

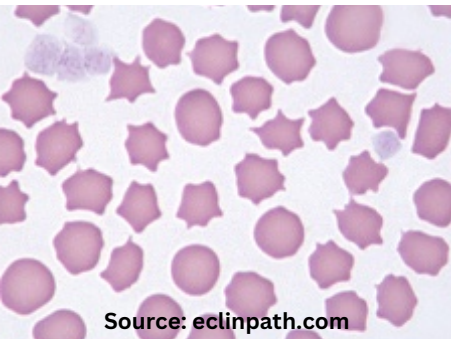
Red Blood Cell Morphologic Changes: Study Guide

Provided by Rocky Mountain Veterinary Clinical Pathology



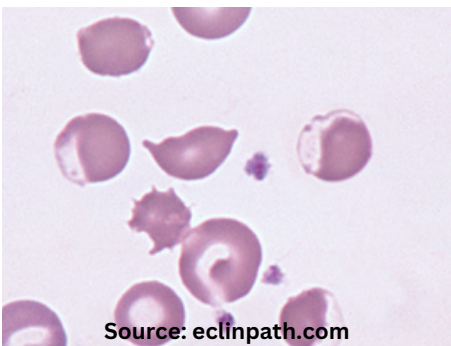
Acanthocytes (spur cells)

- Irregularly spaced projections
- **Fragmentation injury**
 - DIC, neoplasia (hemangiosarcoma, osteosarcoma, lymphoma, etc.), iron deficiency anemia, etc.
- **Alternations in lipid composition**
 - Liver disease



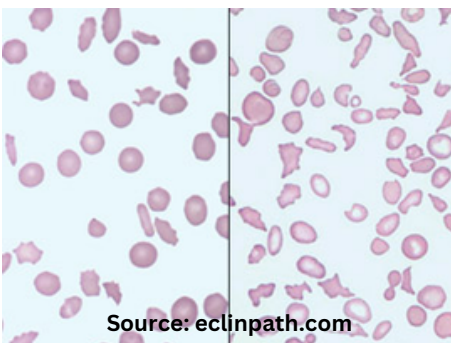
Echinocytes (burr cells)

- **Regularly** spaced projections, can be blunt or sharp
- **Artifact**
 - Storage, excess EDTA
- **Drugs**
 - Salicylates, doxorubicin, furosemide
- **Other**
 - Snake/bee envenomation, electrolyte abnormalities, colic in horses, renal disease/pyelonephritis



Eccentrocytes

- Exposure to oxidants, can be associated with hemolytic anemia
- **Oxidant ingestions**
 - Onions, zinc pennies, moth balls, skunk spray, copper tox in sheep, phenothiazine drenches in horses, VitK1 in dogs
- **Endogenous oxidants**
- **Inherited enzyme defects**
 - Glucose-6-phosphate dehydrogenase def and flavin adenine dinucleotide def in horses



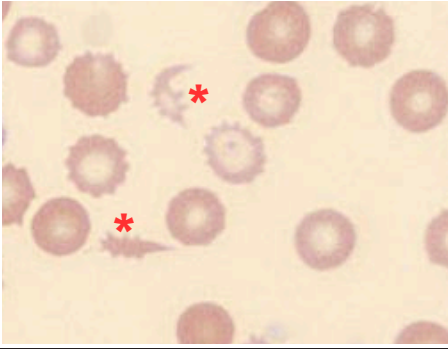
Elliptocytes

- Elongated red blood cells
- **Liver disease**
 - Especially in cats (lipidosis)
- **Myelofibrosis**
 - Non-regenerative immune mediated anemia, precursor directed immune mediated anemia, pure red cell aplasia, neoplasia
- **Chemotherapy**



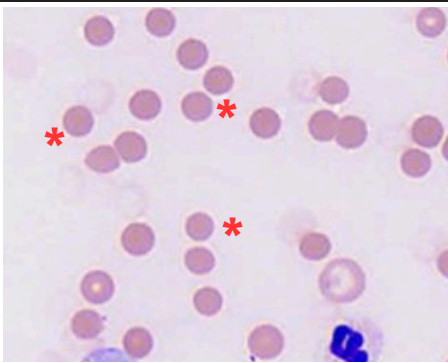
Keratocytes

- Blister like vesicle
- **Fragmentation injury**
 - DIC, hemangiosarcoma, vasculitis
- **Liver disease**
 - Especially in cats (lipidosis)
- **Oxidant injury**
 - Eccentrocytes and Heinz bodies too



Schistocytes

- RBC fragments
- **Fragmentation injury**
 - DIC, glomerular disease, vasculitis, vascular neoplasms, portosystemic shunts, iron deficiency anemia
- Rarely seen in cats with DIC but fairly common finding in dogs with DIC



Spherocytes

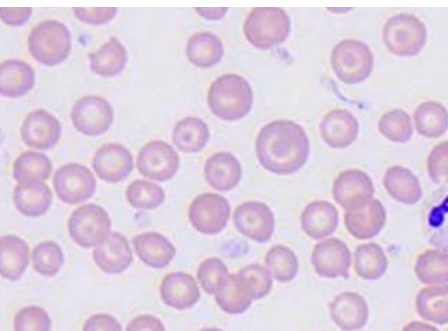
- RBCs that are spheroid instead of the normal discoid shape due to loss of part of the red blood cell membrane
- Smaller than normal RBC, round, without central pallor
- $\geq 5/\text{hpf}$ consistent with IMHA
- **Fewer can be seen with:**
 - Fragmentation anemia, oxidative injury, PK def in Basenjis, blood transfusion artifact, or artifactual at feathered edge
- Not seen in cats *



Source: eclinpath.com

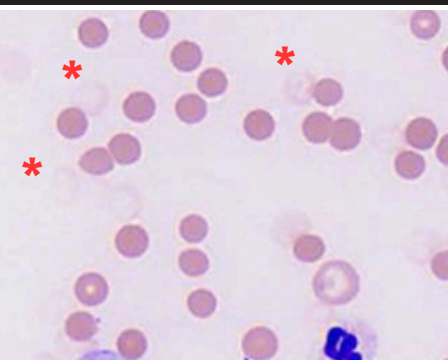
Stomatocytes

- Mouthlike area of central pallor
- **Artifact** of thick blood smear
- **Hereditary stomatocytosis**
 - Various breeds
- Normal in Woodchuck, manatee, and dolphin



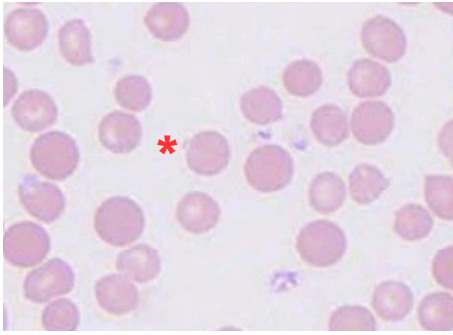
Target cells

- AKA leptocytes or codocytes
- Bullseye appearance due to increased surface to volume ratio
- Normochromic target cells can be seen with **liver disease** or **hypothyroidism**
- Polychromatophils can occasionally have this appearance because they have increased surface to volume ratio , not significant



Ghost cells

- Lysed red blood cells
- **Artifact** due to in vitro hemolysis, aged sample, smear preparation
- **Drugs** DMSO in horses
- **Other:** IMHA (intravascular), Babesia infection, copper tox in sheep, zinc tox in dogs, hypophosphatemia, acute transfusion reaction, neonatal isoerythrolysis in horses
- May see Heinz bodies associated associated with oxidant injury



Heinz body

- Denatured hemoglobin inclusion on cell membrane, oxidant injury
 - **Toxins:** onions, zinc, skunk musk, naphthalene (mothballs)
 - **Drugs** acetaminophen, vitamin K1, propofol, phenothiazine drenches, benzocaine
 - **Inherited disorders:** pathways that protect against oxidant injury (G6PD and FAD in horses)
 - Low numbers of small Heinz bodies can be normal in cats
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