Detection of Early Neurotoxicity in Children With Environmental Exposure to Polychlorinated Biphenyls and Methyl Mercury

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Methyl mercury and polychlorinated biphenyls (PCBs) are recognized as serious pollutants worldwide, to a large extent because of their reported adverse neurobehavioral effects. Major predominant environmental sources of PCBs and methyl mercury in the human diet include contaminated fish, crustaceans, mollusks and marine mammals. People who depend on seafood may therefore be exposed to high levels of PCBs and methyl mercury, and they, especially the very young, may possibly be at risk for neurobehavioral effects. Such a population exists in the Faroe Islands.

We have begun a prospective study of a birth cohort in the Faroe Islands, which are located in the North Atlantic between Scotland, Iceland, and Norway. The 45,000 people living on the islands are highly dependent on fish and pilot whale as a food source. However, because some individuals eat a relative large amount of whale blubber (which contains high levels of PCBs) whereas others eat primarily whale muscle (which contains high levels of methyl mercury), there should be an exposure gradient. During a 22-month period during 1986 and 1987, we obtained samples of umbilical cord, cord blood, and maternal hair collected during 75% of all births (about 1,000) in the Faroes, we also obtained extensive questionnaire information on maternal diet and hospital chart data on the course of pregnancy and parturition. The Faroese population is particularly well suited for such a study because of the homogeneity and stability of the population and the efficient coverage of the Nordic-type health care system. Rates of alcohol and tobacco use are low among Faroese

women: 75% abstained from alcohol during pregnancy, and 60% are nonsmokers. No major selection bias of the cohort has been identified in relation to pregnancy outcome. We are examining 7-year-old children, and we anticipate a high participation rate (about 95%). We chose to use 7-year old children because neurotoxicity is the potential critical effect and may not become apparent before children reach preschool or school age. In addition to conducting a detailed pediatric examination, we are also giving the children a test battery, which includes psychological tests and neurophysiological measurements of evoked potentials.

Mercury levels have been measured in the umbilical cord blood samples and maternal hair (1). To protect against prenatal toxicity, the World Health Organization proposed a tentative limit of 10 ppm for mercury in maternal hair; this limit was exceeded by 13% of the sampled population. A similar limit of 40 µg/L has been suggested for mercury in cord blood samples; this limit was exceeded in 25% of the samples. To determine prenatal exposure, we will measure the PCBs (as total PCBs and congeners) in the umbilical cords. We have documented elevated levels of PCBs (including co-planars) in pooled milk samples from the Faroe Islands. In these same samples, the polychlorinated dibenzo-p-dioxin and dibenzofuran levels were similar to those found in samples from moderate consumers of Baltic fish (2).

References

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