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Title: Functional and metabolic consequences of increasing levels of neuromuscular electrical stimulation in non-depleted patients with COPD and healthy controls

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Body: Rationale: Neuromuscular electrical stimulation (NMES) has been progressively used to improve skeletal muscle performance in patients with COPD. It is presently unknown, however, whether NMES is able to induce similar physiological and metabolic responses in COPD patients and healthy subjects. Objective: To compare functional (torque) and metabolic (deoxygenation) effects of NMES at increasing levels of stimulation in patients with COPD and age- and gender-matched controls. Methods: Fifteen males with moderate-to-severe COPD ($FEV_1 = 46.2 \pm 18.1$ % pred) and 10 controls underwent high-frequency (50Hz) NMES at 20 to 50 mA. Torque was measured by isokinetic dynamometry, muscle deoxygenation (HHb) by near infrared spectroscopy, and muscle mass by DEXA. Results: Maximal voluntary contraction (MVC) was significantly lower in patients than controls; these differences, however, disappeared after muscle mass correction ($p > 0.05$). There were progressive increases in torque and HHb with amplitude of stimulation in both groups. Although absolute torque at given level of stimulation was systematically lower in patients, MVC-corrected values were similar (20 mA and 50 mA = 5.7 ± 3.7 % and 24.4 ± 8.4 % in patients and 6.4 ± 5.2 % and 22.4 ± 10.0 % in controls, respectively). Moreover, there were no between-group differences in HHb (% cuff-induced maximal) across the stimulation intensities ($p > 0.05$). Conclusions: Our results indicate preserved functional and metabolic responses to NMES in non-depleted patients with moderate to severe COPD. These data suggest that they might derive full physiological benefit from this intervention.