Traumatic brain injury increases risk of Parkinson's disease, researchers say

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(Medical Xpress) -- Traumatic brain injury has entered the public's consciousness as the silent, signature wound brought back by many of our military warriors from Iraq and Afghanistan. But such injuries don't only happen in warfare, they happen to civilians too. Think car crashes, a slip and fall, two football players colliding helmet to helmet.

While most people know the results of a traumatic brain injury — ranging from a simple headache to long-term problems with memory and thinking, depending on the severity — few are aware that such an injury can also increase one's risk later in life for Parkinson's disease, the neurodegenerative disorder that affects roughly 1 percent to 2 percent of the population over the age of 65.

Now scientists at UCLA have found the mechanism for this elevated, long-term risk of Parkinson's: the loss of a specific type of neuron.

In a pre-clinical study, the researchers found that a moderate traumatic brain injury in rats caused a 15 percent loss in the brain cells known as nigrostriatal dopaminergic neurons shortly after the trauma, and that this loss continued to progress to a 30 percent loss 26 weeks after the initial injury.

The loss of these particular neurons can result in the cardinal motor symptoms observed in Parkinson's patients, including akinesia (problems with movement), postural tremor and rigidity. Further, when combined with a second known risk factor for Parkinson's, the pesticide paraquat,

the loss of dopaminergic neurons doubled to 30 percent much faster.

The study, which appears in the current online edition of the journal *Neurotrauma*, was conducted by first author Che Hutson, a former UCLA graduate student, and senior author Dr. Marie-Francoise Chesselet, a professor of neurology and chair of the UCLA Department of Neurobiology, along with colleagues.

While traumatic brain injury was known to be a risk factor for Parkinson's, no one knew why. Nor was it known whether traumatic brain injury acts synergistically with pesticides such as paraquat, one of the most widely used herbicides in the world, which is known to be toxic to human beings and animals and has been linked to the development of Parkinson's.

Nigrostriatal dopaminergic neurons are involved in the production of dopamine, which plays an important role in the regulation of movement, among other things. The current study demonstrated that while a traumatic brain injury does not cause Parkinson's, it can make individuals more susceptible to the disorder, Chesselet said.

"We found that with a moderate traumatic brain injury, the loss of neurons was too small in number to cause Parkinson's disease, but it is enough to increase the risk of PD," she said. "By decreasing the number of dopaminergic neurons, any further insult to the brain will be attacking a smaller number of neurons; as a result, the threshold for symptoms would be reached faster."

Second, Chesselet noted, "shortly after a traumatic brain injury, these neurons are more vulnerable to a second insult."

The research looked at both the long-term effects of traumatic brain injury and the acute, or short-term, effects, combined with an exposure

to low doses of paraquat. In the acute study, rats receiving moderate traumatic brain injury alone experienced a 15 percent loss of dopaminergic neurons. The addition of paraquat increased the effect, causing a 30 percent loss of neurons.

In the long-term study, which did not include the addition of paraquat, the rat's brains showed a 30 percent loss of dopaminergic neurons 26 weeks after the injury. This suggests that in the long term, traumatic brain injury alone is sufficient to induce a progressive degeneration of dopaminergic neurons.

"These are the first data revealing that in a model of experimental traumatic brain injury, not only do nigrostriatal dopaminergic neurons degenerate, those that survive become sensitized to paraquat toxicity," said study author David A. Hovda, a professor of neurosurgery and director of the UCLA Brain Injury Research Center.

"These results suggest that greater attention should be given to the long-term risk of Parkinson's after traumatic brain injury, and that the epidemiology of both risk factors, brain injury and exposure to paraquat, should be evaluated in combination," Chesselet said.

Other authors of the study included Dr. Christopher Giza of UCLA; Carlos Lazo, now at Emory University; and Farzad Mortazavi, now at the Boston University School of Medicine.k and follow us on Twitter.

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