Feline transfusion practice in South Africa: current status and practical solutions

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ABSTRACT

Blood transfusion therapy is often under-utilised in feline practice in South Africa. However, it is a technique that can be safely and effectively introduced in practice. Cats have naturally occurring allo-antibodies against the blood type that they lack, which makes blood typing, or alternatively cross-matching, essential before transfusions. Feline blood donors must be carefully selected, be disease free and should be sedated before blood collection. The preferred anticoagulant for feline blood collection is citrate-phosphate-dextrose-adenine. Blood can either be administered intravenously or into the medullary cavity, with the transfusion rate depending on the cat's hydration status and cardiac function. Transfusion reactions can be immediate or delayed and they are classified as immunological or non-immunological. Indications, methods and techniques to do feline blood transfusions in a safe and economical way are highlighted.

Key words: blood types, cross-matching, feline blood transfusion, feline donors, transfusion reactions.

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INTRODUCTION

In South Africa, blood transfusion medicine is often a neglected area of feline practice and transfusions are infrequently administered, with the exception of practices situated in areas where there is a high prevalence of feline babesiosis. At the Onderstepoort Veterinary Academic Hospital (OVAH) fewer than 10 feline transfusions were administered during 1998, compared to an average of 2 canine transfusions per day. Canine transfusions are performed more frequently in the USA as well[2], in spite of the low prevalence of canine or feline babesiosis. However, this phenomenon is compounded in South Africa for the following reasons: feline blood is not readily available, few veterinarians are familiar with blood transfusion protocols in cats, and most South Africans do not view cats as animals with a high economic value. In spite of this, there are definite indications for feline transfusions and it is possible to do transfusions in practice in a safe and economical way.

FELINE BLOOD TYPES

Cats have an AB blood group system with 3 blood types identified within the system: A, B and AB[2–5,10]. The prevalence of the blood types varies worldwide[2,4]. The A blood type is the most common blood type in both the domestic shorthair and longhair cats[3,4]. Breeds such as the British shorthair and Devon Rex show a high prevalence of the B blood type, whereas AB blood type is extremely rare[3–5]. The situation in South Africa is unknown, but considering that very few transfusion reactions have been reported in cats in South Africa, it is likely that it is similar to that in the USA. However, further studies are necessary to confirm this.

Cats are unique amongst the domestic animals in that they have naturally occurring antibodies (called allo-antibodies) against the blood type antigen that they lack. This is of great importance when blood transfusions are given. Type B cats have very strong haemagglutinin and haemolysin antibodies against type A antigen. Transfusion of A blood to a type B cat can therefore result in a fatal reaction, even with as little as 1 mℓ of incompatible blood[3]. Type A cats have weak antibodies against the B antigen and this will lead to shortened survival of the transfused blood, but generally does not cause fatal reactions[3,4,8,10]. AB type cats will evince a strong reaction to type B blood and will either be compatible with type A blood or evince a weak reaction against it. The extremely rare cat with AB blood type can thus be transfused with type A blood[2]. There are no universal feline blood donors.

Neonatal isoerythrolysis

Kittens begin to produce natural allo-antibodies at 6 weeks of age and maximal levels are reached at a few months of age[4]. Colostral antibodies from the queen will be transferred to the kittens within 2 days of birth[4]. Neonatal isoerythrolysis may occur in type A or AB kittens from type B queens. Clinical signs in these kittens may vary from peracute death to subclinical signs such as moderate anaemia. Neonatal isoerythrolysis is of importance in breeds with a high prevalence of type B blood such as the British shorthair, Devon Rex, Cornish Rex and Persian[2–4].

Typing and cross-matching

Commercial feline blood-typing cards are readily available in the USA and several laboratories can also do feline blood typing serologically. These facilities are still not readily available in South Africa. As blood-typing cards are very easy to use and results are immediately available, they are ideal for use in private practice. When blood typing is not possible, a cross-match test should be performed before transfusions are administered to determine the compatibility of the patient and donor blood. The test has a major and a minor component. The major cross-match detects recipient antibodies against donor red blood cells and the minor detects donor antibodies against recipient red blood cells. (Table 1)

DONORS

There are a number of criteria to consider when selecting a feline blood donor. A donor cat should have a lean body weight of at least 4 kg[1,2,7–9]. Cats used as blood donors should be cooperative and easy to handle. The type of cat that would make a good pet for a child is the ideal donor[7]. If a donor is difficult to handle, even handling for pre-collection sedation can be too stressful for the donors as well as the staff, and blood transfusions may be neglected. Donors should be healthy animals and their vaccination status

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Table 1: **Cross-match method.**

Samples	EDTA and serum tubes from both recipient and donor(s)
Reagents	Physiological saline
Equipment	Incubator, centrifuge, slides, microscope, test tubes, pipettes
Procedure	Label 2 test tubes, one 'DONOR' and one 'RECIPIENT'
	Place 6 drops of EDTA blood in each of the tubes and fill with saline
	Mix and centrifuge for 1 minute at 1000 G (*c.* 2000 rpm on the average bench centrifuge)
	Remove supernatant saline by pipette and resuspend cells in saline. Repeat twice
	Prepare a suspension of red cells in saline, *c.* 2 drops of cells in 1 mℓ saline. It appears cherry red in transmitted light
	Allow serum tubes to stand for *c.* 1 hour, then centrifuge the serum tubes for 10 minutes and remove the serum
	Label 3 test tubes for every donor: 'MAJOR', 'MINOR' and 'CONTROL'
	In the 'MAJOR' tube place 2 drops of the recipient's serum and 2 drops of the donor's red cell suspension
	In the 'MINOR' tube place 2 drops of donor's serum and 2 drops of the recipient's red cell suspension
	In the 'CONTROL' tube place 2 drops of the recipient's serum and 2 drops of the recipient's red cell suspension
	Incubate for 30 minutes at 37 °C
	Centrifuge tubes at 1000G for 3 minutes
	Examine supernatant for the presence of haemolysis and note if present
	Mix the contents of the tube gently by tapping to detect macroscopically visible agglutination
	Transfer a small drop to a glass slide and examine under low power (10 × 10) of the microscope for microscopic agglutination

should be current (rabies, feline upper respiratory tract infections and panleukopenia)[1,2,7]. The donor should be negative for feline leukaemia virus, feline immunodeficiency virus, *Haemobartonella felis* and *Babesia felis*. A retrospective study of data from 1993 to 1997 demonstrated that the incidence of feline immunodeficiency virus and feline leukaemia virus in 3414 cats tested in South Africa was 18 % and 2.9 % respectively (M van Vuuren, Department of Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, and J Muller, Golden Vetlab, pers. comm., 1998). The prevalence of feline leukaemia virus is therefore much lower in South Africa than in Europe and the USA, which means that the risk of transmitting this virus during transfusions is lower. The donor cat should have a haematocrit (Ht) of at least 0.35 ℓ/ℓ. As feline blood transfusions are infrequently given in most South African veterinary practices, keeping an in-house feline blood donor is usually not justified, and the best solution is to use indoor cats owned by clients or staff. Since housing cats indoors is rare in South Africa, the best alternative would be to use donors that are frequently vaccinated and screened for infectious diseases.

BLOOD COLLECTION

Anticoagulants and preservatives

Heparin: as heparin has no preservative properties, it can be used to collect fresh whole blood for transfusion shortly after collection. Giger[2] advises against the use of heparin because it may induce platelet aggregation and inhibit coagulation factors. This is, however, a relatively easy method for feline blood collection in private practice. A dosage of 5–10 units of heparin per 1 mℓ of blood collected is recommended[2,11].

3.8 % Sodium citrate: it has no preservative properties and should only be used for collection of fresh whole blood. It should be used at 1 mℓ sodium citrate for every 9 mℓ of blood collected[2,11].

Acid-citrate-dextrose (ACD): this is an anticoagulant as well as a preservative. It is used at mℓ ACD per 7–9 mℓ of blood collected[11].

Citrate-phosphate-dextrose-adenine (CPDA-1): it is an anticoagulant and a preservative. The adenine is a substrate for the red blood cells. One mℓ of CPDA-1 to 7 mℓ of blood collected is used.

Blood collection technique and hardware

Cats should be sedated for blood donation. A combination of ketamine hydrochloride and diazepam is recommended[1]. This ensures good control of the patient and has very little effect on blood pressure. The most practical method of blood collection in cats is to place the anticoagulant of choice into a 20- or 50-mℓ syringe, using the correct amount for the volume of blood to be collected. After the area over the jugular vein has been shaved and aseptically prepared, a 19-gauge butterfly needle (Adcock Ingram Critical Care) is inserted into the jugular vein and the blood is then collected into the syringe[2,8,9]. A maximum volume of 11 mℓ/kg body weight can be collected from the donor[2], with a total volume of 50 mℓ usually being collected[2,7,8]. It may be necessary to replace the volume lost with 2–3 times the volume of resuscitative fluids[2], such as Ringer Lactate (Intramed) or Plasmalyte B (Adcock Ingram Critical Care). The blood can then be transferred to a Buretrol (Adcock Ingram Critical Care) *via* a large-bore needle. As this method of collection is not a closed system and therefore not sterile, it is not advisable to store the blood. Small collection bags for feline blood transfusions available in the USA are currently unavailable in South Africa.

INDICATIONS FOR TRANSFUSION

The most frequent indication for transfusions in cats is anaemia[2,3]. At OVAH the most frequent causes include haemolytic anaemia due to hemobartonellosis or paracetamol poisoning, post-traumatic and surgical blood loss, and non-regenerative anaemia due to chronic renal failure. Similar causes have been reported by Giger *et al.*[2,3]. At OVAH, blood transfusions are also given to cats with liver disease and coagulation defects, which have to undergo liver aspirates or biopsies. Where *B. felis* has a high prevalence in South Africa, blood transfusions are frequently administered to affected cats.

BLOOD ADMINISTRATION

Method

A blood transfusion set with a 170 μm filter is used for transfusions to prevent the infusion of micro-thrombi[6]. Stored blood or components are warmed to

±30 °C. Blood products should not be heated in a microwave oven and should not be overheated, as red cells start to haemolyse *in vitro* at about 37 °C and proteins start to denature[6]. The jugular, cephalic or femoral vein can be used for blood administration[2] and in cases where venous access is not possible, blood can also be administered into the medullary cavity[2,8]. It is not advisable to give blood through catheters smaller than 20-gauge as this can lead to red cell destruction[8].

Volume

The recommended formula for calculating the desired volume for transfusion is[2]:

$$\text{Volume of whole blood required} = \text{body weight (kg)} \times \frac{66\ (\text{desired Ht} - \text{patient Ht})}{\text{Ht of transfused blood}}$$

A post-transfusion Ht between 0.15 ℓ/ℓ and 0.20 ℓ/ℓ is desired if the anaemia is regenerative[2,8]. In cases of non-regenerative anaemia, the desired post-transfusion Ht is 0.35 ℓ/ℓ[2]. In private practice, the total volume of blood collected from the donor is usually given to the patient.

Rate of transfusion

The hydration status as well as the cardiac function of the patient should be taken into consideration when the transfusion rate is calculated. In a cat with normal hydration status blood can be transfused at 11–22 mℓ/kg/h, in dehydrated cats the rate can be increased to 66 mℓ/kg/h[2]. In these patients intermittent bolus transfusions can also be given. In cats with heart failure, the transfusion rate should not be more than 5 mℓ/kg/h[2]. During blood transfusions access to food should be restricted as the cat may vomit.

POSSIBLE COMPLICATIONS

Complications of blood transfusion can be classified as immunological or non-immunological and as immediate or delayed (Table 2). Immediate transfusion reactions are usually more serious than delayed reactions. Some reactions may go undetected or be detected too late if the patient is not closely monitored during and after the transfusion. It is necessary to monitor temperature, capillary refill time, respiration and pulse rate, attitude and record and investigate any urination, defaecation or vomition during the transfusion. If a reaction occurs or is suspected, the transfusion should be stopped immediately. The patient should be evaluated and the cause determined and treated. The transfusion can then be continued if it is safe and in the best interest of the patient.

Table 2: **Transfusion complications.**

Immunological reactions
Immediate
AB-mismatched transfusion (anaphylaxis and haemolysis)
Fever
Allergic reactions (Type I hypersensitivity)
Delayed
AB-mismatched transfusion (haemolysis)
Delayed hypersensitivity
Non-Immunological reactions
Immediate
Septicaemia due to contaminated blood
Circulatory overload
Hypocalcaemia
Hyperammonaemia
Hypothermia
Coagulation defects due to dilution
Unexplained vomition
Delayed
Disease transmission
Septicaemia due to non-sterile transfusion technique

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