

A WORKSHOP

Exercise-Induced Pulmonary Hemorrhage Findings, Part 3

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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 Part 3 of the proceedings of the workshop. Part 1 was presented in Equine Practice, January 1992, Vol. 14, No. 1, page 19, and Part 2 was presented in February 1992, Vol. 14, No. 2, page 9.

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Prevention, Prophylaxis, and Treatment

Approaches to reducing the incidence of exercise-induced pulmonary hemorrhage (EIPH) may be considered under three major headings:

- prevention,
- prophylaxis, and
- treatment.

In the absence of knowledge concerning the etiology and pathogenesis of EIPH these approaches tend to be empirical, based on signs and pathological findings. Alternative approaches are based on theories as to the causes of EIPH.

This section has been developed from a strictly therapeutic point of view. While the outlined preventive measures that follow are essentially principles of good husbandry, the possibility of post-race treatments should not be incompatible with the rules of racing. The concept of prophylaxis touches on sensitive regulatory areas. Nevertheless, EIPH is a substantial clinical problem in performance horses and it is appropriate for the veterinary profession to carefully evaluate potential approaches that may advance the treatment of this problem.

PREVENTION

The concept behind prevention is to reduce the incidence of small airway disease in young horses based on the hypothesis that airway disease is an important precipitating factor in EIPH. If this is correct, then measures that reduce the incidence of small airway disease in young horses should prevent or delay the appearance of EIPH. These measures would include better housing and ventilation of barns in which young horses are raised with the objective of reducing the inhalation of particulates. Other measures include rigorous vaccination programs to reduce the incidence of respiratory disease in young horses and aggressive treatment of respiratory condition in young horses to reduce the incidence of low-grade respiratory infections. Finally, young horses should be allowed generous recuperation periods, at least 2 weeks after disappearance of clinical signs, before they are put back into training.

PROPHYLAXIS

Prophylaxis is the administration of medications or agents to racing horses prior to strenuous exercise to reduce or eliminate the probability of an episode of EIPH. Administration of furosemide before racing is a well-established

prophylactic approach. Because small airway disease with its resultant narrowing of airways and mucus accumulation is thought to be important in the development of EIPH, diuretics, bronchodilators, and mucolytic agents should theoretically be effective prophylactic agents. The use of diuretics is an already well-established practice in the prophylaxis of EIPH. While there are good theoretical reasons why diuretics might be effective in the prophylaxis of EIPH, there is no clear and unequivocal evidence that furosemide is effective in reducing the incidence or severity of EIPH.

Anticholinergic drugs reduce bronchial secretions and also produce bronchodilation, and both of these actions may be expected to reduce the incidence of EIPH associated with small airway disease. While there is some preliminary evidence in this area, clinical trials of anticholinergic drugs in the prophylaxis of EIPH need to be carried out. Similar studies might also be carried out with the adrenergic bronchodilators, but these agents are chemically related to the adrenergic stimulants and present problems with their prophylactic use in racing horses.

While mucolytics should theoretically be effective, practical experience has shown that these drugs tend to be irritant and produce bronchoconstriction. For this reason, they are often used in conjunction with bronchodilators, which tend to reduce their usefulness and make interpretation of their clinical efficacy difficult. The possible use of corticosteroids is based on the success of steroid therapy in the treatment of human asthmatics. Steroid therapy could take place prior to race day to reduce the inflammatory response, or be restricted to post-race use to reduce the degree of lung damage associated with secondary effects of the inflammatory response. Steroids may be administered systemically, or by nebulization for optimal effect in the respiratory tract.

Extensive new blood vessel formation is characteristic of the EIPH lesion, which has led to suggestions that heparin antagonists might be useful in this condition. It is hypothesized that these agents should reduce the number of fragile new blood vessels in the EIPH lesion, thereby reducing the incidence of EIPH episodes and proliferation of the lesion.

If high blood pressure in the pulmonary circulation is an important factor in the development of EIPH, then antihypertensive agents that reduce pressure in the pulmonary circulation should also be effective prophylactic agents.

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TREATMENT

There are no well-recognized, posttrace treatments for EIPH, despite the common occurrence of this condition, its progressive nature, and clear-cut pathological changes associated with its later stages. This is due to the unknown etiology of EIPH and the relatively recent recognition of the pathological changes associated with it. With the identification of these pathological changes it is clear that efforts should be directed toward developing posttrace therapies that could alleviate any damage to the horse's respiratory system and also prevent or delay the development of classical end-stage EIPH lesions. Until there is a clearer understanding of the pathogenesis of EIPH it is difficult to make rational recommendations for posttrace treatments.

Research Directions

A large number of questions concerning EIPH remains to be answered.

A list of outstanding questions follows, as well as some approaches to preventing and treating EIPH.

• Does the blood found in the airways come from the bronchial or the pulmonary circulations? What is the significance of the anastomoses between the bronchial arteries and the pulmonary arteries?

• What is the effect of hemorrhage into airways? Is the presence of blood in airways alone sufficient to start the sequence of pathological changes that continues to end-stage EIPH?

• Little is known about the pathological changes seen in early episodes of EIPH and how these lesions progress to end-stage EIPH lesions.

• The end-stage EIPH lesion is clearly regional in the lung and we need to develop research approaches to regional lung function testing.

• Studies of regional pulmonary mechanics during strenuous exercise may lead to understanding the localization of end-stage EIPH lesions.

• A better understanding of the hemodynamics of the bronchial and pulmonary circulations during strenuous exercise is required.

• Because of the likely role of small airway disease in initiating episodes of EIPH we need more knowledge of the "normal" incidence of small airway disease in horses, starting with foals and including all ages.

• The role of environmental conditions in barns and other environmental areas in predisposing horses to small airway disease needs to be investigated.

• EIPH appears to represent a continuum from mild episodes of EIPH in virtually all exercised horses to substantial end-stage disease. The performance effects of EIPH vary from little apparent effect to acute incidents of pulling up and possible death. The epidemiology of the performance effects, wastage, and death of horses due to EIPH needs to be evaluated.

• As knowledge of EIPH develops, mathematical models of the role of environmental conditions, small airway disease, edema, bronchial proliferation, and pulmonary hemodynamics and mechanics need to be developed to aid in our understanding of this condition.

• Information is needed as to what pressures are required to produce mechanical rupture of normal blood vessels in the pulmonary and bronchial capillary beds.

• Better investigation methods for prevention, prophylaxis, and treatment of EIPH need to be established.

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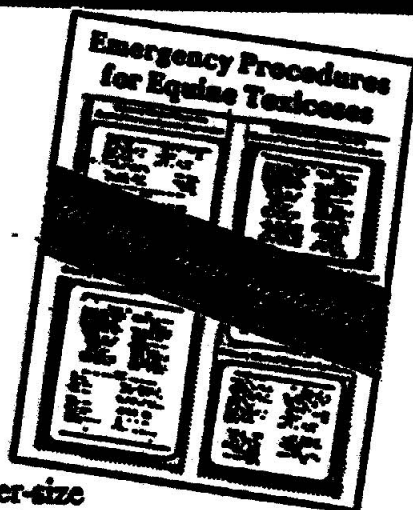
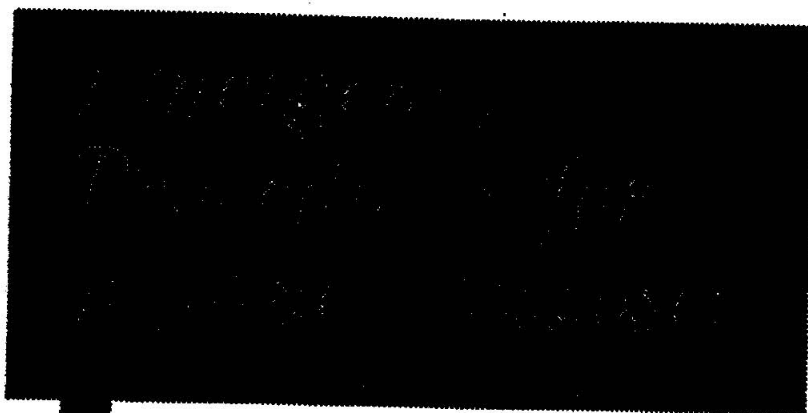
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