

AAEP Convention 2005: Exercise Induced Pulmonary Hemorrhage

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Posted by Christy M. West | Feb 17, 2006 | AAEP Convention, American Association of Equine Practitioners, Article, Exercise Induced Pulmonary Hemorrhage (EIPH), Thoroughbreds

Exercise-induced pulmonary hemorrhage (EIPH), or bleeding in the lungs after exercise, costs the United States horse racing industry a great deal—estimated at up to \$260 million per year by Kenneth W. Hinchcliff, BVSc, MS, PhD, Dipl. ACVIM, of The Ohio State University. During his presentation at the American Association of Equine Practitioners Convention, held Dec. 3-7 in Seattle, Wash., he discussed the prevalence of the disease and its economic and performance effects on U.S. Thoroughbred and Standardbred racehorses.

“Exercise-induced pulmonary hemorrhage is ubiquitous among Thoroughbred racehorses throughout the world, and there is no apparent important geographic variation in incidence of the condition,” he noted.

One study examining Thoroughbreds via endoscopy after a single race found that 55% exhibited EIPH to some degree, he reported. After following the horses for three races, 85% bled after at least one race. Standardbred racehorses showed a prevalence rate of 87% after at least one of three races. Using examination of bronchoalveolar lavage (BAL; "washing" of a part of the lung with fluid and collecting the fluid for analysis) fluid, one study found that almost all Thoroughbreds racing or in race training examined had evidence of EIPH (more on diagnosis in a moment).

"The risk factors for EIPH are not well defined," Hinchcliff said. "Suggested factors include age, distance, speed, track surface, and environmental conditions."

Hinchcliff spent a bit of time discussing the economic impact of this common disease, which he noted is not well defined and does not include less tangible costs such as impaired performance, missed races, lost training days, or shortened careers. "This is quite difficult to calculate," he said.

He reported that there were about 250,000 Thoroughbreds and Standardbreds in race training in the United States in 2003, with 444,586 Thoroughbred starts and 635,292 Standardbred starts. He estimated the costs of detection and treatment (excluding furosemide, or Salix) at \$450-\$900 per horse per year. Furosemide costs nearly another \$36 million annually for the 90% of Thoroughbreds and 50-70% of Standardbreds that race on it, he added. The total impact of EIPH on the U.S. racing industry he estimated at \$135-\$260 million annually.

Performance Effects of EIPH

The industry seems to offer a chicken-and-egg conundrum of how EIPH relates to performance; some say bleeding causes poorer performance, while some say that bleeders are performing better and working harder, which is why they bleed. So who's right? Some studies have found no association between the

two, but others have. Hinchcliff described in particular one study of Australian racing Thoroughbreds that sought to answer this question.

Of 744 horses flat racing in Melbourne without furosemide, horses with grade 2 EIPH were 4.03 times less likely to win than those with no EIPH or grade 1 EIPH. Horses graded 3 or 4 were 2.178 times less likely to place in the top three. And as EIPH grade increased, so did the number of lengths affected horses finished behind the winner.

Earnings were also significantly affected—horses with no EIPH or grade 1 EIPH were 3.03 times more likely to be in the top 10% of money earners than horses with more severe disease. Grade 2-4 EIPH was associated with a lower likelihood of winning or placing.

Hinchcliff noted that a study evaluating EIPH's effects on career longevity was in progress.

Diagnosis

Hinchcliff briefly discussed multiple means of diagnosing EIPH, including videoendoscopy (examination of the airways with a camera on the end of a long probe) and BAL. He reported that endoscopy is more commonly used, more convenient for routine use in racehorses, and has good agreement between multiple evaluators.

He said BAL is more invasive, must be done under sedation, and might give a false negative result if the area washed is not an area that is bleeding.

The grading scale for endoscopic examination of EIPH is as follows:

- Grade 0: No blood detected in the pharynx, larynx, trachea, or mainstem bronchi.
- Grade 1: Presence of one or more flecks of blood or two or fewer short (less than one-quarter the length of the trachea) and narrow (less than 10% of the tracheal surface area) streams of blood in the trachea or mainstem bronchi (the two airways the trachea splits into; these carry air to and from the right and left lungs) visible from the tracheal bifurcation.
- Grade 2: One long stream of blood (more than one-half the length of the trachea) or more than two short streams of blood occupying less than one-third of the tracheal circumference.
- Grade 3: Multiple, distinct streams of blood, covering more than one-third of the tracheal circumference, with no blood pooling at the thoracic inlet.
- Grade 4: Multiple, coalescing streams of blood covering more than 90% of the tracheal surface with blood pooling at the thoracic inlet.

EIPH Treatments

Despite the impact of EIPH on equine health and the racing industry, researchers haven't yet been able to determine its exact causes or develop a universally effective treatment. "Proposed causes of EIPH include high blood pressure in the lungs, blood clotting disorders, small airway disease, impact-wave trauma, blood thickness, and upper airway obstruction, which probably all factor in in some way," said Hinchcliff. "With no clear etiology, it is very tough to have one clear treatment."

The diuretic (increases urinary output) medication furosemide is used worldwide in an attempt to combat the disease, including in the United States, Canada, parts of South America, Saudi Arabia, and the Philippines. In the Breeder's Cup in 1990, 40% of horses raced on it, and in 2002, that rose to 90%. Different U.S. tracks averaged 92% usage in May-June 2001, he reported.

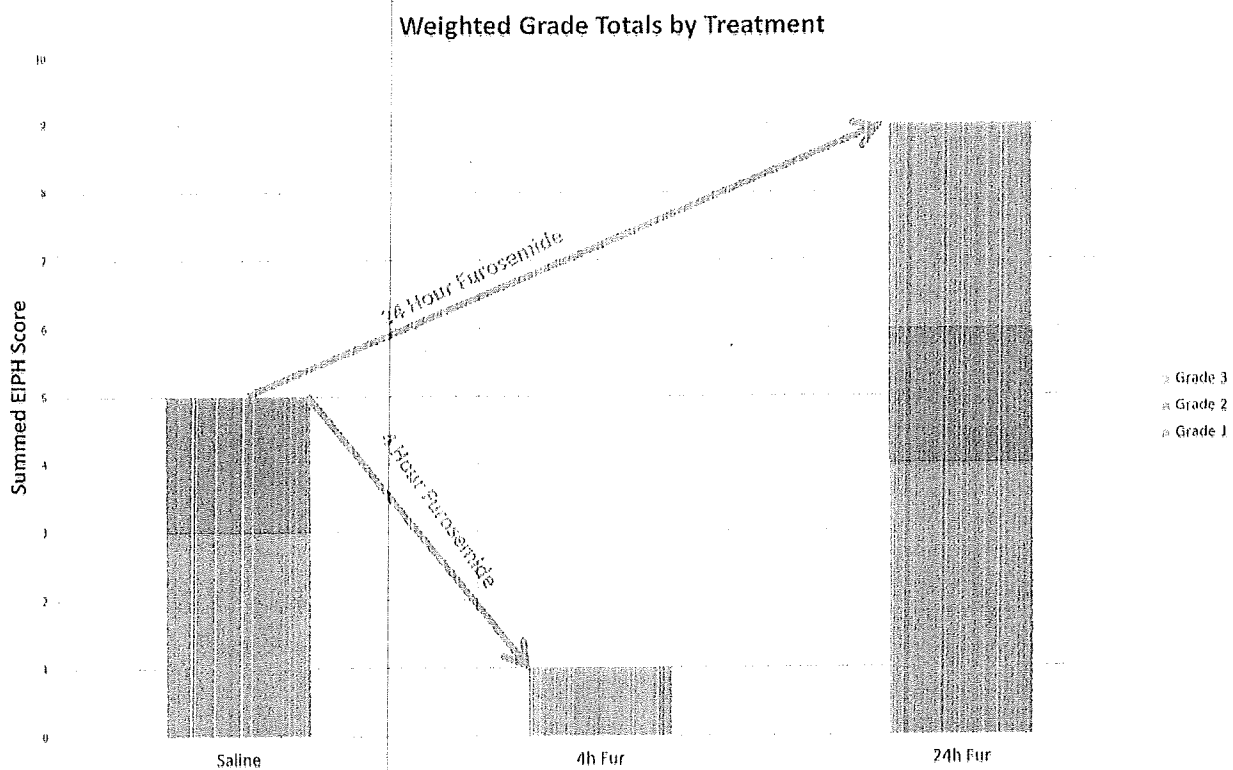
The effect of furosemide on severity or frequency of EIPH in race horses has not been demonstrated, in Hinchcliff's opinion. The medication is commonly used and it does result in horses performing better, with one study finding

that treated horses were much more likely to win and finish in front by up to a second. However, whether this effect on performance is due to reduction in the severity of EIPH in affected horses, or because of the lower body weight (10-20 pounds) of treated horses, is unknown.

Other medications used to treat EIPH include hypotensive agents, bronchodilators, inhalants, and herbal/naturopathic remedies. In summary, Hinchcliff stated, "EIPH is a highly prevalent, expensive disorder, with variable expression between horses and over time, which impairs performance. It likely impairs career longevity, and treatment is not well defined. We need a precise accounting of the costs of EIPH, its effects on well-being and career longevity/productivity, risk factors including heritability, the efficacy of furosemide, and control/prevention."

In this time of crisis, the last thing the racing industry needs is MORE dead horses. The attached necropsy report is the actual necropsy of a horse that died at Arapahoe Park, racing for the \$1000 no-medication bonus. Just offering extra money for no-Lasix costs horses lives. This proposal will inevitably have a similar result. The last group of horses we need to experiment on is 2 year olds. There are dozens of studies that support the use of Lasix to attenuate bleeding, but only 2 studies (4 papers) that look at 24 hour Lasix with water withholding. Both studies have their drawbacks, but this graph, taken from the data in Knych et al, 2017 "Effectiveness of Furosemide in attenuating exercise-induced pulmonary haemorrhage in horses when administered at 4- and 24-h prior to high speed training." Equine Veterinary Journal.

sums up the results pretty well:



At least some, if not all, of the beneficial effect of Lasix in horses is the decrease in pulmonary blood pressure mediated by the Angiotensin-system that affects pulmonary blood pressure. In humans, it has been shown that there is a rebound increase in pulmonary blood pressure after the effects of the Lasix are gone. Not a problem for a racehorse when it is safely in its stall 24 hours after Lasix...unless we are now expecting that horse to race when the increased blood pressure effect is in full swing. This rebound effect could easily have resulted in the findings of Knych, shown above.

We are embarking on a full scale experiment on two-year-olds, without critical important information that we should have before risking their health and lives.

Threshold: Dr. Sams has provided us with a threshold of 1 ng/mL in blood as the appropriate threshold, without providing the underlying data. As with many of the RMTC thresholds, they have applied the 95/95 tolerance method, which they insist provides far less than a 5% risk of a positive test. However, the definition of the method is that it provides 95% confidence that 95% of the population will not have a positive test. The RMTC insists that it actually provides greater safety, but a recent paper (Machin et al., 2018, *Variability in plasma concentrations of methylprednisolone 6 days after intrasynovial injection of methylprednisolone acetate in racing horses: A field study* Equine Veterinary Journal), as well as several presentations at a recent international conference demonstrate that, in fact, the 95/95 tolerance is exactly what it says it is: approximately a 1 in 20 risk. If horsemen actually rely on this threshold, we will risk a positive test in as many as 1 in 20 horses receiving 24 hour Lasix, treated completely appropriately.

Like almost all of the RMTC-supported thresholds, the researchers performing these studies aren't producing any data for anyone to review. The data from Knych were requested by a Public Records Request, and she refused to produce it. The CTT and National HBPA sued UC Davis to see the data, and UC Davis prevailed. This means that we are unlikely to ever see the data underlying the threshold. At a time when transparency is encouraged, and all Federally funded research is mandated to have all underlying data provided in a public database, shouldn't our regulators provide the data by which we are regulated?

Even if there were any solid basis to provide a 24 h Lasix regulation, the 24 h on track requirement, in a jurisdiction where many horses ship-in to race places an onerous burden on the horsemen.

Laboratory Report
Final

*This report supersedes all
previous reports for this case*

Case #: F1550578
Referral #: Dr. Jack Muller
Date Collected: 06/20/2015
Date Received: 06/21/2015
Case Coordinator: Dr. Tawfik Aboellail
Owner: Juan Martin Triana

Email To: mark.brown@state.co.us
H07430 Colorado Racing Commission
1678 Campus Delivery-Clinical Sciences
Fort Collins, CO 80523

Electronically Signed and Authorized
By:
Dr. Tawfik Aboellail
sent by Tina Kane
on 7/15/2015 1:47:01PM

Case Contacts

Submitter	H07430 Colorado Racing Commission	9704916144	mark.brown@state.co.us
Veterinarian	Smith, D. Woodrow	303-621-2054	
Veterinarian	Kawcak, Chris	970-297-4470	ckawcak@colostate.edu

Specimen Details

ID	Taxonomy	Sex	Age
Ace Away	Thoroughbred Horse	Neutered Male	

Owner: Juan Martin Triana

Specimens Received: Body;

Clinical History

Collapsed and died after race.

Laboratory Findings/Diagnosis

DIAGNOSIS:

1. Lungs: Diffuse pulmonary congestion and hemorrhage, acute, severe.
2. Heart: Epicardial hemorrhage, cute, multifocal and coalescing.

REMARKS: Lesions are indicative of exercise-induced pulmonary hemorrhage. No vascular lesions including ruptured aneurysms were detected in the great vessels.

GROSS NECROPSY: 5-year-old thoroughbred bay gelding with tattoo number N30881 was submitted dead for necropsy. The gelding weighed approximately 1000 pounds and showed moderate autolysis. No significant external lesions were noted. The neck muscles and chest were moderately congested. Upon opening the chest cavity both lungs were still inflated with air but diffuse dark reddened. On cut surface, there was dark blood oozing from both lungs and also tracheal mucosa was dark red. The epicardium contained multifocal and coalescing areas of hemorrhage around coronary vessels. No significant lesions were present in the great vessels including aorta, pulmonary trunk, pulmonary vessels and including both arteries and veins. Coronary vessels were within normal limits and no rupture of chordae tendinae was found. No other gross lesions were noted. The glandular portion of the stomach was multifocally reddened but the contents were not bloody.

HISTOPATHOLOGY:

Slide 1.

Trachea and lungs: Both organs are markedly decomposed due to obliteration of all cellular details. Diffusely the pulmonary parenchyma and the tracheal submucosa contain hemorrhage with no significant inflammation.

Owner: Juan Martin Triana

Slide 2.

Spleen: Similarly markedly autolyzed.

Stomach: Shows no significant inflammation apart from multifocal superficial hemorrhages. Submucosal vessels of the stomach are also congested.

Slide 3.

Liver and kidneys: No significant inflammation or necrosis is present in either organ but hepatic sinusoids are moderately congested.

Slide 4.

Different sections of the heart show no significant histologic lesions apart from the epicardial hemorrhages.

Slide 5.

Different sections of small and large intestine show no significant histologic lesions.

Tawfik A. Aboellail, BVSc, MVSc, PhD, DACVP

Prelim report: 6/23/2015 TAA

Full report: 07/02/2015 cja

N e c r o p s y

Necropsy Colorado Racing Commission

Animal/Source	Specimen	Specimen Type	Result Date	Results
Ace Away	1	Body	15-Jul-2015	Complete

End of Report