

# Ventricular Septal Defects in Dogs

## What is a ventricular septal defect?

A ventricular septal defect (**VSD**) is a congenital cardiac anomaly, or an abnormality in the heart that is present at birth, rather than beginning later in life. Specifically, a VSD is characterized by a hole in the septum that divides the more muscular “bottom” portion of the heart into two chambers, the left and right ventricles. These are the main pumping chambers of the heart and are normally completely separated from one another by this septum.

The left ventricle is the strongest chamber in the heart and generates high pressure in order to supply blood to the entire body, with the exception of the lungs. The right ventricle has the sole purpose of pumping blood to the lungs, and so generates much lower pressure than the left ventricle. For this reason, when a VSD is present, blood tends to flow through the defect from the left ventricle into the right ventricle under most conditions.

If a VSD is small, then the correspondingly small amount of blood *shunting* through it may not cause a problem. If it is large, however, then the large volume of blood passing from the left ventricle to the right ventricle puts a strain on the circuit of the heart and lungs. Although it is somewhat counterintuitive, it is the left ventricle that is typically most affected by this abnormal pattern of blood flow. This is because the blood flowing across the VSD is immediately sent to the lungs and then back to the left side of the heart. This overcirculation of blood can eventually overload the left ventricle and lead to *left-sided congestive heart failure*, characterized by fluid accumulation in the lungs.

In rare cases and through a complex sequence of events, a large and long-standing VSD may lead to extremely high pressures in the lungs (a situation called *pulmonary hypertension*) and the right ventricle. This, in turn, results in “reversal” or right-to-left shunting of blood flow through the VSD and distribution of oxygen-poor blood to the rest of the body.

## How is a VSD diagnosed?

A congenital heart condition is often first suspected following detection of a heart *murmur* during routine **physical examination** in a young dog. This is an abnormal “whooshing” sound associated with the normally crisp heart sounds, heard while listening to the heart with a stethoscope. The murmur is described according to its loudness and where it is heard best on the chest. Although many different conditions result in the presence of a heart murmur, the location where the murmur is loudest may raise suspicion for a VSD in particular. If congestive heart failure is already present at the time of first examination, other findings may include abnormally loud lung sounds (also heard with a stethoscope) as well as rapid or labored breathing.

Diagnosis of a VSD is confirmed by performing an **echocardiogram**. This is an ultrasound examination of the heart, during which information is collected about the size and function of the heart, as well as blood flow through its chambers. In the case of a VSD, observation of blood flow through a hole in the ventricular septum leads to this specific diagnosis.

**Chest x-rays** are used to obtain a “big picture” view of the heart within the chest cavity, which is sometimes important in assessing the true importance of a VSD. In particular, chest x-rays allow evaluation of the lungs and so are necessary to confirm or rule out congestive heart failure. An **electrocardiogram** is performed to identify and characterize arrhythmias that may be present, and to guide antiarrhythmic therapy if necessary. If medications are begun or changed, blood work may be necessary in order to obtain information about kidney function and electrolytes. Some of these tests may need to be repeated periodically to monitor progression of this condition and its response to therapy.

## **How is a VSD treated?**

Fortunately, the majority of VSDs are small. These are called *restrictive* VSDs because the small size of the defect naturally restricts the amount of blood that flows through it. Restrictive VSDs typically do not lead to heart enlargement, cause congestive heart failure, or require treatment.

Large (*nonrestrictive*) VSDs resulting in enlargement of the left side of the heart may benefit from treatment. Medical therapy may include agents that discourage blood flow from the left ventricle into the right ventricle (e.g. “ACE inhibitors” like *enalapril*). Unfortunately, there is no evidence that such agents effectively delay progression toward heart failure. If congestive heart failure does develop, medications are used to reduce fluid accumulation (these agents are called *diuretics*, such as *furosemide*).

Beyond medical therapy, a surgical procedure called *pulmonary artery banding* has been used in some dogs to increase pressure in the right ventricle and reduce the amount of blood flow into it from the left ventricle. In people, synthetic devices are often used to seal the VSD, thereby correcting the underlying problem. While this solution has obvious appeal, there is limited experience with it in the veterinary field at this time. Dogs with right-to-left shunting VSDs are not eligible for such procedures.

## **What is the prognosis? What should I watch for?**

For a dog with a small VSD, subsequent heart enlargement leading to congestive heart failure is extremely unlikely. Long-term prognosis is excellent in this case, and although periodic re-evaluation is still warranted, a normal lifespan is common. Dogs with large VSDs have a more guarded prognosis, particularly once heart failure develops or in the case of a right-to-left shunting VSD. If a procedure is performed early in the course of disease and successfully reduces blood flow through the defect, a good prognosis is still possible. Otherwise, medical therapy is employed, and treatment for heart failure is used if and when necessary.

Symptoms related to the more common left-to-right shunting VSD may include **lethargy, weakness, intolerance to activity or exercise, coughing, and rapid or labored breathing**. In the more rare case of a right-to-left shunting VSD, weakness may be noted particularly following activity or exertion, and **collapse or fainting** may occur. Observation of even the milder of these symptoms warrants a phone call to either your regular veterinarian or Dr. Marshall at Veterinary Specialty Services. More severe symptoms, such as difficulty breathing or collapse, require immediate attention on an emergency basis.