

# Degenerative Valve Disease and Congestive Heart Failure

## How Does the Heart Work?

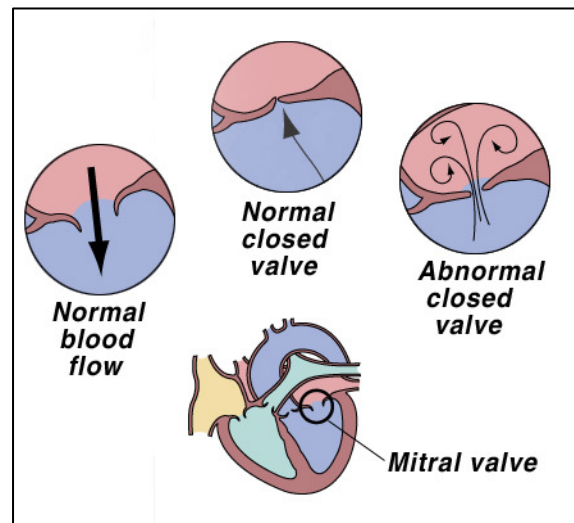
The heart is the organ responsible for pumping blood to and from all tissues of the body, and is divided into right and left sides. The job of the right side is to pump oxygen-deficient blood returning from the body into the lungs to get more oxygen to take back to the body, and to get rid of the carbon dioxide that the body produces. Returning from the lungs, the now-oxygenated blood enters the left side of the heart where it is pumped out into the aorta and to the body via the arteries.

Each side of the heart also has two chambers, an upper atrium and a lower ventricle. The left ventricle is surrounded by the largest and strongest of the heart muscles. This large muscle is necessary to pump blood throughout the body. 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 chambers. As the heart pumps, 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. From the ventricles, blood is then forced to flow out into the pulmonary artery (on the right) or the aorta (on the left) through a second series of one-way valves (the pulmonic valve and the aortic valve).

## What Is Degenerative Valve Disease?

Because of the high pressure created when the left ventricle contracts, the mitral valve may begin to leak or “wear out” in some dogs. This is known as mitral valve insufficiency (MVI) and is often associated with a heart murmur and left-sided congestive heart failure (LS-CHF).

Degenerative valve disease (DVD), also called endocardiosis, valvular regurgitation, valvular insufficiency or chronic valve disease, refers to a degeneration of the cardiac valves, not caused by infection. In dogs and cats, the most commonly affected valve is the mitral valve (on the left side of the heart), followed by the tricuspid valve (on the right side of the heart). The pulmonic and aortic valves are rarely affected by this condition. For reasons we don't completely understand, the mitral or tricuspid valve leaflets can become abnormally thickened and develop a nodular appearance in some breeds (see below). These, and other changes to the valves, impede their ability to form a tight seal between the atrium and ventricle during systole (contraction of the heart muscle) – they begin to leak. As a result, some of the blood in the ventricle now flows back into the atrium through the leaky valve (known as regurgitation) instead of moving forward from the ventricle into the aorta (on the left side) or pulmonary artery (on the right side) with each beat. The consequences of this are discussed below.



## What Animals Are Affected by DVD?

Approximately 10% of all dogs will develop some form of heart disease. Degenerative valve disease accounts for about 75-80% of cardiovascular disease in dogs. Approximately 60% of affected dogs have degeneration of the mitral valve, 30% have problems in both the tricuspid and mitral valve leaflets, and 10% have only tricuspid valve disease. In dogs, the disease is age and breed-related, with older, small-breed dogs more commonly affected.

Miniature poodles, Cocker Spaniels, Miniature Schnauzers, and Dachshunds are the most commonly affected breeds. Cavalier King Charles Spaniels, another commonly affected breed, tend to develop DVD

earlier in life with a faster progression than the other small breed dogs. Terrier breeds are also commonly seen with DVD.

Larger breeds are also affected by this disease (most commonly the mitral valve leaflets) although much less often.

Degenerative valve disease is uncommon in cats.

## **How Does DDV Affect your Pet?**

The outcome of DVD in dogs depends on the severity of the condition. The clinical signs depend on which valve is affected. Some dogs are never bothered by a leaky valve, and others have severe debilitation, and can even die from the problem. A heart murmur does not mean that heart failure is imminent. But as time goes on, the leak may become more severe as more and more blood flows backwards. If things progress, this results in reduced pumping efficiency and eventually congestive heart failure. From the time a murmur develops, it may be a few months to several years until heart failure occurs, if it occurs at all.

The regurgitation of blood due to DVD causes a murmur when your veterinarian listens to your dog's heart – often the first sign of a leaky heart valve. When mitral regurgitation is substantial, the flow of blood back into the left atrium results in a blood volume overload inside the left atrium and left ventricle, causing these chambers to get bigger as they attempt to accommodate the extra blood. If the regurgitation is severe, then the chamber enlargement reaches a limit and the pressure inside these chambers begins to increase. If the left atrial pressures become significantly high as a result of increased blood volume, fluid within the lung vessels (which are connected to the left atrium) begins to leak out, resulting in clinical signs of congestive heart failure (also known as pulmonary edema, or fluid in the lungs) . Dogs and cats with fluid in the lungs do not breathe well.

Congestive heart failure due to DVD of the mitral valve usually presents as coughing, shortness of breath and rapid breathing. The generalized decrease in effective forward circulation of blood to the tissues of the body may also manifest as lethargy, exercise intolerance, lack of appetite, blue color to the gums, or weight loss.

Tricuspid valve DVD has a similar course of events as mitral valve DVD, but instead of fluid building up in the lungs (pulmonary edema), fluid builds up in body cavities – the belly, the pleural space (chest cavity around the lungs), or in the sac around the heart (the pericardium). Dogs with right-sided congestive heart failure tend to develop a grossly distended abdomen. This can cause some discomfort, especially when lying down, and can cause a shortness of breath, especially when sleeping or resting.

## **How Will I Know if my Pet Goes into Congestive Heart Failure?**

When the heart is not properly pumping blood, the blood moves more slowly through the lungs. This results in small amounts of fluid leaking out of the capillaries into the air passageways. This fluid collection produces the earliest signs of heart failure that include gagging as if trying to clear the throat, a chronic, hacking cough, and lack of stamina.

Congestive heart failure begins when the body is unable to provide the tissues with adequate oxygen. Without adequate oxygen, the body's cells become desperate and trigger a series of responses. Various hormones are released in an attempt to correct the problem. These hormones conserve fluid in an effort to increase blood volume and the output of blood and oxygen by the heart. For several months, these compensatory responses help the situation. Eventually the increased fluid retention becomes a detriment as more and more fluid leaks out of capillaries and into the lungs, abdomen and other body tissues. Fluid in the lungs is called *pulmonary edema*, fluid below the skin is called *peripheral* or *limb edema*, and fluid in the abdomen is called *ascites*. When these are present, congestive heart failure is present.

## What Tests are Done to Diagnose Valve Disease and Congestive Heart Failure?

**Cardiovascular Examination** - During this special examination the heart and lungs are listened to with a stethoscope, and observations are made about the heart sounds, heart rhythm, pulses of the large arteries and veins, fluid retention, etc. It may be possible to predict which valve is affected based on the murmur's location and intensity, and to detect abnormal heart rhythms (arrhythmias and dysrhythmias) and other related problems.

**Blood and urine tests** – Your veterinarian will be especially concerned about liver and kidney function because these organs are often affected in heart disease. Their function must be monitored if heart failure is to be managed well.

**Chest X-rays** – Chest radiographs allow your veterinarian to examine the lungs and measure the size and shape of the heart. Chest x-rays are the best indicator of whether your cat is in heart failure, and how well that heart failure is being controlled.

**Electrocardiogram (ECG or EKG)** – This is an assessment based on the electrical activity of the heart. It allows your veterinarian to accurately determine heart rate and to diagnose any abnormal rhythms.

**Blood Pressure** – if your pet has high or low blood pressure, this must be normalized with medications if your pet is to do well long term.

**Ultrasound examination (echocardiogram)** – This gives the most accurate determination of each heart chamber's size and thickness of the heart walls. Measurements of the heart contractions can be taken to evaluate the heart's pumping efficiency. This test is needed to determine which medications are needed to best control the heart disease.

The combination of all of these tests gives the best evaluation of the dog and its heart function.

## How are Valve Disease and Congestive Heart Failure Treated?

Treatment of DVD centers on eliminating signs of congestive heart failure, if it is present, and controlling the coughing. Below, drugs commonly used to treat congestive heart failure are discussed.

**Diuretics** – These are drugs that stimulate the kidneys to remove excess fluid from the body, and are probably the most important single drug to controlling congestive heart failure. Furosemide is the most common diuretic used for CHF. Spironolactone or hydrochlorothiazide might also be used.

**Angiotensin Converting Enzyme (ACE) inhibitors (vasodilators)** – ACE-inhibitors work by lowering blood pressure and reducing the after-load or resistance to blood flowing out of the heart. They are one of the most powerful and commonly used classes of drugs for heart disease in both humans and pets. Enalapril and benazepril are commonly used ACE-inhibitors in dogs. Lisinopril and ramipril might also be used.

**Nitroglycerin** – This drug dilates the veins throughout the body, especially the ones leading to the heart muscle. This permits better heart contractions and allows blood to move more freely to the other body tissues. However, it is only effective for one to two days before the body builds tolerance (resistance) to it. Nitroglycerin is used only in case of emergency, when CHF suddenly becomes worse.

**Digitalis** – This drug regulates excess hormones that have been released in response to CHF, and slows the heart rate when it beats dangerously fast. It also has a mild effect of strengthening each contraction of the heart. Digoxin is the most common digitalis drug used in veterinary medicine, but is no longer used as much as it was in years gone by, since the release of pimobendan.

**Pimobendan** – is a vasodilator as well as a drug that increases the strength of contraction of the heart muscle (called a positive inotrope). Pimobendan is the first truly effective positive inotrope in the history of veterinary medicine, and has helped many pets who could not have been helped in the past. Pimobendan is indicated only when the heart contraction is weakened, which can happen in some cases of valvular disease and congestive heart failure. An echocardiogram (ultrasound of the heart) is required to determine if pimobendan is needed.

There are other heart medications that might be indicated in specific cases – calcium channel blockers, antihypertensives (for high blood pressure), antiarrhythmics (for abnormal heart beats), etc. Not all of these treatments are used in an individual case of heart failure. The results of the various tests will determine which ones are appropriate for your pet's condition.

With right-sided congestive heart failure (fluid in the abdomen, chest, or around the heart), repeated physical removal by your veterinarian is often the best option, along with drugs that may help prevent it from reforming as fast.

## **Can I Slow Down or Reverse the Progression of DVD in My Pet?**

Several trials have looked at preventing DVD from progressing to the point of congestive heart failure. Unfortunately, no drugs that have been looked at have proven effective in either preventing or slowing down progression of DVD or CHF. As new drugs are developed, these will also undergo testing, so there may be drugs in the future that could help with DVD progression.

## **Can Diet Help?**

Some animal diet manufacturers have developed heart-specific diets that are moderately restricted in salt. However, while these diets are unlikely to be harmful, they have not been shown to affect progression of the disease or control of clinical signs. In many cases, animals reject them, because they don't taste very good.

## **Is There Surgery to Correct DVD?**

In human medicine, valve replacement or repair is a common surgical procedure. Unfortunately, surgical exposure of the mitral or tricuspid valves requires cardiopulmonary bypass. Although currently being performed by a few veterinary surgeons throughout the country, bypass surgery is difficult to perform in small animals. Costs for valve repair/replacement are approximately \$10,000-15,000. There are limitations on the types of patients that are suitable for surgery. If you wish to investigate the possibility of surgical correction, you should discuss this with your veterinarian. Alternative corrective procedures are in trials and may one day be available to canine patients with DVD.

Heart transplants are not an option in dogs because it would require killing a healthy dog to obtain its heart – something that is considered unethical by the veterinary profession.

## **What Should You Monitor at Home?**

It is important that you monitor your pet's overall attitude and any change in behavior. It may also be helpful for you to keep record of your pet's respiratory rate (number of breaths per minute) so that you will notice increases or changes from normal breathing. Normal dogs, and dogs with well controlled heart disease usually have a breathing rate of 1 breath every 2 to 3 seconds (20-30 breaths/min). If breathing rates are higher than 40 per minute at rest, or if you notice any of the following signs, please contact a veterinarian immediately:

- heavy, labored, or rapid breathing
- increased coughing
- fainting spells
- restlessness
- lack of appetite

### **How much longer will my dog live?**

There are many factors that must be considered before that question can be answered. The results of the diagnostic tests are important and your pet's response to treatment is another indicator. If response does not occur within a few hours or days, the prognosis is not good. However, most dogs that stabilize quickly will live for many months or even years. Once disease is severe enough that pimobendan is needed, survival is rarely longer than 1-2 years.