ECG Findings And Performance In Thoroughbred Racehorses

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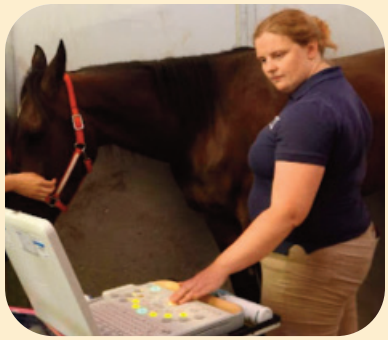
This study will use ECGs to improve diagnosis of cardiac related poor performance allowing for increased monitoring to reduce the frequency of exercise-associated sudden death in Thoroughbred racehorses.



73% of Thoroughbred racehorses (TBs) that perform poorly have irregular heart rhythms known as arrhythmias. It is difficult to decide how important these arrhythmias are though, because up to 92% of health TBs also develop arrhythmias during exercise.

Arrhythmias are also through to cause sudden death during exercise (exercise associated sudden death, EASD). There are different types of arrhythmias. Some arrhythmia types are clearly bad for performance, but many are more complicated because they occur in both health and poorly performing TBs. This overlap makes it difficult to decide which arrhythmias should lead to a horse having additional tests to ensure that they are safe to continue racing and training. This makes it very difficult to reduce the number of EASDs.

Electrocardiograms (ECGs) are used to monitor the electrical activity of the heart and can be used to detect arrhythmias. They can also be used to detect very small changes in the heart rate (heart rate variability) that can be used to predict risk of sudden death in people. We have collected 5,461 ECGs from 1,124 TBs. Early-stage analysis of 1,215 of these ECGs has shown that 81% of TBs have an arrhythmia. Our long-term goal is to reduce the number of EASDs by improving our ability to identify horses that have increased risks of developing an arrhythmia that can cause poor performance and maybe EASD.

We believe that the type of arrhythmia and how often an arrhythmia occurs during an ECG is linked to reduced performance and that heart rate variability can be used to identify horses that perform poorly. Our aims are to see if:

1. The number and type of arrhythmias is linked to reduced performance around the time that the ECG was collected.

2. ECG findings from the same horse agree with each other if taken less than two weeks or more than four weeks apart.

3. Heart rate variability can be used to predict poor performance in TBs.

Equine medicine specialists are evaluating the ECGs. Only excellent quality ECGs will be used in this study. In aim 1, we will use a single ECG from 1,040 TBs. If a horse has more than one ECG, then the ECG with the most severe findings will be used. We will look to see if the number of arrhythmias and if the arrhythmia findings are considered be complex, which is usually multiple abnormal beats in a row, are associated with reduced performance within two weeks of the ECG being performed.

For aim 2, we use 3,518 ECGs from 411 TBs with at least 4 ECG recordings per horse. We will determine how similar the ECG findings are between two ECGs collected within two weeks of each other, and two ECGs collected more than four weeks apart from each other. We will also determine how similar the ECG findings are across all ECGs collected from that horse.

In aim 3, we will use heart rate variability differences in 675 ECGs to develop a model that can predict if a horse is likely to have reduced performance, based on speed. We then test how well the model works using an additional 168 ECGs.

This project will lead to better guidelines for interpreting exercising ECGs. This will help veterinarians distinguish between healthy TBs and those with performance issues. By understanding how consistent ECG findings are, we can determine whether it is necessary to repeat an ECG to

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identify if an arrhythmia is present/ Combined, this will improve how veterinarians interpret their patients ECGs and help regulatory veterinarians decide when a horse is safe to race and train. Additionally, our prediction tool could help identify horses at high risk for poor performance. These horses may be at increased risk of developing more serious heart problems and so can be monitored more closely. We can also look for additional risk factors that may cause exercise associated sudden death, which is part of our ongoing and future research projects. Our long-term goal is to reduce the frequency of EASD by identifying things that contribute to EASD risk.

Irregular heart rhythms (arrhythmias) that lead to poor performance has a negative impact on the equine industry, including negatively impacting horse welfare and the public, especially when a horse finishes a long way behind the rest of the field. There are also financial implications for owners, trainers, and the betting public. Arrhythmias are also thought to lead to sudden death, which is a major welfare concern and has a dramatically negative impact on public perception of ratio. The overlap in the frequency and type of arrhythmias make it very difficult to decide when a horse is or is not having poor performance due to those arrhythmias.

The outcomes of this proposal include: updated recommendations for how to interpret arrhythmias that are identified in Thoroughbred racehorses, establishing how similar arrhythmia findings are on repeated examinations, and developing a tool to predict poor performance based on subtle differences in the beat to beat changes in the heart (heart rate variability). Theseoutcomes should have a positive impact on multiple members of the equine industry:

1) Equine veterinarians and specialists by improving interpretation of arrhythmias and establishing which ones are likely to be causing reduced performance.

2) Regulatory veterinarians by helping to decide when a horse should be added or removed from the vet's list based on the frequency and type of arrhythmias.

3) Trainers by improving their ability to identify horses that are at higher risk of cardiac related poor performance.

4) The racing industry due to helping identify horses with arrhythmia related poor performance which will help determine if these horses are at increased EASD risk, and if so, identifying which factors contribute to the development of potentially fatal arrhythmias.

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