Monthly Update
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Updates In the Diagnosis of Respiratory Disease

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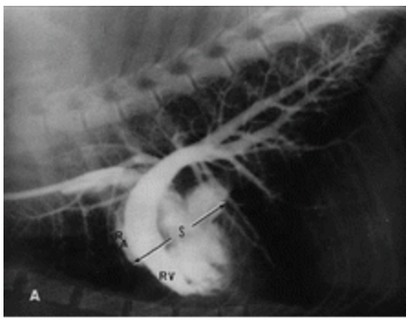
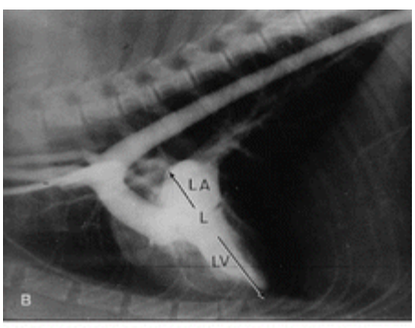


Figure 1a

One of the biggest challenges facing veterinarians is the dyspneic patient. We all have the nightmarish knowledge (and unfortunately experience) that a chest radiograph or blood draw can push the gasping cat into respiratory arrest. Unfortunately, there is still no easy, minimally invasive test with rapid turn-around that definitively answers questions like: atypical pneumonia or cancer? heart failure or asthma? Researchers and specialists from various disciplines, however, have been looking at precisely these questions over the past several years trying to find markers or diagnostic modalities which are best for certain disease processes. The purpose of this little update is to highlight some recently developed or newly utilized diagnostics which I believe show the most promise to assist with the diagnosis of respiratory disease in our small animal patients.



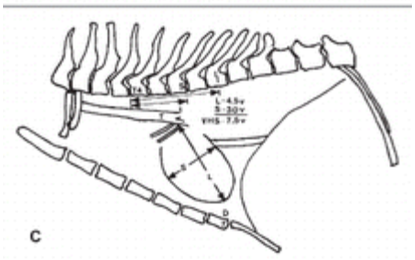


Figure 1b and 1c

The vertebral heart score (VHS) was developed in the nineties as a method of evaluating the relative size of a patient's heart in light of the fact that our patients come in many shapes and sizes. The VHS is determined from a left lateral radiograph in cats and a right lateral radiograph in dogs. The long axis of the heart is measured from the ventral aspect of the left mainstem broncus to the left ventricular apex (see figure 1). This distance ("L") is then measured out along the vertebral bodies starting at the cranial edge of the fourth vertebrae. The maximum perpendicular short axis is then measured and the number of vertebral bodies it encompasses is similarly quantified starting at the cranial edge of the fourth vertebrae. The vertebral body count from "L" and "S" are then added together to determine the VHS.1 When done correctly, the VHS takes the left atrium into account. It has been found, however, that VHS normals vary from breed to breed with some breeds having relatively larger hearts and some degree of overlap in heart size between dogs with and without heart disease. Labrador retrievers and boxers have larger hearts than other breeds evaluated including the German shepherd dog and Cavalier King Charles Spaniels.[1] A study published several years ago presented an excellent retrospective analysis of multiple breeds

Continued next page

CCVS Scan Hours

8:00 AM-6:00PM 7 days a week.
1-800-457-4900

The breakdown of CT charges are as follows:

1. CT Scan, In patient $905.00 (case already hospitalized at CCVS or referred to CCVS for work up and treatment and has a CT scan)
2. CT Scan, Additional image (if you add an additional scan site $300.00)
3. CT Scan, Out patient $985.00 **(case sent to CCVS exclusively for a CT; this includes charges for doctor overseeing case, IV catheter, and fluids post CT).
4. CT "Met Check" $590.00
5. CT STAT fee, $50.00 (on top of whatever you are doing).

These charges cover the CT, the contrast, radiologists read, rapid infuser, sevo anesthesia, and technician fee if we need to call someone in for the CT. It does not cover injectable drugs, if needed for IV anesthesia; estimated additional cost $50.00-$75.00.

This month I continued with spinal deformities in the thoracic and lumbar vertebrae. On plain radiographs these are often difficult to define and evaluate for spinal cord and/or nerve root compression. It also greatly helps in whether surgical intervention for decompression and stabilization of the spine is a consideration .

See CT Scans attached.

Business Tip

This month's Business Tip
Tip is an example of how Trupanion provides updates on the clients enrolled in your practice and the income generated in the previous 6 to 12 months for your practice. It becomes a list of your AAA clients whose records can designated as such.

See attachment to read more.

and proposed cutoff points above which animals of each breed were more likely to have heart disease (see chart 1).[1] Boxers had the most overlap in VHS between healthy dogs and those with heart disease making the VHS a less sensitive and specific test in this breed.[1]

Chart 1: VHS in multiple canine breeds
Values obtained from Lamb et al. 2001.[1]

Breed	Mean (SD) VHS Normal Dogs	Mean (SD) VHS Heart Disease	Cutoff VHS delineating normal and abnormal (percent sensitivity and specificity)
Boxer	11.6 (0.8)	12.1 (0.9)	11.7 (60%)
Laborador Retriever	10.8 (0.6)	11.5 (1.0)	11.0 (65%)
Cavalier King Charles Spaniel	10.6 (0.5)	12.4 (1.5)	10.9 (80%)
Doberman	10.0 (0.6)	11.1 (1.0)	10.3 (68%)
German Shepherd	9.7 (0.7)	11.1 (1.0)	10.2 (75%)
Yorkshire Terrier	9.7 (0.5)	11.2 (0.9)	10.2 (82%)

Heart disease and respiratory distress due to heart failure can be a challenge to diagnose in cats. Unfortunately, cats with heart murmurs may have completely normal hearts and cats without heart murmurs could very possibly have significant heart disease.[2] Furthermore, chest radiographs can show various combinations of bronchial, interstitial and alveolar disease with heart disease in cats (not to mention pleural effusion!) and may not be definitive for the diagnosis of heart failure.[2] Recent data evaluating the vertebral heart score (VHS) has shown some promise in determining if heart disease is the cause of dyspnea in cats. A normal VHS in cats has been previously identified as <8.0 with a mean around 7.3-7.5.[2] A recent manuscript, however, evaluated the VHS of cats in respiratory distress with the specific goal of finding a cutoff point over which a cat's respiratory disease was definitively due to heart disease. The authors found that a cutoff point of 8.0 was very sensitive for the diagnosis of heart disease as the cause of dyspnea and a cutoff point of 9.3 was very specific for heart disease.[2] In other words, if a cat has a VHS< 8.0, it likely is dyspneic due to a disease process other than heart disease and if the VHS is >9.3, you can be certain that the dyspnea is due to heart disease. For those cases with VHS' between 8.0 and 9.3, further testing such as echocardiography, is necessary to definitively determine if congestive heart failure is present.[2]

The natriuretic peptides are a group of structurally related proteins which have been evaluated extensively in experimental, human clinical and veterinary clinical subjects as indicators of heart disease as well as markers in a myriad of respiratory, central nervous system and inflammatory diseases.[a] There are multiple natriuretic peptides with various physiologic functions in the body. All natriuretic peptides are synthesized as preprohormones and are rapidly processed to form prohormones.a Prohormones are further cleaved into two parts creating the biologically inert amino-terminal prohormone (eg.NT-proBNP) and the biologically active C-terminal hormone (eg. C-BNP). Once in circulation, the active hormone is degraded into fragments. The amino-terminal prohormones have a longer half-life than the active hormones, and, in general, these have been found to be more useful to measure clinically as the timing of sampling to capture peak hormone levels is less pivotal.a Amino terminal-proBNP is the most extensively studied natriuretic peptide in veterinary medicine and has been looked at in both dogs and cats as an indicator of whether or not heart disease is the cause of dyspnea in animals with respiratory compromise. Amino terminal proBNP levels were elevated in dogs with CHF over levels in dogs with other causes of respiratory distress including pneumonia, pulmonary neoplasia, neoplastic pleural effusion, laryngeal paralysis, chronic bronchitis, collapsing trachea, lung lobe torsion, non-cardiogenic pulmonary edema, and eosinophilic bronchopneumopathy.[a] In addition, NT-proBNP has been found to be significantly higher in dogs with CHF compared to those with primary pulmonary disease and concurrent asymptomatic heart disease.[a,3] It was found that a NT-proBNP value greater than 1158 pmol/L was 85.5% sensitive and 81.3% specific for the diagnosis of CHF in dogs.[3] Similarly, NT-proBNP has been found to be significantly higher in cats with CHF compared to those with non-cardiac related respiratory distress.[4,5] Different researchers found NT-proBNP values in the range of 220-265pmol/L and higher were relatively sensitive and specific for the diagnosis of CHF as the cause of dyspnea in cats with respiratory distress.[4,5] It is important to note that there are cases which do not read

Tech Tip

OH, SEW EASY: UNDERSTANDING SUTURE MATERIALS was written by an LVT and given at the 2013 ACVS Symposium Technician's Seminar. The early 1900s of "silk and catgut" have changed dramatically with the advent of synthetic suture materials. Since 1960, many new types of suture material have become available. This discussion outlines the many types and applications of these synthetic suture materials. I have divided it into two parts. Last month Part 1 discusses their use and general application. This month Part 2 discusses the specific types and application.

Read Part 2: Oh Sew Easy: Suture Material Overview attached.

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the book and have elevations of NT-proBNP suggestive of CHF when heart disease, in fact, is not present. As clinicians, we must remember to look at the whole picture and take each diagnostic result as part of the puzzle rather than the entire picture. Amino terminal-proBNP is a diagnostic test available through IDEXXb which has been validated in dogs and cats and has a turnaround time of 1-2 business days. Sample handling can drastically affect the measurement and special sampling tubes that contain a protease inhibitor to minimize NT-proBNP degradation in plasma are supplied by IDEXX. IDEXX is currently undertaking a multi-center, prospective study to evaluate a point-of-care test for NT-proBNP in cats.

Some initial veterinary investigation of NT- proCNP indicates that this marker may be helpful in distinguishing infection (bacterial or fungal) from non-infectious inflammation.[6] A recent study found NT-proCNP elevations to be sensitive and specific for an underlying septic disease process as the cause of the systemic inflammatory response syndrome in dogs with the exception of peritoneal infections.[6] Although not specifically looked at in respiratory disease, this early research suggests that NT-proCNP may one day help us distinguish infectious pneumonia from other causes of pulmonary infiltrates or non-infectious pneumonitis. Currently, however, NT-proCNP analysis is not readily available to the majority of veterinary practitioners.

The use of high resolution computed tomography to diagnose respiratory disease in veterinary medicine has increased dramatically over the last ten years. It is now considered standard of care in critical care by experts in the field of small animal respiratory disease.[c] Computed tomography results in cross sectional images of slices of variable (1-10mm) thickness of the lungs. Helical CT scanners have increased the speed at which images are obtained, minimizing motion artifact from the heart and respirations. High definition CT is comprise of thin (1-2mm) slices that allows for fine detail and markedly increased sensitivity for parenchymal and vascular changes one can't detect using plain radiography.[c,7] Recent studies have confirmed that CT is more sensitive for the detection of metastasis than plan radiography.[8-10] High resolution CT with angiography can be used to detect pulmonary thromboembolism, a pathologic process which is thought to be involved in clinical respiratory disease more often than we previously thought due to limitations in diagnosis.[c,d] A recent preliminary study (not yet published) demonstrated the use of the pulmonary artery in comparison to the aorta and bronchial lumen to detect pulmonary hypertension.[c] Figures 2 and 3 depict thoracic radiographs and CT respectively of a case seen recently at CCVS. The dog had progressive, severe dyspnea with relatively underwhelming radiographs. The CT demonstrated nodular interstitial lung disease which was diagnosed as pulmonary carcinoma on endotracheal wash.

Figure 2

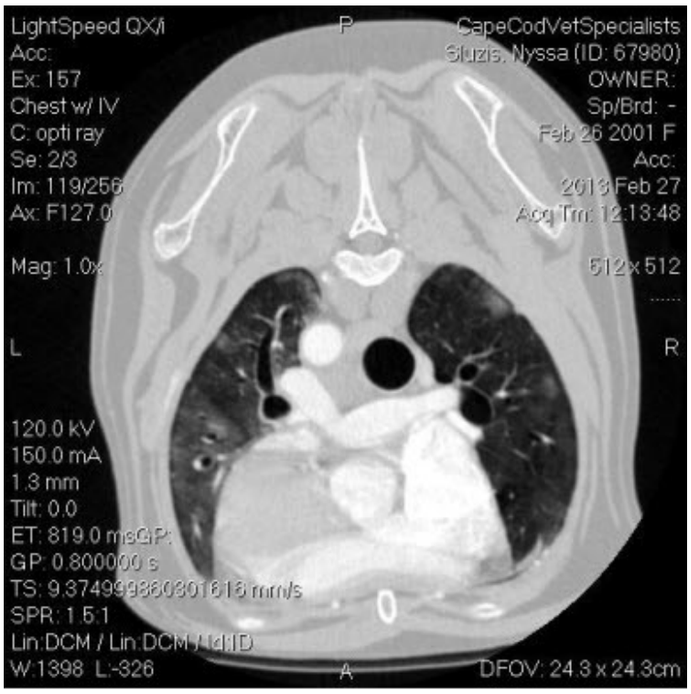

Figure 3

Figure 4

The requirement of absolute stillness to render images without motion artifact has dictated that CT scans have traditionally been performed under general anesthesia in veterinary medicine. Some animals can be scanned with heavy sedation and those with significant intracranial disease may even be scanned awake.c The recent development of a chamber, the "mousetrap", by a group at the University of Illinois has started to standardize a method of restraining cats for CT (see figure 4).

The area of diagnostics for respiratory disease in veterinary medicine is one of intense research right now. Hopefully this research will help us to determine the most sensitive and specific modalities as well as develop bed side tests to help categorize disease processes in the emergent setting.

Footnotes

[a] Smith K et al. Biomarkers as a tool for diagnosis of respiratory distress in dogs and cats: A review of the current literature. Part 1: Introduction, cardiac diseases and pulmonary hypertension. In review with J Emergency and Critical Care.

[b] Cardiopet proBNP IDEXX laboratories, Westbrook, ME

[c] Conference proceedings: Advanced Imaging for Thoracic Disease. Elizabeth Rozanski, DVM DACVECC DACVIM. Post graduate Review & Multi-Discipliary Review. Critical Care Congress, January 2014.

[d] Conference proceedings: Intra-alveolar fibrin and altered coagulation in pulmonary disease. Elizabeth Rozanski, DVM DACVECC DACVIM. Post graduate Review & Multi-Discipliary Review. Critical Care Congress, January 2014.

References

[1] Lamb CR et al. Use of breed-specific ranges of the vertebral heart scale as an aid to the radiographic diagnosis of heart disease in dogs. Veterinary Record 2001 148: 707-711.

[2] Sleeper MM et al. Use of the vertebral heart scale for differentiation of cardiac and noncardiac causes of respiratory distress in cats: 67 cases (2002-2003). J AmVet Med Assoc 2013; 242: 366-371.

[3] Oyama, MA et al. Assessment of serum N-terminal pro-B-type natriuretic peptide concentration for differentiation of congestive heart failure from primary respiratory tract disease as the cause of respiratory signs in dogs. J Am Vet Med Assoc 2009; 235(11): 1319-1325.

[4] Connolly DJ et al. Assessment of the diagnostic accuracy of circulating natriuretic peptide concentrations to distinguish between cats with cardiac and non-cardiac causes of respiratory distress. J Vet Cardiol. 2009; 11(S1):S41-50.

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[6] DeClue AE et al. Evaluation of serum NT-pCNP as a diagnostic and prognostic biomarker for sepsis in dogs. J Vet Intern med 2011; 25: 453 -459.

[7] Prather AB et al. Use of radiography in combination with computed tomography for the assessment of noncardiac disease in the dog and cat. Vet Rad Ultrasound 2005; 46: 114-121.

[8] Nemanic S et al. Comparison of thoracic radiographs and single breath-hold helical cT for detection of pulmonary nodules in dogs with metastatic neoplasia. J Vet Intern Med 2006; 20: 508-15.

[9] Armburst LJ et al. Comparison of three-view thoracic radiography and computed tomography for detection of pulmonary nodules in dogs with neoplasia. J Am Vet Med Assoc. 2012; 240: 1088-1094.

[10] Eberle N et al. Comparison of examination of thoracic radiogrpahs and thoracic computed tomography in dogs with appendicular osteosarcoma. Vet Comp Oncol 2011; 9:131-140.