



Dogs who DNA 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**. More drugs are likely to be added as mdr1 research progresses.

Drugs PROVEN to Cause Neurotoxicity

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).

Apomorphine, one of the most effective medications that can induce vomiting in dogs. Contact MDR1Caddie™ for dosing recommendations.

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).

Cyclosporine, An immunosuppressive agent that is used to treat a spectrum of inflammatory and immune-mediated diseases in dogs. Contact MDR1Caddie™ for dosing recommendations

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.

Grapiprant, This analgesic and anti-inflammatory drug is primarily used as a pain relief for mild to moderate inflammation related to osteoarthritis in dogs. Contact MDR1Caddie™ for dosing recommendations

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

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

Maropitant. An antiemetic used to treat vomiting and motion sickness in dogs and cats. It also may act as a mild pain control medication. Contact MDR1Caddie™ for dosing recommendations.

Milbemycin, and Moxidectin, Selamectin (antiparasitic agents)-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.

Afoxolaner	Nexgard	The manufacturer of Nexgard has tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. Dogs with the MDR1 mutation are not at increased risk for adverse effects.
Fluralaner	Bravecto	The manufacturer of Bravecto has tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. Dogs with the MDR1 mutation are not at increased risk for adverse effects.
Milbemycin	Interceptor, Interceptor Plus	The manufacturer of Interceptor has tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. The FDA determined Interceptor is safe for dogs with the MDR1 mutation when used at label doses. For other formulations of milbemycin <u>contact MDR1Caddie™</u> for dosing recommendations.
Milbemycin Oxine	Sentinal Spectrum	The manufacturers of these products have tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. The FDA has determined that these products are safe for dogs with the MDR1 mutation when used at label doses.

Moxidectin	ProHeart, Simparica Trio, Nexgard Plus, Advantage Multi	The manufacturers of these products have tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. The FDA has determined that these products are safe for dogs with the MDR1 mutation when used at label doses.
Selamectin	Revolution	The manufacturer of Revolution has tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. The FDA determined Revolution is safe for dogs with the MDR1 mutation when used at label doses.
Sarolaner	Simparica	The manufacturer of Simparica has tested the product for safety in dogs with the MDR1 mutation. No adverse effects were observed. Dogs with the MDR1 mutation are not at increased risk for adverse effects.

(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).

Ondansetron, Most often used in dogs and cats undergoing chemotherapy, to stop the vomiting caused by anti-cancer drugs. It is given to veterinary patients when other drugs have not controlled severe vomiting or when patients are unable to tolerate the more commonly prescribed anti-emetics. Contact MDR1Caddie™ for dosing recommendations.

Vincristine, Vinblastine, Vinorelbine, 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

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:

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.

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*)

Domperidone	Mitoxantrone	Fentanyl	Paclitaxel	Rifampicin
Etoposide	Buprenorphine	Morphine	Quinidine	

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

Please note that the information above is current as at January 2025, 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.

References:
 Veterinary Clinical Pharmacology Laboratory at Washington State University at <https://prime.vetmed.wsu.edu/2022/03/01/problem-medications-for-dogs/>
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Dosage recommendations can be obtained at: <https://secure.vetmed.wsu.edu/VCPLContactUs/MDR1Caddie>