

Pulmonary rehabilitation: art or science?

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In recent years growing attention has been paid to rehabilitation of patients with chronic obstructive lung disease and other respiratory cripples. Issue number 6 of the European Respiratory Review is devoted to this topic [1], and in the present issue of the Respiratory Journal, recommendations for the use of Pulmonary Rehabilitation are published [2]. The latter publication is from the European Respiratory Society Rehabilitation and Chronic Care Scientific Group.

Pulmonary rehabilitation aims to restore an independent, productive and gratifying life, and prevent further clinical deterioration of the disease to the maximum extent compatible with the stage of the disease. Its goal is to minimize pulmonary limitation and to achieve an optimal functional and activity level for a given pulmonary impairment. After smoking cessation and optimal medical therapy, patients are admitted to multidisciplinary programmes, sometimes even in specialized institutions, which are aimed at maximal restoration of their functional capacity [3, 4].

Various means and techniques are used. These include: patient and family education, chest physiotherapy, exercise reconditioning, training of respiratory muscles, respiratory muscle rest and oxygen therapy. A detailed account of the clinical usefulness of these techniques is found in the European Respiratory Review [1]. The present editorial will attempt to focus on recent developments and improved insight into the techniques used for pulmonary rehabilitation which have been evaluated scientifically in the past few years.

The degree of airflow obstruction, as estimated by forced expiratory volume in one second (FEV_1), and exercise capacity do not correlate well in chronic obstructive pulmonary disease (COPD) patients [5]. Several factors interfere, adding complexity to the relationship. These include: pulmonary vascular disease, diffusion disorder and generalized muscle weakness. Malnutrition, detraining and treatment with corticosteroids may contribute to the latter [6-8]. Steroid-induced muscle weakness in COPD patients is of great conceptual interest and, consequently, reduction of steroids to the lowest dose possible may prove to be an important step in rehabilitation. Alternatively, if FEV_1 does not correlate well with exercise capacity, it also means that improving FEV_1 by bronchodilators

does not necessarily improve exercise capacity *per se*, which is another way to formulate the rationale for pulmonary rehabilitation.

While chest physiotherapy and its clinical usefulness is more open to debate [9, 10], exercise programmes are applied to COPD patients with an increasing degree of enthusiasm. A reasonable strategy to train COPD patients would be to apply endurance training for 30-45 min a day, 3-5 days a week, for 2 months. Using this training regimen, increased exercise tolerance with a true physiological basis has been achieved [11] in patients with moderate reductions in pulmonary function. In patients with more severe ventilatory limitation, the exercise intensity obtained during endurance training may be too low to produce lactic acidosis and, hence, to result in training effects. Interval training may be more appropriate for the latter patients [12]. Until now, little scientific basis has been available to choose an optimal training strategy for an individual COPD patient. In particular, the limitations of interval training remain ill-defined. This technique is likely to be of great interest to pretransplant training programmes involving patients with severe ventilatory limitation.

Specific training of the respiratory muscles might also be of major importance to the latter patients. There is sufficient evidence that, when properly applied, respiratory muscle training improves both respiratory muscle strength and/or endurance [13-15]. Appropriate application demands control of the load applied during training. The significance of improved respiratory muscle function in COPD patients, however, is less clear. It is likely to reduce the sensation of dyspnoea [14, 16], and it may improve exercise tolerance. In this context, it is noteworthy that respiratory muscle training is expected to improve exercise capacity primarily in patients in whom the ventilatory pump limits exercise capacity [17]. Gross *et al.* [18] have shown that respiratory muscle training in preparation for cardiac surgery improves post-operative ventilatory function and reduces the period during which patients are mechanically ventilated. Similarly, clinical studies could be directed towards weaning outcome after ventilation for acute respiratory failure and towards the immediate post-operative recovery period after pulmonary transplantation. If similar effects were observed, this technique might both improve survival and substantially reduce costs of in-patient stay in the intensive care unit. The value of assisted ventilation and respiratory muscle rest in COPD patients remains questionable [19].

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Pulmonary rehabilitation has so far been directed towards improving the quality of life of COPD patients. Except for oxygen therapy [20, 21], none of the techniques or interventions of pulmonary rehabilitation have been shown to improve survival, despite suggestive evidence [22]. Although this issue has been a matter of debate for patients involved in cardiac rehabilitation programmes for a considerable length of time, two recent meta-analyses demonstrated a 20% reduction in overall mortality rate in patients involved in cardiac rehabilitation programmes [23, 24]. Similar studies need to be performed for pulmonary rehabilitation. Candidates for pulmonary transplantation may be an interesting subgroup for rehabilitative efforts, because their short-term mortality is known to be high. If clear reductions in mortality were to be demonstrated in patients involved in pulmonary rehabilitation programmes, their widespread application would become all the more important.

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