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Blood transfusion in veterinary medicine: A review

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Abstract

Blood transfusion is a critical therapeutic procedure in veterinary medicine used to manage life-threatening conditions such as hemorrhage, anemia, and coagulopathies. This review provides a comprehensive overview of indications, donor selection, blood groups, transfusion techniques, blood products, and associated complications. Emphasis is placed on evidence-based clinical practices and careful monitoring to improve patient outcomes. (Fletcher *et al.*, 2012 & Silverstein and Hopper, 2015).

Keywords: Blood transfusion, veterinary medicine, dogs, cats, anemia, critical care

1. Introduction

Blood transfusion involves the transfer of whole blood or blood components from a donor to a recipient to restore circulating volume, improve oxygen-carrying capacity, or correct coagulation deficiencies. Since its early experimental use in the 17th century, transfusion medicine has evolved significantly, particularly with the discovery of blood groups and compatibility testing. In veterinary practice, transfusion therapy is now an essential component of emergency and critical care (Hofmeister *et al.*, 2009) ^[5].

2. Indications

Blood transfusion is indicated in cases of acute hemorrhage, severe anemia, hypoproteinemia, immune-mediated hemolytic anemia, thrombocytopenia, clotting disorders, and infectious diseases such as babesiosis and anaplasmosis. It is also commonly required during major surgical procedures where significant blood loss occurs (Kisielewicz and Self, 2014) ^[6].

3. Blood Groups

In cats, three blood types (A, B, and AB) are recognized, with naturally occurring alloantibodies necessitating strict blood typing prior to transfusion. Dogs possess multiple blood group systems known as dog erythrocyte antigens (DEA), with DEA 1.1 being the most clinically significant. Unlike cats, dogs do not typically have naturally occurring antibodies, but sensitization can occur following transfusion (Chan, 2015) ^[2].

4. Blood typing

A) Alveia technique for blood typing

- It is based on migration of RBC's on a membrane treated with DEA 1.1 specific antibody
- The antibodies retain the RBC's, Characterized by a red band in the mid portion of the membrane

B) Cross matching

1. Major cross match

- Donor RBC and patient plasma or serum
- Centrifuge donor citrated RBC at lower centrifuge at 10 min
- 0.2 ml RBC + 4.8 ml NS = 5 ml centrifuge and wash 3 times
- Place 0.1 ml of RBC and 0.1 ml plasma in different 3 small test tubes

- Theses 3 test tubes incubate at 37°C, room temp, and + 4°C temp for 15 min.
- Centrifuge for 1 min
- Examine for hemolysis, any hemolysis it indicates incompatibility, it observes under microscope also, if it showing micro agglutination this indicates cross match incompatibility.
- Donor RBC + Recipient serum

2. Minor cross matching

- Auto control cross match.
- Recipient RBC + Donors serum

(Callan and Giger, 2015) ^[1].

5. Donor Selection

Ideal donors should be healthy, adequately sized, and free from infectious diseases. Dogs weighing more than 25 kg and cats over 4–5 kg are preferred. Donors should have normal hematological values and no prior history of transfusion. Screening for transmissible diseases is essential to ensure safety.

6. Blood Collection

- A minimum of 405 ml of blood is to be collected otherwise will cause citrate toxicity in recipient, due to high anticoagulant level in the blood
- Transfusion should be completed within 4 hours.
- After collection of blood donor should be offer small meal and plenty water

A) Closed system

- Risk of bacterial contamination minimize
- Mostly used in dogs. 20 ml/kg donate

B) Open System

- More chance of bacterial contamination
- Mostly used in cats. 10ml/kg donate
- a) Place the donor in lateral recumbency on a table, clip and surgically prepare the jugular vein
- b) Place the blood bag on a gram scale set to zero to keep track of the amount of blood collected
- c) Insert the needle into vein and allow blood to fill the bag
- d) Once the correct amount of blood is collected (450g from dog and 60 g from cat) and remove the needle from vein
- e) Apply to mild pressure to the jugular vein to avoid haematoma for 10 min
- f) Strip the blood in the line back into the bag so it mix with anticoagulant
- g) Place the clamps on the tubing at 2 to 3 cm interval to create 4-5 segments for cross matching (Kisielewicz and Self, 2014) ^[6].

7. Blood Products

Commonly used blood products include fresh whole blood, stored whole blood, packed red blood cells, fresh frozen plasma, and cryoprecipitate. Each product has specific indications; for example, packed red blood cells are used to treat anemia, while plasma is used for coagulation disorders.

8. Administration and Monitoring

Transfusions should be initiated slowly and monitored closely for adverse reactions. Vital parameters such as temperature, heart rate, respiratory rate, and mucous membrane color should be assessed regularly. The entire transfusion should

ideally be completed within 4 hours to minimize complications.

Table 1: Blood Products and Clinical Use

Product	Indication	Dose
Fresh Whole Blood	Acute hemorrhage	10–20 ml/kg
Packed RBC	Anemia	6–10 ml/kg
Fresh Frozen Plasma	Coagulopathy	6–10 ml/kg
Cryoprecipitate	vWF deficiency	1 unit/10 kg
Platelet-rich plasma	Thrombocytopenia	1 unit/10 kg

Table 2: Transfusion Rates in Small Animals

Species	Initial rate	Maximum rate
Dog	0.5 ml/kg/hr	5 ml/kg/hr
Cat	0.25 ml/kg/hr	3 ml/kg/hr

7. Transfusion Reactions

Transfusion reactions may be immunologic or non-immunologic. Acute reactions include hemolysis, anaphylaxis, and shock, while delayed reactions may occur days later. Non-immunologic complications include volume overload, sepsis, and citrate toxicity, which may result in hypocalcemia and cardiac disturbances (Davidow, 2013) ^[3].

1) Acute immunologic reactions

- Anaphylaxis
- Tachycardia
- collapse/ Shock
- Hemolysis – hemoglobinemia/ hemoglobinuria
- Hives, urticaria, pruritus
- Pulmonary edema (cats)

2) Delayed immunologic reactions c

- Can occur 2-21 days post-transfusion
- Hemolysis - Seen after 72 hours

3) Non-immunologic reactions

- Volume overload (pulmonary edema)
- Sepsis/infection
- Hemolysis – due to trauma to the RBC (overheating, freezing, administration or collection with a small gauge needle or catheter).
- Citrate intoxication – occurs when citrate/blood volume ratio is disproportionate or in massively transfused patients
- Thromboembolism (McMichael, 2012) ^[7].

8. Conclusion

Blood transfusion is a life-saving intervention in veterinary practice when performed correctly. Proper donor selection, compatibility testing, and vigilant monitoring are essential to ensure successful outcomes and minimize complications.

Conflict of Interest

Not available

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Not available

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