Proceedings of the 12th International Congress of the World Equine Veterinary Association
WEVA

November 2 - 5, 2011
Hyderabad, India

Reprinted in IVIS with the Permission of WEVA Organizers
The most common cardiac arrhythmias and murmurs

R Buhl
Department of Large Animal Sciences, Faculty of Life Sciences, University of Copenhagen, Højbakkegård Alle 5, 2630 Taastrup, Denmark
Email: rib@life.ku.dk

The clinician working in equine practice will often be challenged by abnormal cardiac auscultatory findings where the clinical influence on the horse needs to be considered. This presentation will focus on the most common arrhythmias and murmurs that may influence performance abilities of the horse.

Cardiac murmurs
Blood flow through the heart is generally laminar, but a number of circumstances may alter the laminar blood flow, resulting in turbulent flow. Turbulent flow causes vibrations of cardiac structures resulting in a murmur that can be heard by auscultation. Three different types of murmurs exist where the physiological and functional murmurs are benign and not associated with cardiac changes. This presentation will focus on the most common pathological murmurs which develop due to acquired or congenital cardiac malformations, e.g. valvular regurgitations or ventricular septal defects (VSD) that result in high velocity blood flows from low pressure to high pressure areas, inducing cardiac murmurs. With some practice, auscultation is almost sufficient to identify the source-of-the-murmur. However, the exact diagnosis and quantification of the severity requires echocardiographic examination. In most equine patients with valvular disease, specific therapy is not indicated and management is aimed at periodic monitoring of cardiac function, client information as well as supportive therapy if congestive heart failure is present.

Tricuspid regurgitation (TR) is the most common valvular regurgitation in racehorses probably as a result of athletic training where training-induced myocardial hypertrophy may expand the valvular annulus leading to valvular incompetence. This systolic murmur has the point-of-maximal-intensity (PMI) over the right-side of thorax. Despite the difficulties in auscultating right-sided heart sounds, this murmur is surprisingly easy to hear. TR can result from pulmonary regurgitation but often it is an incidental finding that seldom leads to clinical symptoms. If the regurgitation is severe, signs of right-sided heart failure may develop with jugular distension, jugular pulsation and dependent oedema. If a right-sided systolic murmur is auscultated then it is important to differentiate TR from VSD, see below.

Mitral regurgitation (MR) is the most important valvular condition affecting the athletic performance in horses. In severe cases, this murmur results in reduced performance, tachycardia, tachypnoea and coughing. It may be caused by dysfunction of any part of the mitral valve apparatus, and often reported as degenerative myxomatous changes with cellular infiltration of the valves leading to general or nodular thickening. In addition, physical training may result in regurgitations due to training-induced myocardial hypertrophy leading to valvular incompetence. The MR murmur is a systolic murmur with PMI over the mitral valve area often radiating caudodorsally. Secondary to MR, left atrial enlargement and left ventricular volume overload may develop predisposing the horse to supraventricular arrhythmias, such as atrial fibrillation.

Aortic regurgitation (AR) is common in older horses and arises because of normal progressive changes due to ageing. It is the most common cardiac valve diagnosed with pathological changes such as nodular or general fibrous thickening on the valve leaflets. AR is auscultated as a holodiastolic murmur with PMI over the aortic valve at the basal area of left hemithorax. As the aortic valve is located centrally in the heart, the murmur may also be heard on the right hemithorax. The murmur sometimes has a decrescendo musical quality, and in these cases it is relatively easy to diagnose. However, the intensity of the murmur may not always be correlated to the severity of the disease. For older horses, AR will seldom result in clinical signs of poor performance. When aortic regurgitation is diagnosed in younger horses then this may indicate
premature aortic valve disease. Progression of aortic regurgitation leads to volume overload of the left ventricle and dilatation and eccentric ventricular hypertrophy. Also, MR may develop due to dilation of the mitral annulus. The enlargement of the ventricle results in increasing myocardial oxygen demand. The myocardium is supplied during diastole via the coronary arteries just above the aortic valve, and coronary perfusion is reduced as a result of the rapid decrease of diastolic blood pressure. Ischemia of the ventricles may lead to ventricular arrhythmias that can result in poor performance and possible collapse or even death.

**Ventricular septal defect (VSD)** is the most common congenital cardiac defect and usually situated at the base of the interventricular septum. The hemodynamic effect of VSD results in blood flowing from left ventricle (high pressure) towards right ventricle (low pressure) resulting in a systolic murmur over the right-side of hemithorax radiating ventrally. However, the murmur associated with VSD is typically lower on the chest wall in comparison to TR. Due to right ventricular volume overload, a relative pulmonic stenosis develops which produces a systolic murmur over the left hemithorax with PMI over the pulmonic valve. The diagnosis of VSD can be diagnosed by careful auscultation alone. However, the severity of right ventricular overload and maintenance of the pressure gradient between left and right ventricle can be estimated only by echocardiography. The influence on the horse’s performance depends on the severity of the defect, varying from no clinical symptoms and unaffected performance to symptoms of congestive heart failure.

**Cardiac arrhythmias**

Arrhythmias occur commonly in athletic horses, where the majority usually do not affect performance. Alterations in cardiac rhythm are common in horses due to their high parasympathetic tone, and thus clinicians will be challenged by a wide variety of normal rhythm disturbances in the resting horse. Typically these are bradyarrhythmias i.e. sinoatrial block (SA block), atria-ventricular block (AV block) and sinus pauses. An ECG is required when the exact diagnosis is warranted, but often these arrhythmias disappear when heart rate increases and will not influence the horse’s performance. Therefore, this presentation will focus only on arrhythmias with the potential to negatively influence the horse’s performance.

**Supra ventricular premature contractions (SVPC)** originate in the atria, before the SA node fires, and occur frequently in horses both at rest and during exercise. The aetiology is not clarified but the arrhythmia is often an incidental finding in clinically normal horses or associated with myocardial damage, electrolyte disturbances or systemic diseases. During auscultation, a premature heartbeat is heard followed by a regular heartbeat with no compensatory pause, but a definitive diagnosis must be determined by ECG. The influence on athletic performance is not known but recent studies indicate that some normal performing horses have up to 10-20 SVPCs during exercise. If SVPCs are diagnosed during rest, exercise ECG should be performed. If the arrhythmia is suspected to affect performance, corticosteroids can be considered although no proven effect has been documented.

**Atrial fibrillation (AF)** is the most common arrhythmia in horses and will often be associated with reduced athletic performance. AF occurs primarily due to an altered function of the ion channels in the atrial myocytes, called electrical remodeling. AF results in an irregularly irregular rhythm which by auscultation often is described as a chaotic cardiac rhythm. Horses are predisposed to AF due to their high vagal tone and large atrial chambers. This is probably the explanation as to why AF seldom is reported in ponies. AF can be sustained in the horse or short-lived and paroxysmal that resolves spontaneously within hours or days. Most horses with AF have no underlying heart disease, although MR predisposes to AF and therefore a systolic murmur may be heard over the left hemithorax. Horses with no or little underlying cardiac disease are candidates for therapeutic intervention, either medical (e.g. quinidine sulphate) or by electroconversion. Horses with chronic (>3 months duration) AF are less likely to convert to a normal sinus rhythm and thus more likely to revert to AF after successful conversion. In contrast, acute onset of AF (<3 months duration) have a very high treatment success.

**Ventricular premature contractions (VPC)** arise within the ventricular myocardium. The prevalence of VPC is much lower in comparison to SVPC, and as for SVPCs, the exact aetiology is not known although ventricular hypertrophy and hypoxia is associated with development of VPC. As for SVPC, a premature heartbeat is heard by auscultation followed by a regular heartbeat and a definitive diagnosis must be determined by ECG. If more than three consecutive ventricular premature beats are observed, this is termed ventricular tachycardia which is potentially life threatening for the horse. Generally, it is accepted that VPCs can lead to reduced performance; however, the exact number of VPCs required before cardiac output is reduced significantly is not well established. If VPCs are diagnosed during resting cardiac examination, exercise ECGs, 24 hour Holter and echocardiography are indicated. If the arrhythmias occur frequently or during exercise, then treatment with corticosteroids can be considered. If ventricular tachycardia develops, then lidocaine should be used.