RESEARCH ON MORBIDITY DUE TO CARDIOVASCULAR DISEASES AMONG THE WORKERS EXPOSED TO LEAD AND CADMIUM WITHIN A NONFERROUS METALLURGY FACTORY

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Abstract: This study aims at analysing morbidity due to chronic diseases among the people working in a nonferrous metallurgy factory, as well as the possible contribution of lead to the increased level of morbidity due to these diseases, on a sample group of subjects with chronic cardiovascular diseases. The obtained results have shown certain correlations between the exposure, certain rates of internal burden and the level of cholesterol and triglycerides, results which were comparable to literature data, as well as to the conclusions of other studies.

Keywords: chronicle cardiovascular diseases, lead in blood (plumbemia), lead in urine (plumburia), DALA-U, cholesterol, triglyceride.

Rezumat: Lucrarea își propune analiza morbidității prin boli cronice la lucrătorii unei întreprinderi de metalurgie neferoasă și posibila contribuție a plumbului la creșterea morbidității prin aceste boli, pe un lot de subiecți cu boli cronice cardiovasculare. Rezultatele obținute au evidențiat unele corelații între expunere, unii indicatori de încărcare internă și valorile colesterolului și trigliceridelor, rezultate comparabile unor date din literatură și concluziilor altor studii.

Cuvinte cheie: boli cronice cardiovasculare, plumbemia, plumburia, DALA –U, colesterol, triglyceride

INTRODUCTION

A large number of industrial agents, such as the heavy metals, may contribute to the occurrence and evolution of atherosclerosis and its consequences, by mechanisms that have not been known yet. There are many possible theories supported clinically and experimentally, through which these toxic substances may play a part in producing vascular diseases, such as: increase of blood pressure, of cholesterol level and/or favouring the accumulation of lipids on the vascular wall, the introduction of the lipid peroxidation, favouring the changes made in the arterial wall cells. (1)

Many studies have researched on the possible association between the level of lead in blood and the level of cholesterol and lipoproteins in serum, both based on experiments made on animals and on samples of subjects taken from the general population and on subjects occupationally exposed to heavy metals. The research made on animals showed increased levels of plasmatic cholesterol and of lipoproteins as a result of lead administration, even in small doses, levels that may play a part in atherosclerosis development. (2,3)

The result of other studies made on animals did not make any observation on the fact that lead exposure might induce cholesterol increase. (4)

The research made on human subjects also reached the contradictory conclusions. Certain studies found associations between the levels of lead in blood and the level of the total cholesterol or of HDL cholesterol, (5,6), while others either did not mention these indicators, or they even found negative associations. (7,8,9,10)

Other studies, although they did not find any relation between the level of lead in blood, cholesterol and triglycerides, noticed significant increased levels of lipids peroxidation in the exposed lead, the possible cause could be the direct effect of lead on erythrocytes or the pro-oxidative action of the delta amino levulinic acid. (11)

PURPOSE OF RESEARCH

The paper aims at analysing morbidity due to chronic diseases among the employees working in a nonferrous metallurgy factory and the possible contribution of lead to the morbidity increased rate due to these diseases, on a sample of subjects suffering from chronic cardiovascular diseases.

MATERIAL AND METHOD

The studied batch was represented by 31 subjects whose morbidity data were gathered from evidences of the medical office within the factory and from the medical records of the employees. The results of certain medical analyses and laboratory investigations were gathered from the medical records and the results of the medical periodical check ups on an interval of seven years, as well as hospitalisation during this period of time for acute lead intoxications or increased lead absorptions were processed from the evidences of the labour medicine department of the Public Health Authority, Sibiu.

RESULTS AND DISCUSSIONS

Between 1997 and 2007, the following affections were identified among the factory's employees: 31

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persons with ischemic heart disease and valvulopaties, 33 persons with hypertension, 40 persons with chronic respiratory affections (bronchial asthma, chronic bronchitis, chronic obstructive bronchopneumonia), a person with glaucoma, 13 persons with endocrine affections (diabetes type I and II and nodular goiter), 22 persons with chronic hepatitis, 22 persons with ulcer (gastric and duodenal), 7 persons with malign tumours, 2 persons with TBC and 17 persons with chronic renal affections.

Firstly, we noticed increased frequencies of ischemic heart diseases, secondly ischemic heart disease associated to infarct sequela and valvulopaties thirdly.

Out of the cardiovascular diseases, hypertension also registered increased frequencies among the employees, the majority of them being diagnosticated as hypertensive stage II.

Regarding the respiratory affections, one may notice that the most increased frequencies are recorded by chronic bronchitis and regarding the chronic renal affections, mention must be made of the increased frequency of chronic nephropathy, respectively of chronic nephropathy associated to chronic renal insufficiency.

Within the batch made up of the patients suffering from cardiovascular diseases, such as ischemic heart disease and valvulopathy, except hypertensives, the average age of those 31 subjects was 45.6 years, with a minimum of 33 years old and a maximum of 55 years old.

The repartition of subjects on age groups showed that the largest number of the patients was between 46 and 50 years old.

By analysing the batch taking into account the patients' residence, we found out that 65% of them were living in Copşa Mică. Having in view the fact that there was an historic pollution in the town and in the neighbourhood, these people were exposed both to the workplace pollution and to the environment one.

Anamnesis proved that 22.50% are smokers and 87% admitted the occasional alcohol consumption.

The analysis of the pathological personal antecedents showed that 50% of the subjects were not registered with other affections, 16% had ulcer and there were a low percentage of chronic hepatitis cases, anemia, renal and respiratory affections.

The average length in services of those 31 patients, in fact the average of the lead exposure length in years, regarding a daily exposure of 6 hours during a working day, is of 17,7 years, with a maximum of 30 years and a minimum of 6 years.

The distribution of subjects on the length in service showed that the largest number of subjects had a seniority of 16-20 years and were working in the departments: furnace, agglomeration, electrolysis, refinery and maintenance, departments where the highest level of heavy metals pollution was recorded. Picture no. 1 Weight of subjects per departments



During 2000 and 2006, out of those 31 subjects, 15 persons were hospitalized in the occupational diseases sections of the County Clinical Hospital of Sibiu, Cluj-Napoca and Tg. Mureş, diagnosticated with plumbism. During the above-mentioned period of time, these persons had between 1 and 4 hospitalizations, the majority of them having 2 hospitalizations.

The results of the laboratory investigations proved the following:

The distribution of plumbemia values showed that 80% of the values were above the accepted limit of $40\mu g/dl$, the largest percentage of subjects having values of $65\mu g/dl$. The average of the values was of $53.51\mu g/dl$, value considered "acceptable".

Plumburia values were totally above the accepted limit of $80\mu g/l$. Most of the subjects (66.66%) had values between $80-150\mu g/l$, a value considered "acceptable", and the rest of 33.33% had "excessive" values.

Urinary DALA values distribution proved that 93,34% of the subjects had values above the accepted limit and 60% of them recorded "dangerous" values in the interval of 20-30mg/l.

Cholesterol values were between 165mg/dl and 339mg/dl, and most of the subjects, a percentage of 40%, registered values of cholesterol between 200 and 250 mg/dl.

Only 33.33% of the subjects had values of triglycerides below 150mg/dl, and the largest percentage of the subjects who had values above the accepted limit fitted the interval 150-200mg/dl. The maximum value was of 442mg/dl and the minimum of 93mg/dl.

The statistical correlations between the variables which characterized the batch, by assessing Pearson product-moment correlation proved the strongest correlation between plumbemia and residence (r=0.609), followed by the correlation alcohol-cholesterol (r=0.333), and triglycerides-plumburia correlation (r=0.254). Weaker correlations were also observed between cholesterol and plumbemia (r=0.125) and between triglycerides and urinary - DALA (r = 0.184).

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Table	no.	1.	Tre	end	and	di	stributio	n	of	the	
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Variable	average± standard deviation	maximum	minimum
Age	46.9±5.99	55	36
Length in service	19.2±6.36	28	6
Cholesterol mg/100ml	238.6±46.91	339	165
Triglyceride mg/100ml	203.26±104.67	442	93
Pb-emia μg%	53.51±13.42	65	33.2
Pb-uria µg/l	278.33±105.02	460	134
Urinary DALA mg/l	25.12±10.95	45.3	4.6

CONCLUSIONS

The results of the studies made on animals and on samples of the general population (adults and children), as well as on the workers occupationally exposed to lead, regarding the possible association between the lead level in blood and cholesterol level and lipoproteins in serum are contradictory.

This study observed certain correlations between exposure, some internal burden indicators and cholesterol and triglycerides values in the people suffering from cardiovascular diseases, employed in a nonferrous metallurgy factory, results which may be compared with literature data and with the conclusions of other studies.

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