

## Dilated Cardiomyopathy in Dogs

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### *Abstract*

Dilated Cardiomyopathy (DCM) is a disease of predominantly large and giant breed dogs that results in progressive heart muscle dysfunction, chamber dilatation, and eventual congestive heart failure or death of affected patients. The exact cause of the condition is unknown but genetic factors are presumed to play a role. There is no known effective preventative strategy for the condition. Treatment of affected individuals may improve their quality of life, delay the onset of heart failure symptoms and potentially improve life expectancy. Treatment is not curative; however, most affected individuals eventually die from the disease.

**Keywords:** DCM, Treatment, Dogs

### **Introduction**

Cardiomyopathies are recognized as common ailments in small animal clinical practice. Among cardiomyopathies, Dilated Cardiomyopathy (DCM) remains as an independent risk factor for chronic morbidity and mortality (Thomas, 1987). DCM is a primary disease of the heart muscle in which the heart muscle (myocardium) of the lower pumping chambers (ventricles) becomes weak and loses its ability to contract normally. DCM most commonly affects the left side of the heart (the side that receives blood from the lungs and pumps it to the body), specifically the left ventricle. When the myocardium cannot pump blood out of the left heart effectively, the kidneys retain sodium and water to increase the amount of blood returning to the heart. This leads to an enlargement of the ventricles in order to compensate for the ineffective pumping. This is helpful for years but ultimately becomes detrimental when it causes the blood pressure in the heart to back up into the lungs, thereby causing fluid accumulation within the lungs (pulmonary edema). This is called heart failure or Congestive Heart Failure (CHF) (Wynne and Braunwald, 2001). Although less common, DCM affecting the right ventricle can also occur. Blood backs up on the right side, which receives blood from the body and

pumps it to the lungs, resulting in right-sided CHF, where fluid accumulates in the abdomen (ascites) and chest (pleural effusion). DCM affecting the right ventricle is almost always accompanied by DCM of the left ventricle (Sisson *et al.*, 2000; Tidholm *et al.*, 2001).

## CAUSATIVE FACTORS

### Breed predisposition

- There are several breeds that are predisposed to DCM. These include Doberman Pinschers, Great Danes, Irish Wolfhounds, Boxers, Newfoundlands, Portuguese Water Dogs, Dalmatians and Cocker Spaniels. Large and giant breeds are most commonly affected, but it also occurs in smaller breed dogs.
- Genetic factors seem to play a large role in the inheritance and development of DCM in the dog. In fact, the definitive genetic mutation causes DCM in some breeds, such as the Doberman and Boxer. Boxers get a specific type of cardiomyopathy called Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC). They are prone to fainting and sudden death. The fainting most commonly happens when they develop a very fast heart rate (greater than 300 beats/min). Sudden death usually occurs when this fast rate degenerates into ventricular fibrillation (cardiac arrest) (Kittleson and Dion, 1991; McEwan, 2000).

### Nutritional deficiencies

- Taurine is an amino acid required for the development and function of the myocardium. Consequently, pets may develop DCM on taurine-deficient diets, such as vegetarian diets, and may benefit from appropriate supplementation. Some breeds, such as American Cocker Spaniels and Golden Retrievers, may have a predisposition to taurine deficiency, possibly through defects in metabolizing taurine (Martin *et al.*, 2010)
- L-carnitine is another amino acid that has rarely been implicated in the development of DCM in people. L-carnitine is required for the myocardial cells to produce energy and thus contract. There is some evidence that a deficiency in this molecule will contribute to myocardial dysfunction in Boxers (reported in earlier studies). Some American cocker spaniels need to be supplemented with it, along with taurine, to produce a beneficial response.

### Diet

- Grain-free diets, certain boutique diets, and diets with exotic ingredients may also be linked to dilated cardiomyopathy.

### Drug or Toxin induced

- Occasionally, toxins can cause DCM. The most common toxin is Doxorubicin (Adriamycin), an anti-cancer drug used to treat various cancers in dogs. In some cases, dogs receiving Doxorubicin will develop DCM.



### Hormonal problems

- There are a few less common secondary causes of dilated cardiomyopathy. Hormonal issues like hypothyroidism and hypoadrenocorticism (Addison's disease) can predispose dogs to heart diseases (Satish Kumar *et al.*, 2012)

### Infectious (Myocarditis)

- Infectious causes of dilated cardiomyopathy are rare. Puppies infected with parvovirus at two to four weeks of age can develop dilated cardiomyopathy (Braz-Ruivo, 1999).

### CLINICAL SIGNS

- DCM occurs in dogs of all ages, but the risk increases substantially with advanced age. The majority of dogs with DCM were above 6 years of age (Kathryn, 2005).
- Signs of DCM vary depending on the breed of dog and stage of the disease. Loss of appetite, pale gums, increased heart rate, coughing, difficulty breathing, periods of weakness, and fainting are signs commonly seen.
- Since blood is backed up into the lungs, respiratory signs (CHF) due to pulmonary edema are most common. Blood returning to the right side of the heart from the body may also back up leading to fluid accumulation in the abdomen (ascites) or in the chest cavity (pleural effusion). Weakness or collapse may be caused by abnormal heart rhythms (arrhythmias) and occasionally by decreased blood flow to the body (depressed cardiac output).
- In some breeds, sudden death or fainting can occur well before any signs of CHF.

### DIAGNOSIS

- The identification of DCM is initially based on physical examination findings, chest radiographs, electrocardiography, and recognition of characteristic features (dilated poorly contracting heart) on an echocardiogram.
- Chest radiographs identify any pulmonary edema (fluid in the lungs backed up from the heart) or pleural effusion (around the lungs) and evaluate the heart size.
- The echocardiogram is interpreted in conjunction with several other tests to rule out systemic conditions that can cause similar echocardiographic findings such as a low thyroid level, amino acid deficiency (taurine, carnitine), inflammation of the heart muscle (myocarditis), or decreased blood flow to the heart muscle (ischemic heart disease) (Paul Wotton, 2010).
- In some breeds (Boxer, Doberman pinscher), screening with a 24-hour ECG recording (Holter monitor) may be able to identify animals early in the course of the disease process so that they can be removed from the breeding population if they are potential breeding animals (Jeyaraja *et al.*, 2008).



- In other affected individuals, a Holter monitor may be recommended to determine the frequency and severity of irregular heart rhythms to help guide treatment.
- Genetic mutation causing DCM is known in a certain breed (Doberman, Boxer), DNA from a cheek swab or blood sample can be used to screen for the disease.

## **TREATMENT**

- There are no proven strategies for preventing the development of DCM, although many medical protocols and nutritional supplements have been proposed. Some medical therapies have been demonstrated to delay the progression of DCM once a diagnosis is reached, and in patients with underlying conditions causing heart muscle weakness (thyroid deficiency, taurine deficiency), supplementation with the appropriate therapies can halt or reverse the heart muscle changes.

### **Diuretics**

These are drugs that stimulate the kidneys to remove excess fluid from the body. Furosemide and spironolactone are two commonly used diuretics.

### **Angiotensin converting enzyme (ACE) inhibitors**

ACE-inhibitors work by lowering blood pressure and reducing the after-load or resistance to blood flowing out of the heart. ACE-inhibitors are the only drugs proven to extend life expectancy in both humans and dogs. Enalapril and benazepril are commonly used ACE-inhibitors in dogs.

### **Cardiac glycosides**

These drugs improve heart function in several ways. They slow the heart rate and strengthen heart contractions, so the blood is pumped more effectively. Digoxin is the most common digitalis glycoside used in veterinary medicine. Because of the potential for toxic side-effects, the dose must be closely regulated and monitored through routine blood tests and ECG (Electrocardiography) analyses.

### **Vasodilators**

These drugs dilate the arteries or veins of the body so that the heart does not have to work so hard to pump blood to the body. ACE-inhibitors have vasodilator activity and are the vasodilators used most widely in the therapy of congestive heart failure associated with DCM.

### **Bronchodilators**

These drugs make breathing easier for dogs experiencing DCM. It includes theophylline and aminophylline.

### **Pimobendan**

This drug lowers the pressure in the arteries and veins and improves the heart muscle strength, therefore increasing blood flow to the body.



## Anti-arrhythmic drugs

Many dogs with DCM have arrhythmias. If arrhythmias are not controlled with the above medications, antiarrhythmic drugs may be added cautiously. Two main classes are beta-blockers (Atenolol, sotalol, carvedilol) and calcium channel blockers (Diltiazem). Other types of antiarrhythmic drugs used long term can include procainamide, mexiletine, and amiodarone.

## CONCLUSION

Dilated Cardiomyopathy in dogs is a disease that causes enlargement of the heart, meaning it cannot pump blood effectively. Treatment and prognosis can vary depending on the underlying causes. The prognosis for dogs with secondary dilated cardiomyopathy is generally good, as long as the underlying disease can be identified and treated. However, the prognosis for dogs with primary dilated cardiomyopathy is more variable and depends on their condition. Boxers and Dobermans with inherited heart disease typically live only for a few weeks to a few months after diagnosis. Dogs with dilated cardiomyopathy will require monitoring for the rest of their lives.

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