

Peer Reviewed

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Blood Transfusion Basics

Anemia, a common condition in dogs and cats, is primarily caused by blood loss, hemolysis, or decreased erythropoiesis. In addition to being evaluated for an underlying cause, patients with severe anemia often require red blood cell (RBC) transfusion. Packed RBCs and fresh whole blood are the two main blood products for the treatment of anemia in dogs and cats.

The choice of blood component should be tailored to the patient's needs. Although both packed RBCs and fresh whole blood are hemoglobin sources for improving oxygen-carrying capacity, whole blood has the advantage of providing clotting factors and platelets to help with hemostasis when necessary. However, this advantage is provided at the cost of increased infusion volumes, which all patients may not tolerate.

Plasma-containing products were initially used to improve oncotic pressure in patients with hypoalbuminemia. With the widespread availability of synthetic colloids and their superior ability to improve oncotic pressure, however, there are fewer indications today for whole blood transfusions.

BLOOD TYPING

Safe administration of blood products is important because of the potential for adverse transfusion reactions. Although a sample can be submitted to an outside laboratory for blood typing,

Blood Group Systems

Dogs



The blood group system recognized in dogs is the dog erythrocyte antigen (DEA) system; DEA 1.1 is the most antigenic and is used for typing purposes. A first-time RBC transfusion can be performed using DEA 1.1–negative blood without blood-typing because DEA 1.1–negative dogs are considered universal donors.

Cats



In cats, AB is the recognized blood group system. Most cats are type A, some are type B, and type AB is rarely seen; the frequency of each type varies geographically and among breeds. Blood typing is imperative in cats because they have preformed alloantibodies to the opposite type with no universal donors.

WHAT YOU WILL NEED

- Blood unit
- Transfusion administration set*
- Transfusion monitoring table for patient's record
- Thermometer
- Blood pressure monitoring device and supplies

*Most blood transfusion administration sets incorporate a 150- to 260-micron pore size filter that prevents blood clots or debris emboli. Neonatal 18-micron pore size filters exist; however, these may cause in vitro hemolysis and tend to obstruct easily, particularly with larger blood volumes (>20 mL), and are not recommended.



STEP-BY-STEP BLOOD TRANSFUSION BASICS

STEP 1

Verify the blood product unit size, number, and expiration date as well as the donor species and blood type. Perform a visual inspection to detect any macroscopic abnormalities in color and consistency. Bacteria-contaminated blood often appears brown or purple because of deoxygenation, hemolysis, and methemoglobin formation. Also evaluate the unit for the presence of clots.



the turnaround times are impractical. In-house blood typing kits are easy to use, provide quick results, and are fairly accurate for blood typing both species.

CROSSMATCHING

If an appropriate blood-type unit is used, a crossmatch is not required for the first lifetime transfusion in either dogs or cats. Because antibody formation to the first transfusion may occur after 3 to 5 days, crossmatching should be performed for subsequent RBC transfusions.

Sensitization from birthing has never been proven in dogs or cats. While compatibility testing helps identify and prevent possible acute hemolytic reactions, immune reactions can occur, even with appropriately cross-matched units.

POSTTRANSFUSION MONITORING

Patients should be monitored closely for at least 60 minutes after receiving a blood transfusion. Fluid balance status should be reassessed, especially in patients with unstable cardiovascular status.

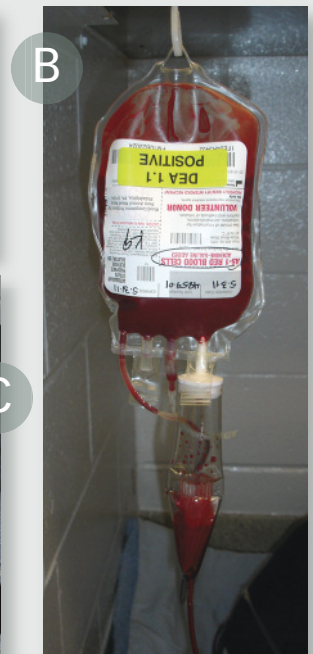
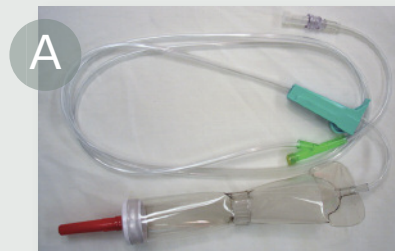
Sensitization to any RBC antigens may occur even with compatible units, and delayed transfusion reactions may take several days to manifest. Although delayed reaction (ie, hemolysis, icterus, purpura) is a well-known clinical problem in human patients, it occurs rarely in small animals.

AUTHOR INSIGHT

Warming refrigerated units is only necessary in neonates, hypothermic patients, or patients receiving large blood transfusion volumes. Warming RBCs may lead to membrane damage and hemolysis and should be avoided; blood should not exceed 37°C (98.6°F) in any instance. The unit can be brought to room temperature for 10 to 15 minutes without active warming, but for no longer, as doing so may result in bacterial growth.

STEP 2

Attach the blood transfusion administration set (A) to the blood unit, and prime it with blood (B) to eliminate all air. Then connect it to the patient's catheter (C). Both IV and intraosseous (IO) catheters can be used. Smaller catheter sizes do not cause more hemolysis than larger ones but are the main factor in limiting the infusion rate; therefore, use a catheter with the largest available diameter.



CONTINUES

AUTHOR INSIGHT


In neonates or when venous access cannot be achieved, IO transfusion is a good choice. About 95% of transfused blood cells will reach the systemic circulation within 10 minutes after IO administration, but the infusion rate tends to be faster and may require closer attention.

AUTHOR INSIGHT

If the infusion rate slows or stops, do one or more of the following: 1) verify patency of the infusion site; 2) examine the filter for air, excessive debris, or clots; or 3) raise the unit. If the unit is too viscous, consider adding 0.9% sodium chloride.

STEP 3

Using a **Transfusion Monitoring Chart** similar to the sample shown, carefully monitor physiologic parameters and adverse reactions, including fever, hypotension, urticaria, pruritus, pigmenturia, vomiting, and shivering. Record baseline vital signs before starting the transfusion, then q15min for the first 45 minutes and q30min until the end of the transfusion. The initial infusion rate should be approximately 0.25 mL/kg for the first 30 minutes, after which the rate can be increased if no reactions are seen. The entire volume should be administered within 4 hours to prevent functional loss or bacterial growth.

 TRANSFUSION MONITORING CHART										
Time	Temperature	Pulse Rate	Pulse Quality	Respiratory Rate/Effort	CRT	Blood Pressure (MAP)	Mentation	Other Observations	Initials	
0 min (baseline)										
15 min										
30 min										
45 min										
1 hr 15 min										
1 hr 45 min										
2 hr 15 min										
2 hr 45 min										
3 hr 15 min										
3 hr 45 min										
4 hr 15 min										

To download this chart for use in your clinic, go to cliniciansbrief.com/journal/blood-transfusion-chart

CRT = capillary refill time, MAP = mean arterial pressure

STEP 4

When the transfusion is complete, flush the infusion site with 0.9% saline before initiating other infusions or drugs. Saline (0.9%) is the most compatible fluid with RBC products; hypotonic solutions cause hemolysis, and calcium-containing solutions (eg, lactated Ringer's) can overcome the anticoagulant properties of citrate and lead to clot formation.

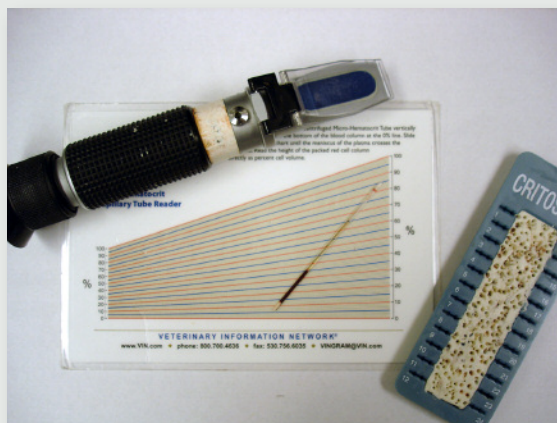


AUTHOR INSIGHT

Ideally, drugs and food should be withheld during the transfusion. If a drug or fluid must be administered during the transfusion, it should be infused using a different venous access site.

STEP 5

Check packed cell volume (PCV) and total solids 1 to 6 hours after transfusion. If there is no ongoing loss or hemolysis, 70% of the transfused RBCs are expected to remain in circulation. Thereafter, if fresh whole blood was used, the RBCs should have a normal lifespan (approximately 110 days in dogs, 70 days in cats). The lifespan of packed RBCs depends on the age of the unit: the longer the unit has been stored, the shorter the lifespan.



AUTHOR INSIGHT

If a reading is obtained too soon after the transfusion, fluid compartment equilibrium may be incomplete, leading to inaccurately high PCV readings. Fluid compartment equilibrium typically occurs 30 to 60 minutes after infusion.

See Aids & Resources, back page, for references & suggested reading.

TRIFEXIS™

(spinosad + milbemycin oxime)

Chewable Tablets

Before using TRIFEXIS chewable tablets, please consult the product insert, a summary of which follows:

Caution: Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

Indications:

TRIFEXIS is indicated for the prevention of heartworm disease (*Dirofilaria immitis*). TRIFEXIS kills fleas and is indicated for the prevention and treatment of flea infestations (*Ctenocephalides felis*), and the treatment and control of adult hookworm (*Ancylostoma caninum*), adult roundworm (*Toxocara canis* and *Toxascaris leonina*) and adult whipworm (*Trichuris vulpis*) infections in dogs and puppies 8 weeks of age or older and 5 pounds of body weight or greater.

Contraindications:

There are no known contraindications to the use of TRIFEXIS Chewable Tablets.

Warnings:

Not for human use. Keep this and all drugs out of the reach of children.

Serious adverse reactions have been reported following concomitant extra-label use of ivermectin with spinosad alone, one of the components of TRIFEXIS Chewable Tablets (see **ADVERSE REACTIONS**).

Precautions:

Treatment with fewer than 3 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention (see **EFFECTIVENESS**).

Prior to administration of TRIFEXIS, dogs should be tested for existing heartworm infection. At the discretion of the veterinarian, infected dogs should be treated with an adulticide to remove adult heartworms. TRIFEXIS is not effective against adult *D. immitis*. While the number of circulating microfilariae may decrease following treatment, TRIFEXIS is not indicated for microfilariae clearance. Mild, transient hypersensitivity reactions manifested as labored respiration, vomiting, salivation and lethargy, have been noted in some dogs treated with milbemycin oxime carrying a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

Use with caution in breeding females. The safe use of TRIFEXIS in breeding males has not been evaluated. Use with caution in dogs with pre-existing epilepsy. Puppies less than 14 weeks of age may experience a higher rate of vomiting.

Adverse Reactions:

In a well-controlled US field study, which included a total of 352 dogs (176 treated with TRIFEXIS chewable tablets and 176 treated with an active control), no serious adverse reactions were attributed to administration of TRIFEXIS chewable tablets. All reactions were regarded as mild.

Reactions that occurred at an incidence >2% (average monthly rate) within any of the 6 months of observation are presented in the following table:

Average Monthly Rate (%) of Dogs With Adverse Reactions

Adverse Reaction	TRIFEXIS Chewable Tablets ^a	Active Control Tablets ^a
Vomiting	6.13	3.08
Pruritus	4.00	4.91
Lethargy	2.63	1.54
Diarrhea	2.25	1.54

^an=176 dogs

In the US field study, one dog administered TRIFEXIS experienced a single mild seizure 2½ hours after receiving the second monthly dose. The dog remained enrolled and received four additional monthly doses after the event and completed the study without further incident.

Following concomitant extra-label use of ivermectin with spinosad alone, a component of TRIFEXIS, some dogs have experienced the following clinical signs: *trembling/twitching, salivation/drooling, seizures, ataxia, mydriasis, blindness and disorientation*. Spinosad alone has been shown to be safe when administered concurrently with heartworm preventatives at label directions.

In US and European field studies, no dogs experienced seizures when dosed with spinosad alone at the therapeutic dose range of 13.5-27.3 mg/lb (30-60 mg/kg), including 4 dogs with pre-existing epilepsy. Four epileptic dogs that received higher than the maximum recommended dose of 27.3 mg/lb (60 mg/kg) experienced at least one seizure within the week following the second dose of spinosad, but no seizures following the first and third doses. The cause of the seizures observed in the field studies could not be determined.

For technical assistance or to report an adverse drug reaction, call 1-888-545-5873. Additional information can be found at www.TRIFEXIS.com.

Effectiveness:

Heartworm Prevention:
In a well-controlled laboratory study, TRIFEXIS was 100% effective against induced heartworm infections when administered for 3 consecutive monthly doses. Two consecutive monthly doses did not provide 100% effectiveness against heartworm infection.

In another well-controlled laboratory study, a single dose of TRIFEXIS was 100% effective against induced heartworm infections. In a well-controlled six-month US field study conducted with TRIFEXIS, no dogs were positive for heartworm infection as determined by heartworm antigen testing performed at the end of the study and again three months later.

Flea Treatment and Prevention:

In a well-controlled laboratory study, TRIFEXIS demonstrated 100% effectiveness on the first day following treatment and 100% effectiveness on Day 30. In a well-controlled laboratory study, spinosad, a component of TRIFEXIS, began to kill fleas 30 minutes after administration and demonstrated 100% effectiveness within 4 hours. In field studies conducted in households with existing flea infestations of varying severity, flea reductions of 98.0% to 99.8% were observed over the course of 3 monthly treatments with spinosad alone. Dogs with signs of flea allergy dermatitis showed improvement in erythema, papules, scaling, alopecia, dermatitis/pyodermitis and pruritus as a direct result of eliminating the fleas.

Treatment and Control of Intestinal Nematode Infections:

In well-controlled laboratory studies, TRIFEXIS was ≥ 90% effective in removing naturally and experimentally induced adult roundworm, whipworm and hookworm infections.

NADA #141-321, Approved by the FDA

Manufactured for Elianco Animal Health
A Division of Eli Lilly & Co.
Lilly Corporate Center, Indianapolis, IN 46285

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