THE RELATIONS BETWEEN NEUROBEHAVIORAL FUNCTION AND BLOOD DIOXIN CONCENTRATION AMONG WORKERS EXPOSED TO FLY ASH

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Introduction

Although there are many epidemiological studies trying to estimate the effects of dioxins to central nervous system[1,2] there is still no sound conclusion about the effects to adult nervous system. We intended to investigate the neurobehavioral effects of dioxins among workers of incinerators, who have possible exposure to dioxins through exposure to fly ash[3,4].

Subjects

Subjects were 26 male, 20 from municipal solid waste incinerator and 6 from environment pollutant measuring company. Age was 44.4 in average (25～61). This study was approved by the ethics board of National Institute of Occupational Safety and Health, Japan. Written informed consents were obtained from all subjects.

Methods

In the morning of examination day 70-90 ml of blood was collected from fastened subjects and then they were interviewed by occupational physicians about their job histories. Blood was used for measurements of 7 polychlorinated dibenzo-*p*-dioxins (PCDDs), 10 polychlorinated dibenzo-*p*-dibenzofrans (PCDFs), and 10 coplanar polychlorinated biphenyls (Co-PCBs), of those TEF was determined by WHO. Twenty nine PBDEs were also measured. After the interview, reaction times to light were measured. Subjects were patched a flat negative electrode on the belly of digital extensor muscle and a positive electrode on the middle of the wrist. A reference electrode was patched on the middle of the two electrodes. Mechanical button was placed in front of the subject so it can control comfortably. Voltage changes when the button was pushed and the response of pushing and releasing can monitor precisely by voltage meter.

Measurement of simple reaction time was described as follows: Subjects were asked to push the button by

dominant side of index finger at the first LED lamp flashes (reference flashing) and remain pushing until the second LED lamp flashes (signal flashing) after about one second. This time the subjects were asked to release the button as fast as possible. The interval between the start of two flashings was randomly fluctuated at mean of 1 second, which avoids subjects to predict the timing of signal flashing and respond without recognizing it. The test was repeated at least 60 times for each subject.

Measurement of color selection time was described as follows: Subjects were asked to push the button at reference flashing and remain pushing, and if the color of signal flashing was yellow then subjects were asked to release the button as fast as possible. On this occasion the color of signal flashing changes randomly between blue, green, and yellow and the interval between the start of two flashings were fixed to 1 second. Test schedule constitute of 100 test including 34 response requiring signals.

Two time points were measured. Those are the time between the start of signal flashing and the appearance of EMG, which is usually called latency (LT), and the time between the start of signal flashing and the time of button release, which is usually called reaction time (RT). We get two other indexes, one of which is obtained by subtracting latency from reaction time, which we call motion time (MT), and another is obtained by subtracting latency to simple reaction from color selection latency, which we call discrimination time (DT). We used median as representative indicator for each subject.

Results and Discussion

The levels of Blood PCDDs、PCDFc、and Co-PCBs were 5.6（2.3～12.0）、5.1（2.1～15.0、and 8.8（2.5～33.0）pg/gfat TEQ, respectively and were not high compared with the local residents[5].

After excluding the subjects, of which either of four measurements deviated from 3 x [standard deviation], 24 subjects remained. We analyzed these 24 subjects. The RT had moderate correlations with LT and MT. There was also a weak correlation between RT and DT. Considering correlations between blood dioxin levels, MT had weak negative correlations with the level of blood PCDDs and that of PCDFs. RT also had weak negative correlation with PCDFs.

	LT	MT	RT	DT	PCDD	PCDF	Co-PCB
Age	0.427*	-0.323	0.004	0.113	0.342	0.244	0.663*
LT	1.000	0.115	0.667*	0.310	-0.038	-0.151	0.231
MT		1.000	0.804*	0.263	-0.38#	-0.383#	-0.056
RT				0.344#	-0.290	-0.391#	0.111
DT					-0.047	0.182	0.234
PCDD						0.821**	0.493*
PCDF							0.329

#: $p<0.10$ *: $p<0.05$ **: $p<0.01$

Because of moderate correlation between MT and RT, weak negative correlation between the level of blood PCDFs and RT may be a reflection of the negative correlation between the level of blood PCDFs and MT. Reduction of MT demands dexterous movement, which suggests the activation of cerebellar function. Accordingly our results suggest that exposure to dioxins may activate cerebellar function at least at low level not far from regular environmental exposure in Japan.

Our conclusion is limited because of small number of subjects and low level of exposure. Further investigations are needed to overcome these limitations.

References

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