What is Pulmonic Stenosis?
Pulmonic stenosis (PS) is a congenital (present from birth) condition that results in obstruction of flow from the right ventricle out to the pulmonary artery. The most common form of pulmonic stenosis is *valvular* pulmonic stenosis, and is the most amenable to correction.
Valvular PS is a congenital defect whereby the pulmonic valve leaflets open incompletely in the contraction phase (systole) of the cardiac cycle. Supravalvular PS is when there is a ring or ridge of tissue above the pulmonic valve causing obstruction of outflow while subvalvular PS refers to obstruction below the pulmonic valve. The rest of this discussion will focus on valvular PS but the pathophysiology is the same for all three types.

In order for you to understand how this disease may affect your dog, it is important to understand how blood travels through the heart. The venous blood from the body drains into the right atrium, through the tricuspid valve, and into the right ventricle. The right ventricle then pumps this un-oxygenated blood to the lungs through the *pulmonic valve*
into the pulmonary artery. Moving through capillaries, the blood picks up oxygen from the lungs. This blood then drains through large pulmonary veins into the left atrium, through the mitral valve and into the left ventricle where it is pumped through the aorta and back to the body.

Dogs with PS have partial fusion of the valve leaflets that causes an acceleration of blood flow as it crosses the valve, forcing the right ventricle to pump harder to push blood through the valve. The abnormal blood flow is what causes the heart murmur that was ausculted by your veterinarian. Because the outflow tract is abnormally narrowed, the pressure the right ventricle must overcome in order to pump blood into the pulmonary artery is elevated. This change in pressure is termed the pressure gradient and the degree of elevation of the pressure gradient is how PS is classified. Like any muscle, the right ventricular muscle thickens and enlarges because it has to work harder to overcome the increase in pressure. Unlike other muscles in the body, the heart has a limited blood supply, and as the right ventricle gets thicker, it only receives limited supply of blood (called “perfusions”). With time, this lack of perfusion can result in damage to portions of the muscle. This damaged heart muscle can cause rhythm disturbances and with time, can start to fail – resulting in congestive heart failure.

How is Pulmonic Stenosis diagnosed?
An echocardiogram is the diagnostic of choice because it enables your cardiologist to visualize the heart’s structure and function, and also to determine the severity and type of abnormality present. In normal dogs, the pressure gradient across the pulmonic valve is less than 20mmHg. In dogs with mild PS, the pressure gradient is between 20 and 50mmHg. Dogs with moderate PS have a pressure gradient between 50 and 80mmHg and dogs with severe PS have a pressure gradient greater than 80mmHg.

Not only is an echocardiogram used to make the diagnosis of PS and to classify its severity, but it is also important to evaluate for concurrent defects. Many dogs with PS also have a patent foramen ovale (abnormal connection between the right and left atria) as well as a malformed tricuspid valve. These findings can significantly effect prognosis and treatment options.

How is Pulmonic Stenosis treated?
Dogs with mild PS have a good prognosis and generally live a full life without treatment. Dogs with moderate PS also have a good prognosis, however a small percentage may go on to develop muscle failure late in life. In dogs with moderate PS that have concurrent tricuspid valve dysplasia or a patent foramen ovale, therapy should be considered. Dogs with severe PS are at risk for sudden death, fainting, and exercise intolerance as well as eventual muscle failure.

Therapeutic options for valvular pulmonic stenosis include balloon valvuloplasty (BV) as well as surgical valvulotomy. BV is the preferred treatment as it is minimally invasive and offers a good outcome. It is performed by a cardiologist in a catheterization laboratory. Surgical valvulotomy is performed by a surgeon and entails a thoracotomy (incision into the thoracic cavity).

Supra or sub valvular obstructions are less amenable to balloon valvuloplasty. Surgery is indicated in cases where the obstruction is severe. Few institutions are able to provide this option.

With therapy, the prognosis for severe PS is good. Some dogs require lifelong therapy of a beta blocker while others can be maintained on no medication. Lifelong monitoring with echocardiograms is warranted in all cases of moderate severe PS.