PUBLIC HEALTH

Methylmercury exposure: fishing for answers

Epidemiology: Mercury appears in many guises — a planet, a god, a messenger — but as a metal it conducts electricity, becomes fluid at room temperature and slips easily between inorganic and organic states through the processes of oxidation, reduction and methylation. These properties make it attractive for use in industry and in commercial products such as thermometers, switches and batteries.

The amount of mercury that cycles throughout the world is constant, but its distribution and formulations vary by location, climate and industry. The amount released into the air, water and soil has increased to a level 2.5 times that of pre-industrial times because of industrial air emissions, water discharges and the combustion of mercury-containing fuels.[1] Most of this released mercury ends up in soils and waterways, where it is methylated by microbes to form methylmercury, which then accumulates in the tissues of predatory fish and mammals. Although exposure to elemental and inorganic mercury through occupational and accidental spills poses a recognized risk to human health, there is growing concern that insidious, chronic exposure to methylmercury poses a greater problem to public health.

Epidemics of methylmercury poisoning caused by the consumption of contaminated seafood in the area around Minamata Bay, Japan, and in Niigata, Japan, in the 1950s and 1960s[2] provided strong epidemiologic evidence that methylmercury at high doses is a potent human neurotoxin that causes demyelination and delayed nerve conduction. The offspring of women from the Minamata area, who themselves showed minimal symptoms, displayed profound neurologic deficits, which demonstrated the fetal nervous system's vulnerability to the effects of methylmercury. Evidence on the cumulative health effects of exposure to lower doses of methylmercury is patchy, but growing.[3,4] To fill some of the gaps in knowledge, 2 longitudinal cohort studies involving children living in communities that eat a lot of fish (Denmark's Faroe Islands and the Seychelles Islands in the Indian Ocean) are underway. Preliminary results have identified no observable health effects among the residents of the Seychelles; however, the Faroese cohort is showing dose-related deficits in language, attention and memory.[5]

Clinical management: Acquired cases of acute methylmercury poisoning may not manifest until several months after exposure. The patients present with ataxia, blurred vision, auditory impairment and paresthesia. Patients with congenital poisoning exhibit mental retardation, deafness, blindness, dysphasia, microcephaly and cerebral palsy, but no peripheral neuropathy; however, peripheral neuropathy is a major manifestation of chronic exposure.[6]

Mercury has a very short half-life in blood but a relatively long half-life in the body. Cases of acute poisoning may be diagnosed by assaying samples of whole blood. A 24-hour urine collection or sample of hair can be used to assess chronic exposure, although measured levels may not correlate well with clinical symptoms, because the mercury burden may be concentrated in tissue compartments. The objectives of treatment are to stop the exposure, provide supportive care and enhance the excretion of the metal from the body. Chelation therapy may be indicated in patients with acute exposure who are symptomatic or have toxic blood and urine levels. It generally requires several cycles, each lasting several days. Physicians should be aware of the adverse reactions associated with different chelating agents.[6]

Prevention: Preventive strategies are being developed at local, regional and international levels. Canada, the United States and Mexico are developing a trilateral North American Regional Action Plan on mercury. Phase II of the plan has identified 6 areas for collaboration: emission inventories and reporting; reductions in mercury manufacturing processes and products; mercury waste-management practices; monitoring, research and assessment; communication and dissemination of mercury risk information; and audits of regulatory and nonregulatory compliance.[7] Under the Great Lakes Binational Toxins Strategy, the US Environmental Protection Agency and Environment Canada, in consultation with Aboriginal tribes and First Nations, are working to eliminate the release of persistent bioaccumulative substances, including mercury, from the Great Lakes Basin. Municipal recycling systems in various provinces have established community collection programs for mercury-containing devices, and the Ontario Dental Association is developing a program to manage mercury releases from dental offices. To manage existing exposures, Health Canada has established guidelines for levels of mercury in most commercial fish. These are based on a

Canapress

Methylmercury collects in the tissue of predatory fish and mammals

complicated physical risk assessment methodology that has been criticized for its simplicity, given the complexities of the indirect impact of methylmercury exposure on the health and lifestyle of indigenous people.[8,9] — *Erica Weir*, CMAJ

References

1. Pilgrim W, Poissant L, Trip L. The Northeast States and Eastern Canadian Provinces mercury study: a framework for action. Summary of the Canadian chapter. *Sci Total Environ* 2000;261: 177-84.
2. Tsubaki TK, Irukayama K. Methylmercury poisoning in Minamata and Niigata, Japan. In: Tsubaki T, Irukayama K, editors. *Minamata disease*. Amsterdam: Elsevier; 1977. p. 143-253.
3. McKeown-Eyssen G, Ruedy J, Neims A. Methylmercury exposure in northern Quebec. II: Neurological findings in children. *Am J Epidemiol* 1983;118:470-9.
4. Lebel J, Mergler D, Branches F, Lucotte M, Amorim M, Larribe F, et al. Neurotoxic effects of low-level methylmercury contamination in the Amazonian Basin. *Envir Res* 1998;79:20-32.
5. Mahaffey, K. Methylmercury: a new look at the risks. *Public Health Rep* 1999;114:396
6. Ozuah PO. Mercury poisoning. *Curr Probl Pediatr* 2000;30(3):91-9.
7. Pilgrim W, Schroeder W, Porcella D, Santos-Brugoa C, Montgomery S, Hamilton A, et al. Developing consensus: mercury science and policy in the NAFTA countries. *Sci Total Environ* 2000;261:185-93.
8. Wheatley B, Wheatley M. Methylmercury and the health of indigenous peoples: a risk management challenge for physical and social science and for public health policy. *Sci Total Envir* 2000;259:23-9.
9. Dumont C, Girard M, Bellevance F, Noel F. Mercury levels in the Cree population of James Bay, Quebec, from 1988 to 1993/94. *CMAJ* 1998;158(11):1439-45. Abstract available: www.cma.ca/cmaj/vol-158/issue-11/1439.htm