

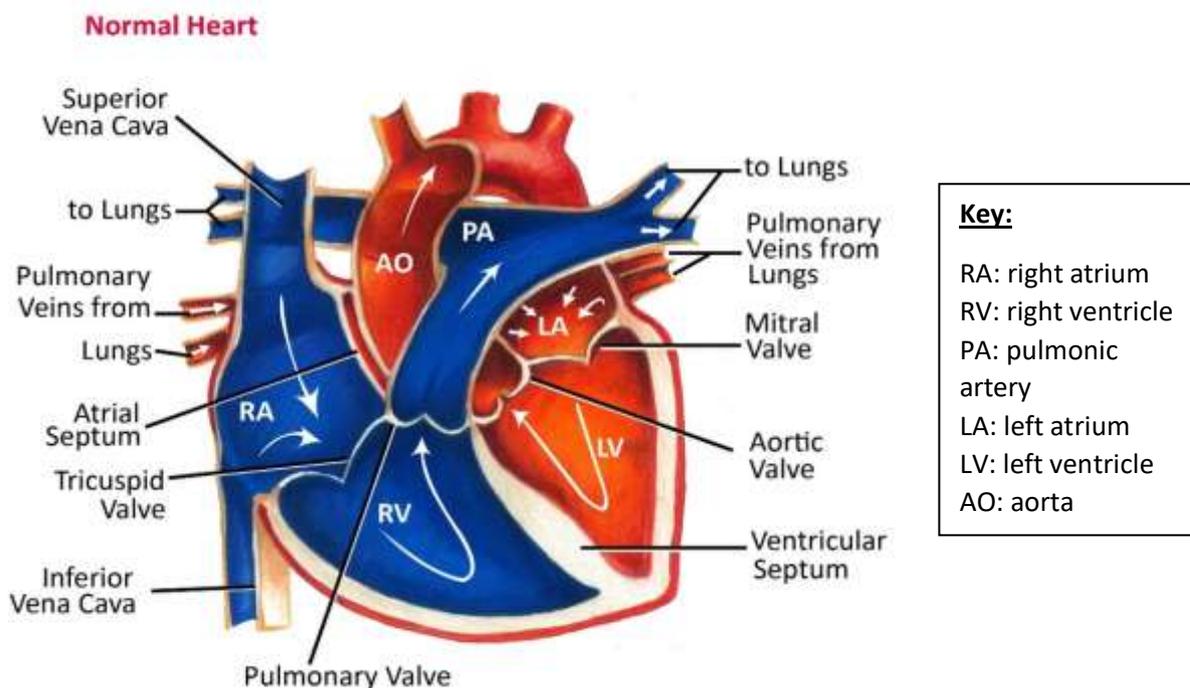


Septal Defects

How does the heart work?

The heart is the organ responsible for pumping blood to and from all tissues of the body. The heart is divided into right and left sides. The job of the right side is to pump oxygen-deficient blood returning from the body into the lungs where fresh oxygen is collected and carbon dioxide is removed. The oxygen-rich blood returning from the lungs enters the left side of the heart where it is pumped into the aorta then to the rest of the body via the arterial system.

Each side of the heart has two chambers, an upper atrium and a lower ventricle. Between the atrium and ventricle on each side lies a valve – the tricuspid on the right and the mitral on the left – that regulates blood flow into the chambers. As the heart pumps, these valves act as one-way gates allowing blood to flow from the atrium above to the ventricle below and preventing blood from flowing back into the atrium. From the ventricles, blood is then forced to flow out into the pulmonary artery (on the right) or the aorta (on the left) through a second series of one-way valves called the pulmonic valve and the aortic valve, respectively. The right and left ventricles are separated by a wall called the interventricular septum while the right and left atria are separated by a wall called the interatrial septum.





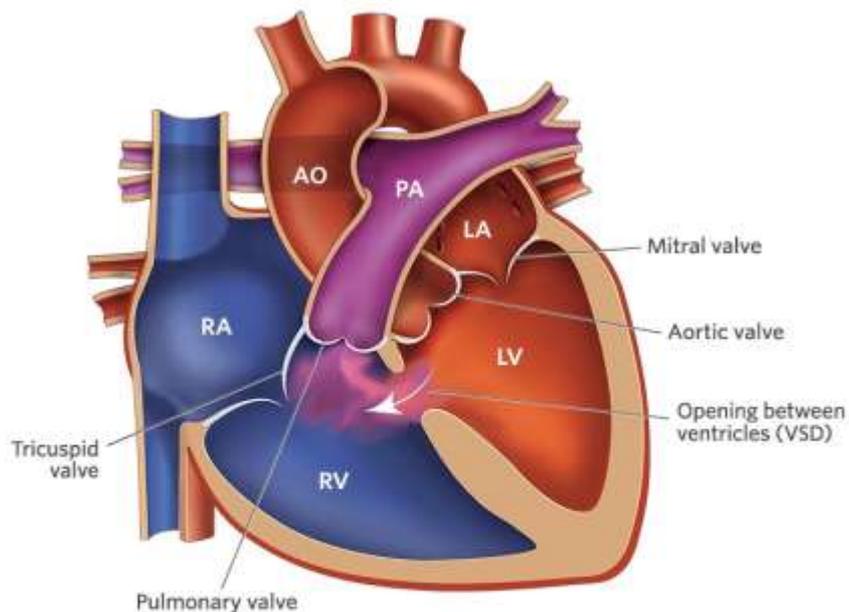
What are Septal Defects?

The two main types of septal defects are called ventricular septal defects (VSD) and atrial septal defects (ASD). A VSD refers to a 'hole' in the interventricular septum whereas an ASD refers to a 'hole' in the interatrial septum. Almost all septal defects in small animals are congenital malformations i.e. they are born with these abnormalities.

Septal defects create an alternative pathway for blood to move within the heart. The direction of blood flow through a septal defect is almost always from the left side of the heart to the right. The consequences of a VSD and ASD are different therefore these will be discussed separately now.

A VSD allows some of the blood within the left ventricle to be shunted directly into the right ventricle (rather than all into the aorta). This additional blood volume passes through the lungs and returns to the left side of the heart. In animals with moderate to large VSD's the result is a volume overload of the left side of the heart. This causes the left heart chambers to enlarge (this initial enlargement is compensatory and does not cause a problem). However, the enlargement will eventually reach a limit, which causes the pressures inside these chambers to increase. If the left atrial pressure becomes significantly high, fluid within the lung vessels (which are connected to the left atrium) begins to leak out, resulting in clinical signs of left-sided congestive heart failure (also known as pulmonary oedema).

Ventricular Septal Defect (VSD)

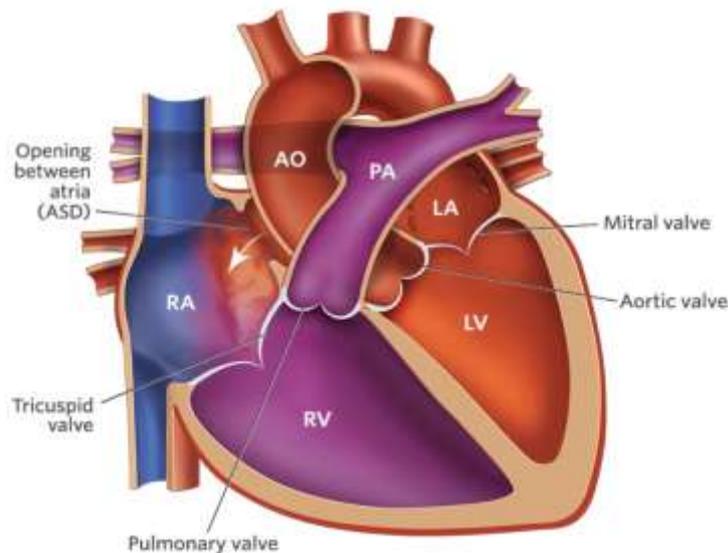


- | | | |
|---------------------|------------------|----------------------|
| ● Oxygen-rich blood | AO: Aorta | PA: Pulmonary artery |
| ● Oxygen-poor blood | LA: Left atrium | LV: Left ventricle |
| ● Mixed blood | RA: Right atrium | RV: Right ventricle |
| ● Mixed blood | | |



An ASD causes similar changes to a VSD, however the right side of the heart is affected rather than the left. With an ASD, blood flows from the left atrium directly to the right atrium and right ventricle (rather than all the blood passing from the left atrium into the left ventricle). This additional blood volume in the right heart eventually causes enlargement of these chambers. Ultimately, in animals with a moderate to large ASD, the result is right-sided congestive heart failure (fluid backs up in the abdomen and less commonly around the lungs).

Atrial Septal Defect (ASD)



- Oxygen-rich blood
 - Oxygen-poor blood
 - Mixed blood
 - Mixed blood
- | | |
|------------------|----------------------|
| AO: Aorta | PA: Pulmonary artery |
| LA: Left atrium | LV: Left ventricle |
| RA: Right atrium | RV: Right ventricle |

What animals are affected by septal defects?

Septal defects can occur in any dog breed however some breeds are considered predisposed. Such a predisposition suggests a genetic/heritable basis in these breeds.

VSD's have a higher incidence in English Bulldogs compared to other breeds.

Breeds more commonly diagnosed with an ASD include Boxers, Standard Poodles and Samoyeds.

Septal defects are also recognised with some frequency in cats (more commonly VSD's).



How do septal defects affect your pet?

Small septal defects generally do not cause a problem for your pet. They are nothing more than incidental findings.

Left-sided congestive heart failure (CHF) is the main clinical consequence of a moderate to large VSD. Left-sided CHF usually presents as rapid breathing and laboured breathing (contrary to popular belief, coughing is not a common clinical sign of congestive heart failure in dogs or cats). With more advanced disease, generalised decrease in forward circulation of blood to the body can result, which may manifest as lethargy, exercise intolerance, lack of appetite and/or weight loss.

In contrast, right-sided CHF is the main clinical concern in animals with moderate to large ASD's. Animals with right-sided congestive heart failure tend to develop a grossly distended abdomen. This can cause some discomfort, especially when lying down, and can cause a shortness of breath, particularly when sleeping or resting.

How are septal defects diagnosed?

Although there are many diagnostic modalities for heart disease, the only way to make a definitive diagnosis of septal defects is using echocardiography (cardiac ultrasound). Thoracic radiographs (x-rays) may be suggestive of a septal defect however cannot be used to make a definitive diagnosis.

How are septal defects treated?

Treatment of septal defects is predominantly aimed at eliminating signs of congestive heart failure, if or when they develop. Drugs commonly used include diuretics (frusemide, spironolactone), angiotensin converting enzyme inhibitors (benazepril, enalapril) and the inodilator drug pimobendan. The diuretic forces the kidneys to excrete more sodium and water. This in turn eliminates pulmonary oedema (fluid in the lungs) and so improves your pet's breathing. With right-sided congestive heart failure (fluid in the abdomen or chest cavity), repeated physical removal by your veterinarian is often the best option (generally by using an appropriately sized needle or catheter under sedation).

Can I delay the onset of congestive heart failure in my pet?

Unfortunately, no medical treatment is currently known which delays the onset of CHF in animals with any type of septal defect.



Can diet help?

Some animal diet manufacturers have developed heart-specific diets that are moderately restricted in salt. However, while these diets are unlikely to be harmful, they have not been shown to affect progression of the disease or control of clinical signs.

Is there surgery to correct septal defects?

In human medicine, open-heart surgery using cardiopulmonary bypass is an option to facilitate closure of an ASD or VSD (resulting in a cure). Although currently being performed by a few veterinary surgeons around the world, bypass surgery is difficult to perform in small animals. Costs are prohibitive for most pet owners.

Newer, minimally invasive techniques (i.e. 'keyhole' techniques) have been successfully performed by a small number of experienced interventional veterinary cardiologists around the world, however these procedures are not commonly performed (even by most veterinary cardiologists).

What should you monitor at home?

It is important that you monitor your pet's overall attitude and any change in behaviour. However, the most important monitoring tool a pet owner has at their disposal is the sleeping/resting respiratory rate. Please see the separate sleeping respiratory rate form for more details.

Other clinical signs to watch for include:

- laboured breathing
- fainting spells
- abdominal enlargement
- restlessness
- reduced appetite

If you notice any of the above clinical signs please contact your veterinarian immediately.

What is the prognosis for dogs with septal defects?

The prognosis depends on the stage of disease (again it must be emphasised small septal defects will never cause a problem). The prognosis prior to the onset of CHF is highly variable- dogs and cats may remain in this stage for many years prior to the development of CHF. For animals with VSD's, once CHF has developed, the



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prognosis is 12 months on average. However, dogs with an ASD and right-sided congestive heart failure, have been known to live 2-3 years before euthanasia is elected (owners normally opt for euthanasia due to uncontrollable fluid accumulation in the belly or fluid drainage that is becoming too frequent).

Although medical treatment is palliative only, quality of life for the most part is considered very good (particularly if owners are closely monitoring sleeping respiratory rates).

Additional Resource:

<http://vetmed.tufts.edu/heartsmart/>

This is a very useful and well-written resource, providing pet owners with a clear and credible source of information about veterinary cardiology.