

# Dilated Cardiomyopathy in Dogs

(A Type of Heart-Muscle Disease)

## Basics

### OVERVIEW

- The heart of the dog is composed of four chambers; the top two chambers are the left and right atria and the bottom two chambers are the left and right ventricles; heart valves are located between the left atrium and the left ventricle (mitral valve); between the right atrium and the right ventricle (tricuspid valve); from the left ventricle to the aorta (the main artery of the body; valve is the aortic valve); and from the right ventricle to the main pulmonary (lung) artery (pulmonary valve)
- “Cardiomyopathy” is the medical term for disease of the heart muscle; “dilated cardiomyopathy” (DCM) is a disease in which the heart muscle is flabby and weak
- Dilated cardiomyopathy in dogs is characterized by left- and right-sided enlargement of the lumen of the chambers of the heart; normal coronary arteries; normal (or minimally diseased) atrioventricular valves (that is, the mitral and tricuspid valves); significantly decreased ability to contract the heart muscle; and heart-muscle dysfunction



### GENETICS

- Genetic cause or heritable susceptibility strongly suspected in most affected breeds and documented in some breeds (Portuguese water dog, boxer, and Doberman pinscher), with variable forms of inheritance
- A genetic test is available commercially for the genetic mutations in the boxer and Doberman pinscher; these particular genetic mutations do not appear to cause dilated cardiomyopathy in other breeds that are likely to develop the disease

### SIGNALMENT/DESCRIPTION OF PET

#### Species

- Dogs

## **Breed Predilections**

- Doberman pinscher, boxer
- “Giant” breeds: Scottish deerhound, Irish wolfhound, Great Dane, Saint Bernard, Afghan hound, Newfoundland
- Cocker spaniel, Portuguese water dog

## **Mean Age and Range**

- 4–10 years of age

## **Predominant Sex**

- Males are more likely to be affected than females in most, but not all, breeds

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

- Some dogs do not have clinical signs, having what is termed “preclinical dilated cardiomyopathy” and appear normal
- Rapid breathing (known as “tachypnea”), difficulty breathing (known as “dyspnea”), coughing
- When listening to the chest with a stethoscope, may hear muffled breath sounds due to the presence of fluid between the chest wall and lungs (known as “pleural effusion”) or may hear short, rough snapping sounds (known as “crackles”) due to the presence of fluid in the lungs (known as “pulmonary edema”)
- Weight loss
- Weakness, sluggishness (lethargy), lack of appetite (known as “anorexia”)
- Abdominal swelling or distention
- Fainting (known as “syncope”) usually associated with heart rhythm disturbances
- Depression
- Possible cardiogenic shock (condition in which the heart is unable to pump adequate blood to the tissues and the tissues become oxygen starved)
- Abnormal femoral pulses from the low volume of blood being pumped by the heart (known as “cardiac output”)
- Irregular heartbeats (known as “arrhythmias”)
- Pulse deficits with irregular or rapid heartbeats (such as seen with atrial fibrillation, ventricular or supraventricular premature contractions, and paroxysmal ventricular tachycardia); the “pulse” is the rhythmic “throbbing” of the arteries as the heart beats—normally the artery “throbs” each time the heart beats so that the pulse and the heart rate are the same; pulse deficits occur when the pulse and heart rate do not match, with the number of pulses being lower than the number of heart beats—pulse deficits usually indicate serious disease as the heart is unable to pump adequate blood with each heart beat
- The external jugular veins (located on either side of the neck) may have a pulse from backflow of blood through the tricuspid valve (known as “tricuspid regurgitation”), irregular heartbeats (arrhythmias), or right-sided congestive heart failure (CHF); “congestive heart failure” is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs
- Muffled breathing sounds when fluid is present
- Heart murmur or abnormal heart sounds
- Pink color of the gums is slow to return when the gums are blanched by finger pressure (known as “poor capillary refill time”)
- Bluish discoloration of the skin and moist tissues (known as “mucous membranes”) of the body caused by inadequate oxygen levels in the red blood cells (known as “cyanosis”)—infrequent
- Enlarged liver, with or without buildup of fluid in the abdomen (fluid known as “ascites”)

## **CAUSES**

- Primary mechanism yet to be identified and is of unknown cause (so-called “idiopathic disease”) in the vast majority of cases
- Majority of cases probably represent familial (runs in certain families or lines of dogs) abnormalities of structural or contractile heart proteins
- Nutritional deficiencies (taurine and/or carnitine) have been documented in several breeds, including golden retrievers, boxers, Newfoundlands, Doberman pinschers, and cocker spaniels; “taurine” is an amino acid (the smallest component of protein); “carnitine” is a compound involved in enzymes that transport fatty acids, which are important in the heart for energy

- Viral, protozoal, and immune-mediated mechanisms have been proposed
- Inadequate thyroid hormone (known as “hypothyroidism”) or tricuspid heart valve malformations present at birth may cause reversible heart-muscle failure

## Treatment

### HEALTH CARE

- With the exception of severely affected dogs, most therapy can be administered on an outpatient basis

### ACTIVITY

- Allow the dog to choose its own level of activity

### DIET

- Maintain adequate caloric intake during initial treatment for clinical signs
- Goal: reduce dietary sodium intake
- Severe sodium restriction typically is not necessary when using various heart medications Best to use commercially prepared diets

## 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
- In a trial (PROTECT Trial), early intervention with pimobendan changed the course of disease when given in Doberman Pinschers

### INITIAL STABILIZATION

- Treat low levels of oxygen in the blood (known as “hypoxemia”) with oxygen administration; prevent heat loss, if the pet has low body temperature (hypothermia) by placing in a warm environment; the veterinarian will wait to administer fluids only after fluid buildup in the lungs (pulmonary edema) is controlled and/or fluid buildup in the space between the chest wall and lungs (pleural effusion) has been drained
- If fluid buildup in the lungs (pulmonary edema) is present: medications to remove excess fluids from the body (known as “diuretics”), such as furosemide will be administered
- 2% topical nitroglycerin for the first 24–48 hours for pets with severe fluid buildup in the lungs (pulmonary edema) may be given
- If pleural effusion is present, drainage will be done
- If severe heart failure and cardiogenic shock (condition in which the heart is unable to pump adequate blood to the tissues and the tissues become oxygen starved) are present, dobutamine (drug to increase contraction of the heart muscle) may be indicated; pimobendan may be beneficial as well
- Other medications (such as lidocaine or procainamide) may be administered for certain irregular heartbeats (arrhythmias)

### MAINTENANCE THERAPY

- Medications to enlarge or dilate blood vessels (known as “vasodilators”)—especially the angiotensin converting enzyme (ACE) inhibitors (such as enalapril, benazepril, lisinopril) are considered a cornerstone of therapy for dilated cardiomyopathy
- A daily maintenance dose of digoxin is given to some giant-breed dogs; digoxin is used primarily for control of ventricular response rate in atrial fibrillation (rapid, irregular heart rhythm involving the top two chambers of the heart [atria])
- Pimobendan is used to improve heart-muscle contraction
- Furosemide (a diuretic to remove excess fluid from the body) is used to control fluid buildup in the lungs (pulmonary edema), in the space between the chest wall and lungs (pleural effusion), or in the abdomen (ascites)
- Spironolactone (a diuretic to remove excess fluid from the body) may be given with or without hydrochlorothiazide, a third diuretic

- Beta-blockers can be used cautiously once heart failure is controlled with other drugs; if tolerated, may improve heart-muscle function with long-term (chronic) use—Carvedilol is an example
- The role of taurine and carnitine in the therapy of dilated cardiomyopathy remains controversial; however, American cocker spaniels with dilated cardiomyopathy generally respond favorably to taurine and l-carnitine supplementation when used in addition to cardiac medications

## **IRREGULAR HEART BEATS (ARRHYTHMIAS)**

- In the case of atrial fibrillation (rapid, irregular heart rhythm involving the top two chambers of the heart [atria]), slowing of the ventricular response rate is achieved with long-term (chronic) administration of extended release diltiazem or atenolol, sometimes combined with digitalis
- Therapeutic goal is obtaining a resting ventricular rate between 100 and 140 beats per minute
- Amiodarone may either control ventricular response rate or in some cases result in conversion to normal heart rhythm
- Long-term (chronic) oral therapy for fast heart rate originating in the ventricles (known as “ventricular tachycardia”) includes procainamide, mexiletine, amiodarone, or sotalol
- Procainamide and mexiletine can be combined with a beta-blocker, if necessary

## **Follow-Up Care**

### **PATIENT MONITORING**

- Serial clinical examinations, chest x-rays (radiographs), blood-pressure measurements, routine blood work (serum biochemical evaluations, including electrolytes) and electrocardiograms (ECGs, recordings of the electrical activity of the heart) are most helpful
- Repeat echocardiography (use of ultrasound to evaluate the heart and major blood vessels) rarely is informative or indicated
- Serial evaluation of serum digoxin levels (therapeutic range, 0.5–1 ng/ml) taken 6–8 hours following administration of the pill and serum biochemistries may help prevent side effects of the drug

### **POSSIBLE COMPLICATIONS**

- Sudden death due to irregular heartbeats (arrhythmias)
- Side effects of drugs associated with medical management

### **EXPECTED COURSE AND PROGNOSIS**

- Always fatal
- Death usually occurs 6–24 months following diagnosis
- Doberman pinschers typically have a worse prognosis, with survival generally less than 6 months from the time of diagnosis (addition of pimobendan in their treatment may increase survival time substantially)

## **Key Points**

- Understand potential signs associated with progression of disease and adverse side effects of medications
- Monitoring resting breathing rate often gives insight into worsening condition