TACSM Abstract

Cerebral Vasoreactivity Is Impaired Beyond Symptom Resolution Following Concussion in Collegiate Athletes

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ABSTRACT

Compromised cerebral blood flow (CBF) regulation is linked to impaired functional outcome following concussion. Cerebral vasoreactivity (CVR), an important mechanism in CBF regulation, is the ability of cerebral blood vessels to alter blood flow during dynamic changes in arterial carbon-dioxide (CO_2). P**URPOSE**: The purpose of this study was to examine CVR in an ongoing prospective cohort of collegiate athletes during acute (day-3) and sub-acute (day-21) phases following concussion and compare them with non-injured athletes. **METHODS**: Sixteen male and female collegiate athletes (21±1 years) with sports-related concussion and 16 sports matched non-injured controls (21±1 years) were enrolled in the study. For injured athletes, data was collected during the acute and sub-acute phase following concussion and for the controls data was collected at one time point. Symptom severity and cognition were assessed using the Sports Concussion Assessment Tool-3rd Edition. Continuous middle cerebral artery blood flow velocity (MCAV) was obtained with transcranial Doppler ultrasonography (TCD) while subjects were seated in an upright position. End-tidal CO_2 ($PetCo_2$) was measured with an infrared CO_2 analyzer attached to a nasal cannula. MCAV was evaluated in response to changes in $PetCo_2$ for 2-minutes each during normal breathing (normocapnia), inspiring a gas mixture containing 8% CO_2, 21% oxygen (hypercapnia) and, hyperventilating (hypocapnia). CVR was analyzed as the slope of the linear relationship between $PetCo_2$ and MCAV, which was expressed as the percent change in CBF velocity per mmHg change in $PetCo_2$. Independent and paired t-tests were used to compare symptom severity, and CVR between acute and sub-acute phase following concussion with the controls. **RESULTS**: As anticipated, concussed athletes exhibited higher symptom severity (26.3±0.5 versus 5±7 P= 0.0007) and lower cognition (26.5±1.6 versus 28.3±2.4 P=0.03) during acute phase compared to the controls. Although symptoms and cognition were resolved during the sub-acute phase, CVR was lower in the acute phase compared to the non-injured controls (1.7±0.5U versus 2.3±0.3U, P=0.0006) and it continued to be blunted in the sub-acute phase following concussion (1.9±0.5U P=0.04). **CONCLUSION**: Despite improvements in symptom and cognition, cerebral vasoreactivity appears to be impaired in the sub-acute phase following concussion. Cerebral vasoreactivity utilizing TCD may be a useful vascular biomarker for physiological recovery and aid in accurate return-to play decision-making.