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**APPLICATION OF A MULTIDISCIPLINARY APPROACH IN A CLINICAL  
MANAGEMENT OF VEGETATIVE DISORDERS INDUCED BY INCREASED  
ANXIETY AT PATIENTS WITH METABOLIC SYNDROME**

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*Our study aimed to analyze the impact of complex physical rehabilitation on the state of autonomic regulation in the initial phases of metabolic syndrome, under conditions of chronic stress using a multidisciplinary approach. After all, according to modern scientific sources, multiprofessional rehabilitation is the effective basis of metabolic syndrome therapy. In addition, a proportional relationship between excess weight and neuropsychiatric disorders, including anxiety and depression, and the need for therapeutic intervention during the period of initial growth of the body mass index, when dyslipidemic processes and energy deficit occurs, and autonomic regulation disorders are established. Homeostasis features and the level of anxiety were determined by the method of heart rate variability assessment and assessment of the emotional sphere according to Beck's anxiety scale. The patients were divided into 2 groups: the main group (10 people, including 3 men and 7 women aged 47–60 years), who for six months received a complex of medical basic therapy and rehabilitation measures involving physiotherapeutic and ergotherapeutic interventions; a control group (10 people, including 4 men and 6 women of the same age), who received the prescribed medical basic therapy (vasoactive, antihypertensive, hypoglycemic drugs, statins) and followed recommendations for optimizing lifestyle and nutrition. The conducted studies revealed the peculiarities of homeostasis in the form of a tendency to sympathicotonia and a low rate of adaptation processes, when the the body's compensatory stress reactions index – the tension index (TI) at rest is 125.1 units against the norm of 65.0 units.*

This reflected a decrease in autonomic regulation of heart rate and an increase in the influence of central mechanisms. An increase in anxiety (29.5 points) of medium level was found – in 68%, high level (57.3 points) – in 32%. Taking into account the individual assessment data according to the international classification of functioning (ICF) and the goals set according to the SMART format, a complex of rehabilitation measures was developed.

As a result of the course of complex therapy, a decrease in the anxiety index by  $9.1 \pm 0.2$  points was obtained in the patients of the main group, and a less significant decrease – by  $5.0 \pm 0.1$  points in the control group. The intensity of compensatory mechanisms became optimal according to the tension index (TI) parameter, which approached the norm:  $60.7 \pm 2.0$  units in patients of the main group and had insignificant dynamics in the control group:  $75.0 \pm 2.4$  units. The dynamics of BMI decrease mainly in the main group – by  $8.5 \pm 0.3$  kg/m<sup>2</sup> (12%) compared to the second group – by  $4.1 \pm 0.4$  kg/m<sup>2</sup> (5%). We have proven that the use of a complex approach in the management of autonomic disorders associated with increased anxiety in patients with metabolic syndrome helps to reduce the tension of compensatory mechanisms of autonomic regulation. A patient-centered orientation ensures the achievement of lifestyle optimization and improvement of metabolic indicators and psycho-emotional state in patients with metabolic syndrome.

**Key words:** metabolic syndrome, autonomic disorders, anxiety disorders, physical rehabilitation.

### Наталія Гришуніна, Максим Манін, Ігор Олексенко, Вікторія Мохна, Наталія Стогній, Олена Шарапова. Застосування мультидисциплінарного підходу в клінічному менеджменті вегетативних розладів, індукованих підвищеною тривожністю, у пацієнтів із метаболічним синдромом

Метою нашого дослідження було вивчення впливу комплексної фізичної реабілітації на стан вегетативної регуляції на початкових фазах метаболічного синдрому в умовах хронічного стресу із застосуванням мультидисциплінарного підходу. Адже, за даними сучасних наукових джерел, ефективними засадами терапії метаболічного синдрому є мультипрофесійна реабілітація. До того ж встановлено пропорційний зв'язок надлишкової ваги та нейропсихічних розладів, у тому числі тривожних та депресивних, і необхідності терапевтичного втручання в період початкового зростання індексу маси тіла, коли відбуваються дизліпідемічні процеси, виникає енергодефіцит, відбуваються порушення вегетативної регуляції. Методом оцінки варіабельності ритму серця та оцінки емоційної сфери за шкалою тривоги Бека були визначені особливості гомеостазу та рівень тривожності. Пацієнти були поділені на дві групи: основна група (10 осіб, із яких 3 чоловіки та 7 жінок у віці 47–60 років), що протягом пів року отримували комплекс медикаментозної терапії реабілітаційних заходів із залученням фізіотерапевтичних та ерготерапевтичних утручань; контрольна група (10 осіб, з яких 4 чоловіки та 6 жінок того ж віку), які отримували призначену медикаментозну базисну терапію (вазоактивні, антигіпертензивні, сахарознижжучі засоби, статини) та дотримувалися рекомендацій оптимізації способу життя і харчування. Проведені дослідження виявили особливості гомеостазу у вигляді схильності до симпатикотонії і низького показника процесів адаптації, коли індекс напруження ІН у стані спокою 125,1 одиниць за норми 65,0 одиниць. Це відображало зниження автономної регуляції серцевого ритму та зростання впливу центральних механізмів. Було виявлено підвищення тривоги (29,5 бали) середнього рівня у 68%, високого рівня (57,3 бали) – у 32%. З урахуванням індивідуальних даних оцінювання за міжнародною класифікацією функціонування (МКФ) та поставлених за SMART-форматом цілей було розроблено комплекс реабілітаційних заходів.

У результаті курсу комплексної терапії у пацієнтів основної групи було отримано зниження показника тривоги на  $9,1 \pm 0,2$  бали та менш значне зниження – на  $5,0 \pm 0,1$  бали у контрольній групі. Стала оптимальною напруженість компенсаторних механізмів за даними параметру індексу напруження (ІН), який наблизився до норми:  $60,7 \pm 2,0$  одиниць у пацієнтів основної групи та мав незначну динаміку в контрольній групі:  $75,0 \pm 2,4$  одиниць. Динаміка зниження показників індексу маси тіла (ІМТ) переважно в основній групі – на  $8,5 \pm 0,3$  кг/м<sup>2</sup> (12%) порівняно з другою групою – на  $4,1 \pm 0,4$  кг/м<sup>2</sup> (5%). Нами доведено, що застосування комплексного підходу в менеджменті вегетативних розладів, пов'язаних із підвищеною тривожністю у пацієнтів із метаболічним синдромом пацієнтів, сприяє зниженню напруженості компенсаторних механізмів вегетативної регуляції. А пацієнт-центрична спрямованість забезпечує досягнення оптимізації способу життя та поліпшення показників обміну речовин і психоемоційного стану у пацієнтів із метаболічним синдромом.

**Ключові слова:** метаболічний синдром, вегетативні розлади, тривожні розлади, фізична реабілітація.

**Introduction.** Nowadays, the problems of metabolic syndrome, as a complex of sequential disorders of the metabolic processes of central neurogenesis and its connection with stress, are becoming increasingly relevant [2, 4, 8].

Metabolic syndrome is a complex of disorders of hydrocarbon and fat metabolism that is characterized by dyslipoproteidemia of insulin resistance, hypertriglyceridemia, abdominal obesity and polymorbidity of various body systems. One of the pathogenetic links of the metabolic syndrome is the

increase in the function of the sympathetic link of the autonomic nervous systems, which is a significant provoking factor in the development of this condition nowadays [3, 5, 6].

The increase in stress hormones – cortisol, corticosterone leads to changes in lipid metabolism, arterial hypertension, hyperglycemia, hypo immune conditions, abdominal obesity, and a high concentration of adrenaline and catecholamines contributes to the pathology of small vessels and tissue hypoxia. With an increase in the tone of the

sympathetic link of the autonomic nervous system, changes in lipid metabolism, hyperinsulinemia occur. Increased prolactin causes hyperestrogenia, osteoporosis, ovarian cycle disorders. In addition, the stressful

conflict between the perception of needs and pleasure leads to the appearance of symptoms of psych trauma – excessive motor excitability, musculoskeletal disorders and emotional excitability [2, 3, 7].

Psycho-traumatic situations and lack of sleep during the war, when negative ways to overcome are included: daily readiness for repetition of stress, the desire to reduce anxiety levels lead to an increase of cortisol levels, a decrease in the synthesis of TSH, melatonin, glucagon, an imbalance of hormones: leptin, adiponectin, ghrelin and as a result – changes in eating behavior with further weight gain. It has been found that anxiolytic effect of ghrelin has a reinforcing effect in the vicious circle of pathogenesis of food addiction, as a result of which psychological exhaustion of patients, disorders of vegetative regulation [4, 8].

Currently, the theory of the advantage of the psychological nature of eating disorders in patients with psych trauma over the neurohumoral mechanism of eating disorders in the form of psychogenic compulsive overeating is recognized. This is associated with a change in the sensitivity of the ventral zones of the prefrontal cortex, which belong to the reward system. Recent publications show that disorders of cortical-subcortical regulation of emotions of achievement in the form of a hedonic type of metabolism are realized with the participation of genetic mechanisms induced by anxiety and manifested in violation of the balance of stages of nutrition: dopaminergic stage of reward and opioid stage of satisfaction. There is now a direct proportional association between overweight and neuropsychic disorders including anxiety and depressive [5, 8].

A modern approach to the therapy of manifestations of metabolic syndrome is an intervention at the first phases of metabolic syndrome during the initial increase in body mass index when dyslipidemic processes occur, membrane protective functions and myelin synthesis are disrupted, energy deficiency occurs, vegetative regulation disorders occur, physical performance decreases, which are combined with a change in self-perception and social relationships. Timely intervention can achieve the reversibility of this state [7, 9].

Effective principles of metabolic syndrome therapy are multiprofessional rehabilitation on the principle of patient-centrality, analysis of problems and

goals set according to the SMART format aims: hierarchical, measurable and achievable for the patient's health.

Achieving a positive dialogue with the patient is possible through recovery strategies: reducing anxiety and transforming life goals, self-control of regime and nutrition quality, sleep hygiene, optimizing lifestyle, physical activity [1, 6].

Implementation of the strategy of anxiety control and transformation of life goals through psychotherapeutic interventions is effective in the form of individual and family therapy, collective activities in physical rehabilitation groups, which are caused by the need for socializing [9].

The strategy of healthy eating in metabolic syndrome is provided by proven effective dietary interventions: avoiding loads of fatty, sweet food, which stimulate vegetative imbalance, inclusion in the menu of products containing tryptophan, B vitamins, which in the presence of this amino acid and intestinal lacto and bifido flora contribute to the synthesis of melatonin and the regulation of circadian rhythm. The strategies of the diet are recommended now: discussion of the choice of the type of dishes, observance of the daily diet, exclusion of snacking, eating calorie food in the active part of the day – contribute to the formation of healthy food behaviour.

Providing a lifestyle optimization strategy today is implemented through the intervention of an occupational therapist as a basis for a therapeutic alliance with the patient: setting up for constant lifestyle changes, encouraging the use of self-control tools, including mobile applications for the organization of work and sleep health. As the sleep process provides the synthesis of hormones serotonin, adiponectin, thyrotropin, reducing cortisol levels, its hygiene contributes to weight loss and improving the balance of adrenergic and cholinergic systems in a whole [1, 8].

The healthy lifestyle strategy is based on the optimal physical activity of the patient, which is implemented through physiotherapeutic interventions [5, 6]. Recent studies indicate a slowdown in the development of metabolic syndrome due to the activation of oxidative processes in the tissues of working muscles, an increase in the consumption of fatty acids, carbohydrates, triglycerides, decreased glucose levels, increased sensitivity to insulin.

Proved ones are physical activities in the types of therapeutic exercises of low and medium intensity, taking into account tolerance to the patient's physical activity. Incorporating relaxation exercises and breathing exercises to reduce sympathicotonia provides balancing of vegetative regulation [7, 9].

**Purpose of the study.** Studying the effect of complex physical rehabilitation on the state of vegetative regulation at metabolic syndrome in conditions of chronic stress.

**Material and methods.** We observed 20 patients with metabolic syndrome who had its components: arterial hypertension, an increase in body mass index (BMI) of  $35.7 \pm 0.1 \text{ kg/m}^2$ , an increased triglyceride level of  $2.3 \pm 0.01 \text{ mmol/L}$  and an index of insulin resistance – HOMA index of  $5.9 \pm 0.04 \mu\text{mol/L}$ .

The main group consisted of 10 people (3 men and 7 women) aged 47–60 years who for six months received a complex of drug therapy and rehabilitation measures involving physiotherapy and ergotherapy interventions. The control group of 10 people (4 men and 6 women) of the same age who received the prescribed drug therapy (vasoactive, antihypertensive, sugar-lowering agents, statins) and performed recommendations for optimizing lifestyle and healthy eating.

**Results.** A vegetative regulation state was assessed using the heart rhythm variability method and an emotional sphere score on the Beck anxiety scale. The survey found that patients had frequent episodes of anxiety, indicated the presence of diabetes in a family history – 25%, complaints of headache with psycho-intellectual loads – 68.5%, physical exertion – 45%, symptoms of vegetative imbalance increased fatigue – 79%, non-loss of air – 20%, pain in the heart – 37%, abdominal pain spastic – 58%, shallow sleep – 78%.

The survey found the presence of an average level of increased anxiety (29.5 points) at 68%, high increased anxiety (57.3 points) – at 32%.

Data from the autonomic tone survey indicated the features of homeostasis in the form of predisposition to sympathicotonia and a low indicator of adaptation processes. The suppression of humoral regulation of the heart rhythm was detected according to the cardiointerval mode index (Mo), at rest: 0.58 s at a norm: 0.74 s. Also, a decrease in the activity of parasympathetic regulation was observed according to the indicator of variational scope ( $\Delta X$ ) at rest 0.2 s at a norm of 0.3 s. At the same time, with a decrease in the vagotonic reaction, increased activity of the indicator of sympathetic intensity was observed regulation of heart rate AMo 29.0% at a norm of 22%. This suppression of homeostatic mechanisms of regulation of heart rhythm (parasympathetic and homeostatic) was also expressed in the increase in the index of the strength of compensatory reactions of the body – tension index (TI), which at rest reached 125.1 units (units) at a norm of 65.0 units.

This reflected a decrease in autonomous regulation of heart rate and an increase in the influence of central mechanisms.

Taking into account the individual characteristics of the disorders of function and structure according to the classification of the international classification of functioning (ICF), a comprehensive therapy of prevention and adaptation to the stress effect on the regulatory mechanisms was applied. The list of strategies from the perspective of the multidisciplinary approach included the following areas:

1. Lifestyle optimization.
2. Reducing anxiety levels.
3. Correction of vegetative disorders.
4. Reduction of overweight, correction of insulin resistance.
5. Recovery of physical health.

The main components of the interventions were coordination with the physical therapist, occupational therapist, relatives, interaction with members of the multidisciplinary team. The list of interventions included medical appointments and doctor's recommendations on the regime and quality of nutrition, lifestyle optimization, physical therapy, ergotherapy.

Physical therapist interventions included FITT treatment gymnastics formula: frequency per week, intensity, time, load type.

Aerobic exercises were used with a load intensity range of 40–60% of the maximum heart rate, lasting 25–30 minutes, a complex of morning hygiene exercises lasting 15–20 minutes, during a course of 6 months. The complex included general stretching therapeutic exercises for the upper extremities and shoulder girdle, neck, torso with full amplitude in the medium and fast pace of classes. To reduce peripheral vascular resistance, exercises for small muscle groups, relaxation exercises were carried out. To reduce sympathetic reactivity, breathing exercises were included – static and dynamic, taking into account the predominant tone of the autonomic nervous system.

Neurofasulation techniques (myofascial release, post isometric relaxation) were used using segmental massage in order to reduce extensor sympatho-tonic reflexes of the body. In order to increase intensity and adapt to physical activity gradually, specific exercises were used to increase mobility, for coordination. In order to socialize, create an environment of support, motivation for actions, a small-group method of practicing therapeutic exercises was used. In order to activate extracardiac factors and reduce peripheral vascular resistance, a dosed procession was used at an average pace of 60 minutes.

The occupational therapist's interventions included explaining and encouraging lifestyle changes, using a food diary and self-monitoring of the diet, labor and recreation regimen, discussing and enabling changes in dishes and the patient's menu, involving relatives in the process of daily physical activity and organizing the patient's healthy eating regime.

As a result of the course of complex therapy, patients in the main group received a decrease in the anxiety score by  $9.1 \pm 0.2$  points and a less significant decrease – by  $5.0 \pm 0.1$  points in the control group.

When assessing the status of autonomic regulation in patients in the complex therapy group, an approximation to the physiological values of the activity of sympathetic regulation of the heart rhythm was noted: parameters of the indicator AMo decreased by 21.0%. In patients of the second group, there was a decrease in sympathetic regulation of heart rhythm – by 7.0%.

The activation of the humoral channel of regulation was observed according to the data of the cardio interval (Mo) fashion index mainly in the main group – by 24.2% and to a lesser extent – by 16% in the control group. And also there was a restoration of vagotonic reactivity – an increase in the variational scale of  $\Delta X$  by 28% in the main group and 21% in the control group. As a result of achieving the balance of the nervous and humoral channels of regulation of the heart rhythm, the intensity of compensatory mechanisms became optimal, as evidenced by the

parameter of tension index (TI), which approached the norm:  $60.7 \pm 2.0$  units in patients of the complex therapy group and had a slight dynamic in the control group:  $70.0 \pm 2.4$  units.

The comparison of the dynamics of IMT indicators showed the predominant dynamics in the main group:  $8.5 \pm 0.3$  kg/m<sup>2</sup> (12%) compared to the second group:  $4.1 \pm 0.4$  kg/m<sup>2</sup> (6%). There was a decrease in the HOMA index by  $2.3 \pm 0.01$  mmol/L in the main group and only by  $1.5 \pm 0.02$  mcm/L. At the same time, the normalization of triglycerides by  $0.2 \pm 0.01$  mmol/L in the main group was achieved.

1. So, the condition of patients during the examination was marked by an imbalance in the regulation of heart rhythm in which the central mechanisms outweigh the homeostatic (autonomous) ones.

2. The use of an integrated approach in the management of vegetative disorders associated with increased anxiety in patients with metabolic syndrome contributed to the reduction of the tension of compensatory mechanisms of autonomic regulation and the balance of humoral and central circuits of heart rhythm regulation. An approximation to physiological values of the sympathetic regulation activity index was achieved.

3. The patient-centric focus ensured the achievement of lifestyle optimization and the reduction of metabolic and psycho-emotional indicators in patients with metabolic syndrome.

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