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 occurred. 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 adenyly cyclase, thereby relaxing bronchial, uterine, and vascular smooth muscles.3 It is commonly used to treat bronchospasm in asthmatic humans1,4 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
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 increase the risk of cardiac arrhythmias.

Digitalis glycosides (e.g., digoxin, digitoxin) may increase the risk of cardiac arrhythmias.

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. 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.3

Case Studies
Case 1
A veterinarian called the APCC at 9:30 PM regarding a 2.5-year-old spayed dalmation (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 had 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

Acknowledgment
The author thanks Safdar A. Khan, DVM, MS, PhD, Diplomate of the American Board of Veterinary Toxicology, who is affiliated with the ASPCA–National Animal Poison Control Center, Urbana, Illinois, for his contribution and review of the column.

References

(continues on page 329)
Toxicology Brief (continued from page 306)

About the Author
Ms. Bough is a certified veterinary technician at the ASPCA–National Animal Poison Control Center (NAPCC), Urbana, Illinois. She is a graduate of the veterinary technician program at Parkland College, Champaign, Illinois, and received her toxicology training at the NAPCC. She resides with her family and menagerie of pets in Fithian, Illinois.