THE SEYCHELLES CHILD DEVELOPMENT STUDY: RESULTS AND NEW DIRECTIONS THROUGH TWENTY-NINE MONTHS

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ABSTRACT. The Seychelles Child Development Study was begun in 1986 to prospectively examine the association between child development and prenatal and postnatal methylmercury exposure from a high fish diet. Hair mercury levels from mothers and children are used as the index of exposure. A cross-sectional Pilot Study of 789 infants suggested that prenatal mercury exposure may affect development and that the effect decreased with age independently of exposure. A follow up of 217 Pilot Study children at 66 months of age also suggested that neurodevelopmental effects of prenatal exposure might be present, but the associations were dependent on outcomes in a small number of children. On the basis of the initial results of the Pilot Study a prospective, longitudinal Main Study, with more data on confounding variables and more extensive developmental testing, was begun on a new cohort of 779 children. No association between prenatal exposure and primary neurodevelopmental outcomes was seen at 6 1/2, 19, or 29 months of age. There was an inverse relationship at 29 months in boys only between maternal hair mercury level and activity level, as judged by the examiner during the testing session (one of seven behavioral subscales of the Infant Behavior Record, of the Bayley Scales of Infant Development). In addition to an interaction between maternal hair level and gender, subsequent, secondary analyses are examining interactions between mercury level and a number of socioeconomic factors. Secondary analyses of developmental milestones, similar to those used in the Iraq study, are also under way. Although the association with activity suggests the need for further study of this cohort, no definite adverse neurodevelopmental effects from fetal mercury exposure have been detected through 29 months of age.

In a related study, brains were obtained at autopsy from thirty-two Seychellois infants. Tissue from six different brain regions was examined histologically and analyzed for mercury. No definite histological abnormalities were found. Mercury levels ranged from about 50 ppb to 300 ppb and there was good correlation among brain regions. For 27 brains maternal hair from delivery was available and maternal hair mercury levels correlated well with levels in infant brain.

1. Introduction

This paper provides an updated summary of the results of the Seychelles Child Development Study (SCDS). Marsh et al., (1995) describe the origin of the study, the design, and details on exclusions and confounding variables used in the statistical analysis. Shamlaye et al., (1995) present the background of the study, including information on the Republic of Seychelles and demographic data on the pilot and main cohorts.

The analytical and dosimetry aspects of the study are presented by Cernichiari et al., (1995a). This includes the methods for collection, transport, and analysis of maternal and child hair samples. These are used as the main biological monitoring medium for pre and postnatal methylmercury exposure. Sampling of blood, breast milk

and fish is also described, as well as the collection of blood samples for measurement of lead and PCBs.

Clinical and epidemiological data have been presented in a series of papers. The cross-sectional pilot study was described and results of the primary evaluation of the cohort discussed by Myers et al. (1995a). This was followed by a report on a subset of the pilot cohort examined at 66 months of age (Myers et al., 1995b). Enrollment of the Main Study cohort was described and evaluations at 6 1/2 months of age discussed by Myers et al. (1995c). Testing procedures and the resulting distributions were described in Davidson et al. (1995a). This was followed by a description of the results of the 19 and 29-month evaluations of the main cohort (Davidson et al., 1995b). Subsequently, secondary analyses have been undertaken. The first of these is examining the associations between maternal hair levels and developmental milestones similar to those used in studies in Iraq. The second is examining interactive effects between prenatal exposure and various socioeconomic factors, including maternal intelligence, family income and the home environment.

In a related but separate study, a series of thirty-two brains was obtained at autopsy from infants dying from a variety of causes. After fixation in formalin, histopathological examinations and mercury analyses were performed on 6 brain regions (Lapham et al., 1995). For a subset of 27 brains, samples of maternal and infant blood and maternal hair were also available for mercury analysis. This allowed correlation of mercury levels from biological monitoring media (maternal hair and blood) with levels in the target organ (infant brain) (Cernichiari et al., 1995b).

Statistical analyses for both clinical studies included multiple logistic or linear regression using all covariates (full model) as well as only those covariates felt to be most important in Seychelles (reduced model). For each analysis an interaction between gender and mercury exposure was also examined.

2. Results

2.1 PILOT STUDY

In this cross-sectional study, 789 Seychellois infants and toddlers were enrolled and examined at ages between one and 25 months (Myers et al., 1995a). This examination included a medical history and complete neurological evaluation, as well as administration of the Denver Developmental Screening Test - Revised (DDST). Based on results from studies in Iraq, two neurological outcomes were selected as primary endpoints in addition to the overall examination. These were muscle tone and deep tendon reflexes.

Table 1 summarizes the results of the statistical analysis of the primary endpoints from the pilot study. An association between maternal hair levels and scores on the DDST was found. Separate effects of gender and age at testing were also found. This result was present only when scores of abnormal were combined with questionable scores, and disappeared when the analysis combined questionable scores with normal. The standard scoring for the DDST is to treat only abnormal scores as failures. No