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RESPIRATORY TRAININGS WITH POSITIVE END-EXPIRATORY PRESSURE AND LIFE QUALITY OF ELDERLY PATIENTS WITH COPD

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Summary. Assessment of the quality of life allows individualizing treatment measures and increasing treatment efficacy. The chronic obstructive pulmonary disease (COPD) decreases the functional pulmonary capacities and worsens the quality of life. The possibilities of drug therapy in old age are limited and, therefore, our work aimed to evaluate effects of respiratory trainings, using PEEP (positive end-expiratory pressure), on the life quality of the elderly patients with COPD. Forty patients suffering from COPD were examined. Of them, 26 persons were given real respiratory trainings with PEEP and 14 patients received imitated respiratory trainings. Each training course had 10 daily sessions. Each session included 15-minute breathing with PEEP 5 cm H₂O. The life quality was assessed using the EuroQol-5D questionnaire, visual analogue health scale and the specific St. George's respiratory questionnaire. After the respiratory training course with PEEP we observed the increase of physical activity of patients, the improvement of disease symptomatic as well as social-psychological status and subjective health self-assessment. The disease stage and clinical group had no impact on the effectiveness of breathing trainings with PEEP in elderly patients with COPD. Summing up, the respiratory trainings with PEEP can be the effective and safe method for improving life quality of elderly patients with COPD.

Key words: quality of life, COPD, aging, respiratory trainings with PEEP.

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ДИХАЛЬНІ ТРЕНУВАННЯ З ПОЗИТИВНИМ ТИСКУ НАПРИКІНЦІ ВИДИХУ ТА ЯКІСТЬ ЖИТТЯ У ХВОРИХ ПОХИЛОГО ВІКУ З ХОЗЛ

Е. О. Асанов, І. А. Дыба, С. О. Асанова*Резюме*

Хронічне обструктивне захворювання легень (ХОЗЛ) знижує функціональні можливості легких і погіршує якість життя. Можливості медикаментозної терапії в літньому віці обмежені, тому метою дослідження було оцінка впливу дихальних тренувань з РЕЕР (Positive End Expiratory Pressure) на якість життя у хворих похилого віку з ХОЗЛ. Обстежено 40 хворих похилого віку з ХОЗЛ. З них 26 осіб отримували реальні дихальні тренування з РЕЕР, а 14 чоловік отримували імітовані дихальні тренування. Курс тренувань складався з 10 щоденних сеансів, кожен сеанс включав в себе 15 хвилинне дихання з РЕЕР 5 см вод. ст. Для оцінки якості життя використовували опитувальник EuroQol-5D, візуальну аналогову шкалу здоров'я, а також «Респіраторний опитувальник госпіталю Святого Георгія». У обстежених хворих після застосування дихальних тренувань з РЕЕР підвищилася фізична активність, покращилася симптоматика хвороби, соціальний і психологічний статус, а також суб'єктивна оцінка здоров'я. Стадія і клінічна група хвороби не впливали на ефективність дихальних тренувань з РЕЕР у хворих похилого віку з ХОЗЛ. Дихальні тренування з РЕЕР можуть бути ефективним і безпечним методом поліпшення якості життя у хворих похилого віку з ХОЗЛ.

Ключові слова: якість життя, ХОЗЛ, старіння, дихальні тренування з РЕЕР.

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Introduction. The life quality measurement is essential in chronic diseases as it allows evaluating efficacy of medical measures in order to make patient's life comfortable, to increase the functional activity and adaptation of patients during disease [6, 10]. Their psychosocial and spiritual wellness is directly linked with the life quality [8]. Life quality evaluation allows judging about medical health care level as well as proper choosing of the methods of their treatment and rehabilitation [9].

The life quality reflects patient's perception of his health, functional possibilities and attitude to his illness. For this reason the definition of life quality allows to individualize treatment approaches in order to increase treatment effectiveness. However, in the routine practice it frequently happens that life quality, as one of the criteria of treatment effectiveness, is not assessed while more attention is given to the elimination of pathological symptoms.

The majority of investigators assume that the concept of life quality must include the state of patient but not only pathology manifestations [9, 10]. The patient's functional state reflects the level of his health, that is to say his physical and social activity, mental status, self-servicing and the wellbeing. In large measure, life quality is a broad concept which should not be determined solely by the effects of illness but also by its presence.

In the modern demographic processes one can observe the increase of the number of elderly people. This leads to the change of age-related morbidity and mortality structure and an increased portion of older population [16]. The lung diseases are one of the key reasons of morbidity and mortality among elderly and very old people [17].

Chronic obstructive pulmonary disease (COPD) occupies a special place in the geriatric pulmonology. On the one hand, age-related pathologic-morphological changes of the bronchial apparatus promote development of COPD, lengthen the disease course and worsen its prognosis [6]. The symptoms of disease in the old age are marked by non-specificity, diversity and changeability of the clinical manifestations [11]. This makes it difficult to diagnose and perform health care arrangements without a worsening of the life quality. The life quality worsening in elderly patients with COPD also promotes the polymorbidity, polipragmasia and side impacts of the drugs used for their therapy as well as their psychosocial disadaptation [11].

COPD is the chronic illness causing not only bronchial obstruction and decreasing pulmonary function but also worsening of patient's daily life activities that has a negative impact on the quality of life [15]. Therefore, the life quality of such patients and their treatment has been a focus of thorough investigation [7, 10, 15].

According to recent editorship of the GOLD, one of the aims of this illness treatment is the improvement of the life quality [13]. It is a priority task in the geriatrics in caring and servicing of elderly patients suffering from this disease [4]. The safe medication use is very important in view of the physiological peculiarities (slowed drug absorption from the gastrointestinal tract, dis-

turbed binding of the drugs with the proteins, reduced rate of their biotransformation and elimination from the organism, which can change drug pharmacokinetics and pharmacodynamics) [8]. As it is known, the elderly people suffer from several diseases and take many drugs. This increases the risk of their side effects. Thus it has been proved that such risk is 2-times higher in the 60-old patients and 7-times higher in the patients older than 70 years of age as compared with the young [8].

Medications are not the only option available to treat elderly patients. In this sense, the breathing trainings with a positive end-expiratory pressure (PEEP) are recommended [3, 12, 16, 18].

The literature data show that creation of positive expiratory pressure has a favorable effect on the external respiratory system. It increases its functioning and produces a curative effect at lung diseases [10, 18]. This method is widely used for artificial lung ventilation in anesthesiology, reanimatology and surgery during post-surgical period [5].

The main mechanism of action with positive pressure at the end of expiration is the prevention of early expiratory closure of the respiratory pathways [5]. This smoothes out the alveoli and involves so-called "unstable" non-functional alveoli into gas exchange process that, in turn, reduces alveolar dead space volume, improves ventilation-perfusion ratio and increases pulmonary gas exchange [5, 12]. During creation of positive end-expiratory pressure the number of so-called "unstable" alveoli involved in the gas exchange increases. The author reported the tendency to a decrease in the number and quality of surfactant and, as a consequence, reduction of the residual volume and the alveolar blood flow [5]. Artificially created positive pressure in the respiratory pathways brings back the initial volume for the alveoli to recover residual capacity and perfusion. Some research works have shown even some increase of the surfactant amount at the expense of restitution of perfusion and activation of the cholinergic mechanisms [18]. An increase in residual capacity results in a decrease of compliance and a reduction in intrapulmonary shunting. This promotes a decrease of the alveolar dead space and an increase of the efficient alveolar ventilation, leading to an increase of PaO_2 , a decrease of $PaCO_2$ and a better oxygen provision of the organism. Therefore, the respiratory PEEP trainings are widely used in clinical medicine for treatment and prophylaxis [12, 16, 18].

However, PEEP respiration can negatively influence on the hemodynamics. In particular, an increased intrathoracic pressure during PEEP breathing can lead to the worsening of venous blood return and consequently to the decrease of cardiac output and pulmonary blood circulation [5, 12]. PEEP breathing can lead to worsening of blood outflow from the brain and increase of the intra-cranial pressure [5, 12]. All these undesirable effects of PEEP breathing are being developed at sufficiently high pressure during exhalation and depend on the hemodynamic status of a concrete person.

It is known that the venous blood return, minute volume and blood circulation as well as the pulmonary

and brain blood flow are decreased in old age. Therefore the unfavorable effects of PEEP breathing can develop already at the lower breathing values during exhalation.

Previously, the studies on the effects of PEEP breathing on old human organism were carried out at the D. F. Chebotarev Institute of Gerontology NAMS of Ukraine [2, 3, 16]. According to their findings, the most optimal PEEP level during breathing trainings in old people was 5-10 cm H₂O [3, 16]. The respiratory trainings using PEEP improved the systemic and cerebral hemodynamic, pulmonary gas exchange, microcirculation and increased hypoxia tolerance in the elderly people [2, 3, 16].

Nevertheless, there are not enough research works to study the effects of respiratory trainings using PEEP on the quality of life in the elderly patients with increased reserve capacities of the lung in the elderly patients with COPD.

Aim. To assess the effects of course respiratory trainings with PEEP on the life quality in the elderly patients with COPD.

Subjects and Methods

The study included the 60-74 year-old patients (n = 40) suffering from COPD without exacerbation 1st-2nd degree of bronchial obstruction (GOLD I-II), clinical groups A and B. The duration of disease was 7-27 years.

The disease diagnosis was made according to the GOLD recommendation and Health Ministry of Ukraine Order no. 555 dated 27.06.2013.

The inclusion criteria were:

- bronchodilator therapy during no less than two months prior to inclusion into the study;
- withdrawal of prolonged β_2 -agonists 12 hours prior to the inclusion into the study;
- withdrawal of M-cholinolitics 48 hours prior to the inclusion.

In the course of investigation, a short-acting inhaled beta 2-agonist Salbutamol was given on the request as an urgent aid to relieve COPD-caused symptoms.

Participation in the study was voluntary. All participants received detailed information about the study and signed their written consent to participate.

All participants were divided in two groups: group 1 (n = 26) who received the real respiratory trainings with PEEP and group 2 (n = 14) who received the imitated respiratory trainings.

The training course had 10 daily sessions each of them included one min breathing with PEEP 5 cm H₂O. PEEP respiratory trainings were performed with help of respiratory apparatus "Threshold" PEP (Germany). The choice of the level of resistance to expiration was made before the respiratory trainings based on the results of the previous investigations [2, 3, 16]. The most optimal was breathing with resistance to expiration 10 cm H₂O. For the elderly persons with an accelerated aging of the respiratory system it was 5 cm H₂O [16]. Considering the fact that COPD is a clinical model of accelerated aging of the respiratory system, in the given study the level of

resistance to expiration 5 cm Hg was used during respiratory trainings with PEEP.

The ventilatory function of the lung and bronchial permeability were determined using the spirometer "Spirobank" (Mir, Italy).

The quality of life was assessed using the questionnaires: non-specific EuroQol-5D (EQ-5D) and visual analogue health scale (VAS) as well as the specific St. George's respiratory questionnaire (SGRQ).

The non-specific questionnaire EQ-5D allows to estimate the mobility, self-servicing ability, daily living activity, pain or discomfort, anxiety or depression [19].

The specific respiratory questionnaire SGRQ was used to assess life quality per symptom, activity, impact and grand total [14].

All assessments were performed in the initial state and one month after the course of imitated and real respiratory trainings with PEEP.

The obtained data were processed by variation statistical method using computer program Statistica 6.0 for Windows. The mean values of indices (M) and their errors (m) were assessed. All study indices had mean distribution close to normal and, therefore, the parametric statistical procedures were used. The differences in mean values of the indices in the study groups were assessed according to the Student criterion. The statistical values of the differences in the category indices were determined by χ^2 criterion Pearson (with accurate correction of Fisher). The differences at p < 0.05 were taken as statistically significant.

Results and Discussion

The quality of life is an integral index, reflecting both the clinical manifestations of disease and functional activity of the organism as well as social adaptation and psychological status of the patient. According to our findings, the life quality of elderly patients with COPD was mainly characterized by decreased physical activity, marked clinical symptoms and anxiety (Table 1). It is noteworthy that at the initial state the quality life indices in the elderly patients with COPD were comparable with the indices of our patients who had been examined earlier [1].

As had been shown earlier, the decrease of life quality during disease development in the elderly patients with GOLD were in great measure determined by the pronouncement of bronchial obstruction and hence by the disturbances of pulmonary gas exchange [1].

Therefore, improvement of pulmonary gas exchange after respiratory trainings with PEEP should promote life quality improvement in elderly patients with COPD.

Indeed, as has been shown by the investigations, the life quality of the patients with COPD improved after respiratory trainings with PEEP. Analysis of changes taken from the data of the specific respiratory questionnaire SGRQ proves this (See Table 1). As is seen from this table, after the course of breathing trainings with PEEP there was the increase of physical activity (section

Table 1. Effects of real and imitated respiratory trainings using PEEP on life quality in elderly patients with COPD (SGRQ questionnaire)

Indices	Imitated trainings		Real trainings	
	Initial state	After course	Initial state	After course
Symptoms, scores	58,14 ± 4,32	52,61 ± 4,73	65,52 ± 3,45	50,04 ± 2,31*
Activity, scores	55,27 ± 2,45	59,77 ± 5,26	64,95 ± 3,17	53,22 ± 2,24*
Impact, scores	50,12 ± 4,19	53,86 ± 4,36	43,62 ± 3,25	28,18 ± 3,01*
Grand total, scores	49,49 ± 3,42	47,53 ± 5,35	54,45 ± 3,22	37,51 ± 3,36*

Note: * — the significant differences compared to initial state, $p < 0,05$.

Table 2. Effects of real and imitated respiratory trainings using PEEP on life quality in elderly patients with COPD (EQ-5D questionnaire and VAS)

Показатели	Imitated trainings		Real trainings	
	Initial state	After course	Initial state	After course
EQ-5D, scores	7,95 ± 0,31	7,56 ± 0,42	8,00 ± 0,36	6,37 ± 0,24*
VAS, mm	58,49 ± 2,64	60,18 ± 2,22	52,33 ± 2,50	64,05 ± 2,12*

Note: * — the statistically significant differences in comparison with the initial state, $p < 0,05$.

Table 3. Improvement of life quality after respiratory trainings with PEEP and the degree of bronchial obstruction in elderly patients with COPD

Groups of patients	With improved life quality	Without life quality improvement
GOLD I	8	2
GOLD II	14	2

Note: χ^2 Pearson criterion (with accurate Fisher's correction) = 0,625, $p > 0,05$.

Table 4. Life quality improvement after respiratory trainings using PEEP in clinical groups of elderly patients with COPD

Groups of patients	Improved life quality	Unimproved life quality
Group A	7	3
Group B	15	1

Note: χ^2 Pearson criterion (with accurate Fisher's correction) = 0,287, $p > 0,05$.

“physical activity”) in the elderly patients with COPD. Lesser improvement of disease symptoms was observed in the section “symptoms” (See Table 1). Decrease of illness symptoms, increase of physical activity led to improvement of social and psychological status (section “impact”) in the elderly patients with COPD after respiratory trainings. As a whole, positive effects of the course of respiratory trainings with PEEP on the illness course and life quality in elderly patients with COPD are the grand total of the questionnaire SGRQ. Notably, the changes in the dynamic of the SGRQ questionnaire indices in the elderly patients with COPD were sufficiently essential and clinically significant.

On the whole, a positive impact of respiratory trainings with PEEP on the disease course and life quality of elderly patients with COPD reflects the decrease of their summary EQ-5D questionnaire score. The analysis made after course respiratory trainings with PEEP showed the improvement of EQ-5D questionnaire indices reflecting both physical and psycho-emotional state of the elderly patients with COPD (Table 2).

The obtained results showed improvement of the subjective health assessment in the elderly patients with

COPD. This was reflected in the increase of the VAS indices after course therapy of respiratory trainings with PEEP in the elderly patients with COPD (See Table 2).

It was interesting to assess effects of respiratory trainings with PEEP on the life quality depending on the stage and clinical group of elderly patients with COPD. Our analysis allows to state that both the stage and the clinical group of the patients with COPD did not influence on the efficacy of respiratory trainings with PEEP in the elderly patients with COPD (Tables 3 and 4).

Naturally, there arose a question about the mechanisms of positive effects of the respiratory trainings with PEEP on the life quality in the elderly patients with COPD. Our early investigations have shown that course respiratory trainings using PEEP influence favorably on the bronchial permeability and ventilation in such patients [3]. This manifested itself in the improved bronchial permeability at the level of large and medium-sized bronchi, optimization of breathing pattern and increased reserve capacities of the lung [3]. On the other hand, course respiratory trainings using PEEP improved lung perfusion in the

elderly patients with COPD [2]. Consequently, the ventilatory-perfusion interrelations improved leading to an increase of pulmonary gas exchange efficacy, a decrease of arterial hypoxia and improvement of oxygen provision of the organism in the elderly patients with COPD [3]. It is more likely that the described changes lead to life quality improvement in elderly patients with COPD after respiratory trainings with PEEP.

It is noteworthy that no side effects were registered in these patients. The optimally selected expiratory level of resistance ensured safe use of respiratory trainings using PEEP in elderly patients with COPD [3, 16].

Thus, the use of imitated respiratory trainings did not lead to the improvement of life quality in the elderly patients with COPD. This follows from the analysis of changes in the life quality indices EQ-5D and SGRQ questionnaires in elderly patients with COPD after imitated respiratory trainings (See Tables 1 and 2).

REFERENCES

- Asanov EO. Kachestvo zhizni u bolnykh pozhilogo vozrasta s HOZL: vliyanie gipoksicheskikh trenirovok (Quality of life in elderly patients with COPD: the effect of hypoxic training). *Krovoobraschenie i gemostaz*. 2015;3-4:75-80.
- Asanov EO, Dyba IA, Osmak ED. Vliyanie dyihatelnykh trenirovok s pozitivnym davleniem na vyidohe na serdechno-sosudistuyu sistemu u pozhilykh bolnykh s HOZL: MaterIali naukovo-praktichnoy konferentsiyi, prisvyachenoyi pam'yati akademika L. T. Maloyi «Schorichni terapevtichni chitannya: vid doslidzhen do realiy klinichnoy praktiki XXI stolitnya» (Influence of breathing exercises with positive pressure during exhalation on the cardiovascular system in elderly patients with COPD: Materials of the scientific-practical conference, attributed to academicians L. T. Malaya "Greatly therapeutical readings: from research to the realities of clinical practice of the XXI century"). Harkiv, 23-24 travnya 2015:17.
- Asanov EO, Dyba IA. Vliyanie dyihatelnykh trenirovok s polozhitelnym davleniem v kontse vyidoha na ventilyatsiyu i gazoobmen v legkikh u bolnykh pozhilogo vozrasta s HOZL (Influence of respiratory training with positive pressure at the end of expiration on ventilation and gas exchange in the lungs in elderly patients with COPD). *Ukr. pulmonolog. zhurnal*. 2018;3:38-43. DOI: 31215/2306-4927-2018-101-3-38-43.
- Dvoretzkiy LI. Vedenie pozhilogo bolnogo HOBL (Maintaining an elderly patient with COPD). Moskva: Litterra; 2005. 216 p.
- Zilber AP. Etyudyi respiratornoy meditsiny (Etudes of Respiratory Medicine). Moskva: MEDpress-inform; 2007. 792 p.
- Korkushko OV, Chebotarev DF, Chebotarev ND. Vozrastnyie izmeneniya dyihatelnoy sistemyi pri starenii i ih rol v razvitii bronholegochnoy patologii (Age-related changes in the respiratory system during aging and their role in the development of bronchopulmonary pathology). *Ukr. pulmonol. zhurnal*. 2005;3(dodatok):35-41.
- Lopuhova VA, Tarasenko IV. Issledovanie kachestva zhizni patsientov s bronhialnoy astmoy i bolnykh hronicheskoy obstruktivnoy boleznyu legkikh na fone kombinirovannoy terapii (Study of the quality of life of patients with bronchial asthma and patients with chronic obstructive pulmonary disease on the background of combined therapy). *Vestnik VolgGMU*. 2011;3(39):94-96.
- Maneshina OA, Belousov YB. Polipragmaziya i lekarstvennyie vzaimodeystviya u pozhilykh patsientov (Polypharmacy and drug interactions in elderly patients. Good clinical practice). *Kachestvennaya klinicheskaya praktika*. 2008;3:90-93.
- Novik AA, Ionova TI. Rukovodstvo po issledovaniyu kachestva zhizni v meditsine (Guidance on the study of the quality of life in medicine). 2-d ed. Moskva: OLMA-Media grupp; 2007. 320 p.
- Chuchalin AG, et al. Kachestvo zhizni u patsientov s hronicheskoy obstruktivnoy boleznyu legkikh: mozhem li myi ozhdat bolshego? (rezultaty natsionalnogo issledovaniya IKAR-HOBL) (Quality of life in patients with chronic obstructive pulmonary disease: can we expect more? (results of the national study ICAR-COPD). *Pulmonologiya*. 2006;5:19-27.
- Dyer C. The interaction of ageing and lung disease. *Chron. Respir. Dis*. 2012;9(1):63-67. DOI: 10.1177/1479972311433766.
- Fagevik OM, Westerdaal EA. Positive Expiratory Pressure in Patients with Chronic Obstructive Pulmonary Disease. Systematic Review. *Respiration*. 2009;77:110-118. DOI: 10.1159/000163062.
- Global initiative for chronic obstructive lung disease (GOLD). Global Strategy for the Diagnosis, Management, and prevention of COPD (revised 2018) NHLB/WHO workshop report. URL: <http://www.goldcopd.org> (last accessed: 17.12.18).
- Jones PW, Quirk FH, Baveystock CM. The St. George's Respiratory Questionnaire. *Respir. Med*. 1991;85(suppl.B):25-31.
- Jones PW, Prince M, Wijkstra PJ, et al. Quality of life in patients with chronic obstructive pulmonary disease. *Eur Respir Mon*. 2006;38:375-86.
- Korkushko OV, Asanov EO, Dyba IA. Effect of Positive End-Expiratory Pressure on Pulmonary Gas Exchange in the Elderly with Accelerated Aging. *International Journal of Physiology and Pathophysiology*. 2012;3(3):7-19. DOI: 10.1615/IntJPhysPathophys.v3.i3.40.
- Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012;380 (9859):2095-2128. DOI: 10.1016/S0140-6736(12)61728-0.
- Manzano F, et al. Positive-end expiratory pressure reduces incidence of ventilator-associated pneumonia in nonhypoxemic patients. *Crit Care Med*. 2008;36:22-25. DOI: 10.1097/CCM.0b013e31817b8a92.
- Notesontheuse of EQ-5D developed by the EuroQol Group, 2003. EuroQol Business Management. PO Box 4445 3006 AK Rotterdam, the Netherlands. URL: <http://www.euroqol.org> (last accessed: 17.12.18).

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