

# Irregular Heartbeat: Ventricular Premature Complexes

## Basics

### OVERVIEW

- The heart of the dog or cat is composed of four chambers; the top two chambers are the right and left atria and the bottom two chambers are the right and left ventricles; heart valves are located between the right atrium and the right ventricle (tricuspid valve); between the left atrium and the left ventricle (mitral valve); from the right ventricle to the main pulmonary (lung) artery (pulmonary valve); and from the left ventricle to the aorta (the main artery of the body; valve is the aortic valve)
- In order to pump blood to the lungs and body, the heart must work in a coordinated fashion; the normal control or “pacemaker” of the heart is the sinoatrial (SA) node, which starts the electrical impulse to begin the coordinated contraction of the heart muscles—the electrical impulse causes the atria to contract, pumping blood into the ventricles; the electrical impulse moves through the atrioventricular (AV) node and into the ventricles, causing the ventricles to contract and to pump blood to the lungs (right ventricle) and the body (left ventricle)
- An electrocardiogram (“ECG”) is a recording of the electrical impulse activity of the heart; the normal ECG is a tracing with P, QRS, and T waves; the P wave is the first upward deflection of the ECG tracing that looks like a “bump” in the tracing; the P waves are a measure of the electrical activity of the atria; the QRS looks like an exaggerated “W” with the Q wave being a short, downward deflection, the R being a tall, spiked upward deflection, and the S being another short, downward deflection; the QRS is a measure of the electrical activity of the ventricles; finally the T wave may be an upward or downward deflection of the ECG tracing; the T wave is a measure of ventricular recovery prior to the next contraction
- “Ventricular premature complexes” are a type of irregular heart beat; an electrical impulse is initiated within the ventricles instead of the sinoatrial (SA) node, causing the ventricles to contract too early (thus the “premature”)
- Recording of an electrocardiogram (“ECG,” a recording of the electrical activity of the heart), characterized by abnormal QRS complexes not associated with P waves
- Also known as “VPCs”



### GENETICS

- Inherited ventricular irregular heart beat (known as an “arrhythmia”) in German shepherd dogs; polygenic (many genes control the trait)

### SIGNALMENT/DESCRIPTION OF PET

#### Species

- Dog
- Cat

#### Breed Predisposition

- Common in large-breed dogs with disease of the heart muscle (known as “cardiomyopathy”), especially boxers and Doberman pinschers
- Inherited ventricular arrhythmia in German shepherd dogs

- Common in cats with disease of the heart muscle (cardiomyopathy); occasionally seen in cats with excessive levels of thyroid hormone (known as “hyperthyroidism”)

### **Mean Age and Range**

- Seen in all age groups

## **SIGNS/OBSERVED CHANGES IN THE PET**

- Weakness
- Exercise intolerance
- Fainting (known as “syncope”)
- Sudden death
- Often no signs observed
- Irregular heartbeats associated with pulse deficits (situation in which the number of heart beats and number of pulses do not match, usually indicating inadequate filling of the ventricles prior to contraction); the veterinarian may hear splitting of the first or second heart sound when listening to the heart with a stethoscope
- Heart beats may be normal during physical examination, if the irregular heart beat (arrhythmia) is intermittent
- May observe signs of congestive heart failure (such as cough and difficulty breathing [known as “dyspnea”]) or detect a heart murmur, depending on the cause of irregular heart beat; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs

## **CAUSES**

- Disease of heart muscle (cardiomyopathy)
- Congenital (present at birth) heart defects (especially subaortic stenosis, a birth defect involving narrowing just below the aortic valve, the heart valve from the left ventricle to the aorta [the main artery of the body])
- Long-term (chronic) disease of the heart valves
- Stomach dilates with gas and/or fluid (known as “gastric dilatation”), and subsequently rotates around its short axis (known as “volvulus”)—condition known as “gastric dilatation-volvulus” or “bloat”
- Traumatic inflammation of the heart muscle (known as “traumatic myocarditis”) in dogs
- Digitalis toxicity; digitalis is a heart medication
- Excessive levels of thyroid hormone (hyperthyroidism) in cats
- Heart tumors or cancer
- Inflammation of the heart muscle (myocarditis)
- Inflammation of the pancreas (known as “pancreatitis”)

## **RISK FACTORS**

- Low levels of potassium in the blood (known as “hypokalemia”)
- Low levels of magnesium in the blood (known as “hypomagnesemia”)
- Acid–base disturbances (abnormalities in blood pH levels)
- Low levels of oxygen in the blood and tissues (known as “hypoxia”)

## **Treatment**

### **HEALTH CARE**

- Generally outpatient basis
- Varies with underlying cause
- Correct any low levels of potassium in the blood (hypokalemia) or low levels of magnesium in the blood (hypomagnesemia), correct low oxygen levels, acid-base disturbances

### **ACTIVITY**

- Restrict if the irregular heart beat is accompanied by clinical signs or evidence of structural heart disease

### **DIET**

- Mild to moderate sodium restriction if the pet is in congestive heart failure; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs

### **SURGERY**

- Continuous recording of an electrocardiogram (“ECG,” a recording of the electrical activity of the heart) will be done while the pet is anesthetized
- Premedicating the pet with acepromazine raises the threshold (and thus decreases the likelihood) for ventricular fibrillation (a condition in which the ventricles rapidly contract in a chaotic manner and cannot pump blood to the body—it is a life-threatening emergency)—other adjustments also will be made for a pet with irregular heartbeats in preparation for an anesthetic

## **Medications**

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

### General Comments

- Drug therapy in the absence of clinical signs—controversial; no animal studies similar to studies done for people have been done
- Low blood potassium and magnesium levels will be corrected
- Medications to control the irregular heartbeats (antiarrhythmic drugs) generally are not prescribed unless the pet has evidence of low blood volume being pumped by the heart (known as “low cardiac output”), such as episodic weakness or fainting (syncope) or the pet is at high risk of sudden death
- If medications to control the irregular heart beat (antiarrhythmic treatment) is initiated in an attempt to lower the risk of sudden death, a  $\beta$ -blocker or sotalol generally is selected; no studies have been done to confirm effectiveness of  $\beta$ -blockers for prevention of sudden death in dogs or cats

### Dogs

- Pet is not in congestive heart failure or does not have low blood pressure (known as “hypotension”)—treatment with a  $\beta$ -blocker (such as propranolol, atenolol, or metoprolol) or sotalol
- Pet is in congestive heart failure or has low blood pressure (hypotension)—treatment with a medication to control the irregular heart beat (class I antiarrhythmic agent, such as mexiletine or procainamide)
- Combination of a medication to control the irregular heart beat (class I antiarrhythmic drug) with a  $\beta$ -blocker, if significant irregular heartbeats persist may be recommended; may also elect amiodarone (some dogs)
- The veterinarian may decline to use sotalol alone in German Shepherds—may have pro-arrhythmia side effect

### Cats

- $\beta$ -blocker—atenolol
- Consider sotalol or procainamide for cats that do not tolerate  $\beta$ -blockers

## Follow-Up Care

### PATIENT MONITORING

- Holter monitoring (where the pet wears a “vest” in which a continuous, mobile battery-powered ECG monitor has been placed; the ECG recording is performed over several hours, giving a better overall picture of the heart rate and rhythm) is preferred for monitoring severity of the irregular heart beat (arrhythmia) and effectiveness of treatment; the goal of treatment is to reduce the frequency of ventricular premature complexes by more than 85%
- Serial recordings of an electrocardiogram (“ECG,” a recording of the electrical activity of the heart) are not as useful as Holter monitoring—ventricular premature complexes and sudden onset of a very fast heart rate originating in the ventricles, causing the heart to beat ineffectively (known as “paroxysmal ventricular tachycardia”) can occur sporadically through the day
- Serum digoxin levels should be monitored in pets receiving this heart medication

### PREVENTIONS AND AVOIDANCE

- Correct factors that increase the risk of ventricular premature complexes, such as low levels of potassium in the blood (hypokalemia), low levels of magnesium in the blood (hypomagnesemia), low levels of oxygen in the heart muscle (known as “myocardial hypoxia”), and digoxin toxicity

### POSSIBLE COMPLICATIONS

- Fainting (syncope)
- Sudden death

### EXPECTED COURSE AND PROGNOSIS

- If cause is metabolic—condition may resolve with good prognosis
- If condition is associated with heart disease—prognosis is guarded; ventricular premature complexes may increase the risk of sudden death

## Key Points

- “Ventricular premature complexes” are a type of irregular heart beat; an electrical impulse is initiated within the ventricles instead of the sinoatrial (SA) node, causing the ventricles to contract too early
- Potential for the irregular heart beat (arrhythmia) to worsen and for the pet to have signs of fainting (syncope) or sudden death
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