

Ethylene Glycol (Antifreeze) Poisoning

Basics

OVERVIEW

- Results from ingesting substances containing ethylene glycol (such as antifreeze)
- Common in small animals (such as dogs and cats)
- Highest fatality rate of all poisons; fatality rates higher for cats than dogs
- Higher likelihood of pet having ethylene glycol (antifreeze) poisoning in colder areas, where antifreeze use is more common

SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs, cats, and many other species, including birds

Mean Age and Range

- Any age is susceptible (3 months-13 years)
- Mean—3 years of age

SIGNS/OBSERVED CHANGES IN THE PET

- Signs are dependent on the amount of ethylene glycol (antifreeze) ingested
- Almost always sudden (acute)
- Signs caused by ethylene glycol itself and its toxic metabolites (frequently fatal); “metabolites” are substances produced by the body's chemical processes as it breaks down the ethylene glycol
- Early signs—seen from 30 minutes to 12 hours after ingestion of ethylene glycol in dogs; nausea and vomiting; mild to severe depression; wobbly, incoordinated or “drunken” appearing gait or movement (known as “ataxia”) and knuckling; twitching muscles; short, rapid movements of the eyeball (known as “nystagmus”); head tremors; decreased withdrawal reflexes and righting ability; increased urination (known as “polyuria”) and increased thirst (known as “polydipsia”)
- Dogs—with increasing depression, the pet drinks less but increased urination (polyuria) continues, resulting in dehydration; central nervous system signs lessen transiently after approximately 12 hours, but return later
- Cats—usually remain markedly depressed; do not exhibit increased thirst (polydipsia)
- Production of only small amounts of urine (known as “oliguria”) often develop in dogs 36–72 hours after ingestion of ethylene glycol (antifreeze) and in cats 12–24 hours after ingestion of ethylene glycol; lack of production of urine (known as “anuria”) is seen 72–96 hours after ingestion of ethylene glycol—if untreated
- May note severely low body temperature (known as “severe hypothermia”)
- Severe sluggishness (lethargy) or coma
- Seizures
- Lack of appetite (known as “anorexia”)
- Vomiting
- Oral ulcers
- Salivation or drooling
- Kidneys—often swollen and painful, particularly in cats



CAUSES

- Ingestion of ethylene glycol, the principal component (95%) of most antifreeze solutions; food in the stomach delays absorption

RISK FACTORS

- Access to ethylene glycol—widespread availability; somewhat pleasant taste; small minimum lethal dose (in other words, ingestion of a small amount can kill a pet); lack of public awareness of toxicity of ethylene glycol-containing antifreeze

Treatment

HEALTH CARE

- Cats—usually inpatient
- Dogs—usually outpatient if presented to veterinarian under 5 hours from the time of ingestion and treated with fomepizole; inpatient if presented to veterinarian more than 5 hours after the time of ingestion for intravenous fluids to correct dehydration, increase blood flow to the tissues, and promote production of urine (known as “diuresis”)
- Goals—prevent absorption of ethylene glycol into the body; increase excretion or removal of ethylene glycol from the body; prevent chemical processing (metabolism) of ethylene glycol by the body to toxic compounds
- Induction of vomiting and flushing of the stomach (known as “gastric lavage”) with administration of activated charcoal are not recommended, unless they can be performed in the first 30 minutes following ingestion, due to the rapid absorption of ethylene glycol
- Intravenous fluids—correct dehydration, increase blood flow to the tissues, and promote production of urine (diuresis); accompanied by administration of bicarbonate (given slowly intravenously) to correct metabolic acidosis (condition in which the pH of the body is too low)
- If the pet develops excess levels of urea and other nitrogenous waste products in the blood (known as “uremia” or “azotemia”) and kidney failure characterized by production of small amounts of urine (oliguria) in dogs—most of the ethylene glycol has been metabolized; little benefit from treatment specifically designed for ethylene glycol poisoning; correct fluid, electrolyte, and acid–base disorders; promote production of urine (diuresis); medications to induce production and elimination of urine (known as “diuretics”; particularly mannitol) may help; peritoneal dialysis (a type of dialysis in which fluids are put into the abdomen and the lining of the abdomen [known as the “peritoneum”] acts as a filter to remove waste products from the blood; after a certain amount of time, the fluids and waste products are removed from the abdomen) may be useful; may need extended treatment (several weeks) before kidney function is reestablished

SURGERY

- Kidney transplantation—successfully employed in cats with ethylene glycol–induced kidney failure

Medications

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive

DOGS

- Fomepizole (4-methyl pyrazole; Antizol-Vet®)—effectively inhibit ethylene glycol metabolism; non-toxic to liver, more expensive than ethanol but requires less intensive care
- Ethanol, propylene glycol, 1,3-butanediol—alternative drugs; high affinity, inhibit metabolism of ethylene glycol; may cause central nervous system depression; even in early stages of ethylene glycol (antifreeze) poisoning, requires hospitalization for approximately 3 days; constant intravenous (IV) infusion (ethanol and fluids); continuous monitoring for breathing and acid–base status

CATS

- Fomepizole (4-methyl pyrazole; Antizol-Vet®)—cats must be given a much higher dose of fomepizole than dogs
- Ethanol—use if fomepizole not available; given in an intravenous (IV) drip

Follow-Up Care

PATIENT MONITORING

- Bloodwork to monitor the kidneys (such as blood urea nitrogen [BUN]), acid–base status, and urine output—monitored daily for the first few days
- Monitor urine pH to determine response to treatment of acidosis

PREVENTIONS AND AVOIDANCE

- Increasing awareness of the toxicity of ethylene glycol (found in most brands of antifreeze)—help prevent exposure; earlier treatment of pets
- Use new antifreeze products, containing propylene glycol (relatively non-toxic)

POSSIBLE COMPLICATIONS

- Without excess levels of urea and other nitrogenous waste products in the blood (azotemia)—usually no complications
- Urine concentrating ability—may be impaired with excess levels of urea and other nitrogenous waste products in the blood (azotemia); pets recover
- Death

EXPECTED COURSE AND PROGNOSIS

- Untreated—kidney failure characterized by the production of only small amounts of urine (oliguria) is seen in dogs at 36–72 hours after ingestion of ethylene glycol and in cats at 12–24 hours following ingestion; lack of production of urine (anuria) is seen by 72–96 hours following ingestion; pets < 6 months of age with oliguric failure sometimes fully recover
- Kidney failure may lead to death
- Dogs treated less than 5 hours following ingestion of ethylene glycol—prognosis is excellent with fomepizole treatment
- Dogs treated up to 8 hours following ingestion of ethylene glycol—most recover
- Dogs treated up to 36 hours following ingestion of ethylene glycol—may benefit from prevention of the body's chemical processing (metabolizing) of any remaining ethylene glycol
- Cats treated within 3 hours following ingestion of ethylene glycol—prognosis is good
- If a large quantity of ethylene glycol is ingested, prognosis is poor, unless treated within 4 hours of ingestion
- Pets with excess levels of urea and other nitrogenous waste products in the blood (azotemia) and kidney failure characterized by the production of only small amounts of urine (oliguria)—prognosis poor; almost all of the ethylene glycol will have been chemically processed by the body (metabolized) to toxic metabolites

Key Points

- Ethylene glycol poisoning results from ingesting substances containing ethylene glycol (such as antifreeze)
- Signs are dependent on the amount of ethylene glycol ingested
- Ethylene glycol is readily available in many brands of antifreeze; it has a somewhat pleasant taste that attracts pets to ingest it; ethylene glycol has a small minimum lethal dose (in other words, ingestion of a small amount can kill a pet)
- The public needs to be aware of toxicity of ethylene glycol—containing antifreeze; people should take precautions to safeguard their pets and other pets from potential sources of ethylene glycol