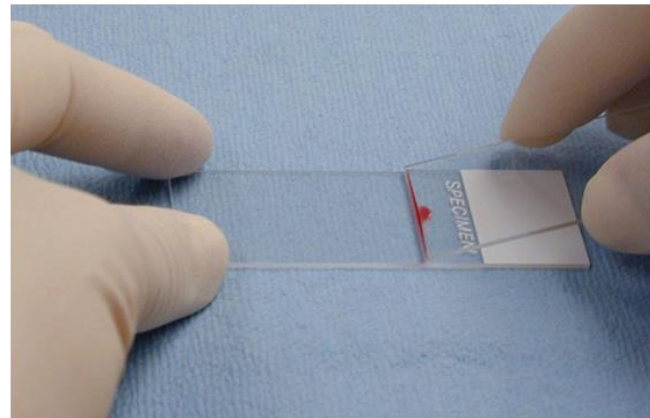
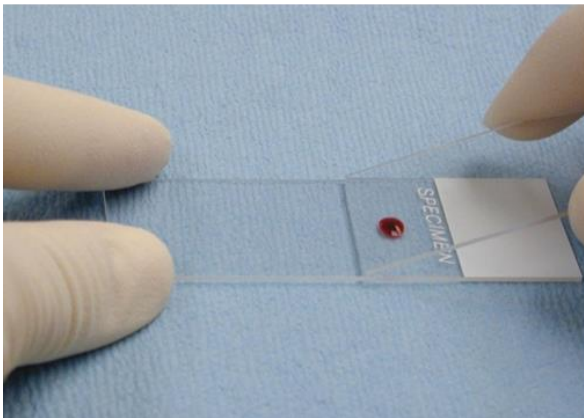
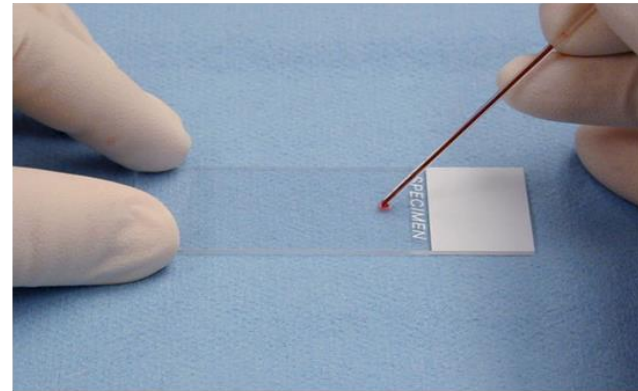
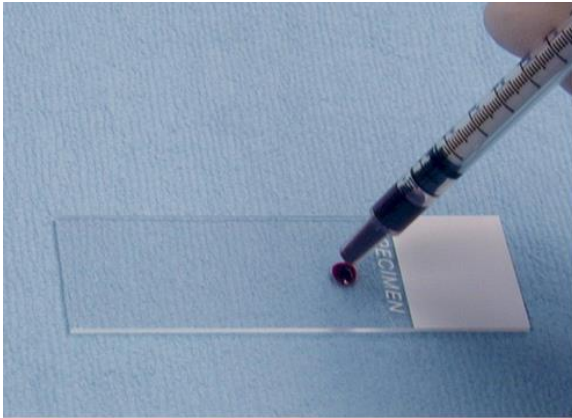


# 血液抹片教學

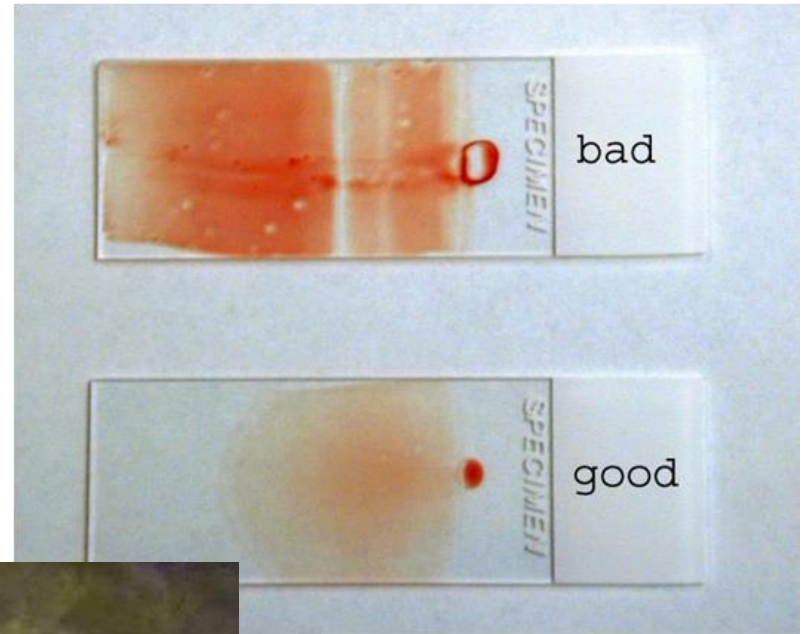
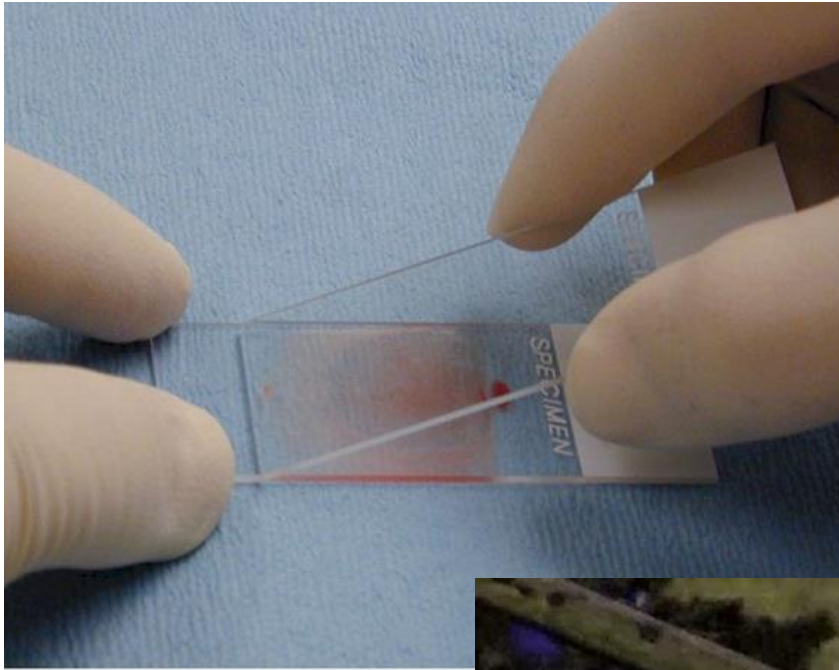
血液腫瘤科

吳宜穎

# Steps for Blood Film



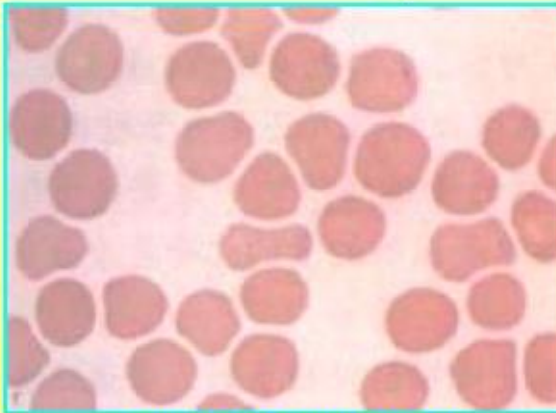
# The shape of blood film



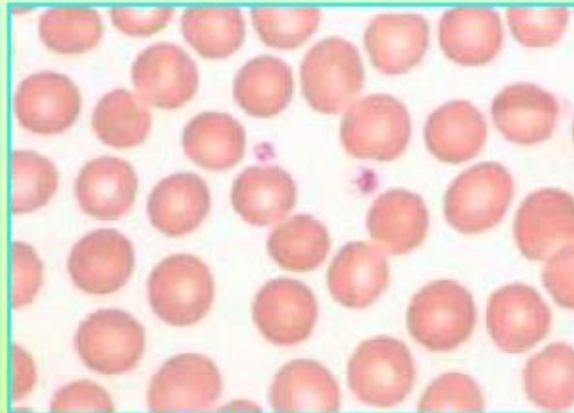
# The shape of blood film



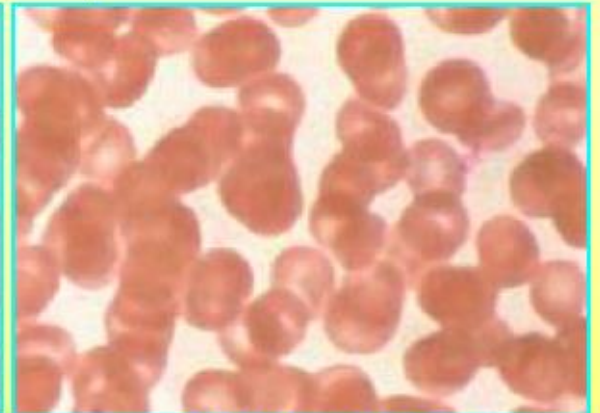
不適宜 適宜 不適宜



RBC雖然很分散  
但立體構造看不清



RBC分散均勻立體構造  
也看得見（中央明亮）



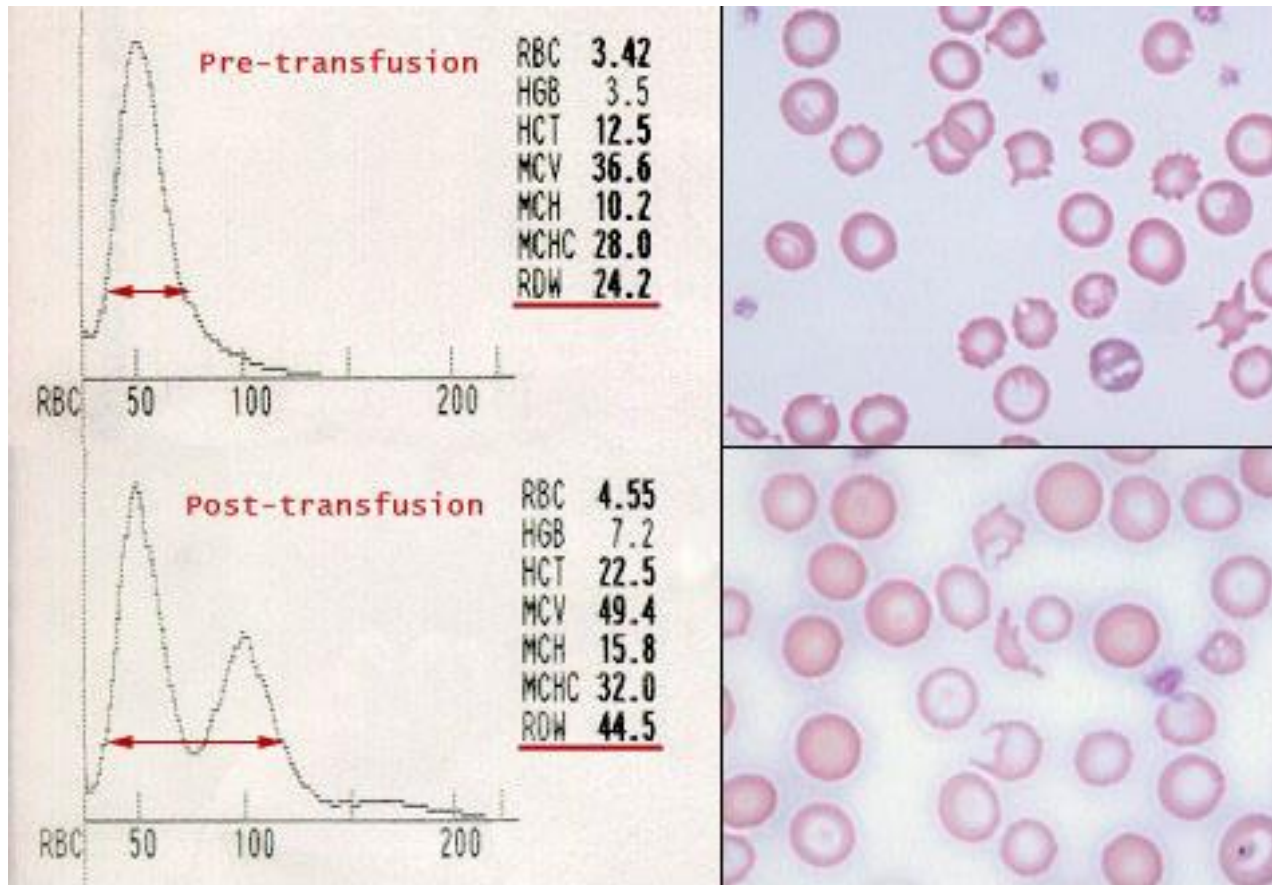
RBC互相重疊

# Simple key points (I)

- Rule of three:  $Hb \times 3 = Hct \pm 3$ 
  - 如果不符合,建議觀察血液抹片
- MCV 以此判定應做之後續檢查
  - $< 80\text{fL}$ : microcytic,  $80\text{-}100\text{fL}$ : normocytic,  $> 100\text{fL}$  macrocytic
- $MCHC = Hb \times 100 / Hct$ 
  - $< 32 \text{ g/dL}$ , IDA, thalassemia
  - $> 36 \text{ g/dL}$ ,可能和血球形狀有關,或有冷凝現象

# Simple key points (II)

- RDW= histogram of RBC volume (CV%)
  - Increased in anisocytosis (紅血球大小不一)

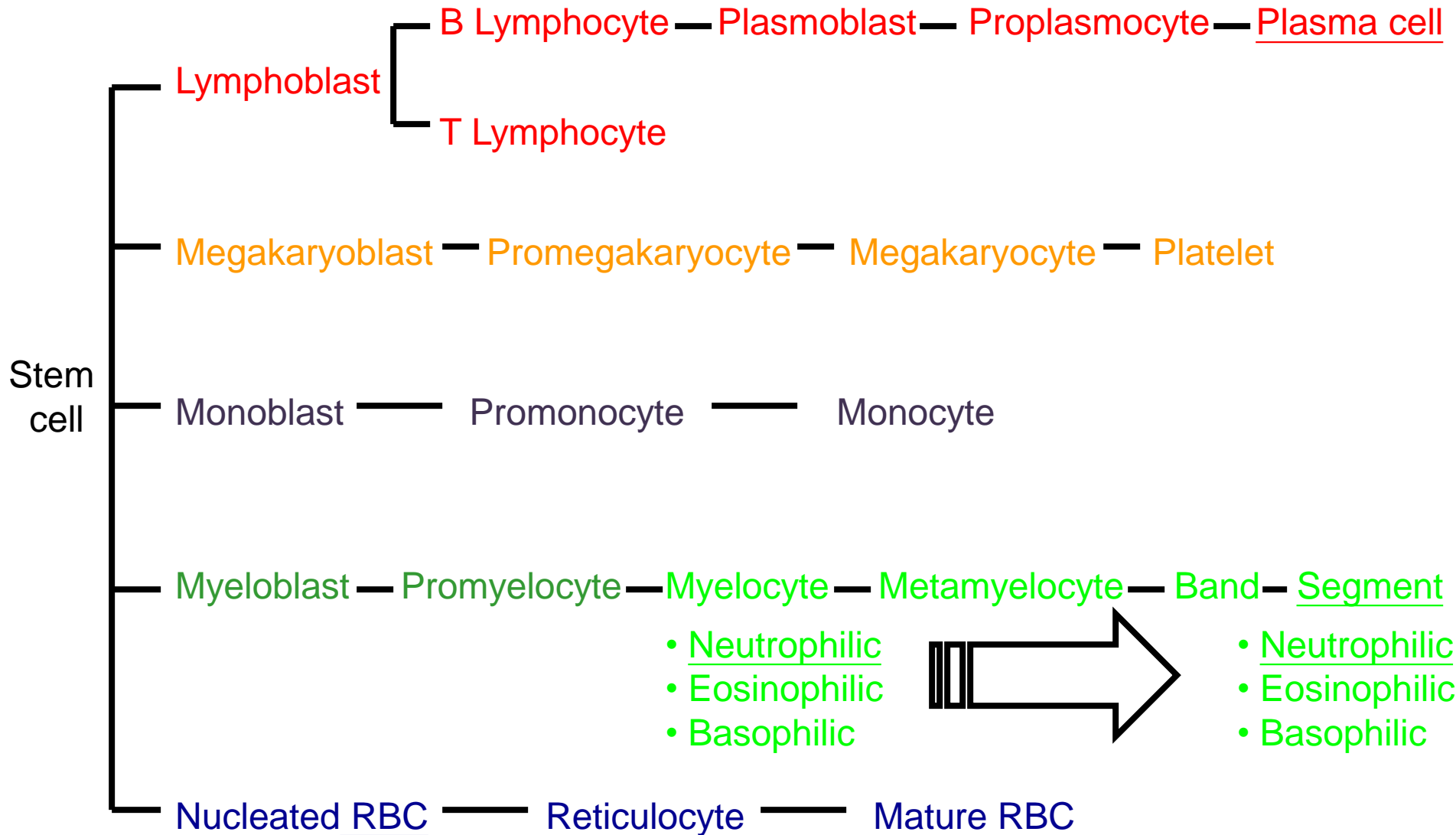


# Simple key points (III)

- **Reticulocyte production index**
  - **RPI = Reticulocytes (percent) x (HCT ÷ 45) x (1 ÷ maturation time)**
  - **>3 adequate bone marrow response**

<b>Hematocrit</b>	<b>Maturation time</b>
<b>40-45%</b>	<b>1.0 days</b>
<b>35-39%</b>	<b>1.5 days</b>
<b>25-34%</b>	<b>2.0 days</b>
<b>15-24%</b>	<b>2.5 days</b>
<b>&lt;15%</b>	<b>3.0 days</b>

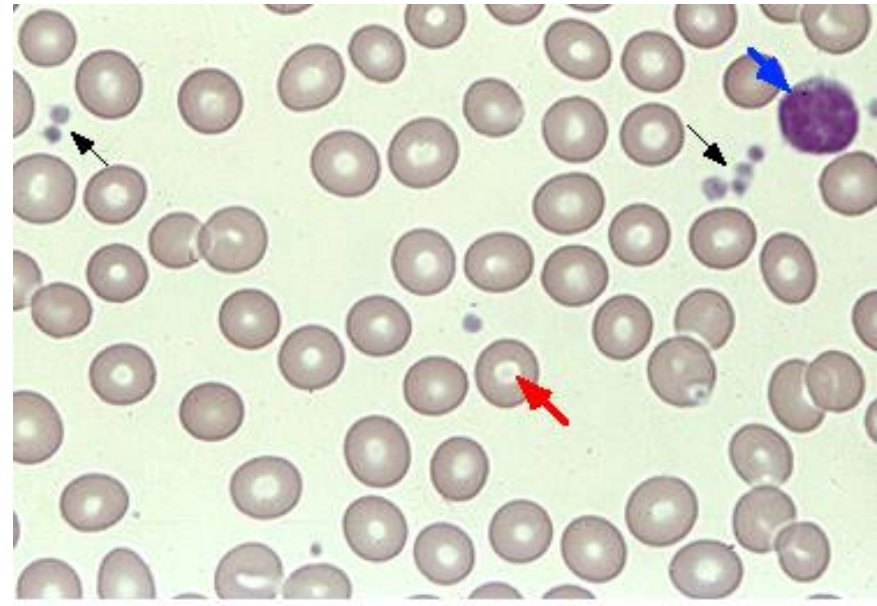
# 正常人血球之演化過程





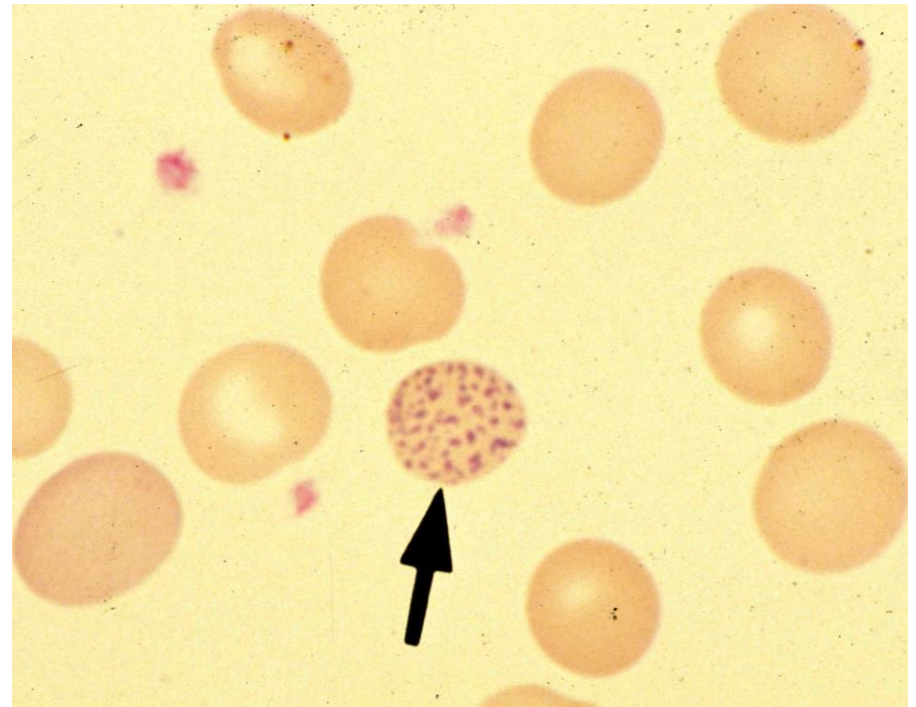
# RBC morphology

- 7-9  $\mu\text{m}$  with 1/3 central palor
- Lifespan of 110-120 days
- About the size of nucleus of normal lymphocyte
- Poikilocytosis & Anisocytosis



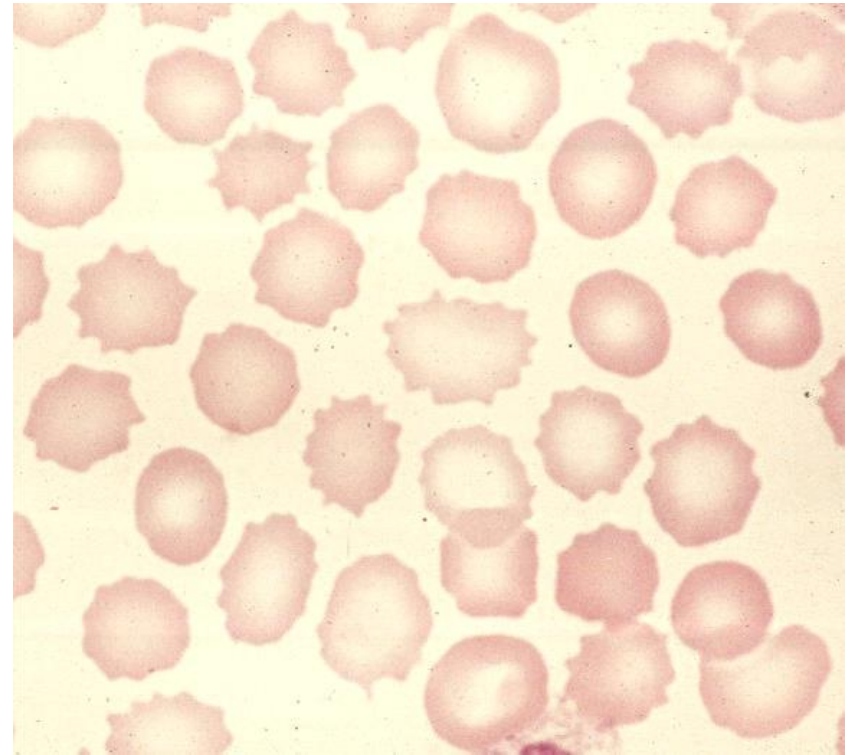
# Basophilic stippling

- Precipitated RNA
- Lead or heavy metal poisoning
- Thalassemia
- Hemoglobinopathies



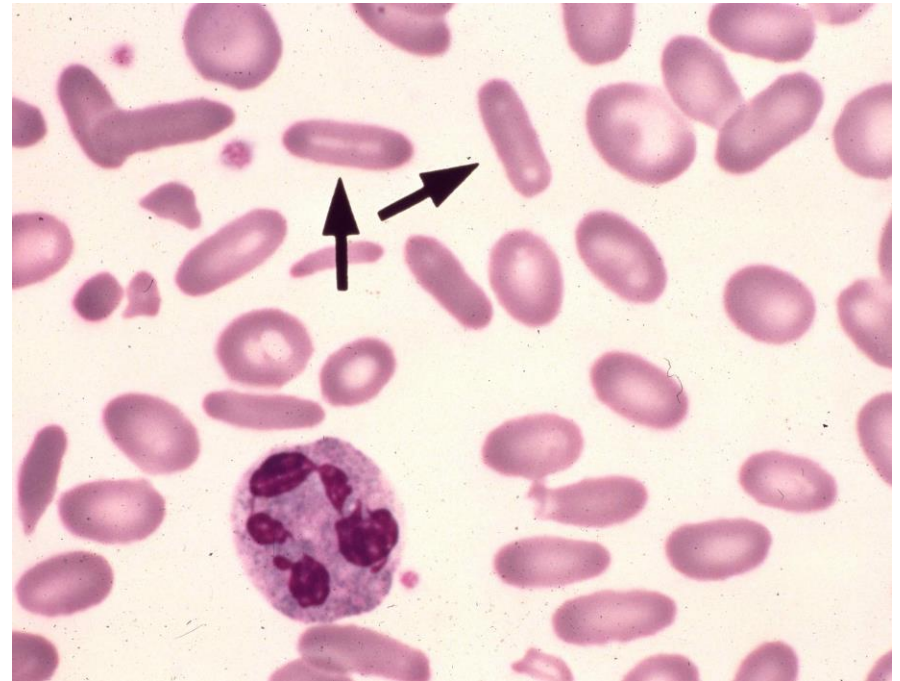
# Burr cells

- Altered lipid in cell membrane
- Artifact
- Uremia
- Pyruvate kinase deficiency



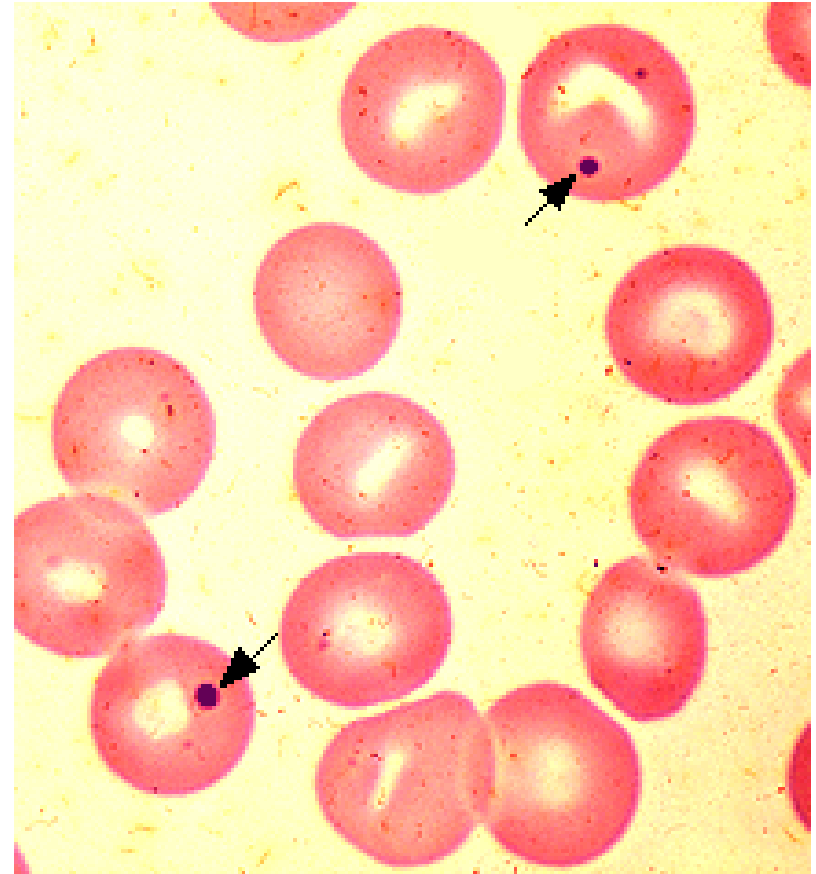
# Elliptocytes/ovalocytes

- Abnormal cytoskeletal proteins
- Hereditary elliptocytosis
- IDA
- Thalassemia major



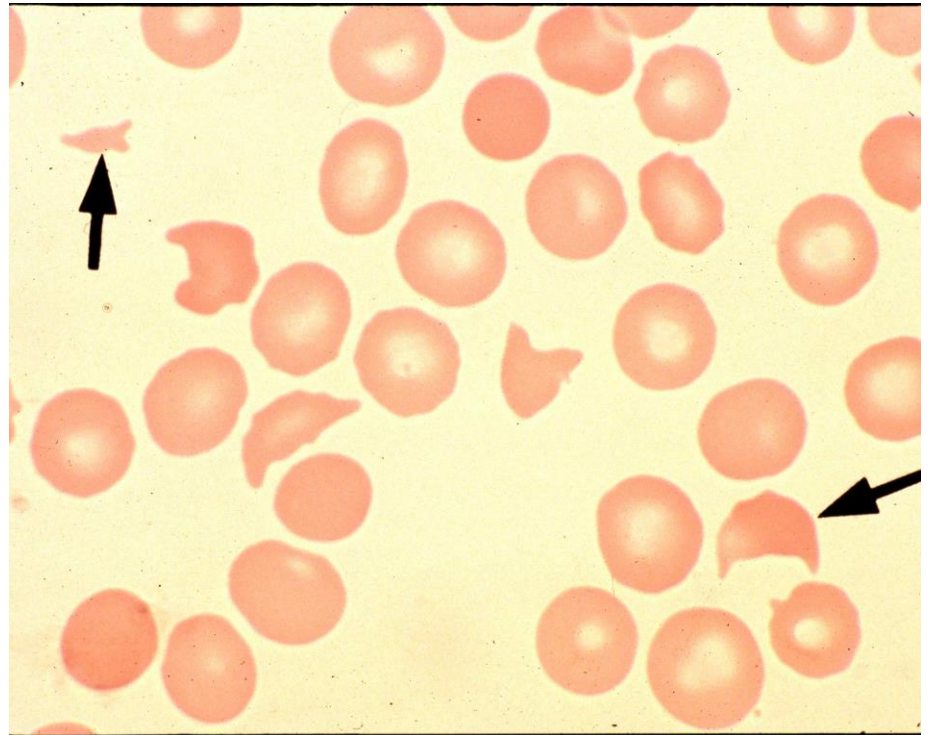
# Howell Jolly body

- Nuclear remnant - DNA
- Hemolytic anemia
- Absent or hypofunction spleen
- Megaloblastic anemia
- Hemolytic anemia



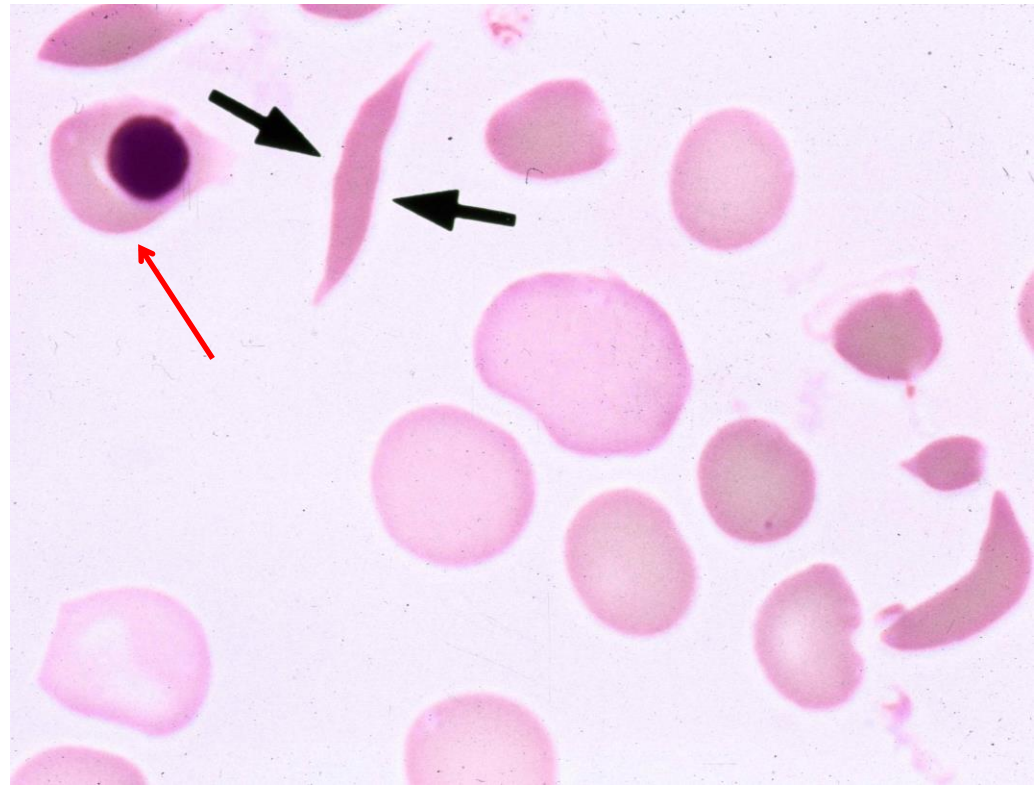
# Schistocyte/helmet cells

- Fragmented (mechanical or phagocytosis)
- DIC
- TTP
- HUS
- Vasculitis
- Prosthetic heart valve
- Severe burns



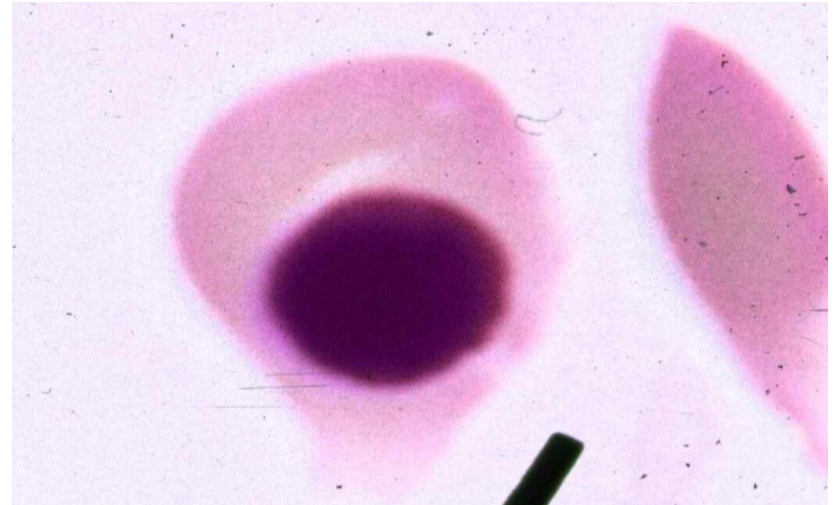
# Sickle cells

- Molecular aggregation of Hgb-S
- Sickle cell anemia
- Sickle cell- $\beta$ -thalassemia



# NRBC

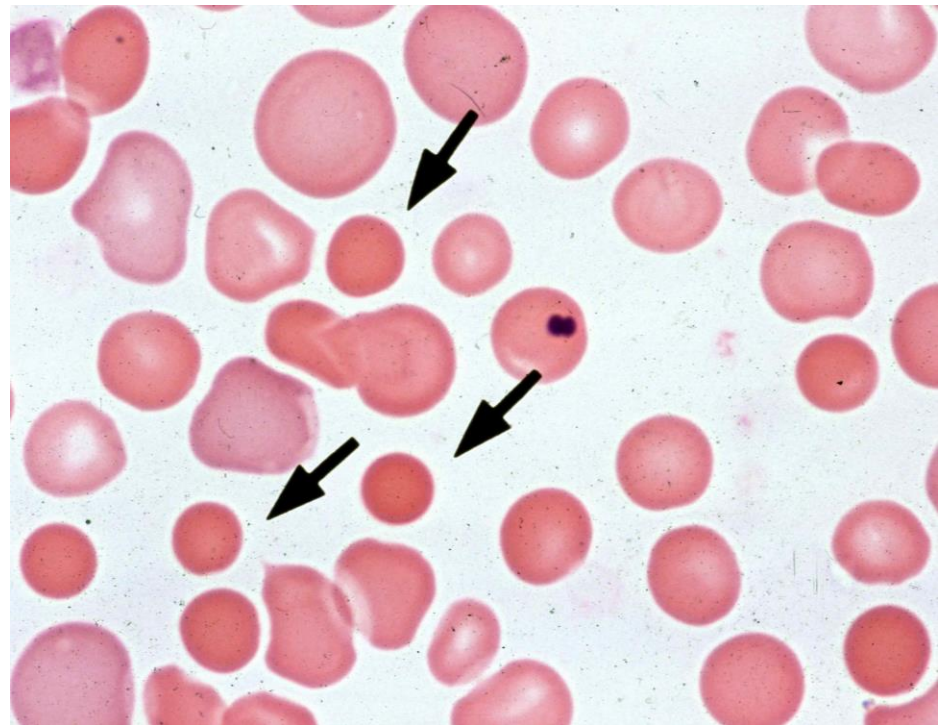
- Common in newborn
- Severe degree of hemolysis





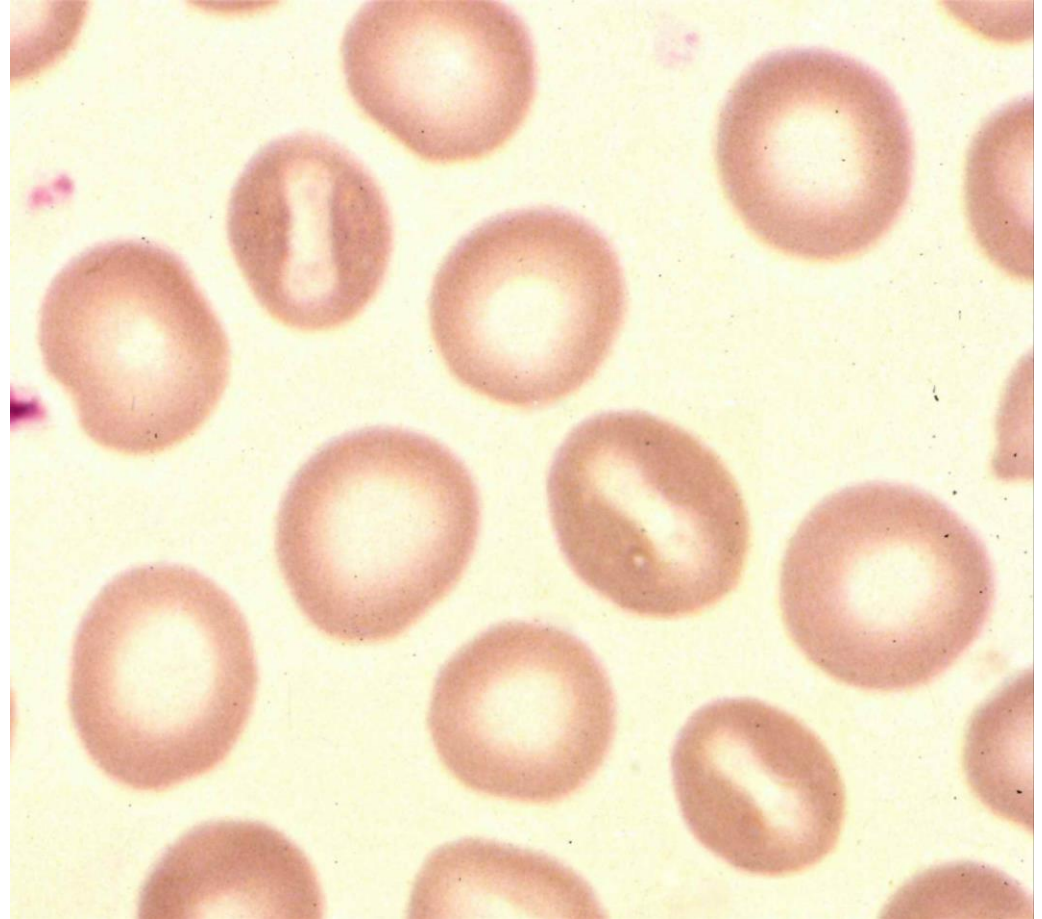
# Spherocyte

- Absent central pallor
- Smaller
- Hereditary spherocytosis
- Immune hemolytic anemia



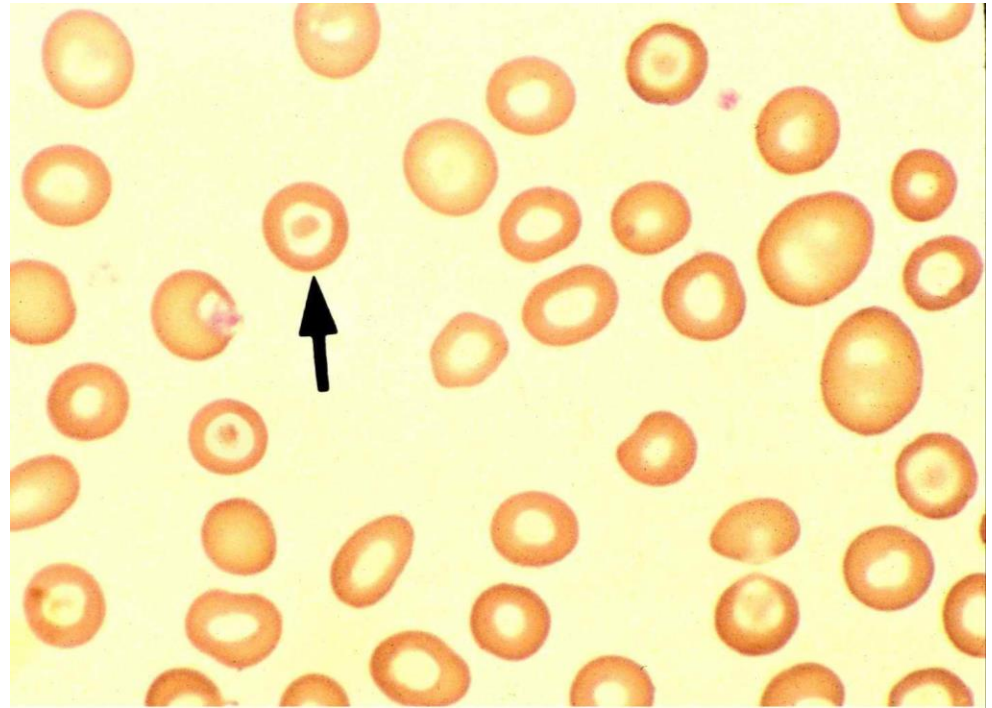
# Stomatocyte

- Mouth like
- Membrane defect
- Smear artifact
- Hereditary stomatocytosis
- Liver disease
- Alcoholism
- Artifact



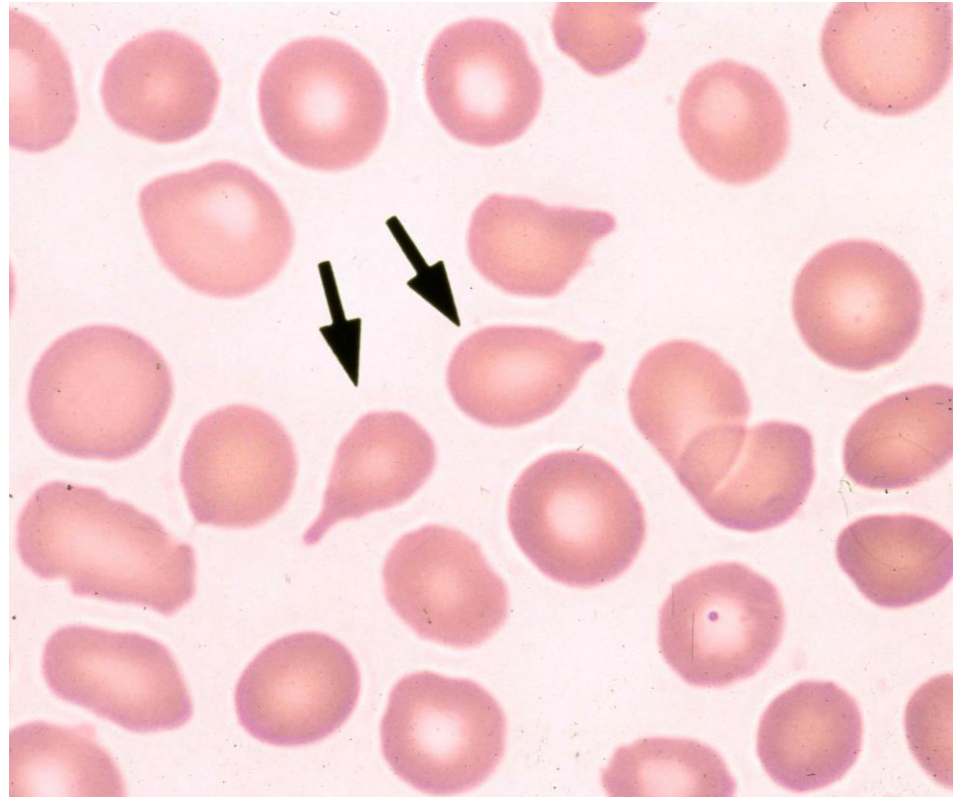
# Target cells

- Increased redundancy of membrane
- Hemoglobinopathies
- Thalassemia
- Liver disease



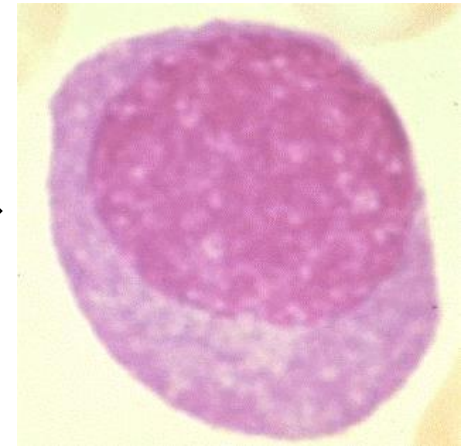
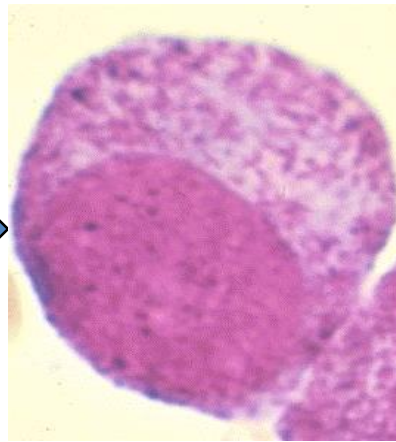
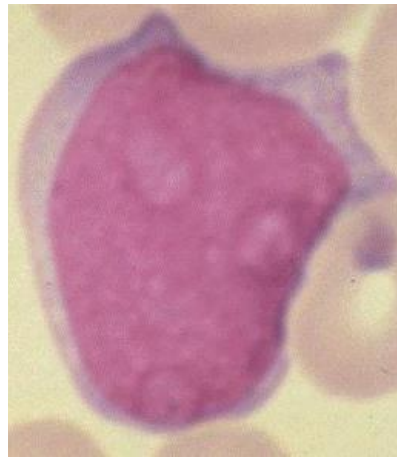
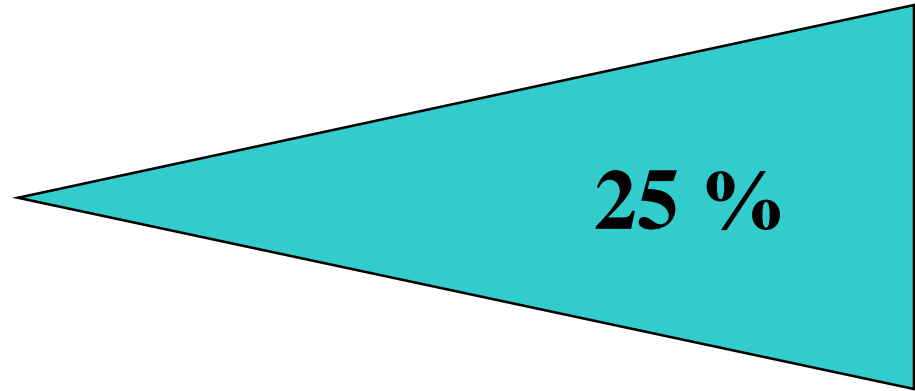
# Tear drop cells

- Distorted drop shaped
- Smear artifact
- Myelofibrosis
- Thalassemia
- Megaloblastic anemia



# Neutrophil Maturation - Proliferative Phase

**Proliferation**



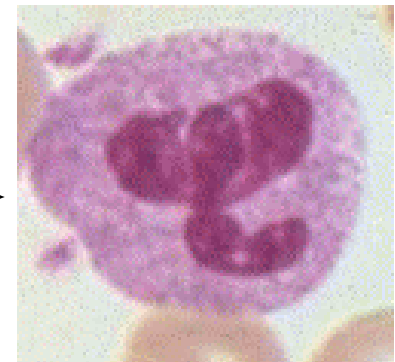
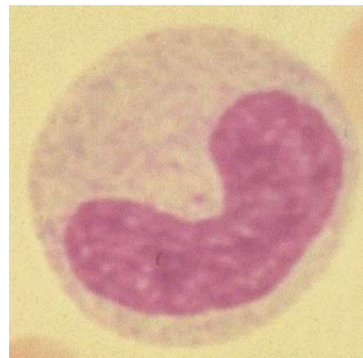
**Myeloblast**

**Promyelocyte**

**Myelocyte**

**65 % of myeloid cells**

**Maturation 6-7 days**

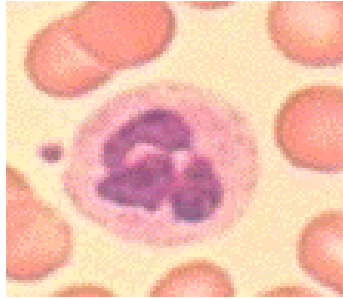


**Metamyelocyte**

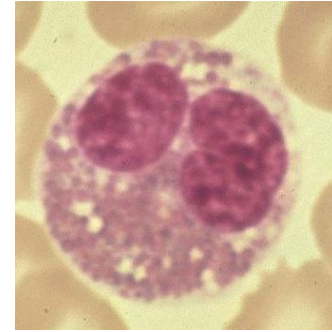
**Band**

**Neutrophil**

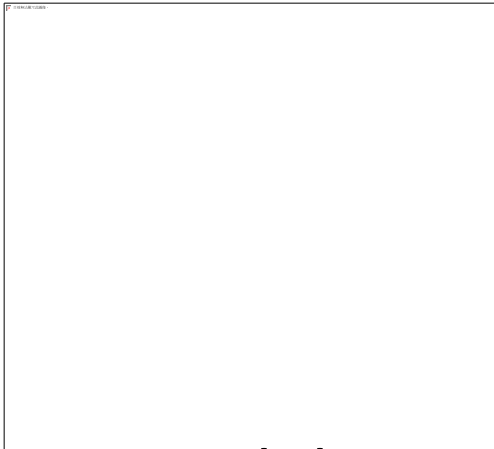
# Mature Myeloid Cells



Neutrophil



Eosinophil

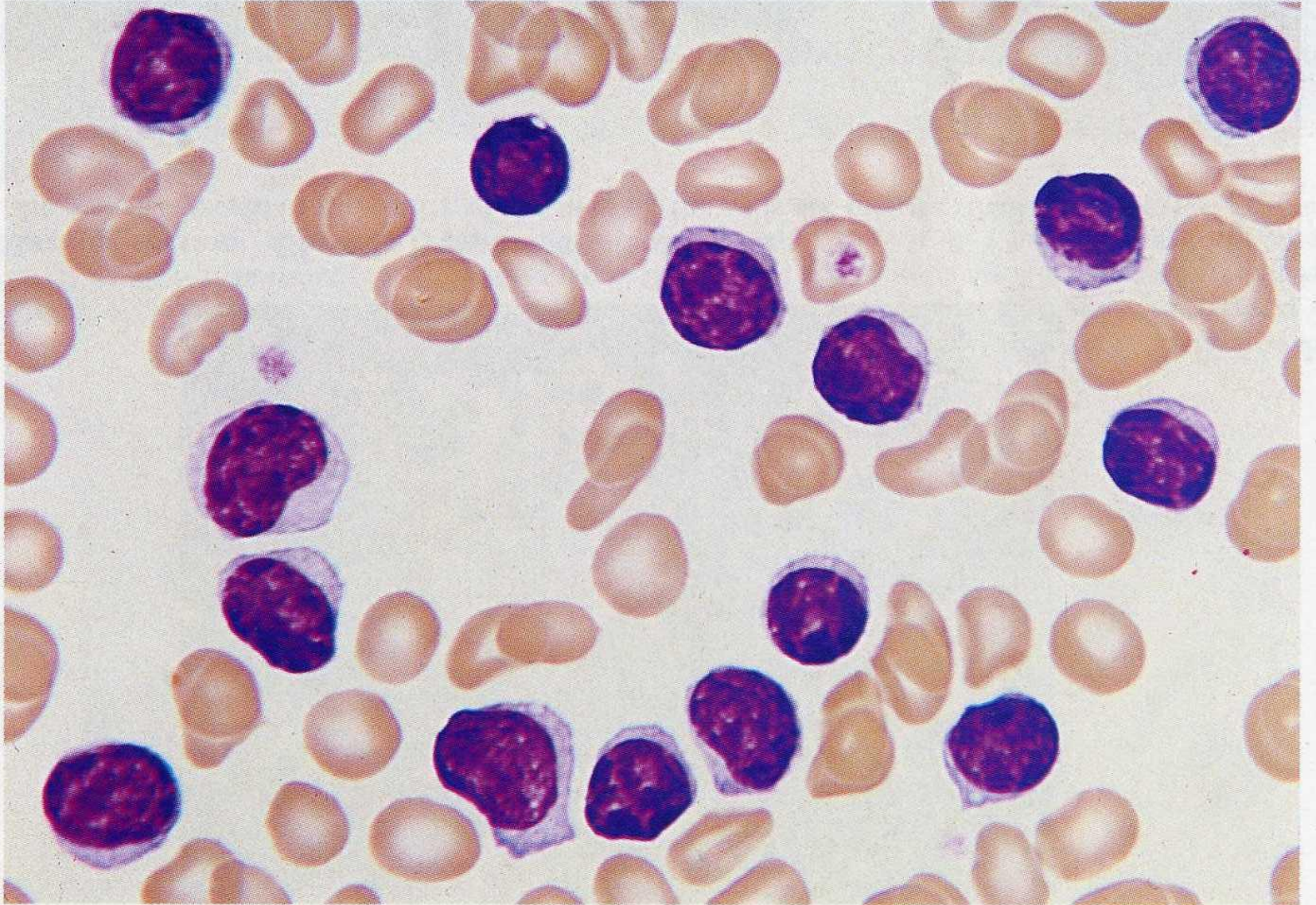


Basophil



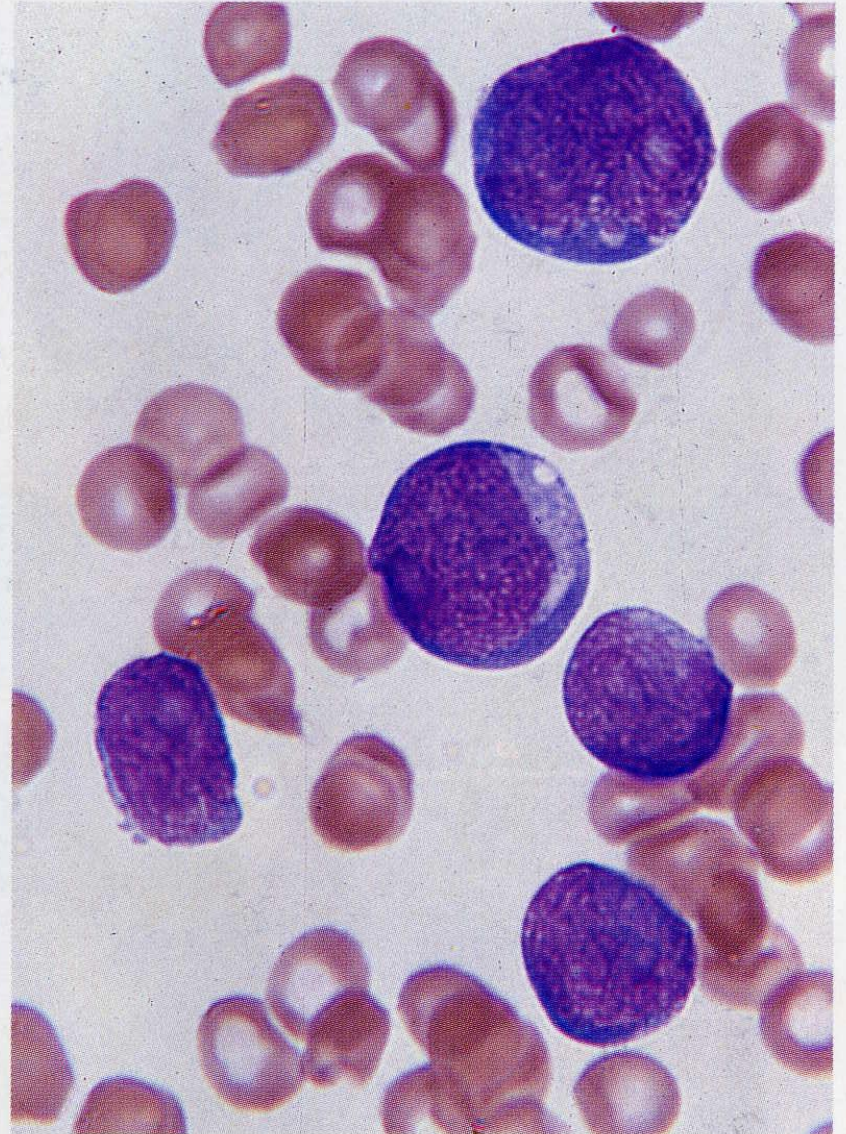
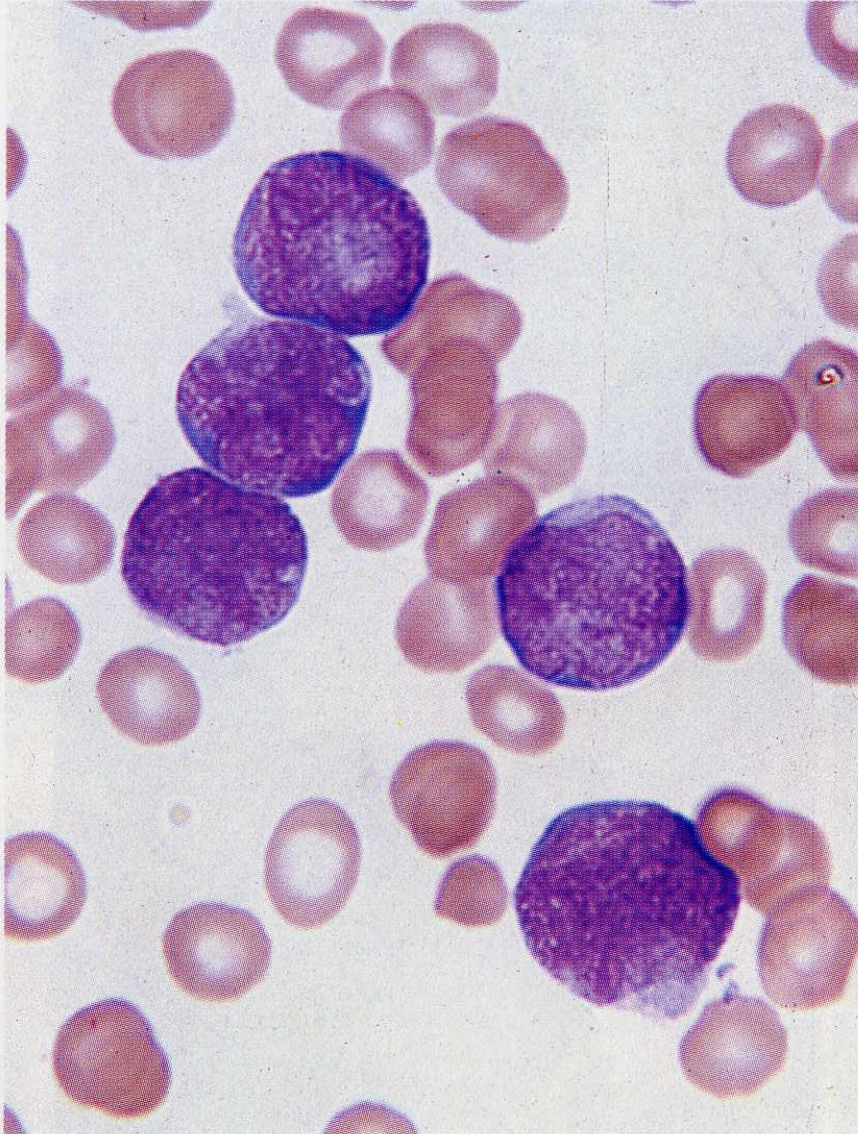
Monocyte

# Lymphocyte

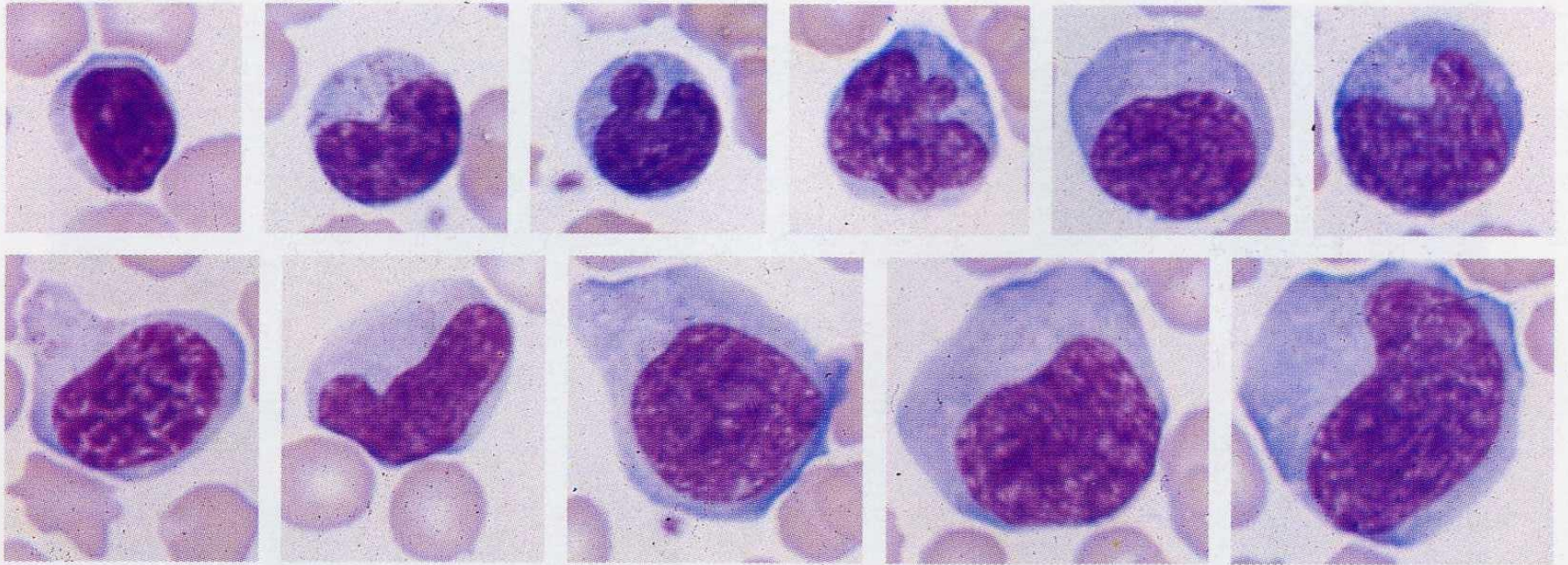




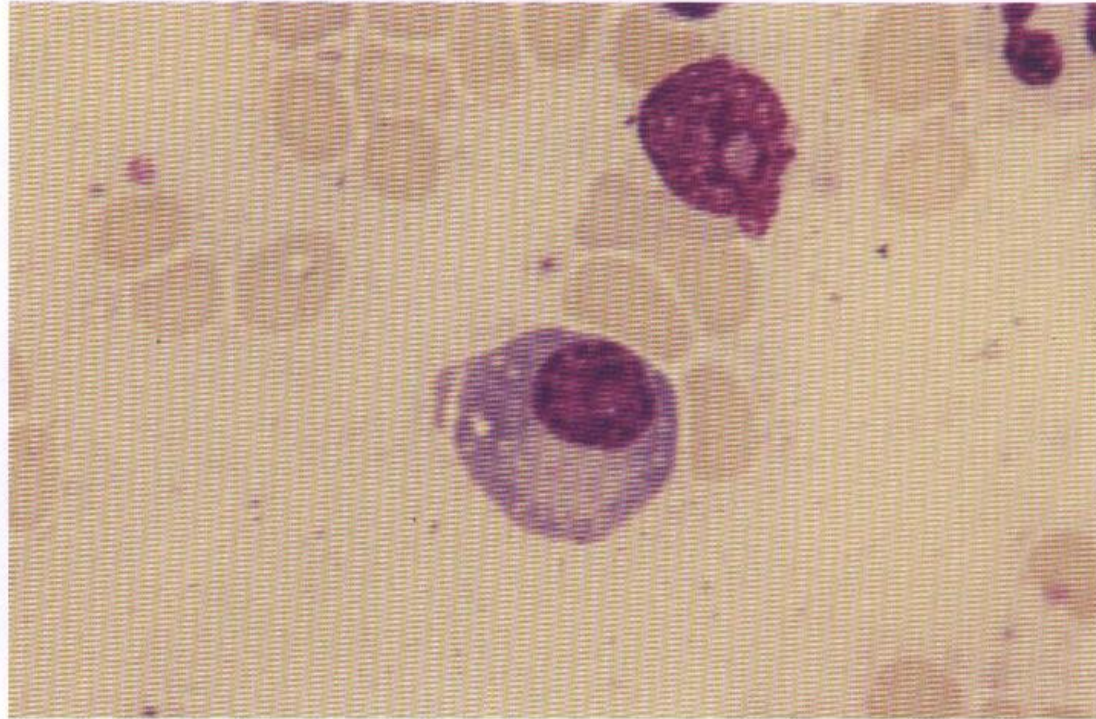
# Lymphoblast



# Atypical lymphocyte



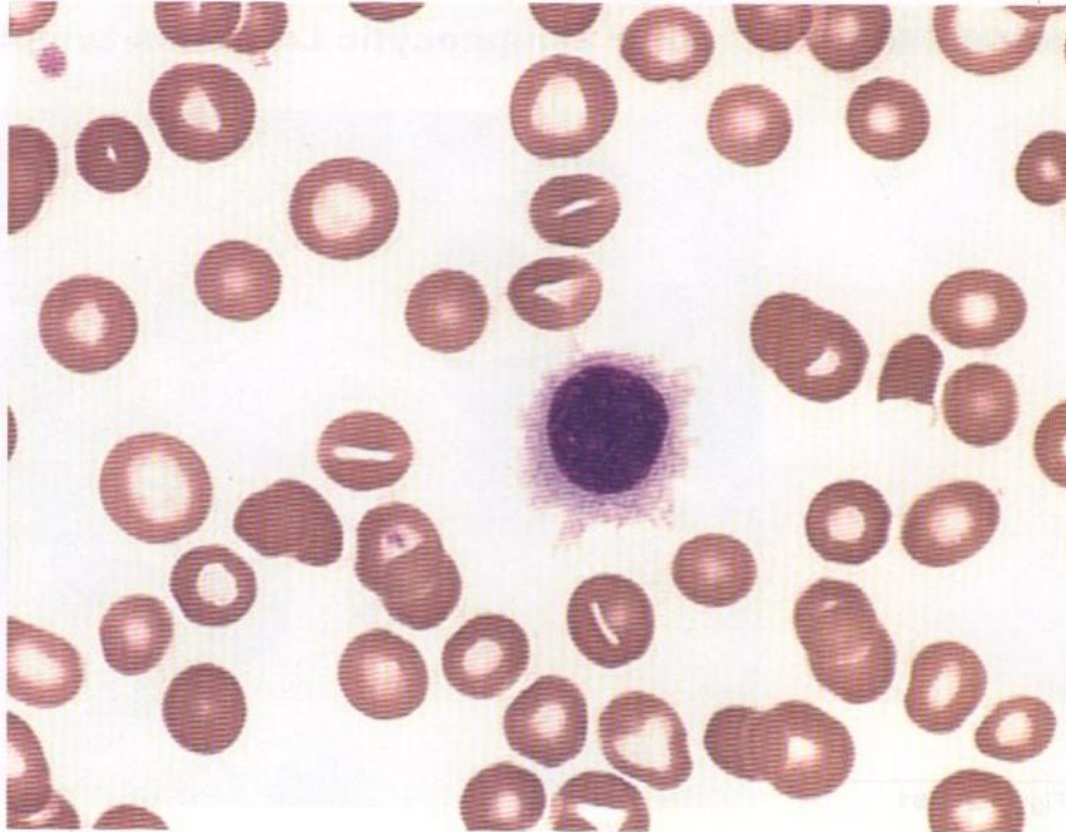
# Plasma cell



Plasma cell disorders

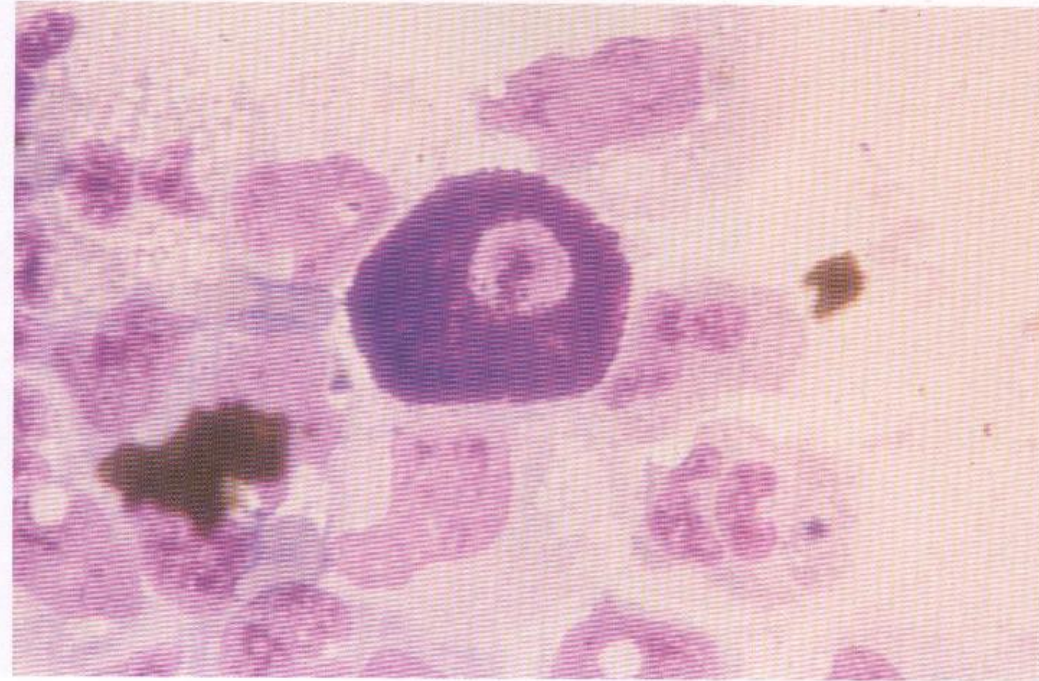
Response to infection

# Hairy cell



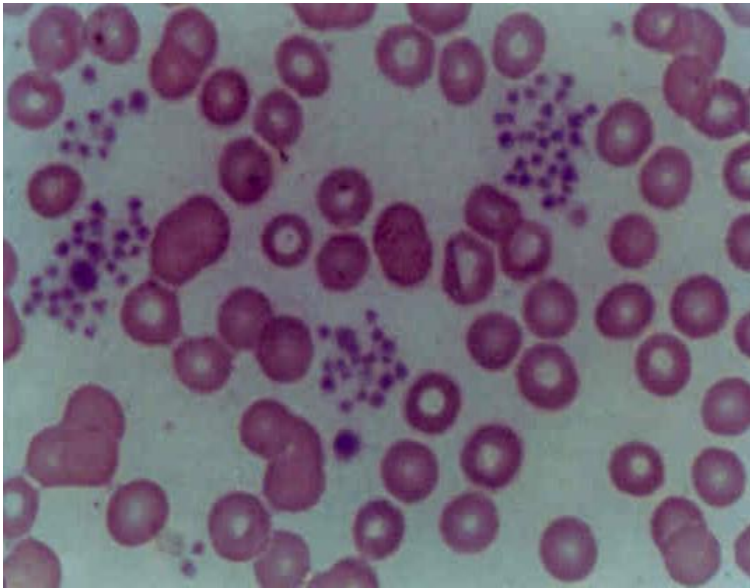
Hairy cell leukemia

# Mast cell

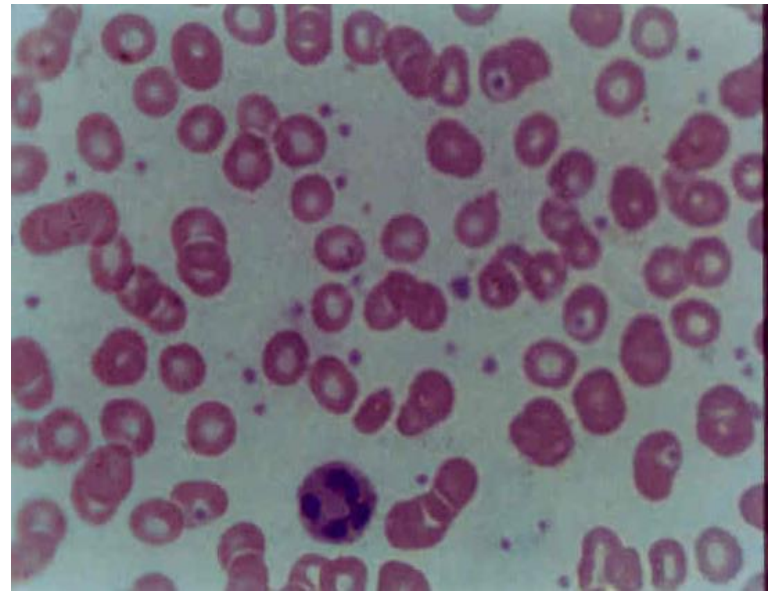


Mast cell disease

# Pseudothrombocytopenia

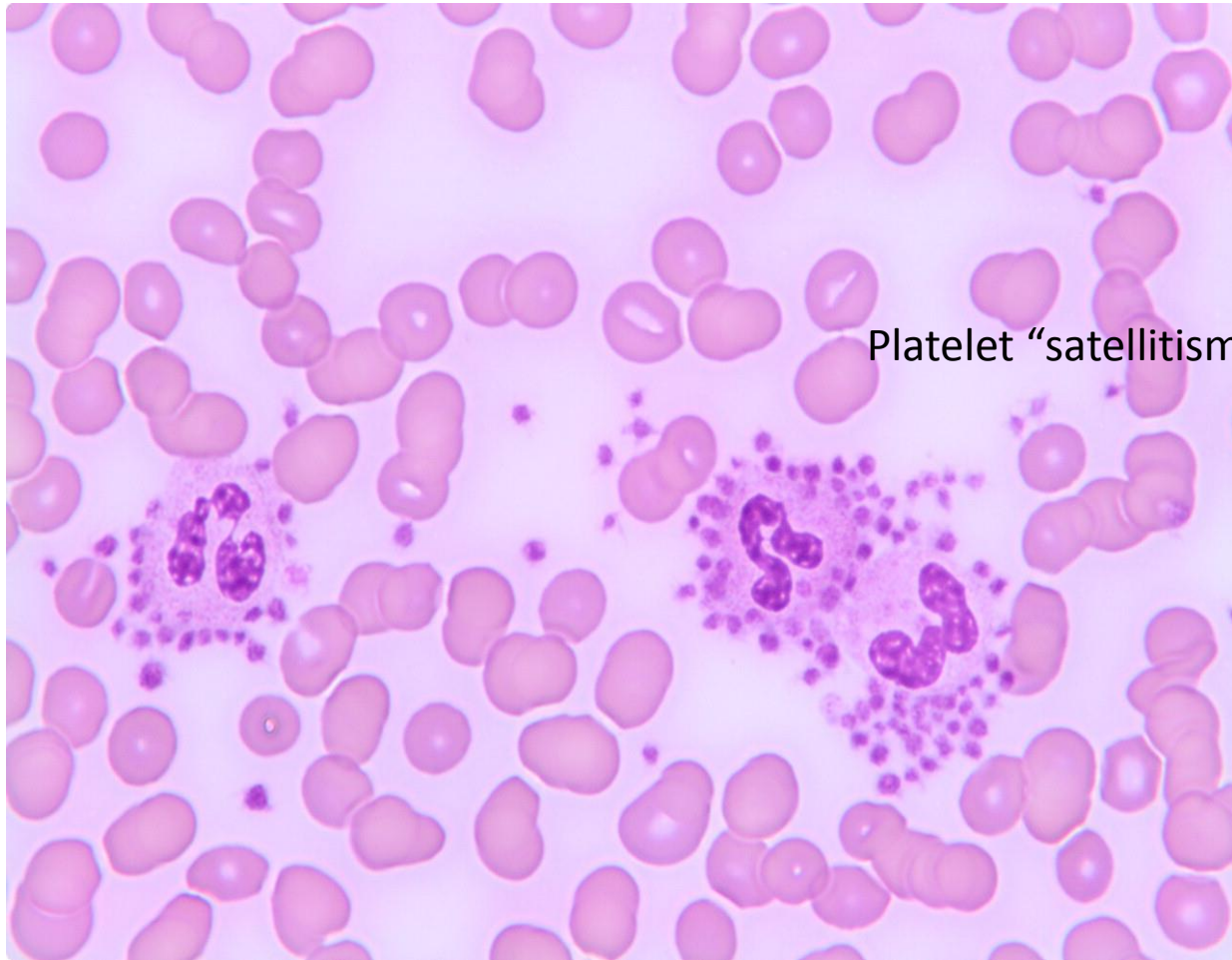


Platelet clumping in EDTA

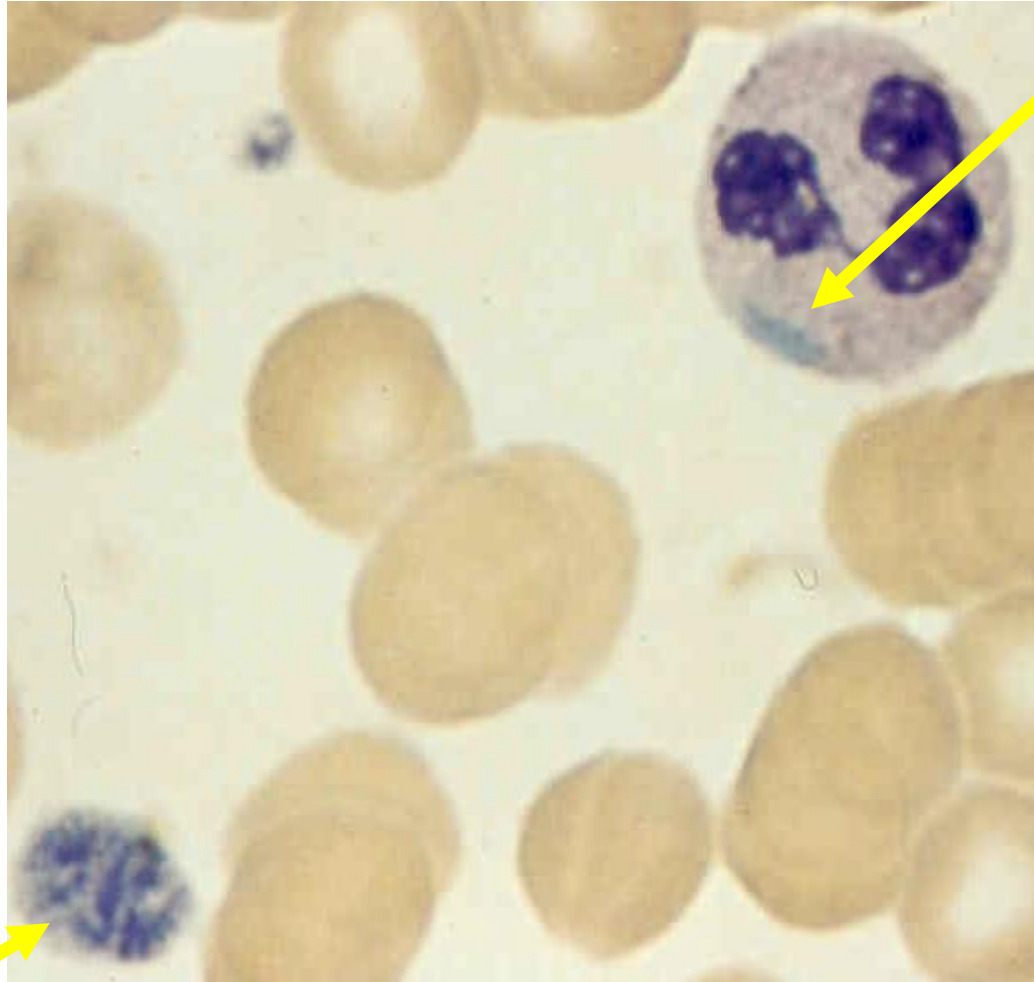


No clumping in heparin

# Pseudothrombocytopenia



# May-Hegglin anomaly



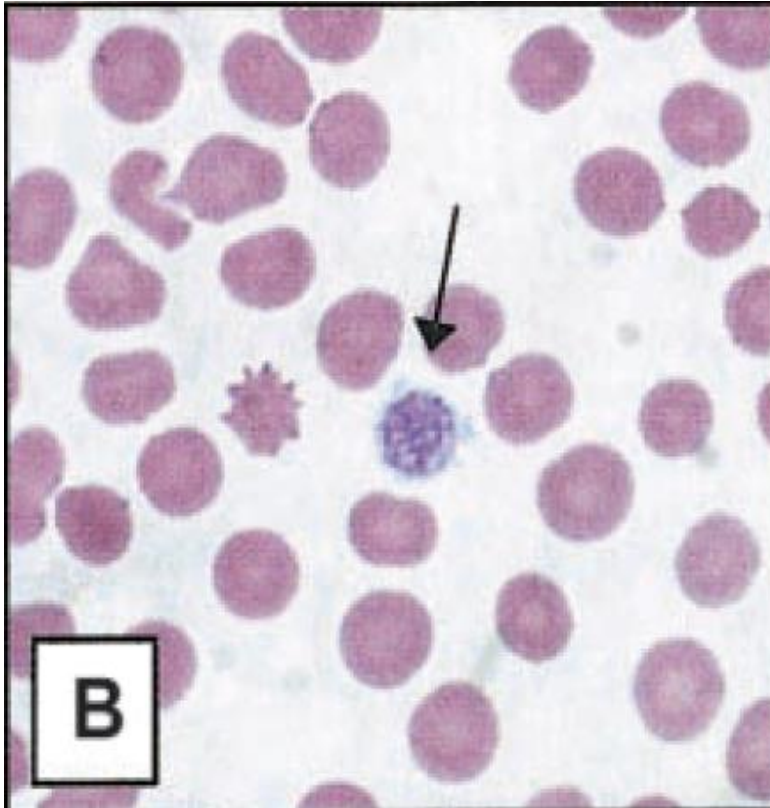
PMN inclusions

Giant platelets  
(macrothrombocytopenia)

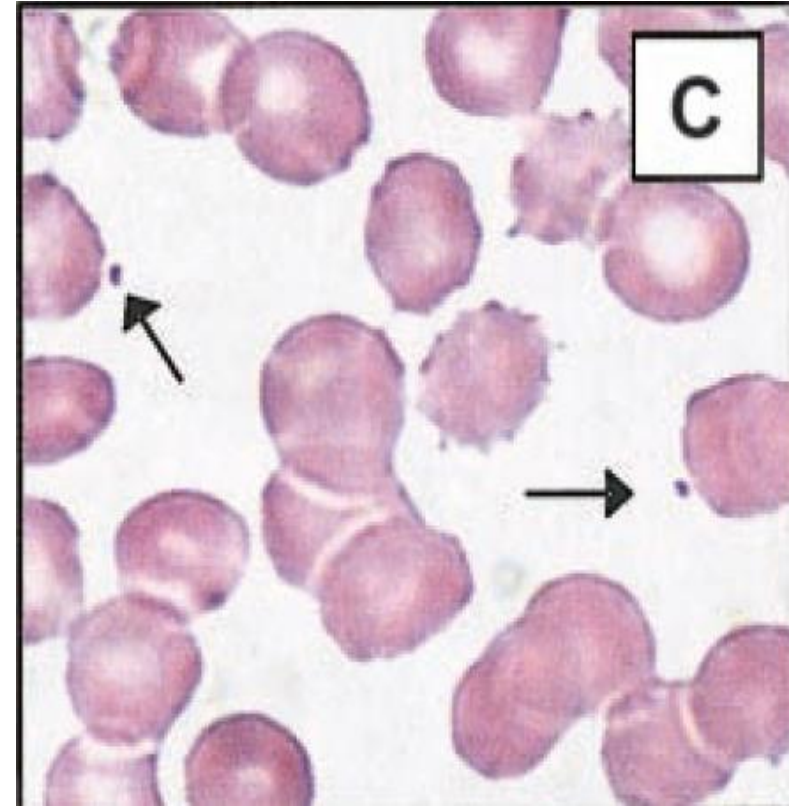


Bernard-Soulier syndrome

Wiskott-Aldrich syndrome



Macrothrombocyte



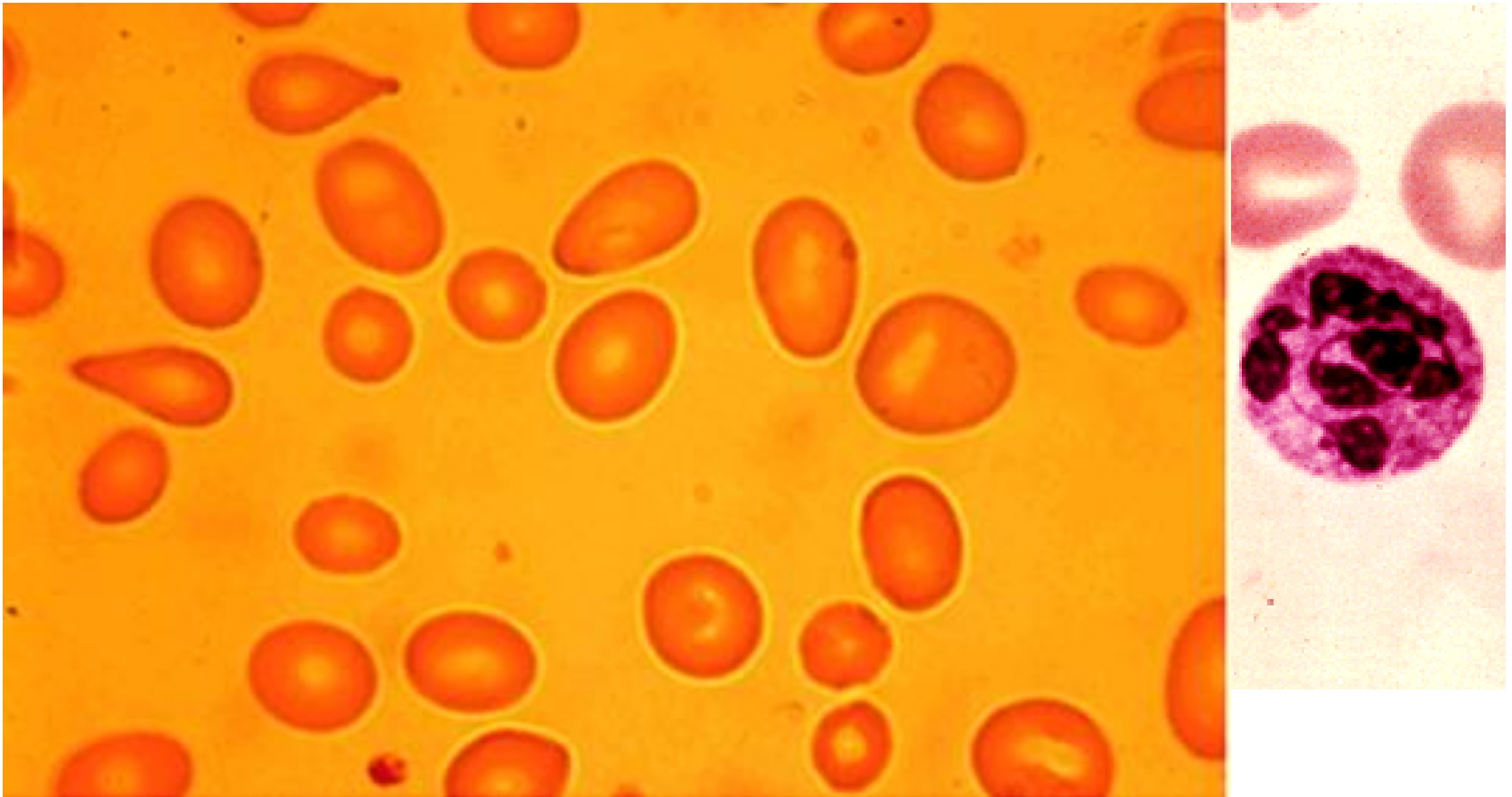
Microthrombocytes

# Case 1

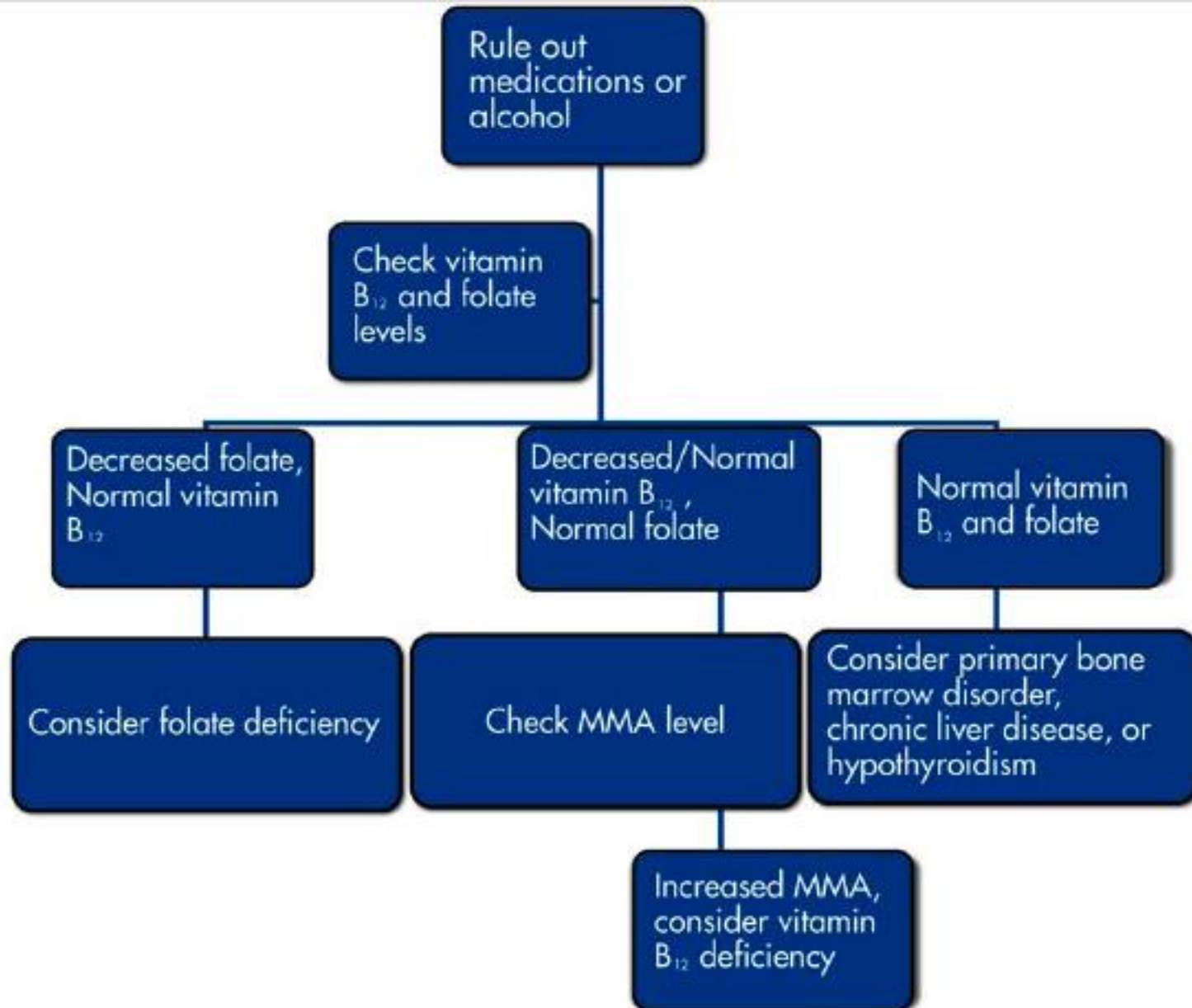
- 76歲男性,最近常有健忘和行走困難的情形,因為擔心有中風之情形,被家人送來門診,理學檢查發現,有眼瞼蒼白、黃疸及周邊神經病變,血液檢查如下:
- WBC 3200, RBC 2.22, Hb 8.5g/dL, Hct 27%, MCV 121fL, MCHC 31.5g/dL, RDW 18%, PLT 115K, Ret 1.8%

1. 哪些數值有異常?如何分析?
2. 還有什麼病史想詢問
3. 進一步想做什麼檢查?

# Peripheral blood smear



# D/Dx



# Neurological

- Subacute degeneration of post columns
  - Symmetrical neuropathy
    - Parasthesia, ataxia, loss of vibration & position sense
    - Lhermitte syndrome
  - Central neuro symptoms
    - Progress to severe weakness, incontinence
    - Memory loss, dementia

# Case 2

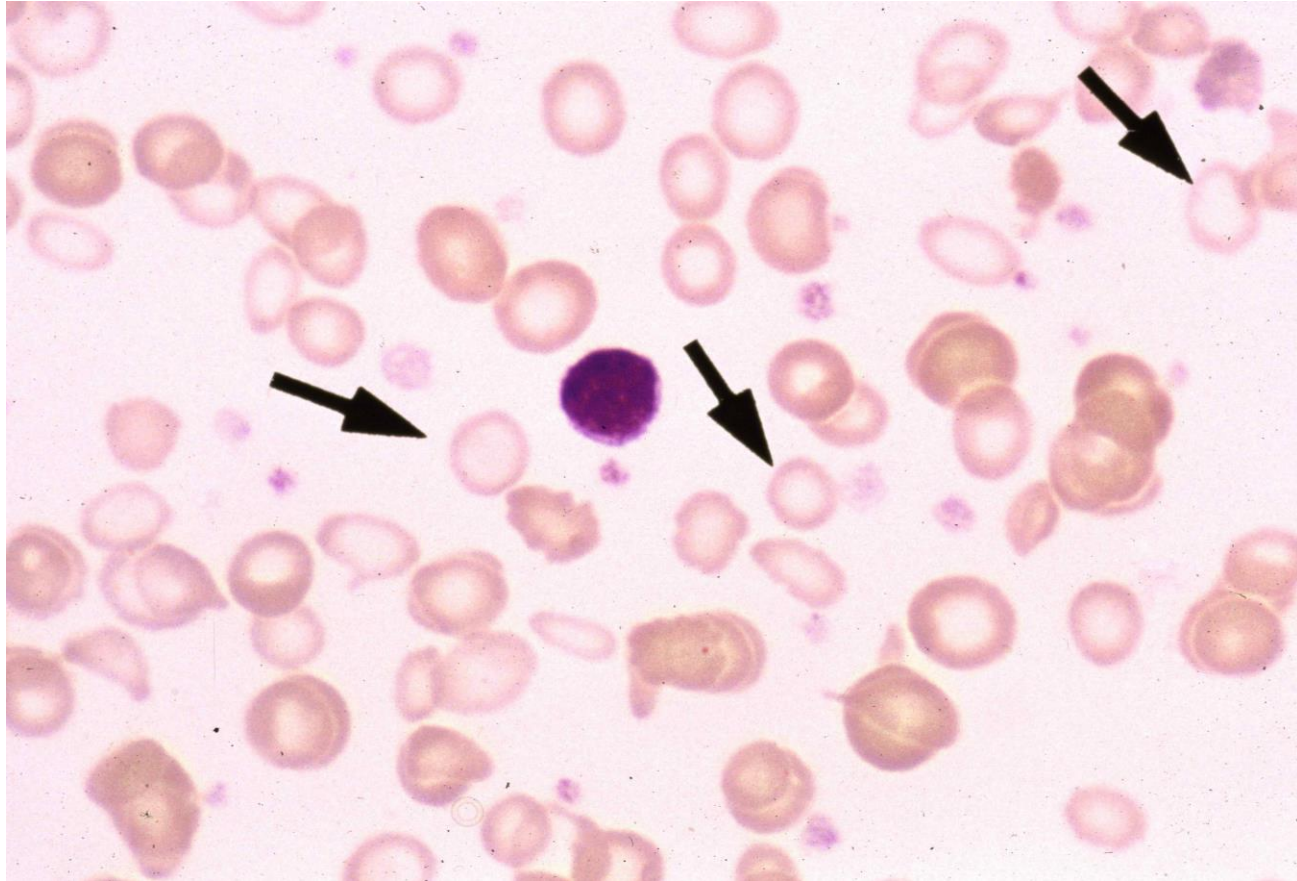
- 病歷號碼:60379206 性別/出生日期:F/1982/09/22(25.014)
- 病患來源:急診 病床號:- 採檢日期 時間:2007/09/27 15:23

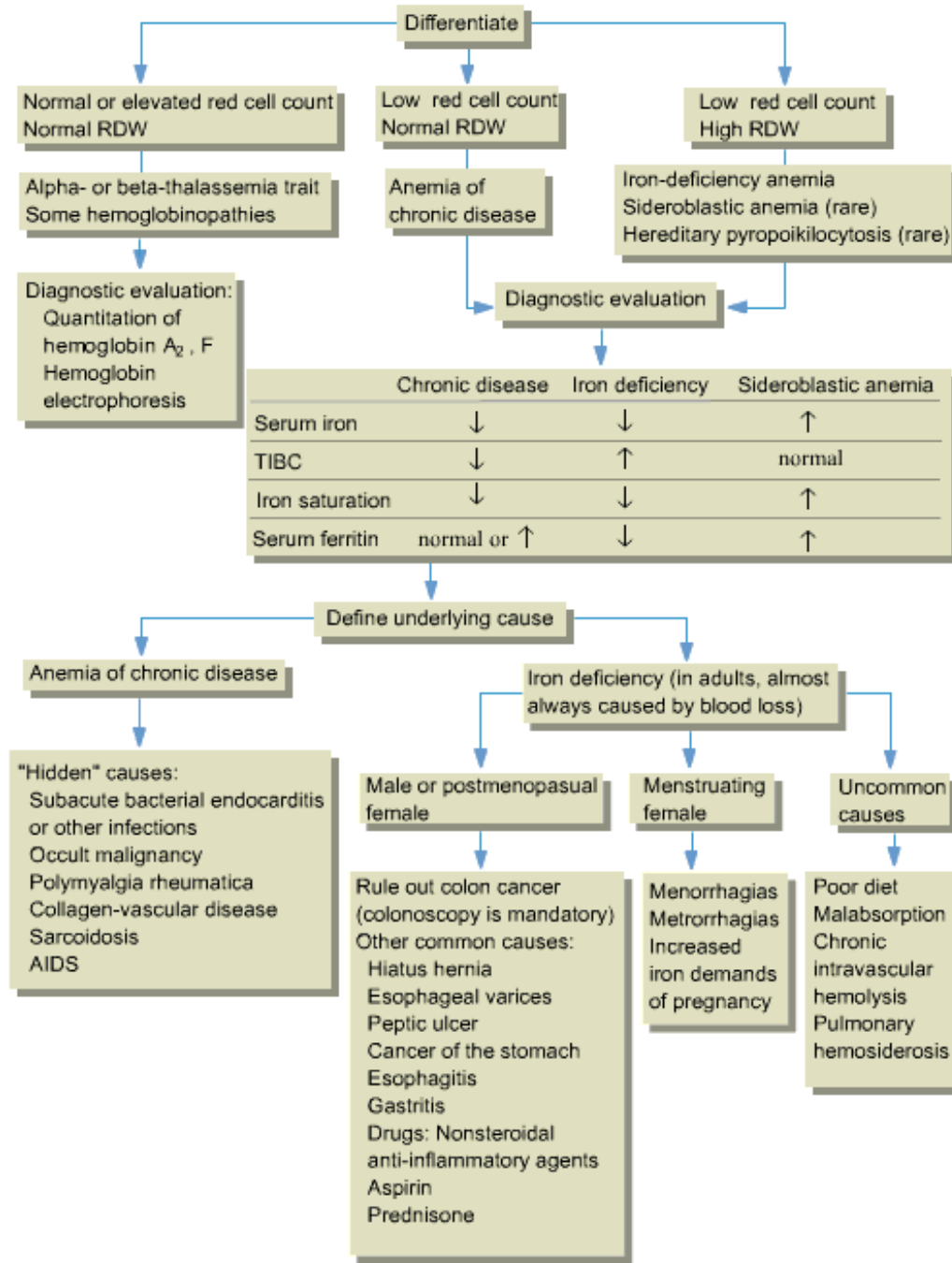
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檢驗項目	檢驗值	單位	H/L	參考值	改
• WBC	10.7	1000/CMM		M3.9-10.6 F3.5-11	
• RBC	3.84	MILION/CMM	L	M4.5-5.9 F4.0-5.2	
• HGB	7.6	<u>g/dL</u>	L	M13.5-17.5 F12-16	
• HCT	25.7	%	L	M41-53 F36-46	
• MCV	66.9	FL	L	80-100	
• MCH	19.8	pg/Cell	L	26-34	
• MCHC	29.6	<u>g/dL</u>	L	31-37	
• RDW-SD	46.4	%	H	38-45	
• PLATELET	371	1000/CMM		150-400	
• RDW-CV	19.1	%	H	11.0-14.0	
• SEGMENT	82.5	%	H	42-74	
• LYMPHOCYTE	11.7	%	L	20-56	
• MONOCYTE	5.6	%			
• EOSINOPHIL	0.1	%			
• BASOPHIL	0.1	%			

1. 哪些數值有異常?如何分析?
2. 還有什麼病史想詢問
3. 進一步想做什麼檢查?

# Peripheral blood smear







# Diagnosis of Microcytic Anemia

Tests	IDA	ACD	Thalassemia	Sideroblastic anemia
Smear	Micro/hypo	Normo/micro hypo	Micro/hypo with targeting	Variable
Serum iron	<30	<50	Normal ~High	Normal ~High
TIBC	>360	<300	Normal	Normal
Iron saturation	<10%	10~20%	30~80%	30~80%
Ferritin	<15	30~200	50~300	50~300
Hb EP	Normal	Normal	Abnormal	Normal

# Management of IDA

## 1. Seek and correct the underlying causes of iron deficiency

**Intake & absorption:** vegetarian, heavy tea-drinking, post-gastrectomy,

**G-I bleeding:** gastric ulcer, duodenal ulcer, angiodysplasia, hemorrhoid, parasites, malignancies,

**Menorrhagia or metrorrhagia:** uterine myoma, vWD, thrombocytopenia

# Management of IDA

## 2. Treatment:

Iron Requirement = (desired Hb – Patient Hb) × 2.4 × BW (kg)  
+ 500 ~ 1000 mg (for storage pool)

### Oral iron

- 100-200 mg iron daily, best ac
  - Hematonic (Fe<sup>2+</sup>) 50mg/tab
  - Ferrum (Fe<sup>3+</sup>) 100mg/tab
- Till target Hb
- Extra 3-6 months for storage iron

### Parenteral iron

- inability to tolerate oral iron
- iron malabsorption
  - Atofen (Fe<sup>3+</sup>) 40mg/amp
- Side effect: headache; dyspnea; flushing; chest, abdominal, or back pain; nausea and vomiting; fever; hypotension; seizures; urticaria; and 0.6% anaphylaxis
- Test dose: 10~25 mg

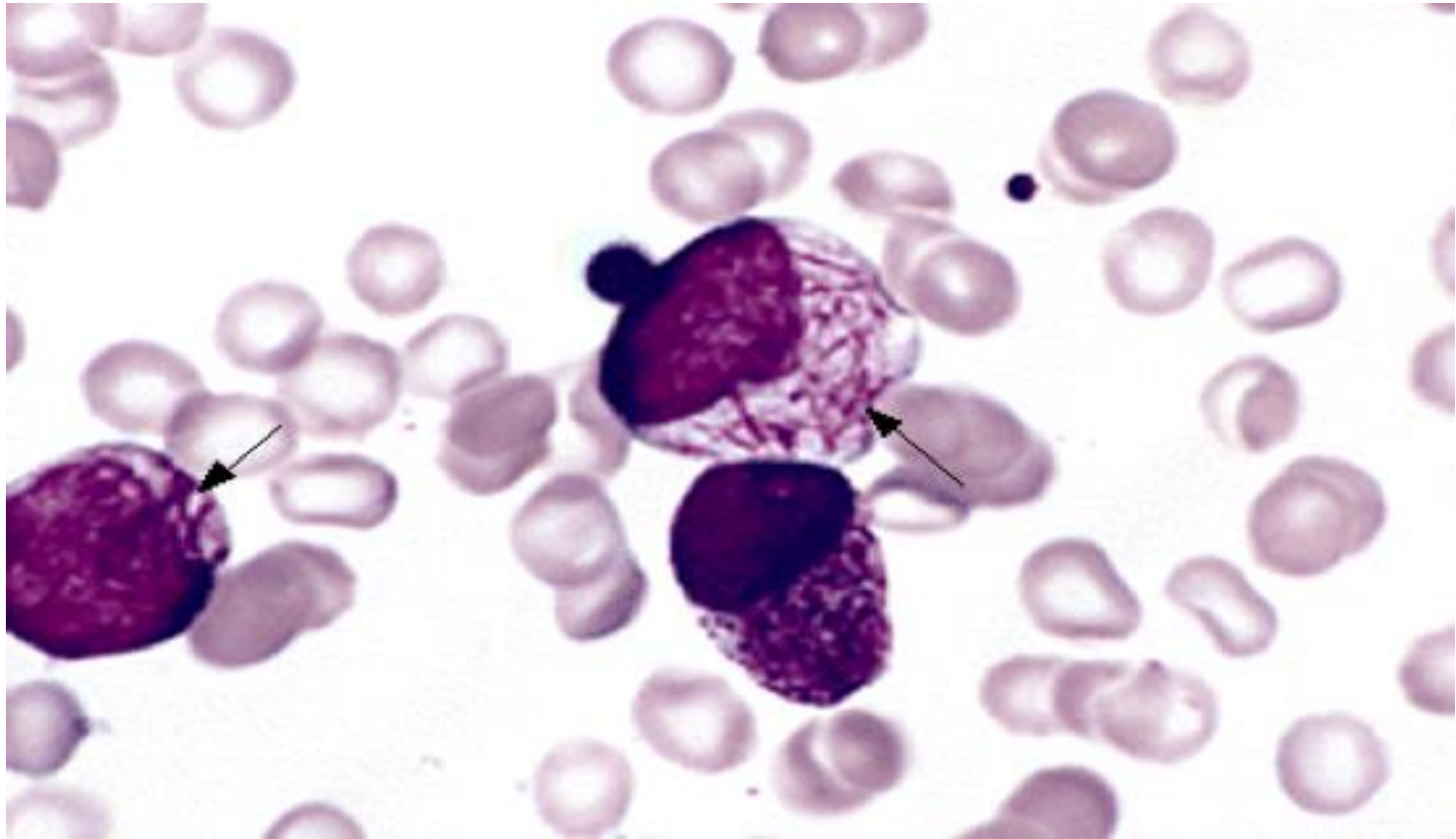
# Case 3

- 51 y/o female
- Easy bruising and gum bleeding noted
- Easy fatigue and dizziness

CBC-I		
WBC	H 17.87	10 <sup>3</sup> /uL
RBC	1.69	10 <sup>6</sup> /uL
Hb	L 5.5	g/dL
HCT	L 17.1	%
MCV	H 101.2	fL
MCH	32.5	pg
MCHC	32.2	g/dL
RDW-SD	70.1	/ul
RDW-cv	19.9	/ul
Platelet	L 19	10 <sup>3</sup> /uL
PDW	10.0	/ul
MPV	9.9	/ul
P-LCR	24.2	%
DC		
HEMA NO.	9	
Young cells	5.0	%
Blast	38.0	%
Myelocytes	6.0	%
Metamyelocytes	2.0	%
Neutrophil	L 32.0	%
Lymphocyte	L 17.0	%
Monocyte	L 0.0	%
Eosinophil	0.0	%
Basophil	0.0	%
Platelet Count	100	
Neutrophil Count	H 1.68	%

1. 哪些數值有異常?如何分析?
2. 還有什麼病史想詢問
3. 進一步想做什麼檢查?

# Peripheral blood smear



# Clinical Manifestations

## Bone marrow failure

- **Thrombocytopenia** → Petechiae, ecchymosis, epistaxis, gingival oozing
- **Neutropenia** → Fever, infection
- **Anemia** → Fatigue, pallor, tachycardia

## Tissue infiltration

- Splenomegaly ~ 50% (modest)
- Extramedullary (chloroma/ granulocytic sarcoma)
- Diffuse bone pain (usually flat bone) ~25%
- Skin nodules and plaques (leukemia cutis) ~ 10%

**Acute leukemia requires >20% clonal blasts in the bone marrow.**

# Treatment of AML

## 2 phases:

- **Induction therapy**

(Standard “7+3”, Ara-C x7days + Daunorubicin/  
Idarubicin x 3 days)

- **Post-remission / consolidation therapy**

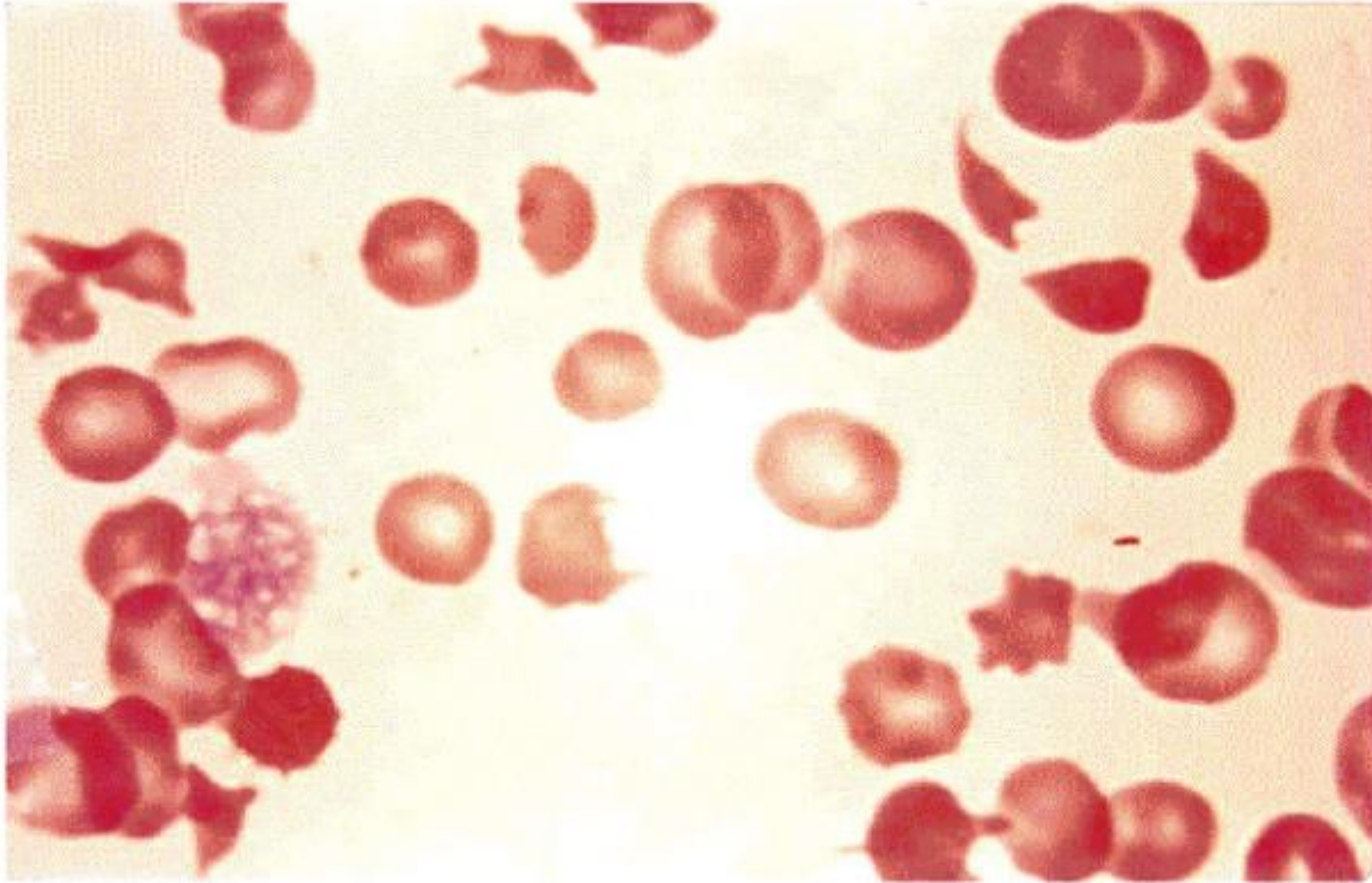
# Case 4

1. 哪些數值有異常?如何分析?
2. 還有什麼病史想詢問
3. 進一步想做什麼檢查?

- 73 y/o male
- Chest tightness & SOB for 1 day
- He caught a common cold 2 weeks ago, and took herb drugs for treatment.
- PE: Vital signs: BT: 38.5 (x), PR: 100/min, RR: 20/min, BP: 130/90
- Consciousness: alert; Mentality: disoriented;
- No skin purpura
- CBC: Hb: 7.1, MCV: 93.5, WBC: 22280, N/L/M: 84/7/6  
Platelet: 31K; nRBC: 8%, Reticulocyte: 11.6%



# Peripheral blood smear



# Pentad of TTP

- Thrombocytopenia:
- Microangiopathic hemolytic anemia:
  - PB smear: fragmented RBC (schistocytes)
  - Evidence of intravascular hemolysis: Reticulocytosis, unconjugated hyperbilirubinemia, high LDH, hemoglobinemia, hemoglobinuria, low haptoglobin
- Renal function abnormalities
- Neurological disturbance
- Fever

# Treatment

- Plasmapheresis
- Immunosuppressive therapy
  - Glucocorticoid steroids
  - Vincristine
  - Cyclophosphamide
  - Splenectomy
  - Rituximab

# Take home message

- 請先初步分析CBC data,做進一步鑑別診斷,再行會診
- 輸液治療應在確定診斷後在給與,以免干擾診斷並有可能造成新的問題