



Cardiac dysrhythmias:

when to worry?



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“Rhythm is something you either have or don't have, but when you have it, you have it all over”. Elvis Presley

Elvis may have known a thing or two about rock and roll, but when it comes to the horse's heart, this is not quite true. Many perfectly healthy horses have slightly irregular cardiac rhythm – in fact, the healthier and happier they are, the more irregular the heartbeat becomes. However, certain dysrhythmias are not normal – so how do vets tell the difference?

How is the heart rhythm controlled?

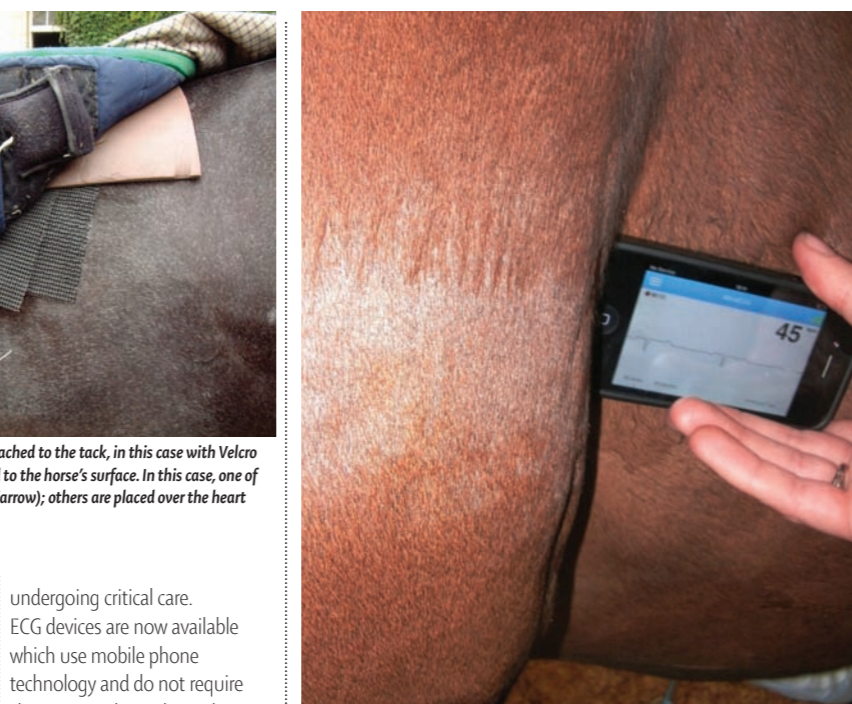
In both horses and man, the cardiac rhythm is controlled by a pacemaker called the sinoatrial node (or SA node). This is a collection of specialised cells that is located within the right atrium, one of the four chambers of the heart. These cells have an inherent rhythm and send out an electrical signal that spreads first through the rest of the two atria. When the electrical signal reaches the junction between the atria (filling chambers) and the ventricles (the pumping chambers), it is delayed slightly at another collection of specialised cells called the atrioventricular node (or AV node). The electrical signal then passes down into the ventricles through various conducting fibres and out into the muscle itself. This electrical signal is the message the heart muscle needs to tell it to contract and pump blood to the body and lungs so it is critical that the heart muscle receives this message in a co-ordinated and controlled manner.



For an exercising ECG, a small monitor is attached to the tack, in this case with Velcro on a saddle pad, and electrodes are attached to the horse's surface. In this case, one of the electrodes is just visible under the girth (arrow); others are placed over the heart below this one and on the right side.

How can we assess heart rhythm?

The ECG is the primary tool that is used to determine heart rhythm. An ECG is essentially a road map of how the electrical impulse makes its way through the different chambers of the heart. In equine practice, it is recorded by placing at least two electrodes on the surface of the horse's body, detecting the electrical signal and displaying that as a waveform, either on paper, or more commonly with modern units, on a computer file that can be analysed in real time or subsequently. The simplest ECG involves clipping electrodes onto the horse's neck and chest, but there are also a variety of ways that the horse's cardiac rhythm can be detected during exercise. Some vets will use radio or blue-tooth technology to send the ECG information to a monitor that they can watch as the horse is exercised. Other systems allow the ECG to be recorded in a digital file for subsequent analysis, while many vets use a combination of both to provide both an immediate result and a file that can be analysed in more detail later. Similar systems are also used for horses



ECG devices designed for human use can be attached to an iPhone and an ECG is recorded easily by placing the phone directly on the horse's chest.

undergoing critical care. ECG devices are now available which use mobile phone technology and do not require clip-on or stick-on electrodes, simply sensors embedded within a phone case. The device is held direct to the horse's chest and a basic ECG can be obtained very easily with inexpensive equipment.

What is a dysrhythmia?

Dysrhythmia is a 'catch-all' term used to describe any form of irregularity of cardiac rhythm. The important thing to understand about the horse's cardiac rhythm

is that it is often slightly irregular. As a species, horses have large hearts that are adapted for maximal exercise. At rest, the heart is much more powerful than is needed. As a result, all horses have fairly slow heart rates, often around 30-40 beats per minute. The heart rate is adjusted to keep blood pressure fairly constant and to achieve this, horses will often

skip or drop a beat. On the other hand, the cardiac rhythm can become irregular when the horse is sick or when there is cardiac disease.

'Normal dysrhythmias'

Surveys of healthy horses monitored over prolonged periods, using systems which allow the horse to be undisturbed overnight, have shown that around 40% of horses have second degree atrioventricular block, also known as 2AVB. Vets will often also pick this up when listening to horses with a stethoscope. The important point about 2AVB is that it is a normal healthy process that allows the horse to subtly adjust its heart rate and prevent its blood pressure being higher than it needs to be at rest. When listening to a heart with 2AVB, a pause in the rhythm is heard, usually at regular intervals, but between this, the cardiac rhythm is regular. Most often, one beat is



A vet is watching the cardiac rhythm continuously because this patient has an unstable cardiac rhythm. The radio technology means the horse can be left quietly in its stable while the vet watches from the nearby nursing station.

and its rider than continue with their normal life, content in the knowledge that Elvis is not always right.

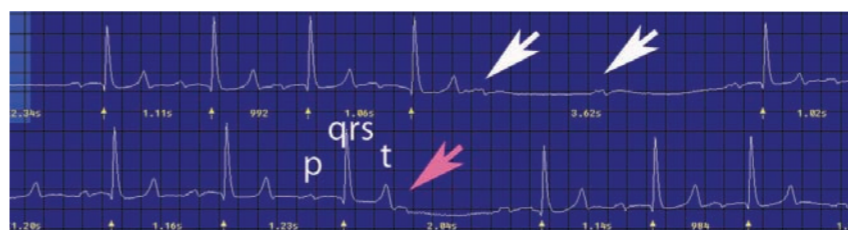
Atrial fibrillation

Atrial fibrillation is the commonest form of clinically significant dysrhythmia. This term is used when the cardiac rhythm is completely irregular because random waves of electrical activity have set up within the atrial tissue. The ventricles continue to beat but they do so in a random manner.

Atrial fibrillation occurs in several completely different sets of circumstances. In some horses, the atrial fibrillation occurs in isolation with no underlying heart disease and is known as 'lone atrial fibrillation'. However, in some horses, the atrial fibrillation is accompanied by pathology in the heart and therefore is part of a much more complex problem. These different settings explain why not all horses with atrial fibrillation are alike and why the veterinary advice for one horse with atrial fibrillation might be very different from others. Lone atrial fibrillation can self-correct, usually within 24 to 48 hours after its onset and this is called paroxysmal atrial fibrillation. This form of atrial

fibrillation is actually rather common in Standardbred and Thoroughbred racehorses and it accounts for around 1.5% of disappointing race performances. Usually it is a one-off occurrence and horses that have had this problem go on to race successfully again. Recently, the racehorses Sprinter Sacre and Be Ready have been reported as having had an episode of paroxysmal atrial fibrillation. If lone atrial fibrillation does not self-correct, it may have to be treated. There are two basic approaches. Atrial fibrillation can be treated with various drugs, of which quinidine sulphate is the most common. Alternatively, some horses are treated with electrical shocks. Both options have pros and cons. The drugs require very careful monitoring and side effects mainly relating to gastrointestinal problems are common. Horses that have had atrial fibrillation for a fairly short period of time will typically respond well to quinidine sulphate treatment. Electrocardioversion is only available at one centre in the UK at the moment, RosSDales Equine Hospital. It is a quite a complex procedure; the shocks are delivered via electrodes inserted

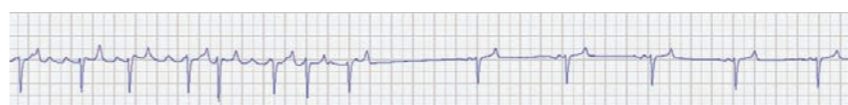
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The normal heartbeat consists of a p wave followed by qrs-t. With second degree atrioventricular block, there is a p wave which is not followed by a qrs-t (pink arrow). Sometimes two beats are dropped in succession (white arrows).

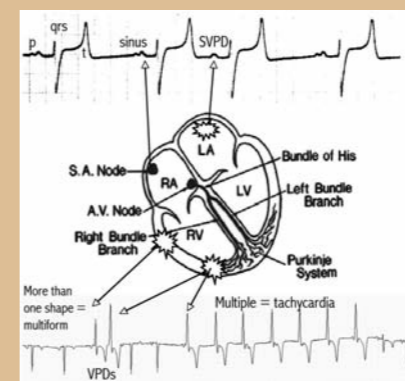


With atrial fibrillation, there is continuous electrical activity within the upper chambers of the heart (the atria) indicated by the continuously fluctuating trace. At irregular intervals there are complexes showing electrical impulses in the ventricles.

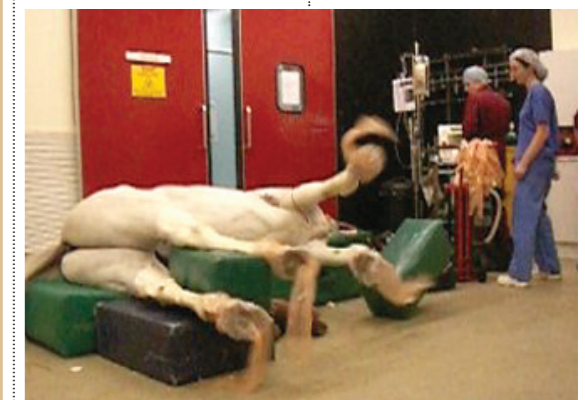


This horse is receiving treatment with quinidine sulphate for atrial fibrillation, seen at the left half of this trace, and this restores the heart to a regular rhythm, seen on the right half of this trace.

dropped but in some healthy horses, two beats are dropped. When the horse's heart rate increases, for example in recompose to exercise or excitement, the cardiac rhythm becomes regular. This is one of the features a vet is looking for when the heart is listened to after exercise during a vetting examination. With 2AVB, the same features are evident on an ECG. With a normal heartbeat, the p wave represents the impulse starting in the pacemaker and spreading through the atria. It then travels more slowly through the AV node, represented by the p-r interval and if the impulse passes on into the ventricles, the ECG shows a QRS-T complex. With 2AVB, the impulse starts in the pacemaker and the p wave is present. But, instead of passing through the AV node, it is blocked here, so there is no QRS complex. This can occur both singly or in pairs. When 2AVB is detected, as long as this disappears with exercise, it is regarded as being completely normal and further investigations are not necessary and the horse



The ECG is a roadmap of how electrical impulses travel through the heart. The normal heart beat starts in the SA node, is passes across the right (RA) and left (LA) atria, to the AV node. There is a short delay then the impulse travels down into the right (RV) and left (LV) ventricles through a network of specialised fibres. A beat originating in the sinus (the SA node), has a specific pattern of a p formed of a double peak, followed by the qrs and t complex. An SVPPD is an abnormal impulse that starts in the atria and the p wave has a different shape. A VPD is an abnormal impulse that starts in the ventricles and the qrs-t have a different shape. If the abnormal impulses are starting at several sites, the qrs will have several shapes. If there are multiple abnormal impulses in succession, this is called tachycardia.



General anaesthesia, specialist expertise and a great deal of equipment are required for electrical cardioversion. At the moment the shock is delivered, the horse's limbs will move violently so it is important that the horse is on a padded surface and the veterinary staff are safely well out of the way.

Continued from previous page inside the heart. It requires a team of at least two experienced cardiologists and specialist equipment is needed not only to deliver the shock but also to place the electrodes, which is done under X-ray and ultrasound guidance. It also requires general anaesthesia. Its main advantage is that horses that have had atrial fibrillation for several weeks are likely to respond better to electrocardioversion. As both procedures involve interfering with the electrical activity of the heart, both are dangerous, with potential to cause fatal side effects. It is important to recognise that the overall safety of the two approaches is fairly similar, so the choice of one versus the other is usually based on the clinical history and the findings on detailed cardiological examination.

Atrial fibrillation is a recurrent condition. There are various factors that will influence, the likelihood of recurrence, but the duration that the dysrhythmia has been present is important. If the problem is picked up quickly and dealt with promptly, the recurrence rate is very low. In horses that have had the problem for several weeks before treatment, recurrence rates are higher. The problem is often hard to detect in horses that are performing lower levels of exercise as the dysrhythmia may not be detected until the horse has its heart listened to during a routine examination, such as at vaccination. These horses are more likely to require electrocardioversion and more likely to have recurrent problems when compared to racehorses or advanced eventers, in which the



The donkey filly had a pacemaker fitted by a team combining vets from Rosssdales, the Royal Veterinary College and University of Nottingham. Here she is having an ECG to check progress. The pacemaker is visible as a bump under the skin of her neck and for the last three years she has had no further fainting episodes.

problem is usually detected quickly because there is an obvious and dramatic reduction in performance.

Other cardiac dysrhythmias

Atrial fibrillation can also occur in horses with underlying heart disease. For example, horses with leaking heart valves can develop atrial fibrillation. Horses can also develop different forms of cardiac rhythm irregularity involving the ventricles rather than the atria. Individual extra heartbeats that originate in the atria are called supraventricular premature depolarisations, or SVPD. Individual extra beats that originate in the ventricles are called ventricular premature depolarisations and where extra heartbeats occur in quick succession this is a tachycardia. Ventricular dysrhythmias are more unstable than supraventricular

dysrhythmia. The key to appropriate management of these dysrhythmias is to establish the underlying cause and to treat that if possible. This might involve investigations like echocardiography to look at the heart structure and will often involve procedures to determine whether the heart is simply responding to disease elsewhere including a range of blood tests. Specific treatment for dysrhythmias usually involves drugs that suppress abnormal electrical activity in the heart but all these drugs require careful monitoring and generally involve admission to an equine intensive care unit. Some dysrhythmias are classified as pathological bradyarrhythmias and instead of extra electrical activity, the pathway of the electrical impulses through the heart is blocked completely. In these cases, pacemakers are sometimes used.

Should I be riding a horse with a dysrhythmia?

The answer is 'it depends'. Some dysrhythmias are unstable and might cause the horse to faint or even die suddenly and this obviously places a rider at

considerable risk of injury. This risk can exist even in horses that have shown absolutely no signs of problems at rest or at exercise previously. Fortunately, many horses that have dysrhythmias are not likely to destabilise during exercise. Most studies to date have been performed in racehorses, but there has also been research performed in dressage horses and showjumpers, so there is a growing body of evidence on what rhythm disturbances can be regarded as unlikely to cause problems during exercise. Exercising ECGs can easily be performed now. Typically, this might involve exercising the horse with ECG monitoring equipment on several occasions and at a level that matches or exceeds the horse's usual workload. This sort of test can often be performed at home, although it may involve your local vet liaising with a specialist who can provide equipment and interpret the results. The message for horse owners and riders is do not take any chances and have any suspicious dysrhythmia investigated fully.



In this ECG recorded during fast exercise, the cardiac rhythm begins to become irregular at the gallop (yellow arrow) and continues to destabilise further then the horse pulls up (indicated by the red line). This horse showed no signs of cardiac problems at rest illustrating the value of exercising ECG to diagnose dysrhythmias associated with exercise.



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This ECG from a young donkey filly that had been fainting frequently shows that there are very long pauses with on the p waves present and intermittently, there is abnormal electrical activity within the ventricles (pink arrow). This confirms that the filly has complete heart block.