

ORGANOPHOSPHATE AND CARBAMATE TOXICITY

(TYPES OF INSECTICIDE POISONING)

BASICS

OVERVIEW

- Organophosphates and carbamates are insecticides used to control insects on animals and plants, around the home and yard, and in agricultural settings
- Organophosphates and carbamates decrease the activity of acetylcholinesterase, an enzyme that breaks down acetylcholine; acetylcholine is a chemical that transmits information from the autonomic nervous system to various organs in the body (such as the heart, blood vessels, and gastrointestinal tract); decreased levels of the enzyme lead to excessive amounts of acetylcholine being present, resulting in “over stimulation” of the target organs
- The autonomic nervous system is involved in the control of muscles in the heart, blood vessels, gastrointestinal tract, and other organs; it is composed of two parts—the sympathetic and the parasympathetic parts; the two parts cause opposing responses; for example, the sympathetic nervous system speeds up the heart and causes the blood vessels to constrict or become small while the parasympathetic nervous system slows the heart and causes the blood vessels to expand or dilate
- Organophosphate and carbamate toxicity results from exposure to organophosphorous compounds or carbamates
- From 2003 to 2005, the ASPCA Animal Poison Control Center experienced a 46% decrease in calls regarding organophosphates—this decrease likely is related to the federal Environmental Protection Agency (EPA) cancellations of various registrations of some organophosphate insecticides and approval of new formulations; however, canceled products often remain for years in homes and businesses; carbamate inquiries increased 15% during the same period
- Products intended for use on or around animals—organophosphate: chlorpyrifos, coumaphos, cythioate, diazinon, famphur, fenthion, phosmet, and tetrachlorvinphos; carbamate: carbaryl and propoxur
- Products intended for use in agriculture and lawn and gardens—organophosphate: acephate, chlorpyrifos, diazinon, disulfoton, fonofos, malathion, parathion, terbufos, and others; carbamate: carbofuran and methomyl

GENETICS

- Animals with inherently low levels or activity of the enzyme that breaks down acetylcholine (that is, has low cholinesterase activity)—more susceptible to cholinesterase depression
- Cholinesterase activity—more easily inhibited in cats than in dogs

SIGNALMENT/DESCRIPTION of ANIMAL

Species

- Cats and small or exceptionally lean dogs—most susceptible

Breed Predispositions

- Lean dogs (such as sight hounds and racing breeds) and lean longhair cats—more susceptible to cholinesterase inhibition because of lack of fat; many organophosphorous compounds and their breakdown products (known as “metabolites”) are stored in fat and slowly released into circulation

Mean Age and Range

- Young animals—more likely to become poisoned due to lower ability to diminish or remove (detoxify) the poison from their bodies

Predominant Sex

- Intact males more susceptible to some organophosphates

SIGNS/OBSERVED CHANGES in the ANIMAL

- Parasympathetic nervous system stimulation usually predominates, causing such signs as slowing of the heart and dilated blood vessels
- History often discloses heavy or repeated applications of flea and tick insecticides; evidence of exposure to an agricultural or home and garden product
- Carbamate insecticides (methomyl and carbofuran)—may cause rapid onset of seizures and breathing (respiratory) failure; treat aggressively without delay
- Organophosphate insecticides (cats, especially chlorpyrifos)—long-term (chronic) lack of appetite (anorexia), muscle weakness, and muscle twitching, with or without episodes of sudden (acute) poisoning (toxicosis), which may last for days to weeks
- Excessive salivation (known as “hypersalivation”)
- Vomiting
- Diarrhea
- Constricted or small pupils (known as “miosis”)
- Slow heart rate (known as “bradycardia”)
- Depression
- Wobbly gait (known as “ataxia”)

- Muscle tremors
- Seizures
- Increased body temperature (known as “hyperthermia”)
- Difficulty breathing (known as “dyspnea”)
- Breathing (respiratory) failure
- Death
- Patient may not exhibit all signs
- If sympathetic nervous system stimulation predominates—may result in lack of specific expected signs; signs may be reversed or opposite of expected (as described in preceding list)

CAUSES

- Overuse, misuse, or use of multiple organophosphate or carbamate insecticides
- Misuse of organophosphate insecticides in cats
- Intentional application of house or yard insecticides to the skin of animals

RISK FACTORS

- Concurrent exposure to multiple organophosphate- and/or carbamate-containing products
- Exposure to floors that are damp with organophosphorous premise products
- Incorrect dilution of insecticides
- Organophosphate-containing dips *labeled for dogs only*—inappropriately applied to cats

TREATMENT

HEALTH CARE

- Outpatient—mild signs from exposure to flea and tick collars and powders; treated by simply removing the collar or brushing excess powder from the coat
- Inpatient—continued salivation, tremors, or difficulty breathing (dyspnea)
- Basics of care—stabilization of patient; decontamination to remove source of exposure to insecticide; antidotal treatment with atropine (and pralidoxime chloride for organophosphate poisoning); supportive care
- Oxygen—if necessary, until breathing (respiration) returns to normal
- Fluid therapy—may be needed in cats that are not eating (anorectic)
- Bathing (for skin [dermal] exposure)—rinse with large volumes of water

DIET

- Cats that have long-term (chronic) lack of appetite (anorectic cats)—maintain nutritional and fluid requirements

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.

- [Pentobarbital to control seizures](#)
- [Diazepam](#) or phenobarbital—controls seizures
- [Atropine](#) sulfate—antidote; administered immediately; repeated only as needed to control life-threatening clinical signs from parasympathetic stimulation
- [Pralidoxime chloride or 2-PAM](#) (Protopam®)—antidote; reduces muscle twitching; most beneficial against organophosphorous insecticides when started within 24 hours of exposure; even several days after skin (dermal) exposure may stimulate cats that are not eating (anorectic cats) with or without muscle tremors to resume eating
- If animal has history of ingesting a liquid insecticidal solution—avoid inducing vomiting (emesis) due to the risk of aspiration, because many solutions contain hydrocarbon solvents; your pet’s veterinarian and/or Animal Poison Control should provide guidelines if inducing vomiting is appropriate
- If the animal has no clinical signs and the insecticide ingested was not liquid, induce vomiting with 3% hydrogen peroxide after feeding a moist meal; your pet’s veterinarian and/or Animal Poison Control should provide guidelines if inducing vomiting is appropriate
- Evacuation of the stomach for patient with clinical signs—flush the stomach (known as “gastric lavage”) with the patient intubated, under anesthesia, with a large-bore stomach tube; then administer activated charcoal containing sorbitol as a cathartic (to clean out the intestinal tract) in a water slurry
- Diarrhea—do not administer sorbitol-containing products

FOLLOW-UP CARE

PATIENT MONITORING

- Monitor heart rate, breathing (respiration), and fluid and caloric intake

PREVENTIONS AND AVOIDANCE

- Closely follow directions on labels of insecticides—be especially careful to use products *only* on animals for which they are indicated (that is, use “dog only” products on dogs and *do not* use “dog only” products on cats)
- Avoid use on sick or debilitated animals
- Avoid simultaneous use of organophosphate and carbamate products

POSSIBLE COMPLICATIONS

- Death

EXPECTED COURSE AND PROGNOSIS

- Long-term (chronic) organophosphate insecticide-induced weakness and lack of appetite (anorexia) in cats—signs may last 2 to 4 weeks; most patients fully recover with aggressive nursing care
- Sudden poisoning (acute toxicosis) treated promptly—good prognosis

KEY POINTS

- Follow insecticide label directions carefully; read entire label before using insecticide
- Be especially careful to use products *only* on animals for which they are indicated (that is, use “dog only” products on dogs and *do not* use “dog only” products on cats)
- Avoid use on sick or debilitated animals
- Avoid simultaneous use of organophosphate and carbamate products
- Cats with long-term (chronic) lack of appetite (anorexia) and weakness may need days to weeks of supportive care for full recovery

