

# CANINE: GENERAL INFORMATION SHEET



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Dogs have 8 major blood groups called Dog Erythrocyte Antigen (DEA) 1-8. Dogs can present or not, each of the 8 groups. They can therefore be positive for multiple blood groups as they are thought to be inherited co-dominantly.

## **HENCE, A TRUE UNIVERSAL DONOR IS DEA 4 POSITIVE AND NEGATIVE FOR ALL OTHER DEA GROUPS**

The DEA 1 group is the exception having originally listed allelic subgroups: DEA 1.1, DEA 1.2 and even DEA 1.3. Recent advances in monoclonal and immunofluorescence testing have found that DEA 1.2 and 1.3 are erythrocytes with less DEA 1 antigen on their surface rather than separate groups. Detection of even low levels of DEA 1 antigen now means that dogs are either DEA 1 positive or negative only. (Acierno et al., 2014)

Prominence of cell surface antigen: DEA 1.1 > DEA 1.2 > DEA 1.3

(which is why DEA 1.3 is often not mentioned)

DEA 1.2 antibodies which are weak DEA 1 Ab could be used to find reactions to weak Ag that the strong Ab may have missed or destroyed.

It is now rightly or wrongly assumed that DEA 1 variations are only subjective agglutination reactions strengths and not a separate blood group. Therefore dogs will be reported in a binary manner DEA POS or NEG. It must be kept in mind that a reaction may still occur with 1.2 (weak or not) to a previously sensitized 1.2 NEG dog.

## **Acute haemolytic transfusion reactions ONLY occur in DEA 1.1- and DEA 1.2- dogs.**

New blood groups are being detected including Dal (Blais et al., 2007, Goulet et al., 2017), kai-1 (IgM) and kai-2 (IgG) (Euler et al., 2016)

Below is a table showing population incidence as well as antibody production for antigens dogs are negative for:

- Naturally occurring Ab occur in 20% of DEA 3-, 10% of DEA 5- and 20-50% of DEA 7- dogs.

DEA group	Population incidence*	Natural antibody	Transfusion significance
1.1	40-60%	No	can cause an acute hemolytic transfusion reaction
1.2	10-20%	No	can cause an acute hemolytic transfusion reaction
3	5-20%	Yes	Delayed hemolysis
4	90-100%	No	None
5	10-25%	Yes	Delayed hemolysis
6	98-99%	No	Unknown
7	10-45%	Yes	Delayed Haemolysis. Usually reacts only at colder temperatures.
8	40%	No	Unknown
Dal	100%**	No	Acute hemolysis
Kai-1	94%***	Not as yet	Unknown
Kai-2	1%***	Not as yet	Unknown

\*Incidence is breed-dependent, e.g., most Greyhounds are negative for DEA 1.1 (explaining their choice as blood donors) but are positive for DEA 3

\*\* Of 43-75 dogs tested, 100% of non-Dalmation dogs were positive for Dal, 58% were positive DEA-1 (extended gel), 13% were DEA-3 positive, 100% were DEA-4 positive, and 23% were positive for DEA-7 (Kessler et al 2010). In an extended study of 1130 dogs, there were 85.6-100% *Dal*+ Dalmations (n=2-90), 43-79% *Dal*+ Doberman Pinschers (n=14-158), 21-100% *Dal*+ of Shih Tzus (n=2-12) versus 99-100% of other breeds (Goulet et al 2017). *Dal*-reactive antibodies were only found in previously transfused dogs, but we have seen cases of transfusion reactions in *Dal*-negative dogs after the first transfusion. It is unclear how the latter dogs acquired the presumptive anti-*Dal* antibodies. Due to the low prevalence of *Dal*-negative dogs, it is difficult to find a compatible donor for a *Dal*-negative dog with anti-*Dal* antibodies.

\*\*\* Of 503 dogs surveyed (in the same study, 60% were DEA 1 positive) (Euler et al 2016)

Dogs that are DEA 1.1 NEG and 1.2 NEG do NOT have naturally occurring Ab therefore a reaction will only be seen after sensitization of the dog through exposure to DEA 1.1 POS (and DEA 1.2 POS) blood. This sensitization takes 7-10 days after exposure. This is why it is said that the first transfusion "doesn't matter". Even though true to an extent this should no longer the standard we adhere to.

Conversely, dogs that are DEA 3 NEG, DEA 5 NEG and DEA 7 NEG DO produce naturally occurring Ab to DEA 3,5 and 7 positive cells, these groups do not elicit severe hemolytic reactions. What will happen is the transfused cells will be haemolysed more rapidly (within 4 to 5 days) compared to "compatible" blood where the lifespan of erythrocytes will be approx. 21 days. THIS IS A DELAYED REACTION. Therefore

crossmatching in dogs does not need to be done on the FIRST transfusion but MONITORING is still important even on the first transfusion!

In an acute reaction the lifespan of erythrocytes will range from minutes to 12 hours.

### **Example:**

DEA 1.1 – dog receives DEA 1.1+ blood for the first time → all appears successful BUT the delayed reaction cannot always be perceived. Antibody production induces premature extravascular haemolysis of erythrocytes infused. Overall still a “successful” transfusion.

Dog requires a second transfusion, DEA 1.1+ is given again except this time the antibodies are ready and start destroying transfused cells within minutes to hours leading to a SEVERE haemolytic reaction and potentially FATAL.

It is estimated that 25% of the “random” primary transfusions induce the production of DEA 1.1 antibodies.

*NB Ab to DEA 1.1 in DEA 1.1- dogs have been found in dogs exposed during pregnancy. BE CAREFUL!*

Also of note, neonatal isoerythrolysis has been reported in DEA 1.1 negative female dogs (previously sensitized to DEA 1.1+ erythrocytes) mated to DEA 1.1+ male dogs.

**DON'T BE SELFISH! THINK LONG TERM! YOUR TRANSFUSION IS ONLY A BRIEF MOMENT IN THE DOGS LIFE**

## **Blood Typing**

Like in humans not all groups are tested in dogs. The clinically most relevant blood group is DEA 1.1. It is true that many blood groups have no reagents available for testing especially newer groups being discovered. Thankfully few transfusion reactions are reported outside the DEA 1 group.

Alloantibodies (producing a transfusion reaction) can be of the immunoglobulin G or M class and may be haemagglutinins or haemolysins.

Experimental and clinical data showed dogs can be sensitized after a mismatched transfusion (this applies to all groups ie a blood unit positive for one or more blood types not found on the recipients erythrocytes). Dogs cannot be sensitized through pregnancy but this can affect the pregnancy as described with cases of neonatal isoerythrolysis!

- ➔ Pregnancy cannot cause sensitization because of a complete placenta in dogs and therefore does not produce an alloantibody production response. Therefore dogs with prior pregnancies could still be used as donors.

**REMEMBER THAT TRANSFUSION REACTIONS MAY ALSO OCCUR AFTER A SENSITIZED DOG RECEIVES BLOOD THAT IS MISMATCHED FOR AN ANTIGENIC GROUP OTHER THAN DEA 1. THE INCOMPATIBLE BLOOD GROUP CANNOT ALWAYS BE DETERMINED HENCE TYPING DOES NOT EXCLUDE THE NEED FOR CROSSMATCHING!**

**Eg:** A DEA 4 NEG dog has received a second DEA 4 POS transfusion and developed an acute haemolytic reaction

Blood typing cards have become routinely available for DEA 1.1 antigenicity. This is important for 2 reasons:

- 1) Severe reactions
- 2) Safeguarding precious DEA1.1 NEG blood for DEA 1.1 NEG dogs or emergencies

**Care should be taken if the patient's blood is autoagglutinating or has a low hematocrit (<10%).**

Clinicians should check for autoagglutination of blood with saline on a slide or the card. Autoagglutinating blood may first be washed three times with saline to overcome the apparent autoagglutination (similar to a Coombs and crossmatch test). If autoagglutination persists at more than 1+ it is considered to reflect true autoagglutination which precludes typing, coombs and crossmatching because it will always look like DEA 1.1 + blood. In these circumstances DEA 1.1- should be used until the patient does not auto agglutinate anymore and be retyped.

Furthermore, DEA 1.1+ blood from anaemic patients may not agglutinate when exposed to the DEA 1.1 or other reagents. This is called the PROZONE EFFECT. In these cases, some of the patients plasma may be discarded before applying a drop of blood onto the card.

Recently transfused dogs may display a mixed field reaction with only transfused or recipient cells agglutinating. It has been recommended to only ever use a truly universal donor (positive only for DEA 4) for blood transfusions. This should no longer be done due to the low frequency of such donors as well as the difficulty and cost associated with blood typing beyond DEA 1.1.

Typing for more than DEA 1.1 does not eliminate the need for crossmatching after the first transfusion. Crossmatching may help identify incompatibilities against yet unknown blood groups.