Multiple Drug Resistance 1 (MDR1)

Affected breeds:
Australian Shepherd, Border collie, Collie, German Shepherd, Old English Sheepdog, Rough Collie, Shetland Sheepdog, Smooth Collie and other related breeds

Multiple Drug Resistance 1 (MDR1) is caused by a defect in a protein which is responsible for removing certain types of drug from the system. Without this protein these drugs – which may have been administered for a number of reasons including anti-parasitics and anaesthetics – can build up to toxic levels in the bloodstream.
The drug types which are of concern include acepromazine, butorphanol, doxorubicin, emodepside, erythromycin, ivermectin, loperamide, milbemycin, moxidectin, rifampin, selamectin, vinblastine and vincristine.
If an at-risk dog is treated with one of these drugs they are at risk of developing neurologic symptoms that could range from tremors, excess salivation, anorexia, and blindness to coma and even death. Because of the defective ability to metabolize these drugs, they can be lethal even at low doses. The MDR1 mutation does not cause adverse effects in dogs unless the dog is exposed to these drugs. Therefore, veterinarians should be notified when a dog is at risk for Multidrug Resistance 1 prior to administration of any medications.

Multiple Drug Resistance 1 (MDR1) is caused by a recessive genetic mutation, however dogs which have one copy of the mutation may show a low sensitivity to these drugs. Puppies which inherit two copies of the mutation are highly likely to display drug sensitivity.

This test is particularly useful for breeders:

- To identify dogs which carry one or two copies of the mutation so that the use of certain drugs can be avoided or used with caution.
- To identify dogs which carry none, one or two copies of the mutation so that sensible breeding plans can be made.

This test will be reported as:

CLEAR : have two normal copies of DNA and will not show drug sensitivity
1 COPY : have one copy of the MDR1 mutation and may show some drug sensitivity – they will pass the mutation on to 50% of their offspring
2 COPIES : have two copies of the MDR1 mutation and will show drug sensitivity – they will pass the mutation on to all their offspring

The genetic status of dogs can be used to predict breeding outcomes when different combinations are mated:

2 COPIES X 2 COPIES	= 100% 2 COPIES
2 COPIES X 1 COPY	= 50% 2 COPIES, 50% 1 COPY
2 COPIES X CLEAR	= 100% 1 COPY
1 COPY X 1 COPY	= 25% 2 COPIES, 50% 1 COPY, 25% CLEAR
1 COPY X CLEAR	= 50% 1 COPY, 50% CLEAR
CLEAR X CLEAR	= 100% CLEAR

References

Ivermectin sensitivity in collies is associated with a deletion mutation of the mdr1 gene. Mealey KL, Bentjen SA, Gay JM, Cantor GH. Pharmacogenetics. 2001 Nov;11(8):727-33.