

THE PART PLAYED BY CERTAIN OCCUPATIONAL TOXIC SUBSTANCES IN THE OCCURRENCE AND EVOLUTION OF THE CARDIOVASCULAR DISEASES REGARDING THE OCCUPATIONAL EXPOSURE

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Abstract: *The heart illnesses are the first cause of deceases in the entire world, with a larger weight in the developed countries, where these illnesses represent, in general approximately 50 percent of the total number of deaths, by all causes. The risk factors related to cardiovascular diseases were deeply studied, but the role of occupational exposure is less known. Some physical and chemical factors can be associated to cardiovascular diseases. However, the scientific data indicate a direct causal relation for only few of them. The possibility of association between lead and cadmium exposure and cardiovascular diseases remains a controversial subject; Epidemiological studies have found positive connections between the exposure to those metals and mortality due to cardiovascular diseases, as well as between the levels of those metals inside the human body and blood pressure, conduction defects, arrhythmia and electrocardiographic abnormalities.*

Keywords: *cardiovascular diseases, risk factors, occupational exposure, lead, cadmium, epidemiological studies.*

Rezumat: *Bolile cardiovasculare constituie în lume prima cauză de deces, cu o pondere mai mare în țările mai dezvoltate, în care aceste afecțiuni reprezintă în general, în jur de 50% din totalul de decese prin toate cauzele. Factorii de risc care contribuie la apariția bolilor cardiovasculare au fost bine studiați, dar contribuția expunerii la anumite noxe din mediul ocupațional ca și condițiile de apariție a acestor boli a fost mai puțin studiată. Unii agenți fizici și chimici se suspectează a dezvolta afecțiuni cardiovasculare ca urmare a expunerii. Oricum datele științifice indică o relație cauzală directă pentru foarte puțini din aceștia. Posibila asociere între expunerea la plumb și cadmiu și bolile cardiovasculare rămâne un subiect încă extrem de controversat. Studiile epidemiologice au găsit corelații pozitive între expunerea la aceste metale și mortalitatea prin boli cardiovasculare și între nivelurile acestor metale în organism și tensiunea arterială, tulburări de conducere și ritm și modificări electrocardiografice.*

Cuvinte cheie: *boli cardiovasculare, factori de risc, expunere profesională, plumb, cadmiu, studii epidemiologice.*

Morbidity and mortality due to cardiovascular diseases have registered an important increase in the last decades. This situation is due to the increase of the average length of life up to 70 years old, to the lifestyle and working conditions of the modern society, which expose population to an increased risk and to the accelerated rate of obesity and sugar diabetes (1). If at the beginning of the XXth century, the deaths as a result of the cardiovascular diseases represented no less than 10% of the world total morbidity, today, these diseases have been responsible for almost 1/2 of the total deaths in Europe, determining more than 4,35 million of deaths within the 53 member states of the World Health Organization – Europe each year and more than 1,9 million of deaths in the European Union, yearly (2).

The lifestyle dependent risk factors (smoking, food, physical activity, body mass index), as well as the main factors of biologic risk (hypertension, dislipidemia and hyperglycemia) were deeply studied, but the knowledge regarding the contribution of the exposure to certain toxic substances within the communal and/or industrial environment to the occurrence of these diseases is still limited.

For a small number of physical and chemical agents, the scientific data indicate a direct causal relation. For the majority of these, the evidences are based on case reporting or on epidemiologic studies. It is also the case of the heavy metals, such as lead or cadmium, which may bring about cardiovascular changes, although their part is not fully elucidated.

Certain occupational toxic substances such as: noise, vibrations, temperature and increased caloric radiations, distress or the increased physical and psychological stress, as well as the exposure to heavy metals are considered as second favouring factors which participate in the occurrence of the cardiovascular diseases, as occupational diseases, together with other non occupational ethyologic factors (3).

The noise action has as a result the release of catecholamine, the increase of the plasmatic levels of lipids, the increase of the cardiac frequency, of blood pressure and of the risk of myocardial infarction (4). Noise also produces disorders of the central nervous system and changes in haemostasis.

The occupational mechanical vibrations with the frequency between 20 –200 Hz directly influence the local vascular system, bringing about the occurrence of a vascular hypertonicity and implicitly of the local syncope caused by the noradrenalin released at the level of the adrenergic terminations of the sympathetic. Also, the vibrations produce neurosis with focuses of excitation stagnating at the brain level, generator of trophic and vascular disorders, especially of the superior limbs. Pre-existing diseases, such as: arthritis, atherosclerosis are favouring etiologic factors.

Also, the exposure to mechanical vibrations with physical characteristics (amplitude, acceleration, speed) over the limit values, for a significant period of time, may produce the occupational Raynaud vascular syndrome. This is the result of the direct action of the noise on the vascular wall which becomes more sensitive to cold and/or of the indirect action of the noise through a state of hyperactivity at the brain level, or through alterations of the perivascular sympathetic with exaggerated response to physical stimuli, such as the cold (5).

Stress may lead to pectoral angina episodes, rhythm disorders and accelerates the occurrence of the cerebral vascular accidents and of the myocardial infraction. The intense and long term psychological tension at the working place leads to the activation of the sympathetic nervous system and in time, it may cause the occurrence and the aggravation of the metabolic syndrome (obesity, hyperglycemia, hyperinsulinemia and an increased profile of lipids).

The high temperature and the increased caloric radiations, taking into account a background of alcoholism, advance age or existing cardiovascular affections, determine chronic disorders of the cardiovascular apparatus, as well as arterial hypertension in workers who have been working in these conditions for a long term. The long term exposure to reduced temperatures causes ischemic injuries of the circulatory apparatus.

The long term exposure to heavy metals, such as lead or cadmium may produce a series of cardiovascular changes, such as arterial hypertension, cardiac arrhythmia, myocardial infraction, peripheral obliterating arteriopathy or possibly, coronary disease.

The possible association between lead and cadmium exposure and the cardiovascular diseases and the contribution of these metals to the occurrence and evolution of atherosclerosis is still a very controversial subject.

A series of epidemiologic and experimental research sustains the existence of a causal link between lead exposure and the incidence of certain cardiovascular diseases, while others have not found any significant relations (6).

Studies regarding mortality to the workers exposed to lead more than 30 years showed a higher index of mortality through arterial hypertension and cerebrovascular diseases as against a witness batch without occupational exposure (Flanning 1988, Michaels

et al 1991), suggesting a possible association between the occupational exposure to lead and these diseases.

A lot of studies made on the general population and on groups of people with occupational exposure for short periods of time recorded increases of the blood pressure and the decrease of the glomerular filtration; these two factors may also represent confusion factors.

The increase of the blood pressure was associated with the lead levels in bones (tibia and fibula) and in blood, especially to the middle-aged persons. Regarding the chronic exposure, the lead in bones, as a unit of measurement, seems to be a better predictor of the increase of the blood pressure than the lead poisoning. A meta-analysis of 31 studies published between 1980 and 2001 including 58 518 of subjects (Nawrot et al 2002) estimated an increase of the systolic blood pressure with 1 mmHg in relation with the double lead poisoning and an increase of the diastolic blood pressure with 0.6 mm Hg. Other studies found larger increases, even of 4 mmHg for the systolic blood pressure (NHANES II).

A research made on the general population of the United States taking into account the subjects with the average age of 67 years old, without cardiovascular accidents found significant correlations between the lead concentration in patella and arterial hypertension; another research showed relations between the systolic arterial hypertension and lead poisoning and the lead in the tibia.

Other cardiovascular effects of the lead include conduction and rhythm disorders with electrocardiographic changes which may be secondary to the influence of the lead on the peripheral nervous conduction (Bockelmann et al 2002), as well as changes within the peripheral hemodynamics. These latter changes were emphasized by pletismography, which registered significant high values in the exposed workers, correlated with increased values of the lead poisoning and with the exposure length (Aiba et al 1999). Also, a research made on the ceramics painters of Japan linked the lead poisoning with the blood flux in fingers (Ishida et al 1996).

Cadmium exposure seems not to have significant effects on the cardiovascular system. Most of the studies made on the occupationally exposed workers did not find any similarities between cadmium and cardiovascular toxicity (7). Certain studies have found even a reduced mortality rate through the cardiovascular diseases in those occupationally exposed for 11 years, in comparison with those unexposed (Armstrong and Kazantzis 1983).

Only one study has found significant increases of the blood pressure of the exposed workers in comparison with the witness batch, but the mortality rate was more reduced than the expected one (Thun et al 1985). Almost all studies emphasized that the toxic effect of cadmium on heart is unclear.

Today's studies try to clarify the mechanisms through which these metals interfere with the action of other cardiovascular risk factors, as well as with the pathogeny of atherosclerosis and its manifestations.

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