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News From the World of Hockey

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Study Shows Possible Brain Damage Caused by Subconcussive Blows

By JEFF Z. KLEIN

A hockey concussion study published Friday in the journal Neurosurgical Focus includes in its findings an intriguing element - possible radiological evidence of brain trauma caused by subconcussive blows.

The effect of subconcussive blows on the brain is in many ways the Planet X of concussion science. Researchers say that small blows have a cumulative effect and can lead to damage in the brain similar to that caused by diagnosed concussions. They say that if small blows, like the ones in hockey that result from checks into the boards or routine collisions and falls to the ice, are repeated often enough, they can even lead to chronic traumatic encephalopathy, or C.T.E., a degenerative brain disease.

The problem is that the effect of subconcussive blows had not been measured comprehensively until now -- if researchers from Harvard, the University of Montreal and elsewhere are correct about what they are seeing in the new hockey study and in a recently published study of soccer players in the Journal of the American Medical Association. The researchers caution that the results in this area of the study are preliminary and inconclusive, but they use words like "striking" and "surprising" when talking about them.

The new hockey concussion study followed two unnamed Canadian university teams - one men's, one women's - through the 2011-12 season. Researchers scanned every player's brain before and after the season, using advanced magnetic resonance imaging like diffusion tensor imaging and MR spectroscopy.

When the scans were analyzed, researchers found substantive metabolic changes among the majority of players, including those who were not diagnosed with concussions.

"It was pretty compelling," said Dr. Martha E. Shenton, a researcher who analyzed pre- and postseason diffusion tensor imaging of white matter in the brains of 17 players on the men's team.

Only 3 of the 17 players had sustained diagnosed concussions during the season, and two of those three showed the most pronounced white-matter changes in the study. But most of the 14 non-concussed players displayed a lesser degree of the same kind of changes - and that was what surprised Shenton.

"To see changes in such a short period of time, I was surprised," she said. "I was betting, quite frankly, that we wouldn't see any changes between pre- and postseason."

Shenton, who works at Brigham and Women's Hospital in Boston and the Neuroscience Division of the V.A. Hospital in Brockton, Mass, added: "When you see brain chemistry changes like this, it's clear something's going on. Are some of these people are going to end up with more serious kind of brain injury damage? How sensitive is the brain? How resilient? These are all things we don't know the answer to these questions."

Dr. Inga K. Koerte, a researcher who worked alongside Shenton in this part of the study, noted that the changes observed might have been affected by concussions the hockey players sustained earlier in their careers, or evidence of something else altogether. But she, too, suspected that the scans were showing the effects of subconcussive blows sustained during the 2011-12 season.

"You may not need to have a diagnosed concussion to actually have changes in your white matter," said Koerte, of Brigham and Women's Hospital, Harvard and the University of Munich. "It may be that subconcussive blows to your head accumulate over time, so that you develop changes that are similar to those that you get when you have one clinical concussion."

Koerte and Shenton published research earlier this month in JAMA, in which they and other researchers also found evidence of white matter changes in German soccer players who had no history of diagnosed concussion. They noted that after advanced scanning of the soccer players' brains, changes were found consistent with findings observed in patients with concussion damage."

They said that study showed the first radiological evidence of damage to the brains of athletes caused by subconcussive blows.

In hockey study published Friday, researchers analyzed MR spectroscopy imaging of the brains of the male and female players involved, again using scans taken before and after the season. Those scans showed evidence of

neural damage in the brains of the female players not diagnosed with concussions over the course of the season.

"It is very interesting that the damage was found primarily in the women rather than the men," said Dr. Hugo Théoret of the University of Montreal, who analyzed the MR spectroscopy scans.

Théoret stressed that these findings, too, are preliminary. But he said the evidence of greater damage in the brains of the female players might point to greater susceptibility to concussion among women. (The study published Friday, and other hockey studies, showed higher concussion rates for female players, believed to be a product of women's smaller necks and lesser ability to withstand whiplash in collisions when compared with men.)

The MR spectroscopy may also show evidence of damage caused by subconcussive blows, Théoret said. He looked at the scans of the 14 female players who had not sustained a diagnosed concussion, and found that most showed a marker for damage in the tissue connecting the two brain hemispheres and is particularly vulnerable to blows to the head.

"Most of those players had a concussion previously in their careers," Théoret said. "What we could be seeing is damage caused by hits to the head that are subconcussive, but on a concussed brain that is not normal to begin with. If so, it's very alarming."