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Are Polychlorinated biphenyls (PCBs) plasmatic levels related to the development of soft tissue sarcomas? A case control study

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Background Soft tissue sarcomas (STS) are rare tumours and their aetiology is still unknown. Occupational exposure to dioxin and to dioxin-like compounds as Polychlorinated Biphenyls (PCBs) has been invoked in their pathogenesis. According to International Agency for Research on Cancer (IARC), PCBs have been classified as carcinogens to humans class 1. Data regarding the association with soft tissue sarcomas are still controversial.

Questions/Purposes Is the exposure to PCBs a possible cause for soft tissue sarcomas? The aim of study is to evaluate the plasmatic levels of PCBs in patients with soft tissue sarcomas and in not-oncological control subjects.

Patients and Methods A case control study has been conducted in an Italian reference center for both bone and soft tissue sarcomas and occupational health medicine. IRB approval was obtained. 64 consecutive cases of soft tissue sarcoma were enrolled. Inclusion criteria: new diagnosis of soft tissue sarcoma histologically confirmed, no history of other malignancies, age range 20-85 ys. 114 subjects were enrolled and included in the control group. People with similar demographic characteristics were selected among individuals inpatient in the same hospital for acute medical or surgical conditions, excluding people inpatient with direct consequences of diabetes, chronic renal or epatic failure, eating disorders, alcohol abuse, smoking abuse, and people with cognitive impairment or history of previous neoplasms. An informed consent was obtained by all the case and control subjects. Questionnaires regarding alimentary habits and occupation-related risk factors for PCBs were administered by an occupational health medicine resident through an interview. All the data obtained were related to BMI and demographic characteristics of the individuals (jobs, habits, geographical residential or working area). Blood samples were taken in all subjects (5 mL to measure plasma levels of 17 PCBs congeners by high resolution gas chromatography with ion trap mass spectrometry GM/MS) but analyzed in 52 cases and 99 controls. The remaining samples were excluded because the blood was partially clotted and consequently insufficient for analytical determination or the relative questionnaires were largely incomplete. An adipous tissue sample was taken in all cases and in all surgical controls, whereas a tumour sample was taken by the pathologist in cases after tumor excision. Statistical analysis was performed with SAS v.9.2 (SAS Institute-Cary, NC, USA): Chi-squared, Fisher's exact test, Wilcoxon's test, OR ($p<0.05$, CI 95%).

Results: No statistically significant difference was observed between group 1 and 2 regarding PCBs plasmatic levels ($p>0.05$). The risk of developing a soft tissue sarcoma in relation to PCBs plasmatic levels was slightly higher in group 1 but the results were not statistically significant (CI 95%) comparing the different percentils of plasmatic levels. (Table 1)

Table 1. Odds ratios (OR) and 95% confidence intervals (CI) of STS according to plasma concentration levels (approximate tertiles) of selected PCB congeners.[a]

	Cases n (%)	Controls n (%)	OR (95% CI) [b]
PCB 138			
≤0.14 µg/L	18 (34.6)	33 (33.3)	1 (reference)
0.14-≤0.34 µg/L	14 (26.9)	34 (34.3)	0.62 (0.24-1.57)
>0.34 µg/L	20 (38.5)	32 (32.3)	1.00 (0.41-2.42)
PCB 149			
≤0.10 µg/L	30 (57.7)	42 (42.4)	1 (reference)
0.10-≤0.16 µg/L	7 (13.5)	25 (25.3)	0.34 (0.12-0.93)
>0.16 µg/L	15 (28.8)	32 (32.3)	0.59 (0.25-1.38)
PCB 180			
≤0.10 µg/L	20 (38.5)	42 (42.4)	1 (reference)
0.10-≤0.20 µg/L	13 (25.0)	26 (26.3)	0.88 (0.35-2.16)
>0.20 µg/L	19 (36.5)	31 (31.3)	0.86 (0.34-2.14)
PCB 170			
0.05 µg/L	31 (59.6)	59 (59.6)	1 (reference)
>0.05-≤0.10 µg/L	10 (19.2)	23 (23.2)	0.66 (0.26-1.67)
>0.10 µg/L	11 (21.2)	17 (17.2)	0.91 (0.35-2.38)
Sum of 4 dioxin-like PCBs [c]			
0.20 µg/L	29 (55.8)	54 (54.5)	1 (reference)
>0.20-≤0.25 µg/L	4 (7.7)	16 (16.2)	0.47 (0.14-1.62)
>0.25 µg/L	19 (36.5)	29 (29.3)	1.17 (0.54-2.53)
Sum of 6 major non-dioxin-like PCBs [d]			
<0.52 µg/L	18 (34.6)	31 (31.3)	1 (reference)
0.52-<0.80 µg/L	16 (30.8)	35 (35.4)	0.66 (0.27-1.62)
≥0.80 µg/L	18 (34.6)	33 (33.3)	0.68 (0.27-1.71)
Sum of all examined PCBs			
<1.25 µg/L	15 (28.8)	31 (31.3)	1 (reference)
1.25-<1.71 µg/L	15 (28.8)	35 (35.4)	0.82 (0.33-2.07)

≥1.71 µg/L	22 (42.3)	33 (33.3)	1.20 (0.50-2.92)

[a] *Congeners considered were those detected in at least 33% of controls.*

[b] *OR adjusted for age, sex, smoking habit, alcohol consumption and body mass index.*

[c] *Congeners no. 77, 126, 169 and 118*

[d] *Congeners no. 28, 52, 101, 138, 153 and 180*

Conclusions We observed no relation between PCB plasmatic levels and the risk of developing soft tissue sarcomas. We know that PCBs accumulate in adipous tissue. Further analysis are ongoing to integrate the plasmatic level values by comparing PCB levels in adipous tissue of cases and controls and by studying the presence of PCBs in neoplastic tissue. Up to our knowledge this is the first study that evaluates PCB plasmatic levels in patients with soft tissue sarcomas. Due to the rarity of these neoplasms, multicentric studies with larger populations are desirable.