

Intermittent Hypoxia Attenuates Ischemia-Reperfusion Injury

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ABSTRACT

Brief periods of ischemia preceding an ischemia-reperfusion injury, known as ischemia preconditioning, attenuate the reduction in brachial artery endothelial function. It remains unknown whether brief bouts of systemic hypoxemia would similarly mitigate the blunted vasodilatory response induced by an ischemia-reperfusion injury. **PURPOSE:** To determine whether intermittent hypoxia protects against an ischemia-reperfusion injury in young healthy adults. **METHODS:** Sixteen healthy individuals, 9 men and 7 women (age: 23 ± 3 years, height: 175 ± 9 cm, body weight: 72.9 ± 13.4 kg), participated in the study. Brachial artery endothelial function was assessed by flow-mediated dilation before and after a 20-minute blood flow occlusion. Blood flow occlusion was preceded by either intermittent hypoxia (Hyp) or intermittent normoxia (Norm). Both visits were separated by a period of seven days. Women who had regular menstrual cycles were scheduled in the early follicular phase. Intermittent hypoxia was created by titrating nitrogen into a breathing system to achieve an arterial oxygen saturation of 90%. Intermittent hypoxia consisted of three 4-minute hypoxic cycles separated by 4-minute normoxic cycles. **RESULTS:** Intermittent hypoxia resulted in a lower arterial oxygen saturation (Hyp: 87 ± 3 vs. Norm: $99 \pm 1\%$, $p < 0.01$), which was equivalent to a lower fraction of inspired oxygen (Hyp: 0.123 ± 0.013 , Norm: 0.210 ± 0.003 , $p < 0.01$). When preceded by intermittent normoxia, blood flow occlusion resulted in a blunted flow-mediated dilation (Norm: 7.1 ± 2.5 to $4.0 \pm 2.4\%$). In contrast, the reduction in flow-mediated dilation following blood flow occlusion was attenuated by prior exposure to intermittent hypoxia (Hyp: 6.4 ± 1.9 to 4.4 ± 2.3 , $p = 0.048$). Exposure to intermittent hypoxia did not affect mean arterial blood pressure (Hyp: 96 ± 10 , Norm: 96 ± 8 mmHg, $p = 0.90$) but significantly increased heart rate (Hyp: 72 ± 7 , Norm: 63 ± 7 bpm, $p < 0.01$). **CONCLUSION:** Exposure to mild levels of intermittent hypoxia attenuates the reduction in flow-mediated dilation induced by blood flow occlusion in young healthy individuals. Thus, intermittent hypoxia represents a potential strategy to mitigate the effect of ischemia-reperfusion injury associated with ischemic cardiovascular events.