The use of blood products is necessary in many aspects of small animal practice, and babesiosis is endemic in South Africa, thus we are all very familiar with blood transfusions. But with that familiarity there often creeps in a blasé attitude for the details and intricacies of the product and we are also not utilising the resource to our best capacity.

I would like to lay out the basics of transfusion therapy in these notes. The establishment and maintenance of a small blood bank is also within the capability of the general practitioner. Judicious use of blood products on a case specific basis will result in better utilisation of the product and improved patient outcomes. Understanding the basic principles is essential to meaningful utilisation of this resource.

**CANINE TRANSFUSION THERAPY**

**Basic overview**

1. Dogs do not have natural antibodies (alloantibodies) to other blood types.
2. There are seven different dog blood types: DEA 1.1/1.2/1.3, 3, 4, 5, and 7. Dogs can have any combination eg, DEA 1.1, 3 and 7 on the same red blood cell. DEA 1.1/1.2 and 1.3 are alleles: i.e. only one can be expressed.
3. DEA 1.1 and 1.2, (although less so), is the only blood type which will induce a severe haemolytic transfusion reaction (it is a haemagglutinin). The remaining blood types will induce a low grade extravascular haemolysis.
4. Approximately 47% of the general canine population is DEA 1.1 negative. Definite breed differences are present in SA and probably worldwide:
   - Less than 20% of GSD and boxers tested DEA 1.1 positive
   - Greater than 75% of Rottweilers, Boerboels, Great Danes and St Bernards tested DEA 1.1 positive
5. The first incompatible transfusion will not be problematic (no alloantibodies) but will sensitize the patient to further transfusions with that blood type.
6. It will take at least 3-4 days for a patient to acquire antibodies to an incompatible transfusion. By three weeks the patient should be fully sensitized. The sensitivity is long lived (lifelong).
7. Blood donors should be DEA 1.1 negative to decrease risk of incompatible transfusions. It is too costly to type recipients to ensure a match.
8. Major and minor cross matching is an alternative if you do not have typed DEA 1.1 negative donors and need to give a patient a second transfusion.
9. Typing kits are easily available in South Africa.

**Collection and storage of blood**

1. Donor dogs should be > 25kg and fully grown before they donate. Well trained dogs are obviously easier to manage.
2. Dogs can donate 1 unit (425 ml) for every 20-25 kg in body weight every 4-6 weeks. Supplementation may be required if the frequency is increased long term to every 2-3 weeks.
3. A blood smear and PCV must always be performed prior to collection to ensure that the patient is fit to donate. Full screening for blood parasites (PCR) should be performed prior to inclusion in a donor program. A parasite control programme is imperative.
4. Sedation can be administered but should not drop the blood pressure as this slows the collection process and may lead to clotting of the blood.
5. Site preparation should be surgical and a high standard of asepsis must be applied during collection to prevent contamination of the product.
6. Blood must be collected using gravity or a light vacuum.
7. Blood must be collected in the appropriate collecting bags according to the product required. The units must be properly sealed, dated and labelled.
8. It is preferable to use collecting bags that contain an anticoagulant (citrate) as well as a preservative, as this prolongs the shelf life of the product. CPDA-1 (Citrate-Phosphate Dextrose adenine) is contained in multiple bag collection systems.
9. Alternative anticoagulants:
   - 625 U heparin/ 50 ml for immediate transfusion
   - 3.8% sodium citrate: 1ml/9ml blood for
immediate transfusion

10. Processing is immediate.

11. The correct storage of the blood is vital in maintaining its quality. Blood is still metabolically active, the citrate has only inhibited the coagulation cascade.
   a. Carbon dioxide needs to be able to diffuse through the plastic of the bag. It is thus not ideal to pack the blood bags on top of each other or into plastic containers.
   b. The preservative, which contains phosphate and dextrose, needs to be mixed in with the blood to be effective. Sedimentation of the cells occurs if the bags aren’t constantly mixed. This applies to packed red blood cells (PRBC) as well as whole blood.
   c. I suggest hanging the bags from the rack in the fridge using hooks. These bags can breathe and just need to be “squeezed” daily to mix the preservative.

12. Whole blood should last four weeks and PRBC should last six weeks.

Administration:

1. Always be aware that you are administering a biological product. Even if the blood is DEA 1.1 negative the patient can still develop transfusion reactions.
   a. Acute reactions occur due to plasma proteins (Type I anaphylaxis), other red blood cell antigens (Type II) not tested for, and non-immunological reactions due to product contamination, citrate overload, electrolyte disturbances, dilutional coagulaopathy.
   b. Delayed transfusion reactions include infectious disease transmission, and development of type 3 immune reaction (“serum sickness”).
   c. A filter is essential to remove microthrombi from the infused blood. These are in the blood administration sets. For small volumes of blood in a syringe a filter may not be necessary if it is a fresh blood transfusion. Luckily dogs are less susceptible to emboli than humans.

3. ALWAYS administer blood slowly in the first 15 minutes if possible. This will reduce the severity of any anaphylactic type reaction which may develop. I generally do not use a calculation but give the blood at about 1 drop/6 to 10 seconds for the first 15 minutes and then increase to about 1 drop/4s. The entire transfusion should run in within 4 hours.

4. Monitor for transfusion reaction:
   a. Temperature, pulse and respiration should be recorded every 10 minutes for 30 min and thereafter every 30 min. A Type I reaction will show increased respiratory rate, tachycardia, facial swelling. A Type II reaction will result in haemoglobinuria and haemoglobinemia within a few hours.

5. It is not necessary to warm the blood unless your patient is hypothermic or very small.
   a. The blood will warm to room temperature as it moves down the administration set.
   b. If you need to warm the blood, wrap the line around a water bottle at body temperature. Do not warm the whole bag and do not cook the blood. Temperatures greater than 42°C will cause protein denaturation.
   c. Plasma can be thawed at room temperature or placed in a ziplock bag and thawed in a water bath at 30-37°C.

6. It is also not always necessary to give the full calculated dose of blood, especially in a babesia case, where there is generally a good regenerative response. You just need to replace enough to get the patient out of its decompensated state. In babesia cases, you will not always see an equivalent increase in your PCV due to fluid shifts and also ongoing haemolysis of infected cells.

7. There is no risk in mixing blood from different donors within the first 5 days or so of giving a transfusion, even if your donors are untyped, as the patient will not have had time to develop an immune response.

8. Large volume transfusions (> 1 blood volume in 24hrs) can cause hypocalcaemia, hypothermia and coagulation abnormalities due to dilution of coagulation factors.

9. Do not put medications into the bloodline and do not run ringers lactate concurrently as the calcium may reactivate the coagulation cascade. Hypertonic solutions are also contra-indicated.

Blood Products

1. In practice blood is generally just fresh or stored whole blood. If the blood is separated and stored as components you can get more mileage out of each donor dog and collection.

2. Definitions:
   a. Fresh whole blood: Collected that day and transfused within hours. Must not be refrigerated as this inactivates the platelets.
   b. Whole blood: Collected and stored at 4°C for 4-5 weeks.
   c. Packed red blood cells (PRBC): The whole blood is centrifuged, the plasma drawn off into another unit and a preservative solution is mixed with the remaining cells to create PRBC. The PCV is normally in the 70s.
   d. Fresh frozen plasma (FFP): Plasma is drawn off and frozen to a minimum of -20°C within 8 hrs of collection. All the clotting factors are active. Remains FFP at -30°C for 12 months or at -20°C for 6 months.
   e. Frozen plasma (FP): FFP older than 1 yr and thawed and refrozen fresh frozen plasma. Has a freezer life of an additional 4 yrs at -20°C. This plasma contains sufficient albumin, immunoglobulin and other proteins. The vitamin K dependent clotting factors are also not that labile and are still present. vWF,
FELINE BLOOD TRANSFUSION

Basic overview
1. Cats do have natural antibodies to other blood types and can exhibit a transfusion reaction on the first transfusion.
2. Cat blood types are A, B and AB
3. Blood types A is the most common in the general population, but breed and geographical differences do occur.
   a. Siamese, Oriental, Burmese and Norwegian Forest cats are almost 100% type A.
   b. The common DSH is 95%-98% type A, except in Australia where it is about 73%
   c. Persians, Sphinx, Cornish Rex have a 20 – 45% likelihood of being type B.
   d. British shorthair and Devon Rex up to 50% are type B.
4. Type B cats have strong natural agglutinin antibodies to type A.
5. Type A cats have a weaker, more variable antibody titre to type B.
6. Neonatal isoerythrolysis is a risk in type A kittens from type B females mated with Type A males.
7. Cat must be tested to be free of Feline Leukemia Virus (FeLV) and Feline Immunodeficiency Virus (FIV). A negative FeLV should be checked again after 3 months. If client owned cats are used they should be indoor cats.
8. Typing kits are available in South Africa. If typing cards are not available and there is a risk of a reaction a cross-match can be performed.
9. The authors’ opinion is that in SA it is very unlikely that a transfusion reaction will occur between DSH cats and also the oriental breeds as > 98% of both are type A.

Collection and storage of blood
1. Cats have a smaller circulatory volume and only 11 ml / kg should be collected. Cats weighing over 5 kg are preferred (lean body weight).
2. Cats are more likely to need sedation prior to collection. A 0.2 ml medetomidine combined with 0.2 ml ketamine works without dropping the blood pressure too much. Another alternative is 10 mg Ketamine and 0.5 mg diazepam i.v.
3. I generally use a needle, jelco or butterfly to collect from the jugular vein.
4. Because we only collect when we have a case requiring a transfusion we keep the blood in the 20 ml syringe and transfuse directly.
5. Each 20 ml syringe is primed with 2.5 - 3 ml citrate (1 ml citrate to about 7-9 ml blood).
6. Alternative anticoagulant is 625 U heparin in 50 ml for immediate transfusion. Citrate is preferred to heparin, which might cause a coagulopathy in cases.
7. Because the collection system is classified as “open” blood can only be stored for 2 weeks. The blood is injected via the tubing into a paediatric if we are planning to store it.

Administration:
1. Administration can be manually by slow injection (about 1 ml / minute) or via drip. Do not waste blood by leaving it in the admin set line.
2. You should place an inline filter. An 18 μm filter is...
useful in small volume transfusions and will not damage the red blood cells. It does however clog up with larger volumes.

**Blood products and appropriate product utilisation:**

1. Whole blood is generally utilised due to the small volumes obtained in blood processing.
2. Blood is usually collected on an as needed basis or can be collected and stored for 20 days.
3. Serum can be collected and stored (-20°C) for use in failure of transfer of passive immunity. This has been proven to be effective in kittens with a regimen of 5 ml given SQ or IP three times in the 24 hrs after birth.

**CPD Questions**

AC/1327/15

1. Which one of the following statements is CORRECT?
   a. Auto-antibodies are natural antibodies against non-self blood types
   b. Allo-antibodies are natural antibodies against non-self blood types
   c. Dogs have natural alloantibodies
   d. Cats have natural autoantibodies
   e. Cats do not have natural alloantibodies

2. Which one of the following statements is INCORRECT?
   a. DEA 11 is a haemagglutinin
   b. DEA 11 can cause a Type I transfusion reaction in a sensitised patient
   c. DEA 11 can cause a Type I transfusion reaction in any patient
   d. DEA 11 occurs in approximately half the canine population
   e. DEA 11 can be tested for

3. Which one of the following statements is INCORRECT?
   a. A patient can receive blood from different untyped donors in the first 5 days of treatment without causing a Type I transfusion reaction.
   b. A Type I transfusion reaction may occur if mismatched blood is administered 3 days after a mismatched transfusion
   c. A Type I transfusion reaction may occur if mismatched blood is administered 3 weeks after a mismatched transfusion
   d. A Type I transfusion reaction will not occur after a mismatched first transfusion in a patient
   e. A Type I transfusion reaction is an immunological reaction

4. Which one of the following statements relating to suitability of donors is INCORRECT?
   a. Canine blood donors should weigh ≥25 kg.
   b. Dogs safely can donate 20ml/kg
   c. Dogs and cats can safely donate 20ml/kg
   d. Cats can safely donate 11ml/kg
   e. Feline donors should weigh more than 4kg

5. Which one of the following statements relating to Plasma is INCORRECT?
   a. Plasma must be stored at -20°C minimum.
   b. Fresh Frozen Plasma (FFP) is frozen within 6 hrs and is considered stable for 1 year
   c. Frozen plasma (FP) is FFP 1-5 yrs old
   d. FP supplemets albumin, macroglobulins as well as the majority of coagulation factors, including the Vit K dependent factors
   e. FP is only useful to supplement albumin and some macroglobulins due to the lability of coagulation factors

6. Which one of the following is NOT a transfusion reaction?
   a. Delayed extravascular haemolysis
   b. Hypocalcaemia
   c. Hypothermia
   d. Anaphylaxis
   e. Pyrexia

7. Which one of the following statements relating to feline blood types is INCORRECT?
   a. Cats have 3 main blood types Type A, B and AB
   b. Cats have breed and geographical variations in their blood types
   c. Domestic shorthair cats in SA can be considered to be type A in 97% of cases.
   d. Persian cats and exotic shorthair cats are often

References on [www.vet360.vetlink.co.za](http://www.vet360.vetlink.co.za)
Alternative surgical option for correcting incontinence in spayed bitches


Summarised by Dr H van der Zee BVSc, MMedVet (Surg) Bridge Veterinary Hospital

Why they did it
Acquired urinary incontinence can occur in up to 10% of bitches after sterilisation. Medical treatment can control the symptoms in about 80% of cases, but needs continuous medication and phenylpropanolamine, the most effective, is no longer available. Surgery is an option if medical treatment fails or if continuous medication is a problem.

Previous techniques are quite cumbersome and do not have a higher success rate. Since the 1990s, an intravaginal sling plasty called “tension-free vaginal tape” (TVT) has become the most popular surgical procedure for the treatment of female urinary stress incontinence in humans throughout the world, with a success rate of 92%.

What they did
With this technique a strap of polypropylene mesh is passed over the urethra just proximal to its opening. Although there are differences in the reasons for incontinence between humans and dogs, the principal could be effective in dogs. A variation of the original TVT technique, the “trans-obturator vaginal tape inside-out” (TVT-O) technique, has been shown to be safe and effective in the female dog and an initial report showed success in 6/7 dogs.

Due to the cost of the original human products, a variant of the TVT – O technique was used with a nylon tape. The procedure was done on 12 female dogs, with a median age of 5.5 years, which became incontinent after sterilisation. The technique is described in the article. After an episiotomy, one end of the nylon tape is passed through an incision in the vagina, just proximal to the opening of the urethra. The tape is passed through the obturator foramen and out through the skin on the midline below the pubis. The other end is passed around the contra-lateral side. The ends of the tape are pulled through the skin until the middle section lay against the urethra with only mild pressure. The ends of the tape were then knotted underneath the skin. Routine closure of all incisions were made. Post-operative pain relief was provided and the dogs were discharged as soon as they could urinate with ease.

What they found
Post-operative dysuria was present in seven dogs, with three dogs needing temporary catheterisation. In one dog there was severe dysuria and the knot had to be cut to relieve tension. This dog remained greatly improved despite the knot being cut. At two weeks post-operatively, 11 of 12 dogs did not show any episodes of leakage.

At the second evaluation with a median follow-up time of 21 months, three patients (25%) were “cured”, six