PULMONARY REHABILITATION - FROM GUIDELINES TO PRACTICE

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PULMONARY REHABILITATION – FROM GUIDELINES TO PRACTICE (Abstract): Pulmonary rehabilitation is an integral part of clinical management and health maintenance of patients with chronic respiratory disease who remain symptomatic or continue to have decreased function despite standard medical therapy. It is a spectrum of evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory problems. Most evidence for the efficacy of respiratory rehabilitation is for patients with chronic obstructive pulmonary disease but there are encouraging results for extending its indications. Current programs of pulmonary rehabilitation are based on guidelines which formally grade the level of scientific evidence and on practical recommendations developed by several prestigious societies. The main components of a pulmonary rehabilitation program are patient selection and assessment, exercise training, education and self-management of the disease, psychosocial and behavioral intervention, nutritional support, outcome assessment and enhancement of long-term adherence to the rehabilitation recommendations. Exercise training is the central component of respiratory rehabilitation, aiming at physical reconditioning, and upper and lower limb muscle training, using several strategies to optimize training. Outcome assessment is an integral part of the program including the measurement of several valid, interpretable and easy to administer parameters. The beneficial effects of pulmonary rehabilitation are the improvement of dyspnea and degree of physical and social disability, less hospitalizations and exacerbations, better overall quality of life by increasing independence. Keywords: GUIDELINES, PULMONARY REHABILITATION, PROGRAM.

According to the current definition, pulmonary rehabilitation is “an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities. Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health-care costs by stabilizing or reversing systemic manifestations of the disease” (1,2).

Pulmonary rehabilitation has become a standard of care for patients with chronic lung diseases. The current evidence-based guidelines for diagnosis, management and prevention of these diseases (3) refer to pulmonary rehabilitation patients with chronic obstructive pulmonary disease
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(COPD). In the last years was assessed the role of rehabilitation programs in chronic lung diseases other than COPD: pulmonary fibrosis (4), primary pulmonary hypertension (5), before and after pulmonary surgery (lung transplantation) (6), the results being encouraging for expanding the indications of such programs.

The practical need for pulmonary rehabilitation occurred because patients with a chronic respiratory disease are highly symptomatic, need frequent hospitalizations, are physical deconditioning, and have a significant psycho-social dysfunction, all of which are accompanied by a significant decrease in their quality of life. From these observations it also came out the particularity of rehabilitation intervention, namely that it primarily addresses the subjective aspects of the disease, represented by the persistence of symptoms and the degree of disability (7).

In 2006 was published a joint statement on pulmonary rehabilitation of the European Respiratory Society (ERS) and American Thoracic Society (ATS) (2) this being complementary to other two major documents: the evidence-based guidelines of the American College of Chest Physicians (ACCP) and American Association of Cardiovascular & Pulmonary Rehabilitation (AACVPR) (8), which formally graded the level of scientific evidence, and AACVPR guidelines for pulmonary rehabilitation programs that offer practical recommendations (9). Updated evidence-based clinical practice guidelines for pulmonary rehabilitation, published in Chest in 2007 (10), AACVPR guidelines in 2010 (11) and the Canadian Thoracic Society guidelines (12) are added. These guidelines should be implemented by a multidisciplinary team that covers all the aspects of a comprehensive rehabilitation program and could be performed in all settings, including hospital inpatient, outpatient or even home in order to maintain the favorable results of respiratory rehabilitation (13).

COMPONENTS OF PULMONARY REHABILITATION PROGRAM

According to the guidelines, the main components of a pulmonary rehabilitation program are patient selection and assessment, exercise training, education and self-management of the disease, psycho-social and behavioral intervention, nutritional support, outcome assessment, and enhancement of long-term adherence to the pulmonary rehabilitation recommendations (2, 10, 11).

❖ Patient selection and assessment

Based on current evidence pulmonary rehabilitation should be considered primarily for the symptomatic COPD patients, presenting with reduced exercise capacity and decreased daily life activities but other patients with chronic respiratory disease and impairment can also be referred for achievement of some beneficial effects (14) (tab. I).

Concurrent diseases or conditions such as severe cardiovascular diseases, disabling neurological or orthopedic conditions may negatively interfere with physical training program while cognitive dysfunction and severe psychiatric disorders prohibit cooperation and understanding, being considered exclusion criteria.

Before entering a pulmonary rehabilitation program, patients should be complexly assessed in order to develop a strictly individualized program tailored to the patient’s needs for maximal benefits (14) (fig. 1).
### TABLE I
Pulmonary diseases appropriate for pulmonary rehabilitation

<table>
<thead>
<tr>
<th>OBSTRUCTIVE LUNG DISEASE</th>
<th>RESTRICTIVE LUNG DISEASE</th>
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<tbody>
<tr>
<td>Chronic obstructive lung disease</td>
<td>Interstitial diseases (interstitial fibrosis, sarcoidosis, occupational lung disease)</td>
</tr>
<tr>
<td>Asthma</td>
<td>Neuromuscular diseases (Parkinson’s disease, amyotrophic lateral sclerosis, multiple sclerosis)</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>Chest wall diseases (ankylosing spondylitis, kyphoscoliosis)</td>
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<tr>
<td>Cystic fibrosis</td>
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</table>

**OTHER PULMONARY CONDITIONS**

- Lung cancer
- Primary pulmonary hypertension
- Obesity-related respiratory disease
- Before and after thoracic and abdominal surgery

Clinical elements such as orthopnea, behavioral signs associated with pain (antalgic position, grimacing), dyspnea scales (mMRC scale - modified British Medical Research Council, modified Borg scale) and pain scales (visual analogue, verbal numerical scales) are used in order to assess these two symptoms that may directly affect patient's ability to follow the physical training program, thus reducing the benefits of the rehabilitation program (14).

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**Medical history & Diagnostic tests & Main symptoms (dyspnea, pain) and clinical signs assessment**

**Exercise capacity assessment (exercise testing)**

**Activities of daily living assessment & Nutritional assessment & Educational and psychosocial assessment**

**Fig. 1.** Main steps in the assessment of patients included in pulmonary rehabilitation programs (14)

Exercise capacity is determined through incremental exercise tests on cycle ergometer or treadmill or through field tests, particularly the 6-minute walk test, and the guidelines for its application reducing the variability in administration of the test (15). This stage of assessment is crucial for the correct prescription of physical training level in the setting of respiratory rehabilitation program.
Initial assessment of activities of daily living (ADL) allows determining the degree of dependence of chronic pulmonary patients on family members or caregivers.

In recent years were developed questionnaires extremely easy to use by physicians and patients having a small number of items that cover all key elements with impact on the quality of life of patients with lung diseases, such as CAT (COPD Assessment Test) (16,17) and ACT (Asthma Control Test) (18), the Romanian version of these questionnaires being validated.

**Exercise training**

Exercise training is the central component of the comprehensive respiratory rehabilitation program and has three practical goals: physical reconditioning, respiratory muscle training and upper and lower extremities exercise.

The program is gradual and individualized, tailored to the patient’s exercise performance under the supervision of a physician. Its benefits are increased exercise capacity, reduced ventilatory effort at submaximal work loads, and improved perception of dyspnea and fatigue, so common in patients with chronic lung diseases. In addition, sequences of high-intensity training result in an anabolic stimulus and improve oxidative capacity of the skeletal muscles, their dysfunction being improved gradually (19).

**Physical reconditioning** aims at achieving a sensation of „well-being” and improving the chances of survival. Physiologically, this is achieved by increased maximal oxygen uptake, improved tissue oxygen utilization, increased skeletal muscle strength and endurance, improved motor coordination and change in body composition with loss of adipose tissue in favor of muscle mass (19).

These benefits are achieved by selecting the adequate intensity, frequency and duration of training sessions, and by maintenance strategies following pulmonary rehabilitation in order to slow benefits’ decline after stopping the program.

There is still controversy over the best parameters for training sessions, but the evidence-based recommendations suggest an intensity of 50% -70% of the predicted maximal heart rate or peak oxygen uptake, session duration of 30 minutes, and a frequency of 3-4 sessions /week for 6-12 weeks (1, 7, 10, 12, 19).

Given the resting tachycardia and severe skeletal muscle dysfunction in patients with chronic respiratory diseases some authors have proposed the use of dyspnea ratings instead of heart rate to guide exercise training intensity, and a two-phase training, intensive training followed by maintenance training, in order the benefits to last longer (19,20). Also, there are several strategies to optimize physical training of these patients: use of optimal bronchodilator therapy, oxygen supplements whether desaturation is present or not, administration of helium gas mixtures, application of noninvasive mechanical ventilation, respiratory muscle training, neuromuscular electrical stimulation, extension of the training program beyond 12 weeks, and combined resistance and aerobic exercise (1, 12, 19, 21).

**Lower-limb muscle training** leads to increased walking distance, improved peak oxygen consumption, and even reduces the severity of dyspnea when performed at an intensity of 60-80% of maximal work capacity as determined by an exercise test, with close monitoring of heart rate and dyspnea. Exercise intensity is progressively increased during a 24-session training cy-
cle. Studies on this issue of physical training in patients with chronic pulmonary disease had conflicting results, some showing benefits across all stages of disease, others only in those with mild to moderate impairment (22).

**Upper-limb muscle training** is beneficial in strengthening scapular belt and upper chest wall muscles, thus improving the traction force applied on the thoracic cage during inspiration in this patient in which diaphragm functions in ventilatory mechanics are affected. The best results are obtained with supported arm ergometry training, performed 20 minutes/session, at 60% of maximal work capacity as assessed by an exercise test. Also beneficial is the method for unsupported arm training, consisting in lifting dowels (weight = 750 g) to shoulder level in the rhythm of breathing rate and progressively increasing its weight by 250 g/week. Each session dyspnea and heart rate should be monitored (11, 14).

**Education and self-management**

Education delivery in pulmonary rehabilitation is performed individually or in small groups and is focused on behavioral modification of both the patient and his/her family members in order to achieve active involvement.

Any educational intervention should begin with a basic simple to understand overview of the main physical and psychological changes occurring in chronic lung diseases and their evolution over time. The patient should be advised to advanced planning, simplify and prioritize his daily activities so that in the early stages of the disease to be able to perform his job-related tasks and in the advanced stages to carry out activities of daily living (23).

For the purpose of energy conservation essential is the assisted acquisition of breathing, cough, and postural drainage techniques, particularly important in patients with hyperinflation (COPD patients) and/or in those with bronchial hypersecretion (bronchiectasis or cystic fibrosis). Relaxation and stretching techniques (yoga, Pilates) help to improve the patient’s psychological distress and increase ventilatory coordination (24).

Essential in chronic pulmonary patient education is counseling and therapeutic support for quitting active smoking and avoiding exposure to secondhand smoke or other respiratory hazards. Also, the patient has to know how to self-administer the inhaled medication properly, how to use auxiliary devices (spacers), to be aware of the possible side effects and of the effects of drug abuse, concerning especially sympathomimetics, theophylline or antibiotics (tachyarrhythmias, elevated blood pressure, precipitation of angina episodes, microbial multiresistance). Proper use of long-term oxygen therapy and noninvasive positive pressure devices should also be explained to the patients with chronic respiratory disease.

**Nutritional assessment and counseling**

Various studies have shown that weight loss in chronic respiratory patient is a poor prognostic indicator, especially in those with COPD. Alarming weight loss refers to the loss of more than 10% of body weight in the last six months or more than 5% in the last month and is particularly dramatic in disease exacerbations when food intake decreases, systemic inflammation is markedly increased, and energy balance becomes negative. On the other hand, obesity adversely affects respiratory function by increasing the load on the already compromised respiratory system (2, 14). Anthro-
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Pomometric measurements of nutritional status are body mass index (BMI) and estimation of lean body weight by bioimpedance, a simple and noninvasive method (25, 26).

Nutritional counseling is aimed at achieving an adequate alimentary plan for achieving and maintaining an optimal weight including, if necessary, supplements in liquid form.

Psychosocial support

Patients with chronic pulmonary disease commonly have psychiatric co-morbidities, primarily anxiety and depression, generated by the difficulty of accepting their illness as well as coping with the associated physical and neuropsychological impairments having major adverse consequences on the quality of life (27). Assessment is done by clinically validated questionnaires and scales (Beck depression inventory and depression scale for geriatric patients) and the results are integrated into the multidisciplinary program of pulmonary rehabilitation (28).

The practical way of providing psychosocial support is to organize support groups focused on specific issues, group therapy and education, individual psychotherapy, stress reduction and panic control techniques with the permanent involvement of family members and caregivers (14, 21).

Outcome assessment

Outcome assessment is an integral part of a comprehensive respiratory rehabilitation program and aims to quantify its beneficial effects (fig. 2).

The clinical practice use several types of measurements, validated in studies, easy to interpret and manage. To evaluate the dyspnea, the most severe symptom of patients with chronic respiratory impairment, are used dyspnea scales (Borg, mMRC), whichever is subjective improvement, which correlate with decreased ventilatory burden during exercise as a result of training (1, 2, 10).

Exercise capacity and its improvement after aerobic or resistance exercise training is assessed by conventional exercise testing, cardiorespiratory testing - which is more complex, or by the pragmatic option of field tests, the 6-minute walk test being the most commonly used and recording the increase in the walking distance – the estimated minimal clinically important difference being 54 meters (2, 10, 29). Pedometers have been introduced recently, being simple and portable devices that measure the number of steps and are useful in self-monitoring, progress assessment, and in enhancing compliance with the training program and activities of daily living (30).

Health-related quality of life is assessed using generic or disease-specific questionnaires, being commonly used in COPD. St
George's Respiratory Questionnaire (SGRQ) is one of the most frequently used questionnaires being designed for long-term studies and having well represented psychometric properties, the Romanian version being validated. In studies, SGRQ score improvement was maintained even 1 year after the end of respiratory rehabilitation program (2, 10, 21).

CONCLUSION
Pulmonary rehabilitation is a dynamic evidence-based field of pneumology, which is an integral part of the current treatment of chronic respiratory diseases.

Respiratory rehabilitation programs follow the current guidelines, being delivered in inpatient or outpatient settings, their success depending on the skill and experience of the multidisciplinary team, socio-economic conditions, and adherence of patients and their families.

The most important benefits of pulmonary rehabilitation are the relief of symptoms, particularly dyspnea, improvement of complications, less and shorter exacerbations and hospitalizations, with significant cost-reduction, decreased physical and social disability, improved muscle deconditioning and increased exercise capacity, reduced anxiety and depression and improved emotional well-being, all these resulting in an improved overall quality of life for patients with chronic lung disease.

REFERENCES


