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A COMPARISON OF TWO METHODS FOR PULMONARY FUNCTION TESTING IN HORSES WITH UPPER AND LOWER AIRWAY OBSTRUCTION

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The aim of this study was to compare a new technique for measuring respiratory mechanical parameters in horses, the Impulse Oscillometry System (IOS), to a current reference technique (CRT) for the evaluation of two common obstructive diseases affecting either upper or lower airways. In contrast to the CRT, which requires the introduction of an esophageal balloon-tipped catheter for the evaluation of pleural pressure changes, the IOS is a totally non-invasive alternative for pulmonary function testing in horses, based on the forced oscillation principle. The IOS enables to measure resistance (R) and reactance (X) in a spectre of frequencies, from 5 to 35 Hz.

Mechanics of breathing were determined using both methods in random order, (1) in six horses suffering from Chronic Obstructive Pulmonary Disease (COPD) before and during a crisis characterized by bronchospasm induced by exposure to mouldy hay, and (2) in five healthy horses before and after an experimentally induced left laryngeal hemiplegia (LLH). Main results obtained with IOS and CRT in both conditions are summarized in Table 1.

Table : Mechanics of breathing in 6 COPD-affected horses before and during an acute crisis, and in 5 horses before and after LLH (results expressed as mean \pm s.d).

		Before crisis	During crisis	Before LLH	During LLH
I O S	R5 Hz (kPa/l/s)	0.062 \pm 0.009	0.124 \pm 0.016*	0.060 \pm 0.005	0.070 \pm 0.004°
	R20 Hz (kPa/l/s)	0.088 \pm 0.011	0.068 \pm 0.015	0.077 \pm 0.005	0.101 \pm 0.008°
	X5 Hz (kPa/l/s)	0.011 \pm 0.002	-0.106 \pm 0.027*	0.001 \pm 0.008	0.003 \pm 0.007
	X20 Hz (kPa/l/s)	0.022 \pm 0.008	-0.046 \pm 0.009*	-0.020 \pm 0.014	-0.012 \pm 0.007
C R T	R _L (kPa/l/s)	0.062 \pm 0.016	0.274 \pm 0.058*	0.058 \pm 0.012	0.069 \pm 0.014
	C _{dyn} (l/kPa)	20.937 \pm 3.805	4.261 \pm 1.830*	16.37 \pm 2.512	17.27 \pm 3.014

* significantly different from values obtained before crisis (bronchospasm) (p < 0.05).

° significantly different from values obtained before LLH (p < 0.05).

Both techniques were able to detect a significant difference of respiratory mechanical parameters during an obstruction of peripheral airways. However, not only was the IOS more sensitive than CRT in detecting LLH but it also allowed to differentiate between central and peripheral airway dysfunction as the behaviour of R and X in the frequency domain was modified according to the level of obstruction.

To conclude, the IOS seems to be a reliable technique, able to evaluate and localize impaired mechanics of the respiratory system in case of common upper and lower airway obstructions in horses. Compared to the CRT, the IOS was found to be quicker, easier to use and well tolerated by all animals.