

# Ventilatory inefficiency as a limiting factor for exercise in patients with COPD.

Iván Caviedes, Iris Delgado y Rodrigo Soto

## Abstract

### BACKGROUND:

Ventilatory inefficiency increases ventilatory demand; corresponds to an abnormal increase in the ratio of minute ventilation ( $V_{\dot{E}}$ ) to  $CO_2$  production ( $V_{\dot{CO}_2}$ ); represents increased dead space, deregulation of respiratory control, and early lactic threshold; and is associated with expiratory flow limitation that enhances dynamic hyperinflation and may limit exercise capacity.

### OBJECTIVE:

To evaluate the influence of ventilatory inefficiency over exercise capacity in COPD patients.

### METHODS:

Prospective study of 35 COPD subjects with different levels of severity, in whom cardiopulmonary stress test was performed. Ventilatory inefficiency was represented by the  $V_{\dot{E}}/V_{\dot{CO}_2}$  relation. Its influence over maximal oxygen consumption ( $V_{\dot{O}_2\max}$ ), power (W), and ventilatory threshold was evaluated. Surrogate parameters of cardiac function, like oxygen pulse ( $V_{\dot{O}_2}/\text{heart rate}$ ) and circulatory power ( $\%V_{\dot{O}_2\max} \times \text{peak systolic pressure}$ ), were also evaluated.

### RESULTS:

Cardiopulmonary stress test was stopped due to dyspnea with elevated  $V_{\dot{E}}$  and marked reduction of breathing reserve. A severe increase in  $V_{\dot{CO}_2}$  (mean  $\pm$  SD  $35.9 \pm 5.6$ ), a decrease of  $V_{\dot{O}_2}$  (mean  $\pm$  SD  $75.2 \pm 20\%$ ), and a decrease of W (mean  $\pm$  SD  $68.6 \pm 23.3\%$ ) were demonstrated. Twenty-eight patients presented dynamic hyperinflation. Linear regression showed a reduction of 2.04% on  $V_{\dot{O}_2\max}$  ( $P < .001$ ), 2.6% on W ( $P < .001$ ), 1% on  $V_{\dot{O}_2}/\text{heart rate}$  ( $P = .049$ ), and 322.7 units on circulatory power ( $P = .02$ ) per each unit of increment in  $V_{\dot{E}}/V_{\dot{CO}_2}$ , respectively.

### CONCLUSIONS:

Ventilatory inefficiency correlates with a reduction in exercise capacity in COPD patients. Including this parameter in the evaluation of exercise limitation in this patient population may mean a contribution toward the understanding of its pathophysiology.