The dyspneic feline patient presents a unique challenge to the emergency veterinarian. These are among the most fragile patients seen in the emergency setting, as well as some of the most difficult to definitively diagnose and treat. A thorough knowledge of normal and abnormal respiratory physiology in these patients can be extremely helpful in working up the unstable dyspneic cat. Given that excessive handling and stress can exacerbate respiratory distress in these patients and be potentially life-threatening, an initial visual examination should be performed prior to handling the patient for a physical examination. In general, “treat first, diagnose later” is often the norm when working with these patients. Differentiation of cardiac and non-cardiac causes of respiratory distress is often the biggest challenge posed by these patients, since treatment for cardiac and non-cardiac diseases varies so dramatically.

Identification of normal and abnormal breathing patterns is one of the first steps in evaluating these patients.

Normal inspiration:
- Ribs pulled cranially and laterally by external intercostal muscles.
- Diaphragmatic contraction creates negative pressure within the chest.
- Abdomen moves outwards.

Respiratory distress:
- Increasing work of inspiration results in greatly increased diaphragmatic excursions.
- Secondary muscles of respiration are then recruited.
- Increase in chest wall excursion as well as a greater abdominal component in expiration follow, along with breathing through an open mouth, and nostril flaring.

Evaluation of the phase of respiration affected can be extremely helpful in localizing the likely anatomical source of symptoms. It is important, however, to remember that patients with severely decompensated disease can show both inspiratory and expiratory dyspnea.
- Inspiratory dyspnea: localizes disease to the upper airway- nasopharynx and larynx.
- Expiratory dyspnea: localizes disease to lower airways and pulmonary parenchyma.
Evaluation of the pattern of breathing and respiratory noise can further help narrow down the anatomic location from where the respiratory distress is arising. Some of these respiratory noises include:

- **Stertor**: This is a low-pitched noise that arises from diseases affecting the upper airway and nasopharynx. In cats, stertor may be caused by nasal disease such as nasopharyngeal polyps, rhinitis or nasal neoplasia.
- **Stridor**: This is a much more high-pitched noise arising from laryngeal disease. In cats, stridor is usually uncommon, but can occur in patients with laryngeal neoplasia.
- A short, shallow breathing pattern (also known as “restrictive breathing pattern”) is commonly seen with pleural space disease in dyspneic cats, including pleural effusion, diaphragmatic hernia and pneumothorax.
- **Wheezing noises** can be ausculted in cats with lower airway disease, particularly feline asthma.
- **Crackles** can be ausculted with primary pulmonary parenchymal disease.
- **As work of breathing increases, respiratory muscle failure may ensue as muscles fatigue.**
- “Paradoxical” breathing is another type of breathing pattern that can be occasionally observed in dyspneic cats. This breathing pattern opposes the normal expansion of chest wall. In normal respiration, both the abdomen and chest move in and out together, allowing maximum expansion of the lungs. In paradoxical respiration:
  - The intercostal muscles collapse inwards with inspiration as they fatigue, and as greater negative pressures are created within the thoracic cavity.
  - The abdomen collapses inwards during inspiration for the same reason.
  - In expiration the abdomen appears to move outwards due to increased activity of the abdominal muscles as the diaphragm fatigues.
- **Thoracic auscultation findings** can also help potentially.

**Emergent Stabilization**

- Place the cat in the oxygen cage or start flow-by oxygen supplementation.
- **LOW STRESS HANDLING** is key!!
- Sedation is helpful in these patients to minimize anxiety and stress. Care must be taken to select drugs that are cardiovascularly sparing and cause minimal respiratory depression, since often these drugs may need to be given before the patient’s hemodynamic stability can be accurately assessed. Butorphanol (0.1-0.3 mg/kg) which is an agonist-antagonist opioid is usually a good choice for initial sedation in these patients. This medication can be given IV or intramuscularly or even subcutaneously in those patients that do not have vascular access obtained initially.
due to extreme dyspnea. If IV access is not able to obtained, it is not advisable to keep attempting it repeatedly as this can be extremely stressful for these patients.

- Often, empiric therapy is needed without full diagnostic testing since these patients can worsen quickly. Treatment is typically initiated for two of the most common disease conditions causing a respiratory crisis in cats:
  - Congestive heart failure (CHF)
  - Status asthmaticus

- Emergency treatment for CHF in the dyspneic feline includes:
  - Furosemide (1-2 mg/kg) IM/IV. Furosemide is a loop diuretic that acts on the Na/K/2Cl channels in the thick, ascending loop of Henle in the nephron. By causing diuresis and a subsequent decrease in overall intravascular volume, furosemide results in a decrease in cardiac preload and decreases overall work load of the heart. It is important to remember that furosemide does not help in clearing any pulmonary edema and extravascular lung water that has already accumulated. However, by decreasing preload, it can help prevent formation of further edema.
  - In severe decompensated CHF, preload reduction is sometimes not sufficient. After-load reduction is the next step in patients where repeated dosing of furosemide fails. Vasodilating drugs lower systemic vascular resistance and decrease cardiac work. These drugs include:
    - Nitroglycerin: this is a nitrate vasodilator that is available in both transdermal and IV formulations. Data supporting a strongly beneficial effect, particularly of the transdermal formulation is very limited, and is mostly anecdotal. If used transdermally, typically a ¼” strip may be applied every 4-6 hours on any area of exposed skin such as the pinnae.
    - Sodium nitroprusside: This is an intravenous nitrate vasodilator. Sodium nitroprusside is administered as a continuous rate infusion with a starting rate of 1-2 mcg/kg/minute.
    - Caution must be exercised when using vasodilating drugs as these can precipitate hypotension and cardiovascular collapse in patients with pre-existing hypotension.

- Treatment for status asthmaticus includes:
  - Terbutaline (0.01mg/kg) SQ/IV. This is a beta-2 adrenergic receptor agonist that causes bronchodilation. Terbutaline, however, can also cause tachycardia, and the patient should be monitored for this as much as possible.

- In the most severely dyspneic of patients, particularly in those cats where it is challenging to even auscult the thorax, three drugs (butorphanol, furosemide and terbutaline) can be administered on presentation following which the patients should
be left in an oxygen cage with minimal to no handling until some response is observed. The respiratory rate is noted initially, then every 30 minutes or so without disturbing the cat. Catheter placement, blood sampling, radiographs, and other tests and therapies should be delayed until the cat’s condition is more stable. Airway suctioning and mechanical ventilation with positive end-expiratory pressure can be considered in extreme cases. Most patients will show some improvement with the “dyspneic cat cocktail” of drugs after 20-30 minutes. A more thorough physical exam can be performed at this time, in addition to further diagnostics.

- Thoracocentesis is often necessary in dyspneic cats to assist in stabilization attempts. The presence of pleural effusion can be confirmed with a combination of visual examination of the patient (restrictive breathing pattern), auscultation (muffled heart and lung sounds ventrally with fluid accumulation) and brief bedside ultrasound exam, if available. If pleural effusion is suspected, thoracocentesis should be performed, even if the presence of fluid cannot be confirmed before the centesis. A negative thoracocentesis attempt is diagnostic; therefore, the emergency clinician should not hesitate to perform this potentially life-saving procedure in a dyspneic cat if pleural space disease is suspected. To perform thoracocentesis:
  - Position the patient in sternal recumbency.
  - Provide flow-by oxygen support.
  - Clip and prep area over lateral thoracic wall between 6th-9th intercostal spaces.
  - Using sterile technique, assemble the setup:
    - 21-22G needle, or butterfly needle in most cats
    - 3-way stopcock
    - Extension set (if using needles)
    - Syringe for fluid aspiration
  - Enter the pleural space perpendicular to the chest, in the ventral 1/3rd, at the cranial aspect of the rib. Once in, as a “pop” is felt when the pleural space is entered, an assistant can start to apply gentle negative pressure and aspirate fluid.
  - Fluid should be aspirated until negative pressure is finally attained.

**Thoracic Imaging in the Dyspneic Feline**

- Thoracic radiographs are typically the imaging modality of choice in most veterinary practices. However, attempting to position a dyspneic feline patient for radiographs can be extremely stressful and potentially life-threatening. Therefore, these patients should not be radiographed until they have been stabilized appropriately. Once a patient has been stabilized, radiographs can often aid in obtaining a diagnosis of underlying disease conditions causing signs of dyspnea. The use of thoracic
radiographs in dyspneic cats, while useful, may not always be reliable in distinguishing cardiac disease from non-cardiac causes of respiratory distress. This is because:

- The most common feline cardiomyopathy, HCM, is not easily identifiable on thoracic radiographs and left atrial enlargement may not be evident.
- Findings to evaluate for cardiogenic pulmonary edema include cardiomegaly, enlarged pulmonary vasculature and patchy interstitial to alveolar infiltrates. Findings that are indicative of chronic lower airway disease include the presence of a bronchial pattern, hyperinflation of lungs with flattening of the diaphragm, and potentially chronic rib fractures with severe lower airway disease.
- Cardiogenic pulmonary edema in cats, unlike dogs, can be uneven and patchy, without necessarily the perihilar distribution seen in dogs.
- Cats are also apt to develop pleural effusion with left sided CHF, unlike dogs where this is typically only seen with right sided CHF. Pleural fluid also obscures the cardiac silhouette on radiographs, further making it challenging to determine if CHF is present.

- **Bedside thoracic ultrasonography-** (T-FAST): The thoracic FAST scan (Focused Sonographic Assessment in Trauma) was originally developed for use in patients presenting with trauma, but has since found widespread application in the diagnosis of various conditions in the emergency settings. Bedside ultrasonography is typically less stressful than restraining and positioning a dyspneic feline patient for radiographs. It can be used to evaluate a patient for:
  - Pleural space disease
  - Pneumothorax
  - Pleural effusion
  - Pericardial effusion
  - Pulmonary parenchymal disease
  - Congestive heart failure

Use of the T-FAST scan for cardiac causes of dyspnea include evaluation of the cardiac silhouette for left atrial size by comparing the left atrium to aorta (La:Ao) ratio.

**Biomarkers for Differentiation of Cardiac and Non-Cardiac Causes of Dyspnea**

- The two main biomarkers that have been evaluated for use in cats include natriuretic peptides such as NT proBNP and cardiac troponins.
- Concentrations of cTnl may be elevated in cats with hypertrophic cardiomyopathy, myocardial contusions, hyperthyroidism, and renal insufficiency. A bedside assay has been evaluated to measure troponin levels in dyspneic cats - requires 0.16-0.22 mL blood. A cTnl concentration of >0.66 ng/mL was found to have 100% specificity and 72% sensitivity
nT-proBNP levels have also been evaluated in cats. A value of 265 pmol/L distinguished between cats with heart failure and cats with primary respiratory disease with a sensitivity of 90.2% and specificity of 87.9%. A reliable bedside assay for this test is yet to be widely available.

In conclusion, respiratory distress in cats can be caused by a variety of disease conditions. Ultimately, a combination of sedation, oxygen supplementation and slow, gentle handling of these patients are crucial elements of successful management of the dyspneic feline patient.