



TOXICOLOGY BRIEF

Airing the Dangers of Albuterol Exposure in Dogs

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From 1992 to 1998, the ASPCA—Animal Poison Control Center (APCC) received over 300 calls regarding albuterol exposure in dogs after they had bitten into inhaler canisters.¹ Often in these cases, the entire contents are propelled into their mouths and are then inhaled or swallowed.² Albuterol is rapidly absorbed, and its effects may be seen within 5 minutes of inhalation or 30 minutes of ingestion (Figure 1).³

Clinical Signs

Albuterol exposure in dogs may affect the cardiovascular, central nervous (CNS), and gastrointestinal (GI) systems.

- Cardiovascular effects include arrhythmias, bradycardia, tachycardia, heart block, extrasystole, tachypnea, and hypertension.^{2,3}
- CNS stimulation (e.g., hyperactivity, tremors, seizures) may occur followed by CNS depression and recumbency. The carriers in albuterol inhalers, chlorofluorocarbons, have CNS depressant effects and may sensitize the myocardium to the arrhythmogenic effects of albuterol.¹
- GI signs include vomiting and hypersalivation.^{2,3}
- Electrolyte abnormalities have been reported, with hypokalemia being the most frequent.¹⁻³
- Other regularly reported signs are fever, mydriasis, and death.^{2,3}

Table 1 cites clinical signs observed in 20 cases of albuterol inhaler exposure in dogs.² In each of these cases, the pet owner or attending veterinarian called the APCC for recommendations and a member of the APCC veterinary staff made an assessment based on evidence of exposure (i.e., presence of a chewed inhaler), clinical signs, and time frame in which the signs oc-



Figure 1—Albuterol exposure can lead to problems in a matter of minutes.

curred. All clinical signs from these cases were judged highly likely to have been caused by albuterol exposure.²

Mechanism of Action

Albuterol (a β -adrenergic agonist available in tablet, liquid, and inhaler forms) is believed to act by stimulating production of cyclic adenosine monophosphate through activation of adenylyl cyclase, thereby relaxing bronchial, uterine, and vascular smooth muscles.³ It is commonly used to treat bronchospasm in asthmatic humans^{1,4} and has also been used to alleviate bronchospasm and coughing in dogs.³

At usual doses, albuterol has minimal effects on the heart. However, cardiac signs are more likely to occur in conjunction with an overdose or concomitant intake of a similar drug (Box 1).

Treatment

Treatment of albuterol inhaler exposure in dogs involves treating the

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TABLE 1
Common Clinical Signs of
Albuterol Exposure in Dogs^{2,a}

<i>Clinical Sign^b</i>	<i>Occurrence in 20 Cases</i>
Tachycardia	17
Tachypnea/panting	10
Depression	7
Hypokalemia (2.1–3 mEq/L)	4
Other arrhythmias	3
Hyperactivity	3
Tremors	2
Hypersalivation	2
Vomiting	2

^aFrom January 1, 1998 to August 24, 2000.

^bIn addition, each of the following clinical signs occurred in one case: polydipsia, elevated chloride level, elevated sodium level, mydriasis, glazed eyes, bowel incontinence, retching/gagging, dyspnea, pulse abnormality, hypertension, respiratory abnormality.

signs and providing supportive care. Decontamination from respiratory exposure is not possible, and GI decontamination is not usually recommended because the onset of signs is so rapid. Propranolol, a nonspecific β -adrenergic blocking agent, can be administered (0.02 to 0.06 mg/kg IV slowly)³ for tachycardia if the heart rate is 140 to 260 beats/minute.⁵ Additional doses may be administered every 6 to 8 hours if signs warrant as the half-life of propranolol in dogs is short (i.e., 45 minutes to 2 hours).^{3,6} Diazepam (0.5 to 1.0 mg/kg IV in increments of 5 to 10 mg, to effect)³ is helpful in controlling hyperactivity,

tremors, and seizures. If the serum potassium level falls below 2.5 mEq/L, IV fluids can be supplemented with potassium chloride (not to exceed 0.5 mEq/kg/hr IV). Because potassium salts are contraindicated in patients with impaired renal function, IV potassium replacement should be used cautiously or not at all in these patients.³ Hydration status, serum potassium level, serum glucose level, heart rate, heart rhythm, and blood pressure should be assessed regularly until signs have completely resolved, which may take a few hours to 48 hours. Prognosis is generally good for otherwise healthy animals that receive treatment, as demonstrated in the following case studies.²

Case Studies

Case 1

A veterinarian called the APCC at 9:30 PM regarding a 2.5-year-old spayed dalmatian (25.9 kg). At 10 AM that day, the dog had punctured an inhaler. It was not known how much medication was in the inhaler. The dog had a heart rate of 200 beats/minute and moderate tachypnea. The APCC staff member who received the call recommended giving an IV β -blocker, such as propranolol. The staff member also recommended that fluids be given and electrolytes checked. On follow-up, the APCC learned that the dog completely recovered with the recommended treatment.²

Case 2

The owner of a 9-month-old spayed

pit bull–German shepherd mix (19.1 kg) called the APCC at 9:13 AM. Sometime during the night, the dog chewed on a nearly new inhaler and had severe tachycardia, moderate tremors, and severe tachypnea. The APCC staff member recommended that the owner take the dog to a veterinarian for treatment and have a veterinary staff member call the APCC for treatment advice. Twenty-six minutes later, a veterinary staff member called the APCC for recommendations. The APCC staff member recommended that a β -blocker, such as propranolol, be given for a heart rate over 180 beats/minute and that diazepam be given for tremors. On follow-up, the APCC learned that the dog had completely recovered with the recommended treatment.²

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References

1. Rosendale ME, Volmer PA: Albuterol inhaler toxicosis in dogs. *J Vet Emerg Crit Care* 8(3):255, 1998.
2. Unpublished data, ASPCA National Animal Poison Control Center Case Databases, 1995–1997 and 1998–2000.
3. Plumb DC: *Veterinary Drug Handbook*, ed 3. Ames, Iowa State University Press, 1999, pp 12, 547.
4. Petruska PM, Beattie JG, Stuart BO, et al: Cardiovascular effects after inhalation of large doses of albuterol dry powder in rats, monkeys and dogs: A species comparison [article number: FA972370]. *Fundam Appl Toxicol* 40:52–62, 1997.
5. Morgan RV: *Handbook of Small Animal Practice*, ed 3. Philadelphia, WB Saunders Co, 1997, pp 74–75.
6. Stiles J, Plumb DC: Toxicity associated with β -agonist aerosol exposure in three dogs. *JAAHA* 29:235–238, May/June 1993.

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BOX 1

Potential Drug Interactions with Albuterol³

- An increase in cardiovascular effects may be expected with exposure to **other sympathomimetic amines** (e.g., phenylpropanolamine, ephedrine, pseudoephedrine).
- **Tricyclic antidepressants** (e.g., amitriptyline, desipramine, doxepin, clomipramine) or **monoamine oxidase inhibitors** (e.g., lazabemide, phenelzine, selegiline, tranylcypromine) may potentiate the vascular effects (e.g., hypertension) of albuterol.
- **Inhalant anesthetics** (e.g., halothane, isoflurane, methoxyflurane) may predispose patients (most commonly those with preexisting cardiac disease) to ventricular arrhythmias.
- **Digitalis glycosides** (e.g., digoxin, digitoxin) may increase the risk of cardiac arrhythmias.

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