

Introduction to Feline Transfusion Medicine

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Anna Threlfall BVSc. MVetMed. DipACVIM DipECVIM-Ca (anna.threlfall@vetspecialists.co.uk)

Blood groups

Blood groups are genetically determined antigenic markers on the red blood cell surface which are antigenic in recipients that lack the same marker.

Feline blood groups

- Type A – type A antigens are displayed on red blood cell surface (N-glycolyl-neuraminic acid [NeuGc]). This is the most common blood group in cats, although the prevalence varies depending on geographical location.
- Type B – type B antigens are displayed on the red blood cell surface (N-acetyl-neuraminic acid [NeuAc]). Type B cats appear to lack the enzyme (cytidine monophospho-N-acetylneuraminic acid hydroxylase [CMAH]) that converts NeuAC to NeuGC in Type A cats.
- Type AB – there are equal amounts of type A and type B antigens on the red blood cell surface.

Alloantibodies

Cats have naturally occurring alloantibodies. These antibodies appear within the first few months of life, after the degradation of maternally derived antibodies. Type A cats have a low anti-B antibody titre, whereas Type B cats have a high anti-B antibody titre. It is therefore imperative that cats receive blood from a donor of the appropriate group, even if they have never received a transfusion before. AB mismatched transfusions can cause life-threatening haemolytic transfusion reactions, without prior sensitisation.

Type AB cats do not have naturally occurring alloantibodies against Type A or Type B red blood cells. Type AB cats can therefore be considered universal recipients of packed red blood cells. It should, however, be noted that there is a small amount of plasma present in all units of packed red blood cells, and a larger amount of plasma present when whole blood is used. Plasma from Type A or Type B cats will contain antibodies against the opposite blood group and therefore a minor transfusion reaction might be expected if plasma of either Type A or Type B cats is administered to a Type AB recipient. Type AB blood donors are exceptionally rare, and therefore it is advised to use blood/plasma from a Type A donor for a Type AB recipient. The anti-B antibody titre of Type A cats is relatively low and unlikely to cause a significant transfusion reaction in the AB recipient. The anti-A antibody titre of Type B cats is high and more likely to result in a significant reaction in an AB recipient.

Blood typing

There are many different blood typing kits available and there is good to excellent agreement between various different blood typing methods, although the GEL or TUBE laboratory methods are still considered gold standard.¹ In a study comparing various different blood grouping methods¹, 4/13 samples with discordant test results originated from FeLV positive cats. These cats were incorrectly identified as type AB by several methods, although confirmed to be Type A using the TUBE assay. The reason for this is incompletely understood, although it is known that various disease states can affect results of blood typing in humans and animals. Some form of antigenic mimicry with the B antigen on the surface of the red blood cells in some FeLV positive cats has been postulated. An alternative explanation is that the FeLV virus could interfere with the action or production of the CMAH enzyme which converts the type B antigen to the type A antigen on the red blood cell surface (in Type A cats). It is therefore suggested that all cats that appear to be Type AB based on standard blood grouping methods should be retested using the laboratory TUBE method and tested for FeLV.

Cross-matching

It is likely that there are a number of non-AB antigens of variable importance on the surface of red blood cells, to which cats do not have naturally occurring antibodies. After a cat has received a blood transfusion, they might go on to develop antibodies against a host of other red cell antigens present on the donor red blood cells. These

antibodies form within 3-5 days and will last for variable lengths of time. Therefore, it is important to perform cross-matching in any patient that has received a transfusion >3-5 days earlier.

Mik – another important blood group?

A number of haemolytic transfusion reactions have been reported in transfusion naïve cats receiving appropriately AB matched blood. This suggests that the recipients must have naturally occurring alloantibodies against another relatively common blood group. The blood group has been termed Mik.² This discovery raised the question of whether we should consider cross-matching of all cats prior to their first transfusion, since we do not perform *Mik* blood typing. The presence of non-AB blood type incompatibilities was investigated in 112 cats the UK³ and no conclusive evidence for non-AB blood type incompatibilities was identified, suggesting that cross matching prior to first transfusion was not essential. However, a more recent retrospective USA study⁴ of 300 cats documented 23/154 (14.9%) transfusion naïve cats to have major cross match incompatibilities detected, and febrile transfusion reactions were noted more commonly in cats that received non cross-matched blood. This study therefore recommends that cross-matching is performed prior to first transfusion in cats, although this was a USA population of cats. At Davies Veterinary Specialists, we have reviewed the available evidence and assessed the number of transfusion reactions that we encounter. This information has been balanced against the difficulties in sourcing feline blood, the ability to perform cross-matching in a timely fashion (especially out of hours), and the cost of cross-matching. At present, we do not routinely cross-match cats prior to their first transfusion, but we always use AB matched blood and always cross-match patients that have received prior transfusions (>3-5 days before). Cats are carefully monitored throughout administration of blood products.

Future of feline blood banking in the UK

At the time of writing, the Pet Blood Bank UK (PBB) is only able to collect and store canine blood products in the UK. However, the PBB UK are at advanced stages of discussion with the RCVS and VMD about the possibility of feline blood banking. At present, please see the PBB UK website for further detailed information about feline blood collection and administration protocols:

<https://www.petbloodbankuk.org/vet-professionals/transfusion-information-and-guidance/guides/collection/feline-blood-collection/>

The welfare of both the donor and recipient cat is the absolute priority of the PBB. Cats will be thoroughly screened prior to inclusion as a donor. Only healthy young adult cats will be included, and these cats must be amenable to donation without sedation. Prior to every donation, donors will be examined, have a limited echocardiography and blood pressure check, together with a PCV/TP assessment. Each donor will be screened for FeLV, FIV, *Mycoplasma haemofelis*. The PBB have designed a bespoke closed collection system to reduce the risk of contamination as much as possible. As far as I am aware, this is the first closed collection system available for cat blood donation.

Blood components – replace what your patient is missing

Packed red blood cells - (improvement of oxygen carrying capacity)

Fresh frozen plasma [FFP] - (delivery of coagulation factors – all available in FFP)

Frozen plasma – (delivery of stable coagulation factors II, VII, IX, X; labile factors not available)

All blood products (including plasma) must be appropriately AB matched prior to administration.

Practical tips

Always use a filter [blood giving set or in-line filter]

Only use fluid pumps that have been evaluated for administration of blood products. Many fluid pumps can result in haemolysis.

Warming is not generally required for red blood cells

FFP needs to be thawed in a warm water bath prior to administration

Go slowly to start with – monitor closely for immediate reactions. Then increase administration rate, deliver over a maximum of 4 hours.

Maintain a closed system of delivery

Monitor closely throughout administration of all blood products [TPR, nausea, skin]

Common questions / misconceptions

At what PCV should I transfuse my patient?

- This depends on the clinical status of the patient, the chronicity of the anaemia and the underlying disease process.

How much should I give?

- Approximately 1ml/kg of pRBCs will increase the PCV by 1%
- Give as much blood as required to stabilise your patient's clinical parameters
- Care re: fluid overload
- Give as much plasma as required to correct PT/APTT

If I give fluids to my anaemic patient, won't I dilute the blood?

- The PCV will drop, yes. BUT the number of red blood cells in the circulation will not drop. Ensuring adequate blood volume will improve the transport of these red blood cells (and therefore delivery of oxygen) to the relevant areas. Correction of hypovolaemia takes priority over anaemia in the majority of cases.

My feline patient has a prolonged APTT and a normal PT, but has no signs of bleeding. What does this mean?

- This could mean that the patient has a reduction in factors XII, XI, IX or VIII. In cats, factor XII deficiency is relatively common and does not result in bleeding (Hagemann factor). This does not require treatment. Other factor deficiencies more commonly result in bleeding.

Should I perform a blood clotting profile prior to performing percutaneous ultrasound guided liver biopsies in cats?

- APTT and PT are not well correlated to risk of bleeding following liver biopsies in cats. Liver biopsies hold a relatively high risk of bleeding (often clinically silent), regardless of coagulation parameters.⁵

My patient has a low total protein, should I give plasma?

- No. Approximately 45ml/kg plasma is required to increase the albumin by 1g/dl (10g/L).⁶ The effect on oncotic pressure is minimal at doses used clinically.⁷

Can I give dog blood to cats (xenotransfusion)?

- There have been many studies relating to this in recent years due to lack of available feline products.^{8, 9, 10, 11}
- Only recommended if absolute emergency and no other superior option available.¹¹

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