Blood transfusion in dogs

DONOR PROFILE

Criteria to be a blood donor

Age	Between 1 and 8 years old.
Weight	At least 25 kg. Exclude : • obese dogs; • too skinny dogs.
General health condition	No sign of a potential disease (vomiting, diarrhea).
Diet	Balanced diet.
Sex	• male; • preferably spayed nulliparous female.
Character	Calm and docile.
Current vaccination status	Heartworm preventative. No blood collection within 10 days after booster vaccination.
History of transfusion	No history of previous blood transfusion.
Medical treatment	No current treatment. No flea preventative just before blood collection.
Medical follow-up	Clinical examination before each donation. Annual check-up.
Typing and compatibiliy	Determination of donor's blood group is compulsory, (cf. compatibility). *NB : in any case, a crossmatch is needed before transfusion.*
Infectious disease and transfusion risks	Depending on geographical area and age of animal, additional laboratory testing (blood film examination, serology, PCR test) may be required for following diseases : • Babesiosis (Babesia canis, B. gibsoni); • Leishmaniasis (Leishmania infantum); • Ehrlichiosis (Anaplasma phagocytophilum, A. platys, Ehrlichia canis); • Brucellosis (Brucella canis); • Bartonellosis (Bartonnella vinsoni, B. henselae); • Hemobartonellosis (Mycoplasma haemocanis).

BLOOD GROUPS & COMPATIBILITY

1. Blood group in dogs

Numerous blood group systems (DEA, for Dog Erythrocyte Antigen) have been described in dogs. More than one blood group can be present in any given donor. Highly antigenic DEA 1 is the most described and the only one to have a clinical importance. That's why DEA 1 typing is the only one recommended today.

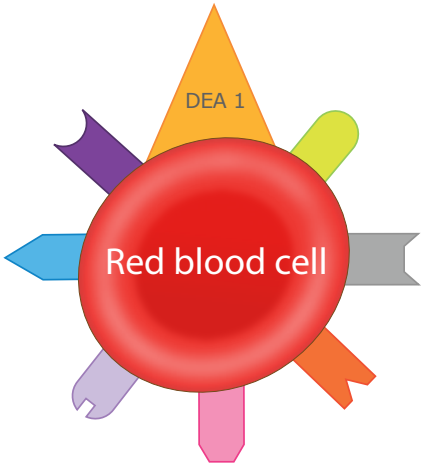
Frequency of erythrocyte antigen

Blood group systems	Incidence
DEA 1	**60%**
DEA 3	6%
DEA 4	98%
DEA 5	23%
DEA 6	98%
DEA 7	45%
DEA 8	40%

Erythrocytary antibodies:

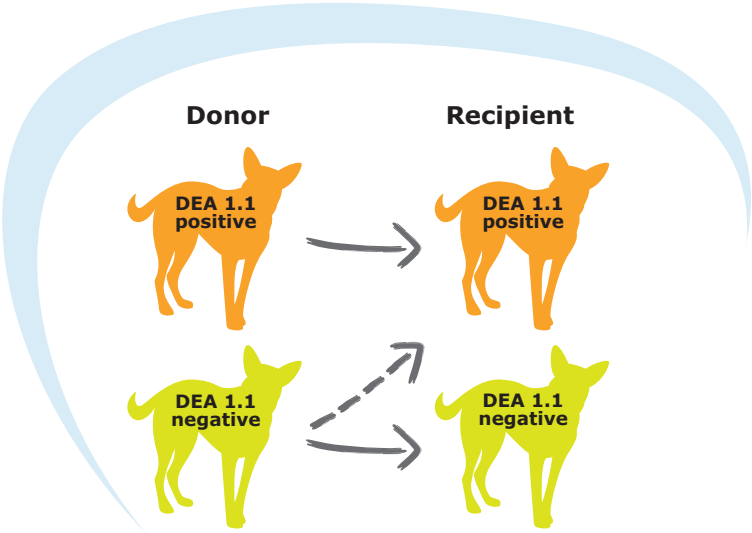
DEA 1 (60% of dogs are DEA 1+)
very immunogenic

- Acute hemolysis: less than 12 hours
- Delayed hemolysis: 7 to 10 days for a negative and unsensitized dog



Determination of DEA 1 group is the only one recommended today.

Compatibility:



BLOOD TYPING & CROSSMATCHING

2. Blood typing

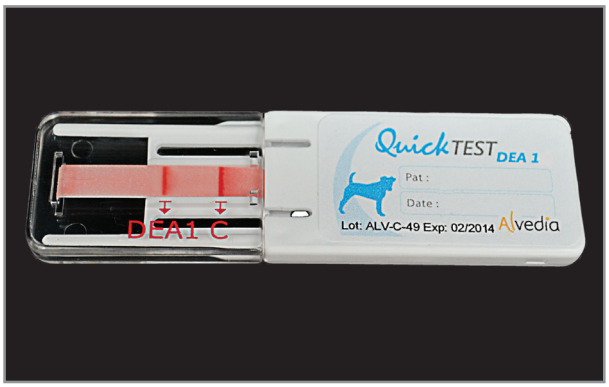
The determination of donor and recipient's blood groups is highly important. Thanks to blood typing, appropriate blood is transfused and sensitization of the dog can be avoided. An exhaustive determination is only possible in a laboratory.

The determination of DEA 1 is thus essential because it is the most immunogenic.

Alvedia's blood typing test : **Quick test**.

The Alvedia's blood typing test is the easiest and most reliable test on the market with a 2 minutes procedure time.

The system is based on the migration of red blood cells on a membrane. This membrane has previously been specially treated, under the influence of a buffer flux moving along due to capillary action. A monoclonal antibody specific to the DEA 1 antigen has been incorporated into the membrane. Positive DEA 1 red blood cells will be retained by this antibody showing a red line on the mid portion of this membrane (in front of "DEA 1" as written on the kit).



Quick Test DEA 1 for blood typing in dogs

3. Crossmatching

A crossmatch should always be performed to detect all clinically important anti-RBC antibodies (DEA 3, 4, 5, 7).

The major and minor crossmatch are performed to assist in providing compatible red cell products and possibly alleviating adverse reactions to transfusion.

Two different tests reveal the presence of antibodies in the serum :

- The **major crossmatch** : recipient's serum, donor's erythrocytes. It is performed to detect antibodies in the recipient's serum that may agglutinate or hemolyse the donor's erythrocyte. In case of a positive result, there is a risk of transfusion reaction : the donor has to be changed.
- The **minor crossmatch** : recipient's erythrocytes, donor's serum. It is performed to detect antibodies in the donor's plasma directed against recipient erythrocytes. In case of a positive result it is recommended to change donor.

The ***Alvedia*** crossmatch test is a reliable method with very easy interpretation.

Procedure time is 20 minutes.

BLOOD COLLECTION

1. For a dog weighing from 25 to 30 kg

- **Volume** : a maximum of **22 mL/kg** of blood may be donated, which represents a bag of 450 ml.
- **Frequency** : Blood may be donated every 21 to 28 days with no risk.

2. Equipment needs

- **Essential** : a bag of 450 mL/250 mL containing anticoagulant and preservatives. Most frequently used anticoagulants are CPD (Citrate Phosphate Dextrose) and CPD-A (CPD and adenine).
- **Complementary** :
  - bag with additives (AS-1 Adsol®, AS-3 Nutricel®, AS-5 Optisol®);
  - clamps;
  - agitator;
  - tube stripper;
  - metal clips.

NB: Blood collection systems are available in a variety of configurations. They are composed of the primary bag and satellite bags. The needle is attached to the primary bag. The primary bag contains anticoagulant, blood will flow directly into the primary bag.Other bags, which are attached to the primary bag through sealed ports, are the satellite bags. Satellite bags are intended for storage of red cells, plasma or platelets.

3. Precautions

- **Regular donor :**
  In any case, healthy animal.
  Clinical exam is always recommended before blood collect.
  Iron supplement : 5 mg/mL of collected blood is recommended.
- **Restless donor :**
  - 0,05 mg/kg of acepromazine Im or IV +/- 0,075 mg/kg of buprenorphine IM;
  - 0,1 mg/kg of morphine slow IV or SC;
  - narcotic (0,05-0,2 mg/kg oxymorphone IV ou IM, ou 0,05-0,4 mg/kg butorphanol IV ou IM de butorphanol) +/- 0,25-0,5 mg/kg IV of diazepam ou 0,01-0,025 mg/kg of acepromazine IV ou IM;
  - 0,1 mg/kg of butorphanol IV 15 minutes before collection.

NB : Traces of medicine in blood are not worrying, except for acepromazine which impairs platelet function. Blood obtained will thus not be used in dogs suffering from thrombocytopenia.

BLOOD COLLECTION

3. Collection in a few steps

1. Prepare intervention :
   - shaving : jugular vein is the most common punction site;
   - cleaning : use of chlorhexidine is recommended;
   - disinfection.
2. Apply anaesthetic gel.
3. **3 people** required:
   - one to restrain the donor;
   - one to sample blood;
   - one to handle the collecting bag.
4. The patient is restrained in a **sitting position or in lateral recumbency.**
5. **Clamp the tubing** using a hemostatic clamp (does not damage the tubing) or a **coupe tubulure** in order to avoid anticoagulant to go up and out of collection bag.
6. Wear gloves (sampler).
7. **Compress** jugular groove.
8. **Stretch skin** in order to locate vein clearly.
9. Insert needle with the tip pointing cranially and withdraw blood by **puncturing vein frankly**.
10. As soon as blood enters tubing, **remove clamp**. If blood does not come, then tubing has to be clamped again, needle withdrawn and puncture done again.
    - Hold needle in vein on 1,5 cm.
    - Hold **tubing manually** against table or at root of needle against skin.
    - Hold collection **bag inclined** from patient
11. **Agitate collection bag** (manually or using agitator) so that blood and anticoagulant mix together.
12. **Once collection bag reaches required weight (477 +/- 48g)**, stop compression, clamp tube close to needle. Remove needle and put cap back on.
13. Apply **compress on puncture site** and if needed, bandage for 30 minutes
14. **Push blood** present in tube into the collection bag.
15. **Seal tube** close to the bag.
16. **Label collection bags** indelibly : date and time of collection, expiration date, type of animal, name of donor, blood group.

    NB: in case the animal moves and the needle slips out of vein, either push needle forward or remove it and start the puncture again.

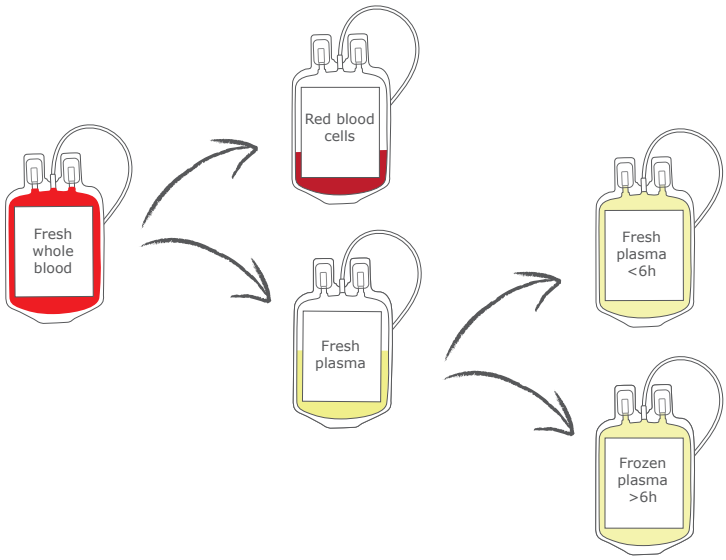
Blood transfusion in dogs

BLOOD PRODUCTS

1. Blood Product Overview

Treatment of whole blood to obtain packed red blood cells and plasma is the easiest to carry out in practice.

Thanks to the separation of blood in its two components, two products are obtained and two animals can be treated.



2. Characteristics and use of blood products

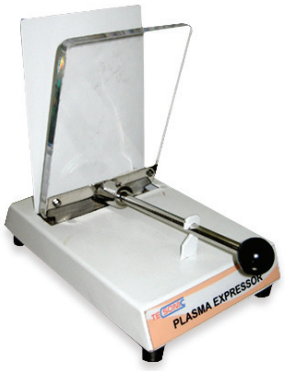
Blood product	Use	Precautions
Whole blood • until 24 hours after collection	• Haemostasis disorders : thrombocytopenia, thrombopathias, coagulopathies; • Anaemia, hemorrhage; • Renal failure; • Liver failure; • Septic shock.	• In anaemic patients, risk of volume overload.
Fresh Plasma • separated for less than 4 h use within 24 h **Frozen Plasma** • frozen within 6 to 8h	• Hypovolemia (trauma, surgical resuscitation); • Acquired or hereditary deficiency of coagulation factors; • Antivitamin K poisoning • Hypoproteinemia; • Pancreatitis; • Antioxydant properties.	• Because of the short half-life of coagulation factors, several transfusions may be necessary.
Packed Red Blood Cells • Erythrocyte suspension obtained after centrifugation: 2000 rpm for 30 min, or 5000 rpm for 5 min • 50% < Ht < 80%	• Anaemia.	• High viscosity reduces administration speed. • Dilution with NaCl 0,9% (0,5mL per mL of concentrate).

BLOOD PRODUCTS

3. Separation process

Material

Refrigerated centrifuge



Plasma extractor

Scale

Centrifugation

The unit of whole blood should be centrifugated at 5000 g during 10 minutes.

Separation

1. Remove the unit of blood from centrifuge without agitation so as not to disturb red cells and plasma. Then place the blood unit on a plasma extractor in order to express the plasma into the satellite bag.
2. Clamp off the line of the bag containing the harvested plasma. Then break the seal from additive and let it flow into the red cells. Seal the bag containing the red cells and additive and remove it from the plasma bag.
3. Gently mix the red cells. Then, the final products should be labeled with the product name and volume.

BLOOD PRODUCTS

4. Conservation

Blood product	Storage	Remarks
Whole blood	CPD-A 35 days	• Changes in blood with time: progressive cell alteration, rise in haemoglobin, potassium and plasmatic ammonia products, reduction of potassium in erythrocytes. • Gently agitate blood bag twice a week. • Thanks to vertical or lateral storage of the bags, shocks are minimized, sorting facilitated, diffusion of oxygen inside the bags and carbon dioxide outside is easier.
Fresh plasma	24 hours at 1-6°C	
Frozen fresh plasma	6 month to 1 year between -18°C et -30°C	• At -30°C, coagulation factors remain active during one year. • At -20°C, in the freezer, coagulation factors remain active during 6 month. • For albumin and K-dependant coagulation factors (II, VII, IX, X), shelf life of 3 years. • It is not recommended to use an auto-defrost freezer. • Once frozen, the bag becomes fragile and has to be handled with carefully. Wrap the bags.
Packed red blood cells	3-4 weeks at 1-6°C	• Beyond 2 weeks, do not administer to dogs in a critical state: loss of a part of ATP and of the 2,3DPG of erythrocytes, their membrane becomes rigid and half-life is reduced. • Gently agitate blood bag twice a week in order to maintain sufficient rate in ATP and 2,3DPG. • Vertical or lateral storage of the bags. • Avoid opening and closing freezer too often.

ADMINISTRATION OF BLOOD PRODUCT

Flow

Blood product	Indications	Volume and administration speed	Frequency
Whole blood	Anaemia, deficiency in platelets, coagulation factors, immunodeficiency, hypoproteinemia, haemorrhagic hypovolemic shock, leucopenia	12-20 mL/Kg 3-6 mL/min • 4 mL/kg/h for dogs with heart diseases.	Every 24 hours
Packed red blood cells	Anaemia	6-10 mL/Kg 3-6 mL/min • Addition of 10 mL of NaCl 0,9% pro 30-40 mL of concentrate in order to improve the flow.	Every 12 to 24 hours
Fresh Plasma **Fresh Frozen Plasma**	coagulopathies, DIVC, hypoproteinemia, Von Willebrand disease, pancreatitis, immunodeficiency, non haemorrhagic hypovolemic shock	6-12 mL/Kg 3-6 mL/min	Every 8 to 12 hours

TRANSFUSION AND POST-TRANSFUSION ACCIDENTS

Reactions during transfusion and post transfusion reactions

	Reactions during transfusion	Post transfusion reactions
Immunological	• Haemolysis; • Type I Hypersensitivity; • Anaphylactoid reactions; • Reactions to white blood cells and platelets; • Bacterial infection; • Citrate intoxication.	• Extravascular hemolysis; • Purpura.
Non immunological	• Erythrocyte distortion; • Volume overload; • Embolus; • Hyperammonaemia; • Hypothermia; • Electrolyte disorder.	• Transmission of infectious agents; • Iron Overload.