EFFECTS OF PERINATAL EXPOSURE TO ENVIRONMENTALLY PERSISTENT ORGANIC POLLUTANTS AND HEAVY METALS ON NEUROBEHAVIORAL DEVELOPMENT IN JAPANESE CHILDREN: AN INTERIM REPORT

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Introduction

Several longitudinal prospective studies to examine the long term effects of in utero and lactational exposure to polychlorinated biphenyls (PCBs) and dioxins on growth and neurodevelopment in children have been undertaken. Some of those studies indicate that perinatal exposures to background levels of PCBs and dioxins is associated with postnatal growth delay and poorer cognitive functioning. Similar neurobehavioral toxicities are also observed after perinatal exposures to lead and methyl mercury. Especially, methyl mercury has been shown to be a potent neurotoxicant to the developing fetal brain in a Danish cohort study, in which a low dose methyl mercury in utero exposure significantly affected to neurodevelopment in children. Dioxins, PCBs and methyl mercury are highly lipophilic and chemically stable compounds that accumulate in the food chain. The main sources of environmental exposure to those toxic compounds are dairy products, meat and fish; especially seafood eating might be most responsible. Since Japanese likes seafood eating, the health hazard problems in relation to these environmentally contaminated compounds are of importance1.

The final destination of this study is to examine the effects of perinatal exposure to environmentally persistent organic pollutants and heavy metals on neurobehavioral development in Japanese children. This study is an interim report of our prospective longitudinal study in Tohoku area of Japan.

Methods and Materials

We have started to recruit the healthy pregnant mothers with informed consent at two large hospitals in Sendai from December 2000. To establish an optimal study population, only infants born at term (36 to 42 week of gestation) without congenital anomalies or diseases were included. Pregnancy and delivery had to be completed without overt signs of serious illness or complications.

A blood sample was taken from the mothers at 28 week of their pregnancy. Blood was collected in a vacuum system heparin tube, and centrifuged within 6 h for 20 min at 3000 rpm; plasma and whole blood were stored at –80°C until analysis. A blood sample of the umbilical cord was also taken into a bottle using heparin as the anti-coagulant after the delivery, and treated

similarly. The tissues from placenta and cord were collected and stored. Two days after the delivery, hair samples were taken from the mothers and the questionnaire including food frequency were performed. The mothers were finally asked to give us a sample of breast milk a month after the delivery.

The neurobehavioral development were examined with Brazelton Neonatal Behavioral Assessment Score (NBAS) when the infants were three days old. We are also thinking to evaluate the cognitive activities of the children when they are from 5 to 36 months old. For this purpose, we started to translate several assessment scores including Beyley Neurodevelopmental Screener (BINS) to Japanese and to compare with common test batteries used in Japan.

The study protocol was approved by the Medical Ethics Committee of the Tohoku University School of Medicine.

Results and Discussion

We started to explained the purpose and details of our cohort study to obtain the informed consent from this January. In the first hospital, we explained to 184 mothers and obtained the informed contents from 83 mothers, indicating that the rate of consent obtained was approximately 45%. In the second hospital, we explained to 140 mothers and obtained only 22 informed contents. We are now trying to modify the method to recruit mothers in this hospital. The yearly birth number of the two hospitals is 1400. Supposing that 20% of mothers will be excluded due to several conditions, we will try to recruit 300 mothers a year .

We are thinking to measure total PCB, TEQ, and heavy metals in mother's blood, placenta blood and breast milk. We have not yet decided the analytical method to determine TEQ; we need suggestions how to measure TEQ with a small volume of large sample number. We are also collecting placenta, cord and mother's hair. Especially, we are trying to utilize placenta as a biological monitoring material to estinmate the exposures, since it is easy to collect placenta. We may show the data of some heavy metals in these samples.

Since we did not yet completed our prospective longitudinal study, this is an interim report to show our study protocol and the preliminary data.

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References

1. Satoh H. Occupational and environmental toxicology of mercury and its compounds. Ind Health 38: 153-164, 2000.