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Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)

What is ARVC?

Arrhythmogenic right ventricular cardiomyopathy, or “ARVC” is a form of heart disease identified predominantly in Boxer dogs and English Bulldogs. It occurs occasionally in cats. ARVC causes both electrical (*cardiac arrhythmias*) and structural (*poor pumping function*) disease of the heart, although the electrical disease tends to precede the structural disease in most cases. ARVC in Boxer dogs is inherited (passed down genetically to offspring) but dogs do not usually develop detectable signs of the disease until middle or older age. At least one gene for ARVC has been identified in Boxer dogs.



The disease occurs in three phases:

- 1) The genetically predisposed phase (Boxer dogs)
 - o If one or more copies of the abnormal gene associated with ARVC has been identified via genetic testing, the dog is known to be at risk for developing ARVC later in life
- 2) An occult phase, during which time the disease is confirmed to be present but the patient displays no clinical signs (symptoms). This phase can last 3-5 years.
- 3) A clinical phase, when symptoms develop. The most common clinical sign is collapse or fainting with activity. Other signs include exercise intolerance, labored breathing, coughing, lethargy or even sudden death.

How might ARVC impact my pet's health?

ARVC initially causes disruption of the cardiac conduction system, causing abnormal heart rhythms (*cardiac arrhythmias*). In many dogs, the initial arrhythmias are sporadic and cause no signs. More complex arrhythmias result in exercise intolerance, collapse/fainting, or sudden death.

Dogs that develop poor cardiac pump function can experience congestive heart failure. This manifests as coughing, labored breathing, lethargy, and weakness.

How is ARVC diagnosed?

- Genetic testing can be performed by veterinarians or by pet owners themselves to determine if a Boxer dog is *predisposed* to developing the disease. For more information, discuss with your pet's cardiologist or visit the North Carolina State Veterinary Genetics lab website:

<https://cvm.ncsu.edu/genetics/boxer-arrhythmogenic-arvc/>

- Most Boxer dogs are diagnosed in the occult phase, when they lack clinical signs. A cardiac arrhythmia is detected during a routine examination, general anesthesia, or similar. A referral to a board-certified cardiologist is advised at that time. Your dog's cardiologist will likely perform some or all of the following diagnostic tests:

- Echocardiogram (cardiac ultrasound) – this test is normal in 80% of Boxers at the time of their initial diagnosis of ARVC
- Electrocardiogram (ECG, EKG): Up to 5 minute recording of the electrical activity of the heart
- Holter monitor: Recording of all cardiac electrical activity over 24-48 hours at home



Electrocardiogram displaying ventricular arrhythmias in a Boxer dog

- Since arrhythmia activity is often sporadic, a Holter monitor is usually still required to confirm the diagnosis and determine whether the arrhythmias are significant enough to warrant immediate treatment.
- Diagnosis during the symptomatic phase involves interpreting the patient's clinical signs in the context of an echocardiogram, electrocardiogram, and/or Holter monitor. Thoracic radiographs (x-rays of the chest), blood pressure testing, and baseline bloodwork may also be part of an evaluation during the symptomatic phase.



Holter monitor

What is the treatment for ARVC?

In the occult phase, treatment is dependent on the severity of cardiac arrhythmias and the presence or absence of reduced cardiac pump function. Antiarrhythmic medications (e.g. sotalol, mexiletine, amiodarone), pimobendan (vetmedin), and angiotensin converting enzyme (ACE) inhibitor are the medications most commonly prescribed in this phase. Not all dogs in the occult phase require immediate treatment.

Treatment in the symptomatic phase is often very similar to the occult phase, although it will additionally require medications (diuretics) to treat congestive heart failure, if present.

My dog has been diagnosed with ARVC. What is his/her prognosis?

- Prognosis for dogs with ARVC who have *only* cardiac arrhythmias is highly variable. Unfortunately the risk of sudden cardiac death exists for these patients, but if this does not occur they can live with the disease for 3-5 years or more
- Prognosis for dogs with ARVC *and* congestive heart failure is poor, with survival not expected to exceed 6-12 months with treatment.

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