CLINICAL REPORTS

Two Hundred and Thirteen Cases of Marijuana Toxicoses in Dogs

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ABSTRACT. Marijuana (*Cannabis sativa*) is a commonly used recreational drug among humans; animals may be exposed following ingestion or accidental inhalation of smoke. From January 1998 to January 2002, 213 incidences were recorded of dogs that developed clinical signs following oral exposure to marijuana, with 99% having neurologic signs, and 30% exhibiting gastrointestional signs. The marijuana ingested ranged from ½ to 90 g. The lowest dose at which signs occurred was 84.7 mg/kg and the highest reported dose was 26.8 g/kg. Onset of signs ranged from 5 min to 96 h, with most signs occurring within 1 to 3 h after ingestion. The signs lasted from 30 min to 96 h. Management consisted of decontamination, sedation (with diazepam as drug of choice), fluid therapy, thermoregulation and general supportive care. All followed animals made full recoveries

Marijuana (*Cannabis sativa*) is one of the world's most widely used recreational drugs. The active constituents are cannabinoids, with 9-tetrahydrocannabinol (THC) the primary component responsible for its clinical effects (1). Dried leaves of *C sativa* may contain up to 10% THC, while hashish oil may contain up to 20% THC (2). Medicinally, a synthetic form (nabilone) and a pure form (dronabinol) of THC are used as antiemetics for human patients undergoing chemotherapy and to decrease intraocular pressure in glaucoma patients (3). THC acts on brain cells via the specific cannabinoid receptor, CB1, which mediates inhibition of adenylate cyclase, inhibition of N- and P/Q-type calcium channels, stimulation of potassium channels, and activation of mitogen-activated protein kinase (4).

Previous reports of marijuana intoxication in dogs are limited to a few reports of oral ingestion and a survey of teenagers reporting their experience exposing their pets to marijuana smoke (5,6). In the latter report, clinical signs in 13 cats and 12 dogs included somnolence, "glassy" eyes, ataxia, bumping into furniture, biting or aggressive behavior, and vomiting (6). Between January 1, 1998 and January 1, 2002, the ASPCA Animal Poison Control Center (APCC) consulted on 213 cases of accidental marijuana ingestion in dogs that resulted in clinical signs. This report evaluates the effects of marijuana ingestion in a large group of dogs by summarizing clinical signs and discussing treatment of marijuana ingestion in dogs.

CASE REPORTS

Information on dogs ingesting marijuana (*C sativa*) was compiled from the APCC computerized database for the period of January 1, 1998 to January 1, 2002. The APCC consultation service receives calls primarily from North America, and veterinary staff collects information for each case on species, breed, age, gender, weight, number of animals at risk, number of animals affected, estimated amount of product ingested, and time of ingestion. The case report also documents the onset, severity, and duration of clinical signs.

On the basis of clinical signs and exposure history, APCC veterinarians assessed each report of marijuana ingestion as exposure only, toxicosis, suspected toxicosis, possible toxicosis or doubtful. A report was assessed as exposure only if no clinical signs were observed after ingestion. A report was assessed as a toxicosis if clinical signs and exposure history were consistent with an expected reaction to marijuana. The report was assessed as a suspect toxicosis if the clinical were consistent with an expected reaction but some data was lacking. A report was assessed as a possible toxicosis when either the clinical signs were not consistent with marijuana ingestion or the time of ingestion was not known with certainty. If the clinical history and signs were not consistent with an expected reaction to marijuana, or if another cause for the clinical signs was discovered, the report was assessed as doubtful. Follow-up calls were made to collect information on the progression of clinical signs and to determine final outcomes. Assessments were not confirmed by analytical methods.

From the period of January 1, 1998 to January 1, 2002, 216 cases of marijuana exposure resulting in clinical signs were retrieved from the APCC database. In 1998, 48 marijuana intoxications were recorded, in 1999 the number was 54, in 2000 it was 58 and in 2001 56 oral marijuana toxicosis in dogs were recorded. The route of exposure was oral in 213 cases; 2 cases where the route of exposure was not reported and 1 case of dermal exposure were excluded from this study. Of the 213 dogs ingesting marijuana, no breed predilection was noted, and both male and female animals were represented in similar percentage (100 males, 101 females; in 12 cases the gender was not reported). Ages were available for 208 dogs and ranged from 6 w to 13 y, with an average of 1.7 y. One hundred and thirty-eight animals (64.8%) were < or equal to 1 y of age.

Of the 213 oral exposures, 4 cases involved brownies containing marijuana, 6 cases involved cookies containing marijuana, and the remaining 203 cases involved marijuana in the

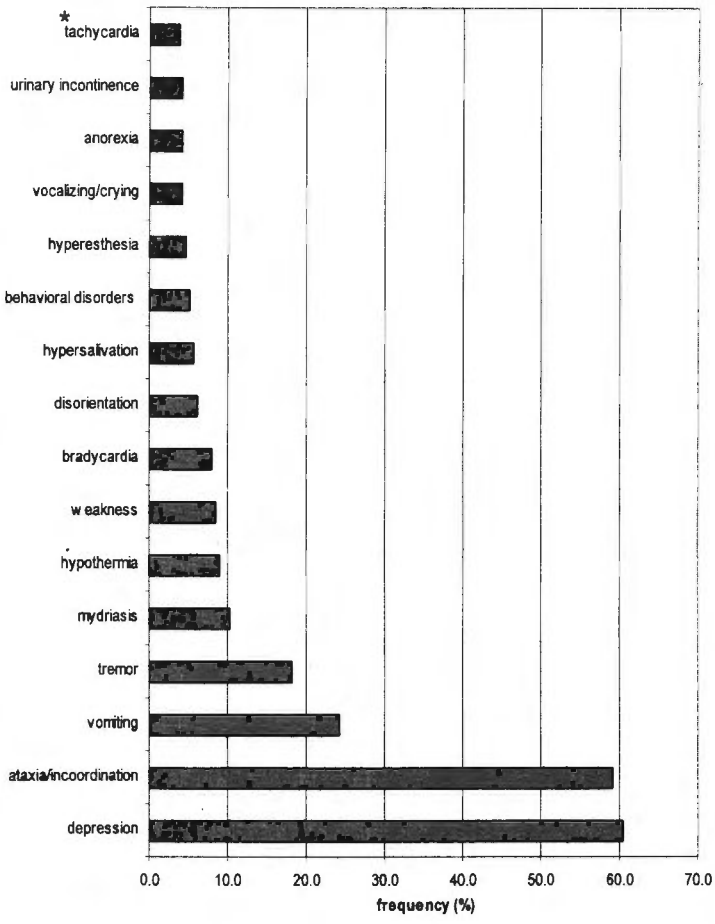

Figure 1. *Frequency of most common signs reported from 1998-2001 with oral marijuana toxicoses in dogs. * Other clinical signs reported in order of decreasing frequency were: coma, hyperthermia, hyperactivity (3.8%); head bobbing (3.3%); glassy eyes (2.8%); recumbancy, stupor, diarrhea (2.4%); apprehension, seizure, nystagmus (1.9%); abdominal pain, stiffness (1.4%); bradypnea, circling/head tilt, adipsia, aggression (0.9%); and goose stepping. polyuria, conjunctivitis, exaggerated menace, CNS pathology, hydrothorax, dyspnea (0.5%).*

form of either loose leaves or as marijuana cigarettes. The amount of marijuana ingested, when reported, ranged from ½ to 90 g. The lowest dose at which signs occurred was 84.7 mg/kg and the highest reported dose was 26.8 g/kg. Onset of clinical signs following ingestion ranged from 5 min to 96 h, with most cases developing signs within 1 to 3 h post ingestion. The signs lasted from 30 min to 96 h.

The type and frequencies of signs are shown in Figure 1. Neurological signs occurred in 211 cases (99.1%), and gastrointestinal signs occurred in 65 cases (30.5%). Treatment recommendations consisted of decontamination, sedation (with diazepam as the drug of choice), fluid therapy, thermoregulation and other supportive care as needed. In cases where complete follow up information was available, all animals fully recovered with the appropriate veterinary care.

DISCUSSION

Based on the results of this study, dogs are most often exposed to marijuana through accidental ingestion of marijuana cigarettes, loose marijuana, and cookies or brownies containing marijuana. Given the inquisitiveness of young puppies, it is not surprising that the majority of exposed dogs were < a year of age. The largest dose of marijuana ingested in this study was 26.8 g/kg, which was approximately 2.7 g/kg of THC, assuming the dried marijuana contained 10% THC (2).

All the dogs included in this study developed clinical signs. Ninety-nine percent of the dogs displayed neurological signs and 30% also developed gastrointestinal signs, primarily vomiting. These results are in contrast to a prior report in which neurological signs were observed in 87% of cases and vomiting occurred in only 5 % (5). This difference is likely due to the differences in route of exposure (ie inhalation vs ingestion); when there is oral exposure, the plant compounds may be irritating to the gastrointestinal tract mucosa, resulting in vomiting.

The neurologic effects of marijuana are due to the effects of cannabinoids on CB1 receptors in the brain (4). In this study neurologic signs included depression, ataxia, tremors, seizures, mydriasis, disorientation, behavioral disorders, hyperesthesia, hyperactivity, head bobbing, recumbency and stupor. Many of these signs were also reported in previous animal studies (5,6), although signs such as seizures and tremors had not previously been reported. Other signs reported in the dogs in this study were hypothermia, bradycardia, unspecified behavioral abnormalities, vocalizing, anorexia, urinary incontinence and tachycardia.

The pharmacokinetics of THC in dogs has not been studied, although extensive human information is available (3,7,8). In humans exposed to marijuana, THC is absorbed more readily from the lungs (18-50%) than from the gastrointestinal tract (5 to 20% of THC in humans) with onset of signs in 6-12 min after inhalation and 30–60 min after oral exposure (3). The duration of signs in humans is generally 4–6 h, after either inhalation and oral exposure (3). According to human data, THC absorbed from the gastrointestinal tract undergoes first-pass metabolism and then is further metabolized in the liver to a variety of metabolites, of which 11-hydroxy THC is the most abundant (7). The parent compound is primarily excreted in the feces (approximately 35%) as an unconjugated metabolite, and approximately 10-15% of the ingested amount is excreted in the urine as acidic metabolites and conjugates (3). The half-life of THC in humans is 25 to 30 h due to its high lipid solubility (8).

Based on the results of this study, the kinetics of marijuana in dogs appeared similar to that in humans in that marijuana was rapidly absorbed orally and relatively slowly eliminated. In this study, the time of onset of clinical signs in dogs after marijuana exposure ranged widely (from 5 min to 96 h), although most of the clinical signs appeared in 1 to 3 h, indicating rapid oral absorption. Signs from oral exposures lasted from 30 min to 96 h in comparison to 1 to 2 h in dogs with inhalation exposure (6). In a prior report of marijuana ingestion by 3 dogs, signs were apparent for 36 to 48 h after onset (5), which was similar to this present study.

Treatment of marijuana ingestion included decontamination of the digestive tract, prevention of absorption, control of CNS signs, thermoregulation and other general supportive care. Decontamination consisted of emesis induction if the expo-

sure was within 15–30 min and the animal was asymptomatic; emesis induction in dogs showing clinical signs should be done with caution due to the potential for aspiration. Activated charcoal was recommended at a dosage of 1-2 g/kg every 8 h for first 24 h; use of a cathartic, such as sorbitol, with the first dose of charcoal was recommended to hasten removal of marijuana from the digestive tract (9). Diazepam at an initial dosage of 0.25-0.5 mg/kg was used to control agitation, hyperesthesia, tremors and seizures (9). Comatose dogs should be monitored closely for evidence of respiratory depression or hypothermia, and patient physical rotation every 4 h should be provided. Additional supportive care, such as fluid support, should be provided as needed.

In cases where marijuana exposure is suspected, tactful questioning by the veterinarian may be necessary to obtain an accurate history from reluctant pet owners. Owners are generally more willing to admit to the exposure if it is made known that without confirmation of marijuana exposure, extensive (and expensive) laboratory testing may be required to reach a diagnosis. When marijuana intoxication is suspected but cannot be confirmed by the pet owner, urine samples may be submitted to a human hospital for an illicit drug screen. Alternatively, over-the-counter drug test kits are available at most pharmacies, and may be useful in diagnosing marijuana intoxication. Unfortunately the accuracy of most of these kits when using dog urine has not been clearly established.

Ingestion of marijuana in dogs may produce a variety of clinical signs, but most are primarily neurologic. In followed-up cases, dogs made complete recoveries after symptomatic and supportive care by veterinarians. Most cases of marijuana ingestion in dogs have a favorable prognosis provided prompt veterinary care is obtained.

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Association Between Droperidol Use and Sudden Death in Two Patients Intoxicated with Illicit Stimulant Drugs*

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ABSTRACT. Illicit drug intoxication is often a cause of extreme agitation in the emergency department and prehospital settings. Chemical restraint is often required to protect patient as well as health-care providers. Droperidol has commonly been used to sedate extremely agitated patients in the emergency department and psychiatric settings. Its safety has been demonstrated in these settings and in patients who's agitation has been attributed to amphetamine toxicity. We present 2 cases of sudden death following the use of droperidol to sedate I patient who was extremely agitated secondary to cocaine intoxication and another secondary to phencyclidine intoxication.

Droperidol has been used for many years as a method of chemical restraint in acutely agitated patients. It has been studied in both the emergency department and prehospital settings and has been shown to be effective (1-3). The cause of agitation in the prehospital and emergency department settings is often due to intoxication with alcohol or illicit drugs (1, 2). We report 2 cases in which droperidol was administered to acutely agitated patients in the prehospital setting resulting in sudden death; 1 case involved cocaine intoxication and the other involved phencyclidine and tetrahydrocannabinol (THC) intoxication.