Use of Oxygen Therapy in COPD

General points about oxygen therapy in chronic obstructive pulmonary disease

- There is strong evidence of survival benefit of long-term oxygen therapy (LTOT) in patients with COPD and severe chronic hypoxaemia when used for at least 15 hours daily\(^1\).
- Therefore, oxygen therapy in COPD must be used with care in the acute setting but it can have distinct benefits in the long term. Chronic hypoxaemia causes slowly progressive pulmonary hypertension with the development of right ventricular hypertrophy and possible cor pulmonale with secondary polycythaemia. Secondary polycythaemia increases blood viscosity and hence resistance to flow. There is also sludging and a tendency to thrombosis.
- A Cochrane review of randomised controlled trials (RCTs) of domiciliary oxygen therapy for COPD found\(^2\):
  - Long-term home oxygen therapy improved survival in a selected group of COPD patients with severe hypoxaemia (arterial PaO\(_2\) less than 55 mm Hg (8.0 kPa)).
  - Home oxygen therapy did not appear to improve survival in patients with mild-to-moderate hypoxaemia or in those with only arterial desaturation at night.
- National Institute for Health and Care Excellence Clinical Knowledge Summaries (NICE CKS) recommend that, if the patient will not stop smoking, oxygen therapy should be withheld\(^3\). There is a real risk of fire and burns to the face and any benefit relating to polycythaemia is counteracted by smoking.

Oxygen therapy in the acute setting (in hospital)\(^4\)

- For most COPD patients, you should be aiming for an SaO\(_2\) of 88-92%, (compared with 94-98% for most acutely ill patients NOT at risk of hypercapnic respiratory failure). Mark the target saturation clearly on the drug chart.
- The aim of (controlled) oxygen therapy is to raise the PaO\(_2\) without worsening the acidosis. Therefore, give oxygen at no more than 28% (via venturi mask, 4 L/minute) or no more than 2 L/minute (via nasal prongs) and aim for oxygen saturation 88-92% for patients with a history of COPD until arterial blood gases (ABGs) have been checked\(^5\).
- Treat patients aged over 50 with possible COPD in the same way (eg, long-term smokers with a history of chronic breathlessness) and get ABGs urgently.

It is particularly important to check ABGs promptly if the patient has been brought in as emergency by an ambulance: ambulance crews have to give high-flow oxygen if a patient is hypoxic, regardless of previous history.

- Measure ABGs within 60 minutes of starting supplemental oxygen or changing its concentration. If PaO\(_2\) improves with an associated drop in PaCO\(_2\) and the pH is relatively unaffected (pH >7.26) then the concentration of the supplemental oxygen may be increased to maintain PaO\(_2\) >7.5 kPa.
- Oxygen therapy will have to be complemented with other interventions for any acute exacerbation of COPD.
- If acidosis develops (falling pH) with a rising PaCO\(_2\), other therapeutic interventions need to be discussed with the acute medical team; the intensive treatment unit (ITU) may need to be involved and decisions regarding ceiling of care have to take place at this point. Non-invasive positive pressure ventilation (NIPPV), intermittent positive pressure ventilation (IPPV) and doxapram are all options.
- Check ABGs on air before discharge in those who presented with a low pO\(_2\) and/or hypercapnia to guide later formal assessment for LTOT.
- 4- to 6-week follow-up should include consideration of LTOT assessment - not before, as the patient needs to be clinically stable.

Long-term oxygen therapy\(^{[1,6]}\)

Editor’s Note
Dr Sarah Jarvis, January 2019.
NICE has published new guidance on management of COPD\(^{[7]}\), which includes updated guidance on use of LTOT. They recommend that LTOT should be considered in patients who do not smoke and who:
- Have a partial pressure of oxygen in arterial blood (PaO\(_2\)) below 7.3 kPa when stable; or
- Have a PaO\(_2\) above 7.3 and below 8 kPa when stable, if they also have 1 or more of the following:
  - Secondary polycythaemia
  - Peripheral oedema
  - Pulmonary hypertension.
They recommend that assessment should include assessment of the risks of falls from tripping over equipment and of burns and fires, especially if someone in the household smokes. They do not recommend LTOT as an option for treatment of isolated nocturnal hypoxaemia due to COPD. Nor do they recommend ambulatory or short-burst oxygen for breathlessness in people with mild or no hypoxaemia at rest.

Once this is started, LTOT is likely to be lifelong. It is usually given over a minimum of 15 hours a day, including overnight when arterial hypoxaemia worsens during sleep (some advocate 18 or even 24 hours a day). See also the separate Prescribing Oxygen article.

- Assess the need for oxygen therapy in people with any of the following:
  - Very severe airflow obstruction - forced expiratory volume in one second (FEV1) less than 30% predicted.
  - Cyanosis.
  - Polycythaemia.
  - Peripheral oedema.
  - Raised jugular venous pressure.
  - Oxygen saturation 92% or below when breathing air.

- Consider assessment for people with severe airflow obstruction (FEV1 30-49% predicted).
- Assess by measuring ABGs on two occasions at least three weeks apart in people with confirmed stable COPD who are receiving optimum medical management. Obtaining ABGs in the community can be difficult and may require a visit to the local hospital or involvement of the specialist respiratory nurse.
- Offer LTOT to people with PaO2 less than 7.3 kPa when stable (or less than 8 kPa when stable and with peripheral oedema, polycythaemia (haematocrit ≥55%) or pulmonary hypertension). Be aware that inappropriate oxygen therapy in people with COPD may cause respiratory depression.
- All healthcare settings should have a pulse oximeter to ensure all people needing LTOT are identified and to review people receiving LTOT at least once a year.
- People receiving LTOT should breathe supplemental oxygen for at least 15 hours a day. If they smoke, warn them about the risk of fire and explosion.
- Use oxygen concentrators to provide the fixed supply for LTOT at home.
- Refer people who are hypercapnic or acidic on LTOT to a specialist centre for consideration of long-term non-invasive ventilation (NIV).
- NIV should be used as the treatment of choice for persistent hypercapnic ventilatory failure during exacerbations not responding to medical therapy.

### Ambulatory oxygen therapy[^6]

- Offer ambulatory oxygen therapy (AOT) to people already on LTOT who want to use oxygen outside the home, following assessment by a specialist.
- Consider it in motivated individuals who have exercise desaturation and PaO2 less than or equal to 7.3 kPa and whose exercise capacity and/or breathlessness improve with oxygen.

The British Thoracic Society (BTS) recommends[^1]:

- AOT should not be routinely offered to patients who are not eligible for LTOT.
- AOT should not be routinely offered to patients already on LTOT.
- AOT assessment should only be offered to patients already on LTOT if they are mobile outdoors.
- AOT should be offered to patients for use during exercise in a pulmonary rehabilitation programme or during an exercise programme following a formal assessment demonstrating improvement in exercise endurance.

### Short-burst oxygen therapy[^1]

- Short-burst oxygen therapy (SBOT) is typically given to patients for the relief of breathlessness not relieved by any other treatments.
- It is used intermittently at home for short periods - for example, 10-20 minutes at a time.
- Oxygen used in this way has traditionally been ordered for non-hypoxaemic patients and used for subjective relief of dyspnoea prior to exercise for oxygenation or after exercise for relief of dyspnoea and recovery from exertion.
- Consider SBOT (from cylinders) only for episodes of severe breathlessness not relieved by other treatments and continue only if breathlessness improves[^6].

### Prescription[^1, 8]

See the separate related Prescribing Oxygen article for full details but some aspects are repeated here.

- Patients need to be assessed first by a specialist team before a GP can make the prescription.
- The supply of home oxygen has been transferred from community pharmacies to regional oxygen supply companies[^9]. These companies are responsible for supplying cylinders, concentrators and liquid oxygen as part of an integrated service.
- Oxygen should be ordered directly from one of four regional supply companies via the Home Oxygen Order Form (HOOP).[^10] This has replaced prescribing of oxygen on FP10 prescriptions.
- Form completion notes are on the back - ensure you specify all the details (notably, the oxygen concentration).
- Regular orders should take three days; emergency ones should be delivered in four hours.
The NHS home oxygen service is available throughout the UK. However, delivery is different in Scotland and Northern Ireland:

- In Scotland patients should be referred for assessment by a respiratory consultant. If the need for a concentrator is confirmed the consultant will arrange for the provision of a concentrator through the Common Services Agency.
- In Northern Ireland oxygen concentrators and cylinders should be prescribed on form HS21. Oxygen concentrators are supplied by a local contractor.
- In Scotland and Northern Ireland prescriptions for oxygen cylinders and accessories can be dispensed by pharmacists contracted to provide domiciliary oxygen services.

Maximising benefit

- As a general rule, it is more economical to use an oxygen concentrator rather than cylinders if oxygen is required for more than eight hours per day or if prescriptions exceed 21 cylinders per month. Use nasal prongs at 2-4 L/minute (depending on ABGs).
- There is no benefit from LTOT for less than 15 hours a day.
- Smokers should stop smoking or benefit is unlikely. There is a very significant risk of burns and fire.
- Get optimum benefit from other forms of therapy, including inhalers.

Monitoring

- The patient's ABGs need to be monitored. Simply measuring \( \text{SaO}_2 \) is not enough, as assessment of hypercapnia and its response to oxygen therapy is required.
- ABGs can be radial, femoral or from the earlobe. Collect a sample when the patient has been breathing air for at least 30 minutes after having received any prior supplemental oxygen.
- Once therapy has started, measure ABGs with oxygen therapy (for at least 30 minutes on therapy, using the same equipment as at home if possible), to assess response and ensure \( \text{pO}_2 > 8.0 \text{ kPa} \) without unacceptable hypercapnia.
- Subsequently, measure ABGs when the patient is clinically stable and on optimal therapy on two occasions at least three weeks apart.
- All patients should be visited at home within four weeks of prescription by a specialist nurse, physiotherapist or technician (depending on local arrangements), experienced in the provision of domiciliary oxygen therapy. The aim is to provide education and support and to measure the \( \text{SaO}_2 \) with oximetry both on air and with therapy. This should be 92% or above with therapy.
- It is important to maintain six-monthly follow-up with reassessment for early recognition of problems. The BTS recommends domiciliary assessment by a respiratory health worker.

Travel

- Travel by land or sea presents a few potential problems:
  - Reduced \( \text{pO}_2 \) in airline cabins will increase hypoxia in those patients with hypoxia at sea level.
  - The BTS states that commercial air travel is contra-indicated for patients with usual oxygen requirement at sea level at a flow rate exceeding 4 L/minute\(^{[11]}\).
  - Most major airlines can provide supplemental inflight oxygen and assistance with embarkation if arranged in advance.
  - It is usually possible to arrange temporary provision of LTOT from a local chemist during a holiday but many patients can manage well without LTOT for several days.

Further reading & references

- Domiciliary Oxygen Therapy Service; National Advisory Group (NAG) for Respiratory Managed Clinical Networks (MCNs)
- Home Oxygen Service; Health Facilities Scotland
- The Global Initiative for Chronic Obstructive Lung Disease (GOLD)
  3. Chronic obstructive pulmonary disease; NICE CKS, November 2010 (UK access only)
  4. Guideline for emergency oxygen use in adult patients; British Thoracic Society (October 2008)
  7. Chronic Obstructive Pulmonary Disease; NICE Guidance (December 2018)
  9. Wenzhcha JA, Calverley PMA; All change for home oxygen services in England and Wales; Thorax 2006;61:7-9 [full text]
  10. EMS HOOF Wizard
  11. Managing passengers with stable respiratory disease planning air travel; British Thoracic Society (2011)

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