

Physiotherapy in Patients with Chronic Obstructive Pulmonary Disease

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Abstract

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BACKGROUND: Physiotherapy is an essential for the treatment of patients with chronic respiratory non-inflammatory diseases especially for chronic obstructive pulmonary disease (COPD).

AIM: To assess the effect of six months physiotherapy (PT) program on functional status in patients with COPD.

MATERIAL AND METHODS: The patients were divided into two groups according to the severity of the disease. Group A included 33 patients (mean age 68.6 ± 7.3 ; GOLD II – III stages). Group B included 32 patients (mean age 71.7 ± 6.9 ; GOLD I – II). They were referred to supervised PT program performed three times weekly for a half a year. All the patients were on standard medical care. At entry and after PT, six minutes walking test (6 MWT), Borg scale and modified Medical Research Council (mMRC) scale were assessed.

RESULTS: Significant changes in 6 MWT ($p < 0.001$) and mMRC scale ($p < 0.001$) were found after applied physical therapy program in patients of group A. Exertional dyspnoea decreased significantly in patients with group A ($p < 0.001$). Positive changes were found in physical tolerance in the patients of group B ($p < 0.001$).

CONCLUSIONS: The present study revealed the positive effect of six months physiotherapy in physical tolerance and dyspnoea in patients with COPD at different stages of the disease.

Introduction

Chronic obstructive pulmonary disease (COPD) is a common disease that affects the bronchopulmonary system. The progressive course of COPD is connected with the development of extra pulmonary complications such as cardiovascular diseases, skeletal muscle dysfunction, osteoporosis, cachexy, anxiety and depression. Thus deteriorates the health related quality of life and increases physical intolerance in patients with COPD. Pulmonary rehabilitation is a multidisciplinary program for treating patients with chronic pulmonary diseases. It is individually tailored, and its principal goal is to optimize physical and social status of the patients. Physiotherapy (PT) is the milestone in the structure of pulmonary rehabilitation. PT increases exercise tolerance, mobility in daily activities, reduces

breathlessness, improves quality of life by applying various therapeutic exercises and breathing techniques [1-3].

The study aims to assess the effect of the same six months physiotherapy protocol on functional status in patients with COPD at different stages of the disease.

Material and Methods

The patients with COPD were divided into two groups according to the stage of the disease. Group A consists of 11 males and 22 females with proven clinical and functional chronic obstructive pulmonary disease, mean age 68.6 ± 7.3 . Patients are in the

second to third stages of COPD according to GOLD (2014) and mean disease duration 7.3 years (5 to 12 years). Concomitant diseases include arterial hypertension (70%), ischemic heart disease (49%), diabetes type II (6%) and degenerative joint diseases including osteoporosis (9%). The number of concomitant diseases is on average 3.3 per person. Group B included four males and 28 women with COPD at an average age of 71.7 ± 6.9 . Patients are in the first to second stages according to GOLD (2014) with mean disease duration 2.5 years (1.5 to 4 years). Concomitant diseases are a hypertonic disease (53%), ischemic heart disease (31%), type II diabetes mellitus (9%), and degenerative joint diseases including osteoporosis (6%). The number of concomitant diseases is an average of 3.0 per person.

The following including criteria for patients in the both groups were used: patients with clinical and paraclinical proven COPD, according to spirometric data; patients from both sexes, smokers and non-smokers; stable haemodynamic parameters; motivation and positive attitude while performing therapeutic exercises for a long time; informed written consent to participate in this research.

Exclusion criteria were: severe acute respiratory and cardiovascular failure; history of cerebrovascular accidents and/or myocardial infarction, within the past six months, and fractures of the lower extremities in the last three months; neurological and joint diseases, which can interfere implementation of the physiotherapeutic sessions and tests (such as rheumatoid arthritis, Parkinson's disease, polyneuropathy); decompensate diabetes mellitus; expressed cognitive impairments. The patients with COPD from the two groups were treated with adequate medication (bronchodilators, mucolytics, expectorants) and individual additional treatment for the patients with co-morbidities.

In the two groups, physiotherapy was performed according to our methodology developed for COPD patients in outpatient settings. The PT protocol was applied for six months, divided into three training periods - initial, main and final. The initial period includes the first 4-6 weeks and aimed patient's adaptation to the regular physical activity and creating habits for proper breathing. The main period lasts four months, aimed at achieving optimal therapeutic influence (improvement of the vital capacity, endurance and strength of the respiratory muscles, reduce symptoms, an increase of fitness level, prevention of the complications, normalization of the cardiorespiratory function).

The final period covers the last 3-4 weeks, and in PT session's air baths, sun baths, water procedures and general physical strengthening and endurance training were included. For these reasons, a healing camp is being carried out in the early autumn months with a full-time activity program with moderate intensity and climatotherapy at the sea or in

the mountain's balneology resorts, around 800 m average altitude. In the outpatient conditions, physiotherapeutic group sessions were conducted three times weekly with duration of 30 min at the beginning of the study, to one hour at the end, including aerobic exercises with low intensity (walking, slow running, cycling); entertaining and low intensity games; hiking; equilibrium exercises; resistance exercises; callisthenic exercises for all over fit in adults and the elderly with COPD.

The specific PT techniques included: teaching in correct physiological breathing, training in diaphragmatic breathing, breathing in the lower, middle, and upper portions of the lungs, breathing through the nose and mouth at rest and during exercises. Aiming to reduce of bronchoconstriction and dyspnoea we included exercises in different specific respiratory postures sitting on a chair; inhalations; slow breathing with an emphasis on the exhalation; self-massage of the intercostal muscles and the neck.

To increase the strength and endurance of the respiratory muscles we used in the PT sessions pushed, forced exhalation exercises; "coughing" exercises; exhale by pronouncing the syllables", exercise for prolonged inhalation and short-time exhale, combined with gymnastic exercises for the chest, abdominal and back muscles.

The following indicators, before and after the experimental period were monitored: six-minutes walking test, Borg Dyspnoea Scale and mMRC scale [4-6].

Results

Regarding the demographic and anthropometric data, (sex, age, height, and weight) both groups of patients with COPD were almost identical. During the experimental period, the patients in the group A and the group B (with different severity of COPD and varying degrees of functional impairments) were treated by our physiotherapeutic methodology, and objective information about the changes in the monitored parameters were collected. The obtained study results were statistically analyzed using SPSS version 19.0, and a paired sample t-test was applied. The significance level was set up at $p < 0.05$

The results of the group A, concerning physical tolerance and the dyspnoea levels during daily or physical activities, are presented in table one. At the beginning of the experiment the patients in the group A, had worse indicators of the functional status due to the severity of the disease.

Table 1: Changes in the mean values of physical tolerance and levels of dyspnoea before and after physical therapy in group A

Measurement Test n=33	X ₁ ± SD	X ₂ ± SD	X ₁ -X ₂	t	p
Six minutes walking test (m)	351.3 ± 74.3	389.3 ± 72.4	38.0	6.12	< 0.001
Borg Scale (points)	4.5 ± 2.4	3.6 ± 2.0	- 0.9	5.72	< 0.01
mMRC Scale (points)	1.8 ± 1.1	1.6 ± 1.0	- 0.2	1.98	0.05

X₁ ± SD - mean values and standard deviation at the start of the study; X₂ ± SD - mean values and standard deviation at the end of the study; t-criteria of Students t-test; ** p < 0.01 - significant difference compared with baseline values; *** p < 0.001 - significant difference compared with baseline values.

Increasing walking distance with an average of 38 m was observed. The reported difference showed statistically significant improvement (p < 0.001). We believe that the improved tolerance to physical exercises was because specific exercises for the lower extremities were included in PT sessions. Similar results in patients at different stages of COPD have also been observed by some other authors [7-11].

Considering the importance and prevalence of the breathlessness as the main limiting factor for physical activity in patients with COPD, patients were examined using two additional special tests. One of the tests was used to evaluate the dyspnoea in performing daily activities (mMRC Dyspnoea Scale), and the other was used to assess the dyspnoea during physical exertion (Borg Dyspnoea Scale). According to the final research results for the patients in group A, a tendency for reducing the occurrence and severity of dyspnoea was reported. The changes were improved, based on the Borg Scale - 0.9 points (p < 0.01), as well as the mMRC Scale - an average of 0.2 points (p < 0.05). We believe that the reducing the feeling of breathlessness was associated with the following: improved bronchial patency and mechanics of breathing through learning, training and improving diaphragmatic breathing, exhaling through pursed lips, and exhaling while making whistling and buzzing sounds (producing a low-pitched sound resembling the bee humming). A diaphragmatic breathing technique is more economical for the body, but it is more difficult for women, who constitute the majority of the studied contingent. It became clear that decrease of this indicator has been achieved as a result of applying the physiotherapeutic methodology, where the special breathing exercises took place [12].

A baseline dyspnoea reduction of 0.3 points and improvement of the patient's subjective status after a six-month unsupervised home physiotherapeutic program which included physical exercises for strength and endurance was found [13]. Clini E et al (2008) established higher levels of improvement in the feeling of shortness of breath in daily living after at least 15 physiotherapeutic sessions, applied to patients with all stages of COPD [14]. The obtained results from mMRC Scale decreased on average by 1.1 points, compared to the baseline levels, which had been on average 2.7 points. At the beginning of their study, the baseline status of the monitored patients showed a significantly

pronounced dyspnoea when compared to our patients (1.8 points) probably due to including patients from the fourth COPD stage in their study.

The changes occurring in the physical tolerance and the feeling of breathlessness in group B before and after physiotherapy are presented on Table two.

Table 2: Changes in the mean values of physical tolerance and level of dyspnoea before and after physical therapy in group B

Measurement Test n = 32	X ₁ ± SD	X ₂ ± SD	X ₁ -X ₂	t	p
Six minutes walking test (m)	426,6 ± 57,3	455,9 ± 71,7	29,3	4,43	< 0,001
Borg Scale (points)	0,53 ± 1,16	2,38 ± 1,80	1,85	5,72	< 0,001
mMRC Scale (points)	0,59 ± 0,61	0,63 ± 0,61	0,04	0,57	> 0,05

X₁ ± SD - mean values and standard deviation at the start of the study; X₂ ± SD - mean values and standard deviation at the end of the study; t-criteria of Students t-test; *** p < 0.001 - significant difference compared with baseline values.

The changes in 6MWT after the physiotherapeutic treatment were statistically significant (p < 0.001). The improvement in the walking distance for six minutes was on average 29 m, which was with 10 m less than the results of group A (38 m). According to the Enright P, (1998) formula, the referent value for healthy adults of the same age, height and weight, as the patients with COPD in the group B, was 452 m. After the initial examination the data obtained (427 m) represented 94% of the normative values, and at the end of the study, it corresponded to the normative value (456 m). Moreover, better physical tolerance was probably due to the lower degree of bronchial obstruction in the group B.

In the group B, increased dyspnoea levels were found with 1.85 points, according to the Borg Scale, tested after the 6MWT. However, after the final examination, dyspnoea levels (2.4 points) showed a lower degree (0-4 points), according to the ten-point Borg Scale.

Discussion

Our findings suggested that the results obtained in the group B would be favourable about the perceived breathlessness because the dyspnoea was kept at a relatively low level throughout the monitored period [15-19].

The baseline level of dyspnoea while performing daily living activities was almost unchanged, which was a favourable result, considering the nature and expected prognosis of COPD. Breathlessness in daily lifestyle in the group B was less pronounced (between 0-1 points), according to the five-point mMRC Scale, which indicated that the breathing disturbances occurred only after intense physical exertion, such as fast walking speed on a flat

or a light slope surface, or climbing more than three floors of stairs. The dyspnoea did not adversely affect physical tolerance, objectified by a six minutes walk test. A lot of researchers recommend the Borg scale to assess the effect of performing physical therapy [20-25].

In conclusion, the present study revealed the positive effect of the same six months physiotherapy protocol on physical tolerance, the level of dyspnoea after physical exertion and during daily living activities in patients with COPD at the different stages of the disease and especially for the patients with more pronounced disease severity which is very important for PT practice.

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