CLINICAL AND PSYCHOLOGICAL CORRELATIONS WITH TYPE D PERSONALITY IN PATIENTS WITH CHRONIC CORONARY SYNDROME

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ABSTRACT

Recently, it has become common to identify type D personality, which is predisposed to the development of psychological distress. Negative behavioral characteristics of individuals with type D personality contribute not only to the development of cardiovascular diseases, but also to other comorbid pathologies that can influence the progression and prognosis of coronary heart disease.

The aim of the study. *To identify clinical and psychological correlations with type D personality in patients with chronic coronary syndrome.*

Methods. *The study included 113 patients (68 men and 45 women; median age – 64 years) admitted for planned percutaneous coronary intervention at the Research Institute for Complex Issues of Cardiovascular Diseases (Kemerovo, Russian Federation). Based on the results of the DS-14 test, patients were divided into two groups: patients with type D personality (n = 40) and patients without this type (n = 73).*

Results. *In patients with chronic coronary syndrome with type D personality, compared with patients without this type, concomitant diabetes mellitus (35 % and 15 %, respectively; p = 0.018), signs of diastolic dysfunction of left (E/e' ratio 7.1 [6.48; 8.0] and 5.0 [4.55; 5.74], respectively; p = 0.0038) and right (Et/At ratio – 0.8 [0.66; 1.35] and 1.38 [1.28; 1.63], respectively; p = 0.014) ventricles were more often diagnosed. Correlation analysis revealed associations of diabetes mellitus with type D personality (r = 0.243; p = 0.011), severity of negative excitability (r = 0.253; p = 0.008) and social suppression (r = 0.224; p = 0.020), as well as association of ankle-brachial index (ABI) with the severity of negative excitability (r = 0.393; p = 0.004) and social suppression (r = 0.414; p = 0.002).*

Conclusion. *In patients having chronic coronary syndrome with type D personality, concomitant diabetes mellitus, as well as left and right ventricular filling disorders are more often detected. Correlation analysis revealed associations of diabetes mellitus with type D personality and its subscales; the ABI level was associated with subscales of type D personality, but not with the level of anxiety and depression.*

Key words: *type D personality, psychological risk factors, chronic coronary syndrome*

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КЛИНИКО-ПСИХОЛОГИЧЕСКИЕ КОРРЕЛЯЦИИ ПРИ ТИПЕ ЛИЧНОСТИ Д У БОЛЬНЫХ ХРОНИЧЕСКИМ КОРОНАРНЫМ СИНДРОМОМ

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РЕЗЮМЕ

В последнее время принято выделять тип личности Д, предрасположенный к развитию психологического дистресса. Негативные поведенческие особенности лиц с типом личности Д способствуют не только развитию сердечно-сердечных заболеваний, но и другой коморбидной патологии, способной влиять на прогрессирование и прогноз ишемической болезни сердца (ИБС).

Цель исследования. *Выявить клинико-психологические корреляции при типе личности Д у больных хроническим коронарным синдромом.*

Методы. *В исследование включены 113 пациентов (68 мужчин и 45 женщин; медиана возраста – 64 года), поступившие на плановое чрескожное коронарное вмешательство (ЧКВ) в ФГБНУ «Научно-исследовательский институт комплексных проблем сердечно-сосудистых заболеваний». По результатам теста DS-14 пациенты были разделены на две группы: пациенты с типом личности Д (n = 40) и пациенты с его отсутствием (n = 73).*

Результаты. *У больных хроническим коронарным синдромом с типом личности Д по сравнению с пациентами с отсутствием типа Д чаще диагностировали сопутствующий сахарный диабет (35 % и 15 % соответственно; p = 0,018), признаки диастолической дисфункции левого (отношение E/e' – 7,1 [6,48; 8,0] и 5,0 [4,55; 5,74] соответственно; p = 0,0038) и правого (отношение Et/At – 0,8 [0,66; 1,35] и 1,38 [1,28; 1,63] соответственно; p = 0,014) желудочка. При корреляционном анализе выявлены ассоциации сахарного диабета с типом личности Д (r = 0,243; p = 0,011), выраженностью негативной возбудимости (r = 0,253; p = 0,008) и социального подавления (r = 0,224; p = 0,020), а также ассоциации лодыжечно-плечевого индекса (ЛПИ) с выраженностью негативной возбудимости (r = 0,393; p = 0,004) и социального подавления (r = 0,414; p = 0,002).*

Заключение. *У больных хроническим коронарным синдромом с типом личности Д чаще выявляется сопутствующий сахарный диабет, а также нарушения наполнения левого и правого желудочка. При корреляционном анализе выявлены ассоциации сахарного диабета с типом личности Д и его подшкалами, уровень ЛПИ был ассоциирован с подшкалами типа личности Д, но не с уровнем тревожности и депрессии.*

Ключевые слова: *тип личности Д, психологические факторы риска, хронический коронарный синдром*

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INTRODUCTION

Currently, the main trend in medical care is a patient-oriented approach. This is a fairly broad term that includes both personalized medicine (assessment of genetic and epigenetic factors, consideration of gender, ethnic, and social characteristics) and indicators focused on the personal traits of the patient (the effect of treatment on quality of life, the patient's choice of the nature of treatment depending on the profession, psychological characteristics, etc.). In the latter case, it is inevitably necessary to take into account the psychological characteristics of the patient, for example, attitude to the disease [1], ways to overcome stressful situations [1–3], manifestations of psychological distress [2, 4, 5]. Recently, it has been customary to identify a special type of personality predisposed to the development of psychological distress (or type D personality). It is characterized by a combination of pessimistic emotions in response to stressful situations and introversion [6]; people with this type of personality more often develop depressive reactions [2, 7]. The presence of type D personality is associated with poor quality of life [8–10] and with an unfavorable prognosis for various diseases [11, 12]. Cardiovascular diseases have been studied most of all in this regard; exactly in these diseases that this type of personality was first identified and proposed for clinical use [13]. Further studies have made some clarifications to the prognostic effect of type D personality: a negative effect on the prognosis was confirmed in patients with coronary heart disease (CHD) and in younger patients [14, 15] and none was found in chronic heart failure (CHF) and in older age groups [16]. The adverse effect on the prognosis in patients with CHD with type D personality makes us think about both the possible mechanisms through which this prognosis is realized, and ways to correct this effect. In general, two main pathogenetic mechanisms of realization of the negative impact of type D personality in patients are considered: biological (exposure through activation of neurohormonal systems in response to stressful effects, development of endothelial dysfunction, etc. [16–18]) and behavioral (tendency to an unhealthy lifestyle, negative reaction to doctor's recommendations, less frequent seeking medical help [19]). In addition, negative behavioral features of individuals with type D personality contribute not only to the development of cardiovascular diseases, but also to other comorbid pathologies that can influence the progression and prognosis of coronary heart disease [16, 20]. Therefore, there is a need for a broader assessment of the clinical condition of patients in order to identify the possible additional effect of comorbid conditions on the prognosis in patients with coronary heart disease with type D personality. This served as the basis for this study, the aim of which was to identify clinical and psychological correlations in type D personality in patients with chronic coronary syndrome.

MATERIAL AND METHODS

113 patients were included in the study, 68 men and 45 women. The median age was 64 (58.0; 69.0) years. All patients were admitted for elective percutaneous coronary intervention (PCI) in the department of surgical treatment of complex cardiac arrhythmias and pacing of the Research Institute for Complex Issues of Cardiovascular Diseases in the period from October 2020 to October 2021. The inclusion criteria were as follows: stable CHD; planned PCI; ability to adequately complete the questionnaire. Exclusion criteria: acute coronary syndrome; severe concomitant diseases; inability of the patient to complete the questionnaire; refusal of the patient to participate in the study. The study was approved by the Ethics Committee of Research Institute for Complex Issues of Cardiovascular Diseases (extract from meeting No. 8 dated October 10, 2022) and was conducted in accordance with the World Medical Association Declaration of Helsinki. After signing the voluntary informed consent, the patient was included in the study.

At the hospital stage, a standard preoperative examination was performed, including an echocardiographic examination using an extended protocol on Vivid S5 (General Electric Healthcare, USA). The images were obtained using the long and short axes of the parasternal and apical projections. When analyzing left atrium and ventricle of the heart, its structural characteristics were evaluated: left ventricular (LV) end-systolic and end-diastolic volumes, LV mass, and left atrium (LA) maximum transverse diameter in the diastole. The left ventricular ejection fraction (LVEF) was calculated using the Simpson method. When analyzing the structural characteristics of right atrium and ventricle of the heart, the following indicators were evaluated: right ventricle wall thickness in diastole (RVWd), the size of the right ventricle (RV) and right atrium, tricuspid annular plane systolic excursion (TAPSE).

LV functional parameters were studied in the Doppler mode: isovolumic relaxation time (IRT), maximum velocity of early (E) and late transmitral filling (A) of LV and their ratio (E/A). In the analysis of RV diastolic function, velocity of early (Et) and late transtricuspid filling (At) of RV and their ratio (Et/At) were estimated. The velocity of early/late diastolic/systolic excursion of rings of mitral/tricuspid of valves and their ratios (e', a', e'/a', E/e'; e't, a't, e't/a't, Et/e't, s', s't), as well as Tei index of the left and right ventricles was measured in the mode of spectral tissue Dopplerometry. RV diastolic dysfunction was considered to be cases when the value of the Et/At ratio was < 0.8 or > 2.1 and/or the Et/e't ratio was > 6.

All patients in the hospital were additionally examined using volumetric sphygmography (VaSera VS-1000, Fukuda Denshi, Japan). The device automatically calculates vascular stiffness indicators – cardio-ankle vascular index (CAVI), blood pressure, ancle-brachial index (ABI) on the right and left.

During the examination, additional patient questionnaires were conducted. In order to identify patients with type D personality, the DS-14 questionnaire was used, including the subscales NA («negative affectivity») and SI («social inhibition») in 14 questions [21]. Type D personality was diagnosed with 10 points or more for each of the studied subscales. The patients were divided into two groups

TABLE 1
CLINICAL AND DEMOGRAPHIC CHARACTERISTICS OF COMPARED GROUPS

Indicators	Type D (*n* = 40)	Not Type D (*n* = 73)	*p*
Male, *n* (%)	18 (45.0)	27 (37.0)	0.4
Age (years), Me [LQ; UQ]	64.0 [56.0; 70.0]	64.0 [58.5; 69.0]	0.64
BMI (kg/m^2), Me [LQ; UQ]	24.9 [21.8; 27.3]	21.3 [21.3; 27.7]	0.66
Disability, *n* (%)	12 (30.0)	22 (30.1)	0.95
Employed, *n* (%)	14 (35.0)	32 (43.8)	0.365
Retired, *n* (%)	26 (65.0)	41 (56.2)	0.265
Smokers, *n* (%)	16 (40.0)	34 (46.5)	0.38
Arterial hypertension, *n* (%)	33 (82.5)	60 (82.2)	0.735
Diabetes mellitus, *n* (%)	14 (35.0)	11 (15.0)	0.018
Prior stroke, *n* (%)	4 (10.0)	6 (8.2)	0.806
Prior myocardial infarction, *n* (%)	19 (47.5)	43 (58.9)	0.16
Prior coronary bypass surgery, *n* (%)	4 (10.0)	6 (8.2)	0.81
Prior carotid endarterectomy, *n* (%)	2 (5.0)	1 (1.4)	0.26
Angina pectoris, *n* (%)	33 (82.5)	10 (86.3)	0.635
CHF, *n* (%)	37 (92.5)	4 (94.5)	0.7
Laboratory parameters			
Total cholesterol (mmol/L), Me [LQ; UQ]	4.15 [3.4; 4.85]	4.0 [3.5; 5.2]	0.58
HDL (mmol/L), Me [LQ; UQ]	1.26 [0.93; 1.77]	1.03 [0.85; 1.22]	0.18
LDL (mmol/L), Me [LQ; UQ]	2.67 [1.75; 3.84]	2.62 [1.81; 3.03]	0.7
Triglycerides (mmol/L), Me [LQ; UQ]	1.4 [1.1; 1.9]	1.3 [1.1; 1.6]	0.51
Urea (mmol/L), Me [LQ; UQ]	6.85 [5.75; 8.2]	6.4 [5.35; 8.2]	0.38
Creatinine (mmol/L), Me [LQ; UQ]	84.5 [75.0; 99.5]	92.0 [78.0; 114.0]	0.11
Glucose (mmol/L), Me [LQ; UQ]	6.35 [5.15; 7.7]	5.9 [5.3; 6.8]	0.12
Lesion of vascular beds			
Stenosis of one coronary artery, *n* (%)	28 (70.0)	50 (68.5)	0.76
Stenosis of two coronary arteries, *n* (%)	8 (20.0)	16 (21.9)	0.811
Stenosis of three coronary arteries, *n* (%)	3 (7.5)	6 (8.2)	0.892
Stenosis of left main coronary artery, *n* (%)	1 (2.5)	1 (1.37)	0.66
Stenosis of the internal carotid artery more than 50%, *n* (%)	4 (10.0)	9 (12.3)	0.71
Stenosis of the internal carotid artery more than 30%, *n* (%)	3 (7.5)	4 (5.48)	0.67

Note. CHF – chronic heart failure; HDL – high density lipoproteins; LDL – low density lipoproteins.

based on the test results: patients with type D personality (n = 40) and patients without type D personality (n = 73). Additionally, the level of anxiety and depression in patients was assessed using the Hospital Anxiety and Depression Scale (HADS) [22]. Four possible answers correspond to each HADS statement. The higher the overall score, the more pronounced the symptoms of anxiety or depression.

Statistical processing was carried out using the Statistica 8.0 software package (StatSoft Inc., USA). The distribution of quantitative variables for normality was checked using the Shapiro – Wilk test; due to the fact that the distribution was different from normal, these variables are represented as median and quartiles (25th and 75th percentiles). Mann – Whitney and χ^2 (chi-squared) test were used to compare groups with and without type D personality. The Spearman correlation was used to evaluate the associations of clinical indicators with type D personality, its subscales (NA and SI), levels of anxiety and depression. The value of 0.05 was taken as the level of critical significance (p).

STUDY RESULTS

The median age of patients in both groups was 64 years. It should be noted that male patients prevailed in the group with type D personality, in contrast to the group without type D personality (45.0 % vs. 37.0 %, respectively; p = 0.4). Most patients had arterial hypertension. Type 2 diabetes mellitus was more common in patients with type D personality (p = 0.018). A history of myocardial infarction was detected equally often in patients of both groups, as well as a history of stroke. As the results show, there were no statistically significant differences in glucose, creatinine, urea concentrations and lipid profile parameters between the study groups. According to color duplex scanning of extracranial arteries, no differences were found in the groups. According to the coronarography data, no statistically significant intergroup differences were obtained (Table 1).

The analysis of volumetric sphygmography indicators among the entire cohort of patients with coronary heart disease is presented in Table 2.

The median systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were within the normal range. The median stiffness index (CAVI) was within the boundary values in patients with type D personality, and in patients without type D personality, the median stiffness of CAVI exceeded 9.0 and was pathological, but no statistically significant difference was achieved in the groups ($p > 0.05$). ABI < 0.9 was more often detected in patients with type D personality ($p > 0.05$).

Table 3 shows the assessment of structural and functional parameters according to echocardiography data.

The median left ventricular ejection fraction in both groups was in the range of normal values. Evaluation of transtricuspid flows in the group of patients

TABLE 2

INDICATORS OF VOLUMETRIC SPHYGMOGRAPHY (VASERA VS-1000, FUKUDA DENSHI, JAPAN)

Indicators	Type D (n = 40)	Not Type D (n = 73)	p
SBP on the right (mmHg), Me [LQ; UQ]	131.5 [117.0; 144.0]	131.0 [119.0; 141.0]	0.63
SBP on the left (mmHg), Me [LQ; UQ]	130.0 [121.0; 144.0]	127.5 [118.0; 139.0]	0.43
DBP on the right (mmHg), Me [LQ; UQ]	80.0 [76.0; 90.0]	80.0 [73.0; 84.0]	0.29
DBP on the left (mmHg), Me [LQ; UQ]	78.0 [72.0; 86.0]	78.0 [73.0; 86.0]	0.83
HR (min), Me [LQ; UQ]	59.0 [54.0; 65.0]	61.0 [55.0; 73.0]	0.12
CAVI on the right, Me [LQ; UQ]	8.5 [7.9; 10.4]	9.2 [7.6; 10.5]	0.614
CAVI on the left, Me [LQ; UQ]	8.3 [7.8; 9.3]	9.3 [7.6; 10.1]	0.252
CAVI > 9.0	12 (30.0)	24 (32.2)	0.192
ABI on the right, Me [LQ; UQ]	1.02 [0.92; 1.16]	1.09 [0.96; 1.18]	0.53
ABI on the left, Me [LQ; UQ]	1.01 [0.85; 1.13]	1.01 [0.92; 1.12]	0.61
ABI < 0.9	13 (32.5)	19 (26.0)	0.563

Note. SBP – systolic blood pressure; DBP – diastolic blood pressure; HR – heart rate; CAVI – cardio-ankle vascular index; ABI – ancle-brachial index.

TABLE 3

ECHOCARDIOGRAPHY INDICATORS DEPENDING ON THE PRESENCE OF THE TYPE D PERSONALITY

Indicators	Type D (*n* = 40)	Not Type D (*n* = 73)	*p*
Ao (mm), Me [LQ; UQ]	3.5 [3.3; 3.7]	3.5 [3.5; 3.9]	0.48
LA (mm), Me [LQ; UQ]	4.4 [4.1; 4.7]	4.3 [3.9; 4.6]	0.21
LV EDS (mm), Me [LQ; UQ]	5.2 [5.0; 5.5]	5.5 [5.1; 6.1]	0.197
LV ESS (mm), Me [LQ; UQ]	3.3 [3.2; 3.5]	3.5 [3.2; 4.2]	0.129
LV EDV (ml), Me [LQ; UQ]	124.0 [118.0; 147.0]	147.0 [124.0; 180.0]	0.079
LV ESV (ml), Me [LQ; UQ]	44.0 [38.0; 51.0]	51.0 [41.0; 79.0]	0.067
LVEF (%), Me [LQ; UQ]	62.0 [58.0; 65.0]	63.0 [51.0; 68.0]	0.73
IE (ml), Me [LQ; UQ]	85.0 [77.0; 96.0]	90.0 [77.0; 96.0]	0.14
LV mass (g), Me [LQ; UQ]	213.0 [181.0; 262.0]	247.0 [200.0; 287.0]	0.311
LV MMI, Me [LQ; UQ]	116.0 [100.5; 136.5]	118.0 [100.0; 151.0]	0.48
ISTd (cm), Me [LQ; UQ]	1.1 [1.0; 1.3]	1.0 [1.0; 1.2]	0.68
LVPVTd (cm), Me [LQ; UQ]	1.1 [1.0; 1.3]	1.0 [1.0; 1.2]	0.311
Indicators of LV diastolic function			
LV IRT (ms), Me [LQ; UQ]	88.5 [88.0; 90.0]	90.0 [88.0; 90.0]	0.162
E (cm/s), Me [LQ; UQ]	65.0 [51.0; 78.0]	54.0 [47.0; 70.0]	0.43
A (cm/s), Me [LQ; UQ]	63.0 [56.0; 80.0]	67.0 [50.0; 88.0]	0.84
E/A, Me [LQ; UQ]	0.81 [0.68; 1.27]	0.77 [0.67; 1.31]	0.72
e' (cm/s), Me [LQ; UQ]	9.8 [7.5; 10.4]	10.6 [9.6; 12.5]	0.21
a' (cm/s), Me [LQ; UQ]	9.4 [8.0; 11.0]	10.0 [7.5; 11.0]	0.66
e'/a', Me [LQ; UQ]	0.86 [0.7; 1.06]	1.32 [1.06; 1.59]	0.082
s' (cm/s), Me [LQ; UQ]	9.2 [8.4; 11.2]	10.4 [9.0; 12.0]	0.19
E/e', Me [LQ; UQ]	7.1 [6.48; 8.0]	5.0 [4.55; 5.74]	0.0038
LV Tei-index, Me [LQ; UQ]	0.29 [0.23; 0.32]	0.27 [0.25; 0.35]	0.71
Indicators of the right ventricle before CABG			
RV (mm), Me [LQ; UQ]	2.0 [2.0; 2.2]	2.0 [1.9; 2.2]	0.81
RVEF (%), Me [LQ; UQ]	50.0 [46.0; 54.0]	50.0 [47.0; 55.0]	0.78
RA (mm), Me [LQ; UQ]	118.0 [109.0; 129.0]	122.0 [113.0; 131.0]	0.39
PAP av. (mmHg), Me [LQ; UQ]	13.0 [11.0; 17.0]	13.0 [12.0; 15.0]	0.68
Indicators of diastolic function			
Et (cm/s), Me [LQ; UQ]	41.0 [36.0; 48.0]	49.5 [45.0; 51.0]	0.013
At (cm/s), Me [LQ; UQ]	44.0 [34.0; 56.0]	36.0 [33.0; 39.0]	0.062
Et/At, Me [LQ; UQ]	0.8 [0.66; 1.35]	1.38 [1.28; 1.63]	0.014
e›t (cm/s), Me [LQ; UQ]	11.6 [10.6; 11.9]	9.8 [8.6; 11.3]	0.033
a›t (cm/s), Me [LQ; UQ]	14.5 [12.5; 15.6]	12.5 [11.1; 15.2]	0.26
e't/a't, Me [LQ; UQ]	0.82 [0.69; 0.95]	0.68 [0.58; 0.95]	0.06
s't (cm/s), Me [LQ; UQ]	13.0 [12.5; 14.6]	12.5 [11.6; 14.6]	0.43
Et/e't, Me [LQ; UQ]	3.58 [3.19; 4.47]	5.0 [4.17; 5.81]	0.014
RV Tei index, Me [LQ; UQ]	0.27 [0.24; 0.29]	0.27 [0.23; 0.29]	0.81

Note. Ao – aorta; LA – left atrium (diameter); EDS – end-diastolic size; LV – left ventricle; ESS – end-systolic size; EDV – end-diastolic volume; ESV – end-systolic volume; EF – ejection fraction; IE – impact ejection; MMI – myocardial mass index; ISTd – interventricular septum thickness in the diastole; LVPVTd– left ventricular posterior wall thickness in the diastole; IRT – isovolumic relaxation time; E – velocity of early diastolic filling of the left ventricle; A – velocity of late diastolic filling of the left ventricle; e' – lateral early diastolic mitral annular velocity; a' – lateral late diastolic mitral annular velocity; s' – lateral systolic mitral annular velocity; RV – right ventricle; RA – right atrium (diameter); PAP av. – pulmonary artery average pressure; Et – rate of early diastolic filling of the right ventricle; At – rate of late diastolic filling of the right ventricle; e't – rate of early tricuspid annular plane diastolic excursion a't – rate of late tricuspid annular plane diastolic excursion; s't – rate of tricuspid annular plane systolic excursion.

with type D personality revealed a decrease in the velocity of early tricuspid annular plane diastolic excursion (e't) compared with the group without type D personality (p = 0.033). The median ratio of early and late diastolic transtricuspid flow (Et/At) was within the normal values in all patients, however, the ratio of Et/At in patients with type D personality was lower compared with the group without type D personality (p = 0.014). It was revealed

TABLE 4

PSYCHOLOGICAL STATUS OF PATIENTS WITH CORONARY HEART DISEASE DEPENDING ON THE PRESENCE OF TYPE D PERSONALITY

Indicators	Type D (n = 40)	Not Type D (n = 73)	p
	Scales of the DS-14 questionnaire		
NA (score)	14.0 [12.0; 16.0]	8.0 [6.0; 9.0]	< 0.001
SI (score)	12.5 [11.0; 14.0]	8.0 [6.0; 9.0]	< 0.001
	HADS scale		
Personal anxiety (score)	7.0 [5.0; 10.0]	5.0 [3.0; 7.0]	< 0.001
Depression level (score)	5.0 [3.0; 9.0]	4.0 [2.0; 6.0]	0.0102

Note. NA – negative affectivity; SI – social inhibition.

TABLE 5

CORRELATIONS OF PSYCHOLOGICAL STATUS WITH CLINICAL INDICATORS

Indicators	Type D		NA		SI		Anxiety		Depression	
	r	p	r	p	r	p	r	p	r	p
Age (years)	0.059	0.550	–0.009	0.921	0.107	0.282	0.215	0.029	–0.009	0.930
Weight (kg)	–0.197	0.046	–0.057	0.567	–0.051	0.616	–0.159	0.109	–0.036	0.716
BMI (kg/m^2)	–0.128	0.195	–0.018	0.854	–0.119	0.229	–0.136	0.172	0.059	0.550
Smoking	0.008	0.935	0.071	0.474	0.148	0.134	0.141	0.155	0.115	0.249
Prior MI	–0.119	0.229	–0.016	0.876	0.069	0.489	0.047	0.662	–0.029	0.768
Prior stroke	0.073	0.466	0.211	0.033	0.091	0.363	–0.097	0.328	0.093	0.350
Prior AH	–0.018	0.855	0.072	0.467	0.106	0.283	–0.117	0.239	–0.014	0.890
Prior diabetes	0.243	0.011	0.253	0.008	0.224	0.020	0.075	0.435	0.018	0.851
SBP	0.153	0.274	0.301	0.028	0.051	0.716	0.144	0.303	0.263	0.057
DBP	0.186	0.182	0.122	0.383	0.006	0.962	0.295	0.032	0.103	0.461
ABI < 0.9	0.266	0.054	0.393	0.004	0.414	0.002	0.181	0.897	0.089	0.526
CAVI > 9.0	–0.104	0.456	0.086	0.539	0.171	0.220	0.058	0.678	–0.009	0.947
HDL	0.246	0.185	0.331	0.073	0.001	0.999	0.144	0.448	0.462	0.01
LDL	–0.133	0.481	–0.389	0.034	–0.228	0.226	–0.062	0.745	–0.189	0.315
Creatinine	–0.107	0.573	–0.011	0.995	–0.039	0.834	–0.124	0.506	0.122	0.521
Glucose	–0.051	0.792	0.215	0.252	–0.105	0.579	–0.081	0.667	–0.047	0.804

Note. NA – negative affectivity; SI – social inhibition; BMI – body mass index; MI – myocardial infarction, AH – Arterial Hypertension, DM – diabetes mellitus; SBP – systolic blood pressure; DBP – diastolic blood pressure; CAVI – cardio-ankle vascular index; ABI – ancle-brachial index; HDL – high density lipoproteins; LDL – low density lipoproteins.

that the ratio of Et/et was statistically significantly lower in the group with type D personality ($p = 0.014$).

In patients with type D personality, the median scores on the scales of «negative affectivity» and «social inhibition» were significantly higher than in patients without type D personality ($p < 0.001$). It was also noted that the level of personal anxiety and the level of depression were higher in the group with type D personality ($p < 0.05$) (Table 4).

When studying the correlations of psychological status with clinical indicators, a negative dependence of weight on the presence of type D personality was established ($r = 0.197$; $p = 0.046$). Associations of diabetes mellitus with type D personality ($r = 0.243$; $p = 0.011$), severity of negative affectivity ($r = 0.253$; $p = 0.008$) and social inhibition ($r = 0.224$; $p = 0.020$) were revealed. Negative affectivity component of type D personality had a statistically significant correlation with a history of stroke ($r = 0.211$; $p = 0.033$), SBP level ($r = 0.301$; $p = 0.028$), ABI < 0.9 ($r = 0.393$; $p = 0.004$) and low density lipoprotein (LDL) levels ($r = -0.389$; $p = 0.034$). An association of an increased level of anxiety with age ($r = 0.215$; $p = 0.029$) and the level of DBP ($r = 0.295$; $p = 0.032$) was established. The level of high-density lipoproteins (HDL) had a statistically significant correlation with an increased level of depression ($r = 0.462$; $p = 0.01$) (Table 5).

DISCUSSION

This study shows that patients having chronic coronary syndrome with type D personality, concomitant diabetes mellitus, as well as left and right ventricular filling disorders are more often detected. Correlation analysis revealed associations of diabetes mellitus with type D personality and its subscales; the level of ABI was associated with the subscales NA and SI, but not with the level of anxiety and depression.

In previous studies, it was shown that with type D personality in patients with coronary heart disease, not only manifestations of psychological distress (anxiety and depression) and a decrease in quality of life are more common, but also certain changes associated with the severity of the process in the cardiovascular system. Thus, in patients with coronary artery disease, coronary angiography revealed a greater degree of coronary artery lesion on a scale with type D personality compared with patients without type D personality (26.21 ± 12.03 and 15.49 ± 8.89, respectively; $p < 0.001$) [23]. In patients with type D personality, optical coherence tomography of the coronary arteries revealed more pronounced signs of instability of atherosclerotic plaques [24]. In the cohort of patients with coronary artery disease before coronary bypass surgery, the presence of type D personality was associated with a greater prevalence of the atherosclerotic process, which was manifested by more frequent detection of multifocal atherosclerosis [20]. In the population cohort of the ESSAY study, more pronounced calcification of the coronary arteries was detected in individuals with type D personality [25]. In this study, we were unable to identify associations of personality type with either the number of affected coronary arteries or with manifestations of peripheral atherosclerosis (the values of ABI and the frequency of stenosis of the internal carotid artery did not differ in the groups). Nevertheless, we have identified more pronounced changes in the filling indices of both the left and right ventricles in patients with type D personality. This is consistent with the data of V.R. Enatescu et al. [23], which revealed in patients with type D personality an increase in the E/e ratio (13.49 ± 4.15 and 10.24 ± 3.25; $p = 0.03$) and left atrium volume (85.79 ± 34.4 and 71.03 ± 26.49 ml; $p = 0.012$) compared with patients without type D personality. In contrast to the present study, in this study, the deterioration of left ventricular filling was accompanied by systolic dysfunction (decrease in left ventricular ejection fraction and s' index), apparently due to the more frequent presence of postinfarction atherosclerosis in this group. The deterioration of the filling of the ventricles in our study is explained by the more frequent detection of diabetes mellitus in patients with type D personality, which was accompanied by a decrease in myocardial elasticity, but did not lead to a decrease in heart pump function.

The presence of somatic manifestations in individuals with type D personality may mediate the influence of various behavioral factors and biomarkers on the prognosis of patients with coronary heart disease. So, Y. Wang et al. showed that patients with coronary heart disease with type D personality had higher levels of tumor necrosis factor α, interleukin 6, total inflammation indices (with additional inclusion of highly sensitive C-reactive protein), kynurenine and the kynurenine/tryptophan ratio (activated kynurenine pathway of tryptophan metabolism is associated with MACE (major adverse cardiac events) in patients with coronary heart disease). In addition, during prospective observation, it was noted that increased total inflammation indices and the level of the kynurenine/tryptophan ratio mediated the influence of type D personality on vulnerable coronary plaques and the prognosis of patients with coronary heart disease [17]. The same group of authors revealed that for patients with type D personality not only was there a low level of fruit and vegetable consumption, but this was largely due to the high incidence of stent restenosis after PCI. It has also been shown that it is the nutrients of fruits and vegetables, including vitamin C, vitamin E and fiber mediated the influence of type personality on the development of stent restenosis [19].

What is the clinical significance of the data obtained? The revealed differences in the clinical manifestations of CHD patients with type D personality emphasize the assumption of N. Kupper and J. Denollet [16] that there is not a chain of events in the influence of type D personality on the prognosis, but a network of potential biological and behavioral mechanisms, as well as a variety of pathophysiological «routes» that can be realized in them. Since coronary heart disease is multifactorial in na-

ture, it is not surprising that type D personality also exerts its influence through a group of interacting mechanisms, each of which contributes.

CONCLUSION

In patients with chronic coronary syndrome with type D personality, compared with those without this type, concomitant diabetes mellitus (35 % and 15 %, respectively; $p = 0.018$), signs of left diastolic dysfunction of left (E/e ratio – 7.1 [6.48; 8.0] and 5.0 [4.55; 5.74], respectively; $p = 0.0038$) and right (Et/At ratio 0.8 [0.66; 1.35] and 1.38 [1.28; 1.63], respectively; $p = 0.014$) ventricle were more often diagnosed. Correlation analysis revealed associations of diabetes mellitus with type D personality ($r = 0.243$; $p = 0.011$), severity of negative affectivity ($r = 0.253$; $p = 0.008$) and social inhibition ($r = 0.224$; $p = 0.020$), as well as association of ABI with the severity of negative affectivity ($r = 0.393$; $p = 0.004$) and social inhibition ($r = 0.414$; $p = 0.002$). These results should be taken into account in rehabilitation programs for psychological problems affecting the course of coronary heart disease.

Conflict of interest

The authors of this article declare the absence of a conflict of interest.

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