Peripheral Chemosensitivity during Head Out Water Immersion

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Carbon dioxide (CO_2) 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 (V_E) 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 (PCS_{O2}) and hypercapnia (PCS_{CO2}) in 3 participants (age: 25 ± 4 y, BMI: 28 ± 3 kg/m^2) before, during, and after thermoneutral (35 ± 0° C) HOWI. V_E, arterial oxygen saturation (%SaO_2), and the partial pressure of end tidal CO_2 ($PETCO_2$) were recorded continuously. We determined PCS_{O2} by having participants inhale 2-6 breaths of 100% N_2, followed by 3 min of room air breathing, 4 separate times. We determined PCS_{CO2} by having participants inhale 1 breath of 13% CO_2, 21% O_2, and 66% N_2, followed by 3 min of room air breathing, 4 separate times. The mean of the 3 highest consecutive V_E values, the lowest %SaO_2, and the peak $PETCO_2$ were determined within 2 min following each hypoxic or hypercapnic administration. The PCS_{O2} and PCS_{CO2} data are reported as the slope of the linear regression line of V_E vs. %SaO_2 or $PETCO_2$, respectively. Measurements were taken at baseline, at 10, 60, and 120 min of HOWI, and post HOWI. **RESULTS:** V_E 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; $p = 0.39$). $PETCO_2$ 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; $p = 0.10$). PCS_{O2} was lower at 10 min of HOWI (0.25 ± 0.10 L/min/%SaO_2, $p = 0.09$) and post HOWI (0.32 ± 0.16 L/min/%SaO_2, $p = 0.04$) vs. baseline (0.41 ± 0.17 L/min/%SaO_2). The PCS_{CO2} 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 PCS_{O2} and PCS_{CO2} are altered during HOWI while breathing room air. The transient decrease in PCS might contribute to CO_2 retention in divers using a self-contained underwater breathing apparatus.