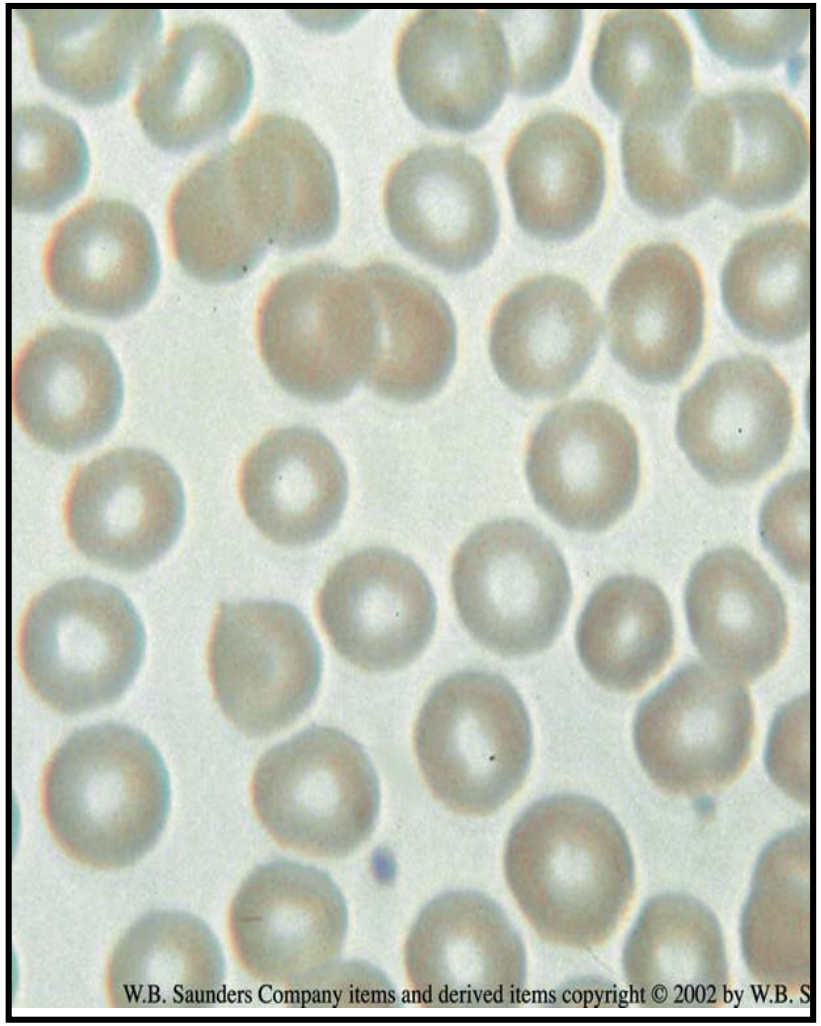
# ABC of CBC
# LA  AAP 2018

# Disclosure

- Nothing to disclose in relation to this talk

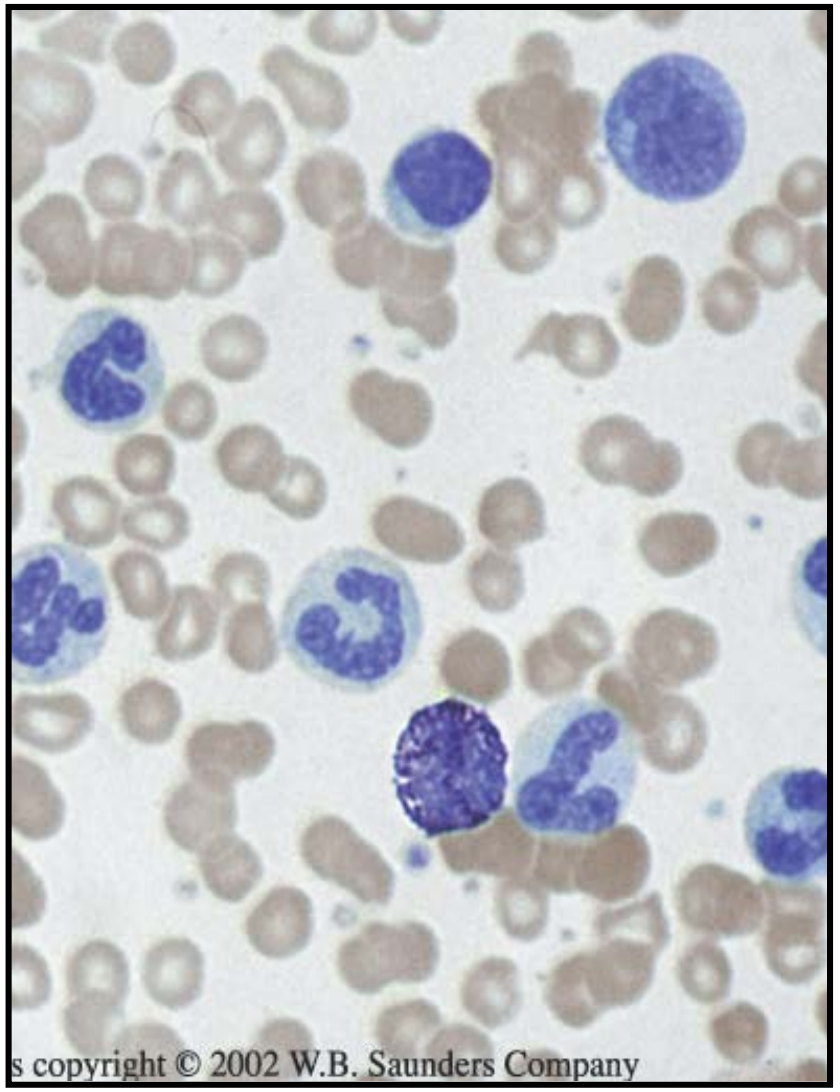
# Erythrocytes

- **Normal range 4.2-5.5 million per $mm^3$ in adults.**
- **Biconcave shape.**
- **Diameter 7 microns.**
- **Cells for transport of $O_2$ and $CO_2$.**
- **Life span 120 days.**



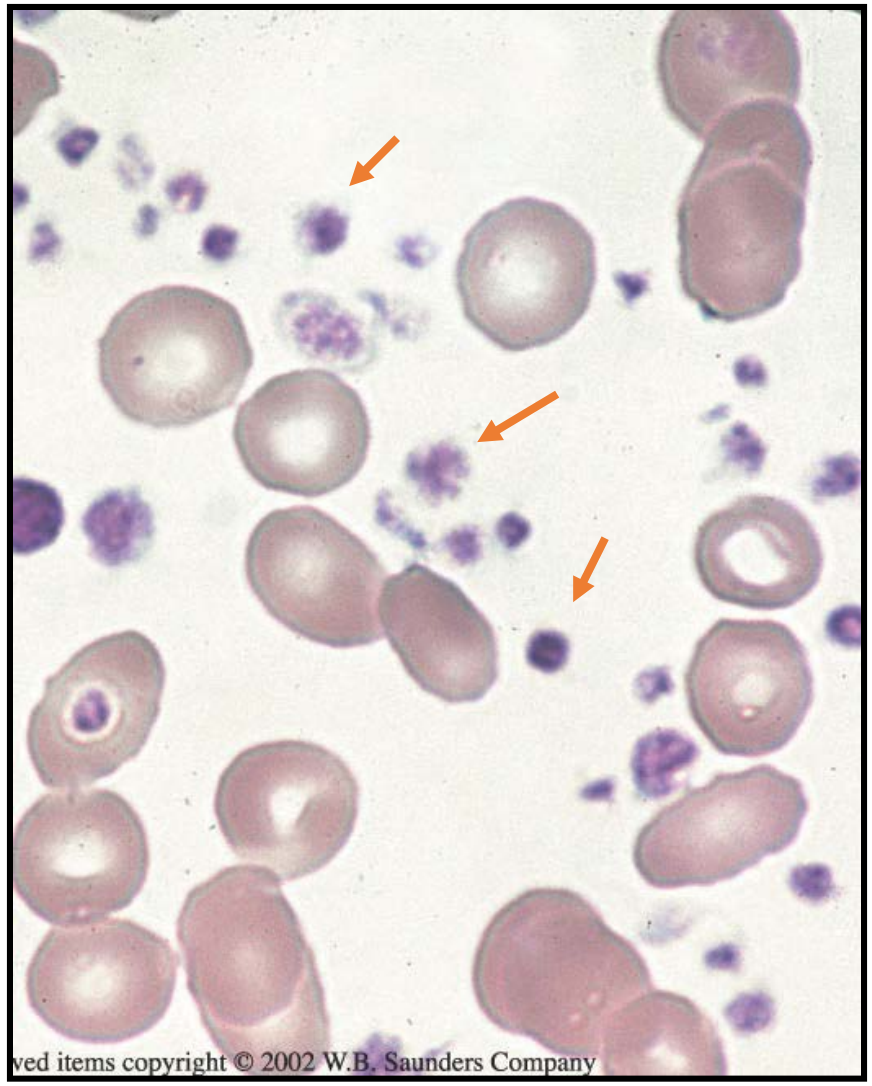
# Leukocytes

- **Normal range 4 - 11 thousand per $mm^3$ in adults.**
- **Five types.**
- **Size 8-20 microns.**
- **Involved in fighting infection, combating allergic reactions, and immune responses.**



# Thrombocytes

- **Smallest cells in the blood.**
- **Normal range 150,000-400,000.**
- **Active role in coagulation and hemostasis.**



# Routine Hematology

***Anticoagulant of choice: EDTA***

- **Complete Blood Counts (CBCs)**
- **Manual WBC Differentials**
- **Erythrocyte Sedimentation Rates (ESRs)**
- **Sickle Screens**
- **Reticulocyte Counts**

# Automated Counting

***Coulter Principle***

**Electrical impedance: resistance or change in current when cell passes between two electrodes in NaCl solution.**

***Flow Cytometry***

**Uses lasers to measure both forward and side scatter.**

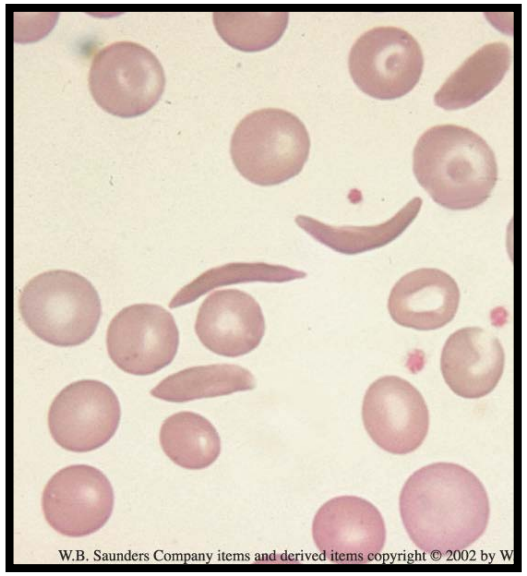
**Forward scatter measures size.**

**Side scatter measures granularity.**

# Sources of Error

- ***Inadequate mixing of specimen.***
- **Hemolyzed specimens.**
- **Lipemic specimens.**
- **Cold agglutinins.**
- **Clotted specimens.**
- **Platelet clumps or platelet satellitosis. - psuedotcytopenia**
- **Diluted specimens.**

# COMPONENTS OF COMPLETE BLOOD COUNT (CBC)

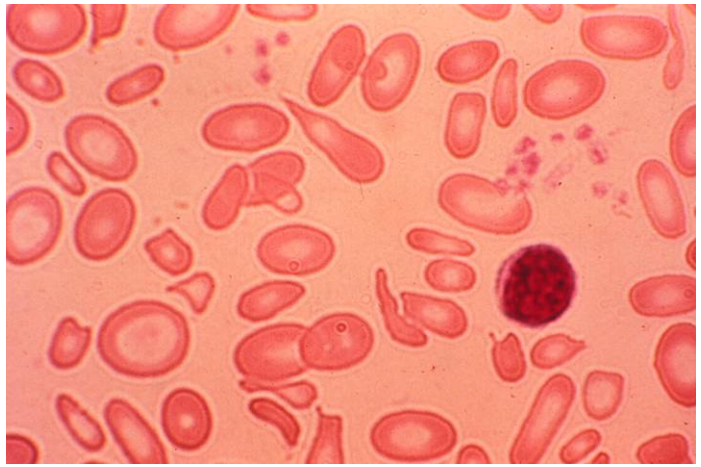



- Hemoglobin, Hematocrit
- RBC count
- Red blood cell indices
  - Mean Corpuscular Volume (MCV)
  - Mean Corpuscular Haemoglobin (MCH)
  - Mean Corpuscular Haemoglobin Concentration (MCHC)
- Red cell distribution width (RDW)
- Platelet count, MPV
- WBC – total & differential count (in %) and absolute counts of neutrophils, lymphocytes, eosinophils and basophils

# CBC Parameters

- RDW, MCV,MCHS ,Mentzer Index – normal values
- Automated cell count vs manual
- Flags for  abnormalities. – Lab initiated
- Absolute retic count
- Smear – based on clinical picture or results of CBC ,less than 10% of cases , cost
- Age, sex, clinical course

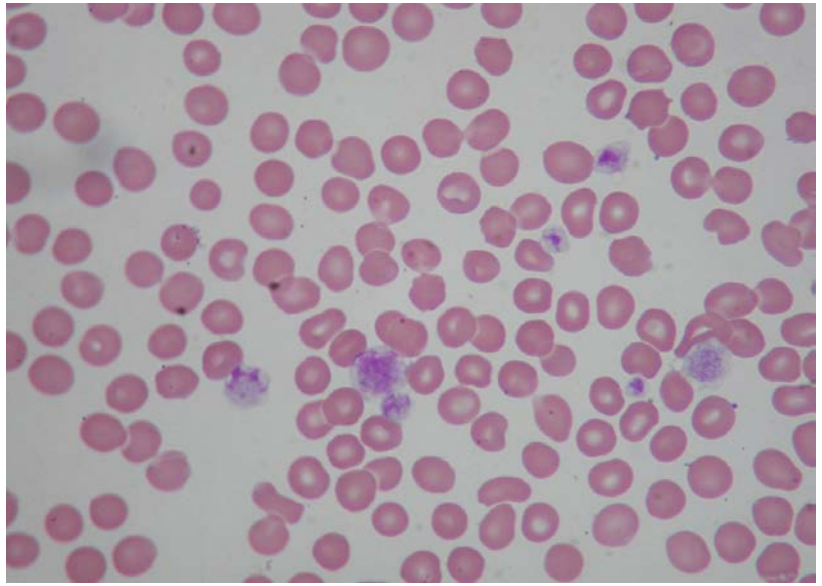
# Well known



- Hb/Hct , MCV ,MCHC
- RDW  - iron def vs Thal minor
- Mentzer Index – iron def vs Thal minor – MCV/ RBC
- Reflex testing

# Less well known

- IRF – immature reticulocyte fraction
- Absolute retic count
- Reticulocye Hb %
- MPV , Large plts, Giant plts, small plts
- PDW , Immature platelet fraction



# Reticulocyte Count

***Uses supravital stain which stains cells in the living state.***

**Macrocytic, polychromic cells in smear**

**Retic %**

**Corrected retic**

**Absolute reticulocyte**

**Reticulocyte Index( RPI)- above 3**

**Immature reticulocyte fraction**

**Reticulocyte Hb**

# Immature Reticulocyte Fraction (IRF)

- Proportion of young reticulocytes with the highest RNA content
- In many clinical situations, IRF increases before the total reticulocyte count
  - bone marrow or stem cell regeneration post-transplant or chemotherapy
  - monitoring the efficacy of therapy in nutritional anemia
  - evaluate optimal timing for stem cell collection following mobilization

# Fragmented Red Cells (Schistocytes)

Seen in

- microangiopathies (eg, TTP,HUS ,DIC)
- cardiovascular disorders (eg, prosthetic valve – wearing blender and endocarditis)

- Serial counting in TTP may correlate with changes in serum LDH levels
- normal reference range for the schistocyte count is as 0.03–0.58%

# Functional Iron Deficiency (FID)

- iron stores are normal, or even high, but the iron is not delivered to the bone marrow and so is unavailable for erythropoiesis
- may be due to the inappropriate production of hepcidin
- Anemia of chronic disease , inefficicent iron utilization

# Reticulocyte haemoglobin(CHr)

- Indirect measure of functional iron available for new red blood cell production over the previous 3–4 days
  - Measures functional iron deficiency state (if CHR is less and iron stores are normal)
  - an early measure of the response to iron therapy, (CHR increases within 2–4 days initiating iron  therapy)
- reference values – 28 - 30.8 pg

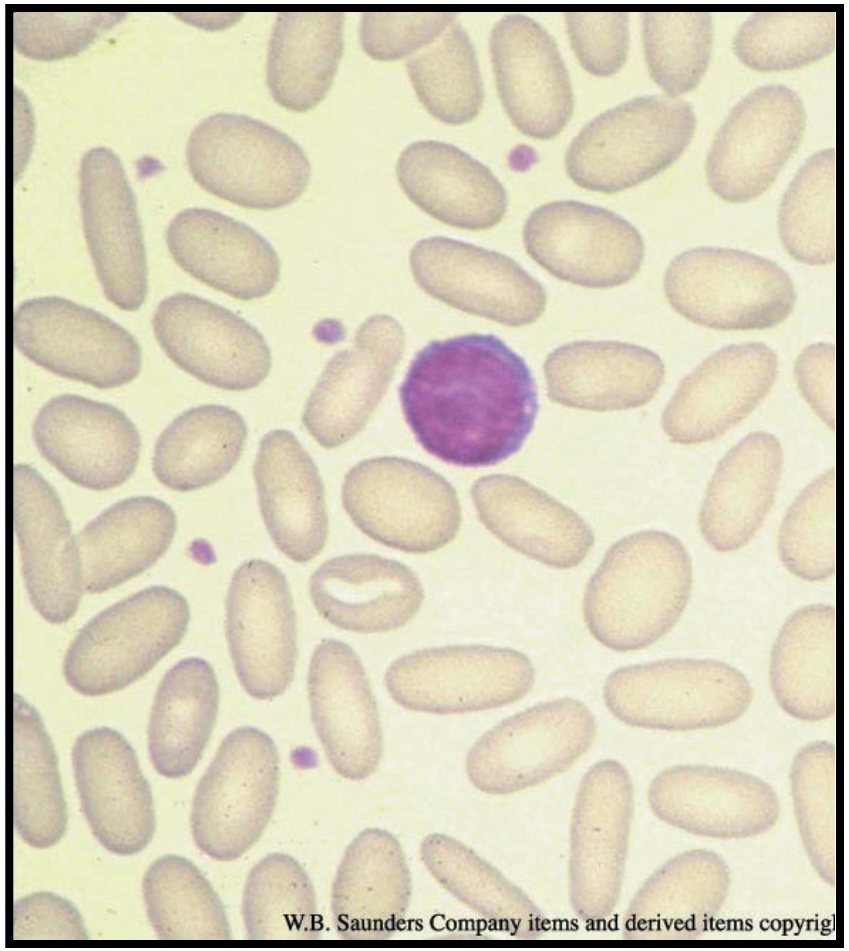
# Immature Granulocytes (IG)

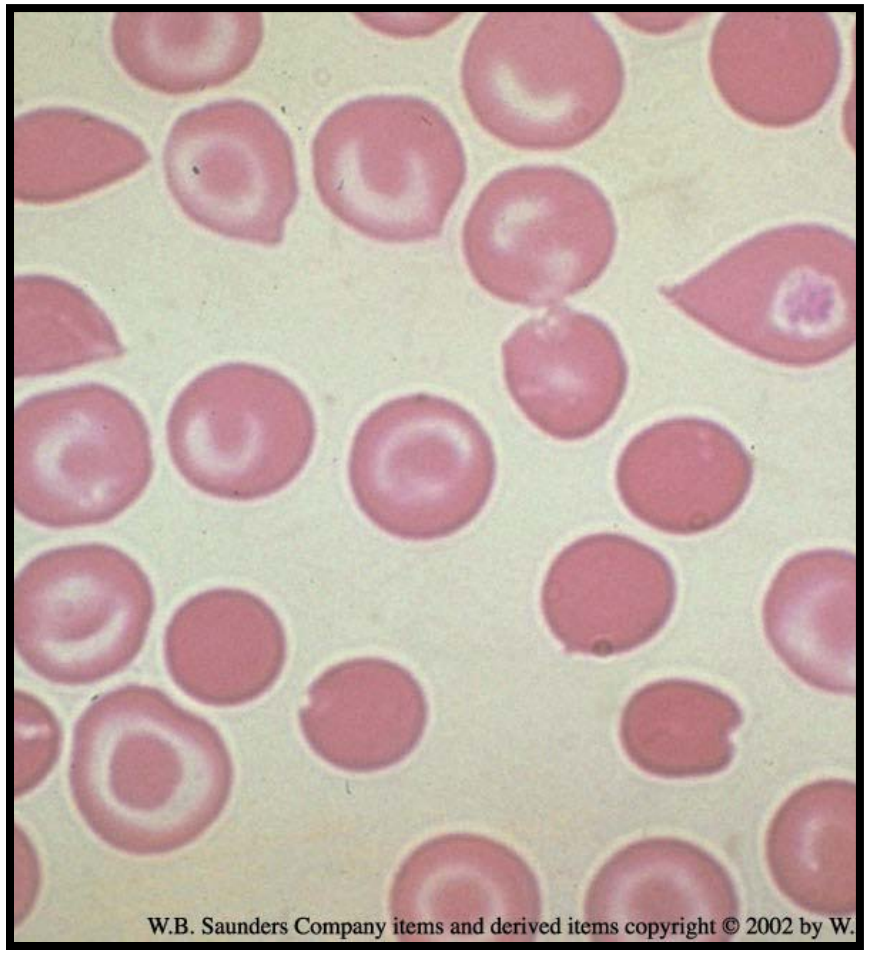
- Analogous to “band” cells → useful for the diagnosis of infections, especially neonatal sepsis
- IGs - normally absent in peripheral blood
- Increased in
  - Bacterial infections
  - Acute inflammatory diseases,
  - Acute transplant rejection,
  - Surgical and orthopedic trauma,
  - Myeloproliferative diseases,
  - Steroid use

# Age Specific Indices

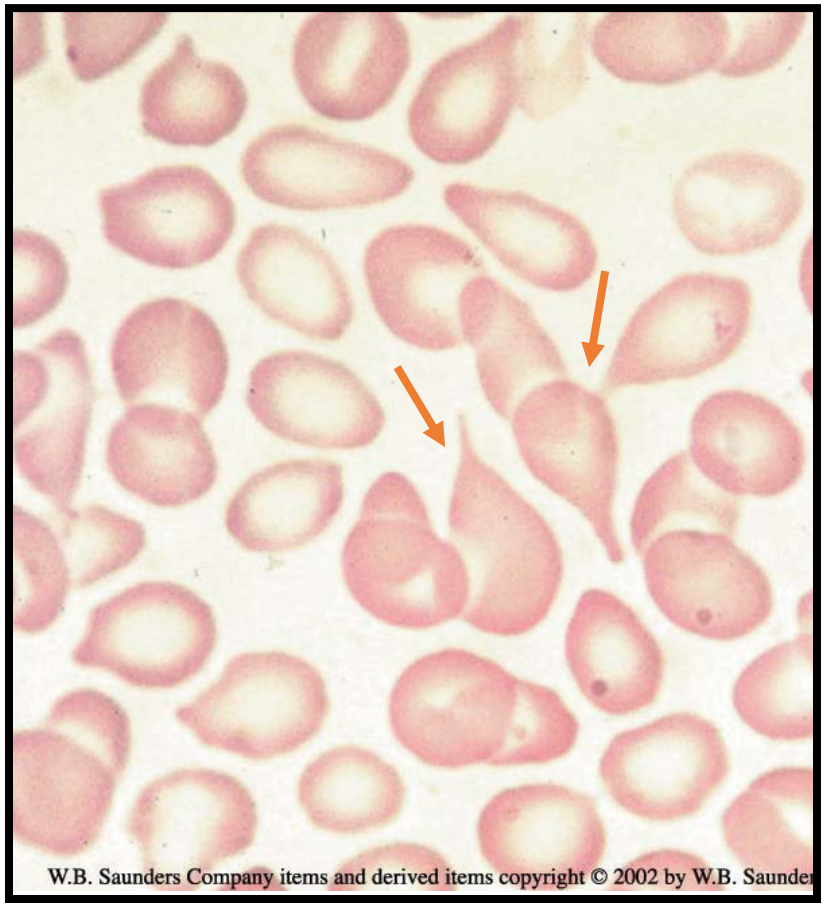
| | Hgb | Hct | MCV | MCHC | Retic | WBC/mm$^3$ | Plt |
|---|---|---|---|---|---|---|---|
| Term | 16.5 | 51 | 108 | 33.0 | 3-7 | 18.1 | 290 |
| 1-3 days | 18.5 | 56 | 108 | 33.0 | 1.8-4.6 | 18.9 | 192 |
| 2 wks | 16.6 | 53 | 105 | 31.4 | | 11.4 | 252 |
| 1 month | 13.9 | 44 | 101 | 31.8 | 0.1-1.7 | 10.8 | |
| 2 months | 11.2 | 35 | 95 | 31.8 | | | |
| 6 months | 12.6 | 36 | 76 | 35.0 | 0.7-2.3 | 11.9 | |
| 6 mo-2 yr | 12.0 | 36 | 78 | 33.0 | | 10.6 | 150-350 |
| 2-6 yrs | 12.5 | 37 | 81 | 34 | 0.5-1.0 | 8.5 | 150-350 |
| 6-12 yrs | 13.5 | 40 | 86 | 34 | 0.5-1.0 | 8.1 | 150-350 |

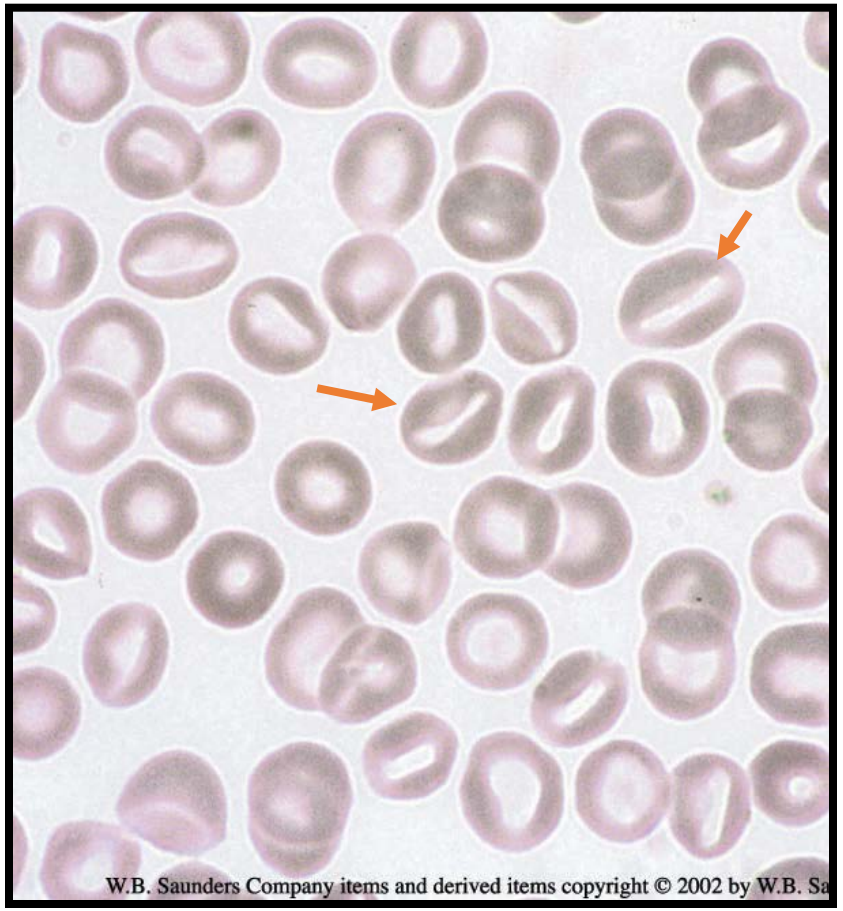
# Elliptocytes Target Cells



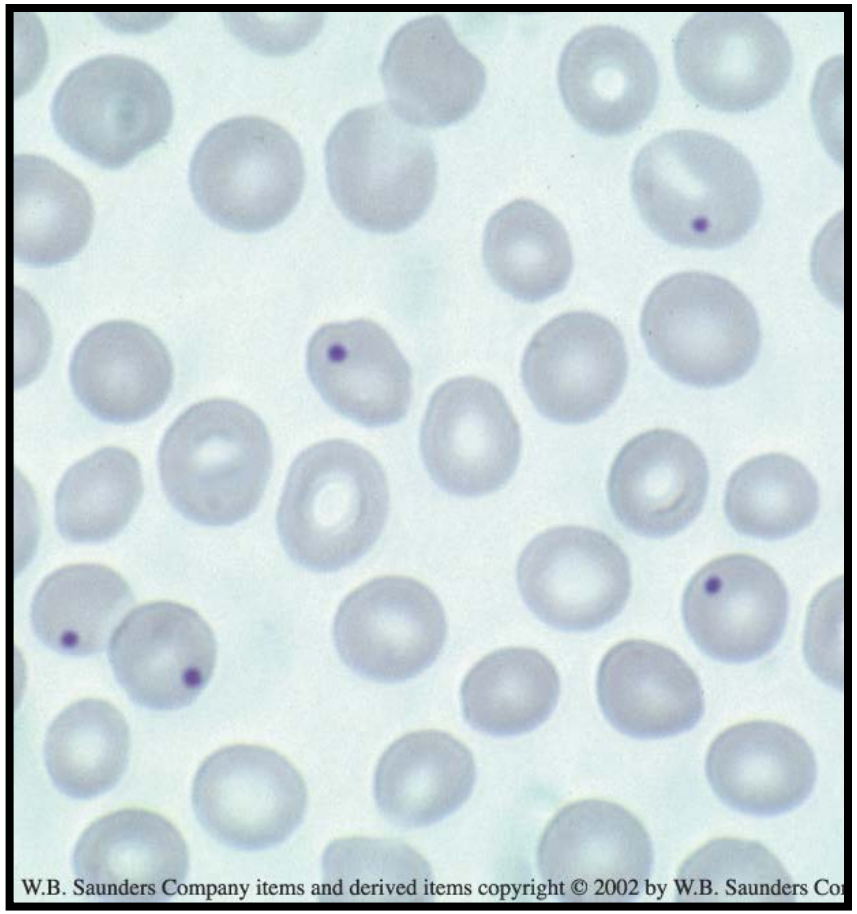
# Tear Drops Stomatocytes



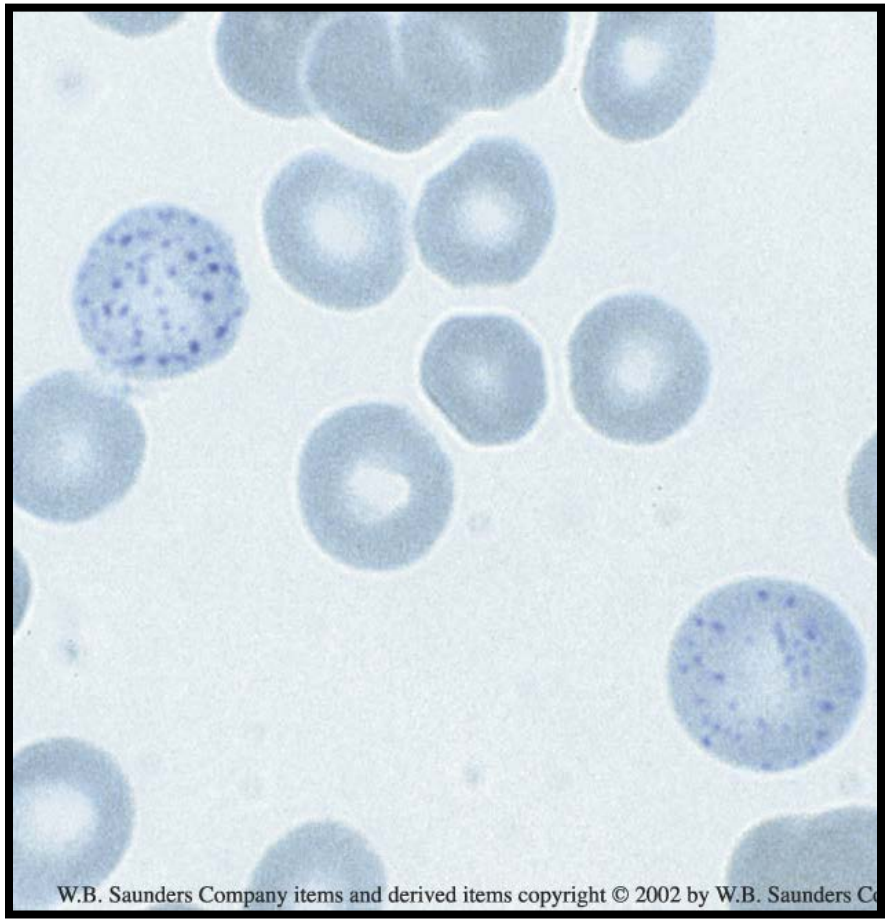
# Howell-Jolly Bodies

- **Round, purple inclusions in RBCs.**
- **Composed of DNA.**
- **Commonly seen in in patients with hypofunctioning spleens.**
- **Splenectomy.**



# Basophilic Stippling

- **Numerous, small purple inclusions in RBCs.**
- **Aggregates of ribosomal RNA.**
- **Most commonly seen in lead poisoning.**



# Classifications of Anemias

***Microcytic, Hypochromic***

- **Iron deficiency- RDW, Mentzer Index**
- **Thal Minor**
- **Chronic disease, Inflammation**
- **Lead poisoning**
- **Sideroblasti anemia , Cu def**

**Iron, TIBC, Transferrin , Ferritin**

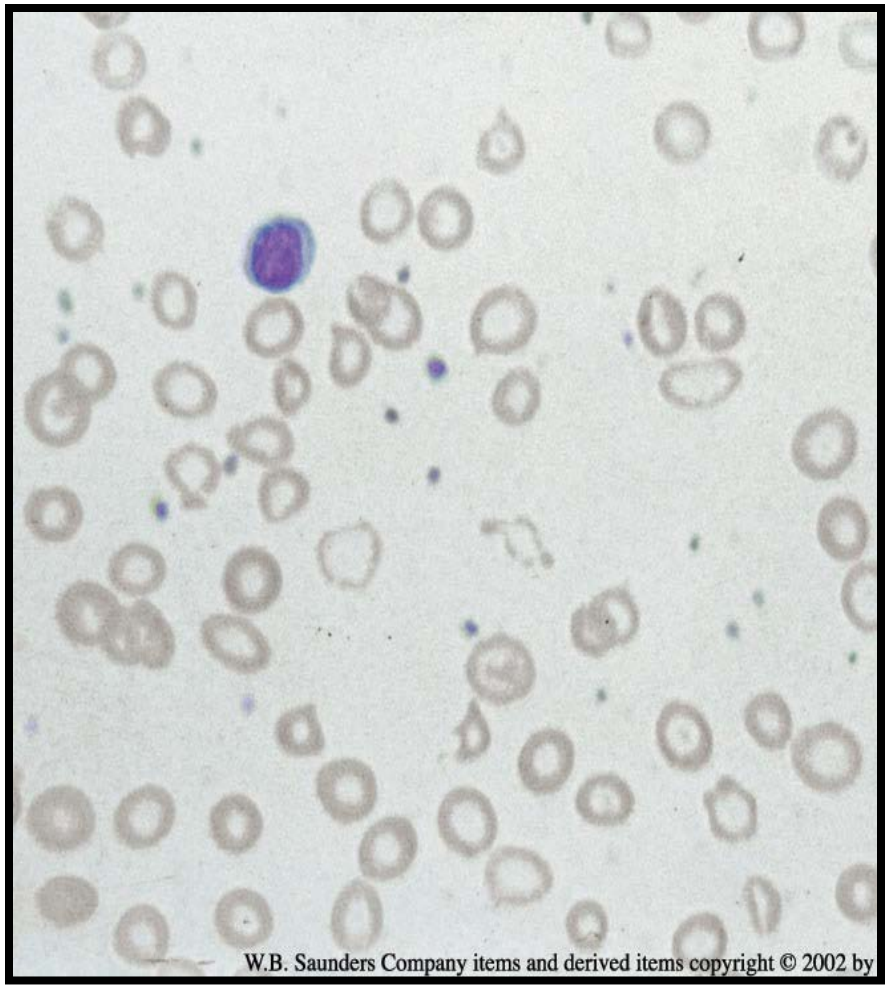
- **Soluble transferring receptor**
- **Str / Ferritin ratio , Bone marrow**
- **Hypochromic Macrocytes!**

# Microcytic, Hypochromic

- **Many RBCs smaller than**

  **nucleus of normal**

  **lymphocytes, increased central pallor.**
- **Iron deficiency, thalassemias, anemia of chronic disease.**



# Classifications of Anemias

***Normochromic – poly chromasia /retic > vs low retic***

- **Hereditary Spherocytosis**
- **Hereditary Elliptocytosis**
- **PNH**
- **G6PD deficiency**

**Low retic**

- **Aplastic anemia, Leukemia**
- **Acute blood loss**
- **TEC – 17 month old ,Low Hb, Normal MCV**
- **Diamond Blackfan ( stress erythropoeisis- macrocytosis)**

# Classifications of Anemias

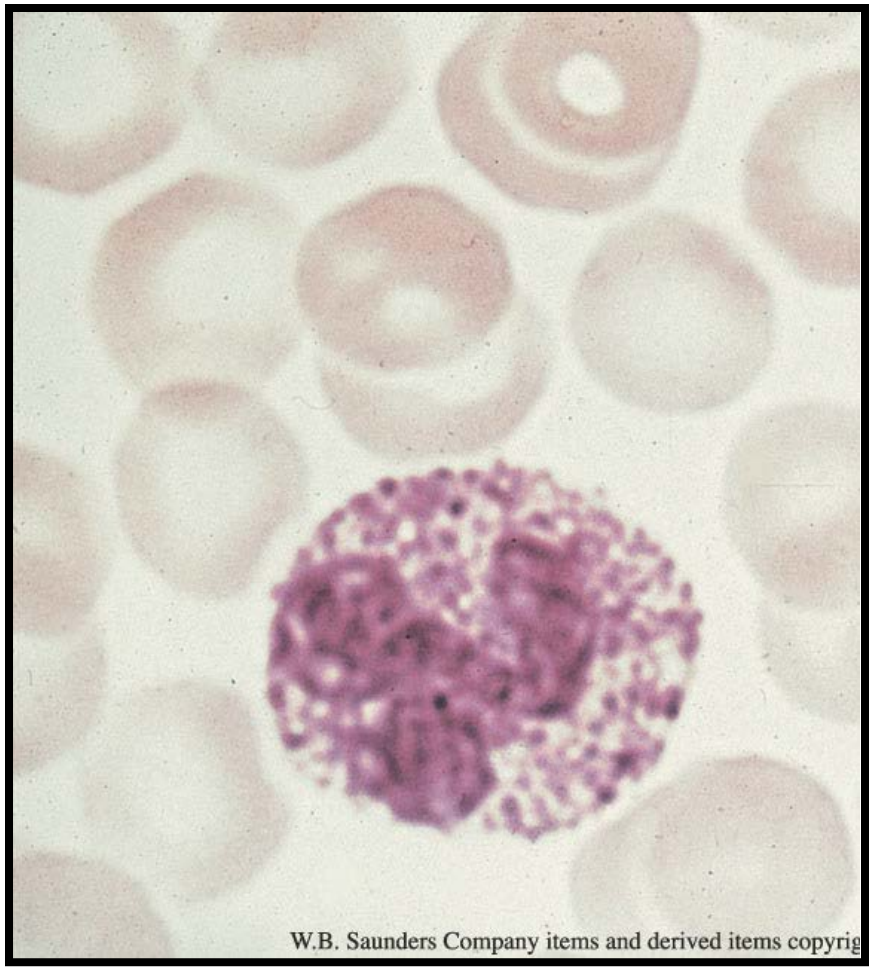
***Macrocytic***

- **Vitamin B12 deficiency**
- **Folate deficiency**
- **Liver disease**
- **Alcholism**
- ***Hypochromic Macrocytes***

# *Toxic Granulation*

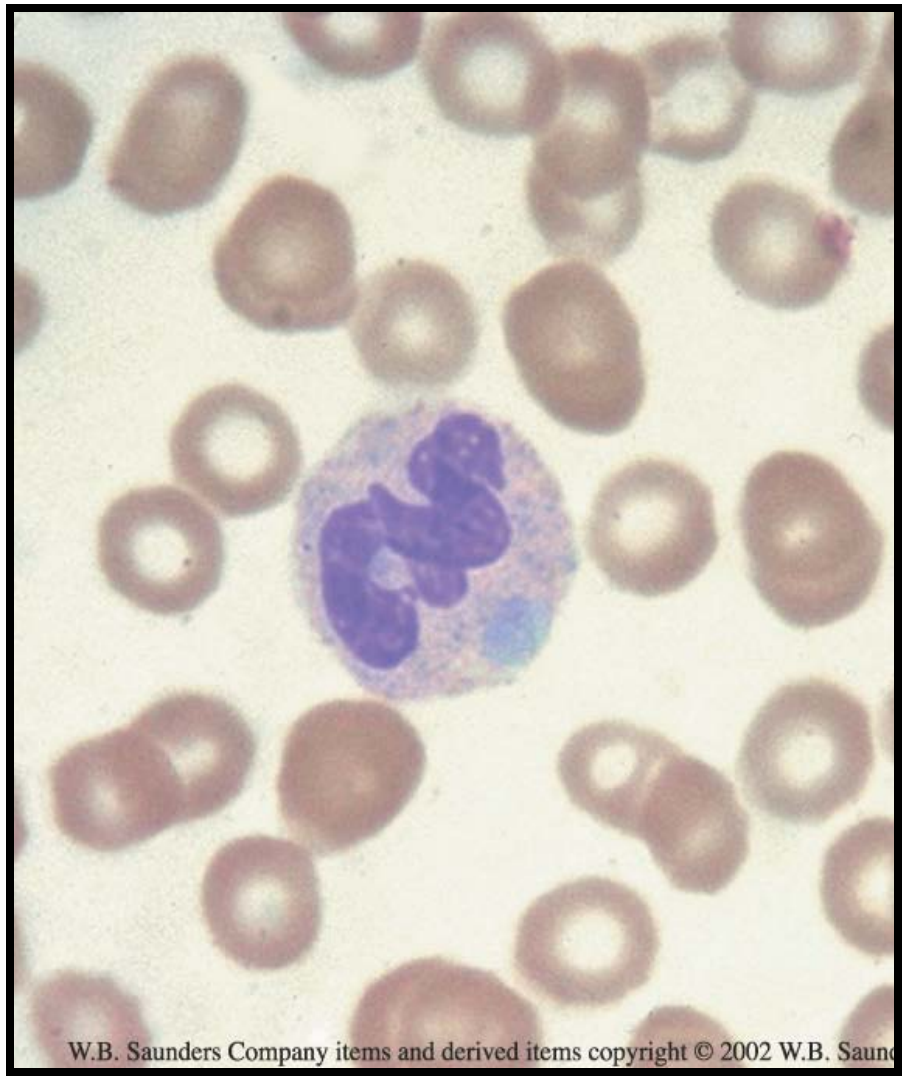
- **Increased basophilic granules**

  **in neutrophils.**
- **Seen in severe infections, burns, malignancies, and pregnancy.**
- **Distinguish from basophils.**

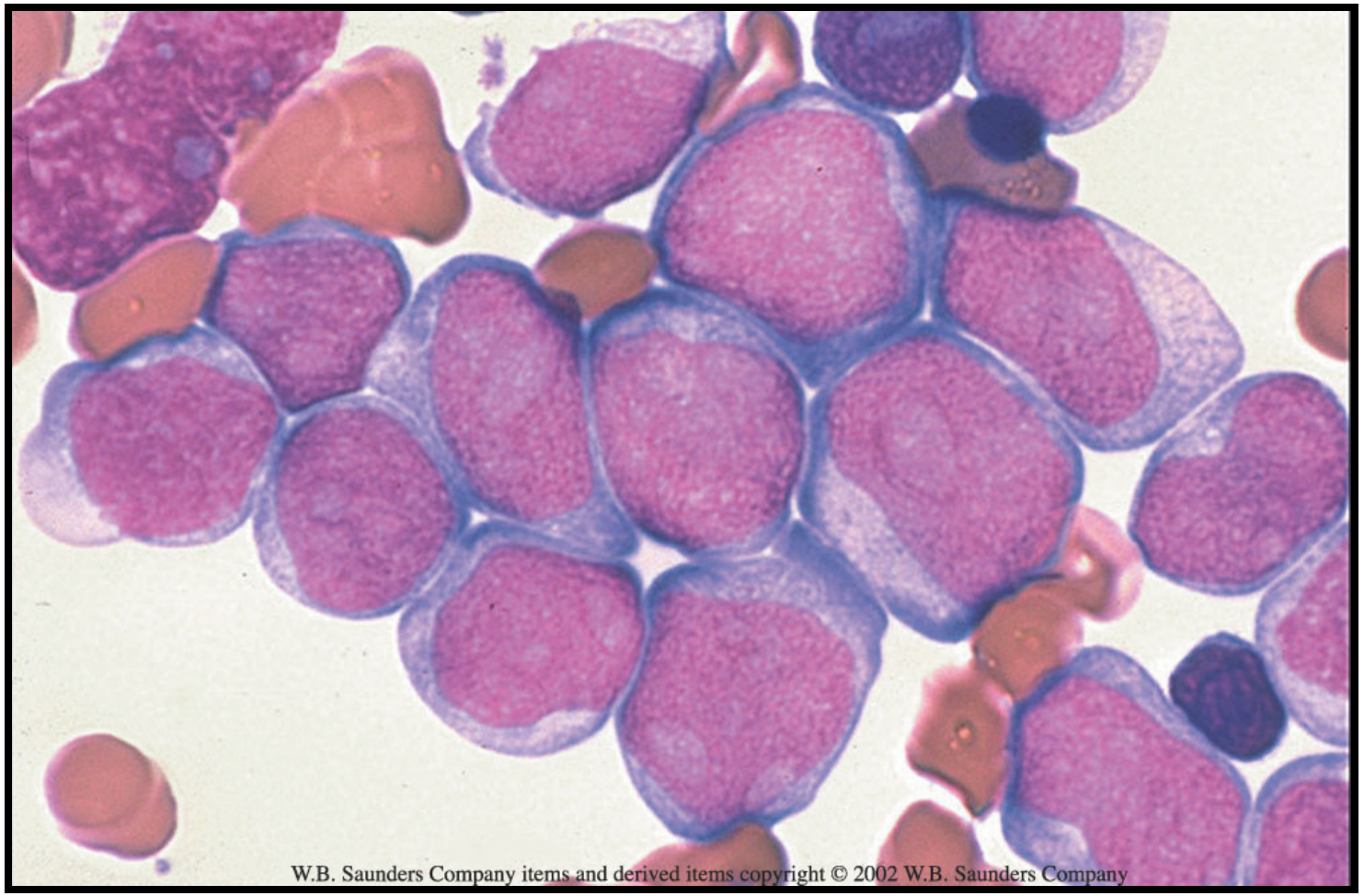


# *Dohle Bodies*

- **Sky blue inclusions in cytoplasm of neutrophils.**
- **Seen in infections, burns, myleproliferative disorders, and pregnancy.**
- **Composed of RER and glycogen granules.**



# WHO dat FAB


W.B. Saunders Company items and derived items copyright © 2002 W.B. Saunders Company

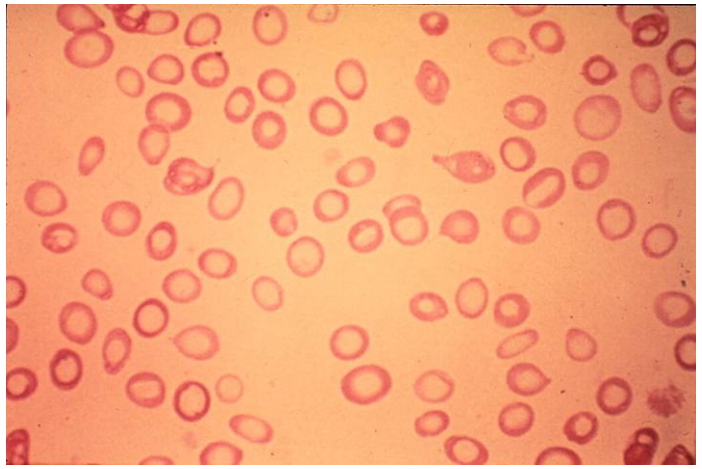
# CASE 1

A 9 months old girl, exclusively breast fed,  pallor.

| Parameter | Report |
|---|---|
| Hb | 6.4 g% |
| TLC | 6600 |
| DLC | N40, L50, E6,M4 |
| Platelet count | 5.5 0000/cu.mm |
| MCV | 57 |
| MCH | 20.4 |
| MCHC | 30.1 |
| RBC count | 2.14 million/cu.mm. |
| RDW-CV | 22.4 |

# Anemia in an infant

- 8 month old white male ,born preemie
- Drinks cow's milk since 4 months when he was weaned from breast milk
- Hb 7.2 gms, MCV 62 RBC 3.1 RDW 21
- Heiner's Syndrome
- Pagophagia in Older - ice



# Case – 1: Answers

1. Identify the diagnosis

   Iron deficiency anemia

2. Explain how did you arrive at the diagnosis.

   low Hb

   microcytic hypochromic picture

   RBC count decreased

   RDW – increased

   Mentzer index – 26 (i.e. >13)

   platelet count increased

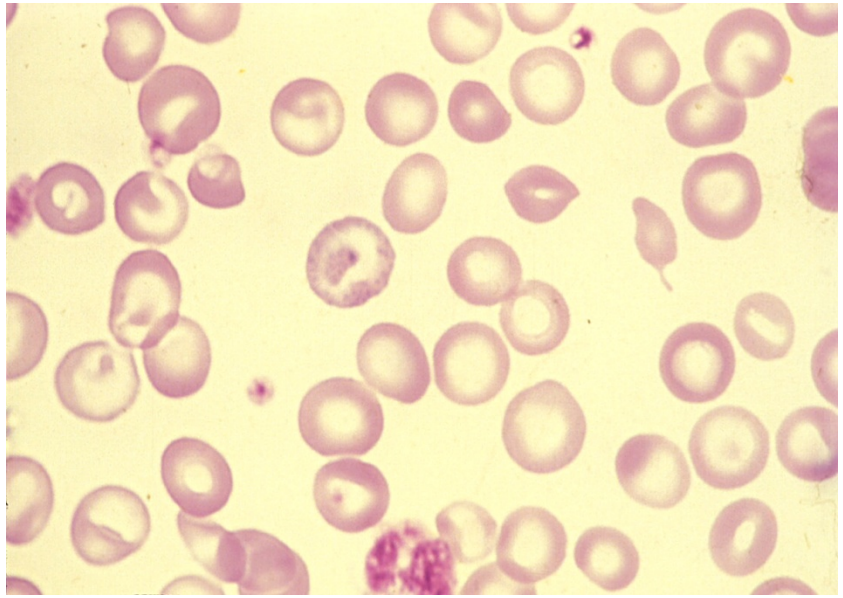
# CASE 2

A 5 year old girl with mild pallor.

| Parameter | Report |
|---|---|
| Hb | 9.4 g% |
| TLC | 7600 |
| DLC | N62, L32, E3,M3 |
| Platelet count | 350000/cu.mm |
| MCV | 60 |
| MCH | 19.4 |
| MCHC | 32.1 |
| RBC count | 6.14 million/cu.mm. |
| RDW-CV | 13.5 |

# Thalassemia Minor (β or α)

- Basophilic stippling
- Target cells
- Hb electrophoresis: ↑ A2 in β Thal minor
- Beta – Italians, Asian Indians
- Alpha – Far East, African Americans



# Case – 2: Answers

1. Identify the diagnosis

   Thalassemia trait

2. Explain how did you arrive at the diagnosis.

   microcytic hypochromic picture

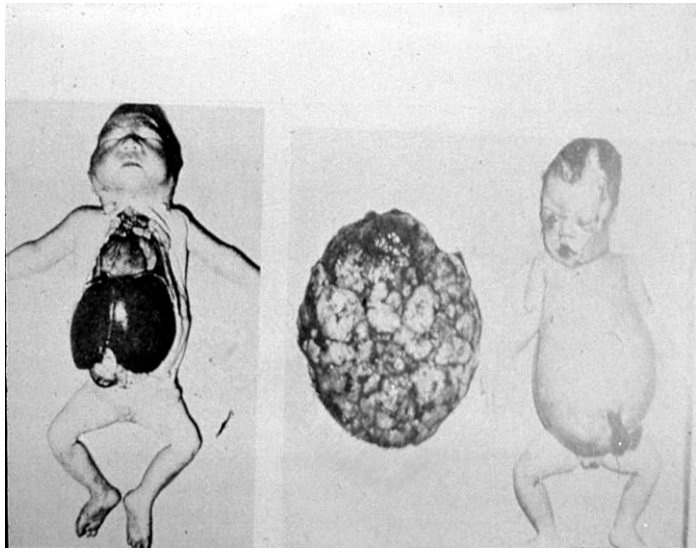
   RBC count increased

   RDW – normal

   Mentzer index – 9.8 (i.e. <13)

| PARAMETER | IRON DEFICIENCY ANEMIA | THALASSEMIA TRAIT |
|---|---|---|
| Severity of anemia | *Variable (mild to severe)* | *Always mild* |
| Red cell distribution width (RDW) | *Increased (>14.5%)* | *Normal* |
| RBC count | *Decreased* | *Normal to increased* |
| Platelet count | *Normal / increased* | *Normal* |
| Mentzer index (MCV/RBC count in million) | *> 13* | *< 13* |
| S. Ferritin | *Decreased (<15 ug/L)* | *Normal* |
| S. Iron | *Decreased* | *Normal* |
| Total iron binding capacity | *Increased* | *Normal* |
| Transferrin receptor | *Increased* | *Normal* |
| Transferrin saturation | *Decreased* | *Normal* |
| Free erythrocyte protoporphyrin | *Increased* | *Normal* |
| HPLC | *Normal* | *Hb A2 increased; F normal* |
| Bone marrow iron stores | *Absent* | *Normal* |
| Response to iron therapy | *Subjective improvement, reticulocytosis followed by rise in hemoglobin* | *No response* |

# Target cells, stippling, crystals! – alpha thal, Hb E, Hb CC

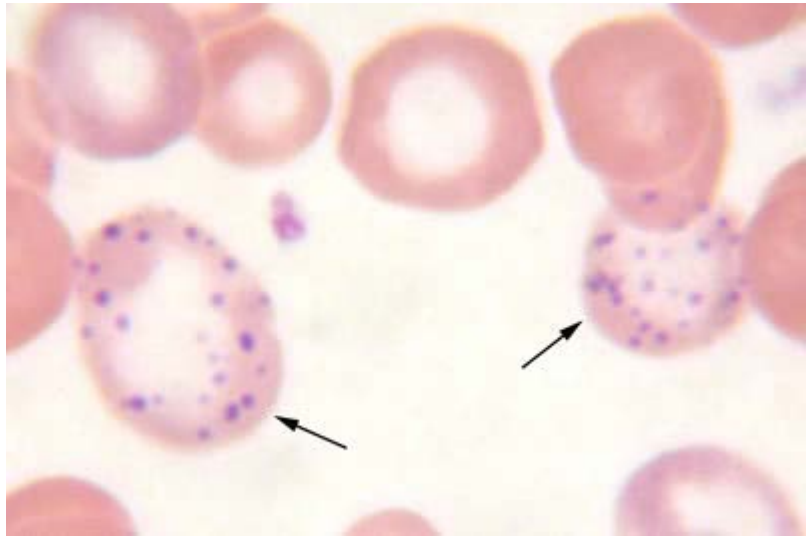


# Hyperactive in Detroit – not the patient in the picture!

- 2 ½ yr old AA male living in public housing
- Hb 9.0 Gms
- H/O Pica +
- Review smear
- Long term sequelae?

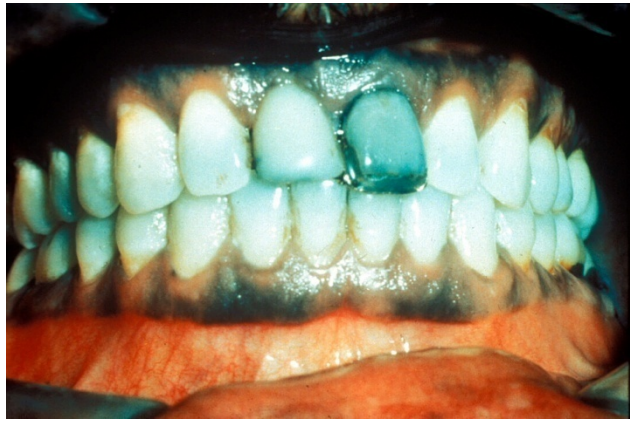
# Lead Poisoning

- Neurological Sequelae
- Basophilic Stippling
- Denatured RNA



# Anemia and Lead

- 90% of Pb in blood in RBC
- Decreased Heme, Increased FEP
- Anemia uncommon unless associated with Fe ,Hemoglobinopathies
- Basophilic stippling – denatured RNA , lack of 2-5’ Pyrimidine Nucleotidase
- ½ life is 20- 30 days
- Deposited in bones, teeth.” Lead lines”



# CASE 3

A 13 months old boy with recurrent BT, Hepatosplenoomegaly

| Parameter | Report |
|---|---|
| Hb | 3.6 g% |
| TLC | 22600 |
| DLC | N62, L32, E3,M3, nRBCs 30/100 WBCs |
| Platelet count | 160000cu.mm |
| MCV | 54 |
| MCH | 17.4 |
| MCHC | 29.1 |
| RBC count | 1.1 million/cu.mm. |
| RDW-CV | 23.5 |

# Case – 3: Answers

1. Identify the diagnosis

   Hemolytic anemia, likely beta thalassemia

2. Explain how did you arrive at the diagnosis.

   classical clinical presentation

   severe anemia

   microcytic hypochromic picture

   RBC count decreased

   elevated nucleated RBCs

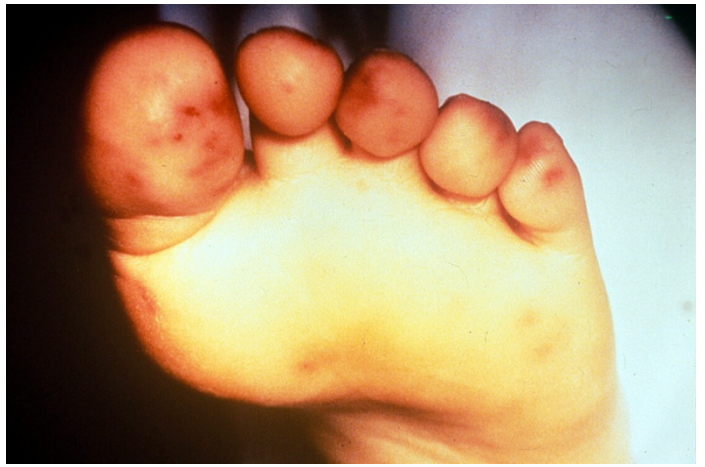
   RDW – increased

# NUCLEATED RED BLOOD CELLS

- Precursors of peripheral red blood cells
- Physiologically seen - only in neonates and premature babies
- NRBC have nuclei → erroneously counted as white blood cells by some automated methods
- Conditions seen
  - extreme increases in erythropoietic activity
  - Infiltration of bone marrow - myelofibrosis, leukaemia or storage cells

# Confused Adolescent

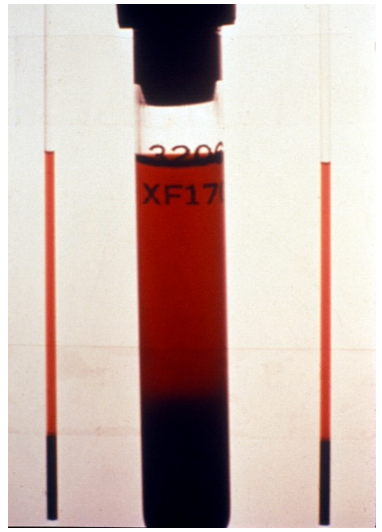
- 15 yr old AAF ,Fever x 2 weeks
- Bone and joint pains
- Jaundice and Hematuria
- Skin Rash

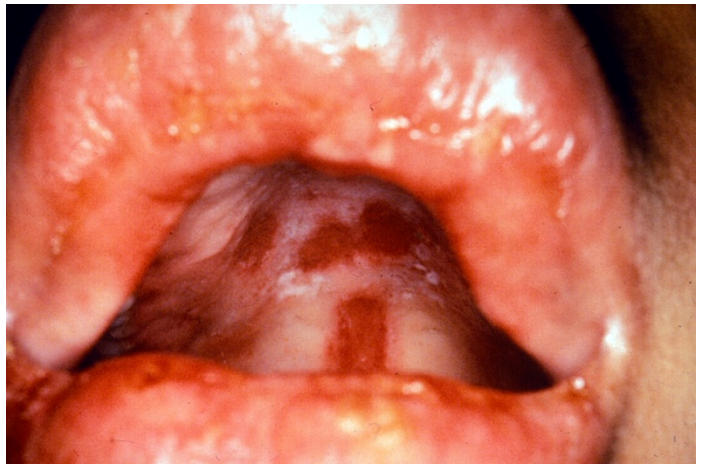


# P/E

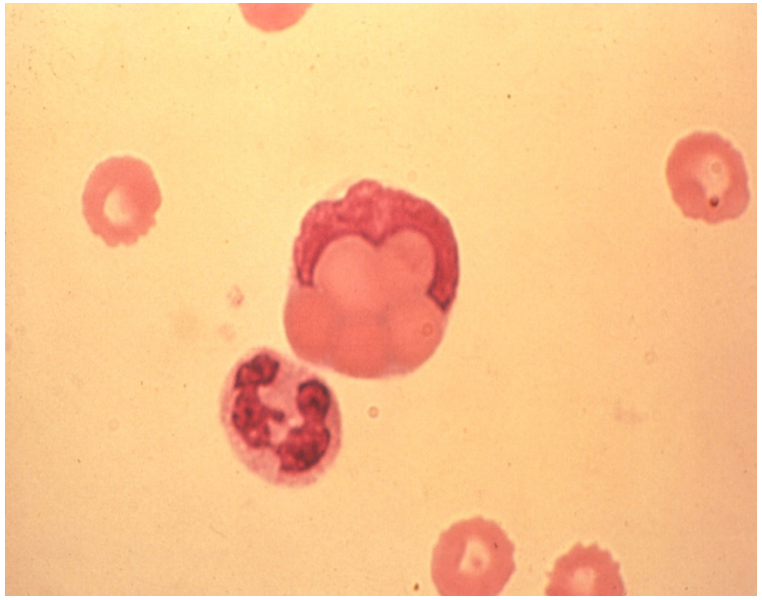
- Pallor ,Jaundice, Mouth ulcers, No Splenomegaly
- No evidence of impending CHF
- Hb 7.6 gms, MCV 90 Retic 12
- Smear
- ESR 100
- Bili 4.2 Indirect 4.0 LDH – 1400
- U/A – 20 RBC,

Protein +,blood +,Casts +

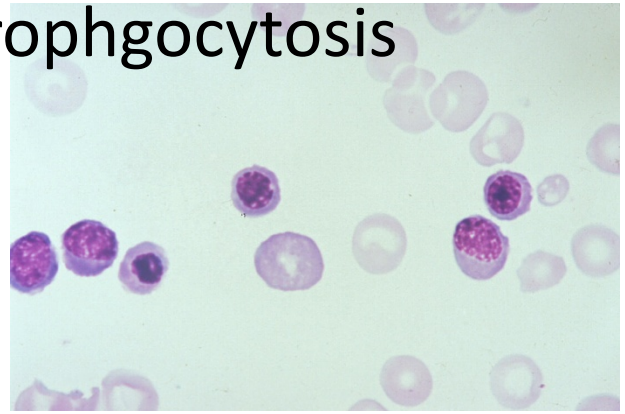




# Smear knows all!



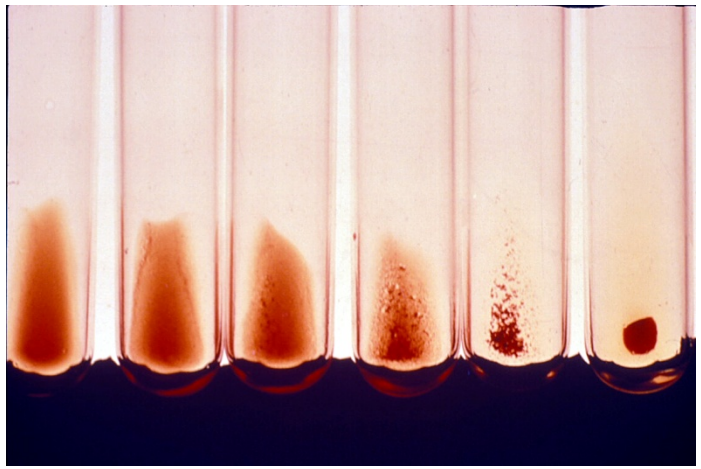
- Erythrophgocytosis



## DIAGNOSIS OF PEDIATRIC ANEMIA

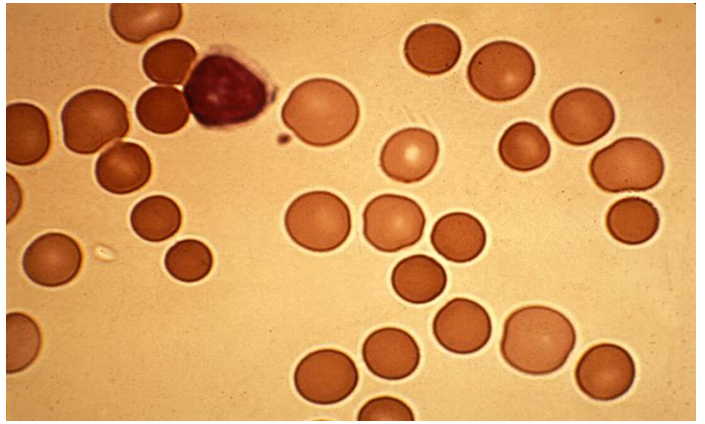
### HEMOLYTIC ANEMIAS
### (NORMOCHROMIC, NORMOCYTIC, HIGH RETIC COUNT POLYCHROMASIA)

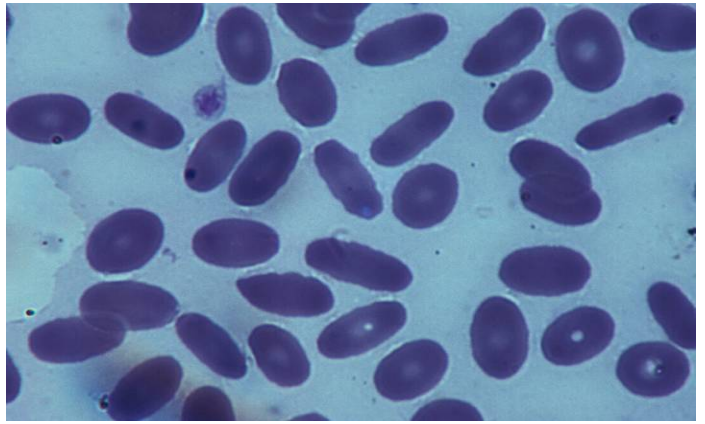
| COOMBS NEGATIVE | | COOMBS POSITIVE |
|---|---|---|
| Intracorp. | Extracorp | Isoimmune |
| G-6PD | Toxic | (Rh. ABO) |
| S-S, S-C | Infections | Autoimmune |
| S-Thal. | Uremia | (Idiopatic acqui: secondary) |
| CC, etc. | Burns | |
| HS CNSHA | | |



# Not fat, forty, fertile or flatulent!

- 3 yr old white male
- H/O Gall Stones and splenectomy in mother's family
- Hb done 2 months ago was 9.6,retic 11.1
- Now has pallor , tachycardia and Hb 3.0gms,retic 0.1
- No jaundice





# HS

Diagnosis:

- Identification of spherocytes in PBS
- Elevated MCHC
- DAT negative
- The osmotic fragility - Sensitivity of the test is enhanced by 24-hour incubation at 37°C
  - Not specific – positive on warm AIHA
- Eosin-5-maleimide (EMA) binding test:
  - EMA binds to band 3 on RBCs, and a reduction in binding, measured by fluorescence intensity, corresponds to a quantitative reduction in erythrocyte band 3, consistent with HS – Higher PPV

# Coombs Negative Hemolytic Anemias

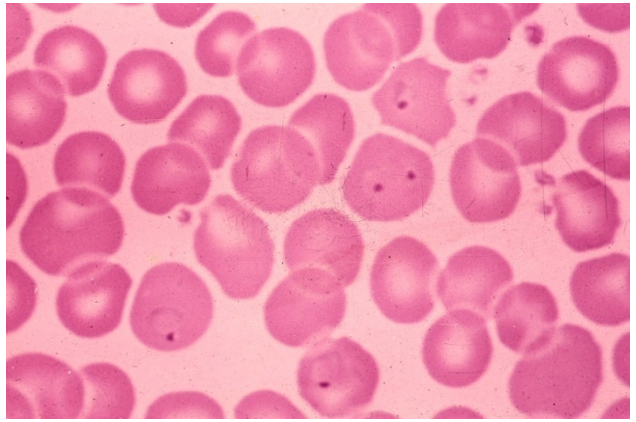
Enzyme deficiencies – G6PD,PK

Hemoglobinopathies - SS,SC

Mechanical – DIC, Hemangiomas

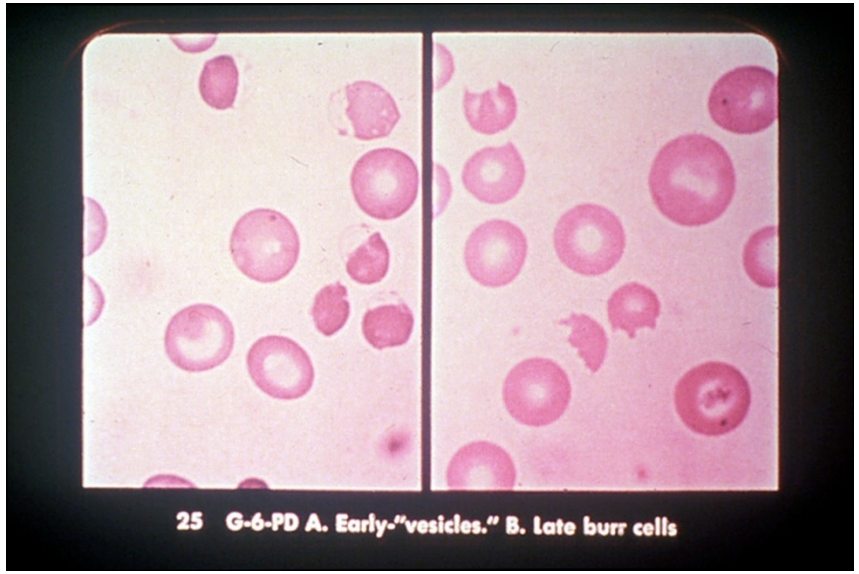
Infection – Malaria

Red cell membrane defect - Spherocytosis



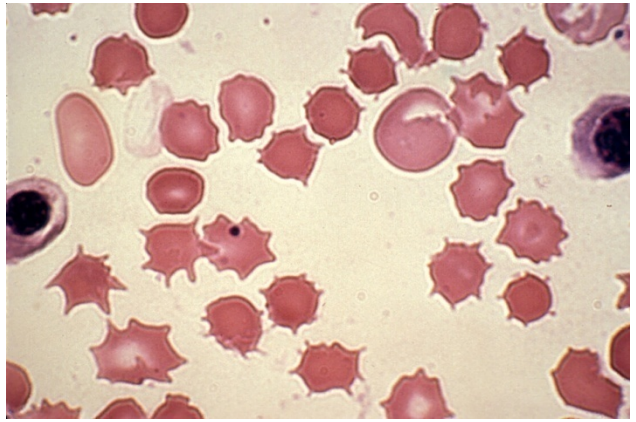
# G-6-P-D Deficiency

- X-linked recessive, genetic variants
- Enzyme needed for production of reduced NADPH – prevention of oxidative damage
- Precipitated by oxidative challenge
- ‘Bite cells’, blister cells
- Greeks, Asians – more severe disease
- African Americans – usually mild disease



# G6PD

- Oxidative challenge
- Enzyme levels in NRBC and retics are higher – resistance to lysis, falsely high levels after hemolysis
- Exogenous stimuli – Fava Beans, Moth Balls, Infections
- Drugs – Antimalarials, Aspirin, Sulfa
- PK,TPI



# CASE 4

A 12 years old boy with progressive pallor, no HSM

| Parameter | Report |
|---|---|
| Hb | 5.6 g% |
| TLC | 2600 |
| DLC | N34, L56, E5,M5 |
| Platelet count | 30,000 /cu.mm |
| MCV | 114 |
| MCH | 28.4 |
| MCHC | 33.1 |
| RBC count | 1.7 million/cu.mm. |
| RDW-CV | 21.5 |

# Differential diagnosis of pancytopenia

**COMMON CAUSES**

- Nutritional – B12, folate deficiency
- Infections – Hepatitis A, B, C, EBV, HIV, CMV
- Acquired aplastic anemia (idiopathic)
- Malignancy (leukemia, metastasis)
- Drug induced aplasia
- Immune mediated (Evans, SLE, Sjogren syndrome)
- Hypersplenism
- HLH (Hemophagocytic lymphohistiocytosis)

**RARER CAUSES**

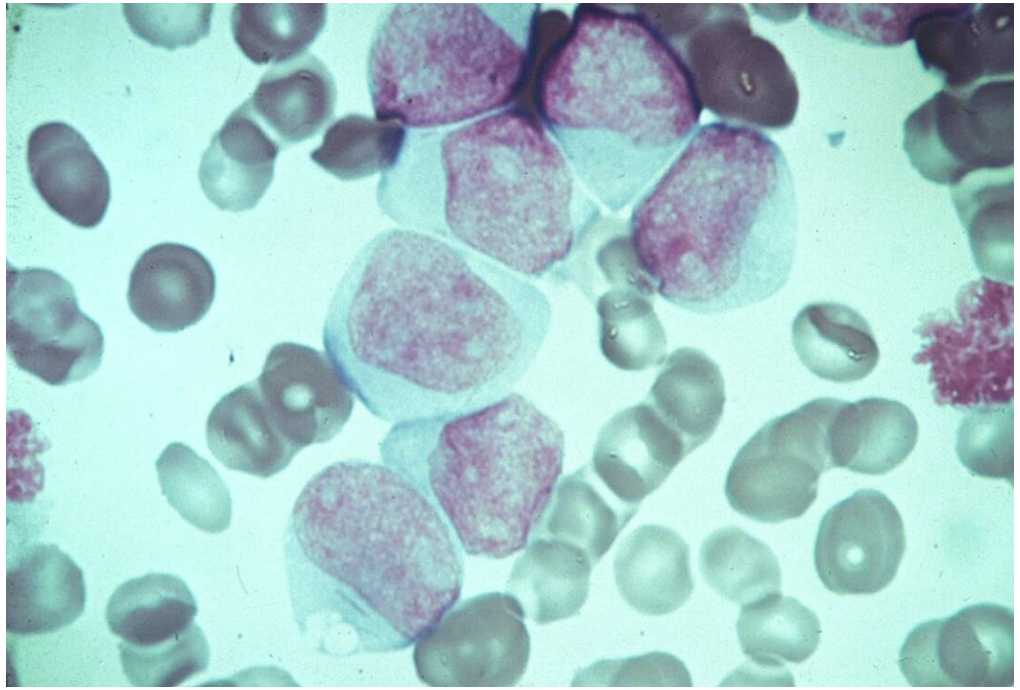
- Inherited marrow failure syndromes
- PNH (Paroxysmal nocturnal hemoglobinuria)
- Storage diseases
- Osteopetrosis
- Secondary to chemotherapy / radiotherapy

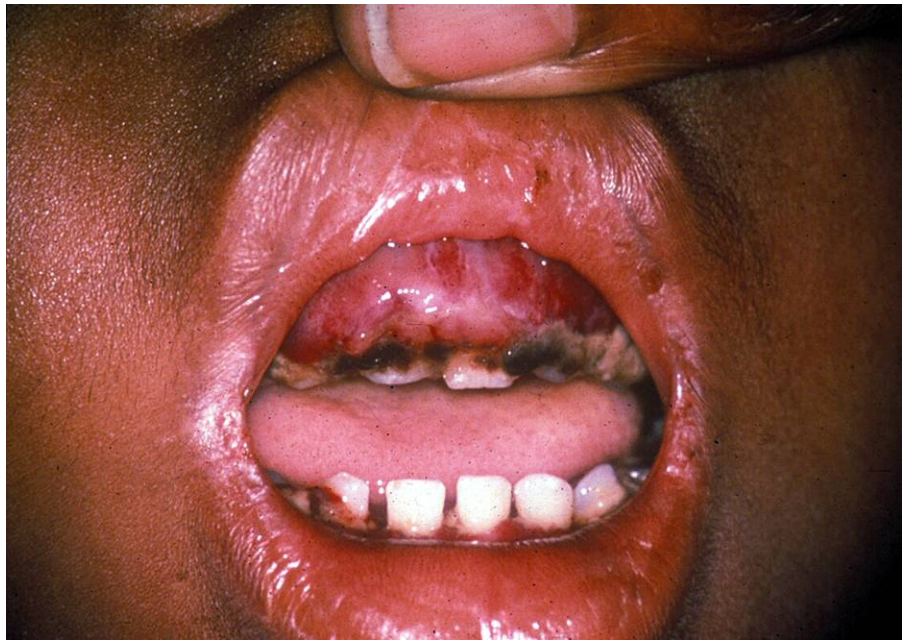
**RAREST CAUSES**

- Refractory cytopenia of childhood (MDS)
- Myelofibrosis
- Anorexia nervosa (in adolescent / adults

- Fever
- Bone pain and joint pain
- Weight loss
- 14 yr old AA male

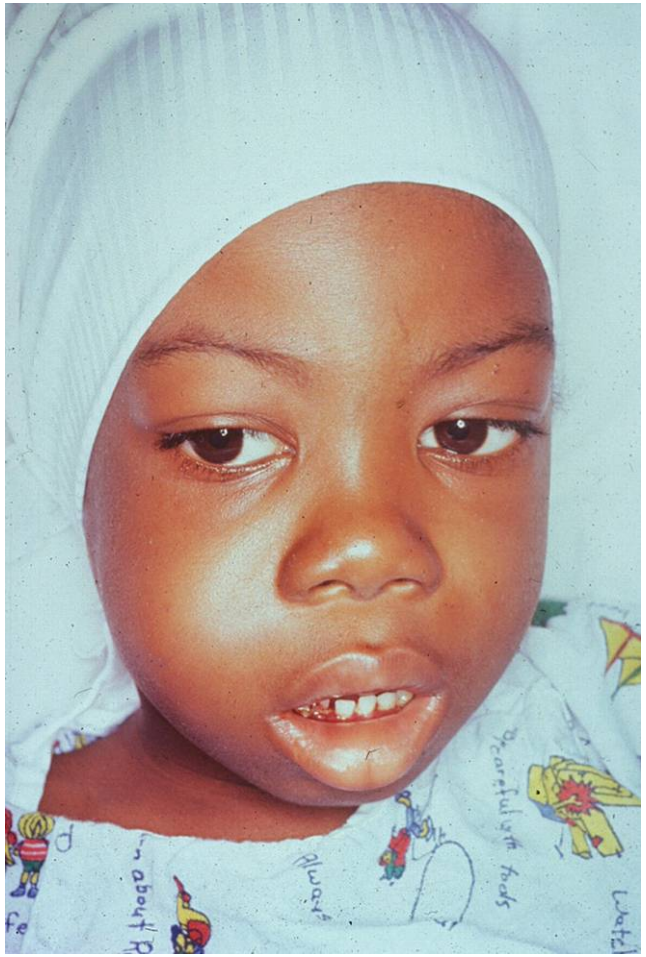
# Bone pain again!



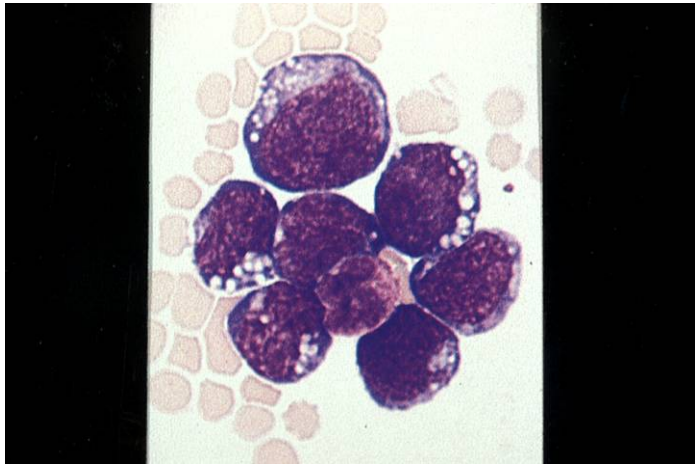


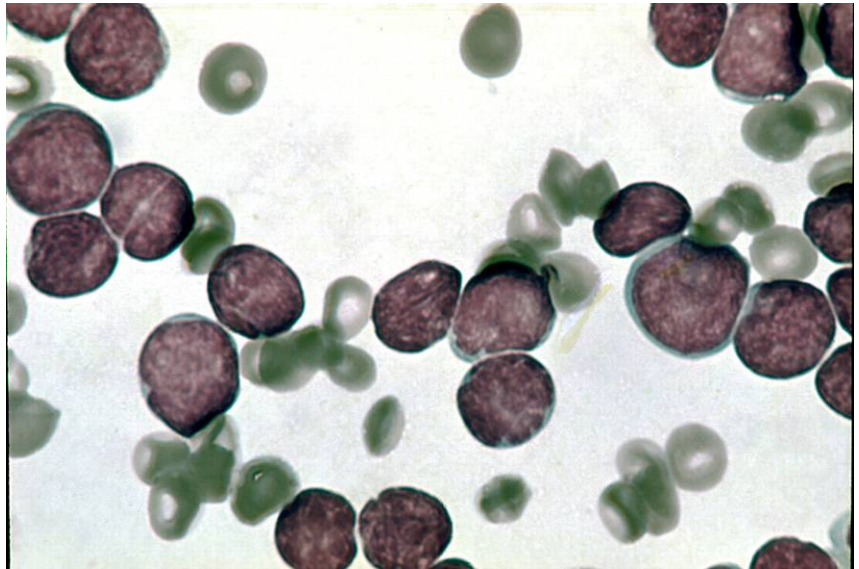
# Beware of fever with bone pain!

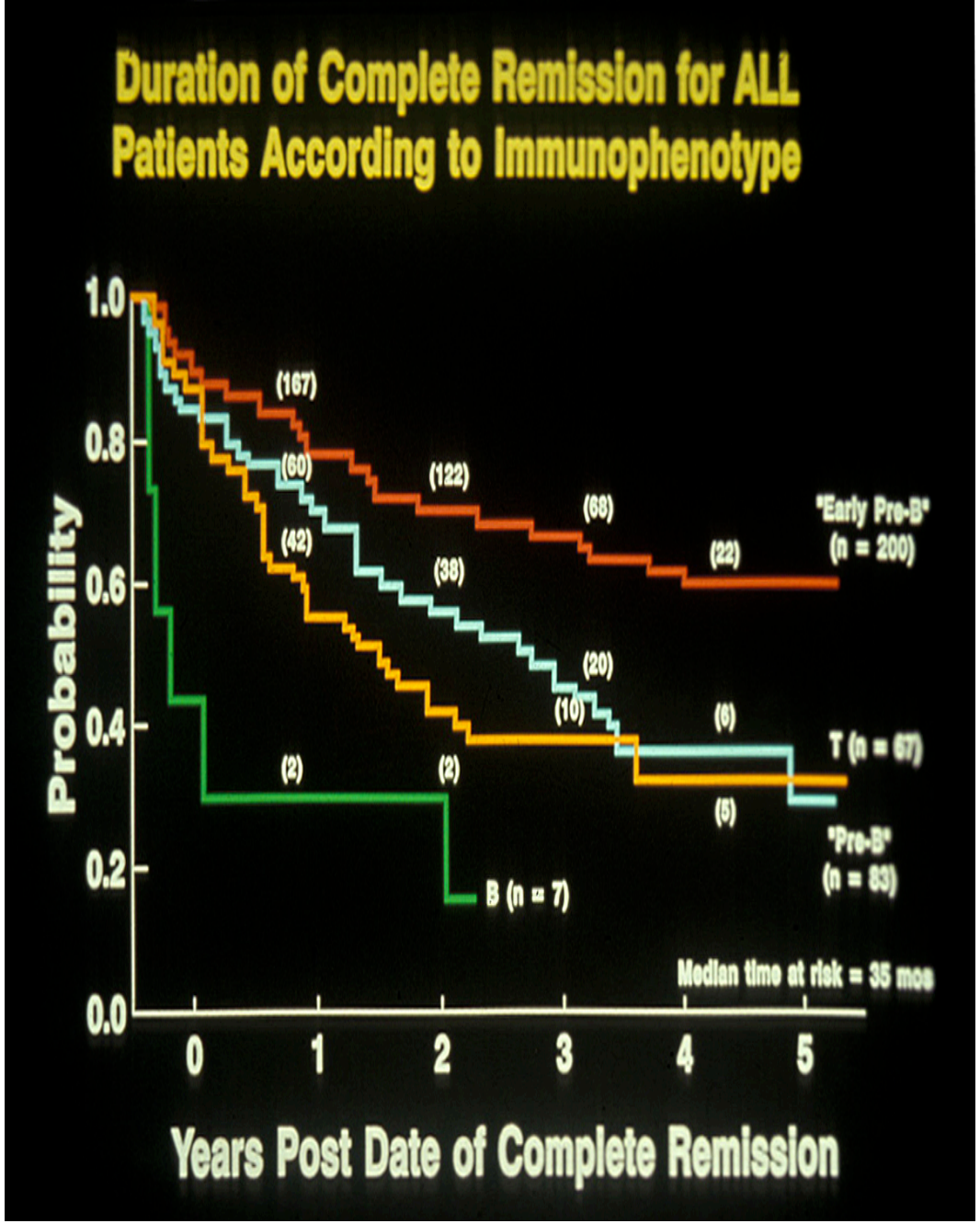
- 8 yr old AA female
- Fever x 2weeks
- Joint pain
- Bleeding from gums
- Easy bruising



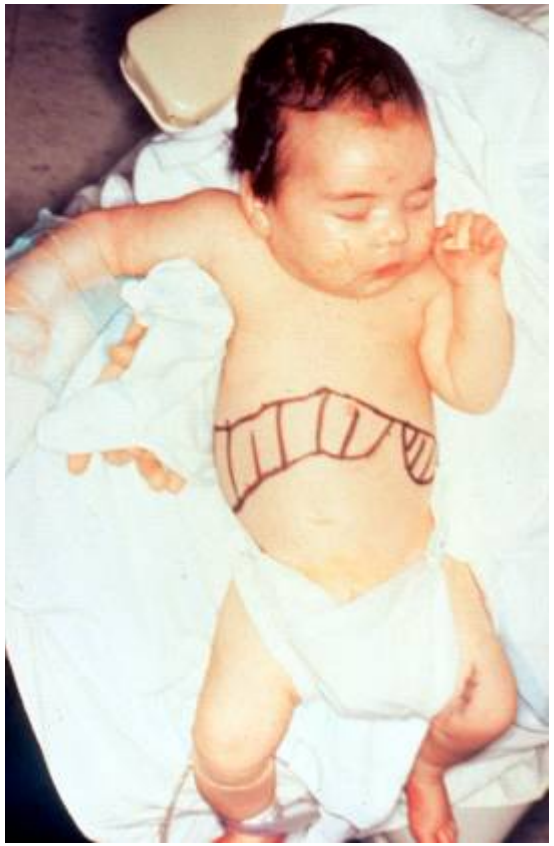
# A.L.L



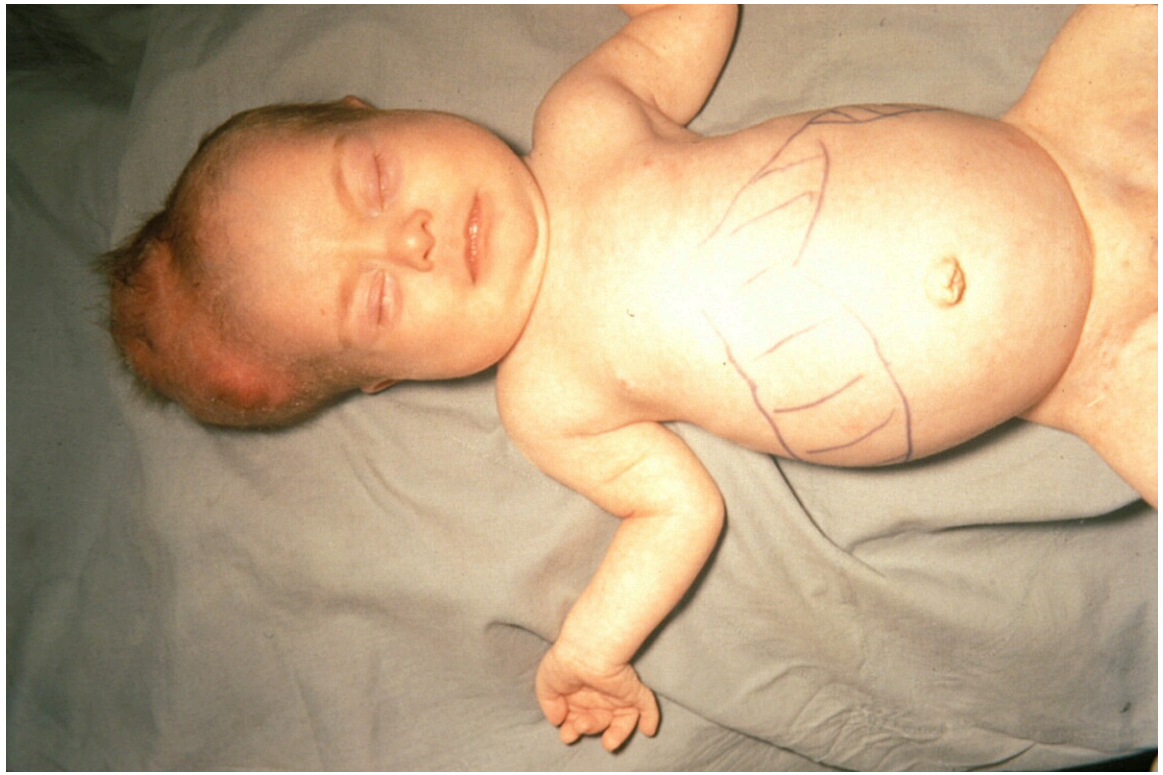



Duration of Complete Remission for ALL Patients According to Immunophenotype
Probability
1.0
0.8
0.6
0.4
0.2
0.0
(167)
(60)
(122)
(68)
(42)
(38)
(22)
(20)
(10)
(6)
(2)
(2)
(5)
"Early Pre-B" (n = 200)
T (n = 67)
"Pre-B" (n = 83)
B (n = 7)
Median time at risk = 35 mos
0
1
2
3
4
5
Years Post Date of Complete Remission

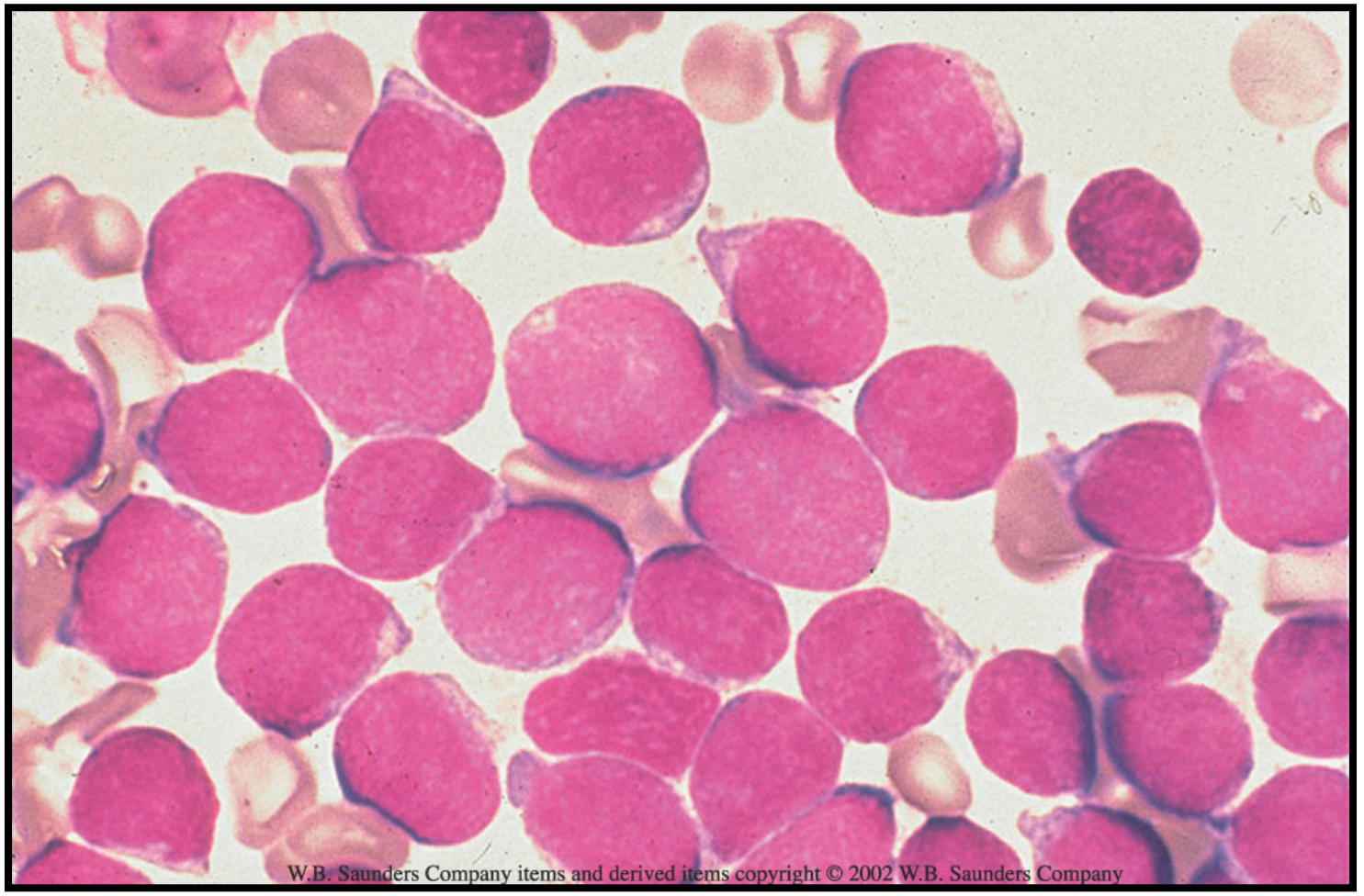
# Newborn with cutaneous nodules

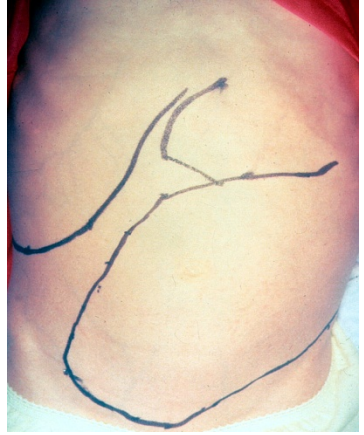


# Fever, Hepatosplenomegaly

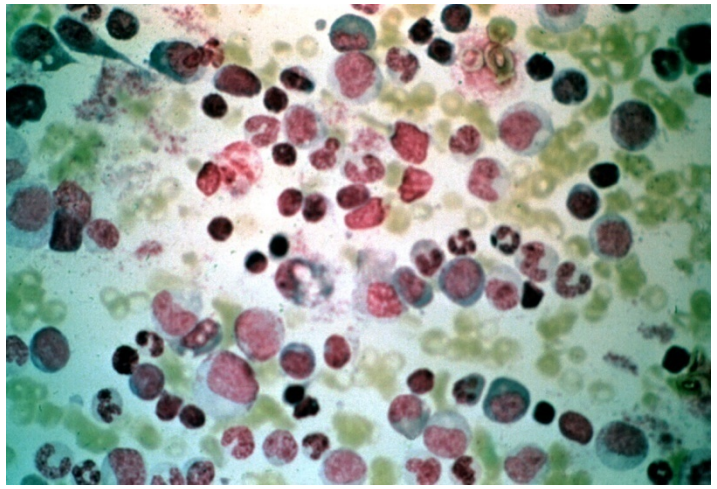


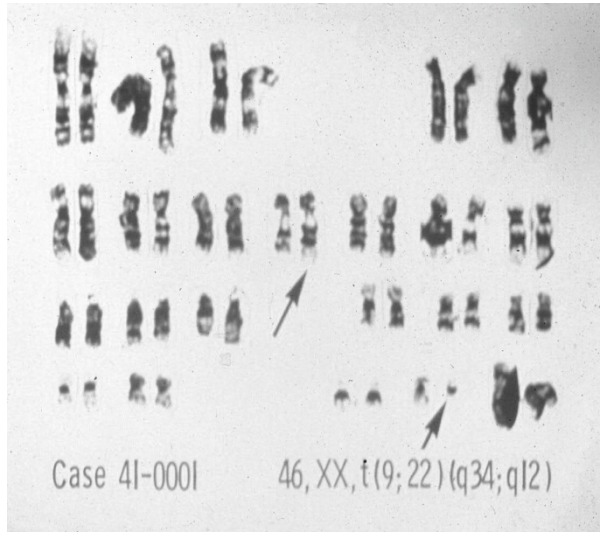
# Acute Lymphoblastic Leukemia



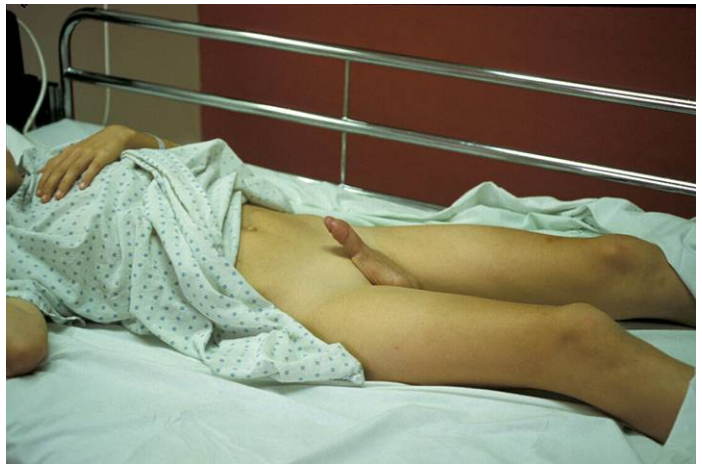


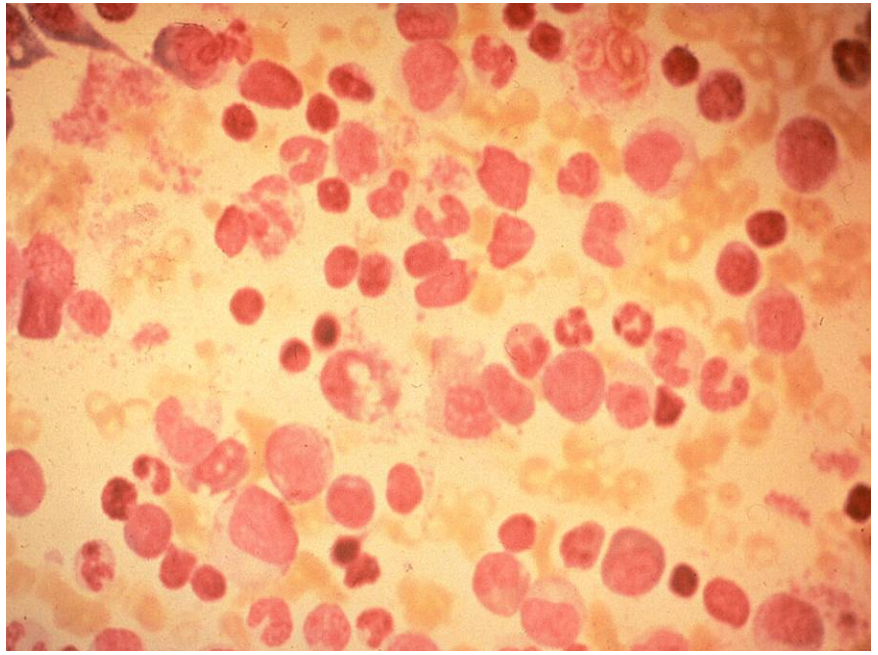
# Teen ager with fatigue

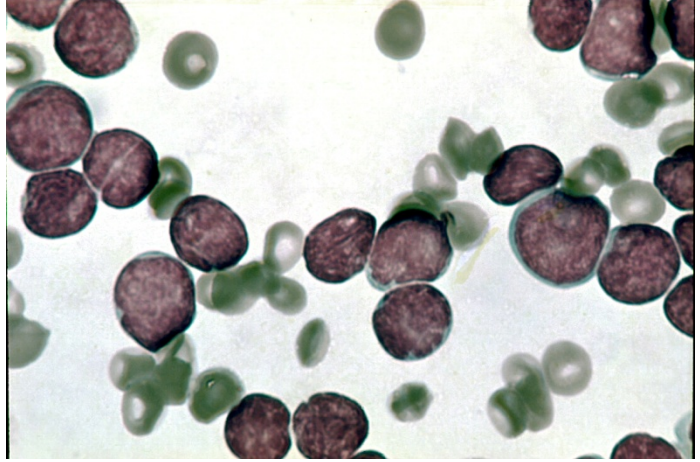


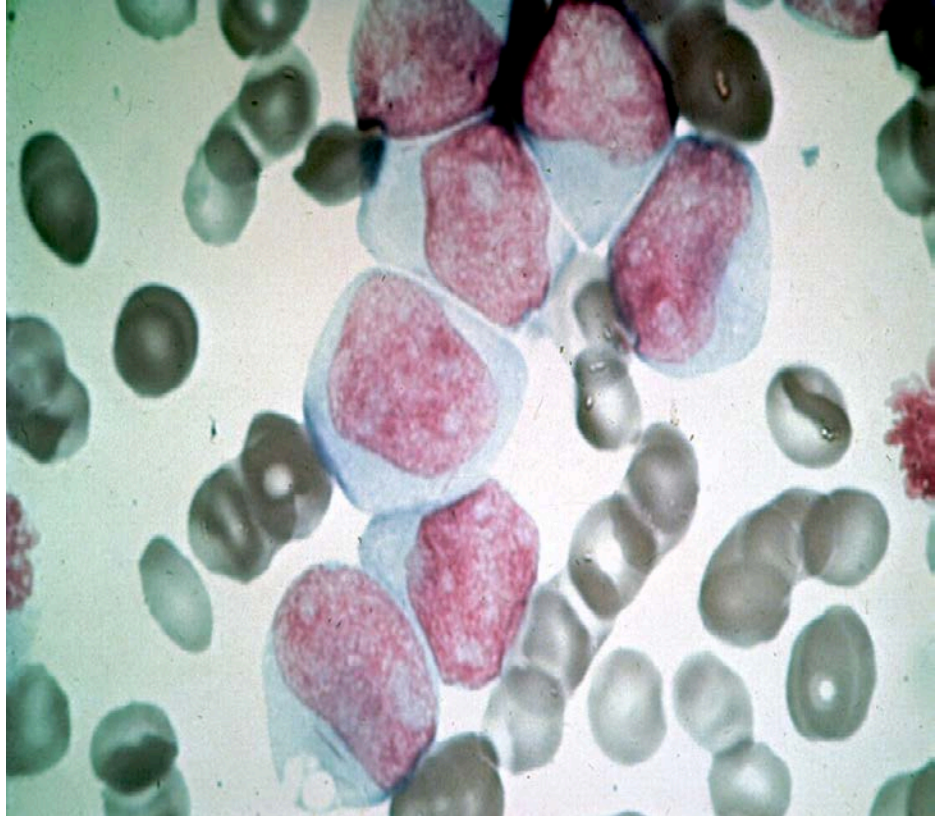


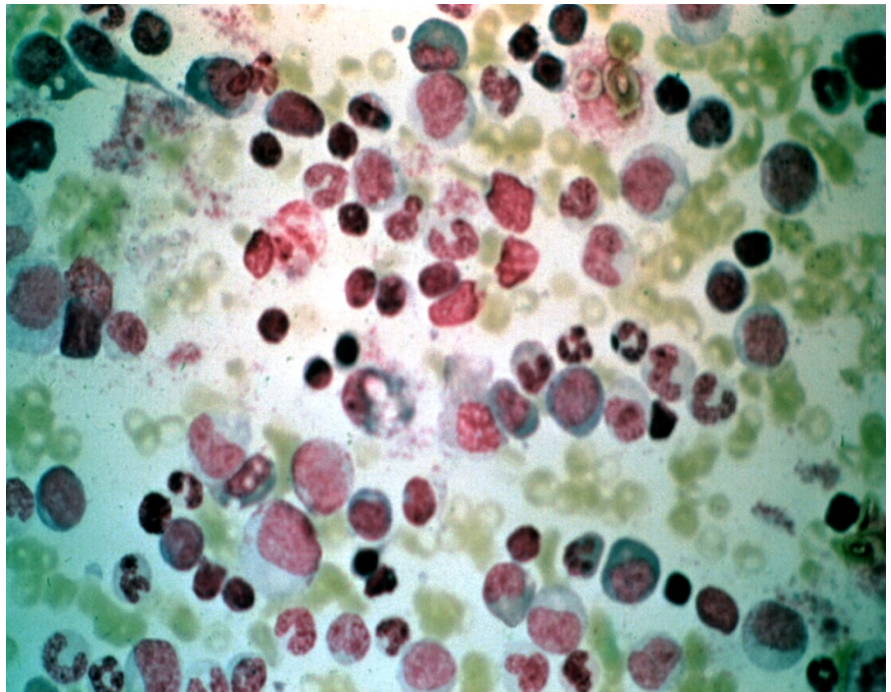
# Priapism in an adolescent

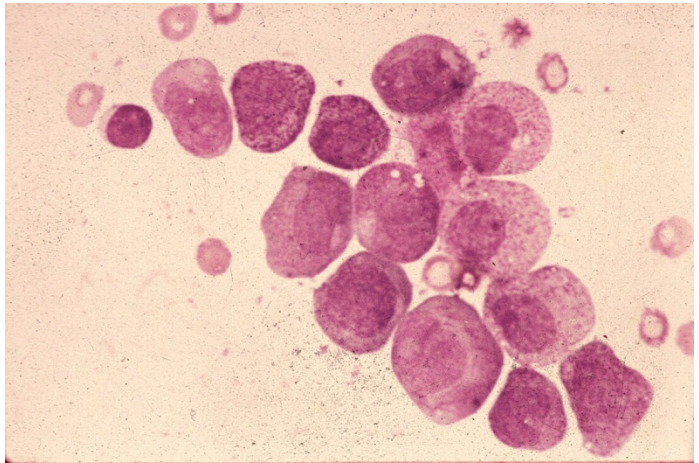












# CASE 5

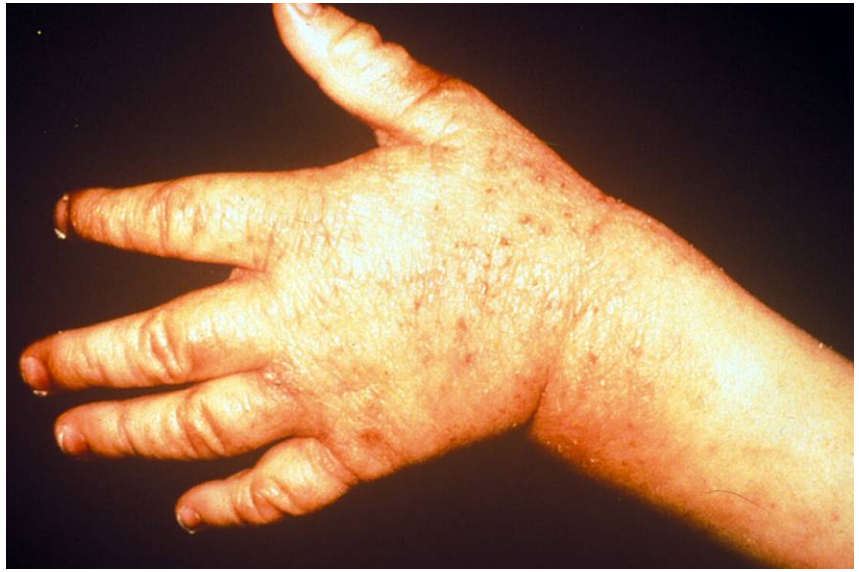
A 3 years old boy presented with recurrent history of epsitaxis, gum bleeds and petechial spots since past 1 year.

H/O recurrent respiratory tract infections, skin infections present.

| Parameter | Report |
|---|---|
| Hb | 10.6 g% |
| TLC | 6600 |
| DLC | N44, L46, E5,M5 |
| Platelet count | 10,000 /cu.mm |
| MCV | 84 |
| MCH | 29.4 |
| MCHC | 33.1 |
| RBC count | 3.7 million/cu.mm. |
| RDW-CV | 14.5 |
| MPV | 5.6 fL |

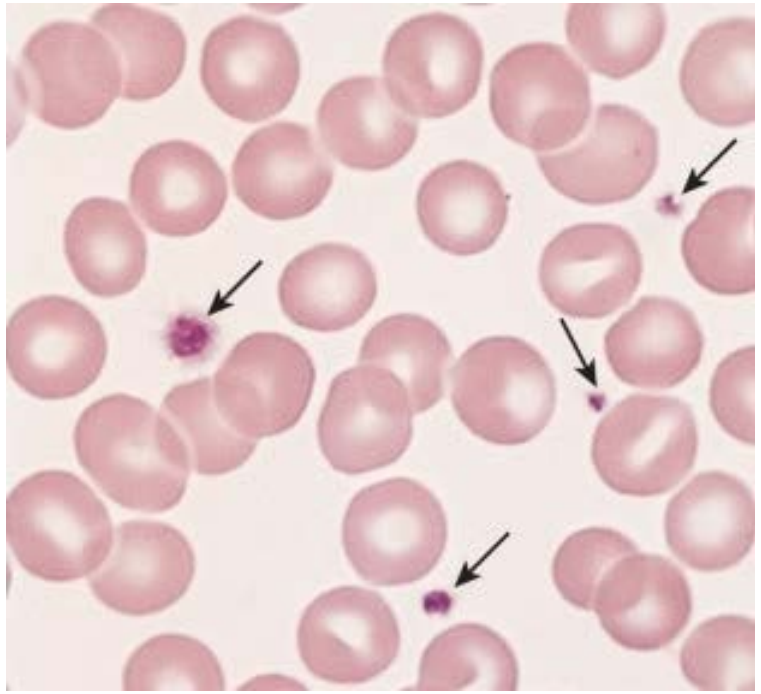
# Recurrent infections and cancer

- 2 yr WM, h/o recurrent pneumonia, persistent skin rash and lymphadenopathy. Platelets 40,000.
- Small platelet size MPV
- A male sibling died of septicemia 4 years ago. Skin tests for mumps, Candida and PPD are negative



# Mean Platelet Volume (MPV)

- Normal MPV - 7 to 11 fL
- Platelets newly released - larger in size
- Platelets decrease in size with aging



- High MPV
  - Rapid turnover of platelets (ITP, TTP)
  - Bernard Soulier syndrome
  - MYH9- related thrombocytopenias [May-Hegglin anomaly, Sebastian platelet syndrome, Fechtner syndrome and Epstein syndrome]

- Low MPV
  - Wiskott Aldrich syndrome
  - X linked thrombocytopenia

# NEWER CBC PARAMETER

- Immature platelet fraction
- Immature granulocytes
- Immature reticulocyte fraction
- Red cell fragments/ Schistocytes
- Reticulocyte hemoglobin

# CASE 6

A 7 years old boy admitted with Dengue Hemorrhagic fever

Afebrile, Hemodynamically stable

No bleeding complaints currently

| Parameter | Report |
|---|---|
| Hb | 10.6 g% |
| TLC | 4600 |
| DLC | N34, L56, E5,M5 |
| Platelet count | 10,000 /cu.mm |
| IPF (Immature platelet fraction) | 24% (Ref: 1 - 7) |

Will you transfuse the child?

# Immature Platelet Fraction (IPF)

- Quantified by flow cytometry using any fluorescent dye that binds RNA
- Newly released, larger and more reactive
- Reflects the rate of thrombopoiesis
- Usual reference range: 1 – 7%

# Immature Platelet Fraction (IPF)

**Low IPF → Decreased Production**

–Aplastic anemia
– Leukemia
– Marrow suppression
– Drugs

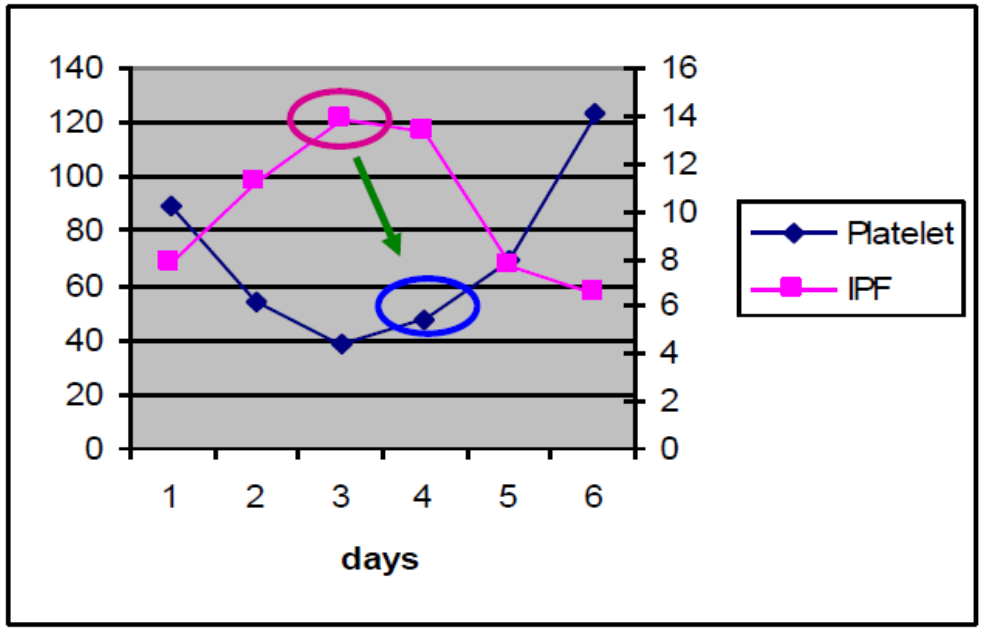
**High IPF →Increased Destruction / Regeneration after suppression**

- Immune Thrombocytopenia (ITP)
- ThromboticThrombocytopenic Purpura TTP
- Disseminated intravascular coagulation (DIC) – Drugs

# Immature Platelet Fraction (IPF)

- During regeneration phase, IPF rises 1–2 days prior to the platelet count rise.

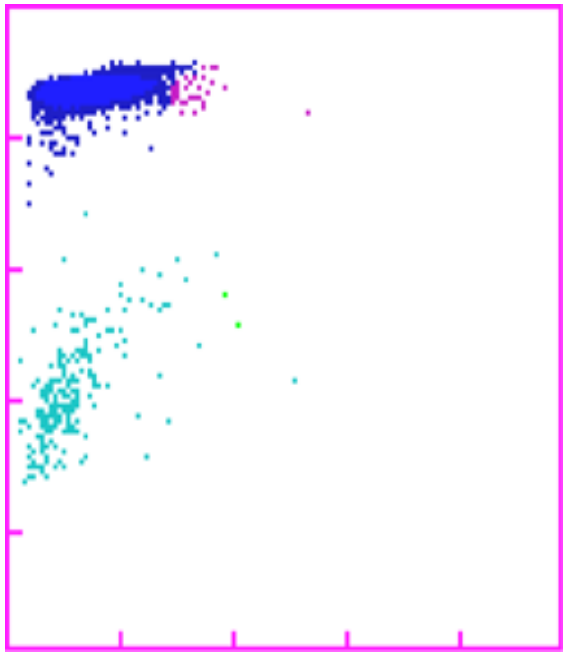
| DAYS | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| PLATELETS | 89 | 54 | 39 | 47 | 70 | 123 |
| IPF | 7.8 | 11.2 | 13.9 | 13.3 | 7.7 | 6.5 |



# Transfusion Assessment

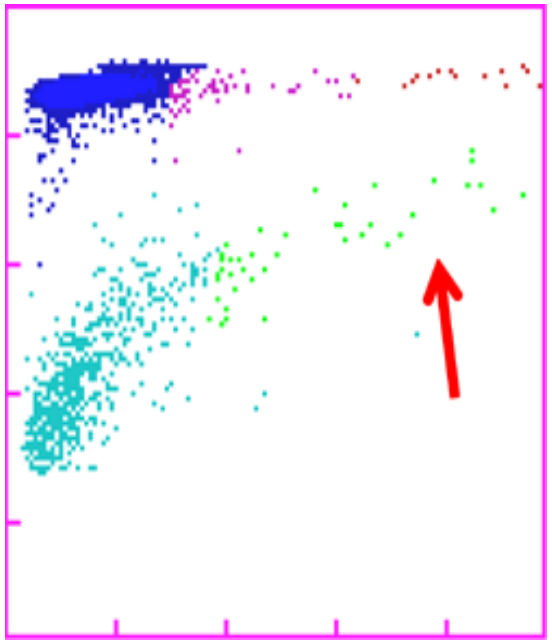
## Low PLT + Low IPF

- No Production
- Transfuse



## Low PLT+ High IPF

- Production
- Do Not Transfuse



# Platelets

- Psuedothrombocytopenia
- Small platelets /low plts -

  Hyoplastic and aplastic BM

  Wiskott Aldrich Syndrome

  X linked thrombocytopenia

  THC 2 ( ANK RD26)

  Familial Plt disorder with predisposition to AML

( FPD/AML)

# Platelets

- Large Platelets

  ITP , Auto immune

  BS , Grey plt syndrome

  Type 2 B vWD

  May Hegglin anomaly

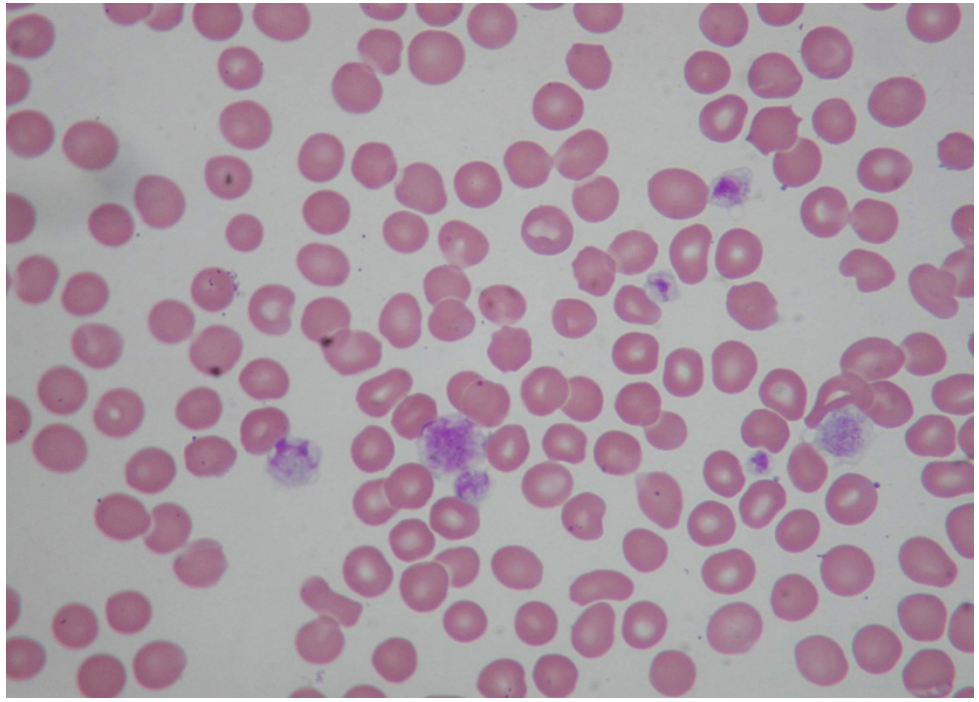
  Di George syndrome ,Epstein Syndrome

  Sebastian Syndrome , Jacobsen Syndrome

  Familial Meditarranean macrothrombocytopenia

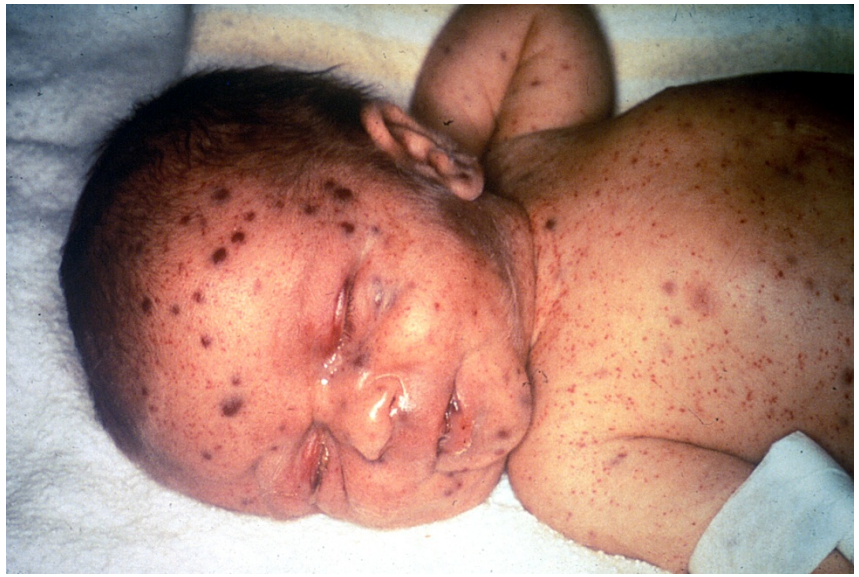
# H/O Nose bleeding, bleeding after extractions

- Large Platelets, decreased numbers

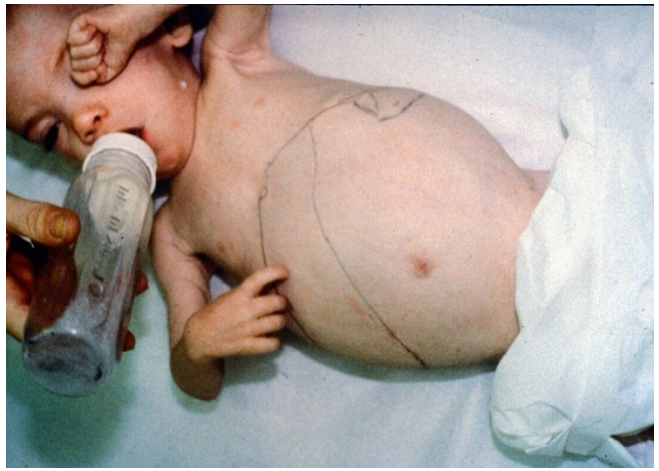


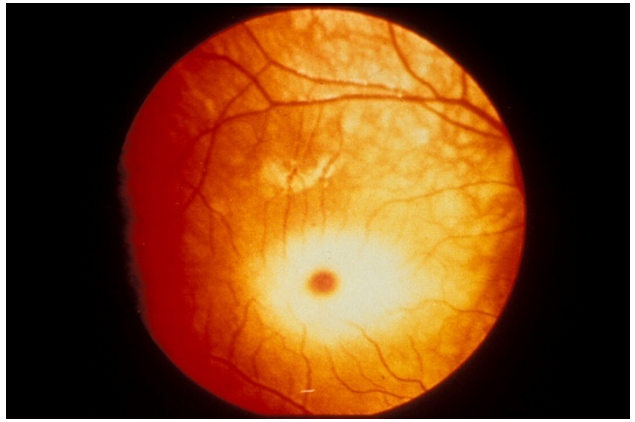
# Clinical Case

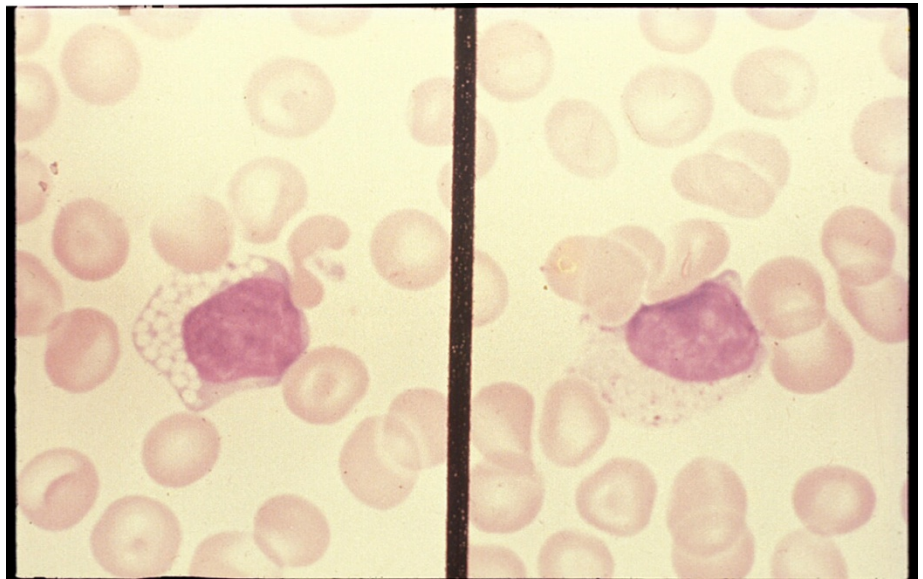
- LBW, premie at 30 weeks
- Jaundice
- Anemia – Normocytic, NC
- Purpura and Petichiae
- Hepatosplenomegaly
- Platelets – 40,000

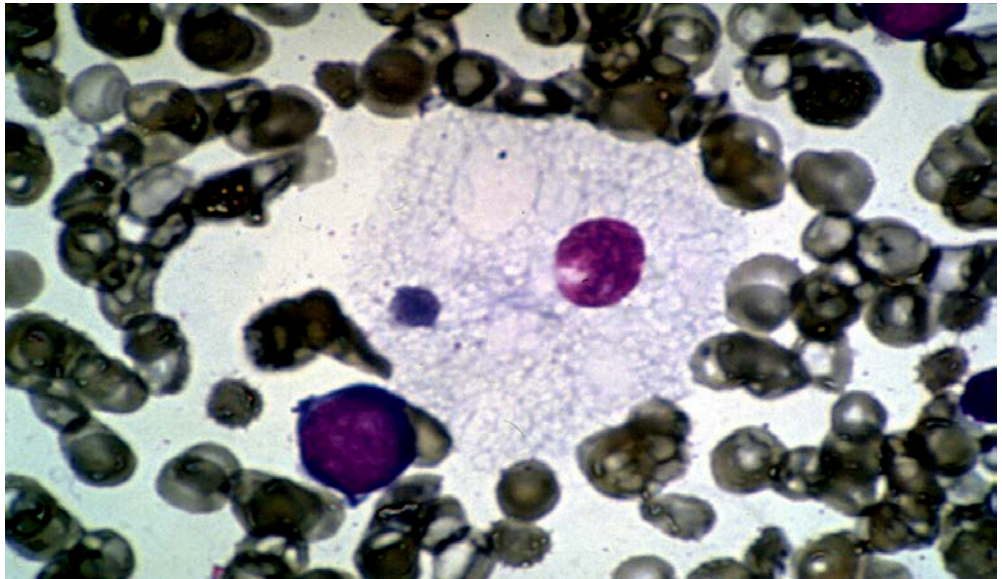


# Regression, Hepatosplenomegaly and Pancytopenia





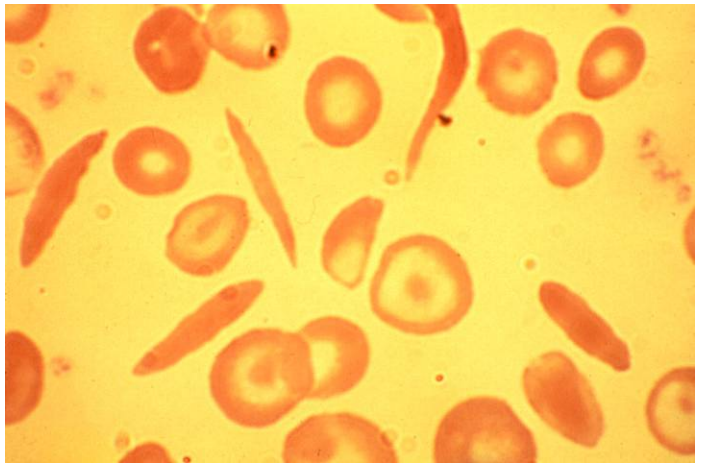


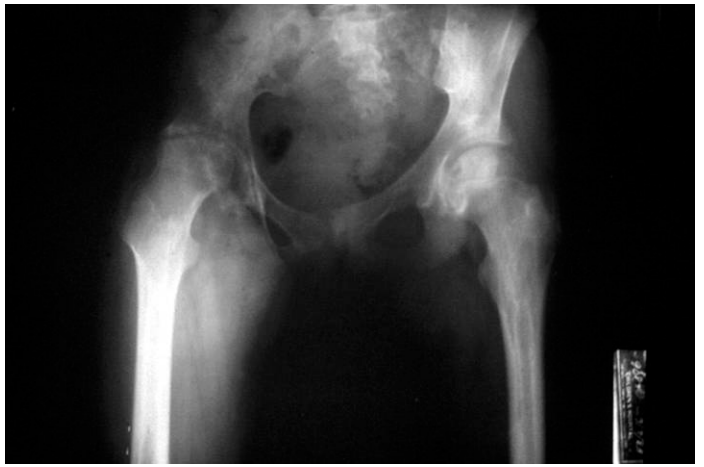


14
15
16 cm

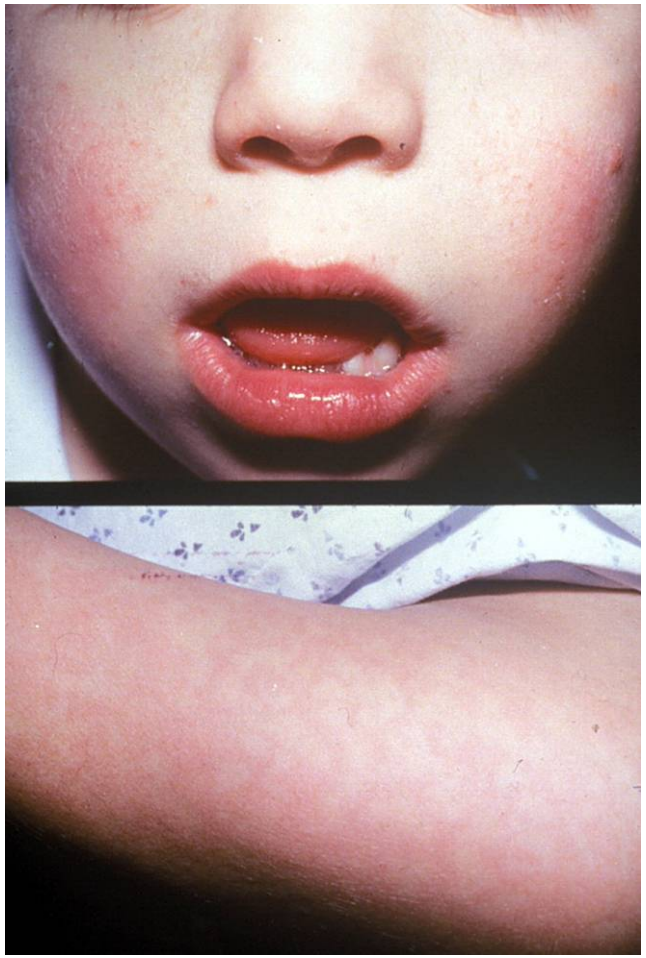
# Limping adolescent

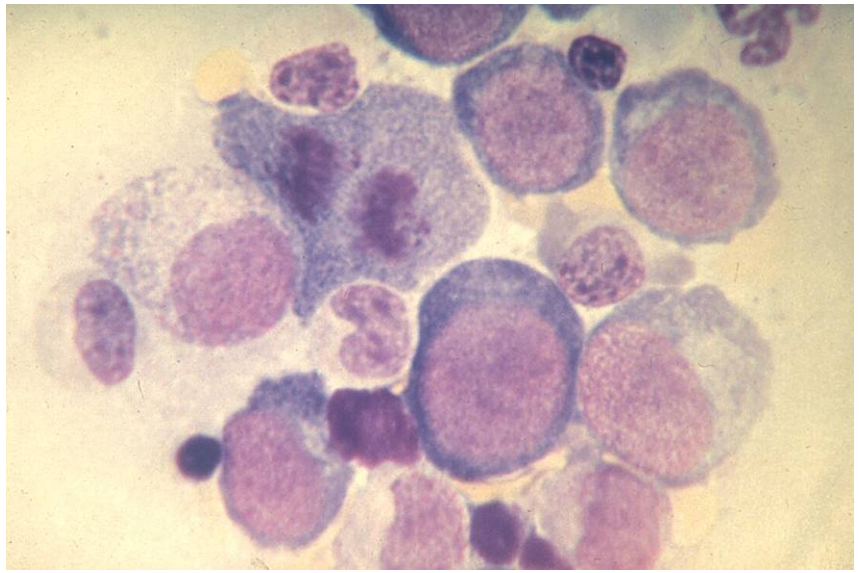
- 15 yr old AA female
- C/O Pain in the hips and limping for 1 month
- Afebrile, No h/o trauma
- H/o Multiple admissions in the past
- Review X-rays



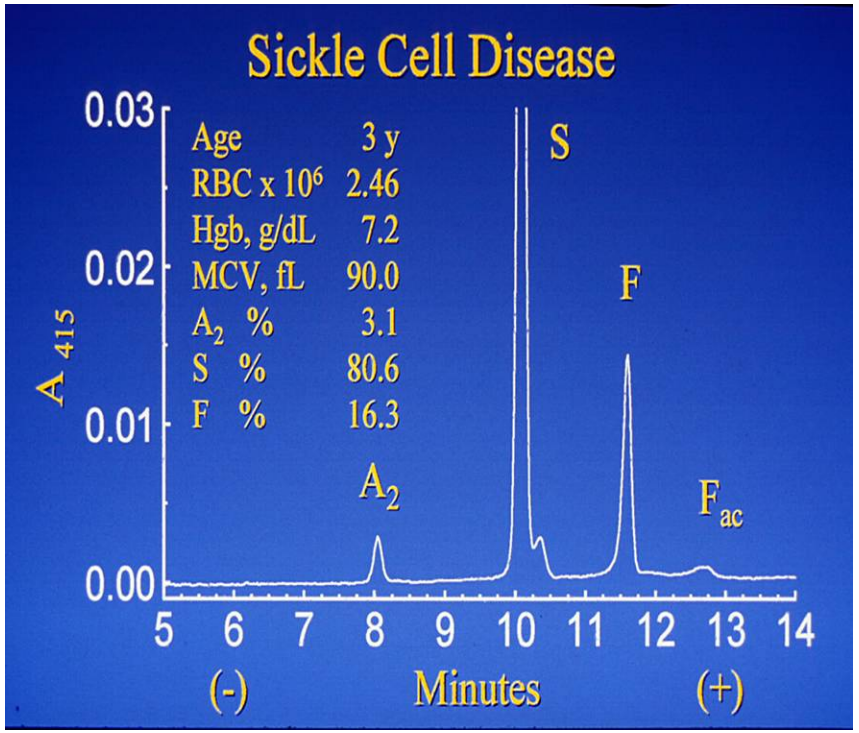


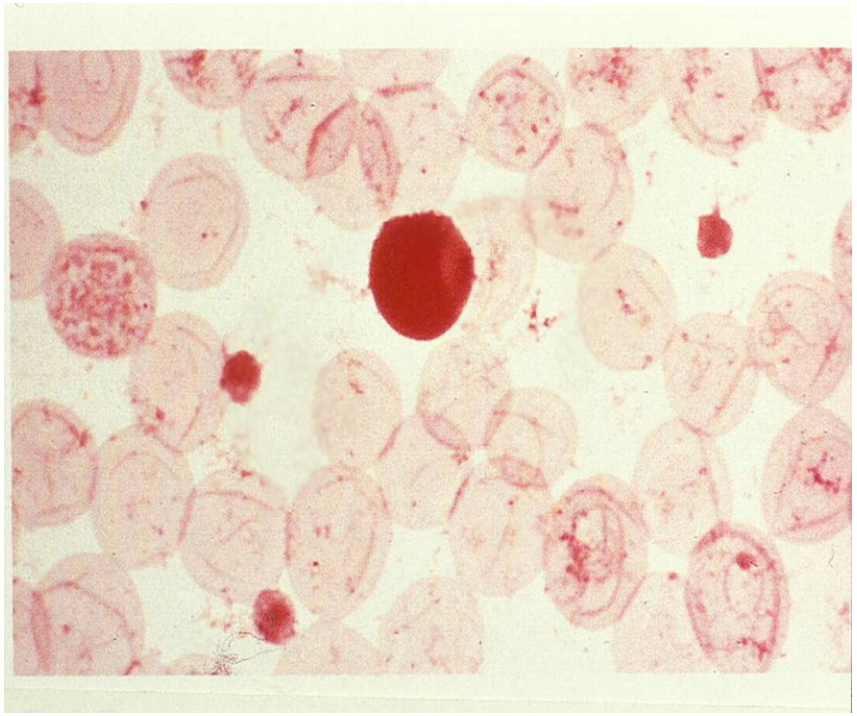
# Parvo B 19 Viral Infection





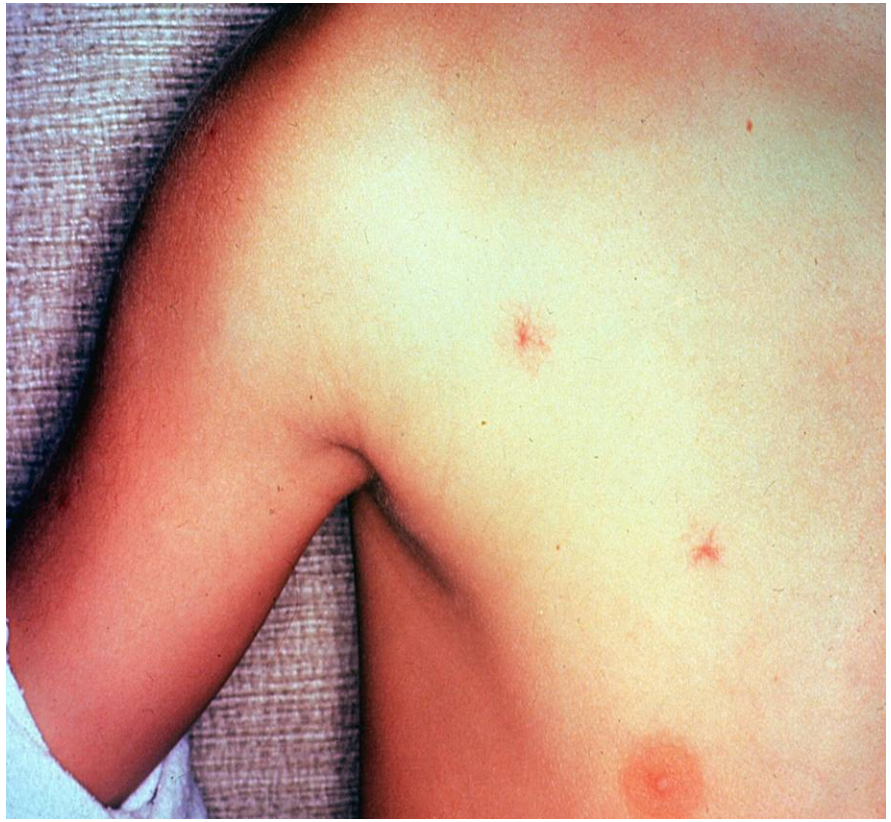
# Hb F – protective effect



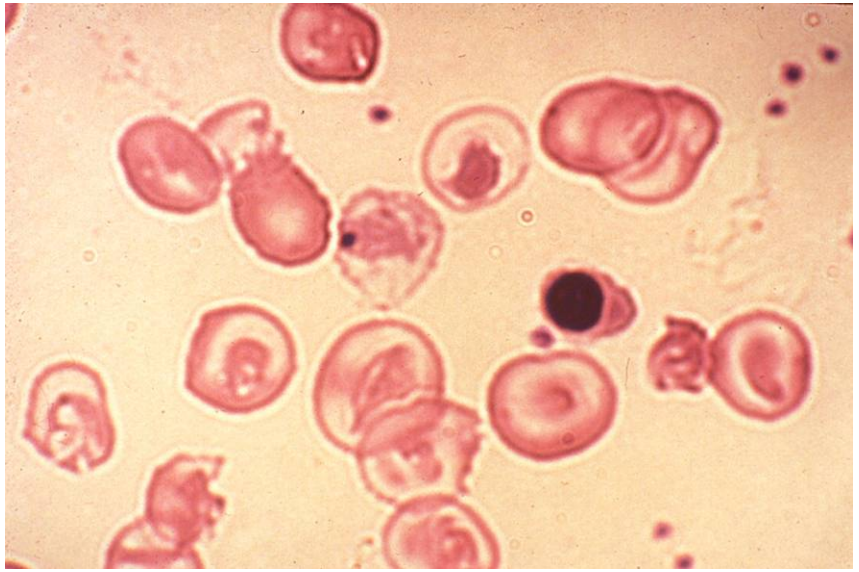



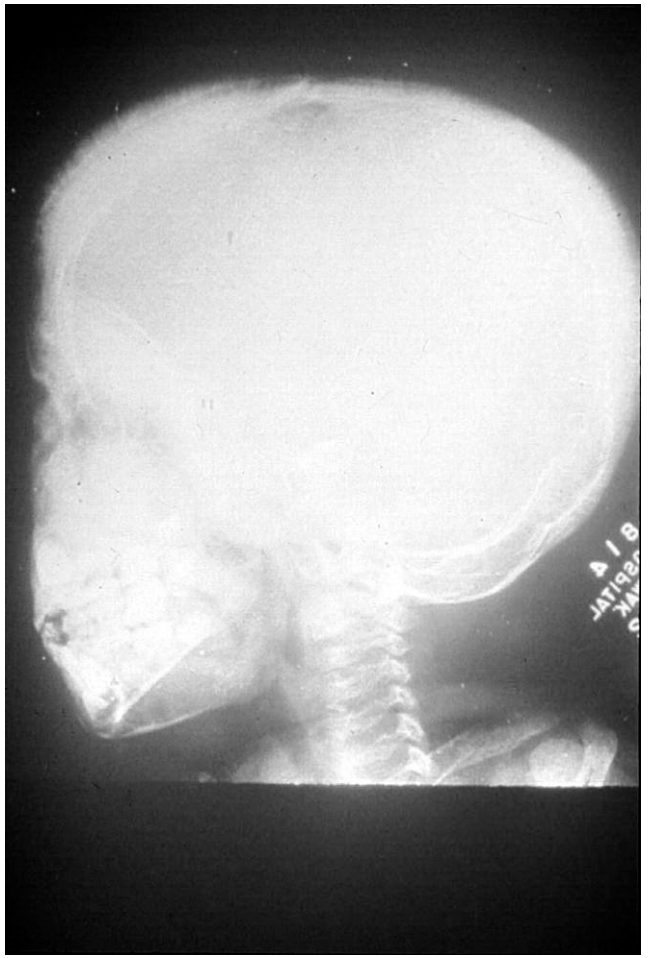
# “Bronzed Diabetes”

- Italian male
- Transfused since early infancy
- Review smear
- Comprehensive Diagnosis
- Options for treatment



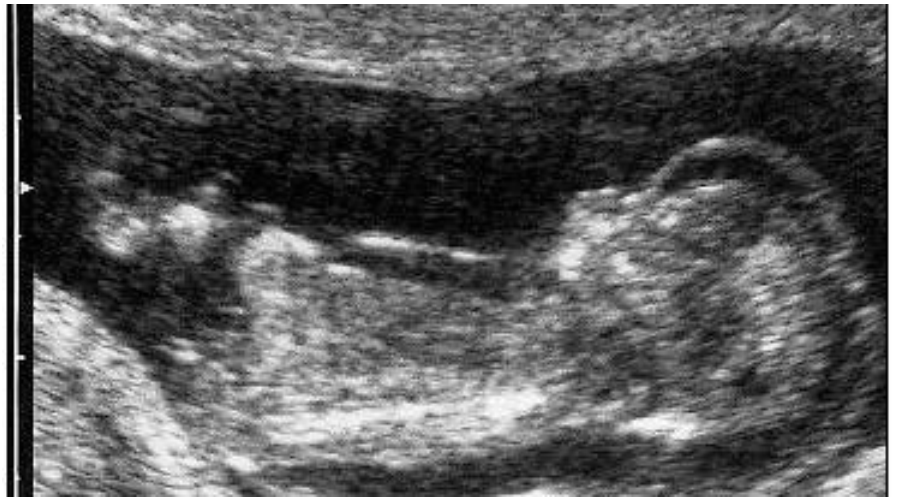
# Target cells, Howell Jolly bodies and “hair on end”

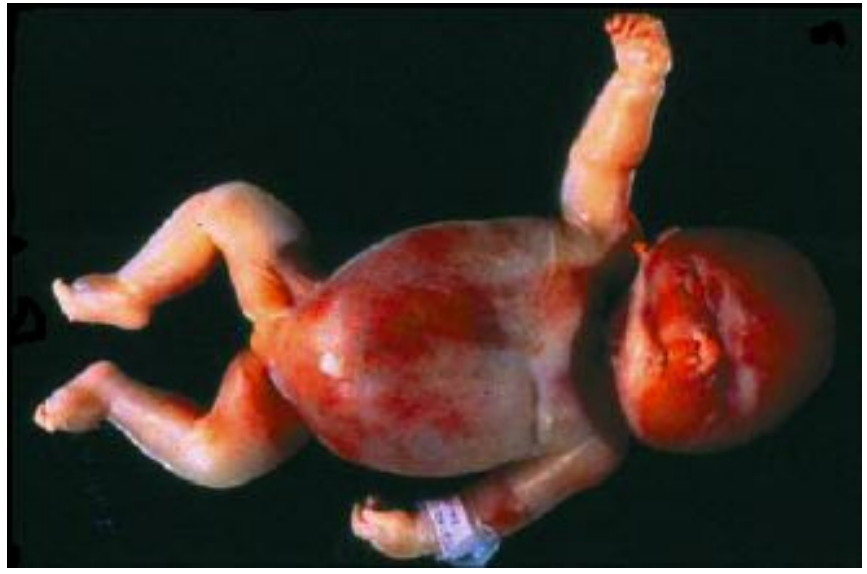




- Death occurs in utero or shortly after delivery
- About 17% of these fetuses also have developmental abnormalities
- Maternal complications:

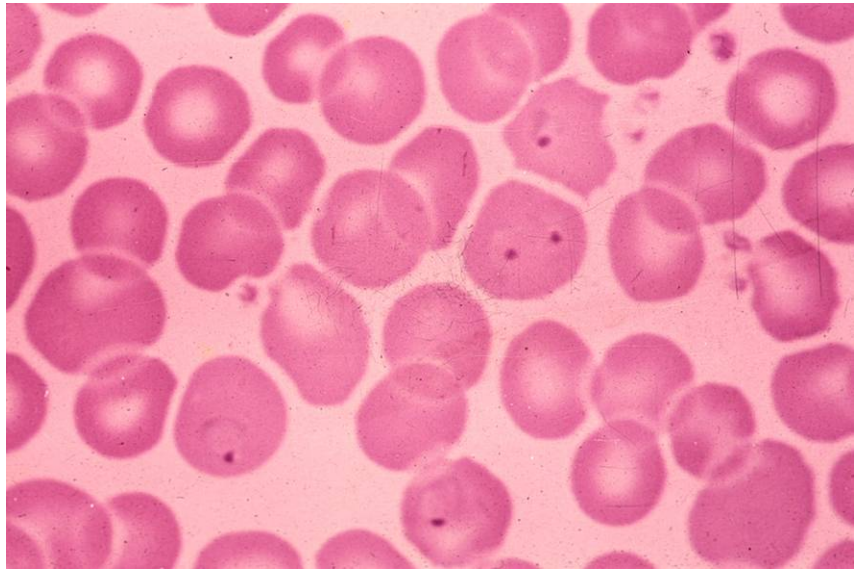
# Thai child with anemia





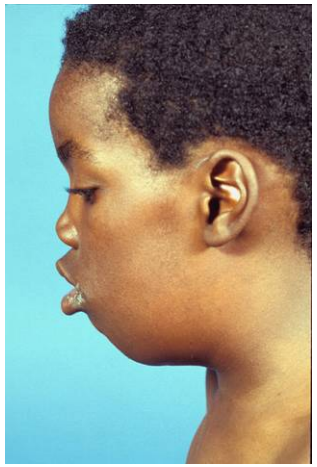
# Risky travel!

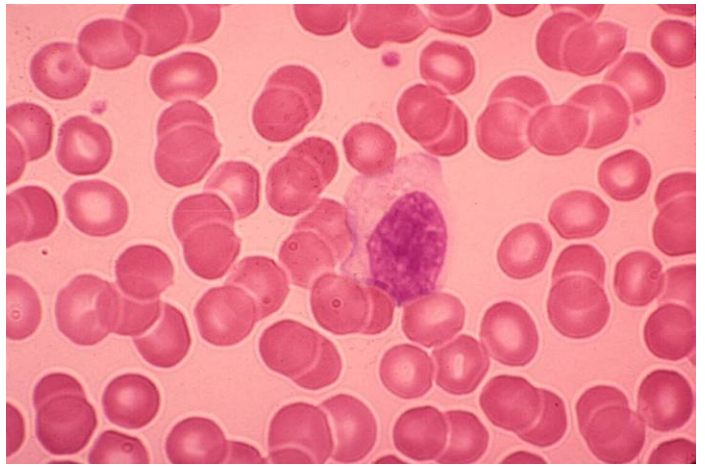
- 7 yr old with h/o travel to Pakistan
- Fever and dark urine
- Splenomegaly
- Review smear



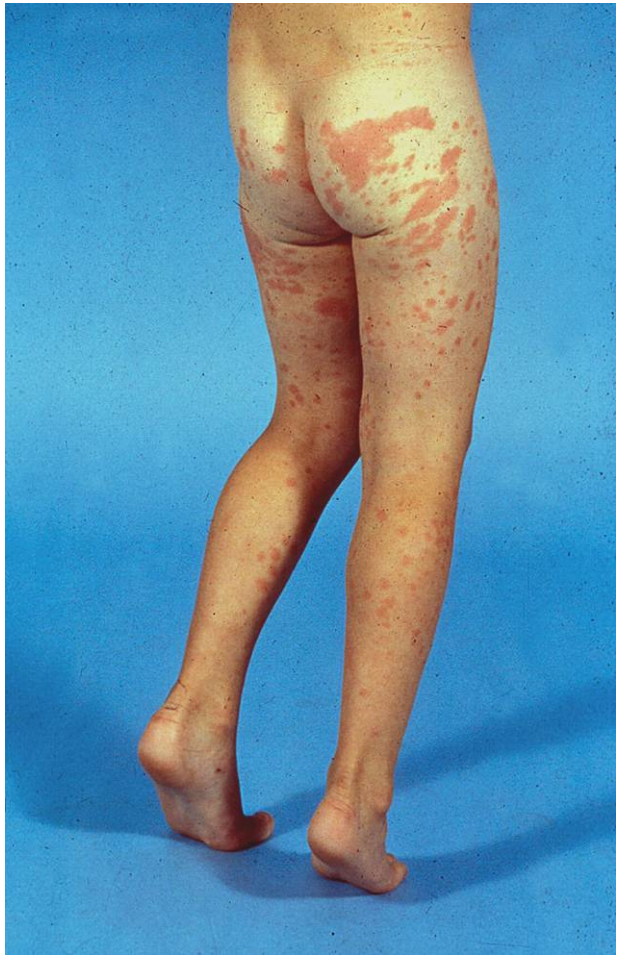
# “Kissing cousins”

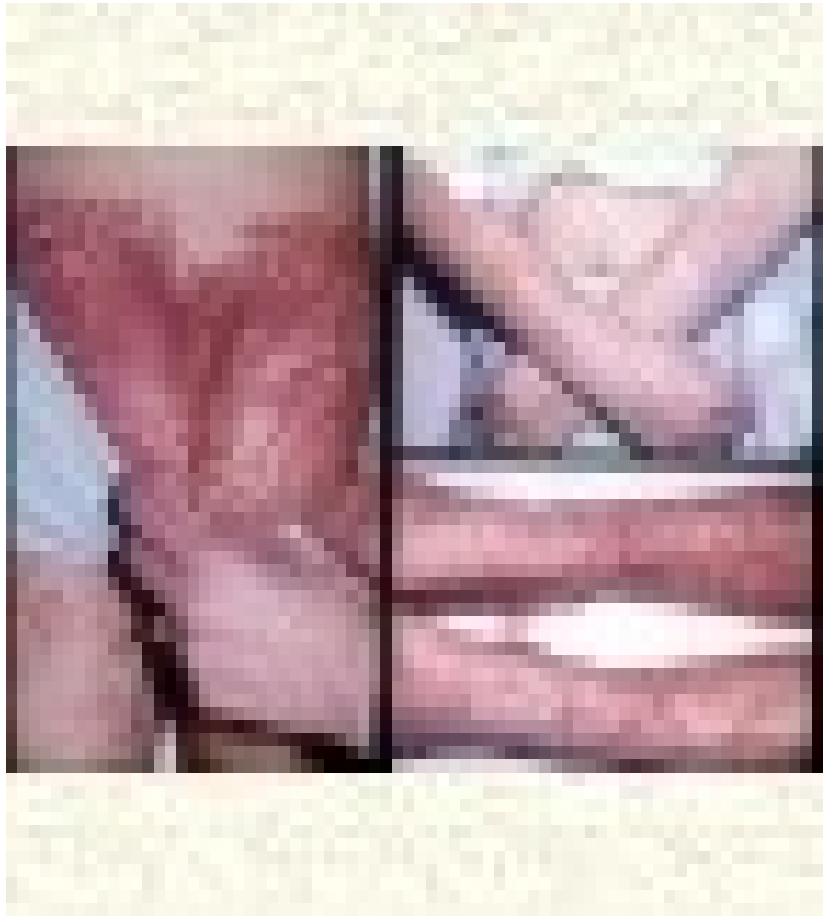
- Fever, arthralgia
- Exudative Tonsillitis
- Hepatosplenomegaly
- Review smear





# Look at the patient first



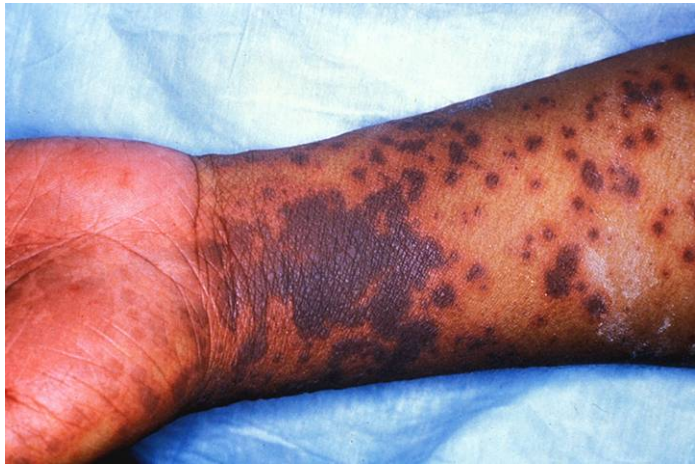


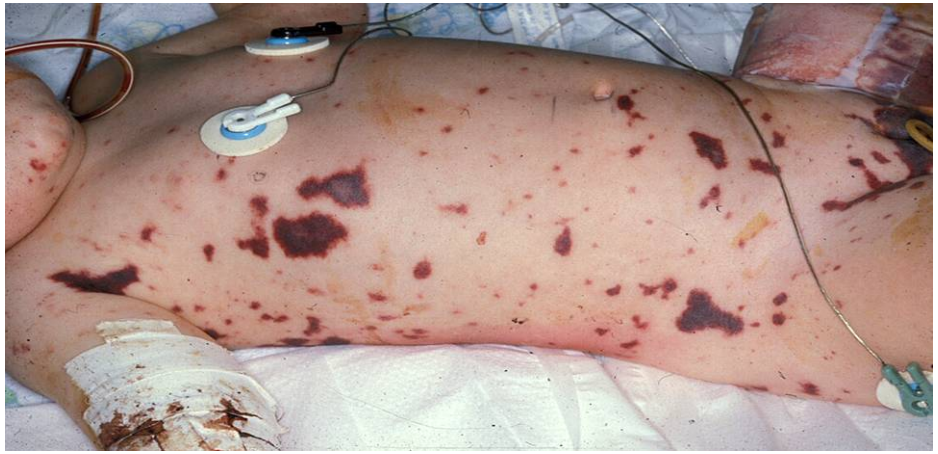
# “Blotchy Bottoms”

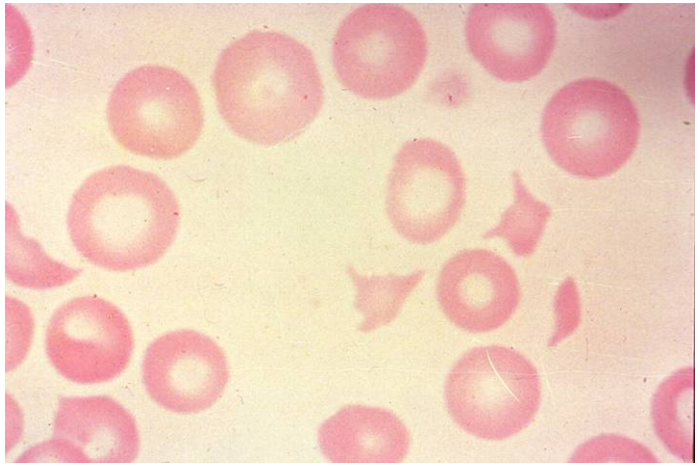
- 10 yr old white female
- Hematuria x 2 days
- Left knee pain and swelling
- Normal CBC, PT,PTT and smear
- What can cause her to have acute abdominal pain with blood in stools?
- Long term sequelae?

# Toxic child in ER

- 2yr old with h/o fever for 1 day
- Toxic, hypotensive
- Hb 5 gms, platelets 21000
- Review smear

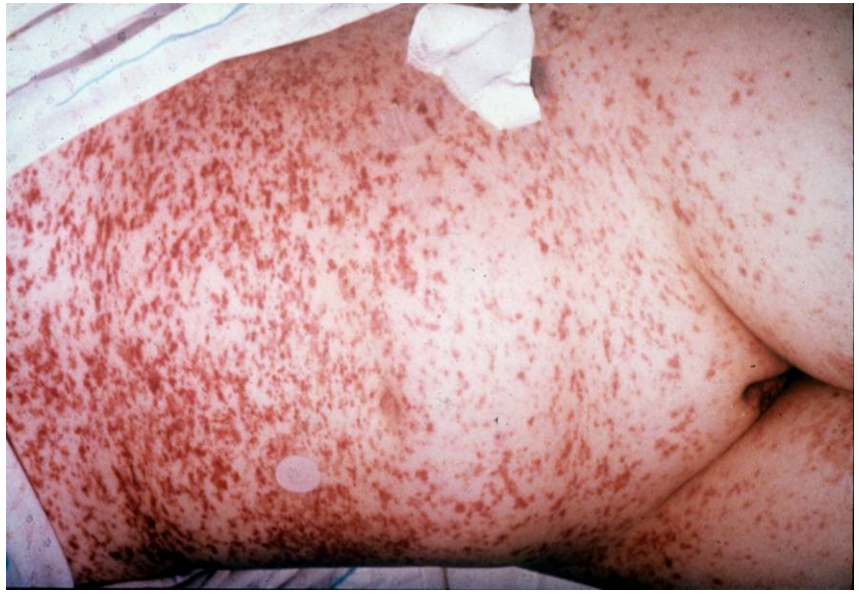




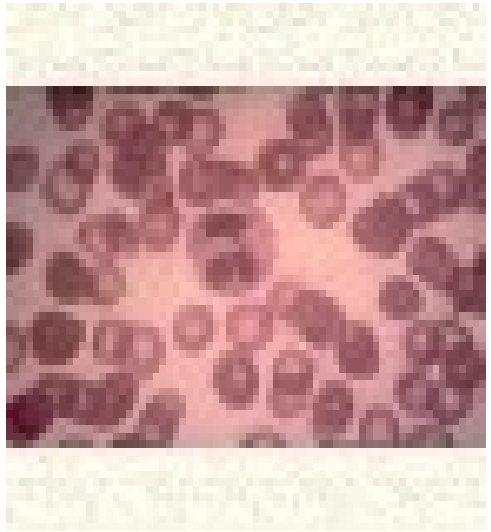


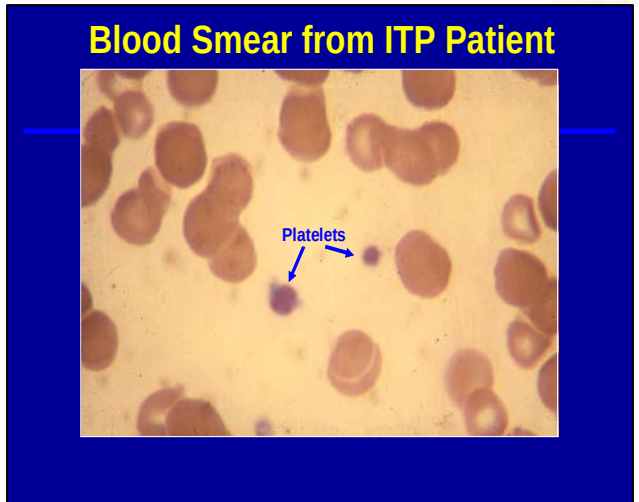
# “Covered with bloody spots”

- 6 yr old white female
- Acute onset of Petechia, Purpura
- H/O viral infection
- Normal CBC, platelet - low
- Mega thrombocytes +
- ? Bone marrow needed - DX ?



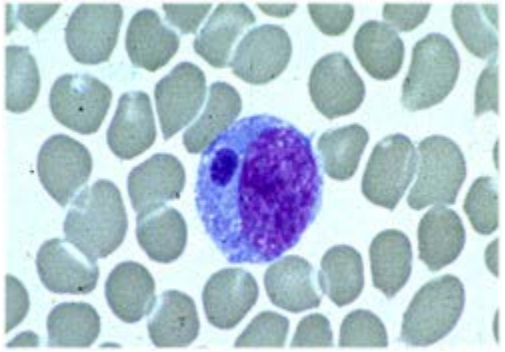
# Peripheral Thromboctyopenia with Megathrombocytes





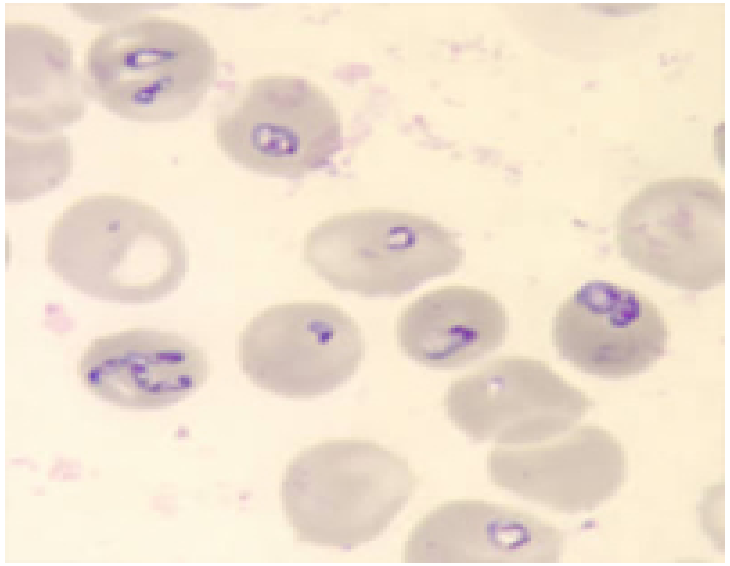

# Ticking time bomb!

- Fever, rash on face, neutropenia, thrombocytopenia and hyponatremia in a 17 yr old Louisiana boy
- Lone star state



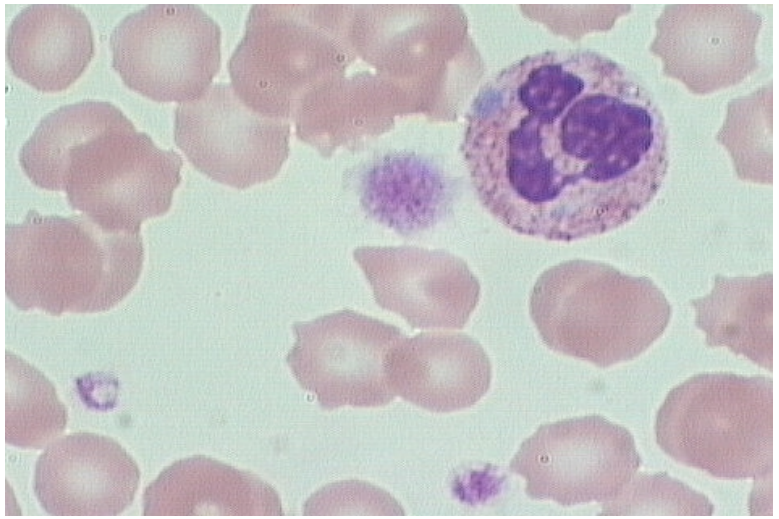
# Hemolytic anemia

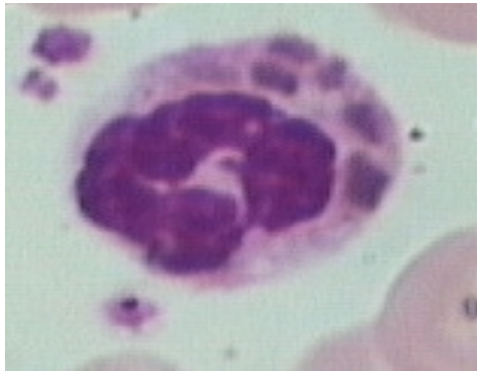
- Deer Tick  - Babeisos

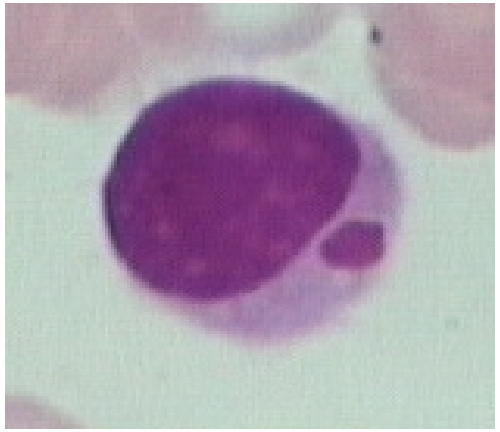



# Inclusions in WBC

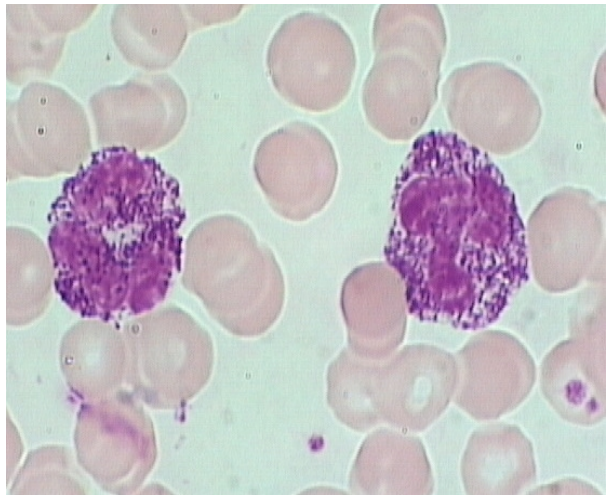
- May Hegglin anomaly  Chediak Higashi

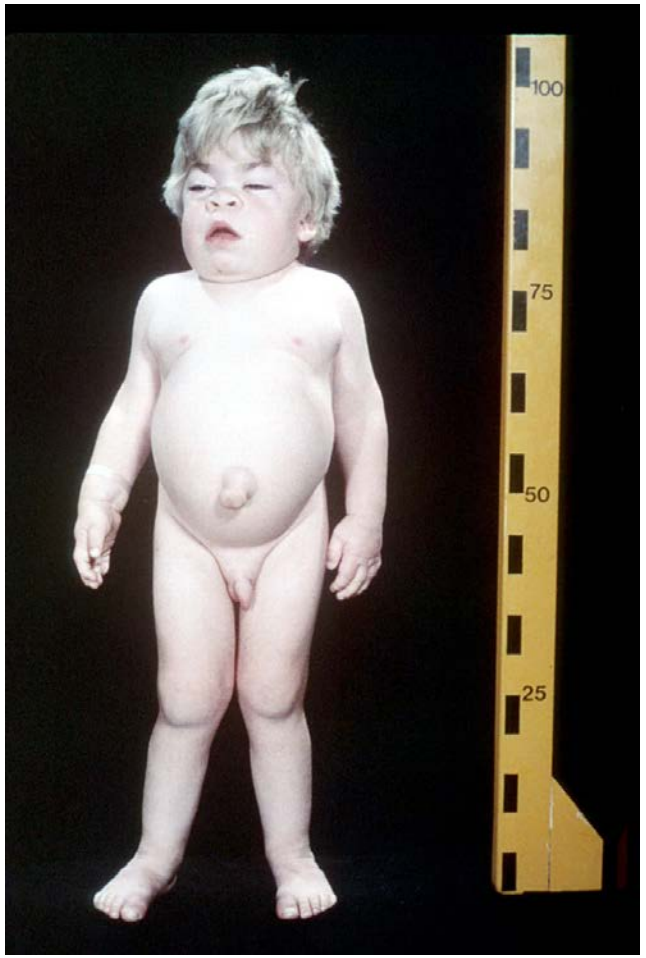






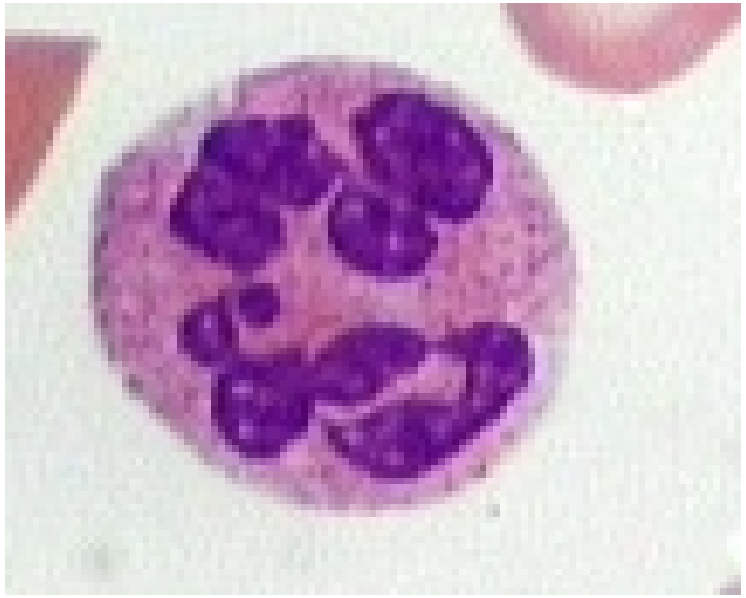
# Coarse facies, Developmental delay





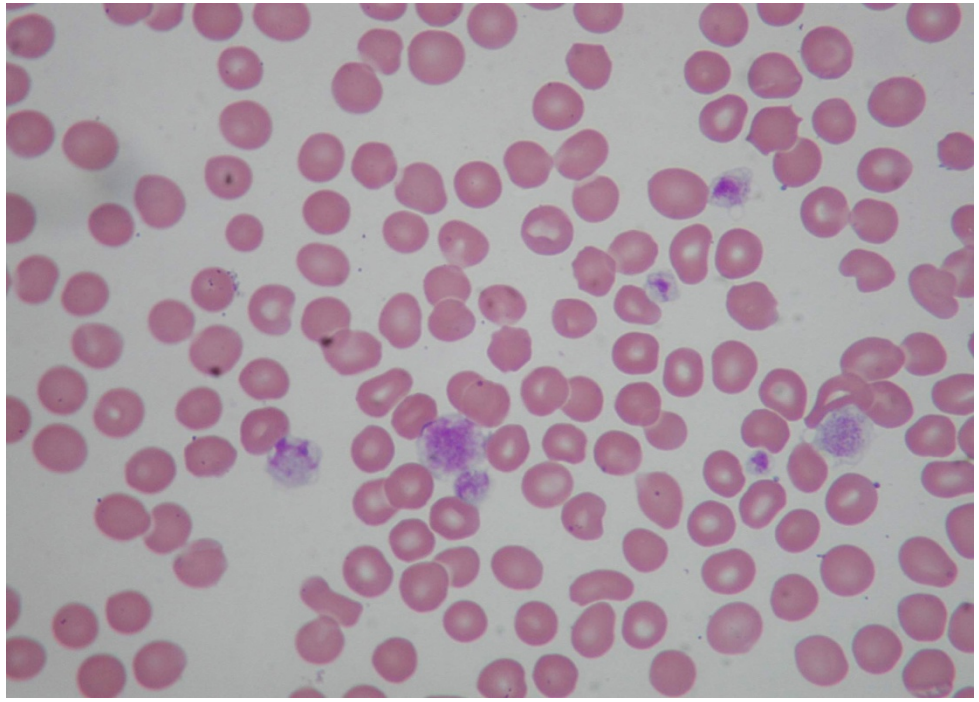
# Goat milk drinking infant

- MCV 102 Hb 8.1



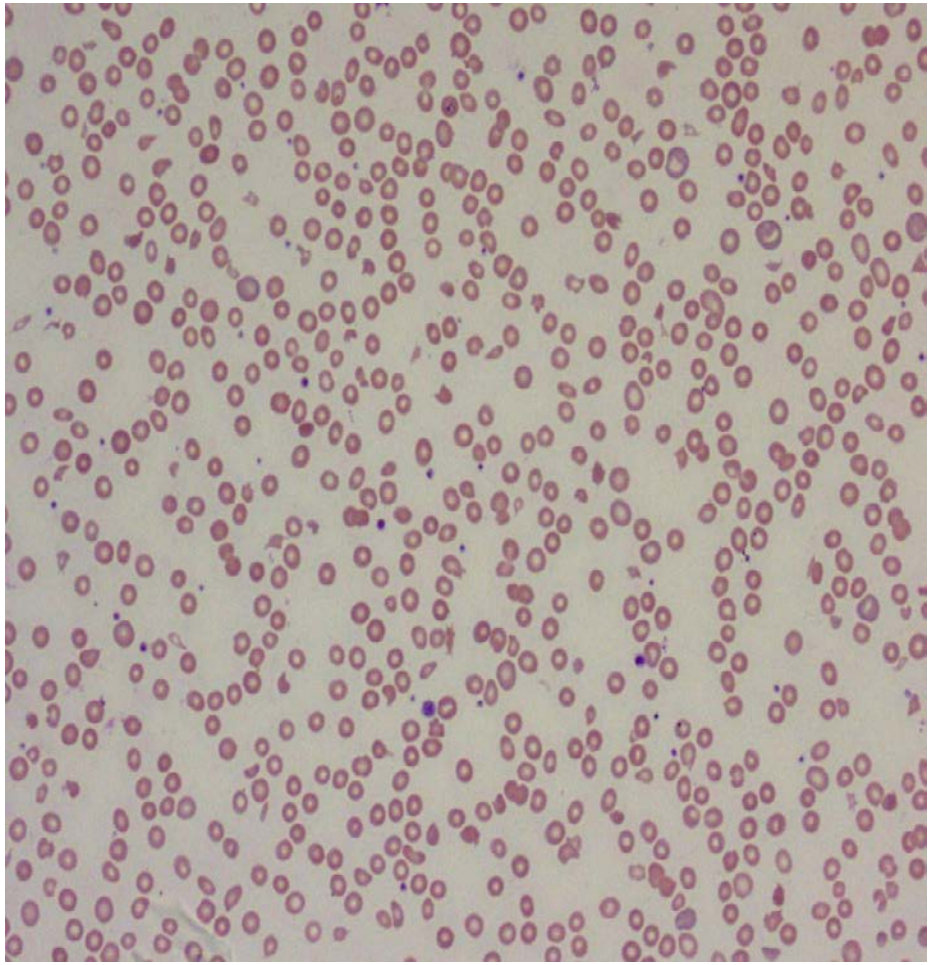
# H/O Nose bleeding, bleeding after extractions

- Large Platelets, decreased numbers



**Hgb 7.7 g/dl**
**HCT 22%**
**Platelets 150,000/mcL**
**WBC 8,200/mcL**
**Retic 240,000/mcL**
**Tbili 3.2 mg/dL Direct 0.2 mg/dL**

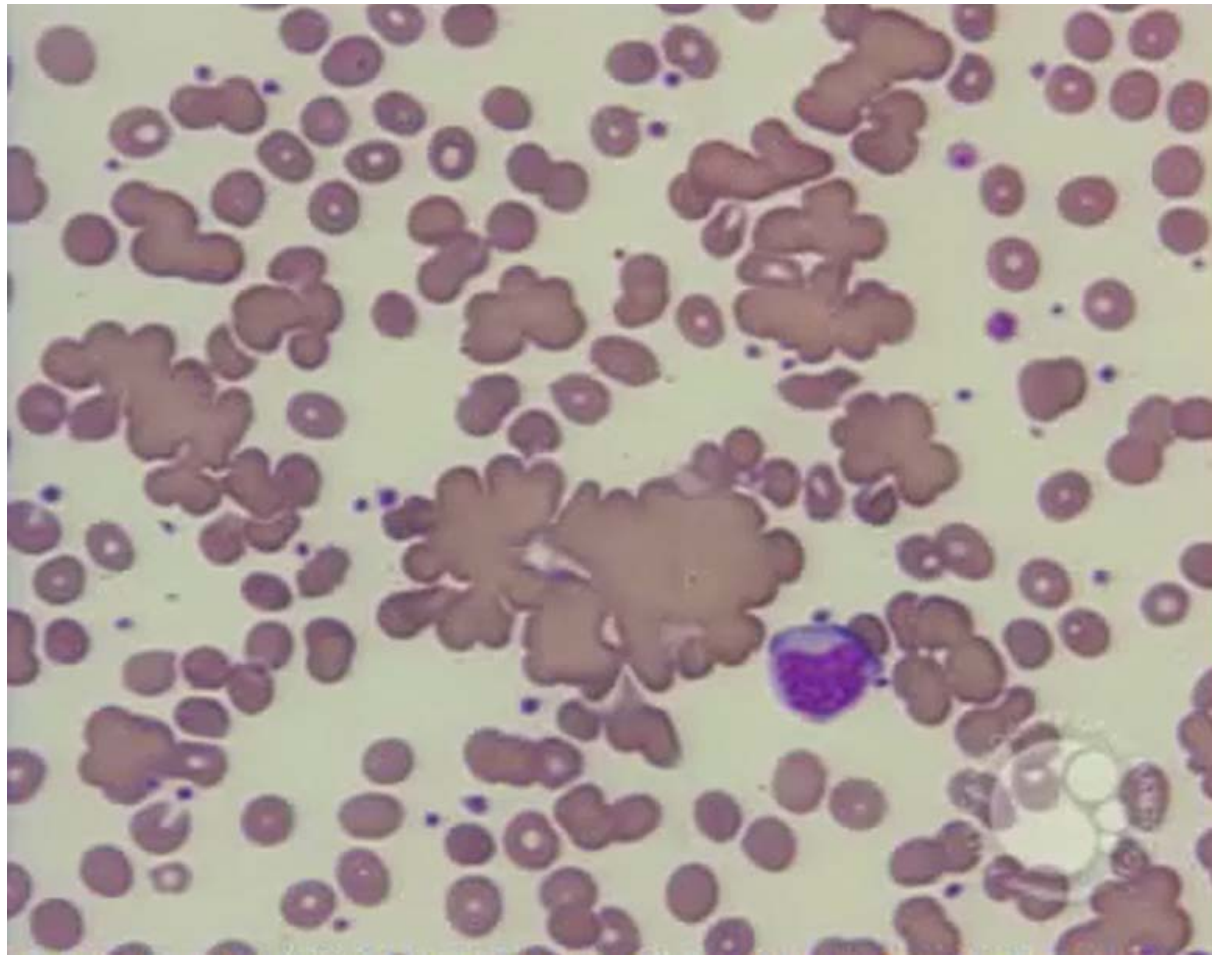
**h/o heart surgery for mechanical valve**



John Lazarchick, ASH Image Bank 2011; 2011-1066

**<u>What is your diagnosis</u>?**

**A. Warm antibody hemolytic anemia**
**B. Cold agglutinin disease**
**C. Valve hemolysis**
**D. Iron deficiency**
**E. Thalassemia trait**



# Get ready for years of microscope viewing!!

# Summary

A. Good H & P

B. CBC, Retic, Smear

C. Further Specific Tests

D. Careful Follow-Up