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РАСПРОСТРАНЕННОСТЬ СИНДРОМА РАННЕГО СОСУДИСТОГО СТАРЕНИЯ У МУЖЧИН, РАБОТАЮЩИХ В УСЛОВИЯХ ВОЗДЕЙСТВИЯ ШУМА

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Prevalence of Early Vascular Aging Syndrome in Men Working Under Noise Exposure

Резюме

Шум может быть одним из факторов, провоцирующих преждевременное развитие изменений в стенке артерий, ассоциированных с возрастом. **Цель:** оценить жесткость сосудистой стенки и распространенность синдрома раннего сосудистого старения у мужчин трудоспособного возраста в зависимости от контакта с шумом, статуса курения и наличия артериальной гипертензии. **Материалы и методы.** Обследовано 148 мужчин, работавших в шуме и 90 мужчин, для которых уровень всех вредных производственных факторов на рабочем месте не превышал допустимых нормативов. Средний возраст обследованных составил 41,6 ± 9,9 лет, 133 человека (55,9 %) являлись курильщиками, 43 человека (18,1 %) страдали ожирением, 47 человек (19,7 %) имели отягощенную по сердечно-сосудистой патологии наследственность, у 132 человек (55,5 %) была выявлена гиперхолестеринемия, 37 человек (15,5 %) страдали артериальной гипертензией (АГ). Каждый из пациентов, страдавших АГ, получал антигипертензивную терапию. Существенных различий структуры антигипертензивной терапии в сравниваемых группах пациентов не было. Группы обследованных были сопоставимы между собой по возрасту, индексу массы тела, распространенности курения, ожирения и артериальной гипертензии. Всем пациентам была проведена объемная сфигмография по стандартной методике в первой половине дня на аппарате VaSera 1500N (FukudaDenshi, Япония), прибором автоматически определены сердечно-лодыжечный сосудистый индекс (СЛСИ) справа и слева, расчетный возраст артерий. За синдром раннего сосудистого старения (EVA — синдром) принимали клиническое состояние, ассоциированное с превышением расчетным возрастом артерий паспортного возраста пациента на 4 года и более (критерии VaSera). **Результаты и их обсуждение.** После исключения из анализа курильщиков и гипертоников и коррекции на возраст индекс жесткости сосудистой стенки справа и слева в основной группе пациентов значимо превышал указанный показатель в группе сравнения. СЛСИ справа составил 7,2 [6,9; 7,9] и 7,05 [6,05; 7,45] соответственно, p=0,02; СЛСИ слева — 7,3 [7,0; 7,9] и 6,85 [6,05; 7,65] соответственно, p =0,007. В группе лиц, работавших в шуме, расчетный возраст артерий достоверно превышал паспортный возраст пациентов (p=0,004), тогда как в контрольной группе указанные показатели были сопоставимы (p=0,27). Распространенность EVA — синдрома в основной группе пациентов составила 14 случаев (27,5 %,) что в 8,6 раза превышало распространенность EVA — синдрома в группе сравнения — 1 случай (3,2 %); p=0,004. Сопоставимость групп пациентов по основным факторам кардиоваскулярного риска и критерии исключения из исследования позволили предположить, что выявленные изменения состояния сосудистой стенки были связаны с воздействием шума на организм обследованных. **Заключение.** Шум может быть фактором, ускоряющим сосудистое старение. Необходим контроль состояния сердечно-сосудистой системы у лиц, работающих в шуме.

Ключевые слова: *раннее сосудистое старение, сосудистая жесткость, шум*

Конфликт интересов

Авторы заявляют, что данная работа, её тема, предмет и содержание не затрагивают конкурирующих интересов

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Abstract
Noise can be one of the factors provoking the premature development of changes in the artery wall associated with age. **Aim:** to assess the stiffness of the vascular wall and the prevalence of early vascular aging syndrome in men of working age, depending on contact with noise, smoking status and the presence of hypertension. **Materials and methods.** 148 men worked in noise and 90 men for whom the level of all harmful production factors in the workplace did not exceed the permissible standards were examined. The average age of the examined patients was 41.6 ± 9.9 years, 133 people (55.9 %) were smokers, 43 people (18.1 %) were obese, 47 people (19.7 %) had a complicated heredity, 132 people (55.5 %) had hypercholesterolemia, and 37 people (15.5 %) suffered from arterial hypertension (AH). Each of the patients suffering from hypertension received antihypertensive therapy. There were no significant differences in the structure of antihypertensive therapy in the compared groups of patients. The groups of surveyed were comparable in age, body mass index, prevalence of smoking, obesity and hypertension. All patients underwent volumetric sphygmography according to the standard procedure in the morning on the VaSera 1500N device (FukudaDenshi, Japan), the device automatically determined the cardio-ankle vascular index on the right and left (R/L — CAVI), the estimated age of the arteries. The syndrome of early vascular aging (EVA syndrome) was considered to be a clinical condition associated with an excess of the estimated age of the arteries of the patient's passport age by 4 years or more (VaSera criteria). **Results and discussion.** After exclusion of smokers and hypertensive patients from the analysis and correction for age, the vascular wall stiffness index on the right and left in the main group of patients significantly exceeded the indicated indicator in the comparison group. R — CAVI was 7.2 [6.9; 7.9] and 7.05 [6.05; 7.45], respectively, p=0.02; L — CAVI was 7.3 [7.0; 7.9] and 6.85 [6.05; 7.65], respectively, p =0.007. In the group of people working in noise, the estimated age of the arteries significantly exceeded the passport age (p=0.004), whereas in the control group these indicators were comparable (p=0.27). The prevalence of EVA syndrome in the main group of patients was 14 cases (27.5 %), which was 8.6 times higher than the prevalence of EVA syndrome in the comparison group — 1 case (3.2 %); p=0.004. The comparability of the patient groups according to the main cardiovascular risk factors and the exclusion criteria from the study suggested that the identified changes in the state of the vascular wall are associated with the effects of noise on the body of the examined. **Conclusion.** Noise can be a factor that accelerates vascular aging. It is necessary to monitor the state of the cardiovascular system in persons working in noise.

Key words: *early vascular aging, vascular stiffness, noise*

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AH — arterial hypertension, BBA — beta-blocking agents, CCB — calcium channel-blocking agents, ARB — angiotensin II receptor blockers, ACEi — angiotensin converting enzyme inhibitors, BMI — body mass index, CAVI — cardio-ankle vascular index, RHS — routine health screening, EVA-syndrome — early vascular ageing syndrome

Introduction

The concept of early vascular ageing (EVA) syndrome includes early development of age-associated mechanical and functional changes in arterial walls. The main pathogenetic aspects of EVA-syndrome are epithelial dysfunction, thickening of intima-media complex, more rigid vascular walls, impaired elastic artery dilatation, and higher pulse wave velocity. Recently, the vascular age has been considered as an important predictor of cardiovascular risk [1, 2]. According to researchers, the incidence of early vascular ageing syndrome in the population varies a lot and depends on the assessment method used and the age-sex group of subjects. For instance, the incidence of EVA-syndrome in a population of citizens of St. Petersburg aged 25 to 65 years old (VaSera method) was 13.5 % to 37.5 % [3].

Vascular wall rigidity and the rate of vascular ageing are affected by numerous factors. To begin with, sex and genetic differences in cardiovascular system ageing should be emphasised [4]. Also, the incidence of EVA-syndrome is higher in persons with carbohydrate metabolism disorders [5, 6]. Arterial hypertension (AH) also adversely affects vascular wall condition [7]. On the other hand, vascular ageing is impacted by exogenous factors. Smoking is known to significantly increase arterial rigidity [8]. Some studies describe a possible increase in vascular wall rigidity when the body is exposed to such common environmental factors as air pollution and noise [9-11]. However, at the moment, the role of noise exposure in early vascular ageing is not completely clear. Since the level of noise affecting the patient can be easily modified, it is very important to assess how this harmful factor changes the rate of vascular ageing.

Currently, numerous methods are available for the assessment of the patient's vascular age [1, 3]. One of the most accessible and representative methods of non-invasive EVA-syndrome diagnosis is 3D sphygmography. During this assessment, the pulse wave velocity is used to calculate the vascular wall rigidity index (CAVI). Automated determination of CAVI correspondence to the available age standards is used to generate a conclusion whether the patient has early vascular ageing syndrome or not. It has been shown that 3D sphygmography can be used in the assessment of the impact of various endogenous and exogenous factors on the rate of vascular ageing [12].

The objective of the study is to assess vascular wall rigidity and the incidence of early vascular ageing syndrome in men of working age, depending on exposure to noise, smoking status and presence of arterial hypertension.

Materials and Methods

We have conducted a cross-sectional study in 238 men aged 21–65 years old, who were undergoing a routine health screening (RHS) in the medical centre of the Federal Budgetary Scientific Institution Nizny Novgorod Scientific Research Institute of Hygiene and Occupational Pathologies. Inclusion criteria in this study were the age of over 18 years old; male sex; exposure to occupational noise at work or work outside industrial health hazards; possibility to perform 3D sphygmography; informed consent for the participation in the study. Exclusion criteria were the age of over 65 years old; BMI of over 40 kg/m^2; a history of a significant somatic pathology (diabetes mellitus, ischemic heart disease, arterial sclerosis of lower limbs; chronic obstructive pulmonary disease; bronchial asthma, chronic kidney disease); and hyperglycaemia diagnosed for the first time during RHS.

The study was performed in accordance with the Declaration of Helsinki (2000); it did not violate the rights and freedoms of subjects and did not jeopardise their safety . Each patient provided their voluntarily informed consent for the participation in the study. This study was approved by the Local Ethics Committee at the Federal Budgetary Scientific Institution Nizhny Novgorod Scientific Research Institute of Hygiene and Occupational Pathologies (meeting minutes No. 1 dated January 26, 2021).

Based on a special assessment of the working conditions provided by the employer, all subjects were divided into two groups. The main group included 148 males (mean age: 41 [35; 48] years old), at the working stations of which the noise level exceeded the maximum permissible level (80 dBA), whereas all other occupational factors were normal. Mean duration of working in conditions of noise exposure in the main group was 15.5 [10.0; 23.0] years. Controls were 90 males (mean age: 40 [34; 49] years old), the social and economic status of which was similar to that in the main group and at the working stations of which all hazardous occupational factors, including noise, were normal.

The clinical and demographic characteristics of patients are presented in the table (Table 1).

Table 1. *Clinical and demographic characteristics of patient groups*

	The main group (148 people)	**Comparison group (90 people)**	**Significance level p**
Age, years, Me [Q_{25}; Q_{75}]	41 [35; 48]	40 [34; 49]	0,86
The number of persons under the age of 40 inclusive, n (%)	68 (45,9)	44 (48,9)	0,66
The number of persons aged 55 and over inclusive, n (%)	15 (10,2)	15 (16,7)	0,14
The number of people with heredity burdened by cardiovascular pathology, n (%)	27 (19,6)	20 (22,5)	0,60
Number of smokers, n (%)	80 (54,1)	53 (58,9)	0,47
The number of people suffering from hypertension, n (%)	24 (16,2)	13 (14,4)	0,71
Body mass index, kg/m^2, M±SD	26,8±3,2	26,8±4,0	0,96
The number of obese people, n (%)	25 (16,9)	18 (20)	0,55
The number of people with total blood cholesterol≥5.0 mmol/l, n (%)	88 (59,5)	44 (48,9)	0,11

Table 2. Structure of antihypertensive therapy in patient groups, n (%)

Groups of medicines	The main group (24 people)	Comparison group (13 people)	Significance level (p)
ACE inhibitors or ARBs	13 (54,2)	7 (53,8)	0,74
ACE inhibitors or ARBs + diuretics	8 (33,3)	4 (30,8)	0,59
ACE inhibitors + CCB	2 (8,3)	1 (7,7)	0,72
ACE inhibitors or ARBs + beta blockers.	1 (4,2)	1 (7,7)	0,59

Notes: ACE inhibitors — angiotensin converting enzyme inhibitors, ARBs — angiotensin II receptor blockers, CCB — calcium channel blockers, beta-blockers — beta-adrenoceptor antagonists

According to the information presented, there were no statistically significant differences between groups in terms of the main cardiovascular risk factors: age, BMI, incidence of smoking, obesity, hypercholesterolemia and arterial hypertension (AH).

AH was diagnosed in accordance with the current clinical guidelines [13]. At the time of inclusion in the study, all patients with AH were taking antihypertensives: angiotensin converting enzyme inhibitors (ACEi), angiotensin II receptor blockers (ARB), calcium channel-blocking agents (CCB), beta-blocking agents (BBA), diuretics. The structure of the antihypertensive therapy in groups of patients is presented in the table (Table 2).

According to the data presented, there were no major differences in the structure of the antihypertensive therapy in the study groups.

All patients underwent a comprehensive medical examination, which included physical examination with anthropometry and Quetelet body mass index calculation (BMI = body mass (kg)/ height (m^2)); chest X-ray; laboratory (complete blood count, urinalysis, blood glucose, total cholesterol) and functional (ECG) tests. Vascular wall condition was assessed using 3D sphygmography performed under a standard method before noon (VaSera — VS 1500N, FukudaDenshi, Japan). During 3D sphygmography, the following parameters were calculated automatically: cardio-ankle vascular index (CAVI) on the right and left sides, estimated vascular age. Early vascular ageing syndrome (EVA-syndrome) was a clinical condition, in which the estimated age of an artery was at least 4 years older than the real age of the patient (criteria VaSera) [3].

Resulting data were processed statistically using Statistica 6.1 (Stat Soft, USA). Normality of quantitative data distribution was checked using Shapiro-Wilk's test. The tabular data are given as a mean value (M) and standard deviation (SD) or a median value (Me) and interquartile range [Q_{25}; Q_{75}], depending on the type of distribution. When parameter values were compared in two unassociated groups, modified Student t-test (taking into account uneven dispersion) and Mann-Whitney u-test in non-parametric distribution were used. When parameter values were compared in two associated groups, Wilcoxon test was used. Where a frequency estimation was performed, tabular data were presented as an absolute and relative frequency of the parameter (n (%)). In order to compare frequencies of a parameter in two groups, χ^2, Yates corrected χ^2 or Fisher's exact test were used (depending on the absolute frequency of a parameter in the groups). Differences between groups were statistically significant at $p < 0.05$.

Results and Discussion

3D sphygmography results obtained during the study are presented in the table (Table 3).

Patients in the main group had statistically higher vascular wall rigidity index, both on the right and left sides. According to a number of studies, CAVI for patients of 31–40 years old is 7.4 ± 0.63 units, while in patients of 41–50 years old, it is 7.55 ± 0.7 units [14]. Therefore, neither in the main group not in controls, mean CAVI was higher than the age-associated normal value, thus indicating challenges in the identification of changes in a vascular was exposed to noise.

A higher estimated artery age in the main group could be indicative of impaired biological mechanisms, maintaining normal vascular wall elasticity. Besdies, in persons exposed to noise, the estimated artery age was 44 [39; 54] years and was statistically higher than the real age of patients (41 [35; 48] year) (Wilcoxon test, $p < 0.001$), whereas in controls these values were 39 [34; 39] years and 40 [34; 39] years, respectively, and were comparable (Wilcoxon test, $p = 0.52$). Over one forth of patients in the main group had early vascular ageing syndrome, while in controls the incidence of this syndrome was 3.6 times lower ($p = 0.003$).

Given comparability of groups in terms of main cardiovascular risk factors and exclusion criteria, it is impossible to rule out that the identified differences in D sphygmography results were associated with exposure of patients from the main group to noise.

Table 3. *Indicators of volumetric sphygmography in the study groups*

	The main group (148 people)	Comparison group (90 people)	Significance level (p)
R — CAVI, Me [Q_{25}; Q_{75}],	7,25 [6,8; 7,8]	7,1 [6,5; 7,6]	0,016
L — CAVI, Me [Q_{25}; Q_{75}],	7,2 [6,9; 7,8]	7,1 [6,6; 7,7]	0,025
Estimated age of the arteries, years, Me [Q_{25}; Q_{75}],	44 [39; 54]	39 [34; 39]	0,035
The number of people with EVA syndrome, n (%)	42 (28,4)	7 (7,8)	0,003

Notes: CAVI — cardio-ankle vascular index (R — on the right, L — on the left), EVA — syndrome — syndrome of early vascular aging

Table 4. *Indicators of volumetric sphygmography in the groups of patients, depending on arterial hypertension*

	with AH			without AH		
	The main group (24 people)	Comparison group (13 people)	Significance level (p)	The main group (124 people)	Comparison group (77 people)	Significance level (p)
R — CAVI, Me [Q_{25}; Q_{75}],	8,1 [6,8; 9,15]	7,9 [7,6; 8,4]	0,91	7,2 [6,8; 7,7]	7,0 [6,4; 7,4]	0,005
L — CAVI, Me [Q_{25}; Q_{75}],	7,9 [7,0; 8,85]	8,4 [7,7; 8,8]	0,90	7,2 [6,9; 7,6]	6,9 [6,5; 7,5]	0,007
Estimated age of the arteries, years, Me [Q_{25}; Q_{75}],	56,5 [44; 64]	59 [49; 64]	0,75	44 [34; 49]	39 [29; 44]	0,011
The number of people with EVA syndrome, n (%)	11 (45,8)	2 (15,4)	0,07	31 (25)	5 (6,5)	0,0005

Notes: CAVI — cardio-ankle vascular index (R — right, L — left), EVA syndrome — early vascular aging syndrome

However, some patients from both groups had confirmed AH, and each of them was taking antihypertensives. According to some researches, AH is a key determinant of early vascular ageing [3]. As for the effect of antihypertensives on vascular wall elasticity, currently there are evidences of reduced vascular rigidity with regular administration of products, which stabilise blood pressure [15, 16]. Despite the absence of significant differences in the structure of antihypertensive therapy in the study groups, it was necessary to account for the individual character of changes in vascular wall rigidity in response to the intake of antihypertensives. Besides, since the study was cross-sectional, it was impossible to reliably assess compliance with antihypertensive therapy and the degree of achievement of target blood pressure values. Therefore, analysis of 3D sphygmography values in patients with and without AH, depending on exposure to noise, seems to be more informative. Analysis of resulting values in presented in the table (Table 4).

An increase in the vascular wall rigidity index and estimated artery age in men exposed to noise was observed only in subjects without AH. EVA-syndrome was more common in subjects with AH who was exposed to occupational noise — 11 cases (45.8 %), and was rare in subjects with normal blood pressure who were not exposed to noise — 5 cases (6.5 %). The mean age of patients with AH in the main group was 48.3 ± 9.7 years old, in controls — 53.4 ± 8.2 years old. Subjects with AH exposed to occupational noise were slightly younger than subjects in the control group; however, the differences were not statistically significant (p = 0.12). Thus, intake of antihypertensives in AH concealed changes in vascular wall resulting from exposure to loud noise. Smoking was likely to have a similar effect. According to literature, smoking adversely affects the arterial wall condition. In studies conducted over 10 years ago, arterial rigidity was growing in regular smokers [17, 18]. A literature review of the effect of smoking on the pulse wave velocity and augmentation index demonstrated that acute, chronic and even passive smoking adversely affect the condition of vascular wall and increase its rigidity [19]. The negative impact of tobacco consumption on arterial rigidity can be observed at young age with a short smoking history [20]. The objective of this study was not to assess the

Table 5. *Indicators of volumetric sphygmography in the studied groups of people, depending on smoking*

	Smokers			Non-smokers		
	The main group (80 people)	**Comparison group (53 people)**	**Significance level (p)**	**The main group (68 people)**	**Comparison group (37 people)**	**Significance level (p)**
R — CAVI, Me [Q_{25}; Q_{75}],	7,15 [6,7; 7,65]	7,1 [6,6; 7,4]	0,60	7,45 [6,9; 8,35]	7,0 [6,1; 7,8]	0,004
L — CAVI, Me [Q_{25}; Q_{75}],	7,1 [6,7; 7,5]	7,1 [6,7; 7,6]	0,97	7,55 [7,0; 8,3]	7,0 [6,1; 7,7]	0,003
Estimated age of the arteries, years, Me [Q_{25}; Q_{75}],	39 [34; 49]	39 [34; 49]	0,65	44 [39; 59]	39 [24; 49]	0,002
The number of people with EVA syndrome, n (%)	19 (23,8)	6 (11,3)	0,12	23 (33,8)	1 (2,7)	0,0001

Notes: CAVI — cardio-ankle vascular index (R — right, L — left), EVA syndrome — early vascular aging syndrome

Table 6. *Volumetric sphygmography indicators depending on noise exposure in non-smoking patients without arterial hypertension*

	The main group (51 people)	**Comparison group (31 people)**	**Significance level (p)**
R — CAVI, Me [Q_{25}; Q_{75}],	7,2 [6,9; 7,9]	6,9 [5,9; 7,3]	0,002
L — CAVI, Me [Q_{25}; Q_{75}],	7,3 [7,0; 7,9]	7,1 [5,9; 7,5]	0,0009
Estimated age of the arteries, years, Me [Q_{25}; Q_{75}],	44 [39; 54]	34 [24; 44]	0,0003
The number of people with EVA syndrome, n (%)	14 (27,5)	1 (3,2)	0,004

Notes: CAVI — cardio-ankle vascular index (R — right, L — left), EVA syndrome — early vascular aging syndrome

impact of smoking on arterial rigidity, therefore, exclusion of smokers from analysis was considered informative. Results of 3D sphygmography comparison in the study groups, with account to the smoking status, are presented in the table (Table 5).

It has been found that a higher vascular rigidity index, higher estimated arterial age and higher incidence of early vascular ageing syndrome were observed only in non-smokers. The results demonstrated that smoking, a contributor to the arterial wall condition, could interfere with identification of changes in vascular rigidity caused by exposure to noise. Currently, literature sources confirm the ability of smoking to affect arterial rigidity. A large population-based study in 15,010 patients demonstrated that smoking facilitates an increase in arterial rigidity both in men and women [21]. Studies by Russian researchers show that CAVI is higher in a group of smoking patients [8] and correlates with the smoking history [22].

Thus, in order to understand the role of smoking in changes of the vascular wall condition, the most informative is an analysis of 3D sphygmography parameters in non-smokers who do not suffer from arterial hypertension. Analysis results are presented in the table (Table 6).

Given all results, it can be concluded that 3D sphygmography parameters presented in Table 6 were most representative of changes in vascular wall elasticity caused by exposure to noise. However, once non-smokers and subjects with AH were excluded from the study, the real age of patients in the main group was 42 [37; 48] years old, that is, statistically higher than the real age of controls — 36 [30; 45] years (p = 0.017). Therefore, the vascular rigidity index should have been adjusted depending on the age group of patients. According to the literature, average differences in vascular rigidity index between age groups of 31–40 years old and 41–50 years old is 0.15 units [13]. Available information was used for age-related correction of CAVI in controls. The obtained results are presented in the table (Table 7).

Despite the adjustment factor, CAVI on the right and left side in the main group was still higher than the value in controls. The estimated artery age in the study groups

Table 7. *Volumetric sphygmography scores in normotensive nonsmokers adjusted for age, Me [Q_{25}; Q_{75}]*

	The main group (51 people)	Comparison group (31 people)	Significance level (p)
R — CAVI	7,2 [6,9; 7,9]	7,05 [6,05; 7,45]	0,02
L — CAVI	7,3 [7,0; 7,9]	6,85 [6,05; 7,65]	0,007

Notes: CAVI — cardio-ankle vascular index (R — right, L — left)

did not require adjustments, since it could be compared with the real age of patients. In the groups of subjects exposed to noise, the estimated artery age was 44 [39; 54] years, and was statistically higher than the real age — 42 [37; 48] years (p = 0.004), whereas in the control group, these values similar: 34 [24; 44] years and 36 [30; 45] years, respectively (p = 0.27).

Analysis of the incidence of early vascular ageing syndrome also did not require adjustments, since in diagnosis of this syndrome, individual parameters of vascular rigidity were compared to the age-appropriate normal value. The incidence of EVA-syndrome in non-smokers who did not suffer from AH was significantly higher in men exposed to occupational noise: 14 cases (27.5 %) in the main group vs. 1 case (3.2 %) in the control group (p = 0.004).

Literature sources discuss a few studies containing information on the condition of vascular wall when the body is exposed to working-environment factors. Studies by Russian researchers demonstrated higher vascular rigidity in subjects exposed to industrial aerosols [23] and high copper concentrations in workplace air [24]. Foreign researchers showed an increased thickness of carotid intima-media complex when the body was exposed to loud noise [25]. However, changes in vascular rigidity in patients exposed to occupational noise have not been studied thoroughly. Therefore, this study allows suggesting a possible mechanism of the effect of noise on the cardiovascular system and emphasises the need for thorough follow-up of the heart and vessel condition in persons exposed to loud noise. In the future, it is advisable to study the correlation between the current noise level and the risk of late cardiovascular events.

Conclusions

Men exposed to occupational noise had a higher arterial wall rigidity index as compared to men who were not exposed to noise. The estimated arterial age values in subjects exposed to noise were significantly higher than the real age. The incidence of early vascular ageing syndrome in subjects exposed to occupational noise was 8.6 times higher vs. persons who were not exposed to hazardous occupational factors (after adjustment for the standard cardiovascular risk factors: age, smoking and arterial hypertension). Thus, exposure of the human body to higher than normal noise levels can be seen as a factor contributing to faster vascular ageing.

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