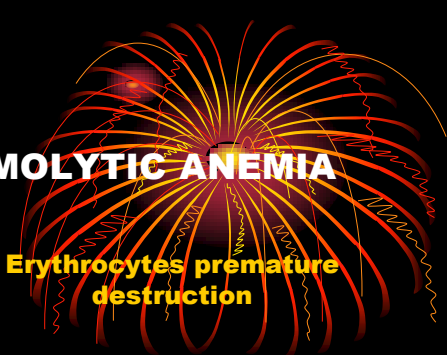
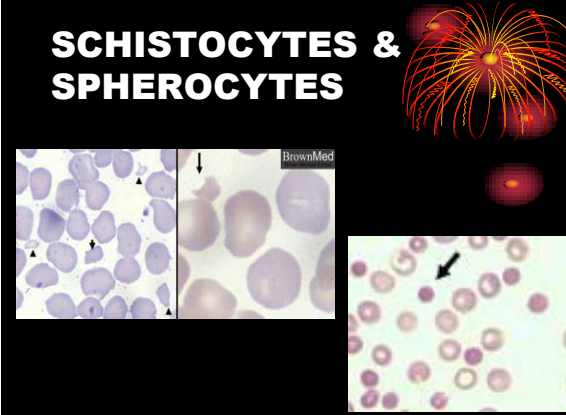


HEMOLYTIC ANEMIA

Erythrocytes premature destruction




SCHISTOCYTES & SPHEROCYTES



BrownMed

LABORATORY FINDINGS

- M:E ratio decreased
- Increased Reticulocytes
- Nucleated RBC in peripheral blood
- Shistocytes and Spherocytes
- Increased Bilirubin
- Other

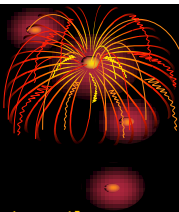


CLINICAL FINDINGS



- Jaundice
- Gallstones
- Dark or Red Urine
- Symptoms of Anemia
- Thinning of Cortical Bone
- Extramedullary Hematopoietic Masses
- Splenomegally

INTRAVASCULAR HEMOLYSIS



- Within the Circulation
- Causes
 - Activation of Complement on the RBC Membrane
 - Physical or Mechanical Trauma
 - Toxic Substances

*spherocytes

EXTRAVASCULAR HEMOLYSIS



- Within the Macrophages of the Spleen, liver, or BM
- Causes
 - Inherited RBC Defects
 - Acquired RBC Defects
 - Immuno-hemolytic Anemias

INTRINSIC DEFECTS



- **Membrane Defects**
 - Hereditary Spherocytosis, elliptocytosis, pyropoikilocytosis, stomatocytosis, xerocytosis, and Paroxysmal Nocturnal Hemoglobinuria
- **Enzyme Disorders**
 - Embden-Meyerhof Pathway Enzymes Deficiencies
 - Hexose-Monophosphate Shunt Enzyme Deficiencies
- **Abnormal Hemoglobins**
 - Thalassemia
 - Structural Hemoglobin Variants

EXTRINSIC DEFECTS



- **Antagonistic Plasma Factors**
- **Traumatic Physical Cell Injury**
- **Immune Medicated Cell Destruction**

*Spherocytes

HEMOLYTIC ANEMIA: MEMBRANE DEFECTS

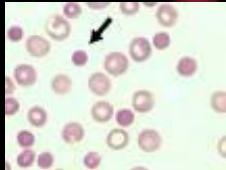


- **Skeletal Protein Abnormalities**
 - Vertical
 - Horizontal
- **Lipid Composition Abnormalities**

HEREDITARY SPHEROCYTOSIS



- Autosomal Dominate
- Decreased MCV, Increased MCHC
- Osmotic Fragility
- Autohemolysis Test



HEREDITARY ELLIPTOCYTOSIS



- Autosomal-dominate
- Elliptocytes



From: Johnson RA, Taylor TH, Adgey AA, Wang B, Johnson A. Atlas of Hematology. 10th ed. Saunders/Elsevier; 2009. © The Author(s). All rights reserved.

HEREDITARY PYROPOIKILOCYTOSIS



- Autosomal Recessive
- Elliptocytes, other bizarre shapes



From: Johnson RA, Taylor TH, Adgey AA, Wang B, Johnson A. Atlas of Hematology. 10th ed. Saunders/Elsevier; 2009. © The Author(s). All rights reserved.

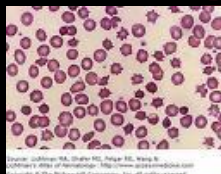
HEREDITARY STOMATOCYTOSIS

- Autosomal Dominate
- Stomatocytosis



ABNORMAL MEMBRANE LIPID COMPOSITION: ACANTHOCYTOSIS

- Spur Cell Anemia
- Abetalipoproteinemia
- Lecithin-Cholesterol Acyl Transferase Deficiency



PROXYSMAL NOCTURNAL HEMOGLOBINUREA

- Acquired Disorder
- Hyperhemolysis, Venous Thrombosis, Infection, and Bone Marrow Hyperplasia
- Ham Test

HEMOLYTIC ANEMIA: ENZYME DEFICIENCIES

- **Hexose Monophosphate Shunt**
 - Pyruvate Kinase
 - Glucose Phosphate Isomerase
 - Hexokinase
 - Phosphoglyceratekinase
 - Triosephosphate Isomerase
- **Embden-Meyerhoff Pathway**
 - Glucose-6-phosphate Dehydrogenase
 - Glutathione Synthetase
 - Glutamylcysteine Synthetase

GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY

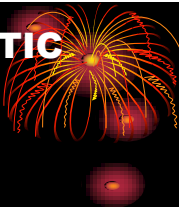
- **Sex linked**
- **Oxidant Stress**
- **Heinz Bodies**
- **Favism**

PYRUVATE KINASE DEFICIENCY

- **Normocytic, Normochromic Anemia**
- **Jaundice**
- **Gallstones**
- **Transfusions, Splenectomy**

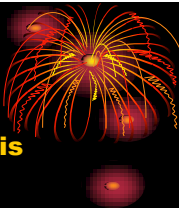
IMMUNE HEMOLYTIC ANEMIA

- Autoimmune
- Drug-Induced
- Alloimmune



MECHANISMS OF HEMOLYSIS

- IgG- Mediated Hemolysis
- Complement-Mediated Hemolysis
- IgM-Mediated Hemolysis



LABORATORY TESTING

- Direct Antiglobulin Test
- Indirect Antiglobulin Test



AUTOIMMUNE HEMOLYTIC ANEMIA



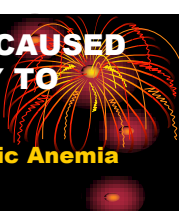
- **Warm Autoimmune Hemolytic Anemia**
- **Cold Autoimmune Hemolytic Anemia**
- **Paroxysmal Cold Hemolytic Anemia**
- **Mixed-Type**
- **Drug-Induced Hemolytic Anemia**

ALLOIMUNE HEMOLYTIC ANEMIA



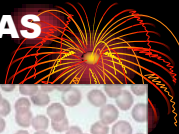
- **Hemolytic Transfusion Reactions**
- **Hemolytic Disease of the Newborn**

HEMOLYTIC ANEMIA CAUSED BY PHYSICAL INJURY TO THE ERYTHROCYTE



- **Microangiopathic Hemolytic Anemia**
 - **Hemolytic Uremic Syndrome**
 - **Thrombocytopenic Purpura**
 - **Disseminated Intravascular Coagulation**
 - **HELLP Syndrome**
 - **Malignant Hypertension**
 - **Traumatic Cardiac Hemolytic Anemia**
 - **Thermal Injury**
 - **March Hemoglobinuria**

HEMOLYTIC ANEMIAS CAUSED BY ANTAGONISTS



- **Infection Agents**
 - Malarial Parasites
 - Babesiosis
 - Bartonellosis
 - Clostridium Perfringens
- **Animal Venoms**
- **Chemicals and Drugs**

