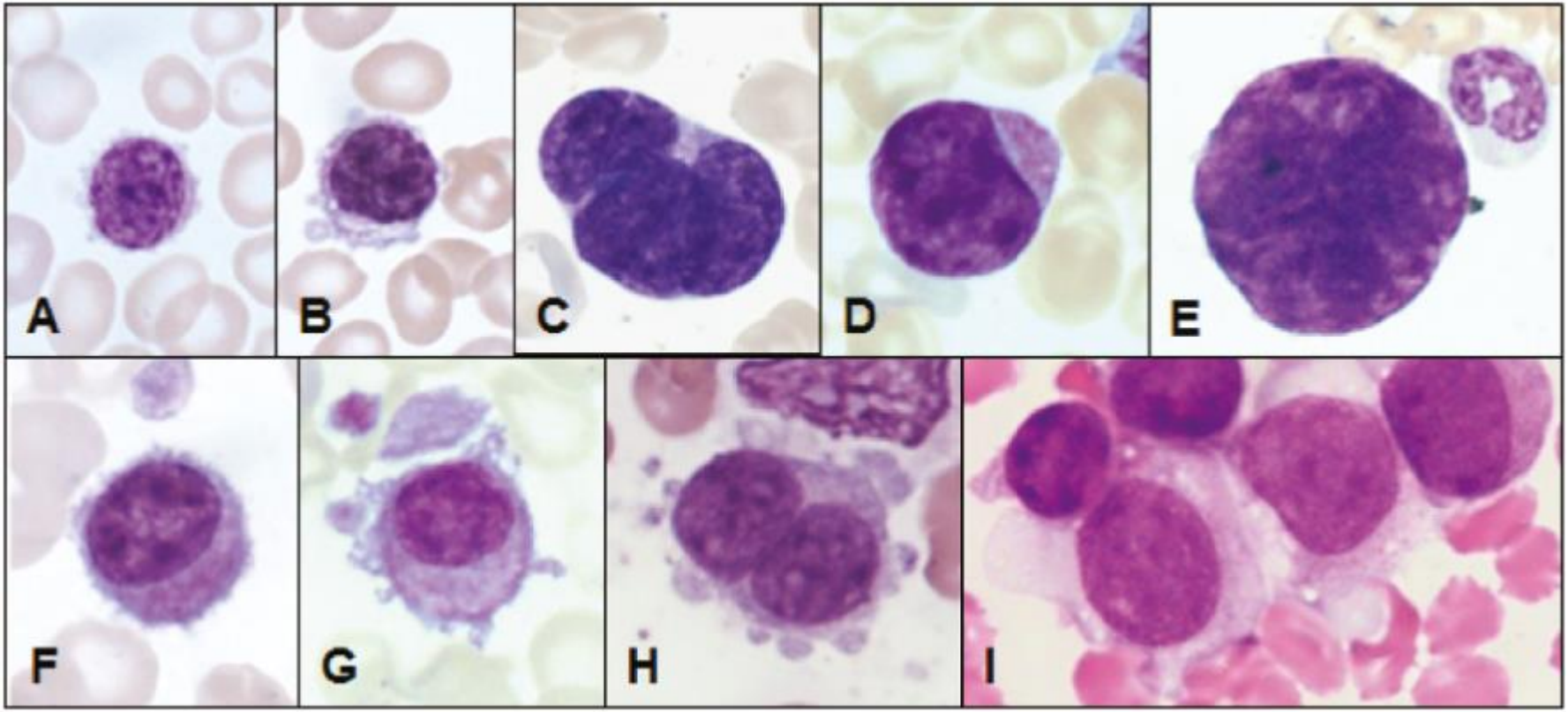
(B) and (C) agranular and hypogranular platelets in a patient with a myelodysplastic syndrome;

(D) giant platelet;

(E) platelet anisocytosis, large platelets and platelets with abnormal granulation in a patient with primary myelofibrosis; (F) platelet anisocytosis, a giant platelet and granulation anomalies in a patient with essential thrombocythaemia.

Qualitative abnormalities

PLATELETS CONT…



Circulating megakaryocytes, micromegakaryocytes and megakaryoblasts.
(A–E) Megakaryocytes; (F–H) micromegakaryocytes; (I) megakaryoblasts.

Recommendation:

Comment about the presence of hypogranular platelets, megakaryocytes, micromegakaryocytes and megakaryoblasts should be made if seen in the PB smear

Thank You
For Your Attention