

STUDY SUMMARY

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***Use of inhaled medication to treat respiratory disease in small animals***

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June 2012



Trudell Medical International\*

## Foreword

The **AeroKat**\* Feline Aerosol Chamber and **AeroDawg**\* Canine Aerosol Chamber are designed to be used along with metered dose inhalers (MDIs) to deliver aerosol medication to animals suffering from respiratory diseases. When the chamber is attached to the MDI it allows the animal to breathe normally and inhale the aerosol medication. Both chambers include a **Flow-Vu**\* Inspiratory Flow Indicator, a valuable feedback tool that moves as the patient breathes, allowing the caregiver to ensure a good facemask seal, coordinate actuation with inhalation and count patient breaths. The chambers include two facemasks designed to accommodate different breeds and sizes.

Aerosol medications delivered by metered dose inhalers have been used to treat human respiratory conditions since the 1960s. Because respiratory disease in animals imitates human conditions, they can be treated in a similar way. Aerosol delivery provides many benefits including the potential for attaining high drug concentration at the disease site with minimal systemic absorption.<sup>1</sup> Therapeutic effect can often be achieved with a fraction of the dose required for systemic delivery of the same drug.<sup>2</sup>

Metered Dose Inhalers are the most prescribed drug format for respiratory medications because they act quickly, at the site and with few side effects. There are two main categories of drugs available in MDI format:

- 1) Corticosteroids - for control of the inflammation that causes respiratory symptoms
- 2) Bronchodilators - for quick relief of symptoms

This study summary includes some of the more recent and relevant studies on the use of inhaled medication to treat respiratory disease in small animals.

### About Trudell Medical International

Trudell Medical International has a strong history of leadership in creating innovative aerosol drug delivery devices that enhance the quality of life for people and animals suffering from respiratory disease. In addition to the **AeroKat**\* Feline Aerosol Chamber and **AeroDawg**\* Canine Aerosol Chamber, Trudell Medical International develops and manufactures the **AeroHippus**\* Equine Aerosol Chamber for horses suffering from respiratory disease. On the human side, the flagship **AeroChamber**\* brand of Valved Holding Chambers are the most prescribed chambers in the world.

## **USE OF INHALED MEDICATIONS**

“Inhalant therapy is the most significant advance in the treatment of feline asthma that has occurred in decades.”

*(For asthmatic cats, relief may be a few puffs away. CatWatch, April 2005)*

“ Few owners have trouble administering the inhaled medication in this fashion. In fact, many owners have commented that aerosol therapy is far simpler than pilling their cat.”

*(Inhalational delivery of medications to dogs and cats. Cohn LA. International Congress of the Italian Association of Companion Animal Veterinarians, 2006)*

“Breath holding by the dog or cat can be a reason for treatment failure, although the newest spacing chambers created by Trudell Medical have a Flow-Vu indicator that allows visualization of respiratory movements.”

*(Using Inhaled Medications – Keys to success. Johnson L. NAVC Proceedings, 2012)*

“Over the past 4 years we have treated more than 100 steroid-dependent asthmatic cats with twice-daily Flovent, and proventil on an as needed basis. Approximately 80% of these patients no longer use oral prednisone.”

*(Diagnosis and therapy of feline bronchial disease. Padrid P. Proceedings of the World Small Animal Veterinary Association, 2007)*

“Typically, with some patience and practice, most cats tolerate treatment both at home and in hospital with minimal resistance.”

*(Inhalation Therapy: New Approaches to Old Diseases. Mazzaferro EM. NAVC Proceedings, 2006)*

“Recent studies in cats have demonstrated that passive inhalation thru a mask and spacer combination (AeroKat) is an effective method of delivering sufficient medication to be clinically effective.”

*(Feline Bronchitis and Asthma. Padrid P. Proceedings of the European Veterinary Conference, 2009)*

## **USE OF INHALED MEDICATION IN FELINES**

**EFFECT OF SHORT-TERM ORAL AND INHALED CORTICOSTEROIDS ON AIRWAY INFLAMMATION AND RESPONSIVENESS IN A FELINE ACUTE ASTHMA MODEL.** Leemans J, Kirschvink N, Clercx C, Snaps F, Gustin P. *Vet J.* 2012 Apr; 192(1): 41-8.

The objective of this study was to investigate whether high-dose inhaled fluticasone propionate (FP), alone or in combination with salmeterol (SAL), is as effective as oral prednisolone in reducing airway inflammation and obstruction in cats with experimentally-induced acute asthma. Six cats sensitised to *Ascaris suum* (AS) were enrolled in a prospective controlled therapeutic trial and underwent four aerosol challenges, at 1-month intervals with AS allergen. The allergen-stimulated animals received four consecutive days treatment with either oral prednisolone at 1mg/kg twice daily, 500µg of FP inhaled twice daily, or a combination of FP/SAL at 500µg/50µg inhaled twice daily, respectively, according to a randomised cross-over design. Treatment-related changes in lung function, airway responsiveness (AR) and bronchoalveolar lavage fluid (BALF) cytology were assessed. Barometric whole-body plethysmography (BWBP) was used for the assessment of respiratory variables and AR. No significant differences in respiratory rate or Penh (an estimate of airflow limitation measured by BWBP) were detected among treatment groups. Allergen-induced airway hyper-responsiveness was significantly inhibited by all three steroid treatments ( $P < 0.05$ ). The mean BALF eosinophil percentage ( $\pm$ SEM) was lower after oral and inhaled corticosteroid treatment and these changes were significant for groups receiving prednisolone and the FP/SAL combination. Findings suggest high-dose FP, particularly in combination with SAL, is effective in ameliorating airway inflammation and hyper-responsiveness in this model of acute feline asthma, and highlight the potential use of these drugs in cats experiencing acute exacerbations of the naturally occurring disease.

**FELINE ASTHMA: WHAT'S NEW AND WHERE MIGHT CLINICAL PRACTICE BE HEADING?** Venema C, Patterson C. *Journal of Feline Medicine and Surgery.* 2010; 12: 681-692.

Practical relevance: Feline bronchial asthma is one of the most commonly diagnosed respiratory conditions of cats. Clinical signs range from intermittent wheezing and coughing, which can compromise quality of life, to episodes of severe dyspnea that can be life-threatening. Clinical challenges: Feline asthma can be easily disregarded as a simplistic condition. However, much about its pathophysiology remains obscure. There is no gold standard method of diagnosis, and current approaches are associated with various limitations. Also, feline asthma is typically treated with long-term glucocorticoid therapy, which can have significant consequences. Audience: Because of its prevalence, general practitioners encounter asthma regularly. Refractory cases are often managed by veterinary internists and pulmonologists. Patient group: Asthma can be diagnosed in cats of any age but is usually seen in young to middle-aged adults (mean 4 years, range 1–15 years). There is no sex predilection, but the Siamese breed appears to be overrepresented. Evidence base: While the standard clinical approach to feline asthma has changed little in recent years, new research has provided greater insight into many aspects of this complex disease and new strategies are being studied. This article reviews the current literature in order to raise awareness of how advances in the understanding of the pathophysiology, diagnosis and treatment of feline asthma may be determining the future direction of clinical practice.

**EFFECTS OF FLUTICASONE PROPIONATE DOSAGE IN AN EXPERIMENTAL MODEL OF FELINE ASTHMA.** Cohn LA, DeClue AE, Cohen RL, Reinero CR. *J Feline Med Surg.* 2010 Feb; 12(2): 91-6.

Cats with inflammatory bronchial disease are usually treated with glucocorticoid (GC) drugs to reduce airway inflammation. Inhalant GC delivery can preserve airway effects while systemic effects are minimized. An appropriate dosage regimen for inhaled GC in cats has not been investigated. A blinded, randomized, cross-over study design was used to investigate the ability of three different dosages of the inhalant GC fluticasone propionate delivered by metered dose inhaler to ameliorate eosinophilic airway inflammation in cats with

experimentally induced allergic airway inflammation. Further, suppression of the hypothalamic-pituitary-adrenal axis (HPAA) at each dose was assessed. Fluticasone administered at dosages of 44, 110, or 220 microg q 12h reduced airway eosinophilia by 74%, 82%, or 81%, respectively (no difference). None of the dose regimens tested caused HPAA suppression. We conclude that a twice daily dosage of 44 microg fluticasone should be evaluated for the management of cats with naturally occurring inflammatory bronchial disease.

**FELINE ASTHMA.** Pernas GS. Veterinary Focus. 2010; 20(2): 10-17.

Feline asthma is an inflammatory disease that affects the lower respiratory tract and is characterized by bronchial hyper-reaction to different stimuli. The reduction in air flow is typically the result of a combination of inflammation, mucous accumulation and the contraction of airway smooth muscle. Typical signs include coughing, wheezing, distress, orthopnea, tachypnea, and dyspnea with an excessive expiratory effort. Clinical signs may be more permanent or intermittent, mild, moderate or severe. The treatment for asthma as a disease must be focused on the control of inflammation in order to prevent bronchoconstriction. Inhalation therapy is considered as a key solution for human asthma management and nowadays it is widely recommended to treat feline asthma. Alternative therapies that may be beneficial to manage feline asthma are available, but more investigation is required in order to prove their efficacy.

**INHALANT THERAPY: FINDING ITS PLACE IN SMALL-ANIMAL PRACTICE.** Cohn LA. Vet Med. 2009; 336-341.

The use of inhaled respiratory medications in dogs and cats is becoming more common. Inhalant delivery of aerosolized medication offers a number of theoretical benefits, including an enormous absorptive surface area across a permeable membrane, a low enzyme environment that results in little drug degradation, avoidance of hepatic first-pass metabolism, and reproducible absorption kinetics. When the target of inhaled medications is the respiratory tract itself, additional benefits include the potential for attaining a high drug concentration directly at the disease site with minimal systemic absorption and toxicity. Often, therapeutic effect can be achieved with only a fraction of the dose required for systemic delivery of the same drug. Because of these advantages, inhalant delivery of medication has gained widespread use for treating airway diseases in people. More than 30 drugs licensed for people are available for inhalation, including anti-inflammatory drugs and bronchodilators. An enormous body of evidence in the medical literature exists regarding the efficacy and toxicity of inhalational drug therapy in people. In veterinary medicine, the literature on inhalant therapy to treat naturally occurring disease is sparse. Regardless, aerosol delivery of medication has become popular for treating dogs and, especially, cats with respiratory disease.

**ADVANCES IN RESPIRATORY THERAPY.** Rozanski EA, Bach JF, Shaw SP. Vet Clin North Am Small Anim Pract. 2007 Sep; 37(5): 963-74.

Effective respiratory therapy depends on obtaining a definitive diagnosis and following established recommendations for treatment. Unfortunately, many respiratory conditions are idiopathic in origin or are attributable to nonspecific inflammation. In some situations, disorders are controlled rather than cured. Recent advances in pulmonary therapeutics include the use of new agents to treat common diseases and application of local delivery of drugs to enhance drug effect and minimize side effects.

**INVESTIGATION AND TREATMENT OF FELINE CHRONIC BRONCHIAL DISEASE.** Mardell E. In Practice. 2007; 29: 138-146.

Domestic cats presenting with a chronic cough or wheeze are encountered with some frequency in small animal practice. The problem may be persistent or episodic, and can vary widely in severity. Clinically, many cases resemble human chronic bronchial disease but, with much still to learn about the feline disease, terms as specific

as 'feline asthma' and 'chronic bronchitis' may be misleading. This article reviews the options for investigation available to the veterinary clinician, which are limited compared with the techniques used in the medical field. As discussed, inhaled therapy is becoming an increasingly important component of therapy, again based on experiences gained in human medicine, but at present treatment remains essentially symptomatic.

**USE OF INHALED MEDICATIONS TO TREAT RESPIRATORY DISEASES IN DOGS AND CATS.** Padrid P. J Am Anim Hosp Assoc. 2006 Mar-Apr; 42(2): 154-9.

Noninfectious disorders of the respiratory tract, including laryngitis, tracheitis, bronchitis, and asthma are common problems in dogs and cats. Traditional therapies have often included corticosteroids and bronchodilators given by mouth or injection. Side effects of this form of treatment can be severe and can result in cessation of therapy. Inhaled corticosteroid drugs are not as absorbed into the systemic circulation, do not result in significant side effects, and are now the standard of care for dogs and cats with respiratory diseases that would otherwise be treated with systemic medications.

**INHALED FLUTICASONE REDUCES BRONCHIAL RESPONSIVENESS AND AIRWAY INFLAMMATION IN CATS WITH MILD CHRONIC BRONCHITIS.** Kirschvink N, Leemans J, Delvaux F, Snaps F, Jaspert S, Evrard B, Delattre L, Cambier C, Clercx C, Gustin P. J Feline Med Surg. 2006 Feb; 8(1): 45-54.

This study investigated the effect of inhaled fluticasone on lower airway inflammation and bronchial responsiveness (BR) to inhaled carbachol in cats with very mild, chronic bronchitis (n = 5) that were compared with healthy cats serving as controls (n = 6). Chest radiographs, BR tests performed non-invasively by barometric whole body plethysmography (BWBP) and bronchoalveolar lavage (BAL) were performed before and after treatment. BR was quantified by calculating the concentration of carbachol inducing bronchoconstriction (C-Penh300%), defined as a 300% increase of baseline Penh, an index of bronchoconstriction obtained by BWBP. BAL fluid was analyzed cytologically and the oxidant marker 8-iso-PGF2alpha was determined. At test 1, healthy cats and cats with bronchitis were untreated, whereas for test 2 inhalant fluticasone (250 microg once daily) was administered for 2 consecutive weeks to cats with bronchitis. Control cats remained untreated. Inhaled fluticasone induced a significant increase in C-Penh300% and a significant decrease of BAL fluid total cells, macrophages, neutrophils and 8-iso-PGF2alpha in cats with bronchitis, whilst untreated control cats did not show significant changes over time. This study shows that a 2-week fluticasone treatment significantly reduced lower airway inflammation in very mild bronchitis. BR could be successfully monitored in cats using BWBP and decreased significantly in response to inhaled fluticasone. 8-Iso-PGF2alpha in BAL fluid was responsive to treatment and appeared as a sensitive biomarker of lower airway inflammation in cats.

**EFFECTS OF DRUG TREATMENT ON INFLAMMATION AND HYPERREACTIVITY OF AIRWAYS AND ON IMMUNE VARIABLES IN CATS WITH EXPERIMENTALLY INDUCED ASTHMA.** Reinero CR, Decile KC, Byerly JR, Berghaus RD, Walby WE, Berghaus LJ, Hyde DM, Schelegle ES, Gershwin LJ. Am J Vet Res. 2005 Jul; 66(7): 1121-7.

**OBJECTIVE:** To compare the effects of an orally administered corticosteroid (prednisone), an inhaled corticosteroid (flunisolide), a leukotriene-receptor antagonist (zafirlukast), an antiserotonergic drug (cyproheptadine), and a control substance on the asthmatic phenotype in cats with experimentally induced asthma. **ANIMALS:** 6 cats with asthma experimentally induced by the use of Bermuda grass allergen (BGA). **PROCEDURES:** A randomized, crossover design was used to assess changes in the percentage of eosinophils in bronchoalveolar lavage fluid (BALF); airway hyperresponsiveness; blood lymphocyte phenotype determined by use of flow cytometry; and serum and BALF content of BGA-specific IgE, IgG, and IgA determined by use of ELISAs. **RESULTS:** Mean +/- SE eosinophil percentages in BALF when cats were administered prednisone (5.0 +/- 2.3%) and flunisolide (2.5 +/- 1.7%) were significantly lower than for the control treatment (33.7 +/- 11.1%). We did not detect significant differences in airway hyperresponsiveness or lymphocyte surface markers among

treatments. Content of BGA-specific IgE in serum was significantly lower when cats were treated with prednisone (25.5 +/- 5.4%), compared with values for the control treatment (63.6 +/- 12.9%); no other significant differences were observed in content of BGA-specific immunoglobulins among treatments. **CONCLUSIONS AND CLINICAL RELEVANCE:** Orally administered and inhaled corticosteroids decreased eosinophilic inflammation in airways of cats with experimentally induced asthma. Only oral administration of prednisone decreased the content of BGA-specific IgE in serum; no other significant local or systemic immunologic effects were detected among treatments. Inhaled corticosteroids can be considered as an alternate method for decreasing airway inflammation in cats with asthma.

**FELINE ASTHMA – A REVIEW AND NEW INSIGHTS.** Hirt RA. The European Journal of Companion Animal Practice. 2005 Oct; 15(2): 141-154.

Feline asthma is a chronic idiopathic, spontaneously occurring disease of the lower airways with great similarities to its human equivalent. It is characterised by chronic coughing, wheezing, intermittent respiratory distress due to bronchoconstriction and airway hyper-responsiveness to various stimuli. The disease is diagnosed by history, clinical signs, radiographic changes, the presence of eosinophilia in bronchoalveolar lavage fluid (BAL) and exclusion of other diseases causing similar clinical signs. The introduction of barometric whole body plethysmography (BWBP) as a diagnostic tool in cats permits diagnosis and quantification of asthma associated bronchoconstriction impeding normal airflow. In the acutely dyspnoeic patient, it facilitates the differentiation between bronchoconstriction and other causes of respiratory distress (e.g. cardiac failure, pleural effusion). Furthermore, the effects of drug therapy can be directly monitored without additional distress to the patient. The similarity to human asthma may, in part, justify extrapolation of new therapeutic options with fewer side effects than conventional therapy. The purpose of this paper is to elucidate parallels and differences between human and feline asthma with regard to the pathogenesis, pathophysiology, diagnosis and treatment.

**BRONCHODILATORS IN BRONCHOSCOPY-INDUCED AIRFLOW LIMITATION IN ALLERGEN-SENSITIZED CATS.** Kirschvink N, Leemans J, Delvaux F, Snaps F, Clercx C, Gustin P. Journal of Veterinary Internal Medicine. 2005 March; 19 (2): 161-167.

This study investigated the effect of bronchoscopy and bronchoalveolar lavage (BAL) on respiratory function, determined by barometric whole-body plethysmography (BWBP), of healthy and allergen-sensitized cats. Furthermore, the efficacy of inhaled bronchodilators in preventing changes in respiratory function was determined. For test 1, 18 healthy experimental cats were investigated on day 1 by BWBP. On day 2, the cats underwent BWBP after sedation (medetomidine), after anesthesia induction (propofol), and after bronchoscopy and BAL. Enhanced pause (Penh) was significantly increased after bronchoscopy and BAL ( $1.64 \pm 0.17$  versus  $1.23 \pm 0.07$ ,  $P < .05$ ). For test 2, 6 cats were sensitized to ovalbumin (OVA), 6 cats were sensitized to *Ascaris suum* (AS), and 6 cats served as controls. On day 0, OVA- and AS-sensitized cats underwent an inhaled allergen challenge, whereas controls were exposed to saline. On days 1 and 2, the same protocol as described for test 1 was repeated. Post-BAL Penh of the AS-sensitized cats was significantly higher than at test 1 ( $2.28 \pm 0.22$  versus  $1.69 \pm 0.33$ ,  $P < .05$ ) and was correlated with BAL fluid neutrophil count ( $r = 0.55$ ,  $P < .05$ ). During tests 3, 4, and 5, the same protocol as used for test 2 was applied to each cat group, with the animals being randomly treated before sedation with inhaled salbutamol (200 µg), ipratropium bromide (40 µg), or a combination of both (200 + 40 µg). Post-BAL Penh of the AS-sensitized group was significantly decreased after the salbutamol + ipratropium bromide treatment ( $1.56 \pm 0.18$  versus  $2.28 \pm 0.22$ ,  $P < .05$ ). This study suggests that bronchoscopy and BAL induce airflow limitation in cats, which is more severe in the presence of lower airway inflammation. Inhaled salbutamol + ipratropium bromide reduce BAL-induced bronchoconstriction in AS-challenged cats and might be recommended as preventive treatment of asthmatic cats undergoing bronchoscopy.

**FELINE BRONCHIAL ASTHMA: TREATMENT.** Byers CG, Dhupa N. Compend Contin Educ Vet. 2005; 27: 426-431.

Treatment of feline bronchial asthma is directed toward promoting bronchodilation, reducing inflammation, and restoring normal mucus clearance. Therefore, determining and subsequently eliminating the inciting cause(s) of feline bronchial asthma should be the therapeutic priority of veterinary practitioners. Emergency treatment, including supplemental oxygen therapy, glucocorticoids, b2-adrenergic agonists, and methylxanthines, is often indicated. Long-term therapy is aimed at further reducing inflammatory cell infiltration into the tracheobronchial tree and may be accomplished with inhalant glucocorticoids and antileukotriene medications.

**INVESTIGATION OF PULMONARY DEPOSITION OF A NEBULIZED RADIOPHARMACEUTICAL AGENT IN AWAKE CATS.** Schulman RL, Crochik SS, Kneller SK, McKiernan BC, Schaeffer DJ, Marks SL. American Journal of Veterinary Research. 2004 June; 65(6): 806-809.

Objective: To determine whether conscious, unsedated cats will inhale a nebulized material administered via a facemask and whether this material will reach the lower airways. Animals: 20 healthy adult cats. Procedure: Technetium Tc<sup>99m</sup>-diaminetriaminopentaacetic acid (<sup>99m</sup>Tc-DTPA) was nebulized into a spacer and administered to the cats via a closely fitting facemask. By use of a gamma camera, images were then immediately obtained to determine the distribution of <sup>99m</sup>Tc-DTPA within the lower airways. Results: Images obtained by use of the gamma camera revealed that all 20 cats had inhaled <sup>99m</sup>Tc-DTPA from the facemask. In each cat, deposition of the radiopharmaceutical agent was evident throughout the lung fields. Conclusions and Clinical Relevance: Awake cats that were not used to the application of a facemask did inhale substances from such a device. Aerosolization of medications may be a feasible route of administration for cats with lower airway disease.

**FELINE LOWER AIRWAY DISEASE: A RETROSPECTIVE STUDY OF 22 NATURALLY OCCURRING CASES FROM GREECE.** Adamama-Moraitou KK, Patsikas MN, Koutinas AF. Journal of Feline Medicine & Surgery. 2004 August; 6(4): 227-233.

In this retrospective study of 22 cats with lower airway disease of either intermittent (23%) or persistent nature (77%), the Siamese breed (55%) was significantly over-represented. Females (68%) were slightly but not significantly over-represented. No significant association was found between the clinical stage of disease and the physical findings, thoracic radiographic changes or the response to treatment. Cough, the most common presenting complaint, was the only symptom detected in the cats with intermittent disease, yet the two most severely affected animals did not show it. Thoracic auscultation did not reveal any abnormality in 41% of the cats. Haematology revealed eosinophilia in 46% of the cats. A bronchial pattern was the most common radiographic abnormality (73%), followed by alveolar (32%) and interstitial patterns (23%). Interestingly, thoracic radiographs were normal in 23% of the cats. The combination of short-term corticosteroids and bronchodilators resulted in complete and long-term remission of symptoms in nine cats, while the other 11 required ongoing medication because of relatively frequent relapses. One of the remaining two cats died during an asthmatic crisis, while the other was lost to follow up.

**FELINE ASTHMA....A DISEASE THAT CUTS YOUR BREATH.** Caron I, Carioto L. Can Vet J. 2003 Aug; 44(8): 654-6.

Feline asthma is characterized by the presence of inflammation and bronchoconstriction. The diagnosis is based on history-taking, clinical and radiographic signs, bronchoalveolar lavage, and response to therapy. Treatment focuses primarily on eliminating the inflammation and reversing bronchoconstriction. This article contains an analysis of new therapeutic avenues, including inhalers.

**OPTIONS FOR TREATING FELINE ASTHMA.** Dowling PM. Veterinary Medicine. 2001; 96: 353-356.



Appropriate pharmacologic therapy in asthmatic cats involves drugs that manage acute signs and drugs that manage chronic inflammation. Metered dose inhalers with spacers can be easily used to treat cats with inhaled medications, which offer greater efficacy and safety than injectable or oral medications. Studies are needed to determine the most efficacious treatment regimens.

**FELINE ASTHMA. DIAGNOSIS AND TREATMENT.** Padrid P. Vet Clin North Am Small Anim Pract. 2000 Nov; 30(6): 1279-93.

Human asthma is not a curable disease, although spontaneous resolution is common in adult asthmatics who developed asthma in childhood. We do not know if this is true or not for cats with asthma. We do know that some cats may be only mildly and intermittently symptomatic and that others may suffer life-threatening illness. An important new development in our understanding of this disease is the occurrence of airway inflammation even when patients are symptom-free. It is therefore crucial that we direct our therapeutic attention toward the underlying chronic inflammation that causes the acute clinical signs of cough, wheeze, and increased respiratory effort. Client education is also critical so that our clients develop realistic expectations of the effectiveness of these treatments for their pets. A great deal still needs to be learned regarding the pathogenesis of feline asthma and the optimal approach(es) to treating cats with this sometimes debilitating and potentially fatal respiratory syndrome. There is great hope and anticipation that ongoing research can bring new treatments for human and feline asthmatics alike.

**EXPERIMENTAL DRUG THERAPY FOR RESPIRATORY DISORDERS IN DOGS AND CATS.** Mandelker L. Veterinary Clinics of North America: Small Animal Practice. 2000; 22: 1087-1099.

Experimental therapy in veterinary medicine is based on empiric reasoning. If a particular therapy is labeled experimental, it means that its effectiveness has not been demonstrated scientifically. Empiric therapy is experimental and is based on experience, not on scientific proof. The purpose of this article is to suggest the use of specific experimental drug therapies for certain respiratory disorders in dogs and cats.

**Proceedings:**

- **Recent advances in Respiratory Medicine: Diagnostics and therapeutics you can use.** Rozanski E. North American Veterinary Conference Proceedings, 2012.
- **Using inhaled medications – Keys to success.** Johnson L. North American Veterinary Conference Proceedings, 2012.
- **Top 10 mistakes to avoid in your dyspneic patients.** Lee JL. North American Veterinary Conference Proceedings, 2012.
- **Feline Bronchitis: What do we know? What do we need?** Clercx C. 35<sup>th</sup> World Small Animal Veterinary Congress, 2010.
- **Feline bronchial disease including use of inhaled medications.** Padrid P. Proceedings of the Southern European Veterinary Conference, 2010.
- **Coughing and wheezing cats: Diagnosis and treatment of feline asthma.** Little S. CVC Proceedings 2010.

- **Chronic Coughing in Cats.** Johnson L. Proceedings of the Southern European Veterinary Conference and Congreso Nacional AVEPA 2009.
- **Feline Bronchitis and Asthma.** Padrid P. Proceedings of the European Veterinary Conference, 2009.
- **Practice tips: caring for cats.** Scherk M. International Congress of the Italian Association of Companion Animal Veterinarians, 2009.
- **Inhaled steroids to treat feline lower airway disease: 300 cases 1995-2007.** Padrid P. Proceedings ACVIM, 2008.
- **Feline Medicine: How I treat Feline Asthma.** Rozanski E. Proceeding of the Southern European Veterinary Conference, 2008.
- **Comparative Respiratory Medicine; what we can learn from understanding human respiratory diseases.** Corcoran BM. Proceedings of the 33<sup>rd</sup> World Small Animal Veterinary Congress, 2008.
- **Top practice tips for cats.** Scherk M. Proceeding of the Latin American Veterinary Conference, 2008.
- **A Pot Pourri of Practice Tips.** Scherk M. Proceedings of the 33<sup>rd</sup> World Small Animal Veterinary Congress, 2008.
- **Diagnosis and Therapy of Feline Bronchial Disease.** Padrid P. Proceedings of the World Small Animal Veterinary Association, 2007.
- **Inhalation Therapy.** Powell LL. North American Veterinary Conference Proceedings, 2007.
- **Too much sugar, not enough air: managing feline diabetes and asthma.** Cohn LA, Graves TK. North American Veterinary Conference Proceedings, 2007.
- **How to help the asthmatic cat breathe easy.** Cohn LA. North American Veterinary Conference Proceedings, 2007.
- **Inhalational delivery of medications to dogs and cats.** Cohn LA. International Congress of the Italian Association of Companion Animal Veterinarians Proceedings, 2006.
- **Aerosol Delivery of Medications to Small Animals.** Cohn LA. North American Veterinary Conference Proceedings, 2006.
- **Diagnosis and Management of the Coughing Cat.** Johnson L. North American Veterinary Conference Proceedings, 2006.
- **Inhalation Therapy: New Approaches to Old Diseases.** Mazzaferro EM. North American Veterinary Conference Proceedings, 2006.
- **Feline Asthma Diagnosis and Treatment.** Padrid P. North American Veterinary Conference Proceedings, 2006.

## **USE OF INHALED MEDICATION IN CANINES**

### **ENDOCRINE AND IMMUNOLOGIC EFFECTS OF INHALED FLUTICASONE PROPIONATE IN HEALTHY DOGS.** Cohn LA, DeClue AE, Reiner CR. J Vet Intern Med. 2008; 22: 37-43.

Background: Inhaled glucocorticoids reduce airway inflammation while minimizing systemic effects in several species. Hypothesis: Inhaled fluticasone suppresses the hypothalamic–pituitary–adrenal axis (HPAA), modifies immune function, and induces clinical signs to a lesser extent than PO-administered prednisone in dogs. Animals: Seven healthy adult pet dogs. Methods: Dogs were randomized to 1 of 3 treatment groups in a crossover design: fluticasone propionate (220 µg actuation of a metered dose inhaler delivered via a spacer and mask, q12h), placebo (spacer and mask alone, q12h), or prednisone (1 mg/kg PO q24h). Each treatment was administered for 3 weeks followed by a 4-week washout. Appetite, attitude, and water consumption were recorded during the last week of each treatment period. Urine cortisol : creatinine ratios, ACTH stimulation tests, white blood cell counts, lymphocyte phenotype, and serum IgM and IgA concentrations were recorded at each baseline and after the last day of each treatment. Clinical observations were expressed descriptively. Friedman's test was applied to all data comparisons. Pairwise comparisons were made with a mixed model analysis when data were normally distributed, whereas signed rank tests were used otherwise (significance P-value <.01). Results: Appetite and water consumption increased during prednisone treatment. Peak serum cortisol concentrations post-ACTH were significantly decreased in prednisone- and fluticasone-treated dogs compared with placebo (prednisone > fluticasone). Serum IgM concentrations were significantly decreased in dogs treated with prednisone. Conclusions and Clinical Importance: As used, fluticasone suppresses the HPAA to a lesser extent than prednisone and may avert systemic signs associated with PO-administered glucocorticoids in dogs.

### **MANAGEMENT OF 13 CASES OF CANINE RESPIRATORY DISEASE USING INHALED CORTICOSTEROIDS.** Bexfield NH, Foale RD, Davison LJ, Watson PJ, Skelly BJ, Herrtage ME. J Small Anim Pract. 2006 Jul; 47 (7): 377-82.

OBJECTIVES: To determine the value of inhaled corticosteroids in the management of chronic inflammatory airway disease in dogs. METHODS: Medical records of dogs that were presented for the investigation of respiratory disease were reviewed retrospectively. Criteria for inclusion were knowledge of previous medical treatment including side effects, diagnosis of the underlying disease, use of inhaled corticosteroids and at least two-months follow-up data. RESULTS: Thirteen dogs that fulfilled the criteria were identified. Ten dogs were diagnosed with chronic bronchitis and three with eosinophilic bronchopneumopathy. Four dogs had not previously received corticosteroid treatment for their respiratory disease, and all these showed a reduction or a resolution of clinical signs without obvious side effects after inhaled corticosteroid therapy. Nine dogs had previously received oral or parenteral corticosteroids for treatment of their respiratory disease, and all had exhibited side effects. Five of these dogs were treated with inhaled corticosteroids alone, and all exhibited an improvement in clinical signs without observable side effects. The remaining four dogs were treated with a combination of inhaled and oral corticosteroids, and all showed improvement in clinical signs and reduction in side effects. Inhaled medication was well tolerated in all dogs. CLINICAL SIGNIFICANCE: Inhaled corticosteroids were used for the management of chronic bronchitis and eosinophilic bronchopneumopathy in 13 dogs, and these may have the advantage of reducing side effects associated with oral corticosteroids.

### **USE OF INHALED MEDICATIONS TO TREAT RESPIRATORY DISEASES IN DOGS AND CATS.** Padrid P. J Am Anim Hosp Assoc. 2006 Mar-Apr; 42(2): 154-9.

Noninfectious disorders of the respiratory tract, including laryngitis, tracheitis, bronchitis, and asthma are common problems in dogs and cats. Traditional therapies have often included corticosteroids and bronchodilators given by mouth or injection. Side effects of this form of treatment can be severe and can result in cessation of therapy. Inhaled corticosteroid drugs are not as absorbed into the systemic circulation, do not result in significant side

effects, and are now the standard of care for dogs and cats with respiratory diseases that would otherwise be treated with systemic medications.

**DIAGNOSIS AND TREATMENT OF CANINE CHRONIC BRONCHITIS. TWENTY YEARS OF EXPERIENCE.** McKieran BC. Vet Clin North Am Small Anim Pract. 2000 Nov; 30 (6): 1267-78.

Chronic bronchitis is a frustrating disease because the cause is rarely determined, the pathologic changes that accompany and define the disease are usually nonreversible and often progress to life-threatening disorders, and there is a lack of direct scientific evidence for the treatment recommendations that have been offered for the management of this disease in dogs. This article reviews the pathophysiology, clinical presentation, diagnosis, and evaluation of chronic bronchitis in dogs. Important diagnostic tools for use in diagnosis are discussed, including clinical pathology, chest radiographs, and culture and cytology of airway fluid samples.

**Proceedings:**

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