Lasting Brain Damage Found From Prenatal Mercury Exposure

by Pat McCaffrey

HSPH's Philippe Grandjean worked with Japanese, Danish, and Faroese colleagues to study the long-term effects of mercury from seafood on brain function in children from the Faroe Islands. (Photo courtesy of Philippe Grandjean)

An 18-year study of more than 800 children whose mothers ate mercury-containing seafood while pregnant shows that the toxic effects of prenatal exposure to mercury on brain functions can be permanent. Even low levels of mercury from the maternal diets produced slowing of hearing-related electrical signals in the brain when the children were tested at age 14. The teenagers also had impaired neurological regulation of their heart rate, a sign of mercury toxicity in the brain stem.

The publication of the study coincides with the Environmental Protection Agency doubling its estimate of the number of babies born in the U.S. with blood mercury levels that pose a risk for developmental toxicity. New data suggest that one in six babies may have mercury levels exceeding the EPA's safe limit.

Mercury-rich Meals

Starting in 1986, Philippe Grandjean, adjunct professor in the Department of Environmental Health at HSPH, and his colleagues measured levels of mercury in the blood of more than 1,000 mothers and their newborns from the Faroe Islands, located in the North Atlantic between Iceland and Norway. The Faroese eat seafood an average of three times a week, including an occasional meal of mercury-rich whale meat. The mothers and babies averaged blood levels of mercury around 10 times higher than the U.S. average. The researchers recently tested 859 of the children at age 14 for evidence of mercury toxicity. The scientists measured hearing-

related electrical activity in the brain via electrodes attached to the children's heads. They found that the speed at which a nerve signal goes from the ear to the brainstem after a noise stimulus is slower in children who had been exposed to higher levels of mercury in utero. There was a dose-dependent correlation between prenatal mercury exposure as measured in the mothers' and children's blood at birth and delays in nerve transmission 14 years later.

"Mercury, as we well know, is toxic to the developing brain. This study confirms that such effects are lasting, that they are permanent," said Grandjean, author on two research reports that appear in the February Journal of Pediatrics. To put it another way, he said, "The brain cells don't get a second chance."

Though postnatal mercury exposure in the children, measured when they were 7 or 14 years old, did not correlate with the signal delays, the researchers did see an additional delay further along the signaling pathway in some children, which seemed to indicate additional neurotoxicity from continued mercury exposure during childhood.

Heart Beaten by Mercury

The researchers also found that the effects on the nervous system from prenatal exposure influence the cardiovascular system, making the heart rate less responsive to neurological control. "We see that the way the autonomic system regulates heart beat is less efficient," said Grandjean, adding that heart beat abnormalities like these have been related to heart attack risk later in life.
Delays in nerve signaling were not associated with hearing loss in the children, but the changes in electrical activity are important indicators of the subtle and persistent effects of mercury on the brain, Grandjean said. Commonly used tests to determine mercury toxicity include measures of mental or motor skills such as word memorization, drawing, or assembling puzzles. But these measures can be affected by socioeconomic factors, and such tests have led to conflicting conclusions about mercury exposure and development. Electrical signals, on the other hand, represent a cleaner measure of a physiological effect caused by toxicants. "These are entirely objective measures conducted with electrodes on the skull or the chest, and our results support the

notion that mercury does cause toxic effects at very low exposure levels," explained Grandjean.

The researchers are continuing their work, testing the children on mental and motor measurements and collecting information on their school performance. The data is now on its way through the computer, said Grandjean, who hopes to have results within the next two years.

Based on the present study, the EPA's estimate of the safe level of blood mercury in women and children may be "too optimistic," cautioned Grandjean, since the new findings suggest that similar blood mercury levels may be associated with reductions in nerve transmission signals in children.

Research: Harvard Medical, Dental & Public Health Schools

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