

CHRONIC COUGHING IN CATS Part II: Diagnosis

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Particulars and history

Cats with respiratory compromise are often very difficult to handle. Stressful handling can result in respiratory decompensation, hysteria and death. Severely affected cats often benefit from being placed in an oxygen-enriched environment (oxygen box or tent) prior to being handed for the physical examination. (Figure 10). In all cases, it is important to collect as much background detail as possible, prior to undertaking the physical examination, as this may give an indication of most likely differential diagnoses.

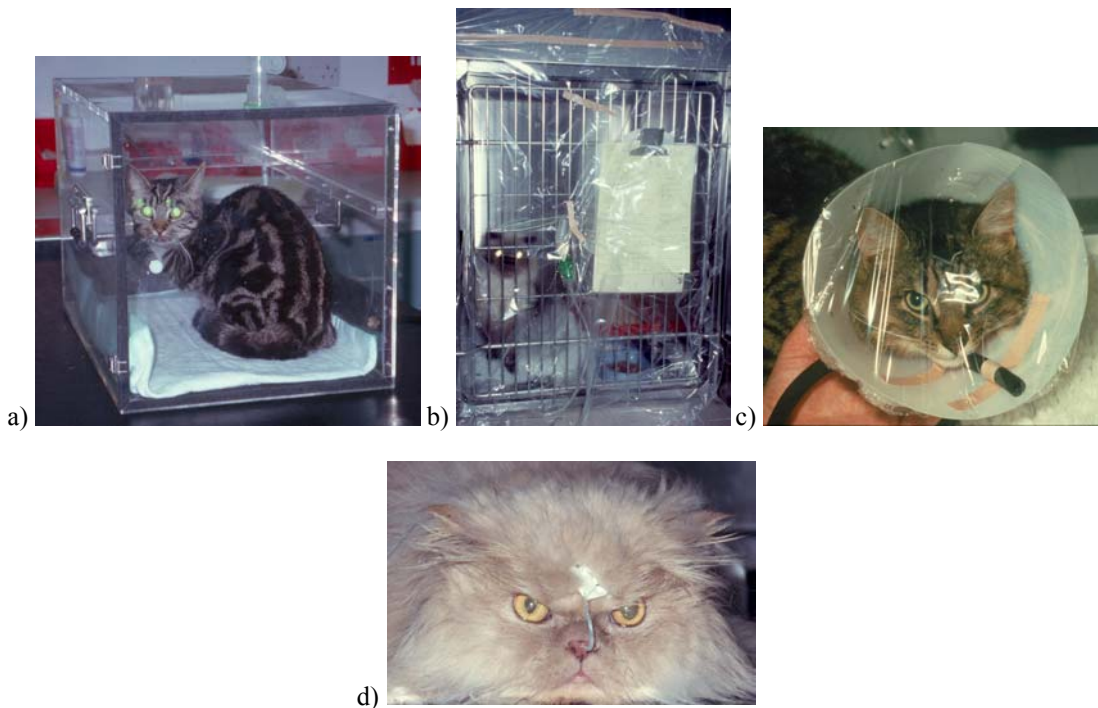


Figure 10. Methods of supplying oxygen-enriched air. a) Oxygen box b) Oxygen tent c) Oxygen mask (it is better to add an extension tube to the end of the black oxygen tube so that the mask is not pulled down by its weight. Also, ensure that there is an area of cling film that is not secured at the top of the mask so that CO₂ can leave) (Courtesy of BDX Laselles) d) Nasal oxygen supply – this is not usually well tolerated by cats.

The *particulars* of the patient can help. While cats of any age, breed or sex may develop a chronic cough; kittens from an unhygienic and crowded environment are more likely to develop bacterial pneumonia; cats with clinically significant lung worm infections are typically young adult males that hunt and eat their prey; Siamese and Burmese middle-aged cats are over-represented in cats with chronic bronchopulmonary disease; and primary lung tumours are seen mainly in older cats.

From the *history* it is important to determine;

- what type of environment the cat lives in (or has previously lived in)
- whether or not it is allowed outside, and whether or not it hunts
- whether or not there is any history of previous illness, or trauma
- at what age did the clinical signs begin
- what was the pattern of onset of the clinical signs
- how have the clinical signs progressed
- have the clinical signs ever responded to previous treatments
- what other animals it lives with
- have any other animals from the same household been affected

This will help to determine what potential pathogens and/or irritants the cat may have been exposed to. It is very helpful to know whether or not the disease was acute in onset, or slowly progressive. Foreign bodies initially cause acute disease. A cough that starts seasonally may be suggestive of 'feline asthma' or lungworm infection. 'Asthmatic' cats may cough more at night when sleeping on their owner's bed, or at the end of a bout of play, and their clinical signs may be exacerbated by their owner's smoking. Cats that go outside, hunt, or eat snails are more likely to become infected with *A. abstrusus*.

Physical examination

The physical examination should always be carried out gently and thoroughly. However, in very dyspnoeic cats it may need to be interspersed with periods of time in an oxygen chamber. Particular points to look for include:

- The *character of the breathing*: Generally, LRT disease is associated with expiratory dyspnoea. Severely 'asthmatic' cats may have a much exaggerated expiratory effort. Disease affecting the URT or pleural cavity usually results in inspiratory dyspnoea. An increased abdominal effort is seen in many dyspnoeic cats. Orthopnoea (dyspnoea when recumbent), tachypnoea (rapid breathing), or open-mouthed breathing are generally associated marked respiratory compromise. However, it is important to remember that the latter two may result from non-respiratory as well as respiratory causes of dyspnoea (e.g. cardiovascular disease [anaemia, congestive heart failure, hypotension or polycythaemia], abdominal enlargement [ascites, organomegaly, pregnancy], hyperthermia, metabolic acidosis [e.g. diabetic ketoacidosis], fear, anxiety, severe pain, or respiratory muscle weakness.
- The *character of the cough*: A dry harsh cough is most commonly associated with tracheal or bronchial irritation, while a productive moist cough is usually associated with bronchopneumonia. The nature of a cough in a cat with obvious URT disease may help to determine the underlying cause. If the cough is dry and harsh it is most likely to result from 'post-nasal drip'. However, when the cough is productive and moist it is more likely to be associated with a secondary bronchopneumonia.
- The presence of *tracheal sensitivity* confirms inflammation of the upper airways.
- Looking at the *mucous membranes* can help to assess the general peripheral perfusion, determine whether or not the animal is cyanotic (an indication of severe

respiratory dysfunction), assess the patient's hydration, and see whether or not the cat is septic (injected dirty-red membranes). The presence of petechial haemorrhages may suggest a clotting disorder.

- *Thoracic palpation* should be used to check for the presence of trauma (bruises, pain, fractured ribs), or congenital defects ('flat-chested' kittens, or kittens with sternal deformities). Thoracic palpation will also help to localize the position of the apex beat of the heart, and detect whether or not a cardiac thrill is present. In severely 'asthmatic' cats the exaggerated expiratory effort may lead to a barrel-chested appearance, and enhanced musculature (a 'heave line').
- *Thoracic compression* will be reduced in cases of extensive pleural fluid accumulation or when an intrathoracic mass is present. It may also be reduced in COPD (or severe 'asthma') as a result of air trapping within the pulmonary parenchyma. Reduced anterior thoracic compression is seen most commonly in cases of thymic lymphosarcoma (LSA). (Interestingly, we now recognise that Siamese kittens of less than two years of age appear to be predisposed to FeLV-negative thymic or anterior mediastinal LSA – See Figure 1).
- *Thoracic percussion* can help to detect the presence of fluid or soft tissue masses within the chest (a reduction in resonance, typically ventrally), or unusual gas accumulations (an increase in resonance, typically dorsally). It can also be used to determine the extent of the thoracic cavity, and this is often increased in cats with COPD because of air trapping. Thoracic percussion is a particularly useful procedure in cats, particularly since so many of them purr. However, it does require some practice to perfect (Figure 11).

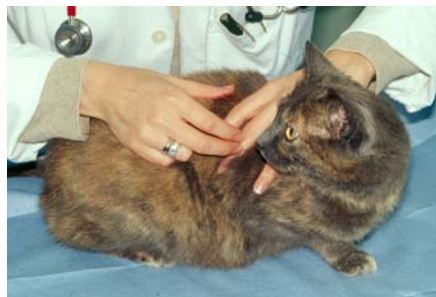


Figure 11. Thoracic percussion is a particularly useful test in cats, particularly since so many of them purr.

- *Thoracic auscultation* can be used to detect wheezes and crackles, an increase or decrease in respiratory noise, and the extent of the respiratory field. It should also be performed as part of the cardiac examination. Wheezes are generally associated with narrowing of the airways, while crackles indicate fluid within the airways. Respiratory noise may be increased in LRT disease, referred for the URT, or amplified due to the presence of air in the pleural space. It is necessary to auscultate over the trachea to determine how much of the sound is referred from the URT. A decrease in respiratory noise may be associated with fluid or soft tissue within the pleural space.

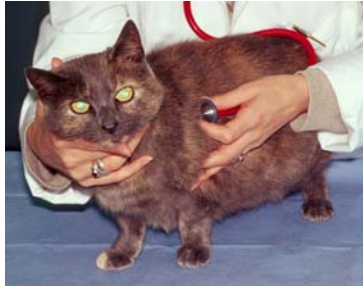


Figure 12. Thoracic auscultation is an essential part of the physical examination of a coughing cat. It is usually better to use a paediatric stethoscope.

- *Physical examination for cardiac function*; this includes an assessment of the capillary refill time, mucous membrane colour, quality of peripheral pulses, position of the apex beat, presence of a cardiac thrill, presence of jugular distension, a jugular pulse, or a hepatjugular reflex, and cardiac auscultation. The presence of a cardiac thrill, jugular distension, a jugular pulse, a positive hepatjugular reflex, or abnormalities detected on cardiac auscultation warrant a more detailed cardiac examination. *It is important to note that while cardiac disease in cats can lead to either LRT disease (pulmonary oedema), or thoracic cavity disease (pleural fluid), unlike dogs it very rarely causes coughing.*
- *Regurgitation* may be present when disease within the thoracic cavity impedes the transit of food through the oesophagus (e.g. with thymic LSA). When regurgitation and coughing are seen together mixed disease is usually present, e.g. megaesophagus resulting from mediastinal disease, with secondary aspiration pneumonia and coughing. Mediastinal disease alone rarely causes coughing. When it does it usually results from marked enlargement of the hilar lymph nodes.
- *General body condition and body weight*: Severely dyspnoeic cats often have a poor appetite and loose weight. Marked weight loss is more suggestive of neoplasia, or severe systemic disease, such as congestive heart failure.
- *General physical examination*: Many intrathoracic diseases have systemic involvement therefore a full physical examination is essential.

Further investigations

While assessment of serum biochemistry, haematology, and FeLV/FIV status will help to gain an overall picture of the cat's health, they rarely lead to a definitive diagnosis. For this, radiography is usually required, plus the collection of samples for cytological, histopathological, and microbiological examination.

Haematology may support a diagnosis of pneumonia (a raised neutrophil count with a left shift, and possibly the presence of toxic changes within the neutrophils). Lymphopenia may be associated with FeLV or FIV infections, or indicate severe disease. Eosinophilia may be associated with 'feline asthma' or lungworm infection, or be unrelated to the

thoracic disease (e.g. concomitant flea infestation). Outdoor cats should be assessed for FeLV and FIV status as an aid to determining prognosis. Any cat found to have evidence of heart disease should have its serum thyroxine concentration assessed.

In theory, lungworm larvae (*A. abstrusus*) should be sort by *faecal examination*. However, it is often more convenient to perform a therapeutic trial, using fenbendazole @ 50mg/kg/day PO for ~10 days, without this diagnostic investigation.

Where there is evidence of cardiac dysfunction a more detailed *cardiac examination* should be performed. This may include ECG, thoracic radiographs, assessment of blood pressure, and echocardiography.

Radiographic investigations:

Ideally, the investigation should include good quality ventrodorsal (VD – good for pulmonary detail), dorsoventral (DV – good for cardiac detail), and lateral views. A general anaesthetic may be helpful as it allows control of respiration, enabling radiographs to be taken at the end of inspiration. It also allows the patient to have an increased oxygen supply. If facilities are available a standing (sternal) lateral radiograph can be very useful in assessing cats with potential pleural effusions. However, if a significant pleural effusion is suspected, thoracocentesis should be performed prior to taking radiographs.



Figure 13. Where possible, a standing (or sternal) lateral view can be very useful as it causes the patient less stress.

Radiographs should be assessed for the integrity of the thoracic skeleton, presence of pleural or mediastinal fluid, masses or gas shadows, lung density and position, heart size and position, the presence of masses within the lung-fields, and the integrity of the diaphragm. (Abdominal radiographs may be needed to assess the position of the abdominal organs, the size of the liver, and the presence of ascitic fluid).

Care should be taken when assessing thoracic radiographs since on some occasions they may show few or no changes, despite the presence of severe disease. This is often true of chronic bronchopulmonary disease, or pulmonary thrombosis. To assess these cats further radiography may need to be repeated at a later date. Where fluid is present radiography should be repeated after thoracocentesis.

Radiography of cats with chronic bronchopulmonary disease usually reveals a prominent bronchial pattern, with or without interstitial changes, and/or patchy alveolar infiltrates.

The right middle lobe may occasionally be collapsed, presumably due to occlusion of the bronchi with mucus and debris. The lungs may appear over-inflated due to air-trapping, with flattening of the diaphragm and peripheral emphysema. In very severe cases rib fractures may be evident (typically caudal ribs, close to the spine).

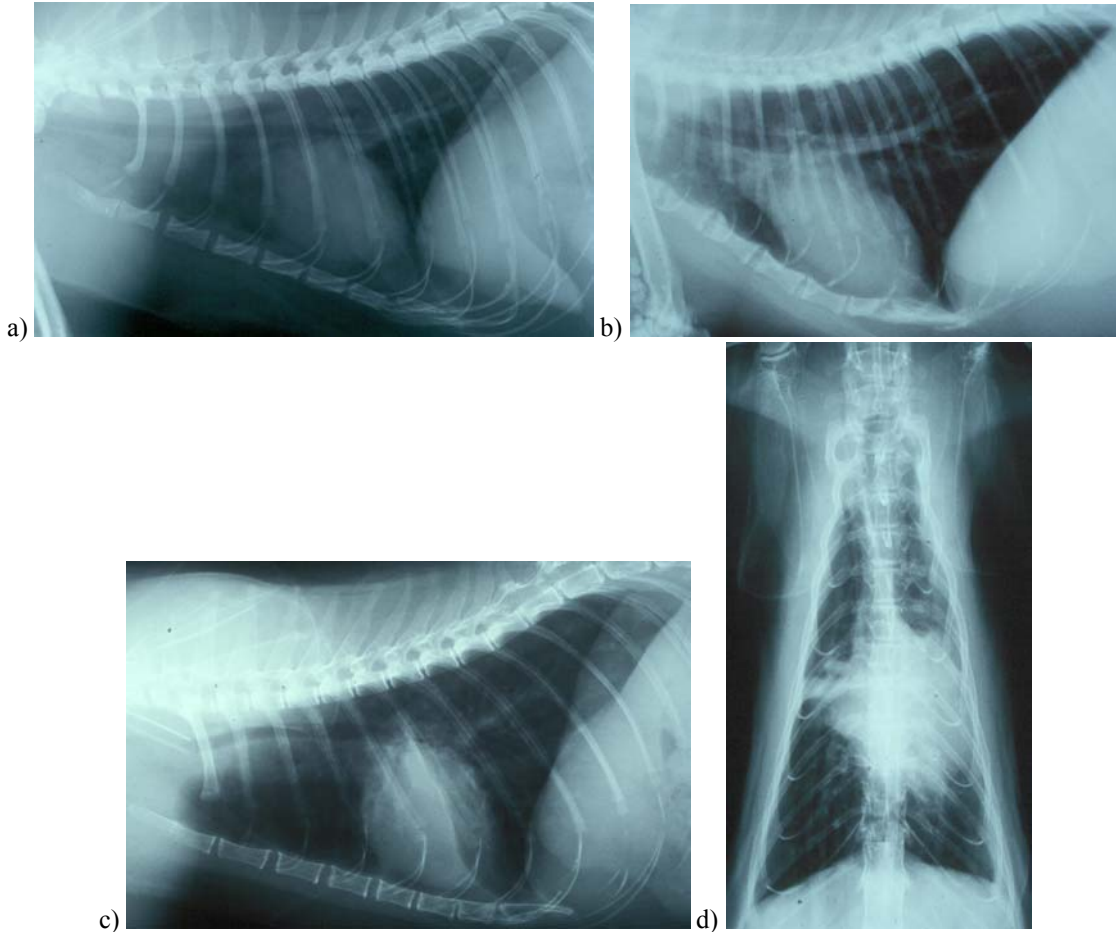


Figure 14. a) Lateral radiograph of a 5 year old Siamese cat with severe but episodic signs of coughing and dyspnoea. Radiograph shows a mild bronchial pattern and evidence of previous rib fractures. b) Lateral radiograph of a 7 year old DSH with moderate chronic signs of coughing and dyspnoea. Radiograph shows a significant bronchial pattern and collapse of the right middle lung lobe. c&d) Lateral and VD radiographs of a 10 year old Burmese cat with severe chronic signs of coughing and dyspnoea. Radiographs show significant bronchial/interstitial pattern, collapse of the right middle lung lobe, and air-trapping within the lung parenchyma (the latter seen as caudal extension of lung fields, flattening of diaphragm and marked separation of the heart from the diaphragm).

Ultrasound examination:

Ultrasound examination can be useful at detecting masses located within the thoracic fluid. It can also be used to provide guidance for fine needle aspiration (FNA) or True-Cut needle biopsy of thoracic masses, and in the assessment of cardiac function (echocardiography).

Bronchoscopy:

Where available, a small bronchoscope may enable the clinician to view the trachea and main-stem bronchi. It can be used to look for the presence of tracheal inflammation, narrowing, oedema, collapse, foreign bodies, granuloma, neoplasia, or helminths (Figure 15). Where the correct tools are also available foreign bodies can be removed and bronchoalveolar lavage can be directed to particular lung lobes. Cases of chronic bronchopulmonary disease may reveal erythema of the tracheal and bronchial mucosa, and/or the presence of excessive mucus/mucopurulent material within the airway.



Figure 15. Bronchoscopy of a 14 year old DSH cat that presented with acute onset coughing showing an adenocarcinoma in the right main-stem bronchi (Radiograph shown in 7b).

Collection of samples:

Samples can be collected from the LRT using one of a number of different methods:

- Tracheal wash
 - Bronchoalveolar lavage (BAL)
 - Bronchial mucosal biopsy
(Transthoracic FNA of a soft tissue mass)
(Ultrasound guided True-Cut needle biopsy of a soft tissue mass)
- *Tracheal washes* can rarely be performed in conscious cats, and the technique can only sample the upper respiratory tree. The author finds this procedure unrewarding.
 - *Bronchoalveolar lavage (BAL)*. This technique is much more rewarding. The cat is lightly anaesthetised, and placed in sternal or lateral recumbency. Lateral recumbancy may be used when disease is predominantly one-sided, and the diseased side placed is ventrally. Where a human paediatric bronchoscope is available an endoscopically-guided BAL can be collected. When performing the technique without endoscopic guidance a narrow sterile catheter is measured against the cat's chest and marked at a level ~2/3 of the way down the chest. A canine urinary catheter or an endoscopic catheter may be used. (Note: the narrower the catheter the further down the respiratory tree it is likely to be able to reach, and the more successful the BAL is likely to be). The catheter is then introduced through the sterile endotracheal tube and advanced gently until it can be advanced no further (approximately to the level at which it was pre-marked). Warmed sterile saline is then flushed down the catheter (~3-10ml/cat). Very little of this first flush can usually be re-aspirated. A second and third flush/aspiration cycle are then performed. The cat's chest can be coupaged (clapped) between each flush as this helps to release cells into the saline. The second flush is generally used for microbiological culture, while the third flush is assessed

cytologically. The third flush usually has the best harvest of alveolar cells. Fluid that is aspirated back should be slightly cloudy (cellular) and frothy (denoting the presence of surfactant). After performing a BAL the cat should be given oxygen enrichment for a few minutes prior to being allowed to recover from the anaesthetic. Since BAL can, very occasionally, stimulate bronchoconstriction it is sensible to have emergency bronchodilator therapy available (e.g. i.v. terbutaline).

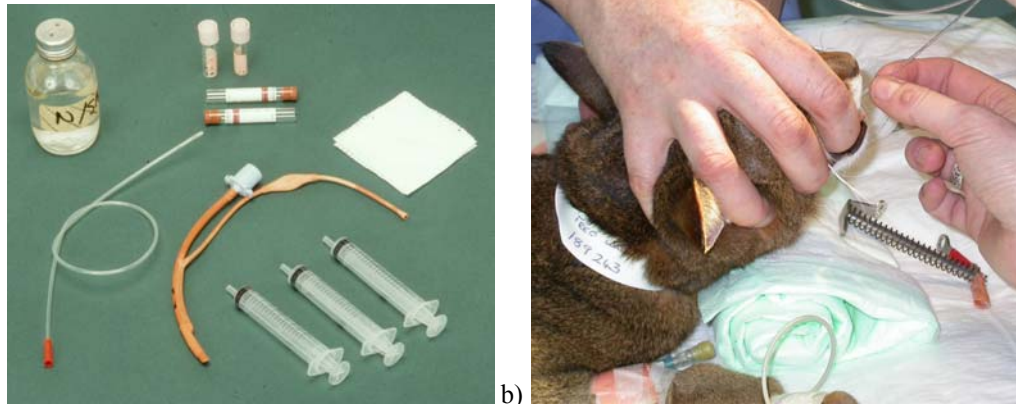


Figure 16. a) Typical equipment required to perform a BAL: A sterile canine urinary (or endoscope) catheter, warmed sterile saline, tubes for the collected fluid [EDTA for cytology and plain for culture], cotton swab [if needed], three 5 or 10 ml syringes, and a sterile ET tube [preferably uncuffed]. b) Passing an endoscope catheter through the ET tube. (Special ET tube connectors are available that allow this procedure to be performed without disconnecting the ET tube from the anaesthetic circuit). It is important to establish IV access in case the anaesthetic needs to be 'topped up', or a bronchodilator is needed (in the very rare cases of bronchospasm).

There is considerable debate as to what constitutes a BAL; as opposed to a tracheo-bronchial lavage. Some authors state that much higher volumes of saline are required to perform a BAL (up to 50 ml/cat). However, the author finds this unnecessary. It is relatively easy to determine whether or not the samples contain material from the alveoli: Fluid recovered from the alveoli contains mostly alveolar macrophages, while fluid from the bronchial tree tends to contain mostly epithelial cells.

From cats, normal BAL fluid contains: 150-450 nucleated cells/ μ l
60-90% macrophages
2-30% eosinophils*

Cats with bacterial bronchopneumonia usually have elevated numbers of neutrophils (which may be seen to contain engulfed bacteria), while chronic bronchopulmonary disease usually results in increased neutrophils, macrophages, hyperplastic epithelial cells, and/or excessive amounts of mucus. Cats with allergic lung disease ('feline asthma') may have raised numbers of eosinophils, mast cells, neutrophils and macrophages. (Figure 17).

*Occasionally, normal healthy cats can have up to 85% eosinophils in BAL fluid.

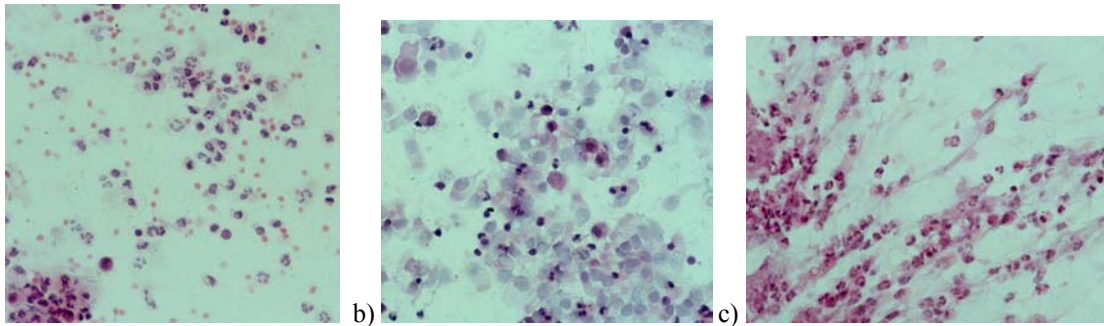


Figure 17. Cytology, H&E stain. a) BAL fluid from a cat with bronchopneumonia showing increased numbers of neutrophils and red blood cells. b) BAL fluid from a cat with chronic bronchopulmonary disease showing increased numbers of macrophages and hyperplastic epithelial cells. c) BAL fluid from a cat with 'feline asthma' with increased numbers of eosinophils and excessive amounts of mucus.

- *Bronchial mucosal biopsy* can be performed with or without endoscopic guidance. It is usually achieved using endoscopic biopsy grabs. The procedure should not be undertaken without prior training as the generation of a full-thickness perforation may lead to pneumothorax or pyothorax. The collection of bronchial cells using an endoscopic brush is considerably less traumatic.

Treatment of samples:

BAL fluid should be submitted for culture and cytology.

- *Culture:* This requires a sterile container. All of the air should be removed from the container if anaerobic culture is to be performed. Ideally, all fluids should be assessed for aerobic and anaerobic bacteria, fungi and yeasts. It is very important to contact the diagnostic laboratory prior to collecting and sending the samples as special transport media may be required. Since most laboratories do not routinely look for *Mycoplasma spp.* or *B. bronchiseptica* it is important to ask them to do so as we now recognize that they are much more common infectious agents than previously thought; up to 20-25% of cats with chronic bronchopulmonary disease are found to have a *Mycoplasma spp.* infection.
- *Cytology:* Heparin or EDTA tubes are suitable for cytology. They should be processed promptly before cellular detail is lost. Where samples are to be sent away for assessment 4-6 slides should be prepared at the time of collection as preferred by the cytologist (air dried, spray fixed or fixed in alcohol). If few cells are present, the sample can be spun (200 rpm for 2-4 minutes) then smears can be made with the cell pellet. For in-house assessment Gram stain and 'Diff-Quik' are suitable stains. Cell counts can be performed on EDTA anti-coagulated samples.

References for further reading are listed at the end of the third article in this series.