Canine Congestive Heart Failure

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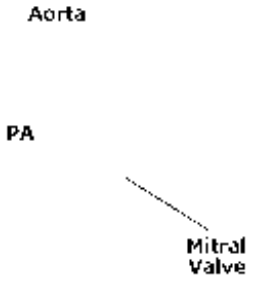
The heart is one of the most miraculous "machines" ever devised. It is capable of operating, non-stop, for many, many decades.

Before we discuss canine congestive heart failure, let's first discuss how a mammalian heart works. The heart is a pump that is responsible for moving blood through the network of blood vessels found in the body. It is actually two pumps, one on the right side and one on the left. The right side of the heart is a smaller, lower pressure pump that receives blood from the body and delivers it to the lungs where the blood gives up carbon dioxide and is replenished with oxygen. The left side of the heart is a larger, more muscular pump and operates at a much higher pressure. It receives the oxygenated blood from the lungs and delivers it back to the body. This cycle continues non-stop during life.

Each pump contains two chambers. The first chamber, called the atrium, is a staging area for the main pumping chamber called the ventricle. These chambers are separated by a valve that prevents the back-flow of blood during contraction of the ventricle. Additional valves are found in the vessels that carry the blood out of the ventricles. These valves also prevent the back-flow of blood.



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

The strength and speed of the heart's beat can be influenced by many factors including exercise, mental status and disease conditions.

What is congestive heart failure?
Congestive heart failure (CHF) occurs when the heart is no longer able to pump blood to the lungs and/or body at the designed volume and pressure.

When the output of blood from the heart is decreased, the relative amount of blood entering the heart is increased. This increase in blood upstream from the heart changes the balance of fluid pressures in the upstream blood vessels and surrounding tissues. When these pressures are increased, blood fluids leave the vessels and congest the surrounding tissues.

What causes congestive heart failure?
For this article, we will concentrate on the two most common causes of CHF in dogs: Degenerative valvular disease (DVD) and Dilated cardiomyopathy (DCM).

Degenerative valvular disease is a condition that reduces the ability of the heart valves to prevent the back-flow of blood during ventricular contraction. In dogs, the valve found between the left atrium and left ventricle (the mitral valve or left atrial-ventricular valve) is most commonly involved. When it is, it is called mitral valve disease (MVD). The cause of MVD is unknown.

Dilated cardiomyopathy is a progressive enlargement of the chamber within the ventricle, with a steady loss in the strength of the ventricular contraction. DCM is separated into the sub-clinical or occult phase and the overt clinical phase. In the occult phase the ventricles' ability to pump blood is diminishing. However, there are no outward clinical signs of heart disease. As the strength of the ventricle to contract is reduced, the amount of blood exiting the heart is reduced. This reduced out-flow from the heart increases the volume of blood upstream, leading to congestion. Dogs with DCM typically progress from the occult stage to the overt-clinical stage. The cause of DCM is often times unknown.

In the early stages of congestive heart failure, the dog's body is able to compensate for a lower output of blood from the heart. Blood vessels in the body constrict increasing the resistance to blood flow, the heart rate will be elevated, and a mechanism will be activated that causes the dog's body to retain sodium and water. These three factors lead to an increase in blood

pressure which helps to maintain normal blood circulation. Eventually this increase in blood pressure can lead to an accumulation of fluid in tissues and body cavities. In the case of a decrease in output on the left side of the heart, the fluid will accumulate in the lungs. This condition is called pulmonary edema. If this occurs on the right side, there will be congestion in the abdomen or other body spaces.

Who gets CHF?
Mitral valve disease is seen primarily in elderly, small breed dogs. Dilated cardiomyopathy is seen most commonly in adult large breed dogs, particularly the Doberman Pinscher, Irish Wolfhound, Scottish Deerhound and Great Dane.

What are the symptoms of CHF?
Whether CHF is caused by MVD or DCM, the symptoms are very similar. As the dog's heart pumps blood with a leaky valve or a weakened ventricular wall, its ability to deliver blood efficiently to the body is reduced. In either case, the symptoms are progressive. Common symptoms of CHF include:

- Exercise intolerance
- Sleepiness
- Cough
- Decreased appetite
- Syncope (fainting)
- Difficulty sleeping (especially on its side)
- Ascites (fluid in the abdomen)

How is CHF diagnosed?
A diagnosis of CHF is based observing the following:

- History of exercise intolerance
- Shortness of breath
- Cough
- Ascites
- Episodes of fainting

Diagnostic tests the veterinarian may use include:

- Auscultation of (listening to) the heart
- Radiographs of the chest
- Electrocardiogram
- Echocardiogram
- Blood chemistry profile

Especially with mitral valve disease, the veterinarian will almost always hear a heart murmur. Crackles in the lungs may also be heard if pulmonary edema is present. Radiographs of the chest may reveal an enlarged heart and congestion of the lungs. Electrocardiography may be used to evaluate the strength and regularity of the heart's beat. An echocardiogram may be used to evaluate the size of the heart and the strength of the beat.

How is CHF Treated?
Since CHF most often results from a physical change in the heart (a poorly functioning valve or a weakened ventricular wall) and is progressive, treatment involves certain medications and centers on relieving the symptoms.

Medications can be administered to:

- Increase the body's urine output thereby lowering the overall fluid load in the body
    - Diuretics (water pills), like furosemide, are commonly prescribed
- Dilate the blood vessels; lowering the load against which the heart pumps.
    - Vasodilators
        - Angiotension-converting enzyme inhibitors, ACE inhibitors like enalapril: These medications block the dog's natural ability to constrict blood vessels
        - Inodilators, like pimobendan: Opens blood vessels that carry blood to and from the heart
- Strengthen the heart's beat
    - Positive inotropic medications
        - Digitalis glycosides (digoxin)
- Suppress a cough
    - If cough is a result of compression of the airways by the enlarged heart, and not from pulmonary edema
        - Hydrocodone
        - Butorphanol
- Restrict sodium intake
    - The amount of sodium in the body determines the amount of water in the blood vessels and tissues.
        - In the past, veterinarian would prescribe a special diet for dogs with CHF. While there may still be a place for these prescription diets, the main objective is to reduce the amount of sodium consumed overall without sacrificing palatability and appetite.

At this point in time, there are no practical surgical alternatives to these heart conditions.

What is the prognosis for a dog with CHF?
The prognosis for dogs with CHF depends on the cause, severity and their response to treatment. CHF is progressive. The changes to the heart, whether from DCM or MVD, cannot be reversed. We can only manage the symptoms.

Many dogs can survive for over one year after symptoms are discovered.

The prognosis for dogs that have developed DCM is always more guarded.