Feline UPDATE online
The Feline Centre Langford and zoetis™ working together for the benefit of cats
www.felineupdate.co.uk

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

***Angie Hibbert*** *BVSc CertSAM DipECVIM-CA MRCVS European Veterinary Specialist in Internal Medicine and RCVS Recognised Specialist in Feline Medicine.*

*The arrival of an unstable, dyspnoeic cat is a common emergency in general practice and initial management and stabilisation are critical in patient survival. Here,* ***Angie Hibbert*** *outlines triage of these patients, facilitating a coordinated approach from the whole practice team.*

**Fig. 1: A dyspnoeic cat receiving flow-by oxygen via facemask.**

Dyspnoea is a relatively common presentation in feline patients. The severity of disease is often particularly advanced at the time of emergency presentation, due to the cat's inherent nature of hiding early signs of illness, in part due to their lifestyles. The patients are typically fragile, therefore careful handling and emergency stabilisation are essential. It is often necessary to delay more extensive diagnostic tests such as radiography or echocardiography, until the patient has been stabilised. **Correct management of the dyspnoeic cat is essential since excessive stress or interventions *before appropriate stabilisation* may precipitate a terminal respiratory crisis.**

- **Dyspnoea:** difficulty in breathing; often manifests in cats as open-mouth breathing.
- **Tachypnoea:** increased rate of breathing.
- **Hyperpnoea:** increased depth of breathing, with or without an increase in the rate of breathing.
- **Orthopnoea:** adoption of a standing or sternal position to aid respiration.

Dyspnoea can be caused by many different conditions and primarily relates to disease originating within the respiratory system, but other processes that may cause tachypnoea and open-mouth breathing such as pain, fear, anaemia, hyperthyroidism, metabolic acidosis, abdominal distension or neurological disease have to be considered. In the case of primary respiratory disease, it can be be helpful to think about possible causes by location of the affected region of the respiratory tract, dividing it into the upper respiratory tract (nares through to the trachea), lower respiratory tract (bronchial tree), pulmonary parenchyma, pleural space and mediastinum, and thoracic wall (including the ribs, intercostal muscles and diaphragm).

## BE PREPARED!

In order to deal with any type of emergency presentation, it helps if all members of the veterinary team are familiar with the steps that will need to be taken in the emergency situation and what tasks they will perform.

- As soon as the impending arrival of a cat with breathing difficulties has been logged, equipment should be assembled.

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

- An open area is ideally used for assessment and stabilisation, preferably with access to oxygen and a 'crash' kit, so that the nurses and vets are in a position to perform cardiopulmonary resuscitation if necessary.
- Essential items for the crash kit that are important for dealing with respiratory emergencies include a laryngoscope suitable for feline patients (with appropriate blades and functioning light bulb), range of endo-tracheal tubes, suction device (to clear airway secretions), urinary catheter (to connect to oxygen tubing if intubation using an ET tube cannot be achieved quickly), T-piece or an ambu-bag, local anaesthetic spray (e.g. *Intubeaze*™), tracheostomy kit, drugs (including a bronchodilator e.g. terbutaline or salbutamol), short-acting corticosteroid (e.g. dexamethasone sodium phosphate, hydrocortisone) and furosemide, thoracocentesis kit and a thoracic drain.
- Monitoring equipment should be easily accessible, ideally this would include an ECG, non-invasive blood pressure monitor, pulse oximetry and capnography. However it is important to remember that much can still be achieved with careful monitoring using clinical observations alone.

**FOR ALL CASES, REGARDLESS OF THE CAUSE OF DYSPNOEA, TACHYPNOEA OR HYPERPNOEA, THE FIRST STEPS IN AN EMERGENCY ARE:**

1. **Immediately begin supplemental oxygen.**
2. Minimise oxygen demands through gentle handling and perform initial cardiorespiratory assessment (if the cat is fractious a hands-off approach is necessary).
3. Prepare equipment for placement of an intravenous catheter; this will be necessary for drug administration and in case of deterioration of respiratory function leading to a requirement for intubation for ventilation or resuscitation.

| Technique | Equipment and set up | Suggested flow rate | Advantages | Disadvantages |
|---|---|---|---|---|
| **Flow-by ± facemask** | Connect breathing system or tubing to oxygen cylinder. Attach clear facemask and hold over nose or in proximity to face; if mask is poorly tolerated try with tubing only. | 2-3 litres/min. | • Quick to set up.<br>• Suitable for immediate supplementation during triage.<br>• Equipment readily available. | • Poorly tolerated by some cats.<br>• Short-term unless patient is unconscious or recumbent as restraint is required.<br>• Wastes oxygen.<br>• Risk of carbon dioxide accumulation if tight-fitting mask applied. |
| **Oxygen tent/cage** | Specially designed chambers (e.g. Kruuse) and cage doors are available. Alternatively cover front of a cage with clear plastic and run oxygen through front. Second-hand paediatric incubators work well. | 3-10 litres/min depending on cage size. | • Allows hands-off approach without restraint, minimising stress.<br>• Suitable for conscious dyspnoeic patients on immediate arrival. | • Delay in reaching inspired oxygen concentrations.<br>• Very difficult to maintain oxygen levels if patient requires intervention and hands-on monitoring.<br>• High flow rates required.<br>• Risk of Hyperthermia; monitor for overheating. |
| **Oxygen hood** | Cover the bottom 80% of the front of an Elizabethan collar with cling film; place on cat. Run oxygen tubing through the back of the collar. | 0.5-1 litres/min. | • Allows hands-off approach without restraint, minimising stress.<br>• Suitable for conscious dyspnoeic patients on arrival.<br>• Cheap. | • May not be tolerated by some patients.<br>• Risk of hyperthermia and carbon dioxide acculumulation reduced by leaving gap at the top of the front of the collar. |
| **Nasal catheter** | Instil local anaesthetic (e.g. proxymetacaine) into nares; wait 1-2 minutes. Take a 4-6 Fr soft feeding tube catheter and measure to level of medial canthus. Apply sterile lubricant and insert tube via ventral meatus to level of medial canthus. Secure in place to hair with tape and spot of super glue. Nasal catheter can be connected to a T-piece using a 5ml syringe and ET tube connector. | 50-100ml/kg/min; slowly increase flow rate to desired level over 3 - 5 minutes. A gradual increase is generally well tolerated, reducing risk of inducing sneezing and dislodging the catheter. | • Highly effective.<br>• If tolerated, can apply two catheters to maximise maximum oxygen supplementation. | • Insertion can be stressful **- do not attempt if the cat struggles.**<br>• Often poorly tolerated.<br>• Contraindicated if coagulopathy, nasal disease or raised intracranial pressure.<br>• Oxygen should be humidified if possible to prevent nasal mucosa irritation. |

**Table 1: Oxygen supplementation methods**

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

## OXYGEN SUPPLEMENTATION

Techniques for oxygen supplementation are detailed in *Table 1*. The most suitable technique for supplementation will be dependent upon several factors including whether the patient is collapsed, whether the cat will tolerate flow-by oxygen sitting on a table or the bottom half of a carrier and the number of personnel available to assist.

In many patients triage can be performed on a table or in the bottom half of the cat carrier whilst the cat receives flow-by oxygen *(Fig.1)*. However if the cat struggles with administration of flow-by oxygen or you are alone with the patient, setting up an oxygen hood or cage *(Fig.2)* are the next safest options. Placement of the cat within an oxygen enriched cage allows time for the cat to settle but remember it will take a significantly longer period of time for oxygen levels to rise, it is therefore important to minimise opening of the cage door and start with high flow rates of oxygen.

**Fig. 2: Oxygen cages typically used in the management of dyspnoea.**

**The effectiveness of oxygen delivery can be determined by:**

**1. Clinical evaluation**

- Change in rate and depth of respiration.
- General demeanour - the patient should look less anxious and be more aware of its surroundings.
- Heart rate, mucous membrane colour +/- blood pressure.

**2. Pulse oximetry**

- Measures oxygen saturation of haemoglobin. Cats may tolerate placement of the probe across the pinna or phalanx; peripheral vasoconstriction (e.g. due to shock), skin pigmentation and administration of oxyglobin interfere with readings.
- Hypoxia = $PaO_2$ of <80mmHg. A $PaO_2$ of 80mmHg approximates to a $SpO_2$ of 95%.
- Oxygen supplementation is indicated where the $PaO_2$ <60 mmHg which approximates to a $SpO_2$ of 90% and below, but aim to maintain ≥95%.
- Arterial blood gas analysis allows measurement of the partial pressure of dissolved oxygen in the plasma ($PaO_2$) but sampling is technically much more demanding in cats and the risk in a dyspnoeic conscious patient is not warranted.
- Methaemoglobinaemia (e.g. paracetamol toxicity) and carboxyhaemoglobinaemia (e.g. carbon monoxide toxicity) interfere with haemoglobin saturation, however they would not be detected by regular pulse oximetry.

If oxygen saturation fails to improve to acceptable levels with non-invasive methods of oxygen supplementation, intubation for manual ventilation may be required.

## EXAMINATION

Initially only a limited examination may be possible in the dyspnoeic patient. A significant amount of information can be gleaned by:

- observing the patient's respiratory pattern *(see overleaf)*.
- assessing the mucous membranes (include capillary refill time, colour and note petechiation etc).
- assessing peripheral pulses bilaterally, noting quality and deficits.
- auscultating the heart, noting any murmurs, arrhythmias (especially gallop rhythms) or displacement of the apex beat.
- auscultating and percussing all lung fields of the thorax in a gentle, systematic manner.

At this stage the aim is to simply to look for clues as to whether the patient has signs of primary cardiac, respiratory or metabolic disease (e.g. anaemia) and to assess baseline vital parameters (mucous membrane colour, respiratory rate, heart and pulse rate).

*(continued)*

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

**EXAMINATION** *(continued)*

**Normal Breathing Patterns**

- Normal rate 12-30bpm for cats.
- No visible effort should be noticed.
- Expiration and inspiration usually of similar duration, often with an end expiratory pause.
- Thoracic movement:
  - **Inspiration**
    - The ribs move cranially and dorsally to expand the thorax. At the same time, the diaphragm contracts, which displaces the cranial abdominal organs caudally. This appears as an increase in the size of the cranial abdomen.
    - Thoracic and abdominal walls move ***out.***
  - **Expiration**
    - The ribs move caudoventrally, with passive intercostal muscle recoil, reducing the volume of the thorax. The diaphragm relaxes, moving cranially and the cranial abdomen returns to normal size.
    - Thoracic and abdominal walls move ***in***.
  - **Panting vs. open-mouth breathing due to dyspnoea**
    - Rapid rate, minimal thoracic wall excursion, body position not restricted.

**Respiratory features to assess:**

- Rate.
- Presence of any respiratory noise.
  - Stertor - soft, 'snorting or snoring' noise, localises to the oropharynx or nasopharynx.
  - Stridor - harsh high-pitched sound localises to the larynx or trachea.
  - Wheezing - typically due to airflow through narrowed airways.
  - Crackles - heard when an airway reopens after being blocked by fluid.
- Whether any increased effort is associated with inspiration or expiration.
- Whether inspiratory or expiratory phase are of similar duration.
- Co-ordination of movement of the thoracic and abdominal wall.
  - **'Paradoxical breathing'**
    - Describes movement of either the thoracic or abdominal wall in the opposite direction to what is expected.
    - Inward movement of the abdominal wall during inspiration can be associated with diaphragmatic weakness and pleural space disease.
    - Decreased outward movement of the thoracic wall during inspiration can occur with intercostal muscle paralysis. A flail chest-segment of the thoracic wall (when present) moves inward during inspiration.
  - **'Abdominal breathing'**
    - Increased abdominal effort on expiration.
    - Contraction of the abdominal muscles increases intra-abdominal pressure and forces the diaphragm cranially; may be seen with bronchial disease.

Signs of extreme dyspnoea and life-threatening respiratory failure include cyanosis, gasping, serous fluid visible at the nares (could suggest fulminant pulmonary oedema), marked distress with open mouth breathing (thrashing in carrier or cage) or severe hypoventilation with only intermittent breaths.

## CAUSES OF DYSPNOEA AND ABNORMAL BREATHING PATTERNS

Assessment of respiratory patterns can be helpful in deciding what area of the respiratory tract is affected in a dyspnoeic patient. The animal will make compensations in the rate and/or depth of breathing to try to maintain appropriate levels of oxygen delivery to the lungs.
Two main problems can occur that limit airflow into the alveoli of the lungs; obstruction of the airways or restriction to inflation of the lungs.

**Airway disease (nose to trachea)**

**Large airway obstruction**

- Causes **inspiratory dyspnoea** when the problem is located between the nares and tracheal bifurcation.
  - Typically causes **increased inspiratory effort (prolonged duration of inspiratory phase) with minimally increased rate**.
  - Large airway obstruction is often associated with respiratory noise such as stridor or stertor.
- Obstruction of the lower airways e.g. chronic bronchitis, feline asthma, causes **expiratory dyspnoea,** which may manifest with abdominal effort and wheezing may be heard over the lower airways.

*(continued)*

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

## CAUSES OF DYSPNOEA AND ABNORMAL BREATHING PATTERNS *(continued)*

- Other aspects of the patient's history may also help to localise the problem for the veterinarian e.g. presence of a cough (type, onset, duration and whether nature has changed), exercise tolerance and whether there is dysphonia (feature of laryngeal disease).

### Lung disease (Bronchial tree and pulmonary parenchyma)

Dyspnoea associated with lung diseases can be considered by the mechanisms affecting normal ventilation. The disease may be:

- **Primarily obstructive** e.g. feline asthma due to bronchospasm and increased luminal secretions.
- **Primarily restrictive** e.g. pulmonary fibrosis, pulmonary oedema whereby the pulmonary changes reduce lung compliance, making it more difficult for the patient to inflate the lungs.
- **A combination of obstructive and restrictive** mechanism; this occurs most commonly and examples include pulmonary oedema and bronchopneumonia.

### Pattern of breathing

- *Obstructive* lung disease results in relatively prolonged and effortful expiration.
- *Restrictive* lung disease results in an increased frequency of respiration with rapid shallow inspirations.
- With progression animals frequently adopt postural efforts to maximise ventilation (e.g. head and neck extension, sternal position with elbows abducted) and are reluctant to lie in lateral recumbency. Respiratory fatigue may develop quickly.
- The distinction between obstructive and restrictive lung breathing patterns are much more subtle than patterns associated with upper airway obstructions - the most important thing is to look and make some sort of assessment of how the cat is breathing and decide whether any abnormal respiratory noise is present, often it will not be possible to strictly categorise the respiration into a single pattern.

### Auscultation

- Expiratory wheezes may be heard in obstructive lung disease due to asthma or bronchitis.
- Crackles are more common with restrictive lung disease such as pulmonary oedema or bronchopneumonia.
- Gallop or heart murmurs - consider cardiac disease and pulmonary oedema.

### Historical features that may be relevant to consider

- A history of coughing (cats do not typically cough with cardiac disease).
- Whether there have been prior episodes of open-mouth breathing.
- Signs of exercise tolerance e.g. panting or open-mouth breathing after exertion.

### Pleural space and mediastinal disease

- Due to the presence of pleural effusion, pneumothorax or space occupying lesions (e.g. diaphragmatic rupture, mediastinal mass).
- Auscultation using a grid pattern can help to detect and localise decreased or absent lung sounds in the presence of a pleural effusion or pneumothorax.
- Cardiac sounds may be muffled by the presence of pleural effusion.
- Remember to check a cranial rib spring - decreased compliance can occur with mediastinal masses, and pleural effusions.

### Breathing pattern

- Typically consistent with a *restrictive* pattern.
  - Increased rate with rapid shallow inspiration.
  - Exaggerated abdominal motion may be seen during inspiration.
- Some cats with pleural effusions will have paradoxical breathing, with the abdominal wall sucked in on inspiration.
- In severe pneumothorax the intercostal muscles may be seen to be sucked inwards as the ribs forcibly expand, due to the presence of an intra-thoracic vacuum.

### Diaphragmatic weakness or paralysis

- Causes include phrenic nerve injury or degeneration and generalised myopathies (e.g. botulism).
- If only the phrenic nerve and diaphragm are affected, compensation will occur by increasing the respiratory rate and inspiratory excursion of the thoracic wall.
- May see paradoxical abdominal wall movement (inwards during inspiration).

### Thoracic wall disease

- Traumatic (e.g. rib fractures) or non-traumatic (e.g. neuropathy, myopathy or motor unit disorder) causes affect intercostal muscle function and therefore rib movement.
- Reduced thoracic wall movement or paradoxical movement (thoracic wall moving in during inspiration) +/- tachypnoea.

# TRIAGE OF THE DYSPNOEIC CAT: IS YOUR PRACTICE PREPARED?

## ADDITIONAL STABILISATION TECHNIQUES/TREATMENTS FOR DYSPNOEIC PATIENTS

As stated earlier, oxygen supplementation, cage rest and minimising stressful handling are important until the dyspnoeic patient is stable enough to undergo further diagnostic investigations. In many situations empirical therapy may be necessary on the basis of the patient's history, presenting signs and examination findings alone. The following details how some of the more common causes of dyspnoea may be managed empirically.

**Upper airway dyspnoea e.g. due to laryngeal oedema, laryngitis**

- Low-dose sedation may be useful to reduce anxiety and promote more effective ventilation.
    - Butorphanol (0.1-0.2mg/kg i.v. or i.m.) is often effective.
- Cooling the patient is important if hyperthermia (>40 C) has developed, to try to reduce respiratory work
    - Wetting the coat and applying fans is usually effective.
- Anti-inflammatory doses of short-acting corticosteroid are indicated if airway swelling is possible e.g. dexamethasone sodium phosphate 0.1-0.2mg/kg i.v. or i.m or hydrocortisone 2mg/kg i.v.
- Intubate as necessary for ventilation if dyspnoea becomes severe.
- Ensure nares are free of discharge and debris. Steam nebulisation can be helpful if discharge is causing obstruction.

**Pulmonary disease**

**Lower airway disease e.g. feline asthma**

- Administration of a bronchodilator e.g. terbutaline (0.015mg/kg i.v. or i.m) or salbutamol via inhalational chamber is essential.
- Anti-inflammatory doses of glucocorticoid may also be used.

**Pulmonary oedema**

- If due to congestive heart failure, furosemide (2mg/kg i.v. i.m or s.c.) is the first line treatment. Repeat at 1mg/kg after 30-60 minutes if only partial improvement. Consider topical nitroglycerine.
- Avoid intravenous fluids.

**Bronchopneumonia**

- Broad spectrum intravenous antibiotics are used based on likely bacterial population.
- Nebulisation can also be beneficial.

**Contusions**

- Opioid analgesia. Care with intravenous fluids

**Pleural space disease**

**Pleural effusion**

- Where pleural effusion is suspected from clinical exam findings in a dyspnoeic cat, thoracocentesis can be performed as both a diagnostic and therapeutic measure (i.e. to confirm and relieve the presence of fluid) without first confirming the presence of fluid using radiography. Ultrasound is especially helpful in this setting. Thoracocentesis is usually tolerated without sedation +/- use of local anaesthesia.

**Pneumothorax**

- Again, thoracocentesis can be considered as a priority in cases where pneumothorax is suspected. Thoracic drain placement may need to be considered if there is on-going air leakage into the pleural space; small bore catheters are well tolerated e.g. *Mila.*™

**Thoracic wall disease**

- Fractured ribs and subcutaneous emphysema can be extremely painful; use of opioid analgesia is necessary. Appropriate management of associated pain will also improve ventilation.

## CONCLUSION

The key to managing the dyspnoeic cat is to remain calm, provide immediate supplemental oxygen and minimise handling and interventions until the patient stabilises, as indicated by sustained improvement/normalisation of vital parameters. Once stabilisation has been achieved, further investigation into the underlying disease can be undertaken, employing methods that minimise stress and respiratory compromise where possible. Practice and team preparation for receiving dyspnoeic cats will improve the emergency response and therefore aid successful stabilisation of these challenging patients.

***References and further reading:***

Beatty J. & Barrs V. (2010) Pleural effusion in the cat: a practical approach to determining aetiology. *Journal of Feline Medicine and Surgery* **12**, 693-707.

Crowe D. (2008) Oxygen therapy. In: Kirk's Current Veterinary Therapy XIV. Eds. J. D. Bonagura and D. C. Twedt. Elsevier Saunders, St. Louis pp. 596-603.

Hibbert A. (2013) Dyspnoea, tachypnoea and hyperpnoea In: BSAVA Manual of Feline Practice. Eds. A. Harvey and S. Tasker BSAVA Publications, Gloucester pp.105-111.

Mawby D. (2005) Dyspnoea and tachypnoea In: Textbook of Veterinary Internal Medicine 6th Edn. Eds. S. Ettinger and M. Feldman Elsevier Saunders, St Louis pp.192-195.

Sigrist N.E., Adamik K. N., Doherr M. G. *et al.* (2011) Evaluation of respiratory parameters at presentation as clinical indicators of the respiratory localisation in dogs and cats with respiratory distress. *Journal of Veterinary Emergency and Critical Care* **21**,1323.

Swift S., Dukes-McEwan J., Fonfara S. *et al.* (2009) Aetiology and outcome in 90 cats presenting with dyspnoea in a referral population. *Journal of Small Animal Practice* **50**, 466-473.