

King-Devick Test Score is Linked to Cerebral Vasoreactivity During Acute Recovery Phase Post-Concussion

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ABSTRACT

The King-Devick (KD) test is a quick screening tool used to detect oculomotor and attention related brain function impairments following a concussion. Adequate cerebral blood flow (CBF) is an indicator of structural and functional integrity and impairments in CBF have been linked to cognitive deficits following concussion. Cerebral vasoreactivity (CVR), a key measure of hemodynamic reserve, is an important factor in CBF regulation. **PURPOSE:** To examine the association between CVR and oculomotor and attention function, using KD test scores, in collegiate athletes following a concussion. **METHOD:** Eighteen male and female athletes diagnosed with a sports-related concussion were enrolled in the prospective cohort study. Twenty-two non-injured athletes were enrolled as controls. Data was collected longitudinally on day-3, day-21, and day-90 following a concussion. Middle cerebral artery blood velocity (MCAV) was obtained using transcranial Doppler ultrasonography (TCD). CO₂ was used as a stimulus to assess CVR. End-tidal CO₂ (EtCO₂) was monitored with an infrared CO₂ analyzer attached to a nasal cannula. Continuous MCAV was obtained for 2-minutes each in response to three CO₂ stimuli; normal room-air (normocapnia), inspiring 8% CO₂ and 21% O₂ gas mixture (hypercapnia), and during hyperventilation (hypocapnia). MCAV and EtCO₂ data were plotted and CVR was estimated as the slope of the MCAV and EtCO₂ relationship. For the KD test, subjects read aloud single-digit-numbers left to right from three test cards with progressive level of difficulty. Subjects were instructed to read as fast as possible without making errors. KD test score was determined as the sum of the total time required to complete the three test cards. Nonparametric Wilcoxon test was used to assess CVR and KD test scores between control and the concussed group at each of the three time points. Spearman rank order correlation was used to assess the association between CVR and KD scores at each time point. **RESULTS:** Compared to the control, CVR (1.33±0.31vs.1.14±0.43U; p=0.03) was blunted and KD score (44.4±7.7vs.48.1±6.9sec; p=0.04) was slower on day-3. CVR was comparable to the controls on days 21 and 90. However, a learning effect was observed in KD test score over time (42.1±8.9, p=0.02 [day-21]; 42.03±8.5, p=0.03 [day90]). In addition, a negative correlation between CVR and KD test was observed on day-3 (p= 0.04). **CONCLUSION:** The preliminary results indicate that deficits in oculomotor function and attention, as identified by KD test, may result from inadequate CBF regulation during the acute recovery phase post-concussion. Further studies should be done to evaluate the potential role of CVR in oculomotor function following concussion in collegiate athletes.