

CLINICAL PRACTICE GUIDELINES

Clinical Practice Guideline on Adult Domiciliary Oxygen Therapy: Executive summary from the Thoracic Society of Australia and New Zealand

CHRISTINE F. MCDONALD,^{1,2} KEN WHYTE,³ SUE JENKINS,^{4,5} JOHN SERGINSON^{6,7} AND PETER FRITH⁸

¹Department of Respiratory and Sleep Medicine, Austin Health and Institute for Breathing and Sleep, ²Department of Medicine, University of Melbourne, Melbourne, Victoria, ⁴School of Physiotherapy and Exercise Science, Curtin University, ⁵Physiotherapy Department, Sir Charles Gairdner Hospital, Lung Institute of Western Australia, University of Western Australia, Perth, Western Australia, ⁶Respiratory Department, Caboolture Hospital Queensland, Caboolture, ⁷School of Nursing and Midwifery, University of Queensland, Brisbane, Queensland, ⁸Department of Respiratory Medicine, Flinders University, Adelaide, South Australia, Australia, and ³Respiratory Services, University of Auckland and Auckland District Health Board, Auckland, New Zealand

Key words: clinical respiratory medicine, long-term oxygen therapy, oxygen guideline, oxygen therapy.

Abbreviations: COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airways pressure; LTOT, long-term continuous oxygen therapy; PaO₂, partial pressure of oxygen in arterial blood; SpO₂, arterial oxygen saturation.

INTRODUCTION

This is a summary of the recent Thoracic Society of Australia and New Zealand Clinical Practice Guideline on Adult Domiciliary Oxygen Therapy (available at <http://www.thoracic.org.au>),¹ which revises a previous position statement published in 2005. Changes to previous recommendations are highlighted, and explanation is provided in cases where recommendations have not changed, generally because of absence of new evidence. Recommendations are based upon available evidence, and the revised Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach was used to categorise recommendations.²

Correspondence: Christine F. McDonald, Department of Respiratory and Sleep Medicine, Austin Health and Institute for Breathing and Sleep, Studley Road, Heidelberg, Vic. 3084, Australia. Email: christine.mcdonald@austin.org.au

Received 12 April 2015; invited to revise 17 June 2015; revised 21 September 2015; accepted 5 October 2015 (Associate Editor: Neil Eves).

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

Article first published online: 24 November 2015

LONG-TERM OXYGEN THERAPY

Long-term continuous oxygen therapy (LTOT), ideally for ≥ 18 h/day, is indicated to improve longevity when:

- Stable daytime partial arterial oxygen concentration (PaO₂) is ≤ 55 mm Hg (7.3 kPa) at rest; or
- Stable daytime PaO₂ is 56–59 mm Hg (7.4–7.8 kPa) and there is evidence for hypoxic organ damage (including right heart failure, pulmonary hypertension or polycythaemia)

Flow rate should be set to maintain PaO₂ > 60 mm Hg (8 kPa) (arterial oxygen saturation measured by pulse oximetry (SpO₂) $> 90\%$) during waking rest. (GRADE Recommendation: Strong; Evidence: High).

There is clear evidence for benefit of long-term oxygen therapy in hypoxaemic chronic obstructive pulmonary disease (COPD). GRADE recommendations relate to COPD. However, results from studies in COPD have been extrapolated to recommend LTOT for all suitable patients with chronic hypoxaemia from any cause. This recommendation regarding provision of LTOT is largely unchanged from previously.³ There are no data directly comparing different durations of oxygen above 15 h/day. Two studies published in the 1980s^{4,5} compared no oxygen with oxygen for 15 h/day and nocturnal oxygen with continuous oxygen (median 18 h/day). Because of the similarity in study designs and populations, the results of these two non-placebo-controlled studies were pooled and have informed all subsequent guidelines including the current one. As the median duration of oxygen usage achieved by the 'continuous' group in the Nocturnal Oxygen Treatment Trial³ was 18 h, and given that the 'continuous' group demonstrated a significantly lower mortality than the group receiving only nocturnal oxygen, we have recommended an increase from 15+ h/day to 18+ h/day,

where this is possible, noting that such recommendations must take into account patient factors including tolerance of treatment.

NOCTURNAL OXYGEN THERAPY

Nocturnal oxygen therapy may be prescribed for occasional individuals with lung disease who desaturate to $\text{SpO}_2 \leq 88\%$ for more than one third of the night, particularly if they suffer sequelae such as pulmonary hypertension or polycythaemia. (GRADE recommendation: strong; evidence: low).

This recommendation is unchanged from previously. No new studies have examined this question since previously cited trials¹ that revealed conflicting results. A New Zealand study suggested that isolated nocturnal desaturation was very uncommon in the general COPD outpatient population, and patients with nocturnal desaturation had no worse sleep quality, quality of life or daytime somnolence than those without desaturation.⁶ Based on consensus, we have maintained the recommendation regarding the provision of oxygen nocturnally predominantly for those with evidence of sequelae of chronic hypoxaemia.

AMBULATORY OXYGEN

a. Patients on LTOT who are active outside the home and wish to maximize their duration of oxygen therapy.

In patients commencing LTOT who wish to maximize the number of hours during which they receive oxygen supplementation over the 24-h period, through supplementing stationary concentrator use with portable oxygen for physical activities outside the home, we continue to recommend that they be offered ambulatory oxygen to maximize both their physical activity and their oxygenation (GRADE recommendation: strong; evidence: very low).

b. In occasional cases of chronic lung disease, where patients do not have resting hypoxaemia severe enough to warrant LTOT but are breathless and desaturate on exertion; and where benefit is demonstrated through a blinded trial of oxygen versus air, assessing outcomes such as exercise capacity or improvement in dyspnoea. (GRADE recommendation: weak; evidence: very low).

This recommendation has been downgraded further from that in our previous position statement, as a consequence of new data.³ Despite laboratory-based studies demonstrating small acute improvements in dyspnoea and exercise capacity for patients with COPD breathing supplemental oxygen (compared with supplemental air), in patients with only mild hypoxaemia (who desaturate with exertion) longer term studies, including a large Australian study,⁷ found no overall benefit in terms of dyspnoea, exercise capacity or quality of life, of supplemental oxygen compared with supplemental air used for exertion during activities of daily living in trials of up to 12 weeks. In the latter study⁷ there appeared to be a

strong placebo effect of supplemental gas. As very occasional patients may obtain benefit, a blinded trial should be performed prior to initiating a trial of oxygen therapy for this indication. Patients prescribed oxygen for exertional use should be educated about how and when to use their oxygen and should be reviewed early to establish any perceived benefit (or lack thereof). As this treatment is for symptomatic benefit, if no benefit is reported, the oxygen should be ceased.

PALLIATIVE OXYGEN

Supplemental oxygen may provide symptomatic relief for patients with intractable dyspnoea and significant hypoxaemia (despite maximal treatment) due to terminal illnesses, including late-stage lung disease (GRADE recommendation: strong; evidence: very low).

However, hypoxaemia may not necessarily be associated with the subjective experience of dyspnoea and reversal of hypoxaemia with oxygen therapy may not necessarily relieve dyspnoea. The two are known to be poorly correlated.⁸

In the setting of refractory dyspnoea for so-called 'palliative' use in a population of patients without resting hypoxaemia and with a variety of long-term cardiopulmonary conditions (predominantly COPD) or lung malignancy, oxygen at 2 L/min delivered via concentrator over 15 h for 7 days did not confer a greater benefit than intranasal air at the same flow rate and is not recommended.⁹

OXYGEN IN HEART FAILURE

Daytime hypoxaemia is uncommon in chronic heart failure. Some patients with chronic heart failure have central sleep apnoea for which continuous positive airways pressure (CPAP) may be indicated after maximization of medical therapy. For those intolerant of CPAP, there is some evidence that oxygen therapy provides small improvements in left ventricular ejection fraction and in severity of sleep disordered breathing.¹ Oxygen may therefore be indicated in patients with maximally treated chronic heart failure with symptomatic central sleep apnoea and CPAP intolerance (GRADE recommendation: strong; evidence: moderate).

OXYGEN DURING AIR TRAVEL

Commercial passenger aircraft operate at cabin pressures similar to ambient pressures experienced at up to 2500 m above sea level. This is analogous to breathing 15% oxygen at sea level. At this 'altitude', the PaO_2 for healthy people falls to around 53–64 mm Hg (7.1–8.5 kPa), with corresponding oxygen saturations of 85–91%.¹ As a general rule, supplemental oxygen is unlikely to be required if the resting oxygen saturation is $\geq 95\%$ but is recommended for patients who qualify for continuous oxygen therapy at home or who have a

demonstrated fall in SpO₂ to <85% during an altitude simulation test (GRADE recommendation: strong; evidence: low).

ASSESSMENT FOR HOME OXYGEN

Although a pulse oximetry measurement of ≤92% may be useful as a screening tool to determine which patients should be referred for assessment for home oxygen therapy, arterial blood gases must be measured to determine eligibility for LTOT.

CONTRAINDICATIONS TO OXYGEN THERAPY

Oxygen is not indicated for patients with severe cardiopulmonary disease whose main complaint is dyspnoea, but who maintain a PaO₂ greater than 60 mm Hg (8 kPa) and who show no secondary effects of chronic hypoxia.

Oxygen therapy is not indicated in patients who continue to smoke cigarettes because of the increased fire risk and the probability that the poorer prognosis conferred by smoking will offset treatment benefit.^{1,10}

Oxygen therapy is not indicated for patients who have not received adequate therapy for the underlying medical condition(s) responsible for causing hypoxaemia, or who are not sufficiently motivated to undertake the discipline required in using oxygen therapy for the prescribed number of hours per day.

REFERENCES

- 1 Thoracic Society of Australia and New Zealand. Clinical Practice Guideline on Adult Domiciliary Oxygen Therapy (Available at: <http://www.thoracic.org.au>) 2014.
- 2 GRADE Working Group. Grading quality of evidence and strength of recommendations. *BMJ* 2004; **328**: 1490.
- 3 McDonald CF, Crockett AJ, Young IH. Adult domiciliary oxygen therapy. Position statement of the Thoracic Society of Australia and New Zealand. *Med. J. Aust.* 2005; **182**: 621–6.
- 4 Continuous or nocturnal oxygen therapy in hypoxemic chronic obstructive lung disease: a clinical trial. Nocturnal Oxygen Therapy Trial Group. *Ann. Intern. Med.* 1980; **93**: 391–8.
- 5 Long-term domiciliary oxygen therapy in chronic hypoxic cor pulmonale complicating chronic bronchitis and emphysema. Report of the Medical Research Council Working Party. *Lancet* 1981; **317**: 681–6.
- 6 Lewis CA, Fergusson W, Eaton T, Zeng I, Kolbe J. Isolated nocturnal desaturation in COPD: prevalence and impact on quality of life and sleep. *Thorax* 2009; **64**: 133–8.
- 7 Moore RP, Berlowitz DJ, Denehy L, Pretto JJ, Brazzale DJ, Sharpe K, Jackson B, McDonald CF. A randomised trial of domiciliary, ambulatory oxygen in patients with COPD and dyspnoea but without resting hypoxaemia. *Thorax* 2011; **66**: 32–7.
- 8 Hardinge M, Annandale J, Bourne S, Cooper B, Evans A, Freeman D, Green A, Hippolyte S, Knowles V, MacNee W *et al.* BTS guidelines for home oxygen use in adults. *Thorax* 2015; **70**(Suppl. 1): i1–43.
- 9 Abernethy AP, McDonald CF, Frith PA, Clark K, Herndon JE, Marcello J, Young IH, Bull J, Wilcock A, Booth S *et al.* Effect of palliative oxygen versus room air in relief of breathlessness in patients with refractory dyspnea: a double-blind, randomised controlled trial. *Lancet* 2010; **376**: 784–93.
- 10 Cooper BG. Home oxygen and domestic fires. *Breathe (Sheff)* 2015; **11**: 4–12.