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Bleeding from the Lungs and Its Relationship to Performance in Racing Horses

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Bleeding from the lungs in racehorses is a very common condition, but because it is a poorly understood condition, it is difficult to treat effectively, or prevent. Only when the industry understands how and when the condition affects performance can methods and rules be developed to reduce the impact of this condition on performance.

To begin that journey, we performed a study to determine if in fact a high volume of blood in a horse's lungs affects his athletic performance. Anecdotal evidence indicates that sometimes blood in the lungs is associated with poor performance, while on other occasions it appears to have no effect. It is well-known that horses winning or placing in races often bleed in those events. By putting a large volume of blood into the lungs of horses that then were asked to perform on a high-speed treadmill, we discovered that there was a definite association between that volume of blood in the lungs and impaired performance.

While a lot is known about the cause of bleeding (or exercise-induced pulmonary hemorrhage [EIPH], as it is more correctly known), the circumstances under which it interferes with performance are poorly understood. Factors that may play a role probably include (1) the amount of blood lost into the lung, (2) the time when bleeding begins in relation to the start or finish of a race or training run, (3) the site of the bleeding within the lung, and (4) the effects of repeated episodes of bleeding on lung function during exercise.

Because of the inadequacy of our present knowledge, the existence of EIPH is currently presumed to always reduce exercise ability and is treated accordingly. In fact, sometimes this treatment may be unnecessary because the bleeding did not affect performance and is an incidental finding. In other cases, the treatment may be inappropriate because the poor performance is caused by other undetected lung diseases. These other diseases can remain undiagnosed because of the almost automatic presumption that bleeding caused the problem and so no one looks any further. Therefore, we felt that it was in the racing industry's best interest that more be learned about the effects of bleeding on performance.

We began by testing a "worst-case" scenario. We simulated severe EIPH by instilling 100 ml of blood (slightly less than a half-cup) into each lung of six horses immediately before they performed a fatiguing bout of high-speed treadmill exercise. We specifically wanted to determine whether the horses' abilities to perform this high-intensity exercise test would be compromised after the introduction of this known volume of blood into their lungs.

We used six well-conditioned Thoroughbreds that were very accustomed to exercising on a treadmill. They exercised before and immediately after the infusion of either 100 ml of their own blood or 100 ml of saline, a mild, harmless saltwater solution. These fluids were placed in the section of each lung furthest from the nose because EIPH has been shown to most likely occur in this region. In addition to these runs, the horses also performed the same test following a sham infusion procedure, where nothing was actually injected into the lung. That is done to verify that the procedure itself would not cause impairment in exercise..

The exercise tests consisted of a two-minute warm-up at the trot immediately followed by a gallop to fatigue at a speed that each horse could only sustain for one to two minutes. The oxygen content of the blood leaving the lungs and the total oxygen consumption of the horse's body were measured before exercise, at the end of the warm-up, after 50-60 seconds of galloping, and at the point of fatigue.

We found no difference in the test results following introduction of the saline or after the sham procedure. However, after infusing blood into the lungs, the oxygen content of the blood was significantly lower, as was the maximal amount of oxygen that the horses could use during exercise. The duration of galloping exercise before fatigue was also shorter by about 16% following the introduction of blood into the lungs.

These results indicated that the presence of 100 ml of blood in the highest, furthest-most region of each lung from the nose had a negative effect on the horses' ability to perform at a high-speed gallop on a treadmill. It appeared that this was not because the horses could not breathe, but rather due to interference with the movement of oxygen from the lungs into the blood supply. Because of this interference, the amount of oxygen in the blood declined, so the horses had less oxygen available for their muscles to use. It is presumed that the reduced oxygen exchange after the introduction of blood into the lungs was due to the presence of this fluid in the small air sacs that represent the primary site of oxygen exchange.

This study showed that there is no question that when relatively large amounts of blood are in the lungs, a horse's ability to perform at high speed is impaired. It does not provide any information about the effects of lesser volumes of blood on performance. It remains to be determined whether there is a "critical volume" of blood that, if exceeded during a bout of EIPH, will interfere with performance.

The Southern California Equine Foundation supported this project, with funds provided by the Dolly Green Research Foundation, Inc.