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Hidden dangers of ethylene glycol

ETHYLENE glycol is found in vehicle antifreeze, some vehicle screen washes and de-icers. It is very toxic to domestic animals, particularly cats. It is said to be sweet-tasting and is perhaps palatable. However, it rarely causes serious effects in children, and many products have bittering agents added to them. What is not clear is whether cats and dogs are attracted to antifreeze or deterred by the bittering agents used.

MOST antifreeze is more or less pure ethylene glycol; some ready-to-use radiator top-up fluids are approximately 50 per cent pure. Most car engines will have around 50 per cent antifreeze in their cooling system. It follows that both the neat product and run-off or drained antifreeze is a danger to pets.

Whatever the taste, only a few millilitres could cause serious toxicity and death in cats, and not much more will have the same effect in dogs. The often-quoted lethal dose in cats is around 1g (or 1ml)/kg – effectively any amount. For dogs it might be somewhat more and we recommend intervention for more than 2ml/kg of undiluted product.

Ethylene glycol itself is not the major toxicant. The parent compound is metabolised by alcohol dehydrogenase to form glycoaldehyde, which is then metabolised to glycolic acid, responsible for the acidosis seen with these poisonings. Oxalate, a metabolite of glycolic acid, causes renal damage and hypocalcaemia by binding to calcium to form calcium oxalate. Calcium oxalate crystals appear in the urine of poisoned animals – a useful diagnostic aid as the crystals may be visible in urine samples when left to stand. Aldehydes produced may inhibit oxidative phosphorylation and respiration.

Treatment of ethylene glycol ingestion is aimed at blocking the formation of these toxic metabolites and, therefore, the longer the delay between ingestion and treatment initiation the less favourable the prognosis. Cats that present late after exposure

and are already unwell (where ingestion is not witnessed) may have a poor prognosis. Once renal damage has occurred the outcome is likely to be very poor and at this stage antidotal treatment is of limited or no benefit.

Ethanol is an antidote to ethylene glycol poisoning as it is the preferred substrate for alcohol dehydrogenase. Metabolism of ethylene glycol is blocked by administration of ethanol and is excreted as the parent compound with very limited toxic metabolites. Ethanol should be considered in any symptomatic case presenting within 24 hours of supposed ingestion; the sooner the better. There is no point giving ethanol to block ethylene glycol metabolism if it has already been metabolised. Ethanol should not be given to an animal in renal failure as it is unlikely to be effective and may be detrimental.

Fomepizole (4-methylpyrazole or 4-MP) is another direct inhibitor of alcohol dehydrogenase; this antidote is often used

in human poisonings due to limited adverse effects and a slower elimination. Clinical reports suggest fomepizole is successful in treating ethylene glycol toxicity in dogs and recent evidence suggests in cats also. However, fomepizole is not widely available, even for human poisonings, and is very expensive.

While the severity of poisoning from ethylene glycol cannot be underestimated, and the fatality rate is high – especially in cats – aggressive treatment as early as possible (of which the above is only a summary and partial) can be successful.

Be aware of cats presenting with a history of potential antifreeze exposure (or where there may have been an “outbreak” of such poisonings locally) that have central nervous system signs (due early on to unmetabolised ethylene glycol), including depression, vomiting, ataxia, tachycardia and weakness. They may also have polyuria, polydipsia, dehydration, tachypnoea, acidosis and hypothermia. ■

Ethanol treatment

- Ethanol is available as medicinal, pharmaceutical-grade injectable material and is the preferred treatment. However, it is not widely held by veterinary practices.
- Vodka is widely available, if not actually held by veterinary practices.
- Oral use – it is possible to give ethanol orally; however, the disadvantage is that animals are often already unwell and even diluted vodka may induce vomiting.
- A constant-rate infusion is preferred (to achieve more consistent ethanol levels high enough to block metabolism of ethylene glycol, but not so high as to cause toxicity) and if there is no IV ethanol available then IV vodka may be used.

For advice in handling specific cases of ethylene glycol poisoning, or any other animal poisoning case, readers may contact the VPIS on 020 7188 0200.

POISONS