Effect of CPAP-therapy on quality of life of patients with bronchial asthma, combined with obstructive sleep apnea/hypopnea syndrome

**Key words:** bronchial asthma, obstructive sleep apnea/hypopnea syndrome, quality of life.

Bronchial asthma (BA) — a chronic inflammatory disease of the airways combined with bronchial hyperreactivity and symptoms manifested by recurrent wheezing, breathlessness, chest tightness, cough, especially at night and early morning. These episodes are usually associated with widespread but variable bronchial obstruction that reverse spontaneously or under the influence of therapy [1, 2].

For asthma inherent variability of physiological, clinical and functional manifestations, inflammation, pictures of exacerbations and complications, manifested as separate phenotypes of the disease. The other side of this heterogeneity of asthma is comorbidity, as 95% of adults with asthma suffering from rhinosinusitis, hypertension, diabetes, sleep obstructive apnea/hypopnea syndrome (OSAHS), depression and other diseases. Thus, asthma is a complex disease that combines a set of their own inherent and comorbid states pathophysiological mechanisms [10].

The goal of asthma treatment is to achieve the control of the symptoms and reduce future risks, because uncontrolled disease is a risk factor for exacerbations, reduced quality of life and mortality of patients [8]. But often, despite adequate therapy control cannot be reached. One reason the uncontrolled disease is hypodiagnostics and inadequate treatment of comorbid diseases [3, 6].

Thus, a sign of inadequate control of the disease is nocturnal symptoms that bother 60–74% of patients. Circadian rhythm causes asthma symptoms daily variability when they are more pronounced at night and in early morning hours. However, the cause of nocturnal asthma often is its combination with obstructive sleep apnea/hypopnea syndrome. OSAHS — a combination of excessive daytime sleepiness and sleep disordered breathing, caused by multiple repeated episodes of upper airway collapse. This is a widespread disease that significantly affects the quality of life of patients and is a risk factor of many pathological conditions and premature death of patients [7].

For asthma and SOAHS inherent common risk factors (obesity, gastro-oesophageal reflux), common pathologic mechanisms (inflammation of both airway and systemic inflammation, hypoxemia, lipid metabolism, oxidative stress) and joint manifestations (nocturnal awakening, fragmentary sleep and excessive daytime sleepiness), and as a result — a violation of the quality of life [9].

World Health Organization has defined quality of life as «an individual’s perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person’s physical health, psychological state, level of independence, social relationships, and their relationship to salient features of their environment. Undoubtedly, the quality of life of patients with asthma who are also suffering not only because of nocturnal asthma, but also from sleep apnea, significantly disrupted [17].

The «gold» standard of OSAHS treatment is CPAP-therapy (continuous positive airway pressure) — support continuous positive airway pressure in the airways. CPAP-therapy provides a pneumatic tire, «stent» for upper respiratory tract, preventing periodic soft tissues collapse and episodes of apnea. Another positive mechanism CPAP-therapy — is to increase the rigidity of the trachea due to increased lung volumes and reduce swelling of the upper respiratory tract. The immediate effect of CPAP therapy — a disclosure of collapsed alveoli, reducing lung hyperinflation, improve respiratory mechanics and ease the
burden on the respiratory muscles. Inclusion hypo ventilated areas of gas exchange in the lungs decreases lung hemodynamic shunt (release venous blood into arterial). When combined with OSAHS asthma patients needs CPAP therapy regardless of the seriousness of bronchial obstruction [14].

This study aimed to investigate the effect of CPAP therapy on quality of life of patients with asthma, combined with obstructive sleep apnea/hypopnea syndrome.

To achieve the goal we resolved the following tasks:

- to examine the features of the quality of life of patients with asthma, combined with the obstructive sleep apnea/hypopnea syndrome;
- to investigate the changes in the quality of life of these patients under the influence of CPAP-therapy.

Materials and methods

This work was financed from the state budget of Ukraine. The study was coordinated with the local Medical Ethics Committee of the NIPHP NAMS, participants were familiarized with the study protocol and signed an informed consent form to participate in the study.

The study involved 90 BA patients for OSAHS screening. Selected, comprehensively examined and treated 20 patients with asthma, which by polysomnography was finally set concomitant diagnosis – OSAHS [13].

Inclusion criteria for asthma patients were:

- signed an informed consent form to participate in the study;
- women and men from 18 years inclusive;
- confirmed asthma diagnosis;
- the basic treatment of asthma according to severity of the disease according to current standards of treatment for 4 weeks prior to study entry;
- confirmation of clinical symptoms of OSAHS by polysomnography;
- the ability to understand and perform maneuvers diagnostic procedures.

Exclusion criteria for were:

- other than asthma, respiratory diseases (lung cancer, tuberculosis, sarcoidosis, cystic fibrosis, lung surgery history);
- severe uncontrolled progressive chronic diseases that can affect the results of investigation, mental disorders;
- taking any medicines with psychotropic activity, a history of neuropsychiatric pathology;
- pregnancy, breastfeeding;
- intolerance to auto-CPAP therapy;
- changes in the basic treatment of asthma for the last 4 weeks before inclusion of patients in the study.

All patients with asthma received basic therapy according to the severity of the disease according to current standards of treatment, which was held for 4 weeks before inclusion in the study, and had stable disease (exacerbations in the past 4 weeks was not observed).

Selection of patients with asthma conducted in accordance with the criteria of the Order № 868 of Ministry of Health of Ukraine of 08.10.2013 p. «On approval and introduction of medical and technical documents on standardization of care in asthma» [5]. To assess the symptoms of asthma and definition of control of the disease in patients with asthma were asked to complete a questionnaire ACQ [5].

To assess the quality of life of patients with asthma filled questionnaire SGRQ [15]. To determine the presence of daytime sleepiness patients were asked to fill sleepiness scale Epworth [16].

Data collection and mathematical processing carried out by licensing software products included in the package Microsoft Office Professional 2007 license Russian Academic OPEN No Level № 43437596. Statistical analysis was performed using mathematical and statistical features MS Excel (Lapach S.N. et al., 2000). The parameters studied in this work were evaluated by determining the mean (M), the mean error (m), reliability (t), the level of significance (p) followed by comparison using Student-test [4].

During the study, patients were consistently two modes of therapy conducted sequentially. In the first 10 days of observation, patients continued to receive standard drugs treatment in daily doses according to current standards of treatment that they received within 4 weeks before inclusion in the study. Then the same patients administered second regimen – a combination of standard drugs treatment with auto-CPAP therapy (while sleeping). For the auto-CPAP therapy device used for the treatment of snoring and sleep apnea with humidifier SOMNOsmart 2 with SOMNOclick Smart PAP (auto-CPAP) [11]. The duration of combine therapy was 10 days.

**Table 1**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Beginning of the study</th>
<th>After 10 days standard drug therapy</th>
<th>After 10 days CPAP-therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACQ, points</td>
<td>1.8 ± 0.1</td>
<td>1.7 ± 0.1</td>
<td>1.1 ± 0.1*</td>
</tr>
<tr>
<td>Epworth scale, points</td>
<td>15.2 ± 0.8</td>
<td>15.1 ± 1.0</td>
<td>8.1 ± 0.8*</td>
</tr>
</tbody>
</table>

Note. * statistically significant difference before and after treatment, p < 0.05.

**Table 2**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Beginning of the study</th>
<th>After 10 days CPAP-therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms score</td>
<td>66.4 ± 3.8</td>
<td>49.0 ± 3.1*</td>
</tr>
<tr>
<td>Activity score</td>
<td>51.3 ± 4.5</td>
<td>25.8 ± 4.1*</td>
</tr>
<tr>
<td>Impacts score</td>
<td>44.0 ± 3.7</td>
<td>22.9 ± 2.2*</td>
</tr>
<tr>
<td>Total score</td>
<td>50.0 ± 3.2</td>
<td>28.1 ± 2.5*</td>
</tr>
</tbody>
</table>

Notes: * statistically significant difference before and after treatment, p < 0.05; & clinically meaningful difference before and after treatment, with a difference of 4 points.
Results and discussion

Regarding screening of 90 asthma patients results in 20 (22.2%) of them diagnosis of OSAHS was revealed by polysomnography.

Treatment with CPAP therapy was conducted in 20 patients with asthma (among them 13 men and 7 women) with a mean age of 56.7 ± 2.2 years and the level of bronchial obstruction in terms of forced expiratory volume in the first second of 68.0 ± 3.3%. Anthropometric parameters of the patients — height — (106.0 ± 5.5) cm, BMI — (35.4 ± 1.7) kg/m² and neck circumference — (48.4 ± 6.2) cm meet the risk factors OSAHS. In addition, concomitant obesity aggravates the course of broncho-obstructive diseases such as by increasing the intensity of symptoms, making restrictive component in breach of respiratory function and by reducing response to corticosteroid therapy [12].

Analysis of the survey, conducted in patients with asthma in combination with OSAHS, revealed the following. Prior to treatment in the studied patients had uncontrolled asthma course in terms of the questionnaire ACQ — (1.8 ± 0.1) points. Patients noted the waking at night due to asthma symptoms several times a day, morning moderate symptoms, limit daily activities due to asthma, shortness of breath, wheezing in the chest for some time — from a small to moderate amount of time. During the basic treatment of asthma (10 days observation) level of control has not changed — (1.7 ± 0.1) points (table. 1).

The additional appointment of CPAP-therapy after 10 days contributed to the improvement of controls to (1.1 ± 0.1) points with statistical (p < 0.05) and clinical (more than 0.5 points) significance difference indicator. Night, morning, day symptoms significantly reduced. The limitation in daily activity was either absent or very small, shortness of breath and wheezing patients experienced very little or almost never. Although the values of the ACQ after CPAP therapy refers to the «gray zone» within 0.75—1.25 points where control of asthma is regarded as border adequate control, as compared to patients before beginning CPAP-therapy was observed convincing clinical dynamics.

Prior to treatment in evaluation of patients with asthma observed high levels of daytime sleepiness on a scale Epworth — (15.2 ± 0.8) points, which did not change during the basic treatment — (15.1 ± 1.0) points. The additional purpose of auto-CPAP therapy helped reduce the degree of sleepiness to (8.1 ± 0.8) points, (p < 0.05), followed by a decrease to sleepiness (6.5 ± 0.7) 5 points at the time of the visit (table. 1).

At baseline quality of life associated with asthma has been studied and it was impaired in patients because of the large number and severity of symptoms, limit daily activities by the disease (table. 2). Symptoms score formed on the basis of complaints of cough, sputum production, shortness of breath, wheezing breath. It is this setting was the most impaired in patients with asthma when combined with its OSAHS. Activity score is measured by the degree of dyspnea whether it occurs during exercise, climbing a mountain or stairs, walking on level ground during washing or even alone. Activity score in the patients surveyed by us was less pronounced than the symptom score. The smallest in the studied patients were impacts score relating to the patient severe manifestations of the disease (shortness of breath while talking, pain, cough, loss of power during panic shortness of breath, feeling of disability).

After the combined therapy improvements in quality of life according to the quality of life questionnaire SGRQ. All domains of the questionnaire and the score improved WITH a statistical and clinical significance of changes.
Thus, symptom score SGRQ in examined patients at baseline ranged from 30 to 88 points. After CPAP-therapy due to decreased symptoms in 19 of 20 patients and did not exceed 66 points in all the observations (fig. 1). Activity score of patients before treatment reaches 86 points according to the SGRQ. Following the appointment of CPAP therapy positive dynamics relative activity of patients was the best among the four domains of the questionnaire (Fig. 2).

Impact score had a magnitude from 15 to 80 points among all observations also declined after a course of CPAP-therapy had the least value among the four domains of SGRQ (fig. 3).

From the above result follows naturally that the dynamics of the SGRQ total score also had a positive pattern WITH clinically and statistically significant difference indicator (Fig. 4).

The use of CPAP-therapy to patients of asthma, combined with OSASH promotes a statistically significant improvement in the quality of life of patients: a decrease in symptoms score from (66, 4 ± 3,8) to (49,0 ± 3,1) points, with a decrease in activity score from (51 3 ± 4,5) to (25,8 ± 4,1) points, with a decrease in activity score from (44,0 ± 3,7) to (22,9 ± 2,2) points and total score from (50, 0 ± 3,2) to (28,1 ± 2,5) points, (p < 0,05) according to the St George’s respiratory questionnaire (SGRQ) with clinically significant difference in rates.

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ВПЛИВ CPAP-ТЕРАПІЇ НА ЯКІСТЬ ЖИТТЯ ХВОРИХ НА БРОНХІАЛЬНУ АСТМУ, ПОЄДНАНУ З СИНДРОМОМ ОБСТРУКТИВНОГО АПНОЕ/ГІПОПНОЕ СНУ

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Резюме

Бронхиальная астма (БА) присуща суточная вариабельность симптомов, когда они более выражены ночью и в предутренние часы, что при сочетании с синдромом обструктивного апноэ/гипопноэ сна (СОАГС) значительно нарушает качество жизни больных.

Цель работы — изучить влияние CPAP-терапии на качество жизни пациентов с БА, сочетающейся с СОАГС.

Материалы и методы. В исследовании приняли участие 20 больных БА, сочетающейся с СОАГС, которые получали CPAP-терапию на фоне стандартного базисного лечения. Качество жизни оценивалось с помощью опросника качества жизни пациентов от Святого Георгия.

Результаты. Назначение CPAP-терапии больным БА, сочетающейся с СОАГС, способствует статистически достоверному улучшению качества жизни пациентов: уменьшилось число симптомов с (66,4 ± 3,8) до (49,0 ± 3,1) балла, ограничения активности — с (51,3 ± 4,5) до (25,8 ± 4,1) балла, ограничения деятельности — с (44,0 ± 3,7) до (22,9 ± 2,2) балла и общего счета — с (50,0 ± 3,2) до (28,1 ± 2,5) балла (р < 0,05), по данным опросника качества жизни пациента Святого Георгия с клинически значимым различием показателей.

Выводы. Использование CPAP-терапии у пациентов с БА, сочетающейся с СОАГС, позволило клинически значимо и статистически достоверно улучшить качество их жизни.

Ключевые слова: бронхиальная астма, синдром обструктивного апноэ/гипопноэ сна, качество жизни.

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ВЛИЯНИЕ СРАР-ТЕРАПИИ НА КАЧЕСТВО ЖИЗНИ БОЛЬНЫХ БРОНХИАЛЬНОЙ АСТМОЙ, СОЧЕТАННОЙ С СИНДРОМОМ ОБСТРУКТИВНОГО АПНОЕ/ГИПОПНОЕ СНА

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