



## **THE STATE OF THE SYMPATHETIC-ADRENAL SYSTEM IN MENOPAUSAL WOMEN WITH HYPERTENSION**

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<b>Received:</b> April 11 <sup>th</sup> 2023 <b>Accepted:</b> May 11 <sup>th</sup> 2023 <b>Published:</b> June 20 <sup>th</sup> 2023	The purpose of this work was to study the relationship of disorders of the functional state of the sympathetic-adrenal system in menopausal women with metabolic syndrome. The results of the conducted studies have shown that in the metabolic syndrome, the sympathetic-adrenal system and lipid peroxidation processes are activated. With the onset of menopause in women with hypertension, there is an increase in the average daily systolic blood pressure, as well as the speed and magnitude of its morning rise, which are more pronounced in the postmenopausal period. The formation and development of hypertension in women in the menopausal period occurs against the background of activation of the sympathetic nervous system.

**Keywords:** Metabolic syndrome, menopausal syndrome, sympatho-adrenal system, arterial hypertension, menopause.

**MANAGEMENT:** MS metabolic syndrome is a comorbid disease that includes several pathologies at once: diabetes mellitus, hypertension, obesity, coronary heart disease. The term "syndrome X" was first introduced at the end of the twentieth century by the American scientist Gerald Stephen. The disease most often affects people aged 35 to 65 years, mainly male patients suffer. In women, the risk of developing the syndrome after menopause increases by 5 times. HYPERTENSION often serves as one of the first clinical manifestations of MS[4.10]. To understand atherosclerosis, hypertension and coronary heart disease, it is necessary to study biogenic amines (adrenaline, norepinephrine, serotonin, etc.) and their precursors, metabolic products and enzymes involved in their metabolism [1, 2]. Of course, the fundamental role in the formation of hypertension in perimenopause is assigned to the natural deficiency of female sex hormones for the menopausal period, but the main mechanisms increases in blood pressure are universal and are primarily associated with activation of the sympathetic-adrenal (SAS) and renin-angiotensin-aldosterone systems (RAAS), as well as with vascular endothelial dysfunction [3, 4]. In the menopausal period, as a result of a deficiency of sex hormones, arterial hypertension often develops, general somatic and cardiohemodynamic manifestations of which reduce the quality of life of women and reduce its duration. However, the features and patterns of manifestation of psychosomatic disorders in arterial hypertension in menopausal women require further study.

**OBJECTIVE:** to study the functional activity of the sympathetic-adrenal system and clinical and functional

features in menopausal women with metabolic syndrome.

**MATERIALS AND METHODS:** In a hospital setting, 42 examined women aged 25-49 years were randomized into the following 3 groups: I (control) – healthy individuals aged 25-40 years – 15 people; II – patients with arterial hypertension – 14 people aged 30-49 years; III group – MS patients – 28 women aged 30-49 years. The diagnosis in all examined patients was made on the basis of data from clinical observation, laboratory analysis and functional diagnostics. MS is exposed based on the recommendations of experts of the All-Russian Society of Cardiologists. The stage and degree of AG were determined according to the recommendations of WHO and the International Society for Hypertension (1999) and in accordance with the classification adopted at the meeting of the All-Russian Scientific Society of Cardiology. To quantify the severity of menopausal syndrome, the Kupperman menopausal index, generally accepted in clinical practice, was used (modified by E.V.Uvarova, while the detected neurovegetative manifestations of menopausal syndrome were considered mild at 10-20 points, moderate - 21-30 points, heavy - more than 30 points.

**INSTRUMENTAL EXAMINATION:** General clinical examination was carried out according to generally accepted programs (clinical analysis of blood, urine, ECG, X-ray examination of the chest organs, etc.). Determination of adrenaline (A), norepinephrine (NA), dopamine (DA) and DOPA in daily urine was performed by trioxyindole fluorimetric method modified by E.S. Matlina, Z.M. Kiseleva, I.E. Sofieva. Determination of



the content of conjugates of catecholamines (KA) in urine was carried out according to the method described by T.I. Lukicheva, V.V. Menshikov, T.D. Bolshakova. The results of clinical studies were processed using the applied statistical processing programs of the Excel program, as well as by the method of variational statistics using the Student's t-criteria tables. The differences between the arithmetic averages were considered statistically significant at  $p < 0.05$ .

**RESULTS AND DISCUSSION.** The maximum level of total cholesterol, triglycerides, LDL is marked in group III, compared with the control and II groups at  $t > 2$  according to the Student criterion ( $R < 0.05$ ;  $R < 0.01$ ;  $R < 0.001$ ). Compared with the control, the value of total cholesterol in patients with hypertension increased by 42.2%, and in women with MS - by 51.1%. The triglyceride content in group III exceeded the control value by 46.6%, in group II by 20%. The LDL level in group II exceeded the indicator of the control group by 60.7%, the LDL content in group III

increased by 85.7% compared to the healthy group. HDL in group II and III was reduced compared to the control. Fluctuations in blood pressure were significantly more common in postmenopausal women, 90.3% of individuals, and with preserved ovarian function only in 15.7% of patients. An increase in blood pressure in menopausal women was accompanied by a symptom complex "hot flashes" 81.2% of cases. Also, in all the observed groups there were patients with type II diabetes mellitus (2.6% women with preserved ovarian function and 20% postmenopausal women), which may indicate the presence of a relationship between carbohydrate and lipid metabolism disorders in menopausal women. The tendency to increase the incidence of type II diabetes in the postmenopausal period (20% compared to 2.6% in women of the control group,  $p < 0.05$ ) indicates the progression of metabolic disorders with the development of menopause in the observed category of patients. When comparing the first and second groups, the difference in blood glucose levels was 7.1%, and in groups I and III - 47.6%.

**Table 1.**

**Daily excretion of catecholamines in urine in practically healthy and patients with metabolic syndrome**

Group	Catecholamines									
	A, mcg/day			NA, mcg/day			DA, mcg/day			DOPA mcg/day
	Sv	con.	Sum.	Sv	con.	Sum.	Sv	con.	Sum.	
I	4,5±0,1	3,7±0,2	8,2±0,2	8,9±0,2	9,2±0,1	18,1±0,2	79,2±6,2	182,6±5,8	461,8±6,4	47,3±0,8
II	6,0±0,1***	5,8±0,2***	11,8±0,2***	11,8±0,1***	12,3±0,1***	24,1±0,2***	159,8±5,1*	168,3±4,6^	328,1±8,6^	50,2±0,6*
III	9,2±0,3***	8,2±0,2***	17,4±0,2***	12,9±0,4***	12,2±0,3***	25,2±0,2***	165,2±4,4*	159,4±2,8^	324,6±9,4*	58,8±0,8* *

Note. A – adrenaline, NA – norepinephrine, DA – dopamine, MAO – monoamine oxidase, Sv. – free, Con. – conjugated, Sum. – total. \* -  $P < 0.05$ ; \*\* -  $P < 0.01$ ; \*\*\* -  $P < 0.001$ ; ^ - unreliable.

In the study, we noted a statistically significant increase in the excretion of A and NA in the daily urine of patients with hypertension and MS. Thus, the daily excretion of total A in patients with hypertension with healthy individuals increased by 38.2% ( $P < 0.001$ ), total by 31.8%. Excretion in the daily urine of all fractions of DA and DOPA in patients with hypertension is statistically significantly lower than the control level. The excretion of free, conjugated and total A and NA in MS patients was statistically significantly higher than in healthy patients. The difference in DOPA excretion in MS was 39.1% ( $P < 0.001$ ). Thus, we found a statistically significant

increase in the daily excretion of free and conjugated forms of KA (A, NA, DA) in MS patients. In the alimentary factor group, patients indicate excessive consumption of carbohydrates and fats. Overweight and obesity are considered the main components. In the examined patients, the Quetelet index, body mass index and the degree of abdominal obesity were determined. Measurement of waist circumference in group I showed  $78.8 \pm 1.14$  cm, in group II  $80.3 \pm 0.46$ , and in group III  $102.5 \pm 1.5$  cm. Neurovegetative disorders were the most pronounced, and their severity significantly increased during the transition to postmenopause in both women



with hypertension (from 22 to 29 points) and without hypertension (from 18 to 25 points). Thus, in premenopause, grade 1 hypertension was encountered in 48.2% of women, and grade 2 in 46.5%. During the transition to postmenopause, the number of patients with grade 2 hypertension sharply increased (81.6%) and a threefold increase in those with grade 3 hypertension (from 5.1% to 15%). The revealed changes in postmenopausal women with hypertension may be associated with their gradual adaptation to changed physical, psychological and social conditions. A further increase in the tension of the activity of the SAS is aimed at mobilizing the internal reserves of the body. However, at one of the stages of this process, the catabolic orientation of the effects of SAS begins to manifest itself, and a further increase in the activity of which becomes one of the main elements of the formation of this pathology and its complications.

**CONCLUSIONS:** Thus, the results of the conducted studies have shown that in MS, the activation of CAC occurs, expressed by an increase in the content of A and NA in the blood and urinary excretion of KA (A, NA, YES, their precursor DOPA). With the onset of menopause in women with hypertension, there is an increase in the average daily systolic blood pressure, as well as the speed and magnitude of its morning rise, which are more pronounced in the postmenopausal period. A study of patients with metabolic syndrome showed a change in the functional activity of the sympathetic-adrenal system with increased urinary excretion of free and conjugated forms of catecholamines, and therefore early correction is necessary to prevent the development of complications.

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