



UNIVERSITY OF CALGARY FACULTY OF VETERINARY MEDICINE

This review accompanies the relevant episode of the Cutting Edge veterinary podcast. In each episode of this podcast, 3rd year students in the University of Calgary's veterinary medicine program fill you in on the most up-to-date literature and evidence-based practices on topics that matter to you, the practising veterinarian.

Hocus POCUS: The Magic of Point of Care Ultrasound to Diagnose Feline Asthma

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How to approach a case of feline respiratory distress:

The most important concept when managing a cat in respiratory distress is to prevent excessive stress. This can cause the patient to decompensate quickly and may even lead to a fatal outcome due to increased difficulty breathing and oxygen consumption. Therefore, some initial treatments a clinician should provide to a cat in respiratory distress include:

Oxygen supplementation: If the cat will tolerate flow by oxygen this should be provided. A better option, especially for a cat that is not tolerating flow by oxygen, is an oxygen cage (if available in the practitioner's clinic).

Anxiolytics: Administer butorphanol 0.2 mg/kg IM or IV (can be given twice up to 0.4mg/kg)(1, 2, 3). Butorphanol is an opioid that is an anxiolytic and sedative. This will allow the cat to remain calm, take deeper breaths and decrease the work of breathing. It may have antitussive effects as well (1). If staff are unable to administer butorphanol IV with minimal stress or place an intravenous catheter, butorphanol can easily be given IM. It is imperative to minimize stress – an IV catheter can always be placed once the cat is stable enough to allow gentle restraint/handling to facilitate IV catheter placement.

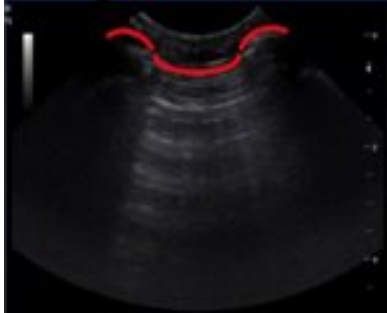

Intubation supplies: Be prepared to perform emergency intubation if the cat decompensates. Have an appropriately sized ET tube ready with a tie, laryngoscope, lubricant, and lidocaine spray. An IV catheter should be placed as early as possible without causing stress to the cat.

Basic vitals: Obtain some basic physical exam parameters such as heart rate and auscultation, respiratory rate, lung auscultation, pulse quality, mucous membranes, and CRT. In an unstable respiratory distress patient temperature should be avoided to decrease stress on the patient. These vitals should be obtained if the cat will tolerate it. If not, then the cat should be left to rest with oxygen supplementation until the sedation takes effect.

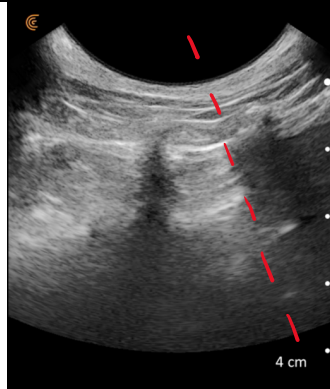
Ultrasound is an excellent diagnostic tool for a dyspneic cat:

After obtaining initial vitals, providing sedation, and providing oxygen therapy, a thoracic point of care ultrasound (POCUS) should be performed, if this is tolerated by the patient. This procedure is no more stressful than the auscultation previously performed to obtain vitals. It may arguably be less stressful as the cord attached to the probe is longer than a stethoscope allowing the examiner’s body to remain further away from the cat. Ultrasound allows the practitioner to examine inside the cat's chest without moving the cat from its original location and position. The cat can remain in sternal recumbency with minimal restraint. The transport and restraint necessary to obtain radiographs can cause the cat to decompensate and/or cause death (4). In human medicine, ultrasound was even found to be a more sensitive and specific diagnostic tool for respiratory distress cases than auscultation and radiographs (5). Thoracic POCUS can be performed by any practitioner with the correct training and can even be performed inside an oxygen cage (4). The practitioner should use the infant access ports through the cage to prevent oxygen loss into the environment. This allows the cat to simultaneously receive therapeutic treatment and diagnostic investigation while limiting stress. Flow-by oxygen should be given during a POCUS exam if an oxygen cage is not available to the clinician.

What will you see when you place the ultrasound on the chest?

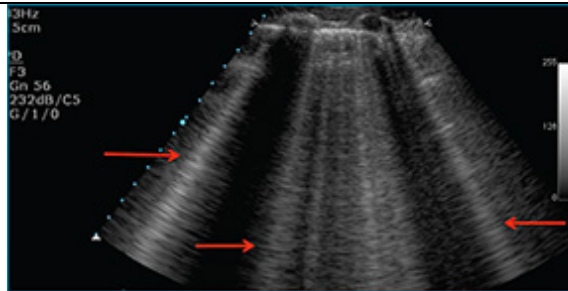
Ultrasound term	Image
<p>Bat sign: Ultrasound beams do not go through bone, therefore there is a shadow created deep to the ribs. Between the ribs, the ultrasound beams will penetrate through the skin into the lung tissue. Ultrasound beams cannot visualize the entire lung. The air filling the lung prevents visualization past the lung surface and pleural line. This rib shadows are referred to as the “bat sign.” Bat signs are a <u>normal finding</u> during a thoracic POCUS (4,6).</p>	 <p>i.</p>
<p>Glide sign: The glide sign is seen when the parietal and visceral pleura are in contact. It appears as a horizontal glimmering line that indicates pleural contact throughout lung movement as the patient breathes. The glide sign is a <u>normal finding</u> during a thoracic POCUS(4,6).</p>	 <p>ii.</p>

Curtain sign: The curtain sign is seen at the caudal border of the lung field as the ultrasound probe extends off the caudal end of the lung. This allows visualization of the artifact created by the edge of the lung overlying the soft tissue in the abdomen (dashed red line in the image to the right). The curtain sign will move as the patient breathes and is a normal finding during a thoracic POCUS (4,6).



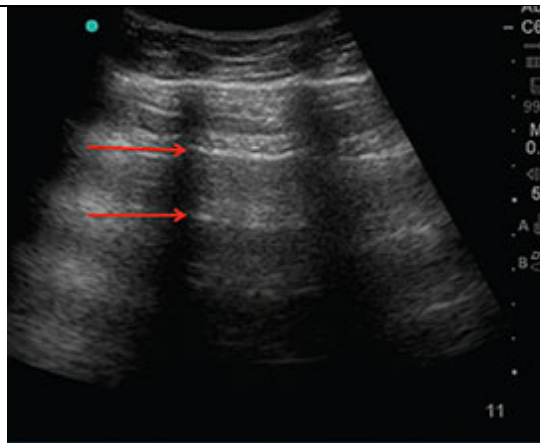
iii.

B lines: Also called “comet-tails” or “lung rockets”, B lines are vertical lines that may indicate abnormal pulmonary parenchyma depending how many are seen. Some B lines can be normal, but more than 3 B lines in more than one or two locations over the surface of the hemithorax indicate decreased aeration (from fluid, infiltrates, or atelectasis for example) (4,6).



iv.

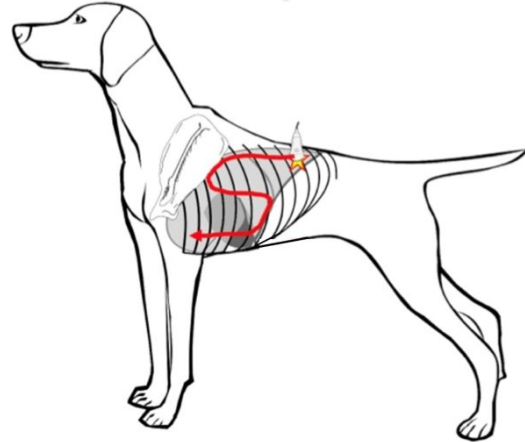
A lines: A lines are normal horizontal lines in the lung parenchyma, they do not indicate fluid in the lungs. They are an artifact caused by the soft tissue air interface. A lines are normal findings during a thoracic POCUS (4,6).



iv.

How to perform a thoracic POCUS (6):

1. Place the ultrasound probe on the chest with the probe marker pointed cranially. Look for the glide sign and the bat sign, as described previously.
2. The probe should be moved caudally towards the 9th-11th ribs until the curtain sign is seen, indicating the end of the lung field.
3. Move the probe to the caudodorsal lung field where the glide sign disappears dorsally, and the curtain sign can be seen caudally.
4. Starting from here, examine the entire lung field in an "S" pattern looking at all locations with the probe marker cranially. It is important to examine the tissue in transverse planes.
5. Repeat the thoracic POCUS on the other side.



Before beginning a POCUS exam for suspected feline asthma:

Before starting a diagnostic thoracic POCUS the cat should be premedicated with butorphanol (0.2mg/Kg) and oxygen therapy (flow-by or oxygen cage), if not already administered. Feline asthma is diagnosed via a combination of the patient's history and then ruling out other causes of respiratory distress, such as pulmonary edema, pleural effusion and pneumothorax.

Ruling out pulmonary edema:

Ultrasound of various regions of the lungs would reveal significant B lines if pulmonary edema was implicated in the cat's respiratory distress indicating lung with reduced aeration from pulmonary fluid or infiltrates (4,6). Specifically, more than 2 locations in the lung field would have more than 3 B lines. Specific etiologies of pulmonary edema will change the locations in which these B lines are detected. Note that pulmonary edema and pleural effusion can simultaneously be present and the detection of one does not exclude the other. A lack of significant B lines allows the practitioner to rule out pulmonary edema as a main cause of respiratory distress.

Ruling out pleural effusion:

If pleural effusion was a cause of respiratory distress, ultrasound of the chest would show anechoic or echogenic fluid between the visceral pleura and the parietal pleura (4,6,7). Because fluid is susceptible to gravity, this would be most evident in the ventral, dependent regions of

the lung field. There would be no apparent glide sign in these regions, as the fluid would cause the two pleural layers to not be in contact. Scanning towards the heart from the region of the xiphoid, you can also rule out the presence of fluid between the diaphragm and the heart (6). Note that any fluid contained within a circular pericardium would be pericardial effusion, whereas fluid not contained within a circular structure in this location would be pleural effusion. At minimum, two views are necessary to rule in or out pleural effusion (8).

Ruling out pneumothorax:

To rule out pneumothorax, the practitioner should scan the dorsal most portions of the lung field, considering that air would be found dorsally in a patient in sternal recumbency. As with pleural effusion, a lack of glide sign would indicate that the visceral and parietal pleura are not in contact, but in this case, it would be due to air preventing transmission of ultrasound waves beyond the parietal pleural layer. If a normal glide sign is seen across all the lung fields, the practitioner can effectively rule out pneumothorax as a cause of respiratory distress (4,6).

Feline asthma:

Clinical signs: A history of clinical signs typically observed in asthmatic cats will raise the clinician's suspicion of this being the cause of respiratory distress. This may include episodes of coughing and dyspnea (9). Note that owners may have difficulties identifying a history of coughing in their cats, as this can be mistaken for sneezing, gagging and "coughing up a hairball". Additionally, on physical exam, the clinician may auscultate crackles and wheezes in the lung fields, but not always (9).

Diagnosis: Ultrasound and/or radiographs can be used to diagnose feline asthma. Radiographs will show overexpanded, hyperinflated lungs with a flattened diaphragm (8). A bronchial pattern is often present in cases of chronic asthma, and the right middle lung lobe might be collapsed (8). With a cat in respiratory distress, practitioners should consider if radiographs are an appropriate method of diagnosis, as there is considerable risk of decompensation with restraint and transportation (4). Ultrasound is a diagnostic option that is less stressful to the patient (6). Clinicians should perform thoracic ultrasound with a standardized approach, looking for pleural effusion, B lines, and atrial enlargement, all of which should be absent in typical cases of feline asthma. There should be no pleural effusion - the glide sign should be present, meaning the parietal and visceral pleura are in contact. In cats with asthma, there will be minimal B lines, indicating there is no fluid, infiltrates, or decreased aeration (4). It is worth noting that in some cases of feline asthma there have been anecdotal reports of increased B lines; however, this is not a common finding (3). Finally, there will be no atrial enlargement, indicating that cardiac disease is not the cause of the respiratory distress.

<p>Overview of feline asthma working diagnosis on POCUS: No pleural effusion, normal B lines (not more than 2-3 B lines at more than 1-2 sites, for a typical asthma case), and no atrial enlargement in cats with a history supporting asthma.</p>
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Acute Treatment: Initial, acute treatment for stabilizing an asthmatic patient always starts with oxygen and sedation at the time they present to the clinician. To further support the diagnosis of asthma in a feline patient, their response to further treatment should be monitored:

- Dexamethasone 0.1 mg/kg IV q12-24 hours can be used to reduce inflammation of the airways (3,8,11).
- Additionally, a bronchodilator can be administered. Positive clinical effects of bronchodilator administration should be seen 5-10 minutes post-administration (8).
Bronchodilator options include:
 - Aminophylline 10 mg/kg IV or IM (3,11,12)
 - Two puffs of an Albuterol inhaler using a children's chamber over the patient's face. (3,12)
 - Albuterol can also be administered at 4 ug/kg IV, diluted if required (3,8).

With feline asthma treatment in general, the stress level of the patient must be considered. IM injections can be less stressful for cats than placing an IV catheter or administering an inhaled medication. Finally, euthanasia can be considered depending on the severity of the dyspnea, any concurrent conditions affecting the patient, and the feasibility of long-term treatment for the owners, both financially and in terms of practicality of home care.

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