

Indicators of exposure and disease in the late phase of dioxin poisoning

Manfred Neuberger^x, Christoffer Rappe^{xx}, Andrew Smith^{xxx}, Sture Bergek^{xx}, Reinhard Jäger^{xxxx}, Michael Kundi^x, Chang Kee Lim^{xxx} and Hakan Wingfors^{xx}

^x
Institute of Environmental Health, University Vienna, Austria

^{xx}
Institute of Environmental Chemistry, University Umea, Sweden

^{xxx}
MRC-Toxicology, University Leicester, United Kingdom

^{xxxx}
Occupational Health Center, Linz, Austria

Introduction

A cohort of 159 cases of chloracne reported to the Austrian Worker's Compensation Board in 1969-75 became part of the IARC multicenter study (1) on cancer mortality (2) in workers exposed to dioxins (3) during herbicide production (4). The heavily contaminated production of 2,4,5-T was stopped in 1973. In survivors of this chloracne-cohort still active at the chemical plant in 1990 who volunteered in a preventive checkup 2,3,7,8-TCDD levels ranged from 98 to 659 pg per g blood lipid (5). The purposes of the present study were to achieve a higher participation rate by inviting all survivors (including retirees) to an independent occupational health center screening for signs and symptoms of disease and to relate them to levels of PCDFs, PCDDs and PCBs in blood and porphyrins in urine in 1996.

Materials and Methods

50 participants (49 males, 1 female) were matched by age and sex to 100 control persons without occupational exposure to PCDD/Fs. Control group A, drawn from different professions, have had the same preventive checkups by the same occupational physician and clinical chemist. Control group B was drawn from a cohort of asbestos cement workers (6) who participated in the same health care program with standardized questionnaire, clinical examination, blood and urine tests. Analytical methods used for exposure assessment in the chemical workers have been described before (7,8).

Results and Discussion

In the cohort of chemical workers chloracne had persisted in 32%. Neurological and gastrointestinal symptoms were reported more frequently than in controls. BSR, leucocytes, γ -GT, SGOT and SGPT were higher than in controls. The effects of exposure ($p=0,0021$) and alcohol ($p=0,0017$) on γ -GT (fig.1) were found to be independent of each other (interaction: $p=0,656$).

Table 1 shows blood lipid concentrations of 24 congeners in chemical workers. After log-transformation TCDD was found higher. in workers with a history of liver disease (mean 801 pg/g) than without (mean 407 pg/g). Adjustment for smoking did not change the significance essentially (p= 0,035). PCB#105 and #118 were found reduced in workers with a history of liver disease.

Table 1: Plasma concentration in pg/g extracted fat for PCDD/Fs (I-TEQ) and PCBs (TEQ)

	congener	median	mean	maximum
PCDF	2,3,7,8-TCDF	0.1	0.1	0.5
	1,2,3,7,8-PeCDF	0.0	0.0	0.3
	2,3,4,7,8-PeCDF	17.0	24.5	95.0
	1,2,3,4,7,8-HxCDF	0.9	1.2	3.7
	1,2,3,6,7,8-HxCDF	1.0	1.2	4.0
	2,3,4,6,7,8-HxCDF	0.3	0.3	0.6
	1,2,3,7,8,9-HxCDF	0.4	0.4	1.0
	1,2,3,4,6,7,8-HpCDF	0.1	0.1	0.2
	1,2,3,4,7,8,9-HpCDF	0.0	0.0	0.1
	OCDF	0.0	0.0	0.0
PCDD	2,3,7,8-TCDD	280.0	465.5	2900.0
	1,2,3,7,8-PeCDD	7.5	14.6	155.0
	1,2,3,4,7,8-HxCDD	0.5	0.5	1.0
	1,2,3,6,7,8-HxCDD	3.3	3.7	7.8
	1,2,3,7,8,9-HxCDD	0.7	0.7	1.9
	1,2,3,4,6,7,8-HpCDD	0.3	0.4	0.9
	OCDD	0.3	0.4	1.0
PCB non-o	PCB#126	7.1	9.9	44.0
	PCB#169	1.4	1.5	2.8
mono-o	PCB#105	0.3	0.4	2.3
	PCB#118	2.2	2.6	11.0
	PCB#156	21.5	23.2	85.0
	PCB#157	2.5	2.7	9.0
di-o	PCB#180	3.4	3.8	14.0

Table 2 gives results of multiple regression analysis showing significant effects of log-TCDD on SGOT and SGPT and an interaction with age indicative of persistent liver damage after high TCDD exposure at young age. A more sensitive test for persistent or late effects of TCDD on liver functions could be the excretion of urinary porphyrins: In 48% coproporphyrin I exceeded coproporphyrin III in amount, this group showing higher plasma TCDD (mean 719 pg/g). 7 men excreted an unknown porphyrin (mean TCDD 767 pg/g). Half life of TCDD was found longer than reported for younger ages and earlier stages of poisoning (9). 2 subjects with a considerable weight loss between 1990 and 1996 even increased in plasma TCDD. In the third decade after poisoning we still discourage rapid weight loss with possible mobilization of TCDD from subcutaneous fat into blood and liver, and above all we discourage exposure to other hepatotoxic agents and recommend continuation of preventive checkups.

Table 2: Multiple regression results for the dependent variables SGOT and SGPT (β =standardized regression coefficient, p=level of significance).

	SGOT		SGPT	
	β	p	β	p
age	1.147	0.067	1.118	0.078
alcohol	0.834	0.570	0.167	0.265
log TCDD	2.679	0.024	2.396	0.045
TCDD - age	-3.165	0.034	-3.001	0.047
R ²	0.145		0.122	

Keywords: TCDD, liver, porphyrin

Acknowledgements: Supported by CEC (PL910664), Austrian Worker's Compensation Board and Swedish Environmental Protection Agency. We thank, H.Cai, M.Hansson, G.Kufner and B.Piegler for their contributions.

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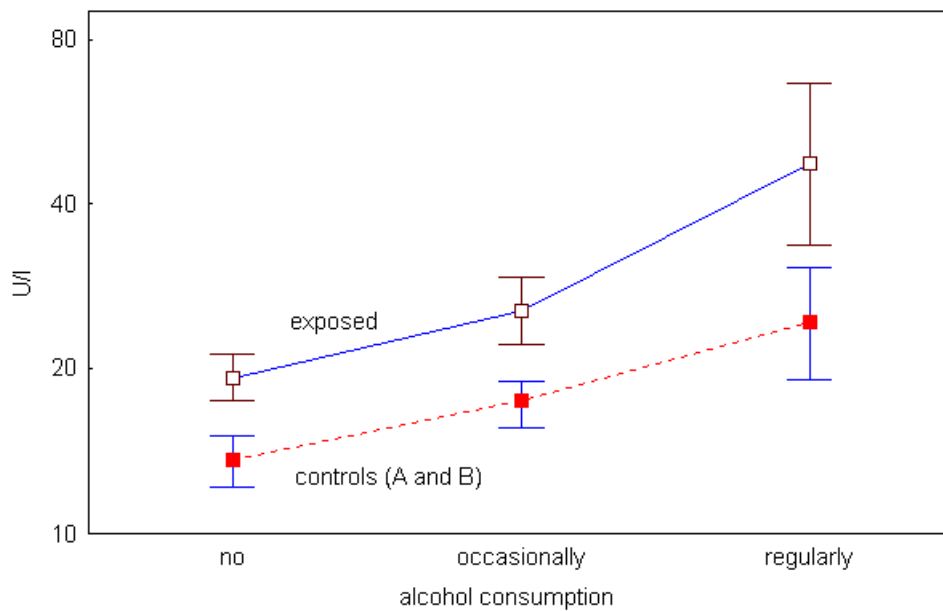


Fig. 1 : Means and standard errors of γ -GT (U/l) in TCDD-exposed and controls stratified for alcohol consumption