

The feline asthma (Bronchitis allergica) – case report and associated overview

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Abstract. The purpose of this article is to highlight the problem of existing asthma and the increasing number of patients, which suffer from it and to inform about factors, diagnostics, symptoms, and the importance of distinguishing it from Bronchitis, which can lead to irreversible changes in lungs. This article will show cases of two cats suffered from Feline Asthma. A European cat at the age of 6 was brought to the vet because of a constant cough. The frequency of cough with expectoration appears several times per day. During these episodes, the cat has crouched posture with an extended neck and open mouth. The owner had noticed all the changes began after bringing into home, a Christmas tree. The auscultation revealed rales. The vet decided to take a chest x-ray and then adjust treatment to this case. Another European cat at the age of 10 came into a vet's office with dyspnea, which had been appearing for nearly 2 years. Previous treatment help only for a while. In this disease, all the symptoms, diagnostic results (some changes in chest X-ray, the percentages amount of characteristic cells in Balf or some response to methacholine, carbachol or AMP-agonist), auscultation even patient's reaction to treatment or differentiation between diseases which give similar symptoms, should be taken into consideration to make a diagnosis of Feline Asthma. It is impossible to finally put a diagnosis - no methods can give us insurance to put Asthma's diagnosis. What's more, combination of adequate diagnostic methods with appropriate treatment and allergene's elimination can reduce the percentage of badly diagnosed cats. Based on described cases above it is needed to pay attention to factors, which sometimes are unexpected and not obvious such as Christmas Tree. This case prove cats sensitivity to environmental changes. This information is usually overlooked medical interview but it can play a main role in putting appropriate diagnosis and choosing treatment. The second cat i an example of bad-diagnosed patient and badly matched treatment which led to deepen asthma's symptoms.

Key Words: asthma, cat, pathophysiology, recognition, treatment

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Introduction

The histological structure of the respiratory trunk (the muscle tissue surrounding the terminal and respiratory bronchioles) in cats predisposes them to Feline Asthma (Bronchitis Allergica) and additionally increases the risk of the illness (Kuehn). However, the problem of making the wrong diagnosis is still unresolved. This can lead to the muting of the symptoms, but not to nullify them, and hence to irreversible changes in the upper respiratory tract. The aim of this article is to highlight the importance of: putting appropriate diagnosis and treatment, allergens elimination from the patient environment, owner-held knowledge about this problem and the factors that can lead to asthma, can reduce asthma attacks and improve the patient's condition.

Feline Asthma (Bronchitis Allergica) is a sudden and, in the early stages, reversible form of bronchial spasm that is combined with whistling, inflammation, and suffocation. It is a response to the presence of allergens or allergic factors and it is connected with hypersensitivity type I or III (Mike and Corcoran 2010). Chronic or acute inflammation of the airway forms the basis of the asthma condition and can lead to airway stricture and hypotrophy as a result of spasm. The last factor which has to occur is a thick discharge rich in eosinophils, lymphocytes, and mast cells (Smith & Tilley 2008). Cats aged between 6-9 years and

particularly Siamese, Birman, Korats, and other oriental breeds are diagnosed more frequently as asthmatic. What is more, cats are more predisposed to asthma than dogs (Sherbo 2018).

Asthma affects the sensory receptors and Clara's or Club or bronchiolar exocrine cells (CCs) in the bronchial epithelium (Blanda 2014). These cells are believed to play a role in pulmonary homeostasis, inflammatory conditions, xenobiotic metabolism, and the pulmonary immune system. Their accumulation is observed in sarcoidosis and pulmonary fibrosis, and also indicate a dysfunction of the respiratory system's integrity (Rokicki 2016). It is suggested that one of them - Clara's cells are responsible for secretion of a pulmonary phospholipid surfactant. During an asthma attack, the smooth muscle (which has bearing on the bronchiole diameter) contracts strongly and can completely shut the bronchioles when the smooth muscle tone is not strong enough (Histology Guide © Faculty of Biological Sciences).

The factors that can trigger an asthma attack include the breathing in of perfumes or different aerosols or similar breathing irritants, medicaments, dust, ozone, stress, a season of the year and cold air, allergens, pollens, pathogens, vaccines, fungi etc. Cornell indicates that asthma symptoms appear when the cat's immune system develops antibodies to some allergens (Cornell 2014) When these are encountered again, these antibodies trigger

lung inflammation, swelling, airway constriction and mucous secretion, and hence to problems with (Bauhaus 2019). There are two types of lung sounds, which can mostly occur in asthma. First of all are coarse crackles, which sounds like pouring water out of a bottle. The second one - wheezes, which are sibilant and high – pitched sounds, which are a result of getting narrowed airways (Lampert 2019).

It is suggested that there is a dependence between the use of perfumes or aerosols and the frequency of asthma attacks in pets, and there are cases of patients whose attacks had stopped after the elimination of aerosol use in their owner's houses. When the aerosol volatiles enters into the pulmonary tract, they trigger an immune system response within the bronchi and the bronchiole epithelium. Leukotrienes (cysLTs) and histamines are then released from mast cells and generate inflammation and mucous secretion (Guidance&Management 2013), hence, airway obstruction, airway mucosal edema and bronchial secretion.

As a response to inhaled allergens, histamine concentration in the bronchoalveolar lavage fluid (BALF) is much higher in asthma than it is, for example, as a response to rhinitis (Yamauchi and Ogasawara 2019). Leukotriene secretion leads to bronchoconstriction and possibly eosinophilic inflammation. It is suggested that in asthmatic patients, LTE₄ and LTB₄ concentration is higher in their exhaled breath and their sputum samples. Other research has shown that cysLTs (also discovered in the sputum) are refractory to corticosteroids treatment, which can suggest that the leukotrienes pathway is independent of regular treatment. The heightened CysLT release is said to be the main indicator of the asthmatic episode (Ogawa and Calhoun 2006). What is interesting, some pathophysiological studies indicate that there are similarities between humans and cats in their response to inhaled aeroallergen triggers (Reinero *et al* 2009).

There is also some research that suggests the negative influence of potassium bromide, which is commonly used in seizures in cats (USP 2007). In some cats, this therapy induces a nonproductive cough, bronchoalveolar in nature, which can be fatal. Another medicament, aspirin, which is commonly used in thrombotic disease and easily overdosed, can be toxic to cats. It is a direct irritant on the mucosa (USP 2004). In humans, aspirin is known for intolerance in 5-6% of the total population and for the tired side effects of rhinitis, sinusitis, and asthma. It is possible that in cats, it can play a similar role (Babu and Salvi 2000). The grit which is used in a litter tray can also intensify symptoms of asthma, because of its dusty, brittle form. Other types of litter, for example, cedar, and pine litter, contain acids that can damage the respiratory tract (Carey 2011). Silicone cat litter is a suggested resolution for animals that are predisposed to some bronchial disease, because of its low-dusty nature in comparison to the other types (Jason 2014).

Stressful situations can lead to asthma attacks because cats are creatures of habit and that unusual circumstances can provoke shortness of breath (Carey 2011). There are plenty of factors that can make cats feel stressed, for example, changes in an everyday schedule or routine, discontinuation of play time, new people at home or new animals, shortness of food or its delays, changing caretaker etc. (Stella *et al* 2013). Stress is suggested to be a factor that can increase the frequency, duration, and severity of asthma attacks and potentiate cat reaction allergens (Chen & Miller 2007). Some research suggests that it can also

lead to cystitis and upper airway tract disease, but there is no proof that it can lead to asthma (Reinero 2011). Ozone is another factor that can induce airway tract hyper-responsiveness, but there is no proof that exposure to ozone can cause eosinophilic inflammation too.

There is also some speculation about exposure to cold air as a factor that can cause asthma in cats and in dogs. Some research suggests that, for example, dogs, which are kept and worked outside, especially in wintertime, suffer from asthma more often than other dogs, so activity and season can play a key role in inducing some asthma symptoms. Cold air and heavy exercise bring about a situation wherein masses of air are taken in through the mouth rather than through the nasal passages (Tinkelman 2012). Taking into consideration the fact that these two factors can cause asthma symptoms in cats (and dogs), we need to think over the length of time which is spent outside. On the other hand, air conditioners used in warm weather can trigger asthma symptoms, especially if they have not been cleaned and disinfected (Shoraka & Soodejani 2019).

Air-borne pollen can provoke asthma attacks. Allergy animal testing has indicated that cats can be allergic to trees, weed, grass pollens, dust components, mold spores and insects (UW veterinary care 2018).

The same cells in humans and other animals trigger asthma symptoms in response to these factors (mast cells, eosinophils, T-regulatory cells). In cats, allergens can trigger bronchial asthma or some cutaneous changes such as eosinophilic granuloma complex, head and neck pruritus, symmetric self-induced alopecia. To confirm pollen allergy, intradermal testing or serology is done. It is suggested that Abyssinian cat and Devon Rex are predisposed genetically to have a higher risk of hypersensitivity to pollen. In asthmatic cats, spastic cough can appear and bronchoalveolar lavage fluid (BALF) testing is one of the diagnostic methods which can prove eosinophilic inflammation (Jensen-Jarolim *et al* 2015). Research indicates that certain pathogens (i.e. Herpesvirus and Calicivirus) do not lead to asthma, and while *Mycoplasma* spp. were isolated in cats with eosinophilic inflammation in the airway tract, we do not know anything about its influence on asthma. To sum up, all potential triggers, allergens have the biggest influence on the induction of asthma (Reinero 2011).

There seems to be a clear connection between asthma and the seasons. In summer, there are more asthmatic attacks because of the allergens in the air. However, in winter, asthma symptoms may come as a response to, for example, a natural Christmas tree is erected. Asthma arises here due to the fungi and dust which are located on its surface. The lack of fresh air and its movement, standing water or moisture can also lead to conditions of mold that produce irritants and allergens.

Finally, some research suggests that the prevalence of having asthma rises proportionally with age. What's more – older organisms are significantly more susceptible to complications from mild symptoms and these symptoms can be stronger than in young animals (Gilkes 2017).

Some research suggests the negative influence of vaccines on feline asthma (Carey 2011). It is said that asthma can increase the risk of fatal anaphylaxis and they can occur together. The symptoms of each are similar and it is hard to differentiate between them (ASCIA May 2019). Type I reactions called Anaphylaxis

appear as a sudden and excessive response to antigens that are in food, insect bites, injections, blood products or vaccines (Tizard 2018). The owners of asthmatic cats should prevent their contact with known allergens and inform their vet about past reactions especially before vaccination because it is preferable to use component types of the vaccine in such scenarios. In a clinical interview, pet owners describe symptoms such as cough leading to vomit or vomiting without a discharge. Such symptoms always appear suddenly as coughing episodes that can lead to coughing with discharge, taking a crouched posture (open mouth with the tongue outside, extended neck), membrane bruising and dyspnea. Herein, rales or crackles can be heard in the lungs by way of auscultation. In chronic asthma, overgrowth of smooth muscle tissue and fibrosis can be observed. This situation can cause atelectasis and lung hypertension which can provoke right-side heart failure due to ventricular hypertrophy and dilatation. An increase of goblet cells also leads to mucus secretion and bronchi wall edema (Smith & Tilley 2008). Feline Asthma should be differentiated from heart disease. Patients who are in cardiogenic shock will broadcast hypothermia and lower cardiac minute capacity with lower tissue perfusion, while asthmatic patients will have normal body temperature. Other symptoms such as cough will suggest a lung obstruction rather than cardiac problems, as a cough in heart disease appears really rarely - especially in dogs (Byers & Dhupa 2005). Bronchitis Allergica should be differentiated with chronic bronchitis because these two diseases have similar symptoms and they react to the same glucocorticosteroid treatment and bronchodilators. It is suggested that asthma is a disease in which an immune system creates a sudden response to an allergen in three ways: inflammation, mucus production, and narrowing of the air tract. Bronchitis is described as a response to an allergen that induces an irritation, resulting in the production of clear or white sputum and bronchial and tracheal inflammation. The difference between them is based on pathogenic factors. Herein, sudden bronchial obstruction is typical for asthma, not for chronic bronchitis. Additionally, in Balf cytology, in asthma, there is a greater percentage amount of eosinophils, while in bronchitis, known-degenerative neutrophils are observed. However, Balf cytology will also indicate eosinophils and neutrophils in chronic asthmatic inflammation, hence, Balf cytology must be confirmed by other diagnostic tools. It is suggested that some tests involving carbachol and methacholine can be used to assess airway hypersensitivity, while others that apply AMP-agonists can help in declaring and differentiating between airway tract disease with inflammation or without it (Reinero 2011) (see table 1).

Pharmacological treatment in Bronchitis Allergica depends on the clinical case and the severity of symptoms. Following

Table 1. The most important differences between Feline Asthma and Chronic Bronchitis

Feline Asthma	Chronic Bronchitis
Sudden form of spasm and attacks	No sudden form, only irritation
Mucus production	Inflammation – non-regenerative neutrophils in Balf cytology
Narrowing air tract.	Bronchial White or clear mucus
Inflammation – eosinophils in Balf	Tracheal inflammation

assessment, the vet can create an individual treatment plan with regard to medicament, frequency of and size of the dose, and removal of outside drivers. Basic medicaments used in asthma are glucocorticosteroids, antibiotics, bronchodilators, immunostimulators, and hypoallergenic food. Oral prednisolone or inhalation forms of it are used in basic dose at 2-4 mg per kg per day. Treatment should extend for 10-14 days, with dosage reduced at night. Dexamethasone can be used in connection with bronchodilators at the dose of 0.5-1 mg per kg in injection. Bronchodilators are typically used when there are no results in corticosteroid therapy. In the cat, the preferred medicament is Beta-2-agonists, for example, terbutaline in the dose of 0.01 mg per kg i.m or s.c. Medicaments that enable the bronchioles to expand can be used in inhalation. Herein, the offline in a basic dose of 4-5 mg per kg I .v. or s.c. can be increased to a dose of 10 mg per kg if the previous does not work well. In recurrent airway tract inflammation, antibiotic therapy is required. The most useful in this case are amoxicillin combined with clavulanic acid at a dose of 15mg per kg in injection, once per 48h. Useful immunostimulators in Bronchitis Allergica treatment include L-lizin and B-glucan in oral form (Carey 2011).

Material and methods

A European female cat called Pusia at the age of 6 was brought to the vet because of the cough. The frequency of cough with expectoration was several times per day. A video film that had been taken during one of the cough episodes shows a coughing cat in a crouched posture with an extended neck and open mouth. The owner had noticed all the changes began after bringing into her home, a Christmas tree. The auscultation revealed rales. The vet decided to take a chest x-ray (see fig. 1).

A European cat Cezar at the age of 10 came into a vet's office with dyspnea. This had been appearing for nearly 2 years. Previously it had been treated in a different vet clinic, the therapy being antibiotic administration. This helped for a while.

Results

The taken Cezar's chest X-ray reveals interstitial concentrations and a not clearly remarked bronchial drawing. All these changes evidence old inflammation or asthma. The cardiac silhouette is regular. The Vet prescribed prednisolone (Encorton 1mg Polfa Pabianice, Poland) in the dose of 0.8 mg/kg twice a day in each 12 h po and theophylline (Theovent 100mg GSK Pharmaceuticals Poznan, Poland) -6 mg/kg in every 12 h p.o., and amoxicillin with clavulanic acid s.c. in the dose of 8,75mg/kg (Synulox injection 140mg/ml +35mg/ml Zoetis, Warsaw, Poland) once per day for 5 days. After 5 days cat should be seen by a vet on a control appointment. The continuation of treatment depends on its effect on patients health and it was planned to reduce prednisolone and theophylline to the smallest effective dose in the future.

Informed consent has been obtained for client-owned animals included in this article.

The frequency of dyspnea attacks decreased after treatment, however, it would return suddenly, especially in the wintertime. The owner still did not recognize the trigger, but they followed the vet's recommendations regarding the cat's environment and

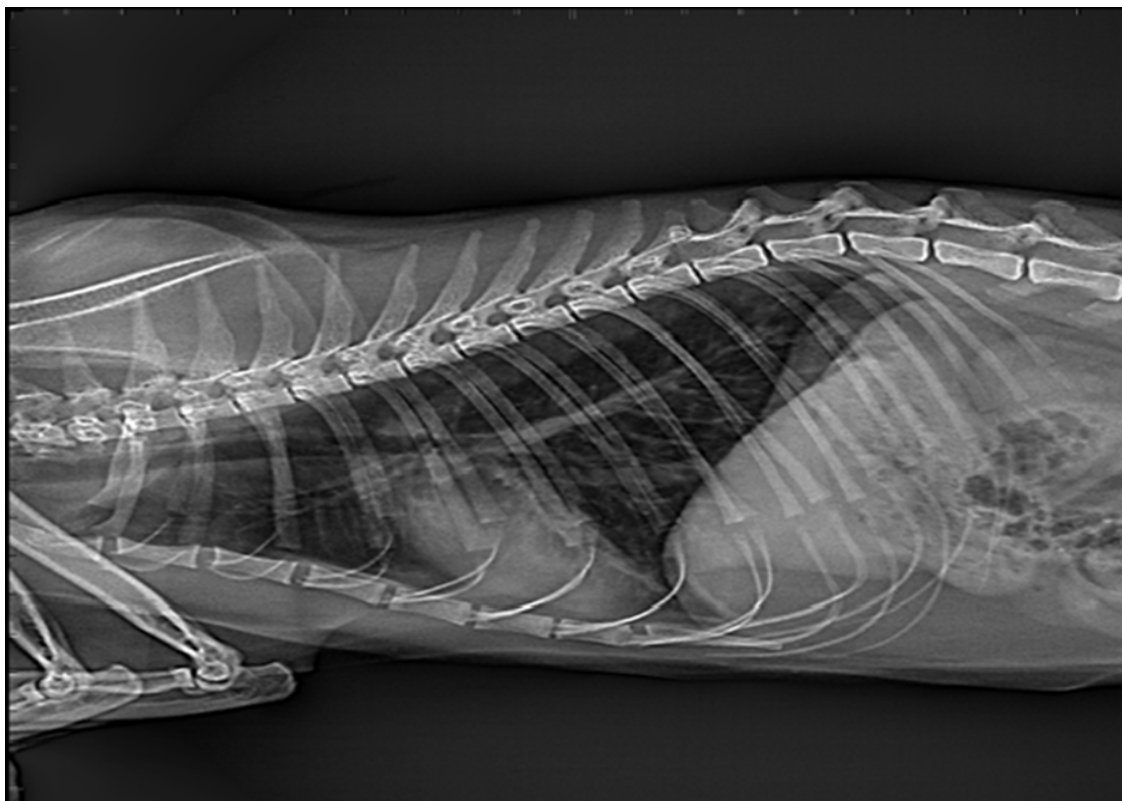


Fig. 1. Intensified vaso-bronchial drawing with peribronchial densities that can be a result of the accumulation of discharge within the initial section of the bronchial tree. In the chest X-ray, the cardiac silhouette is regular. There are many peribronchial and interstitial concentrations majorly in front of the lung fields and a high selected vaso-bronchial drawing. Front lung fields were extended, which can evident the effects of asthma. No photo correction has been made instead of changing its size. X-ray was made with the use of ZooMax 325HF Control-X.

had attempted to eliminate all factors that could have led to the asthmatic symptoms (see fig. 1).

Discussion

Feline Asthma is frequently undiagnosed or is mistakenly diagnosed in every age group because of trouble in diagnostics and differentiation. Badly chosen treatment can occur irreversible and chronic changes in bronchial tissue, and, as a result, cause decline of the standard of life (Dye 1992). The radiographic diagnostics (RTG) is one of the methods of pulmonary tissue representation that uses exposure to roentgen rays. It can show some asthmatic changes, but it is not a method that can give a 100% certainty in diagnosing Feline Asthma.

One of the most obvious asthma-induced changes in a chest x-ray is vaso-bronchial drawing (Moise & Spaulding 1981). In a typical asthmatic cat's chest x-ray, a tendency to swelling of the bronchial walls and displacement of the diaphragm is noticeable. Other signs are atelectatic lung lobes as a consequence of the accumulation of bronchial discharge. Although atelectasis can appear in every lobe, research indicates that it is present mainly in the lobes of the right lung as a result of bronchial weight growth which is filled with secretion (Bay 2004). These changes or signs of asthma are not always visible in RTG, so the absence of these signs on the picture cannot eliminate the probability of asthma (Dye & McKiernan 1996). Hence, RTG can be considered a helpful device within the total clinical examination, but it cannot be treated as a sure method of diagnosing Feline Asthma.

To sum up, Feline Asthma is a disease with non-specific and sudden symptoms and it needs to be well-diagnosed and also well treated to avoid the complications of chronic bronchitis. Because of the fact that it is quite often difficult to diagnose, there is a need to educate cat owners about its symptoms and the allergens which can lead to an asthma attack. Using certain diagnostic methods (often in combination) that can indicate asthma and then introducing appropriate treatment can significantly improve cat quality of life.

Conclusion

There is a need to stress the importance of cooperation between vet and the owner with regard to the cat environment and the elimination of triggers (allergens), by a special diet, not using aerosols or perfumes, elimination of dust and mold hazards, etc. When those conditions are met, there is a likelihood that the patient can be stabilized. In doing so, the cat's life circumstances improve and they will live far longer.

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