TECHNICAL SESSION – II

# BLOOD GROUPS AND BLOOD TRANSFUSION IN DOGS & CATS

Speaker:

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CONFERENCE HALL
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MOTITHANG

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Ministry of Agriculture & Livestock

# Blood Groups and Blood Transfusion in Dogs and Cats

# BLOOD GROUPS IN DOGS AND CATS

A blood type, or blood groups is based on the inherited antigens on RBC surface:

- The major blood group antigens on canine erythrocytes are classified as dog erythrocyte antigen (DEA)
- Blood group antigen in cats are classified according to the AB system

# Canine Blood Groups

Recognized DEA blood groups include DEA 1, 3, 4, 5, 6, 7, and 8. DEA 1 is considered most clinically relevant blood type in dogs. DEA 1 is now described as negative, weak positive, and 2+ to 4+ positive.

Approximately 33 - 65% of dogs are DEA 1-positive. Anti-DEA 1 antibodies can be induced in DEA 1-negative dogs by transfusion with DEA 1-positive blood, leading to future hemolytic transfusion reactions.

# Canine Blood Groups

Other identified canine blood groups include Dal, the Japanese D1D2 systems and Kai 1 and 2.

The Dal antigen is present on the surface of the most canine erythrocytes, and therefore most dogs are considered Dal-positive.
Breeds frequently negative for Dal include Doberman Pinschers, Dalmatians and Shih-Tzu.
Exposure of Dal-negative dogs to Dal-positive erythrocytesleads to sensitization and hemolytic transfusion reactions upon repeated exposure

# Feline Blood Groups

The AB group is the predominant feline blood grouping system.

Cats are commonly positive for type A, although prevalence of type B varies geographically and by breeds. Rarely, cats are positive for A and B antigens (type AB)

# Blood Typing in Dogs and Cats

Blood type testing is performed to help decrease the risk of immunological transfusion reactions in dogs and cats.

- Card-based typing is available for dog erythrocyte antigen (DEA) 1, 4 and 5, as well as Dal antigen of dogs and for AB typing of cats. Monoclonal antibody in the card wells causes agglutination to indicate positive blood type result for a patient.
- Immunochromatographic membrane test kits contain a membrane embedded with the relevant monoclonal antibody and are used for detection of DEA 1, including weak DEA 1 expression, and in cats for detection of AB

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# Blood Typing in Dogs and Cats

## Card-based typing - dog


*Example of Dal blood typing card. The autoagglutination saline screen is negative, as expected, while the positive control show the expected agglutination. This patient does not have agglutination in the patient test well, indicating that the dog is negative for Dal antigen*

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# Blood Typing in Dogs and Cats

## Immunochromatographic blood typing - Cat


*Example of feline AB immunochromatographic blood type test showing a positive result for B blood type. the line marked "C" shows a positive control reaction, indicating that the test was performed successfully.*

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# Crossmatching in Dogs and Cats

Crossmatching helps identify immunological (antigen-antibody) incompatibilities between a donor and a recipient

- The ***major crossmatch test*** combines the donor's erythrocytes with the recipient's plasma (or serum) to assess for the presence of recipient alloantibodies that destroy the donor's RBCs.
- The ***minor crossmatch test*** combines the donor's plasma (or serum) with the recipient's RBCs, assessing for the risk of transfusing alloantibodies from the donor that destry the recipients RBCs.

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# Crossmatching in Dogs and Cats

Crossmatching can be performed in reference laboratories or in clinics manually using a tube or slide methods. Immunochromatographic commercial crossmatch options are also available.
Incompatible donor-recipient pairing result in agglutination and entrapment of RBCs within the gel matrix or on the immunochrmatographic membrane, signifying a positive (incompatible) reaction.

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# Crossmatching in Dogs and Cats

## Gel crossmatch test - Dog

*A commercial gel test used for a major crossmatch in a dog. Three potential blood donors were tested. Gel tube A shows a compatible result between donor RBCs and recipient plasma, with the RBCs forming a pellet at the bottom of the tube. Tubes B and C show incompatible reactions between donor RBCs and recipients plasma, causing agglutination and entrapment of RBCs with the gel matrix*

# Crossmatching in Dogs and Cats

- Crossmatching is not required before a first transfusion in a dog due to the lack of naturally occurring alloantibodies (NOAbs), but strongly recommended > 4 days after a subsequent transfusion.
- Due to the presence of highly immunogenic NOAbs in cats, major crossmatching is strongly recommended both before a first transfusion in cats and then > 2 days after any subsequenr transfusion

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# Screening of Blood Donors

Blood donors requires screening to ensure good health and negative status for geographically relevant infectious diseases that could be transmitted via blood transfusion, including vector-borne diseases in dogs and cats as well as retroviruses (***Feline Leukemia Virus*** (FeLV) and ***Feline Immunodeficiency Virus*** (FIV) in cats.

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# Blood Transfusions in Dogs and Cats

Blood transfusions in dogs and cats are essential for treating severe anemia or blood loss. Transfusion typically involves whole blood or packed red blood cells.

Blood products are administered in a dedicated IV line with an in-line filtration set. only pumps approved for blood products or gravity flow without a pump should be used for delivering blood transfusion.

Transfusion rate depends on patient condition, with rapid rates warranted in patients with hemodynamic instability and slower delivery in more stable patients.

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# Indications of Blood Transfusion

- **Severe Anemia**
  - *A PCV below 25% in dogs and 20% in cats*
- **Life-Threatening Bleeding**
  - *Blood loss during surgery, from trauma*
- **Reduced Oxygen Delivery**
  - *Decreased SPO2, tachycardia, Hypotension*
- **Pre-Surgical Preparation**

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# Blood Transfusion Process

- **Donor Selection**
  - *Blood collected from a healthy donor*
- **Blood Typing and Crossmatching**
  - *ensures compatibility & minimizes the risk of adverse reactions*
- **Administration**
  - *Administered intravenously - slow rate initially then adjusted as needed*
- **Monitoring**
  - *vital signs (TPR) are monitored during & after transfusion*
- **Post-Transfusion Care**
  - Continued *monitoring for any signs of reactions*

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# Risks of Blood transfusion

- **Fever**
  - *A febrile nonhemolytic transfusion reaction (FNHTR) - body temp. >39 deg.C (102.2 deg.F)*
- **Hemolysis**
  - *Acute hemolytic transfusion reaction (AHTR) - fever,, tachycardia, and dyspnea to hypotension, shock, hyperbilirubinemia or hemoglobinemia*
- **Respiratory Distress**
  - Transfusion-associated circulatory overload (TACO) - tachypnea, cough
- **Acute Allergic Reactions**
  - *Dogs - involves the skin & GI tract - urticaria, edema, vomition*
  - *Cats - primarily respiratory in nature causing dyspnea, skin and GI signs can also occur*

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# Risks of Blood transfusion

- **Infection**
  - *arise after transfusion of pathogen-contaminated blood products - vomiting, fever & shock*

**Infusion Set v/s Blood Transfusion Set**

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# Normal Blood Volume

- Dogs - approximately 80 - 90 ml/kg b. wt
- `Cats - Approximately 40 - 60 ml/kg b. wt

## How much blood can be collected from a donor?

For safe blood collection for transfusion, dogs can typically donate upto 16 ml/kg of blood every 3 weeks.

Cat can donate a smaller volume, typically around 40 -50 ml.

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# Factors influencing donation

- Weight of donor
- Blood volume
- Overall health, free of diseases and not on any medications

## Storage of blood

- Fresh blood should be transfused within 4 - 6 hrs of collection
- Plasma can be stored frozen for up to a year
- Whole blood alone in CPDA -1 can be stored up to 20 days but with additives like Adsol or Nutrisol, this storage time can be extended to 35 - 37 days.
  Whole blood is stored at 4 deg C and should be gently rocked daily

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**Each 100 ml of CPDA Solution Contains:**

| | |
|---|---|
| Citric Acid (anhydrous) U.S.P. | 0.299 gm. |
| Sodium Citrate (dihydrate) U.S.P. | 2.630 gm. |
| Monobasic Sodium Phosphate (monohydrate) U.S.P. | 0.222 gm. |
| Dextrose (monohydrate) U.S.P. | 3.190 gm. |
| Adenine (anhydrous) U.S.P. | 0.0275 gm. |
| Water for injection U.S.P. q.s. | 100 ml. |

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# Canine Transfusion Calculation

To calculate the amount of blood to transfuse in dogs, we need to determine:

- the desired increase in PCV (Packed Cell Volume)
- the dog's body weight
- the PCV of the donor

**Transfusion Volume (ml) = ([Desired PCV - Current PCV] / Donor PCV) x BV x BW**

BV = Blood Volume - In dogs it is approx. 80 - 90 ml/kg of body weight
BW = Body Weight in Kg.

***Example:***
*15 kg dog with a current PCV of 29% and we want to raise it to a PCV of 35%. The donor blood has a PCV of 55%.*

1. ***Calculate the desired PCV increase** : 35% -29% = 6%*
2. ***Insert the values into the formula:** (6% /55%) x 80 ml/kg x 15 kg =130.9 ml packed red blood cells (pRBCs)*

# Transfusion Rate

- Start all transfusions at 1 to 2 ml/minute
- Adult dogs : maximum rate of 3 to 6 ml/minute
- Cats, kittens, puppies: maximum rate of 1 to 2 ml/minute

# Transfusion Guidelines

| Product | Volume | Frequency |
|---|---|---|
| Fresh whole blood | 12 to 20 ml/kg | q. 24 h |
| Packed red cells | 6 to 10 ml/kg | q. 12 to 24 h |
| Platelet rich plasma | 6 to 10 ml/kg | q. 8 to 12 h |

# THANK YOU