

Canine Packed Red Blood Cells (PRBC)

1. Product Description

Canine PRBC is a blood product intended for clinical transfusion use in dogs. Blood (~250ml) is collected aseptically into 35ml of citrate-phosphate-dextrose (CPD) anticoagulant-filled blood bags licensed for human use by Baxter Healthcare Corporation.

All donor dogs are healthy animals maintained at an isolated, closed colony environment. All donor dogs are of blood type DEA 4(C) and are negative for all other known canine red blood cell antigens, including DEA 1.1 (A1), DEA 1.2 (A2), DEA 7 (Tr), the antigens most associated with clinically significant transfusion incompatibilities in dogs. All product labels indicate the donor's blood type.

All donors receive on-site, 24 hour-a-day veterinary care and maintenance, and have been blood and serologically tested for canine brucellosis, haemobartonellosis, *Borrelia burgdorferi* (Lyme disease), *Dirofilaria immitis* (heartworm disease), *Ehrlichia canis*, Rocky Mountain spotted fever, *Coccidioides immitis*, *Babesia canis*, *Babesia gibsoni*, and plasma level of von Willebrand factor. All donor dogs are current on immunizations for canine distemper, hepatitis, parainfluenza, leptospirosis, parvovirus, Bordetella, coronavirus and rabies virus. The expiration date on the label is calculated from the date of collection. Please note this expiration date upon receipt of the blood at your facility.

Canine PRBC consists of ~ 125 ml of red blood cells, white blood cells, platelets and a small residual volume of plasma, plus about 10 ml of anticoagulant. This product has been obtained by centrifugation of a 250 ml unit of freshly collected, CPD-anticoagulated canine whole blood, followed by antiseptic transfer of the majority of supernatant plasma (~ 125 ml) and about 25 ml of anticoagulant to a plastic transfer bag. About 50 ml of red blood cell nutrient solution (Adsol, saline-dextrose-adenine-mannitol solution, Baxter Healthcare Corporation) is then added to this product to preserve and extend the shelf-life of Canine Packed Red Blood Cells from 28 to 42 days. The additive preservative solution provides increased concentration of dextrose and adenine for intracellular energy metabolism, and mannitol to diminish red cell lysis.

2. Indications

Canine PRBC are indicated for parenteral replacement of red blood cells to carry oxygen to tissues in order to sustain tissue and cellular viability. This product is essentially equivalent to whole blood in providing this capacity. PRBC are useful for treating both acute (e.g. traumatic or surgical hemorrhage, acute autoimmune anemia) and chronic (e.g. internal and external parasitism, bone marrow failure, chronic autoimmune anemia) blood loss anaemia. The volume of packed red blood cells required to sustain a canine patient will depend upon clinical assessment of the patient's status by the attending surgeon or clinician. The minimum amount needed to stabilise the patient should be given in life-threatening cases of immune-mediated hemolytic disease.

PRBC are preferred over whole blood for routine use for several reasons. PRBC stored in nutrient solution have an extended shelf-life of 42 days versus 28 days for whole blood. For cases not requiring replacement of plasma proteins and coagulation factors, packed red blood cells avoid the risk of fluid volume overload for compromised patients and the potential of adverse immunologic reactions to plasma proteins. Red blood cells are also less likely to cause febrile nonhaemolytic transfusion reactions. Furthermore, use of red blood cells conserves a source of fresh-frozen plasma for patients needing this product for a variety of other clinical needs (see below).

For surgical procedures, there is no need to transfuse a patient to achieve a PCV within normal limits either before or after surgery because a moderate degree of haemodilution is considered beneficial in most situations.

3. Precautions / Contraindications

All blood donor dogs are negative for all recognised canine erythrocyte antigens except for DEA 4 (C), so that blood units from them should be cross-match compatible with any naïve

recipient. For dogs that have received prior blood transfusions, it may be advisable to perform a routine major and minor blood crossmatch at least at 37C before transfusing packed red blood cells. However, these dogs may show some non-specific reaction in cross-match tests because of their prior exposure to leukocyte and platelet antigens.

The volume of PRBC transfused will depend upon the individual patient's needs which generally should not exceed 1.35- 2.25ml/kg (3-5 ml/lb) of body weight given once or twice daily and not more than 4.5 ml/kg (10ml/lb) bodyweight over a 24 hour period for normovolemic animals.

The rate of administration of PRBC should be slow for the first 10-30 minutes to monitor for signs of incompatibility. The average rate for normovolemic patients should be 4.5ml/kg (10 ml/lb) over 4 hours. The rate in hypovolemic patients should not exceed 4.5ml/kg/hr (10 ml/lb/hour). For acute needs, patients can usually tolerate transfusion give at 4-6 ml/minute. For cardiac or other compromised patients at risk for circulatory embarrassment, the rate should be much slower (up to 0.9ml/kg/hr or 2 ml/lb/hour).

This product must not be mixed with or administered in the same intravenous or other parenteral line with Lactated Ringer's solution or any other solution containing divalent cations. The safest fluid to mix with or administer via the same infusion apparatus is 0.9% sodium chloride (NaCl).

Filters should always be used when administering blood cells. Standard drip type blood administration filters and special filter sets that adapt to syringes for filtering smaller volumes of blood cells should be considered.

Transfusion reactions or blood-transmissible diseases can still arise despite donor blood typing, patient-donor cross matching reactions including circulatory overload, and refrain from adding medications to the blood bag or into the same infusion system during transfusion. If a reaction occurs, STOP the transfusion immediately, and then initiate appropriate supportive measures (see section 5).

Gently mix the contents of each blood bag before administering. Do not use any blood product if the bag has been damaged and is leaking contents or if the contents are clotted, excessively haemolyzed or discoloured.

4. Administration

Canine PRBC are to be used only in dogs.

Use of Canine PRBC to sustain or resuscitate a patient is usually reserved until the PCV is at or below 15%. As a general rule, the clinician or surgeon may select a "lower limit for alert" of impending transfusion once the PCV reaches 20%.

Refrigerated Canine PRBC should be warm to room temperature before transfusion. Do not let this product become overheated (beyond 37C / 98.6 F) as haemolysis will occur.

Whenever Canine PRBC is to be given, a PCV should be performed before and after the transfusion and again 24 hour later to evaluate the response. The PCV peaks at 24 hours post-transfusion because of the volume contraction that follows transfusional expansion.

The volume of Canine PRBC needed is calculated as follows:

i) As a general rule, 10 ml /kg (4.5 ml/lb) of transfused PRBC will raise the patient's haemoglobin level by 3 grams or the PCV by 9 points, or

ii) The volume of donor packed red blood cells needed =
$$\frac{(\text{Recipient weight in lbs} \times 40) \times (\text{PCV desired} - \text{PCV recipient})}{\text{PCV of donor packed red blood cells unit}^*}$$

*Measure or assume PCV of 70% for packed red blood cells.

iii) The expected rise in patient PCV =
$$\frac{\text{Volume of packed red blood cells transfused} \times 2}{\text{Body weight in lbs}}$$

The preferred site for transfusion is intravenous because 100% of the infused material circulates. Alternate sites for very young or compromised animals are intraperitoneal (50% circulates within 24 hours; 70% within 48 – 72 hours), and intramedullary (80-95% circulates within 5 minutes; trochanteric fossa of the femur is location of choice).

For the recommended rate of administration please refer to Section 3.

5. Adverse Transfusion Reactions

Complications of transfusion can be manifested by a variety of clinical signs: restlessness, cardiac arrhythmias, irregular respirations, salivation, lip smacking, writhing, vomiting, defecating, urination, oedema, erythema, hives, urticaria, fever, jaundice, haemoglobinuria, anuria, DIC, bruising, haemorrhage, acute renal failure and death. Delayed haemolytic reactions can occur days to weeks following transfusion and the animal may become anaemic and haemoglobinuric. The direct Coombs test is positive in these patients.

6. Shelf-Life and Storage

Canine PRBC stored in nutrient solution have a shelf-life of 42 days from the date of collection from the donor dog. The expiration date is clearly indicated on the product label. Units should be stored at normal refrigerator temperature (1-6 C) immediately upon receipt. It is best if they are stored in a refrigerator that is opened minimally to maintain the proper temperature. Blood bags should be stored in a vertical position with an airspace left to provide breathing room between bags. Try not to store the bags too close together or on top of each other, as this limits the oxygenation of the blood surface areas.

In order for the PRBC to be evenly exposed to and bathed in the nutrient solution, the refrigerated blood pack should be mixed by gentle inversion several times each week during storage. Otherwise, small crevices that typically form at the sides or bottom of the pliable plastic blood bag prevent some of the blood cells from receiving sufficient nutritional and energy support. Failure to regularly mix the contents of the blood pack may be an important contributing factor in causing PRBC to turn black around the edges before the expiration date.

7. Selected References

- Smith, CA (editorial). 1991. Transfusion Medicine: the challenge of practical use. J Amer Vet Med Assoc. 198: 747-752
- Cotter, SM (ed). 1991. Comparative transfusion medicine. Adv Vet Sci Comp Med 36; Academic Press, NY, 343 pages.
- Authement, JM, Wolfsheimer, KJ and Catchings, S. 1987. Canine blood component therapy: product preparation, storage, and administration. J Amer Anim Hosp Assoc, 23:483-493.
- Pichler, ME and Turnwald, GH. 1985. Blood transfusion in the dog and cat: Part I. Physiology, collection, storage, and indications for whole blood therapy. Comp Cont Ed Pract Vet 7:64-72.
- Turnwald, GH and Pichler, ME. 1985. Ibid. Part II. Administration, adverse effects and component therapy. Ibid 7:115-126.
- Dodds, WJ. 1991. Autologous transfusion. Adv Vet Sci Comp Med 36:239-256.
- Dodds, WJ. 1991. Blood substitutes. Adv Vet Sci Comp Med 36: 257-290.
- Hohenhaus, AE (ed). 1992. Transfusion medicine. Prob Vet Med 4(4); Lippincott, Philadelphia, pp 555-670.
- Stone, E, Badner, D and Cotter, SM. 1992. Trends in transfusion medicine in dogs at a veterinary school clinic: 315 cases (1986-1989). J Amer Vet Med Assoc 200:1000-1004.
- Howard, A, Callan, B, Sweeney, M and Giger, U. 1992. Transfusion practices and costs in dogs. J Amer Vet Med Assoc 201: 1697 – 1701.
- Dodds, WJ. 1993. Animal blood banking: medical and ethical perspective. DVM Newsmagazine 23 (1): 44-45.
- Dodds, WJ. 1993. Update on animal blood banking services. Vet Pract STAFF 5(2): 1, 4-7.
- Kerl, ME and Hohenhaus, AE. 1993. Packed red blood cell transfusions in dogs: 131 cases (1989). J Amer Vet Med Assoc 202: 1495-1499.