Subconcussive Head Impact Results in a Unique Circulating Exosomal MicroRNA Signature

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A large segment of the population participates in sports (e.g. football and soccer) and endure hundreds to thousands of low level head impacts over their lifetime. While a continuously growing body of evidence indicates concussive head injury can lead to long term medical problems, little is known about the effects of subconcussive head impact. Subconcussive head impact is defined as mild head impact that does not result in a clinical indication of concussion. While little evidence exists, recently our group has shown that subconcussive head impact results in acute vestibular dysfunction. Thus, the possibility exists that not only does high magnitude head impact like concussions lead pathological changes, but also repetitive subconcussive head impact. Recent research has shown that small circulating molecules termed exosomes contain cargo including microRNAs that may be indicative of pathological events and signaling occurring in the tissue they were released from. **PURPOSE:** To identify a unique circulating exosomal microRNA profile indicative of subconcussive head impact. **METHODS:** We used a common soccer heading task as a controlled head impact model to elicit subconcussive head impact in college males (n=6), in which subjects headed a soccer ball 10 times at a set velocity from ~30 meters away. Pre, immediately post, and 24 hours post blood samples were collected. Exosomes were isolated from blood, and microRNA was isolated from exosomes. Small RNA Next generation sequencing (NGS) was performed on microRNAs in pre and 24 hour post plasma to unbiasedly identify alterations in levels of exosomal microRNAs. To verify NGS results quantitative real time polymerase chain reaction (qPCR) was performed on microRNAs of interest. **RESULTS:** A unique microRNA signature in circulating exosomes was identified 24 hours following subconcussive head impact. Specifically, based on abundance and fold change a small unique panel was identified including 3 microRNAs that were increased 4 fold or more, and 4 microRNAs that are decreased 3 fold or more. **CONCLUSION:** Subconcussive head impact leads to a unique panel of circulating exosomal microRNAs that could potentially be indicative of head injury following repetitive subconcussive head impacts.

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