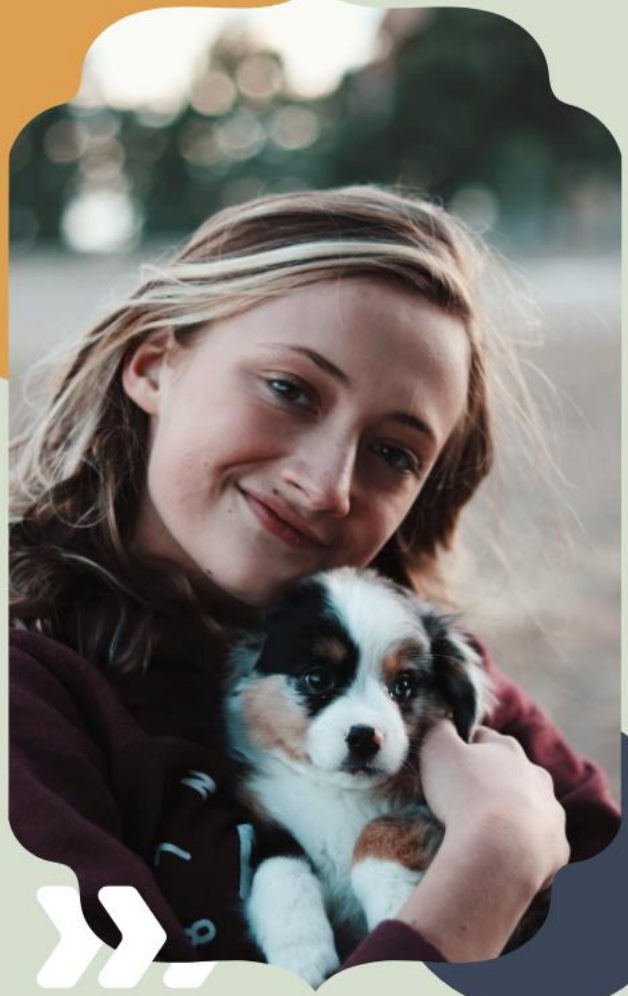
Advancements in Canine Blood Transfusion: Ensuring Optimal Health and Vitality



1. Importance of Canine Blood Transfusions

With the continual advancements in canine blood transfusion, ensuring optimal health and vitality in our furry companions has never been easier. By utilizing cutting-edge techniques and technologies, veterinary professionals are now able to provide life-saving transfusions with greater precision and safety. Join us as we explore the exciting breakthroughs that are revolutionizing the field of canine blood transfusion, and learn how these advancements are ensuring a healthier and happier future for our beloved pets.

2. Understanding Canine Blood Types

Canine blood types play a crucial role in ensuring successful transfusions. Just like humans, dogs have different blood types, and compatibility must be considered to prevent adverse reactions. Understanding the different blood types and conducting proper screening tests is essential for veterinarians to provide optimal care and ensure the health and vitality of our furry companions.

3. Safety Measures in Canine Blood Transfusions

To ensure safe canine blood transfusions, veterinarians follow strict safety measures. These include careful donor selection, thorough blood typing and cross-matching, screening for infectious diseases, and monitoring vital signs during the transfusion process. By adhering to these measures, veterinarians can minimize the risk of complications and ensure the well-being of the recipient dogs.

4. Advances in Canine Blood Screening

Advancements in canine blood screening have revolutionized the transfusion process. New screening technologies can detect a wider range of infectious diseases, ensuring safer blood transfusions. Additionally, veterinarians now have access to rapid blood typing and cross-matching methods, allowing for quicker and more efficient transfusions. These advancements contribute to the overall health and vitality of dogs receiving blood transfusions.

5. Simultaneous Blood Transfusions and Procedures

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7. Improvements in Canine Blood Matching Techniques

Improvements in Canine Blood Matching Techniques

8. Canine Blood Transfusions and Enhanced Recovery

Canine blood transfusions play a vital role in enhanding the recovery of our furry friends. With advancements in blood matching techniques, veterinarians can ensure optimal health and vitality for dogs in need. By providing the right blood type and matching donors, we can support their healing process and provide them with a better quality of life.

9. Challenges in Canine Blood Transfusion Research

Although canine blood transfusion research has made significant advancements, there are still challenges that need to be addressed. These include finding a sufficient number of suitable donors, managing potential complications such as transfusion reactions, and ensuring the availability of compatible blood types for emergency situations. Overcoming these challenges will lead to improved outcomes and better lives for our beloved furry companions.

10. Future of Canine Blood Transfusions

Promising Developments and Potential Impacts
Advancements in technology and research are paving the way for exciting possibilities in canine blood transfusions. These include the development of artificial blood substitutes, improved donor screening methods, and the creation of blood banks for emergency situations. These innovations have the potential to revolutionize veterinary care and significantly improve the health and vitality of our canine friends.

- The dog erythrocyte antigen or blood type system is known as the DEA system and has historically included DEA 1 (1 neg, 1.1, 1.2, 1.3) and DEAs 3–8. Recent reports indicate DEA 1.1 and 1.2 are the same antigen with varying strengths of expression. Furthermore, it has been shown that dogs with weak red-cell DEA 1 expression do not develop antibodies when transfused with those of strong DEA 1 expression The most important canine blood type is DEA 1, which is present in approximately 60% of the canine population

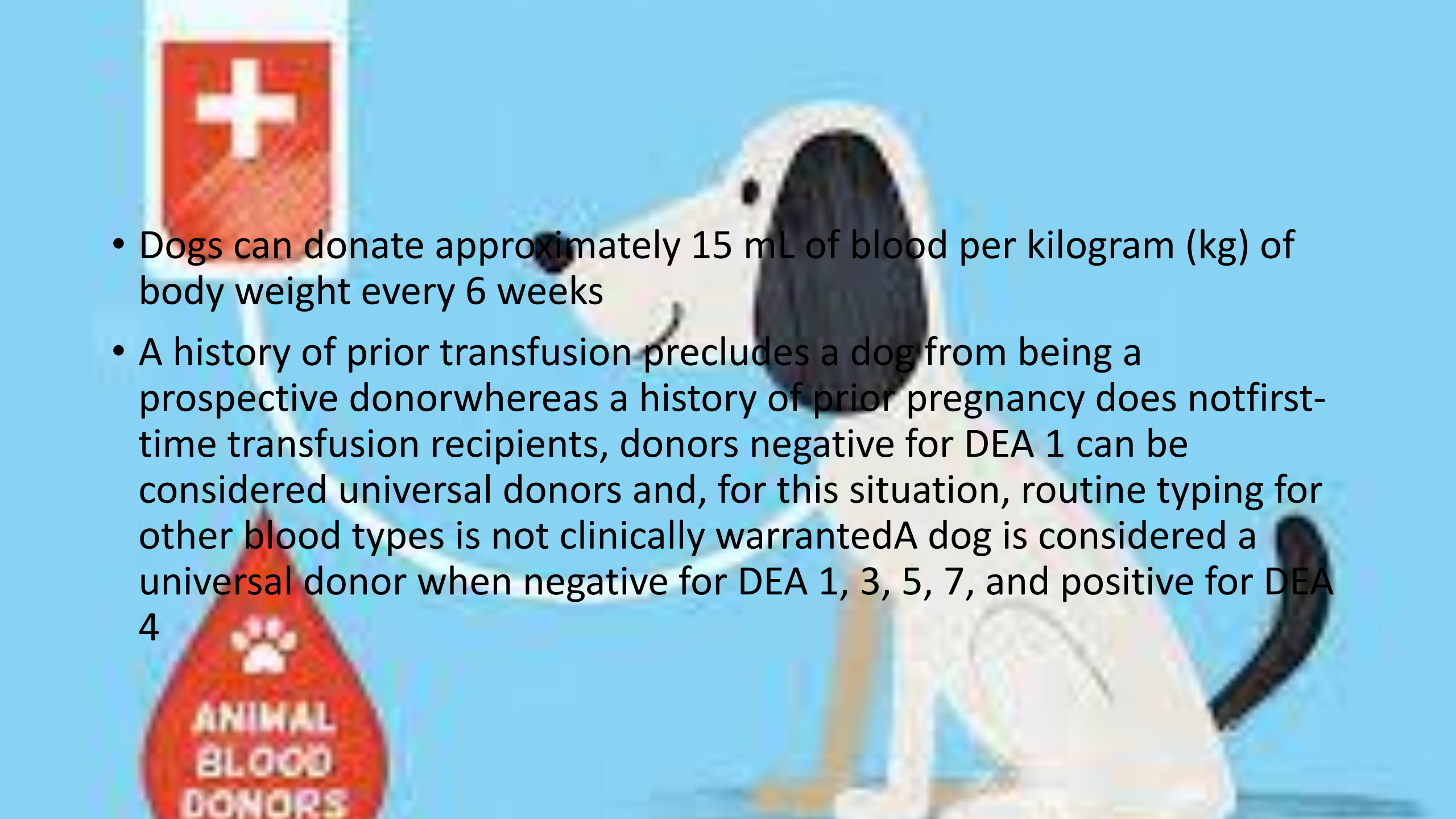
- naturally occurring DEA 1 alloantibodies have not been described, this antigen will induce severe transfusion reactions in previously sensitized dogs. Other DEA alloantibodies are reportedly of limited clinical significance in dogs, unlike the situation in cats, but may exist in some dogDEA 4 is a high-frequency antigen that can result in hemolytic transfusion reactions in DEA 4-negative dogs previously sensitized by DEA 4-positive blood transfusions

- DEA 7 may elicit an antibody response in dogs that lack it, and DEAs 3 and 5 are low-incidence antigens in which naturally occurring alloantibodies can occur; anti-DEA 3, 5, and 7 can result in delayed transfusion reaction

- The high-frequency Dal erythrocyte antigen was so named as it was originally identified after accidental sensitization of a Dalmatian dog by transfusion of Dal-positive blood

Species	Major immunogenic antigens	Naturally occurring alloantibodies	Recommended donor type	First transfusion risks and recommendations	Matched transfused RBC half-life (d)
Dog	DEA 1	Rare; DEA 3, 5, 7; cold reacting	DEA 1 type-matched or DEA 1 negative for first transfusion. Crossmatch-compatible for repeat transfusions. *No* prior transfusion.	Low. Use of universal donor minimizes sensitization risk. Crossmatch if ≥4 d since prior transfusion.	24 [1]
Cat	A most common	Common. Anti-B, usually mild in type A cats.	Type A	Low if A/B type-matched. High if A/B type mismatched.	29–39 [2]
	B rare except select breeds.	Common. Anti-A, strong in type B cats.	Type B	Crossmatching always recommended.	
	AB very rare – in breeds that also have B.	No anti-A or anti-B	Type AB if available (rare); Type A		
	Mik	Anti-*Mik* reported in DSH	A/B type-specific crossmatch compatible	6% in type A/B-matched blood. Crossmatch recommended.	
Horse	Complex system of 30+ antigens in seven blood groups. Donkey RBC antigen.	Occur. Anti-Aa, -Qa most important. Probably none.	None. Aa/Qa negative or same breed class is best starting choice.	Considerable; use least incompatible. High neonatal isoerythrolysis risk for mule foals.	9 [3], 24–43 [4]
Cattle	Eleven blood groups: B and J most important. B very complex in ruminants.	Occasionally anti-J.	J-negative.	Low for first transfusion. Close match difficult. Hemolytic crossmatch recommended.	12–20 [5]
Sheep Goat	Seven blood groups in sheep: sheep R similar to	Weak. Goat anti-R.	Not defined	Low for first transfusion. Hemolytic crossmatch	16 [6]

- Donor selection



- Dogs can donate approximately 15 mL of blood per kilogram (kg) of body weight every 6 weeks
- A history of prior transfusion precludes a dog from being a prospective donorwhereas a history of prior pregnancy does notfirst-time transfusion recipients, donors negative for DEA 1 can be considered universal donors and, for this situation, routine typing for other blood types is not clinically warrantedA dog is considered a universal donor when negative for DEA 1, 3, 5, 7, and positive for DEA 4

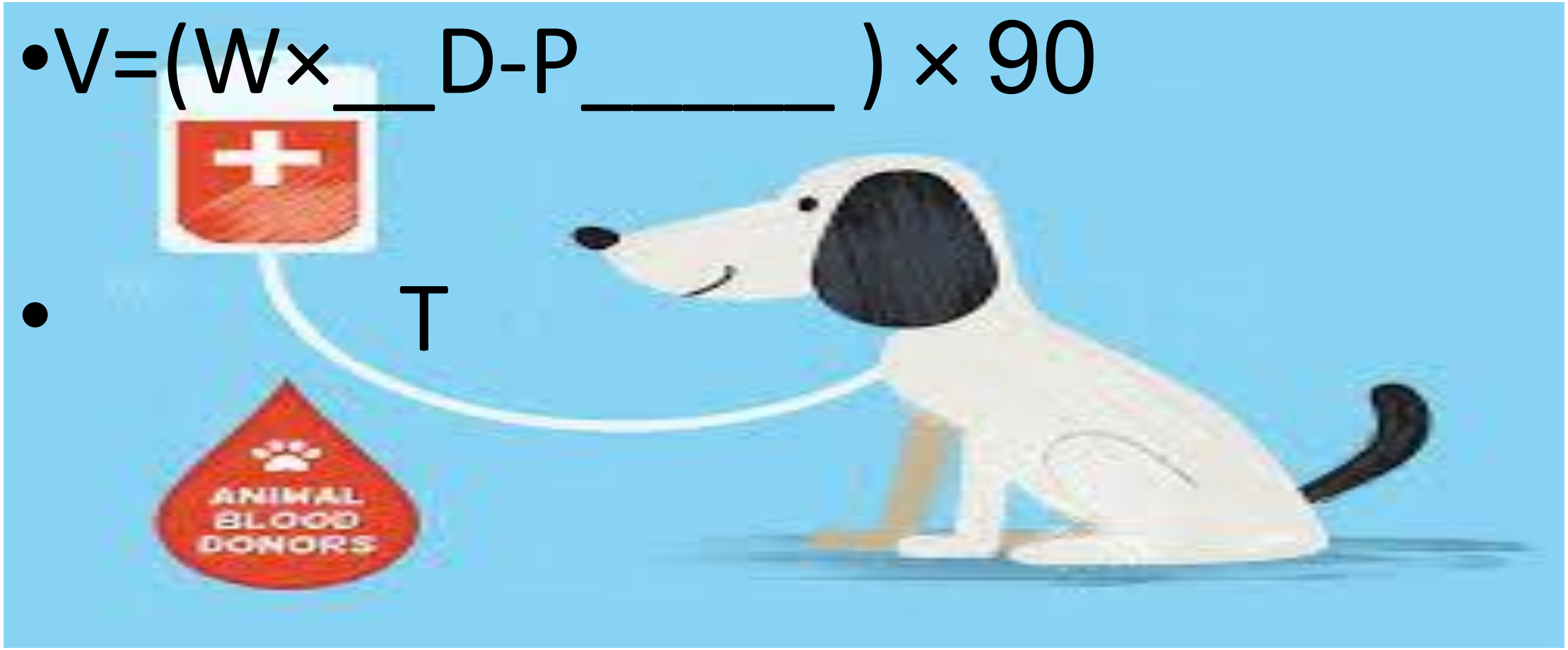
- To minimize potential sensitization of the recipient and improve the odds of identifying compatible donors, the use of universal donors is recommended when periodic transfusions are anticipated. Since about half of dogs are DEA 1-positive and testing for DEA 1 is a practical procedure, having DEA 1-positive donor blood available for DEA 1-positive recipients is prudent. A practical summary is that DEA 1-negative dogs are ideal for first-time transfusions regardless of recipient blood type, and DEA 1-positive donors should be limited to DEA 1-positive recipients.

- Dog donors should be greater than 25–30 kg, bled less than once per month to prevent iron deficiency, and well nourished, including supplementation with oral iron if collected frequently. To ensure general good health, donors should have negative fecal and heartworm disease examination.

- donors should test negative for transmissible infectious diseases including babesiosis, leishmaniasis (especially foxhounds) brucellosis, ehrlichiosis, anaplasmosis, and neorickettsiosis
- should be consulted for specific recommendations on diseases relevant to particular geographical regions, such as trypanosomiasis, bartonellosis, and hemoplasmosisttsios

The volume of blood required to be transferred to the animal (Dog)

- $V=(W\times \_\_D-P\_\_\_\_\_)\times 90$
- T

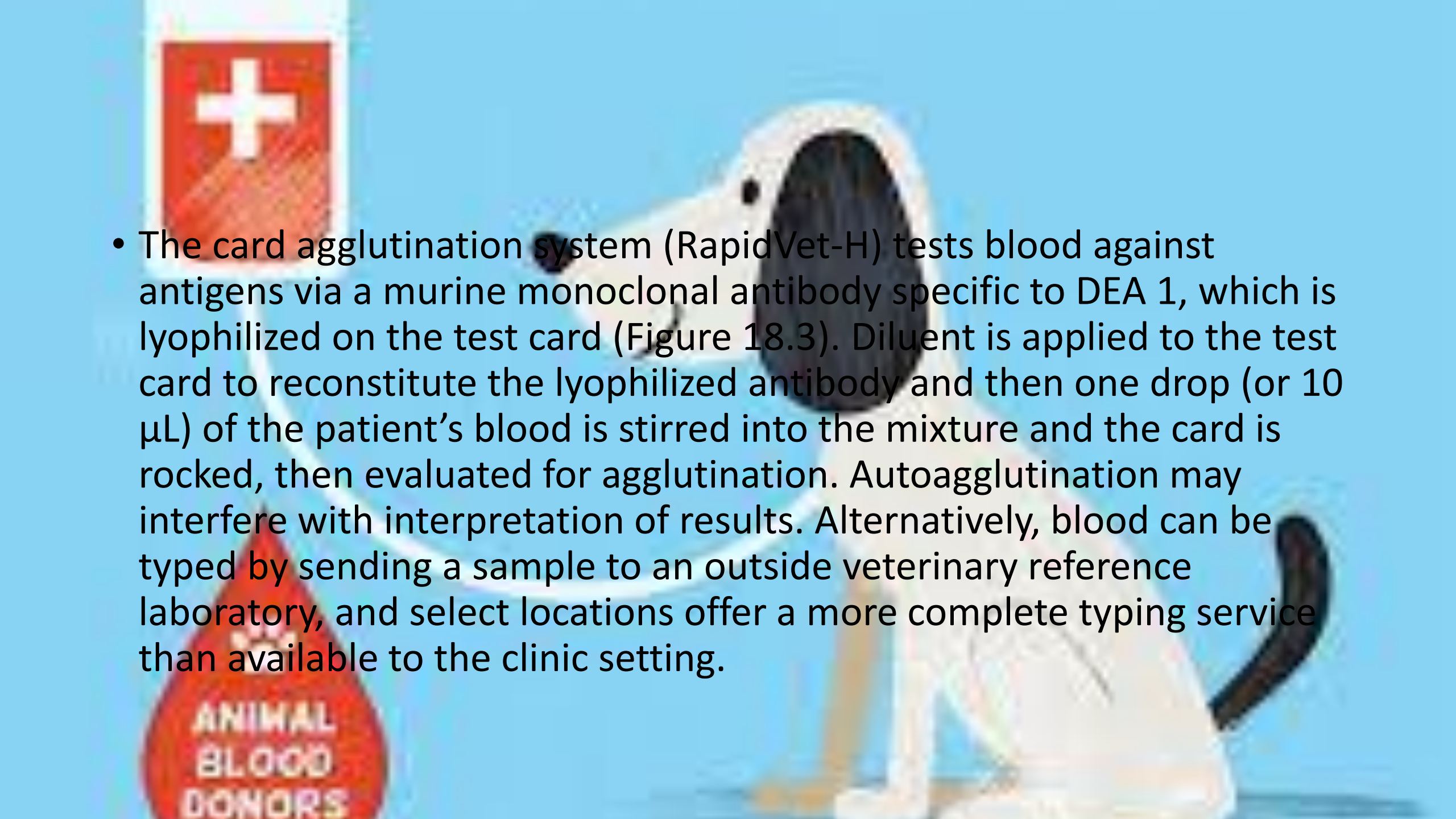


- W=وزن بيمار بر حسب كيلوگرم
- D=هماتوكريت يا PCVطبيعي در سگ
- P=هماتوكريت يا PCVبيمار
- T=هماتوكريت يا PCVخوني كه منتقل مي شود (PCVدام دهنده)

- -در صورتی که وزن سگی 50کیلوگرم ، هماتوکریت طبیعی درصد ۴۵،هماتوکریت بیمار درصد 12 و هماتوکریت خونی که منتقل می کنید40 درصد باشد در این صورت حجم خون مورد نیاز برای انتقال بر حسب میلی لیتر چقدر خواهد بود؟

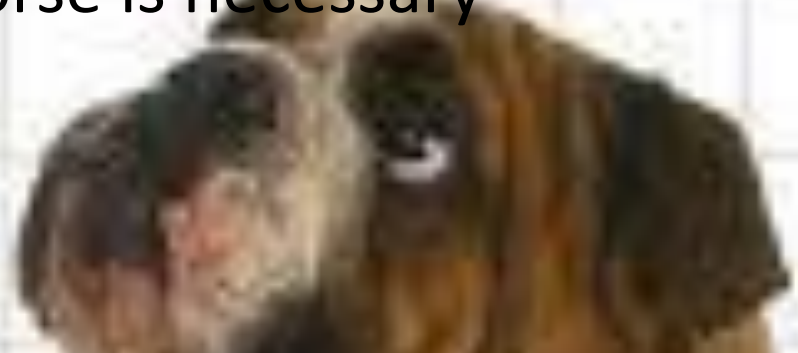
- How to type and crossmatch

- In-house blood typing has become more common thanks to commercially available blood-typing products. Ethylenediaminetetraacetic acid (EDTA)-anticoagulated whole blood is generally required as other anticoagulants, such as heparin or citrate, have not been validated. Two popular typing methods amenable for in-clinic use include immunochromatography housed within a cartridge and agglutination performed on a card. These test for the DEA 1 antigen in dogs and A, B, or AB in cats and take just minutes to complete



- The card agglutination system (RapidVet-H) tests blood against antigens via a murine monoclonal antibody specific to DEA 1, which is lyophilized on the test card (Figure 18.3). Diluent is applied to the test card to reconstitute the lyophilized antibody and then one drop (or 10 µL) of the patient's blood is stirred into the mixture and the card is rocked, then evaluated for agglutination. Autoagglutination may interfere with interpretation of results. Alternatively, blood can be typed by sending a sample to an outside veterinary reference laboratory, and select locations offer a more complete typing service than available to the clinic setting.

- Crossmatching is performed to help determine compatible red-cell products so as to reduce adverse transfusion reactions. A “major” crossmatch is performed to detect antibodies in the recipient’s serum that may agglutinate or lyse the donor’s erythrocytes. A “minor” crossmatch is performed to detect antibodies in the donor plasma directed against the recipient’s erythrocytes. The antibodies detected may be naturally occurring or induced. The agglutination technique is adequate for the dog and cat, whereas testing for both agglutinating and hemolytic antibodies in the horse is necessary



- Cattle, sheep, and goats have minimal agglutinating antibodies, thus the use of a hemolytic test is warranted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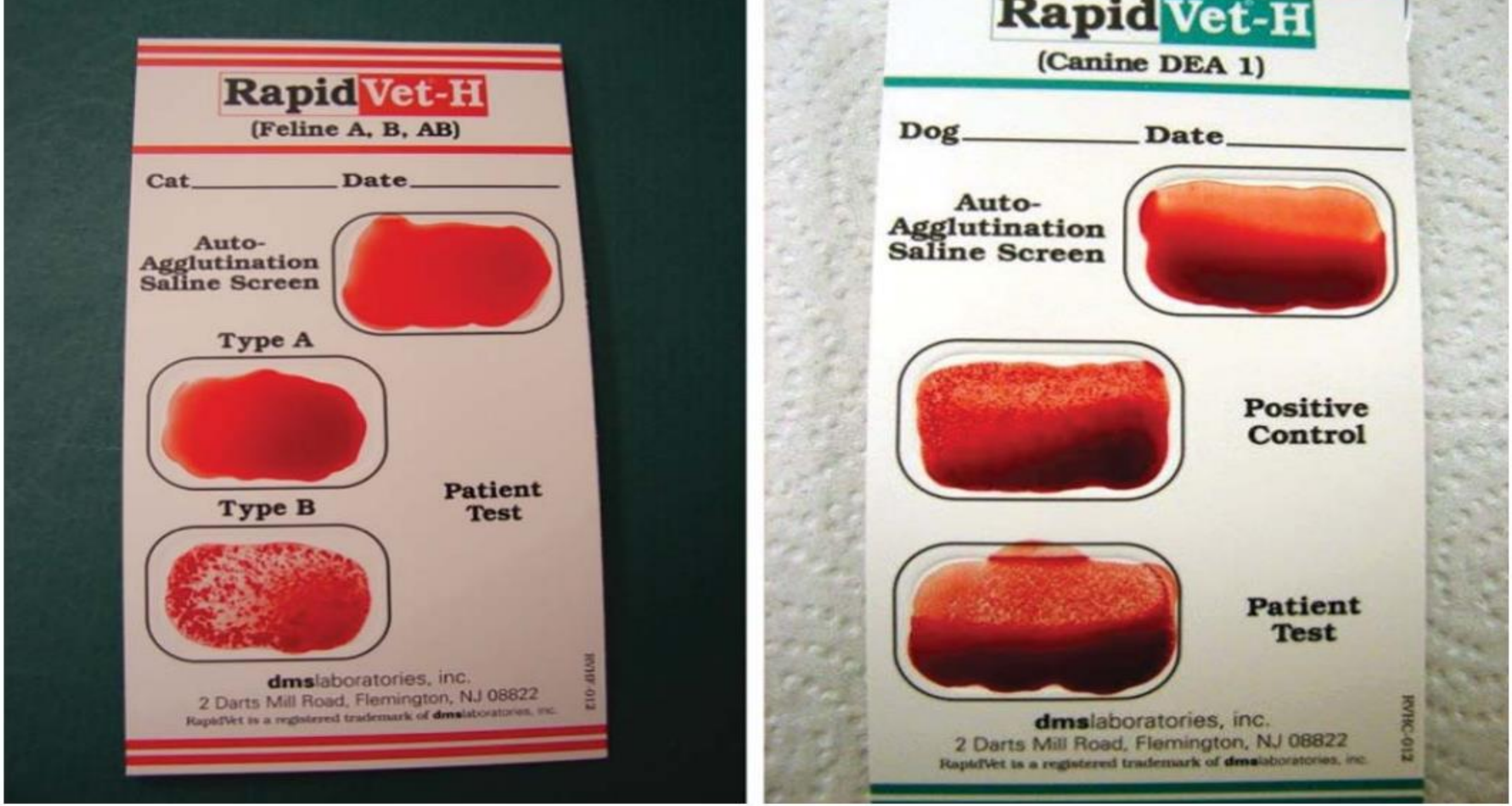

Figure 18.3 RapidVet-H typing cards demonstrating type B in a cat (left) and type DEA 1 in a dog (right), both with negative autoagglutination reactions. Source: Courtesy of DMS Laboratories, Inc.

- Transfusion reaction

- The type of transfusion reaction of most concern is an acute haemolytic reaction with intravascular haemolysis. This is an antigen–antibody, type II hypersensitivity reaction, primarily mediated by IgG. This type of reaction is seen in DEA 1.1-negative dogs sensitized to DEA 1.1 upon repeated exposure, as well as other sensitized alloantibody-mediated incompatibilities. Clinical signs may include fever, tachycardia, dyspnoea, muscle tremors, vomiting, weakness, collapse, haemoglobinaemia and haemoglobinuria. These reactions may lead to shock, and uncommonly DIC and renal damage.

- If such a reaction is suspected,
- the transfusion should be discontinued immediately, and intravenous access must be maintained with administration of a crystalloid solution, or colloid when required, while carefully monitoring the patient for development of fluid overload (by measuring central venous pressure and heart rate, and by lung auscultation). Blood pressure and urine output should be monitored because hypotension may follow, and pressor agents and diuretics may be administered as required (e.g. low dose dopamine infusion, furosemide).

- Acute febrile non-haemolytic transfusion reactions and reactions to bacteria-contaminated blood products may have similar signs to acute haemolytic reactions. The donor and recipient blood type should be confirmed and a cross-match performed, if not already performed pre-transfusion. The product type, date of expiration, volume and rate of administration should be checked. A sample of donor and recipient blood should be examined for evidence of haemolysis, and saved for microbial culture and further infectious disease screening if needed. A Gram or haematological stain of a smear of donor blood may be helpful initially to investigate contamination of the unit, and if bacterial contamination is suspected, broad-spectrum intravenous antibiotic therapy should be initiated. Given that DIC and renal failure may occur, monitoring the animal's coagulation profile, BUN, creatinine and electrolytes is advisable.

- Non-haemolytic reactions

- Non-haemolytic immunological reactions are those of acute type I hypersensitivity reactions (allergic or anaphylactic), most often mediated by IgE and mast cells. These patients show a range of clinical signs from urticaria to pulmonary oedema, which may include pruritus, erythema, oedema, vomiting and dyspnoea. If this type of reaction occurs, the transfusion should be stopped and the patient examined for evidence of haemolysis and shock. Antihistamines (diphenhydramine 1–2 mg/kg i.m. or chlorphenamine 2.5–5 mg i.m. for a small to medium-sized dog, or 5–10 mg i.m. for a medium to large dog) and steroid medication (dexamethasone 0.5–1.0 mg/kg i.v.) may be required. If the reaction subsides, the transfusion may be restarted at 25–50% of the previous rate. If there is evidence of anaphylactic shock, adrenaline, intravenous fluids, antihistamines, H2 blockers (e.g. cimetidine, ranitidine), colloids, dopamine and aminophylline may also be administered at standard dosages as needed, in addition to the above treatment measures

- Reactions to leucocytes and platelets may occur, manifested by a febrile non-haemolytic transfusion reaction, which may last up to 20 hours post transfusion. These are recognized as an increase in body temperature by > 1°C without an obvious underlying cause. The risk of these types of reaction may be minimized by the use of leucocyte reduction filters in the preparation of blood components

- Delayed reactions

- A delayed haemolytic reaction with extravascular haemolysis may be recognized 2–21 days after transfusion, and some signs may be similar to those of an acute haemolytic reaction (e.g. hyperbilirubinaemia/bilirubinuria), but they are usually less severe. The owner may notice jaundice or anorexia, and on examination the animal may be febrile or have an unexpected decline in PCV (Kerl and Hohenhaus, 1993). This type of reaction requires intervention less frequently, other than perhaps administration of anti-pyretics. Other delayed immune-mediated transfusion reactions that may occur include post-transfusion purpura (thrombocytopenia noted within the first week after blood transfusion), neonatal isoerythrolysis, and immunosuppression of the recipien

- Non-immunological transfusion reactions

- Non-immunological transfusion reactions
- These include anaphylactoid reactions, which often result from too rapid an infusion rate and may subside after discontinuation of the transfusion or reduction of the infusion rate. They may be clinically indistinguishable from urticarial and anaphylactic reactions. If an apparent allergic reaction is mild and subsides, the transfusion may be continued at a slower rate. If a reaction does not recur, the reaction was probably anaphylactoid. Continuing the transfusion is not recommended if the reaction was moderate to severe. Circulatory overload may occur in any patient receiving excessive volumes of blood products, especially those with cardiac or renal disease, and treatment with diuretics may be required. A potential consequence following administration of large volumes of plasma or whole blood is citrate intoxication causing hypocalcaemia, which is of greater risk in patients with impaired liver function. Clinical signs of hypocalcaemia may be noted (e.g. vomiting, muscle tremors, tetany, changes on the ECG), but routine serum calcium levels will be normal. The ionized calcium level, if available, will be low. Treatment includes calcium gluconate (50–150 mg/kg i.v. of a 10% solution) or calcium chloride (5–10 mg/kg i.v. of a 10% solution) by slow infusion

- Other non-immunological reactions include
- polycythaemia and hyperproteinaemia (typically as a consequence of excessive product administration), hypothermia, dilutional coagulopathy (from treatment of major haemorrhage with large volumes of stored whole blood), thrombosis, microbial contamination, hyperammonaemia, hypophosphataemia, hyperkalaemia, acidosis, pre-transfusion (in vitro) haemolysis, haemosiderosis, air embolus, and infectious disease transmission.
- Many of the potential contributors to a non-immunological transfusion reaction occur as a result of processing or storage lesions. Hypothermia, uncommonly encountered following transfusion of refrigerated or frozen products to neonates or very small dogs, would be noted and should be addressed by routine patient monitoring during and following transfusion. Preventive measures necessary to minimize the risk of transfusion reactions include appropriate donor screening, collection, preparation, storage and administration of products. Adherence to standard protocols helps to ensure safety and efficacy of transfusions in practice