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Face Cooling Reveals Transient Cardiac Parasympathetic Dysfunction in Recently Concussed College Athletes

Muhammed M. McBryde, James R. Sackett, Morgan C. O'Leary, Zachary J. Schlader, John J. Leddy, Blair D. Johnson. University at Buffalo, Buffalo, NY

Autonomic control of the cardiovascular system during sympathetic stress appears to be impaired in concussed patients. However, evidence is lacking regarding the autonomic responses to parasympathetic stimulation in concussion. Cooling the forehead, eyes, and cheeks (i.e., face cooling) transiently increases cardiac parasympathetic activity within 1-2 min. **PURPOSE:** Test the hypothesis that recently concussed college athletes (CA) have impaired cardiac parasympathetic activation during face cooling. **METHODS:** Seven healthy controls (HC) (age: 23 ± 2 years, height: 175 ± 10 cm, weight: 76 ± 16 kg, 4 women) and four symptomatic CA (age: 20 ± 1 years, height: 184 ± 15 cm, weight: 94 ± 33 kg, 1 woman, 6 ± 2 days from injury) participated. Participants rested supine for 10 min before a plastic bag of ice water ($\sim 0^\circ\text{C}$) was placed over the forehead, eyes, and cheeks for 3 min. Recovery data were collected for 1 min. Heart rate (3-lead ECG) and blood pressure (photoplethysmography) were continuously recorded. The root mean squared of successive differences (RMSSD) was calculated from the R-R interval as an indicator of cardiac parasympathetic activity. Change from baseline data were analyzed across 1 min intervals. **RESULTS:** There were no differences between HC and CA at baseline for heart rate (58 ± 10 vs. 53 ± 8 bpm, respectively; $P=0.38$), RMSSD (78 ± 56 vs. 175 ± 179 ms, respectively; $P=0.21$), or mean arterial pressure (97 ± 9 vs. 93 ± 5 mmHg, respectively; $P=0.55$). Changes in heart rate were not different between groups ($P=0.55$) or across time ($P=0.46$). At 1 min of face cooling there was a significant increase in RMSSD in HC (122 ± 120 ms; $P < 0.01$) but no change was observed in CA (-96 ± 158 ms; $P=0.26$). The change in RMSSD was greater in HC vs. CA at 1 min ($P=0.01$) but was not different thereafter ($P > 0.12$). Mean arterial pressure increased 1 min into face cooling and remained elevated thereafter in HC (peak increase at 2 min, 24 ± 6 mmHg; $P < 0.01$). Mean arterial pressure increased 2 min into face cooling in CA and remained elevated at 3 min (peak increase at 2 min, 16 ± 4 mmHg; $P < 0.01$). The increase in mean arterial pressure was greater in HC (23 ± 6 mmHg) vs. CA (15 ± 7 mmHg) at 3 min ($P=0.04$). **CONCLUSION:** Cardiac parasympathetic activation during face cooling appears to be attenuated in CA and might contribute to impaired autonomic cardiovascular control in CA.