

If Only They Could Talk

Our regular focus on equine health. This month vet **BECKY DINSDALE** considers the impressive cardiovascular system of the horse.

FOLLOWING my recent article on Exercise-Induced Pulmonary Haemorrhage (EIPH), I was asked why it was that the respiratory system is commonly the cause of poor performance and not the cardiovascular system. The short answer is that the equine cardiovascular system has evolved to be hugely efficient with impressive reserves for exercise demands, meaning that a major pathology is required to make this system the limiting factor.

The respiratory system is responsible for getting oxygen from the nostrils to the bloodstream and the cardiovascular system ensures that oxygen in the bloodstream reaches the tissues and organs. The rarity of cardiovascular disease in equines is often misunderstood because there is so much focus upon 'cardio' in the human athletic world. But the evolution of the horse as a prey animal and breeding of the thoroughbred as an elite athlete means that the likelihood of a cardiovascular issue being the cause of poor performance is very slight.

It might be expected that the complexity of the system would predispose it to failure but, remarkably, this is rarely the case. The murmurs and arrhythmias discussed below are most often a result of over-efficiency and functional reserve being unused; cardiac disease is very uncommon; the equine's herbivorous diet means coronary artery disease is unheard of in horses; and sudden death due to cardiac failure is extremely rare.

The horse has evolved as a prey animal, requiring rapid bursts of intense movement to escape predators. One unique adaptation which makes the equine very well equipped for this is its ability to release a huge reserve of red blood cells from the spleen. This almost instantaneously increases the capacity for oxygen carriage around the body, further

reducing the likelihood of poor performance resulting from a failure of oxygen supply to the tissues.

The cardiovascular system in the horse is comprised of the heart, the blood vessels and the blood itself. The heart is a four-chambered muscular pump, that under electrical stimulation in an average thoroughbred horse moves 35 litres of blood around the 500kg body, ensuring the tissues and organs remain supplied with oxygen. The heart rate can vary between 20 bpm (beats per minute) at rest to 240bpm at gallop.

The size of a racehorse's heart has been linked to performance for many years, based on the presumption that a larger heart is more capable of efficiently moving the volume of blood and at greater speed. But despite that being apparently common sense and certainly being popular folk law, it is not always the case. The average thoroughbred heart weighs between 3.5 and 8kg, and the heart size, shape and weight can change slightly with conditioning/training. The heart size does not always correlate to the size of the horse.

The vessels vary in size and structure dependent upon their function. Arteries carry the oxygenated blood from the

heart towards the tissues. They are muscular in structure to be able to withstand the high pressure involved. The veins have much thinner walls and are less muscular as the blood they transport from the tissues back to the heart and lungs is under much lower pressure. The capillaries, which are the smallest vessels, form fine networks at low pressure and slow blood movement at the peripheral tissues to enable the exchange of oxygen and other chemicals.

The cardiovascular system is assessed most commonly via listening to the heart sounds with a stethoscope on the horse's chest wall, which allows a check on the heart rate and the detection of any abnormal sounds. If further investigation is indicated then it is commonly done through an electrocardiogram (ECG), which provides a study of the electrical patterns of the heart that coordinate the contractions (Systole) and relaxation (Diastole) periods to enable the heart to move blood efficiently. An ECG involves the placing of pads on to the horse's chest to detect the electrical patterns and the information is then recorded as a graph. This can be carried out at rest or at exercise.

Murmurs and arrhythmias are

collective terms used to group cardiovascular abnormalities.

Murmurs

A murmur is an abnormal heart sound, resultant of changes in blood flow – whether that be a leak at a valve in the heart or turbulence in a vessel or heart chamber. Murmurs are characterised based on their intensity, the timing of their occurrence in the contraction cycle, the type of sound made (harshness, pitch etc), and the location in which they are heard loudest. Murmurs can be categorised as physiological or pathological.

Physiological: meaning the murmur is associated with normal blood flow. Surprisingly 30-40% of thoroughbreds have heart murmurs that cause no clinical impact at all, but result from the sheer size of their heart chambers and vessels, which allow blood to move in multiple directions and hence cause an audible murmur.

Pathological: these murmurs are associated with underlying cardiac disease. In horses, unlike other species, these murmurs are most commonly due to blood moving against the normal blood flow direction at valves or are due to congenital abnormalities (birth defects).

The two most common murmurs detected are aortic flow murmurs and ventricular filling murmurs. These are both physiological murmurs, meaning they have little clinical relevance, and are usually only detectable at rest. They are heard due to the size of the aorta (the large artery leading from the heart to the

abdomen) and ventricles (the two 'pumping' chambers of the heart) respectively.

Arrhythmias

An arrhythmia is an abnormality in the heart's rhythm of contraction and relaxation, caused by disruption to the electrical control of the heart muscles. The heart's contractions are controlled predominantly by two 'nodes' in the wall of the heart muscle. These are special groups of cells that act as a pacemaker. Arrhythmias result in problems, for if the heart doesn't relax and contract in a regular, coordinated pattern the blood is not moved effectively through the heart and around the body – and hence tissues are deprived of fresh blood and oxygen.

Examples of arrhythmias seen in thoroughbreds:

Atrial fibrillation is relatively rare, but it is the most significant pathological arrhythmia seen in racing thoroughbreds. The two atria of the heart are chambers that receive blood, one receiving from the lungs and the other from the rest of the body. Atrial fibrillation is when the atria go into spasm, leading to insufficient contraction and discoordination which disrupts the entire blood movement through the heart and potentially results in a lack of oxygen supply to muscles and tissues. There is rarely a detectable cause for the fibrillation and the onset can be sudden and unpredictable. Horses suffering atrial fibrillation present with exercise intolerance, reduced performance or epistaxis (nose bleeds). There are treatment options for atrial fibrillation but they are not without major

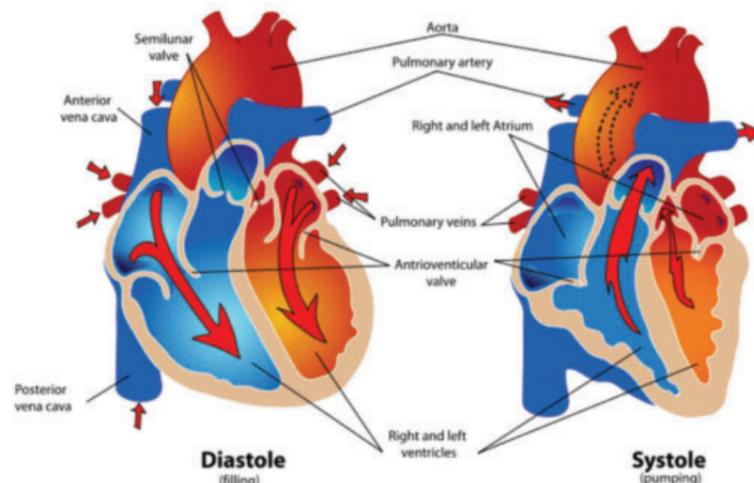
risks and not uncommon complications.

Other rare cardiovascular conditions:

Vascular rupture: This is the most common cause of sudden death in horses at exercise. Exercise results in increased heart rate and blood pressure, which increase the likelihood of any damaged vessels rupturing because the walls of the vessels are under more stress. The aorta and the pulmonary artery (the main vessel from the heart to the lungs) are most at risk of rupture as they transport blood under the highest pressures as they connect to the ventricles, the pumping chambers.

Endocarditis: Endocarditis is inflammation of the lining of the heart and tissues covering the valves in the heart, and is most commonly due to bacterial infection. This is a rare but extremely serious condition; horses present initially with signs of infection -- fever, depression and heightened respiratory rates before murmurs are diagnosed. Aggressive antibiotic treatment is indicated and the outcomes are very guarded.

In conclusion, the likelihood of a cardiovascular problem being the cause of poor performance is very small, and sudden death due to cardiac failure or disease even rarer. The efficiency, vast functional reserve and integration of the spleen results in a system acutely effective at ensuring sufficient oxygen is delivered to the organs and tissues even during the most intense exercise. At Johnston Racing any potential cause of poor performance is investigated, but the likelihood of the cardiac system being the weak link is incredibly slim. ■



Becky Dinsdale

At Johnston Racing, the peace of mind of our owners is a priority. This is why we have included the vet fees in our inclusive daily rate for horses in training.

Becky Dinsdale was born and raised on a farm in upper Wensleydale. She attended Ripon Grammar before studying veterinary science at the University of Liverpool, graduating in July 2019. She had a spell shadowing the vets at Kingsley Park as part of a university placement, and had further placements in France and New Zealand. After graduating she had another stint at Johnston Racing as an assistant to the vets. She then worked at a first-opinion veterinary practice in west Yorkshire before joining the yard as a full-time vet in early 2020.

Our veterinary team



John Martin

John Martin is from the town of Stradbally in County Laois in Ireland's Midlands. He was raised on a farm and from a young age had ambitions to be a vet.

He trained at University College in Dublin and it was there that he first took an interest in horse racing, which nurtured an ambition to eventually specialise in working with horses as a vet.

After graduating he took up a post at a veterinary hospital in Navan, County Meath, before moving to England to join a practice in Louth, Lincolnshire.

He joined Mark Johnston Racing at the start of 2010, staying for more than two years before returning to Ireland for a brief spell and then resuming his position at the yard in April 2013.