Animal Specialty Hospital of Florida

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Pulmonary Hypertension:

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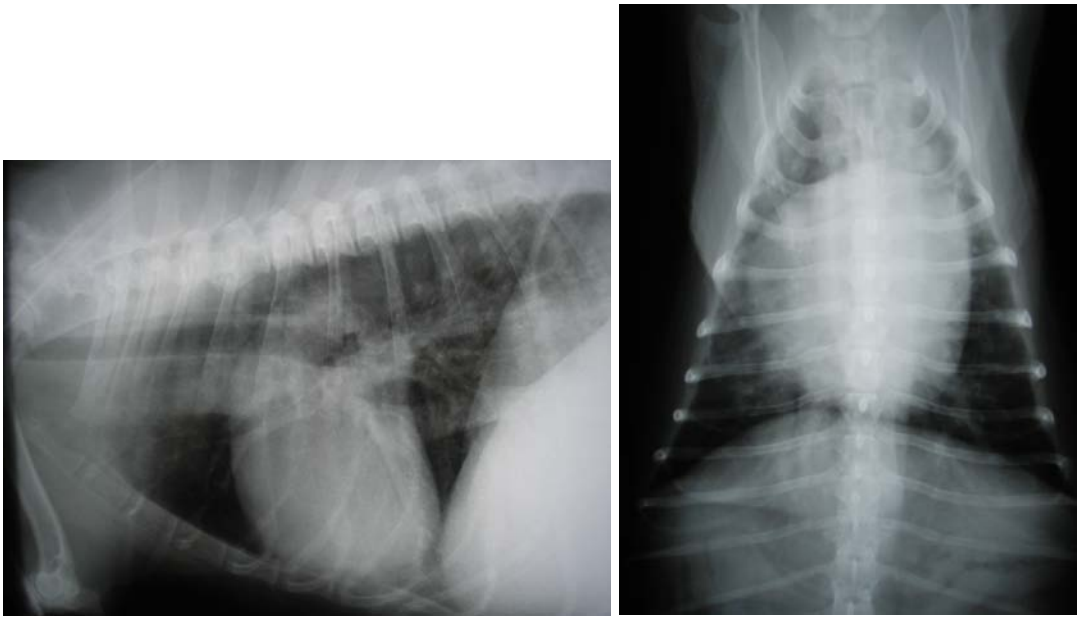
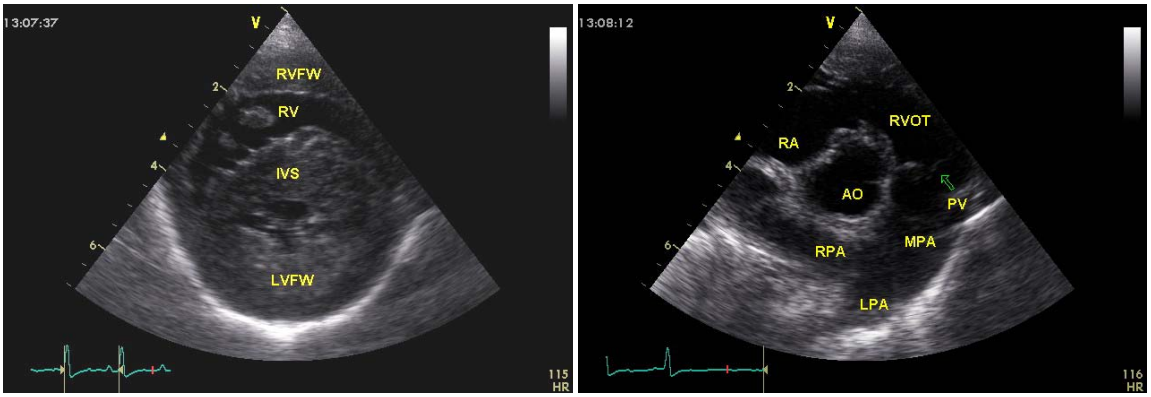
Pulmonary hypertension (PHT, *pulmonary arterial hypertension* or PAH) is a condition in which the blood pressure in the lungs is excessively elevated. The normal blood pressure in the pulmonary artery is no more than 30 mmHg. Patients with severe pulmonary hypertension may have pulmonary arterial pressures greater than 80 mmHg. This condition may rarely develop suddenly secondary to a large clot called a pulmonary thromboembolism. Patients with massive pulmonary thromboemboli typically have severe difficulty breathing and unfortunately tend to pass away suddenly. Most commonly, pulmonary hypertension develops over a long period of time. *Primary* pulmonary hypertension occurs in the absence of obvious underlying lung or left heart disease. *Secondary* pulmonary hypertension may develop in response to chronic left-sided congestive heart failure, in which case the degree of pulmonary hypertension tends to be modest and resolves with appropriate therapy for heart failure. Pulmonary hypertension also commonly develops secondary to **heartworm disease** and chronic lung/airway disease (airway collapse, chronic bronchitis/COPD).

Patients with severe pulmonary hypertension often present to the veterinarian for difficult or labored breathing. In some cases, patients may have obvious oxygen depletion, and have a bluish color to the tongue and gums. This is called *cyanosis*. Some patients may have fainting episodes (syncope). Patients with cyanosis, difficulty breathing and fainting typically respond to the administration of supplemental oxygen. The blood tends to shunt around ventilated regions of the lung in patients with pulmonary hypertension, and this is what leads to the low oxygen content in the bloodstream and subsequent clinical signs.

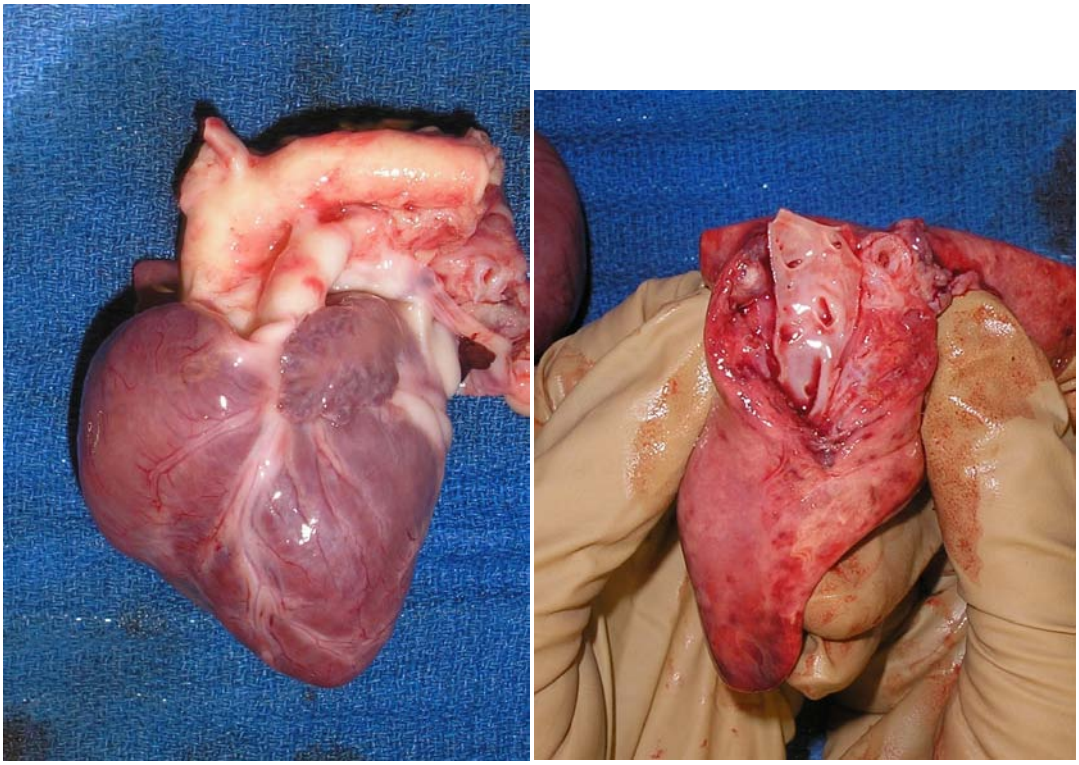
Chest x-rays may show dilated pulmonary arteries with occasional heart enlargement. Changes consistent with chronic lung disease or airway collapse may be present. The diagnosis of pulmonary hypertension is best made with invasive catheterization of the main pulmonary artery with a direct blood pressure measurement. This is typically not practical in patients with severe respiratory distress, as it requires general anesthesia in dogs. The best way to non-invasively diagnose this condition is through the use of echocardiography (ultrasound of the heart). The pressure on the right side of the heart may be estimated using Doppler technology, and the veterinarian can assess for any secondary heart muscle thickening that may develop in response to the high pressure load. We are also able to diagnose concurrent underlying structural heart disease. Blood testing is used to rule-out underlying heartworm infestation.



Radiographs of a dog with severe pulmonary hypertension. The pulmonary arteries are dilated. A diffuse interstitial pattern in the caudodorsal lung field suggests chronic lung disease.



Echocardiographs of a dog with pulmonary hypertension. The right ventricular free wall (RVFW) is thickened. The main pulmonary artery (MPA) and right and left pulmonary artery branches (RPA, LPA) are dilated. (RV: right ventricle, IVS: interventricular septum, LVFW: left ventricular free wall, RA: right atrium, RVOT: right ventricular outflow tract, Ao: aorta, PV: pulmonic valve).



Gross specimen from a patient with severe pulmonary hypertension present since birth. The right side of the heart is severely enlarged. To the right, the lungs are opened, revealing thickened pulmonary arteries.

The treatment of pulmonary hypertension involves medical management of any underlying causes (i.e. medical therapy for heart failure or lung/airway disease if present), oxygen therapy in severely affected patients and sometime specific medical therapy for pulmonary hypertension. The use of phosphodiesterase inhibitors is often advocated. The most commonly used medication is sildenafil (*VIAGRA®, REVATIO®*). This medication acts directly on the pulmonary arteries to help them relax, and may improve the symptoms of patients suffering from severe pulmonary hypertension. Other phosphodiesterase inhibitors may be used in different situations. Pimobendan (*VETMEDIN®*) may be prescribed if the patient has concurrent heart failure, and theophylline (*THEO-DUR®*) may be given to patient s with chronic lung disease.

The prognosis for patients with pulmonary hypertension depends on many different factors. Patients that have treatable underlying causes may do well for some period of time, depending on the severity of the underlying condition. Cases that have no obvious underlying cause (primary pulmonary hypertension) generally have a guarded prognosis.