Increased brain injury markers in response to asymptomatic high-accelerated head impacts

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In this paper, the authors used helmet-based accelerometers and measurements of serum biomarkers of traumatic brain injury (TBI) to examine the effects of high-acceleration head impacts (HHIs) and to specifically answer the following questions:

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(UCH-L1), neurofilament light protein, glial fibrillary acidic protein, and spectrin breakdown products.

The authors' review of TBI biomarker levels showed statistically significant increases in serum levels of both tau and UCH-L1 after an athlete sustained a single HHI, compared with levels in athletes who did not experience an HHI. When the authors examined TBI biomarker levels over the course of the season, they also found statistically significant increases in post-season levels of both tau and UCH-L1, compared to pre-season levels, in athletes with no diagnosis of concussion. There were no significant increases in the serum levels of the other TBI biomarkers that were tested.

UCH-L1 is a biomarker of neuronal body injury and tau is a biomarker of axonal injury. In their prospective, observational cohort study, Joseph and colleagues identified an association between increased biomarkers of neuronal and axonal head injury and HHI in high-school varsity football players. In addition, the authors showed an association between increased biomarkers of neuronal and axonal head injury, and athletes who played throughout the course of an entire football season, even those athletes in whom no HHI exposure occurred.

The authors acknowledge the small sample size, the lack of non-collision sport controls, and other limitations of the study. They indicate difficulty in trying to interpret the present findings, because the football players did not exhibit the clinical signs and symptoms of concussion. They also raise several questions that can only be answered by future studies.

When asked about the importance of this pilot study, Dr. Joseph responded, "This study suggests asymptomatic high acceleration head impacts, which represent only 0.001% of all impacts, may be on the same spectrum as concussion. Whether these elevations in blood biomarkers of traumatic brain injury are clinically significant is yet to be known. However, we are excited as this potentially provides a new avenue to reduce the risk to young athletes. Specifically, we believe that technological improvements and refinements of game rules may be able to reduce the incidence of HHI."