Peripheral Chemosensitivity during Head Out Water Immersion
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Carbon dioxide (CO₂) retention is a potentially dangerous issue in divers who use a self-contained underwater breathing apparatus. The peripheral chemoreceptors contribute to ventilatory control and the rise in ventilation (Vₑ) during hypercapnia. However, it is unknown if head out water immersion (HOWI) blunts peripheral chemosensitivity (PCS). **PURPOSE:** We tested the hypothesis that PCS is blunted during two hours of HOWI. **METHODS:** We assessed PCS to hypoxia (PCSₐO₂) and hypercapnia (PCSₐCO₂) in 3 participants (age: 25 ± 4 y, BMI: 28 ± 3 kg/m²) before, during, and after thermoneutral (35 ± 0°C) HOWI. Vₑ, arterial oxygen saturation (%SaO₂), and the partial pressure of end tidal CO₂ (PETCO₂) were recorded continuously. We determined PCSₐO₂ by having participants inhale 2-6 breaths of 100% N₂, followed by 3 min of room air breathing, 4 separate times. We determined PCSₐCO₂ by having participants inhale 1 breath of 13% CO₂, 21% O₂, and 66% N₂, followed by 3 min of room air breathing, 4 separate times. The mean of the 3 highest consecutive Vₑ values, the lowest %SaO₂, and the peak PETCO₂ were determined within 2 min following each hypoxic or hypercapnic administration. The PCSₐO₂ and PCSₐCO₂ data are reported as the slope of the linear regression line of Vₑ vs. %SaO₂ or PETCO₂, respectively. Measurements were taken at baseline, at 10, 60, and 120 min of HOWI, and post HOWI. **RESULTS:** Vₑ was not different during the trial (baseline: 12.9 ± 1.1 L/min; at 10 min: 12.6 ± 2.0 L/min, 60 min: 12.2 ± 2.0 L/min, and 120 min: 11.9 ± 1.5 L/min; post: 11.9 ± 0.8 L/min; p = 0.39). PETCO₂ was statistically indistinguishable during the trial (baseline: 45.9 ± 0.8 mmHg; at 10 min: 47.8 ± 0.9 mmHg, 60 min: 48.3 ± 0.9 mmHg, and 120 min: 48.0 ± 1.3 mmHg; post: 43.2 ± 2.4 mmHg; p = 0.10). PCSₐO₂ was lower at 10 min of HOWI (0.25 ± 0.10 L/min/%SaO₂, p = 0.09) and post HOWI (0.32 ± 0.16 L/min/%SaO₂, p = 0.04) vs. baseline (0.41 ± 0.17 L/min/%SaO₂). The PCSₐCO₂ tended to be lower (p = 0.09) at 10 min of HOWI (0.07 ± 0.03 L/min/mmHg) vs. 120 min of HOWI (0.08 ± 0.03 L/min/mmHg). **CONCLUSION:** These preliminary data indicate that PCSₐO₂ and PCSₐCO₂ are altered during HOWI while breathing room air. The transient decrease in PCS might contribute to CO₂ retention in divers using a self-contained underwater breathing apparatus.