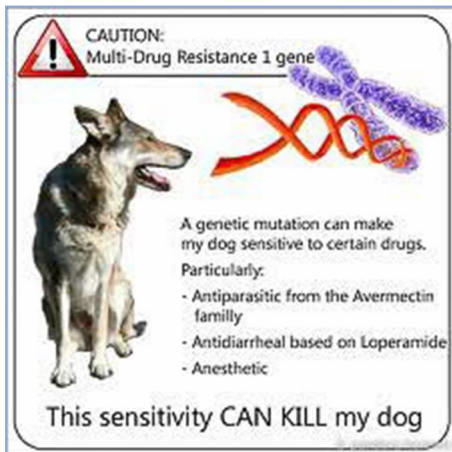


Multi-Drug Resistance 1 (MDR1)

What is MDR1?



MDR1

MDR1 is the abbreviated name of a gene called **Multi-Drug Resistance 1**.

A mutation of this gene causes sensitivity to Ivermectin and a number of other drugs. Dogs with the mutation will react to those drugs. Having two copies (=affected) of the mutation will lead to drug reactions, but having a single copy can also confer some sensitivity with some drugs. Dogs with this mutation have a transport defect: the drug goes in to their brains, fails to be transported out, and builds up to toxic levels. This causes serious neurological problems including seizures and sometimes death.

Drug Name	Category
Ivermectin, Doramectin, Abamectin, Emodepside, Milbemycin, Moxidectin, Selamectin, Metronidazole, Nitroscanate	1
Loperamide, Metoclopramide	2
Acepromazine, Butorphanol, Morphine, Buprenorphine, Fentanyl	3
Domperidone, Cimetidine, Ranitidine, Ondansetron	4
Phenytoin	5
Estradiol	6
Miltefosina, Levamisole	7
Cyclosporin, Dexamethasone	8
Digoxin, Digitoxin, Quinidine, Diltiazem, Verapamil	9
Erythromycin, Spiramycin, Enrofloxacin	10
Doxycycline, Grepafloxacin, Sparfloxacin, Rifampicin	11
Ketoconazole, Itraconazole	12
Vincristine, Vinblastine, Doxorubicin	13
Paclitaxel, Dactinomycin, Mitoxantrone, Etoposide	14

Mutation MDR1 DANGEROUS DRUGS

- 1 ANTIPARASITIC
- 2 ANTIDIARRHEAL
- 3 ANTIEMETIC
- 4 PRE-ANESTHETIC / ANELGESIC
- 5 ANTILULCER
- 6 ANTI-EPILEPTIC
- 7 STEROID
- 8 ANTIPROTOZOAL
- 9 IMMUNOMODULATOR
- 10 IMMUNOSUPPRESSIVE
- 11 CARDIAC
- 12 ANTIBACTERIAL
- 13 ANTIFUNGAL
- 14 ANTINEOPLASTIC

● Totally Prohibited
 ● Potential High Risk
 ● Caution and minimum doses
 ● Prevention for some past cases of toxicity

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MDR1

Which drugs cause reactions?

Ivermectin was the first drug recognized to cause a reaction, but it is far from the only one. Ivermectin at low dosage, as found in heartworm medications, will not cause a reaction. The larger doses needed for worming will. Other commonly administered drugs on the list include Acepromazine and Imodium. Fortunately, there are alternative medications available if your dog requires treatment.

There is an extremely accurate DNA test that will let you know whether your dog has this mutation. All you have to do is provide a cheek swab.

There are 3 outcomes possible: clear/normal , carrier, affected

Clear/normal = free $+/+$

Carrier = one copy of the mutation $+/-$

Affected = two copies of the mutation $-/-$

For breeders it is extremely important to know whether the parent dogs have this mutation. See diagram below to understand why breeders should not breed a carrier to a carrier, or a carrier to an affected dog:

MDR1		Result female		
		Clear $(+/+)$	Carrier $(+/-)$	Affected $(-/-)$
Result male	Clear $(+/+)$	100% $(+/+)$	50% $(+/+)$ 50% $(+/-)$	100% $(+/-)$
	Carrier $(+/-)$	50% $(+/+)$ 50% $(+/-)$	25% $(+/+)$ 50% $(+/-)$ 25% $(-/-)$	50% $(+/-)$ 50% $(-/-)$

	Affected (-/-)	100% (+/-)	50% (+/-) 50% (-/-)	100% (-/-)
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