Short-burst oxygen therapy in chronic obstructive pulmonary disease

O’Neill B, Mahon J M, Bradley J

CRD summary
The authors concluded that the prescription of short-burst oxygen therapy for patients with chronic obstructive pulmonary disease is not evidence-based and a scientific rationale is required for continued prescription. The authors’ cautious conclusions recommending a scientific rationale and the development of an appropriate method of assessment appear reasonable. However, the review suffers from potential biases.

Authors’ objectives
To review the evidence for short-burst oxygen therapy in patients with chronic obstructive pulmonary disease.

Searching
MEDLINE, CINAHL, EMBASE and various respiratory journal websites were searched to April 2005; the search terms were reported. In addition, the references of included studies and relevant reviews were checked. The searches were restricted to English language articles.

Study selection
Randomised controlled trials (RCTs) comparing short-burst oxygen (oxygen at rest, before exercise or activity, after exercise or activity) with placebo in patients with chronic obstructive pulmonary disease, and reporting breathlessness as the primary outcome and measures of exercise capacity, oxygen saturation (SaO₂), and other ventilatory parameters (ventilation, oxygen consumption, inspiratory capacity or patient preference) as the secondary outcomes, were eligible for inclusion. The included studies were crossover RCTs assessing mainly male patients aged between 43 and 78.8 years. The patients were recruited from hospitals or a school of medicine. The included studies used oxygen or air, with or without a face mask, nasal cannulae, mouthpiece or venturi. Oxygen or air was administered at 28% or 67%, or using flow rates between 2 and 10 litres per minute. Pre-dosing levels ranged from 1 to 15 minutes, and post-dosing levels from 5 to 20 minutes, or throughout the recovery period. Exercise tests included maximal or submaximal step tests, a 6-minute walk, treadmill tests or cycle ergometry. Breathlessness was reported as the primary outcome, and exercise capacity and SaO₂ as the secondary outcomes. Maximum heart rate, rate of return to baseline heart rate, subjective recovery rate, ventilation during recovery, rate of return to baseline, and rate of return to baseline subjective recovery were also reported.

The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
Two reviewers independently assessed validity using the PEDro scale. The studies were allocated a score out of 10.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The included studies were presented as a narrative synthesis and in tables. Studies with sufficient data and using similar methods to report the results were included in the meta-analysis. Random-effects and fixed-effect models were used, as appropriate, to pool the weighted mean difference (WMD) for each outcome, with 95% confidence intervals (CIs).

Statistical heterogeneity was assessed using the χ² and I² tests. A sensitivity analysis was also carried out by removing one study with conflicting results.

Results of the review
Eight RCTs were included in the review (n=104 pre-dosing and n=113 post-dosing; it is unclear whether the same or different patients were used in studies that assessed both pre- and post-dosing). The sample sizes ranged from 10 to 34 patients.

The included studies scored between 6 and 9 on the PEDro scale.

None of the included studies assessed the effects of oxygen at rest.

Breathlessness (5 pre-dosing and 6 post-dosing study arms): 4 of the 5 studies assessing pre-dosing and all 6 studies assessing post-dosing found no significant benefit of oxygen. This was supported by a meta-analysis of 3 post-dosing studies. The sensitivity analysis did not significantly alter the results.

Exercise capacity (four pre-dosing study arms): meta-analysis using 2 out of 5 studies reported significant improvements in exercise distance when using pre-dosing with oxygen compared with placebo (pooled WMD 5.99 metres, 95% CI: 1.11, 10.88, p=0.02). Two out of 5 studies reporting the duration of exercise showed no significant benefit from pre-dosing with oxygen.

$\text{SaO}_2$ (4 pre-dosing and 3 post-dosing study arms): findings from the pre-dosing and post-dosing studies were inconsistent.

Other outcome measures (3 pre-dosing and 6 post-dosing study arms): no significant differences were reported.

Significant statistical heterogeneity was evident from a meta-analysis of post-dosing studies reporting return to baseline breathlessness and $\text{SaO}_2$.

Authors’ conclusions
Widespread prescription of short-burst oxygen does not appear to be evidence-based. In order for prescription to continue, the scientific rationale must be established and an appropriate method of assessment developed.

CRD commentary
The review question was clear and supported by appropriate inclusion criteria for the participants, intervention, outcomes and study design. Appropriate literature searches were conducted using several electronic sources and other appropriate sources. However, the searches were restricted by language and, as there was no apparent attempt to search for unpublished material, it is possible that relevant papers were missed. Details of the methods used to select the studies and extract the data were not reported, thus the potential for reviewer error and bias cannot be ruled out. Validity was assessed according to published criteria. Appropriate methods were used to investigate statistical heterogeneity. However, the authors noted differences in methodology and reporting by the included studies, which means that it may not have been appropriate to pool the results. Furthermore, the CIs appeared wide and sample sizes were small, which affect the reliability of the data synthesis. The authors also acknowledged that potentially important clinical information on patient characteristics was not reported in the included studies; this might have introduced bias as some of the participants may not have been suitable for short-burst oxygen. The authors' cautious conclusions recommending a scientific rationale and the development of an appropriate method of assessment appear reasonable. However, the review suffers from potential biases.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that future research should use validated, reliable and responsive outcome measures that can detect both clinical importance and statistical change. Methods taken to minimise contamination of the results from order and carry-over effects should also be stated clearly.

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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.