Childhood lead exposure causes permanent brain damage

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A study using functional magnetic resonance imaging (fMRI) to evaluate brain function revealed that adults who were exposed to lead as children incur permanent brain injury. The results were presented today at the annual meeting of the Radiological Society of North America (RSNA).

"What we have found is that no region of the brain is spared from lead exposure," said the study's lead author, Kim Cecil, Ph.D., imaging scientist at Cincinnati Children's Hospital Medical Center and professor of radiology, pediatrics and neuroscience at the University of Cincinnati College of Medicine. "Distinct areas of the brain are affected differently."

The study is part of a large research project called the Cincinnati Lead Study, a long-term lead exposure study conducted through the Cincinnati Children's Environmental Health Center, a collaborative research group funded by the National Institute of Environmental Health Sciences and U.S. Environmental Protection Agency. The Cincinnati Lead Study followed prenatal and early childhood lead exposure of 376 infants from high-risk areas of Cincinnati between 1979 and 1987. Over the course of the project, the children underwent behavioral testing and 23 blood analyses that yielded a mean blood lead level.

Lead, a common and potent poison found in water, soil and lead-based paint, is especially toxic to children's rapidly developing nervous systems. Homes built before 1950 are most likely to contain lead-based paint, which can chip and be ingested by children.

"Lead exposure has been associated with diminished IQ, poor academic performance, inability to focus and increased risk of criminal behavior," Dr. Cecil said.

Dr. Cecil's study involved 33 adults who were enrolled as infants in the Cincinnati Lead Study. The mean age of the study participants, which included 14 women and 19 men, was 21 years. The participants' mean blood lead levels ranged from 5 to 37 micrograms per deciliter with a mean of 14. Participant histories showed IQ deficiencies, juvenile delinquency and a number of criminal arrests.

Each participant underwent fMRI while performing two tasks to measure the brain's executive functioning, which governs attention, decision making and impulse control. The imaging revealed that in order to complete a task that required inhibition, those with increased blood lead levels required activation from additional regions within the frontal and parietal lobes of the brain.

"This tells us that the area of the brain responsible for inhibition is damaged by lead exposure and that other regions of the brain must compensate in order for an individual to perform," Dr. Cecil said. "However, the compensation is not sufficient."

Imaging performed during a second task designed to test attention revealed an association between higher lead levels and decreased activation in the parietal region and other areas of the brain.

According to Dr. Cecil, the brain's white matter, which organizes and matures at an early age, adapts to lead exposure, while the frontal lobe, which is the last part of the brain to develop, incurs multiple insults from lead exposure as it matures.

"Many people think that once lead blood levels decrease, the effects

should be reversible, but, in fact, lead exposure has harmful and lasting effects," she said.

Dr. Cecil believes that these findings lend support to previous reports from the Cincinnati Lead Study showing that the lasting neurological effect of lead exposure, rather than a poor social environment, is a key contributor to the subsequent cognitive and behavior problems in this group.

Source: Radiological Society of North America (news : web)