Background and Introduction

The history of veterinary transfusion medicine began in 1665 with the first reported transfusion of canine blood. From that time to the present day, whole blood and blood component administration has been used to treat many disease states and for surgery in veterinary medicine. Early complications associated with transfusions of animal blood were attributed to incompatibilities, inadequate anticoagulation, sepsis, and circulatory overload. Today, modern techniques in blood banking and more widespread use of component therapy are being advocated by veterinary clinicians and specialists.

The need for establishing local, regional, and national blood banking services for animals has become apparent in recent years with the development of sophisticated medical and surgical support for dogs that parallel those of human medicine. At the same time, the emergence of pet animal health insurance programs helps to provide a means of financial support for advanced critical care.

Local blood donor programs have now been established at most of the University based veterinary teaching hospitals and the larger urban veterinary referral and emergency clinics. A private commercial animal blood bank was started in Northern California in 1988. In 1990, this author opened the first private non-profit national canine blood bank. In November 1991, the University of Pennsylvania initiated an animal bloodmobile to help satisfy their veterinary hospital's needs. Despite these efforts, most of the country's needs are not being met today. The demand exceeds supply and the individual programs still need to be standardized to ensure safety and efficacy. A coordinated national effort through the Association of Veterinary Hematology and Transfusion Medicine is underway, as the essential next step to maximally utilize what is available and set the appropriate procedural standards.

Present and Future Needs

It has been this author's longstanding goal to facilitate the use of transfusion medicine in veterinary practice. Until recently, this type of critical care for animals has not been readily available or well-utilized. Typical hurdles encountered by most veterinarians include; the expense of maintaining donor animals; difficulty in isolating donors in a practice setting after screening for pathogens; the fact that usage of blood is too sporadic to justify maintaining donors or there are not enough donors to meet the demand; concern for the health and well-being of donors used infrequently; locating suitable animals for donors, selecting them by blood type, and screening to ensure their health; and confusion about how and when to use blood components. Today, veterinary transfusion medicine is a vibrant emerging specialty. Recent developments and projects underway include: commercial source of animal blood typing reagents; a coordinated national animal blood bank program to serve veterinary medical needs;
improved screening and treatment of blood to reduce risks of transfusion-transmitted diseases; blood substitutes such as artificial hemoglobin (e.g. Oxyglobin® , now licensed for veterinary use) and perfluorocarbons to support transfusion needs by providing oxygen to sustain tissue viability; more effective educational outreach to implement practical, safe blood component and blood substitute therapy nationwide. For the future, we need more affordable blood substitutes, and a commercial source of gamma globulin and albumin for therapy and prophylaxis in veterinary medicine.

Prior Transfusion Practices

Until recently most veterinarians gave blood transfusions as whole blood from un-typed and non-crossmatched donors for emergency life-saving measures to combat traumatic or surgical shock, severe anemia and hypoproteinemia, and bleeding. This would usually be the animal’s first transfusion. Today, while animal blood typing reagents are commercially available for the major blood group antigens of dogs (DEA 1) and cats (A, B), more complete typing services and reagents are provided only by veterinary researchers and certain blood banks, so that universally compatible blood donors can be identified. Current research in veterinary transfusion medicine has provided a wealth of practical knowledge that can be applied directly by veterinary clinicians.

Need for Compatible Blood

It is important that veterinarians use typed, compatible blood whenever a transfusion is given. For cats, cross-matching the recipient and donor beforehand is an essential standard of practice today, to avoid serious or life-threatening transfusion reactions. All cats have naturally-occurring alloantibodies against the other blood type allele, with strong incompatibility reactions seen when blood type B recipients receive blood from type A donors [because type A cats have potent anti-B antibodies.] Knowing the blood type of in-house feline donors (and recipients) is also advisable. Commercial blood typing cards are available for this purpose.

Because of this blood group situation in cats, hemolytic disease of the newborn can occur with type-incompatible matings, and result in significant neonatal morbidity and mortality. A parallel situation is well known in people, and also occurs in other species like the horse and pig.

In contrast to cats, dogs do not have naturally occurring alloantibodies against other canine blood group antigens. However, because it is usually impractical from an economic and timing standpoint to determine the blood type of dogs requiring immediate transfusion, most blood bank programs depend upon in-house or local canine donors that have been pre-screened. The donor dogs are selected for overall health and vigor, ease of bleeding and docile temperament, and they should have what is termed “universal donor” blood type [negative for all canine red cell antigens except DEA 4, which is essentially present in all dogs]. This means that their red blood cells do not carry any of the surface antigens associated with transfusion reactions or incompatibilities.

Another issue surrounds the transfusion of incompatible blood to breeding females, as it poses a potential risk of immunologic sensitization (alloimunization). If a sire also mismatched in blood type is subsequently mated with this female, hemolytic disease of the newborn can be exhibited by some of the puppies. This occurs after they suckle colostrum containing antibodies against the sire’s red blood cells. Hemolytic disease of the newborn can therefore be a significant cause of the “fading puppy syndrome”. The problem can be avoided by transfusing only universal-donor blood or by blood typing the sensitized dam and selecting only type-compatible sires for future breedings.
Need for Safe Blood

A second, but equally important aspect of veterinary transfusion medicine, is to ensure that all blood used for transfusion is properly screened for blood-transmitted infectious diseases. At the 2003 American College of Veterinary Internal Medicine annual meeting, an expert task force concluded that safety issues are of major concern, because about 60% of blood transfusions given in private practice settings use blood from local animal donors (non-commercial source) that may not be blood-type compatible and are usually not screened for infectious diseases. This practice poses a significant potential liability for malpractice should an adverse transfusion event occur.

Blood Component Therapy

Whole blood is no longer the treatment of choice, nor is it desirable for the primary therapy of most veterinary transfusions. Processing freshly collected blood into several clinically useful components is a more cost-effective, efficient and safer use of the precious life-saving resource. The most commonly used blood components in veterinary medicine parallel those in human medicine: packed red blood cells and fresh-frozen plasma. The red blood cells are primarily used to treat acute blood loss anemia from trauma, surgery, or acute hemolytic disease, and for chronic anemias caused by internal (hookworms) and external (fleas, ticks) parasites, bone marrow failure and chronic hemolytic disease. Fresh frozen-plasma is used mostly to treat or control bleeding disorders and to provide other plasma proteins and globulins to help alleviate or protect against acute or chronic infectious diseases. Other treatment approaches to control excessive bleeding include use of L-thyroxine, desmopressin (DDAVP) and danazol.

BLOOD CROSS-MATCHING

| Collect 0.5 mL blood in EDTA (LTT) from patient (recipient) and one or more potential donors. |
| Spin blood and separate plasma from blood cells. Label tubes: Recipient RBCs; Recipient Plasma; Donor(s) RBCs; Donor(s) Plasma. |
| Major cross-match: Recipient Plasma + Donor RBCs |
| Minor cross-match: Donor Plasma + Recipient RBCs |
| Recipient control: Recipient Plasma + Recipient RBCs |
| Donor control: Donor Plasma + Donor RBCs |

Canine | Feline
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Add one drop of Donor RBCs to 3 mL saline. Repeat with a second tube. | For each potential donor, prepare three microscope slides.
Add one drop of Recipient RBCs to 3 mL saline. Repeat with a second tube. | Label slides: Major cross-match; Minor cross-match; Recipient control.
Spin each tube for 15 secs at 3500 rpm. Pour off saline; add fresh saline as before; spin down; decant saline, add fresh saline and repeat until each RBC tube is washed three times. Pour off saline, leaving cells in tubes. | Place two drops of Recipient Plasma + one drop of Donor RBCs on Major cross-match slide; two drops of Donor Plasma + one drop of Recipient RBCs on Minor cross-match slide; and two drops of Recipient Plasma + one drop of Donor RBCs on control slide.
Add two drops of Recipient Plasma to washed Donor RBCs = Major cross-match. | Mix each slide gently back and forth with rocking motion and examine for several mins, looking for hemagglutination. This should be obvious to the naked eye, and the recipient control slide should be negative.
Add two drops of Donor Plasma to washed Recipient RBCs = Minor cross-match. | Mix, place drop of each tube on separate microscope slides to check for agglutination or hemolysis. Both controls should be negative.
Add two drops of Recipient Plasma to washed Recipient RBCs = Recipient control. |
Add two drops of Donor Plasma to washed Donor RBCs = Donor control. |
Mix, place drop of each tube on separate microscope slides to check for agglutination or hemolysis. Both controls should be negative. | Repeat procedure for other potential donors.
Bibliography


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