COLIC AND MURMURS: AN OVERVIEW

Gunther van Loon, DVM, PhD, Department of Large Animal Internal Medicine, Ghent University, Merelbeke, Belgium

Introduction

Many horses with colic present with a cardiac murmur and are a diagnostic challenge for the veterinarian. For each murmur one needs to know whether this murmur is of any clinical importance or not. Does the murmur pose a problem for anaesthesia of the colic patient? Will it influence future performance or is the horse even unsafe to ride? In most cases a thorough clinical examination will allow to make an accurate diagnosis.

The reason why a murmur can be heard is the occurrence of a turbulent blood flow in the heart or the great vessels. This turbulence and vibration of structures can result in an audible noise in-between the normal heart sounds. Whether or not turbulence will occur is predicted by Reynold's number:

$$\Re_e = \frac{r \cdot v \cdot d}{h}$$

with *?* = fluid density, *v* = blood velocity, *d* = diameter of the vessel and *?* = blood viscosity.

For blood, Reynold's number needs to exceed ~ 2000 to result in turbulence. Because fluid density and aortic diameter are constant, the occurrence of turbulence mainly depends on blood flow velocity and blood viscosity. Thus, turbulence will occur at high blood flows and/or low blood viscosity (e.g. anaemia).

Heart murmurs can be pathological, caused by cardiac disease (e.g. valvular regurgitation), or can be functional, produced by normal cardiac function. To make the difference between the two murmurs need to be classified.

Classification of cardiac murmurs

Whenever a cardiac murmur is diagnosed, it should be classified depending on the timing, duration, location, radiation, intensity and quality.

Timing and duration:

systolic (between the first ('lub') and second ('dub') heart sound) or diastolic

holo-, pan-, early-, mid-, …

Location and radiation:

On the left side pulmonary, aortic and mitral valve areas can found
On the right side the tricuspid valve area

Intensity

the intensity of the murmur should be graded:

1/6	A soft murmur, only heard after careful auscultation of a localised area of the thorax
2/6	A quiet murmur that is heard immediately once the stethoscope is placed over its localised point of maximal intensity
3/6	A moderately loud murmur, immediately heard but radiating over a limited area
4/6	A loud murmur over a large area but without a palpable thrill
5/6	A loud murmur with a precordial thrill
6/6	The loudest possible murmur that is still heard when the stethoscope is just removed from direct contact with the thoracic wall. A thrill is always present.

Quality

describe the frequency of the murmur (low-pitched, high-pitched)
the murmur can be continuous (plateau type) or it can wax (crescendo) or wane (decrescendo).

Different murmurs

Systolic murmurs

Left-sided systolic

Functional

Ejection murmur: this type of murmur is usually early systolic, crescendo-decrescendo and ends before S2. Because it is caused by the ejection of blood into the aorta and pulmonary artery, the point of maximal intensity is over the aortic and pulmonary valve area. Typical for the ejection murmur is that its intensity changes with sympathetic tone and so it tends to come and go. The gradation of the murmur is usually 1-3/6 and it is

never associated with a palpable thrill. Especially in foals and animals with fever, colic or anaemia the murmur may be loud and almost holosystolic making it occasionally difficult to differentiate this murmur from mitral regurgitation.

Pathological

Mitral regurgitation: naturally the point of maximal intensity is located over the mitral valve area but it may extend cranially and dorsally. The intensity varies between 1-5/6. In general, the louder murmurs indicate a more severe regurgitation, although loud musical murmurs may be of limited importance. In general the murmur is plateau shaped and holo(or pan)systolic. Occasionally, a crescendo murmur is present indicating mitral valve prolapse.

Right-sided systolic

Functional

Ejection murmur: similar findings as on the left side, although cardiac sounds are in general less obvious on the right side.

Pathological:

Tricuspid regurgitation: with the point of maximal intensity over the tricuspid valve, tricuspid regurgitant murmurs usually are plateau shaped and holosystolic. The intensity usually varies from 1/6 to 4/6 and vibrant murmurs are uncommon. In general, loud murmurs indicate a more severe regurgitation. 'Functional' tricuspid regurgitation is frequently encountered.

Ventricular septal defect: ventricular septal defect is the commonest congenital heart defect in horses. The point of maximal intensity of this murmur is located slightly cranial and ventral to the tricuspid valve. Generally, the murmur is harsh and plateau shaped. An intensity of more than 3/6 is usually present, frequently with a palpable thrill. Typically, the murmur radiates cranial and ventral towards the sternum, which helps to differentiate it from tricuspid regurgitation.

Diastolic murmurs

Left-sided diastolic

Functional

Early diastolic: early in diastole, between S2 and S3 a soft murmur may be heard which is thought to be due to rapid ventricular filling. The murmur is soft and blowing or sometimes musical ('whoop' or '2 year old squeak'). It can be heard from the left or right side. The intensity may vary and may be increased after mild exercise.

Pre-systolic: the short pre-systolic murmur occurs between S4 and S1 and may be difficult to distinguish from S4 and S1. It can be heard from the left or right side of the chest and generally has a low intensity.

Pathological

Aortic regurgitation: aortic regurgitation occurs commonly, especially in older horses. The point of maximal intensity of the murmur is over the aortic valve area. The murmur is holodiastolic, usually decrescendo because of the gradual fall in pressure gradient between left ventricle and aorta. The murmur may be harsh, but frequently has a musical appearance, which is a very typical feature. Especially for loud musical murmurs, intensity is not always related to severity of the regurgitation.

But what about colic and murmurs?

Obviously, a murmur that is detected during an episode of colic may have been present but undetected for some time. However, most frequently, the systolic murmur heard during an episode of colic is typically an ejection murmur and it usually disappears as the horse recovers from the colic. The reason why these ejection murmurs can be come very loud during the colic is not exactly understood but most likely it is caused by an increased cardiac output as a result of an increased sympathetic tone. Due to the increased blood flow, turbulence is more likely to occur. Frequently, these horses still have a normal circulation and are not markedly dehydrated yet. When the hematocrit increases, blood viscosity increases and, according to Reynolds formula, turbulence will occur more difficultly.

One should also realise that certain drugs may influence heart rate and thereby the ejection murmur. Certain spasmolytic drugs are known to cause tachycardia which may temporarily accentuate the ejection murmur.

Theoretically, in horses with trivial mitral valve regurgitation, the intensity of the mitral valve regurgitation could slightly increase during a colic episode because of an increased afterload caused by pain-induced hypertension. However, whether or not this mechanism is important in horses is not known.

From human medicine we know that myocardial depression can occur during a (longer) period of sepsis and as a result, mitral regurgitation can increase. However, myocardial depression is not likely to occur during an episode of colic in the horse.

Conclusion

When a horse with colic presents a murmur accurate auscultation and classification of the murmur should allow distinguishing between an ejection murmur and a pathological murmur. When a pathological murmur is present or when the exact cause of the murmur is not known, the horse should be re-examined when other clinical problems have been resolved and ancillary diagnostic techniques should be applied if necessary.