



A WORKSHOP Exercise-Induced Pulmonary Hemorrhage Findings, Part 1

Moderator

James D. Smith, DVM; Chairman of the
Association of Racing Commissioners
International (RCI) Quality Assurance Program

Contributors

Rick Arthur, DVM; Monrovia, California
James Barton, VMD; American Quarter Horse
Association, Amarillo, Texas
Edward Bowen; The Blood Horse, Lexington,
Kentucky
Doug Byars, DVM; Lexington, Kentucky
Fred Derksen, DVM, PhD; Michigan State
University
Howard Erickson, DVM, PhD; Kansas State
University

Bob Gowen, VMD; Racing Commissioners
International Quality Assurance Program,
Lexington, Kentucky
Ken Hinchcliff, BVSc, MS, PhD; The Ohio State
University
Muri Manohar, BVSc, PhD; University of Illinois
Mike O'Callaghan, BVSc, PhD; Tufts University
John Pascoe, BVSc, PhD; University of
California, Davis
Ed Robinson, B Vet Med, PhD, MRCVS;
Michigan State University
Rick Same, PhD; The Ohio State University
Larry Soma, VMD; University of Pennsylvania
Corinne Sweeney, DVM; University of
Pennsylvania
Tom Tobin, MVB, PhD; University of Kentucky

A workshop on Exercise-Induced Pulmonary Hemorrhage was held by the Association of Racing Commissioners International Drug Testing and Quality Assurance Program, on January 3, 1991, in Cincinnati. Equine Practice is pleased to present the proceedings of the workshop. This workshop was generously supported by Arlington Park Racetrack, The Blood Horse, The Keeneland Association, and the Racing Commission International Drug Testing and Quality Assurance Program. Prepared for publication by Tom Tobin, MVB, PhD; University of Kentucky.

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Introduction

[Editor's Note: This introduction was prepared by James D. Smith, DVM, Chairman of the Racing Commission International Assurance Program and Moderator of the Exercise-Induced Pulmonary Hemorrhage Workshop.]

While exercise-induced pulmonary hemorrhage (EIPH) was identified in its most severe form, bleeding from the nostrils, more than 300 years ago, it is generally agreed among horsepeople, veterinarians, regulators, and others involved with performance horses of all breeds that EIPH is a problem which leads to significant wastage and loss of horses.

Recognizing that fact, the Racing Commission International (RCI) Drug Testing and Quality Assurance Program convened a blue ribbon panel of experts on the subject to consider the best scientific approach to identification of the causes of EIPH with a view, to developing scientifically and medically sound acceptable approaches to this problem.

While extensive discussions were held on the pathophysiology of EIPH, it was the strong consensus among those at the meeting that there is little accurate scientific knowledge concerning the actual causes of EIPH.

The consensus of the meeting was that extensive research needs to be performed in the areas of:

- the factors that predispose a horse to EIPH and the precise significance of EIPH in horses;
- the role of environmental factors in predisposing horses to small airway disease;
- how early episodes of EIPH progress to "end-stage" EIPH or actual bleeding;
- the relationship of various stages of EIPH to the performance of the horses it affects; and
- better methods of prevention and treatment of EIPH.

It is the strong consensus of the practitioners and scientists assembled at this workshop that while a sizeable amount of research into these questions has already been performed, the horse industry is still a long way from a complete understanding of EIPH, or its causes, prevention, treatment, and cure. Substantial additional resources should be committed in support of further scientific approaches to identifying the causes and developing improved treatments and/or cures for this long-standing problem in performance horses.

Summary

The following list summarizes what is currently known about EIPH.

• EIPH has occurred when evidence of hemorrhage into an airway is found posttrace. Virtually all horses show evidence of EIPH after intense exercise. While its incidence is thought to be comparable worldwide, little is known about factors that predispose horses to EIPH.

• The best current thinking is that a combination of racing stress (high blood pressures/increased blood viscosity) and local small airway disease leads to development of the initial EIPH lesions. The source of blood, either from the bronchial or pulmonary circulations, and the role of alveolar hemorrhage in the pathogenesis of the EIPH lesions are unknown at this time.

• Horses retired from racing with a history of bleeding show well-established, "end-stage" EIPH lesions in the dorsal portion of the caudal lobes of the lungs. These lesions appear to increase in size during the horse's racing career, and eventually become nonfunctioning, large, and essentially irreversible lesions.

• Each episode of intense exercise is thought to increase the size of established EIPH lesions.

• Micropathological examination of end-stage EIPH lesions shows destruction of alveolar tissue, extensive proliferation of bronchial blood vessels, and greatly increased numbers of anastomoses between the bronchial and pulmonary circulations. These anastomoses provide sources for systemic arterial blood to enter pulmonary capillaries and may be a source of hemorrhage into the airways.

• Mild episodes of EIPH appear to have little effect on racing performance. On the other hand, horses that bleed from the nose sometimes pull up and clearly suffer a substantial reduction in performance. A small but significant number of horses die acutely posttrace and some investigators consider EIPH to be the most important cause of acute nontraumatic posttrace death.

Major research topics to be addressed include:

- determination of the source of the blood found in the airways;
- the role of small airway disease in development of this condition;
- the role of airway blood in development of the lesion;
- definition of the steps between triggering of the initial lesion and the well-characterized end-stage lesions described by O'Callaghan;¹ and
- development of effective prophylactic and therapeutic approaches to treating and preventing EIPH.

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Background

The "bleeder," a horse that bleeds from the nose (Fig. 1) (epistaxis) after racing, has been known for at least 300 years. The "occult bleeder," a horse that bleeds in the lungs but not from the nostrils, was also postulated but until recently remained unidentified.^{2,3}

Bleeding, either overt or unobserved, was thought to negatively influence performance and was considered a liability. In 1974, Cook identified the lungs as the source of hemorrhage,⁴ but beyond this little progress was made in understanding bleeders until the late 1970s.

In 1978, Pascoe and his coworkers endoscopically examined the airways of horses racing in California and Illinois. They showed that up to 50% of Thoroughbred horses bled into the lungs post-race, establishing "occult bleeding" as quite a common event. Based on the association of bleeding with exercise Pascoe renamed the condition exercise-induced pulmonary hemorrhage, or EIPH.⁵ Subsequent investigations confirmed the high incidence of this exercise-induced condition.^{6,7} In the early 1980s O'Callaghan and Pascoe discovered that some horses with a history of EIPH had distinctive radiographic patterns in their dorsocaudal lung fields, although not all horses with EIPH show this lesion.^{10,11} In the mid-1980s, these same two researchers conducted a postmortem survey on horses retired from racing with a history of bleeding in Hong Kong. In the lungs of these horses O'Callaghan and Pascoe demonstrated extensive and characteristic bilaterally symmetrical lesions in the dorsocaudal portion, in good agreement with their radiographic observations. This work established the location, extent, micropathology, and severity of these end-stage lesions in horses with a history of bleeding.¹

While the epidemiology and end-stage pathology of EIPH are firmly established, there is still little understanding of the factors that predispose horses to EIPH, the nature of the initial lesions in EIPH, and the progress of the condition to the end-stage pathology described by O'Callaghan.

Additionally, there is also little understanding of the effects of this condition on racing performance and its prevention, prophylaxis, and treatment. To consolidate our progress in this area and chart directions for future research, the RCI Drug Testing and Quality Assurance Program convened a 1-day workshop on EIPH which brought together the leading authorities in this area to review the current state of knowledge and chart future investigations.

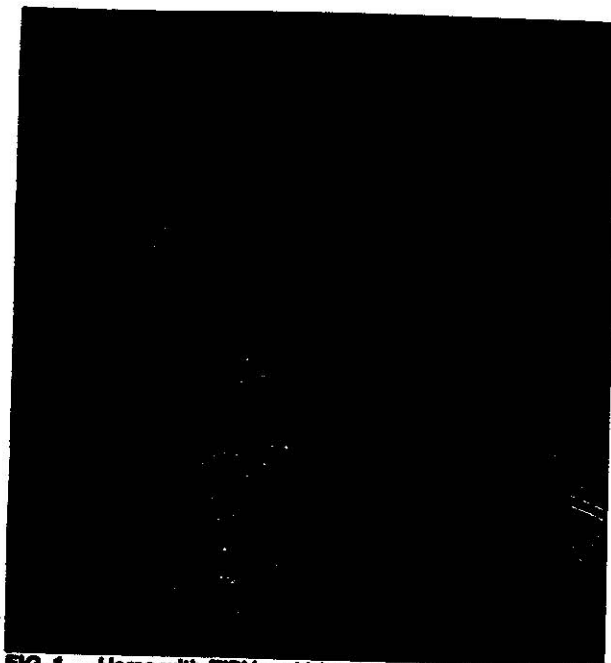


FIG. 1 — Horse with EIPH and blood present at the nostrils. (Photo courtesy of Dr. Sweeney.)

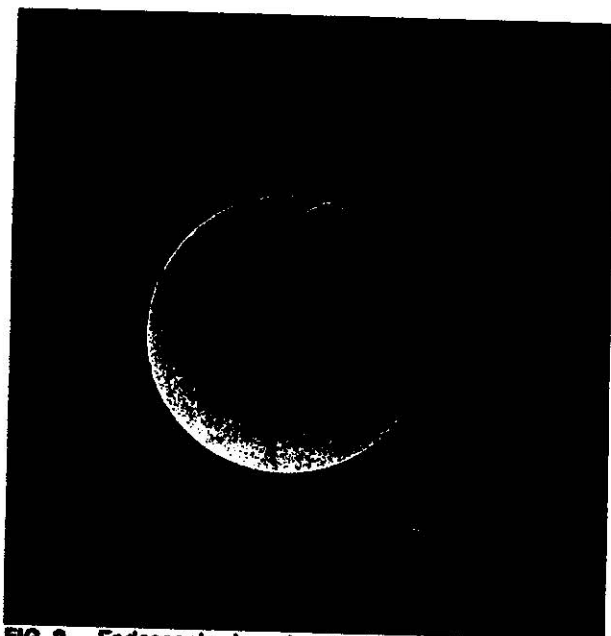


FIG. 2 — Endoscopic view of multiple streams of blood on tracheal mucosa. (Photo courtesy of Dr. Sweeney.)

Definition and Epidemiology

The definition and epidemiology of EIPH were first outlined. Observations made included the following.

- EIPH has occurred when horses show the presence of blood in an airway or other evidence of hemorrhage into an airway after strenuous exercise (Table 1).²

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• EIPH is a clinical sign that may be the result of strenuous exercise and/or pathological change. It is not, however, a disease in and of itself in the same way that coughing is a clinical sign of pathological change but is not a disease.

• If the hemorrhage is identified endoscopically it is usually detected within 6 hours after exercise.

If hemorrhage is present for more than 6 hours it is usually red-brown in color and its presence suggests serious underlying pathology. Hemosiderophages can be detected for several weeks after the last incident of strenuous exercise.⁷

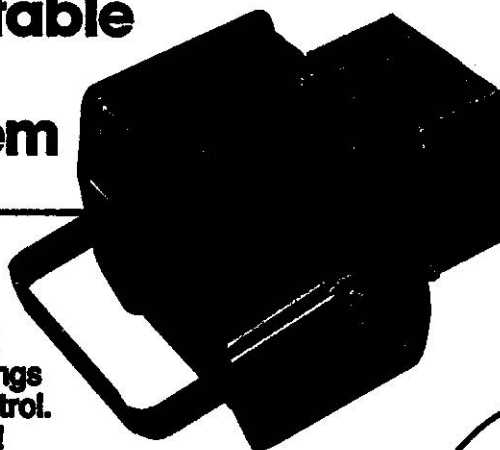
• Endoscopic evidence of EIPH is observed in 50 to 70% of horses subjected to strenuous exer-

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TABLE 1
Incidence of Exercise-Induced Pulmonary Hemorrhage (EIPH) in Horses After Different Types of Exercise

Exercise	Breed ^a	No. Examined	No. With EIPH	% With EIPH	No. With Epistaxis	% With Epistaxis	Reference
Racing	TB	1180	497	42	15	3	Pascoe, Wheat ^b
Racing	TB	191	144	75	13	9	Raphel ^c
Racing	TB	25	16	64	0	0	Voynick ^d
Racing	QH	231	144	62	12	8	Hilledge, et al ^e
Racing	App	94	49	52	2	4	Hilledge, et al ^f
Breeding	TB	139	62	45	1	2	Raphel ^c
Pacing	Stndbd	249	66	26	9	14	Pascoe, Wheat ^b
Steeplechase	TB	31	21	68	3	14	Raphel ^c
Flat turf racing	TB	14	2	14	0	0	Raphel ^c
Timber races	TB	3	2	67	2	100	Raphel ^c
Endurance	Mixed	10	0	0	0	0	Sweeney, Soma ^g
Polo	TB/TB-X	27	3	11	0	0	Voynick ^d
Cross-country event	Mixed	45	6	13	1	17	Voynick ^d

^aTB - Thoroughbred; TB-X - Thoroughbred cross; Stndbd - Standardbred; QH - Quarter Horse; App - Appaloosa.

^bPascoe JR, Wheat JD: Historical Background, Prevalence, Clinical Findings, and Diagnosis of EIPH in the Racing Horse. *Proceedings of the American Association of Equine Practitioners*, 1980, p 417.

^cRaphel CF, Soma RB: EIPH in Thoroughbreds After Racing and Breeding. *Am J Vet Res* 48:1123, 1982.

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^eHilledge CJ, Lane TJ, Johnson EL, et al: Preliminary Investigations of EIPH in Racing Quarter Horses. *Eq Vet Sci* 4:21, 1984.

^fHilledge CJ, Lane TJ, Whitlock TW: EIPH in the Racing Appaloosa Horse. *Eq Vet Sci* 4:251, 1984.

^gSweeney CR, Soma LR: EIPH in Horses After Different Competitive Exercises. Oxford, England, *Proceedings of the First International Conference on Equine Exercise Physiology*, 1983, p 51.

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cise examined endoscopically posttrace (Fig. 2). Evidence of EIPH can be detected in virtually 100% of exercised horses for several weeks after exercise if they are examined for the presence of hemosiderophages.²

- EIPH, therefore, likely occurs in virtually all horses strenuously exercised and differences between individual horses are a matter of degree. Although data are not available from all countries it appears likely that EIPH occurs at about the same rate worldwide.

- Little is known about the factors that predispose horses to EIPH and the etiology, location, and histopathological characteristics of early lesions of EIPH.

- Studies from Hong Kong suggest that horses with EIPH that continue in racing develop unique and characteristic pathological changes in their lungs and that these end-stage EIPH lesions are sufficiently extensive to substantially reduce the performance of these horses.¹

- Based on the extensive and characteristic lesions seen in the lungs of horses showing end-stage changes associated with EIPH, this condition is not considered normal in the horse.

- EIPH in racing horses has many aspects of a production disease. It is seen in animals bred/selected for a certain performance and the stress associated with the performance causes or exacerbates the condition. Production diseases are characteristically insidious, low grade, progressive, not easily detected, and initially have little measurable effect, as seems to be the case with EIPH.

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Editor's Note: Parts 2 and 3 of the EIPH Workshop will appear in future issues of *Equine Practice*.

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