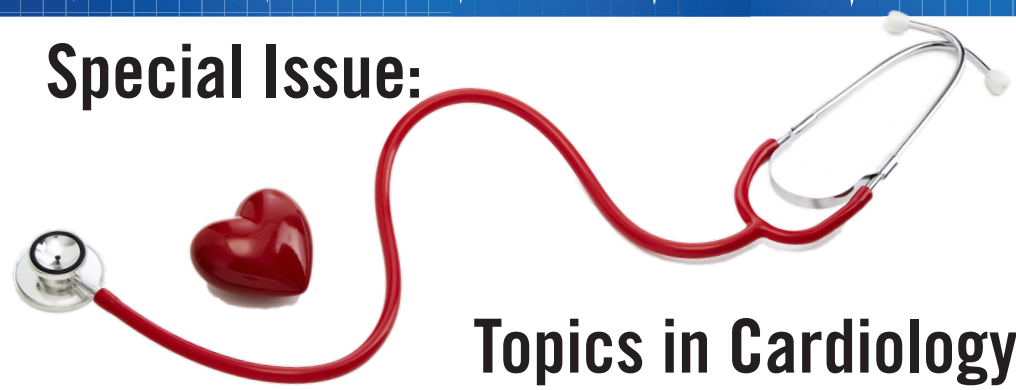
Winter 2019 / Volume 3, No. 1

ANTECH IMAGING SERVICES

ANTECH IMAGING NEWS

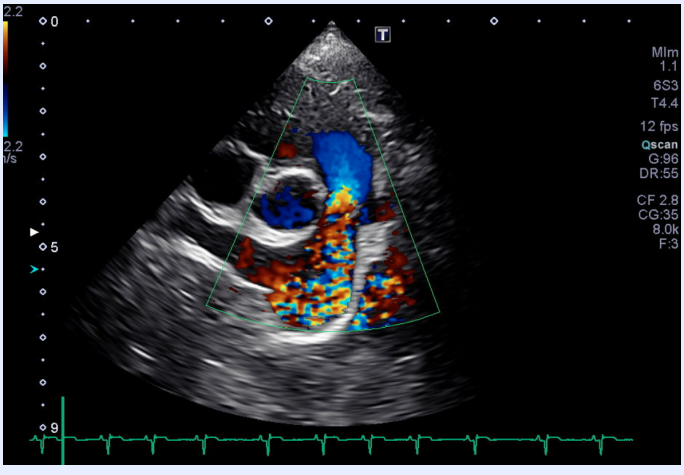
Special Issue:



Topics in Cardiology

Pulmonic Stenosis

Pulmonary stenosis is considered one of the most common congenital cardiac defects found in the canine patient. It can also be seen, but less commonly in the feline patient. Some breeds at increased risk for pulmonic stenosis include the English bulldog, boxer, beagle, keeshond, mastiff, Samoyed, miniature schnauzer, American cocker spaniel, and terrier breeds (especially West Highland white terrier).



Color Doppler image showing turbulent blood flow across the pulmonic valve

It is important to be able to identify congenital defects early on in a pet's life. This helps give the client an idea on the pet's prognosis and life expectancy, as well as providing treatment or interventional therapy early on- which may also give the pet a better long-term outcome. Additionally, being aware of underlying cardiac disease helps with creating an anesthetic protocol (such as prior to a spay or neuter). Also, as congenital defects are inherited, it provides knowledge that the pet is not suitable for breeding and can allow for other litter mates to be assessed more carefully. Furthermore, it provides feedback knowledge for the breeder (ie, regarding the potential issues on breeding lines).

Pulmonic stenosis occurs when there is a narrowing at the right ventricular outflow tract. This can occur bellow the valve (subvalvular pulmonic stenosis), at the valve (valvular pulmonic stenosis) or above

Continued on next page

the valve (supravalvular pulmonic stenosis). The most common form of pulmonic stenosis is valvular stenosis.

Pulmonic stenosis results in increased resistance to blood exiting the right ventricle and therefore, causing increasing right ventricular pressure. The increase of right ventricular pressure and stress causes increased muscle mass, or right ventricular wall hypertrophy.

On physical exam, the most common finding is a systolic murmur heard best at the heart base (over the pulmonic valve) and in many cases these animals are asymptomatic. In severe cases, exercise intolerance or syncope (typically after exercise or excitement) may be described by the owner. You may also see signs of right-sided congestive heart failure, such as a distended abdomen with a fluid wave (from peritoneal effusion) or decreased lung sounds/ increased respiratory effort (from pleural effusion).

Diagnostics such as ECG and thoracic radiographs may provide supportive evidence for pulmonic stenosis, but would not be considered the best method in making a definitive diagnosis. Radiographs in dogs with moderate-to-severe pulmonic stenosis often demonstrate a prominent right ventricle and dilatation of the main pulmonary artery. In milder cases the radiographs may be normal. In some cases, ECG may show evidence of right heart enlargement with a right-axis deviation or right bundle branch block with deep S waves and wide QRS complexes. More severe cases may also show cardiac arrhythmias, such as ventricular arrhythmias.

Cardiac catheterization can be used to make a diagnosis, but with the advancement of echocardiography, this modality is no longer used as a baseline diagnostic since it requires the use of anesthesia and is invasive.

Echocardiography is the primary method of diagnosing pulmonic stenosis in animals. This imaging modality has become the gold standard as a baseline diagnostic since it is not invasive and does not require anesthesia. Two-dimensional echocardiography can be used to identify most of the cardinal changes that occur in the heart in response to pulmonic stenosis. Moderate-to-severe right ventricular hypertrophy is usually readily identified, and the right ventricular papillary muscles may be notably enlarged. You may notice right atrial enlargement (secondary to increased right ventricular pressure). In severe cases, the septum may be flattened. In many cases, the poststenotic dilation of the main pulmonary artery can be visualized. The pulmonary valve can be difficult to image clearly using transthoracic echocardiography in dogs with pulmonic stenosis because of interference with lung tissue and abnormal cardiac anatomy. Therefore, multiple views from both sides of the chest are often necessary for complete evaluation. When the valve is able to be visualized, several findings may be evident- such as a hyperechoic (bright), thickened and restricted valve.

Another tool used in echocardiography, called Doppler echocardiography, provides a means for estimating the severity of the stenosis and may be necessary for confirming the diagnosis in mild cases in which secondary findings on

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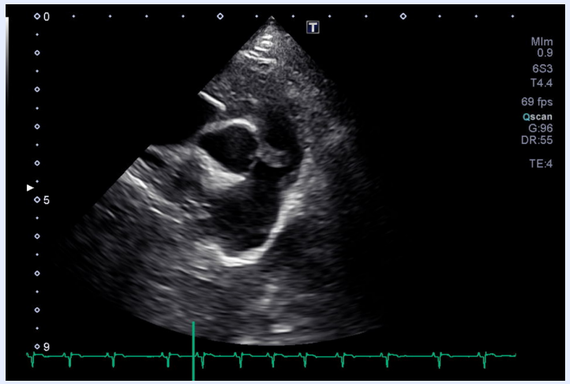
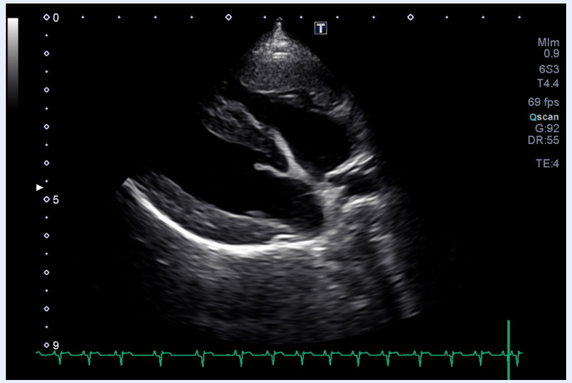
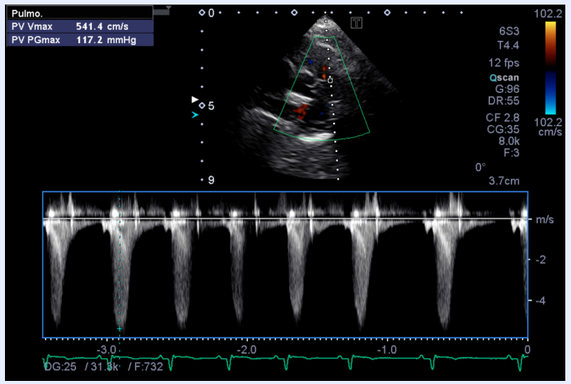


Two Dimensional echocardiogram image showing thickened and hyperechoic pulmonic valve leaflets with post-stenotic dilation of the pulmonary artery



Two dimensional echocardiogram image showing thickened right ventricular walls



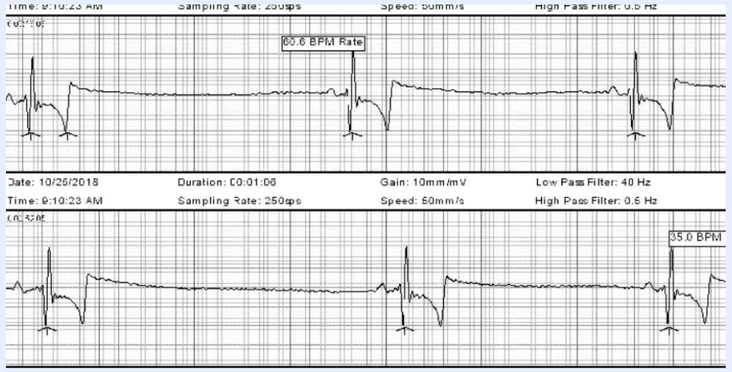
Echo Doppler image showing a high velocity pulmonic outflow consistent with severe pulmonic stenosis

M-mode and two-dimensional examinations are equivocal. This modality uses both Color Doppler and Spectral Doppler to assess for turbulent blood flow across the valve and then measure an outflow velocity – which can be calculated into a pressure gradient to determine if the disease is mild, moderate or severe. Echocardiography can also help assess for the presence of additional congenital diseases that may be present.

Mild cases of pulmonic stenosis may not require treatment. While more moderate or severe cases may be treated with oral medications such as beta-blockers or minimally invasive catheterization procedures such as a balloon valvuloplasty.

Expand Your Diagnostic Skills

A method to evaluate bradyarrhythmias



Benefits and uses of an Atropine Response Test

The Atropine Response Test is the diagnostic administration of atropine used to differentiate vagally-mediated and non-vagal bradyarrhythmias.

Examples of bradyarrhythmias that may be seen in practice include sinus bradycardia, pronounced sinus arrhythmias, sinus arrest and AV block. In some cases, increased vagal tone can contribute to these arrhythmias. Other times, primary SA or AV node diseases such as infection, infarction, degeneration or neoplastic invasion of the SA or AV node can be a contributing cause.

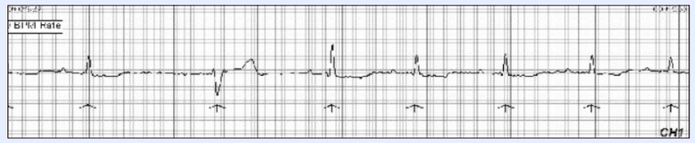
Increases in vagal tone can occur secondary to physiological or pathological conditions. Extreme fitness can result in increased vagal tone, resulting in bradycardia or bradyarrhythmias. Additionally, there can also be pathological conditions that increase vagal tone. Some examples of these diseases include chronic respiratory diseases (that exaggerate the respiratory phasic variations in vagal tone), primary CNS disorders (brain tumors), gastrointestinal disorders, and some endocrine conditions (Addison's Disease). The exact mechanisms that result in bradycardia with these conditions are complex, and not always well-defined.

It is important to differentiate between vagally induced bradyarrhythmias or primary SA/AV node disease when considering the safety of routine anesthesia for the patient. Also, if the patient is showing clinical signs such as lethargy or syncope from the arrhythmia, differentiating between the two forms of pathology can alter how you treat the arrhythmia- oral medication to maintain the heart rate versus a pacemaker.

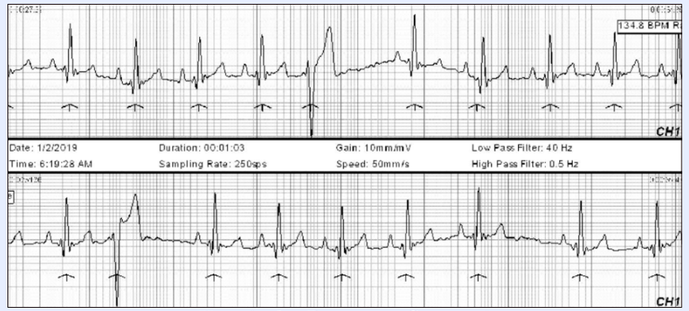
Atropine sulfate is an anticholinergic agent that competitively inhibits acetylcholine at postganglionic parasympathetic neuroeffector sites. In dogs, the test result is considered positive when the sinus node rate is > 150 bpm at 30 minutes after SC injection of atropine (0.04mg/kg) or at 5-10 minutes after IV administration of a similar dose.

Sinus Arrhythmia

Atrial Fibrillation



Ventricular Escape beats following a Sinus Pause



Ventricular Premature Contractions

2nd Degree AV Block

Test Your Knowledge

Can you identify the abnormalities in these ECG tracings?

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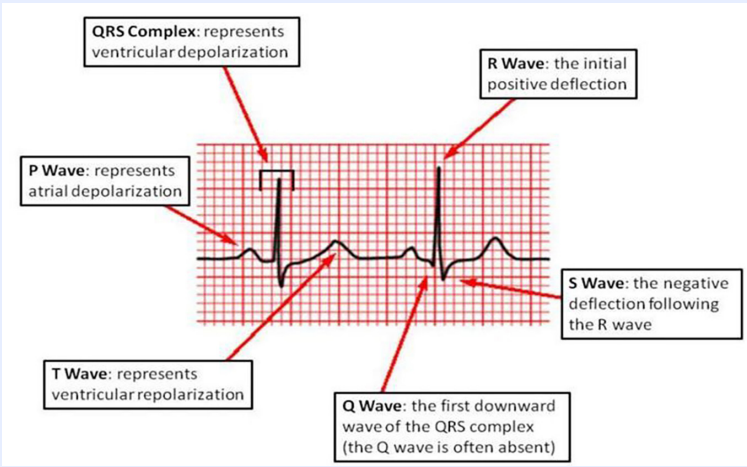
The Basics: Learn How to Read ECGs



Questions to ask when interpreting ECGs:

Normal Sinus Rhythm

1. What is the heart rate (HR)?

   -Is it normal, bradycardia, or tachycardia?

2. What is the rhythm?

   -Is there a QRS complex for every P wave?

   -Is there a P wave for every QRS complex?

   -Are they consistently and reasonably related?

3. What is the morphology of the QRS complex?

   -Does it look normal?
   -If not, what way is it abnormal?
   -Is it narrow and upright, or is it wide and bizarre?

Look inside for examples to test your knowledge!

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