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Physical activity and fatigue in chronic obstructive pulmonary disease – A population based study

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Summary
Background: In subjects with chronic obstructive pulmonary disease (COPD), symptoms of fatigue, concomitant heart disease and low physical activity levels are more frequently described than in subjects without COPD. However, there are no population-based studies addressing the relationship between physical activity, fatigue and heart disease in COPD. The aim was to compare physical activity levels among subjects with and without COPD in a population based study, and to evaluate if concomitant heart disease and fatigue was associated to physical activity.
Methods: In this, 470 subjects with COPD and 659 subjects without COPD (non-COPD) participated in examinations including structured interview and spirometry. A ratio of the forced expiratory volume in one second (FEV_1)/best of forced vital capacity (FVC) and vital capacity (VC) < 0.7 was used to define COPD. Physical activity was assessed with the International Physical Activity Questionnaire (IPAQ), and fatigue with the Functional Assessment of Chronic Illness Therapy - Fatigue scale (FACIT-F).
Results: The prevalence of low physical activity was higher among subjects with $FEV_1 < 80\%$ predicted compared to non-COPD subjects (22.4% vs. 14.6%, $p = 0.041$). The factors most strongly associated with low physical activity in subjects with COPD were older age, OR 1.52, (95% CI 1.12–2.06), a history of heart disease, OR 2.11 (1.10–4.08), and clinically significant fatigue, OR 2.33 (1.31–4.13); while obesity was the only significant factor among non-COPD subjects, OR 2.26 (1.17–4.35).

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Conclusion: Physical activity levels are reduced when lung function is decreased below 80% of predicted, and the factors associated with low physical activity are different among subject with and without COPD. We propose that the presence of fatigue and heart disease are useful to evaluate when identifying subjects for pulmonary rehabilitation.

Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by a progressive, non reversible airflow limitation [1]. Dyspnea at exertion is a cardinal symptom, and muscle impairment and reduced exercise capacity are frequently described, leading to a downward spiral of myopathy, worsening dyspnea and physical activity avoidance [2]. Subjects with COPD spend less time in physical activity and more time in sedentary behaviors compared to healthy controls [3], and subjects with COPD reporting the lowest levels of physical activity have an increased risk of hospitalization and mortality [4,5].

Comorbidities are common in COPD, whereof cardiovascular diseases are the most common [6]. Cardiovascular comorbidity, such as heart disease, contributes to the overall burden of COPD [7] and might lead to even lower levels of physical activity among subjects with COPD.

Fatigue, a symptom often observed in subjects with chronic conditions, has been reported in 20% of the general population [8], and is common among subjects with COPD [9]. Fatigue is commonly defined as "a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity" [10]. In COPD, concomitant heart disease has been associated with increased risk of fatigue [11], and worsening fatigue is in turn associated with acute exacerbations and less time spent outdoors [12], and negatively impacts the subjects' ability to perform daily activities [13,14].

Although substantial data are available on physical activity among subjects with COPD, most studies include selected COPD populations [3,5,14] in which the known under diagnosis of COPD [15] may have affected the results. Data from population-based studies are limited [14,17–19], and the relation between fatigue, heart disease and physical activity has so far not been evaluated.

The aim of this population-based study was twofold; firstly, to compare physical activity levels among subjects with and without COPD; secondly, to evaluate if factors as concomitant heart disease and fatigue were related to the level of physical activity in these groups.

Material and methods

Design

This is a population based case-control study.

The study population

The recruitment of the study population has been described previously [20]. After re-examinations of population-based cohorts within the OLIN (Obstructive Lung Disease in Northern Sweden) studies during 2002–04, all subjects with COPD were identified (n = 993) together with an age- and gender-matched reference group without obstructive lung impairment (non-COPD). The study population (n = 1986) has been invited to annual examinations since 2005 with a basic program including structured interview and spirometry. In addition to the basic program a questionnaire assessing fatigue was used in 2007; and in 2008, a questionnaire assessing physical activity.

The present study is based on cross-sectional data from the 2008 examinations (spirometry, structured interview and assessment of physical activity) together with fatigue data collected in 2007. All subjects with complete spirometry and physical activity data in 2008 were included in the study population (n = 1129), of which a sub-population of 1041 subjects had complete data on fatigue (Fig. 1). The study was approved by the Regional Ethical Review Board at Umeå University, Sweden.

Interview questionnaire

The structured interview questionnaire includes well-validated questions used in several studies [15,21]. The interview questionnaire covers respiratory symptoms, and in addition smoking habits, comorbidities such as heart diseases, and educational level.

Dyspnea was assessed with the modified Medical Research Council (mMRC) dyspnea scale [22]. Subjects rated their dyspnea on a scale from 0 to 4 (with 0 indicating breathlessness only at straining exercise).

Self-complete questionnaires

Physical activity was assessed with the Swedish version of the International Physical Activity Questionnaire (IPAQ) short-form [23,24]. The IPAQ was designed to measure all physical activity in leisure-time, work, transportation and household tasks. Subjects report the frequency and duration of activities in the three activity categories: walking, moderate activities, and vigorous activities. Activity is calculated as the total time (in minutes) spent in the three activity categories. The total time in each category is then weighted by a metabolic equivalent of task, MET (1 MET = resting metabolic rate, 3.5 ml $O^2 \cdot kg^{-1} \cdot min^{-1}$), resulting in a body weight-adjusted activity estimate that is

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