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Wide Use of Merthiolate May Cause Mercury Poisoning in Mexico

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In 1999, Merthiolate (Thimerosal, Thiomersal), an ethylmercurythiosalicylate preservative, was suddenly spotlighted on the grounds that vaccines containing the preservative might increase the risk of autism and/or other neurodevelopmental disorders (Ball et al. 1999). On the basis of current evidence, however, some of investigators consider it improbable that Merthiolate and autism are linked (Nelson and Bauman 2003). On the other hand, Merthiolate had also been widely used as an antiseptic agent, and is still in daily use mainly as a skin antiseptic especially in developing countries, although there is a downward trend. Indeed, in Mexico Merthiolate had been widely employed as disinfectant for the skin or wound surface in hospitals or clinics in the early 1990s. Therefore, we attempted to examine mercury levels in head hair from Mexican staff engaged in medical service in 1991 and 1992, because ethylmercury has some similarities to methylmercury (Clarkson et al. 2003), of which toxicity is well known as Minamata disease (Harada 1995). In addition, they have continued to use Merthiolate as disinfectant until the present, although the use is also on the decrease. Thus, we report here mercury levels in head hair collected from Mexican medical staff in the early 1990s, albeit rather antiquated.

MATERIALS AND METHODS

In 1991, 12 head hair samples were collected from nurses working in a general hospital (Toluca, Mexico) using Merthiolate. Each hair sample was cut as close to the scalp for both total mercury (T-Hg) and methylmercury (MeHg) analyses. Although MeHg has no direct bearing upon Merthiolate, namely, ethylmercury, we determined the MeHg level for reference. As a result, as mentioned later, seven out of 12 samples showed a high T-Hg level, but the ratio of MeHg to T-Hg was very low. Accordingly, the next year we further measured T-Hg levels, but not MeHg level because of the above low level, in head hair from 27 medical doctors, 34 nurses, and two others (an office worker and an expert of clinical examination) working in three general hospitals also using Merthiolate in Mexico City. In addition, we inquired their subjective symptoms. Informed consent was obtained from all subjects, based upon the Declaration of Helsinki, 1964.

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Hair samples were washed firstly with neutral detergent solution and rinsed three times with deionized water, secondly with acetone (Wako Pure Chemical Industries Ltd., Osaka), and dried in an incubator at 60℃ overnight. Five long hair samples (four nurses and one lady doctor) were divided into sections of each 1 cm long, and T-Hg level in each section was determined using a mercury analyzer (Sugiyamagen Co., Ltd., Tokyo), whereas short hair samples were used as a whole as analytical materials. The precision and accuracy of the method used for T-Hg analysis have been repeatedly verified by inter-laboratory calibration exercises (Department of Urban Engineering, Faculty of Engineering, University of Tokyo, Tokyo). There existed a high correlation between both results obtained (the correlation coefficient r=0.983, n=10), thereby indicating that the techniques used in the current study were reliable and accurate. MeHg level was measured according to the method of Akagi et al. (1995). Limits of detection for T-Hg and MeHg were 0.5 and 1.0 ng, respectively. All reagents used were of the best grade available commercially.

RESULTS AND DISCUSSION

In our previous study, we postulated from studies on the Japanese people that the upper limit of a normal hair T-Hg level is 10 ppm (Ohno et al. 1984), thereafter supported by the study by Grandjean et al. (1999). Seven out of 12 hair samples collected in Toluca in 1991, showed a high T-Hg level over 10 ppm (143, 107, 43.6, 21.6, 21.1, 17.6, and 16.4 ppm); nevertheless, none of them developed symptoms of inorganic- or organic-mercury poisoning. Moreover, the mean value also exceeded 10 ppm (Table 1). The MeHg level and the ratio of MeHg to T-Hg were 0.395±0.128 ppm (0.040-1.61 ppm) and 4.06±1.64% (0.114-20.2%), respectively, suggesting direct mercury contamination (not through diet or food chain).

On the other hand, with one exception (12.2 mmHg), any of 62 hair samples collected in Mexico City in 1992 did not exceed 10 ppm, as shown in Table 1. Such a wide difference in T-Hg levels of head hair collected in Toluca and in Mexico City might be attributed to that in frequency in use of Merthiolate; that is, at that time the use of disinfectant for the skin or wound surface was rapidly shifting from Merthiolate to povidone-lodine in general hospitals in Mexico City (which is a large city), but not in Toluca (which is a local city), although the precise figures were vague. As depicted in Figure 1, however, T-Hg levels in long head hair from five female medical staff appeared to increase in the course of time (when head hair grows by about 1.0-1.5 cm every month), although they decreased temporarily. Such temporal decreases seemed to be due, in part, to a permanent wave, because it is well known that the wave reduces hair mercury level (Yasutake et al. 2003). The rising tendency in T-Hg level in the course of time was considered to be attributable to repeated touches by Merthiolate-stained hands on the hair. Unexpectedly, head hair from two subjects exceeded 10 ppm in the parts above a length of 5 cm, with the highest values being 22.2 and 19.0 ppm. Likewise, they showed no symptoms of mercury poisoning.

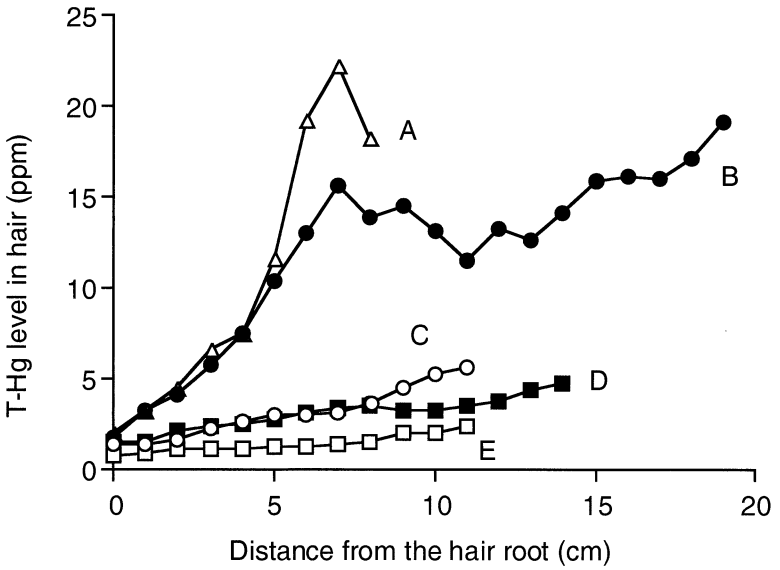

Figure 1. T-Hg level in long head hair collected in Mexico City in the course of time. A: lady doctor, 28 years; B: nurse, 19 years; C: nurse, 36 years; D: nurse, 22 years; E: nurse, 37 years

Table 1. Total mercury (T-Hg) level in head hair collected from Mexican staffs engaged in medical service in Toluca (1991) and Mexico City (1992).

Occupation	Sampling place	N	Sex		Age (years)		T-Hg (ppm)	
			Male	Female	Mean ±S.E.	Range	Mean ±S.E.	Range
Nurse	Toluca	12	0	12	25±1	20-30	32.9±13.1	2.51-143
Medical Doctor	Mexico	27	22	5	30±1	23-42	1.21±0.20	N.D.-4.02
Nurse	Mexico	34	3	31	30±1	17-40	1.23±0.37	N.D.-12.2
Others	Mexico	2	0	2	24±3	21-26	0.076	N.D.-0.076

Mexico, Mexico City; N, number of subjects; N.D., not detected

In an earlier study, we revealed that habitual use of skin-lightening soap containing considerable amounts of mercury in Kenya caused inorganic-mercury poisoning, accompanied by various symptoms, such as tremor, lassitude, vertigo, neurasthenia, and black and white blots, in addition to high hair mercury levels (Harada et al. 2001). As already stated, ethylmercury and MeHg are closely related chemically, have a similar initial distribution in the body, and cause similar types of damage to the central nervous system in toxic doses, by being absorbed into the system through the skin or mucous membrane. On the other hand, ethylmercury is more rapidly converted to the inorganic form, thereby leading to kidney damage in humans unlike MeHg (Clarkson et al. 2003). In Mexico Merthiolate is still in daily use in clinics rather than in general hospitals. As in the case of the mercury-containing soap (Harada et al. 2001), it would not probably be denied that wide and long-term use of Methiolate may cause mercury posoning. Thus, we recommend that Methiolate should be rapidly replaced by other antiseptic agents such as povidone-lodine especially in developing countries involving Mexico.

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