CANINE - 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 factors

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 10^9/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

- Do not use WB or other blood products if the anemia can be treated with specific medications (e.g iron, vitamin B12, or folic acid) and if the clinical condition of the patient permits sufficient time for these agents to promote erythropoiesis.
- Do not use WB when blood volume can be safely and adequately replaced with other volume expanders such as 0.9% Sodium Chloride or Lactated Ringer's.
- Do not use Whole Blood to correct coagulation deficiencies.

Side Effects and Hazards

- Major and minor crossmatch should be conducted before every transfusion, including first transfusions.
    - Even if crossmatched to a repeat donor in the past or the donor and recipient are the same blood type.

Adverse Transfusion reactions include:
Restlessness, cardiac arrhythmias, irregular respirations, salivation, lip smacking, retching, 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 a DEA 1 incompatibility. Hemolytic transfusion reactions usually occur when donor erythrocytes and recipient plasma are incompatible.
    - Delayed hemolytic reactions can occur days to weeks following transfusion and will mimic IHA (anaemic and haemoglobinuric). The direct Coombs test will be positive in these animals. These reactions are usually benign and require no treatment. Rarely, delayed transfusion can be severe and fatal.
    - 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

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 chills, high fever or hypotension occur during or immediately

after the transfusion contamination should be considered. Septic and toxic reactions may be life threatening, and management must be aggressive. Treatment immediately after the collection of recipient blood samples for culturing may include broad spectrum antimicrobials, vasopressors and intravenous fluid therapy.

- 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

- The refrigerated shelf life is (at 1-6°C):
  - CPDA-1: 28 days
  - CPD and CP2D: 28 days
  - ACDA provides 30 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 1-6°C for long term storage, Once above 6°C 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
- 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

- Whole Blood should not be used unless:
  - Donor and recipient are of the same blood type
  - The recipient is blood typed and known to be DEA 1 positive
  - The donor has been blood typed and is known to be DEA 1 negative.
- STILL CROSSMATCH even if the above criteria are met!
- Warm WB before giving (Max 37°C)
- Max 6 hours at room temperature; after discard the unit
- 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 is dosed according to patients' fluid status
  - If hypovolemic, rates up to shock rate can be used
  - blood can be given in 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:

- 2ml/kg of WB can raise the PCV by 1% and the Haemoglobin level by 0.3g
- Amount to be transfused (mL) = $(PCV_{desired} - PCV_{current})/ PCV_{donor}$ x blood volume (ml/kg) x Wt (kg)
  →[Blood volume dog = 88 ml/kg]
- The transfusion should not last more than 4 hours
- Starting dose for WB is usually 20-25ml/kg

Infusion Rates

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: 0.5-1.0ml/kg/h over a 30 minute period
  - After that: As fast as tolerated/needed or normovolemic rate.
- Normovolemic: 5-10ml/kg/h
- Hypovolemic patients up to a maximum of 20 ml/kg/h
- High risk patients (cardiovascular compromise/renal failure): 1-2ml/kg/h
- For acute needs, patients can usually tolerate transfusion given at 4-6 ml/min

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

pRBC vs Whole Blood

Use of pRBC and careful monitoring of the transfusion volume will minimize the occurrence of reactions.

1) pRBC have a much higher PCV per equal volume of WB thereby reducing the volume
2) Plasma removal ensures fewer metabolites debris and antibodies potentially triggering a reaction
3) pRBC contains less sodium
4) Iron overload can be minimized in patients given repeated transfusions over extended periods of time
5) Micro aggregates consisting of fibrin, white cells and platelets may develop during storage of blood. The smallest of these particles will not be retained in a standard filter.
6) pRBC avoid the risk of fluid volume overload and less likely to cause febrile nonhemolytic transfusion reactions
7) pRBCs conserve a source of fresh-frozen plasma for patients in need