Ethylene Glycol (Antifreeze) Poisoning in Dogs and Cats

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Toxin
Ethylene Glycol

Source
Antifreeze, solvents, rust removers, film processing solutions, and taxidermist's preservation solutions.

General Information
Ethylene glycol is an extremely dangerous toxin. It is metabolized by the liver. The metabolites that are produced cause the damage to organs and subsequent symptoms. The metabolites (in the form of oxalates) are most toxic to the kidneys. Many brands of antifreeze contain phosphorus rust inhibitors also, which may increase the phosphorus levels in the bloodstream. Antifreeze has a sweet taste that animals and children like. Be very careful to make sure vehicles do not leak antifreeze and that all antifreeze is cleaned up when changing the fluid.

Tests for ethylene glycol poisoning are not perfect. Urine may be examined for the presence of calcium oxalate crystals which may be seen as early as Stage 1 (see below). However, these crystals may be seen in normal healthy animals also. In an ethylene glycol poisoning, once crystals are found in the urine, kidney damage has already begun.

A test kit for dogs is available which detects ethylene glycol, but not its metabolites. It is useful within 1-4 hours of ingestion. Before or after that time period, a false negative test result may be obtained since either the ethylene glycol has not yet entered the bloodstream, or it has already been broken down into its metabolites. To perform the test, various chemicals are added to a blood sample and if ethylene glycol is present, a color change occurs. This test is not sensitive enough for use in cats.

Antifreeze products containing propylene glycol such as Sierra™ are safer and are unpleasantly flavored to prevent ingestion. These safer products will not metabolize into oxalate, but could cause problems related to the propylene glycol such as Heinz body anemia.

Toxic Dose
Dogs: 2-3 ml per pound of body weight (1 tablespoon for a 20 pound dog).
Cats: 0.64 ml per pound of body weight (1 teaspoon of ethylene glycol diluted 50:50 with water in radiator fluid is toxic to the average-sized cat).

Signs
There are three stages of poisoning.

Stage 1: 0-12 hours after ingestion. Nervous system signs including mild depression, ataxia, knuckling, seizures, hyperexcitability, stupor, and rarely coma, and death. These signs are similar to acute alcohol intoxication and resemble drunkenness. Other symptoms may include lack of appetite, vomiting, drop in body temperature, and an increase in drinking and urination.

Stage 2: 12-24 hours after ingestion. Cardiopulmonary system signs are seen including increased heart rate and respiratory rate.

Stage 3: 12-72 hours after ingestion. Kidneys are affected. Symptoms include severe depression, vomiting, diarrhea, dehydration, kidney failure, and death.

Immediate Action
Induce vomiting and seek veterinary attention immediately.

Veterinary Care
General treatment: The induction of vomiting may be continued, gastric lavage is performed, and activated charcoal is administered.
Supportive treatment: Hydration and the correct acid base balance are maintained with IV fluids. Oxygen is given as needed. Peritoneal dialysis helps remove the ethylene glycol from the body, if used early.
Specific treatment: Ethanol, or 1,3-butanediol and 4-methylpyrazole are given to stop the metabolism of ethylene glycol into its damaging metabolites. Starting treatment early before permanent kidney damage occurs is essential. The treatment process requires several days, and supportive care may need to be given for weeks. Some veterinarians may refer the pet to a specialized veterinary center for treatment.

Prognosis
Grave, if exhibiting any clinical signs; guarded, if treatment begins within an hour of ingestion.