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Chemical and biophysiological processes accompanying patients with obstructive sleep apnea syndrome (OSAS) in group therapies at St. Anna Hospice

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The study included 200 patients with obstructive sleep apnea syndrome (OSAS) (164 men and 36 women), who were undergoing a three-month group therapy program through cardiac rehabilitation (CR) at a specialized medical facility – St. Anna Hospice. Daily performed blood tests showed that the improvement in the patients' condition (over 40%) is due to a decrease in the level of total cholesterol through the activation of chemical and biophysiological processes during group rehabilitation. The planned volume of laboratory testing included analysis of the blood lipid spectrum, liver transaminases, CPK, glycemia, potassium, creatinine, and, according to indications, uric acid level, and glycosylated hemoglobin.

Keywords: sleep, apnea, cholesterol $C_{27}H_{46}O$

INTRODUCTION

The activation of chemical and biophysiological processes in the blood of patients with obstructive sleep apnea syndrome (OSAS) [4] by including them in group therapies with cardiology programs leads to over 40% improvement in their condition. The present study was conducted among 200 patients who were treated at a specialized medical facility, St. Anna Hospice. The laboratory testing included analysis of the blood lipid spectrum, liver transaminases, CPK, glycemia, potassium, creatinine, and, according to indications, uric acid level, and glycosylated hemoglobin.

METHODOLOGY, EXPERIMENTAL, CASE, FINDINGS

People having sleep apnea briefly stop breathing during sleep. Their brain tries to protect them by waking them up frequently, but this in turn interferes with restful, healthy sleep. The condition is chronic, over time it can cause serious, life-threatening complications related to the cardiovascular system and is a reason for a person to seek medical attention. In about 40% of the patient cases studied at St. Anna Hospice, sleep apnea was accompanied by arterial hypertension. There are two main types of the disease – obstructive and central. In both conditions, improvement was observed as a result of group therapies to lower cholesterol levels.

Obstructive sleep apnea is the more common form that successfully responds to group therapy to lower cholesterol. The treatment is combined with sports group training. Special devices are also used that are worn during sleep and with which patients are able to achieve optimal benefits for a wide range of diseases, including those of the cardiovascular system [2].

Sleep apnea can affect people of any age and is one of the modern diseases. The disease itself causes complications similar to those of obesity and diabetes. Therefore, group sports therapies for patients at St. Anna Hospice were primarily focused on lowering the cholesterol level in order to alleviate the symptoms of obstructive sleep apnea. Before the age of 50, the disease is more common in men. After this age, its prevalence in both sexes becomes equal.

The symptoms include:

• *Feeling tired or exhausted upon waking*. Even after 8 hours of sleep, patients with sleep apnea usually feel extremely tired;

• *Daytime sleepiness*. In more severe cases, this can cause drowsiness while driving, working, or other activities;

• *Snoring.* This is a common feature of sleep apnea (but it is not something that happens in all cases). A person can have sleep apnea without ever snoring;

• *Multiple awakenings* during the night or multiple urinations for men, which they usually mistake for a prostate problem;

• *Headache* immediately after waking up;

• *Sweating* in the neck area.

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Among the most dangerous consequences of sleep apnea are heart damage and heart failure. Apnea is often the cause of arrhythmias and atrial fibrillation, which can lead to sudden cardiac arrest. Although not as dramatic as a condition, daytime sleepiness can also be potentially very dangerous, especially if a person's profession involves driving or operating dangerous machinery. Therefore, sports group therapy has benefits for both lowering cholesterol and maintaining patients' alertness.

To assess the effect of group therapy on patients at the St. Anna Hospice, an assessment of their quality of life after lowering cholesterol was applied using the QALY methodology [1].

All patients were previously consulted by a psychologist upon inclusion. During the observation, repeated consultations with a psychologist, psychocorrection using cognitive-behavioral and relaxation techniques, consultations with a psychotherapist, and individual psychotherapy according to indications were conducted. The initial psychodiagnostic examination was performed on 200 patients of the St. Anna Hospice 1 month after therapy, and then annually, according to the following methods:

1. SF-36 - quality of life assessment;
2. TOBOL methodology;
3. Zung depression scale;
4. IAT - integrative anxiety test;
5. E. Khaim's method for assessing disease coping strategies.

The TOBOL methodology is built in the form of a questionnaire that diagnoses the type of attitude towards the disease, based on information on how the patient relates to a number of life problems and situations that are potentially most important to him and are directly or indirectly related to his disease. The relationships of patients are examined through 12 subsystems, forming a common system of personal relationships [3]. These subsystems structure the content of the methodology under 12 topics: attitude towards the disease, towards its treatment, towards doctors and medical staff, towards relatives and loved ones, environment, work (study), loneliness, future, as well as self-assessment of self-esteem, mood, sleep and appetite.

To determine the value of a year of life in different health states, the utility (or strength of preference) of the treatment method for the patient is established. One year of life with its absolute quality has a QALY value of 1, and one year of life with lower quality has a QALY value of less than 1. One of the most common methods for assessing quality of life is the SF-36 questionnaire (The Short Form-36), which rates various aspects of a patient's life functioning on a scale of 1 to 100: physical (general assessment of physical functioning, role functioning that is determined by physical condition, pain intensity, general health status) and psychological (vital activity, social functioning, role functioning, which is determined by the emotional state, mental health). According to the study Percutaneous (PET) coronary angioplasty compared with exercise training in patients with stable coronary artery disease, the use of physical exercise in patients with OSAS is associated with a reduced risk of death, cardiac arrhythmias and is significantly more effective.

RESULTS AND DISCUSSION

The planned volume of laboratory testing included analysis of the blood lipid spectrum, liver transaminases, CPK, glycemia, potassium, creatinine, and, according to indications, uric acid level, and glycosylated hemoglobin. Signs of left ventricular myocardial hypertrophy were found in 154 (77%) patients, the mean myocardial mass index was 120.1 ± 15.3 g/m, diastolic dysfunction - in 80 (40%), reduced systolic myocardial function <50% according to Simpson - in 28 (14%), and areas of impaired local contractility were registered in 74 (37%) of the studied patients. None of the patients had an improvement in OSAS below 40%. All patients were previously consulted by a psychologist upon inclusion. During the observation, repeated consultations with a psychologist, psychocorrection using cognitive-behavioral and relaxation techniques, consultations with a psychotherapist, and individual psychotherapy according to indications were conducted.

The studied activations of chemical and biochemical processes in the patients' blood tests clearly showed that one of the causes of OSAS is the high cholesterol content in the body. The human body can synthesize up to 80% of the cholesterol it needs (Fig. 1).

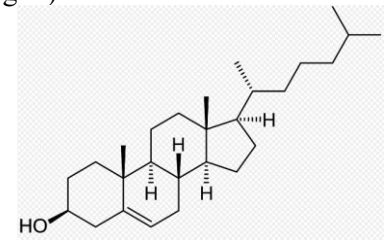

Figure 1. Cholesterol's structure. $C_{27}H_{46}O$

Normal synthesis is about 10 mg of cholesterol per day per 1 kg of body weight. Newly

synthesized cholesterol, as well as that taken in with food, enters the liver. There, cholesterol binds to special transport proteins in low-density lipoprotein complexes (low density lipoproteins – cholesterol, LDL-C, called "bad cholesterol"). LDL-C carries cholesterol to all cells and tissues of the human body.

Criteria for inclusion of patients in the study:

1. The patient's signed informed consent.
2. Patients with obstructive sleep apnea syndrome (OSAS) (164 men and 36 women) and high cholesterol $C_{27}H_{46}O$.

Criteria for excluding patients from the study:

1. Concomitant pathology that affects the patient's immediate prognosis;
2. Concomitant diseases that would prevent physical activity (consequences of stroke, diseases of the musculoskeletal system);
3. Surgical revascularization that was done as an emergency.

The clinical characteristics of the patients when included in the study are presented in Table 1. The majority of patients (164 persons - 82%) suffered from anginal stenosis of functional class III and IV (FC) at the time of sport group therapy. 36% of the patients (72 persons) were regularly seen by a doctor, the average frequency of visits to a cardiologist was 4.1 ± 1.7 (from 1 to 8) times per year; the majority (55%) of all doctor visits were made 3-6 months before hospitalization at St. Anna Hospice and were determined by the preoperative examination and the preparation of the necessary documents.

In the US and most developed countries, a degree of intervention effectiveness has been developed:

- treatment that costs <20 000 $/QALY, is cost-effective;
- medical expenses from $ 20 000/QALY to $ 40 000/QALY are considered as acceptable;
- medical expenses from $ 40 000/QALY to $ 60 000/QALY are on the border;
- treatment that costs > 60 000 $/QALY are considered as expensive;
- over 100 000 USD/QALY are considered as an unacceptable.

The present study was cost-effective because the costs of the group therapy for patients with OSAS were less than $20,000.

Over a period of 4 years of specialized sports group therapies for patients with OSAS, their blood tests showed a reduction in cholesterol $C_{27}H_{46}O$ by over 88%. As a result, in all 200 cases, complete remission of OSAS was achieved.

To reduce direct and indirect costs for contact patients with OSAS, it was necessary to be careful and precise in choosing an effective treatment approach. It is recommended to individually prescribe appropriate treatment for each patient, which should be combined with group sports activities to reduce cholesterol levels.

The clinical characteristics of the patients included in the study are presented in Table 1.

Table 1. Clinical characteristics of patients included in the study, n = 200 patients.

Clinical features	Indicator values
Age of patients	
< 45 years	10 (5%)
45 ÷59 years	110 (55%)
≥ 60 years	80 (40%)
Duration of OSAS during group therapies, years (M ± s)	4.5±3.7
OSAS - obstructive sleep apnea syndrome, patients	200 (100%)
Angina pectoris, patients including	196 (98%)
II FC	32 (16%)
III FC	98 (49%)
IV FC	66 (33%)
Painless myocardial ischemia, patients	12 (6%)
Myocardial infarction with history, patients	128 (64%)
Heart failure, patients including	168 (84%)
II FC	26 (13%)
III FC	120 (60%)
IV FC	22 (11%)
History of myocardial revascularization (PCI), patients	24 (12.0%)
Arterial hypertension, patients	184 (92%)
Stroke with history, patients	10 (5%)
Active smokers, patients	70 (35%)
Former smokers, patients	56 (28%)
Diabetes mellitus, type 2, patients	52 (26%)
Overweight (25>BMI<30 kg/m^2), patients	200 (100%)
Obesity (BMI> 30 kg/m^2), patients	190 (95%)
Heredity for CVD, patients	30 (65%)

Legend: OSAS - obstructive sleep apnea syndrome; FC - functional class; PCI - percutaneous coronary intervention; BMI - body mass index; CVD - cardiovascular diseases

The whole process is even more effective when each patient is educated about how they should change their daily routine to add years of quality life. When patients are hospitalized in a hospice (like the study group at St. Anne's Hospice), the

desired outcome can be achieved much more effectively, because patients receive 24/7 medical care [5]. The public health challenge is related to ensuring access to sleep medicine care. The field is suffering from a small number of specialists, incomparable to the large number of patients with sleep disorders.

CONCLUSIONS

After examining the data obtained, it can be concluded that the misperception of sleep is likely influenced by various psychological, cognitive and physiological factors. For example, dynamic physiological processes [7], alpha-delta sleep [6] (but not all studies have found a connection with alpha-delta sleep [8]), cyclic sleep pattern [9], REM or slow-wave sleep content [10], high cholesterol levels [2], and personality traits [11] are associated with sleep misperception.

Blood tests of the chemical and biophysiological processes that are activated as a result of rehabilitation group therapies in patients with OSAS show that by lowering the level of the so-called bad cholesterol, the human body manages to improve its quality of life (QALY) by over 40%, despite this disease. This is a significant achievement for the medical team of St. Anna Hospice, which is motivated to improve results in the future. This publication publicizes the research on the chemical and biophysiological processes accompanying patients with obstructive sleep apnea syndrome (OSAS) during group therapies at the St. Anna Hospice.

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