



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

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### **Abstract:**

The aim of this work was to study the relationship of disorders of the functional state of the sympathetic-adrenal system in women in the menopausal period with metabolic syndrome. The results of the conducted studies showed that in the metabolic syndrome, the sympathetic-adrenal system and lipid peroxidation processes are activated. With the onset of menopause, women with hypertension have an increase in the average daily systolic blood pressure, as well as the rate 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.

**INTRODUCTION:** Menopausal syndrome is the most unpleasant factor, in connection with which many women are terribly afraid of the onset of menopause and set themselves up in advance for a negative wave, perceiving the natural process as something terrible, problematic and uncontrolled. The menopausal period is a complication of the normal menopausal period and is observed on average in 30-50% of women. Metabolic syndrome MS is a comorbid disease that includes several pathologies at once: diabetes mellitus, arterial hypertension, obesity and coronary heart disease. The term "syndrome X" was first coined in the late twentieth century by the American scientist Gerald Riven. The disease more 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 is often one of the first clinical manifestations [of MS [4, 10]. To understand atherosclerosis, hypertension, and CHD, it is necessary to study biogenic amines (epinephrine, 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 climacteric period. The mechanisms of increasing 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 lack of sex hormones, arterial hypertension often develops, the general somatic and cardio hemodynamic manifestations of which reduce the quality of life of women and reduce its duration. However, the features and patterns of the manifestation of psychosomatic

disorders in arterial hypertension in women of the menopausal period require further study.

**OBJECTIVE:** to study the functional activity of the sympathetic-adrenal system and clinical and functional features in women in the menopausal period with metabolic syndrome.

**MATERIALS AND METHODS:** In a hospital setting, 42 women aged 25-49 years were randomly assigned to 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 old. The diagnosis in all examined patients is based on data from clinical observation, laboratory analysis, and functional diagnostics. MS is issued based on the recommendations of experts of the All-Russian Society of Cardiology. The stage and degree of hypertension were determined according to the recommendations of WHO and the International Society for Hypertension 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, which is generally accepted in clinical practice (modified by E. V. Uvarova), was used, while the detected neurovegetative manifestations of menopausal syndrome were considered light at 10-20 points, moderate - 21-30 points, and severe - 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, etc.). Determination of epinephrine (A), norepinephrine (NA), dopamine (DA),



and DOPA in daily urine was performed by the trioxindole fluorimetric method modified by E. Sh.Matlina, Z. M. Kiseleva, and I. E.Sikhieva. Determination of the content конъюгатов of catecholamine (CA) conjugates in urine was performed according to the method described by T. I. Lukicheva and T. D. Bolshakova. The results of clinical trials were processed using the applied statistical processing programs of the Excel program, as well as by the method of variation statistics using Student t-criteria tables. Differences between the arithmetic mean values were considered statistically significant at  $p < 0.05$ .

**RESULTS AND DISCUSSION.** The maximum level of total cholesterol, triglycerides, LDL is observed in III group III, compared with the control and II groups at  $t > 2$  according to the Student's criterion ( $P < 0.05$ ;  $P < 0.01$ ;  $P < 0.001$ ). In comparison with the control group, the total cholesterol level in patients with hypertension increased by 42.2%, and in women with MS - by 51.1%. The triglyceride content in III group III exceeded the control value by 46.6%, in II group II by 20%. The LDL level in II group II exceeded the control

group by 60.7%, the LDL content in III group III increased by 85.7% compared to the healthy group. HDL in group II and III was reduced compared to the control group. Blood pressure fluctuations were significantly more common in postmenopausal women (90.3% of patients), and only 15.7% of patients with preserved ovarian function. An increase in blood pressure in menopausal women was accompanied by a symptom complex "hot flashes" in 81.2 % of cases. Also, all observed groups included patients with type II diabetes mellitus (2.6% of women with preserved ovarian function and 20% of postmenopausal women), which may indicate a relationship between carbohydrate and lipid metabolism disorders in women in the menopausal period. The tendency to increase the frequency of type II diabetes in the postmenopausal period (20% compared to 2.6% of women in 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 level was 7.1%, and in groups I and III - 47.6%.

**Table 1.**

**Daily urinary excretion of catecholamines in healthy subjects and patients with metabolic syndrome**

Group s	Catecholamines									
	A, mcg /day			NA, mcg /day			DA, mcg /day			DOFA mcg /day
	Sv.	Kon.	Sum.	Sv.	Kon.	Sum.	Sv.	Kon.	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-epinephrine, NA-norepinephrine, DA-dopamine, MAO-monoamine oxidase, Sv - - free, Kon - - conjugated, Sum - - total. \* -  $P < 0.05$ ; \*\* -  $P < 0.01$ ; \*\*\* -  $P < 0.001$ ; ^ - unreliable.

During the study, we noted a statistically significant increase in the excretion of A and HA 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 na - 31.8%. Daily urinary excretion of all DA and DOPA fractions in patients with hypertension is statistically significantly lower than the control level. The elimination of free, conjugated, and total A and HA in MS patients was statistically significantly higher than in healthy subjects. 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 CA (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. The больных Quetelet index body mass index and abdominal obesity level were determined in the examined patients. Measurement of waist circumference in I group I showed  $78.8 \pm 1.14$  cm, in II group II- $80.3 \pm 0.46$ , and III 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 both in women with hypertension (from 22 to 29 points) and without hypertension (from 18 to 25 points). Thus, in premenopausal women, grade 1 hypertension occurred in 48.2%, and grade 2 hypertension-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 related to their gradual adaptation to the changed physical, psychological and social conditions. A further increase in the intensity of CAC activity 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, and the further increase in the activity of which becomes one of the main elements in the formation of this pathology and its complications.

**CONCLUSIONS:** Thus, the results of the conducted studies showed that in MS, CA activation occurs, expressed by an increase in the content of A and HA in the blood and urinary excretion of CA (A, HA, DA, their DOPA precursor). With the onset of menopause, women with hypertension have an increase in the average daily systolic blood pressure, as well as the rate 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 an early correction is necessary to prevent the development of complications.

#### LITERATURE

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