DIOXIN, DIBENZOFURAN, PCB, OTHER CHLORINATED ORGANICS, AND LIPID LEVELS IN THE TISSUES OF AN EMBALMED 52 YEAR OLD MALE 3 MONTHS AFTER BURIAL

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INTRODUCTION

Few dioxin analyses, if any, have been performed on embalmed and buried human tissue. Dioxin and other chemical analyses of human tissues have usually been performed on fresh tissue[1,2]. There are times when it is necessary for forensic purposes to exhume a body in order to test for various chemicals, including dioxins, dibenzofurans, and PCBs. Since dioxin data is now presented on a lipid basis, the changes in lipid content after death become of some importance, as well as the pattern and levels of the congeners. Such a case was recently called to the attention of the Collin County Coroner's office in Texas. The widow of a Vietnam veteran who had developed diabetes and then died of a heart attack believed her husband might have loaded Agent Orange onto fixed wing aircrafts during the war. She was concerned with recent reports from the Ranch Hand study of fixed wing sprayers of Agent Orange, which noted a statistical relation between higher levels of blood dioxin and adult-onset diabetes, which her husband developed between his Vietnam service and his death[3,4]. She also knew that diabetes mellitus is a risk factor for heart disease and mortality from heart disease. She requested dioxin testing to determine whether her husband did have elevated TCDD levels from Agent Orange; however, her request came months after embalming and burial in a mausoleum.

MATERIALS AND METHODS

The body was removed from the mausoleum about 3 months following embalming and "burial" in the mausoleum. It showed usual decomposition as judged by one of us (WR). After extensive interview of the widow by the scientific director of the Ranch Hand study, the coroner, and discussions with another of us (AS), it was felt that the widow was probably mistaken about her husband's exposure to Agent Orange. This was because the type of fixed wing aircraft he worked on was a different type of aircraft than that used for Ranch Hand Agent Orange spraying missions. Nevertheless, the possibility exists that there might still have been some exposure of the Vietnam veteran to Agent Orange, so the measurement of TCDD and the other congeners, to see if there is a relative increase of TCDD consistent with Agent Orange exposure, did seem indicated. In addition to collecting fat and liver, the only two organs necessary, we feel, to identify elevated TCDD, and elected to analyze several other major organs for dioxin and lipid content.

The organs selected and sent from Texas to Germany include, in addition to subcutaneous adipose tissue and liver, lung, brain, testes, and pancreas. Although the body was partially decomposed, organs were easy to identify and dissect out.

Dioxin analysis is being performed using high-resolution gas chromatography-mass spectrometry as previously described[5]. *ERGO Laboratory* has been certified by the World Health Organization to perform congener specific analyses for dioxins, dibenzofurans and PCBs in human blood and milk, and in food.

RESULTS AND DISCUSSION

As seen in Table 1 and Table 2, our previous congener-specific dioxin, dibenzofuran, and PCB results from autopsy tissue are summarized and the partitioning between tissues described from two studies of 3 autopsies[1,2]. In addition, Table 1 indicates levels of DDE, DDT and HCB from three autopsies performed on healthy adults who had died in automobile accidents[2]. They show that for major organs, the brain was very low in dioxin content, and there was not an exact 1:1 partitioning of congeners on a lipid basis in the organs, although in many cases congener partitioning was not far different between tissues on a lipid basis. As far as the number of dioxin molecules per cell, presumably the most important way of considering the data, wet or whole weight reporting of dioxins is of more biological significance than the usual reporting of dioxin congeners and dioxin toxic equivalents (TEQ) on a lipid basis. Therefore, our data is reported on both a wet weight and lipid basis. The new tissues are being analyzed at the time of abstract submission. We assume some decrease in lipids will have occurred, but that the congener specific pattern will remain similar to that found in the living tissues. If correct, this will be the first report to suggest it might be possible to perform forensic dioxin analyses on embalmed human tissue, at least through the third month following embalming and burial.

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Table 1: Total PCBs and other chlorinated organics in human tissue (ng/g of wet tissue, ppb)[2]

Tissue	PCB*	p,p'-DDE	p,p'-DDT	HCB
Patient 1				
Fat-intra abdomominal	86	8	6	15
Fat- subcutaneous	107	9	3	9
Adrenal	25	6	3	4
Liver	5	5	1	<1
Kidney	2	2	1	<1
Muscle	8	2	1	1
Bone marrow	26	5	2	2
Lung	2	1		<1
Spleen	2	2		<1
Patient 2				
Fat- intra abdominal	223	4145	164	24
Liver	3	92		<1
Kidney	31	813	12	<1
Muscle	12	507	5	1
Lung	2	42	48	<1
Testis	3	153	4	<1
Patient 3				
Fat- intra abdominal	423	4406	60	17
Fat- subcutaneous	455	5461	42	16
Adrenal	103	1133	48	4
Liver	149	1294	75	6
Kidney	13	94	4	<1
Muscle	27	209	9	1
Spleen	9	46	3	<1
Kidney fat	226	1624	99	10

*as sum of isomers

Table 2: Total dioxin and dibenzofurans in five tissue types from two autopsies based on whole weight (a) and lipid content (b), ppt[1]

Tissue	% Lipid	Total Dioxin		Total Furan	
		a	b	a	b
Autopsy 1					
Abdominal Fat	75	867	1155	84	112
Subcutaneous Fat	75	888	1184	51	68
Liver	6	253	4215	6.3	105
Muscle	9	194	2156	3.2	36
Kidney	3	39	1290	2.1	70
Autopsy 2					
Abdominal fat	71	618	871	60	85
Subcutaneous Fat	67	751	1121	78	116
Liver	22	448	2037	30	137
Muscle	7	88	1261	1.7	24
Kidney	4	56	1410	4.7	118