

Aerosol Therapy in Dogs & Cats

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Courtesy of Trudell Medical International



Pulmonary diseases, which are common in dogs and cats, may be infectious, inflammatory, or neoplastic. In the treatment of infectious or inflammatory pulmonary disease, aerosol medication, either as sole therapy or adjunctive to systemic treatment and supportive care, can be beneficial.

Fast Fact



The term *aerosol therapy* was introduced in the early 20th century. Since that time, there has been considerable growth in the human field of aerosol therapy.

To date, most recommendations on inhaled medications are based on opinion or extrapolated from human medicine.

Aerosol therapy can be an appealing treatment option because it directly channels medication into the respiratory tract. In contrast, some systemic medications fail to adequately reach the source of infection or inflammation, particularly in patients with excessive mucus or established infection in the airway lumen.

Of note, anatomy, physiology, and compliance differ between human and veterinary patients and may influence whether aerosol therapy is successful. For example, although dogs and cats can be trained to tolerate a face mask, they continue to breathe through their noses. Their complex nasal turbinates, however, prevent most aerosolized medication from reaching the lungs, as it is deposited in the nasal cavity instead. Despite nasal breathing and interference of nasal turbinates, there are clear indications for aerosol and inhalation therapy in these patients.

Indications & Complications

Aerosol therapy should be considered as adjunctive therapy in cats and dogs with chronic inflammatory airway disease (eg, feline asthma) and in dogs with aspiration pneumonia or cough from *Bordetella bronchiseptica* infection. Nebulization is commonly combined with coughage to mobilize secretions.

Considerations

Three types of aerosol generators are used in human medicine: nebulizer, metered-dose inhaler (MDI), and dry-powder inhaler (DPI). DPIs are not used in dogs or cats because of their inability to generate adequate negative pressure on inspiration.

The most common nebulizer is the pneumatic jet, which delivers compressed gas through a jet, causing liquid to break into droplets. A baffle (ie, surface on which large particles fall/deposit) may help make the nebulized particles smaller. Ultrasonic or mesh nebulizers may also be used but are less common.

MDIs create particles by using a pressured propellant called *hydrofluoroalkane* (HFA). Distribution in the airway depends on particle size, with particles >10 µm removed or trapped in the upper airways, particles of 5 to 10 µm settling in the lower airways, and particles of 1 to 5 µm reaching the lung periphery.

Drug deposition can be a major concern, with large percentages of drug settling in the upper airways. Deposition is reflective of 3 separate mechanisms: inertial impaction, gravitational settling, and diffusion of particles <1 µm. Although drug deposition can be variable, studies using nuclear scanning have established that medication administered by MDIs do reach the lungs, with some of the inhalant likely absorbed systemically.

Successful aerosol therapy depends on properly implementing the required hands-on approach, selecting the appropriate medication, and attaining patient cooperation. Medications should be designed for aerosolization in dogs and cats. Of note,

Complex nasal turbinates may limit the success of inhaled medications in companion animals.

N-acetylcysteine should *not* be used as an aerosol because of the risk for bronchospasm or airway irritation.

Pet cooperation is essential, especially for patients requiring long-term aerosol therapy; training and positive reinforcement are required. As with all therapies, each treatment plan should be assessed based on individual patient needs. Although inhaled albuterol is an effective bronchodilator, terbutaline (0.01 mg/kg SC) may be preferable to lower feline patient stress in an asthmatic crisis.

MORE ►

What You Will Need

Nebulization

- Nebulizer (ie, source of compressed air)
- Medication
- Face mask (optional)

Metered-Dose Inhalation

- MDI
- Face mask
- Space chamber (eg, Aerokat, trudellmed.com/animal-health)
- Selected drug (eg, albuterol, fluticasone; see **Table**)

Table Commonly Used Inhaled Medications

Drug	Class	Indications	Species	Comments	Dose	Dose Forms
Albuterol	β ₂ -agonist	Bronchodilation	Feline	Use as needed, not routinely	1–2 puffs	90 µg/puff (each canister ~200 puffs)
Fluticasone	Inhaled glucocorticoid	Airway inflammation	Feline	Overlap with oral prednisolone for 10–14 days when starting	110 µg q12h (may increase)	44 µg/puff, 110 µg/puff, 220 µg/puff (each canister ~120 puffs)
Fluticasone	Inhaled glucocorticoid	Airway inflammation	Canine	Overlap with oral prednisolone for 10–14 days when starting	110–440 µg q12h	44 µg/puff, 110 µg/puff, 220 µg/puff (each canister ~120 puffs)

DPI = dry-powder inhaler, HFA = hydrofluoroalkane, MDI = metered-dose inhaler

Step-by-Step ■ Nebulization

Step 1

Prepare nebulizer with selected product. Children's nebulizers, such as the penguin shown, can be useful and economic in a veterinary setting.



Author Insight For patients with pneumonia, combine nebulization with physiotherapy (ie, coupage).

Step 2

Nebulize the patient until all liquid has been aerosolized. (A) The nebulizer should be carefully aimed to allow inhalation of the medication, such as using a face mask, rather than (B) placing the nebulizer tube near the patient but not close enough for medication to be inhaled.



Step 3

Clean and dry all equipment. Sterilization is necessary if the patient has an infectious disease.

For More



See **Inhaled Corticosteroids & Airway Disease** by Dr. Elizabeth Rozanski at cliniciansbrief.com/inhaled-corticosteroids

IVERHART MAX[®]

(ivermectin/pyrantel pamoate/praziquantel)

Chewable Tablets

CAUTION: Federal (US) law restricts this drug to use by or on the order of a licensed veterinarian.

BRIEF SUMMARY: Please consult package insert for complete product information.

Indications: For use in dogs to prevent canine heartworm disease by eliminating the tissue stage of heartworm larvae (*Dirofilaria immitis*) for a month (30 days) after infection and for the treatment and control of roundworms (*Toxocara canis*, *Toxascaris leonina*), hookworms (*Ancylostoma caninum*, *Uncinaria stenocephala*, *Ancylostoma braziliense*), and tapeworms (*Dipylidium caninum*, *Taenia pisiformis*).

WARNINGS: For use in dogs only. Keep this and all drugs out of reach of children. In safety studies, testicular hypoplasia was observed in some dogs receiving 3 and 5 times the maximum recommended dose monthly for 6 months (see Animal Safety). In case of ingestion by humans, clients should be advised to contact a physician immediately. Physicians may contact a Poison Control Center for advice concerning cases of ingestion by humans.

PRECAUTIONS: Use with caution in sick, debilitated, or underweight animals and dogs weighing less than 10 lbs. The safe use of this drug has not been evaluated in pregnant or lactating bitches.

All dogs should be tested for existing heartworm infection before starting treatment with IVERHART MAX Chewable Tablets, which are not effective against adult *D. immitis*. Infected dogs should be treated to remove adult heartworms and microfilariae before initiating a heartworm prevention program.

While some microfilariae may be killed by the ivermectin in IVERHART MAX Chewable Tablets at the recommended dose level, IVERHART MAX Chewable Tablets are not effective for microfilariae clearance. A mild hypersensitivity-type reaction, presumably due to dead or dying microfilariae and particularly involving transient diarrhea, has been observed in clinical trials with ivermectin alone after treatment of some dogs that have circulating microfilariae.

ADVERSE REACTIONS: In clinical field trials with ivermectin/pyrantel pamoate, vomiting or diarrhea within 24 hours of dosing was rarely observed (1.1% of administered doses). The following adverse reactions have been reported following the use of ivermectin: depression/lethargy, vomiting, anorexia, diarrhea, mydriasis, ataxia, staggering, convulsions and hypersalivation.

ANIMAL SAFETY: Studies with ivermectin indicate that certain dogs of the Collie breed are more sensitive to the effects of ivermectin administered at elevated dose levels (more than 16 times the target use level of 6 mcg/kg) than dogs of other breeds. At elevated doses, sensitive dogs showed adverse reactions which included mydriasis, depression, ataxia, tremors, drooling, paresis, recumbency, excitability, stupor, coma and death. No signs of toxicity were seen at 10 times the recommended dose (27.2 mcg/lb) in sensitive Collies. Results of these studies and bioequivalence studies support the safety of ivermectin products in dogs, including Collies, when used as recommended by the label.

In a laboratory safety study, 12-week-old Beagle puppies receiving 3 and 5 times the recommended dose once weekly for 13 weeks demonstrated a dose-related decrease in testicular maturation compared to controls.

HOW SUPPLIED: IVERHART MAX Chewable Tablets are available in four dosage strengths (see **Dosage** section) for dogs of different weights. Each strength comes in a box of 6 chewable tablets and in a box of 12 chewable tablets, packed 10 boxes per display box.

STORAGE CONDITIONS: Store at controlled room temperature of 59°-86° F (15°-30° C). Protect product from light.

For technical assistance or to report adverse drug reactions, please call 1-800-338-3659.

Manufactured by: Virbac AH, Inc. Fort Worth, TX 76137

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Step-by-Step ■ Metered-Dose Inhalation

Step 1

Choose the inhalant (see **Table 1**, page 33). Metered-dose inhalation should be reassessed if the initial patient response to oral glucocorticoids was poor, as inhaled glucocorticoids may be ineffective if systemic glucocorticoids are ineffective. Fluticasone (eg, Flovent, flovent.com) is the most commonly used glucocorticoid in the United States, although other preparations (eg, QVAR, qvar.com) are available. Clients should be informed that inhaled glucocorticoids may be expensive, particularly as compared with oral prednisolone or prednisone.

Author Insight

Restrain the pet comfortably and provide positive reinforcement as needed.

Step 2

Select the face mask and spacer; the latter allows distribution and suspension of the medication. When medication is inhaled by the patient, there is no need to coordinate actuation of the metered dose at the exact inspiration point. ■ **cb**



Author Insight If the MDI has not been used recently, prime it first by shaking gently before actuating 2 to 3 puffs.

See **Aids & Resources**, back page, for references & suggested reading.

MDI = metered-dose inhaler