

MRI studies show micro brain damage in varsity hockey players after concussions

By Sheryl Ubelacker, The Canadian Press February 4, 2014

TORONTO - Using advanced imaging techniques, researchers have detected microstructural brain damage in male and female varsity hockey players who sustained a concussion — changes that aren't apparent with standard hospital-based MRI scans.

The findings suggest concussions alter the microstructure of the white matter — the "wiring" that transmits signals from one brain region to another — at least in the short term, but possibly in the long term as well.

In three related papers published Tuesday in the Journal of Neurosurgery, an international research team shows the kinds of microscopic brain damage that can result from a concussion.

"It means we're finding organic, objective evidence of this trauma," said Dr. Paul Echlin, a sports medicine physician in Burlington, Ont., who led the studies.

"We know that trauma occurs. We know that in soft tissue you're going to have these findings of inflammation and neuroplasticity, which means changes in the structure, but we'd never seen it before."

Concussion is a traumatic brain injury that results from a blow to the head. Symptoms include headache, confusion, memory loss, dizziness and nausea or vomiting.

Depending on the severity of the concussion, symptoms can last for days, weeks or months. Concentration and the ability to remember may be impaired; the person can be irritable, depressed and experience marked personality changes; sensitivity to light and noise, along with disturbed sleep, are also common.

With repeated concussions, the brain can be permanently damaged.

"Clinically, we know that these symptoms don't resolve," said Echlin, a passionate proponent of rule changes in professional and amateur sports aimed at preventing concussions.

"And these are the patients that I treat on a daily basis," he said. "It affects their school, their occupation, their forward progress in society. It will lessen their ability to achieve the things they want academically or work-wise and often relationship-wise.

"So it has a great effect upon the individual."

To conduct these studies, researchers used advanced techniques to analyze MRI brain scans of 45 male and female athletes who played on two undisclosed Canadian university hockey teams during the 2011-2012 season.

The players were asked to undergo MRIs at the beginning and end of the season. Those who had a concussion also had MRIs within 72 hours of the brain injury, at two weeks and again at two months.

Eleven players — five males and six females — had concussions during the season, and one of them had a second concussion in a subsequent game, all observed and diagnosed by independent doctors unconnected to the teams.

The first study looked at the movement of fluid in and around cells within 72 hours and determined there were changes to the white matter, which appeared to be caused by an inflammatory response to the injury.

"What we think we see is some kind of immune response that is activated right after the concussion," co-author Ofer Pasternak, a researcher at Brigham and Women's Hospital, said Monday from Boston.

"We cannot say yet whether it is long-term damage," although such changes might contribute to long-term neurological deficits or to degenerative diseases such as chronic traumatic encephalopathy, or CTE, in the future, he said.

The second study measured small changes in the blood vessels, which were detected right after a concussion, peaked at two weeks, but had resolved by the two-month MRI. These vascular changes were statistically significant only in male players, although the researchers don't know why.

Although these blood vessel effects went away in the varsity players, Pasternak said it's not clear if that would be the case in people who suffer multiple concussions over a period of years.

"And we don't know whether the changes in vascular properties would be affecting other types of changes in the brain that would persist for a longer time," he said.

In the final study, researchers compared the brain scans of players who had been concussed with non-concussed league-mates and found differences in their white-matter microstructure, which were still evident by the end-of-season MRI.

"We don't know what the long-term effects are. I think we're still at a stage where it's too early to tell," said Martha Shenton, director of the psychiatry neuroimaging laboratory at Brigham and Women's Hospital and co-principal author with Echlin on the studies.

"I think one has to be careful here and not say, 'Hey, we're showing permanent damage,'" Shenton said from Boston. "We aren't saying that. We're saying there's evidence of changes here

and we don't know whether they're going to be long term or whether they're going to resolve and what they're associated with.

"But it's at least a little kind of warning ... that if someone has a concussion, don't send them back (to play) right away, give them the proper rest period they need before they get a secondary impact, which can actually be fatal."

Ofer stressed the findings are important not only for hockey, football and soccer players, but also for anyone who suffers a concussion — from the soldier in combat to those who strike their heads in an automobile accident or as the result of a fall.

"About 15 to 30 per cent of people will have long-term symptoms," he said. "And our study gives us the first steps towards understanding what goes wrong in those people."

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