Activity limitation: a major consequence of dyspnoea in COPD

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In the present issue of the European Respiratory Review, Jolley and Moxham [1] present “A physiological model of patient-reported breathlessness during daily activities in COPD [chronic obstructive pulmonary disease]”. The purpose of their interesting approach is to explain why a given patient may experience breathlessness in some particular situations of his/her daily life, based on the various possible mechanisms of dyspnoea in COPD. This understanding may obviously help in building individualized relieving strategies through counselling and education, occupational therapy, pharmacological agents and physical training.

The ultimate goal of targeting dyspnoea is to improve health status and survival by allowing the patient to increase his/her daily activity. Therefore, to implement the appropriate strategies, the clinician first needs to apprehend the extent to which, and the reasons why, a patient limits this activity. The purpose of this editorial is to increase the awareness of this important aspect of COPD care and to provide clinicians with a few key points for discussion.

Activity limitation in COPD: its determinants and measurement

Activity limitation has both quantitative and qualitative aspects: on the one hand, it refers to the reduction in the daily amount (i.e. intensity, frequency and duration) of activity; on the other hand, it covers the discomfort induced by activities that are still performed in a normal or near-normal amount. Many studies have found a marked reduction in the level of daily physical activity in patients with COPD, including those with moderately to mildly impaired lung function, compared with control populations with similar sociodemographic characteristics (fig. 1) [3–5]. Factors independently associated with the level of daily physical activity include sociodemographic characteristics (activity is decreased in females, older patients and those with a higher socioeconomic status), comorbidity, quality of life, disease severity and the use of long-term oxygen therapy [4, 6].

A major contributor to the level of daily activity is obviously exercise tolerance [5]. In terms of symptoms, determinants of activity and exercise tolerance are not limited to dyspnoea: they also include leg discomfort and less specific complaints, such as fatigue [7]. In a way similar to the more global concept of quality of life, fatigue is not a unidimensional manifestation of disease but relates to several domains that can be classified as general, physical, mental and cognitive. Among them, exercise tolerance correlates rather well with the general and physical domains.

The level of a given activity does not relate only to exercise tolerance: other factors are involved, such as the necessity or desirability of that activity [8]. Dyspnoea can induce an increased discomfort during a given activity without preventing it being performed, if the patient feels it is worth making a greater effort to achieve it. In that sense, “quality of life-like” (or, more simply, qualitative) items may be more sensitive than quantitative activity measurement at assessing the consequences of the impairment in exercise performance, since it will capture both restrictions and increased symptomatic cost [9].

Daily activity can be estimated by questionnaires [10] or more objective instruments, i.e. motion sensors such as pedometers or accelerometers [11]. Studies have shown some differences between the results obtained using these methods of measurement [2, 12]. Such variations may be the consequence of an irregular use of the motion sensor or errors when filling daily diaries. However, they are also likely to relate to the multiple components of activity mentioned above (quantitative, qualitative, symptom/exercise tolerance-limited or linked to other factors); in other words, the two categories of tools do not capture the same aspect of daily activity, with one focusing on perceived activity and the sense of effort/gratification that it provides, the other being restricted to physical movement. This explains the discrepancy.

Correlates of dyspnoea and activity limitation: from quality of life to survival

Activity limitation obviously impairs quality of life by restricting the patient’s interactions with...
his/her environment. In addition, it makes it difficult for the patient to preserve his/her sense of integrity, which is closely related to both the sense of effectiveness (being able to) and the sense of connectedness (being with) [13]. Besides, dyspnoea and exercise performance are related to another determinant of quality of life, *i.e.* self-esteem [14]. Finally, dyspnoea and the limitation in activity that it induces may be such distressing that they lead to anxiety and depression, which are frequently observed in COPD [15].

Exercise tolerance measured using field or laboratory tests has been shown to explain some of the variations in quality of life [16–18]. However, activity limitation *per se* may also account for up to 52% of the variance in quality of life, as measured using specific questionnaires in patients with chronic respiratory failure [19]. In some studies, in which both dyspnoea and exercise performance (estimated by the 6-min walk distance) were studied as determinants of quality of life, dyspnoea during daily activity (assessed by the baseline and transition dyspnoea index) appeared to be the most important contributor [20]. Among quality of life domains, those related to activity limitation are the most closely linked to lung function [21].

Beyond its influence on quality of life, a low level of daily activity is associated with an increased risk of hospital admission for acute exacerbations of COPD and mortality, as shown by the Copenhagen City Heart Survey: in that study, the level of activity was assessed by questionnaires at entry and the follow-up lasted up to 20 yrs (fig. 2) [22, 23]. In another study in Spain, self-reported activity was an independent prognostic factor, together with airflow obstruction, general health condition and dyspnoea [24]. Other studies have also found significant associations between leisure time physical activity and all-cause, cardiovascular and noncardiovascular mortality [25, 26].

Such results are not that surprising since daily activity is correlated with exercise performance, a known predictor of survival in COPD patients, whether assessed by field tests (such as the 6-min walk test) or maximal laboratory tests (maximal oxygen uptake) [27]. Likewise, so is physical fitness, as reflected, for example, by muscle strength [28].

FIGURE 1. Mean daily time spent walking by Global Initiative for Obstructive Lung Disease (GOLD) stage in chronic obstructive pulmonary disease compared with healthy subjects. Data taken from [2].

FIGURE 2. Hazard ratio of death from all causes during follow-up in the Copenhagen City Heart Study, stratified by level of physical activity at entry. The reference is the group with very low physical activity. Levels of activity are defined as follows. Low: engaging in light physical activity, such as walking or biking for <2 h per week; moderate: engaging in light physical activity for 2–4 h per week; high: engaging in light physical activity for >4 h per week or in more vigorous activity for any duration. Bars represent 95% confidence intervals. Data taken from [22].

Altogether, daily activity relates to both quality of life and mortality. It is also associated with exercise performance. Interestingly, all these correlates of activity are quite closely linked together: the BODE index (body mass index, airflow obstruction, dyspnoea and exercise capacity index), which integrates dyspnoea and the 6-min walking distance, is both a predictor of mortality and a correlate of quality of life [29, 30].

**INCREASING ACTIVITY IN COPD: A NECESSARY COOPERATION**

As outlined earlier, increasing daily activity of COPD patients has the potential for improving both quality of life and survival. Indeed, the increase in daily walking distance after rehabilitation parallels that of 6-min walk distance on the one hand and quality of life on the other [31, 32]. In addition, the improvement in exercise tolerance provided by exercise training correlates to nearly all (*i.e.* not only the physical) domains of quality of life [33].

Both pharmacological and nonpharmacological (rehabilitation) approaches have the potential to improve activity and can provide complementary effects on exercise performance: for instance, both bronchodilators and oxygen therapy may increase the level and the efficacy of exercise training by decreasing hyperinflation [34, 35]. In a given patient, the respective effects of bronchodilators and exercise training depend, in part, on the locus of symptom limitation, *i.e.* leg fatigue or dyspnoea [36].

In itself, exercise counselling with feedback using, for example, pedometers, has some efficacy for increasing daily activity and physical fitness [37, 38]. In the context of pulmonary rehabilitation, activity-specific training (including supervised physical activity) may provide additional benefits to “simple” exercise training [39]. Similarly, including recreational activities in the training programme may enhance the efficacy of rehabilitation [40]. Importantly, the effect of rehabilitation on daily activity appears to increase with the duration of
programmes, as shown for both movement intensity and daily walking time [41].

In any case, maintenance is highly important in preserving the benefits obtained after a course of pulmonary rehabilitation. Indeed, participation at regular walking courses after completion of the initial programme is associated with a slower decline in quality of life and walking self-efficacy and less progression of dyspnoea during daily activities [42]. Rollators (wheeled walking frames) may help increasing and maintaining daily activity, thereby improving well-being, as demonstrated by the high proportion of patients (up to 50%) who continue to use them daily, even outdoors [43].

Other strategies to improve activity obviously depend on the mechanisms of its limitation. In that sense, the approach proposed by OXHAM and JOLLEY [1] is of major interest. For instance, in some patients, physiotherapy approaches such as pursed-lips breathing may be of help by reducing exertional dyspnoea and improving physical function [44]. Ambulatory oxygen therapy, which aims to increase activity and make it easier, does not necessarily improve quality of life, since it is also associated with significant constraints and side-effects, such as decreased self-esteem. However, benefits may appear slowly as the patient gets use to this treatment [45].

CONCLUSION

Activity limitation is a hallmark of COPD. It is the consequence of dyspnoea and poor exercise functional capacity, and is involved in quality of life impairment and increased mortality. Therefore, improving the level of daily activity is a major goal in the care of COPD patients. It implies improving exercise tolerance, at least in a great part through the reduction in the level of dyspnoea that is perceived in the various exercising situations of daily life. Therefore, understanding the corresponding mechanisms of dyspnoea is of utmost importance. The readers will be greatly helped to reach this objective by the paper by JOLLEY and OXHAM [1] in this issue of the Review.

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