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Shantanu Kumar Kuldeep

Teaching Associate Department
of Veterinary Surgery and
Radiology, College of veterinary
and Animal Science, Navania,
Vallabhnagar, Udaipur,
Rajasthan, India

Sandhya Morwal

Assistant Professor Department
of Veterinary Medicine (VCC),
College of Veterinary and Animal
Science, Navania, Vallabhnagar,
Udaipur, Rajasthan, India

Deepika Goklaney

Assistant Professor Department
of Veterinary Medicine, College
of Veterinary and Animal
Science, Navania, Vallabhnagar,
Udaipur, Rajasthan, India

Sunita Meena

Teaching Associate Department
of Instructional Livestock Farm
Complex, College of veterinary
and Animal Science, Navania,
Vallabhnagar, Udaipur,
Rajasthan, India

Naresh Singh Kuntal

Teaching Associate Department
of Veterinary Clinical Complex,
College of Veterinary and Animal
Science, Navania, Vallabhnagar,
Udaipur, Rajasthan, India

Hiteshwar Singh Yadav

Teaching Associate Department
of Veterinary Clinical Complex,
College of Veterinary and Animal
Science, Navania, Vallabhnagar,
Udaipur, Rajasthan, India

Correspondence**Shantanu Kumar Kuldeep**

Teaching Associate Department
of Veterinary Surgery and
Radiology, College of Veterinary
and Animal Science, Navania,
Vallabhnagar, Udaipur,
Rajasthan, India

Blood transfusion in veterinary clinical practice: A review

Shantanu Kumar Kuldeep, Sandhya Morwal, Deepika Goklaney, Sunita Meena, Naresh Singh Kuntal and Hiteshwar Singh Yadav

Abstract

Blood transfusion is the transfusion of the whole blood or its components (blood cells or plasma) obtained from a healthy animal (donor) to another animal (recipient) whose blood is deficient in quantity and quality. In animals blood transfusion may help to restore the blood loss, recovery from anaemia, to overcome the deficiencies of plasma proteins and clotting factor. it also help to improve immunity in sick animals. Blood transfusion is the first line therapy in the treatment of animal which suffering from various type of haemorrhage or blood loss. Infect like humans animals having so many types of blood groups so before going transfusion proper record the amount of blood, type, blood group, rate of transfusion and any type of reaction. This article provides the information about general indication of blood transfusion, blood groups, donor selection, blood collection, cross matching and blood transfusion in different species like cattle, horse, dog, cat, sheep and goat.

Keywords: Blood transfusion, resistant, antigens, cross matching, alloantigen, intramedullary

1. Introduction

Blood transfusion has been used as an emergency and life-saving step, since many years in human as well as animal medicine [5]. It is among the most common practices to save the critically ill patient having low blood parameters. The requirement for transfusion of blood and its components arise to sustain the life of anaemic animals by improving the reduced red cell mass, and other cellular and noncellular components *i.e.*, platelets, leucocytes, circulating hemoglobin level and blood volume that ameliorate most clinical signs. The revolutionized discovery of William Harvey's theory of circulation (1628), made possibilities of advancement in this area [3]. Richard Lower in 1665 transfused the blood in a dog for the first time in the history [8]. With the help of latest techniques and equipment developed after 1950, blood transfusion became more popular in veterinary medicine [4, 5].

2. General indication of blood transfusion

There are several clinical conditions in which blood transfusion is indicated like acute massive blood loss, hemorrhage, hemophilia-A, coagulopathies, shock, burn, anemic condition, haemoprotozoan disease, hypoproteinemia, thrombocytopenia. To develop specific or non-specific resistant against infections [1].

- a. **Cattle:** Pulmonary hemorrhage, Abomasal ulcer, Enzootic hematuria with bladder bleeding, Rupture of middle uterine artery in prolapse, Very heavy infestation of hookworm, Thielerialiasis, Anaplasmosis, Babesiosis.
- b. **Horse:** Packed cell volume (PCV) less than 12%, Hemoglobin concentration less than 8 g/dl, Traumatic injury, Hemophilia, Heavy infestation with strongyles.
- c. **Dog and Cats:** In case of dogs when blood constituents like packed cell volume (PCV) is 15% or less and haemoglobin is 5 gm per dl of blood or less. While regarding the cats PCV below or equal to 12% and haemoglobin is 4 gm per dl of blood or less indicates the urgent need for blood transfusion [9].

3. Blood groups in animals

Blood groups are classified according to specific antigens on the surface of erythrocytes

- a. **Cattle:** In cattle there are 12 major blood groups A, B, C, F, J, L, M, R, S, T and Z. variation in each lead to 60 blood groups. The greatest clinical relevance is in groups B and J. The B group is extremely complex, thus closely matched transfusions are very

difficult. Newborn calves do not have the J antigen. During the first six months of life they generally acquire it [2, 10].

- b. Horse:** Horses have Seven Blood groups A, C, D, K, P, Q and U. The first seven systems are recognized by the International Society of Animal Blood Grouping Research [6, 15].
- c. Sheep:** A, B, C, D, M, R, and X Seven blood groups have been classified in sheep. The B group in these animals is resembled to the B group in cattle, and the R group is resembled to the J group in cattle. For example, antigens are soluble and soluble antigens passively absorbed to erythrocytes [2].
- d. Goat:** In goat, five blood groups A, B, C, M, and J are identified which resemble to those of the sheep [2].
- e. Dog:** The dog blood types are categorized by the DEA (Dog Erythrocyte Antigen) system. DEA 1.1, 1.2, and 1.3 are termed A system. There are also DEA 3, DEA 4, DEA 5, DEA 6, DEA 7 and DEA 8. The DEA 1.1 and DEA 1.2 are most common and clinically important in dogs and DEA 1.1, 1.2 and 7 are the most antigenic blood types [11].
- f. Cat:** In feline the blood types are described by AB blood group system and Mik group system. In AB blood group system there are three types of blood groups A, B and AB. Blood group AB is extremely rare but is found in DSH/DLH cats and in breeds in which group B is also found e.g. Abyssinian, Birman, British shorthair, Norwegian forest, Somali, Scottish fold and Persian [15]. In cats a new blood group is defined as Mik. It is named after the alloantibody identified in the first blood donor cat, Mike. Transfusion between Mik positive and Mik negative cats can result in acute post-transfusion hemolysins [14].

4. Donor selection

Ideal donor is an adult animal with good body condition and good body size, No history of blood transfusion, No history of blood based vaccines, Preferably male, if female then nulliparous, Female should preferably be spayed, Genetically related or of same breed, Free from blood transmitted diseases. Cases of transmission of Prion diseases by blood transfusion have been reported in sheep [13], therefore, screening should be done for prion disease prior to blood transfusion in ruminants.

- a. Cattle:** Cattle can donate 8-14mL of blood per kg of body weight. Closely cross match blood transfusions are very difficult in cattle. First transfusions are generally of low risk, but ideally a donor would be negative for the J antigen [7].
- b. Horses:** For recipient mare, the horse should be Aa and Qa negative, Belgium draft horses are more suitable. Initial transfusions are rarely associated with adverse reactions because horses infrequently produce strongly reactive natural erythrocyte alloantibodies. Vaccinations of rhinopneumonitis, tetanus toxoid, eastern and western encephalitis, botulism toxoid and rabies should have been done. Alloantigens Aa of the A system and Qa of the Q system are the most immunogenic of the equine alloantigens and are highly prevalent among light breed horses. Transfusion of blood from a donor positive with these alloantigens will result in the development of a high alloantibody titer in the recipient that can cause severe hemolysis upon subsequent exposure Donors lacking

those alloantigens are considered safe blood donors [8].

- c. Dogs:** Ideal weight of blood donor for the dog should be more than 25kg as they are able to donate 450 ml of blood at one time after 3 weeks interval. Age should be between 1-8 years, Dog PCV should be 40%, Dog must be free from ectoparasite, endoparasites, blood protozoans, bacterial or viral disease. Donor should be preferably negative for DEAs 1.1, 1.2 and 7. Approximately 40% dogs are negative for DEAs 1.1, 1.2. Approximately 60% dogs are positive for DEAs 1.1 and 1.2 i.e. universal recipients. Dogs positive for DEA 4 and negative for all others are best and considered as universal donors. Hemolytic reactions are unlikely to occur after the first transfusion even after the negative 1.1 and 1.2 recipient is given blood from positive 1.1 and 1.2 donor. But the animal would be sensitized and there would be immediate hemolysis following second transfusion of 1.1 and 1.2 positive donor.
- d. Cats:** Cats must be free from feline leukemia virus, feline immunodeficiency virus, feline infectious peritonitis, toxoplasmosis and hemobartonellosis. Free from ticks fleas and intestinal parasites particularly hook worms. There are no feline universal donors. Type A is used preferably, for cat blood donor should be of more than 5 kg, Cat PCV should be 35%, donor cats must live indoors only

5. Blood collection

- a. Horse:** We collect 15-22 ml/kg BW of blood at one time
- b. Dog:** 10-20 ml/kg BW for dog can be withdrawn of a dog with a maximum of 22 ml/kg
- c. Cat:** 10 ml/kg for cat can be drawn off at one time but Maximum 40 ml is drawn from donor cat

6. Cross matching

Before transfusion of blood and its products, cross matching of recipient and donor blood should be carried out to minimize the risk of transfusion reaction. Collect anticoagulated blood and serum from donor and recipient. Wash RBC in 0.9% saline solution and prepare 5-10% RBC suspension. Put 2 drops of donor cells and 2 drops of recipient serum and mix (major cross match). In the second tube, put 2 drops of recipient cell and donor serum (minor cross match). Controls are set with serum and cells of donor and recipient separately. Incubate for 30 min at room temperature, centrifuge for 1 min at 1000 rpm. Examine the tube for hemolysis, shake the tubes to resuspend cells and check for hemagglutination microscopically. Incompatibility in minor cross match can be used if other compatible donor is not available. Cross matching is not required if platelets or cryoprecipitate is to be transfused.

7. Blood transfusion

Before infusion physiological parameter like rectal temperature, pulse rate, respiratory rate, mucous membrane color, capillary refill time, hematocrit, plasma and urine color of the recipient should be monitored. Blood administration sets are commercially available. Standard filter screens are incorporated in these units of 170 um pore size. These restrain the blood clots and large particle. Debris composed of RBC, platelets, leukocyte and fibrin is formed if blood is stored. To remove debris 20-40 um filters are used. Blood should be warmed to room temperature or preferably to body temperature. Avoid excessive heat to prevent fibrinogen

precipitate which occurs at 56 °C and auto agglutination which occurs at more than 45 °C. Blood is best administered IV, Maximum rate of transfusion in normovolemic animal @ 10-20 ml/kg b. w. per hour, hypovolemic animal @ 20ml/kg body weight per hour, in cardiac failure animal is 1 ml/kg b. w. per hour^[12]. If possible it can also be given intramedullary. 0.25ml/kg/hr should be given for first 15 mins (same for horse). Animal is watched for 15-20 min if no untoward reaction occurs.

8. Conclusion

This review provides important information about selecting the blood group which having an invaluable therapeutic management and also help to prevent various health hazards. Blood transfusion should be help in the management of some severe infection of protozoa (Thieleriasis, Anaplasmosis, Babesiosis) and deficiency disease like post parturient haemoglobinuria and to minimize the blood loss during surgical procedure.

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