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Research Article

Somatoform Disorders in the Pathology of the Cardiovascular System and Irritable Bowel Syndrome

Lychkova AE[1]*, Golubev Yu Yu[2], Golubeva G Yu[3], Severin AE[4], Torshin VI[5], Starshinov Yu P[4], Samsonova NG[6] and Puzikov AM[7]

[1]Head of Division of the Moscow's Clinical Research Practical Center, Moscow Health Department, Moscow, Russia

[2]Associate Professor, Department of Internal Medicine Propaedeutics and Beam Diagnostics, Russian National Research Medical University, Moscow, Russsia

[3]Master of Medical Sciences, City Clinical Hospital No. 4 , Moscow, Russia

[4]Professor, Normal Physiology Department, Russian People's Friendship University, Moscow, Russia

[5]Professor, Head of the Normal Physiology Department, Russian People's Friendship University, Moscow, Russia

[6]Head of the Department of Ultrasonic Diagnostics, Moscow's Clinical Research Practical Center, Moscow Health Department, Moscow, Russia

[7]Researcher of the Division of the Moscow's Clinical Research Center, Moscow Health Department, Moscow, Russia

***Corresponding Author**: Lychkova Alla Edward, Head of Division of the Moscow's Clinical Research Center, Moscow Health Department, Moscow, Russia.

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Abstract

Background: Somatoform disorder (autonomic dysfunction), which occurs on the background of the body's endocrine rearrangements in adolescence, is clinically inadequate vegetative regulation. Up to 50 percent of primary care patients present with physical symptoms that cannot be explained by a general medical condition. In recent years, much attention has been drawn to the problem of somatoform disorders in arterial hypertension, chronic heart failure (CHF). There is a high prevalence of anxiety-depressive disorders, especially in patients with CHF. The unexplained symptoms of somatoform disorders often lead to more frequent office visits, unnecessary laboratory or imaging tests, or costly and potentially dangerous invasive procedures.

Aim: The aim is to study autonomic dysfunction in patients with chronic heart failure and anxiety-depressive disorders and electrophysiological aspects of somatization of pathology in irritable bowel syndrome.

Material and Methods: The study was performed on 35 patients with somatoform disorders in irritable bowel syndrome accompanied by severe pain in the abdomen. The study involved 25 patients with chronic heart failure (CHF) NYHA II-III functional class on the background of arterial hypertension (AH) of ischemic origin.

Results: All patients showed signs of anxiety-depressive or somatoform disorders, asthenia. The presence of signs of anxiety and depressive disorders in patients with CHF and AH is accompanied by disturbances in vegetative regulation of the level of arterial pressure, activity of the sympathetic nervous system, frequent occurrence of cardiac arrhythmias, and a decrease in tolerance to physical activity and deterioration in the quality of life of this category of patients.

The results of investigation of irritable bowel syndrome with the help of electromyography are presented. In the descending section of the colon, there was an increase in the frequency and amplitude of slow waves, while the power of contraction increased up to 3 times. Thus, against the background of pronounced pain syndrome, there is an increase in the power of ineffective contractions of smooth muscles.

Imbalance of sympathetic/parasympathetic systems significantly increases the activation of the sympathetic department of the ANS, contributing to the deterioration of the compromised function of the vascular endothelium. These changes significantly increase the risk of developing a lethal outcome of acute myocardial infarction.

The high prevalence and associated increase in morbidity and mortality justifies future research regarding the management of somatoform disorders in chronic heart failure.

Keywords: *Somatoform Disorders; Cardiovascular System; Irritable Bowel Syndrome*

Background

Somatoform autonomic dysfunction is a chronic polyetiological disorder characterized by the presence of nonspecific, sensory, [neurovegetative] complaints of symptoms and syndromes (gastroenterological, cardiac, respiratory, cerebral, vegetative-vascular [dystonia], psycho-emotional), lacking organic syndromes, as well as a benign course and a good prognosis for life [1]. The frequency of psychosomatic disorders is quite high and varies among the population from 15 to 50%, and in general practice - from 30 to 57% [2,3].

The prevalence of this disease in general medicine is 30% on the average [4], and higher percentage in patients with genetic complications [5]. Genetic comorbidities confirmed by the data of Talley., *et al.* showed the hereditary conditionality of reactions to the influence of the factor of sensitization and the further course of the pathological processes in the intestine [6].

In IBS, psychosocial stress and affective disorders form an increased sensitivity of nociceptors ("painful" receptors) in the abdominal region. Clinically, peripheral sensitization is expressed in hyperalgesia, i.e. a pronounced pain sensation with mild pain irritation and allodynia - the onset of pain sensation in non-neural (e.g. tactile) stimuli. In patients, there is a decrease in the threshold of perception of pain or a more intense sensation of pain at a normal threshold of its perception diffusely throughout the intestine [7]. With prolonged pain stimulation, normal sensory neurons become overexcited, which leads to the release of neuropeptides in the nerve endings, the accumulation and degranulation of mast cells with the release of serotonin and histamine and, as a consequence, the occurrence of neurogenic inflammation in the walls of the intestine [8]. Dysfunction of the intestine and affective pathology, thus, are closely affiliated with each other and show direct interrelations in clinical manifestations and course (with the deepening of affective disorders, the manifestations of somatic pathology (especially pain syndrome) are aggravated). Treatment of affective disorders includes the appointment of antidepressants, inhibitors of the inverse seizure of serotonin and catecholamines, which leads to the reduction of not only the actual psychopathological disorders, but also clinically manifestations of somatic pathology [9].

In recent years, attention has been paid to the problem of arterial hypertension (AH), abdominal obesity (AO), metabolic syndrome (MS). These diseases directly or indirectly, and often occur in conjunction with metabolic disorders, mainly with disorders of carbohydrate and lipid metabolism. Currently, metabolic disorders are associated with a high risk of cardiovascular complications, Type 2 diabetes and a significant progression of the course of atherosclerosis with the development of menacing complications - heart attack and stroke.

Chronic heart failure (CHF) is the main problem of cardiology. The disease is widely prevalent among the population and high rates of morbidity and mortality from CHF explains the considerable interest of scientists to this problem. Clinicians show a greater need to study external and internal factors that affect the prognosis of the disease.

Cardiovascular diseases are accompanied by the increased tone of the sympathetic nervous system (SAS), which is most significantly expressed in patients with abdominal obesity and impaired glucose metabolism, accompanied by the formation of such phenomena as insulin resistance (IR) and hyperinsulinemia. This condition complicates the course of the underlying disease and results in addition to the activation of the SAS and disruption of the endocrine nervous system activation of the renin-angiotensin-aldosterone system. These changes lead to dysfunction of the endothelium, which in turn contributes to a significant progression of atherosclerosis and hypertension.

In addition, there is a high prevalence of anxiety-depressive disorders, especially in patients with CHF on the background of a high level of systolic and diastolic pressure. The frequency of occurrence of this disorder reaches 50 - 60%. Depression itself intensifies the negative effect on the prognosis of cardiovascular diseases to a large extent contributes to the development of vascular events, disability, and death.

The central nervous and autonomic nervous systems undoubtedly play a leading role in the pathogenesis of arterial hypertension and the progression of cardiovascular diseases.

The data presented suggest early detection and diagnosis in the initial stages of signs of autonomic dysfunction and timely correction of these disorders, which will lead to a reduction in the frequency of cardiac catastrophes and deaths.

Improvement and normalization of the sympathetic function of the autonomic nervous system in patients with cardiovascular diseases lead to a persistent decrease in arterial pressure, a decrease in the severity of left ventricular hypertrophy, and in some cases to a reversal of its development. The autonomic nervous system is closely connected with vascular tone. Correction of the hyperfunction of the sympathetic department leads to normalization of the endothelial wall function of the vessels, and is accompanied by its additional protection, in particular, the renal protection effect and reduces traces of protein in the urine.

Of special interest among cardiologists is the use of vegetative correction to restore mental or psychological disorders that appear against the background of diseases of the cardiovascular system: asthenia, depression, hysteria, dystrophy, timidity, physical and mental exhaustion, neurasthenic disorders. These disorders appear under the influence of stress or psycho-traumatic situations.

Another key factor in the correction of the autonomic nervous system is the impact on the central nervous system, which increases the stability of the brain and internal organs to hypoxia, improves metabolic processes in neurons, reducing motor activity and activating mental and physical performance and reducing symptoms of somatoform dysfunction of the autonomic nervous system.

Aim of the Study

The aim is to study the psychological and electrophysiological aspects of somatization of pathology in IBS; study of autonomic dysfunction in patients with chronic heart failure and anxiety-depressive disorders, as well as daily monitoring of blood pressure (ABM), Holter's electrocardiogram (XM-ECG) with an assessment of heart rate variability (HRV); the detection of activity of the sympathetic and parasympathetic departments of the VNS by analyzing the results of SMAD, structural and functional changes in the left ventricle and endothelial dysfunction.

Material and Methods

The study was conducted on 35 patients with somatoform disorders in IBS, accompanied by severe pain in the abdomen.

Electromyogram (EMG) was recorded with the help of skin silver electrodes with a contact surface area of 0.5 - 0.6 mm^2 placed in the projection area of the descending section of the intestine on the anterior abdominal wall. The EMA was registered for 15 - 20 minutes under pre-amplification conditions using the Conan-M hardware and software complex with a bandwidth of 0.01 Hz to 10 kHz and a noise level of less than 1 - 5μV. The study of electromotive activity makes it possible to estimate the total bioelectrical activity of smooth muscle cells of the intestinal wall. The electric motor function of the large intestine was measured by measuring the amplitude-frequency characteristics of the EMG: the amplitude (mV) and the frequency (in minutes) of the slow-wave and spike activity, and the signal power-the ratio of the slow wave frequency to their amplitude [10,11].

Criteria for inclusion: 1) the presence of signs of arterial hypertension, coronary heart disease and signs of CHF in combination with anxiety-depressive disorders, neurasthenia, and asthenia, as well as somatoform disorders of personality. 2) informed consent. Exclusion criteria: 1) acute myocardial infarction, 2) acute stroke, the presence of inflammatory diseases of internal organs, 3) taking psychotropic drugs (antidepressants, anxiolytics, nootropics).

Statistical processing of the data was carried out using the Statistica-6 software package. All quantitative data, subject to a normal distribution, are represented in the form M ± m. To process the data obtained, the student's criterion (t) was applied to the subsequent determination of the level of reliability of the differences (p) and the χ^2 criterion. Differences between the mean values were considered reliable at $p < 0.05$.

Results

Characteristics of patients (Table 1). All patients showed signs of anxiety-depressive or somatoform disorders, asthenia. The total score on the Hamilton Anxiety Rating Scale (HARS) and the average score on the Hospital Anxiety and Depression Scale (HADS) scale and the average on the anxiety scale (Table 1).

Number of patients	25 patients
Mean age of patients	67.4 ± 3.3 years
CHF 2 FC by NYHA	13 patients (52%)
CHF 3 FC by NYHA	12 patients (48%)
Postoperative myocardial infarction	11 patients (44%)
A stroke was transferred	4 patients (16%)
Average number of hospital admissions	2.4 ± 0.3 per year
HARS	16.8 ± 2.2
HADS	10.2 ± 1.4
Level of anxiety	8.4 ± 1.07

Table 1: *Characteristics of the patients under study.*

The severity of psychopathological disorders was assessed according to the HARS, HADS, Spielberg's self-esteem scales, the Clinic Global Impression Scale (CGI), and the quality of life assessed using the 36-item Short Form Survey (SF-36).

Standard methods of echocardiography (ECHO-KG), SMAD and daily monitoring of Holter ECG using a Schiller MT-200 instrument were used in the work. Tolerance to physical activity was assessed by the results of a 6-minute walk test.

The study involved 30 patients with grade II arterial hypertension and abdominal obesity (AO). The duration of the course of hypertension and the presence of concomitant pathology and the main average values of the indices of this study group are presented in table 2.

Number of patients	30 patients
Mean age of patients	61.4 ± 4.8 years
Duration of AG	8.5 ± 7 years
The presence of IHD	5 patients (16.67%)
Presence of diabetes mellitus	2 patients (6.67%)
Body weight (BMI)	32.6 ± 1.7 kg/m^2
Average level of TG	2.13 ± 0.2 mmol/l
The average level of LDL cholesterol of low-density lipoproteins	4.95 ± 0.4 mmol/l
The average level of HDL cholesterol in high-density lipoproteins	1.08 ± 0.3 mmol/l
Fasting glucose	5.95 ± 0.3 mmol/l

Table 2: *Characteristics of the patients under study.*

The standard method of echocardiography (ECHO-KG) was used to determine the standard values of systolic and diastolic function of the left ventricle, SMAD with the use of Schiller BR-102 recorders, Holter monitoring on the Schiller MT-200 instrument with the determination of the vegetative tone for heart rate variability HRC). The degree of endothelial dysfunction was determined in 10 patients by the

method of D Celermajer., *et al*. and evaluation of the vasodilation of the brachial artery with the calculation of the diameter of the brachial artery (ΔD) [12].

In the presence of pain syndrome electromyographically in the descending part of the colon, an increase in the frequency of slow waves to 24 ± 1.5/min, an amplitude of slow waves - up to 0.16 ± 0.02 mV is noted, while the cutoff power (the product of the frequency by the amplitude) was 150, whereas in the norm, these values were 5.0 ± 0.5/min, 0.1 ± 0.01 mV and 50, respectively. Consequently, the power of ineffective contractions increases with pain syndrome threefold. In figure 1 shows a fragment of an electromyogram of a patient with somatoform disorders in IBS. The curve shows a pronounced high-amplitude high-frequency spike activity. Thus, against the background of pronounced pain syndrome, there is an increase in the power of ineffective contractions of smooth muscles.

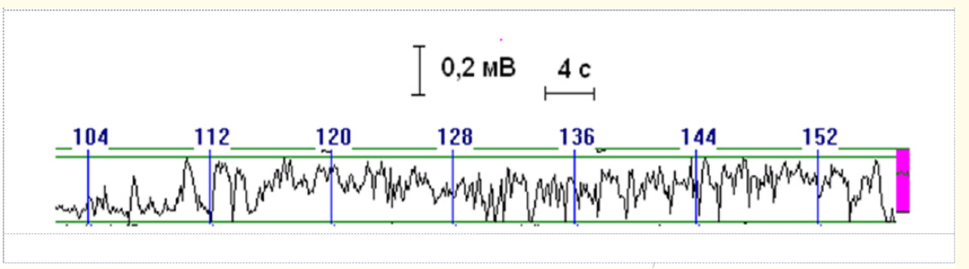

Figure 1: *Electromyogram of the colon with the somatoform disorder in IBS.*

The table 3 presents the results of the analysis of indicators of SMAD in patients with CHF and AH with anxiety-depressive disorders. The patients had a high level of autonomic dysfunction, which correlated with changes in HRV parameters, reflecting significant violations of the vegetative control of the cardiovascular system, which again indicates changes in the autonomic regulation of the heart rhythm in patients with CHF and AH. From table 2 that revealed elevated blood pressure values, the time index (IVE), values of BP variability.

Index	Control (n = 25)	Main group
CAD day	126,0 ± 3,1	148,1 ± 2,6
DBP day	73,0 ± 2,5	89,6 ± 2,2
IVS SAD,% day	14,3 ± 1,9	57,3 ± 2,7
IV DB,% day	12,4 ± 2,2	53,3 ± 3,3
SI SAD,%	10,4 ± 1,3	6,7 ± 0,6

Table 3: *The value of the indicators of SMAD in the control and main groups.*
Notations: DBP: Diastolic Blood Pressure; IV: Time Index; SBP: Systolic Blood Pressure; SI: Diurnal Index.

In table 4, there are significant violations of control of cardiovascular function in the form of: reduction of the main central HRV indicators (SDNN and SDANN). From the data of table 3, the decrease in markers of parasympathetic activity (rMSSD and pNN50) is reliably detected, which indicates sympathetic activity in patients with anxiety-depressive disorders (see table 7) and parasympathetic tone deficiency. R Carney., *et al.* noted in patients with IHD a decrease in the activity of the vegetative system and a pronounced correlation with the level of depression [13].

Index	Control (n = 25)	Main group	P_{1-2}
Average NN, MS day	770,0 ± 27,0	693,0 ± 12,0	–
SDNN, MS day	142,0 ± 3,1	70,0 ± 1,6	< 0,01
SDANN, MS day	120,0 ± 2,7	62,0 ± 2,3	–
SDNN Ind, MS day	51,0 ± 3,0	37,0 ± 2,1	–
rMSSD, MS day	26,0 ± 1,8	25,0 ± 1,5	< 0,001
pNN50,% day	6,3 ± 0,6	5,0 ± 0,8	< 0,05

Table 4: *The value of HRV in the control and treatment group.*
Notation: SDNN is the standard deviation of the values of the NN intervals for the entire period under review; SDANN is the standard deviation of the values of the average NN intervals obtained over all 5-minute sections divided by the registration period; SDNN ind is the average of the standard deviations for all 5-minute sections divided by the observation period; rMSSD is the square root of the sum of the squared differences of the values of successive pairs of intervals NN; pNN50 - the percentage of NN50 from the total number of successive pairs of NN intervals (NN50 is the number of pairs of consecutive NN intervals differing by more than 50 MS, obtained over the entire recording period).

The expressed autonomic dysfunction and imbalance of the sympathetic link was associated with the level of anxiety, depression and more frequent occurrences of cardiac arrhythmias in the form of extra-systole (Table 5), worsened the cardiovascular system and had a negative impact on tolerability of physical load, which is one of the signs of developing heart failure.

Index	Main group
Number of patients with frequent EHF, abs. (%)	9 (36%)
The average frequency of EFA per day	236 ± 14
The number of patients with AF, abs. (%)	3 (12%)
The number of patients with EE II-V grade according to Launu-Wolff, abs. (%)	4 (16%)
Average frequency of EE per day	368 ± 15
Distance covered in the test with a 6-minute walk, m	275,0 ± 9,4

Table 5: *The value of the XM-ECG and the 6-minute test in the main group.*
Notation: AF: Atrial Fibrillation

ECHO-CG showed signs of hypertrophy (Table 6) of the left ventricle, signs of dilatation and changes in the geometry of the left chamber muscle.

Index	Control (n = 25)	Main group	P_{1-2}
MMLZH, g	105,1 ± 6,3	189,0 ± 5,5	< 0,001
LVMI, g/m^2	62,6 ± 2,4	113,0 ± 4,8	< 0,001
Left ventricular cataract, mm	48,1 ± 1,4	57,2 ± 1,4	< 0,001
DAC of the LV, mm	29,3 ± 1,5	39,2 ± 1,2	< 0,01
LVEF,%	63,4 ± 3,3	54,2 ± 2,3	< 0,05
IP	0,62 ± 0,02	0,76 ± 0,01	< 0,01
OTC LV	0,39 ± 0,02	0,35 ± 0,02	-

Table 6: *The value of indicators ECHO-CG in the control and the main group.*
LVEF: LV mass; LVMI: Indexed LVDM, Left Ventricular Ejection Fraction - End-Diastolic LV Size, Left Ventricular Cortex LV - End-Systolic LV; LVEF: LV Ejection Fraction; IS: Sphericity Index; OTC LV: The Relative Thickness of LV Wall.

Thus, the signs of anxiety-depressive disorders (Table 7) in patients with CHF and AH are accompanied by violations of autonomic regulation of blood pressure level, regulation of heart rate, which contributes to the occurrence of cardiac arrhythmias and decrease in exercise tolerance. These signs can increase the risk of disability and the frequency of deaths in cardiovascular events.

NYHA Functional Class CHF	Subscale alarm	Subscale depression
II	8,1 ± 0,6	9,9 ± 0,8
III	8,6 ± 0,8	10,5 ± 1,2
II–III	8,4 ± 0,7	10,2 ± 1,4

Table 7: *Values of anxiety-depressive changes in the main group.*

The results of SMAD show a significant increase in mean daily systolic and diastolic blood pressure (PAD and DBP) ($p < 0.001$) in comparison with the control group, a significant increase in the SBP and DBP time index ($p < 0.001$), as well as the mean daily variability in SBP. There was also a significant increase in the incidence of two unfavorable types of daily blood pressure profile (BP) - “non-dipper” and “night-peaker” (Table 8).

Index	Control (n = 25)	Main group	P_{1-2}
CAD day	126,0 ± 3,1	154,1 ± 3,6	< 0,001
DBP day	73,0 ± 2,5	89,6 ± 3,2	< 0,001
IVS SBP,% day	14,3 ± 1,9	57,3 ± 4,7	< 0,001
IV DB,% day	12,4 ± 2,2	45,3 ± 3,3	< 0,001
SI SBP,%	10,4 ± 1,3	6,7 ± 0,6	< 0,05
SI DAD,%	11,1 ± 1,0	8,3 ± 0,9	< 0,05
V SBP,% DAY	11,0 ± 2,2	16,2 ± 1,3	< 0,05
V DBP,% of day	10,4 ± 1,5	13,4 ± 1,6	-
SP SBP, abs. (%)			
“Dipper”	25 (100%)	10 (33,3%)	< 0,001
“Non-dipper”	0	17 (56,7%)	< 0,001
“Night-peaker”	0	4 (13,3%)	< 0,001

Table 8: *Indicators of DMAD in the control and main groups.*
Notations: DBP: Diastolic Blood Pressure; IV: Time Index; SBP: Systolic Blood Pressure; SI: Diurnal Index; SP: Daily Profile; V: Variability of Pressure.

In echocardiographic study, a significant increase ($p < 0.01$) LVMI, diastolic and systolic LV sizes (indexed end-diastolic and end-systolic volumes) and a sphericity index (IC) were observed in most patients, as well as a statistically significant increase ($p < 0.05$) of the relative thickness of the LV wall, which indicated the formation of concentric LVH in most patients, LV geometry (sphericalization), and a significant increase in afterload. Also, typical signs of LV diastolic dysfunction were identified by the type of delayed relaxation and hemodynamic overload of the left atrium with a significant increase in its size ($p < 0.01$) while maintaining the normal LV ejection fraction (Table 9).

Index	Control (n = 25)	Main group	P_{1-2}
LVMI, g/m^2	62,6 ± 2,4	132 ± 2,3	< 0,001
ICID, ml/m^2	62,8 ± 2,3	70,3 ± 2,5	< 0,05
IKSO, ml/m^2	25,2 ± 1,7	30,3 ± 1,6	< 0,05
LTEF,%	62,4 ± 2,3	57,6 ± 2,7	-
IP	0,65 ± 0,02	0,78 ± 0,02	< 0,001
OTC LV	0,37 ± 0,02	0,44 ± 0,02	< 0,05
LP, mm	25,2 ± 4,7	38,0 ± 3,5	< 0,01

Table 9: *The value of ECHO-CG in the control and main group.*

Indications: LVMI: Indexed LVDM; ICID: Indexed End-Diastolic Volume; IKSO: Indexed Finite Systolic Volume; LVEF: LV Ejection Fraction; IS: Sphericity Index; LTEF: Relative Thickness of LV Walls; LP: Left Atrium

Of the particular interest was the dynamics of the main indicators of HRV. As can be seen from table 10, in a primary examination of patients with AH with AO, statistically significant changes in almost all the main HRV parameters were detected. Thus, in patients, the mean daily SDNN level was 27.3% lower ($p < 0.001$) than in the control group. The SDANN score also decreased by 23.5% ($p < 0.001$), and SDNN ind by 18.5% ($p < 0.05$) compared with the control group. Decrease in SDNN and SDANN indicators together with a significant decrease ($p < 0.01$) of the circadian index (1.17 ± 0.02 versus 1.27 ± 0.02 in healthy individuals) indicated a marked increase in sympathetic effects on heart rhythm and other functions of cardiovascular system. The imbalance of the VNS with a significant shift toward hyperactivation of the sympathetic link was also aggravated by a sharp decrease in the markers of parasympathetic activity (rMSSD and pNN50), which were 35% lower than those in the control group ($p < 0.01$).

Index	Control (n = 25)	Main group	P_{1-2}
Average NN, ms day	759 ± 11,2	752 ± 23	–
SDNN, ms day	142,0 ± 3,1	102 ± 2,3	< 0,001
SDANN, ms day	120,0 ± 2,7	94 ± 2,3	< 0,001
SDNNind, ms day	51,0 ± 3,0	41 ± 3,5	< 0,05
rMSSD, ms day	26,0 ± 1,8	16 ± 1,3	< 0,05
pNN50,% day	6,3 ± 0,6	4,0 ± 0,7	< 0,05
CI	1,27 ± 0,02	1,17 ± 0,02	< 0,01

Table 10: *The value of HRV indicators in the control and main groups.*

Notation: SDNN is the standard deviation of the values of the NN intervals for the entire period under review; SDANN is the standard deviation of the values of the average NN intervals obtained over all 5-minute sections divided by the registration period; SDNNind is the average of the standard deviations for all 5-minute sections divided by the observation period; rMSSD is the square root of the sum of the squared differences of the values of successive pairs of intervals NN; pNN50 - the percentage of NN50 from the total number of successive pairs of NN intervals (NN50 - the number of pairs of consecutive NN intervals differing by more than 50 ms, obtained over the entire recording period), CI: Circadian Index

The changes in HRV and signs of hypersympathicotonia correlated with the data obtained in the evaluation of the initial state of endothelium-dependent dilatation of the brachial artery in 20 patients with AH with AO who underwent a cuff test with reactive hyperemia by the method of D Celermeier., *et al.* (Table 11) [12]. In 15 out of 20 examined, the degree of vasodilation was determined to be 6.27 ± 0.6%, which corresponded to the I-II severity level of ED. Another 5 patients had grade III-IV severity, and the dilatation of the brachial artery corresponded to mean values of 2.35 ± 0.2%. In general, the initial degree of dilatation of the brachial artery was only 5.29 ± 0.5%.

The initial severity of ED	ΔD, %
I-II	6,27 ± 0,6
III-IV	2,35 ± 0,2
All patients	5,29 ± 0,5

Table 11: *Diameter of the brachial artery (ΔD) during the cuff test.*

Thus, the data obtained in the initial survey in accordance with the criteria of ATP III (Adult Treatment Panel III) indicated the presence of MS signs in the vast majority of the patients examined. In this case, the ED that we identified was a consequence of IR and could contribute to increasing the pressure and weighing the severity of the course of atherosclerosis.

The presence of MS in the examined MS patients was also confirmed by high mean values of TG (2.13 ± 0.2 mmol/l), LDL cholesterol (4.95 ± 0.4 mmol/l), fasting glucose (5.95 ± 0.3 mmol/l) and a decrease in the content of HDL cholesterol (1.08 ± 0.3 mmol/l).

Discussion and Conclusions

Somatoform dysfunction of the autonomic nervous system is a group of disorders manifested by symptoms of damage to internal organs or organ systems, but not having an objectively recorded basis. Complaints are presented by patients in such a way as if they are caused by a physical disorder of that system or organ that is mostly or completely under the influence of the autonomic nervous system, i.e. gastrointestinal, cardiovascular, or respiratory system.

The main symptom of IBS is abdominal pain or discomfort, the severity of which in patients can vary greatly. It is important that manifesting pain or discomfort tend to continue and develop. The peculiarity of the pain syndrome in IBS is called visceral hypersensitivity and is determined by two characteristic features - hyperalgesia and allodynia, the latter being the state when sky stimuli, such as tactile, temperature, proprioceptive, cause a sensation of pain.

In ICD-10, disorders synonymous with diagnoses are "vegetovascular/neurocirculatory dystonia" or "Da Costa syndrome," classified as "Somatoform disorders" (F45) which occupies an independent section within the category of "Somatoform autonomic dysfunction" (F45.3). Reliable diagnosis of "SVD" is established in the presence of two or more major symptoms, and with at least two additional clinical criteria [4]. With SVD, due to dysregulation of vasomotor centers with a tendency to sympathicotonia with insufficient inactivation of catecholamines, a cerebral vasospasm of a functional nature develops. In turn, it leads to insufficient adaptability and inadequacy of cerebral blood circulation of a regional character in violation of tissue systems of lipid peroxidation and dyslipidemia in combination with hypercortisolemia [14].

Neurotic and somatoform disorders may be permanent (with the ever-present signs of the disease), paroxysmal (vegetative crises or panic attacks) or latent (dormant). Somatoform disorders occur in the following syndromes:

- In the upper gastrointestinal tract (GIT) is coded as F 45.31 and manifested by dyspeptic disorders (nausea, vomiting, dry mouth, belching, aerophagia, hiccups, functional pylorospasm, and "gastric neurosis");
- In the lower part of the gastrointestinal tract is coded as F 45.32 and manifested by abdominal pain, flatulence, irritable bowel syndrome, gas diarrhea syndrome [15].

Irritable bowel syndrome (IBS) is a typical example of psychosomatic relationships in psycho-vegetative disorders. In ICD-10, IBS relates to two sections: as a gastroenterological disease - IBS with a predominance of diarrhea (cipher K 58.0), IBS without diarrhea (cipher K 58.9) and IBS with a predominance of constipation (code K 59.0). As an independent mental disorder, it is classified as somatoform autonomic dysfunction (F 45.3).

Clinical manifestations of IBS (Rome criteria): lower abdominal pain, improvement with defecation; frequent stools that occur with the beginning of the attack of pain; the appearance of liquid stools with the onset of pain; visible abdominal distension; mucus in the feces; a feeling of incomplete emptying of the bowel after defecation. As can be seen from the description of the clinical picture, a significant place in it is occupied by pain syndrome, in its intensity and manifestation zone, usually not corresponding to the morphological substrate of the disease. The greatest occurrence of this pathology is observed in large megacities and capitals, where the level of stress factors is very high, residents of small towns suffer much less from this disease and practically do not have IBS in rural areas [16].

Irritable bowel syndrome is a typical psychosomatic pathology, because somatic symptoms arise and proceed on the basis and in close connection with psychopathological manifestations, which is recognized by most researchers at the present time [17,18]. It is known that the brain not only perceives, analyzes and modulates input sensory signals, but it is also capable of generating pain perception even in cases when no external impulses and stimuli from the periphery arrive [19,20].

For pain syndrome or discomfort in IBS is characterized by the following:

- Chronic course of pain syndrome with a relatively stable character (no obvious progression);
- Pain is not permanent, but periodic;
- Pain localization: in some patients, abdominal pain can be localized, while others cannot be identified when examining a clear localization;
- Reduction of pain or discomfort after defecation or exhaustion of gases;
- The absence of nocturnal symptoms.

Development of the syndrome of hypersensitivity in IBS is promoted by impaired serotonergic signaling in the central nervous system and in the intestine. The therapeutic effect of agonists and serotonin blockers in the treatment of IBS is probably due to the ability of this regulatory amine to modulate visceral nociception in central stress chains [21].

In patients with somatoform disorders in IBS, there is a violation of synthesis of neurotransmitters or their degradation systems, as well as the configuration of receptors, which can distort the pain impulse that follows from the intestine to the brain. In addition, there is a disruption in the functioning of the antinociceptive system, in particular, a decrease in the production of endogenous opiates. In this case, the process of descending (due to the influence of the cerebral cortex) can also be disturbed, suppressing the perception of pain. The perception of pain is closely related to the change in the emotional modulation of afferent signals from the intestine to the centers of regulation of the perception of pain and the insufficiency of cortical activation of the pain-inhibiting system. This position is consistent with the classical theory of pain, according to which sensory and affective-cognitive components play an important role in its sensation.

In the study of the effect of the transferred emotional stress, it turned out that its action is mediated through changes taking place in the receptor apparatus of the brain structures. In particular, the number of glucocorticoid receptors in the hypothalamus, the hippocampus and the frontal cortex decreases, and the number of inhibitory presynaptic alpha 2-adrenergic receptors in locus coeruleus decrease [22]. Since locus coeruleus is closely related to corticoliberin-secreting neurons, a change in the number of alpha2-adrenergic receptors can lead to disturbances in the functioning of the hypothalamic-pituitary-adrenal system and, as a consequence, perception of pain. A consequence of the stress transferred at an early age is a violation in the serotonergic system in the form of a decrease in the sensitivity of the inhibitory presynaptic 5-HT1A receptors in the frontal cortex responsible for reducing the sensitivity to bowel tension. It should be noted that a change in the sensitivity of presynaptic 5-HT1A receptors, especially in the nerve terminals of the enteral nervous system innervating the large intestine, results in a disruption of the reuptake of serotonin from the synaptic cleft and, thereby, the restoration of its content in the efferent nerve structures. Reduction of serotonin content, in turn, leads to a decrease in the level of the product of its metabolism - melatonin, which is confirmed by the study of O.N. Rodionova. In the group of patients with IBS, a significant decrease in the level of endogenous serotonin and melatonin was found in comparison with the group of patients with organic lesions of the gastrointestinal tract (JAB and NNC) and healthy individuals; revealed an inverse correlation between the severity of organ and systemic manifestations of IBS, with one, and the level of endogenous serotonin or melatonin - on the other hand [23]. The decrease in the reduction of efficacy in case of a pain syndrome found in our study is three times the clinical manifestation of IBS with pain syndrome - a violation of intestinal transit.

Thus, based on somatoform disorders in IBS are dysfunctional in disorders of cortical and subcortical centers, the extrahepatic portion of the autonomic nervous system, peripheral neuroreceptors the apparatus of the intestinal enteric nervous system.

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