Haemolytic Anaemias

Dr. MUBARAK ABDELRAHMAN
MD PEDIATRICS AND CHILD HEALTH
Assistant Professor
FACULTY OF MEDICINE -JAZAN
Objectives:

• To describe the mechanism of anemia.
• To identify the common causes and classification of hemolytic anemia.
• To recognize the clinical presentation, management and long term complications of common hemolytic anemia.
Mechanisms of Anemia

Production Disorders:
- Factor Deficiency (RBC Size)
  - Iron, Vit. B$_{12}$, Folate
- Hematopoietic Cell Damage

Survival Disorders:
- Blood Loss
- Red Blood Cell Destruction (Shape)
  - Hemolytic Anemias
Clasification of haemolytic anaemias

According to cause:

- Intrinsic (intra-corpuscular)
- Extrinsic (extra-corpuscular)
Intrinsic RBC Abnormalities:

**Hereditary**
- Membrane Proteins – Spherocytosis.
- Enzymes - G6PD Deficiency.
- Hemoglobin Synthesis - Sickle Cell Disorders, Thalassaemia.

**Acquired:**
- Paroxysmal nocturnal haemoglobinuria (PNH)
Extrinsic causes

• Immune mediated.
• Mechanical.
• Hypersplenism.
• Infections, toxins, etc
Haemolysis

• Extravascular
• Intravascular
Extravascular Haemolysis

Clinical indicators:
- Pallor
- Jaundice
- Splenomegaly

Laboratory Findings:
- Low Hb.
- High Reticulocyte count.
- Polychromasia in peripheral film.
- Raised unconjugated serum bilirubin.
- Increased urine urobilinogen
Intravascular Haemolysis

Clinical indicators:
• Pallor
• No jaundice initially, later
• Usually no splenomegaly
• Red urine.

Laboratory Findings:
• Low Hb
• High Reticulocyte count
• Polychromasia
• Haemoglobinuria
• Haemosiderinuria in chronic intravascular haemolysis
Complications of chronic haemolytic anaemia:

- Depressed immunity - infections
- Chronic non-healing ulcers
- Gallstone formation --- cholecystitis
- Hypersplenism if huge splenomegaly
RBC Membrane Hereditary Spherocytosis

- Autosomal Dominant - Most Common
- Autosomal recessive - More Severe
- Disorder of RBC Membrane Proteins
- Cytoskeletal Proteins - Maintain RBC Shape, Strength, Flexibility
- Chronic Hemolytic Anemia
Hereditary Spherocytosis

Shear forces in circulation

↓ membrane stability
Chronic hemolytic anemia

splenomegaly

MΦ

membrane loss
spherocyte

↓ membrane loss

Chronic hemolytic anemia
Hereditary Spherocytosis

Clinical manifestation:

- Asymptomatic
- Fluctuating hemolysis
- Splenomegaly
- Pigmented gall stones - 50%
Hereditary Spherocytosis

Laboratory Findings:
• Mild, moderate or severe anaemia.
• Spherocytes.
• Reticulocytes.
• Osmotic fragility test: Increased susceptibility of RBC to lysis in hypotonic solution.
Osmotic Fragility
Management:

- Folic Acid 5mg weekly, prophylaxis life long
- Splenectomy
- Blood transfusion in Ac, severe hemolytic crisis
Hereditary Elliptocytosis

• Equatorial Africa, SE Asia
• AD / AR
• Functional abnormality in one or more anchor proteins in RBC membrane - Alpha spectrin, Protein 4.1
• Usually asymptomatic
• Mx: Similar to H. spherocytosis
Elliptocytosis
Red Cell Enzymopathies

Physiology:

• HMP (Hexose monophosphate) shunt pathway: NADPH & Glutathione production (G6PD def.).
• EM (Embden Meyerhof) pathway: ATP production (Pyruvate kinase def.).
Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency

- Pivotal enzyme in HMP Shunt & produces NADPH to protect RBC against oxidative stress
- Most common enzymopathy - 10% world’s population
- Protection against Malaria
- X-linked
Clinical Features:

• Acute drug induced hemolysis: Aspirin, primaquine, chloroquine, dapsone, cotrimoxazole, nalidixic acid, nitrofurantoin, ciprofloxacin, chloramphenicol, …
• Chronic compensated hemolysis.
• Infection/acute illness.
• Neonatal jaundice.
• Favism.
• RED URINE
• It is a classical example of intravascular haemolysis
Investigations:

- P. Smear: Bite cells, blister cells, irregular small cells, Heinz bodies, polychromasia
- G-6-PD level

Treatment:

- Stop the precipitating drug or treat the infection
- Acute transfusions if required
Paroxysmal Nocturnal Hemoglobinuria

- Acquired Disorder
- 25% Paroxysmal and Nocturnal
- Mutation of Stem Cells - No Anchor Protein
  (Chronic Hemolysis)

Complement-Induced Lysis
(Intravascular - Hgb in Urine)
Hemolytic Anaemias

Extrinsic Abnormalities - Acquired:

- Autoimmune Hemolytic Anemia
  Antibody Mediated (Spherocytes)
- Non-Immune Acquired Hemolytic Anemia
  Mechanical Trauma (Schistocytes), Infection : malaria
Autoimmune Hemolytic Anemia

• Result from RBC destruction due to RBC autoantibodies: Ig G, M, E, A

• Most commonly-idiopathic

• Classification:
  – Warm AI hemolysis: Ab binds at 37° C (Ig G).
  – Cold AI Hemolysis: Ab binds at 4° C (Ig M).
Non-Immune Acquired Hemolytic Anemia

1. Mechanical Trauma:
   A) Mechanical heart valves, Arterial grafts: cause shear stress damage
   B) March hemoglobinuria: Red cell damage in capillaries of feet
   C) Thermal injury: burns
   D) Microangiopathic hemolytic anemia (MAHA): by passage of RBC through fibrin strands deposited in small vessels → disruption of RBC eg: DIC, Malignant HTN, TTP, HUS
TRAUMATIC HEMOLYSIS
Non-Immune Acquired Hemolytic Anemia

2. Infection:
   • Falciparum malaria: severe intravascular hemolysis (Blackwater fever).
   • Clostridium perfringens septicemia.

3. Chemical/Drugs:
   Oxidant denaturation of hemoglobin e.g. Dapsone, sulphasalazine, Arsenic gas,...
Malaria in RBCs