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THE BENEFITS OF PULMONARY REHABILITATION IN COPD PATIENTS

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Abstract:

***BACKGROUND**: Pulmonary rehabilitation (PR) has become a standard of care in patients affected by chronic pulmonary diseases. This article addresses the currently available literature on respiratory rehabilitation in patients with chronic obstructive pulmonary disease (COPD).* ***OBJECTIVES**: To investigate the impact of PR on quality of life and on the physical and psychological conditions of the patient.* ***METHODS**: In June 2016 the Pubmed and Google Scholar databases were searched to retrieve the articles dealing with the efficacy of PR.* ***RESULTS**: It has been demonstrated that positive outcomes from PR programs include increased exercise tolerance, reduced dyspnea and overall improvement in health-related quality of life (QoL), regardless of the patient's age. The BODE index (a multidimensional scoring system) was used to test patients diagnosed with COPD and to predict long-term outcomes for them.* ***CONCLUSIONS**: PR has proved to be clinically beneficial and considered the right therapeutic approach in the follow-up and management of patients suffering from respiratory diseases.*

Key words: *BODE index, chronic obstructive pulmonary disease, COPD, dyspnea, exercise training, guidelines, physical activity, pulmonary rehabilitation, quality of life*

Abbreviations: *AACVPR = American Association of Cardiovascular and Pulmonary Rehabilitation; ACCP= American College of Chest Physicians; COPD= chronic obstructive pulmonary disease; General practitioner (GP); PR= pulmonary rehabilitation; FEV1= forced expiratory in 1 s; MRC= Medical Research Council; PRP= pulmonary rehabilitation protocols*

INTRODUCTION

More and more frequently we hear about the importance of pulmonary rehabilitation (PR), but what exactly is it? In 1994, during the Workshop on Pulmonary Rehabilitation Research, the National Institute of Health defined it as " a multidimensional continuum of services directed to persons with pulmonary disease and their families, usually by an interdisciplinary team of specialists, with the goal of achieving and maintaining the individual's maximum level of independence and functioning in the community" (Fishman 1994 p 826) [1].

PR is a consolidated comprehensive intervention included among the most widely recommended guidelines for the treatment of chronic obstructive pulmonary disease (COPD). Several studies show that it reduces dyspnea, improves health-related quality-of-life, tolerance to physical

exercise and independence (Lacasse et al 1996; Guell et al 2000) [2]. Evidence-based guidelines also exist, aimed at assessing the scientific foundation of PR (ACCP / AACVPR 1997) [3].

The World Health Organization (WHO) and the Harvard School of Public Health in Boston, Massachusetts, believe that by year 2020 COPD will be the fifth-ranked cause of disability and the third-ranked most common cause of death worldwide [4].

COPD is a lung disease characterized by the chronic obstruction of lung airflow which is not fully reversible, associated with an enhanced chronic inflammatory response in the airways and the lungs to noxious particles or gases [5]. Patients show diminished exercise capacity and quality of life, which limits their activities of daily living.

This explains why one of the key objectives in the management of the disease is to improve exercise capacity through respiratory rehabilitation. Most end-stage COPD patients have a significantly impaired quality of life, with severe symptoms such as dyspnea and mucus production.

Symptoms, onset and intensity of the disease depend upon the stage of COPD, but tend to become gradually worse over time. The progression of the disease is very often characterized by a slow but steady functional decline, interspersed with frequent flare-ups from which it is difficult to recover [6]. Exacerbations can be very serious and can cause death, although patients usually die of complications and associated comorbility.

MATERIALS AND METHODS

Aim of this study was to highlight the impact that PR may have on COPD patients. In order to achieve this goal, in June 2016 the Pubmed and Google Scholar databases were searched to retrieve the articles related to this issue. We selected the papers referring to a population study (Population), to evaluate the efficacy of PR treatments and/or of physical exercise (Intervention). An overall comparison among the retrieved papers and/or with control subjects (Control) was made, which produced the results obtained in each of the selected studies (Outcomes).

P = Population
Chronic obstructive pulmonary disease
I = Intervention
PR/physical exercise
C = Control
Physical exercise/no treatment/BODE index
O = Outcome
Outcomes of the analyzed studies

"Pulmonary rehabilitation" was chosen as keyword and inserted in the *abstract* or *title* fields (field). The selected papers included guidelines and full-length papers ; the selection criteria to retrieve the data we needed was made by specifying the conditions that the retrieved data had to meet, in this specific case our research objective and related abstracts.

RESULTS

References [7,8] have reported positive and beneficial effects of PR on patients. Results are based on the Forced Expiratory Volume 1 (FEV1) test, one of the most common indices used to assess airway obstruction. However, COPD patients also suffer from systemic manifestations, which cannot be assessed with FEV1 measurement.

The BODE index is probably the most accurate tool that better predicts the validity of PR in COPD patients and assesses its beneficial effects on patients. When compared to FEV1, the BODE staging system proved to be a better predictor of mortality, discriminating between death caused by general factors and mortality resulting from respiratory diseases. The BODE is a multidimensional index designed to assess clinical risk in people with COPD and to predict the outcome of the disease.

Four major factors have been identified as being predictive of mortality:
Body-mass index **B**
Airflow Obstruction **O**
Dyspnea **D**
Exercise capacity **E**

These variables have been chosen to develop the BODE grading index, which uses a 1-10 score scale where the highest score is proportional to the severity of the disease, meaning a higher prediction of death. These considerations emerge from the observational prospective study on PR and BODE index in COPD patients [9], in which only 116/246 patients underwent pulmonary rehabilitation, while the remaining 130 did not.

The median variation registered with the BODE index in the PR group was - 0.9 (p, 0,0001) at 3 months. On the whole, 83 patients (71%) experienced an improvement >1 units in BODE. Of these, 29 patients (25%) further improved their BODE index of -2 scores, while 54 patients (47%) of -1 score. In 25 patients (22%) no change was observed, while in 8 of them (7%) the BODE index registered a worsening of the condition.

Following an overall 19% initial improvement among the PR group, patients showed a basal BODE index performance after one year (4%) and stabilized after two years. Patients who did not take part in any rehabilitation program showed a decrease of the BODE index of 4% within one year, showing a further worsening (18%) after two years.

Variations in the single variables of the BODE index after a two-year follow-up were the following: patients who were not included in the PR group showed a 160 mL decrease during FEV1, while those who underwent rehabilitation registered a decrease of 20mL (p, 0,0001). All groups experienced a decrease in the capacity to perform physical exercise (PR group: -14m; non PR group: -53m; p,0,001).

Patients included in the rehabilitation protocol had a -0.14 MRC dyspnea decrease, while those who did not participate in pulmonary exercise increased their score of MRC 0,38 units (p, 0.001). No significant change of BMI (Body mass index) was noticed in either group. This observational study of patients who volunteered to participate in PR has produced some important results.

First of all, response to rehabilitation can be objectively measured with the BODE index, whose variations provide useful information on survival rate. Although PR impacts only marginally on the lung function, it has been demonstrated that it does improve dyspnea [10, 11], tolerance to physical exercise [12-14] and health-related quality-of-life [15]. Dyspnea and exercise capacity are two of the variables of the BODE grading score. We must not forget that the way individuals experience medical chronic illness encompasses many different areas, such as social an psychological adjustment and adaptation [16].

All this inevitably impacts on the patient's quality of life (Jones,1995). The assessment and analysis of specific psychological variables (i.e., humor, self-esteem, the subjective experience to enhance quality of life) are therefore a natural path to achieve an overall vision of the patient, which is indespensable to adequately manage the therapeutic intervention [17].

From the available literature we can therefore assert that physical exercise improves muscle strength and endurance, pulmonary function, quality of life and psychosocial health care. Three to six (3/6) months after entering a PR program, a significant reduction in the use of healthcare services was observed [3,7,14,18-20]. It has to be underlined that if a patient expects to experience long-term beneficial effects, he has to totally or partially modify his lifestyle.

One particular study on the intensity of physical activity after PR [21] underlines the importance of dedicating time to walking as a daily routine. This is a relevant observation, considering that walking is believed to be one of the most important physical activity among adults and elderly people [22, 23], whose regular performance has been proved to reduce morbility and mortality [24,25]. The European Lung Foundation (Sheffield, United Kingdom) has outlined some useful hints which may help COPD patients manage dyspnea during physical exercise.

TABLE

The management of dyspnea during exercise

Dyspnea assessment	How to remain active
Not troubled with breathlessness expect under major physical exercise	• Regular physical activity which includes at least 30 minutes of daily moderate exercises, five days a week (i.e., walking at own pace on the level) • Allow yourself sufficient time to recover from physical effort
Dyspnea experienced only when walking quickly or slightly uphill	• Plan your activities in time, so that you do not need to hurry • If you are in a hurry, do not panic as this accellerates dyspnea. Continue walking at a regular pace and as well as you can • If necessary, use the inhaler at onset of symptoms
Dyspnea makes you walk more slowly than your companions on level ground. Forced to stop to catch your breath when walking at your own pace	• It is normal to feel breathless. A moderate dyspnea is not dangerous and means that you are correctly performing the physical exercise • Inhale deeply and slowly • Have a break and use the inhaler if necessary
You stop for breath after walking	• Take frequent breaks during physical activity

about 100 m or after walking a few minutes on level ground	• Achieve your objective by taking all the time you need • It is normal to feel breathless • Seek advice from a lung specialist or a physiotherapist to understand what exercises may help you maintain your physical condition
Dyspnea is too serious to go outdoor. Out of breath when dressing/undressing	• Do one thing at a time • Feeling breathless is frightening but does not cause major damage. Breathing will soon go back to normal after some minutes at rest • Try to distract yourself until you breathe normally again • Continue to carry out simple daily activities

CONCLUSIONS

There is scientific evidence supporting the efficacy of pulmonary rehabilitation protocols (PRP) in improving dyspnea and COPD conditions. These programs are considered an integral part of the treatment used to manage chronic respiratory disorders. These conclusions have been retrieved from prospective studies, randomized and/or controlled trials [26-37] and from meta-analyses [38].

The aims of the education component of a PR program are i) to reduce the symptoms, ii) to improve knowledge of respiratory illness and management, iii) to improve self-health behaviours, iv) to reduce hospital admissions, v) to encourage physical fitness and vi) to improve the patient's quality of life [39].

In terms of learning objectives, the education component of a PR program should assist participants to acquire the ability to develop action plans in consultation with a health professionals. It is extremely important to strengthen the professional relationship between hospital consultants, medical staff and general practitioners (GP), this latter playing a role of utmost relevance in the follow-up of his patients. It is known that the GP provides person centred, continuing, comprehensive and co-ordinated healthcare, and in CPOD patients he also needs to manage complex treatments, such as oxygen therapy (O2) and mechanical ventilation at home.

Physiotherapy is primarily concerned with developing, maintaining and restoring an individual's maximum movement and functional ability. The activity of a physiotherapist who specialises in treating patients with respiratory disease includes a comprehensive assessment of the patient's respiratory function and the clear definition of a treatment and management plan. Among the key points of his interventions, he will outline a therapeutic strategy tailored on the patient's needs and symptoms, define individual objectives and set satisfactory goals that should possibly be achieved.

Assessment and monitoring are therefore crucial for a satisfactory outcome of respiratory rehabilitation. When defining a treatment plan, the physiotherapist has to take into account not only the medical diagnosis, but also include a subjective analysis of the patient's condition, which includes taking control of individual goal setting and problems .

PR programmes should be integrated into the medical and individualized treatment of each patient and involve a dynamic and active collaboration between patients and health care providers. PR assessment plans should always include secondary and updated rehabilitation programs inclusive of specific core components aimed at fostering healthy behaviors and compliance with these behaviors and at promoting an active lifestyle for patients with respiratory disease.

In case of COPD exacerbation, a careful and constant control programme is strongly advised to monitor the respiratory conditions, determine the degree of deconditioning and its complications, such as walking impairment, cough and swallowing [40]. By making a careful assessment, the physiotherapist sets health priorities and treatment parameters, which have to be adequate to the patient's clinical conditions and maximize beneficial effects. The assessment has to be made through validated tools, i.e., by using dyspnea assessment scales, muscle fatigue measurement and lung functions tests. Relying only on the subjective opinion of the health carer is not recommended .

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