

Cerebral Vasoreactivity During Acute and Recovery Phase Post-Concussion: A Pilot Study

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ABSTRACT

The diagnosis of sports-related concussion is based mostly on clinical symptoms. Return-to-play decisions are made when the athletes are symptom free; however, some metabolic and physiological impairments may persist such as impairments in cerebral blood flow regulation. The purpose of this study was to examine cerebral vasoreactivity from acute phase to recovery phase in athletes with a sports-related concussion. Eight NCAA Division I male athletes (21 ± 2 years) with a confirmed sports-related concussion participated in the study. Data was collected on day 3 (acute) and day 21 (recovery) following a concussion. Subjects also reported any incidences of previous concussions. Arterial blood pressure was obtained with finger photoplethysmography and middle cerebral artery blood flow velocity (MCAV) was collected using transcranial Doppler ultrasonography. Expired CO₂ was continuously measured with an infrared CO₂ analyzer attached to a nasal cannula. Data was collected while subjects breathed room air for 2 minutes, hyperventilated for 2 minutes, and then inspired a gas mixture of 8% CO₂, 21% oxygen, and balanced nitrogen for 2 minutes. Cerebral vasoreactivity was analyzed as the slope of the linear relationship between end-tidal CO₂ and MCAV and expressed as the change in cerebral blood flow per mmHg change in end-tidal CO₂. Cerebral vasoreactivity improved from acute phase to recovery phase in 4 subjects, and worsened in 4 subjects. Subjects with no history of concussions had improved cerebral vasoreactivity (0.676 ± 0.11 to 1.218 ± 0.19 cm sec⁻¹ mmHg⁻¹). However, subjects with a history of concussions had poor outcome on cerebral vasoreactivity during recovery phase (1.154 ± 0.23 to 0.793 ± 0.15 cm sec⁻¹ mmHg⁻¹). These data provide evidence that athletes with a history of concussions may require a longer recovery period to prevent long-term complications.