Rehabilitation for patients with chronic obstructive pulmonary disease: meta-analysis of randomized controlled trials

Salman G F, Mosier M C, Beasley B W, Calkins D R

CRD summary
This review assessed rehabilitation programmes in patients with chronic obstructive pulmonary disease. The authors concluded that, compared with no rehabilitation, rehabilitation improved exercise capacity and reduced shortness of breath. Although it appears to be supported by the evidence presented, differences between the included studies limit the strength of this finding.

Authors' objectives
To assess the effectiveness of rehabilitation programmes in patients with chronic obstructive pulmonary disease (COPD).

Searching
MEDLINE (from 1966 to September 2000), CINAHL (from 1990 to September 2000) and the Cochrane Controlled Trials Register were searched for studies published in any language; the search terms were stated. Unpublished data were sought by reviewing abstracts presented at national meetings (American Thoracic Society and the European Respiratory Society) and by checking the reference lists of relevant articles.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for inclusion.

Specific interventions included in the review
Studies of any type of rehabilitation conducted three times a week for at least 4 weeks were eligible for inclusion. The included studies used respiratory muscle, lower and upper extremity rehabilitation, either alone or in combination. The interventions lasted from 6 weeks to 12 months.

Participants included in the review
Studies in patients with COPD, defined as a forced expiratory volume in 1 second (FEV1) of less than 70% of predicted or FEV1 divided by a forced vital capacity of less than 70% of predicted, were eligible for inclusion. The studies had to be in patients who were either symptomatic or who had evidence of limited exercise capacity. Studies in patients with asthma were excluded, as were those that did not report FEV1 values. The participants in the primary studies included patients with mild to moderate COPD (mean FEV1 greater than 35% or 0.8 L) and patients with severe COPD (mean FEV1 35%, or 0.8 L or less). The mean age of the participants ranged from 59 to 72 years across the studies.

Outcomes assessed in the review
Studies that reported measures of exercise capacity or shortness of breath were eligible for inclusion. The primary outcomes in the review were exercise capacity assessed using the walking test, and shortness of breath measured using the Chronic Respiratory Disease Questionnaire (CRDQ).

How were decisions on the relevance of primary studies made?
Two reviewers independently selected the studies.

Assessment of study quality
Studies were assessed for the inclusion of all patients enrolled, blinding of the outcome assessor, baseline comparability
of the treatment groups, and patients treated equally other than in terms of the intervention being studied. One point was awarded for each criterion met, giving a maximum possible quality score of 4 points. Two reviewers independently assessed validity.

**Data extraction**
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. The mean change from baseline in the intervention and control groups, and their standard deviations, were extracted and used to calculate standardised effect sizes (ESs) for each study. Where studies included multiple rehabilitation arms, data were only extracted from the most comprehensive treatment group and the control group.

**Methods of synthesis**
How were the studies combined?
The studies were combined using a meta-analysis. Pooled ESs and 95% confidence intervals (CIs) were calculated using the random-effects model of DerSimonian and Laird. Studies of patients with mild or moderate COPD and those of patients with severe COPD were pooled separately. The possibility of publication bias was tested using the Begg test and by repeating the analysis after excluding studies with less than 25 participants.

How were differences between studies investigated?
A meta-regression was used to examine the relationship between walking distance and shortness of breath and the type and duration of the intervention, or severity of COPD.

Sensitivity analyses were used to explore differences between studies with respect to study quality (studies scoring 2 or less were classified as low quality). Studies with the largest ES were removed in order of size and the pooled ES of the remaining studies was calculated until the pooled ES was no longer significant. Statistical heterogeneity was assessed taking a P-value of less than 0.05 as indicating significant heterogeneity.

**Results of the review**

Twenty RCTs (n=979) were included.

Inter-rater agreement was 91% (kappa 0.79) for the study selection process and 79% (kappa 0.55) for the validity assessment.

Walking test.

The meta-analysis showed that rehabilitation significantly improved results for the walking test in comparison with the control (ES 0.71, 95% CI: 0.43, 0.99). Significant heterogeneity was detected (P<0.001). A subgroup analysis showed that patients with mild to moderate COPD and patients with severe COPD benefited significantly from rehabilitation (the results were presented). Significant heterogeneity remained.

Shortness of breath (12 RCTs, 723 patients). The meta-analysis showed that rehabilitation significantly improved shortness of breath compared with control (ES 0.62, 95% CI: 0.26, 0.91). Significant heterogeneity was detected (P<0.001). A subgroup analysis showed that patients with mild to moderate COPD and patients with severe COPD benefited significantly from rehabilitation. Significant heterogeneity remained for the mild to moderate studies, but no significant heterogeneity was detected between the 4 severe COPD studies (the results were presented).

The meta-regression showed that rehabilitation programmes that included at least lower-extremity training significantly improved the walking test and reduced breathlessness. For patients with severe COPD, only programmes that lasted at least 6 months significantly improved walking and reduced breathlessness (the actual regression was not presented).

The sensitivity analyses showed no significant effect of study quality or publication bias. The pooled ES for the walking test only became non significant when the 9 RCTs with the largest ES were removed.
Authors' conclusions
Rehabilitation improved exercise capacity and reduced shortness of breath compared with no rehabilitation. Patients with mild to moderate COPD improve with short- and long-term rehabilitation, whereas patients with severe COPD may benefit from programmes that last at least 6 months.

CRD commentary
The review question was clear in terms of the study design, participants and outcomes. The inclusion criteria were broadly defined in terms of the intervention. Several relevant sources were searched and attempts were made to minimise language and publication bias. Two reviewers independently selected the studies and assessed validity, which reduces the potential for bias and errors. The methods used to extract the data were not described, so it is not known whether any efforts were made to reduce errors and bias. Validity was assessed using a composite score, but methodological limitations of the included studies were not specified. The losses to follow-up were not reported, and there was insufficient information about the interventions to assess clinical heterogeneity. The evidence presented appears to support the authors' conclusions, but it is worth noting that statistical heterogeneity was found for most analyses.

Implications of the review for practice and research
Practice: The authors stated that programmes that include at least lower-extremity training may benefit patients with COPD.

Research: The authors stated that future studies should be adequately powered RCTs that, in addition to assessing exercise capacity and shortness of breath, also assess survival rate, hospitalisation rate and health care costs.

Bibliographic details

PubMedID
12648254

Other publications of related interest
This additional published commentary may also be of interest. Reishtein JL. Review: rehabilitation improves exercise capacity and alleviates shortness of breath in chronic obstructive pulmonary disease. Evid Based Nurs 2004;7:22.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.