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Evaluating Heart Size on Radiographs

We've all had patients that could not afford a complete cardiac workup for their coughing dog. They may pay for the physical examination, blood work and radiographs, but they just can't pay the cost of a specialist consultation and an echocardiogram. This can put a lot of pressure on generalists to determine the cause of the cough.

Thoracic radiographs are an important tool in differentiating Congestive Heart Failure (CHF) from other conditions such as respiratory disease. However, generalists are expected to read radiographs from different dog breeds (for example, a Dachshund, a Chihuahua and a Great Dane) and be able to tell if the patient has an enlarged heart. With some populations this is easy, but for others, it can be a real challenge.

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To address this dilemma, Drs. James W. Buchanan and Jorg Bücheler at the University of Pennsylvania developed the **Vertebral Heart Scale – VHS** (sometimes called a score) to assist veterinarians in assessing heart size. The VHS is a method that allows veterinarians to evaluate the heart size across dog breeds and provide an accurate assessment of true cardiac enlargement. There is a good correlation between heart size and vertebral body length.

The first step in performing a VHS measurement is to obtain a good thoracic radiograph, which can be tough and sometimes impossible. The radiograph should be centered over the heart. Films that are centered over the diaphragm or abdomen can foreshorten the thoracic vertebral bodies, thus falsely elevating the VHS. The dog needs to remain still, and the radiograph should be taken when the dog is taking a deep inspiratory breath. The patient needs to be in a good straight lateral position, but taking a right or a left lateral doesn't really matter. Taking both laterals can sometimes be helpful.

Pulmonary pathology is often best seen in the lung opposing the recumbency (left lung in right lateral recumbency, and vice versa). However, I would suggest veterinarians always order the same lateral(s) view, because the heart looks a little different on a left lateral versus a right lateral view. I am used to looking at left laterals, so I always order a left lateral or a three-view study. **Be consistent: don't switch back and forth.**

To perform a VHS

1. Take a lateral view of the dog's heart.
2. Measure the long axis, the length from base (ventral margin of the corina) to apex (L), and the short axis, width of the heart perpendicular to the length measurement, typically at the ventral margin of the caudal vena cava(S).
3. Take these dimensions and scale them against the length of the vertebrae dorsal to the heart, beginning with the fourth vertebral body on the spine (T4).
4. Count how many vertebral bodies the length (L) of the heart is and how many bodies can be included in the width (S) measurement. A vertebral body consists of the vertebral body starting at the cranial end-plate and includes the disc space immediately caudal to the that vertebrae.
5. If the sum of these two measurements is higher than 10.5, the dog probably has an enlarged heart. Normal dogs tend to fall within a range of 8.4 to 10.5.

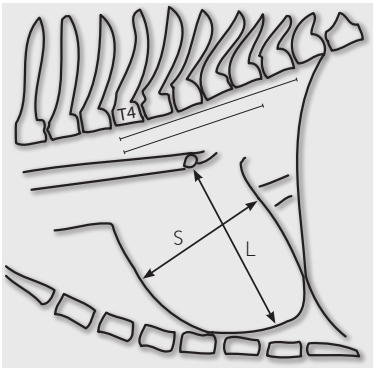

Figure 1 – Demonstrates how to measure the vertebral heart size of a dog

VHS = L + S
VHS = 6.5 + 4.5
= 10.5

"Most radiographic interpretations can be pretty subjective, but the VHS allows the veterinarian to make an objective assessment of heart size."

Some people have trouble finding the fourth vertebral body. If they are not centered over the thorax, it can be hard to see the disc spaces between the vertebral bodies, making it harder to count vertebral bodies. The thoracic vertebrae all have a tall spinous process, so I count the spinous processes because they are easy to see. After finding the fourth thoracic vertebral spinous process, I follow it ventrally until I reach the body of that vertebra, which tends to be slightly cranial to the process.

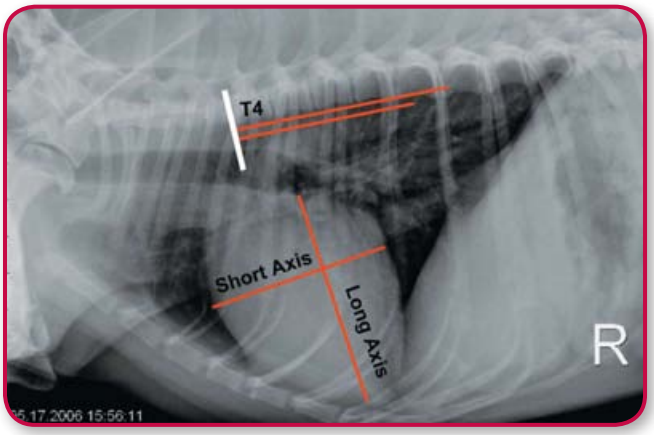

Figure 2: Normal heart
VHS = 5.2 (L) + 4.4 (S)
= 9.6

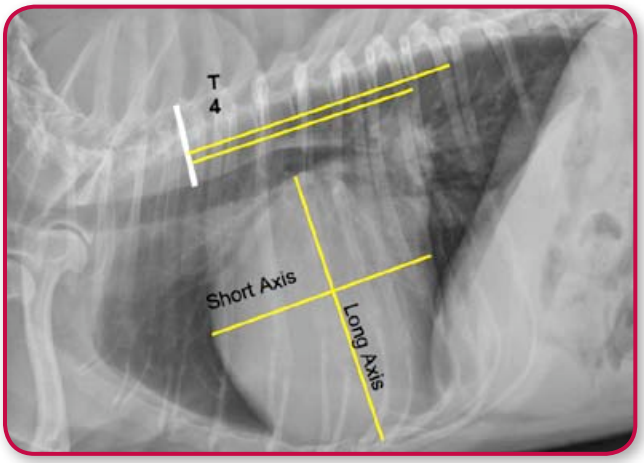

Figure 3: Enlarged heart
VHS = 7.2 (L) + 6.4 (S)
= 13.6

Dr. Buchanan found that the VHS is a good measurement regardless of whether the dog has a wide or deep thorax, is male or female or whether the radiograph was taken in a right or left lateral recumbency.

Most radiographic interpretations can be pretty subjective, but the VHS allows the veterinarian to make an objective assessment of heart size. The veterinarian can look at the heart on a radiograph and think it is enlarged, but if the VHS is 9.4, he or she is probably over-interpreting that radiograph.

This is the nice thing about the VHS – vertebral bodies tend to correlate nicely with body size in dogs. No matter how big the dog, if its vertebral heart scale ends up being more than 10.5 vertebral bodies, the heart is enlarged. In addition, the VHS is something that veterinarians can teach their technicians to do. The technician can look at the radiograph and do a VHS before bringing it to veterinarian for evaluation.

By combining the VHS with the signs of heart failure – breed, age, physical examination (heart murmur) and radiographic evidence of pulmonary edema – a veterinarian can treat the dog even if referral to a cardiologist is declined by the owner. VHS can change what an owner and clinician decide to do if the dog cannot receive an echocardiogram.

Of course, there are dogs that naturally have large hearts, but do not have heart failure. These include the Cavalier King Charles Spaniel, the Golden Retriever and the Boxer. A veterinarian cannot use the VHS and forget everything else he or she learned about reading radiographs. It is not foolproof. It would be nice if we could have a score for each breed, but we don't; there are just too many breeds. However, most dogs in these breeds will still be below 10.7.

It can be critical for veterinarians to confirm a diagnosis of CHF with simply the results of the thoracic radiographs and the vertebral heart scale combined with other predictors of heart failure including the breed, age and physical examination (heart murmur) of the dog. If CHF is mistaken for another diagnosis, for example bronchitis, and the dog does not receive cardiac medication, it can lead to an ER visit when the cough due to CHF has progressed to respiratory distress. However, the converse is not true. If a veterinarian incorrectly diagnoses CHF and administers cardiac medication, the only thing likely to happen is a coughing dog. While the cardiac medications may be a little hard on the kidneys, it is unlikely that the dog will die from this treatment, and the veterinarian will probably get a second shot at diagnosis and treatment when the owner returns with the still-coughing dog.

Too many cardiac patients are euthanized because owners can't afford an echocardiogram, or they are given a negative prognosis. Many owners who decline referral and echocardiography can afford $50 a month for medication, plus chest radiographs and screening blood work. With appropriate treatment, a patient with degenerative valve disease and secondary CHF can live for more than a year and sometimes two while remaining relatively symptom-free. Many of these patients, despite the need for heart failure medication, will feel great and the owners will be very happy with the quality of life.

Although a confirmatory echocardiogram completes the assessment, I think veterinarians can treat mitral valve disease based on the radiographic assessment, including vertebral heart scale, if there are consistent clinical signs.

FOR MORE INFORMATION:

Buchanan JW. Vertebral scale system to measure heart size in radiographs. Vet Clin North Am Small Anim Pract. 2000 Mar;30(2):379-93.

Buchanan JW, Bücheler J. Vertebral scale system to measure canine heart size in radiographs. J Am Vet Med Assoc. 1995 Jan 15;206(2):194-9 ■

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