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Possibilities of physiotherapy in Chronic Obstructive Lung Disease

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Abstract

COPD is a progressive disease of the respiratory system that, if untreated, decreases the quality of life of patients. The treatment of COPD is mainly based on the use of bronchodilators and the use of appropriate exercise training. Numerous studies show that properly selected physical effort has a beneficial effect on improving exercise tolerance, spirometric indexes and reducing dyspnoea in patients. Treatments such as: postural drainage, inhalations, chest patting and learning an effective cough also contribute to improving the

quality of life in patients suffering from COPD. The appearance of special NIV apparatus very effectively facilitates lung ventilation, and most importantly - allows the patient to support treatment at home.

Introduction

Chronic obstructive pulmonary disease (COPD) is considered to be a progressive disease, which afflicted by 8.9% of people over 40 years of age(according to data on the prevalence of COPD confirmed by spiorometry). The incidence of COPD is constantly increasing. The introduction of preventive measures reduces the risk of mortality and mortality due to COPD.

The disease is diagnosed, among others based on anamnesis and spirometry, which is the basic functional study to determine the severity of the disease, control its course and provide information on the effectiveness of the treatment. This study is used in people with suspected COPD to confirm obstructive-type respiratory disease.

Despite the progressive course, it is a disease that can be prevented and can be treated. Prevention is primarily about the elimination of factors that cause the disease, which includes tobacco smoke. Patients with COPD are also advised not to work in places where dust and gas pollution occurs in high concentrations. The goal of preventive measures is to reduce or eliminate potential contaminants in the air. Treatment, in turn, relieves symptoms of the disease, increases lung ventilation, minimizes the frequency of exacerbations COPD, reduce the number of cases, reduce the annual decline in FEV1. The purpose of this therapy is to improve the quality of life of patients and to slow down the progression of the disease. After determining the stage of the disease, the appropriate doses of drugs are selected, which increases depending on the incidence of complaints.

Therefore, after obtaining the appropriate treatment effect, return to the previous dose. However, however, when the patient is getting worse, another intensification of pharmaceuticals is necessary. Drugs that reduce the symptoms of the disease and the frequency of exacerbations are: bronchodilators, inhaled corticosteroids, antioxidants and mucolytics.

Quality of life and COPD

According to the World Health Organization, quality of life is a way of perceiving a given person's position in life in a given value system, it concerns all spheres of human life. The main factor affecting the quality of life is the state of health, both mental and physical. In addition, the factors determining it are general physical fitness, social and economic status, the severity of the disease symptoms, therefore, the quality of dependent and independent of health is distinguished. The quality of life dependent on health is a tool of subjective assessment of the impact of the disease and the effectiveness of the treatment applied to all aspects of life [6]. Data on the subject of quality of life are an important source of information indispensable in comprehensive medical care. It was observed that the higher mortality of patients may be associated with low quality of their life, which is primarily affected by COPD, frequency and severity of symptoms [7].

The quality of life is significantly reduced in all chronic diseases, which also include COPD. The main symptoms of COPD are shortness of breath and cough, which together with the progression of the disease significantly limit the possibility of physical activity in the everyday life of patients, and thus reduce the quality of their lives [6,8]. The decline in physical fitness is accompanied by psychological problems, and the progressive and chronic nature of the disease promotes the development of depressive symptoms. Psychological disturbances adversely affect the overall clinical picture of patients. The occurrence of depression may increase the survival of symptoms of the underlying disease. Studies show that the quality of life of patients with COPD and their motivation for treatment depends on the correlation of disease symptoms with comorbid mental problems. The authors suggest that psychological problems in advanced stages, rather than the symptoms of the underlying disease, reduce the quality of life of patients with COPD. Potoczek A. et al., In a study devoted to the assessment of mental disorders in patients with COPD, observed the occurrence of anxiety or depressive disorders in the majority of subjects. There was no correlation between the duration of the disease and an increase in depression or anxiety symptoms. Researchers underline the impact of mental disorders on the reduced quality of life of patients and the necessity of introducing psychotherapy in the comprehensive treatment of COPD [9].

Acceptance of the disease can have a significant impact on improving the quality of life of patients. In studies by Olek D. et al., It was observed that increased acceptance of the disease improves the quality of life in all its aspects. Young people are less likely than older people to accept their illness, moreover, people who are retired or retired have a lower level of acceptance of the disease than those who work professionally. In the same studies, it was observed that women declared higher quality of life than men and younger people before the age of 50. On the other hand, other factors examined, ie marital status, education, smoking and place of residence did not have a significant impact on the acceptance of the disease and the quality of life [10].

Cigarette smoking is the main risk factor for COPD, withdrawal from an addiction has a positive impact on patients' health. Studies have shown that smokers have a lower quality of life associated with health than non-smokers and smokers in the past, but smoking cessation did not affect its improvement. Pawłowska K. et al. Examined 97 people suffering from COPD, among them 20% never smoked, 58% smoked in the past and 21% were still smoking cigarettes. Researchers have observed that smoking did not affect quality of life. There was no correlation between the severity of symptoms and the continuation or resignation from addiction [7].

Classification of a patient with COPD to the appropriate rehabilitation model

An important element of pulmonary rehabilitation is exercise training. Individual programs of pulmonary rehabilitation differ in intensity of exercise. It is important to qualify the patient for the appropriate physiotherapy model, for which a 6-minute walk test, but also a lung function test are useful. Very often the degree of dyspnoea is also assessed, which is assessed in a modified Borg scale or VAS scale.

After the assessment of exercise tolerance in the 6-minute test and the treadmill test, 174 patients with COPD were classified into a given rehabilitation model. During the 3 weeks of rehabilitation, the patients performed mainly exercise exercises, and their intensity was dependent on the result obtained in the exercise test. After the end of the exercise program, patients were reassessed in the trials and it was concluded that physiotherapy improves exercise tolerance in patients with COPD.

Bogacz K. et al. Examined 80 patients with COPD who underwent stationary treatment to assess whether the qualification of patients for the appropriate rehabilitation

model based on the exercise test on a treadmill according to the modified Bruce protocol and a 6-minute walk test influences the effects of rehabilitation patients with COPD. They were examined before and after comprehensive physiotherapy lasting 3 weeks. Patients in the control group and the study group had exercise tests, spirometry and had They were examined before and after comprehensive physiotherapy lasting 3 weeks. The patients in the control group and the study group had exercise tests, spirometry and had dyspnea assessed according to the modified Borg scale.

The results obtained in the exercise test constituted the basic criterion for the selection of training loads. All were qualified for model C pulmonary rehabilitation and performed breathing and general fitness exercises, as well as training on a bicycle ergometer with the load at which they obtained a training heart rate. Each of these activities was to be allocated 30 minutes during the day. In addition to kinesitherapy, they used inhalations with sodium chloride, used chest drainage, learning how to cough effectively. In patients, there was an improvement in exercise tolerance and values of spirometric indicators as a result of the procedure. Patients have decreased dyspnoea

Physical effort in COPD

The physical activity of patients with COPD is varied. It has been shown that the most inactive persons have a higher BMI index, a lower expiratory volume in the first second - FEV1 and a higher level of dyspnea [11]. It is important to encourage patients to undertake physical activity to improve not only ventilation parameters, but also general health. Low physical activity in patients with COPD contributes to the development of further diseases [12]. Endurance training (continuous and interval) and resistance training with COPD. Exercises should be performed at 50% VO2max [13].

The problem of patients with COPD is intolerance to physical exercise, resulting from the intensification of symptoms such as dyspnea and muscular fatigue, while avoiding physical exercise is associated with adverse clinical results, with increased hospitalization and mortality, which creates a kind of vicious circle. In increasing tolerance of physical activity in patients with COPD, respiratory rehabilitation helps reduce the sensitivity to dyspnea [14,15]. One of the hypotheses of the impact of physical activity is to reduce the number of exacerbations of the disease, shorten their duration and reduce the severity [16].

According to Lewthwaite et al., Walking is the most commonly recommended activity for patients with COPD, which seems justified considering the fact that patients may present an extremely different level of symptom severity. Cycling, strength training and non-specific aerobic training are also recommended. The length of training sessions is usually defined in the range from 20 to 45 minutes per day [17].

The studies carried out among patients with pulmonary hypertension on the basis of COPD indicate a favorable effect of respiratory rehabilitation: a decrease in mean pulmonary artery pressure, a decrease in pulmonary resistance and an increase in the cardiac output. The authors indicate physical effort as the most important element of any respiratory rehabilitation program [18]. Respiratory rehabilitation should be carried out continuously, so that the benefits of therapy can be preserved

In patients struggling with COPD and obesity, the use of a 9-month lifestyle modification, which included regular physical activity in addition to nutritional intervention, resulted in a decrease in body weight, dyspnea severity and markers of inflammation. On the other hand, the distance obtained in the 6-minute walk test and the quality of life increased [19].

Silva et al. Compared the effect of 12-week strength exercises with the use of various accessories (tapes and tubes) and resistance training machines in patients with COPD [20]. A decrease in the level of inflammatory cytokines, a decrease in the blood glucose level was demonstrated, and the groups exercising with the instruments additionally also noted a decrease in triacylglycerol. In a study by Fernandes et al., A resistance exercise program based on 24 exercise sessions increased the proliferative response of lymphocytes. The authors indicate that the additional mechanism causing less exacerbations in patients with COPD is the improvement of TCD4 + cell function [21].

The influence of physical effort on the cognitive performance of COPD patients was also noted [22]. In the study of Aquiono et al. Comparing the effect of high-intensity aerobic training (on the treadmill) and mixed training, combining high intensity aerobic training with resistance training, it was found that physical exercise improves reasoning skills, goal movement, attention ability, verbal fluidity and memory long. Greater benefits were noted in patients participating in mixed training, but the difference was statistically significant only in terms of long-term memory, the ability to perform targeted movements and reasoning skills. 28 men participated in the study, 14 each in each group. The exercise program of both groups

lasted 4 weeks, the participants took part in classes 5 times a week, which took place twice as much during the training day, after 30 minutes. Weekly, it was 10 sessions, and in the whole program - 40. The program's intensity increased from the initial 70 to 90% of HRmax, and the intensity of resistance exercise was similarly increased from 70 to 90% of the 1-RM. (Respectively:% of maximum heart rate and% of maximum weight possible in a given exercise). Also interesting are the reports on the correlation between the level of efficiency of patients (measured by a 6-minute walk test), cognitive performance, and lung function impairment. Greater impairment in the functioning of the respiratory system in patients with an average age of 70 years was associated with worse physical and cognitive fitness [23]

Respiratory rehabilitation, which in addition to breathing and psychoeducation training also includes graded exercises, reduces the level of depression and anxiety in patients with COPD. However, to maintain the effect, it is necessary to continue the exercise. Alternative ways may also be less popular exercises such as Tai Chi or yoga [15].

Physical activity, however, is not a golden remedy for all the ailments that accompany COPD, and its impact has its limitations. It was shown that an 8-week oxygen training conducted three times a week does not change the structure and function of the vessels. Despite the fact that the training lowered the blood pressure of patients with COPD, no significant changes were observed in vasodilatation induced by flow or central pulse wave velocity [24].

Home oxygen therapy

In patients with advanced COPD respiratory failure may occur. In such cases, the inclusion of oxygen therapy should be considered. Home oxygen therapy is the supply of oxygen for at least 15 hours a day, including during sleep. Long-term oxygen therpy is prescriped for patients with significant hypoxaemia ($PaO_2 \leq 55$ mm Hg), despite the use of appropriate pharmacological treatment [3].

The initial oxygen flow through the nasal cannula is set at 2 l/min. If PaO_2 does not improve sufficiently and the suppply of oxygen does not cause to increase $PaCO_2$. the oxygen flow per minute increases by 0. 5-1 l. It has been confirmed that the use of oxygen therapy can extend the life of people with COPD. It was proven that long-term oxygen therapy improve effort tolerance in these people, by increasing the amount of oxygen supplied to working muscles and the uptake of oxygen by myocytes [25].

In the conducted studies, the distance covered during the 6-minute walk during which the patients breathed oxygen from the bottle was significantly extended. In patients with the higher pulmonary obstruction was noted the greater improvement in distance. The FEV1 > 50% group recorded an improvement of 2. 6% (13 m) of the air test distance, in the FEV1 group 35%-50% by 9. 7% (27 m) and in the FEV1< 35% group 20% (32 m) [26]. M. Czajkowska-Malinowska compared the effect of oxygen treatment from stationary and mobile sources. 30 patients used stationary oxygen of the concentrator for 6 months and a portable liquid oxygen for the next 6 months. Through to the use of a portable source, it was possible to extend the daily use of oxygen even up to 19 hours from 14 hours. The results of blood morphology, the distance of 6-minute test walk and quality of life were improved after the first 6 months, and after the following months an even greater improvement was noted [27]. The results of the study indicate positive effects of home oxygen therapy: prolonged duration of exercise, reduced breathlessness, decreased frequency of exacerbations, improved mental condition, inhibition progression of pulmonary hypertension [25].

Non-invasive mechanical ventiliation (NIV)

Non-invasive mechanical ventilation is most often used to treat exacerbations of COPD. The device supports the patient's breathing by creating positive pressure in the airways. The easiest to use ventilator is a BPAP type pressure variable ventilator that generates positive airway pressure, higher during inspiration and lower during exhalation. Breathing support is provided by a special nasal or face mask.

There is no well-proven and recognised NIV algorithm developed that can be used for most adult patients. The minimum difference between inspiratory and expiratory pressure is considered to be 8 cm H_2O. Tidal volume is an important parameter in NIV. NIV therapy should not be adjusted only on the base of tidal volume because of the risk of vesicular hypoventilation. In addition to pressure and volume, the NIV also has an important inspiratory and exhaust duration ratio. In case of obstructive diseases, the duration of inspiration should be shorter, in case of restrictive diseases - longer. Inhalation duration is regulated by the patient's or device’s work. The ratio of inspiratory to expiratory time should be adjusted to the basic respiratory rhythm. [28]

In some patients it is beneficial to use both chronic oxygen therapy and non-invasive ventilation, especially in patients with severe hypercapnia during the day. This can improve

survival, but without improving the quality of life. Research on non-invasive mechanical ventilation in the home is inconclusive.

The use of NIV leads to a decrease in hypercapnia. In a study, 51 patients with POCHP was used NIV for 4 years. The increased CO_2 values before the application of NIV were 8. 6 kPa, and was lowered to the upper range of the norm - 5. 9 kPa . One-, two- and three-year survival of patients with COPD was 83%, 73% and 55%, respectively, which correlated with the results of other studies [29]. The use of non-invasive ventilation in home can effectively reduce the risk of recurrence of acute hypercapical respiratory failure (AHRF). A randomized study comparing the continuation of active home-made NIV with the method of constant positive airway pressure in patients with COPD who survived respiratory AHRF during their hospitalisation. The proportion of patients developing recurrent AHRF was respectively 38. 5% and 60. 2%, after 1 year [30].

Lot of randomized study and not randomized reserch have shown a tendency to improve the effectiveness of treatment with an increase duration ventilation per day, a higher initial pressure of $PaCO_2$ and higher therapeutic pressures used. One study found that the use of NIV at night increases the tidal volume and decreases $PaCO_2$ during the day. [28]

There are observations indicating that in patients with BMI < 20 the use of NIV contributes to weight gain. However, has been demonstrated no positive impact on the prognosis. [28]

The knowledge gained about NIV makes it possible for an increasing number of patients to use ventilation at home. In addition to providing effective breathing support to patients, NIV therapy also helps to improve blood gas composition. However, it does not make it possible to predict if the NIV will be well tolerated. Most of the studies show inconclusiveresults. This suggests that more research is needed to dispel the concerns. [28]

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