Peripheral Blood Cells in Different Animals

By:

Azreen AshafiqaH bt Azmee D11A005
FathiyaH bt Muhamad Jufri D11A006
Murshida bt Shahul Hameed D11A019
Nur Nabila bt Mohd Rozaini D11A027
Nurul Syuhadah bt Ribuan D11A032
WHAT IS PERIPHERAL BLOOD CELL?

- Cellular components of blood, consisting of red blood cells, white blood cells, and platelets, which are found within the circulating pool of blood and be found within the lymphatic system, spleen, liver, or bone marrow.
WHAT IS BLOOD?

• Blood is the life-maintaining transport fluid that circulates oxygen and nutrients throughout the body, carries away waste products, and helps defend against disease.

• Blood consists of numerous components such as erythrocytes (red blood cells), leukocytes (white blood cells) and thrombocytes (platelets).

• Besides transporting vital components, the blood plays an important role in the immune functions of the body and is vitally important to coagulation (ability of blood to clot properly).

• Blood is located in almost every part of the body, because it circulates through the body's heart, arteries, veins and capillaries. Any tissue containing blood vessels normally contains blood.
PERIPHERAL BLOOD CELLS IN CAT

BY: AZREENA
• Most numerous cells found in the blood.

• In the normal cat, there may be 6 to 10 million RBCs in a microliter of blood.

• RBCs are disc-shaped cells that contain hemoglobin, an important protein that transports oxygen.

• Mature red blood cells are unique in that they do not contain a nucleus. (The nucleus is the small, oval area in the cell that contains DNA genetic material.)

• The lifespan of cat’s erythrocytes is 65-76 days.
A few hundred of RBCs in the lumen of a small artery, at slightly lower magnification.

A few of the millions RBCs scattered around.
• There are several classes of white blood cells (WBCs) that circulate in the blood.

• At any given time, in the normal cat, there are roughly 5,000 to 19,000 of these cells per microliter of blood.

• They are classified as either granulocytes (Eosinophils, Basophils, & Neutrophils) or agranulocytes (Lymphocytes & Monocytes).
1. Eosinophils play an important role in the response of the body to allergic and inflammatory reactions, and to parasitic infestations. In the normal cat, only about 0 to 750 cells are seen per microliter of blood, but their numbers may be dramatically increased if parasites or other foreign protein are present in the body.
2. Basophils are the rarest of all white blood cells and are not usually seen in blood samples. They participate in many of the same reactions that eosinophils are involved in. Finding basophils in the circulating blood is significant.
3. Neutrophils are the most numerous of all white cells. In the normal cat there are usually 2,500 to 12,500 of these cells per microliter of blood. They form a primary defense against bacterial infections. They move out of blood vessels into infected or inflamed tissue in order to attack the infection or injury.
1. Lymphocytes are an active component of the immune system and are manufactured in the bone marrow, lymph nodes, spleen and other lymphatic tissues. In the normal cat, approximately 1500 to 7000 of these cells are present in each microliter of blood. A major function of many lymphocytes is to produce antibodies.
2. Monocytes circulate in the blood until they are needed in tissues that are inflamed or infected. They then leave the blood and enter such tissues where they mature into cells called macrophages. Macrophages are capable of engulfing and destroying harmful organisms and other materials. At any one time, there are usually 0 to 850 monocytes present in each microliter of blood in the normal cat.
Platelets (thrombocytes)

• Platelets are not cells.

• They are very tiny disks that look like flat plates.

• They are produced primarily in the bone marrow.

• Their major function is to plug any leak that develops in the walls of blood vessels and to start the process of blood clotting.

• In normal cats, there are often 200,000 to 400,000 platelets per microliter of blood.
PERIPHERAL BLOOD CELLS IN CATTLE

BY: NUR NABILA
Erythrocytes

- Unlike other mammals, the size of red blood cells vary (anisocytosis).
- Biconcave shaped
- Without nucleus
- Rouleaux formation is rare.
- Lifespan is 160 days.
Leukocytes
Monocytes

• In ruminant, the nucleus may appear amoeboid.
• The cytoplasm can be more basophilic and either granular or mottled in appearance.
Lymphocytes

- The lymphocyte in ruminant variable in appearance.
- Size in larger compared to other mammals.
- Some of the lymphocytes of ruminant are binucleate.
Neutrophils

- Ruminant neutrophils have white cytoplasm with small pink granules; these impart an overall pink tint compared to the other species.
- The nucleus of these cells looks like a curved Or U-shaped band.
Eosinophils

- In cows the granules are round and intensely stained.
- The nucleus is less dense than neutrophils and has fewer lobes.
- Ruminant eosinophils have many small very round orange granules.
Basophil

- These cells contain many small deep purple granules that obscure the nucleus in many cells.
- Some basophils have few granules, which probably is the result of degranulation in the sample.
Thrombocytes

• Platelets are small and pale blue, and they have purple central granules in stained smears.

• Bovine platelets are moderately variable in size with granules that are numerous and intensely-stained.
PERIPHERAL BLOOD CELLS IN PIG

BY: MURSHIDA
PIG

• A normal pig has about 40% of its blood volume in red and white blood cell.

• As pigs become dehydrated, the percentage of packed cell volume (PCV also called hematocrit) goes up.

• A PCV or hematocrit value is the percentage of the whole blood that is composed of red blood cells.
## Normal blood values for pigs

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood volume, % of body weight</td>
<td>8</td>
</tr>
<tr>
<td>Total RBC, $10^6 / \mu L$</td>
<td>6-8</td>
</tr>
<tr>
<td>Diameter of RBC, µm</td>
<td>6</td>
</tr>
<tr>
<td>Diameter of WBC, µm</td>
<td>8</td>
</tr>
<tr>
<td>Packed cell volume, %</td>
<td>40</td>
</tr>
<tr>
<td>Glucose, mg/dL</td>
<td>80-120</td>
</tr>
<tr>
<td>Cholestrol, mg/dL</td>
<td>60-200</td>
</tr>
<tr>
<td>Neutrophils, adult, %</td>
<td>45</td>
</tr>
<tr>
<td>Lymphocytes, adult, %</td>
<td>50</td>
</tr>
</tbody>
</table>
Red Blood Cell

- Crenated erythrocytes, characterized by pointed cell margins, are observed most often in pigs.
- Erythrocytes sometimes adhere to each other, forming an arrangement resembling a stack of coins, called a rouleau. It is commonly occurs in horse and cat.
White blood cell

1. Agranulocytes (lymphocytes and monocytes)

- Lymphocytes
  - Are the predominant leucocytes in ruminants and pigs.
  - Most of the lymphocytes in carnivores, horses and pigs are small. Larger occur more often in ruminants.
  - In pig, the nucleus in lymphocytes tends to be oval.
- Monocytes – largest of leucocytes (15-20 µ in diameter)
- 6-lymphocytes
- 4-erythrocytes
- 7-monocyte
2. GRANULOCYTES

- Neutrophils
  - Nucleus in neutrophils is sometimes coiled as in cat and mere often in the pig.
  - The nucleus of these cells looks like a curved or u-shaped band.
  - 8-neutrophils
  - 10-rouleau (common in horse and cat)
• **Eosinophils**
  – nucleus of eosinophils, although similar to that of neutrophil, tends to be less dense and have fewer lobes.
  – In pig, the nucleus commonly oval/kidney-shaped rather than segmented.
  – C-shaped, mononucleated nuclei commonly in ruminants.
  – Pig, sheep and goat: their granules are small, round to oval & numerous, often distorting the cell membrane.

• **Basophils**
  – only a small percentages (0.5-3%) of leucocytes of domestic mammals are basophils.
  – Basophils are not often found in blood smear.
  – In pig the granules are a dumbbell or coccoid shape.
PLATELETS

• Also referred as thrombocytes, but are not cells in mammals.

• They are membrane-bound fragment of cytoplasm from large cells called megakaryocytes found in bone marrow and sometimes lymph nodes and spleen.

• Small
• 9-Platelet
• 5-Erythrocytes crenated
• 3-Eosinophils
• 6-Lymphocytes
1: Basophils
2: Basophils granules
3: Eosinophils
6: Lymphocytes
11: Smudged cell

**From picture:**
the granules of the basophils are dumbell or coccoid in shape.
PERIPHERAL BLOOD CELLS IN HORSE

BY: FATHIYAH
ERYHROCYTES

• Equine erythrocytes are same like feline erythrocytes, similarly lack central pallor (unhealthy pale appearance)
• Spherocytic shape
• Lifespan varies from 140-150 days
• Healthy horses tendency to form prominent rouleaux/aggregates RBC , resembles stacked coins
• Polychromatophilic red cells are absent in non-anemic horses, and rare in blood of horses with regenerative anemia
PLATELETS

- Equine platelets are smooth discs with faint granules
- Platelets size is small and uniform
- Larger platelets can be observed in horse blood
- Platelets granules difficult to see under low magnification
- Platelets count in horse lower compared to other species
BASOPHILS

- Least granulocyte present in peripheral blood
- Basophils of horses and ruminants and human are similar
- Contain many small dark purple granules
- Low number of basophils commonly found in blood of healthy cattle and horses
EOSINOPHILS

• Eosinophil granules in most animals are orange, but there always exception.
• Cat = small rod shaded orange granules
• Horse = very large globular orange granules
• Ruminants = many small round orange granules
NEUTROPHILS

- Predominant granulocyte, in avian, rabbits, amphibians, reptiles called heterophil
- Mature neutrophils called segmented neutrophil
- First line defence against bacterial pathogens
- Short half-life-10-15 hours after released from peripheral blood
- Equine neutrophils; WHITE/pink CYTOPLASM with no visible granules
- Nuclei of equine neutrophil are long, thin and “knobby” with clumps of condensed chromatin
• Under electron microscope, neutrophils contain active Golgi complex but few mitochondria
• Most numerous circulating WBC
LYMPHOCYTES

• Mostly are small cells that have round nuclei with smooth, dense chromatin and small rim of blue cytoplasm
• Small lymphocytes-dog, cats
• Large lymphocytes-sheep, goat, cow
• No lymphocytes circulate in peripheral blood varies among sp.
• 20-40%(cat, dog, horses)
• 50-6-%(cows, pigs)
MONOCYTES

• Largest leukocytes in blood
PERIPHERAL BLOOD CELLS IN DOG

BY: SYUHADA
Red blood cells (Erythrocytes)

- Canine has the **largest red blood cells** amongst the domestic animals.
- Rbc shape – **biconcave disk** and appear pale in center with no nucleus.
- Size: approximately **7-8 µm in diameter** same as human.
- The lifespan of the RBC are vary among species. The **lifespan** of canine’s RBC are **only 3 months**.
- The **RBC produced in bone marrow** in 6-8 days.
- About **400 000 000 hemoglobin** in every canine.
- Function:
  - Carry $O_2$ towards the body cells and $CO_2$ outside the body.
  - Contain hemoglobin: a molecule composed of globulin protein and 4 heme group (iron compound).
  - acts as buffer and maintain the blood pH
RED BLOOD CELL
White blood cells (Leukocytes)

- Granulocytes
  - basophils
  - eosinophils
  - neutrophils

- Agranulocytes
  - lymphocytes
  - monocytes
Basophils

- Difficult to recognise since don’t have readily apparent granules.
- **Nucleus**: has bi-lobed likes “S”.
- When smear, have a deep purplr and granules appear to be like “outside” of cell.
- **Size**: about 14-16 µm.
- Basophils very **rare** in healthy dogs.
- Lifespan : 1-2 years
- Function :
  - secrete **histamin** involve in **inflammation** and **allergic reaction**.
  - secrete **heparin** that help to **prevent blood clotting**.
Eosinophils

- Eosinophils in dogs are differ in size, number n shape in species..
- They are about 0.5-0.3% of all WBC.
- Nucleus : 2/3 lobes.
- When smear, staining a bright pink orange colour.
- Size : about 10-14 μm.
- Lifespan : several days.
- Function :
  - help to control allergic response
  - engulf of foreign bodies.
Neutrophils

- Neutrophils are the **most** (65%) in the WBC.
- **Nucleus**: has **multi nucleus/3-5 lobes**.
- When smear, cytoplasm usually lightly stained in white colour contain small light pink or purple colour of granules.
- **Size**: **about 9-12 µm**.
- **Lifespan**: 10-15 hours
- **Function**:
  - part of immune system: **first line defense** against pathogen (phagocytes)
  - can move
Lymphocytes

- Lymphocytes also are the smallest size among WBC.
- Manufactured in bone marrow, lymph nodes, spleen.
- **Nucleus**: large nucleus
- When smear, Usually stained round large nucleus. Cytoplasm are less than nucleus and dusky blue colour stained.
- Consist of **2 types**: - T cells & B cells
- Size: small- about 5-10 µm
  medium- about 10-18 µm
- Lifespan: T cells: 100-200 days
  B cells: several years
- Function:
  - **T cells**: for cell mediated immune response (attack invader such as cancer).
  - **B cells**: produces antibody promote destruction of antigens.
Monocytes

- Monocytes are the largest amongs the WBC.
- Nucleus: large and kidney shape.
- When smear, monocytes nucleus do not stain deeply like lymphocytes with light blue cytoplasm.
- Size: about 18-25 µm.
- Lifespan: 24 hours in cells and severals months in tissue (macrophages).
- Function:
  - engulf antigen, dead and damage cells
Platelets

- Platelets are classified **not as blood** and **smaller than blood**.
- Shaped: **irregular shape fragments**, lacking in nucleus.
- When smear, platelets granules are well-stained in pink-red colour.
- Lifespan: 8-12 days
- Function:
  - **clotting factors** (produce temporary plug help seal break blood vessels.)
Platelets
Differences between Animals

- Basophils
- Eosinophils
- Neutrophils

Canine, Feline, Equine, Bovine, Greyhound, Band neutrophil
Lymphocytes

Monocytes

Canine  Feline  Equine  Bovine

Reactive  Granular