

# Long-term oxygen therapy - Supplement, maintenance, or palliative drug?

The COVID-19 pandemic during the last 2 years has brought oxygen therapy in a sharp focus. The widely televised visuals of people waiting for oxygen continue to haunt the health personnel. It has also raised the significant issues of medical indications for oxygen. There is hardly any controversy about its emergency need for acute hypoxemia of any cause. However, pulmonologists and physicians are regularly confronted with the vital question of whether oxygen is medically useful on a long-term basis.

In modern medical history, oxygen was first isolated by Joseph Priestley in 1772 although its presence was well recognized in one or the other form in the ancient history as the “*pran-vayu*” (life-air) by *Susrata* (1000 BC) and the *air* (along with earth, fire, and water) as the essential element for life by Aristotle (4<sup>th</sup> century BC). Yet, its medical use for reversal of hypoxemia was not recognized until the early 20<sup>th</sup> century. For the last 100 years therefore, oxygen remains a life-saving drug for all patients suffering from its deficiency.

Oxygen came to be used as a supplement treatment at home on a long-term basis for medical disorders such as polycythemia and pulmonary hypertension in patients with chronic obstructive pulmonary disease (COPD) in the second half of the 20<sup>th</sup> century. The two landmark studies on use of long-term oxygen therapy (LTOT) in COPD patients with severe hypoxemia in 1980–1981 clearly demonstrated the benefits of its use including an improved survival.<sup>[1,2]</sup> The findings soon led to the use of domiciliary LTOT for almost all kinds of breathlessness irrespective of the availability of clinical or scientific evidence. One should however consider the indications for LTOT as conditional in categories other than the COPD with severe hypoxemia. Such an expanded use the world over has posed the important question whether LTOT is indicated as a supplemental therapy, a maintenance drug, or for mere palliation.

LTOT remains an under-used mode of treatment in India. Moreover, compliance with LTOT remains a major limiting factor for its usefulness. This has been particularly so in India in view of the limited resources and availability. Although the issue has been highlighted in different observations, there is hardly any report which systematically studies the noncompliance and the responsible factors.<sup>[3]</sup> In this context, therefore, the study on compliance and factors affecting compliance reported in this issue of *Lung India* is a welcome step.<sup>[4]</sup> The report by Patro *et al.* from Delhi includes a distributive analysis

of 97 patients who had met the inclusion criteria, i.e., the use for at least 15 h/day; of about 55% (53 of 97) patients who were noncompliant, almost half had cited lack of instructions as the major reason of noncompliance.<sup>[4]</sup> In the absence of any other significant reason, this finding puts the onus almost at the door of the prescriber. The authors have made some good suggestions to improve the compliance even though a lot remains to be understood and implemented.

## LONG-TERM OXYGEN THERAPY FOR CHRONIC RESPIRATORY AND OTHER DISEASES

The current guidelines recommend the use of LTOT for 15–16 h/day (the longer, the better) for COPD patients with chronic hypoxemia, i.e., PaO<sub>2</sub> of 55 mmHg or less at rest, in nonrecumbent position. This supplementary treatment for hypoxemia is shown to be associated with a lower mortality rate and also reduce the number of hospitalizations, increase work capacity, and improve health-related quality of life.<sup>[1,2,5]</sup> It also improves exercise tolerance and cognitive mental function. There is also good evidence in favor of its use in COPD patients with moderately severe hypoxemia (patients with PaO<sub>2</sub> of more than 55 mmHg) with demonstrable hypoxic organ dysfunction, such as secondary pulmonary hypertension, cor pulmonale, polycythemia, or central nervous system dysfunction.<sup>[6]</sup> LTOT is also recommended when there is a demonstrable fall in PaO<sub>2</sub> below 55 mmHg during sleep, associated with disturbed sleep pattern, cardiac arrhythmias, or pulmonary hypertension. These patients may benefit from nocturnal oxygen therapy. Similarly, LTOT may be used when there is demonstrable PaO<sub>2</sub> fall during exercise to improve exercise performance, duration, or capacity.

Other than in COPD, LTOT has been shown to provide some benefit in other chronic respiratory diseases/chronic respiratory insufficiency even though the clinical evidence is either lacking or small. For example, LTOT is found of use in patients with interstitial lung disease (ILD), kyphoscoliosis, extensive bronchiectasis, and sleep apnea syndrome.<sup>[7-10]</sup> It has been also employed for use in nonpulmonary conditions such as chronic left heart failure, cerebro-vascular diseases, hemoglobinopathies, as well as for relief of breathlessness in advanced malignancies and chronic neuro-psychiatric conditions.<sup>[11,12]</sup> It is an important question to ponder whether one should consider LTOT as one of the maintenance and/or palliative drugs

in these conditions. Home oxygen is also extensively used in children although there is lack of empirical evidence. Recently, the American Thoracic Society Assembly on Pediatrics has formulated the rationale and clinical guidelines for LTOT for childhood disorders largely based on expert opinion and clinical experience.<sup>[13]</sup>

The recent report of American Thoracic Society Assembly on Nursing provides evidence-based guidelines for home oxygen therapy for patients with COPD and ILD.<sup>[14]</sup> The expert multidisciplinary panel used a modified Delphi approach to formulate and grade clinical recommendations. The Panel made strong recommendations for patients with COPD and severe hypoxemia and conditional recommendations for patients with COPD with moderate and chronic resting hypoxemia. There was low-quality evidence for ILD with severe exertional hypoxemia as well as severe chronic resting hypoxemia. Importantly, it was recommended that patients and their caregivers should receive education on oxygen delivery systems and safety (best-practice statement).

## BARRIERS TO LONG-TERM OXYGEN THERAPY

In spite of a wider medical use of oxygen in the Indian homes, it continues to remain enigmatic for majority of patients. People tend to restrict the time and dose of oxygen to less than prescribed for multiple reasons. The paper under reference cites lack of instructions as the major cause of noncompliance.<sup>[4]</sup> It is important to remember that oxygen use is entirely supplemental required to improve the symptoms and organ function. LTOT does not cure a disease; it is therefore required throughout as long as the disease persists. Before prescribing LTOT, it is important to look for a definitive documented diagnosis responsible for chronic hypoxemia. The other factors which should be considered include that an optimal medical treatment is in effect; patient in a stable condition; and oxygen administration should have been shown to improve hypoxemia and provide clinical benefit. It is important to ensure that the patient is compliant with the general medical regimen and follows instructions, such as smoking cessation. Continued smoking not only aggravates the disease but also reduces the full physiological benefits of oxygen and poses inherent safety risk of accidental fires.

Many patients are afraid of the toxicity and side effects besides being fearful of getting dependent or addicted to the therapy. They tend to believe the principle of “the lesser the better” rather than the clinical evidence and prescription of “the longer, the better.” The accrued benefits are therefore minimal and insignificant, if any. Even though minimal, but cannot entirely do away with side effects such as the nasal dryness and skin irritation. These effects are primarily seen in the places where the cannula and tubing touch the face. Nasal dryness can cause crusting or bloody nose, sometimes tiredness and

morning headaches. Other minor side effects may include coughing, mild throat irritation, muscle twitching, and dizziness. True oxygen toxicity is usually described with hospital use mostly for acute conditions when higher concentrations and pressures are required for oxygen administration. The toxicity does not usually occur with domiciliary use where low concentrations and pressures are used. Oxygen is neither addictive nor it weakens the lungs. Oxygen is a nonflammable gas in itself but it promotes burning and therefore poses a fire risk. One should never smoke or use flammable materials near the oxygen source at home.

Beyond doubt, LTOT has proved as an important and indispensable tool in the therapeutic armamentarium, in particular of pulmonary physicians. It remains the only hope for a respiratory “cripple” due to a chronic respiratory disease especially in the absence of lung transplantation. It is required to be used as a drug with all prescription essentials – the dose and daily duration for use, devices for and method of administration, source of oxygen, and monitoring for efficacy and side effects. The issue of cost, insurance, and reimbursement must be discussed with the patient and/or the caregiver. Regular follow-ups are necessary for appropriate modifications. It is not generally feasible to provide this service merely through outpatient prescriptions from the clinic. It is important to organize domiciliary help and monitoring for these patients who may find it frequently difficult to visit the hospital. There is a general lack of organized and supervised home services in this country. One expects that more such programs will become available with increase of the need for LTOT and sensitization of pulmonary specialists to rationally use the therapy in their clinical practice.

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