



Pediatric Academic Societies Meeting

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Saliva Test Predicts Prolonged Concussion Symptoms in Children

Research shows measuring a biomarker for brain injuries more accurate than standard concussion survey questions to gauge how long symptoms will last.

SAN FRANCISCO – Although most of the 3 million concussions diagnosed in the U.S. each year occur in children, the bulk of clinical guidelines are based on adults. Because of this, pediatricians are limited in how accurately they can advise families about how long a child may suffer symptoms such as headaches, fatigue and trouble concentrating that can interfere with school and other activities.

New research being presented at the 2017 Pediatric Academic Societies Meeting, however, suggests a simple saliva test may yield more answers. Investigators will present an abstract of the study, “Peripheral microRNA patterns predict prolonged concussion symptoms in pediatric patients,” on Saturday, May 6 at 9 a.m. at the Moscone West Convention Center.

Micro ribonucleic acids (miRNAs) are genetic molecules, chiefly found within cells, that help regulate protein production. Previous studies have found altered miRNA levels in the saliva of children with mild concussions. This mirrored similar miRNA changes in cerebrospinal fluid, which cushions the brain and spinal cord, of patients with severe brain injury.

Researchers at Penn State College of Medicine studied 50 children between the ages of 7 and 18 years with mild traumatic brain injury. Spit samples were collected and tested for miRNA levels. In addition, concussion symptoms were evaluated through parent and child Sports Concussion Assessment Tool (SCAT-3) surveys, a standardized tool commonly used to evaluate injured children for concussion and to guide clinical decision-making. The surveys were taken within 14 days of injury and again 4 weeks post-concussion. The 29 children with prolonged concussion symptoms had higher scores for headaches, fatigue and difficulties concentrating.

Steven Hicks, MD, PhD, FAAP, lead author of the study, said the salivary miRNA levels were significantly more effective than evaluations using SCAT-3 survey in predicting which children would continue to experience headaches, fatigue, concentration difficulties and other concussion symptoms that lasted longer than 4 weeks. Results showed the standard survey to be less than 70 percent accurate in identifying children who would have prolonged concussion symptoms, he said. In comparison, he said, miRNA in saliva correctly predicted whether concussion symptoms would remain present for at least a month nearly 90 percent of the time.

“We believe that saliva-based RNA testing holds great promise as an accurate and non-invasive method for evaluating pediatric concussions and giving patients and families a more solid prognosis,” Dr. Hicks said.

Steven Hicks, MD, PhD, FAAP, will present the abstract, “Peripheral microRNA patterns predict prolonged concussion symptoms in pediatric patients,” at 9 a.m. on Saturday, May 6.

Please note: only the abstract is being presented at the meeting. In some cases, the researcher may have more data available to share with media, or may be preparing a longer article for submission to a journal. Contact the researcher for more information.

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The Pediatric Academic Societies (PAS) Meeting brings together thousands of individuals united by a common mission: to improve child health and wellbeing worldwide. This international gathering includes pediatric researchers, leaders in academic pediatrics, experts in child health, and practitioners. The PAS Meeting is produced through a partnership of four organizations leading the advancement of pediatric research and child advocacy: Academic Pediatric Association, American Academy of Pediatrics, American Pediatric Society, and Society for Pediatric Research. For more information, visit the PAS Meeting online at www.pas-meeting.org, follow us on Twitter @PASMeeting and #pasm17, or like us on Facebook.

ABSTRACT

TITLE: Peripheral microRNA patterns predict prolonged concussion symptoms in pediatric patients

Background: Three million concussions are diagnosed in the U.S. each year and the majority occur in children. Yet, the bulk of clinical guidelines are based on adult data, limiting the ability of pediatricians to predict clinical outcomes for patients. The Sports Concussion Assessment Tool (SCAT-3) is one tool commonly used by physicians to assess concussion symptoms and guide clinical decision making.

Objective: Micro ribonucleic acids (miRNAs) are non-coding epigenetic molecules that regulate protein translation throughout the human body. Salivary miRNA levels are altered in children with mild concussion and reflect CSF miRNA patterns in severe brain injury. The objective of this study was to assess the utility of salivary miRNA in predicting prolonged pediatric concussion symptoms relative to the SCAT-3.

Design/Methods: Fifty children (ages 7-18) with mild traumatic brain injury were enrolled in the study. Injury mechanism and demographic features were recorded. Concussion symptoms were assessed with

parental and child SCAT-3 surveys administered within 14 days of injury and again four weeks post-concussion. Expecterated saliva was collected at the time of enrollment and miRNA content was assessed with high-throughput RNA sequencing. Participants with SCAT-3 scores ≥ 5 at four weeks were considered to have prolonged concussion symptoms. Mann Whitney testing assessed differences in SCAT-3 scores and miRNA expression between acute- and prolonged-concussion groups. A logistic regression analysis with 10-fold Monte Carlo cross-validation was used to assess predictive utility of SCAT-3 and miRNA components.

Results: There was no differences in injury mechanism or demographic variables between acute- and prolonged-concussion groups. The 29 children with prolonged concussion symptoms had higher scores on “headache” ($p=0.026$) and “tired a lot” ($p=0.019$) SCAT-3 measures. Their parents noticed increased “difficulty concentrating” ($p=0.028$). There were 11 miRNAs with nominal differences between acute- and prolonged-concussion groups. A logistic regression analysis using 6 of these miRNAs demonstrated an area under the curve (AUC) of 0.878 with 10-fold cross-validation (90% sensitivity and 87% specificity) for identifying participants with prolonged concussion symptoms (Figure 1). In comparison, logistic regression employing SCAT-3 variables demonstrated an AUC of 0.662.

Conclusion(s): Salivary miRNA has prognostic utility for identifying prolonged concussion symptoms in pediatric patients that exceeds the SCAT-3.