Heart disease in the canine is a common problem in veterinary medicine, but it is also a very wide topic, ranging from congenital disorders to acquired diseases, some presenting with no clinical signs to those in overt congestive heart failure.

The two most common presentations seen in practice are degenerative mitral valve disease (DMVD) and dilated cardiomyopathy (DCM), which will be looked at in detail. A definition and understanding of heart failure will also be examined, because it helps us know how to deal with the patient that presents in distress.

What is congestive heart failure?

The most important function of the circulatory system is to maintain adequate blood pressure. When the heart starts to fail, the body starts its own compensatory mechanisms to increase cardiac output, such as increasing heart rate and retention of fluid. As soon as fluid starts to accumulate (pulmonary oedema, ascites or pleural effusion), it can be said that clinical congestive heart failure is present. Heart failure can be either left sided or right sided, and some severe cases can have both.

Acute, life threatening congestive heart failure

The two most important questions to answer are how does the patient in congestive heart failure present, and how should it be treated. With acute failure, the most common presentations are:

- Respiratory distress
- Tachypnoea
- Collapse
- Orthopnoea
- Cough (not always present, but very common in DMVD)

Mucous membrane colour is not a good indicator as patients can be pink, hyperaemic (red), pale, or cyanotic. By the time that a patient is cyanotic, a
severe level of disease has been reached. Acute heart failure patients will often be distressed. Treatment aims at this point are very simple: stabilise the patient by providing oxygen and diuretics, and handle as little as possible (i.e. counting the respiration rate from outside the kennel). When a response to treatment has been noted, then a further diagnostic work up can be pursued.

**Chronic heart failure**
The next question to ask is how these patients differ from the acute patient. The clinical signs are much the same, but vary slightly.

- Breathlessness (rather than in distress)
- Tachypnoea
- Exercise intolerance
- Cough
- Ascites
- Syncope
- Cachexia
- Inappetance

The difference in these cases is that the patient is less likely to present distressed, as they are used to coping with heart failure. However, these patients still need to be handled with great care, as any undue stress can push them from coping with the disease, to not coping with the disease, and thus into acute failure.

**Causes of congestive heart failure in dogs: -**
- Structural heart disease (such as DMVD or DCM)
- Severe arrhythmias
- Pericardial effusion
- Neoplasia

**Heart disease**
Heart disease can occur at any age – either from birth due to a congenital defect, or with acquired degeneration over time. Acquired diseases can take years to develop into congestive failure. Therefore, heart failure can only occur when there is heart disease, but heart disease can be present without heart failure.

**The normal cardiovascular system**
A quick reminder as to the normal physiology of the cardiovascular system is perhaps recommended at this juncture. Oxygenated blood returns from the lungs via the pulmonary veins to the left atrium. During diastole blood flows via the mitral valve to the left ventricle. In systole, the left ventricle contracts which closes the mitral valve and propels blood to the body via the aorta. At the same time, deoxygenated blood returns to the right atrium, goes through the tricuspid valve, which closes behind it, into the right ventricle. In systole, blood is then ejected into the pulmonary artery to go to the lungs for oxygenation.
Clinical signs of left and right sided heart failure:

<table>
<thead>
<tr>
<th>Left sided congestive heart failure (Pulmonary congestion and oedema)</th>
<th>Right sided congestive heart failure (Systemic venous congestion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachypnoea, respiratory distress, orthopnoea</td>
<td>Ascites</td>
</tr>
<tr>
<td>Cough</td>
<td>Hepatomegaly and jugular distension</td>
</tr>
<tr>
<td>Lethargy and exercise intolerance</td>
<td>Dyspnoea (pleural effusion)</td>
</tr>
<tr>
<td>Syncope due to arrhythmias or hypotension</td>
<td>Exercise intolerance and syncope</td>
</tr>
</tbody>
</table>

The most common problems that cause heart failure are the two main acquired diseases seen in dogs, chronic degenerative valvular disease and dilated cardiomyopathy.

**Chronic degenerative valvular disease**

Chronic valvular disease is seen in up to 75% of dogs presenting with heart problems. This is a condition where the atrioventricular valves (more commonly the mitral valve) starts to degenerate. This eventually leads to the valve leaflets becoming deformed and unable to close properly, thus a large amount of blood is ejected back into the left atrium (mitral regurgitation) as well as to the aorta in systole. When advanced or severe, this results in decreased cardiac output.

How do dogs with DMVD present?
- Usually middle aged to older small breed dogs, such as Cavalier King Charles Spaniels, Poodles, Terriers and Chihuahuas.
- Asymptomatic - As valvular disease is a degenerative one, progression to congestive heart failure can be a slow process, and not all will advance that far.
- Exercise intolerance.
- Cough – most commonly due bronchial collapse. The mainstem bronchus can be compressed due to the enlarged left atrium. Can also occur with pulmonary oedema.
- Tachypnoea or respiratory distress, especially if stressed or with exercise.
- Tachycardia and arrhythmias can be present.

Prognosis with a dog diagnosed with chronic valvular disease varies from patient to patient, along with the degrees of severity of the disease. Some patients can cope for years with their disease; others do not do as well.
Dilated cardiomyopathy (DCM)

DCM is the second most common presentation of acquired cardiac disease. Cardiomyopathy is a term used to describe an inadequately functioning heart muscle. With DCM, the ventricle fails to expel all the blood in systole, leading to progressive dilation of the ventricle. This will eventually lead to congestive heart failure. The dilation also causes distortion of the mitral valve apparatus, resulting in mitral regurgitation, which increases the potential for heart failure.

How do dogs with DCM present?

- Usually middle-aged to old large breed dogs. Doberman, Boxer, Newfoundland, Irish Wolfhound and Great Dane are commonly affected.
- Asymptomatic - An incidental murmur on routine vaccination can be the first indicator.
- Signs of left sided congestive heart failure – tachypnoea, cough, exercise intolerance, syncope and respiratory distress.
- In severe cases, both left and right sides affected.
- Some dogs (e.g. Dobermans) present with an acute onset of heart failure, with no previous signs.

The most common form, primary cardiomyopathy, is referred to as ‘idiopathic’ DCM because the cause for the myocardial disease is unknown. There are other causes for cardiomyopathy to occur in dogs, known as secondary cardiomyopathies. Hypothyroidism, taurine deficiency (dogs fed low taurine diets, American Cocker spaniels) and certain drugs that are toxic to the heart (i.e. doxorubicin) can cause secondary cardiomyopathies.

How can DMVD and DCM be treated?

The treatment aims of both diseases are the same:

1). No therapy prior to the onset of heart failure proven to be of benefit;
2). Drug therapy when there are clinical signs of heart failure
3). Environmental modification such as exercise restriction and oxygen therapy in acute heart failure patients, and weight loss in obese patients with chronic disease;

A major difference in therapy occurs in cases of secondary cardiomyopathy, for which the aim is to correct the underlying cause if possible (such as thyroid hormone or taurine supplementation). Average survival time from first onset of congestive signs is between 6-12 months. Those that present without clinical signs however, can live with the disease for years.
Congenital heart diseases

There are a variety of congenital diseases that dogs can have, but the most common ones that can present with heart failure are, Patent Ductus Arteriosus (PDA), mitral (or tricuspid) valve dysplasia (MVD) and either aortic stenosis (AS) or pulmonic stenosis (PS). PDA is an abnormal communication between the aorta and pulmonary artery, which has persisted from birth. Blood shunts from the high pressure aorta to the lower pressure pulmonary artery, and therefore can cause left sided congestive heart failure. This can be corrected either by transcatheter occlusion or surgery.

Dependent upon the severity of the defect, MVD, AS and PS can either cause problems early or later in life due to the chronic nature of the problems they cause. Mitral valve dysplasia, or malformation of the valve apparatus, can present from asymptomatic patients to those with left sided congestive heart failure. Stenosis means narrowing of the valve area, and subsequently causes an obstruction that causes a back-up of blood, on either the left side with AS or right sided with PS. Ventricular septal defects (VSD) and atrial septal defects (ASD) are less common in the dog, and rarely result in heart failure when present alone.

Arrhythmias

There are a wide range of potential arrhythmias that a dog can present with. However, there are only a couple life threatening ones – the very fast ones and the very slow ones.

Bradyarrhythmias – third degree atrioventricular (AV) block

Clinical signs: -

- Sudden onset collapse
- Weakness
- Exercise intolerance, lethargy
- Congestive heart failure (often right-sided)
- Sudden death

Third degree AV block, also known as complete heart block, is a problem with the conduction system of the heart. The sinoatrial node fires, but is blocked at the AV node. To keep the dog alive, there is a slow ventricular rate, but this can stop at any time.

Why does this happen?

Most commonly there is no known reason why a dog goes into third degree AV block. This is referred to as ‘idiopathic AV block’. Sometimes it can be due to cardiomyopathy, endocarditis or some drugs toxicities (e.g. digitalis). Therefore treatment is directed towards the cause if there is one, however, most cases need pacemaker implantation.
**Tachyarrhythmias**

The main fast arrhythmias that are seen in dogs are atrial fibrillation (AF) and ventricular tachycardia. Dogs with AF often present with signs of heart failure and dogs with ventricular tachycardia are usually collapsed. The fast and/or irregular rhythm means that cardiac output is compromised because the heart does not have time to fill in between each contraction. This results in insufficient blood ejected into the systemic and pulmonic circulations.

**Atrial fibrillation**

Commonly seen as a complication of DMVD, DCM or PDA, and resulting in congestive heart failure. Along as the rate is controlled, quality of life can be improved. Adequate control of heart failure is also essential in these patients. Ventricular tachycardia – This is a life-threatening arrhythmia because if left untreated, it can progress to ventricular fibrillation and death. An ECG, intravenous catheter and emergency drugs (e.g. lidocaine) are vital in the treatment of ventricular tachycardia. Any underlying cause, such as DCM, can be investigated when the dog is stable.

Dogs can live with heart disease and even heart failure for many years, but it takes good management from owners and veterinary staff to help provide a good quality of life. Many dogs with severe or advanced heart disease eventually develop heart failure. Therefore the owner needs to understand what they will be dealing with in the future, and staff need to be alert to the clinical signs of acute and chronic congestive heart failure, so that patients on the edge of cardiac failure are treated appropriately at all times.