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Mitral Valve Disease and Heart Failure in Dogs

The heart has four chambers. The upper chambers are called atria (singular: atrium), and the lower chambers are called ventricles. The heart is also divided into right and left sides.

Blood flows from the body into the right atrium. It is stored there for a few seconds, then pumped into the right ventricle. The right ventricle pumps blood into the lungs where it receives oxygen. It flows from the lungs into the left atrium where it is held a few seconds before going into the left ventricle. The left ventricle is surrounded by the largest and strongest of the heart muscles. This large muscle is necessary to pump blood to all parts of the body.

Each side of the heart has a valve to keep blood from going backward from the ventricles to the atria. The valve between the left atrium and left ventricle is called the mitral valve. Because of the very large pressures created when the left ventricle contracts and the eventual process of “wearing out,” the mitral valve becomes leaky in many dogs.

Because this is a progressive disease, we assign each dog to one of four stages based on clinical signs, historical findings, and x-ray findings. Stage 1 is the earliest stage of mitral valvular disease. Stage 4, the final stage, is the presence of life-threatening heart failure.

Prevalence

This is the most common cause of heart failure in small dogs. Large breeds have relatively low incidence. Interestingly, this heart disease is extremely rare in cats. Many small dogs develop a mitral murmur as early as 6 years of age; most of them will have a murmur by 10 years of age.

The breeds most commonly affected include Cocker Spaniels, Boston Terriers, Fox Terriers, Poodles, Miniature Schnauzers, and Chihuahuas. The Cavalier King Charles Spaniel has a high incidence of mitral valve disease, and it tends to occur at a relatively younger age than in other breeds.

Causes/Transmission

The exact cause of the degenerative changes in the mitral valve remains unknown. It is suspected that these changes may be related to alterations in the connective tissue component of the valve. The edges of the valve should be smooth and flat; instead, they become thickened and knobby. When this occurs, the valve is unable to provide an effective seal between the upper and lower chambers of the heart. This results in an audible heart murmur when a stethoscope is placed over the valve.

Clinical Signs

The earliest sign of a leaking mitral valve is a heart murmur. The murmur is created by turbulent blood regurgitating backward from the left ventricle into the left atrium. The murmur is audible through a stethoscope and may progress in intensity as the disease progresses. Another early sign of mitral valve disease is a chronic dry, hacking cough. This occurs because the enlarging left atrium puts pressure on the bronchus (a branch of the airway); this compression leads to a cough.

Heart failure. The presence of a murmur does not mean that heart *failure* is imminent. But, as time goes on, the leak becomes more severe and more and more blood goes backwards. 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.

When the heart begins to fail, it is unable to deliver adequate oxygen to all the tissues of the body. This sets into motion a series of compensatory events. In other words, the body's cells become desperate and trigger a series of responses. Various hormones are released by several organs 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. However, the increased fluid retention eventually becomes harmful. Perhaps the most detrimental event occurs when this excessive fluid leaks out of the pulmonary capillaries and into the air spaces (alveoli) of the lung; this is called *pulmonary edema*. This fluid collection in the lungs produces very obvious signs and may be one of the first things an owner might notice. Noticeable signs include weakness, coughing or gagging, fainting or collapse, and obvious exercise intolerance.

Diagnosis

There are several tests that are used to look at different aspects of the heart's structure and function.

1. Listening with a stethoscope (auscultation). This valuable tool permits identification of murmurs, their location, and their intensity. It also allows us to hear lung sounds so that we can better understand what is happening within the lungs.
2. Blood and urine tests. These do not give direct information about heart function, but they allow detection of other disorders in the body that may have significance to heart function.
3. Chest radiographs (x-rays). The chest x-ray is useful for examining the lungs and for viewing the size and shape of the heart. It is also helpful in determining that the left atrium is enlarging because of backward blood flow.
4. Electrocardiogram (ECG or EKG). This is an assessment of the electrical activity of the heart. It allows accurate determination of heart rate and rhythm. Abnormal rhythms (arrhythmias) can be detected and evaluated.
5. Ultrasound examination (sonogram, echocardiogram). This examination uses sound waves that bounce off the structures of the heart and are read on a TV-like monitor. It gives the most accurate determination of the size of each heart chamber, and permits measurement of the thickness of the heart walls. This is seen on the monitor in actual time so the contractions of the heart can be evaluated. Certain measurements can be taken which allow the actual strength of the heart's contraction to be measured as a number and compared to the normal animal. Ultrasound may not be available in all private veterinary practices because of the additional training needed to learn how to perform the examination and because of the cost of the equipment.

The combination of all of these tests give the best evaluation of the dog and its heart function. However, if cost considerations prohibit performing all of them, two or three will provide much valuable information.

Therapy

A leaky heart valve can be replaced surgically in people. However, this is rarely feasible in dogs. There are several drugs that will improve heart function, even in the presence of a leaky valve. In addition to the drugs described below, a low-salt diet is usually indicated and can be obtained from your veterinarian.

1. Diuretics. These drugs stimulate the kidneys to remove excess fluid from the body. Furosemide is most commonly used, although others will be selected in certain circumstances.
2. Nitroglycerin. This drug is called a venodilator; it dilates the veins throughout the body, especially the ones going to the heart muscle. It decreases the amount of blood returning to the heart by allowing some of it to "pool" in the veins. This temporarily reduces the workload of the heart. This class of drugs can be very useful for treating pulmonary edema.

3. Digitalis. This drug improves heart function in several ways. It helps in control of certain arrhythmias, slows the heart rate, and strengthens each contraction of the heart. It is only indicated in the end-stages of mitral valvular disease.

4. Enzyme blockers. This is a relatively new class of drugs that can help modulate the imbalance of hormones related to heart failure. ACE-inhibitors, such as enalapril, are the most commonly used drugs.

5. Vasodilators. These drugs dilate the arteries and veins of the body to permit better blood flow. They may be used long-term because they continue to be effective, as opposed to the short-term effects of nitroglycerin.

Not all of these drugs are used in each dog in heart failure. The results of the various tests will determine which ones are appropriate.

Prognosis

There are many factors that must be considered before the outcome of treatment can be determined. The results of the tests are important. Dogs in the early stages of mitral insufficiency (Stage 1) can live months to years before failure begins. Dogs in Stage 4 may survive only hours to weeks, but the prognosis is very individualized for each dog.