



**Dogs who test as having a mutated mdr1 gene OR dogs from afflicted breeds, such as collies, rough and smooth, who have not been tested for the mutation should avoid these drugs.**

Drug names in bold are the generic drugs researched and identified as problems by the scientists from the **Veterinary Clinical Pharmacology Laboratory at Washington State University**. Below each generic drug is a list of some of the synonyms, brand, and trade names for the generic drug. More drugs are likely to be added as mdr1 research progresses.

### Drugs **PROVEN** to Cause Neurotoxicity

**Ivermectin** (antiparasitic agent)- This drug should be avoided in all dogs with the MDR1 mutation.

Abamectin	Dimmitrol	Eqvalan	Iversol	Nuheart	Stromectol
Acarexx	Doramectin	Heartguard	Ivexterm	Panomec	Tri-Heart
Advantage DUO	Ecomectin	Ivercare	Ivomec	Phoenection	Unimectrin
Avermectin	Equell	Ivercide	Mectizan	Primectin	Value Heart
Bimectin	Equimax	Iverhart	Megamectin	Privermectin	Virbamec
BMD/Ivomec	Equimectrin	Iver-On	Noromectin	SparMectin	Zimecterin

**Loperamide** (antidiarrheal agent)- This drug should be avoided in all dogs with the MDR1 mutation.

Acanol	Diahalt	Imogen	Loperacap	Rediarin
Acqta	Diamode	Imperim	Nodiamex	Top-Dal
Anti-Diarrheal Formula	Diarr-Eze	Kao-Paverin	PeptoBismol	Valfam
Cryoperacid	Diarrhea Relief	Kaopectate	Permidal	
Deroser	Hurplex	Lomotil	Pramidal	
	Imodium	Lop	Raxamida	

**Acepromazine** (tranquilizer and pre-anesthetic agent)-In dogs with the MDR1 mutation, acepromazine tends to cause more profound and prolonged sedation. VCPL at Washington State University recommend reducing the dose by 25% in dogs heterozygous for the MDR1 mutation (mutant/normal) and by 30-50% in dogs homozygous for the MDR1 mutation (mutant/mutant).

Ace	Aceproject	ACP	PromAce
Acepro	Acevet	Atravet	

**Butorphanol** (analgesic and pre-anesthetic agent)-Similar to acepromazine, butorphanol tends to cause more profound and prolonged sedation in dogs with the MDR1 mutation. VCPL at Washington State University recommend reducing the dose by 25% in dogs heterozygous for the MDR1 mutation (mutant/normal) and by 30-50% in dogs homozygous for the MDR1 mutation (mutant/mutant).

Dolorex	Stadol	Torbugesic	Torbutrol	Torphajet
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**Emodepside** (Profender)-is a deworming drug approved for use in cats only in the U.S., but is approved for use in dogs in some other countries. Use of this drug in dogs with the MDR1 mutation has resulted in neurological toxicity.

**Erythromycin**. Erythromycin belongs to a group of antibiotics and may cause neurological signs in dogs with the MDR1 mutation. A mutant/mutant collie exhibited signs of neurological toxicity after receiving erythromycin. After withdrawal of the drug, the dogs neurological signs resolved. There were no other potential causes of neurological toxicity identified in the dog.

**Vincristine, Vinblastine, Doxorubicin** (chemotherapy agents). Based on some published and ongoing research, it appears that dogs with the MDR1 mutation are more sensitive to these drugs with regard to their likelihood of having an adverse drug reaction. Bone marrow suppression (decreased blood cell counts, particularly neutrophils) and GI toxicity (anorexia, vomiting, diarrhea) are more likely to occur at normal doses in dogs with the MDR1 mutation. To reduce the likelihood of severe toxicity in these dogs, MDR1 mutant/normal dogs should have their dose reduced by 25% while MDR1 mutant/mutant dogs should have their dose reduced by a full 50%. These patients should be closely monitored for adverse effects.

<b>Doxorubicin</b>	Doxolem	Myocet	Velban	Oncovin
Adriamycin	Doxotec	Oxicina	Velbe	Vinblax
Adriblastina	Hydroxydaunomycin	Rubex	<b>Vincristine</b>	Vincasar
Caelyx	Hydroxydoxorubicin	<b>Vinblastine</b>	Citomid	Vinorex
Doxil	Hydroxyldaunorubicin	Lemblastine	Leurocristine	Vintec

**Selamectin, milbemycin, and moxidectin** (antiparasitic agents)-Similar to ivermectin, these drugs are safe in dogs with the mutation if used for heartworm prevention at the manufacturer's recommended dose. Higher doses (generally 10-20 times higher than the heartworm prevention dose) have been documented to cause neurological toxicity in dogs with the MDR1 mutation.

<b>Selamectin</b>	<b>Milbemycin</b>	<b>Milbemycin Oxine</b>	Advantage Multi
Revolution	Interceptor Spectrum	Sentinal Spectrum	Advocate
		Milbemax	Proheart 6
		<b>Moxidectin</b>	

(Note: Dogs in the afflicted breeds should use milbemycin oxide for a heartworm preventative if required as it's generally considered a safer alternative. The Moxidectin alternative is still being questioned by the Collie community as adverse reactions have been known to happen with some brands listed.)

**Drugs that are known to be pumped out of the brain by the protein that the MDR1 gene is responsible for producing but **APPEAR** to be safely tolerated by dogs with the MDR1 mutation:**

**Cyclosporin** (immunosuppressive agent)-While VCPL at Washington State University know that cyclosporin is pumped by P-glycoprotein (the protein encoded by the MDR1 gene), they have not documented any increased sensitivity to this drug in dogs with the MDR1 mutation compared to "normal" dogs. Therefore, do not recommend altering the dose of cyclosporin for dogs with the MDR1 mutation, but do recommend therapeutic drug monitoring.

Atopica	Cyclosporine	Modusik-A	Restasis	Supremunn
Cicloral	Gengraf	Neoral	Sandimmune	
Ciclosporin	Immulem	Optimmune	SangCya	

**Digoxin** (cardiac drug)- While VCPL at Washington State University know that digoxin is pumped by P-glycoprotein (the protein encoded by the MDR1 gene), they have not documented any increased sensitivity to this drug in dogs with the MDR1 mutation compared to "normal" dogs. Therefore, do not recommend altering the dose of digoxin for dogs with the MDR1 mutation, but do recommend therapeutic drug monitoring.

Digibind	Digitalis	Lanoxicaps	Lanoxin	Mapluxin
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**Doxycycline** (antibacterial drug)- While VCPL at Washington State University know that doxycycline is pumped by P-glycoprotein (the protein encoded by the MDR1 gene), they have not documented any increased sensitivity to this drug in dogs with the MDR1 mutation compared to "normal" dogs. Therefore, do not recommend altering the dose of doxycycline for dogs with the MDR1 mutation.

**Drugs SUSPECTED to Cause Neurotoxicity (research is ongoing)**

<b>Domperidone</b>	<b>Buprenorphine</b>	M-Eslon	Onxol	<b>Rifampicin</b>
Motilium	<b>Fentanyl</b>	MOS	Paclisan	IsonaRif
<b>Etoposide</b>	<b>Morphine</b>	MS Contin (MSC)	Praxel	Rifadin
EPEG	Analfin	MSIR	Taxol	Rifamate
Etopophos	Apokyn	Oramorph	<b>Quinidine</b>	Rifampin
Etopos	Astramorph	RMS	Biquin	Rifater
Toposar	Avinza	Roxanol	Chinidinum	Rimactane
Vepesid	DepoDur	Stalex	Cin-Quin	RMS
VP-Tec	Doloral	<b>Ondansetron</b>	Quinact	Rofact
<b>Mitoxantrone</b>	Duralmor	Zofran	Quinaglute	Roxanol
Formyxan	Duramorph	<b>Paclitaxel</b>	Quinalan	
Mitroxone	Graten	Abraxane	Quinatime	
Neotalem	Infumorph	Asotax	Quinidex	
Novantrone	Kadian	Bris Taxol	Quinora	

There are also drugs listed below that the Collie owning community in Australia have come across over the years that Collies have had adverse reactions too. To our knowledge these drugs have not been scientifically researched, we request therefore that you thoroughly research the drugs yourself, and are aware of their side effects before you administer them to you dog.

Deramaxx (anti inflammatory)	Rimadyl (anti inflammatory)
Dexamethasone (steroid)	Tacrolimus (immunosuppressants)
Grepafloxacin (antibiotic)	Advantix (contains Permethrin highly toxic to cats)
Hydrocortisone (steroid)	
Xylitol (Sugar free sweetener toxic to all breeds of dogs)	

Please note that the information above is current as at April 2019, but due to ongoing research in this field, the above information is subject to change at any time.

Please also ensure that your vet is aware of the possible drug sensitivity of your dog.

***Your Collie's life could depend on it.***