

# Hematologic changes in systemic diseases

# Systemic diseases

- Infection
- Renal diseases
- Liver diseases
- Connective tissue diseases
- Malignancy

# Anemia of chronic disease (ACD)

- Chronic infections:
  - Tuberculosis, HIV infection, osteomyelitis etc.
- Chronic inflammatory diseases:
  - SLE, rheumatoid arthritis, scleroderma, polymyositis
- Malignancy
- Others

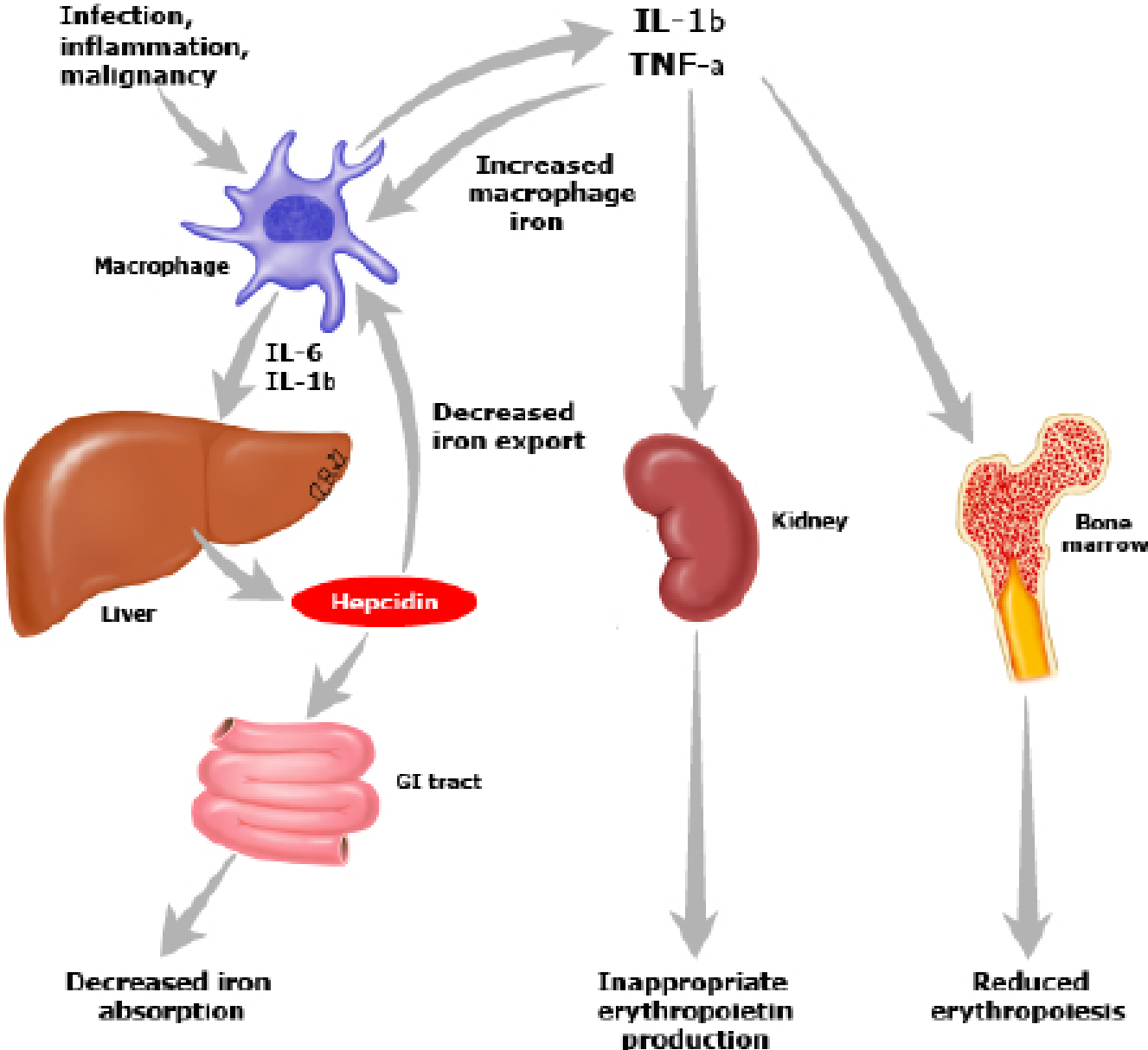
# Diagnosis

- Mild to moderate anemia
- Normochromic normocytic anemia( may be hypochromic microcytic anemia)
- Low reticulocyte count
- Reduced serum iron and TIBC
- Normal or increased serum ferritin

## Laboratory findings in iron deficiency anemia, thalassemia, and anemia of chronic disease/inflammation

Test	Iron deficiency anemia	Alpha or beta thalassemia	Anemia of chronic disease/inflammation
Complete blood count			
Hemoglobin	Decreased	Decreased	Decreased
Mean corpuscular volume (MCV)	Decreased	Decreased	Normal to decreased
Red cell distribution width (RDW)	Increased	Increased or normal	Normal to increased
Iron studies			
Serum iron	Decreased	Normal or increased	Decreased
Total iron-binding capacity (TIBC); transferrin	Increased	Normal	Decreased
Transferrin saturation	Decreased	Normal	Decreased
Serum ferritin	Decreased	Normal or increased	Increased

# Mechanism for the anemia of chronic disease



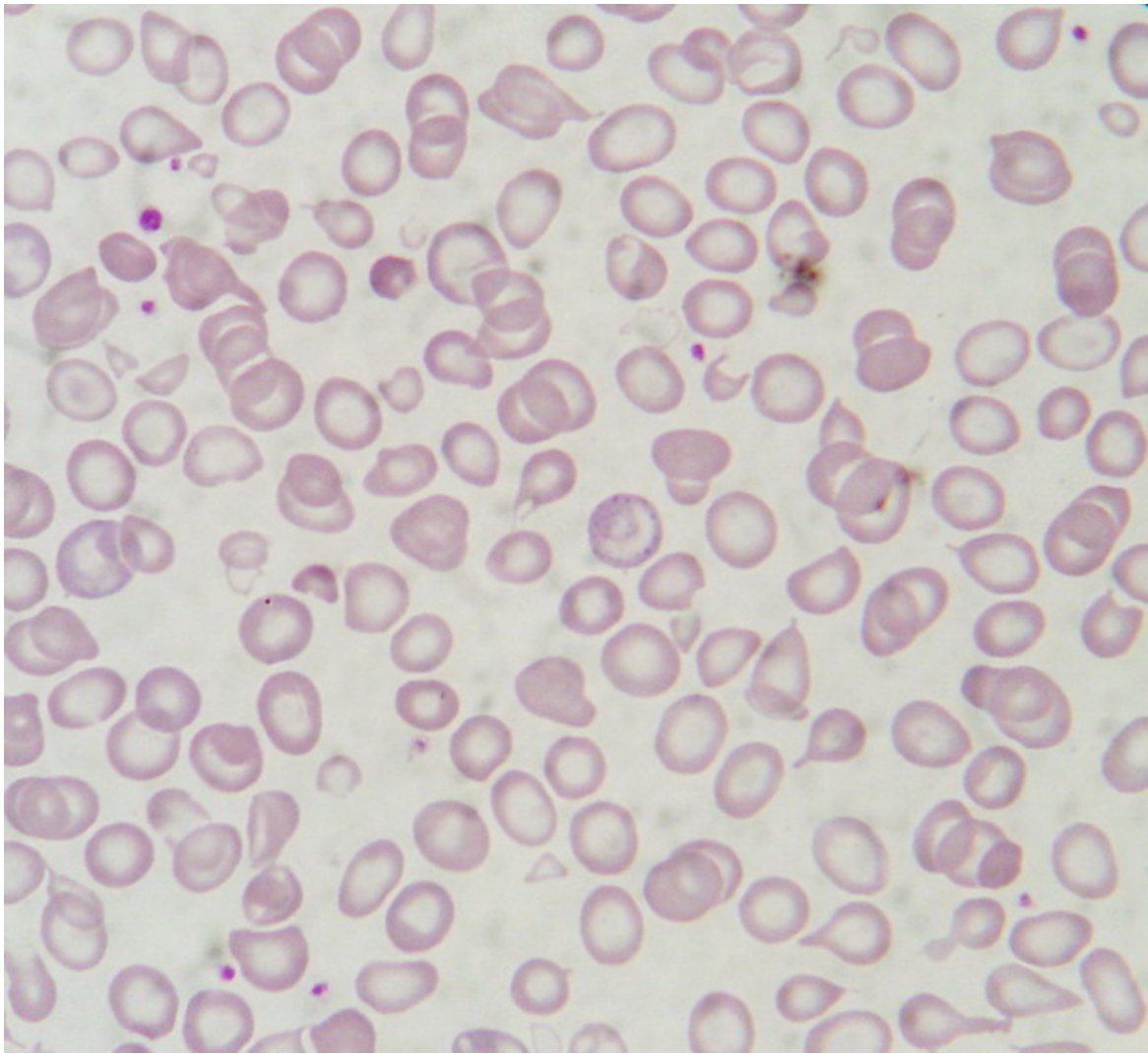
# ACD: treatment

- Treat underlying disease
- Correct other causes of anemia
- PRC transfusion

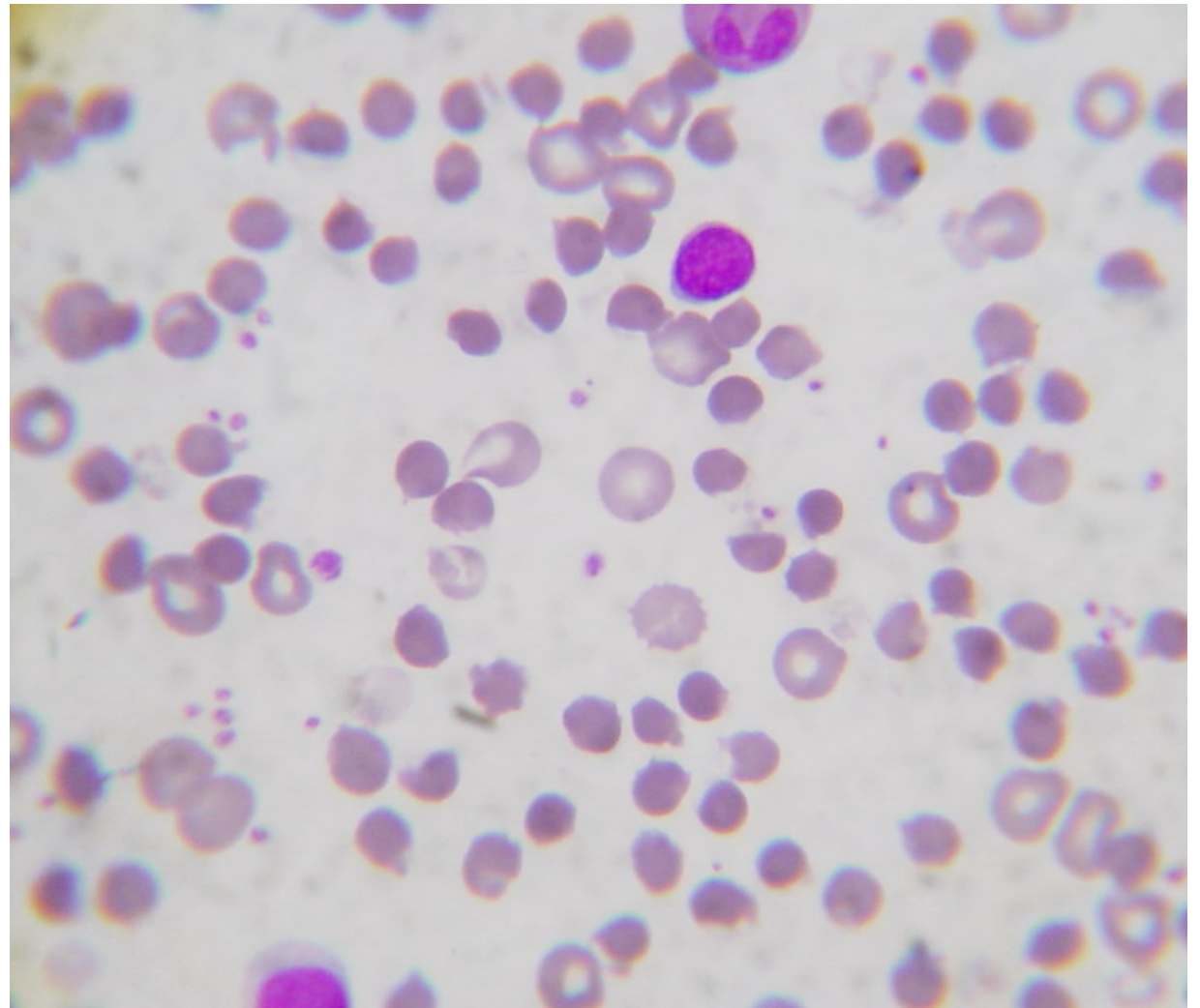
# Infection: acute infection

- Acute hemolytic anemia (underlying HbH, G-6-PD def)
- DIC (severe bacterial infection)
- Leukocytosis (bacterial infection)
- Leukopenia, transformed lymphocyte (viral infection)
- Thrombocytopenia (viral infection)
- Immune hemolytic anemia ( Infectious mononucleosis, mycoplasma pneumonia)

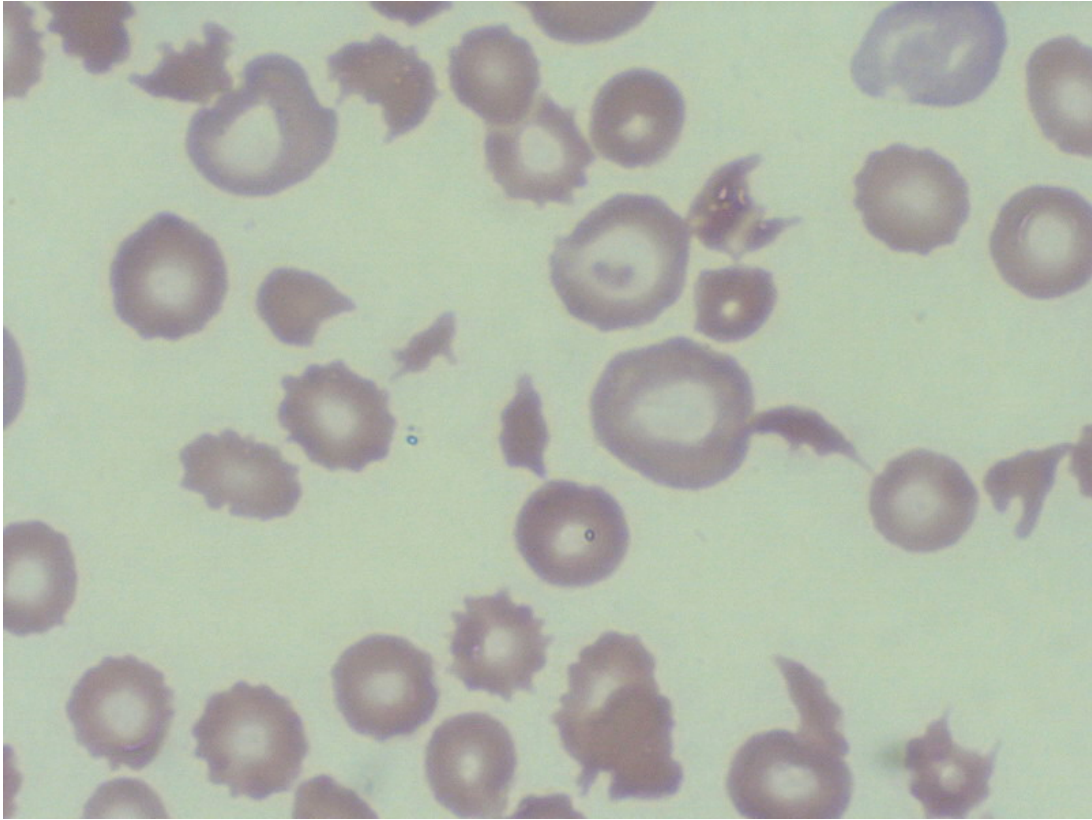




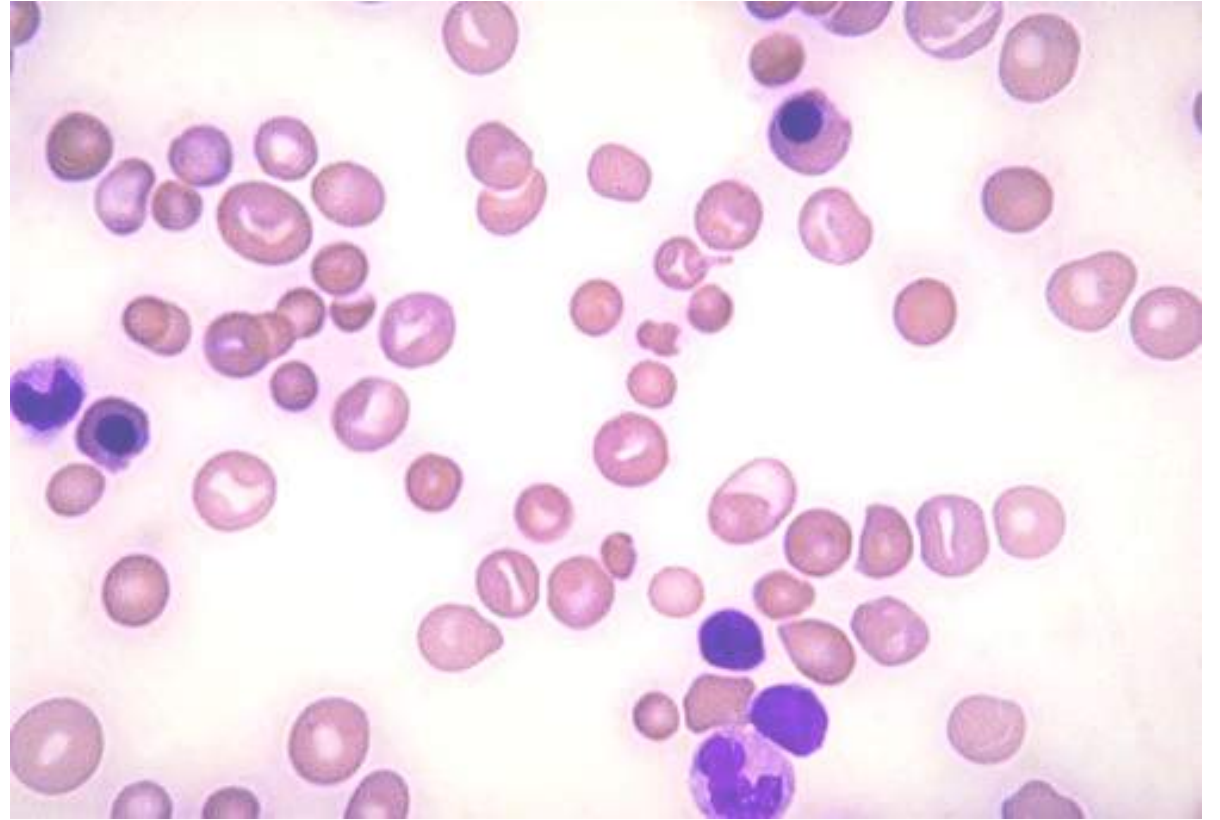
Thalassemia



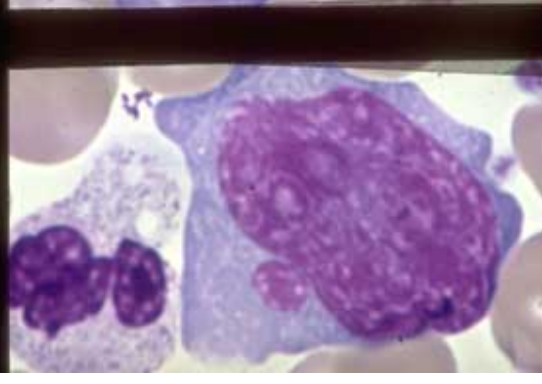
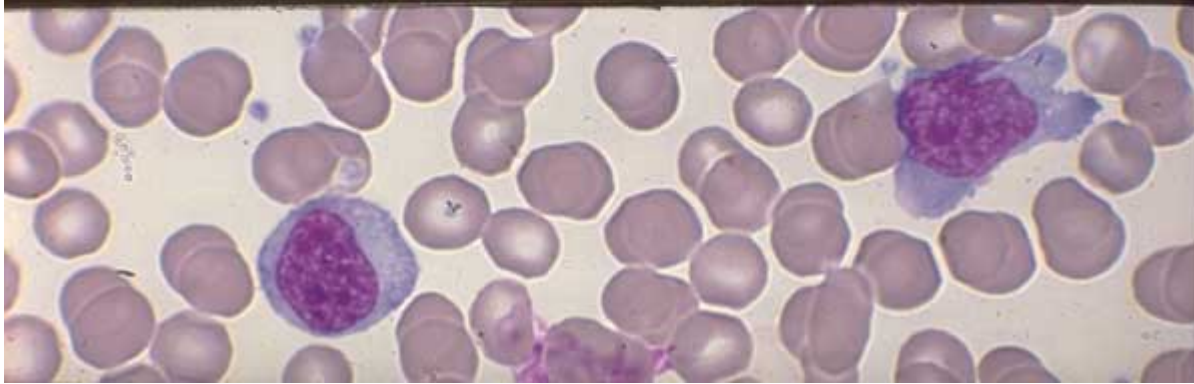
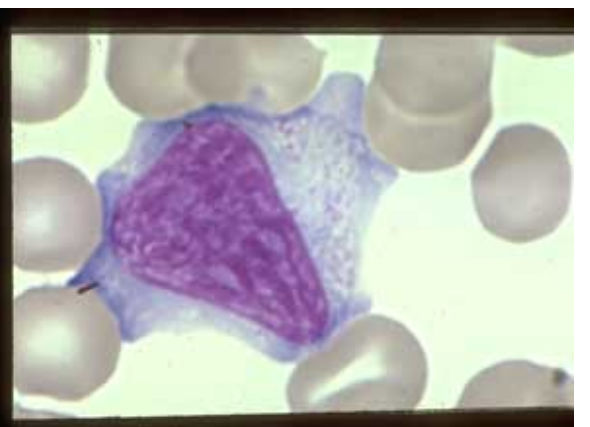
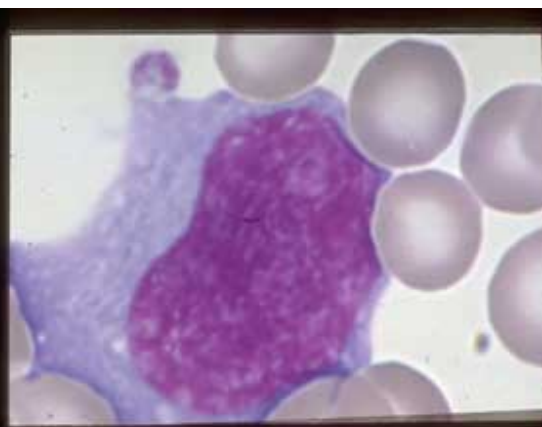
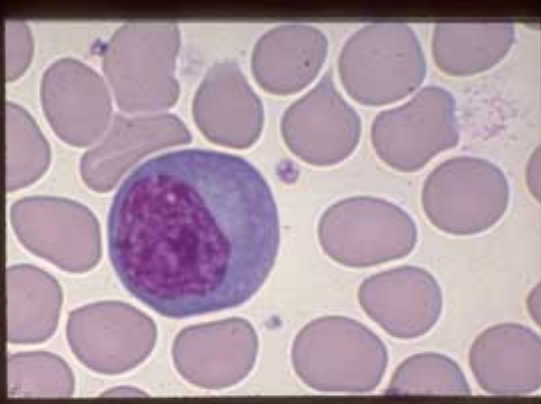
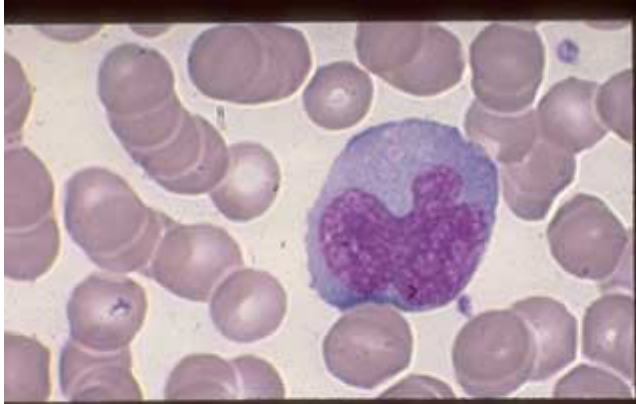
G-6-PD deficiency with acute hemolysis



DIC



AIHA



# Infection: chronic infection

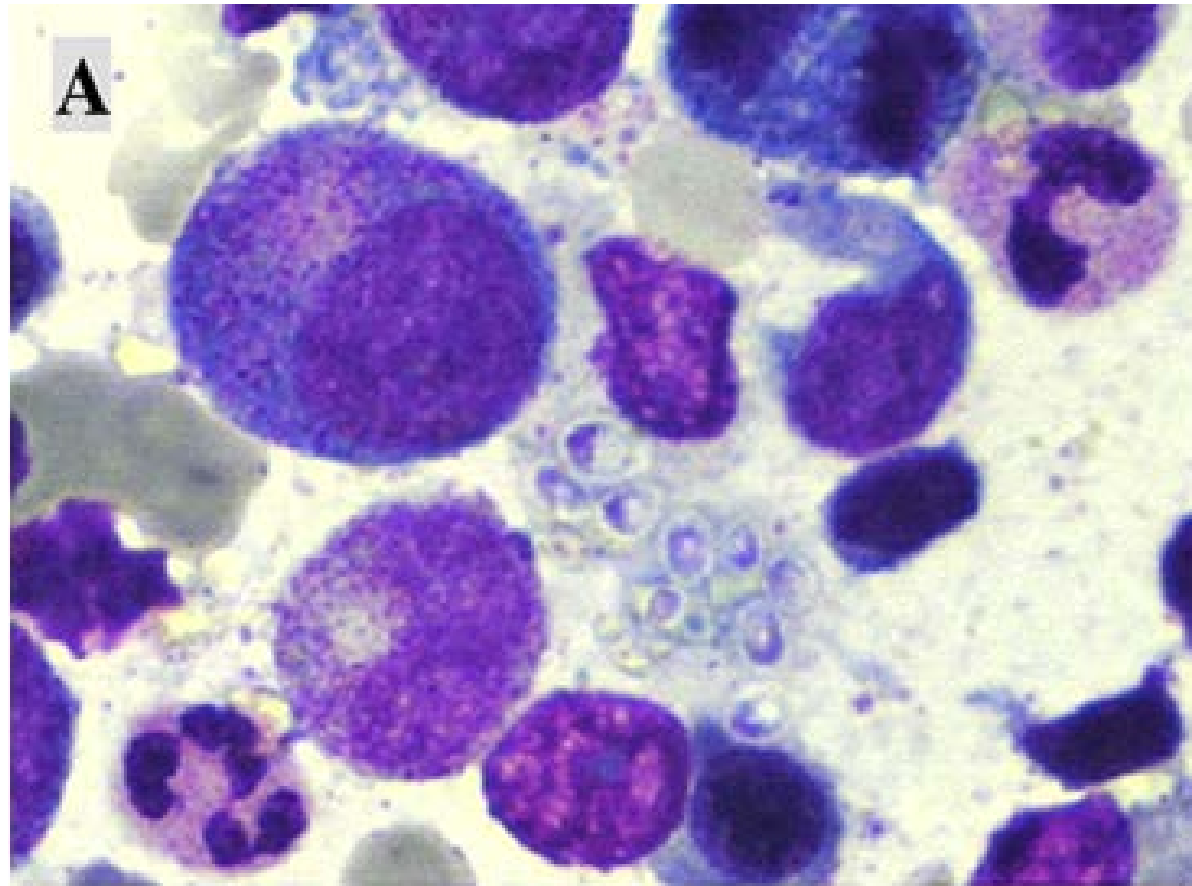
- Anemia of chronic disease
- Myelophthisis anemia
- autoimmune hemolytic anemia

# Infection: HIV infection

- Anemia
- Thrombocytopenia
- Antiphospholipid syndrome
- Lymphoproliferative disorder

# HIV: anemia

- Anemia of chronic disease
- Viral infection: CMV, EBV, Parvovirus B19
- Myelophthisic anemia: opportunistic infection, malignancy
- Nutritional deficiencies
- Autoimmune hemolytic anemia
- Bone marrow suppression: drug-induced



# HIV: anemia - treatment

- Correct reversible causes of anemia:
- Antiretroviral therapy (ART)
- PRC transfusion



# HIV: thrombocytopenia

- May be initial manifestation of HIV infection
- Correlate with degree of immunosuppression
- Treatment:
  - Antiretroviral
  - Corticosteroid

# Anemia in renal disease

- Severity relates to the degree of renal impairment
- Decreased erythropoietin
- Decreased red cell survival
- Iron deficiency anemia
- Nutritional deficiency anemia
- Anemia of chronic disease

# Anemia in renal disease: treatment

- Adequate dialysis
- Erythropoietin: 50 units/kg x 3/week
- Improve nutritional status:
  - Iron supplement: target ferritin >500 microgram/L
  - Folic, vitamin B

# Platelet dysfunction in renal disease:

- Platelet dysfunction is due to both decreased platelet aggregation and impaired platelet adhesiveness.
- Causes of platelet impairment: intrinsic platelet defects, abnormal platelet-endothelial interaction, uremic toxins, increased nitric oxide (NO), functional vWF abnormalities and anemia.
- No specific correlation of BUN or Cr level and bleeding risk

# Platelet dysfunction in renal disease:

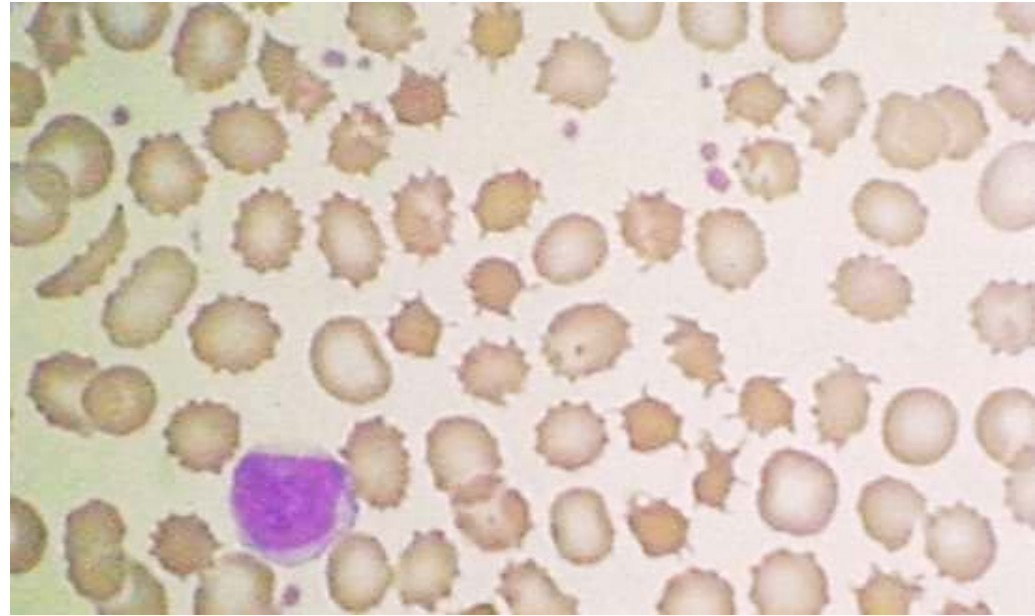
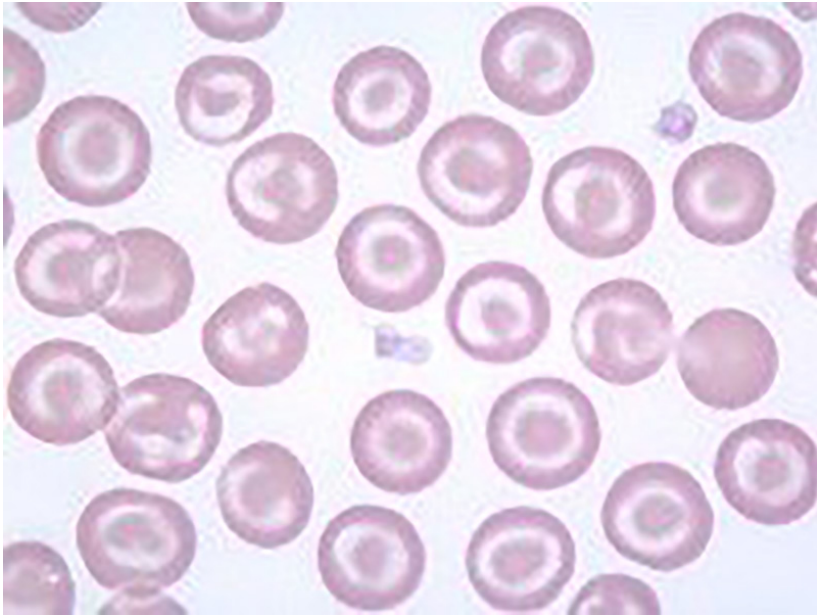
- Clinical manifestation: easy bruising, mucosa bleeding, GI bleeding, excessive bleeding after injury or invasive procedures
- Investigation: prolonged bleeding time, abnormal platelet aggregation test
- Treatment:
  - Dialysis:
  - Desmopressin (DDAVP) 0.3 mcg/kg IV or SC (in 50 mL of saline over 15 to 30 minutes if intravenously), or 3 mcg/kg can be given intra-nasally.
  - Correction of anemia
  - Cryoprecipitate: 10 units IV every 12 to 24 hours

# Anemia in liver disease

- Anemia of chronic disease
- Blood loss from esophageal varices
- Iron deficiency anemia
- Folate deficiency
  - Alcohol → on folate metabolism
  - Nutritional deficiency
- Hypersplenism

# Anemia in liver disease

- Abnormal red cells: macrocyte, target cell, spur cells, acanthocyte



# Thrombocytopenia in liver disease

- Associated with:
  - alcohol
  - HCV infection
  - hypersplenism



# Coagulopathy in liver disease

- Coagulation factor defects:-
  - decreased production
  - Vitamin K deficiency
- Increased fibrinolysis

# Coagulopathy in liver disease

- Laboratory:

- prolonged PT/INR
- Prolonged aPTT
- Elevated D-dimer

- Treatment:

- Vitamin K 10 mg orally x 3days
- FFP only in clinically bleeding patients
- Cryoprecipitate  
(if hypofibrinogenemia)

# Connective tissue disorders

- Anemia of chronic disorders
- Autoimmune hemolytic anemia
- Pancytopenia
- immune thrombocytopenic purpura
- Antiphospholipid syndrome

# Metastatic malignant diseases

## Anemia

- Anemia of chronic disorders
- Blood loss and iron deficiency
- Myelophthisic anemia
- Folate deficiency
- Marrow suppression from radiotherapy or chemotherapy

# Metastatic malignant diseases

White blood cell

- Leukemoid reaction

Coagulation and platelets abnormalities

- Thrombocytosis
- Thrombosis
- Acquired inhibitors to coagulation factors