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CARDIOVASCULAR EMERGENCIES IN FOALS AND ADULTS

Cardiovascular derangements are a common finding in the critically ill horse, seen either in conjunction with gastro-intestinal disease and sepsis or as a presenting sign.

SIRS and the cardiovascular system

Although there are many causes of critical illness in horses and foals, many present with certain clinical signs in common. Most are tachycardic and hypotensive, the latter partly due to vasodilatation. These animals however often have a normal to increased cardiac output and are in hyperdynamic hypovolemic shock with some degree of distributive shock. There are also primary cardiac conditions that can be identified in horses. These can mimic SIRS and in the adult horse present with signs consistent with abdominal pain or with esophageal obstruction.

Types of cardiac dysfunction identified in SIRS and sepsis

Experimentally in horses, it has been shown in a hypovolemia model that left ventricular internal dimensions reduce and free wall thickness increases. However echocardiographic changes in either experimental models of sepsis or in clinical cases have not been undertaken to the authors' knowledge. However in human patients, myocardial dysfunction, characterized by transient biventricular impairment of intrinsic myocardial contractility, is a common complication in patients with sepsis. It is not predictable which patients will have prolonged or severe myocardial depression, but lack of improvement over time has been associated with a poorer prognosis. This can be assessed echocardiographically and newer echocardiographic tools examining strain and strain rate and tissue Doppler imaging may be of value for myocardial assessment.

Based on the pathophysiology of myocardial dysfunction and mitochondrial dysfunction, it is not surprising that rhythm disturbances can be seen in our critically ill patients. Ventricular premature depolarisations and ventricular tachycardia are a common finding in dogs in gastric dilatation-volvulus. In a study of 111 horses that presented with abdominal pain, 27.5% had cardiac rhythm disturbances detected with 15% having ventricular dysrhythmias, 5% supraventricular dysrhythmias, and

1% had both. However other studies have failed to show a difference between the prevalence of dysrhythmias between normal horses and those that have presented with abdominal pain, and this may relate to the high prevalence of dysrhythmias in normal horses. In one study there was an association between the presence of dysrhythmias in horses with abdominal pain and a change in sodium concentration suggesting that hypovolaemia may be contributing to this finding. Very few horses however develop rhythm abnormalities that require therapeutic intervention, which is usually only required if the rate and rhythm significantly affects cardiac output or an R on T phenomenon is observed. Therapy may have limited success if the underlying SIRS or sepsis that has triggered the derangement is still ongoing.

In SIRS and sepsis, due to underlying disease and concurrent electrolyte derangements can lead to cardiac arrest. Cardiac resuscitation can be a challenge in the adult horse and requires a large number of staff in order to try and perform effectively. It is easier to effectively perform in the foal, but success depends upon the underlying cause of the cardiac arrest.

Of all of the electrolyte derangements seen in the horse, hyperkalemia is the most likely to lead to severe cardiac derangements in the horse. There are many causes of this electrolyte derangement, but the one most likely to result in the severe, acute increase in potassium concentration is post-renal disease, specifically ruptured bladders. These animals have characteristic electrocardiographic changes and bradycardia. Management focuses on reducing the potassium concentration and providing mechanisms to try and stabilize cell membranes.

Primary cardiac derangements

The horse that presents with a cardiac murmur and is otherwise critically ill may have a haemic murmur secondary to a primary disease process caused by a change in blood viscosity (in the horse usually due to hypovolaemia) or cardiac dilatation. They may also have an incidental murmur and primary non-cardiac disease or alternatively have endocarditis. Endocarditis is usually diagnosed in young horses and generally affects the mitral or aortic valves leading to a left-sided systolic or left or right sided diastolic murmur, although up to 40% of animals with endocarditis do not have an

auscultatable murmur. Other signs associated with endocarditis are fairly non-specific and include tachycardia, lameness and synovial distention, pyrexia, leukocytosis, hyperfibrinogenemia, hyperglobulinemia, hypoalbuminemia and anemia. Foals can present with severe congenital cardiac disease secondary to large ventricular septal defects, persistent ductus arteriosus and tetralogy of Fallot.

Horses rarely present in heart failure, but when they do it is usually secondary to mitral regurgitation with signs consistent with biventricular failure. These horses will often have tachycardia and concurrent atrial fibrillation. Pulmonary edema can be confused with esophageal obstruction in some cases.

Ionophore toxicosis cases will usually present with the non-specific signs of depression and inappetence as well as diarrhea and ataxia. These animals in moderate to severe cases will have significantly reduced myocardial contractility, resulting in tachycardia in order to maintain cardiac output. These animals are also reported to have an increased prevalence of ventricular dysrhythmias.

Ventricular tachycardia presents similar to abdominal pain. Potential underlying causes include aortic regurgitation, aorto-pulmonary fistula, which are commonly seen in Friesians, aortocardiac fistulas often in older horses, pheochromocytomas, cardiac haematomas, cardiac neoplasia, heart failure, myocarditis and myocardial necrosis, SIRS and electrolyte derangements. Likely success of treatment is dependent upon the underlying cause, which is not always easy to ascertain.

Third degree atrio-ventricular blockade is a rare cause of collapse in the horse and appears that donkeys are over-represented. Often the cause is unknown, although has been associated with pregnancy and rattlesnake envenomation²². Treatment requires a fixed or variable rate pacemaker^{23,24}.

Summary

In summary, there are many causes of cardiac emergencies in the foal and horse. Some are triggered by the inflammatory cascade in SIRS and sepsis and others are due to primary cardiac disease. Primary cardiac disease often mimics more frequent presentations and should be considered when cases don't completely fit the picture. Establishing the cause of the cardiac derangement will allow an appropriate treatment and prognosis to be established.