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Hypoxic Preconditioning Strengthens Diaphragm during Hypoxia via ROS Signaling in COPD Mice

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Hypoxia is a major factor contributed to respiratory muscle dysfunction in chronic obstructive pulmonary diseases (COPD). Recently, hypoxic preconditioning (HPC, muscle treatment with alternative low and high oxygen) was proposed as a novel strategy that can protect diaphragm against hypoxia-induced muscle injuries; yet its underlying mechanism remains elusive in COPD. In this study, we tested the hypothesis that reactive oxygen species (ROS) play a signaling role in HPC protective effects on COPD diaphragm. C57BL6 mice were smoked for three consecutive months to develop COPD symptoms. When smoking was ceased, mice diaphragms were isolated and mounted in a contractile chamber. Diaphragm muscle strips were either treated (n = 6) or non-treated (n = 10) with HPC or exposed to an antioxidant combination of Tiron and N-acetyl cysteine (NAC, 1mM each, n = 7) prior to HPC, followed by 30-min hypoxia. Muscles were electrically stimulated for 5 min during hypoxia. Contraction force at the end of 5-min contraction was normalized by baseline force as an indicator of muscle function. Data were analyzed using multi-way ANOVA, expressed as means ± SE. The results demonstrate that HPC significantly enhanced diaphragm function during hypoxia (29±2.8% for HPC vs. 6±1.3 for control, $p < 0.05$); while elimination of muscular ROS abolished such protective effects (29±2.8% for HPC vs. 8±3.1% for Tiron+NAC+HPC, $p < 0.05$). These data collectively suggest that HPC may protect diaphragm against hypoxia-induced muscle dysfunction in COPD via ROS-involved pathways.

Biography

Li Zuo obtained his PhD at Ohio State University (OSU). Currently, he is an Assistant Professor and Director of the Molecular Physiology and Rehabilitation Research Lab at OSU Medical center. He authored and editted over 140 original papers, abstracts, book chapters, review articles and edited publications. He is serving as associate editor for Frontiers in Physiology (the 2016 #1 most cited open-access journal in Physiology with an impact factor of 4.031). He also earned recognition as a fellow by American College of Sports Medicine (ACSM) in 2015 and won S&R Foundation Ryuji Ueno Award, the largest American Physiological Society (APS) award in 2016.

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