Does upper extremity exercise improve dyspnea in patients with COPD? A meta-analysis
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CRD summary
This review found that upper extremity exercise may alleviate dyspnoea and arm fatigue during activities of daily living in patients with chronic obstructive pulmonary disease. The authors' conclusions appear likely to be reliable.

Authors' objectives
To evaluate the effect of unsupported upper extremity exercise on dyspnoea in patients with chronic obstructive pulmonary disease.

Searching
PubMed and EMBASE were searched to March 2012 for relevant studies in English, Italian or Spanish; search terms were reported. Reference lists of the retrieved studies, unpublished studies and international guidelines were handsearched to identify additional studies.

Study selection
Randomised controlled trials that compared rehabilitation programmes of upper extremity exercise to a control group or upper extremity exercise plus lower extremity exercise compared with lower extremity exercise alone in patients with chronic obstructive pulmonary disease were eligible for inclusion. Eligible interventions need to be at least three weeks duration and report data on the primary outcome of dyspnoea using the Borg score or Borg-modified score during activities of daily living and exercise training. Studies with age- or gender-matched control groups of healthy participants or patients with other respiratory conditions were excluded from the review.

The studies were published between 1988 and 2012. Most patients were male, elderly and diagnosed with moderate to severe chronic obstructive pulmonary disease. Upper extremity interventions consisted of unsupported arm exercise, gravity-resisted exercise and proprioceptive neuromuscular facilitation exercise. Control groups participated in walking training, lower limb training (including endurance training), bronchia hygiene therapy, general exercises and sham training of upper limb flexibility and stretching. Where reported, exercise time ranged from 20 to 30 minutes for three to seven days per week. Intervention durations ranged from three to eight weeks. Dyspnoea in the studies was measured using the simulated activities of daily living tests, endurance tests, standard daily physical activities test, six-minute pegboard and ring test and endurance arm crank test.

Two reviewers performed the study selection; any disagreements were resolved by a third reviewer.

Assessment of study quality
Two reviewers independently assessed methodological quality of the included studies using the PEDro 10-point scale of random allocation, allocation concealment, similarity of groups at baseline, blinding of patients, therapists and assessors, whether measurements were provided for at least 85% of the study population, use of intention-to-treat analyses, group comparisons and point measures. Any disagreements between the reviewers were resolved by a third reviewer.

Data extraction
Data were extracted to calculate mean differences and 95% confidence intervals (CI) for the estimates. Data were requested from authors when necessary.

Data were extracted by two independent reviewers. Any discrepancies were resolved by a third reviewer.

Methods of synthesis
Weighted mean differences (WMD) and 95% CIs were calculated using a fixed-effect model. The presence of statistical heterogeneity was evaluated using the I² test (25% to 50% indicated low statistical heterogeneity, 50% to 75% indicated moderate heterogeneity and >75% indicated high heterogeneity). Study results with moderate or high heterogeneity were combined using a random-effects model. Overall treatment effects were compared with minimally
clinically important differences scores (1 for the Borg scores). Potential sources of heterogeneity were explored using subgroup analyses by omitting results of heterogeneous trials.

**Results of the review**

Seven trials (240 patients, range 22 to 50) were included in the review. All the trials reported randomisation, were similar at baseline and reported use of intention-to-treat analyses, group comparisons and point measures. Three trials reported concealed allocation. Blinding was reported in patients (three trials), therapists (one trial) and assessors (three trials). PEDro scores were 9 for two trials and 8, 7, 6 and 5 points for one trial each.

Statistically significant improvements were observed in groups that received upper extremity exercise compared to control groups in dyspnoea during activities of daily living (WMD -0.58, 95% CI -1.13 to -0.02; I²=0%; three studies) and arm fatigue during activities of daily living (WMD -0.55, 95% CI -1.08 to -0.01; I²=0%; two trials). There were no statistically significant differences between intervention and control groups during the intervention in dyspnoea and arm fatigue.

Overall treatment effects were lower than the minimum clinically important difference of one Borg score for dyspnoea during activities of daily living and arm fatigue during exercise.

**Authors’ conclusions**

The results of the review indicated that unsupported upper extremity exercise can provide relief from dyspnoea and arm fatigue in patients with chronic obstructive pulmonary disease during activities of daily living but it was unclear whether these interventions relieved dyspnoea to a clinically significant level.

**CRD commentary**

The review addressed a clear question. Study inclusion criteria were defined. Appropriate databases were searched for relevant studies. The restriction to studies published in particular languages risked language bias. The authors stated that they reviewed reference lists of conference proceedings and unpublished studies but unpublished studies were not retrieved. There was no assessment of publication bias as the authors stated that the small number of included studies precluded such analyses. Steps were taken at each stage of the review process to minimise errors and biases. Methodological quality was assessed and the quality of the included trials was found to range from medium to good quality. The authors did not use the results of the quality assessment to perform sensitivity analyses or help interpret the pooled results.

There was some clinical heterogeneity in outcome measurements, control groups and length of interventions but the low heterogeneity scores indicated that the authors' decision to combine the results in a meta-analysis were justified. The authors acknowledged limitations of the review surrounding the small number of studies, small sample sizes, short study durations and potential for publication bias.

The authors’ cautious conclusions regarding the evidence appear likely to be reliable.

**Implications of the review for practice and research**

**Practice**: The authors stated that unsupported upper extremity exercise should be included in pulmonary rehabilitation protocols in patients with chronic obstructive pulmonary disease.

**Research**: The authors stated a need for further large randomised controlled trials with standardised training methodology to evaluate the effects of interventions on clinical outcome measures. Future studies should determine the best type of upper extremity exercise in these populations.

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