



Pulmonary rehabilitation: promising nonpharmacological approach for treating asthma?

Elisabetta Zampogna^a, Antonio Spanevello^{a,b}, and Dina Visca^{a,b}

Purpose of review

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation with a history of respiratory symptoms that vary over time and in intensity, together with variable expiratory airflow limitation. The goal of asthma treatment is to reach symptoms control, reduction in future risk and improvement in quality of life (QoL). Guideline-based pharmacologic therapies and the effect of inhaled steroids and bronchodilators have been widely studied over the past decades. We provide an overview of the available evidence on pulmonary rehabilitation as a nonpharmacologic therapy in asthmatic patients.

Recent findings

Recently, some studies have highlighted the promising role of nonpharmacologic therapies in asthma, such as pulmonary rehabilitation demonstrating that a pulmonary rehabilitation programme consisting of exercise training, breathing retraining, educational and psychological support, improve exercise capacity, asthma control and QoL and reduce dyspnea, anxiety, depression and bronchial inflammation at any step of the disease.

Summary

Pulmonary rehabilitation shows positive results on exercise tolerance, respiratory symptoms and QoL in asthmatic patients at any steps of the diseases. However, additional information is required to better characterize rehabilitation programmes in order to improve clinical care in asthma.

Keywords

asthma, exercise training, breathing retraining, education, psychological support

INTRODUCTION

Pulmonary rehabilitation is defined by the American Thoracic Society and the European Respiratory Society as a 'comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors' [1,2].

So far, there is robust literature that supports benefit in terms of symptoms, lung function and quality of life (QoL) in patients affected from chronic obstructive pulmonary disease (COPD), whereas indications, goals and components of pulmonary rehabilitation and the potential benefits for patients with other respiratory diseases, such as asthma, are still not completely investigated.

Aim of this article is to review the available evidence and draw conclusions on the role of pulmonary rehabilitation in asthmatic patients who may experience limitations in their daily life

activities because of worsening of respiratory symptoms on exertion or lung function impairment.

A nonsystematic review based on Pubmed search was performed using specific keywords (pulmonary rehabilitation/exercise and asthma).

All documents published in English were evaluated by the authors and those considered relevant for the purpose of this review were included.

PULMONARY REHABILITATION AND ASTHMA

Asthma is a chronic inflammatory disorder of the airways characterized by variable and recurring

^aIstituti Clinici Scientifici Maugeri IRCCS, Respiratory Rehabilitation of the Institute of Tradate, Tradate, Varese and ^bDepartment of Medicine and Surgery, Respiratory Diseases, University of Insubria, Varese-Como, Italy
Correspondence to Dina Visca, Istituti Clinici Scientifici Maugeri IRCCS, Respiratory Rehabilitation of the Institute of Tradate, via Roncaccio 16, 21049 Tradate, Varese, Italy. Tel: +39 0331829598; e-mail: dina.visca@icsmaugeri.it

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KEY POINTS

- Asthma is a chronic inflammatory disorder of the airways characterized by variable and recurring respiratory symptoms that vary over time and in intensity and airflow limitation, which may affect QoL and exercise performance.
- Pulmonary rehabilitation is a comprehensive intervention based on patient-tailored therapies, including exercise training, education, counseling with specialists who aim to improve the physical and psychological condition of people with chronic respiratory disease.
- Literature so far has highlighted a promising role of pulmonary rehabilitation as a multidisciplinary nonpharmacological treatment in asthma patients.

symptoms, such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity and airflow limitation with bronchial hyperresponsiveness [3,4].

Asthmatic patients may complain of poor QoL because their daily life activities may be limited by worsening of respiratory symptoms on exertion.

Exertional dyspnea is a variable symptom in asthma, in terms of intensity and duration over the time and could be multifactorial [5]: ventilatory limitation, gas transfer abnormalities, pulmonary vascular and cardiac dysfunction, limb muscle dysfunction and comorbid impairments may contribute individually or in association.

Another significant problem is represented by exercise-induced bronchoconstriction consisting of bronchoconstriction onset, occurring during or immediately after exercise [6–8].

In addition, oral steroid therapy taken on a regular basis or occasionally to treat acute exacerbation can lead to steroid-induced myopathy and skeletal muscle remodeling, resulting in a poor endurance muscle performance [9,10]. In this case, exercise can be limited more by leg fatigue than by dyspnea so that some patients prefer to reduce their activity [11].

The goal of asthma treatment is to reach symptoms control, reduction in future risk and improvement in QoL. The treatment of asthma largely depends on guideline-based pharmacologic therapies, which are annually updated and the effect of inhaled steroids and bronchodilators has been widely studied over the past decades.

However, some studies have highlighted the promising role of nonpharmacologic therapies in asthma, such as pulmonary rehabilitation, showing that pharmacologic therapy for asthmatic patients

may be optimized further by the addition of nonpharmacologic therapy.

Pulmonary rehabilitation is a comprehensive approach of disease management and involves a multidisciplinary team, including doctors, respiratory therapists, specialist nurses, psychologists and dietitians. The rehabilitation intervention should be tailored on specific patient's needs, therefore, a preliminary assessment of general condition, comorbidities (especially cardiac, musculoskeletal and neurologic diseases), should be performed in order to operate a more effective rehabilitation intervention. It usually consists of exercise training, breathing retraining, educational and psychological support.

Exercise training

Exercise training plays a central role in pulmonary rehabilitation. There is evidence supporting a positive role of exercise training in improving exercise performance in asthmatic patients; however, as asthma ranges widely, specific programmes should be tailored on patient's characteristics [8].

Prior to enter in a specific programme, patient should, therefore, undergo a complete lung functional assessment, including spirometry before and after bronchodilator and exercise capacity testing. These tests are used to enable an appropriate exercise training. Exercise capacity is usually based on cardiopulmonary exercise testing or a six-minute walk test in order to set physical training sessions that exceed the physical loads of daily life activities.

However, different studies documented the positive role of aerobic training on asthma symptoms, anxiety, depression and QoL in asthma patients. One prospective and randomized study by Mendes *et al.* [12] on 101 asthmatic patients compared the effect of aerobic training (educational programme and breathing exercises and aerobic training) to controls (educational programme and breathing exercises) followed twice a week over a 3-month period. After 3 months QoL, respiratory symptoms, aerobic capacity, anxiety and depression were significantly improved in the trained group.

There is no universal agreement on the type of exercise training in respiratory diseases; it can vary from endurance training or resistance/strength training. So far, the former is the most studied in clinical trials and the most common exercise used in pulmonary rehabilitation programmes worldwide.

Endurance training

It involves upper and lower extremities and the workload should increase as the patient's performance improves. It is typically scheduled two to

five times a week over 3–8/12 weeks. The workload is based on a cardiopulmonary exercise test (60–70% VO₂ max) with continuous exercise for 20–30 min at 60% of the individual's maximal work rate or greater [1,10,13]. As an alternative, the workload could be tailored on a six-min walking test (starting from 80 to 60% of test heart rate max or the theoretical watt max) and should be modified according to patient's symptoms valuated with modified Borg dyspnea and fatigue scale [14–16]. The mechanism by which exercise improves endurance remains unclear. However, several studies have proven that exercise training strengthens peripheral muscles leading to biological and physiological changes that lower respiratory rate, ventilatory requirement and reduce dynamic lung hyperinflation [17], in addition to a psychological training effect. To date, there are few data available regarding baseline factors that can predict who could benefit from pulmonary rehabilitation the most, especially when stratified by disease severity.

In parallel with COPD patients, also asthmatic patients with more severe impairment and poor diseases control are more limited in daily life activities [4]. A retrospective study by Zampogna *et al.* [18[¶]] showed that asthmatic individuals benefit from a pulmonary rehabilitation programme in terms of respiratory symptoms, muscle fatigue and oxygen value at rest and exercise performance at any GINA step. In addition, authors highlighted that pulmonary rehabilitation programme may be more beneficial in younger individuals, with smoking history and worse baseline effort tolerance [18[¶]]. Zampogna *et al.* [19[¶]] performed a similar analysis on a selected population of 317 patients affected from severe asthma and observed that a multidisciplinary pulmonary rehabilitation programme was effective in terms of exercise capacity, assessed through the six-minute walking test, and respiratory symptoms, assessed with Borg fatigue and dyspnoea [19[¶]].

There is evidence in the literature about the benefits of pulmonary rehabilitation in patients with partially or uncontrolled asthma. Sahin and Naz [20[¶]] observed the effect of an 8-week outpatient pulmonary rehabilitation programme on respiratory symptoms, comparing 21 patients with partially controlled and 28 with uncontrolled asthma. The results documented that there was a better improvement in latter highlighting the potential beneficial effect of pulmonary rehabilitation in selected asthmatic patients [20[¶]].

As previously mentioned, asthma is characterized by an underline chronic airway inflammation that drives bronchial hyperresponsiveness leading to an exaggerated contractile response of the airways to a

variety of stimuli and the onset of respiratory symptoms. A prospective randomized trial by Franca-Pinto *et al.* [21] studied the effect of exercise as an add on nonpharmacological treatment on 58 moderate–severe asthma patients randomly assigned to either the control group or the aerobic training group and followed over a 3-month period. The results demonstrated that pulmonary rehabilitation had a positive effect on bronchial hyperresponsiveness, serum inflammation, QoL and asthma exacerbations.

In addition, a systematic review and meta-analysis performed by Eichenberger *et al.* [22] on the effects of exercise training on airway hyperreactivity in asthma showed the beneficial effect of regular physical activity on asthma symptoms, QoL and improvement in bronchial hyperresponsiveness and FEV₁.

Resistance-strength training

Resistance-strength training improves muscle mass and strength because patient is asked to perform a set of repetitive exercises involving peripheral muscle, upper and lower extremities, starting with or without weights tailored according to individual's performance. Patients usually begin with eight repetitions and progressed to 10. Once the patient is able to perform the workload for 1–2 repetitions above the desired number, the load is increased by 2–10% [23]. The training frequency ranges from 3 to 5 weekly sessions for a total amount of 15–20. Potential benefit is that resistance exercise involves single muscle groups and results in lower oxygen consumption and minute ventilation and therefore it provides additive benefit to endurance training. To our knowledge, no data on the effects of resistance-strength training alone in asthmatic patients are available.

Even if research data document a promising role of exercise in asthma, little is known about patient's characteristics that can predict the beneficial effect of rehabilitation programmes in asthma.

Breathing retraining

Breathing retraining is considered an alternative exercise training being a less conventional form of exercise and its role in pulmonary rehabilitation is not completely clear. Retraining with breathing techniques aims to reduce respiratory rate and improve ventilation and gas exchange in order to reduce air trapping. Diaphragmatic breathing increases tidal volume, but studies so far have produced conflicting results in COPD [24,25]. So far, there is no definitive evidence to support or avoid inspiratory muscle training for asthma [26], therefore, specific respiratory muscle tests and training

should be limited to patients carefully selected by clinicians taking into account clinical history.

However, asthmatic patients with not well-controlled respiratory symptoms may benefit from breathing exercises [27]. Up to 30% of patients report that they use breathing techniques to control their symptoms [28]. Usually, the exercises comprise training in nasal and slow breathing, controlled breath holds and relaxation exercises [29,30]. A trained and skilled technician administers the intervention for one-to-one session, each of about 20–30 min duration and/or from a self-guided programme.

Education

Education about lung disease and its management has long been a precious component of pulmonary rehabilitation. It implies that specialists teach patients about respiratory diseases and support them through self-management training. This collaborative approach seems to improve clinical practice and gives an opportunity to patients to share their doubts and practice correct techniques for using inhalers and nebulizers. [31–33]. Knowledge about the disease helps patients to understand, recognize and treat the symptoms of their disease in order to achieve a better asthma control in daily life [1,34–36]. It could be a single short intervention, typically 10 min or standardized (i.e. 30 min through booklet, videos one to one or in a group) on useful topics, including smoking cessation, oxygen therapy, nutrition, physical activity, proper use of medications and health preservation (e.g. vaccinations).

Counseling

Nutritional counseling and weight management

Rehabilitation programmes should include nutritional counseling and weight management.

Patients with lung disease are at risk for obesity because of limitations to physical activity and adverse effects of oral glucocorticoids given for exacerbations; weight loss can help to reduce the work of breathing. Obesity is a major risk factor for asthma, as overweight and obese individuals are 38 and 92% more likely to develop asthma, respectively, than patients with normal weights [37] so that Global Initiative for asthma [4] recommends weight loss for all obese asthmatic patients. Indeed, obesity is a common comorbidity of asthma patients and results in the development of a difficult-to-control asthma

phenotype and patients experience worse clinical control, poorer QoL, reduced lung function, poor responses to corticosteroids and more psychosocial symptoms [38–40].

Psychological counseling

Asthma is a risk factor for the development of anxiety and depression and may contribute to fatigue and reduce physical activities. Psychological counseling should be offered either individually or in small groups to adults with persistent asthma because discussion will enable patients to feel more comfortable with their disease and incline to participate in social activities. In details, cognitive behavioral therapy (CBT) is a form of talking therapy that explores a person's perceptions of themselves and others and how a person's behavior influences their thoughts and feelings. CBT may improve QoL, asthma control and anxiety levels compared with usual care [33].

CONCLUSION

Although evidence supports a well-established role of pulmonary rehabilitation in patients with COPD, the optimal duration of the activity, frequency and intensity of the exercise sessions and specific characteristics of specialist's interventions in asthma patients remain poorly defined. Pulmonary rehabilitation shows positive results on exercise tolerance, respiratory symptoms and QoL in asthmatic patients at any steps of the diseases. Recent studies have highlighted that patients with severe symptoms are likely to be the ones who benefit most from rehabilitation programmes with additional improvement also in airways inflammation. The aim of asthma treatment is to improve symptoms and reduce future risk. In this contest, comorbidities in asthmatic patients like in other chronic respiratory diseases with lung impairment [41,42] play a key role and could negatively interfere in the whole management of the disease. Preliminary data show that obesity, sleep apnea syndrome and bronchiectasis may benefit from pulmonary rehabilitation in asthma patients [19].

However, additional information is required to better characterize rehabilitation programmes in both hospital and home settings in order to improve clinical care in asthma.

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Conflicts of interest

There are no conflicts of interest.

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- of special interest
- of outstanding interest

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