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Hot Topics in Feline Medicine Mini Series

Session 3: Approach to the Dyspnoeic Cat

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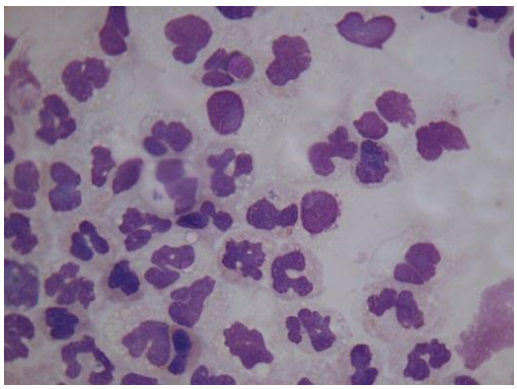


Session 3: The dyspnoeic cat: a closer look at respiratory disease

Approach to the dyspnoeic cat

Dyspnoeic cats are scary cases, stressful for owners and vets. Frequently the cat was previously normal and presents acutely. Our instinct is often to perform tests to reach a rapid diagnosis but with dyspnoeic cats this is not the way to go. You may need to sit on your hands and observe the cat whilst providing supportive treatment and reach a diagnosis later. Importantly:

- Stay calm and logical
- Hands off: these cats can go into cardiopulmonary arrest if a stress pushes them over the edge, plus they have already had the stress of transport
- Reduce stress: keep them away from dogs; even though the prep room feels the right place for them, it is not if surrounded by noisy dogs. They need to be in a quiet environment.
- Provide oxygen immediately: various ways to do this:
    - Ideally an oxygen cage and collapsible ones are available or make one with cling film over the cage door (remember to leave an exit hole for CO2)
    - Flow by oxygen by a mask or simply the anaesthetic circuit, again avoid stress and don't persist if the cat doesn't want the mask on its face
    - You can make an oxygen 'hood' with a buster collar and cling film, again leave an exit hole for CO2. In the authors experience these are poorly tolerated.
    - Avoid overheating – all forms of oxygen supplementation are prone to heat accumulation.
- Place an IV IF you can without causing undue stress to the cat.
- Consider sedation – butorphanol (0.2-0.4mg/kg IM or SC) is 'cardioneutral' i.e. have minimal cardiovascular effects. Avoid medetomidine. Midazolam and ketamine are preferred by some – but ketamine will increase BP and this is not a great idea in cardiac patients.

Where to start

Use the information you have easily at hand to try and help you narrow the differential diagnosis list WITHOUT relying on diagnostics that are unsafe to perform. Use signalment, history and importantly observation of respiratory pattern to narrow your list. Then consider ultrasound before radiography. Empirical treatment may be necessary.

Signalment

Consider the age of the cat, younger cats can get hypertrophic cardiomyopathy (HCM) and resulting congestive heart failure (CHF) but less commonly than middle aged to older cats.

Young cats can get mediastinal lymphoma, pyothorax and FIP more often than older cats. Younger, often purebred, cats with FIP can get large volume pleural effusions along with abdominal effusions. Maine Coons and Ragdolls are predisposed to HCM and Siamese and Orientals to asthma and mediastinal lymphoma. Older cats are more likely to get thoracic neoplasia, thymoma and hyperthyroidism.

History

While you are stabilising the cat, send a nurse or colleague to take the history. As mentioned many cats will have been previously normal, or suffered an obvious trauma (ruptured diaphragm, haemothorax), but appropriate questions should be asked e.g.:

- Has the cat coughed before (note that owners may mistake a cough with a terminal retch for a gag or vomit)? Cats with cardiac disease rarely cough but those with lower airway disease will.
- Has the owner noticed any snoring noises or wheezing? (tend to be noted in upper respiratory tract disease)
- Any dysphonia (can indicate laryngeal disease)?
- Has he cat been unwell or vomiting (aspiration pneumonia)?
- Has the cat been unwell in any other way e.g. weight loss, PU/PD etc. (remember thoracic/upper respiratory tract neoplasia a common cause of respiratory signs, especially in older cats).

Assess respiratory pattern

You can learn a lot from a dyspnoeic cat by observing them. Certain patterns of breathing are very localising. You can do this from a distance. Look at the phases of respiration and concentrate on each and see if it is longer or requires more effort on inspiration or expiration. Note the rate and depth of breathing, deep and slow versus rapid and shallow. A paradoxical pattern occurs when the abdomen draws in on inspiration, this can occur with many diagnoses as the result of respiratory fatigue but is more common with pleural space and lower airway diseases.

Note that cats showing orthopnoea are very fragile indeed and these are the cats that will decompensate on handling. Ensure you handle these cats minimally and consider empirical treatment. See the table below and in the talk videos will illustrate the patterns.

AREA AFFECTED	BREATHING PATTERN	FEATURES
Upper respiratory tract	**Obstructive/inspiratory**	**Increased inspiratory effort** **Stridor +/- stertor, rate near normal**
Lower respiratory tract	**Obstructive /expiratory**	**Increased expiratory effort, abdominal effort, wheezes and crackles, rate usually not severely elevated**
Pleural space or pulmonary parenchyma	**Restrictive (inspiratory = expiratory)**	**Rapid, shallow, effort on both phases, abdominal effort**
Non-specific, respiratory fatigue or pleural space	**Paradoxical**	**Inward movement of abdomen during inspiration**

By observing the breathing pattern you can narrow your list of differentials and decide on the most appropriate diagnostic tests.

Further physical examination

Once the cat has been stabilised in oxygen a minimal physical examination may be possible. Make sure this is done in a quite area with oxygen ideally. Look for signs of trauma such as rib fractures, scuffed claws etc. that may suggest diaphragmatic rupture, pneumothorax or haemothorax, or even flail chest. Look at:

- Mucous membrane colour
- Heart rate and rhythm
- Brief general exam (other disease etc.) e.g. ascites in an FIP case
- Nasal or ocular discharge
- Upper respiratory noise (listen over the larynx with stethoscope)
- Thoracic auscultation: listen over entire chest – dull and reduced heart sounds with pleural fluid, absent breath sounds with pneumothorax. Abnormal airway noises are heard with lower airway disease – wheezes and crackles with asthma and chronic bronchitis. You will also hear soft crackles with CHF.

- Thoracic percussion – put the bell of the stethoscope on the chest and percuss around, dull could mean fluid (or consolidation/tumour) and a tympanic sound can mean pneumothorax.
- Position of apex beat (moved by a mass)
- Cranial rib spring: reduced with mediastinal masses

Cardiac or not?

A crucial decision is whether the cat has cardiac disease or not. It changes your treatment and approach in many ways, although thoracocentesis should always be performed if an effusion is present rather than relying on diuretics. The presence of a heart murmur does not mean the cat has heart disease causing the presenting signs (see below). Other markers of cardiac disease may be useful:

- Tachycardia
- Gallop
- Arrhythmia
- Loud heart murmur (esp in older cat)
- Soft crackles on auscultation (note you can hear crackles with lower airway disease too but if due to CHF they tend to be soft and quiet)
- Jugular venous distension

Cardiac biomarkers – particularly NT-proBNP may be helpful BUT there is a grey area in interpretation, and a negative result is more useful, a positive on the bench side tests may be seen with respiratory and other systemic disease. Note that measuring NT-proBNP in thoracic fluid may be very useful (cut off 322.3 pmol/l had 100% sensitivity and 94.4% specificity in one study – Humm et al 2013).

NT-proBNP level	**Significance**
< 100 pmol/l	Clinically significant cardiomyopathy unlikely
100-270 pmol/l	Grey area, clinically significant cardiomyopathy still unlikely, early disease possible. NOTE; cut off for bench side test is 120-130 pmol/l
>270 pmol/l	Clinically significant cardiomyopathy highly likely.

The significance of a heart murmur

If a dyspnoeic cat has a murmur it can be easy to assume it has heart disease but this is not always the case. Between 15.5 and 44% of apparently healthy cats have murmurs. Of cats with murmurs only 1 in 3 had echocardiographic evidence of heart disease (Wagner et al, 2010). Heart murmurs can be benign and other clinical findings are more significant e.g. a gallop rhythm, arrhythmia or very loud murmur, particularly in an older cat.

Thoracic ultrasonography

We often rush to take a radiograph but this can be risky in dyspnoeic cats. Certainly a lot can be learnt from thoracic ultrasound. A quick scan with the cat in sternal is indicated for cats with restrictive breathing or paradoxical patterns and can tell you:

- Is there free fluid in the thorax?– therapeutic thoracocentesis is indicated
- Is the left atrium a normal size? – You don't need to be a good echocardiographer here – in cats with CHF the left atria is usually enormous. Get a long axis and the LA should be box shaped and around half the volume of the LV. In a short axis view at the level of the aorta (Mercedes Benz sign) the LA should be less than 1.5 the diameter of the aorta. In cats with CHF it is usually > twice the size.
- Look at the lung – there should be a bright line near the probe that moves with breathing – this is the pleural glide sign. This is absent with a pneumothorax. You can also look for 'B' signs – bright, sparkly lines vertical away from the probe suggestive of pulmonary oedema. 'A' lines are the parallel bright lines seen in normal lung.

Thoracic radiography

As mentioned, restraint for radiography has certainly caused the death of some cats with dyspnoea. If taking a radiograph again keep everything quiet and calm, supply flow by oxygen and keep the cat in sternal.

You can take a DV in a cat basket by putting the cassette under the cat and leaving the lid open. Be quick and know what you are looking for. Pleural effusion on radiographs can look simply 'hazy' and ill defined. Laterals and certainly DVs are not recommended; see above for the benefit of ultrasound. Horizontal beam may be possible, but it must be carefully used to minimise environmental scatter.

Thoracocentesis

Thoracocentesis is both therapeutic and diagnostic too. Draining air or fluid will immediately improve the cat's ability to breath. In CHF furosemide will not be enough with large effusions. It is safe to perform without ultrasound or radiography, listen to the chest carefully – dull lung and heart sounds, dull percussion – it is sensible to attempt thoracocentesis.

Again move to a quiet and calm area to do this.

- Sedate with butorphanol if needed
- Continue flow by oxygen
- Use a butterfly needle and three way tap
- Ideally prep in a sterile fashion
- Rib space 7-9, lower third for fluid, higher for air
- Don’t forget to collect samples (EDTA, plain)
- Redirect the needle if needed, fluid may be in pockets

Empirical treatment

Treatment really depends on the localisation of the respiratory disease, but if cardiac disease is suspected then furosemide should be administered at 2mg/kg and repeated at mg/kg after 30 minutes if only partial improvement. Suspected lower airway disease should be treated with a bronchodilator such as terbutaline and a short acting corticosteroid e.g. dexamethasone 0.1-0.2mg/kg IV or IM. Sedation is helpful for all dyspnoeic cats if they are distressed, as this will increase their oxygen demand. Other treatment will depend on the underlying disease process.

Upper airway disease

Upper airway disease is common in cats, certainly nasal disease and cat flu cases will make up a proportion of the cases seen in general practice. Conditions causing respiratory signs include;

- Inflammatory polyps
- Trauma
- Foreign bodies
- Brachycephalic airway syndrome in Persian and related cats
- Laryngeal disease
- Chronic rhinosinovitis
- Neoplasia
- Nasopharyngeal stenosis
- Infectious diseases – cat flu viruses, Cryptococcus

Clinical signs of upper airway disease include dysphonia, nasal discharge, gagging, retching and coughing, facial deformation, dysphagia, halitosis, sneezing, not forgetting non-specific signs such as weight loss and lethargy.

Diagnostics will depend on the area affected and again use of signalment and clinical signs can help localise the lesion. Oriental cats are overrepresented when it comes to nasal lymphoma and inflammatory polyps and younger cats are in general more likely to have upper respiratory tract viruses. Older cats of course are more likely to have neoplasia.

Physical examination should include:

- Is there a nasal discharge? Unilateral or bilateral? Serous or purulent?
- Ocular changes? E.g. epiphora, conjunctivitis – staining for ulcers typical of herpes with rose Bengal stains may be helpful.
- Check nasal airflow both sides with cotton wool
- Check facial symmetry and deformation
- Check for evidence of trauma
- Check local lymph nodes
- Assess for ear disease
- Look for dental disease
- Look for Horner's syndrome

Further investigations as indicated including:

- Haematology, biochemistry and urinalysis: assess organ disease or involvement e.g. nasal lymphoma is associated with renal lymphoma
- Infectious disease testing FeLV and FIV and in some countries Cryptococcus is a common cause of nasopharyngeal disease. FHV and FCV testing may be indicated remembering that PCR for Herpes will give positive results in carrier cats

- Coagulation profile: if epistaxis and also prior to rhinoscopy and biopsy
- Radiography
- CT – can be useful for nasal disease particularly
- Ultrasound – can be used to investigate laryngeal disease but is a challenging technique.
- Rhinoscopy and biopsy – including deep flushing for culture (and therapeutic effect)
- Examination of the nasopharyx – retroflex the endoscope or use a simple dental mirror and spay hook and pull the soft palate forward when the cat is in dorsal recumbancy

More detail on specific conditions:

1. Laryngeal disease

Cats with laryngeal disease can present acutely or with longer standing clinical signs. In the authors experience they present with acute dyspnoea and can be very stressful to manage, despite having treatable disease. In first opinion less severe cases presenting with stridor and stertor as well as a history of gagging and dysphonia, may be more common. Older cats tend to have neoplastic disease, and the author has seen Burmese cats with congenital laryngeal abnormalities.

Management of acute respiratory distress caused by laryngeal disease

- Initial patient triage should be performed promptly and efficiently to avoid stressing an already compromised cat.
- Oxygen supplementation should be provided, again in a way to avoid stress (oxygen tent rather than mask).
- Light sedation, for example with butorphanol +/- ACP can help to reduce severity of dyspnoea during initial stabilisation
- Clinical signs may localise disease to the upper airway but are unlikely to be specific to one diagnosis, further investigations will inevitably be required.
- Cats with severe upper airway obstruction should be anaesthetised in order to secure a patent airway.
- Equipment to aid intubation (guide-wire or urinary catheter to be used to facilitate intubation) or to perform an emergency tracheostomy should be easily accessible.
- Emergency tracheostomy should be reserved for patients which cannot be intubated.
- Less severely affected patients may be treated medically (for example with oxygen supplementation and corticosteroids) and undergo diagnostic imaging conscious or under sedation prior to further investigations.

The causes of laryngeal disease (in order of frequency) are:

- Laryngeal paralysis (can be congenital or secondary to other neuromuscular or thoracic conditions, also seen post thyroidectomy)
- Laryngeal neoplasia
- Inflammatory laryngeal disease (as mentioned may be more common in 1st opinion)
- Miscellaneous conditions e.g. foreign body, trauma, cyst

Diagnostic tests include direct visualisation of the larynx; radiography and CT may be used. Intubation can be challenging and small ET tubes and urinary catheters should be available in case intubation is challenging. Equipment for tracheostomy should be available, especially as biopsy etc. may temporarily worsen the clinical signs. FIV testing is indicated, as there may be an association with laryngeal neoplasia. Ultrasound of the larynx is technically challenging.

FNA and biopsy have been shown to be relatively safe and not worsen clinical signs in most cases. (See ref list for papers on laryngeal disease). Biopsies can be obtained using endoscopy forceps and a short acting corticosteroid may minimise swelling. Laryngeal paralysis is diagnosed by observation of laryngeal movement under light anaesthesia or via ultrasound.

Treatment depends on the aetiology of course; LP is treated with surgery or conservative treatment (weight management, restricted exercise). Surgery (unilateral arytenoid lateralisation) may be indicated for bilateral cases but is technically challenging and complications are not uncommon, the most common being aspiration pneumonia.

Laryngeal lymphoma can be treated with chemotherapy – COP protocols for example. Long-term survival is reported. Laryngeal SCC is only treated palliatively with tracheotomy in some cases.

Inflammatory laryngeal disease can be managed symptomatically, the cause often not being identified. The majority of cats are treated with corticosteroids and antibiotics and the prognosis is very good if they survive the acute episode of dyspnoea. Care with steroids given that some cats may have FHV. If FHV is implicated treatment with famciclovir may be indicated.

2. Nasopharyngeal polyps

Nasopharyngeal polyps are benign, inflammatory masses arising from the lining of the middle ear or Eustachian tube. Histologically they are pseudostratified epithelium and connective tissue stroma infiltrated by lymphocytes, macrophages and plasma cells.

They are located in the nasopharyx or external auditory canal and typically occur in younger cats. The causes are unknown but they could a congenital abnormality of the first pharyngeal pouch. An association with infectious agents such as FHV has not been shown.

Clinical signs of nasopharyngeal polyps include stertor, nasal discharge, dysphagia Horner's and head shaking. Vestibular signs may also be seen. Radiography may show a mass lesion pushing the soft palate downwards. Bullae may also be involved.

Treatment options include traction/avulsion with the polyp grasped with Allis tissue forceps and slowly pulled. Access is via the oral cavity and pulling the soft palate forward or by making an incision in the soft palate. Complications include recurrence and Horner's which usually resolved. Recurrence rates are around 30%, reduced by giving oral prednisolone for 4 week post op. Surgically a ventral bulla osteotomy can be performed to curette the bulla contents. Adverse effects include Horner's, vestibular disease or facial nerve paralysis.

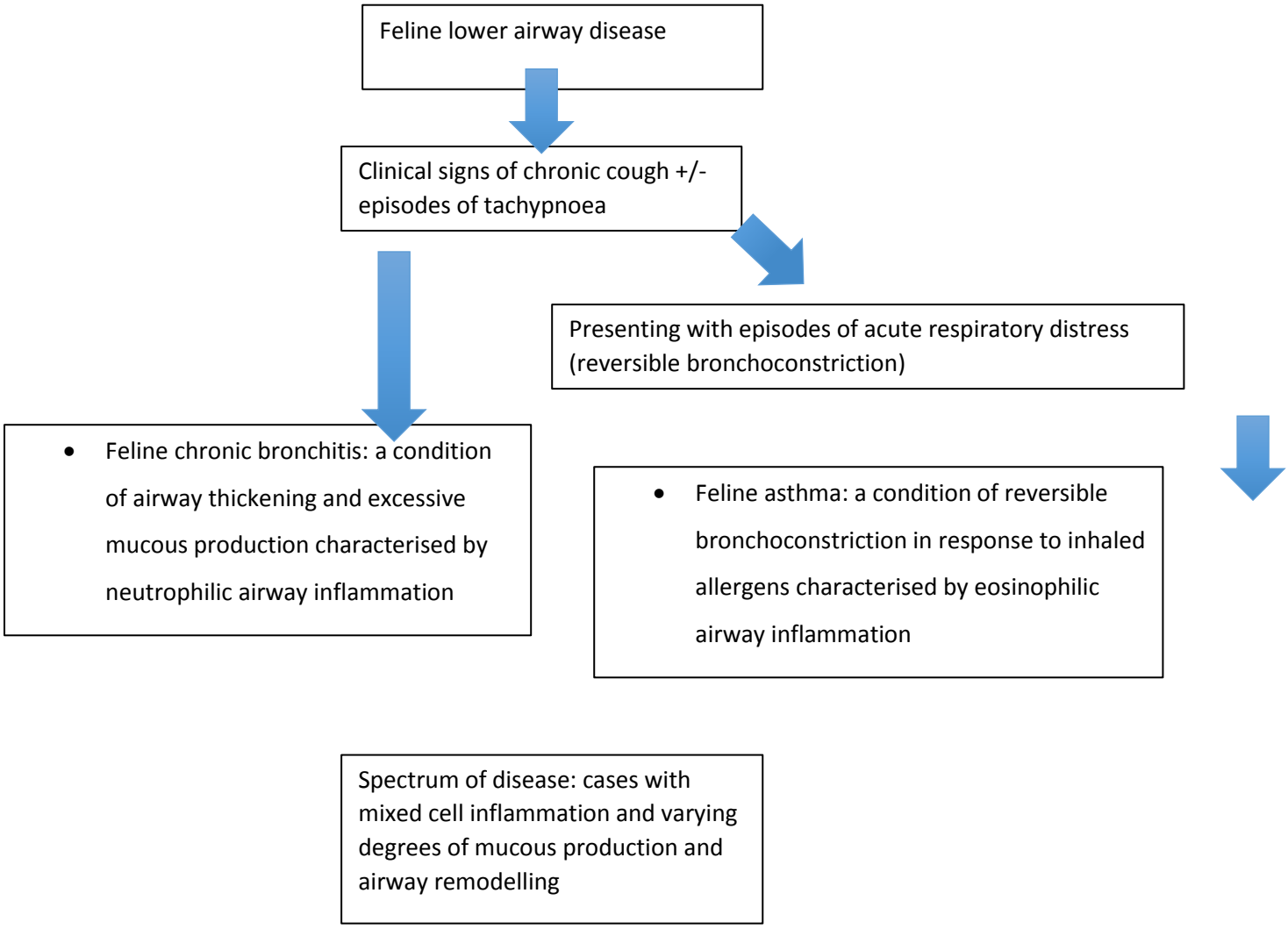
Feline lower airway disease

Lower respiratory disease is common in cats. Differential diagnoses include feline asthma, chronic bronchitis, bronchopneumonia, lungworm, neoplasia and pulmonary oedema.

What is 'asthma'?

The term 'asthma' is sometimes used a little clumsily in feline medicine to describe chronic, inflammatory lower airway disease resulting in a cough. However the name has been borrowed from human medicine and in cats the definitions of inflammatory airway diseases are unclear. Feline lower airway disease is a term used to encompass both asthma and chronic bronchitis, diseases that differ in pathophysiology but are often clinically indistinguishable. Cats with asthma are more likely to present in respiratory distress than cats with chronic bronchitis but both conditions have a cough as a predominant clinical sign. See figure 1.

Figure 1: Feline lower airway disease is a common clinical entity in cats, but terminology is poorly defined. Broadly cats are diagnosed with asthma or chronic bronchitis but the distinction is unclear.



Standardisation of terminology is currently not available, and may not be possible without diagnostic testing such as bronchoalveolar lavage (BAL). In practice there is overlap between the conditions; which may be better considered as a spectrum of lower airway disease.

Pathophysiology

In feline asthma it is generally accepted that a type 1 hypersensitivity reaction occurs within the airways where sensitised cats react to repeat exposure to an antigen with mast cell degranulation. Histamine and leukotrienes result in increased vascular permeability and smooth muscle contraction (acute airway narrowing); eosinophils are recruited and worsen the inflammation and tissue damage. This inflammation results in airway hyper-reactivity, smooth muscle hypertrophy and excessive mucus production. The condition is seen more commonly in Siamese and other Oriental cats and multiple triggering allergens are implicated including dusty cat litter, house dust mites, strong chemical smells, building dust, perfumes, hairspray, cigarette smoke and pollens.

In chronic bronchitis neutrophilic inflammation predominates, with excessive mucous production and airway remodelling and narrowing. This condition does not seem to be acutely triggered by allergens but the causes are not fully understood.

Reduced airflow occurs in both conditions due to oedema, mucus, inflammation and epithelial alterations with bronchoconstriction occurring in cats with asthma. These changes in airway diameter, even if small, result in significant reductions in airflow. Over time changes become more permanent including fibrosis and emphysema.

The role of mycoplasma in feline lower airway disease

Mycoplasmas are small bacterial organisms widely considered to be commensals found in the feline upper respiratory tract. Their role in lower airway disease is debated, although the majority of studies have not detected *Mycoplasma* species in the lower airways of healthy cats. Mycoplasma infection has been reported in association with lower airway, pulmonary and pleural disease (Lee-Fowler, 2014) and it is likely that if not the cause of the disease, *Mycoplasma* species may be responsible for exacerbations of these conditions and it is sensible to test for this bacteria in BAL samples from coughing cats. Recent publications suggest that PCR is more sensitive than culture although performing both is sensible given that PCR detects DNA and provides no information as to the viability of the organism. Treatment options for *Mycoplasma* species include tetracyclines (doxycycline in particular is frequently used, but ensure that if in tablet form they are followed with food or water to prevent oesophageal injury) and fluoroquinolones.

Clinical signs of lower airway disease

Asthma and chronic bronchitis result in a chronic cough, due to airway narrowing, mucous and direct effects of inflammation on mechanoreceptors in the airways. Owners may mistake this cough for a retch, or conclude something is stuck in the cat's upper airway, for example a hairball. Cats at the asthma end of this disease spectrum are more likely to develop respiratory distress and particularly expiratory dyspnoea with increased effort on exhalation compared to inspiration. Paying close attention to the respiratory pattern of a dyspnoeic cat can be useful in narrowing the differential diagnosis. Episodes of tachypnoea and exercise intolerance may be noted, although harder to appreciate than in dogs, affected cats may become tachypnoeic and lethargic after brief periods of playing for example. Signs may be episodic, persistent or intermittent.

On physical examination affected cats may have an expiratory wheeze or crackles, and if in respiratory distress they may be cyanotic.

Diagnosis

Clinical signs and physical examination findings may be consistent with lower airway disease but differential diagnoses such as congestive heart disease, lungworm, pleural space disease or upper respiratory disease must be excluded. Diagnostic tests include:

Laboratory testing

The majority of cats will have normal haematology and biochemistry panels, however circulating eosinophils are found in around 20% of cats with asthma. Faecal analysis should be performed to exclude lungworm (*Aelurostrongylus abstrusus*) infection as a cause of the clinical signs. Other tests will be dictated by the individual case (e.g. feline leukaemia virus and feline immunodeficiency virus testing).

Diagnostic imaging

Radiography is important in the diagnosis of lower airway disease and usually reveals a diffuse bronchial pattern, although an interstitial pattern is also reported in cats with chronic bronchial disease (Gadbois et al, 2009). Other abnormalities include lung hyperinflation, hyperlucency and aerophagia. Right middle lung lobe collapse is another consistent finding, due to mucous accumulating ventrally in this lobe. Thoracic radiographs may also be unremarkable in affected cats; necessitating further investigation.

Thoracic CT is growing in popularity in veterinary medicine and in cases if lower airway disease it can review airway thickening, lung lobe consolidation and mucous accumulation and exclude other differential diagnoses.

Bronchoscopy and bronchoalveolar lavage

Bronchoscopy with BAL is the gold standard for confirming a diagnosis of lower airway disease but BAL samples can also be collected blind, without a bronchoscope by passing a sterile catheter (often a dog urinary catheter) via the endotracheal tube. The tube, or bronchoscope is passed distally to form a seal inside a bronchus and a wedge of lung isolated, before instilling aliquots of sterile saline (usually around 10ml) followed by aspiration. For both bronchial washing and BAL it is helpful to have the saline warmed to body temperature prior to lavage. In addition to improving cellular yield; this may help to prevent bronchoconstriction which can be a complication when the fluid is instilled into the airways. Because this procedure is usually undertaken in cats with known airway disease, and because there may be underlying airway hyper-reactivity in a proportion of these it is sensible to ensure the anaesthesia provides 100% oxygen during and immediately after the washing and it is also prudent to have emergency bronchodilator therapy available (e.g., intravenous terbutaline available). Samples should be submitted for cytology, bacterial culture and, if indicated *Mycoplasma species* PCR. Note that Mycoplasma culture requires special handling so discuss with the lab.

Interpretation of BAL results

Cytological examination in cats with lower airway disease reveals variable levels of inflammation, however results have to be interpreted with caution as normal cats may have up to 25% eosinophils in BAL samples (Baral, 2012). It has been suggested that cats with asthma will have higher total cell counts as well as elevated levels of eosinophils, whereas cats with chronic bronchitis show a predominance of neutrophils (Venema, 2010).

Management of cats with lower airway disease

Emergency treatment

See earlier in notes and remember the hands off approach and looking for the obstructive (expiratory dyspnoea).

Chronic therapy

The mainstay of treatment of lower airway disease is corticosteroid treatment, but bronchodilator therapy can be helpful for cats with bronchoconstriction. As treatment is life-long and potentially associated with side effects, other causes of airway disease should be excluded and treated empirically if necessary such as antiparasitic treatment for lungworm. Clients should also be counselled as to maintaining their cat at a healthy weight and overweight or obese cats should be seen in a weight-management clinic at the practice to encourage slow, healthy weight loss.

1. Removal of triggers: owners of cats with lower airway disease should make efforts to remove aerosol triggers such as cigarette smoke and dusty cat litters.

2. Corticosteroid therapy: forms the mainstay of management of affected cats. Oral prednisolone is recommended as initial treatment, using dosages to control clinical signs (0.5-1.0mg/kg BID) but tapered to avoid side effects such as polydipsia and insulin resistance resulting in diabetes mellitus. Injectable corticosteroids are the least desirable option due to the potential for severe side effects but maybe the only option for some cats. Inhalational corticosteroids are an effective way to manage lower airway disease in cats (Baral 2012), although it is important to remember they can take 1-2 weeks to become effective and cats should be initially treated with oral corticosteroids with a view to using inhaled medications once clinical signs are controlled. More information on inhaled therapy is included in boxes 2 and 3.
3. Bronchodilators: given that bronchoconstriction is a significant cause of clinical signs, bronchodilators may form part of treatment. Inhaled salbutamol can be useful in an acute episode of bronchoconstriction at a dose of 100µg. Other bronchodilators used in cats with lower airway disease include other $beta_2$-receptor antagonists such as terbutaline (which can be given before bronchoscopy or blind BAL and in an acute episode of dyspnoea) and methylxanthines such as propentofylline.
4. Other therapies: antibiotic therapy should be based on culture and sensitivity results, although scant growth due to contamination is not unusual. Results should be interpreted with cytology findings and how heavy the growth is. *Mycoplasma* spp. may play a role in lower airway disease and a PCR is now available in addition to culture and may be performed on BAL samples. Ciclosporin has been used successfully to treat a cat with asthma but further study is required before it can be recommended. Omega-3 polyunsaturated fatty acids and immunotherapy show promise and further publications are awaited.

Inhalational therapy for cats with lower airway disease

Inhalational therapy is provided via a metered dose inhaler (MDI) attached to a chamber and facemask. Inhaled corticosteroids and bronchodilators are used, although none are licensed for cats. Inhaled medications provide local drug distribution into the lungs, and are associated with fewer side effects than oral medication. Systemic absorption of inhaled corticosteroids does occur but adverse effects should be reduced. Fluticasone is used widely as an inhaled corticosteroid at a starting dose of 125-250µg BID and salbutamol is used as a bronchodilator at 100µg every 30 minutes during an acute episode. Both are available from human pharmacies. Chronic use of salbutamol is not recommended as it may exacerbate airway inflammation.

Tips on introducing a facemask and spacer device

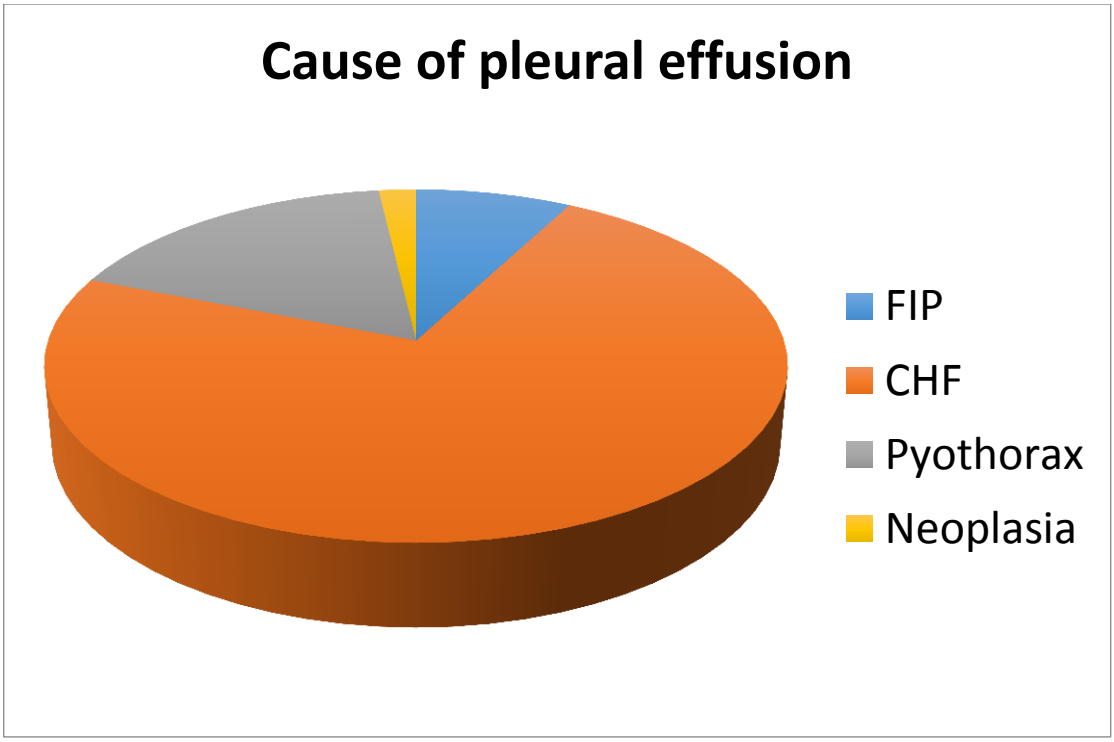
- The nurse should spend time with the client to discuss the benefits of this treatment and demonstrate how to use the equipment.

- Direct clients to reliable sources of information such as http://icatcare.org/advice/cathealth/using-inhaler-treat-feline-asthma-0 and www.breatheazy.co.uk
- The sight, sound and smell of the spacer and inhaler can be alarming to a cat so they should be slowly habituated to the device at home
- Before the owner uses the spacer and inhaler on the cat they should get the cat used to the facemask by applying it very briefly then giving a treat, (or playing with the cat if not food motivated) and very slowly leaving the mask on for longer periods
- If the cat tolerates the mask, the spacer and inhaler can be attached and the process repeated until the cat tolerates having the whole apparatus held up to their face
- The noise of the inhaler can be off putting for cats, it is like a hiss and the medication will smell unfamiliar. Owners should press the inhaler in the same room as the cat and reward with a treat or playing until the cat is not alarmed by the noise
- Owners may lack confidence in their ability to give the medication and the cat's tolerance of the procedure. Support with nurse consults and follow up phone calls to encourage compliance.

Pleural effusions in cats

Pleural effusions are a common cause of severe dyspnoea in cats. The pleural space is really a potential space surrounding the lungs. It is formed by the visceral and parietal pleura and normally a small volume of fluid is present. Processes disrupting normal pleural fluid formation and drainage result in an effusion, so anything affecting capillary or interstitial hydrostatic or oncotic pressures, lymphatic drainage or vessel integrity. The mediastinum in cats is fenestrated so bilateral effusions are common (pyothorax cases with thick effusions, fibrin etc. can be more unilateral). Common causes of pleural effusion include:

- Congestive heart failure
- Effusive FIP
- Neoplasia
- Pyothorax
- Chylothorax (chart based on data from Zoia et al, 2009)



Effusions are classified according to their cell count and protein content but there is overlap and results can be confusing. Certainly for FIP you may get variable cell counts. Chylothorax is diagnosed on the basis of finding an effusion triglyceride concentration of >1.12 mmol/l.

	Transudate	*Modified transudate*	*Exudate*
Protein g/l	<25	25-50	>25
Cells #/µl	<1000	1-5000	>5000
Appearance	Clear	Clear/Cloudy	Clear/cloudy/Opaque
Colour	None/yellow	Yellow/Pink	Yellow/Brown/Red
Fibrin	-	±	+

Don't be hung up on the classification of the effusion, look at the history, clinical signs and the cytology results too. Neoplasia can often be diagnosed on cytology of effusions, however be aware that reactive mesothelial cells can look rather neoplastic; an experienced cytologist should be able to tell the difference.

Other markers in effusion have been studied (Zoia et al 2009). LDH concentrations in fluid have been used to distinguish neoplastic effusions from CHF with the later having lower values. Septic effusions usually have a high LDH (>200 IU/l), pH is <6.9 and glucose < 1.7mmol/l and lower than blood glucose.

Pyothorax

Pyothorax occurs following penetrating trauma in most cases. Haematogenous spread or via respiratory or GI tract rupture is possible but a result of fighting is more common. The effusion is often malodourous (not always!) and has a high cell count of at least 7000 cells/microlitre and a protein count > 30g/l. Cytology shows degenerate neutrophils and in some cases bacteria (intracellularly or extracellularly). Bacteria involved tend to be from the oral cavity or skin, anaerobic or more commonly mixed infection are encountered.

	Cats	Dogs
Anaerobes	Bacteroides Fusobacterium Peptostreptococcus Porphyromonas Prevotella Filifactor Clostridium	Bacteroides Fusobacterium Peptostreptococcus Porphyromonas Prevotella Eubacterium Propionibacterium
Aerobes	Pasteurella Staphs E coli Actinomyces Mycoplasmas Enterococcus	E coil Enterobacter Pasteurella Actinomyces Streps Nocardia

Pyothorax cats may not be dyspnoeic and instead may be inappetant and lethargic. Close examination may reveal dull percussion, muffled heart sounds and pyrexic may occur. In cases with severe sepsis cats may be hypothermic and bradycardic. Haematology may show a neutrophilia and left shift – again in sepsis they may be neutropenic.

Treatment should involve drainage as well as antibiosis as penetration into the purulent material is a challenged for most antibiotics.

Drainage and lavage are indicated most often via a chest drain, although in exceptional cases where owner's finances are limited a one off drainage could be performed. Tubes are placed under GA and usually unilateral placement is all that is needed – bilateral in some cases of thick material and adhesions. Lavage helps break down effusions. Warmed Hartmann's is suitable and you should get 75% of the fluid back – start with 10-25ml/kg but monitor the cat's respiratory pattern whilst you insert the fluid. This should be done every 4 hours initially, tubes usually stay in for 4-6 days – removed on the basis of reduced effusion (<2ml/kg/d), improvement in cytology, absence of microorganisms, improved degenerative appearance of white cells in the effusion and resolution of signs of sepsis.

Antibiotic choice is ideally based on culture results but while these are awaited consider the likely bacteria – 20% Pasteurella, anaerobes. Potentiated penecillins are a good place to

start, +/- clindamycin for example. A fluoroquinolone should be reserved for cases where culture indicates it is appropriate to use. Start with IV antibiotics until an improvement is seen. The prognosis for affected cats is good, occasional cats require surgery to remove for example penetrating foreign bodies or lung abscesses.

A note on mediastinal lymphoma

Mediastinal lymphoma, prior to FeLV vaccination was one of the most common types of feline lymphoma. Since then it has become less common but still an important differential for dyspnoeic cats. Affected cats tend to be young, and Oriental and Siamese cats make up a good proportion of affected cats (21.8% of cases in one study, Fabrizio et al, 2014).

Presenting signs include dyspnoea (restrictive pattern), reduced cranial rib spring and dull heart sounds, absent lung sounds etc. and may be a very acute onset.

Diagnostic tests include thoracocentesis as many will have a pleural effusion as well and ultrasound will reveal a soft tissue structure in the cranial thorax, along with the pleural fluid if present. Cytology of pleural fluid, or an FNA of the mass will provide a diagnosis in most cases; remember an important differential is thymoma.

Treatment wise this is a type of lymphoma you should treat – owners may be reluctant as the cats are often acutely unwell and the thought of chemo is upsetting. A survey of owners who treated their cats with a COP protocol was performed a few years ago and showed that 83% of owners were happy with the treatment and 87% would treat another cat. The Fabrizio study showed a 94.7% response rate and median survival of 373 days (range 20-2015 days). Long-term survival is more common in young, Siamese and Oriental cats.

Conclusions

Dyspnoeic cats are fragile and should be handled very carefully. They should be put in oxygen and sedated if necessary while they are observed. Rushing into radiography can cause a cardiopulmonary arrest. Consider the use of ultrasound as a primary diagnostic and don't forget that thoracocentesis is both therapeutic and diagnostic. Think about differential diagnoses and empirical treatment is also reasonable, based on the likely underlying causes.

Upper respiratory treat disease in general is relatively common in cats, the most common cause of dyspnoea in some studies. Nasopharyngeal polyps and laryngeal disease are a couple of the potential underlying causes and laryngeal disease in particular can present very acutely. Lower airway disease is poorly defined but falls into categories of asthma and chronic bronchitis. Treatment with inhaled medications should be considered. Pleural space disease is a common cause of dyspnoea with differential diagnoses narrowed down by fluid analysis and imaging. Finally mediastinal lymphoma is one of the few cancers with a relatively good prognosis and worth treating, particularly in young oriental cats.

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