

Pulmonary Artery Stiffness in racehorses affected by Exercise-Induced Pulmonary Hemorrhage

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Plain language summary (*< 200 words, summarize your work in text that can be understood by someone with limited scientific background*)

Exercise-induced pulmonary hemorrhage (EIPH) is a common condition in racehorses, characterized by bleeding in the lungs during intense exercise. It has significant economic and welfare consequences in the racing industry and is associated with poor performance and shortened career duration. This study explores a new non-invasive index called Pulmonary Artery Stiffness (PAS), measured through cardiac ultrasound, which reflects the elasticity of the pulmonary blood vessels. Since EIPH progressively damages these vessels, leading to increased stiffness, PAS may help identify horses affected by the condition. In this study, 89 racehorses were assessed, and it was found that horses with EIPH had significantly higher PAS values compared to healthy individuals. These findings suggest that PAS could be a useful tool for monitoring EIPH over time.

Abstract (*< 500 words*):

Exercise-induced pulmonary hemorrhage (EIPH) is a common condition in racehorses, defined as bleeding occurring within the lungs during strenuous exercise. The diagnosis is based on the detection of blood in the tracheal lumen after high-intensity exercise and/or the presence of hemosiderophages in the bronchoalveolar lavage fluid (BALF). The latter has been considered worldwide the gold standard for EIPH diagnosis, since the absence of blood in the trachea does not rule out that pulmonary hemorrhage has occurred [1].

Pulmonary Artery Stiffness (PAS) is a novel, non-invasive echocardiographic index that reflects pulmonary vascular elasticity and structure. In human medicine, it has been demonstrated that PAS can easily detect changes in the elastic properties of the pulmonary artery [2]. In equine medicine, it has been reported that PAS is higher in horses with severe asthma, due to reduced compliance of the pulmonary vessels [3]. Given that EIPH involves progressive vascular remodeling and loss of vascular compliance, PAS could serve as a useful and non-invasive tool to detect these changes in EIPH-affected horses.

This study aimed to assess whether PAS values in racehorses with EIPH were higher compared to those of healthy ones. PAS was assessed by pulsed-wave Doppler echocardiography from the left parasternal angled view of the right ventricular inflow/outflow tract and calculated as already described in the literature [4]. Eighty-nine horses, 44 Thoroughbreds and 45 Standardbreds, were enrolled; 55 were females, 22 were males, and 13 were geldings; the median age was 6.5 (2 – 25) years old. Based on BALF cytology [5], 35 were diagnosed with EIPH, while 54 were deemed healthy. Since the data were normally distributed, the Student's t-test was used to assess the differences between healthy and EIPH-affected horses. Horses with EIPH showed significantly higher PAS values ($p = 0.006$) than healthy horses; the mean PAS values were 22.3 ± 5.0 kHz/s in horses affected by EIPH, while 19.2 ± 6.1 kHz/s in healthy horses. These results are consistent with the hypothesis that pulmonary hemorrhage leads to reduced pulmonary vascular compliance.

EIPH has significant economic and welfare consequences in the racing world. It is associated with reduced performance, shortened career duration, and increased medical management. Moreover, the high prevalence of EIPH raises ethical concerns about the demands placed on equine athletes, underscoring the importance of early diagnostic approaches. Although our findings are just preliminary, PAS measurement may offer a non-invasive, promising adjunct to existing diagnostic methods such as tracheobronchoscopy and BALF cytology, that may improve detection and monitoring of EIPH in racehorses over time.

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