

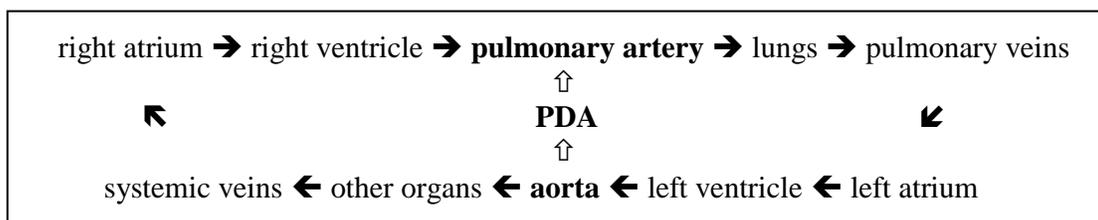
Patent Ductus Arteriosus in Dogs

What is a patent ductus arteriosus?

A **patent ductus arteriosus (PDA)** is a congenital cardiac anomaly, or a structural abnormality in the heart that is present at birth, rather than developing later in life. Specifically, a PDA is characterized by the persistent functioning (or *patency*) of a certain blood vessel (called the *ductus arteriosus*) that normally spontaneously closes and stops carrying blood within a few hours to several days after birth. To understand the significance of a PDA, a brief explanation of blood circulation through the body is helpful.

The heart is divided by a septum down the middle into a right side and a left side, with two chambers (an *atrium* followed by a *ventricle*) on each side. The right side of the heart is dedicated to pumping blood to the lungs via the *pulmonary artery*. The left side of the heart is responsible for pumping blood to the rest of the body's organs via the *aorta*. Normally, there is no direct connection between any of the right- and left-sided structures once an animal is born and begins breathing air.

In the unborn fetus, the ductus arteriosus is critical to normal blood flow, allowing blood to be diverted away from the lungs (which are not yet being used) by connecting the pulmonary artery to the aorta. After birth, however, due to a pressure drop that occurs in the lungs as the neonate begins to breathe, a PDA carries blood in the opposite direction (as shown below) and allows excessive return of blood to the chambers on the left side of the heart. Eventually, the overload placed on these chambers leads to the development of congestive heart failure in most dogs with a PDA. The diagram below shows the path of normal blood flow (solid arrows), along with the alteration in blood flow permitted by a PDA (open arrows).



How is a PDA 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” noise associated with the normally crisp heart sounds, heard while listening to the heart with a stethoscope. Although many different conditions result in the presence of a heart murmur, the murmur associated with a PDA typically has a distinctive sound often described as resembling a washing machine. 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 PDA 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 PDA, observation of turbulent blood flow through the ductus arteriosus leads to this specific diagnosis. Assessment of the shape of the PDA is also made, since this has implications regarding therapy. This is discussed further below.

Chest x-rays are used to obtain a “big picture” view of the heart within the chest cavity. They allow evaluation of the lungs and are necessary to rule out congestive heart failure. An **electrocardiogram** is performed in order to identify and characterize arrhythmias that may be present, and to guide antiarrhythmic therapy if necessary. Bloodwork is performed prior to general anesthesia for PDA correction or if cardiac medications are begun or changed.

How is a PDA treated?

Currently, two options exist for correction of PDAs in dogs, both aimed at terminating blood flow through the ductus arteriosus. Each procedure has pros and cons which are discussed in detail prior to deciding which way to proceed. The more traditional and invasive approach involves **surgical ligation** of the PDA. In this procedure, the PDA is isolated within the chest cavity and a surgical knot is tied around it, thereby occluding blood flow through it.

The newer and less invasive approach is called **transarterial coil occlusion**. Here, a metal coil is advanced into a small artery in the leg, and then through progressively larger arteries to reach the ductus arteriosus. The coil is delivered directly into the PDA where it causes a blood clot to form, thus blocking blood flow from within the vessel. The success of coil occlusion depends on the PDA having the shape of a cone or funnel, as opposed to a simple tubular shape which will not retain the deposited coil. Preliminary determination of the shape of the PDA is made during the initial echocardiogram. If a conical or funnel-shaped PDA is suspected and coil occlusion is chosen, a special “contrast” x-ray study is used to confirm the shape and size of the PDA just prior to delivery of the coil. In some cases, attempted coil occlusion is unsuccessful and surgical ligation must be performed after all.

What is the prognosis? What should I watch for?

Dogs that have their PDA successfully corrected via one of the above procedures have an excellent prognosis for long-term survival and are expected to have a normal lifespan with no restrictions of any kind. Unfortunately, the majority of dogs that do not undergo surgical ligation or coil occlusion go on to develop congestive heart failure during the first year of life, a condition which ultimately leads to death.

Many dogs are asymptomatic at the time of diagnosis and should remain so following correction of the PDA. For dogs diagnosed later in the course of disease or for those not corrected, symptoms may include **lethargy, weakness, intolerance to activity or exercise, coughing, and rapid or labored breathing**. 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, require immediate attention on an emergency basis.