FELINE
-
WHOLE BLOOD

SaBB Veterinary Clinic and Laboratory Dubai 045 911 007 www.smallanimalbloodbank.com

Description
Blood pulled from a donor with no processing. Whole Blood cannot be considered a viable source of platelets, white cells or therapeutic levels of labile coagulation Factors (V and VIII).

Contents
Erythrocytes and plasma components
If used within 6 hours of collection, all coagulation factors and some viable platelets remain. Platelets lose activity after refrigeration.
Platelets and white blood cells in stored blood are NOT viable.

Indications
Whole Blood restores the O_2 carrying capacity and acts as a volume expander. Also provides certain non-labile coagulation properties

Whole Blood is only indicated for:
- Symptomatic deficit in BOTH oxygen carrying capacity with hypovolemic shock (volume loss >50%)*
    - If only the former is present, the component of choice is pRBC.
- Massive blood loss
- Need for multiple components
- Platelet deficiency blood loss*
    - Unlikely to have a significant therapeutic effect in a severely thrombocytopenic patient (10ml/kg of fresh whole blood raises the PLT count by 10 x 109/l). Therefore WB should only be used in acute need for platelets or coagulation factors or acute loss from massive hemorrhage.
- Immune-mediated hemolytic disease*
    - Life-threatening cases ONLY
    - The minimum amount needed to stabilize the patient should be given.

Contraindications
- Major and minor crossmatch should be conducted before every transfusion, including the first transfusion.

- Even if crossmatched to a repeat donor in the past or the donor and recipient are the same blood type

Transfusion reactions mostly appear during or shortly after the transfusion and can be caused by every component of the blood. In cats, altogether they are rare and often mild.

Acute transfusions reactions occur during or a few hours following transfusion.

Delayed reactions occur after completion of the transfusion (months to years). Delayed reactions have not been reported in the cat.

Restlessness, cardiac arrhythmias, irregular respirations, salivation, lip smacking, wretching, vomiting, defecating, urination, edema, erythema, hives, urticaria, fever, jaundice, hemoglobinuria, anuria, DIC, bruising, hemorrhage, acute renal failure and death.

1) Immunologic transfusion reactions
   - Most immediate reactions occur when there is blood type incompatibility. Hemolytic transfusion reactions usually occur when donor erythrocytes and recipient plasma are incompatible.
   - Alloimmunization to erythrocytes, WBC, platelet and protein antigens are a consequence of transfusion. This can be severe and will only be appreciated at the next transfusion HENCE products **MUST BE CROSSMATCHED.**
   - Allergic reactions can manifest as urticaria, fever, wheezing or other angioedematous reactions.
     - Can be prevented by using pRBC instead
     - Pre-treating with anti-histamines in patients with a history of allergic reactions due to transfusions
   - Anaphylactic reactions characterised by bronchospasm, dyspnea and pulmonary edema may occur rarely. Immediate treatment with adrenaline and corticosteroids is indicated. These patients are not good candidates for further transfusions.
   - Febrile non hemolytic reactions most common in cats

2) Non - Immunologic transfusion reactions

   - Anticoagulant and toxin accumulation in products from storage
   - Transfusion related circulatory overload (TACO)
     - This is a particular risk in older patients, in small patients and in patients with chronic severe anemia when there is decreased red blood cell mass and increased plasma volume. Immediate treatment for pulmonary edema should be instituted.
   - Administration of a hypotonic fluid
   - Bacterial infection of the patient or contamination of the donor blood
     - Even though rare, the presence of gram-negative bacilli can cause severe endotoxin reactions. If a blood recipient experiences chills, high fever or hypotension during or immediately after the transfusion, the possibility that the transfused product may have been bacterially contaminated should be considered. Septic and toxic reactions may be life threatening, and management must be aggressive. Treatment should be initiated immediately after the collection of recipient blood samples for culturing. Treatment may include broad spectrum antimicrobials, vasopressors to maintain blood pressure and urinary flow, and intravenous fluid therapy to maintain fluid and electrolyte balance.
   - Improper handling of the blood, such as overheating or freezing.

- Administration of hemolysed blood.
  - usually benign, although hemoglobinuria, chills, DIC, renal failure and fever may occur.
- Metabolic complications can occur when very large amounts of blood are rapidly infused (equal to or greater than the patient's blood volume), or with severe liver or kidney disease.
  - Hypothermia with risk of cardiac arrhythmia may occur with cold blood.
  - Citrate toxicity due to the anticoagulant used is very rare. Citrate is usually rapidly metabolized. Symptoms range from muscle tremors to cardiac arrhythmia, and even cardiac arrest. In the absence of underlying hypocalcemic pathology, most reactions require no treatment. Slow or stop the transfusion.
  - Acidosis, which may occur initially, rarely requires treatment. Citric acid is rapidly converted to pyruvate and bicarbonate, with subsequent metabolic alkalosis.
  - Hyperkalemia
  - Hypomagnesemia
- Cardiogenic pulmonary oedema
  - induced by the blood volume that is administered (eg undiagnosed heart disease)
- Noncardiogenic pulmonary oedema
  - caused by the leakage of fluid out of the pulmonary vessels secondary to increased vascular permeability

3) In Anesthetized Patients
   - Hypotension and evidence of DIC may be the first indications of a transfusion reaction.
     - Hemoglobinemia, hemoglobinuria and subsequent hyperbilirubinemia are usually detectable. Renal failure may ensue. The transfusion must be stopped.

Precautions

- Other anticoagulants approved for the collection of whole blood dictate shelf life (CPD, CP2D and CPDA-1)
  - ACD-A : 28 days.
- Blood bags should be stored in a vertical position with space left in between to allow "breathing"
- Do not mix or administer Lactated Ringer's solution or any other solution containing divalent cations in the same intravenous or other parenteral line.
- Use only 0.9% Saline
- Always use a filter.
- If a reaction occurs, STOP the transfusion immediately, and initiate appropriate measures.
- Gently mix the contents of each blood bag before administering.
- Do not use if the bag has been damaged or if clotted, excessively hemolyzed or discolored.
- Whole blood must remain between 1-6C for long term storage, Once above 6C return it to the fridge and use within 24h. If out of the fridge for more than 15min it is considered to be at room temp and therefore must be used within 24h after placing back into the fridge
- WB contains non labile coagulation factor in the plasma portion but labile coagulation factors and platelets are no longer viable.
  - If excessive bleeding occurs after a transfusion, the possibility of a hemolytic reaction complicated by DIC should be considered

Administration

- WB should ALWAYS have the same blood group
- a cat with lethal hemorrhage or severe clinical signs attributed to anemia can be given WB:

    - As a bolus
    - Over the course of 1 to 2 hours.
- Otherwise over 3-6 hours
- Even if appropriately matched, reactions can occur, ALWAYS CROSSMATCH!
- Warm WB before giving (Max 37 C)
- Max 6 hours at room temperature; after discard the unit
- Always use a filter
- Perform a PCV check before, right after and 24h after a WB transfusion.
    - The PCV peaks at 24 hours post-transfusion because of the volume contraction that follows transfusion expansion
- The preferred site for transfusion is intravenous
    - Alternate sites for very young or compromised animals are intraperitoneal and intramedullary (trochanteric fossa of the femur is location of choice).

Dosage

- WB can be given as fast as required for the patient's condition.
    - If hypovolemic, rates up to shock dose can be used
    - WB can be given as a bolus or over the course of 1 to 2 hours if needed
    - To dilute the blood and regulate the velocity of transfusion more exactly saline can be used.

Quick guide:

- Based on a donor's Hct of 37%, 3ml/kg of WB can raise the PCV by 1%
- Amount to be transfused (ml) = $[(PCV_{desired} - PCV_{current})/ PCV_{donor}]$x blood volume (ml/kg) x Wt (kg)
  → [Blood volume cat = 66 mL/kg]
- Should not last more than 4 hours
- A maximum transfusion volume of 20ml/kg/day is recommended

Infusion Rates

Monitor all patients closely for the first 30 min for a transfusion reaction. Due to the wide range of infusion rates, close monitoring of the patient is essential to determine the most appropriate rate. This may be adjusted throughout the transfusion.

- Initial rate: 2-3 ml over 5 minutes
    - After that: as fast as tolerated/needed
- Normovolemic: 5-10ml/kg/h
- Hypovolemic: up to a maximum of 20 ml/kg/h
- High risk patients (cardiovascular compromise/renal failure): 1-4ml/kg/h

NB. If the patient requires a slow transfusion rate, consideration should be given to the transfusion of pRBC rather than WB.