CANINE AND FELINE TRANSFUSION MEDICINE

WHY IS BLOOD IMPORTANT?
Blood is made up of components:
• Red blood cells - carry oxygen to tissues
• Platelets - form the first ‘plug’ in the coagulation cascade
• Plasma - contain coagulation factors to further clotting
• Leukocytes - fight infection
If one or more of these components are depleted, it can be life threatening.

WHEN TO TRANSFUSE A PATIENT
There are most commonly only two basic reasons for the need to transfuse. What has caused the need for the transfusion is more detailed.

Anaemia - reduced number of red blood cells resulting in reduced oxygen carrying capacity = hypoxia
Coagulopathy - clotting dysfunction = possible haemorrhage - anaemia

Causes of anaemia:
• Acute blood loss - eg: trauma
• Chronic blood loss - eg: GI malignancy
• Blood disorder - eg: IMHA
• Toxicity - eg: rodenticide toxicity (secondary to coagulopathy)

Causes of coagulopathy:
• Toxicity - eg: rodenticide toxicity
• DIC
• Hepatic function disorder
• Blood disorder - ITP (may be secondary to anaemia)
• Acute blood loss (secondary to anaemia)
• Parasitic infestation - eg: angiostrongylus

Do they need a blood transfusion? Transfusion' Triggers'
The 'trigger' for a transfusion is physical examination findings and haematological parameters that have been used to define when a transfusion should be given. These 'triggers' vary depending on opinions eg: packed cell volume (PCV) or haemoglobin (Hb) values, platelet counts and coagulation values (APTT, PT).
These are essential values to obtain without doubt but it is important to assess the patient's clinical status and if they are successfully compensating. blood products are not a benign treatment and do come with potential risks, and are also a financial consideration to the patient's owner - choosing the best time to transfuse to provide the maximum benefit is also essential, especially if finances are limited for multiple transfusions. For example, transfusing a cat during a pelvic fracture repair when there may be ongoing blood loss may be of greater benefit to the cat than transfusion prior to surgery, IF the cat is compensating and is stable.

WHICH PRODUCT IS BEST FOR THE PATIENT?
Like in human medicine, animal blood can be divided into components to a) maximize the benefit of the donation, and b) to transfuse ONLY the component that is required for the patient. This is referred to as 'component therapy'.

Blood Components
• Fresh whole blood (FWB)
• Packed red blood cells (PRBC)
• Fresh frozen plasma (FFP)
• Stored frozen plasma (SFP)
• Cryo-precipitate (CRYO)

Other than whole blood, processing equipment is required to create the other components. Some of these can be purchased from commercial blood banks.

**FWB:**
Blood collected from the donor in whole form and contains both red blood cells and plasma elements. It is easily collected and requires no processing before transfusion. Main purpose - acute blood loss or active bleeding, as it replaces what is directly being lost. Unless transfused to the patient within 6-8 hours of collection, it is a poor source of clotting factors - specifically factors V and VIII.

**PRBC:**
Packed red blood cells is created by centrifugation of a unit of whole blood
Main purpose - anaemia

**FFP:**
Fresh frozen plasma is a unit of fresh whole blood centrifuged and the red blood cells removed.
Main purpose – coagulopathy – contains clotting factors

**FP:**
Frozen plasma is what becomes of FFP after it has been stored frozen for more than one year, or if the plasma has not been separated from the red blood cells after blood collection within 8 hours. Clotting factors have begun to deplete. This is also the case if a unit of FFP has been thawed and re frozen – this is now regarded as FP and not FFP. The best use of this product is for non-liable clotting factor needs such as toxicities causing coagulation, as a volume expansion fluid, or for patients with hypoproteinaemia

**Cryo-precipitate:**
This is a product separated from whole plasma (a plasma fraction) by thawing the FFP slowly and controlled. It is then centrifuged and the cryoprecipitate is extracted. It is a concentrated source of von Willebrands factor.

**Benefits of component therapy to the recipient:**

Reduced volume
Fewer transfusions – less risk of transfusion reactions

**BLOOD TYPING:**

It is best practice to blood type every donor prior to blood collection and every recipient prior to transfusion. Blood typing can be performed at any commercial laboratory from an EDTA whole blood sample. However, there are typing systems that can be purchased for use in clinical practices, which are fast and easy to use, such as a card system (RapidVet-H) or a migrating paper strip cartridge (DME VET alvedia).

**Feline:**
It is **essential** to blood type cats! Both the donor and the recipient **must** be blood typed before transfusion. Cats have naturally occurring antibodies that result in an acute and sometimes fatal haemolytic transfusion reaction if the incorrect blood type has been administered.
Canine:
It is highly recommended to blood type both donor and recipient. We are all aware that the first transfusion for a dog can be transfused relatively trouble free without typing. This is because dogs do NOT have naturally occurring antibodies and the antigens on the transfused red blood cells are not detected as foreign until a day or two later, allowing for the initial emergency to be treated. However, if the incorrect blood type transfusion has been given, the transfused red blood cells may not survive as long. A transfusion reaction may present a few days after transfusion in the form of haematuria, or haemolysis in a blood sample, or the PCV may fall again – this is the transfused red blood cells being destroyed.

It is best practice to blood type every canine recipient as if the recipient required a second transfusion four days or more later, it would be unreliable to type them now having already received donor blood – subsequent transfusions would HAVE to be blood type DEA 1 negative which is often perceived as the universal donor but also can be less common.

Blood groups:

<table>
<thead>
<tr>
<th>Feline</th>
<th>Canine</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DEA 1</td>
</tr>
<tr>
<td>B</td>
<td>DEA 3</td>
</tr>
<tr>
<td>AB</td>
<td>DEA 4</td>
</tr>
<tr>
<td>Mik</td>
<td>DEA 5</td>
</tr>
<tr>
<td></td>
<td>DEA 7</td>
</tr>
<tr>
<td></td>
<td>Dal</td>
</tr>
</tbody>
</table>

CROSS MATCHING
Detects compatibility between donor and recipient

The gold standard would be to cross match the donor and recipient prior to each transfusion as there are blood types that have not been recognised and there is no type system for Mik. This is also thought to be a bit over cautious as long as blood typing has been performed. However, cross matching should be performed if a patient has received a transfusion of red blood cells more than four days previously, or if there was a previous transfusion reaction, or if the patients potential transfusion history is unknown, to minimise the risk of transfusion reactions. Cross matching can be performed in place of typing to assess compatibility, but for multiple transfusions, blood typing is preferable and then subsequent cross matching of type specific blood thereafter.

Major cross match
Recipient’s plasma with donor cells

Minor cross match
Donor plasma with recipient’s cells

FELINE BLOOD COLLECTION
Feline donors can safely donate every two – three months.
As storing feline blood is difficult, knowing how to safely collect blood for a patient can be a very valuable skill. Ensuring you have a healthy and manageable donor is essential. Although a patient is in need of a transfusion, the first priority must be to the care of the donor. There is no gain in causing harm to one cat in order to benefit another. It is wise to have a few cats that have already been selected as potential suitable donors listed to contact easily. These cats ideally will have already had a haematological health
screen performed in the last year and blood typed, leaving only a veterinary physical exam and PCV or Hb at the time of donation to be performed to ensure the donor is not anaemic.

**What is required?**
- Blood donor – age 1-8 yrs, vaccinated, no medication, no previous transfusions, 4.3kg
- Veterinarian - donor health check + PCV, haematology, biochemistry
- Clippers – iv catheter site (cephalic), venepuncture site (jugular)
- Skin prep materials + Emla (60 min)
- i.V catheter (22 gauge)
- CSL/Hartmanns and giving set and fluid pump
- Sedation
- Eye lubrication
- Anticoagulant
- Syringe(s) and butterfly catheter (21 gauge)
- Phlebotomist and two assistants

Keeping you donor as calm as possible is the key to a stress free donation. If time permitting, clip the donor for iv placement and jugular venepuncture first and place a topical local anaesthetic cream on for up to half an hour to minimise discomfort. Keep your donor in a quiet place and select a quiet place for the donation but in reach of any urgent care your donor may need. Prepare your equipment.

**Sedation options:**

<table>
<thead>
<tr>
<th>IV only:</th>
<th>0.2mg/kg Midazolam</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3mg/kg ketamine</td>
</tr>
<tr>
<td></td>
<td>0.1mg/kg butorphanol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IM:</th>
<th>5.0mg/kg Ketamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Then if required:</td>
<td>0.25mg/kg midazolam</td>
</tr>
<tr>
<td>IV:</td>
<td>0.2mg/kg midazolam</td>
</tr>
<tr>
<td></td>
<td>0.2mg/kg butorphanol</td>
</tr>
</tbody>
</table>

| Inhalant:           | Sevoflurane induction and maintenance |

**Anticoagulant options:**
Citrate based anticoagulants are preferable but heparin can also be used.

- **Citrate based anticoagulant – CPD, ACDA:**
  1ml anticoagulant / 7ml whole blood

- **Heparin:**
  5-12.5 IU/ml / 1 ml of collected blood
**Technique:**

**Recommended volume to collect: 10-15ml/kg – maximum 60ml unit**

Once the donor is sedated, place the donor in either sternal or lateral recumbency – head elevated by an assistant. Use an aseptic technique to prep the venepuncture site. Pass the syringe with the primed butterfly needle attached to an assistant, and enter the vessel with the needle. Begin to draw – if blood flows, continue, if not, maintain a small amount of negative pressure on the syringe as the needle is adjusted until flow begins. Do not draw too rapidly. Monitor the donor for respiration, and pulse rate. If there is any concern for the donor’s well-being, stop the donation immediately and seek immediate veterinary care.

Once the required volume has been drawn, remove the needle and place firm pressure with a swab over the venepuncture site. Assess the donor’s pulse rate and quality and respiration and begin fluid therapy.

**Recommended fluid therapy: 10ml/kg/hr crystalloid for 3 hours**

Recover the donor under observation, and once fully awake offer food and water. The donor can return to their owner once fluid therapy is complete, but as the donor has been sedated, it is strongly advised to keep the cat inside over night.

**CANINE BLOOD COLLECTION**

Blood collection bags used for canine blood collection are human collection bags and can be commercially purchased. There is a set amount of anticoagulant (ACD-A) of 63ml requiring approximately 450ml (+/- 10ml), which is approximately 470gm (blood is heavier than water). As discussed earlier, component therapy can at times be better for the recipient but FWB will still deliver and benefit your patient. As for the feline donors, it is beneficial to have a list of suitable canine donors that have already been haematologically screened including blood typed, assessed for temperament and can be contacted when required.

**What is required?:**

- Blood donor – age 1-8 yrs, vaccinated, no medication, no previous transfusions, >25kg
- Veterinarian - donor health check + PCV, haematology, biochemistry
- Clippers –venepuncture site (jugular)
- Scales
- Skin prep materials + Emla (allow 60 min)
- Blood collection bag
- Phlebotomist and two assistants

The donor’s welfare should be priority and choosing a dog that does not need sedating should be fairly easy. Ensuring the donor is comfortable and at ease is essential for a successful donation.

**Technique:**

Canine donors can safely donate every two months.

After clipping the jugular for venepuncture prepare the area with an aseptic technique. The donor should be gently placed in either lateral or sternal recumbency with head elevated and given time to settle. Place the collection bag below the donor on the scales. Insert the needle into the jugular vein and **only** then release the clamp on the tubing. Blood should flow – if not adjust the needle to gain vascular access.
Once the blood reaches the desired weight on the scales, close the clamp on the tubing and remove the needle from the jugular vein, pull the safety guard over the needle, and apply pressure to prevent a haematoma forming. Agitate the bag containing the collected blood to mix the anticoagulant and blood together.

Have the donor sit up slowly and keep settled. Check pulse rate and quality and mucous membrane colour. On rare occasions a canine donor may show signs of dizziness. If this occurs, keep them quiet and calm and have a veterinarian perform a physical exam – it is unlikely the donor will require fluid therapy if >25 kg and is not standard care.

Offer the donor some food and water and check the jugular site for any haematoma formation. Advice to owner – walk only on lead for 24 hours.

**TRANSFUSION:**

**Feline/canine**

What is required?

- In line filter
- Ideally a syringe driver (cats), fluid pump (dogs)
- Extension sets
- Monitoring protocol
- Check compatible blood types

Prior to transfusion, take a base line TPR and PCV. Use a dedicated iv catheter for the transfusion. DO NOT administer Hartmanns/CSL with the blood.

Recommended start is **1ml/kg and 15 minute TPR checks for first hour – hourly TPR checks...**

**Caution:** cats can be very susceptible to fluid overload so a slow transfusion is preferred if the disease process allows – 4-6 hours for one 60 ml syringe.

**Transfusion reactions:**

Monitor the patient for elevation from base line TPR, collapse, facial swelling (FFP), vomiting.

- Elevated TPR – stop transfusion. Repeat TPR. If normal, restart transfusion slowly. Repeat TPR 5min later – if elevated stop transfusion and DO NOT RESTART.
- Vomiting, collapse – stop the transfusion and do not restart – seek veterinary assistance
- Facial swelling – usually limited to FFP transfusions – administer antihistamine and continue.

Antihistamine is only recommended to be given in situations of mild haemolytic transfusion reactions. It is not ideal to give prior to a transfusion as it may mask a reaction.
REFERENCES:


Kisielewicz C, Self I A., Canine and feline blood transfusions: controversies and recent advances in administration practices, Veterinary Anaesthesia and Analgesia 2014, 41, 233-342
