Pediatric Congenital Hematologic
Disorders Research Center
مرکز تحقیقات بیماری های خونی مادرزادی کودکان

In the name of GOD

Hemolytic Anemia

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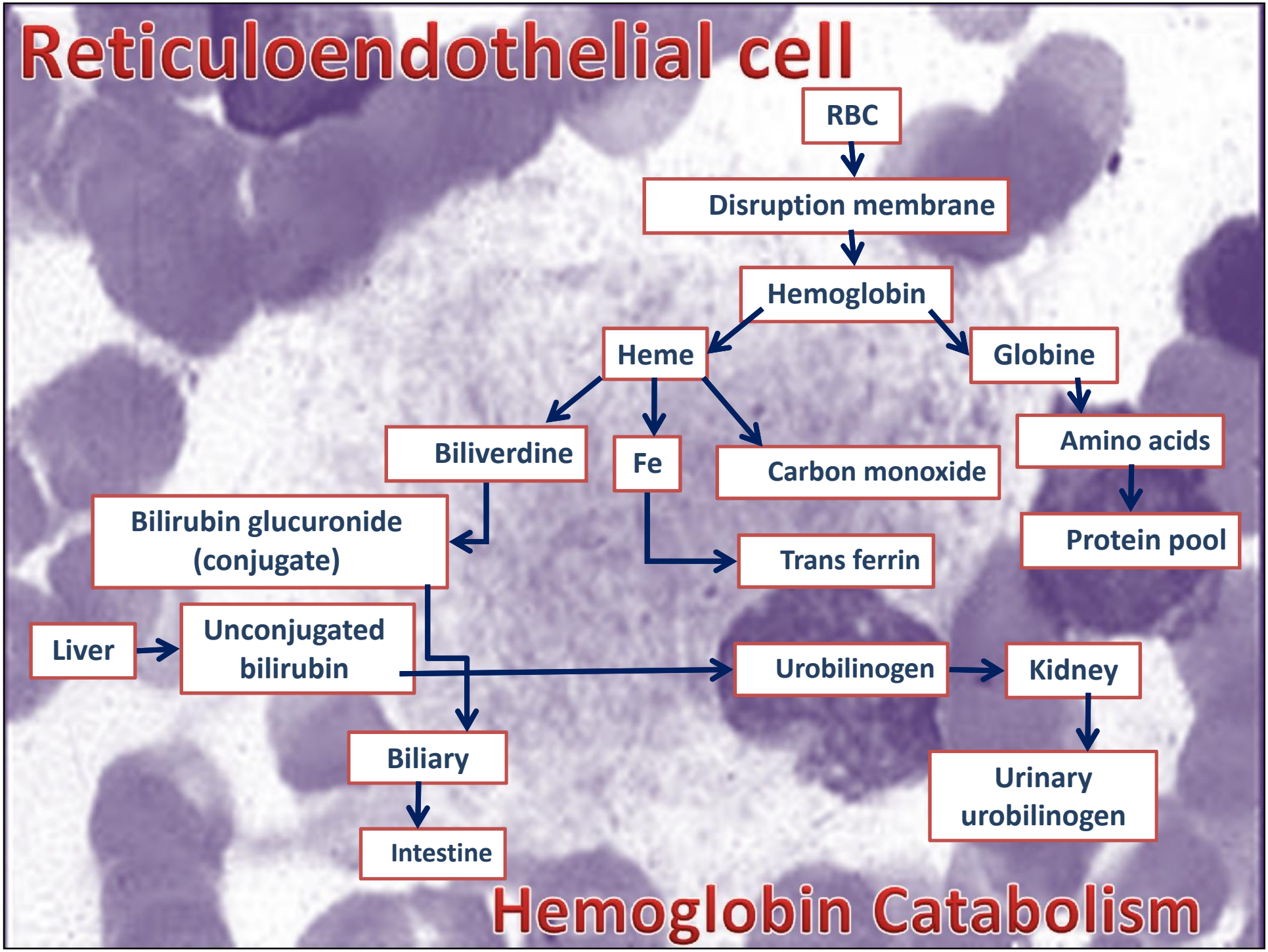
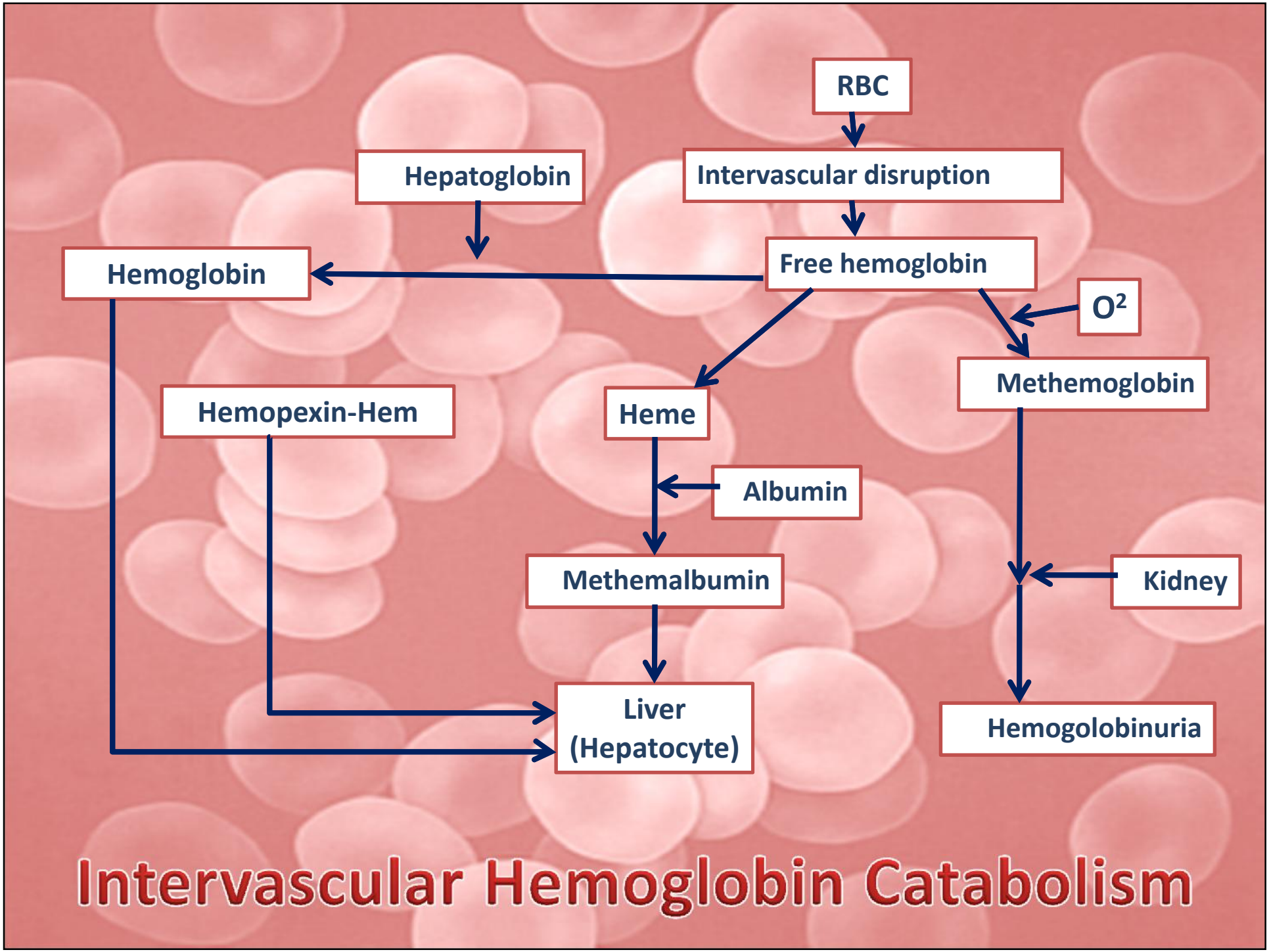
Reduction in the normal red cell survival (120 days)


Reticuloendothelial cell
RBC
Disruption membrane
Hemoglobin
Heme
Globine
Biliverdine
Fe
Carbon monoxide
Amino acids
Protein pool
Bilirubin glucuronide (conjugate)
Trans ferrin
Liver
Unconjugated bilirubin
Urobilinogen
Kidney
Biliary
Urinary urobilinogen
Intestine
Hemoglobin Catabolism


RBC
Intervascular disruption
Hepatoglobin
Free hemoglobin
Hemoglobin
O2
Methemoglobin
Hemopexin-Hem
Heme
Albumin
Methemalbumin
Kidney
Liver
(Hepatocyte)
Hemogolobinuria
Intervascular Hemoglobin Catabolism

Destruction

A. Corpuscular abnormalities

- Cell membrane abnormalities
- Enzymes abnormalities
- Hemoglobin abnormalities

B. Extracorpuscular abnormalities

- Immune mechanisms
- Non immune mechanisms

Approach to diagnosis

1. **Consideration of clinical feature suggesting hemolytic disease**

2. **Laboratory demonstration of presence of hemolytic process**

3. **Determination of the cause of hemolytic anemia**

Clinical Features

Suggest a hemolytic process:

1. Ethnic factors
2. Age factors
3. History of anemia, Jaundice, gall stone in family
4. Persistent anemia associated with reticylocytosis
5. Anemia unresponsive to hematinics
6. Splenomegaly
7. Hemoglobinuria
8. Dark urine

Laboratory Findings

- **Reduce red cell and evidence accelerated of hemoglobin catabolism**
- **Evidence of increased erythropiesis**

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Signs of Extravascular Hemolysis:

1) Increased unconjugated bilirubin

2) Increased fecal urinary urobilinogen

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Signs of Intravascular Hemolysis:

1) Raised plasma hemoglobin
2) Hemoglobinuria
3) Hemosiderinuria
4) Haptoglobin low

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Increased Erythropoiesis

1) Reticylocytosis
2) MCV increased
3) RDW increased
4) Increased normoblasts
5) Specific morphologic abnormalities
   Sickle cells – Target cells
   Basophil stippling – Spherocyts
6) *Expansion of marrow space in chronic hemolysis*
   Prominance of frontal bones
   Hair – on – end appearance of skull
   Biconecave vertebrae (Fish – mouth)
7) *Decreased red cell survival (Cr 51)*

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Test Used to Demonstrate Hemolytic Anemia

1) Hemoglobine , Hematocrit , RBC count ↓
2) Serum hepatoglubin ↓
3) RBC survival (Cr^{51}) ↓
4) LDH (Isoenzymes)
5) Bilirubin level ↑
6) Hemoglobinuria ↑
7) Reticulocyts ↑
8) Antiglobin test (Coomb's test) + - ↑

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Test Used to Establish

Specific Cause of Hemolytic Anemia

A - RBC defect :

1) **Membrane :**
- **Osmotic fragility**
- **Blood Smear**
- **Autohemolysis**

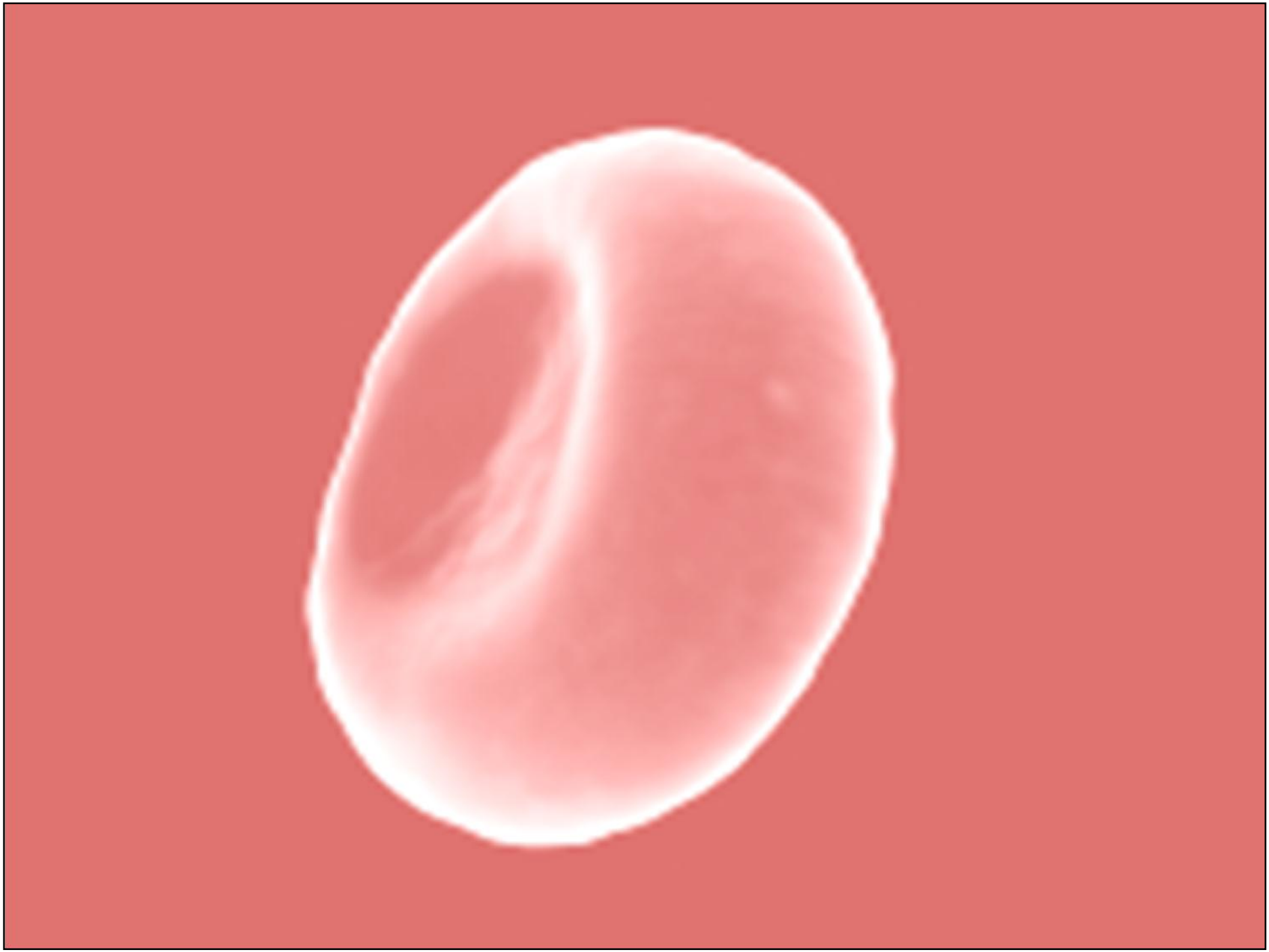
2) **Hemoglobin :**
- **Sickiling test**
- **Hemoglobin electrophoresis**

(Fetal hemoglobin)

3) **Enzyme :**
- **Heinz – body**
- **G6PD , PK (Specific enzym assay)**

B - Aquired hemolytic :

- **Coomb's test**
- **Antibody screening**
- **Blood group - Rh**



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Hereditary spherocytosis

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Genetics :

- Autosomal dominant
- Family history in 75 %
- Incidence 1/5000

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Pathogenesis

1- Dysfunction of RBC skeletal protein

2- Extravascular hemolysis (spleen)

3- Decreased surface -area –volume –ratio

4- Tendency to spherocytosis (reduce flexibility)

5- Cell dehydration

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Test hematology

Hemoglobine , Hematocrit , RBC count

MCV decreased

MCHC increased **Retic (3-15%)**

Osmotic fragility test

Autohemolysis increased (correct by glucose)

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Clinical features

Anemia

Jaundice (depend on rate hemolysis)

Splenomegaly

Newborn hyperbilirubinemia

Gallstones

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Treatment

Folic acid supplement (1mg/day)

Packed red cell transfusion

Splenectomy after 5 year

Glucose 6-Phosphate Dehydrogenase deficiency(G6PD)

G6PD → *Pentose Phosphate Pathway*

1- Sex linked (X - Chromosome)

2- Variable intermediate expression (Female)

(lyon hypotesis – Random deletion X)

3- 35% - In meditranean

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WHO Classification

Class I Chronic hemolytic anemia

Class II Intermitent hemolysis (mediterranean)

Class III -Intermitent hemolysis (infection- drug)

Patogenesis

1 – Red cell G-6PD activity fall was RBC age

2- ↓ glucose metabolism

3- ↓ NADPH / NADP

4 - ↑ H_2O_2

5 - Oxidation hemoglubin

Clinical features

Episodes of hemolysis may be produced by:

- **Drugs**
- **Fava bean**
- **Infection**

1- Acute self limiting hemolytic anemia
2- Hemoglubinuria
3- Heinz bodies
4- Bliste cell ,sphrocyt
5- Reticylotosis
6- Hemoglubine normal between episodes
7- Blood transfusion required
8 - Acute renal failure
9 - Neonatal jundice
10- Chronic hemolysis (European)

- In creased autohemolysis (Not correct)
- Splenomegaly

Treatment

1 – Aviodance

2 – Transfusion packed red blood

- Hb 7 g / dL
- Persistent hemoglubinuria Hb 9 g / dL

Classification of Immune hemolytic anemia

A – Autoimmune

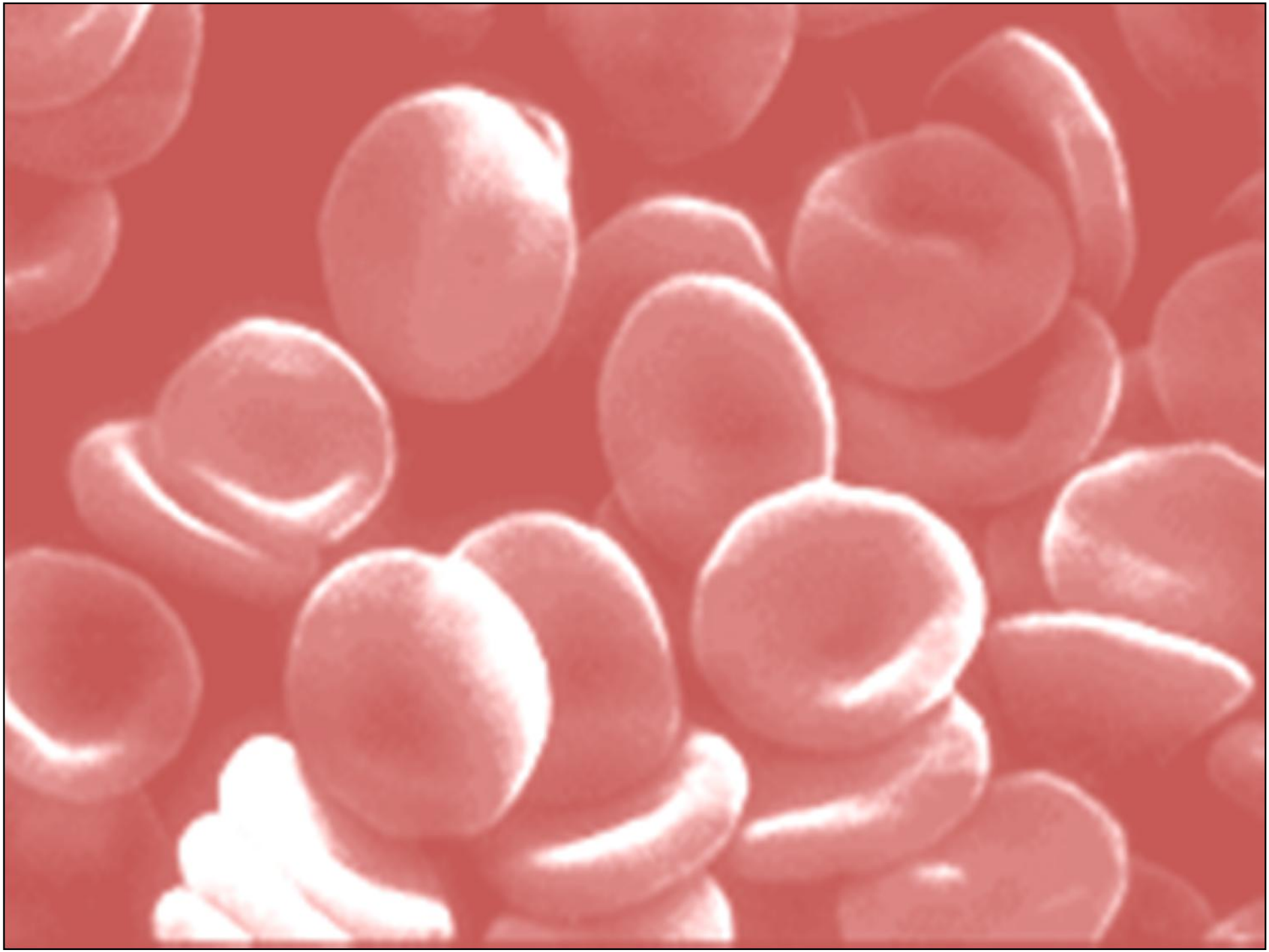
- **Associated with warm antibodies (IgG)**
- **Associated with cold antibodies (IgM)**

B – Isoimmune

- **Hemolytic disease of the newborn**
- **Rh & ABO incompatibility**

C - Drug induced

- **Immune complexes to RBC membrane**
- **Adsorption of drug to RBC**
- **Autoantibody to drug** (Insulin , antihistamine , Sulphanamid)



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Any Questions?

Thank you