Respiratory Medicine (2010) **104**, 1005–1011

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Physical inactivity in patients with COPD, a controlled multi-center pilot-study

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Received 8 July 2009; accepted 15 January 2010
Available online 18 February 2010

KEYWORDS
Physical activity;
COPD;
Activity monitor;
Steps;
Energy expenditure

Summary
Background: Physical activity (PA) has been reported to be reduced in severe chronic obstructive pulmonary disease (COPD). Studies in moderate COPD are currently scarce. The aim of the present study was to investigate physical activity in daily life in patients with COPD ($n = 70$) and controls ($n = 30$).
Methods: A multi-center controlled study was conducted. PA was assessed using a multisensor armband device (SenseWear, BodyMedia, Pittsburgh, PA) and is reported as the average number of steps per day, and the time spent in mild and moderate physical activity.
Results: Patients suffered from mild ($n = 9$), moderate ($n = 28$), severe ($n = 23$) and very severe ($n = 10$) COPD. The time spent in activities with mild (80 ± 69 min vs 160 ± 89 min, $p < 0.0001$) and moderate intensity (24 ± 29 min vs 65 ± 70 min; $p < 0.0036$) was reduced in patients compared to controls. The number of steps reached $87 \pm 34\%$, $71 \pm 32\%$, $49 \pm 34\%$ and $29 \pm 20\%$ of control values in GOLD-stages I to IV respectively. The time spent in activities at moderate intensity was $53 \pm 47\%$, $41 \pm 45\%$, $31 \pm 47\%$ and $22 \pm 34\%$ of the values obtained in controls respectively with increasing GOLD-stage. These differences reached statistical significance as of GOLD stage II ($p < 0.05$). No differences were observed among centers.

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[h] TT and DL are (post)doctoral fellows of the Research Foundation Flanders. Grants: This study was funded through an independent research grant from Pfizer Inc (New York, NY) in collaboration with BodyMedia Inc (Pittsburgh, PA).

doi:10.1016/j.rmed.2010.01.012

Conclusions: Physical activity is reduced early in the disease progression (as of GOLD-stage II). Reductions in physical activities at moderate intensity seem to precede the reduction in the amount of physical activities at lower intensity.

Introduction

Chronic obstructive pulmonary disease was recently defined as a preventable and treatable disease of the airways, with significant systemic consequences.[1] Inactivity is believed to be crucial to the development of these systemic consequences of COPD[2] such as skeletal muscle weakness, osteoporosis and cardiovascular disease.[3] Recent data suggest that patients suffering from COPD with low levels of physical activity have increased risk for hospital admission and have significantly enhanced mortality.[4] Epidemiological data suggest that this may directly or indirectly lead to more rapid decline in lung-function.[5] In the latter study, patients with COPD were followed for 20 years. Being moderately physically active resulted in a median survival benefit of roughly 7 years compared to patients with a very sedentary life style. Given the multiple health benefits of appropriate physical activity it is important to study levels of physical activity, particularly in mild to moderate disease. Identifying modifiable risk factors in early disease stages is particularly attractive as it offers the possibility to provide interventions with potential long term benefits. Recent guidelines of the American Heart Association have reinforced the importance of physical activity in maintaining health, including the elderly population and patients with chronic conditions.[6]

To date, only single centre studies have shown that patients with moderate to severe COPD have physical activity levels well below control subjects. Step or motion counts were 40 to 60 % lower[7–9] and walking time was 55 % lower[10] in patients with moderate to severe COPD compared to healthy control subjects. Patients on long term oxygen therapy were particularly inactive.[8] To our knowledge, the only data available so far in mild to moderate COPD come from a cohort that has been followed in a single center in Germany.[11,12] In these studies reduced daily physical activity was reported as of GOLD-stage II and a gradual decline of physical activity per GOLD-stage was found. A limitation of this study is that control subjects were all former smokers with symptoms of chronic bronchitis who were previously connected to the hospital. Hence it remains possible that physical activity levels could be even lower in comparison with a healthy control group with no prior connection to a hospital. Furthermore, only one study has so far compared physical activity levels from different centers and showed that patients from South America were more physically active than patients from Central Europe.[13] This underlines the need to collect data in different stages of the disease and in different regions of the world in order to increase the generalizability of results.

The aim of the present pilot-study was therefore to investigate physical activity levels in patients across different disease stages in three different centers located in different regions of the world and compare the levels of physical activity with healthy, age-matched control subjects.

Materials and methods

A sample of 70 volunteers with COPD was actively recruited from three outpatient clinics in Palermo, Italy ($n = 29$), Leuven, Belgium ($n = 20$), and Pittsburgh, US ($n = 21$) by personal invitations from the pulmonary physician to participate in the study. In addition, 30 age-matched healthy control subjects were recruited in Leuven, Belgium. None of the volunteers had a previous connection with the hospital and all were relatives of students at the Department of Rehabilitation Sciences of the Katholieke Universiteit Leuven. Control subjects could participate if they were not involved in competitive sports activities and if they had normal lung function. In the healthy controls a clinical examination including a maximal cardiopulmonary exercise test was conducted to exclude any apparent chronic diseases or other morbidity. Subjects were instructed to report any current or past health problems. Resting ECG and lung function were normal in all control subjects. The appropriate institutional review boards approved the study and both patients and healthy controls gave informed consent.

Patients in the study had a known diagnosis of smoking related COPD and post bronchodilator FEV_1 was used to classify the patients into the appropriate GOLD stage.[14] Subjects could participate in the study if they had no other significant co-morbid conditions that would preclude the participants from having potentially normal physical activity levels (except for COPD in the patients). None of the participants used walking aids, as these may interfere with the assessment of physical activity levels with the activity monitor used in the current study. All patients had stable COPD without exacerbations in the past three months. None of the patients was referred for rehabilitation. Patients were distributed over the four GOLD stages. The characteristics of patients and control subjects are displayed in Table 1.

Study procedures

During an outpatient visit, spirometry was performed according to the guidelines of the American Thoracic Society and the European Respiratory Society.[15] The best FEV_1 and FVC of at least three acceptable maneuvers are reported. Body weight and height were assessed on the first study visit barefoot while wearing light clothing.

Assessment of physical activity

Subjects were instructed to wear a device able to assess physical activity (SenseWear Armband, Bodymedia,