Selecting Appropriate Tests for Cardiac Patients

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There is no one single test that is the best test for all dogs with heart disease, but a good physical examination is vital in all cases to help refine the clinical question. History and physical examination are crucial to success. Physical examination is itself is a diagnostic test, and when carefully carried out, has better sensitivity and specificity than many of our other diagnostic tests in cardiac patients. The choice of test also depends on the question being asked: if the reason for diagnostic investigations is to identify the cause of a cardiac murmur, then echocardiography is probably the test of choice. If the question is whether an animal has congestive heart failure or not, the tests of choice will be physical examination and thoracic radiography. It is essential to determine whether any heart disease is present, but it is not always necessary to prove conclusively which type of cardiac disease. If cardiac disease is present, it is nearly always necessary to establish if the animal has signs of heart failure, or whether it is compensating well for any cardiac disease, as treatment usually depends on the stage of heart disease.

Physical Examination

Cardiac auscultation yields information on heart rate, heart rhythm, and presence of abnormal heart sounds (gallops and murmurs). Many dogs in heart failure will have increased sympathetic tone and therefore an increased heart rate. Sinus arrhythmia indicates high resting vagal tone, which suggests a dog is probably well with any heart disease. A fast, chaotic rhythm with pulse deficits suggests atrial fibrillation, which is reasonably specific for heart disease. Presence of a murmur in general does not necessarily indicate heart disease, as some functional murmurs may be present in the absence of structural cardiac changes. Careful characterization of a murmur (paying attention to point of maximum intensity, timing within the cardiac cycle, intensity, character, radiation and variability) will give much better specificity. It is often possible to shorten a differential list to just a few possible causes if a murmur is well characterized.

ECG

An ECG is indispensable when an arrhythmia is present. It is not always possible to identify the precise rhythm disturbance solely from auscultation, although specificity may be reasonably good for atrial fibrillation and some complete heart block cases. Waveform changes are not often helpful in mitral valve disease or dilated cardiomyopathy.

Thoracic Radiography

Together with physical exam, thoracic radiography is one of the most useful tests for identification of pulmonary edema/congestive heart failure. The combination of left atrial enlargement, distension of the pulmonary veins, and interstitial/ alveolar pulmonary infiltrates has high specificity for indicating left-sided heart failure. Radiography is less good for identifying the specific type of heart disease.

Echocardiography

Echocardiography is the best test for identifying the type of heart disease, but only if carried out by an experienced and skilled operator. Doppler echocardiography allows precise characterization of hemodynamic disturbances. Even in skilled hands, there is still controversy over the cut-off points for diagnosing early heart disease in asymptomatic patients. Echocardiography is less useful for identifying congestive heart failure.

Cardiac Biomarkers

Blood tests for NT-proBNP and troponin-I are becoming increasingly available, and are attractive as markers of severity of heart disease. These biomarkers are not specific for different types of cardiac disease. NT-proBNP concentrations are higher in dogs with congestive heart failure than in dogs with asymptomatic heart disease, and may be helpful in differentiating cardiac causes of respiratory distress. Troponin concentrations are increased by cardiac myocyte damage.

WHICH TEST IS BEST IN THE FOLLOWING CLINICAL SCENARIOS?

Old, Small Breed Dog with a Murmur (Asymptomatic)

A left apical holosystolic murmur in an older, small breed dog is likely to indicate degenerative mitral valve disease. An echo can confirm this, but experience and skill is required, and the pre-test probability is already high that the dog has mitral valve disease. It is more important to stage the disease, and this can be done with a careful history and imaging. Either thoracic radiographs or an echo can be used to establish whether there is left heart enlargement. Dogs with normal cardiac size and no left atrial (LA) enlargement are likely to remain asymptomatic for the next 12 months or so, and do not require any treatment. Dogs with LA dilation are at higher risk of developing congestive heart failure (CHF).

Older, Small Breed Dog with a Cough or Respiratory Signs

If a typical mitral murmur is present, it is important to determine whether there are other signs consistent with CHF, and whether the mitral valve disease is sufficiently severe for there to be a risk of CHF. In most instances, thoracic radiography is the most useful test. An echo can identify LA enlargement, and normal LA size can often rule out CHF. Thoracic radiographs have the advantage of identifying primary respiratory disease, although small airway disease can be difficult to identify. The respiratory rate recorded by the owner at home can be extremely helpful in distinguishing cardiogenic pulmonary oedema from airway disease - CHF is usually associated with a resting respiratory rate of > 40/min.

Large Dog with a Murmur and/or Arrhythmia (Asymptomatic)

Dilated cardiomyopathy (DCM) is the main differential diagnosis, but other non-cardiac disease can cause both murmurs (e.g., anemia) and arrhythmias (e.g., splenic masses). If an arrhythmia is present, an ECG must be obtained. Diagnosing preclinical DCM with echocardiography can be very challenging, so this is probably a situation where referral to a cardiologist may be valuable as there are important prognostic implications. A 24-hour Holter ECG should also be considered for dogs with arrhythmias.

Large Dog with a Murmur and/or Arrhythmia and Respiratory Distress

The important question for management is whether the dog has CHF, and this can be based predominantly on physical examination (tachypnea ± crackles/absent breath sounds ventrally; ascites with jugular distension) and thoracic radiographs. However, identification of LA enlargement by echo can support a clinical suspicion of CHF, and pleural effusion can be imaged directly. A 24-hour Holter ECG may be useful for longer term management if arrhythmias are present.

Dogs with Ascites, or Hypotensive Dogs with Weakness

Pericardial effusions are easily missed. Auscultation may be normal or heart sounds may be quiet, but cardiac tamponade is likely to result in a moderate tachycardia with pulses that wax and wane with respiration. Jugular distension is one of the most useful physical exam findings with pericardial effusions. If suspected, pericardial effusions can be imaged with ultrasound, though sometimes it can be challenging to differentiate pericardial from pleural effusions (thoracic radiographs will do this more easily).

Bradycardic Dogs

Sinus bradycardia is rarely associated with primary cardiac disease, and an echo is not likely to be very helpful. An ECG is essential to identify the arrhythmia, and choice of subsequent tests depends on whether pacemaker implantation is being considered.

Tachycardic Dogs

The most important test is an ECG. Irregular tachyarrhythmias are most likely to be atrial fibrillation, which is usually associated with structural heart disease. Regular tachyarrhythmias should be managed differently, whether they are caused by ventricular tachycardia (VT) or supraventricular tachycardia (SVT). Dogs with VT will benefit from an echo to look for structural heart disease, as this is managed differently from VT due to non-cardiac disease. Uncontrolled SVT can cause a DCM phenotype, but this can be reversible if managed appropriately.

A Puppy with a Murmur

A murmur in a puppy may be an innocent functional murmur, or it may be caused by life-threatening congenital heart disease. Quiet, brief murmurs are more likely to be innocent, whereas loud, long murmurs are more likely to indicate congenital disease (especially a continuous murmur, which indicates a patent ductus arteriosus, which can be corrected).