□ SHORT COMMUNICATION □

Colestimide Reduces Blood Polychlorinated Biphenyl (PCB) Levels

Kenichi Sakurai¹⁻³, Hideki Fukata²⁻⁴, Emiko Todaka^{2,3,5},
Yasushi Saito¹⁻³, Hideaki Bujo^{2,3,6} and Chisato Mori²⁻⁵

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The accumulation of persistent lipophilic organic pollutants in the human body is of great concern since many of these compounds may elicit adverse health effects (1). Polychlorinated biphenyls (PCBs) are one such chemical. The adverse health effects of exposure of PCBs include neurological disorders, carcinogenic effects and diminished reproductive and immunological functions. The health effects of extremely high exposure to PCBs in humans are known as Yusho or Yu-Cheng poisoning (2). The half-life of the PCBs in the human body was described to be some five to fifteen years (2). It is necessary to establish a new method to reduce accumulated PCBs and to prevent possible adverse health effects. We have reported that the anion-exchange resin, colestimide, reduces the blood dioxin level in humans (3). Here, we investigated the possibility of colestimide to reduce the blood PCB level in humans was investigated.

Blood samples were collected from eight male and two female subjects who were diagnosed as hyperlipoproteinemia (3). This study has been approved by the "Congress of Medical Bioethics" of Chiba University, and the samples were obtained after receipt of written informed consent. Their mean age was 57.3 (± 9.4) years old.

Five grams of blood sample was hydrolyzed with KOH/ethanol, then extracted with hexane. The extract was washed with distilled water. After dehydration, the solution was concentrated by evaporation. It was then eluted through a florisil column (Florisil PR, GL Sciences Inc, Tokyo, Japan) with hexane, evaporated to a final volume of 1 mL, and analyzed by GC-ECD (GC-17A, Shimadzu Co., Kyoto, Japan). The data were calculated using the lipid-weight basis. Data are expressed as mean ($\pm$ SD). Pair-wise differences were computed by paired *t*-test.

Eighteen blood samples including before and after the

Figure 1. A: Blood level of PCBs before and after the treatment in nine subjects. Closed circles show blood PCB level of each subject. Open circles show the mean blood level of PCB. B: Correlation between initial PCB concentration and reduction ratio (%) of PCB after colestimide treatment. ($R=0.64$) C: Correlation of alteration in PCB and dioxin level after colestimide treatment. Data expresses the percentage of the concentration after treatment compared to that before treatment. There is significant correlation in these alterations. ($R=0.91$)

¹ Department of Clinical Cell Biology, Graduate School of Medicine, Chiba University, Chiba, ² Environmental Health Science Project for Future Generations, Graduate School of Medicine, Chiba University, Chiba, ³ Center of Environmental Health Science for Future Generations (NPO), Graduate School of Medicine, Chiba University, Chiba, ⁴ Department of Bioenvironmental Medicine, Graduate School of Medicine, Chiba University, Chiba, ⁵ Center for Environment, Health and Field Sciences, Chiba University, Kashiwa and ⁶ Department of Genome Research and Clinical Application, Graduate School of Medicine, Chiba University, Chiba

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Correspondence to Chisato Mori, Department of Bioenvironmental Medicine, Graduate School of Medicine, Chiba University, 1-8-1 Inohana, Chuo-ku, Chiba 260-8670

colestimide treatment were analyzed. Two samples from one male subject who stopped taking colestimide a month after this study started were excluded. The mean PCB level of the subjects before the treatment was 0.26 ± 0.16 $\mu\text{g/g-fat}$. Six months later, the mean PCB level was significantly ($p < 0.05$) lowered to 0.20 ± 0.11 $\mu\text{g/g-fat}$ (Fig. 1A). As previously described, the mean total cholesterol level changed from 239.8 (± 10.71) to 208.6 (± 8.795) and LDL-cholesterol level tended to decrease in sixth months compared to the level before the treatment (158.0 ± 3.679 mg/dl to 129.8 ± 9.516 mg/dl, $p = 0.05$) (3). It was found that when the concentration level of PCBs before the treatment was higher, the stronger the effect of colestimide ($R = 0.64$) (Fig. 1B). Similar results were found with dioxin ($R = 0.63$) (data not shown). On the other hand, the subject who stopped taking colestimide showed an increase in the blood PCB level six months later (0.37 to 0.46 $\mu\text{g/g-fat}$).

The reduction rate of blood PCB concentration after colestimide treatment was significantly correlated with the reduction rate of the blood dioxin level ($R = 0.91$) (Fig. 1C).

In this study, the results indicated that colestimide can decrease not only the blood dioxin level (3), but also the blood PCB level in humans. Colestimide is an anion-exchange

resin which has the capacity to absorb lipophilic substances and this ability does not seem to be limited to cholesterol (3). PCBs are excreted into the intestinal tract and reabsorbed into the organs (4). It was reported that another ion exchange resin, cholestyramine, increases the fecal excretion of PCBs (5, 6). It is possible that colestimide absorbs PCBs in the gastro-intestinal tract, inhibits reabsorption of PCBs. However, the blood level of PCBs of a subject actually increased slightly after 6 months of intake of colestimide. One possible explanation for this phenomenon was that this subject ate food with a high content of PCBs, such as fish and shellfish.

It is necessary to establish methods of decreasing the levels of dioxins, PCBs and other organic pollutants detected in the human body (7). In this study, it was shown that colestimide decreases the blood level of PCBs in the human body, the same as dioxins. These data suggest that colestimide absorbs lipophilic compounds non-selectively, and excludes it with feces from the human body.

The present study is a small, non-randomized pilot study, and further study is necessary to conclude the usefulness of colestimide in decreasing PCBs in the human body.

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