

TRANSFUSION REACTIONS AND TREATMENT

Sarah Perry, LVT, BS, VTS (ECC)
Licensed Veterinary Technician
Animal Neurology, Rehabilitation and Emergency Center
1120 Welch Rd.
Commerce, MI 48390

Blood product transfusions can be life savers, however they do not come without risk. Transfusion reactions can happen for several different reasons in dogs and cats. Transfusion reactions can occur due to immune-mediated and non-immune-mediated reasons. Patients may also develop delayed transfusion reactions.

There are a couple of types of immune-mediated transfusion reactions or acute immunologic reactions that patients can develop. Hemolytic transfusion reactions occur when there are antibodies present in the patient's plasma that destroy the red blood cells from the donor blood causing intravascular hemolysis. In dogs there are naturally occurring antibodies against DEA 3, 4, 5 and 7. Reactions occur when dogs that have blood negative for DEA 3, 4, 5 or 7 are transfused with blood from a donor that is positive for DEA 3, 4, 5 or 7. In cats, this occurs when the wrong type of blood is administered. This is the worst of the transfusion reactions that a patient can get. Clinical signs associated with this type of reaction include tachycardia or bradycardia, fever, hypotension, cyanosis, difficulty breathing, vomiting, diarrhea. It can progress to seizures, collapse and even cardiac arrest. Hemoglobinemia and hemoglobinuria may be found as well. For this type of reaction it is important to immediately stop the transfusion and provide supportive care. Urine output and blood pressures should be obtained. Oxygen may need to be administered if the patient is having difficulty breathing (lack of red blood cells and hemoglobin to carry oxygen). To reduce inflammation, corticosteroids can be given, but the use is controversial.

Another form of immune-mediated transfusion reaction is a febrile reaction. This occurs due to an antibody reaction to donor platelets or white blood cells. The most common clinical exam finding with this type of transfusion reaction is an increase in the patient body temperature by a few degrees within 1-2 hours of transfusion. This is the most common form of transfusion reaction seen in veterinary practices. Treatment for this type of transfusion reaction includes giving diphenhydramine and non-steroidal anti-inflammatories and slowing the transfusion rate. The transfusion may also be stopped for a short period and then restarted.

Urticarial reactions are the third type of immune-mediated transfusion reaction. This type of reaction occurs when antigen from donor blood binds to types of antibody that are on the recipient's mast cells and basophils. These cells then degranulate. Symptoms associated with urticarial reactions include erythema, itching and urticaria. Acute allergic reactions can also

develop. This could lead to vomiting, difficulty breathing and non-cardiogenic pulmonary edema, although there has not been a true transfusion related anaphylactic reaction reported in veterinary medicine. Treatment for urticarial transfusion reactions includes giving an antihistamine, such as diphenhydramine as well as corticosteroids. The transfusion may also be stopped or slowed.

The last type of immune-mediated transfusion reaction that can occur is a transfusion related acute lung injury. This is in the form of non-cardiogenic pulmonary edema. This type of reaction is thought to be due to white blood cell antigen reactions with white blood cell aggregate in circulation within the lungs. The clinical findings in these patients are signs of acute respiratory distress without evidence of fluid overload or other acute allergic signs. Treatment consists of IV fluid therapy and oxygen administration. Do not give Lasix to these patients. The viscosity of the pulmonary fluid may be increased with Lasix.

Non-immune-mediated transfusion reactions are potentially due to contamination or improper storage of the blood product. Included in this category of transfusion reactions is sepsis. This occurs from a contaminated blood product. The resultant clinical signs include fever, hypoglycemia, hypotension and possibly coagulation disorders and DIC. Treatment includes administration of antibiotics and supportive care with IV fluids. It is also recommended to culture the unit of blood that was used. Causes for bacterial contamination of the blood product include improper collection techniques, changes in storage temperature, administering blood over a period longer than four hours and not using aseptic techniques when setting up and giving the transfusion.

Storage length of blood products has recently come under scrutiny. It is thought that storage lesions can occur as the length of storage increases with a blood product. The goal of preserving red blood cells after donation is to maintain the viability and functionality of the red blood cell during its shelf-life. This is to maximize the number of functional red blood cells that will exist for transfusion. While the red blood cell is stored it remains metabolically active and undergoes biochemical, biomechanical and immunologic changes. This can result in loss of viability and possibly cause immunomodulation. Red blood cells go through ATP depletion and oxidative damage, reduced oxygen-carrying capacity, and microparticle formation. These changes have become known as red blood cell storage lesion. This can happen as soon as 7-14 days into the storage time. Things that may happen to red blood cells during their storage period are changes in shape, deformability and aggregability. It is important that red blood cells are capable of deformability in order to perfuse into the microvasculature. What happens is the red blood cells lose their biconcave shape and thus their deformability. If the red blood cells cannot perfuse into the microvascular, tissue oxygenation is decreased. Storage lesions can realistically cause thrombi to develop, arrhythmias, systemic inflammation, ARDS, MODS, hypotension, acute respiratory distress and transfusion associated acute lung injuries. Studies have been

performed with no definite conclusion as to whether the age of the stored blood increases mortality in patients. There is no current evidence to change the current blood storage times that have been set in place. There are studies that have linked leukocytes to the primary cause of transfusion reactions. Leukoreduction is being utilized in human blood products to reduce inflammatory reactions. This is a process used to filter the donor's blood to remove leukocytes before storing or before administering. Leukoreduction prior to storage is most ideal to avoid large accumulations of inflammatory cytokines. Early removal of the leukocytes prevents fragmentation of the white blood cells. Leukoreduction requires a filter that can cost an additional \$20-30 to the clinic. It requires the loss of about 50 ml of blood. Therefore, due to the volume needed it is not a viable option for felines.

Volume overload or circulatory overload is another form of non-immune-mediated transfusion reactions. This type of reaction occurs when the patient cannot handle the volume of blood product administered or if the volume was administered too quickly. Clinical signs associated with this type of transfusion reaction are tachypnea, dyspnea, and potentially cough. Blood products are a type of colloid so care must be taken to monitor the patient closely.

Hemolysis not related to an immune response can also occur. This can be caused from excessive changes in temperatures, meaning heating too quickly or cooling to too low of a temperature. It can also be from how the red blood cells were given, such as the use of the wrong type of infusion pump. Also combining the blood product with a non-isotonic fluid can cause hemolysis. There is no treatment for this. Another transfusion may need to be given.

Citrate toxicity can also occur with the delivery of a blood product. This may happen in patients that have concurrent liver disease as they cannot metabolize citrate efficiently. Hypocalcemia may develop when products with citrate anti-coagulant are transfused too rapidly in patients with impaired liver function. These animals may vomit, tremor or twitch, develop tetany and cardiac changes. IV calcium gluconate may need to be given to correct this.

The last form of reaction that is not immune related is hyperammonemia. This can occur in patients given blood that has been stored past its expiration date. Studies have been performed in cats which indicated that ammonia levels increase in stored units of blood. Patients with concurrent liver disease are more prone to developing hyperammonemia. Clinical signs are related to central nervous system function and these patients resemble those with hepatic encephalopathy.

Delayed transfusion reactions are also a possibility. This is not going to occur while the blood product is being administered. This type of transfusion reaction is characterized by the development of an antibody that decreases the life of a red blood cell from the transfusion. Delayed reactions occur due to antibody being formed against antigen in the transfused blood product. This type of reaction occurs during the time of 3 days post transfusion up to several weeks post transfusion. Antibody develops and attaches to the transfused cells. They are then

removed by extravascular hemolysis. A decrease in PCV is the clinical exam finding. The return of anemia is sooner than expected. Melena, epistaxis and ecchymoses may occur. These findings are consistent with DIC. Treatment is to give another transfusion if the patient is clinical for the decreased PCV.

Thorough monitoring including temperature, respiratory rate and effort, heart rate, pulse quality, mucous membrane color is important in recognizing reactions immediately. Technicians should take care to monitor mentation as well as take time to auscult heart and lungs during transfusions. Any change in status should be recorded and the veterinarian alerted.