Cardiology: when to worry

Dangerous arrhythmias: getting and interpreting the ECG in the heat of the moment

N. Sydney Moise

Dangerous ventricular tachycardia is one that compromises perfusion with systemic hypertension. Most commonly, the rate of this type of ventricular tachycardia is greater than 200 bpm; however, the underlying myocardial function is a major determinant of the risk posed. A normal myocardium can tolerate a much faster arrhythmia than a heart with poor systolic function. The electrocardiogram (ECG) characteristics of ventricular tachycardia include a wide QRS complex that is either monomorphic or polymorphic (several morphological shapes). The beat intervals are often constant, but this is not always the case. Reasons that ventricular tachycardia develops in an emergency situation include Boxers with arrhythmogenic right ventricular cardiomyopathy, Dobermanns with dilated cardiomyopathy or any dog with myocardial disease (particularly myocarditis). Understanding the importance of the rate with these arrhythmias will be discussed.

Dangerous supraventricular tachycardias include orthodromic atrioventricular reciprocating tachycardia (OAVRT), which uses an accessory pathway and is usually identified in young large-breed dogs. This particular arrhythmia can be life threatening with extremely rapid heart rates. Fortunately, this is an uncommon arrhythmia. Other causes for a supraventricular tachycardia include focal atrial tachycardia, atrial flutter or atrial fibrillation. The ECG characteristics of supraventricular tachycardias include a narrow QRS complex in most cases. Tolerance for these arrhythmias also depends on the underlying myocardial disease. Focal atrial tachycardia, OAVRT and atrial flutter with 2:1 atrioventricular nodal conduction are most often characterized by a constant beat-to-beat interval. Atrial flutter with variable atrioventricular nodal conduction and atrial fibrillation will have irregular beat-to-beat intervals.

In the treatment of these emergency arrhythmias it is important to assess the primary problem that will

cause death, and that is degeneration of the rhythm to asystole or ventricular fibrillation. Additionally a major consideration of these rhythm disorders is poor perfusion. As well as supporting myocardial function, circulatory support and oxygenation are vital. Preventing deterioration to ventricular fibrillation is paramount. Ventricular tachycardia may be treated with lidocaine, sotalol, amiodarone or cardioversion. Depending on the specific diagnosis of supraventricular tachycardia, treatment would include thoracic thump, vagal manoeuvre, sotalol, diltiazem or beta-adrenergic blockers.

Once the animal is stabilized further examination is important to understand the underlying disease. This examination will include further electrocardiographic study, ideally a baseline 24-hour Holter recording, echocardiography and a troponin I concentration to rule out myocarditis are indicated.

KEY LEARNING OBJECTIVES

- To interpret the key features for diagnosis of ventricular and supraventricular arrhythmias
- To know the treatment options for tachyarrhythmias in the emergency situation
- To be able to develop a follow-up plan for treatment management

MULTIPLE CHOICE QUESTIONS

1. Which of the following breeds is most likely to have arrhythmogenic right ventricular cardiomyopathy?
(A) Golden Retriever (C) Boxer
(B) Dobermann (D) Great Dane
2. Which of the following medications can be given orally with a response expected within 2 hours to control ventricular tachycardia?
(A) Lidocaine (C) Digoxin
(B) Mexiletine (D) Sotalol
3. Which of the following arrhythmias is most likely to respond to a thoracic thump?
(A) Ventricular tachycardia
(B) Atrial fibrillation
(C) Focal atrial tachycardia
(D) Orthodromic atrioventricular reciprocating tachycardia (OAVRT)

Bradyarrhythmias: when to worry

N. Sydney Moise

Sinus node dysfunction indicates abnormal depolarization from the sinus node complex and, if clinical signs are

present, the disorder is called sick sinus syndrome. The latter disorder is most common in Miniature Schnauzers, West Highland White Terrier, Dachshunds, Boxers and Cocker Spaniels. Sinus node function will deteriorate with age; however, the decrease in activity of the older patient may not require a rate response that would be needed for an active young dog. Chronotropic incompetence may be manifested by the inability to increase to a maximum heart rate, inability to maintain an increased heart rate commensurate with the amount of exercise,

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erratic heart rates during exercise or a slowed response to an increased need for a higher rate. In addition to the sinus node having a decreased function with age, atrio-ventricular (AV) node conduction may also slow, resulting in increased PR/PQ intervals. This is probably more common in Cocker Spaniels. The aged dog may have more of a response to drugs that slow heart rate. The clinical signs with sick sinus syndrome include lethargy and syncope or partial syncope.

Although the diagnosis may be made from a routine electrocardiogram (ECG), the underlying sinus node disorder may not be manifested because of the excitement in a hospital, and a 24-hour Holter monitor can provide the diagnosis. Dogs with sick sinus syndrome most often require pacemaker implantation. The ECG of sick sinus syndrome may show sinus bradycardia (heart rate less than 60 bpm), long sinus pauses (the definition depends on the physiological situation), or bradycardia plus tachyarrhythmias.

Cardiovascular reflexes that must be differentiated from sinus node dysfunction include vasovagal responses, Bezold–Jarisch reflex, accentuated antagonism of the vagal response or Cushing's reflex. If a bradycardia is diagnosed, it is also imperative to search for diseases that may cause a slow heart rate.

Third-degree heart block (also known as complete heart block) is the most common reason for pacemaker implantation. If a bradycardia persists for a long period of time, secondary cardiac enlargement and heart failure can develop. Depending on the underlying cause for the third-degree heart block, the prognosis after pacemaker implantation can be good. In most cases, cats with third-degree heart block fortunately have a faster escape rhythm. For this reason, they need pacemaker implantation less frequently. The exception is paroxysmal AV block seen in the cat.

KEY LEARNING OBJECTIVES

- To know the criteria for sinus node dysfunction and when pacemaker implantation is recommended
- To know the cardiovascular reflexes that may result in bradycardia or long sinus pauses that may be confused with sinus node dysfunction
- To recognize third-degree heart block in both the dog and cat and understand the difference in the response of the two species

MULTIPLE CHOICE QUESTIONS

1. How many sinus pauses greater than 2 seconds does the normal dog have during 24 hours?
 - (A) Zero
 - (B) <100
 - (C) 1000
 - (D) 3000
2. In which of the following types of bradycardia might an atropine response test be dangerous?
 - (A) Sinus bradycardia
 - (B) Brady tachy syndrome
 - (C) Second-degree heart block
 - (D) Bradycardia secondary to opioid administration
3. Which of the following causes of long sinus pauses may be treated with medication to decrease tachyarrhythmias?
 - (A) Bezold–Jarisch reflex
 - (B) Cushing's reflex
 - (C) Valsalva manoeuvre
 - (D) Vasovagal reflex

Tachyarrhythmias: when to worry

Pedro Oliveira

Tachyarrhythmias are abnormal heart rhythms with an elevated heart rate. Depending on their origin, they can be distinguished into supraventricular (SVT) or ventricular tachyarrhythmias (VT). The main distinguishing feature on the electrocardiogram (ECG) is the presence of a narrow QRS (<70 ms in dogs and <40 ms in cats) in SVT, and a wide and bizarre QRS in VT. However, SVTs may also occasionally present with a wide and bizarre QRS if a bundle branch block is present. Supraventricular tachyarrhythmias may be further divided into atrial, if they arise from the atrial myocardium, or junctional, if they arise from the atrioventricular junction. Tachyarrhythmias often occur due to underlying structural heart disease but may also occur in cases with extracardiac disease that cause damage/inflammation of the heart muscle, or lead to significant release of catecholamines into the circulation (e.g. pheochromocytoma).

For this reason, a step-by-step detailed investigation is necessary to make sure nothing is missed.

The first step is normally an ECG to identify the type of rhythm disturbance. This is followed by an echocardiogram to assess for the presence of structural heart disease and Holter monitoring should always be performed to assess the heart rhythm throughout the day and during normal activities. This is the only way to assess thoroughly the frequency and severity of the rhythm abnormalities. It is also the only way to assess reliably the efficacy of anti-arrhythmic treatments. Complete blood analyses are essential to identify or exclude concomitant systemic disease. These normally include haematology and biochemistry (including electrolytes) initially, and can be extended to include other tests such as thyroid levels/function and cardiac troponin levels. If, at this stage, a primary cardiac disease has not been identified, or if there is evidence of concomitant systemic disease, additional tests may also be necessary, such as abdominal ultrasonography, chest radiographs, or a computed tomography scan of chest/abdomen, urine catecholamine levels, among others. The decision to treat a tachyarrhythmia depends on its clinical significance and