Field exercise testing in COPD

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Valorization
Valorization is the process by which scientific knowledge can shape and influence the world and have practical application. Knowledge valorization specifically refers to “getting the maximum value and usefulness out of education programs and managed projects, by generalizing what has been learnt from the specialist experiences to other, related fields”.

Based on this definition, this chapter will discuss the current findings of this thesis in the light of the social and economic impact as well as innovative concepts for future health care.

RELEVANCE AND INNOVATION

COPD is highly prevalent disease and a leading cause of morbidity and mortality worldwide. Besides the impairment of pulmonary function, several other factors influence the impact and the evolution of COPD. These factors include the occurrence of hypoxemia or hypercapnia at exertion, limiting functional dyspnea and diminished exercise capacity that are associated with higher risk of mortality and hospitalization. Indeed, the degree of exercise tolerance and pathophysiological response to exercise facilitate the prognosis and can constitute an essential dimension in the evaluation of COPD patients. Clear exercise outcomes and their appropriate interpretation can play a superior role in COPD management and treatment in clinical practice.

This thesis provided new evidence in this field of expertise:

In chapter 2, a comparison between two popular tests of exercise assessment (CET and the 6MWT) in clinical practice revealed different determinants of exercise capacity between CET and the 6MWT. According to this, CET and 6MWT are not interchangeable. Patients’ clinical characteristics should be considered in the interpretation of exercise outcomes derived from CET or 6MWT. Indeed, the new knowledge reported in this thesis facilitates the choice of exercise test and the interpretation of the exercise outcomes which have become an integral part of the evaluation and response to treatment in COPD.

Chapter 3 addresses an important concern about the choice of the appropriate 6MWT reference equation. The right interpretation of walking performance according to the estimation and inference for normative values is great of importance for both health professionals and patients. For health professionals, the estimation of walking capacity using reference values can represent the severity of patients’ exercise intolerance and thus influence on the clinical decision. In addition, reference values are critical to tailor appropriately timed exercise interventions indicating the high importance of choosing the right reference equation. For the patients, walking capacity
expressed as percentage of predicted, can be used to increase the awareness about the impact of disease severity on their exercise capacity.

Chapter 4 investigated the prognostic value of existing and new variables derived from the six-minute walk test in patients with COPD. This knowledge can increase the utilization of the 6MWT in praxis and provide health professionals with insight for the prognostic value of each 6MWT-derived variable. Moreover, the demonstrated prognostic value of the 6MWT-derived variable can also be considered in the clinical decision-making process.

In chapter 5, the relationship of EID with certain patients’ clinical characteristics including pulmonary emphysema and the relative-weight of these determinants on the occurrence of EID was demonstrated. This knowledge provides health professionals with a better understanding about the pathophysiological interaction of several determinants of EID and the risk factors for the occurrence of EID in COPD patients with different degrees of pulmonary emphysema. Practically, health professionals could partly estimate the risks for the occurrence of EID during the 6MWT based on patients’ two basic characteristics which are the degree of pulmonary emphysema and lung obstruction severity according to the data presented in this chapter.

Chapter 6 reported that baseline oxygen saturation levels solely are inaccurate to predict EID, while it demonstrated a combination of clinical characteristics that increases the odds for EID in COPD. Indeed, this is practical knowledge for health professionals who could expect based on certain patients’ characteristics the occurrence of EID prior to exercise testing. Also, it can provide health professionals with rapid clinical information about the risk of EID in cases that the application of a 6MWT is not instantly possible.

Chapter 7 demonstrated the high heterogeneity of PCO₂ responses during the 6MWT and the determinants of CO₂ retention and EIH in COPD patients. Indeed, PCO₂ response during the 6MWT may represent a marker of disease severity that is beyond the walking capacity. Practically, health professionals could assess PCO₂ trends during the 6MWT and specifically the degree of CO₂ retention during walking for the evaluation of therapeutic interventions such as inspiratory muscle training (MIT) or consider the efficiency of non-invasive ventilation in COPD. Moreover, the findings of this chapter could suggest the transcutaneous monitoring of CO₂ during 6MWT for the identification of patients who need special attention regarding to EIH.
TARGET GROUPS

Health care professionals

The main target group of this thesis is health-care professionals including mostly physicians, exercise physiologists, physiotherapists, and nurses. The findings of this thesis provided further insight of the widely-used field test of the 6MWT and the COPD pathophysiological responses to exercise. These findings emphasize the importance of exercise assessment in clinical practice and help to increase the utilization of the 6MWT and the interpretation as well as the prognostic value of the 6MWT-derived variables. Health care professionals are encouraged to assess exercise capacity of the patients and consider exercise outcomes in the clinical decision-making process. Exercise outcomes increase the clinical information of patients’ health status, support timely treatment and facilitate the prognosis.

Patients with COPD

It is a consensus that patient is the most important member of the interdisciplinary health care team. Patients can benefit from the output of this thesis increasing their awareness of the disease, understanding the significance and the role of field exercise testing in clinical practice, and realizing the clinical importance of assessing exercise capacity. Indeed, patients who are aware about their disease and their clinical condition are more likely to have better outcomes. In contrast, patients with low levels of awareness are likely to have poor motivation and being not adequately cooperative in therapeutic plans and intervention. The consequences can include low therapeutic efficacy and added medical expenses. Therefore, the knowledge including in this thesis can be used by COPD patients for increasing their awareness about the disease and utilizing actions plans more effectively, which can result in obtaining the most benefits from the therapeutic procedure.

ACTIVITIES AND PRODUCTS

The findings of the studies in this thesis have resulted in numerous scientific abstracts on international congresses all over the world. All the studies have been published in recognized scientific journals in the respiratory field and they have received numerous citations. Data from chapter 2 have been published in the official European Respiratory Society (ERS) statement of the use of exercise testing in the evaluation of interventional efficacy (Puente-Maestu L. et al. *Eur Respir J* 2016). Moreover, some abstracts of the studies included in this thesis were awarded with travel grants in order to be presented in international congresses in Europe and USA and be the topic of discussions amongst
health-professionals. Considering this publicity, the findings of this study have been widely distributed and may constitute an inspiration for future research questions. Indeed, relative future research is essential as exercise testing can be the cornerstone of chronic patients’ clinical evaluation.