Scientific Works. Series C. Veterinary Medicine. Vol. LXXI (2), 2025
ISSN 2065-1295; ISSN 2343-9394 (CD-ROM); ISSN 2067-3663 (Online); ISSN-L 2065-1295

TRACHEOBRONHOSCOPY AND BRONCHOALVEOLAR LAVAGE IN CATS WITH LOWER RESPIRATORY TRACT SYMPTOMS

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Abstract

Diseases affecting the respiratory system are common in veterinary practice. Various diagnostic techniques are used to evaluate patients showing signs of respiratory problems. The trachea, bronchi, and oropharynx can be directly visualized through flexible tracheobronchoscopy, which is a valuable diagnostic instrument for the evaluation and management of feline respiratory diseases. Diagnostic indications encompass the evaluation of traumatic injuries, inflammatory conditions (chronic bronchitis, anthracosis, pneumonia), and structural abnormalities (tracheobronchial collapse, stricture, intraluminal mass). Tracheobronchoscopy uses a variety of airway sampling techniques. Superior efficacy has been demonstrated by bronchoalveolar lavage fluid (BAL) as a specimen collection method. During the clinical examination of cats exhibiting cough, respiratory distress, or associated symptoms, tracheobronchoscopy was implemented. Airway hyperaemia, stenosis or collapse, mucous accumulation, bronchiectasis, and epithelial abnormalities were evaluated in cats. Cats were classified into categories based on the cytology of the BAL results for bronchitis/asthma, pneumonia, anthracosis, or endobronchial abnormalities. A comparison was made between groups in terms of a collection of bronchial abnormalities and total and differential cell counts. Bronchoscopic abnormalities are frequently seen in felines with lower respiratory tract disease, and airway visualisation offers additional nonspecific clinical insights in cats.

Key words*: anthracosis, asthma, bronchoalveolar lavage, tracheobronchoscopy, pneumonia, respiratory tract endoscopy.*

INTRODUCTION

In professional practice, bronchoscopy is a standard diagnostic instrument for the evaluation of respiratory disorders, typically accompanied by airway sampling via bronchoalveolar lavage (BAL).

Common non-malignant and non-infectious causes of chronic cough include airway collapse and inflammatory airway disorders, such as chronic bronchitis and eosinophilic broncho-pneumopathy in dogs, along with cat chronic bronchitis and asthma (Doherty et al., 2003). Bronchoscopy can be used to visually diagnose bronchiectasis and airway collapse, however, distinguishing between infectious and inflammatory diseases requires cytologic and microbiologic analyses of a fluid sample that has interacted with the epithelial lining, a brush sample, a biopsy specimen or a fine-needle aspiration (Humbles et al., 2004). It may be difficult to conduct BAL in certain animals, particularly cats, and inconsistent BAL recovery may lead to differential dilution of the squamous membrane fluid, which can impact the diagnostic yield of the technique. However, in clinical practice, numerous disorders may remain undetected despite bronchoscopic evaluation (Johnson et al., 2007).

The small size of cats' airways and the high prevalence of reactive airway disease make bronchoscopy of feline lower respiratory tract disease challenging. This predisposes them to bronchoconstriction as a consequence of hyperresponsiveness (Hawkins et al., 1995).

The assessment of airway cytology is necessary to establish a diagnosis, as the clinical and radiographic characteristics of viral and inflammatory lower airway disease do not differentiate the underlying source of clinical manifestations.

Nowadays, the majority of discoveries regarding feline lower airway disease, whether experimental or naturally occurring, have been based on the cytological assessment of lavage samples obtained from the distal airways

through a blind-catheter insertion (Hawkins et al., 2006).

The objective of this study was to examine the nature and prevalence of endobronchial lesions in cats with lower respiratory disease and to correlate these findings with BAL results. Additionally, we sought to recognize endoscopic and cytologic characteristics that could be clinically valuable for the differentiation of pneumonia, neoplasia, and idiopathic inflammatory lower airway illness (feline bronchitis/asthma/anthracosis).

We believed that cats with lower respiratory disease would frequently exhibit noticeable changes in their airways, and that the number and presence of abnormalities seen during a bronchoscopic examination would be correlated with the particular type of lower respiratory disease as well as the total and differential cell counts in BAL fluid (Bottero et al., 2013).

MATERIALS AND METHODS

In this prospective study, feline patients who underwent bronchoscopy at the University Veterinary Emergency Hospital "Prof. Dr. Alin Bîrțoiu" for the evaluation of chronic cough (which lasted more than six months) were selected as suitable. The following information was documented prior to investigation admission: age, breed, sex, neutering status, body condition score, clinical symptoms, physical examination, and thoracic X-rays.

A comprehensive diagnostic evaluation was conducted on all cats, encompassing a complete blood count (CBC), biochemical analysis, packed cell volume/total protein (PCV/TP), and cervical/three-view thoracic radiography (Melamies et al., 2011). Bronchoscopy was conducted under intravenous propofol anaesthesia, initiated with a dose of 5 mg/kg, followed by a continuous infusion of 0.2-0.4 mg/kg/min.

Pulse oximetry, electrocardiography, and blood pressure were continuously monitored in all felines during the surgery. Bronchoscopy was performed using either a 2.8 mm x 70 cm fiberoptic endoscope with a 1.2 mm channel or a 3.8 mm x 55 cm videoendoscope with a 1.2 mm channel.

None of the patients from the study having bronchoscopy received pre-treatment with antibiotics or NSAIDs prior to the procedures.

Bronchoscopy was conducted with the subjects in sternal recumbency, and each feline was assessed uniformly. All accessible airways were examined (Johnson et al., 2011).

The epithelial surface of the normal feline airways was pale-pink to yellowish in colour and exhibited a subtle shining luster. The airway apertures were ovoid, and there were no epithelial irregularities, airway collapse, or stenosis (Johnson et al., 2010). The abnormal findings that were recorded included the presence of bronchiectasis, airway hyperaemia, epithelial abnormalities, and an abundance of bronchial mucus (Kinnear et al., 1991).

A protected specimen brush on a catheter was placed in the endoscope biopsy channel before BAL. After being removed from the catheter, the brush was softly turned and moved against the airway mucosa to collect epithelial and inflammatory cells. Each patient brushed the distal trachea, carina, and mainstem bronchi for 20 seconds. To maximize yield, abnormal mucosal areas were targeted while mucus and pus were avoided (Steehler et al., 2011). The locations of visual anomalies and brush cytology were video documented for examination. The brush was extracted from the endoscope and retracted within the catheter. Glass transparencies were promptly coated with the material extracted from the expanded brush. There were direct specimens of brush cytology samples included in this study (Pinsker et al., 1980).

The bronchoscope was retracted from the airways after a complete airway assessment. The external surface was cleansed with sterile distilled water-soaked cotton gauze, and the biopsy channel was irrigated with sterile saline in preparation for lavage (Hawkins et al., 1990). Precautions were taken to prevent upper airway contamination upon re-entry into the airways, and the designated site for BAL was promptly accessible (Ybarra et al., 2012).

The BAL procedure involved the instillation of 0.5 mL/kg/per cat of warmed, sterile saline through the biopsy channel of the endoscope. The channel was subsequently flushed with 0.5 mL of air, and the fluid was obtained by applying manual suction to the bronchoalveolar space. Cytological evaluation and microbiological culture were conducted on BAL fluid (Rennard et al.,1990).

RESULTS AND DISCUSSIONS

Between January 2023 and March 2025, bronchoscopy was performed in 33 cats.

Those patients were diagnosed with idiopathic inflammatory disease, feline bronchitis, and asthmatic symptoms, like anthracosis. They were also evaluated for cough and/or respiratory distress (Garg et al., 2007). The duration of cough varied from 6 to 12 months (median, 13 months) in cats.

A majority of the cats were female, with most categorized as domestic short-, medium-, or long-haired. Their ages varied from 10 months to 13 years, and their weights ranged from 1.8 to 6.3 kg. No significant differences were noted in age, sex, body weight, or duration of signs among the different diagnostic groups (Table 1).

The patients diagnosed with sterile inflammatory airway disease that exhibited clinical improvement following corticosteroid therapy were classified as having idiopathic inflammatory airway disease, also known as feline bronchitis or asthma.

The cats were categorized based on the type of inflammation observed: those exhibiting predominantly eosinophilic inflammation, those with predominantly neutrophilic inflammation, and those with mixed inflammation or correlation with bronchoscopic findings (Flood-Page et al., 2003).

A second group of cats was diagnosed with pneumonia or anthracosis. This covered cases with intracellular bacteria found in BAL cytology as well as positive bacterial culture findings sensitive for suitable antibiotics (Gibson et al., 2000).

In a cytological examination of cases, 17 exhibited a mixed inflammatory response characterized by the presence of eosinophils, neutrophils, and macrophages. Additionally, positive cultures were obtained in 7 cases, leading to a diagnosis of infectious bronchitis. In 15 of the 33 cases, an eosinophilic inflammatory response was observed, comprising over 60-75% of the cell population, which aligns with the characteristics of feline eosinophilic bronchitis, commonly referred to as feline asthma. In 7 of the 30 cases, a normal inflammatory cell population was noted, comprising 25% eosinophils and macrophages. The clinical signs and cytological results were indicative of eosinophilic bronchitis, idiopathic chronic bronchitis, or anthracosis (Table 2).

Eosinophilic inflammation was identified in the BAL of one cat, while brush cytology indicated both eosinophilic and lymphocytic inflammation. Excessive mucus accumulation, particularly airway obstruction due to mucus, was the predominant finding in the cats tested, followed by anthracosis. Cats with anthracosis generally exhibited several affected lobar bronchi. A majority of cats exhibited airway hyperaemia.

Cats with pneumonia exhibited a higher percentage of neutrophils in their BAL fluid than those with bronchitis, asthma, or anthracosis; however, the total cell count of BAL fluid was consistent among all groups.

Statistical Overview of Bronchoscopy Findings in Cats (Jan 2023-Mar 2025)

Sample Size

- Total number of cats examined via bronchoscopy: **33**

Table 1. Demographics

Variable	Range	Median / Mode	Notes
Age	10 months-13 years	Not specified	No significant difference by diagnosis
Weight	1.8-6.3 kg	Not specified	No significant difference by diagnosis
Sex	Majority female		No significant difference by diagnosis
Hair Type	Mostly domestic short/medium/long hair		
Duration of Cough	6-12 months	**13 months** (not within range; likely typo)	No difference among groups

Diagnostic Classification

Cats were grouped based on clinical response, cytology, and bronchoscopy:

1. Inflammatory Airway Disease (Feline Bronchitis/Asthma)
- Defined by clinical improvement with corticosteroids and cytological findings
- Inflammatory types:

2. Eosinophilic inflammation:
- 15/33 cats (≈ 45.5%)
- Dominated by 60-75% eosinophils

3. Mixed inflammation (eosinophils, neutrophils, macrophages):
- 17/33 cats (≈ 51.5%)

4. Normal cell population (25% eosinophils + macrophages):
- 7/30 cases (≈ 23.3%); interpreted as mild or early bronchitis

5. Infectious Airway Disease (Pneumonia/ Anthracosis)
- Diagnosis criteria: BAL showing intra-cellular bacteria, positive culture, response to antibiotics
- 7/33 cats (≈ 21.2%) had positive bacterial cultures

Table 2. Bronchoscopy and Cytology Findings

Finding	Number of Cases	% of Total (n=33)	Notes
Eosinophilic response (>60%)	15	45.5%	Suggestive of eosinophilic bronchitis/feline asthma
Mixed inflammation	17	51.5%	Eosinophils, neutrophils, and macrophages
Positive bacterial cultures	7	21.2%	Diagnosed with infectious bronchitis
Normal inflammatory cell count	7 / 30	23.3%	Still showed clinical signs of bronchitis
Eosinophilic inflammation in BAL	1	3%	Confirmed with BAL; also lymphocytic via brush cytology
Excessive mucus obstruction	Majority	>50% (estimated)	Common finding
Anthracosis (carbon deposits)	Several cases	Not quantified	Typically, in specific lobar bronchi
Airway hyperemia	Majority	>50% (estimated)	Observed across diagnostic groups
Elevated neutrophils (in pneumonia)	Not numbered	Higher vs. asthma group	Group-specific cytological profile

Table 3. Summary Table of Key Diagnostic Subgroups

Diagnosis / Inflammatory Profile	Number of Cats	% of Total
Eosinophilic Bronchitis / Asthma	15	45.5%
Mixed inflammation	17	51.5%
Infectious bronchitis (positive culture)	7	21.2%
Normal inflammatory profile	7 / 30	23.3%
Anthracosis	Not specified	Several cases
Airway hyperemia	Majority	>50%

CONCLUSIONS

When patient selection is conducted appropriately, BAL is an effective diagnostic method that is applicable to conditions that affect the pulmonary parenchyma and individuals who can safely undergo general anaesthesia. BAL cytology is a less invasive method than lung aspiration or thoracotomy, and it has the potential to provide a definitive diagnosis or supplementary diagnostic insights. When interpreting BAL fluid results, it is important to consider the accuracy limitations in cell counts and negative findings.

BAL should be performed in cases of diffuse alveolar and/or pulmonary interstitial disease proven by radiographic imaging.

This technique assesses a limited portion of the lung, while the administered saline infiltrates the alveoli and adjacent parenchyma. Samples may be indicative in diffuse pulmonary illness but possess limited utility for focal lesions. This procedure is performed when tracheal washes are deemed unrepresentative or non-diagnostic, such as when the airway disease does not involve the major airways. In numerous inflammatory and neoplastic diseases in both humans and animals, BAL cytology is correlated with histological findings.

The most common inflammatory pattern was mixed inflammation, accounting for approximately 51.5%, followed closely by eosinophilic inflammation, at approximately 45.5% (Table 3). A notable subset (21.2%) showed positive bacterial cultures, confirming an infectious ethiology. Mucus accumulation and airway hyperaemia were frequent findings. Anthracosis primarily affected specific regions of the bronchi, although it was less prevalent overall.

A diagnostic challenge is presented by respiratory airway illness. While history, physical examination, and chest radiographs often assist clinicians in making a diagnosis, further diagnostic procedures may be required. In individuals with airway disease, airway visualization serves as a powerful diagnostic tool.

These methods may reduce the confirmation of chronic inflammatory diseases or enable the identification of infectious organisms. The diagnostic value of these tests is paramount. Due to the heightened risks associated with anaesthesia and respiratory operations in patients with airway illness, the potential hazards of the procedure must always be evaluated against the anticipated benefits.

Bronchoscopy and BAL are essential diagnostic procedures that provide direct visualization and sampling of the respiratory tract and should be employed routinely, particularly in patients unresponsive to treatment interventions. The

samples acquired during BAL are appropriate for cytological, bacteriological, and fungal cultures, as well as other diagnostic assessments, such as PCR and specific antigen testing, rendering BAL highly valuable in both clinical and research settings.

Training of physicians and equipment must be prioritized to guarantee the procedure's safety and efficacy.

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