The Effect of Exercise Intensity on Airway and Systemic Inflammation in Patients with COPD

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Rationale: Airway and systemic inflammation are characteristic features of chronic obstructive pulmonary disease (COPD). A single bout of exercise increases systemic inflammation in patients with COPD, but no study has documented the airway inflammatory response, the anti-inflammatory response, or how different intensities of aerobic exercise influence the inflammatory processes.

Objective: To investigate the effect of exercise intensity on airway and systemic inflammation in patients with COPD.

Methods: Ten patients with moderate-to-severe smoking-related COPD (FEV1/FVC<0.7, FEV1 30-80% pred) and ten healthy age- and activity-matched controls were recruited for the study. Following pulmonary function and cardiopulmonary exercise tests at an initial visit, sputum and blood samples were collected ~48 hours before, and 0 (blood only) and 2 hours after a high intensity (HIGH) or low intensity (LOW) cycle exercise trial. The order of exercise was randomized and trials were equated for total work. HIGH consisted of eight intervals of 1 min at 100% workload maximum (Wmax) with 2 min at 30% Wmax, while LOW consisted of ~32 min of exercise at 40% Wmax. Sputum and blood samples were assessed for differential cell count, as well as interleukin (IL) 6, 8 and 10.

Results: Sputum differential cell counts were obtained at all time points in eight patients and six controls while blood samples were obtained in 10 patients and nine controls. Patients with COPD demonstrated higher absolute sputum neutrophils at all time points. Sputum neutrophils were reduced after LOW in patients with COPD (p=0.028), and this reduction was greater than with HIGH (-14.7 vs. -0.8% change in LOW and HIGH respectively, p=0.036). This finding was not observed in controls. A decrease in sputum IL-8 occurred after HIGH in the COPD group (p=0.045) but not in controls. Systemically, IL-8 was elevated and IL-10 was reduced in the COPD compared to controls at all time points (p<0.05). After HIGH, controls had an increase in systemic IL-10 from baseline to immediately after exercise (45.6 vs. 73.6 pg/ml, respectively, p=0.028), while the COPD group had no significant increase in IL-10 at any time point after either exercise trial.

Conclusions: This is the first study to investigate the airway inflammatory response to exercise in patients with COPD and demonstrates that high and low intensity exercise result in differing airway inflammatory responses. Systemically, there is a blunted anti-inflammatory response to high-intensity exercise in patients with COPD, which may have important implications for appropriately prescribing exercise for this population.