

## FELINE BLOOD TRANSFUSIONS

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Initial requirements for patient stabilisation depend on the rapidity of onset, type and underlying cause of the anaemia. Collapsed cats require more intensive and aggressive stabilisation than cats with chronic anaemia who frequently appear cardiovascularly stable (based on heart rate, pulse quality, respiratory rate and systolic blood pressure and general demeanour) despite a low PCV.

Patients with blood loss or hypovolaemia will benefit from immediate intravenous fluid therapy to ensure organ perfusion. Initially this can be administered as crystalloid therapy (40-60 ml/kg) although crystalloids will redistribute rapidly (within 30 minutes). Hypotensive resuscitation may be useful in patients with marked haemorrhage as aggressive fluid therapy may worsen bleeding. This technique requires invasive monitoring methods (e.g. arterial blood pressure) which are rarely available in general practice.

Synthetic colloids (doses ranging from 2-7 ml/kg in cats) may hold fluid within the vascular space for longer than crystalloid fluids depending on the health of the vascular endothelium. They may be used in combination with crystalloids to maintain adequate plasma volume expansion. Caution should be used when administering these products to patients with a coagulopathy as their effect on coagulation is unpredictable in critically ill patients. Information in humans suggests that acute kidney injury maybe associated with colloid administration and use of colloids in general has gone out of favour. In most cats, administration of an appropriate typed whole blood or packed cell transfusion is preferable to the use of colloids, unless blood products are unavailable.

With a sensible approach and careful monitoring of both donor and recipient cats, blood transfusions can provide life saving treatment to anaemic cats.

There is no specific point in haematological parameters where a blood transfusion becomes necessary. A transfusion is only administered if the patient demonstrates signs of cardio-respiratory compromise such as:

- Weakness
- Bounding peripheral pulses
- Hypotension
- Tachycardia (and in cats sometimes bradycardia) and
- Dyspnoea.

These are the so-called "transfusion triggers" and no specific evidence based "cut-offs" exist on what is appropriate. The author considers transfusion in cats with a combination of the above clinical signs together with:

- Chronic, nonregenerative anaemia and PCV<10%
- Ongoing blood loss and PCV <15%
- Acute blood loss, signs of hypoperfusion and decreasing PCV
- Coagulopathy and PCV <15% or
- PCV 10-20%, tachycardia despite normovolemia.

Complications associated with blood transfusion in cats stems from the feline blood group system (AB system). Within this system there are three blood types: Type A, type B, and type AB. In contrast to dogs, cats develop naturally occurring antibodies against the blood type they are lacking. Type B cats possess strong anti-A alloantibodies and a small volume of type A blood administered to a type B cat can result in a profound and fatal transfusion reaction. The majority of pedigree cats are type A, however blood type will vary widely.

Donor group	Recipient Group	Rejection Reaction
A	A	Unlikely
B	B	Unlikely
B	A	Slight
A	B	Very serious
AB	AB	Unlikely
A	AB	Unlikely



Blood typing is essential and no cat should be transfused without prior blood typing wherever possible. Blood typing is easily performed in practice using commercial typing kits. Migration strip cartridges (e.g. Alvedia DME kits) are easy to interpret and less affected in the presence of haemolysis which can make interpretation of card typing kits difficult.

Evidence of an additional blood group in domestic shorthairs has been found – the *Mik* red cell antigen, which could contribute to a haemolytic reaction. This antigen is not currently detected on commercially available kits. It is unclear how clinically relevant this antigen is outside of America, where it was first identified.

Cross-matching of blood should be performed if time permits in transfusion naïve patients and certainly in patients that have received multiple blood transfusions after 4 days. A recent study evaluated the use of major cross matching (donor red blood cells with recipient plasma) in cats who had not received previous blood transfusion. All cats received typed transfusion. One group received cross match tested transfusions and the control group received transfusion with no prior cross matching performed. There was no difference in the rate of transfusion reactions or in the post transfusion packed cell volume at any point.

Cross matching is performed by mixing donor red blood cells with recipient plasma (major crossmatch) and recipient red blood cells and donor plasma (minor crossmatch) and assessing for microscopic evidence of agglutination. It is useful to perform controls (i.e. donor red blood cells and donor plasma) at the same time. Cross matching kits are also commercially available.

### **Blood donation**

Donor selection is extremely important and a list of suitable donor cats should be kept up to date in case of emergencies. The ideal donor is:



Obtaining a blood donation through a semi closed system reduces the risk of bacterial contamination

- Not obese but should weigh over 4.5 kg
- Fully vaccinated
- Preferably indoor only
- Blood typed
- FeLV Antigen and FIV Antibody and Haemoplasma spp. PCR tested.

Ideally, donor cats should receive an echocardiogram at least once prior to donation to exclude the possibility of occult heart disease. Blood collection from the donor cat should be performed in a quiet, stress free environment. The donor cat should be weighed and a PCV checked prior to donation. 6 x 10 ml syringes should be prepared with anti-coagulant (1 ml Citrate phosphate dextrose adenine (CDPA) per 9 mls of blood or 1.3 mls Acid citrate dextrose (ACD) per 10 mls of blood).

Donor cats may be sedated using a combination of midazolam (0.25 mg/kg) and ketamine (5mg/kg) administered intramuscularly. An intravenous catheter should then be placed to facilitate administration of crystalloids to replace the blood volume removed.

It is easiest to obtain the blood for donation from the jugular vein by

restraining the cat in ventral recumbency with their neck elongated and their nose pointing towards the floor. Be careful to ensure a patent airway at all ti

The jugular vein should be prepared using aseptic technique and a 21G butterfly catheter with a 3 way tap attached is inserted into the vein. The maximum volume of blood that can be donated is 10ml/kg body weight. Typically approximately 30-50 mls is collected.



Blood collection is easiest with three people:

- one person to hold the cat
- one to manipulate the syringe and three way tap and
- one to gently agitate each syringe after collection to ensure adequate mixing of blood and anti-coagulant.

Donated blood should then be aseptically transferred into an empty 100ml blood bag or administered via individual syringes, with the syringes being refrigerated and warmed to body temperature in a warm water bath prior to use. Gentle intermittent rolling of the bag/syringe should be continued to ensure mixing.

The volume of blood removed from the donor should then be replaced with intravenous crystalloids over 30-40 minutes.

### **Blood administration**

Blood products should always be administered using an appropriate filter to reduce aggregation and microthrombi from entering the recipient's circulation. The filter should be placed in the administration line as close to the patient as possible. The filters in standard fluid therapy giving sets are too small and blood will clot if administered through them. Blood products should not be administered at the same time as fluids containing calcium or glucose supplementation (e.g. Hartmans). Administration rate is determined by the condition of the patient, however we are faced with two conflicting issues. Transfusion reactions can occur from rapid administration, however, if blood products are not administered within a 4 hour period there is a greater risk of bacterial contamination so a balance must be found between the two. Blood can be stored in the fridge for 24 hours so if donated blood is stored in individual syringes, this may be better for patients requiring a slower rate of administration (e.g. patient with concurrent cardiac disease).



A Cat receiving a blood transfusion. Note the filter is within the line close to the patient



A patient receiving a blood transfusion requires close monitoring

Transfused blood should be administered at 0.5 ml/kg/hour for the first twenty minutes and the patient monitored constantly for signs of a transfusion reaction such as vocalization, tachycardia, vomiting, facial swelling or tachypnoea. After this time the rate may be increased to 1 ml/kg/hr for 20 minutes, followed by 1.5 ml/kg/hr for a further 20 minutes. If there is still no evidence of a transfusion reaction the administration rate is increased so the total volume of the transfusion remaining is administered within a three hour period or faster depending on patient requirements.



Should the patient develop mild signs of a transfusion reaction (e.g. mild (1-2°C) increase in temperature, one episode of vomiting) then the transfusion rate should be reduced. If marked clinical signs develop the transfusion should be stopped and the blood replaced with a crystalloid solution. Monitoring of the patient should be continued for evidence of shock or Disseminated Intravascular Coagulation (temperature, pulse rate, mucous membrane colour and systolic blood pressure). The recipient's serum and urine should be assessed for the development of bilirubinaemia and bilirubinuria which may indicate haemolysis of the transfused red cells. Anti-inflammatory doses of corticosteroids (methylprednisolone succinate 20mg/kg IV once) may be administered in conjunction with an antihistamine (diphenhydramine 2mg/kg IV). The blood bag should be assessed by checking a PCV for evidence of lysis and potentially submitting a sample for bacterial culture.



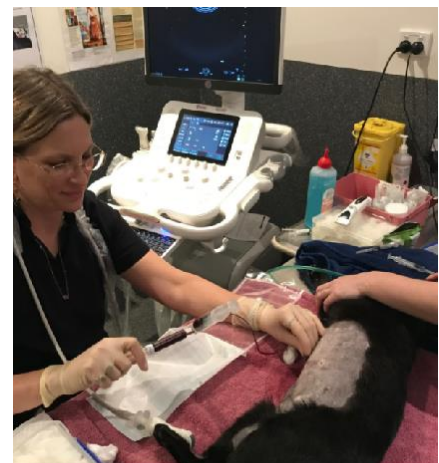
A syringe driver is used to administer the blood transfusion with fine rate control

### **Autologous blood transfusion**

Autologous (autotransfusion) blood transfusion is the administration of a patient's own blood as a transfusion. This can be considered in patients with haemothorax or haemoperitoneum. Crossmatching or blood typing is not required. Blood is collected using a 23G butterfly catheter and 10 or 20 ml syringes. Administration practice is otherwise similar to standard donor-recipient transfusions. There is no clear evidence for whether anticoagulant should be added to the transfusion. Blood in contact with the peritoneal surface is reported to become defibrinated within 1 hour and anticoagulant administration maybe unnecessary or lead to hypocalcemia. The use of a blood filter (18 µm) is strongly recommended to prevent platelet and leukocyte passage. A recent report of 8 cats with haemoperitoneum receiving autologous transfusion did not identify any adverse reactions.

### **Xenotransfusion**

There is also the possibility of transfusion cats with dog blood (xenotransfusion). Studies have shown that cats do not have naturally occurring antibodies against canine red blood cells. Canine blood maybe easier to access and there is no requirement for AB blood typing. Xenotransfusion is ONLY safe as a single transfusion. Subsequent transfusion of dog blood to a cat will result in a severe transfusion reaction, anaphylaxis and likely death. Another disadvantage is that antibodies to the donor canine red blood cells are detected in the cat 4-7 days following transfusion. These antibodies result in the destruction of the donor red blood cells and a late haemolytic reaction hence, a short life span of the donor blood. Typically 30-50 mls of canine blood is administered in the same fashion, using the same administration rates as feline blood. Note the author has seen a severe transfusion reaction immediately upon administration of canine blood to a transfusion naïve cat.



A patient with a haemoabdomen having blood removed for autotransfusion

