

White Matter Tract Neuroimaging and Serum Biomarker Analysis in Sports-related Concussion

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Background:

Traumatic brain injury (TBI) is a leading cause of death and disability throughout the world, estimated to carry an annual global incidence of over 27 million cases. Mild TBI (mTBI), commonly known as concussion, is the mildest form of TBI and accounts for roughly 90% of all head injuries. Sports-related concussion (SRC) contributes significantly to this statistic with millions of athletes sustaining high-impact injuries in contact sports such as football, soccer, and lacrosse. By examining the white-matter microstructure, diffusion tensor imaging (DTI) has shown excellent capabilities for detecting pathophysiologic changes after SRC and monitoring symptom progression. Biomarkers including neurofilament light (NfL) and tau have been implicated in SRC and may provide insight into the duration of post-concussive symptoms. At this time, very few studies have been published evaluating the relationship between these serum biomarkers and alterations to DTI metrics.

Methods:

In the present study, we examined the association between serum biomarkers NfL and tau to further understand the relationship between these biomarkers and neuroimaging findings seen with diffusion tensor imaging (DTI) after exposure to a sports-related concussive event.

Results:

Serum tau levels decreased significantly at the 24-48h post-injury time point compared to 6h post-injury. Serum tau levels then elevated significantly at the asymptomatic time point in comparison to the 24-48h post-injury time point. The serum tau level was significantly associated with higher mean diffusivity (MD) in the white-matter tracts. Serum NfL had minimal associations with white matter diffusion metrics.

Conclusion and Potential Impact:

This research serves to better inform future investigations into the relationship between DTI metrics and serum biomarkers in the context of mTBI and SRC. This information may contribute to the development of a simple bedside serum analysis with potential to offer tremendous insight into the comprehensive brain health of patients who are being evaluated for SRC, thereby streamlining the therapeutic process and providing more accessible healthcare to patients in locations where advanced imaging techniques are not readily accessible.