# Reference Point

## Toxicologic hazards for police dogs involved in drug detection

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During the past half-century, police department personnel have been training dogs for several uses, including detection of illicit drugs. Although most injuries incurred by these dogs during searches are a result of trauma, such as scratches, cuts, and ligament and muscle damage,1 drug-sniffing dogs may be exposed to illicit drugs and other toxic agents in the line of duty, most commonly through inhalation and ingestion. Inhalation is the most common route of exposure. Inhalation exposures are generally of lesser magnitude but may result in a more rapid onset of action of the agent. Originally, dogs were trained to aggressively paw, mouth, or bite at the object of interest, thereby risking contact with chemical substances. Recently, the trend has been toward training that includes more passive search and recognition behaviors to decrease the risk of exposure.1 Passive behaviors include increased rate of respiration, jumping up to the object, and abrupt head turns. Dogs may “break their plane” by sitting or lying down, staring at the strongest odor, or barking.1,2 Astute handlers are well aware of possible chemical hazards that drug-detection dogs may encounter and take measures to avoid dog-chemical contact.1,2 However, exposures can and still do occur. Many illicit drugs have a rapid onset of action, and rapid intervention is necessary to minimize effects. The purpose of this report is to review the most common illicit drugs and toxic agents that police dogs may encounter and provide the veterinarian with practical emergency medical treatment guidelines. In managing cases, it is important to be aware that most police dogs are so-called 1-person dogs, necessitating that the police officer handler be present for examinations and medical procedures.2

### Marijuana

Currently, marijuana is the most commonly and widely used drug to which police dogs may be exposed. The popularity of marijuana as a recreational drug makes it easily accessible. Some street names include pot, weed, Mary Jane, and grass. The toxic principle THC is responsible for the clinical effects; THC is rapidly absorbed both orally and via inhalation of heated plant material1,3 and is excreted primarily in the feces after being metabolized to some extent by the liver.3,4 Some enterohepatic recirculation also occurs, prolonging the half-life of THC.3 The most common signs in dogs following ingestion of marijuana are tachycardia, hypotension,1 depression, ataxia, vomiting, altered behavior, bradycardia, hypersalivation, weakness, hypothermia, and seizures.2

Following oral ingestion, effects are evident within 30 to 60 minutes.1,3 Shortly after ingestion (before signs appear), emesis can be induced to remove solid stomach contents. Emesis is not recommended in dogs with clinical signs of depression or excitement because of the increased risk of aspiration of vomitus. Emesis can be accomplished with apomorphine (1 tablet crushed and mixed with 0.5 mL of water) instilled into the conjunctival sac followed by rinsing of the eye with physiologic saline (0.9% NaCl) solution once emesis has occurred or by injection of apomorphine (0.04 mg/kg [0.018 mg/lb]; IV, IM, or SC). The IV route of administration will effectively induce emesis within minutes. Adverse effects such as CNS or respiratory depression can be reversed with naloxone (0.04 mg/kg, IV). Naloxone will not reverse the emetic actions of apomorphine.1 Emesis can also be induced via oral administration of 3% hydrogen peroxide (1 teaspoon/5 kg [5 mL/11 lb]).1,3 Although ingestion of marijuana is rarely fatal,3 emptying the stomach of an affected dog will help to minimize drug-associated effects.

For dogs in which no clinical signs develop, treatment by the veterinarian should consist of monitoring cardiac function, rectal temperature, and respiratory function.5 After emesis has ceased, all dogs should be given repeated dosages of activated charcoal orally (1 to 2 g/kg [0.43 to 0.91 g/lb]) and a saline cathartic, such as sodium sulfate or magnesium sulfate (1.25 g/3 kg [0.11 g/lb]),1,5,6 to interrupt enterohepatic recirculation and decrease the half-life of THC. Dogs in which clinical signs develop may also

### Abbreviations

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<th>Abbreviation</th>
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<tbody>
<tr>
<td>THC</td>
<td>Delta-9-tetrahydrocannabinol</td>
</tr>
<tr>
<td>PCP</td>
<td>Phencyclidine</td>
</tr>
<tr>
<td>CS</td>
<td>2-chlorobenzylidene malonitrile</td>
</tr>
<tr>
<td>CN</td>
<td>1-chloroacetophenone</td>
</tr>
<tr>
<td>CR</td>
<td>Dibenzoxazepine</td>
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require diazepam, fluid therapy, and thermoregulation as signs warrant.15

Cocaine

Cocaine use surged in the late 1980s and early 1990s but has been replaced lately by newer so-called designer drugs. Cocaine is a CNS stimulant and is absorbed effectively from mucosal surfaces,1 especially in the oral cavity and respiratory tract. It is available as a solid or powder form, and its clinical effects include (but are not limited to) bradycardia, increased systolic arterial pressure,2 tachycardia, decreased mean cardiac output, increased pulmonary vascular resistance,2 ataxia, seizures,3 decreased myocardial contraction,4 hyperthermia, and death.5 Electrocardiographic effects include increased QRS complex duration,6 overall increased sinus cycle length,1 and P-wave abnormalities.5 The toxicokinetic properties of cocaine may result in opposing effects such as cardiac depression and vasodilation or cardiac stimulation and vasoconstriction. The former paired effects are thought to result from local anesthetic actions, whereas the latter are considered a result of reuptake of norepinephrine.3

Cocaine intake can have a rapid onset of action; in humans, peak plasma concentrations are attained within 15 to 120 minutes following nasal mucosal application.7 Therefore, induction of emesis should be undertaken with caution if ingestion has occurred. Once signs begin, inducing emesis may precipitate a seizure, with the concomitant risk of aspiration of vomitus. Sedation and gastric lavage may be a more effective and safer alternative to induction of emesis. Activated charcoal and a saline cathartic should also be administered orally. Seizures can be controlled by use of diazepam or a barbiturate. In dogs with severe hyperthermia, cooling of the body can be achieved with evaporative cooling techniques; for example, tap water can be sprayed onto the dog and a fan used to blow air across it until a desired body temperature is reached, or the dog can be immersed in a tepid water bath.11 Use of these techniques requires constant temperature monitoring to protect against rebound hypothermia. Although a rare event, an intact pouch used to transport cocaine without signs and others such as emesis, cyanosis, seizures, tachypnea, restlessness, and tachycardia.2 In a case report of accidental ingestion of fenproporex in a dog, these signs and others such as emesis, cyanosis, dehydration, and stupor were described. Clinicopathologic analyses may indicate polycythemia, leukopenia, thrombocytopenia, hypoglycemia, abnormal serum liver enzyme activities,12 high serum creatinine kinase activity, and acidosis.13

Peak plasma concentrations of amphetamines can be attained within 1 to 3 hours following oral exposure.1 Because of their rapid onset of action, decontamination of an affected dog via induction of emesis is recommended only if exposure occurs within 30 minutes and signs of drug-associated effects are absent. Emesis should be followed by oral administration of charcoal and a saline cathartic; repeated doses of activated charcoal may be necessary if the exposure involved sustained-release drugs.12 Diazepam or chlorpromazine13 may be given for seizure control, whereas evaporative cooling techniques or immersion in a tepid water bath can be used to lower the dog’s body temperature. Chlorpromazine or haloperidol has also been used to block α-adrenergic and dopaminergic receptors.13,14

To enhance elimination of amphetamines, urine acidification with ammonium chloride has been shown to be effective experimentally.11,13 There is some controversy regarding urine acidification because acidosis may already be present as a result of increased muscle activity. In addition, ammonium chloride is administered orally and urinary acidification is slow to develop. Therefore, if urinary acidification is considered in the treatment of an affected dog, close monitoring of the patient’s acid-base status is highly recommended.

Amphetamines

In human medicine, a large number of amphetamine analogs are available by prescription for the treatment of obesity, attention deficit disorder, and narcolepsy.3 Additionally, methamphetamine and designer amphetamines produced in clandestine laboratories are widely available. The rise in popularity of these drugs may be a consequence of their compact pill formulation or the ability to disguise the illicit drugs as legitimate medications. Designer drugs include 4-methylaminorex (also known as ice); methcathinone (also known as cat); and the most common and probably best-known drug, 3,4-methylenedioxy-N-methylamphetamine (also known as ecstasy). Common street names for amphetamines include speed, dexies, and bennies, whereas the powder form of methamphetamine is often referred to as crank. Amphetamines can act as hallucinogens or stimulants and have been shown to affect α- and β-adrenergic receptors as well as dopamine receptors.13,14 Amphetamines also selectively enhance the release and block the reuptake of dopamine and catecholamine.13

Clinical effects of amphetamines in dogs and other animals can include hyperactivity, mydriasis, hypersalivation, vocalization, tremors, hyperthermia, ataxia, seizures, tachypnea, restlessness, and tachycardia. In a case report of accidental ingestion of fenproporex in a dog, these signs and others such as emesis, cyanosis, dehydration, and stupor were described. Clinical-pathologic analyses may indicate polycythemia, leukopenia, thrombocytopenia, hypoglycemia, abnormal serum liver enzyme activities,12 high serum creatinine kinase activity, and acidosis.13
Phencyclidine

Phencyclidine can act as either a CNS depressant or stimulant depending on which species is affected. It was historically used as an anesthetic in humans and other animals and is an analog of ketamine hydrochloride. The ability of PCP to cause multiple effects results from the drug’s ability to act on virtually all neurotransmitters. Phencyclidine can inhibit α-adrenergic and opiate receptors. In affected dogs, elimination of the drug occurs primarily via metabolic processes in the liver, but some clearance also occurs via the kidneys.

The effects of IV administration of PCP in dogs, although an unlikely route of accidental exposure, include loss of consciousness, excessive salivation, muscle rigidity, hyperventilation on awakening, vertical and horizontal nystagmus, miosis, increased arterial blood pressure, increased cardiac output, and death (associated with continual infusion of the drug). High doses of PCP administered IV have resulted in convulsions in dogs. Orally administered doses of PCP result in muscle rigidity, erratic walking, salivation, and nystagmus; at high doses, the effects are the same as those associated with IV injection of PCP. Other possible sequelae include acidosis, hyperthermia or hypothermia, altered serum electrolyte concentrations, and hypoglycemia.

If possible, decontamination of an affected dog should be carried out as soon as possible via emesis or gastric lavage. Phencyclidine has a capacity for enterohepatic recirculation; thus, repeated oral doses of activated charcoal and a cathartic are indicated. Because of PCP’s ability to affect many receptors, the aforementioned clinical signs are not evident in all cases, and consequently, treatment should address specific signs that develop. Diazepam can be administered if seizures or other signs of excitation, such as rigidity and tremors, develop. Monitoring and correction of body temperature should be performed as needed. Urinary acidification with ammonium chloride has been shown to enhance elimination of PCP, but the dog’s acid-base status should be considered before carrying out this treatment.

Opioids

Opioid drugs have been widely used as analgesics, and many pharmaceutical preparations are available. A few of the more commonly abused opiates are heroin, opium, and, recently, oxycodone. Opioids are classified as agonists, partial agonists, or antagonists. Most opioid analgesics are mu agonists. Although most animal exposures occur as a result of accidental ingestion of misplaced medications, police dogs may be exposed to these drugs during a raid. Clinical effects can include vomiting, defecation, CNS and respiratory depression, miosis, salivation, seizures, and cyanosis. In the absence of clinical signs after a recent ingestion of an opioid, emesis can be induced followed by oral administration of activated charcoal and a cathartic. Oxygen therapy may be necessary because opioid-associated respiratory depression may result in hypoxia and death. Fortunately, naloxone, a pure competitive mu antagonist, is available to counteract the effects of many opioid drugs.

Riot Control Agents

Riot control agents are gaseous irritants (ie, tear gases and lacrimators) intended to disperse crowds or deter people. The most commonly used agents in this group are oleoresin capsaicin, CS, CN, and CR.

Oleoresin capsaicin is a common ingredient of pepper sprays. It acts by causing inflammation of the eye, skin, and upper portion of the respiratory tract when topical exposure occurs; when inhaled, it can cause hypertension, bradycardia, marked ventilatory depression, and, often, an immediate apneic response. The other 3 agents, CS, CN, and CR, are all potent irritants; CN was developed as a riot-control agent in the 1950s but has been largely replaced by CS because of safety concerns. Use of CR, a lacrimator of more recent origin, may increase because of greater potency and lower toxicity than CS or CN. These agents cause intense lacrimation and irritation of the respiratory tract.

Police dogs are often present in areas where tear gas is used, and the dogs may be subsequently exposed. If used outdoors, the onset of action is rapid but should be short-lived as dissipation occurs. Instant effects include lacrimation, blepharospasm, conjunctivitis, dyspnea, and coughing, whereas more chronic exposure can cause bronchitis and pneumonia. As mucosal surfaces are contaminated by these agents, a stinging or burning sensation can develop with subsequent self-trauma as an affected dog paws at its face.

Prevention is the best form of treatment. Dogs should be removed from the area of riot-control agent deployment if possible. There is no specific treatment for exposure; therefore, treatment of clinical signs and supportive care should be instituted. Fresh air or oxygen should be provided. In dogs with respiratory infections or pneumonia, antimicrobials and, in some instances, glucocorticoids may be used. Dogs that have received direct dermal contact with a riot-control agent should be bathed with a mild dish detergent and rinsed with copious amounts of water. Dogs should be monitored for the development of chemical burns of the skin. Ocular exposures should be treated by irrigation with saline solution or water (at room temperature) for 20 minutes. With rapid and appropriate treatment, signs usually abate in 30 minutes. Clinic staff handling directly exposed dogs should take precautions to avoid self-exposure.

Chemical Hazards Associated with Clandestine Drug Laboratories

Several hazardous compounds are used in the production of illicit drugs. Surveys of drug manufacturing laboratories have revealed that for every pound of methamphetamine produced, 5 to 6 lb of toxic waste is left behind. Personnel investigating clandestine laboratories typically wear protective gear. Handlers avoid exposure of dogs to known laboratories; however, accidental encounters can occur, thereby placing dogs working in these areas at risk.

Anhydrous ammonia is often a component of the methamphetamine preparation process and may therefore be present on site during a police raid. Typically used as an agricultural nitrogen fertilizer, stolen anhydrous ammonia may be stored in small, portable
propane tanks. Exposure occurs when the tanks, hoses, or valves leak.\textsuperscript{23} Anhydrous ammonia is hygroscopic and combines with water to form caustic ammonium hydroxide.\textsuperscript{22} Mucous membranes of the eye, nose, and upper portion of the respiratory tract are particularly susceptible because of their high water content. Damage to mucous membranes can cause blindness, sloughing of respiratory epithelium, and secondary bacterial infections; highly concentrated exposures may affect deeper respiratory tissues and result in the development of apnea, laryngospasm, and pulmonary edema, resulting in death.\textsuperscript{23} At the first sign of exposure, both the police officer and dog should vacate the area until the concentrated gas has dissipated. Veterinary medical intervention involves treatment of clinical signs and supportive care and may include oxygen therapy and administration of bronchodilators. Fluids may be administered conservatively while monitoring for development of pulmonary edema. Administration of antimicrobials may be useful against secondary bacterial infections. In worst-case scenarios, euthanasia of the affected dog should be considered.\textsuperscript{23}

Petroleum hydrocarbons found at the site of a drug manufacturing business can include gasoline, motor oil, lighter fluid, paint thinners, kerosene, and propane. Hydrocarbons can be absorbed orally, dermally, or via inhalation; the extent of absorption varies with the type of hydrocarbon as well as the route of exposure. In general, low–molecular-weight molecules are absorbed more readily than high–molecular-weight molecules and aromatic compounds are better absorbed than aliphatics.\textsuperscript{24} In dogs, clinical effects of hydrocarbon exposure include salivation, head shaking, pawing at the face, coughing, aspiration, possible hypoxia, cyanosis, chemical pneumonitis, pyrexia, vomiting, diarrhea,\textsuperscript{24} skin eruptions, epidermal necrosis, conjunctivitis, respiratory distress, seizures, and death.\textsuperscript{23} For dermal exposures, the dog can be bathed with a mild liquid dish detergent.\textsuperscript{25} If exposed orally, emesis is contraindicated and the dog should be taken to a veterinarian as soon as possible. Care of the patient mainly involves treatment of clinical signs and supportive care. The real concern is to prevent aspiration and secondary chemical pneumonitis; thus, thoracic radiographs should be obtained as soon as possible to enable evaluation of changes over time.\textsuperscript{24,26} Cage rest reduces excitation and aids in the healing process.\textsuperscript{24}

Many other chemicals are used in the manufacture of methamphetamine and can be encountered during raids of makeshift laboratories. Cold-remedy tablets containing ephedrine and pseudoephedrine are used as precursors in the manufacturing process.\textsuperscript{7} These are sympathomimetic compounds that can result in severe excitation and stimulation if ingested by dogs. Sulfuric acid, muriatic acid, sodium hydroxide, iodine, isopropyl alcohol, methanol, red phosphorus, trichloroethylene, and table or rock salt (sodium chloride) can all be found on site.\textsuperscript{27} The actual process of heating during the production of methamphetamine can result in various toxic by-products. Veterinarians working with police dogs involved in laboratory raids should be familiar with possible chemical exposures and appropriate treatments.

**Overview**

As illicit drug use continues and evolves, veterinarians and local police dog handlers must work together for the protection of the dogs. Veterinarians may offer guidelines for emergency treatment of exposed dogs. In many cases, potentially life-saving decontamination can be performed at the scene by police officers who have received instruction regarding common treatment procedures. Local police jurisdictions may consider carrying an animal emergency kit with basic necessities such as apomorphine tablets, hydrogen peroxide, activated charcoal, saline solution for ocular irrigation, and syringes for administration. Prompt intervention is the best method for improving the prognosis for dogs exposed to these types of toxicologic hazards.

### References


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