Heart Failure (Mitral Valve Insufficiency) in the Dog

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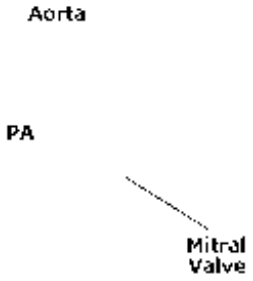
The heart is an organ which may fail in the dog, often due to a disease of the valves of the heart called 'mitral valve insufficiency' or 'chronic mitral valvular disease'.

The heart as a pump

The heart is a mechanical pump. It accepts blood on one side and forces it through the lungs, then its other half pumps the blood on through the entire body. The heart does not change or alter the blood in any way.



LA	**Left atrium**
LV	**Left ventricle**
PA	**Pulmonary artery**
PV	**Pulmonary vein**
RA	**Right atrium**
RV	**Right ventricle**
VC	**Vena cava**

As a quick review, blood returns from the body and enters the right upper chamber of the heart, called the right atrium. At this point, the blood is low in oxygen but high in carbon dioxide. It is then pumped from the atrium through the right atrioventricular valve into the right ventricle. From this larger chamber, it is then pumped into the blood vessels in the lungs through the pulmonary artery. This is the only artery in the body that carries non-oxygenated blood. Carbon dioxide is a by-product of body metabolism and is attached to the red blood cells. In the lungs, carbon dioxide is replaced with oxygen. The reoxygenated blood then moves through the pulmonary vein back into the heart and enters the left atrium. This chamber pumps the blood through the mitral valve into the left ventricle, which is the largest, most heavily muscled chamber of the heart. While other chambers only move the blood a short distance, the left ventricle has the responsibility of forcing blood throughout the entire body through the aorta. This completes the system, which allows blood to circulate throughout the body and then return to the heart.

How is heart disease in dogs different than heart disease in people?

In people, heart disease usually involves the arteries that supply blood to the heart muscle. In some cases, they harden, losing their elasticity and the ability to respond to blood pressure differences as they distribute blood to the cardiac muscle. In other cases, possibly due to diet or genetics, the arteries may become obstructed with a plaque that builds up internally on the artery walls. This causes the muscles of the heart to receive less than adequate amounts of blood. Starved for oxygen, the result is usually a heart attack. In dogs, arteriosclerosis (the hardening of the arteries), plaque formation, and heart attacks are all very rare. However, heart disease is very, very common.

In dogs, heart disease is often seen as heart failure, which means that the muscles 'give out.' This is usually caused by one chamber or side of the heart being required to do more than it is physically able to do. It may be that excessive force is required to pump the blood through an area, and over time, the muscles fail. Also, in some cases, the volume of blood that must be pumped to keep up with other areas of the heart is more than the particular chamber can adapt itself to move, again leading to muscle failure. Unlike a heart attack in humans, heart failure in the dog is a slow insidious process that occurs over months or years. In these cases, once symptoms are noted, they will usually worsen over time until the animal is placed on treatment.

What is mitral valve insufficiency?

Heart failure in older dogs is usually due to problems with the mitral valve of the heart, and occurs most commonly in smaller breeds, such as Poodles, Yorkies, Pugs, Pomeranians, Lhasas, etc. As the dog ages, the mitral valve between the left atrium and left ventricle starts to fail. A heart valve is designed to prevent back flow. Blood can be easily pumped through the valve, but once the ventricle is filled, the valve closes to prevent blood from flowing backwards into the atrium. These valves greatly increase the efficiency of the heart as a pump, since the blood only has to be pumped once to keep it moving forward from one chamber to another chamber. No blood is spilling back, which would require additional effort to move it forward. In the case of a mitral valve disorder (referred to as mitral insufficiency), the valve ages and shrinks and thereby fails to completely close off the area on the left side of the heart between the two chambers. The left ventricle is very strong, and with mitral insufficiency, it easily forces a portion of the blood backward into the left atrium with each heartbeat. The pressure of blood

within a normally functioning heart is highest in the left ventricle, as it is required to move the blood throughout the entire body. When blood flows backwards into the atrium, it elevates the blood pressure in that chamber and even further back into the lung field. There are additional complications, which increase pressures in the right side of the heart as it attempts to correctly pump blood forward into the lungs for oxygenation. Confronted with this elevated pressure within the lung field, the right side of the heart must work harder in moving the blood into the area.

What are the symptoms of mitral valve insufficiency?

The result of mitral insufficiency is elevated blood pressure within both the lung field and right side of the heart. The symptoms caused by this condition are very predictable. When hypertension (higher than normal blood pressure) occurs within the lungs, fluid actually leaves the blood vessels and leaks into the tissues. The medical term used to describe 'fluid in the lungs' is 'pulmonary edema.' This causes the affected individual to have difficulty breathing and cough in an attempt to clear the lungs of the fluid, just as you would do with a chest cold. The cough that typically occurs after exercise, excitement, or when the animal has first gotten up after sleeping is often the first clinical symptom noted with mitral insufficiency.

As the condition progresses, the right side of the heart starts to fail because of its increased work and elevated pressures. At first the muscles strengthen, thereby increasing the mass and thickness of its walls. Over time, however, even these 'athletic' muscles cannot keep up with the ever-increasing pressures and they start to fail. During this congestive heart failure, the animal will be weaker and tire more easily, and may even faint. The dog may also lose weight and appear pale. The systemic blood pressure (blood pressure in the body versus the lungs or heart) may also be low, while the heart rate and respiratory rate are often elevated.

How is mitral valve insufficiency in dogs diagnosed?

The first indication that there may be a problem with the mitral valve is a heart murmur. Your veterinarian can detect the heart murmur when listening to your dog's heart with a stethoscope. Many dogs may have a heart murmur but no signs of any heart problem. If your veterinarian hears a murmur, the next step is to generally do radiographs (x-rays) to determine if the size of the heart has increased due to the increased workload on the heart. Monitoring the size of the heart is the best way to determine how quickly the disease may be progressing. Special testing called 'echocardiography' can be performed to actually visualize the mitral valve and detect insufficiency.

What is the treatment for mitral valve insufficiency?

Treatment of dogs with mitral insufficiency depends upon the size of the heart and if clinical signs are present. Guidelines for the diagnosis and treatment of valvular heart disease in dogs are based on classifying dogs into several stages:

- Stage A: Dogs with no murmur or symptoms but who are at risk of developing valvular heart disease. These include Cavalier King Charles spaniels and small breeds of dogs.
- Stage B1: Dogs with no heart enlargement or symptoms.
- Stage B2: Dogs with enlarged left atriums and/or ventricles but no symptoms.
- Stage C: Dogs with heart enlargement and symptoms of congestive heart failure.
- Stage D: Dogs not responding to treatment for congestive heart failure.

Dogs in Stages A and B1 generally do not receive treatment, but are monitored for any changes in heart size or progression into symptoms.

Treatment of dogs in Stage B2 is controversial. Some veterinarians believe treatment of these dogs will slow progression of the disease, others do not.

Treatment of dogs in the Stage C with heart enlargement and symptoms is based on medications to help the heart pump more efficiently. Drugs that may be used include diuretics that cause the dog to urinate more and thereby remove excess fluids from his lungs. These include furosemide (Lasix) or spironolactone .

Medications such as pimobendan or an angiotensin-converting-enzyme (ACE) inhibitor like enalapril may be given to help the heart pump more efficiently. Digoxin, another heart medication may also be prescribed. If the dog does not respond well to these medications and is in Stage D, other therapies such as amlodipine may be used. Cough suppressants and bronchodilators may be prescribed is there is a chronic cough.

Diets lower in sodium may assist in decreasing the fluid build-up. It is important to maintain adequate protein intake. Attempts should be made to maintain the dog at his ideal weight. The use of omega-3 fatty acid supplements is often recommended.

What is prognosis for dogs with mitral valve insufficiency?

Many dogs with heart murmurs due to mitral valve insufficiency may live for years before developing any symptoms. They should be carefully monitored however, so treatment can be started as soon as warranted. In those dogs with heart failure, approximately half will not survive for more than 6-12 months.

Can mitral valve insufficiency in dogs be prevented?

There are few things that can be done to prevent mitral valve insufficiency. Diagnosing the disease earlier in its course is very

helpful in slowing the progression. Notify your veterinarian of any signs of heart failure in your dog. Keeping your dog healthy and at his ideal weight can lessen the severity of symptoms if mitral insufficiency does occur. Valves of the heart can be injured by infection; this infection can result from severe dental problems, which allow bacteria from the mouth to enter the bloodstream. Good oral health then, is also important.