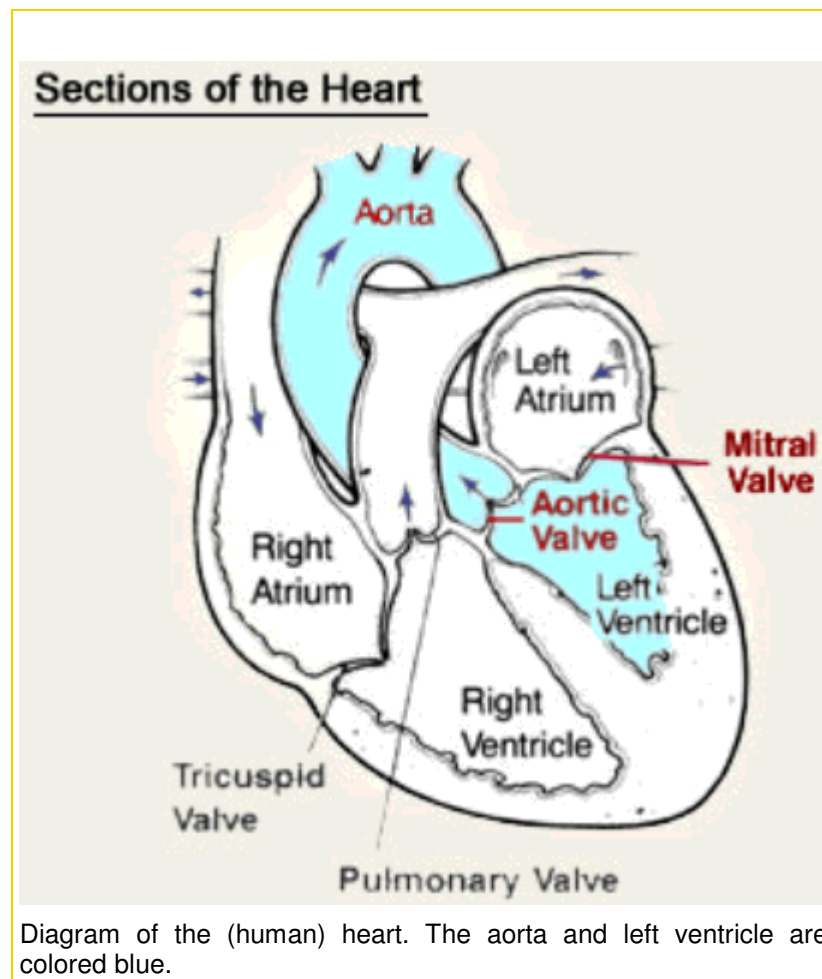


## Subaortic Stenosis (SAS)

Subaortic stenosis, affectionately known as “SAS,” is the most common congenital heart disease of large breed dogs. This article attempts to present a review of this condition, including its diagnosis and treatment.

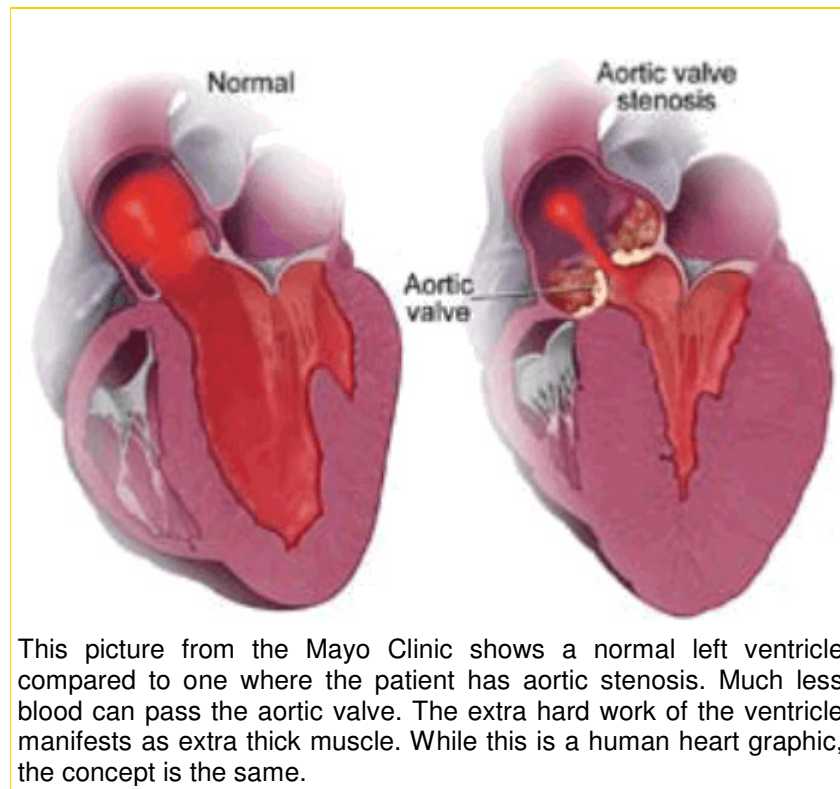
### But First

In order to understand what subaortic stenosis is, it is necessary to understand some normal heart anatomy. The heart sits more or less centrally in the chest and is divided into a left side, which receives oxygen-rich blood from the lung and pumps it to the rest of the body, and a right side, which receives “used” blood from the body and pumps it to the lung to pick up fresh oxygen. Because the left side of the heart must supply blood to the whole body, its muscle is especially thick and strong. Blood is pumped from the left ventricle (pumping chamber) to a particularly large blood vessel called the aorta (the aorta is the body’s largest artery). The valve that separates the left ventricle from the aorta is called the aortic valve. The left ventricle narrows as it leads to the aorta and this area is called the aortic outflow tract.



In subaortic stenosis, the left ventricular outflow tract just below the aortic valve has a scar-like narrowing or “stenosis” (which is another word for narrowing). This means that the left ventricle must pump extra hard to move the correct blood volume through the narrowed area. The blood squirts through in a turbulent fashion (like if you squeezed down on a garden hose) that creates a sound known as a heart

murmur. While any cause of turbulent blood flow can be heard as a murmur, and a murmur does not always indicate disease is present, the murmur is usually the first sign that the puppy in question might have SAS.



The most commonly affected breeds for SAS include the Golden retriever, Rottweiler, Newfoundland, Great Dane, Boxer, German Shepherd, and German Short-haired pointer.

When a puppy with SAS is born, the stenosis is very small, barely a ridge near the valve, but over the first four to six months of life the stenosis grows and the murmur (hopefully) becomes more apparent.

The murmur is best heard on the left side of the chest at the level of the base of the heart. Generally, the louder the murmur, the worse the obstruction of the valve. The murmur is famous for radiating its sound up the carotid arteries of the neck. Over time, the muscle of the left ventricle thickens and grows due to the excess work it must perform. Eventually this interferes with the pumping chamber's flexibility and ability to fill (see how small the chamber in the above graphic has become compared to normal). Abnormal muscle in the heart makes for abnormal electrical conduction in the heart and soon the heart's normal electrical rhythm may be disrupted. These pumping and electrical issues can lead to fainting spells or even sudden death. How long a dog with SAS lives is very much a function of how severely the outflow tract is narrowed. Most dogs with severe SAS do not survive beyond age 3 years without treatment, though dogs with milder cases can have normal life spans. A dog with SAS is always predisposed to electrical arrhythmia and sudden death, heart failure, or infection of the abnormal aortic valve.

## **Recognizing the Disease**

Obviously, the pup is not going to receive proper management unless the condition is recognized. The first step is hearing the murmur.

As mentioned above, a murmur is the sound made by turbulent blood flow. In other words, a murmur is a sound that might or might not indicate heart disease. Puppies under age six months sometimes demonstrate what are called “innocent murmurs,” which simply represent temporary turbulent blood flow. An innocent murmur is not very loud and should disappear by age six months; any murmur that persists beyond this time or is felt to be loud should be pursued as potentially abnormal. Prior to age six months, diagnostics may be difficult to interpret, depending on the patient’s size.

## **After the Murmur**

Chest radiographs are helpful in assessing any evidence of actual heart failure, and may even show a dilation of the aorta near the valve (caused by the high pressure squirt of blood through the narrowing). This said, the real key to diagnosis is ultrasound (echocardiography) where the heart's chamber sizes and wall thicknesses are measured. Generally the cross-sectional area of the left ventricle outflow tract is compared to that of the aorta in a ratio to assess the severity of the stenosis. This information is generally adequate to confirm the diagnosis though a mild case might have values that overlap the normal range. Such a patient might have to be followed over time. A special kind of ultrasound called “Doppler” is particularly helpful in measuring the severity of the stenosis/narrowing. We can do an echodardiogram here, but we do not have Doppler ultrasound.

## **Treatment: Drugs**

The goal in treating SAS is to create normal ability to exercise and normal life span. The most popular class of drug for SAS is the “beta blockers.” Beta receptors are the neurologic areas on the heart that respond to adrenaline (we call it “epinephrine” now) and cause the heart to rate to speed up during exercise. In SAS, this kind of racing pulse is what leads to the abnormal electrical rhythm (and ultimately fainting). It is hoped that the beta blockers will keep the heart from racing. Atenolol, a beta blocker, is currently being investigated. Of all the treatment options available for SAS, atenolol is certainly the least invasive and least expensive, but studies are on-going to determine if it is also the most effective.

## **Treatment: Surgery**

Open heart surgery is uncommonly performed in dogs but it is possible to surgically excise the collar of scarring that is narrowing the outflow tract. One would think this would solve the whole problem, but in fact resulting survival times are similar to those for dogs simply taking beta blockers.

## **Treatment: Balloon Valvuloplasty**

With balloon valvuloplasty, the patient is anesthetized and a type of catheter is threaded into the heart so that it spans the stenosis. The catheter has a tough balloon at the end that is then inflated, breaking down the scarring and dilating the stenosis (think of using a shoe stretcher in too-tight shoes). Again, one would think that this would solve the problem, but survival times are similar to those for dogs simply taking beta blockers.

At this time, invasive procedures cannot be recommended over medication. More complete studies in the future may change this, so we'll update here as we learn more information.