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THE USE OF DOMICILIARY OXYGEN THERAPY

AUTHORS Carol Kelly, MA, BSc, RGN, is senior lecturer, Edge Hill University/Respiratory Education UK; Dave Lynes, PhD, RN, is head of academic services, Respiratory Education UK.


Carole Kelly and Dave Lynes discuss the evidence and assessment for domiciliary oxygen, as well as considering oxygen therapy in palliative care.

The first guidelines for the use of long-term oxygen therapy (LTOT) were published in 1985 (Department of Health, 1985) following research by the Medical Research Council Working Party (1981) and the Nocturnal Oxygen Therapy Trial (NOTT) Group (1980). Both studies showed prolonged survival in patients with hypoxic COPD who received LTOT. The need for oxygen therapy was clear but the protocol for managing patients was not. Moreover, spiralling costs prompted the DH to commission a report (Royal College of Physicians, 1999) into the provision of domiciliary oxygen services in England and Wales, which heralded the recent changes to the supply of oxygen in the home (British Thoracic Society, 2006).

Long-term oxygen therapy (LTOT)

LTOT is indicated for chronic hypoxaemia, which may occur as a result of different conditions (Box 1), or for patients with nocturnal hypoventilation, which can result from obesity, chest-wall disease or obstructive sleep apnoea. The primary goal is to increase the baseline arterial tension of oxygen (PaO$_2$) to at least 8.0kPa at rest, and/or produce a peripheral oxygen saturation (SaO$_2$) of at least 90% (BTS, 2006).

LTOT for patients with chronic hypoxaemia and COPD can increase survival. It reduces polycythaemia (increase in haemoglobin content of the blood) and pulmonary hypertension, increases exercise capacity and improves neuropsychological functioning (MRC, 1981; NOTT Group, 1980).

The MRC (1981) and NOTT Group (1980) studies found patients had to use their therapy for at least 15 hours to benefit from it, and that survival improved when it was used for more than 20 hours per day. This should include night-time use as hypoxaemia can worsen during sleep (NICE, 2004). Once started, LTOT is likely to be a life-long therapy.

Assessment for LTOT

To be eligible for prescription of LTOT, the PaO$_2$ should be ≤7.3kPa when breathing air. It can also be prescribed when the PaO$_2$ is between 7.3Pa and 8kPa if the patient has secondary polycythaemia or evidence of pulmonary hypertension (British Medical Association/Royal Pharmaceutical Society of Great Britain, 2007).

Blood gases should be measured twice, not less than three weeks apart, and when the patient is clinically stable. It is important that the patient breathes air for at least 30 minutes before samples are obtained for blood–gas analysis. Arterial or arterialised capillary blood can be used, usually taken from the ear lobe (Zavorsky et al, 2007).

The patient’s response to LTOT must be established to ensure their arterial oxygen tension is above 8kPa without causing arterial carbon dioxide to rise, which is a risk when oxygen is administered. Oxygen flow of 2L per minute is usual, but this can vary. The patient should be left on a set flow rate for at least 30 minutes before a blood sample is taken for gas analysis.

If a patient does not meet the LTOT criteria but their blood gases are borderline, the assessment should be repeated, perhaps after three months. NICE (2004) guidelines on managing COPD advocate pulse oximetry as a screening tool in chronic stable COPD; those with oxygen saturations ≤92% when breathing room air must be assessed.

Patient education

Patients need to understand the importance of, and rationale for, compliance with oxygen therapy. Education can also identify problems and help find
solutions. It can help the patient overcome fears and barriers to using oxygen and find a greater acceptance of their chronic disease and their oxygen therapy. Written material can be given to reinforce and support advice and information.

A considerable adjustment in lifestyle is required with LTOT. Although patients are encouraged to live a normal life, some restrictions are inevitable. Patients may feel sensitive about their appearance and be reluctant to use oxygen devices outside the home. Many patients will feel unsure, frightened and perhaps angry about the therapy.

Fears of being housebound need to be explored and patients should be reassured that they can take a break from their oxygen, as long as it is used for at least 15 hours a day. There is also the potential to lengthen the time that oxygen therapy is used during an acute exacerbation.

Patients frequently ask about holidays. It is possible to go on holiday with LTOT and the British Lung Foundation produces fact sheets with advice and contact numbers. Advice on exercise and activity is also important to avoid the downward spiral of disability caused by activity avoidance.

Monitoring
Patients should be visited at home within a month of starting LTOT and should return to hospital or to a specialist community service for reassessment approximately three months later (BTS, 2006). Follow-up provides an opportunity to assess compliance and deal with any problems. There is also the opportunity to educate the patient and check their understanding of the therapy.

It is important to ensure that LTOT occurring in the home is adequately correcting hypoxaemia and that the patient still needs it. Recording $\text{SpO}_2$ with pulse oximetry while on LTOT at the prescribed flow rate should provide evidence of satisfactory correction of hypoxemia; the $\text{SpO}_2$ should be at 92% or above (BTS, 2006). During the reassessment visit, blood–gas measurements should be taken while the patient is breathing air and while they are breathing oxygen therapy at the prescribed flow rate. Reassessment is also important if the patient’s condition deteriorates or if there is evidence of worsening hypercapnia; a symptom of this is a morning headache.

Ambulatory oxygen therapy
Oxygen concentrators are the most cost-effective and practical devices used to provide oxygen therapy in the home. However, they are not portable and can restrict the patient to their home. Ambulatory oxygen therapy is therefore usually prescribed for those who are mobile and who leave the home regularly.

Portable devices include cylinders, cylinders with oxygen-conserving devices, and liquid oxygen. Some portable concentrators are available for private purchase. They vary in cost and weight and selection depends on the amount of outside activity in which the patient is likely to engage.

Ambulatory oxygen therapy can also be used by patients who do not have chronic hypoxaemia who show evidence of oxygen desaturation with exercise (BTS, 2006). Desaturation during exercise is defined as a reduction in $\text{SpO}_2$ of 4% to a value of <90% (Eaton et al, 2006). Evidence is still lacking in this area although short-term studies suggest that people with COPD respond to oxygen when exercising (Bradley and O’Neill, 2005).

It is recommended that an assessment is performed by a specialist who can assess any oxygen desaturation with exercise. The specialist can also identify any improvement in exercise capacity with oxygen therapy and the flow rate required to correct the desaturation. Ideally this should take place after a course of pulmonary rehabilitation (BTS, 2006).

Assessment for ambulatory oxygen therapy can involve exercise tests such as a shuttle-walk test, an endurance-walk test (Singh et al, 1992) or a six-minute walking test with a pulse oximeter in place. Assessment may also involve the use of diary cards to establish the appropriateness of a specific device for an individual patient’s lifestyle. It is vital to assess the patient’s motivation to use oxygen outside the home; ambulatory oxygen is expensive to prescribe so it is important to establish the likely benefits. A choice regarding the type of equipment prescribed should take into account the number of hours it will be used for and the flow rate required (Table 1).

Once ambulatory oxygen therapy is commenced, the true value should be judged after two months by interview, diary card and oxygen usage; therapy should be withdrawn if it is unhelpful (BTS, 2006).

Since the inclusion of ambulatory oxygen therapy in recent guidelines (BTS, 2006; NICE, 2004), there has been a considerable interest generated in this area and, although evidence to date is limited, it is anticipated that the body of research is increasing and guidance will be developed in the future.

Short-burst oxygen therapy
Short-burst oxygen therapy is widely prescribed and is one of the most expensive therapies in the NHS (NICE, 2004). It involves the intermittent, occasional use of supplemental oxygen at home.

REFERENCES

and is often prescribed to relieve the sensation of dyspnoea. Although short-burst oxygen therapy is extensively prescribed, there is little evidence that it is effective (Stevenson and Calverley, 2004), despite patients often reporting subjective benefit. The benefit described may simply be a placebo effect and some of its apparent symptomatic benefits may be due to the cooling effect of the oxygen on the face rather than a correction of hypoxia (Schwartzstein et al, 1987).

Short-burst therapy may help to reduce the work of breathing and reduce the volume of air entering the lung each minute (minute ventilation) and, hence, the sensation of breathing (O'Donnell et al, 1997). This may help during exercise, but is unlikely to be beneficial before or after it (Eaton et al, 2006; Stevenson and Calverley, 2004; Lewis et al, 2003). There is a clear need for further research in this area.

There is no specific method of assessment for the prescription of short-burst therapy. BTS (2006) recommends that other causes of breathlessness be excluded before it is prescribed and the patient should report subjective improvement if short-burst therapy is to be continued. Patients should be seen at least every 12 months by their GP or specialist to review the continuing need for short-burst oxygen. It may also be necessary to assess the patient for LTOT.

**Home oxygen in palliative care**

Dyspnoea is a common distressing symptom in many terminal conditions and one for which oxygen is often prescribed. A report from the Association of Palliative Medicine concluded that there is some evidence that oxygen can have a useful role in the palliation of dyspnoea in selected patients with advanced cancer and COPD (Booth et al, 2004). The recommendations also stressed that oxygen is only a part of supportive care and that adverse effects should be assessed.

Caution is necessary to prevent the introduction of new symptoms, for example, the exacerbation of hypercapnia caused by injudicious use of oxygen. There is no physiological rational for administering oxygen to patients with an SaO₂ of >92% at rest, and patients who experience relief are probably experiencing a placebo effect from facial cooling and relief of anxiety (Muers, 2005). Fan therapy or an open window can often have similar benefits to the use of oxygen as the cooling effects stimulate the facial nerves (Schwartzstein et al, 1987), Nebulisers probably work in a similar way.

Other drawbacks of using oxygen as a placebo are that it may cause psychological dependence, restriction of activities, impaired communication and drying effects on the mucus membranes. It may also interfere with the relationships between carers and patients. Despite these considerations, oxygen continues to be recommended for use in the palliation of dyspnoea in patients with normoxaemia when other treatments have not been effective (BMA/RPSGB, 2007; NICE, 2004).

Although an assessment with blood gases is not appropriate in this patient group, Booth et al (2004) support the notion of assessment, suggesting the use of symptom diaries to assess any reduction in dyspnoea and improvement in quality of life. NICE (2004) guidelines also suggest that this therapy should only be continued if an improvement in breathlessness following therapy has been documented.

**Smoking and oxygen therapy**

Cylinders pose a fire and explosion risk in the home. Although a concentrator does not store oxygen, a patient is still at risk from burns if they smoke while wearing oxygen. For the same reason, care should be taken with gas fires and cookers. While these health and safety issues are vital, they are not the basis of smoking habits should be avoided and could be deemed unethical (Lacasse et al, 2006).

**Conclusion**

Domiciliary oxygen therapy can prolong survival in patients with hypoxaemia and improve exercise capacity and quality of life in those who need to use oxygen outside of the home. Oxygen is expensive and can restrict patients’ lifestyles; therefore, it is important that each patient is assessed for its use before it is prescribed.