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Association of coronary heart disease and sleep disorders among men in a medium-sized urban city of Western Siberia

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ABSTRACT

The aim of the study was to establish the association of the prevalence of coronary heart disease and sleep disorders among men between the ages of 25 and 64 belonging to an open population of a medium-sized urban city of Western Siberia.

Materials and methods. A cross-sectional epidemiological study was conducted on a representative sample of the population among males of 25–64 years old in Tyumen. The prevalence of coronary heart disease was determined based on standard epidemiological methods. Self-assessments by participants in the study of quality of sleep was determined by the World Health Organization Monitoring Trends and Determinants in Cardiovascular Disease-Psychosocial Program (WHO MONICA-psychosocial). When calculating the odds ratio of developing coronary heart disease (CHD), self-reports of satisfactory, good, or very good sleep were regarded as a lack of an indicator; while very bad and bad sleep were considered positive indicators.

Results. The prevalence of CHD according to the extended epidemiological criteria for men in an open urban population was 12.4%; the detection rate of "definite" and "possible" CHD was almost equal. The age-standardized prevalence rate of sleep disorders was 50.9%. There is a significant risk of developing CHD with extended criteria (5.05), as well as "definite" (5.28) and "possible" (3.13) forms in the male population at 25–64 years of age. In the 55 to 64 age group, there is a significant risk of developing CHD according to the extended criteria (5.57) and the "definite" form of CHD (10.21).

Conclusion. Thus, the findings suggest the importance of further study of sleep disorders in working age men in Siberian populations, its relationships with conventional and non-conventional risk factors of CHD, as well as the feasibility of preventive measures aimed at reducing the influence of psycho-emotional stress factors among the Russian population.

Key words: epidemiological study, coronary heart disease, sleep disorders, open population, men.

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Ассоциации распространенности ишемической болезни сердца и нарушений сна среди мужчин открытой популяции среднеурбанизированного города Западной Сибири

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РЕЗЮМЕ

Целью исследования явилось установление ассоциации распространенности ишемической болезни сердца (ИБС) и нарушений сна среди мужчин открытой популяции 25–64 лет среднеурбанизированного города Западной Сибири.

Материалы и методы. На репрезентативной выборке населения среди лиц мужского пола 25–64 лет было проведено кросс-секционное эпидемиологическое исследование на модели г. Тюмень. Распространенность ИБС определялась на основании стандартных эпидемиологических методов. Самооценка сна определялась по алгоритмам программы ВОЗ «МОНИКА-психосоциальная». При расчете отношения шансов развития ИБС сон удовлетворительный, хороший, очень хороший расценивались как отсутствие признака, сон очень плохой, плохой – как присутствие.

Результаты. Распространенность ИБС по расширенным эпидемиологическим критериям у мужчин открытой городской популяции составила 12,4%, частота выявления «определенной» и «возможной» ИБС была практически одинаковой. Стандартизованный по возрасту показатель распространенности нарушений сна составил 50,9%. В мужской популяции 25–64 лет при нарушении сна установлен существенный риск развития ИБС по расширенным критериям (5,05), а также «определенной» (5,28) и «возможной» (3,13) ее форм. В возрастной категории 55–64 лет установлен существенный риск развития ИБС по расширенным критериям (5,57) и «определенной» формы ИБС (10,21).

Заключение. Полученные данные свидетельствуют о важности дальнейшего изучения нарушения сна у мужчин трудоспособного возраста в сибирских популяциях, его взаимосвязей с конвенционными и неконвенционными факторами риска ИБС, а также о целесообразности превентивных мероприятий, направленных на снижение влияния факторов психоэмоционального напряжения среди российского населения.

Ключевые слова: эпидемиологическое исследование, ИБС, нарушение сна, открытая популяция, мужчины.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии финансирования при проведении исследования.

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INTRODUCTION

In scientific literature, term of sleep is defined, on the one hand, as natural state of body that determines normal functioning of all its systems and organs, and, on the other hand, as one of the important factors affecting the level of population health. The main function of sleep is a recovery process, which, to a large extent, allows body to adapt to changing conditions of internal and external environment. If it is disturbed, adaptation possibilities decrease, which ultimately leads to the development of somatic pathology, and most significantly cardiovascular diseases (CVD) [1]. In scientific literature, dyssomnia is a term for sleep disturbance (SD) combining the following types of sleep disorders: insomnia – difficulty initiating and maintaining sleep; hypersomnia – sleepiness during the day and excessive sleep; parasomnia – periodic night phenomena (heterogeneous group). Much research devoted to the study of sleep disorders indicate dissatisfaction of people with their sleep and shorter duration of sleep in a significant part of the population [2]. The results of a US National Commission study on sleep disorder showed that nearly 40% of America's population has sleep problems, and more than 40 million adults are suffering from chronic sleep disorders, while almost 30 million have periodic insomnia [3].

Recent studies, which transformed the European guidelines for cardiovascular prevention regarding the importance of psychosocial CVD risk factors (RF), indicate that cardiovascular risk and prognosis essentially determine psychosocial RF. These include factors of chronic social stress as well as negative psycho-emotional states (vital exhaustion, trait anxiety, depression), which in turn, are main factors of SD [4–6]. Changes in autonomic cardiovascular regulation, which turn sleep into periods of significant physiological storms characterized by sudden and abrupt changes in heart rate and blood pressure, are associated with cyclical phases of fast and slow sleep. Revealed cardiovascular instability related to phases of sleep served as a basis for studies on the determination of CVD risk and prognosis, primarily, depending on duration and changes in cyclic phases of sleep. There is a number of studies in which SD acts as a possible risk factor for progression and initiation of cardiovascular pathology [7–9]. In accordance with this, the risk of coronary artery disease (CAD) development due to sleep disorders seems relevant and timely in an open population of working age males.

The aim of the study was to establish the association of CAD prevalence and SD among men between the ages of 25 and 64 belonging to an open population of a medium-sized urban city of Western Siberia.

MATERIALS AND METHODS

A cross-sectional epidemiological study was conducted on a randomly selected representative sample of population from voting lists of the Central Administrative District Tyumen (males aged 25–64, $n = 1000$, $n = 250$ in every decade of life), the response rate was 85.0%.

Within cardiological screening, a resting 12-lead electrocardiogram (ECG) was performed in the supine position.

According to the advanced epidemiological criteria, CAD prevalence was determined based on standard epidemiological methods with the establishment of CAD according to rigorous epidemiological criteria: a "definite" form of CAD (DCAD) and non-rigorous epidemiological criteria : a "possible" form of CAD (PCAD).

DCAD was established on the basis of a positive answer to the WHO questionnaire (effort angina) and The Minnesota Code Manual of Electrocardiographic Findings, including "definite" myocardial infarction (MI), effort angina and painless form of CAD. The basis for PCAD determination was The Minnesota Code Manual of Electrocardiographic Findings, which included "possible" MI, "possible" ischemia, ischemia with left ventricular hypertrophy, and ARRHYTHIAS (arrhythmic form of CAD).

Study of non-conventional (psychosocial) risk factors for CAD was carried out by means of strictly standardized methods of the WHO MONICA-psychosocial program algorithms, using the standard questionnaire [7].

Self-assessment of sleep was determined by the method of questionnaire and included the following responses: very good sleep, good sleep, fair sleep, poor sleep, very poor sleep. When calculating odds ratio for CAD develop-

ment in males with SD, fair, good, very good sleep were considered as the absence of a sign; very poor sleep and poor sleep were considered as the presence of a sign.

Statistical data analysis was performed using the standard IBM SPSS Statistics software, application package, version 21.0.

Age-standardization of quantitative rates was carried out in accordance with the last census of the Russian Federation population (urban male population aged 25–64), age-standardized rates (ASR) were determined. The criterion of Pearson chi-square test (χ^2) was used to assess statistical significance of differences between two groups, $p < 0.05$ was taken as critical level of significance in testing statistical hypotheses.

Prevalence associations of SD and CAD were established by calculating the odds ratio with 95% confidence intervals.

RESULTS

Cardiac screening results showed high prevalence of CAD according to the advanced epidemiological criteria – the age-standardized rate (ASR) in the population was 12.4%.

In the population of Tyumen aged 25–64, incidence of DCAD and PCAD detection was almost the same.

According to rigorous epidemiological criteria, the most vulnerable age periods in relation to the increase in CAD prevalence of Tyumen males were the 45–54 and 55–64 age groups, while according to non-rigorous and expanded criteria the entire age range was vulnerable (Fig. 1).

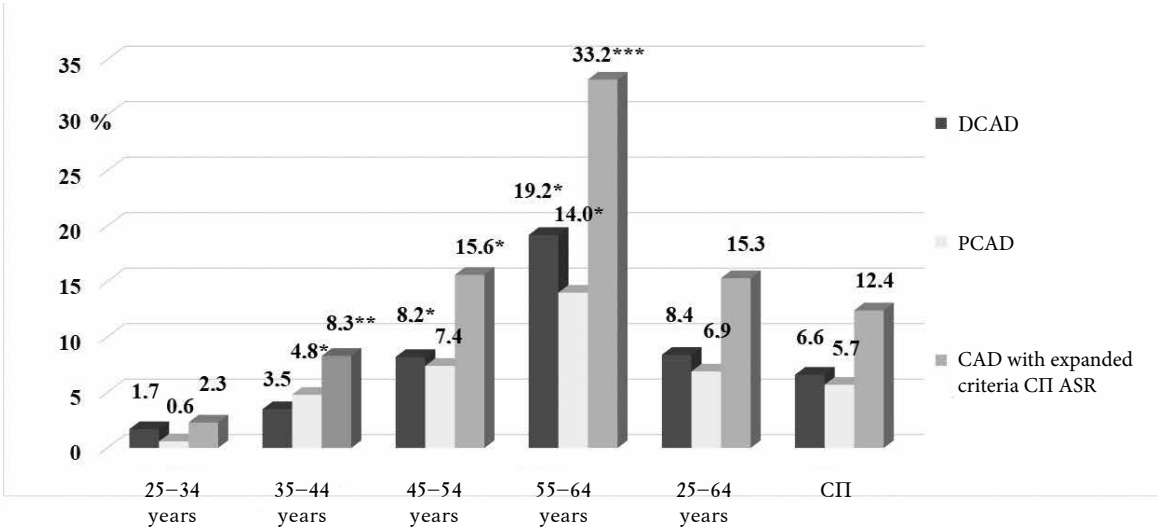

Fig.1. Prevalence of CAD in men aged 25–64 years in an open population; ASR – age-standardized rate; * $p < 0.5$; ** $p < 0.01$; *** $p < 0.001$ – statistical significance of differences between two subsequent age groups

The table shows the results of study on SD in population. 49.2% (ASR) of urban male population identified their sleep as very good or good. The prevalence of "poor sleep" was 8.9%, and "very poor sleep" was 0.6% of male population. Significantly more "very good" answers to the question "How do you sleep?" were received in the youngest (25–34) age group studied compared with the 45–54 age group. Furthermore, the answer "good" was registered more often in young adults aged 25–34 and 35–44, statistically significant differences in these groups and such answers were found in relation to corresponding rates in the mature adults aged 45–54 and 55–64, while in the youngest and oldest age categories, statistically significant differences were also registered at the general population rate.

With regard to fair sleep, in young people in the third decade of life, statistically significant differences were revealed in relation to rates in older age categories and ASR. In the sixth decade of life, fair sleep was registered much more often than in the fourth decade. Poor sleep was also revealed much more often in the 45–54 and

55–64 age categories and in the entire population compared with the rate in young adults aged 25–34; the rate 1.5 times prevailed over ASR in the 55–64 age category. The ASR prevalence rate of respondents with poor and very poor sleep was 9.5% in male population. Good and very good sleep were registered more often in young age categories, fair and poor sleep were in older age categories (Table). Figure 2 shows the odds ratio in the presence-absence of SD and CAD according to rigorous, non-rigorous and the advanced epidemiological criteria in male population aged 25–64. Thus, SD in the population showed the highest risk of CAD (5.28 with 95% CI = 2.67–10.46, $p < 0.05$) and DCAD according to expanded criteria (5.05 with 95% CI = 2, 92–8.74, $p < 0.05$), while the risk of PCAD in the presence of SD was also significant and amounted to 3.13 (95% CI = 1.47–6.65, $p < 0.05$) (fig. 2).

The same trend was not found among different age decades of life, while the rate reached statistical significance only in the 55–64 age category, when the risk of DCAD in the presence of SD almost doubled in this age category compared with the same rate in the general population (10.21 at 95% CI = 3.26–31.93, $p < 0.05$).

According to the advanced epidemiological criteria, risk of CAD in the presence of NS remained basically unchanged in the 55–64 age group compared with the rate of general population (5.57 with 95% CI = 2.30–13.52, $p < 0.05$), and the risk of CAD in the presence of SD was statistically insignificant in the older age group (Fig. 3).

Table

Sleep disturbance in the male population of 25–64 years depending on age

Question/attitude	Age ranges										
	25–34		35–44		45–54		55–64		25–64		CII
	abc.	%	abc.	%	abc.	%	abc.	%	abc.	%	%
How well do you sleep?											
Very well	20	11.3	19	8.3	12	5.2*	13	6.1	64	7.5	8.0
Well	92	52.0	101	44.3	79	34.2***$_{*}$	59	27.6***$_{***}$	331	$_{**}$38.9**	41.2
Satisfactorily	59	33.3	90	39.5	110	47.6**	105	49.1**$_{*}$	364	42.8*	41.4
Badly	6	3.4	17	7.5	28	12.1**	34	15.9***$_{**}$	85	$_{*}$10.0**	8.9
Very badly	0	0.0	1	0.4	2	0.9	3	1.4	6	0.7	0.6

Notes: statistically significant differences in rates between the 25–34 age group and other age groups are indicated by asterisk (*) in the upper case on the right; between the 35–44 age group and other age groups – in the lower case on the right; between the 45–54 age group and other age groups – in the upper case on the left; between the 55–64 and 25-64 age groups – in the lower case on the left. ASR is the age-standardized rate.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

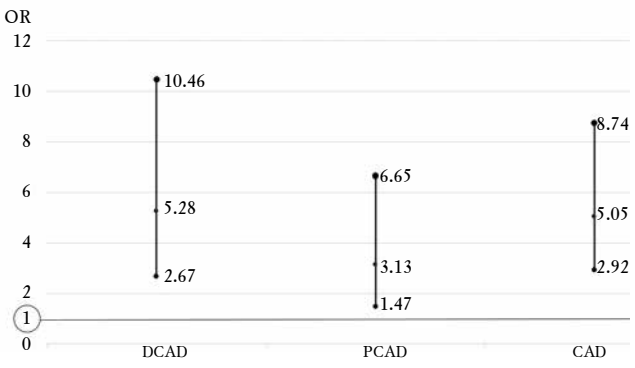

Fig. 2. Odds ratio of developing coronary artery disease relative to sleep disturbance in an open male population aged 25–64 years

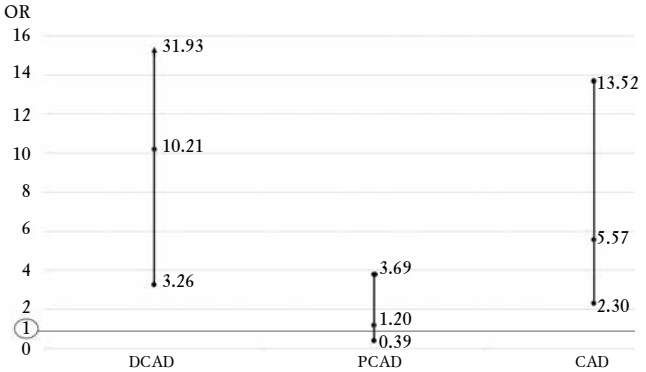

Fig. 3. Odds ratio of developing coronary artery disease relative to sleep disturbance in male population aged 55–64 years

DISCUSSION

In the male population of a medium-sized urban city of Western Siberian (on the model of Tyumen city), ASR prevalence rate of SD was 50.9%. The rate was found to be quite high, but also comparable with the data established on other Siberian populations, namely, the results of Tomsk (61.2%) and Novosibirsk (48.3%) research on working male urban populations [7, 10].

According to T.M. Maximova's study results, among the Russian population, SD rate was on average of 30%, with minimum values of the indicators in young males, and with maximum values in older respondents [11].

At the same time, in the current study among Tyumen males, the incidence rate of SD also prevailed in older age.

According to domestic and foreign researchers, SD appears in presence of psycho-emotional stress factors, such as trait anxiety, vital exhaustion, depression, and, in accordance with this, serves as a predictor of CAD development [2, 3, 5–7, 12].

The study of self-assessment of sleep quality makes it possible to identify SD rate in population, to assess problems associated with SD differentially in various population groups, and to establish groups of population with increased risk of cardiovascular pathology, respectively.

In Tyumen, high SD gradations were five times more likely in males with CAD than in males without CAD, the same tendency was in males with DCAD.

SD with CCAD was detected three times more often compared to ASR in the general population.

In accordance with the current study results concerning other psychosocial factors in Tyumen population [6, 13], general population trends prevailed in the older 55–64 age category, however, alternatively to other factors of psycho-emotional stress, high gradations of SD were significantly more often registered, starting in the 35–44 age category in individuals with DCAD.

This situation is likely to be consequential, because, a significant number of patients with chronic SD associate their complaints with their life situation, and according to studies' data in most cases personal problems predominate. SD arise in connection with problems of identity in the young age, and SD are associated with negative attitudes toward ageing, fear of death and dissatisfaction with overall living in old age. [2].

In Tyumen, the results are confirmed by the data of other studies regarding SD as a predictor of CAD. So, in Novosibirsk male population aged 25–64 with SD and with self-estimation of sleep as "poor", the relative risk of CAD was 2.6 over 10 years of prospective observation compared to males with self-estimation of sleep as "good" [7]. Data analysis of cross-sectional Cardiovascular Health Study in unorganized population showed that daytime sleepiness in males as the only SD was associated with cardiovascular death [12].

According to results of cross-sectional study in Finnish population, the highest prevalence of CAD was found among males whose night sleep was 6 hours or less, and ratio remained after inclusion in multifactor model such parameters as conventional CAD risk factors (smoking, arterial hypertension, alcohol), and in addition, sleep quality, age, taking tranquilizers and sleeping pills, "Coronary" type of personality and presence of psychosocial factors [14].

Thus, findings indicate the importance of further studying in SD of workable male of Siberian populations, its relationships with conventional and non-conventional risk factors for CAD, and expedience of preventive measures aimed to reduce the influence of psycho-emotional stress factors among the Russian population.

CONCLUSION

According to the advanced epidemiological criteria, CAD prevalence was 12.4%, DCAD and PCAD detection rate was almost the same in an open urban male population. ASR prevalence rate for SD was 50.9%. According to the advanced criteria, significant risk of CAD (5.05) was established in male population with SD aged 25–64, as well as DCAD (5.28) and PCAD (3.13). According to expanded criteria, significant risk of CAD (5.57) and DCAD (10.21) was established in the 55–64 age category.

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