Practical Use of the ECG in Practice

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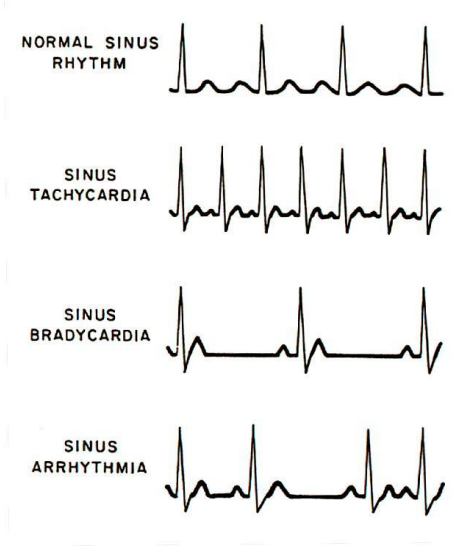
Assess the rate, rhythm and axis; evaluate to P-QRS-T complex morphology.

To recognize arrhythmias, you need to know two things:

1. The site of origin of the abnormal beat.
2. Recognize deviations from the normal rate of automaticity for that site.

Three different arrhythmias can be identified on Lead II by the following features (Figure 1 illustrates common examples):

Figure 1. Common ECG Examples of Arrhythmias.



- Atrial origin – these beats originate from somewhere in the atria other than the SA node. They look just like a normally conducted beat except that their timing is very early. A big hint is that the P-wave of the atrial beat touches the T-wave of the beat before it.
- Junctional origin – these beats originate near the AV node and have a negative deflection P-wave, or no P-wave, with a normally conducted, short-duration QRS complex.
- Ventricular origin – these beats originate somewhere in the ventricles. No P-waves are evident, QRS complexes are wide and bizarre appearing, and may be positive or negative polarity.

The essentials of electrocardiography include the assessment of heart rate, heart rhythm, and the P-QRS-T waveforms. The ECG is needed to accurately diagnose cardiac arrhythmias, and this test is extremely sensitive for this purpose. It should be emphasized that severe, life-threatening arrhythmias, such as ventricular tachycardia or atrial tachycardia, may easily be missed on auscultation, as the cardiac rhythm is often regular on auscultation and an ECG is the only way to accurately make this diagnosis. The ECG should be a standard part of the systemic disease workup, as well as part of the database in animals with suspected heart disease. A markedly irregular cardiac rhythm on auscultation with an arterial pulse deficit may implicate arrhythmias, such as atrial premature complexes and the atrial fibrillation, but requires an ECG to differentiate among them.

It is recommended that practitioners have two ECG machines: an oscilloscope and an electrocardiograph. The electrocardiograph linked with a strip recorder or printer provides a permanent record. A PC based system is highly recommended. The ECG is required for the accurate diagnosis of arrhythmias and conduction disorders. Just some of the indications include arrhythmias heard on auscultation, breathing problems, shock, fainting or seizures, cardiac murmurs, and systemic disease that affect the heart (tumors, kidney function, heartworm disease, etc.). The ECG is also useful as part of the preoperative work-up in older animals, for monitoring patients during and after surgery, and for evaluating the effects of cardiac drugs.

The majority of veterinarians can interpret their own ECG's by just simply focusing on the heart rate and what is the actual rhythm. Mean electrical axis and the size of the complexes can help to determine heart chamber enlargement, but in most cases this is an accurate test. The best way to determine heart enlargement in animals is with a chest X-ray or echocardiogram. The ECG can be recorded in a simple standing position or one can also use a hand-held unit. Since the ECG is so simple to record and interpret, most veterinarians should be running at least one ECG daily. The ECG recordings should be done in front of the client and a small screening ECG fee should be charged since the test is so easy to do. The ECG will make it useful to decide when other diagnostic tests should be done; including blood pressure recording, a chest X-ray, or even echocardiography.

The ECG will make it useful to decide when other diagnostic tests should be done; including blood pressure recording, a chest X-ray, or even echocardiography. A chest x-ray and ECG is always done before an echocardiogram. "Remember: The ECG is the only test that can accurately diagnose an arrhythmia or conduction abnormality--No other test can do that!"

Cardiac arrhythmias are clinically important when they adversely affect hemodynamics and result in reduced cardiac output, hypotension, and organ hypoperfusion. Electrical instability of the ventricles from a severe atrial tachyarrhythmia or ventricular tachyarrhythmia may progress to ventricular fibrillation and sudden death. It is important to rule out non-cardiac causes of arrhythmias (e.g. metabolic, toxic, or systemic disease) before attributing arrhythmias to primary heart disease. The clinical history often contributes to determining the cause of an arrhythmia (e.g. gastric dilatation is often followed within 24 to 48 hours by ventricular arrhythmias).

Before the electrocardiogram is examined, it is preferable to read the tracing before it is cut and mounted. It is important to study long strips of one lead (usually Lead II) for the accurate analysis of rhythm and heart rate. Lead II is usually used for the analysis of heart rate, heart rhythm, and measuring complexes and intervals.

A systemic method for an accurate electrocardiographic analysis of a rhythm strip (usually Lead II) for arrhythmias includes the following steps:

- Step 1. General inspection of the rhythm strip
    - Is the rhythm normal sinus or characteristic of a type of cardiac arrhythmia? The heart rate should also be classified as rapid, slow or normal.
- Step 2. Identification of P-waves
    - Is the atrial activity regular and the shape uniform?
- Step 3. Recognition of QRS complexes
    - The QRS complexes should be characterized as to their morphology, uniformity, and regularity.
- Step 4. Relationship between P-wave and QRS complexes
- Step 5. Summary of findings and final classification of the arrhythmia
    - What is the predominant rhythm? Is the arrhythmia an abnormality of impulse formation or of impulse conduction or both? If either or both, what is the site of the abnormality?

Anti-arrhythmic therapy

Cardiac arrhythmias and conduction disturbances may have profound effects on cardiac output, coronary artery perfusion, arterial blood pressure, and vital organ perfusion. The clinical signs that result from specific arrhythmias have been previously described. Antiarrhythmic therapy may result in a control or abolishment of the arrhythmia and a return to normal hemodynamic function. It is important to have a thorough knowledge of the properties of the agents available to treat specific rhythm disturbances. Many of the available antiarrhythmic drugs are classified based on their electrophysiologic mechanisms.

The purpose of drug therapy for cardiac arrhythmias is to prevent clinical signs, such as weakness, syncope, seizures, personality changes, and congestive heart failure. Drug therapy also may decrease electrical instability and the likelihood of progression to a malignant arrhythmia (e.g. ventricular fibrillation). Be aware that some arrhythmias may require antiarrhythmic drugs in addition to other therapeutic modalities (e.g. "sick sinus syndrome" patients with bradyarrhythmia-tachyarrhythmias may require a permanent cardiac pacemaker for the bradyarrhythmia and an antiarrhythmic drugs for tachyarrhythmia).

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