

Cardiology: The Equine Heart

Cardiac disease is thought to be the third-most-common cause of “poor performance” in athletic horses

Overview

The equine heart is a hollow organ comprised of two chambers—one with two atria and the other with two ventricles—that function in concert to receive deoxygenated blood from veins into the right side and subsequently propel oxygenated blood through the body via arteries from the left side.

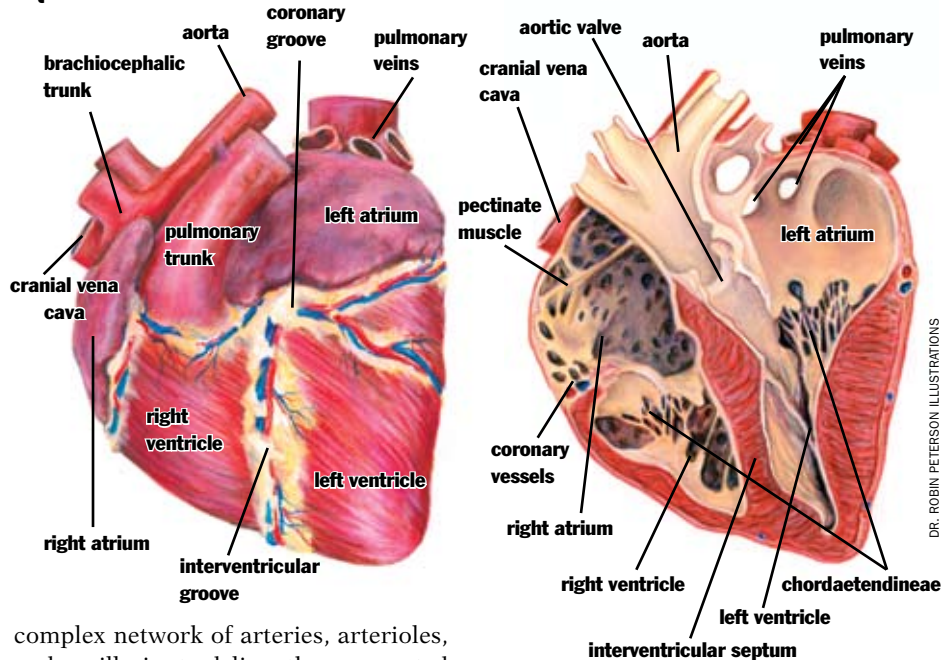
Cardiac disease is considered the third-most-common cause of “poor performance” in athletic horses (after musculoskeletal disease and respiratory disorders); however, cardiac abnormalities are rare. Horses with cardiac dysfunction typically present with a history of poor performance/exercise intolerance, distended veins, swelling of the limbs, weakness, or collapse.

Structure and Function

The equine heart is located in the anterior region, largely covered (externally) by the forelimbs. The exact anatomic location within the chest cavity and the overall size of the heart is breed-dependent. The equine heart is a four-chambered, hollow, muscular organ divided into right and left sides by a septum (wall). Each side has an atrium (a receiving chamber) and a ventricle (an ejecting chamber).

Blood is dumped into the right ventricle from the venous circulation via the inferior and superior vena cava. This oxygen-poor blood then flows through the right atrioventricular valve (also known as the tricuspid valve) to the right ventricle. The right ventricle contracts to pump the blood through the pulmonic valve and pulmonary arteries to the lungs, where oxygen is loaded onto the hemoglobin within the red blood cells. Oxygenated blood returns to the heart by way of pulmonary veins to the left atrium and ventricle, which are separated by the left atrioventricular (mitral) valve. Finally, the oxygenated blood in the muscular left ventricle is pumped out of the heart through the aortic valve and into the aorta. The aorta branches into a

EQUINE HEART



DR. ROBIN PETERSON ILLUSTRATIONS

complex network of arteries, arterioles, and capillaries to deliver the oxygenated blood to the organs and tissues.

In horses, 100% of the blood volume passes through the heart each minute. Thus, coordinated contraction of the heart chambers and proper functioning of the valves located between the atria, ventricles, and their associated blood vessels is essential. The sinoatrial node, located in the right atria, is the heart’s pacemaker. It is responsible for controlling the rate of atrial and ventricular contractions. It achieves this by initiating an electrical signal that travels through the heart between the right and left atria to the atrioventricular node and via “Purkinje fibers” located throughout the ventricles.

When Things Go Wrong

While horses are technically at-risk of suffering from either congenital (present at birth) or acquired cardiac conditions, heart disease is rare in horses. Some of the more common conditions include cardiac arrhythmias and valvular insufficiencies.

Heart murmurs and valvular heart disease

The heart valves play an important role in ensuring unidirectional (moving one direction) flow blood through the heart. Leaky valves, often referred to as insufficient valves, are those that permit blood to flow back across the valve either through the atria or the ventricles. This backflow, depending on the severity and the exact valve that is affected, is often associated with a heart murmur. The murmur itself simply indicates that the blood flow in a specific region of the heart is turbulent, not that the horse has heart disease.

Cardiac arrhythmias An arrhythmia refers to any irregular heartbeat. In some horses, particularly fit ones, the most common arrhythmia is second degree atrioventricular heart block. It is characterized by a “missed” heart beat. This arrhythmia is regular in its irregularity and usually resolves with an increased heart rate.

Atrial fibrillation is the most common

arrhythmia associated with poor performance. It's caused by malfunctioning of the sinoatrial node. Instead of a single signal stimulating contraction of the ventricles, several signals are generated in the atria, resulting in an irregular heart rate and decreased cardiac function during exercise.

Treatment and prognosis for the various cardiac abnormalities that can occur in horses is dependent on the use of the horse, the underlying cause, and the exact nature of the disease process.

Diagnosis

Since many horses have murmurs or arrhythmias that are not clinically relevant (i.e., do not impact health or performance) or occur only intermittently, obtaining a diagnosis and interpreting test results can be challenging. Key diagnostic tests include:

Cardiac auscultation A stethoscope is used to note heart rate and rhythm, detect the presence of a murmur, and assess the status of the valves. The location and specific characteristics of the murmur (e.g., duration and intensity of the murmur) provide some information regarding the significance and cause of the murmur.

ECG (electrocardiogram) Used to assess the electrical activity of the heart and provide a visual representation of the electrical signals generated in the heart. ECGs can be performed for a short period of time while the horse is at rest or can be done continuously in ECG recordings that collect 24 hours worth of data (or more). This latter technique is a useful adjunct for the diagnosis of infrequent arrhythmias, for assessing the severity of an arrhythmia, and for monitoring response to therapy (e.g., horses with atrial fibrillation that are treated with quinidine sulfate). In addition, some ECGs are fitted with a radiotelemetry unit for use while the horse is on a high-speed treadmill or under saddle. This allows veterinarians to evaluate cardiac function during and immediately after exercise. ECGs can also be sent electronically to specialists for additional diagnoses.

X-rays Used infrequently to assess the size and shape of heart, although they do not provide enough specific information.

Cardiac ultrasound (echocardiography) Used to assess the valve's function and the size, shape, and structure of the heart in motion. Color-flow Doppler imaging

FAST FACTS

- The equine heart is a hollow organ comprised of two atria and two ventricles that function in concert to receive blood from veins and subsequently propel blood through the body via arteries.
- Cardiac disease is thought to be the third-most-common cause of "poor performance" in athletic horses after musculoskeletal disease and respiratory tract disorders; however, cardiac abnormalities in horses are rare.
- The most common and relevant cardiac abnormalities diagnosed in horses are valvular insufficiencies and atrial fibrillation.
- Diagnosing a cardiac abnormality that negatively impacts performance can be challenging. Typical tests include auscultation, an electrocardiogram, and cardiac ultrasound.

allows veterinarians to evaluate the speed and pattern of blood flow within the heart and great vessels at rest or immediately after exercise. The use of telemedicine allows field veterinarians to perform an ultrasound and ECGs examinations and send the data to a cardiac specialist for his/her expert opinion. 🐾