

# ADVANCES IN CANINE BLOOD TYPING, CROSSMATCHING, AND DONOR PROGRAMS

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In veterinary critical care and emergency medicine, transfusion therapy has taken an increasingly important role in the life support of an animal. Over the past decade the use of blood products in treating critically ill dogs has drastically increased. At the same time there has been a marked shift from administration of whole blood to component therapy. The benefits of component therapy include more efficient use of blood and reduced risk of transfusion reactions. Furthermore, the need for blood typing and crossmatching, and testing of donors for infectious diseases have now been recognized in order to provide safe and efficacious transfusions. The increased interest in veterinary transfusion medicine was, in part, generated by Transfusion Medicine Academic Awards given by the National Institutes of Health to five veterinary schools. This led to the establishment of several commercial animal blood banks, and recently to the publication of several important clinical studies and three books on veterinary transfusion medicine. Recent advances in canine blood typing, crossmatching, and donor programs will be reviewed and controversial issues will be discussed.

## Canine blood typing

More than a dozen blood group systems have been described in dogs. The various systems are referred to as Dog Erythrocyte Antigens with the abbreviation DEA followed by a number. For all blood group systems other than the DEA 1 system, red blood cells from a dog can be positive or negative for that blood type (e.g., for the DEA 7 system, a dog's cells can be DEA 7 positive or DEA 7 negative). The DEA 1 system, however, appears to have three subtypes: DEA 1.1 (also known as A<sub>1</sub>), DEA 1.2 (A<sub>2</sub>), and A<sub>3</sub> (only recently described in Australia). A dog's red blood cells can be DEA 1.1 positive or negative, and DEA 1.1 negative cells can be DEA 1.2 positive or negative. These blood types appear to be codominantly inherited. Only limited surveys on the frequency of these blood types in the United States have been reported which are summarized below. There may be geographic and breed associated differences in the frequency of these blood types.

Blood types		Percentage (%)	
		Positive	Negative
DEA 1.1	1.1 (A <sub>1</sub> )	33-45	55-67
	1.2 (A <sub>2</sub> )	7-20	35-60*
DEA 3	B	5-10	90-95
DEA 4	C	87-98	2-13
DEA 5	D	12-22	78-88
DEA 7	Tr	8-45	55-92

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\*DEA 1.1 and 1.2 negative dogs

Recently, a blood typing card as a simple in-practice test kit has become commercially available to classify dogs as DEA 1.1 positive or negative from DMS Laboratories, Inc. (2 Darts Mill Road, Flemington, NJ 08822; 1-800-567-4367). The assay, requiring a small amount of anticoagulated blood, is based on the agglutination reaction that occurs within 2 minutes when erythrocytes which are DEA 1.1 positive interact with a murine monoclonal antibody specific to DEA 1.1. Due to the strong antigenicity of DEA 1.1, typing of donors (and recipients) for DEA 1.1 is strongly recommended.

Polyclonal antisera are available to type all 6 of the above mentioned blood types from Dr. Robert Bull, B228 Life Sciences Building, Michigan State University, East Lansing, MI 48824; 517-355-4616; however, the blood typing procedures require some expertise and experience. Besides Dr. Bull's laboratory, some commercial laboratories offer typing for DEA 1.1 and some other blood types (DEA 1.2 and 7). Because of the lack of documentation of the clinical importance of canine blood types other than DEA 1.1 as well as the limited availability of dependable reagents and their costs, we presently do not recommend typing for additional DEAs beside DEA 1.1. The recent request by others to use exclusively canine donors that are negative for all testable DEA except DEA 4 would unnecessarily eliminate many active and potential donors, would be cost prohibitive, and is not supported by our experience and any published clinical reports.

## Crossmatching

In contrast to cats and humans, dogs do not appear to have any clinically important naturally-occurring alloantibodies against other blood types, although some veterinarians have recently expressed concerns about the presence of DEA 7 alloantibodies in some DEA 7 negative dogs. We did not identify any anti-DEA 7 warm

alloantibodies in a small group of tested DEA 7 negative dogs. The absence of clinically important, naturally-occurring alloantibodies in dogs has important clinical implications:

- 1) Blood crossmatch, which is performed to detect alloantibodies in the recipient's (major) and donor's (minor) plasma between 2 dogs that have never before received a transfusion, should be compatible and may, therefore, not need to be done.
- 2) An initial transfusion between 2 dogs that never before received a transfusion is unlikely to cause an acute transfusion reaction.
- 3) Alloantibodies may, however, develop within 4-14 days after donor blood positive for 1 or more blood types is transfused into a negative recipient. After such a transfusion, a major crossmatch between the same recipient and donor (or another donor with the same blood type as the previous donor) could yield an incompatible result. Thus, it is recommended to crossmatch any dog that has previously been transfused (>4 days ago). A simple crossmatch procedure without Coombs' reagent that evaluates agglutinins and hemolysins at room temperature and 37 °C should be used, and appropriate controls to detect autoagglutination should be included.
- 4) Since DEA 1.1 is most antigenic, it is recommended to use DEA 1.1 negative donors for untyped recipients in order to prevent sensitizing and subsequent transfusion reaction in a DEA 1.1 negative patient. DEA 1.1 positive blood can safely be administered to DEA 1.1 positive patients.

### **Blood donor programs**

Initially, veterinarians were mostly using either in-house blood donors kept at veterinary clinics or borrowed dogs owned by clients or staff. Recently, commercial canine blood banks and community voluntary donor programs became available. These blood donor programs adapted standards from the American Association of Blood Banking, and thereby, markedly improved the quality and safety of currently used blood products. The following canine blood banks will ship blood components by overnight mail:

- Animal Blood Bank; Vacaville, CA (916) 678-3009
- Eastern Veterinary Blood Bank; Annapolis, MD (800) 949-3822
- Hemopet; Irvine, CA (714) 252-8455

There are also several regional blood donor programs initiated by veterinary schools. The University of Pennsylvania has developed a voluntary canine donor program through dog breeders and owners. Through generous support, a specially designed animal blood mobile is regularly visiting these donors in the Philadelphia suburban areas. Presently, the Penn Animal Bank provides blood and expertise to the Veterinary Hospital of the University of Pennsylvania and to veterinarians in the Tri-state area.

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Suggested books and references:

- Callan MB, Jones LT, Giger U: Hemolytic transfusion reactions in a dog with an alloantibody to a common antigen. *J Vet Intern Med* 9:277-280, 1995.
- Callan MB, Oakley DA, Shofer FS, Giger U: Canine red blood cell transfusion practice. *J Am Anim Hosp Assoc*, in press, 1996.
- Cotter SM (ed): *Comparative Transfusion Medicine*. Academic Press, New York, 1991 (book).
- Giger U, Gelens CJ, Callan MB, Oakley DA: An acute hemolytic transfusion reaction caused by dog erythrocyte antigen 1.1 incompatibility in a previously sensitized dog. *J Am Vet Med Assoc* 206:1358-1362, 1995.
- Giger U: Transfusion medicine. In: Morgan RV (ed). *Handbook of Small Animal Practice*. Churchill Livingstone, New York, pp 727-731, 1992.
- Hohenhaus AE (ed): *Transfusion Medicine. Problems in Veterinary Medicine*, vol. 4(4), 1992 (book).
- Howard A, Callan MB, Sweeney M, Giger U: Transfusion practices and costs in dogs. *J Am Vet Med Assoc* 201:1697-1701, 1992.
- Kristensen AT, Feldman BF (eds): *Canine and Feline Transfusion Medicine*. *Vet Clinics North Am Sm Anim Pract* 25(6), 1995 (book).
- *Technical Manual*. American Association of Blood Banking, 1995 (book).

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                    Blood typing  
                    Crossmatching  
                    Dog erythrocyte antigen  
                    Transfusion reaction  
                    Blood donors