

LEAD LEVELS IN BODY FLUIDS OF WORKERS OF AN AUTOMOBILE FACTORY WITH CLINICALLY DIAGNOSED ARTERIAL HYPERTENSION

Alicja Wójcik¹, Zdzisław Brzeski², Maria Sieklucka-Dziuba¹

¹Department of Hygiene, Medical Academy, Lublin, Poland

²Clinic of Internal and Occupational Diseases, Institute of Agricultural Medicine, Lublin, Poland

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Abstract: The aim of the study is the evaluation of lead levels in body fluids in a chosen study group with diagnosed arterial hypertension employed in a car factory. The study was carried out on workers diagnosed with various stages of arterial hypertension who had been subjected to long-term lead exposure at different workplaces. The examination of the patients included medical history, physical examination and biochemical tests of blood and urine, following routine in the laboratory diagnosis in order to assess medical condition in terms of subclinical symptoms of lead exposure. Mean values of the lead level in blood and urine of studied population are insignificantly higher than in the control group. The obtained results seem insufficient to confirm the effect of occupational exposure to lead in subthreshold doses on the development of arterial hypertension, and are within the recommended hygienic standards.

Address for correspondence: Prof. dr hab. Maria Sieklucka-Dziuba, Head, Department of Hygiene, Medical Academy, Radziwiłłowska 11, 20-080 Lublin, Poland. E-mail: maria@asklepios.am.lublin.pl

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INTRODUCTION

Pathogenesis of arterial blood hypertension is still open to question. The effects of heavy metals, especially lead and cadmium, are considered among contributing factors.

First reports about the possibility of cardiovascular diseases, especially arterial hypertension, in individuals permanently exposed to lead appeared in the 1960s.

At that time, it was postulated that the disorders may result from the impairment of renal function [2]. However, recent studies have revealed the effect of lead on arterial blood pressure at levels not causing clinical symptoms of renal impairment [1, 3, 4, 5, 12].

The aim of this study was to evaluate the lead level in body fluids of car factory workers with various stages of clinically diagnosed arterial hypertension.

MATERIALS AND METHODS

The study was carried out on a selected group of car factory workers exposed to lead compounds from a homogenous source. The study group included 56 workers employed in the foundry, forge, standardized machine elements department and assembly line, with diagnosed arterial hypertension at various stages of the disease. The control group included 15 healthy office workers. According to the WHO criteria, a total of 56 examined workers were divided into three groups: group I included 21 patients with unstable arterial hypertension, group II included 21 patients with stable arterial hypertension, and group III included 14 patients with renal impairment (5 persons) and cardiovascular disorders (9 persons). The examination of the patients included

Table 1. Mean values of arterial blood pressure and lead concentrations in body fluids in the examined groups.

Examined group	Number of persons in the group	Division into groups based on WHO classification of arterial hypertension	Mean systolic pressure (mm Hg)	Mean diastolic pressure (mm Hg)	Mean lead concentrations	
					Blood ($\mu\text{g}/100\text{ ml}$) $\bar{x} \pm \text{SD}$	Urine ($\mu\text{g}/\text{l}$) $\bar{x} \pm \text{SD}$
Reference group	15	Normal	139.0	80.0	13.32 ± 8.94	22.67 ± 12.23
Group of workers with arterial hypertension	56	–	–	–	16.12 ± 10.72	24.55 ± 13.24
Division into subgroups based on WHO criteria	21	I	172.5	104.2	16.36 ± 9.69	24.52 ± 12.29
	21	II	198.6	113.6	14.56 ± 8.80	26.90 ± 15.33
	14	III	192.5	118.9	15.44 ± 12.80	21.00 ± 11.16

$\bar{x} \pm \text{SD}$: arithmetic mean \pm standard deviation.

medical history, physical examination, monitoring of arterial blood pressure and biochemical tests of blood and urine in order to assess subclinical symptoms of lead exposure.

The following values were used for the modelling of hypertension status:

- systolic pressure >160 mm Hg;
- diastolic pressure >95 mm Hg.

Lead levels in blood and urine from 24 h collection were determined using atomic absorption spectrophotometry [6, 12].

Air samples for determination of lead concentration at the workplace were collected using aspirator AS-50 and SYMPOR filters, and the analysis was performed using atomic spectrophotometry. The concentrations of lead in the air, determined at the workplaces of examined patients did not exceed the threshold limit of the value-time weighted average (TLV-TWA) of $0.05\text{ mg}/\text{m}^3$ recommended as a hygienic standard. At a core-making machine where lead alloy is poured into moulds the mean concentration of lead in the air was $0.022\text{ mg}/\text{m}^3$.

The statistical evaluation of the differences in the concentration of lead in blood and urine between the group of workers with arterial hypertension and the reference group was carried out using Student's t-test. P-value ≤ 0.05 was considered significant.

RESULTS

Mean values of arterial blood pressure lead level in blood and urine of examined groups are presented in Table 1. As seen in the Table, the mean values of the lead concentration in blood and urine in the examined group of workers with arterial hypertension were only slightly higher than in the reference group, and the differences between these two groups were not statistically significant ($p > 0.05$). In patients with arterial hypertension of group III according to WHO criteria, a slight decrease in the lead level in urine was observed.

DISCUSSION

Different clinical studies on the effect of lead on hypertension present various opinions [1, 3, 8, 11]. Occupational lead exposure may result in a moderate increase in arterial blood pressure, there is some doubt, however, about the nature of this relationship. Kirby [7] found a correlation between the lead level and arterial hypertension in the population occupationally exposed to lead. By contrast, Maheswaran *et al.* [9] in their studies of workers employed in a accumulator factory, observed only a very slight clinical effect resulting from occupational lead exposure.

According to the WHO recommendations, lead levels in people non-occupationally exposed to lead should not exceed $200\text{ }\mu\text{g}/\text{l}$. The accepted biological level in blood in occupationally exposed men is $600\text{ }\mu\text{g}/\text{l}$ and in women of reproductive age $300\text{ }\mu\text{g}/\text{l}$ [10]. Normal lead level in urine is $80\text{ }\mu\text{g}/\text{l}$, tolerance range $80\text{--}150\text{ }\mu\text{g}/\text{l}$, and in moderate lead poisoning $150\text{--}250\text{ }\mu\text{g}/\text{l}$ [12]. In this study, lead levels in the biological material were far below recommended hygienic standards.

Thus, the results of our studies, carried out on a relatively small group of patients with arterial blood hypertension employed in the car factory and occupationally exposed for many years to subthreshold lead doses, do not confirm the effect of occupational lead exposure on the development of arterial hypertension.

Nevertheless, the problem of the effect of heavy metals, including lead, on the pathogenesis of arterial hypertension is still open to question and needs further studies.

CONCLUSIONS

1. The lead level in blood and urine in the examined group of car factory workers with arterial hypertension was similar to the reference group of healthy office workers.

2. The results of this study do not provide evidence for the effect of occupational lead exposure in subthreshold doses on the development of arterial hypertension.

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