Hallucinogenic Mushroom Intoxications Are Getting "Higher"

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The popularity of hallucinogenic mushrooms has been on the rise over the past few years as "magic mushrooms" and other psychedelics are growing more accepted both legally and socially.

Psilocybin, the primary hallucinogenic ingredient found in many varieties of mushrooms, has been fully or partially decriminalized in several states, even though it is still classified as Schedule I by the U.S. Drug Enforcement Agency. This increased acceptability has coincided with the interest in "natural" compounds for mental health. Mushrooms fit in this category, and the popularity of functional (nootropic) edible mushrooms (e.g., lion's mane, cordyceps, reishi, chaga) have increased along with the use of psychedelics. Hallucinogenic mushroom products may now include psilocybin, muscarinic, or isoxazole types of mushrooms. This popularity has led to more opportunities for pets to ingest these items, and many have found themselves in an accidental psychedelic experience.

To compound this growing problem, contaminants have been found in these products since there are no laws regulating their contents (**BOX 1**).[1,2] Most of these products come in the form of chocolate bars to mask their bitter taste; therefore, chocolate toxicosis may

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also need to be managed. Gummy formulations are also popular, which are especially attractive to dogs. As the number of hallucinogenic mushroom intoxications continues to rise, this article will outline what general practice veterinarians need to know about these products, intoxications, treatments, and expected patient outcomes.

Magic Mushroom Intoxication 101

There are several genera of mushrooms that are known to be hallucinogenic and contain psilocybin and other toxins (**TABLE 1**). Below are some of the most frequently encountered in the veterinary hospital and their clinical effects on cats and dogs.

Psilocybin Mushrooms

When psilocybin is ingested, it is converted to psilocin, which activates serotonin receptors.[3-5] Psilocin acts as an agonist and partial agonist at serotonin receptors. Animals that ingest large amounts of psilocybin can develop serotonin syndrome. The most common clinical effects from ingestion of psilocybin mushrooms are alteration of mentation, ataxia, and vocalization. Cats may stare off into space, while dogs will vocalize. Frequently, there will also be mydriasis and hyperthermia, and possibly tachycardia, seizures, and muscle weakness. Rarely, death has occurred. No specific laboratory abnormalities are expected.

Minimum toxic doses of psilocybin are unknown in dogs and cats. Doses of approximately 4 to 8 mg psilocybin, found in 2 g of dried mushrooms or 20 fresh mushrooms, can produce signs in humans.[6] The onset of signs is 30 to 180 minutes and the duration of signs is 6 to 24 hours.[7]

Muscarine Mushrooms

Inocybe and *Clitocybe* genera mushrooms contain muscarine (**TABLE 1**). Muscarine is structurally similar to acetylcholine. Free muscarine competes with acetylcholine for the muscarinic acetylcholine receptors in the autonomic nervous system.[8] When ingested, these mushrooms cause salivation, lacrimation, urination, defecation, dyspnea, and emesis (SLUDDE) signs due to postganglionic parasympathomimetic stimulation.[9] The primary cardiovascular effects of muscarine are reduced blood pressure and heart rate. Contractions and spasm of the intestine and persistent contractions of the urinary bladder are caused by the effects on the smooth muscles.[9] At high enough doses, these mushrooms are hallucinogenic. The cholinergic signs predominate without nicotinic or significant central nervous system (CNS) effects. Respiratory and cardiac arrest are rare. Harsh respiratory sounds are due to bronchial secretions.

There are no known minimum toxic oral doses in dogs or cats. The minimum lethal dose in humans is 40 to 100 mg of muscarine.[10] Feline cardiovascular systems are particularly sensitive to muscarine. In cats, as little as 0.01 mg/kg IV can cause hypotension.[10] The onset of clinical signs in dogs is from 15 minutes to 1 hour after

BOX 1
What Is Really in a Chocolate Mushroom Bar?

Without regulation, products may contain ingredients beyond what is indicated on the label.

In 2024, all products from a company that produced mushroom chocolate bars and gummies were recalled and withdrawn from the market. The products were labeled "magic," "nootropic," and/or "microdosing." The mushrooms were listed as a "proprietary blend." These products were sold online and in stores, and they were linked to 145 human illnesses throughout the United States, including 59 hospitalizations, and 2 potential deaths.

Analysis of 22 samples from the products revealed the presence of muscimol in 9; psilocin in 4; psilacetin, a semisynthetic alternative to psilocin, in 9; and pregabalin, a prescription drug, in 3.

Desmethoxyyangonin, dihydrokavain, and kavain (kavalactones from the kava plant) were identified in 18 samples.[1,2]

TABLE 1 Hallucinogenic Mushrooms

TOXIN	SCIENTIFIC NAME	COMMON NAME
Isoxazole (ibotenic acid, muscimol)	*Amanita gemmata*	Gemmed amanita, jonquil amanita
	*Amanita muscaria**	Fly agaric, fly amanita
	*Amanita pantherina**	Panther cap, false blusher, panther amanita
	Tricholoma muscarium	Fly-catcher mushroom, fly agaric tricholoma
Muscarine	*Clitocybe**	Funnel mushroom, funnel cap
	Entoloma	Pinkgills
	*Inocybe**	Fibercaps, fiberheads
	Mycena	Bonnets, fairy helmets
Psilocybin	*Conocybe*	Conecaps, dunce caps, cone heads
	Gymnopilus	Rustgills, gyms
	Inocybe	Fibercaps, fiberheads
	Lycoperdon	Puffball
	*Panaeolus**	Mottlegills, pans, lawnmower's mushroom
	Pluteus	Shields, deer mushroom, fawn mushroom
	*Psilocybe**	Magic mushrooms, shrooms, mushies, gold caps, liberty caps
	Stropharia	Roundheads
	Tylopilus	Bitter boletes

**Most commonly encountered*

ingestion (more rapid than in humans).[11] Signs can persist for several hours if untreated but resolve quickly with administration of atropine.

Isoxazole Mushrooms

Isoxazole mushrooms contain muscimol and ibotenic acid (**TABLE 1**). They are both excitatory amino acids.[12-14] They cross the blood–brain barrier, disrupting normal neurotransmitter function.[15,16] Fluctuating CNS excitation and depression are due to the contrasting effects of muscimol and ibotenic acid.[17] Ibotenic acid acts on glutamate receptors in the brain and causes CNS stimulation. Muscimol, formed by decarboxylation of ibotenic acid, binds γ-aminobutyric acid (GABA) receptors in the CNS. This binding is irreversible, leading to prolonged activity and CNS depression.[17] The most common clinical signs are vomiting, ataxia, and disorientation. Frequently, hallucinations, vocalization, alternating lethargy and agitation, hyperesthesia, recumbency, somnolence, and fasciculations may occur. Tremors, seizures, bradycardia, hypotension, and hypothermia are possible. Combining isoxazole mushrooms with benzodiazepines or other CNS depressants can cause apnea and death, even when used therapeutically.

There is little information on toxic doses in dogs and cats. Approximately 6 mg of muscimol and 30 to 60 mg of ibotenic acid causes CNS effects in adult humans.[18,19] This amount is found in a single cap of *Amanita pantherina* and some *Amanita muscaria*. A lethal dose in humans is approximately 15 caps. The onset of signs with isoxazole-containing mushrooms in dogs is fast; most signs begin within 30 minutes to 2 hours postexposure.[20] Signs last for 8 to 24 hours.

Treating Hallucinogenic Mushroom Intoxication

Decontamination via emesis or lavage can be used in asymptomatic patients after hallucinogenic mushroom ingestion. Lavage effectiveness may be limited due to the size of the gastric tube that can be used. If emesis is not successful, or if there are contraindications for emesis, and the patient is still asymptomatic, a single dose of activated charcoal (1 g/kg) can be given. With ingestion of muscarinic mushrooms, activated charcoal

is recommended to minimize absorption; however, the rapid onset of clinical signs often makes this unfeasible.[21] Osmotic cathartics should be given with concurrent activated charcoal administration.

There is limited timely diagnostic testing available for these intoxications in animals, and many times the type of mushroom involved is unknown; therefore, symptomatic and supportive care is the basis of all therapies. Antiemetics and intravenous fluids should be used in patients with significant gastrointestinal upset. Fluids may also aid in body temperature and blood pressure control. Vasopressors are rarely needed but may be used if hypotension does not respond to fluids.

Minimize sensory stimuli to reduce CNS stimulation. Caution must be used if giving any CNS depressants as they have been linked to apnea with isoxazole mushrooms.[21] Diazepam is suspected to strengthen the action of muscimol.[22,23] Non-GABA sedatives such as acepromazine and dexmedetomidine can be considered. In cases of suspected isoxazole mushroom ingestion with respiratory depression, flumazenil has been suggested theoretically but lacks evidence of efficacy. Intubation and ventilation remain the standard of care for significant respiratory compromise. Atropine should be reserved for patients with clear muscarinic (SLUDDE) signs *and* when isoxazole mushroom ingestion is unlikely or excluded. In suspected isoxazole ingestion (e.g., *Amanita* species), atropine may exacerbate CNS depression and should be avoided. If the mushroom species is unknown, supportive care without atropine is the safer approach.[18]

Seizures are rare but are most commonly seen with psilocybin-containing mushrooms. These can be controlled with diazepam or, if no response, barbiturates, propofol, or isoflurane. Monitor respirations closely if using any CNS depressant as the exact mushroom involved may be unknown. Cyproheptadine (1.1 mg/kg PO or PR q8h to q12h for dogs; 2 to 4 mg q12h to q24h for cats), while not an antagonist, can block the effects of serotonergic drugs and may also be helpful for hyperthermia that is seen with psilocybin intoxication.

The treatments required for symptomatic care secondary to psychedelic mushroom ingestion will also treat most clinical signs caused by chocolate intoxication. However, in addition, pets may need β-blockers to control tachycardia. Tremors respond to methocarbamol. Doses of concern with methylxanthines (stimulant compounds found in chocolate) are > 20 mg/kg for gastrointestinal signs (e.g., vomiting, diarrhea), > 40 mg/kg for cardiovascular signs (e.g., tachycardia, arrhythmias), and > 60 mg/kg for CNS signs (e.g., agitation, tremors, seizures).[24]

Patient Prognosis

Prognosis for most psychogenic mushroom intoxications is generally good, provided apnea does not occur. Death from ingestion of hallucinogenic mushrooms in dogs is rare but is previously reported.[25] No long-term issues are expected after recovery. The biggest concerns with these products are the lack of regulation, as many of these products exist in legal gray areas or are sold without standardized testing.

Summary

Ingestions of hallucinogenic mushroom products can cause neurologic signs in dogs and cats. Psilocybin-containing mushrooms cause serotonin syndrome, while muscarinic mushrooms can cause SLUDDE signs. Isoxazole-containing mushrooms can cause alternating CNS agitation and depression. Treatment is symptomatic, but sedatives should be avoided in patients with isoxazole intoxications. Prognosis in most cases is good. TVP

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