

What is a ventricular septal defect (VSD) ?

A ventricular septal defect is a hole (or defect) in the muscular wall of the heart (the septum) that separates the right and left ventricles.

Before birth, the heart starts out as a single tube which gradually differentiates into 4 chambers during embryological development. Abnormalities can arise at several steps in the process, resulting in defects in the muscular walls that normally separate the heart into the right and left atria, and the right and left ventricles. The result is abnormal blood flow in the heart with varying effects in the dog, depending on the size and location of the defect.

How are VSDs inherited?

In the English bulldog and keeshond, inheritance is [autosomal recessive, with variable expression](#).

What breeds are affected by VSDs?

This disorder occurs sporadically in many breeds. The English bulldog and keeshond are at increased risk for VSD. In either breed, a VSD may be part of the disorder [Tetralogy of Fallot](#).

For many breeds and many disorders, the studies to determine the mode of inheritance or the frequency in the breed have not been carried out, or are inconclusive. We have listed breeds for which there is a general consensus among those investigating in this field and among veterinary practitioners, that the condition is significant in this breed.

What does a ventricular septal defect mean to your dog & you?

The extent to which your dog will be affected depends on the size and location of the defect within the ventricular wall. Many dogs have small defects which may spontaneously close. With such defects there will be no or very minor clinical effects. With larger defects, because of higher pressure in the left side of the heart, there will be a left-to-right blood flow across the defect. This means that the left side of the heart must work harder and that there will be extra blood circulated to the lungs, creating an abnormal load on them. Conditions that increase pressure in the right side of the heart (such as pulmonary hypertension) may result in a right-to-left shunt, also called a reverse shunt.

Signs associated with this disorder may develop within months or years, depending on the significance of the defect, and include shortness of breath, exercise intolerance, sudden death due to an abnormal heart rhythm, or, with a reverse shunt, cyanosis (grey instead of pink mucous membranes). Your veterinarian will monitor your dog's progress and recommend treatment as required. This may include medications to support the heart and to reduce

congestion in the lungs, a special diet, exercise restriction, and precautionary antibiotic therapy before procedures such as dentistry.

Among puppies with large VSDs, it is probable that many die early, before 8 weeks of age or before they are examined by a veterinarian.

How is a ventricular septal defect diagnosed?

Often, as with most heart defects, the first indication of a problem is when your veterinarian hears a heart murmur on your pup's physical examination. Sometimes there is exercise intolerance or respiratory difficulty, but this is usually in an older dog or a young pup with a large defect where congestive heart failure has already developed.

Some low-grade murmurs are "innocent" and disappear by 6 months of age, but if the murmur is significant, your veterinarian will suggest a diagnostic workup to determine the cause. S/he will listen very carefully to your dog's heart to determine where the murmur is loudest and when it occurs during the cardiac cycle. Other diagnostic aids include chest x-rays and an electrocardiogram (ECG). Echocardiography (an ultrasound) is generally required to determine the location and severity of a ventricular septal defect.

Based on the results of these various tests, your veterinarian will discuss with you the prognosis and long term management of your pet. S/he will also be able to tell you whether any detectable change has occurred in the heart already as a result of the defect.

FOR THE VETERINARIAN:

1. **MURMUR:** harsh regurgitant holosystolic murmur, loudest in right intercostal spaces 2 to 4; also can often be heard cranially on left thorax.
2. **ELECTROCARDIOGRAM:** normal or LV enlargement (with larger shunts); may develop right bundle branch block; may indicate right-sided enlargement if right-to-left shunt develops.
3. **RADIOGRAPHS:** normal or left-sided enlargement; with larger shunts, increased prominence of pulmonary vasculature; right-sided enlargement if right-to-left shunt develops.
4. **OTHER:** Clinical signs usually don't occur unless the pulmonary volume is more than 2 to 3 times normal. Most commonly, signs associated with a left-to-right shunt and left-sided heart failure are seen. Where secondary obstructive pulmonary vascular disease develops, so that pulmonary resistance exceeds that of the systemic vasculature, a right-to-left shunt develops (Eisenmenger's physiology). This is associated with cyanosis and polycythemia and has a very poor prognosis.

How is a ventricular septal defect treated?

Signs associated with heart disease are treated when and if they develop. Treatments include medications to support the heart and to reduce pulmonary congestion, a special diet, exercise restriction, and precautionary antibiotic therapy before procedures such as dentistry.

There are 2 current surgical options available. Where a significant defect has been identified, but before right-to-left shunting has developed, pulmonary artery banding can be done to decrease the blood flow across the defect, thereby reducing the overload on the lungs and the left heart. Another procedure involves actual repair of the defect, but this requires open heart surgery and carries a high risk.

Breeding advice

Affected pups and their parents (assumed to be carriers) should not be bred. Siblings that appear normal after careful physical examination may be used for breeding with caution. Their offspring should be carefully examined and, if affected, the breeding of the parents should be discontinued.

Where to find more information?

Bonagura, J.D. and Darke, P.G.G. 1995. Congenital heart disease. *In* S.J. Ettinger and E.C. Feldman (eds.) *Textbook of Veterinary Internal Medicine*, p. 892-943. W.B. Saunders, Toronto.

Patterson, D.F. 1996. The genetics of canine congenital heart disease. *ACVIM- Proceedings of the 14th Annual Veterinary Medical Forum*: 225-226. **This reference has good information for breeders and veterinarians regarding screening and genetic counselling for congenital heart defects.**

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