



Review article

Activity limitation and exertional dyspnea in adult asthmatic patients: What do we know?



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ARTICLE INFO

Article history:

Received 9 December 2015

Received in revised form

11 April 2016

Accepted 6 June 2016

Available online 9 June 2016

Keywords:

Asthma

Exercise physiology

Physical exertion

Review

Symptom assessment

ABSTRACT

Limitation of activity is the most cited symptom described by uncontrolled asthma patients. Assessment of activity limitation can be undertaken through several ways, more or less complex, subjective or objective. Yet little is known about the link between patients sensations and objective measurements.

The present review reports the current knowledge regarding activity limitation and symptom perception (i.e., exertional dyspnea) in adult patients with asthma. This work is based on references indexed by PubMed, irrespective of the year of publication.

Overall, patients with stable asthma do not have a more sedentary lifestyle than healthy subjects. However, during a cycle ergometric test, the maximal load is reduced when FEV1, FVC and muscle strengths are decreased. Additionally, during the six-minute walking test, mild asthma patients walk less than healthy subjects even if the minimal clinically important difference is not reached.

The major complaint of asthma patients when exercising is dyspnea that is mainly related to the inspiratory effort and also to dynamic hyperinflation in some circumstances. Finally, the administration of bronchodilator does not improve the ventilatory pattern and the exercise capacity of asthma patients and little is known on its effect on exertional dyspnea.

The present review allows to conclude that until now there is no gold standard test allowing the objective assessment of "activity limitation and exertional dyspnea" in asthma patients.

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1. Introduction

In patients suffering from chronic lung diseases, the quality of life can be deteriorated by their inability to achieve the physical activity level that they want to. This activity limitation results from complex interactions between mechanical, physiological and psychological mechanisms. To date those are well described in number of chronic lung disease (e.g. chronic obstructive pulmonary disease (COPD) or interstitial lung disease) although some issues remain to be evaluated [1,2]. Pertaining to asthma, the literature on physical activity is relatively scanty although there is a clear relationship between activity limitation and quality of life in asthmatic subjects [3]. Indeed, the limitation of physical activity is identified by 60–75% of uncontrolled patients [4–6]. Uncontrolled asthma itself is associated with a greater than two-fold risk of limitation of physical activity with a negative impact on work and regular activities [7,8]. The level of energy expenditure during physical activities has been found to be negatively correlated with the risk of exacerbation's occurrence, and is associated with lower health care use in individuals with and without asthma [9,10]. On the contrary, exercise and physical activity have also been described as main asthma triggers. In addition, exercise-related respiratory symptoms are known to limit physical activities and negatively impact daily lives [11]. It is then not surprising that activity limitation has been proposed as a main factor to assess the impact of asthma in populations [12].

Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” [13]. This definition includes exercise, sports, and physical activities done as part of daily living, occupation, leisure, and active transportation [14]. This should be differentiated from the exercise capacity which is defined as the maximum amount of physical exertion that the patient can sustain [15].

Activity limitation has been described as “the inability to perform usual activities, commonly associated with chronic physical and mental health conditions” [16]. From the patient's perspective, this definitions may sound vague. Indeed, the perception of limitation of activity may be more linked to the patient's expectation about their physical abilities. This concept is illustrated by the definition of exercise intolerance proposed by Vogiatzis et al.: “a condition where the individual is unable to perform physical exercise at the intensity or for the duration that would be expected of someone in his or her age and general physical condition” [1].

The purpose of this qualitative review is to summarise current knowledge on activity limitation in adult patients with asthma. The review first discusses the mechanisms responsible for activity limitation in asthma, including peripheral and respiratory muscle

weakness, the negative impact of systemic corticosteroids as well as the effect of inhaled therapy. The next chapter focuses on objective measures related to activity such as daily energy expenditure, exercise aerobic capacity or walking tests. Symptoms, in particular exertional dyspnea, as factors limiting activities in asthma patients as well as ventilatory constraints and dynamic hyperinflation are then reviewed. Finally, to what extent exercise limitation and dyspnea can be predicted in asthma patients are also addressed.

We did not conduct a full systematic review on the topic, and therefore did not apply the methods of the Cochrane Collaboration. The search strategy for this review was based on the MEDLINE/PubMed database and used MeSH descriptors. Reference lists from pertinent articles were searched, personal contact was made with authors, and books and targeted journals were manually searched to identify relevant articles. Key words used for the literature search included ‘asthma’, ‘muscle strength’, ‘respiratory muscle’, ‘motor activity’, ‘mobility limitation’, ‘bronchodilator agents’, ‘anti-inflammatory agents’, ‘lung volume’, ‘respiratory mechanics’, ‘dyspnea’, ‘symptom assessment’, ‘exercise capacity’, ‘exercise tolerance’, ‘energy expenditure’, ‘exercise tests’, ‘walking’ and ‘quality of life’. Studies published in English, with adult participants who had a diagnosis of asthma were included.

2. Factors related to activity limitation in adult asthma patients

2.1. Respiratory muscle strength

The respiratory muscle strength is measured during a maximum inspiratory (Maximal Inspiratory Pressure, MIP) or expiratory (Maximal Expiratory Pressure, MEP) effort. Recommendations describe the method of measurement and propose formulas for calculating predicted values [17]. In patients with asthma, it has been observed that the diaphragm thickness at rest is significantly higher than in healthy subjects [18]. Although, during the contraction, the shortening of the muscle was not different between both groups, a significant correlation between this parameter and the MIP was observed only in healthy subjects. ($r^2 = 0.559$; $p = 0.021$).

Few authors were interested to measure respiratory pressures in asthmatics. Data are contradictory. de Bruin et al. have observed significantly lower MIP values in asthmatic subjects than in healthy subjects (-52 ± 18 vs -73 ± 21 cm H₂O respectively) [18]. By studying steroid-dependent and non-dependent asthma patients, Perez et al. found, comparing to a control group, significant lower values in the first group but not in the second one [19].

Conversely, Stell et al., using another technique (Sniff Nasal

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