

Client Information Series

Dilated Cardiomyopathy (DCM)

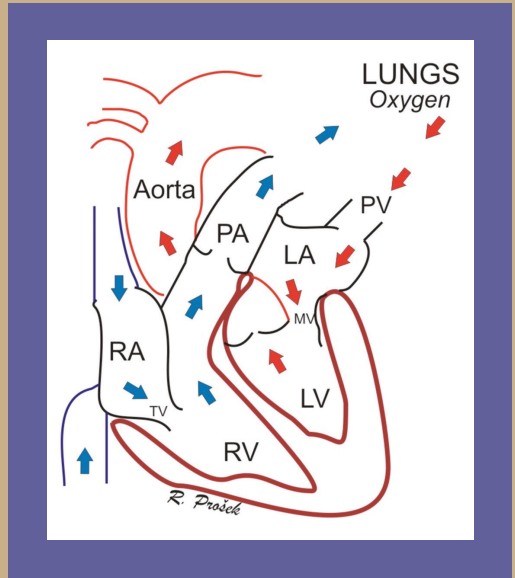


**VETERINARY MEDICAL
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How does the normal heart work?

The heart is the organ responsible for pumping blood to and from all tissues of the body. The heart is divided into right and left sides. The job of the right side is to pump oxygen-deficient blood returning from the body through the lungs to be reoxygenated, and to get rid of the carbon dioxide waste that the body produces. After the blood passes through the lungs and picks up oxygen and gets rid of the carbon dioxide waste it enters the left side of the heart where it is pumped out to the body through the aorta and other arteries. The picture below illustrates the pathway that blood takes as it moves through the heart. The structures shown red contain blood that has lots of oxygen whereas the structures shown in blue contain blood that has very little oxygen and high levels of carbon dioxide.

Blue arrows represent deoxygenated blood flowing through the right side of the heart to the lungs, where red arrows represent oxygenated blood leaving the lungs through the left side of the heart.
RA = right atrium, RV = right ventricle, TV = tricuspid valve,
PA = pulmonary artery, PV = pulmonary vein, LA = left atrium, MV = mitral valve, LV = left ventricle.



Each side of the heart has two chambers, an upper atrium and a lower ventricle. Between the atrium and ventricle on each side lies a valve – the tricuspid on the right and the mitral on the left – that regulates blood flow into the lower ventricular chambers. As the heart pumps (squeezes), these valves act as one-way gates allowing blood to flow from the atrium above to the ventricle below and preventing blood from flowing backwards into the atrium when the ventricle squeezes. From the ventricles, blood is then forced to flow out into the lungs through the pulmonary artery (on the right) or out to the body through the aorta (on the left) through a second series of one-way valves (the pulmonic valve on the right and the aortic valve on the left). The number of heartbeats per minute (heart rate) and the type of heartbeats is controlled by the electrical system in the heart. Normal heartbeats start in the right atrium, but in sick hearts, heartbeats can start from any chamber.

What is dilated cardiomyopathy (DCM)?

DCM is a disease that causes the heart muscle cells (myocardium) to become weak and frequently causes abnormal heart beats (an arrhythmia) to occur. Both of these problems can cause the heart to lose its ability to contract or pump blood effectively out to the body. DCM can affect both sides of the heart simultaneously or separately but typically it affects the left sided chambers,



especially the left ventricle. DCM eventually leads to two main types of problems that can occur alone or together. First, because the heart muscle is weak and does not pump blood effectively, blood backs up in the heart chambers and causes them to enlarge or dilate. In some dogs that have DCM when the heart is significantly dilated the mitral (+/-tricuspid) valves can leak and cause a heart

murmur that your veterinarian can hear with a stethoscope. Second, abnormal heartbeats can occur intermittently though-out the day and night and can reduce the amount of blood pumped to the body and this can lead to weakness or fainting or even sudden death. In cases where the heart chamber size and pumping function are still normal but abnormal heartbeats are present DCM is often referred to as the arrhythmogenic form of DCM. In some dogs that have DCM your veterinarian may hear abnormal heartbeats or abnormal heart sounds with a stethoscope. Many dogs with DCM do not have heart murmurs, abnormal heartbeats or abnormal heart sounds when your veterinarian listens with a stethoscope.

What types of dogs does DCM affect?

DCM is a relatively common heart disease in the dog accounting for approximately 10% of all heart disease. Large and giant breeds are most commonly affected. DCM is very rare in smaller breed dogs (< 30lb or 13.6kg) and cats. The risk of getting DCM increases as dogs get older and rarely occurs in dog that are < 4 years old. Certain breeds have a higher risk of developing DCM, especially Doberman Pinschers.

General risk factors for DCM:

- Dog
- Older (> 4 years)
- Large or giant breed (>30 lb or 13.6 kg)
- High-risk breeds, including:
 - *Doberman Pinscher* (Approximately 60% chance of developing DCM at some point during their life)
 - *Cocker Spaniels*
 - *Boxers* (May get the arrhythmogenic form of DCM—chamber size and pump function is normal but abnormal heart beats are present—as young as 1 year of age)
 - *Great Danes*

What are the causes of DCM?

There are many theories as to the cause of DCM, however the true cause has not been identified and is often referred to as idiopathic for that reason. A familial or inherited genetic component is believed to exist in most cases. However, specific genetic evidence for the majority of DCM cases is lacking.

DCM may be related to a nutritional deficiency in taurine in some dogs and cats but this is a very rare cause of DCM. Taurine is an amino acid required for the development and function of the heart muscle cells. Therefore, some pets (especially Cocker spaniels) may develop DCM if they eat taurine deficient diets or if they cannot absorb taurine normally from the food they eat.

Note: The majority of cases of DCM that are supplemented with taurine will NOT improve. However, if your pet is diagnosed with DCM, ask your veterinarian if they feel that your pet would benefit from taurine supplementation.

L-carnitine is another amino acid that is required for the heart muscle cells to produce energy and pump normally. A nutritional deficiency in L-carnitine can also lead to the development of DCM in some dogs (especially some Boxers and Cocker spaniels). However, the role of L-carnitine deficiency in most dogs with DCM is unknown.

Note: The majority of cases of DCM that are supplemented with L-carnitine will NOT improve. However, if your pet is diagnosed with DCM, ask your veterinarian if they feel that your pet would benefit from L-carnitine supplementation.

What happens to my dog when it gets DCM?

There are two main forms of cardiomyopathy in the dog. The first causes the heart muscles to get weak. This causes blood to back-up into the heart chambers and then the heart chambers enlarge or dilate. The second form causes abnormal heartbeats to occur. Dogs with DCM can have one form at time or suffer from both forms at the same time. Early in the course of the disease dogs with DCM feel and act normal and the only evidence that they have DCM may be the fact that your veterinarian heard a heart murmur, abnormal heartbeat(s) or an abnormal heart sound. In some cases DCM may be diagnosed because

your dog underwent a screening test, such as an echocardiogram or Holter recorder, because they are considered to be a high-risk breed such as a Doberman or a Boxer. At this stage DCM is typically called asymptomatic, preclinical or occult (Stage B). The majority of dogs with asymptomatic DCM will develop 'clinical signs' 6-24 months after they are diagnosed with asymptomatic DCM. In



general, the dogs with the biggest (most dilated) hearts and the dogs with the most abnormal heartbeats are the most likely to develop 'clinical signs'. The clinical signs or clues that you might notice if your dog has DCM include: fast breathing, increased effort when breathing, coughing or fainting (see the list below). In some cases the first sign that a dog has DCM could be that they die suddenly.



The problems or 'clinical signs' occur when the pressures in the dilated heart chambers cause fluid to leak out of the blood vessels into the lungs (called pulmonary edema) and sometimes the belly (ascites) or when there are a lot of abnormal heartbeats. Once a dog develops clinical signs it is considered to have symptomatic DCM. The build up of fluid in the symptomatic stage is called congestive heart failure (Stage C).

Clinical signs that may be associated with DCM in dogs, include:

Note: These clues represent 'clinical signs' that may occur in dogs with DCM but can also occur with other diseases. However, if you know your dog has DCM you should always watch for them to develop and if they do you should contact your veterinarian. Not every dog will develop all of the following 'clinical signs' and many dogs will have more than one.

- Fast breathing when resting or sleeping (> 30-35 breaths per minute)
Note: for details on how and why to evaluate this in your dog see the section on evaluating home breathing rates below
- Increased effort associated with breathing
- Restless sleeping, moving around a lot and changing positions
- Coughing or gagging
- Weakness
- Reduced ability to exercise
- Collapse or fainting
- Decreased appetite
- Weight loss
- Distended belly
- Depressed attitude or quiet and not interactive
- Sudden death

How can my veterinarian determine if my dog has DCM?

Because the majority of dogs with asymptomatic DCM are normal and often have no abnormalities that can be detected by your veterinarian with a stethoscope they frequently do not get diagnosed with DCM until they are symptomatic.

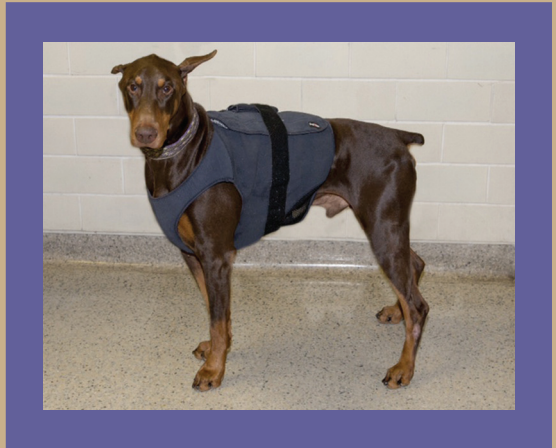
In some high risk breeds such as the Boxer and Doberman pinscher your veterinarian may recommend annual screening tests to determine if DCM is present even if you dog is apparently healthy.

Screening tests for DCM that my veterinarian my recommend:

Note: Screening tests are typically only recommended in high-risk breeds and some of these tests may require referral to a veterinary cardiologist or other veterinary specialist. Other tests maybe recommended if DCM is diagnosed (see below).

- Echocardiogram-ultrasound of the heart
- Holter recorder-24 hr ECG that your dog wears home to detect abnormal heart beats
- ECG-3 minute evaluation that is done in the hospital to detect abnormal heart beats
- NT-proBNP-might be used in Dobermans to help determine if your Doberman should have an echocardiogram
- Genetic tests-might be used in combination with other screening tests

Note: These genetic tests are only available for certain high-risk breeds such as the Doberman and Boxer. It is important to know that a positive genetic test does not mean that your dog has DCM or will get DCM and a negative test does not mean they cannot get DCM. These tests are typically most useful for breeders to help plan breeding programs.



What tests might be recommended by my veterinarian once my dog has DCM?

Asymptomatic dogs with DCM:

If your dog is asymptomatic (no clinical signs of DCM are present as outlined above) and your veterinarian detects a murmur, abnormal heart beats or an abnormal heart sound with a stethoscope they will recommend test(s) to help them determine if DCM is present and to determine if your dog should start taking any heart medications. Some tests are done to determine if there are any other problems that would be bad for dogs to have if they have DCM, for example high blood pressure or kidney disease.

Symptomatic dogs with DCM (heart failure and or abnormal heartbeats)

Dogs with one or more of the clinical signs listed above could have heart failure and require medications. Your veterinarian will recommend tests to help determine the cause of the clinical signs and help them select the appropriate medications.

- Chest radiographs identify any pulmonary edema (fluid in the lungs backed up from the heart) and evaluate the heart size
- Echocardiogram-ultrasound of the heart to confirm the diagnosis and evaluate the size and function of the heart
- ECG identify abnormal heart beats
- Holter recorder-24 hour ECG that the dog wears home to help evaluate abnormal heartbeats
- Blood tests evaluate kidney and liver function
- Urine test evaluates kidney function
- Thyroid blood test
- Blood pressure
- NTproBNP to evaluate the pressure in the heart
- Genetic testing is available for the in the Boxer and Doberman but does not replace other important tests and cannot diagnose DCM
- Referral to a veterinary cardiologist may be suggested in some cases

How is DCM treated in dogs?

The treatment of DCM depends on the stage of the disease and the individual dogs problems.



Asymptomatic dogs with DCM:

There are 3 medications that are commonly used to treat asymptomatic DCM; pimobendan (Vetmedin), an angiotensin converting enzyme inhibitor (enalpril or benazepril), and an antiarrhythmic (sotalol). These medications can be used alone or together and in some cases other medications may also be prescribed. The goal of these medications is to slow down the progression of the disease and help your dog stay asymptomatic and live longer.

Symptomatic dogs with DCM

Medications will be prescribed if your dog has clinical signs and the results of the recommended tests have led to a diagnosis of heart failure with or without a large number or abnormal heart beats. These medications will be continued forever, although the doses and frequency of administration may change over time. Sometimes additional medications are required, while others are sometimes stopped. In addition, your dog may need to stay in the hospital for a few days while adjusting to the medications.

Common medications used to treat heart failure and abnormal heart beats due to DCM:

- Furosemide, also known as Lasix®
- Pimobendan (Vetmedin®)

- Angiotensin converting enzyme inhibitor (ACEI), such as benazepril or enalapril
- Spironolactone
- Sotalol, for abnormal heartbeats
- Mexilitine, for abnormal heartbeats
- Diltiazem, for abnormal heartbeats
- Additional medications are frequently indicated in individual dogs

Note: Some medications and herbal supplements can have adverse interactions with heart medications; therefore it is important that you not use any medications (new or previously prescribed) without talking to the veterinarian that prescribes your dog's heart medications.

Common side-effects of medication used to treat heart failure and or abnormal heart beats due to DCM, include:

- Drinking large amounts of water more frequently

Note: It is critical that dogs on medications like furosemide have free choice access to water at all times.

- Urinating larger amounts more frequently

Note: Using 'doggy doors' and being sure to not give the furosemide pills within 2 hours of bedtime or leaving the house for an extended period of time can limit accidents in the house. Dogs always need to urinate within 1-2 hours after receiving furosemide.

- Reduced appetite or not eating normal amounts of food

Note: If this problem starts and persists, you need to talk to your veterinarian; it is important that your dog does not loose weight.

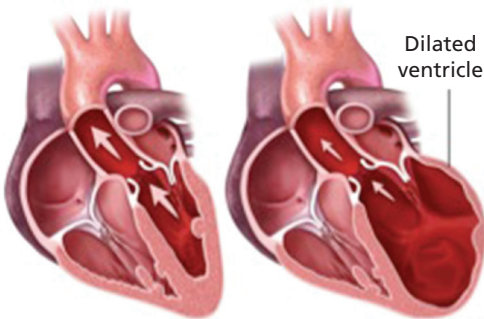
What kind of follow-up will my dog need now that it has DCM?

Recommended follow-up in dogs with asymptomatic DCM (Stage B):

Your veterinarian will recommend recheck appointments every 3-6 months depending on how advanced the disease is. In addition, if and when a medication is started you may need to return in 10-14 days to have a blood test

to check the kidney and liver values, take your dog's blood pressure or re-evaluate the abnormal heart beats. However, if you notice any of the clinical signs listed above at any time, you should not wait for the next recheck appointment, but rather call and make an urgent/emergency appointment. If the clinical signs are severe and or develop suddenly (your dog cannot breath, rest or sleep comfortably

Normal Heart Dilated Cardiomyopathy



or collapses or faints) you may need to take them to the nearest emergency facility as soon as possible. One of the best ways to help your veterinarian determine when to start or adjust your dogs heart medication(s) is to observe and record the home resting/sleeping breathing rate of your dog (see below).

Recommended follow-up in dogs with symptomatic DCM (heart failure and or abnormal heartbeats):

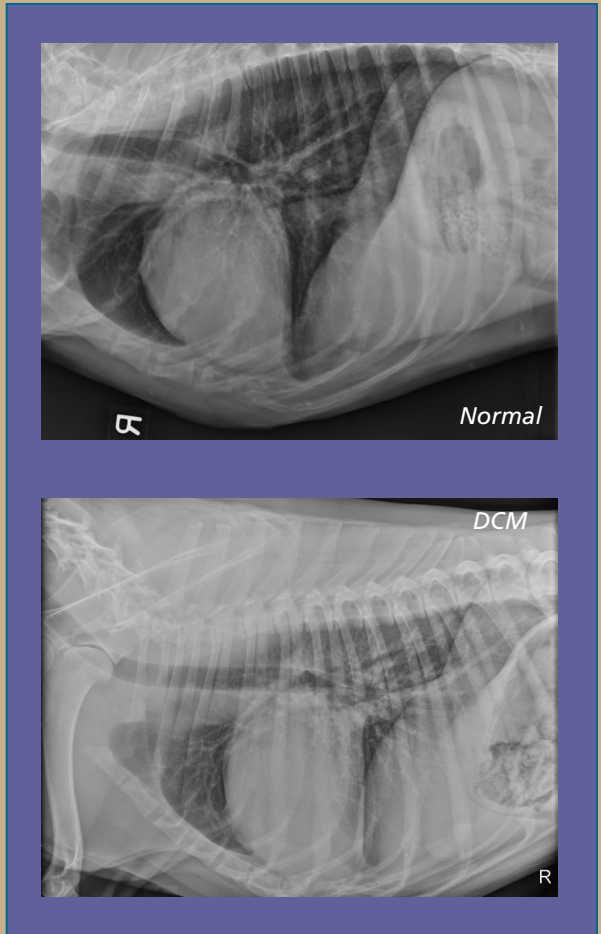
Your veterinarian will recommend a recheck appointment every 2-4 months. In addition, if and when a new medication is started you may need to return in 10-14 day to have a blood test to check the kidney and liver values, and take your dog's blood pressure.

However, if you notice any of the clinical signs listed above at any time, you should not wait for the next recheck appointment, but rather call and make an urgent/emergency appointment. If the clinical signs are severe, and or develop suddenly (your dog cannot breath, rest or sleep comfortably or collapses or faints) you may need to take them to the nearest emergency facility as soon as possible. One of the best ways to help your veterinarian determine when to start or adjust your dogs heart medication(s) is to observe and record the home resting/sleeping breathing rate of your dog (see below).

Why should I evaluate my dog's resting/sleeping breathing rate at home?

An increase in resting or sleeping breathing rate is an important early clinical sign of heart failure that you can evaluate at home.

This is an early clue that heart failure is developing, and your observations can help limit how sick your dog becomes, reduce the chances that your dog will ever have to stay overnight in the hospital, and therefore also help reduce the costs associated with heart failure treatment.



Note: Please see the "Measuring Your Pet's Breathing Rate" brochure in this series for more information on how to monitor your pet's breathing rate at home.

Can special diets help dogs with DCM live longer?

Some animal diet manufacturers have developed heart-specific diets. Some of these diets are severely restricted in salt and some are moderately restricted in salt. The diets that are severely restricted in salt should never be used in asymptomatic dogs with DCM. They may be used in dogs with heart failure as long as the dog will eat them. The heart-specific diets that are moderately restricted in salt (or any diet that is moderately restricted in salt, such as most senior diets) can be used in asymptomatic dogs with DCM. However, while these diets are unlikely to be harmful if used as outlined above, they have not been shown to have any benefit. Therefore, it is unlikely that your veterinarian will recommend that you change your dog's diet if it is otherwise healthy.



Note: It is often beneficial to limit treats that are high in sodium in dogs that have heart disease, especially those in heart failure.

Are there any dietary supplements that may help dogs with DCM live longer?

Supplements are unlikely to be harmful if used as outlined by a veterinarian who is familiar with all the medication(s) your dog is receiving and what type and severity of heart disease your dog is suffering from. However, in most cases there is no proof that your dog needs to take any supplement(s) if they are on a high quality commercial dog food diet. The most common supplement recommended in dogs with DCM is omega 3 fatty acids and in some cases taurine and or L-carnitine. You should discuss any supplements your dog receives, or any new ones you wish to start, with your veterinarian.

What about exercise for my dog once it has DCM?

In general, dogs with both asymptomatic and symptomatic DCM should be allowed to exercise at their normal level if they want to. However, the duration of sustained strenuous activities such as ball retrieval, swimming, Frisbee etc. should be limited especially in really hot or cold weather. Some exercise is good for you and your dog and part of what helps your dog enjoy their life.

Are there any research studies being conducted to learn how to treat DCM more effectively?

Some researchers (Dr. Amara Estrada at the University of Florida Veterinary School) are evaluating stem cell treatment in Dobermans. In future gene therapy may also be available for some dogs. Heart transplantation is not an option in

dogs.

How long will my dog live now that it has DCM?

Asymptomatic dogs with DCM:

On average, the majority of dogs with asymptomatic DCM can live for 1-3 years before they develop any clinical signs of heart failure. However, a few will die suddenly. This can happen at any time but is most common in the dogs that have a lot of abnormal heartbeats and is not painful for your dog. It is however difficult to determine the evolution of an individual, and it is for this reason that your veterinarian recommends tests and recheck appointments.

Symptomatic dogs with DCM:

Once your dog develops clinical signs of DCM, medications can typically eliminate or reduce the severity of the clinical signs but the disease will still progress and eventually the medications will not work as well. In some cases, your dog will seem to be doing very well but will die suddenly. This is most common in dogs with most common in the dogs that have a lot of abnormal heartbeats and is not painful for your dog. Sometimes, new medications can be added or the doses of your dogs' current medications adjusted but eventually this will be insufficient in maintaining your dog's quality of life. Your veterinarian will help you recognize when and if this is the case for your dog. However, in general, with the appropriate medications and recheck appointments, many dogs with heart failure due to DCM live for more than six-12 months.





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