

European Respiratory Society Annual Congress 2012

Abstract Number: 1041

Publication Number: 3310

Abstract Group: 4.1. Clinical physiology and Exercise

Keyword 1: Exercise **Keyword 2:** Gas exchange **Keyword 3:** Physiology

Title: Cerebral cortex oxygen delivery and exercise limitation in patients with COPD

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Body: Background: During hypoxic exercise in healthy humans, limited frontal cerebral cortex oxygen delivery may signal the brain to cease exercise. Aim: Whether in patients with COPD experiencing exercise-induced arterial O₂ desaturation, frontal cerebral cortex oxygen delivery is reduced, remains unknown. Methods: By near infrared spectroscopy, we measured both frontal cerebral cortex blood flow (CBF) using indocyanine green dye, and cerebrovascular O₂ saturation (%StO₂) in 12 COPD patients during constant-load exercise at 75% of peak capacity. Subjects exercised breathing air, 100% O₂ or normoxic heliox, the latter two in balanced order. Results: Time to exhaustion breathing air was less than for oxygen or heliox (394±35 vs. 670±43 and 637±46 sec, respectively). In each condition, CBF increased from rest to exhaustion. At exhaustion, CBF was higher breathing air and heliox than oxygen (30.9±2.3 and 31.3±3.5 vs. 26.6±3.2 ml·min⁻¹·100g⁻¹, respectively), compensating lower arterial O₂ content (CaO₂) in air and heliox, and leading to similar frontal cerebral cortex oxygen delivery (air: 5.3±0.4, O₂: 5.5±0.6 and heliox: 5.6±1.0 ml·O₂·min⁻¹·100g⁻¹). In contrast, end-exercise %StO₂ was greater breathing oxygen compared to air or heliox (67±4 vs. 57±3 and 53±3%, respectively), reflecting CaO₂ rather than frontal cerebral cortex oxygen delivery. Conclusion: Prolonged time to exhaustion by oxygen and heliox despite similar cerebral cortex oxygen delivery as in air, lower %StO₂ with heliox than oxygen, yet similar endurance time, and similar %StO₂ on air and heliox despite greater endurance with heliox, do not support the hypothesis that cortical oxygen delivery is important in limiting exercise capacity in COPD.