# Student Paper Communication étudiante

## Intravenous lipid emulsion for treating permethrin toxicosis in a cat

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**Abstract —** A 2-year-old cat was presented with acute onset seizures, tremors, and hypersalivation. Permethrin toxicity was diagnosed based on a history of recent flea treatment. Measures were taken to minimize further absorption of permethrin, and methocarbamol and intravenous lipid emulsion were used to control tremors. The cat recovered and was discharged within 42 h.

**Résumé — Émulsion lipidique intraveineuse pour traiter une toxicose causée par la perméthrine chez un chat.** Un chat âgé de deux ans a été présenté avec des crises d'épilepsie aiguës, des tremblements et de l'hypersalivation. Une toxicité causée par la perméthrine a été diagnostiquée en se fondant sur une anamnèse d'un traitement récent contre les puces. Des mesures ont été prises pour minimiser l'absorption continue de la perméthrine et le méthocarbamol et une émulsion lipidique intraveineuse ont été utilisés pour contrôler les tremblements. Le chat s'est rétabli et a reçu son congé après 42 h.

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### Case description

A 2-year-old spayed domestic shorthair cat was presented as an emergency to Van Isle Veterinary Hospital, Courtenay, British Columbia, for acute onset of tremors, seizures, and hypersalivation. Upon physical examination, temperature, pulse, and respiration were within normal limits, but the cat was exhibiting seizures, tremors, and hypersalivation. The history revealed that the cat had received a flea treatment of Zodiac PowerSpot for dogs [permethrin 45%, (s)-methoprene 2.9%; Wellmark International, Guelph, Ontario] about 2 h earlier. The patient was diagnosed with permethrin toxicity. The owner indicated that treatment would need to be constrained because of financial reasons.

The patient was given a bath with a gentle shampoo for dermal decontamination to reduce cutaneous exposure. A 20-mL volume of 20% activated charcoal suspension (Charcodote; Pharmascience, Montreal, Quebec) was administered orally to reduce gastrointestinal absorption in the event of possible oral exposure. An IV catheter was placed and Normosol-R (Abbott, Montreal, Quebec) fluid therapy was initiated at maintenance rate. Injectable methocarbamol (Methocarbamol; Summit Veterinary Pharmacy, Aurora, Ontario) was administered as needed to control body tremors and twitching: after 2 h, 250 mg/kg body weight (BW) had been administered. The maximum recommended daily dose is 330 mg/kg BW (1). As a means of reducing treatment costs, and keeping tremors under control without exceeding the recommended daily dose of methocarbamol, intravenous lipid emulsion therapy was started. A 1.5 mL/kg BW bolus of a 20% fat emulsion (Intralipid 20%; Fresenius Kabi, Cheshire, United Kingdom) was given via a cephalic catheter, followed by a constant rate infusion at 0.25 mL/kg BW per minute for 60 min. The cat exhibited a good response and there was marked reduction in the severity of twitching. Intravenous Normosol-R (Abbott) was continued at 2 mL/kg BW per hour overnight.

The following morning the cat was able to sit up on its own but was still exhibiting severe twitching. Temperature, pulse rate, and respiratory rate were within normal limits. Intralipid therapy was repeated at 0.25 mL/kg BW per minute for 60 min, and a marked reduction in tremors was again noted. Intravenous Normosol-R (Abbott) was continued at 2 mL/kg BW per hour. By the evening, the patient looked much better, was bright and alert, eating and drinking on her own, and urinating in the litter box. Mild body tremors were still present.

The next morning (approximately 36 h after presentation), the only residual effect of the toxicosis was mild facial twitching. No additional methocarbamol was required after intralipid therapy was implemented. Intravenous fluids were discontinued and the catheter was removed. The patient was discharged approximately 42 h after initial presentation for continued monitoring at home.

### Discussion

Permethrins are a class I pyrethroid insecticide, a synthetic analog of pyrethrins. Pyrethrins are naturally occurring extracts from the flowers of *Tanacetum (Chrysanthemum) cinerariifolium.*

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Permethrin is a neurotoxicant that acts on gated sodium channels in the cell membranes of muscle and nervous tissue (2,3). Thus, permethrin toxicosis manifests clinically with tremors, ataxia, hyperesthesia, hypersalivation, hyperthermia and, in severe cases, seizures and death can occur (3,4). Permethrin has a low toxicity in most mammalian species and is commonly found in spot-on pesticides used for flea control (2). It is not fully understood why cats are particularly sensitive, though it may be related to a deficiency in glucoronyl transferase. This deficiency results in slower hepatic metabolism of permethrin and increased time for absorption into target tissues (2,4). Permethrins are reported to be the most common cause of poisoning in cats in the USA (5).

Cats may be exposed from cutaneous application of topical products, oral ingestion, and direct contact with topically treated dogs (6). Many pet products contain permethrins, including over the counter spot-ons, flea sprays, flea collars, and flea shampoos. Products that contain over 40% permethrin are labeled for use in dogs only (6). There has been significant concern in the veterinary community about the inadequate labeling of these products and lack of control over their sale, which has resulted in many deaths of feline patients. This could easily be prevented by having more obvious safety warnings on product labels and by improved client education (3,7).

Clinical signs following exposure usually appear within a few hours of application, though they may be delayed up to 72 h. There does not appear to be any correlation between the amount of permethrin applied and the severity of clinical signs (2).

Treatment protocols aim to control the clinical signs while the toxicant is metabolized and excreted (4) and focus on early seizure control, decontamination, and supportive care (2). Control of seizures is often accomplished using either diazepam or midazolam. If seizures continue after administration of benzodiazepine, propofol or alfaxalone may be considered. Methocarbamol is the most commonly used drug to control muscle fasciculation. Other management includes skin decontamination, ensuring a patent airway, IV crystalloids, and temperature monitoring (2). The intravenous route is preferred over the oral route for administration of methocarbamol because of its rapid onset of action, ability to titrate to effect, and safety in compromised patients. On average, it takes 2 to 3 days for cats to recover, though recovery periods of up to 7 d have been reported (3).

Intravenous lipid emulsion (ILE) has been used in treatment of lipophilic toxicities, such as intravenous local anesthetic overdose, moxidectin toxicosis in dogs, and lidocaine toxicosis in cats (4). Permethrins are highly lipophilic molecules, thus there is potential that ILE can be used as adjunct therapy in treating toxicities (4). The exact mechanism of ILE is speculative, though the prevailing hypothesis is the "lipid sink" theory. This theory suggests that expanding the lipid compartment in the blood sequesters fat-soluble toxins within the intravascular space and away from target tissues (nervous and muscle tissue, in the case of permethrins) (6). Adverse effects of ILE are uncommon, and most are due to long-term use as parenteral nutrition. These may include hyperlipidemia, icterus, seizures, hemolytic anemia, and thrombocytopenia (6).

In the present case, the use of ILE significantly reduced the amount of methocarbamol required to control clinical signs. Typical therapy is expensive due to hospitalization and drug costs, so ILE may be a reasonable option to help reduce costs associated with treatment of permethrin toxicosis and reduce the number of cases euthanized due to financial constraints.

Before using ILE, owners should be fully informed of its off-label use and potential for adverse reactions. However, in cases where clinical signs are difficult to control, conventional therapy is unavailable, or euthanasia is imminent, ILE appears to be a relatively safe and inexpensive alternative (4).

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