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Cardiac Care for Pets
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Atrioventricular (AV) Block

First degree, second degree, and third degree AV block

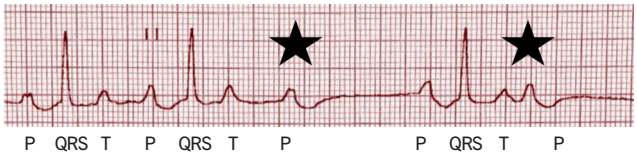
What is AV block?

- Normally, the heartbeat is initiated by the sinus node (the body's natural pacemaker). This impulse conducts through the atria and then through the atrioventricular (AV node) to the ventricles. The AV nodal conduction is naturally slightly slower than that through the heart muscle in order to allow the atria to contract first and fill the ventricles with blood prior to ventricular contraction.
- AV block is a disease of the electric conduction system of the heart where the AV node is not functioning properly. AV block is stratified into three categories:

First degree AV block is when the impulses conduct at a slower rate than normal.

This heart rhythm shows first degree AV block. The P wave represents the atrial activity (termed depolarization). The QRS represents the ventricular depolarization. The timing between the atrial depolarization and ventricular depolarization is called the PQ or PR interval, which is the period where electrical activity is being transmitted through the AV node. In this example, all of the heartbeats are conducted from the atria to the ventricles, but there is prolongation (denoted by the horizontal line) of the PQ interval - this is termed first degree AV block.

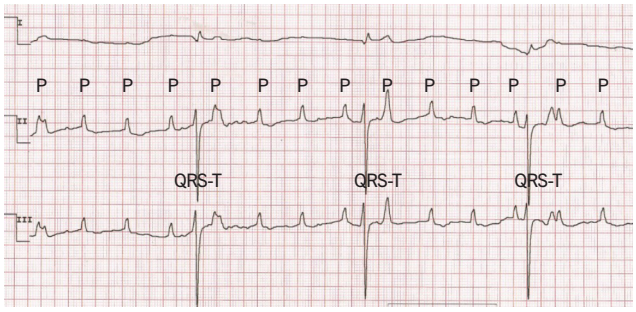
Second degree AV block is when one or more, but not all, of the impulses are conducted through the AV node.



This heart rhythm shows an example of second degree AV block. The P wave represents the atrial activity (termed depolarization). The QRS represents the ventricular depolarization. The timing between the atrial depolarization and ventricular depolarization is called the PQ or PR interval, which is the period where electrical activity is being transmitted through the AV node. On the ECG, second degree AV block appears as the absence of a QRS complex following the P wave (or in other words, an intermittently blocked P wave) - this appearance is due to the AV node not allowing conduction from the atria to the ventricles. In this example, the first two heartbeats have association between the atria and ventricles. This is then followed by a blocked P wave (star), a normal heartbeat, and a second blocked P wave (star). The conducted heartbeats also have a first degree AV block.

There are different types of second degree AV block, which will play an important role in assessing your pet's risk for symptoms and if additional diagnostics are needed. The cardiologist will discuss your pet's type of second degree AV block in more detail during their appointment.

Third degree AV block is when no impulses are able to be conducted through the AV node. The atria are then electrically isolated from the ventricles. In cases of third degree AV block, there are life saving backup pacemakers, termed ventricular escape, to keep the ventricles contracting and generate a heartbeat, but these occur at much slower heart rates.



This heart rhythm shows an example of third degree AV block in a dog. The P wave represents the atrial activity (termed depolarization). The QRS represents the ventricular depolarization. The AV node is unable to conduct impulses from the atria to the ventricles, therefore causing the atria and ventricles to become electrically isolated from and independent of each other. On the ECG there is still the presence of atrial conduction and ventricular conduction, but these are not associated - note that the P waves and QRS-T complexes are not associated. The QRS-T complexes above arise from ventricular escape at a rate of 50 beats per minute.

What does AV block mean for my pet?

- Depending on the degree of AV block, your pet may experience symptoms ranging from asymptomatic, lethargy, weakness, fainting, collapse, or sudden death.

What causes AV block?

- There are many causes of AV block, including high vagal tone, drugs including anesthesia or certain heart medications, scarring of the AV node, toxicities, electrolyte imbalances, and inflammation or infection of the heart.

How is it diagnosed?

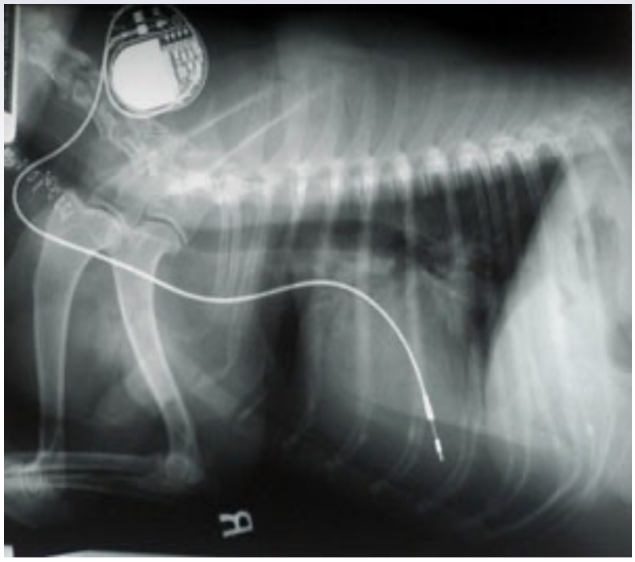
- Veterinarians can be suspicious of AV block by listening to the heart rhythm with a stethoscope, but a definitive diagnosis is with an electrocardiogram (ECG).

When is AV block treated?

- The cardiologist will assess your pet's risk for symptoms from the arrhythmia to determine a treatment and monitoring plan.
- In some cases, an atropine response test will be performed to assess if the AV node can improve its conduction with this medication.
- If indicated, treatment may include oral medications with the goal to improve AV nodal conduction.
- A permanent pacemaker may be recommended for forms of second and third degree AV block that cause symptoms and do not respond to medications.

Monitoring

- Depending on the degree of AV block and risk for symptoms, your pet will need to have their heart rate monitored by their veterinarian in order to monitor for progression. The cardiologist may also discuss the options for at-home monitoring of the heart rate in order to assess for progression.



X-ray of a dog with a pacemaker - the pacemaker lead is placed in the right ventricle, and the generator of the pacemaker sits under the skin in the neck region.