

Congenital Heart Disease In Puppies

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Congenital heart diseases are abnormalities, or structural defects, of the cardiovascular system that are present at birth; they are often called "birth defects."

Congenital implies it is a development of an abnormality that occurred during growth of the fetus while in the uterus. They can occur as a result of a genetic defect, environmental conditions, infections, poisonings, medication taken by the bitch or poor maternal nutrition. In some cases, it is a combination of these factors.

Some studies have suggested fewer than 1% of all breeds of dogs are affected by congenital heart disease. Although not a common occurrence, it is important to detect a congenital heart defect as early as possible because when severe they can cause death at a young age. Certain defects can be corrected with surgery and treatment should be performed before the defect leads to irreversible heart damage or congestive heart failure. Also, early detection allows owners to avoid breeding effected dogs and perhaps preventing a genetic defect in breeding lines. Although in some dog breeds it is more common to have certain congenital heart defects the Cairn terrier is not singled out as being more prone. However, these defects can happen in any breed.

The most common congenital defects in this order are: patent ductus arteriosus (PDA), pulmonic stenosis (PS), and sub aortic stenosis (SAS).

THE 3 MOST COMMON CONGENITAL HEART DEFECTS

(1) PATENT DUCTUS ARTERIOSUS

The ductus arteriosus is a short broad vessel in the unborn fetus that allows blood to bypass the lungs. Unborn puppies do not breath air, they get oxygenated blood from the dam. Most of their blood bypasses the non-functioning lungs via the ductus arteriosus vessel. Blood flow after birth goes from the right heart via the pulmonary artery to the lungs back to the left heart and exits the heart via the aorta artery to go to the body.

In the fetus blood from the right side of the heart exits the heart via the pulmonary artery to go to the lungs but the ductus arteriosus that is connected to the pulmonary artery diverts the blood away from the lungs directly to the aorta artery. At birth the puppy's first breath inflates the lungs and causes the ductus to close allowing blood to flow to the lungs. If the ductus doesn't close, it is "patent" or open and abnormal left to right shunting of blood occurs. Blood flow is forced from the chambers of the left heart to those of the right side which results in over circulation of the lungs and enlargement of the left heart chambers which over time may result in arrhythmias and left sided congestive heart failure.

Without treatment dogs live to 6-18 months of age, most dogs are in congestive heart failure by one year of age. With surgical correction they will have a normal lifespan. The correction is by catheterization to occlude the ductus or surgery to tie off the ductus. It generally occurs in small breeds of dogs. Your veterinarian can hear a continuous machinery murmur.

(2) PULMONIC STENOSIS

Pulmonic stenosis causes an obstruction to the blood flow from the right ventricle to the lungs. It is a deformity on or near the pulmonary valve which narrows (stenosis) the pulmonary valve opening and slows blood flow out of the heart to the lungs. The right ventricle must generate increased pressure during contraction to overcome the stenosis. This leads to right heart enlargement, which leads to increased right atrial pressure and congestion in veins. Increased speed of blood flow results in an enlarged artery. Dogs with (PS) may have a history of failure to thrive and exercise intolerance. In severe cases of right sided heart failure, fluid accumulation in the abdomen and limbs occurs.

Dogs can improve with surgery. One type of surgery involves using a surgical balloon to widen the narrowed valve. The outlook is poor if atrial fibrillation or right sided congestive heart failure is present. PS occurs in small breed of dogs including terrier breeds.

In mild cases they need no treatment and have a normal lifespan. In severe cases they will develop right sided congestive heart failure at 4 to 5 years of age. They have a systolic ejection quality murmur at the left heart base and may have jugular pulses.

(3) SUBAORTIC STENOSIS

Aortic stenosis refers to a narrowing of the aorta, which interferes with blood flow out of the heart to the body. Most commonly this is due to fibrous tissue located within the outflow tract of the left ventricle below the aortic valve. It is more common in large breed of dogs. This leads to thickening of muscle fibers of the left ventricle leading to poor blood flow in the heart which leads to life threatening ventricular rhythm problems. Dogs may faint or have sudden death with no previous illness. Mildly affected dogs require no treatment. Surgery may also help using a balloon but the procedures are costly to perform, may be risky and re-stenosis can occur. If it is mild, they may have a normal lifespan. If severe they may only live to 4-5 years of age. They have a systolic ejection-murmur at the left heart base and their pulses may be late and weak.

A congenital heart defect will cause a heart murmur heard while auscultating the puppy's chest with a stethoscope. The murmur may be the only indication in a young puppy. Congenital heart defects can produce signs that vary depending on the type and severity of the heart disease involved. Possibilities are shortness of breath, difficulty breathing, coughing, fainting, fatigue and or accumulation of fluid in the lungs or abdomen.

In small animals the beating heart makes 2 audible sounds per beat heard with a stethoscope. As the heart muscle relaxes to fill the chamber with blood and contracts to eject blood the valves, or doors, to the 4 chambers (2 ventricles on the bottom and 2 atriums on the top of the heart), open and close. It is the closing of the valves that causes the 2 heart sounds, "lub"-"dub". Blood is flowing through the heart in one direction as the heart fills and then ejects but most of the blood flow is silent because it is normally "laminar", or moving in parallel down the length of a blood vessel or chamber. Blood flow becomes audible (causing an audible heart murmur) when the blood flow is turbulent. Factors that cause turbulence are blood viscosity, velocity, and the diameter of a vessel. So, a murmur is a third heart sound. Murmurs are classified by their (1) timing corresponding to when the valves are open or closed, called diastole for when the ventricles are filling or systole when the ventricles are contracting to eject blood from them, (2) the location of the heart where they are heard the loudest, (3) intensity (loudness usually graded from I to VI) also (4) quality (5) frequency and (6) pitch. The 3 most common heart defects each have their own characteristic murmur.

Heart disease causes heart murmurs. There are other murmurs that puppies have that are called "innocent" physiologic murmurs. These murmurs occur in absence of true structural heart disease. They are soft grade (I-III), heard on the left side of the chest, systolic (heard when the heart contracts), and particularly heard over the base of the heart.

They are frequently heard in young puppies but should disappear by AGE 4 MONTHS, (with a firm cut off of 6 months). The exact cause of these innocent murmurs is debated, but it reflects some of the unique differences between young puppies and adults. Some of these differences are:

- Puppies have larger ventricles compared to their great vessels because the heart and vessel grow at different rates. The size discordance causes turbulence in the aorta and or pulmonary arteries causing a murmur.
- Puppies have a more active sympathetic nervous system than adults, causing increased blood velocity with excitement which can cause an innocent murmur.
- Puppies can have a mild relative anemia (lower red blood cell count) compared to adults causing a slight decrease in blood viscosity causing a soft murmur.

Veterinarians are usually seeing puppies for their vaccine series beginning at 6-8 weeks of age and continuing until 12 to 16 weeks. This is an excellent time for your veterinarian to detect heart murmur. It is important to understand that the presence of a heart murmur in a young puppy does not necessarily indicate a congenital heart defect.

HOW DOES YOUR VETERINARIAN DISTINGUISH BETWEEN AN INNOCENT MURMUR AND A CONGENITAL HEART DEFECT?

If the murmur is left sided, soft, systolic and occurs in a puppy less than 4 months of age (but sometimes persisting to 6 months of age) it is reasonable to wait and have the vet recheck it in a couple weeks before doing testing. Any murmur which is continuous, diastolic (heard when the ventricles are filling), heard on the left and right side of the chest, and is heard after the puppy is 6 months old warrants further testing and referral to a veterinary cardiologist. The evaluation may include echocardiography, x-rays, and electrocardiography of the heart. These tests allow diagnosis and assessment of the severity of the defect so surgery or a treatment plan may be pursued.

REFERENCES:

1. Jessica Ward, DVM, DACVIM (Cardiology), College of Vet. Med. Iowa State University. "To Refer or Not to Refer: Congenital Heart Disease vs. Innocent Heart Murmurs in Puppies and Kittens" VMX 2019 proceedings.

2. Sandra P. Tou, DVM, DACVIM, Assistant Clinical Prof. of Cardiology, College of Veterinary Medicine, North Carolina State University "Overview of Congenital and Inherited Anomalies of the Cardiovascular System" Merck manual.

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