INTRODUCTION

Concussion, a clinical syndrome resulting from mild traumatic brain injury (mTBI), is a global public health concern, with an annual incidence of approximately 1.6–3.8 million in the U.S. alone.1

Cerebral blood flow (CBF) is indicative of neuronal integrity. In collegiate athletes, global & regional deficits in CBF are observed 2,3. Dynamic cerebral autoregulation (dCA) is the intrinsic property of the blood vessels to maintain perfusion despite fluctuations in mean arterial blood pressure (MAP)4.

Postural control involves multiple processes; visual, vestibular, and proprioceptive in addition to feedback from musculoskeletal system5. Postural complexity index measures negative feedback between multiple controls & produces highly variable fluctuations, enabling athletes to generate adaptive responses to daily environmental stress.

Recovery of postural control is critical for the safety of athletes returning to play. Studies have identified an increased risk of musculoskeletal injuries in athletes upon return-to-play. Ineffective dCA may be associated with postural control dysfunction and therefore, perpetuate these risks.

PURPOSE

1. Examine postural complexity index and dynamic cerebral autoregulation (dCA) at rest and during physical stress (squat) in collegiate athletes following a concussion in comparison to non-injured controls 2. Examine the association between postural complexity index and dCA.

METHODS

Subjects: 33 male and female athletes (20±1 years) with sports-related concussions, as well as 27 non-injured controls (20±1 years).

Study Design: Mixed longitudinal and cross-sectional study. Data was collected on day-3 (N = 33), day-21 (N=29), and day-90 (N=21) following a concussion. For the controls (N=27), data was obtained at a single time point.

Data collection: Center of pressure data was obtained on a force plate during quiet standing for 60-sec trials with eyes closed. Middle cerebral artery blood flow velocity (MCAV; transcranial Doppler ultrasonography) and mean arterial blood pressure (MAP; finger photoplethysmography) data were collected during a 5-minute rest while subjects were seated in an upright position, followed by a 5-minute squatting exercise (0.1 Hz).

Data analysis: Transfer function analysis of beat-to-beat MAP and transcranial Doppler ultrasonography oscillations in the low frequency (LF, 0.07-0.20 Hz) range was utilized to assess dCA.

Multiscale entropy analysis was used to determine complexity index from the center of pressure data. Two-sample Mann Whitney U test was used to compare data between control and concussed athletes at the three time points. Spearman correlation was used to examine the association between LF gain and complexity index.

RESULTS

1. LF Gain = Cerebral Autoregulation

2. Complexity Index = Postural Control

CONCLUSION

Impairments in cerebral autoregulation and postural control during the acute and subacute recovery phases following a concussion were observed despite symptom resolution. Poor functional outcome, such as postural control, may be associated with alterations in cerebral blood flow regulation in this population. Tracking cerebral autoregulation during recovery phase may help in preventing musculoskeletal injuries in athletes after return-to-play following a concussion.

LITERATURE CITED


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