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Brains of college athletes with prior concussion show physical changes months, years later

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University athletes with a history of concussion had changes in the size, blood flow and connections in their brains months and even years after the injury - changes not seen in athletes without prior concussions, a new study has found.

The study looked at male and female varsity athletes in seven different contact and non-contact sports, demonstrating the relevance of the findings for the overall sporting community, not just traditional high risk sports such as hockey and football.

the study published today in the *Journal of Neurotrauma*, researchers from St. Michael's Hospital used advanced Magnetic Resonance Imaging (MRI) to comprehensively describe abnormalities in brain structure and function in 43 varsity athletes at the start of their sports seasons - 21 male, 22 female, 21 with a history of concussion and 22 without.

They found the athletes with a history of concussions had:

- Brain shrinkage in the frontal lobes, the part of the brain involved in such things as decision-making, problem solving, impulse control and the ability to speak fluently, although nowhere near to the extent of that experienced by people with Alzheimer's disease. The brains of athletes with prior concussions showed a 10 to 20-per-cent reduction in volume

compared to those with no concussions.
- Less blood flow (25 to 35 per cent) to certain areas of the brain, mainly the frontal lobes, which are very vulnerable to injury because of their location at the front of the brain. Reduced blood flow is associated with a longer recovery
- A greater number of concussions was associated with reduced brain volume and blood flow
- Changes in the structure of the brain's white matter, the fibre tracts that connect different parts of the brain

"Sport concussion is still considered to be a short-term injury, but this study provides further evidence of brain changes that may lead to long-term health consequences, including the risk of re-injury, depression and cognitive impairments," said Nathan Churchill, the study's lead author and a post-doctoral fellow in St. Michael's Neuroscience Research Program.

"We expect to see changes in the brain right after an acute injury, but in this study we saw physical differences in brains of athletes that were scanned months to years after their last concussion."

Behaviours controlled by the frontal lobe such as impulse control and problem-solving are often impaired in older athletes with a history of repeated head injury. These findings suggest that this area of the brain may be affected even for young, healthy adults with few concussions.

"We want to emphasize that, in general, the health benefits of sport participation still outweigh the risk of concussion," said Dr. Tom Schweizer, head of the Neuroscience Research Program and a co-author of the paper. "Our findings can help to guide concussion management, and to minimize any future risk to athletes. The more we know about concussion, the better we can reduce these risks."

Provided by St. Michael's Hospital