



# Great Dane Review

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## Understanding Dilated Cardiomyopathy in Great Danes

**W**hen a Great Dane is diagnosed with dilated cardiomyopathy, the implication of subsequent abnormalities, such as congestive heart failure, also becomes a concern.

Dilated cardiomyopathy (DCM) is prevalent among giant-breed dogs, such as Great Danes. In fact, the breed may be second only to Doberman pinschers in its vulnerability to this condition.<sup>1</sup> While experts agree that the disease is hereditary in some breeds, until recently there's been a question whether that's also the case with Great Danes.

A preliminary answer to that question comes from research led by Kathryn Meurs, D.V.M., Ph.D., associate professor of cardiovascular medi-

cine at The Ohio State University. She and her colleagues have analyzed the pedigrees of 43 Great Danes with DCM and determined that — as with other breeds — the condition is genetically based.

Knowledge of whether DCM in Great Danes is truly hereditary — and if so, what the culprit gene is and how it's transmitted — will go a long way toward helping veterinarians diagnose the disease early enough for treatment to have the best chance for success. Such screenings also will help breeders eliminate affected lines — and with them, the disease — from their breeding programs.

### The Heart of the Matter

To understand DCM, it is important to understand how the heart works. The heart is like a house with four rooms, or chambers. In the upper half of the heart are two chambers: the right and left atriums. The lower portion contains the right and left ventricles. These four chambers work together to pump blood through the body.

Blood enters the heart at the right atrium, where it is stored briefly before being pumped down into the right ventricle, which in turn pumps blood into the lungs. In the lungs, the blood receives oxygen before flowing back to the heart, this time to the left atrium. The blood stays in the left atrium for a few seconds before being pumped down into the left ventricle. From there, the blood is pumped throughout the rest of the body.

Valves regulate the flow of blood to help the heart work efficiently.



These valves, located between the atrium and ventricle on each side of the heart, serve as doors between the two areas. When either atrium fills with blood, the valve between the atrium and the ventricle closes to prevent blood from entering the ventricle prematurely. When the valve opens, the blood passes down to the ventricle; once the blood reaches the ventricle, the valve closes again to prevent the blood from flowing back into the atrium.

This movement of blood through the body requires muscle power from the heart, particularly from the left side. In fact, the heart is made of a special type of smooth muscle called myocardium. Thus, the term dilated cardiomyopathy literally means "enlarged heart muscle disease."<sup>2</sup>

### DCM Symptoms

A Great Dane's DCM begins long before the dog shows symptoms. The disease starts when individual heart cells waste away and are replaced by scar tissue. As the condition



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## Dilated Cardiomyopathy

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progresses, the accumulated scar tissue causes the heart to lose its capacity to pump blood throughout the body. As the heart's pumping capacity deteriorates, a Great Dane begins to exhibit classic symptoms of congestive heart failure: coughing, exercise intolerance and weight loss.<sup>3</sup>

These symptoms occur because the scar tissue in the heart reduces the organ's pumping efficiency. Consequently, the volume of blood and pressure within the heart increases. This increased blood and pressure, combined with the heart's effort to compensate for lost pumping vigor, causes the organ to enlarge; however, the enlargement doesn't fully offset the heart's deteriorating efficiency. Eventually the accumulated blood backs up into the lungs, causing coughing and labored breathing characteristic of heart failure. Without treatment, a dog eventually dies.

Great Danes with DCM also may develop a dangerous complication: a disruption in their heartbeat, called an arrhythmia. These disruptions occur when the scar tissue that replaces the atrophied myocardium disrupts the electrical impulse traveling from the brain to the heart to start each heartbeat. These interruptions generally are expressed as premature ventricular contractions (PVC) or atrial fibrillation (AF). With a PVC, the ventricle beats earlier than it should; with an AF, a storm of electrical energy causes the upper chambers of the heart to quiver or vibrate. Either way, aggressive arrhythmias can be fatal unless the heart's normal rhythm is resumed quickly.

Right now, there is no cure for DCM. Once symptoms become apparent, treatment focuses on controlling symptoms. Veterinarians dealing with this condition try to achieve two goals: control the signs of heart failure and improve the heart's function. For the latter goal, medications such as Lanoxin® can improve the heart's contracting abili-

ty, and vasodilators such as Vasotec® and Enacard® can reduce stress on the heart. To deal with heart failure, veterinarians rely on diuretics such as Lasix®, which help to control the amount of fluid that accumulates in the lungs.

The prognosis for dogs with DCM is generally poor, although Great Danes that receive treatment are known to survive longer than other breeds with the disease, particularly Dobermans. Still, the key to helping a Great Dane with DCM is to diagnose the disease before symptoms of heart failure develop or before arrhythmia causes sudden death.

### Dealing with DCM

The first step toward dealing proactively with DCM in Great Danes is to have the heart checked annually by a veterinarian. That checkup should include an electrocardiogram (ECG).<sup>1</sup>



The ECG makes an electronic recording of the heart's action and may detect the presence of arrhythmias. If the ECG indicates the presence of abnormalities, the next step is an echocardiogram. This ultrasound examination of the heart can confirm a possible DCM diagnosis.<sup>1</sup>

Future prospects for early DCM screening could improve significantly now that scientists are beginning to understand how the disease is transmitted in Great Danes. A grant from the American Kennel Club (AKC) Canine Health Foundation is supporting the research of Meurs and her team at The Ohio State University.

Most significantly, Meurs and her group have been able to make a preliminary determination that DCM in Great Danes probably is an X-linked

recessive trait.<sup>1</sup> This determination not only makes possible specific breeding recommendations, it also provides valuable clues in identifying the specific gene or genes that cause DCM in the Great Dane.

In an article published in the March 2001 issue of the *Journal of the American Veterinary Medical Association*,

### Symptoms of Dilated Cardiomyopathy

- Interruption of heart rhythm (arrhythmia) shown on electrocardiogram
- Exercise intolerance
- Loss of appetite
- Weight loss
- Cough
- Distended abdomen

Meurs explains that an X-linked recessive trait is one that:

- a sire cannot transmit to male offspring;
- results in a higher proportion of affected males than affected females; and
- results in affected females having an affected sire and an affected or carrier dam.

Consequently, Meurs recommends that Great Danes with DCM not be used for breeding and that female offspring of affected dogs be used with caution. She also notes that the male offspring of affected females have a relatively higher risk of developing DCM and that such offspring should be evaluated regularly for early signs of the condition.<sup>1</sup>

The preliminary determination that DCM is an X-linked recessive trait in Great Danes also offers a possible clue in the hunt for the gene that carries the trait. Meurs notes that in human beings, changes in the dystrophin gene have been implicated in the development of X-linked DCM.<sup>1</sup>

Meanwhile, Meurs and her team are continuing their effort to understand DCM in Great Danes. She is evaluating additional dogs — her evaluation pool now includes 26 Danes — and she is collecting DNA samples from each. In addition, she is performing the first molecular evaluation of the Great Dane's dystrophin gene to determine whether this gene indeed carries the DCM trait from one generation to the next.

All these developments may mean that soon Great Dane breeders and owners may be able to eliminate DCM from their bloodlines. By finding the culprit gene, scientists will be able to develop DNA testing for dilated cardiomyopathy that will enable early screening for this disease and new hope for breeders and owners of Great Danes. ■

<sup>1</sup> Meurs K, et al. Clinical features of dilated cardiomyopathy in Great Danes and results of a pedigree analysis: 17 cases (1990-2000). *Journal of the American Veterinary Medical Association*. 2001; 218:5, p. 729-732.

<sup>2</sup> Siemens L. Dilated Cardiomyopathy in the Doberman Pinscher. *Doberman Quarterly*. Winter 1998.

<sup>3</sup> Dilated Cardiomyopathy: What Can Be Done Now? Doberman Pinscher Foundation of America. <http://www.dpfa.org/dcm.html>.

