



## Blood Transfusion in Dogs

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**Received:** May 12, 2022

**Published:** May 26, 2022

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### Abstract

Blood transfusion in dogs was first recorded in the 16th century. Since then, there have been a series of advancements in the practice with an improved rate of success. Apheresis, blood typing, and cross-matching have greatly helped over the years to get the specific blood component needed for specific cases and also to reduce adverse reactions. The success of blood transfusion depends on the strength of accurate diagnosis, selecting a healthy, proper donor dog; crossmatching and blood typing; transfusing the right blood component, blood volume, and flow rate; maintaining asepsis, and monitoring for adverse reactions.

**Keywords:** Blood Transfusion; Dogs; Hemorrhage

### Introduction

The development of blood transfusion in animals came much later than transfusion in human medical practice. Transfusion in animals has been successful since the 20th century and has been used to save the lives of animals in severe hemorrhage and anemia. Basically, blood transfusion is a process where a recipient animal receives a great deal of blood or blood products from a donor animal of the same species [2].

The first successful animal blood transfusion was carried out in dogs by Richard Lower in 1665 [3]. Apheresis, which is the ability to separate whole blood into its various constituents, has greatly helped veterinarians to use the specific blood constituents needed for the condition being managed and also to improve the storage life of blood.

### Indications for canine blood transfusion

Whole blood: anemia with severe thrombopathy, severe thrombocytopenia, disseminated intravascular coagulation, trauma with

severe blood loss, severe blood related rickettsial infection such as anaplasmosis, ehrlichiosis, neorickettsiosis, Rocky Mountain Spotted Fever; protozoan infections such as babesiosis, leishmaniasis, trypanosomiasis; bacterial infections such as hemoplasmosis, bartonellosis, brucellosis; severe anemia with hypoproteinemia [2,6].

- **Packed red cells:** symptomatic anemia from hemorrhage, renal disease, bone marrow suppression, hemolysis; oxygen support
- **Plasma:** plasma loss from a severe burn, anticoagulant rodenticide intoxication, coagulopathy due to the deficiency of certain factors.
- **Platelet concentrate:** thrombocytopenia, hemorrhage due to primary or secondary thrombocytopenia.

### Selecting a donor

Selecting a donor that matches the need must be carefully carried out to avoid complications. The donor must be blood-grouped and compatibility with the recipient must be determined. The ca-

nine donor must be healthy, middle-aged (1-8 years old), free from any infection and parasites, and must not be on any medication. The body weight, temperament, medication, and vaccination history must be assessed. Female donors should be neutered and have no history of pregnancy. A donor dog must have a normal Packed Cell Volume (PCV) of 35-40% depending on the breed and a normal Total Protein (TP) concentration before transfusion. After evaluation, blood should be collected aseptically by venipuncture.

### Cross-matching and blood typing

Unlike in humans, there are probably no universal donors in animals due to the several antigenic components found in animal blood, especially in dogs. However, the process of transfusion has been greatly aided by cross-matching, testing of blood groups, and other advanced screening facilities [2].

Generally, canine blood types are classified using the Dog Erythrocyte Antigens (DEA) system based on the red cells' surface antigen. The typing includes DEA 1.1, 1.2, 1.3, 3, 4, 5, 6, 7 and 8. Although, anti-sera for DEA 6 and 8 are not available anymore. DEA 1.1 has been found to be highly antigenic and must be determined in every donor and recipient dog before transfusion. In most cases, only DEA 1.1 is tested especially in low facility regions [3].

### Determination of the volume of blood required by the recipient

Transfusion to a normovolemic patient with normal PCV is unnecessary irrespective of the clinical signs presented. Usually, a post-transfusion PCV of 25-30 percent is sufficient in dogs to reverse serious anemic conditions. Although, there may be the need to transfuse large volumes of blood in severely anemic patients to achieve the desired blood volume and PCV [4]. The formula to calculate the required blood volume was given by Pichler and Tumwald in 1985 [7].

$$\text{Blood volume to be transfused} = 90 \times \text{Weight (kg)} \times \frac{(\text{Required PCV} - \text{Recipient PCV})}{\text{PCV of donated blood}}$$

### Administration of transfused blood

Dogs can donate up to 10% volume, 4 times per year, although they can donate every 4 to 5 weeks if the need arises. Majorly, intravenous administration is the best. Although, intraosseous routes can be considered especially when venous access proves abortive. Intra-peritoneal administration is not usually considered because absorption is slow and the effect may be much delayed. Blood is

usually collected in blood bags containing anticoagulants. Peristaltic fluid pumps are often used as gravity flow may not work effectively due to small volume and inaccuracy administration rates [3].

The transfusion rate depends on the hydration and cardiovascular status as well as the severity of anemia. In canine patients that are relatively stable with low anemia, the rate can be as low as 0.25ml/kg for about 30 minutes and further evaluated. In severe cases, the transfusion rate can be as high as 2-10ml/kg/hour. Transfusion should not exceed 10-20ml/kg/hour to avoid volume overload.

### The benefit of blood banking

Blood banking offers great benefits to veterinarians, donors, and recipients in terms of convenience and being able to tailor blood and blood products to individual animals' needs. In some cases, it helps to minimize the risks of complications that may arise from transfusion by ensuring proper screening and typing of blood. In cases where blood banking is unavailable or insufficient, in-house donors are used. Some large veterinary hospitals have in-house donors or a list of staff or clients' dogs that can be called upon when the need arises [5].

### Adverse transfusion reactions

Adverse reaction during and after transfusion is quite common but the risk can be greatly reduced by ensuring;

- That the blood and blood products are properly collected, processed, and stored
- That the donors are healthy and their blood groups are known
- That cross-matching screening tests are properly performed

There are generally two main types of adverse reactions; immediate and delayed. The immediate transfusion reaction occurs within 1 to 2 hours following transfusion while the delayed reactions may occur in days, months even years after the transfusion. The severity of these reactions may vary from mild fever to severe symptoms leading to death.

Acute hemolytic reaction is known to be the most serious transfusion reaction that can occur in a dog, although it is rare. In this case, the immune system of the recipient dog has some innate or acquired antibodies against the donor red cell antigens. This results in intravascular hemolysis leading to hemoglobinuria, DIC,

ischemia of vital organs, and eventual shock. Other adverse reactions may include, non-hemolytic fever, delayed hemolytic reaction, septicemia, hypervolemia, post-transfusion purpura, etc. [1].

### **Conclusion**

Blood transfusion from a donor dog to a recipient has evolved over the years. Depending on the condition at hand, a veterinarian has to decide on which blood component is required at any given time. Blood transfusion can be lifesaving in vet practice. However, its success or otherwise in any case depends on maintaining a set of guidelines in practice such as selecting the right donor, deciding on the right blood component required, blood typing and cross-matching, maintaining asepsis, determining the right volume required, and prompt management of reactions.

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