

Pulmonary rehabilitation: an integral part of the long-term management of COPD

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Summary

Pulmonary rehabilitation comprises a variety of interventions grouped into three main categories: exercise training, education, and psychological support. Typically, patients participate in a programme of exercise rehabilitation 2–3 times a week for 6–12 weeks, at the same time being encouraged to incorporate breathing and stretching exercises as part of their daily routine. The physiological rationale for pulmonary rehabilitation in COPD is primarily based on its effect on peripheral muscle dysfunction. A recent meta-analysis demonstrated that pulmonary rehabilitation is effective in reducing dyspnoea and fatigue as well as

improving patients' sense of control (mastery) over their condition. Without compliance with a maintenance programme these improvements will diminish with time. The value of various components of rehabilitation, programme length, the required degree of supervision, the intensity of training and the best approach to maintaining programme adherence represent issues that remain to be explored.

Key words: chronic obstructive pulmonary disease; pulmonary rehabilitation; meta-analysis

Introduction

A recent guideline by the American Thoracic Society defined pulmonary rehabilitation as "a multidisciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimise physical and social performance and autonomy" [1]. To establish the influence of pulmonary rehabilitation on health-related quality of life and exercise capacity in patients with COPD, we recently published a meta-analysis of randomised controlled trials addressing this issue [2]. Rehabilita-

tion included systemic exercise for at least four weeks, treated patients being compared with control patients who were offered only conventional community care. This short review (1) defines pulmonary rehabilitation in practical terms; (2) provides the underlying physiological rationale for this treatment modality in COPD, (3) summarises the findings of our Cochrane review, and (4) comments on strategies to extend the benefits of pulmonary rehabilitation.

Description of treatment and setting

Pulmonary rehabilitation comprises a variety of interventions, typically grouped into three main categories: exercise training, education, and psychological support. Since most rehabilitation programmes incorporate various combinations of these components, it is often difficult to quantify the relative contribution of each to the global improvement documented among those treated. In a typical rehabilitation programme, patients participate in a programme of exercise rehabilitation 2–3 times a week for 6–12 weeks, at the same time

being encouraged to incorporate simpler breathing and stretching exercises as part of their daily routine. For the majority of patients a supervised outpatient programme offers the best combination of efficacy and cost-effectiveness [3]. More severely disabled patients, those with active comorbidities, those who live far from an outpatient facility or those requiring specific resources such as nutritional supplementation or training for home ventilation should be directed to an inpatient programme.

No external funding received. Yves Lacasse is a clinician scientist and François Maltais is a research scholar of the Fonds de la recherche en santé du Québec.

Home-based exercise programmes are also effective in improving exercise tolerance and quality of life [4], although these improvements may be of lesser magnitude compared with programmes in which exercise training is closely supervised [5]. Home-based exercise programmes are well suited for highly motivated, self-directed individuals for whom compliance with exercise does not require close supervision. Once patients become disabled to the point of being housebound, home-based programmes are of limited value [6] and such individuals should be referred to a closely supervised inpatient programme.

Education and psychological support are im-

portant to the overall success of rehabilitation, although their exact contribution is more difficult to define. Education improves knowledge, coping and self-management, actively engaging patients to maintain strategies that reduce dyspnoea, maintain good lifestyle habits and participate in decision-making when acute exacerbations occur. In a randomised controlled trial of disease specific self-management in COPD, Bourbeau and colleagues reported important between-group differences of 40% fewer hospital admissions and 41% fewer emergency room visits among those tutored and supported in self-management, versus control subjects who received the usual care [7].

Physiological rationale

There are no expected changes in lung function and mechanics other than the small changes associated with optimisation of drug therapy, which occurs, as a part of the programme, at the time of assessment or enrolment.

Peripheral muscle dysfunction commonly contributes to exercise intolerance among patients with COPD [8], with muscle wasting and weakness being present in up to 25% of patients referred for pulmonary rehabilitation [9]. The perception of leg fatigue limiting exercise is very common. As with healthy individuals, in COPD leg fatigue is

inversely proportional to muscle strength. Hence for any given power output leg fatigue occurs more readily in weak than in strong individuals. In addition to muscle weakness and wasting, poor peripheral muscle aerobic capacity and reduced muscle endurance are common in patients with COPD [10]. Exercise training will improve peripheral muscle mass and strength [11], reduce muscle fatigability [12], and increase aerobic capacity [13]. In fact exercise training is the most appropriate approach to peripheral muscle dysfunction in COPD.

Short-term effects of pulmonary rehabilitation in COPD: meta-analysis

In 1996 we published a meta-analysis of pulmonary rehabilitation in COPD that was not conducted under the patronage of the Cochrane Collaboration [14]. In its first update which we reported in 2001 we included the 14 trials of the original meta-analysis [2]. We included only randomised controlled trials comparing rehabilitation with conventional community care, to enable us to study the overall effect of rehabilitation without partitioning its components. In the trials more than 90% of patients had COPD defined in terms of clinical diagnosis of COPD plus either the best recorded FEV₁/FVC ratio being <0.7 or the best recorded FEV₁ being <70% predicted. We included inpatient, outpatient, or home-based rehabilitation programmes provided they were of at

least four weeks' duration and provided that they included exercise therapy, with or without other modalities, delivered to patients whose exercise limitation was attributable to COPD.

The main outcome measures were health-related quality of life and exercise capacity. 23 randomised controlled trials were included in the meta-analysis. The primary results of the meta-analysis are summarised in table 1. The levels of evidence and grades of recommendations are according to Cook et al. [15].

Dyspnoea and health-related quality of life

Among the 23 trials included in the meta-analysis, 13 measured health-related quality of life using a total of eight different strategies. The

Table 1
Primary results of the meta-analysis.

Outcomes	number of trials	number of patients	treatment effect (95% CI)	(Weighted mean difference)	homogeneity (p value)	level of evidence*
Dyspnoea	9	277 treated / 242 controls	1.0 CRQ units	0.8–1.2	0.53	level I + (Grade A)
Fatigue	8	273 treated / 240 controls	0.9 CRQ units	0.7–1.1	0.48	level I + (Grade A)
Emotional function	8	273 treated / 240 controls	0.7 CRQ units	0.4–1.0	0.17	level II + (Grade B)
Mastery	8	273 treated / 240 controls	0.9 CRQ units	0.7–1.2	0.87	level I + (Grade A)
Maximal exercise capacity	14	255 treated / 233 controls	5.4 watts	0.5–10.2	0.14	level I + (Grade A)
Functional exercise capacity	10	235 treated / 219 controls	49 meters	26–72	0.08	level II - (Grade B)

* The levels of evidence are graded according to Cook et al. [15].

analysis was restricted to the Chronic Respiratory Questionnaire (CRQ) [16, 17], as it represented the most widely used questionnaire among the trials included. For each domain of the CRQ, the common effect size exceeded the minimal clinically important difference (MCID: 0.5 point on the seven-point scale) [18]. The boundary of the confidence intervals suggested the smallest effect exceeded the MCID for dyspnoea (table 2a), fatigue and mastery domains.

Functional exercise capacity

Defining functional exercise capacity according to the results of 6-minute walk tests, the common effect (weighted mean difference) was 49 metres (95% CI: 26 to 72; homogeneity: p = 0.08;

table 2b). Our estimate of the MCID of the walk test, (50 metres CI: 37-71 metres), was derived from a study in which COPD participants rated their walking ability through subjective comparisons with one another [19].

Maximal exercise capacity

Limiting the meta-analysis to the 14 trials that used the incremental cycle ergometer test as the outcome, the common effect (weighted mean difference) was 5.46 watts (95% CI: 0.49 to 10.23). We found this number difficult to interpret, although it was attaining statistical significance.

This meta-analysis showed that pulmonary rehabilitation was effective in reducing dyspnoea and fatigue as well as improving patients' sense of

Table 2a + b

The effect of respiratory rehabilitation in chronic obstructive pulmonary disease on (a) dyspnoea as measured by the Chronic Respiratory Questionnaire and (b) functional exercise capacity as measured by the 6-minute walk test: meta-views. The Chronic Respiratory Questionnaire results are presented as the domain total score (5 items graded on a 7-point scale; maximal score = 35), as opposed to the treatment effect values in table 1 which are presented as item scores. Abbreviations: QoL: quality of life; SD: standard deviation; WMD: weighted mean difference; CI: confidence interval. (From reference [2], by permission of the Cochrane Collaboration).

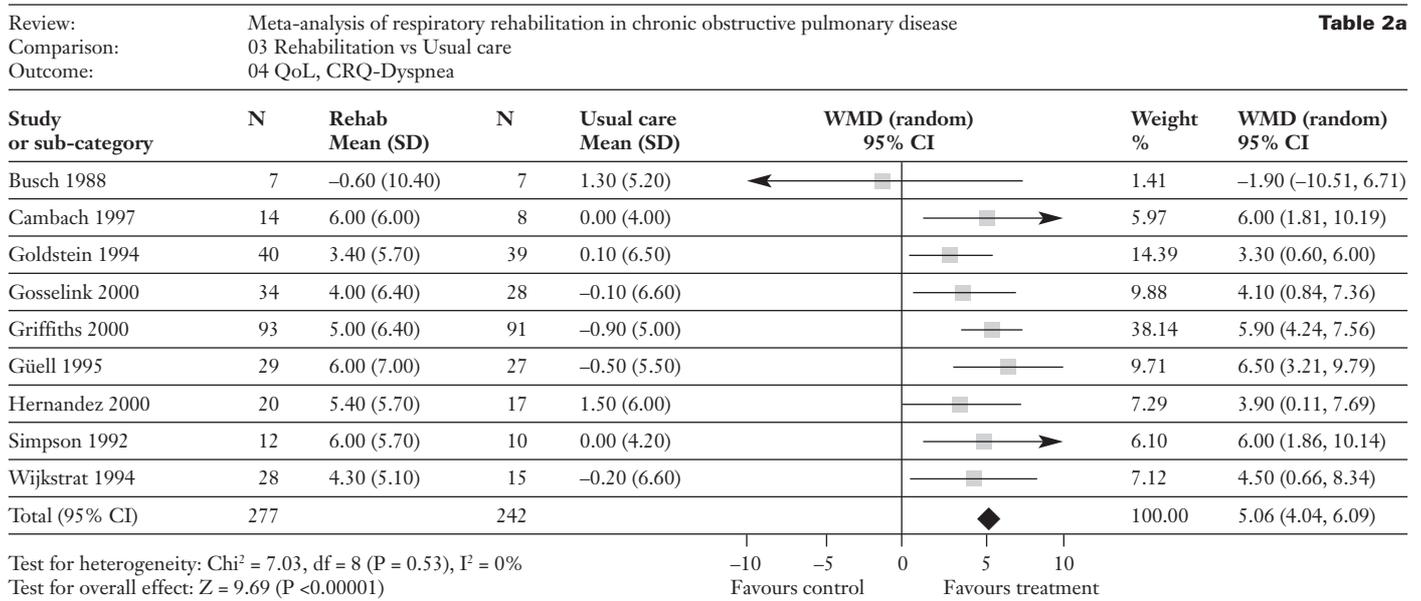


Table 2a

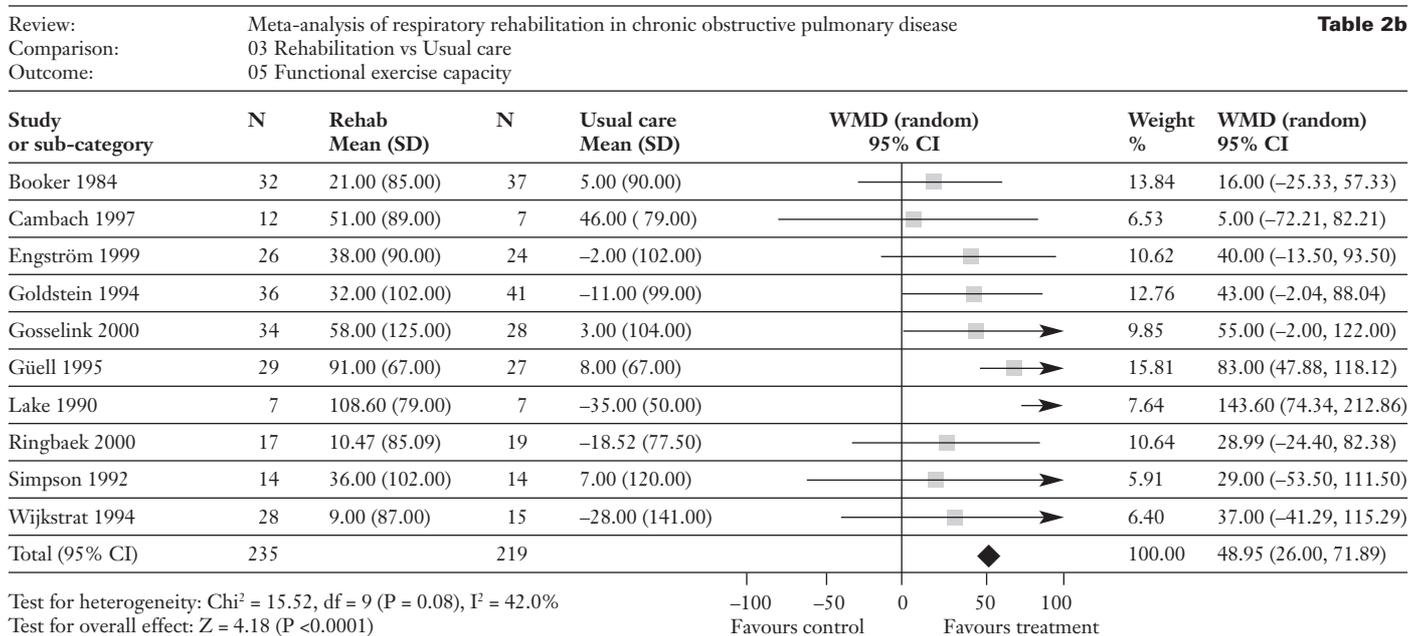


Table 2b

control (mastery) over their condition. The magnitude of these improvements was beyond the minimal clinically important difference of the outcome measures used. Given that the management of patients with COPD is largely symptomatic [20], outcome measures that include health-related quality of life are of prime importance to trials of pulmonary rehabilitation.

Rehabilitation programmes included in the meta-analysis differed in several respects, including their clinical settings, duration and composition. For instance, the contribution of educational activities and psychological support in addition to exercise training remains uncertain. This information would be of the utmost importance to physicians who prescribe rehabilitation and the people

who allocate the resources. Since the publication of our review, further evidence from randomised controlled trials has been published to better define the types and intensity of exercise [11] as well as the influence of programme components [7]. Such questions were too specific to be directly addressed in this meta-analysis, the purpose of which was to investigate the overall effect of rehabilitation in COPD (and not the effect of its components). Nevertheless, the homogeneity among study results suggested that less sophisticated rehabilitation programmes may also be effective in improving quality of life, although the between-study comparison from which this conclusion follows is relatively weak.

Maintenance programmes

Ries noted that the initial improvements in exercise achieved during rehabilitation diminished over the subsequent 18 months [21]. Griffiths attributed the loss of effect following rehabilitation to poor self-management practices and a lack of adherence to treatment protocols after discharge [22].

The explanation as to why some patients do not adhere to medical advice includes many contributing variables [23]. Patient factors include knowledge, health beliefs and attitude towards their condition. The interaction with the health-care provider will probably influence the patient's adherence, as will the presence of anxiety or depression. A previous history of non-adherence is often predictive of future behaviour. Practitioner factors include the quality of information and the amount of individual attention given to the patient. Regimen factors, such as the number and frequency of medications prescribed or the complexity and duration of an exercise programme, are important as they may be quite unrealistic. External factors, such as the presence of a stable social sup-

port network, family cohesiveness, positive environmental attitudes and interpersonal resources, may all have a bearing on compliance with medical advice. Although the determinants of poor compliance are often complex, with many of the sociodemographic variables still to be defined, a better understanding of this issue will assist health-care providers in identifying individuals at high risk.

Although there is strong evidence that rehabilitation improves health-related quality of life and functional exercise capacity, these improvements diminish with time, almost certainly because of reduced patient compliance. Although longer programmes will extend the clinical benefits of rehabilitation [24], programme enhancements with regular facility visits and phone calls have resulted in only minimal gains [23, 25]. It is conceivable that an abbreviated period of rehabilitation, provided for those who have completed an initial rehabilitation programme, may be of value in improving compliance with exercise activities and prolonging the benefit obtained by the patient.

Conclusion

There are now strong arguments to back the claim that pulmonary rehabilitation improves quality of life. There is no need for additional randomised controlled trials comparing pulmonary rehabilitation with conventional community care for patients with COPD. However, several interesting issues remain to be explored. These include the value of various components of rehabilitation, programme length, the required degree of supervision, intensity of training and the best approach to maintaining programme adherence. An improved understanding of these issues will be of value to those who receive, fund and provide pulmonary rehabilitation.

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