

Non-pharmacological management of chronic obstructive pulmonary disease

Education in self-management strategies, oxygen therapy, pulmonary rehabilitation, and surgical interventions all contribute to long-term survival for COPD patients.

ABSTRACT: Chronic obstructive pulmonary disease (COPD) is a complex condition with many aspects that are amenable to therapy. A better understanding of the physiology of COPD and better tools to evaluate outcomes have led to advances in our ability to treat this disease. Pharmacological approaches can improve patients' quality of life considerably by reducing dyspnea and limiting exacerbations. Non-pharmacological approaches can also improve quality of life and prolong survival for patients. Education on a number of topics (including the importance of smoking cessation), oxygen therapy, pulmonary rehabilitation, and surgery can all have an impact on the course of COPD. Although the nonpharmacological interventions at our disposal are not yet consistently available throughout BC, these interventions do promise to change the course of this disabling disease.

Chronic obstructive pulmonary disease (COPD) is a complex condition. The nonpharmacological component of COPD management is at least as important as the pharmacological management. Nonpharmacological interventions can be applied to patients with stable COPD and acute COPD exacerbations. These non-pharmacological measures, which can improve both long- and short-term survival, include patient education and oxygen therapy, as well as pulmonary rehabilitation, noninvasive positive pressure ventilation, and surgical interventions such as lung volume reduction surgery and lung transplantation. The recently updated Canadian Thoracic Society recommendations for management of COPD refers to all of these nonpharmacological approaches (www.copdguidelines.ca).¹

Education

Specific educational interventions provided by the family practitioner, respirologist, and respiratory health care team, such as teaching effective inhaler technique, have been shown to improve lung function and exercise performance.^{1,2} Education is the key to any self-management program. Topics for education include the following:

- The importance of smoking cessation—the single most effective intervention to reduce the risk of developing COPD and to slow its progression.
- The pathogenesis of COPD and the rationale for medical therapy.
- Effective inhaler technique.
- How to self-manage with case manager participation.
- How to recognize and treat acute exacerbations of COPD by following an “Action Plan.”
- Strategies to alleviate dyspnea.
- Advanced directives and/or end-of-life preparation.
- Educational resources.

COPD patients with an understanding of the disease process can become more active and effective participants in disease management. Education can reduce health care utilization by itself and by managing acute exacerbations. The Action Plan referred to above helps patients to recognize an exacerbation and seek appropriate

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interventions. (A COPD exacerbation is a sustained worsening of dyspnea that lasts for at least 48 hours and requires an increase in medication.) When a patient with moderate to severe COPD is expectorating purulent sputum during an exacerbation, the Action Plan directs the patient to take an antibiotic and a course of prednisone, an approach that has been shown to reduce ER visits and hospitalizations.³

Oxygen therapy

Long-term oxygen therapy is essential for hypoxemic COPD patients as it has been shown to significantly improve survival.^{4,5} Indications for long-term oxygen therapy in COPD for BC (consistent with national guidelines) include significant hypoxemia with either a PaO₂ of equal to or less than 55 mm Hg, or a PaO₂ less than 60 mm Hg in the presence of cor pulmonale, pulmonary hypertension, clinically significant congestive heart failure, or polycythemia (hematocrit of greater than 56%). Patients who meet these criteria are provided with oxygen by the Home Oxygen Program. Oxygen should be applied for at least 15 hours per day, the longer the better, to maintain an oxygen saturation of greater than 90%.^{4,5} Long-term oxygen therapy has been shown to improve pulmonary artery pressure and to lower the pulmonary vascular resistance in edematous patients.^{6,7} Continuous oxygen therapy reverses polycythemia and improves cardiac output, exercise tolerance, and quality of life.⁸⁻¹³

Oxygen desaturation during sleep is common in COPD and is associated with a poor sleep quality and increased mortality.¹⁴⁻¹⁶ Nocturnal oxygen therapy alone reverses nocturnal hypoxemia in these patients if no other sleep-related disorder, such as obstructive sleep apnea, is present. However, nocturnal oxygen therapy has

not been shown to improve survival or quality of sleep in patients who experience hypoxemia only during sleep.¹⁷⁻¹⁹ Nocturnal oxygen is, however, recommended to those who desaturate to less than 88% for more than 30% (minimum 4-hour oximetry study) of the night.

Oxygen therapy during exercise improves dyspnea and exercise tolerance.²⁰ Oxygen therapy may increase exercise endurance by reducing dynamic hyperinflation and improving breathing pattern.^{21,22} To qualify for short-term oxygen therapy for ambulation in BC, patients should have a sustained SpO₂ (oxygen saturation as measured by pulse oximetry) of less

than 88% for 1 minute during a 6-minute walk test. To qualify for long-term oxygen therapy for ambulation, the patient must meet the following additional criteria:

than 88% for 1 minute during a 6-minute walk test. To qualify for long-term oxygen therapy for ambulation, the patient must meet the following additional criteria:

- A measured improvement in a 6-minute walk test of 25% and at least 30 m with oxygen therapy *and*
- A 3-point reduction in the dyspnea score on the 7-point Borg Scale; or an SpO₂ less than 80% with ambulation as in the BC Home Oxygen Program medical criteria (www.vch.ca/programs/hop.htm).

The Borg Scale allows subjects to grade the severity of shortness of breath they are experiencing during exercise. In BC 6-minute walk testing

Pulmonary rehabilitation

Pulmonary rehabilitation is a multidisciplinary program of care designed to optimize physical and social performance and autonomy.²³ It is tailored to the individual patient. Components of pulmonary rehabilitation include exercise training, psychosocial and behavioral interventions, and nutritional therapy. A typical exercise program involves strength and endurance training. Exercise programs are individualized to increase exercise capac-

ity and strength; they mainly focus on the lower limbs, but upper extremity exercises are also often part of the routine. Benefits of pulmonary rehabilitation include the following:

- Relief of dyspnea: Pulmonary rehabilitation improves exertional dyspnea and dyspnea associated with daily activities.²⁴⁻³⁴
- Improvement in exercise capacity: Pulmonary rehabilitation improves exercise tolerance, peak oxygen uptake, endurance time, functional walking distance, and peripheral and respiratory muscle strength.^{25,29-33,35}
- Improvement in health status: Pulmonary rehabilitation is associated with an improvement in disease-

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specific and general aspects of health.^{25,26,29,31,36} This occurs by alleviating symptoms such as dyspnea and fatigue, and by improving emotional function, activity level, and quality of life.

- Prevention of complications and exacerbations: Although pulmonary rehabilitation may not influence the frequency of hospitalization, it has been shown to reduce the duration of hospital stay (10.4 versus 21.0 days).³² Other trials have concluded that pulmonary rehabilitation is associated with fewer exacerbations and more efficient primary care utilization.³⁷⁻⁴⁰
- Long-term benefits: The effects of pulmonary rehabilitation on symptoms, activity, and quality of life are usually sustained for several months after the program ends.³⁷⁻⁴⁴ If program activities are not continued there is progressive loss of the acquired benefits. Although pulmonary rehabilitation has not been shown to improve FEV₁ (forced expiratory volume in 1 second), one clinical trial has shown that the nutritional intervention component of pulmonary rehabilitation improves survival.⁴⁵

Indications for pulmonary rehabilitation

COPD patients with all of the following criteria should be considered for referral for pulmonary rehabilitation:

- Patient is clinically stable but symptomatic.
- Patient has experienced a reduction in activity level and an increase in dyspnea despite pharmacological therapy.
- Patient has no evidence of active ischemic heart, musculoskeletal, psychiatric, or other systemic disease.
- Patient is sufficiently motivated to participate.

Most regions in BC have pulmonary

rehabilitation programs. However, access is not optimal and there is a need here and elsewhere to increase the availability of these programs. Increased availability could lead to starting this intervention at an earlier stage of the disease rather than as a last resort and could also allow pulmonary rehabilitation to be offered more economically. A strong argument can be made for increasing pulmonary rehabilitation programs based on their favorable cost-effectiveness profile.

Noninvasive positive pressure ventilation

Noninvasive positive pressure ventilation (NIPPV) is superior to medical therapy alone in the setting of a severe exacerbation of COPD.⁴⁶⁻⁵⁶ One-year mortality was reported to be lower in patients receiving NIPPV for exacerbations of COPD than patients receiving either optimal medical therapy alone⁵⁷ or conventional mechanical ventilation.⁵⁸ A full face mask is shown to be more comfortable than a nasal or oral mask.⁵⁹ Patients with advanced COPD who are not candidates for active resuscitation or ICU admission may still benefit from NIPPV in the general ward with up to 60% hospital survival.⁶⁰⁻⁶²

Indications, precautions, and contraindications for NIPPV

NIPPV in the form of bilevel positive airway pressure therapy should be offered to COPD patients with severe exacerbations (pH less than 7.3) or those who remain excessively dyspneic despite appropriate therapy and oxygenation. Although NIPPV may be initiated safely for most patients in the respiratory ward, subgroups with more severe symptoms should be closely monitored while on NIPPV (i.e., in an intensive care setting) in case an emergency intervention is

needed.⁵⁵ NIPPV should be avoided in patients with the following:

- Respiratory arrest.
- Hemodynamic instability.
- High risk for aspiration.
- Impaired mental status or recent craniofacial trauma.
- Surgery or burns.

Modest sedation is accepted, but excessive sedation may predispose to aspiration. Finally, NIPPV is not indicated in stable patients with chronic hypercapnea.⁶³

Lung volume reduction surgery

Patients with advanced upper lobe predominant emphysema should be considered for lung volume reduction surgery (LVRS). In BC, patients being considered for LVRS must be assessed for specific indications and contraindications (Table). There is increasing evidence for the benefits of LVRS,⁶⁴⁻⁶⁹ which has been shown to improve health-related quality of life, exercise capacity, FEV₁ and lung volumes at 2 years.⁷⁰⁻⁷² Additionally, LVRS is associated with a significant reduction in mortality, especially in patients with upper lobe predominant emphysema and greatly reduced exercise capacity (less than 40 watts). Patients with upper lobe predominant emphysema with high exercise capacity had no survival benefits but showed sustained improvement in exercise capacity and health-related quality of life. Patients with an FEV₁ of less than 20% together with a DLCO (diffusing capacity of the lung for carbon monoxide) of less than 20% or homogeneous distribution of emphysema were found to receive no benefit from LVRS.⁷³

Recently, endobronchial lung volume reduction using a fiberoptic bronchoscopy and unidirectional endobronchial valves has been introduced as a possible future replacement for the more invasive and expensive LVRS.⁷⁴

More data from trials are needed before any recommendations can be made regarding this new technique.

Lung transplantation

Lung transplantation is indicated in patients with very advanced COPD who meet at least one of the following criteria:

- FEV₁ less than 25% of predicted.
- PaCO₂ greater than 55 mmHg.
- Elevated pulmonary artery pressure with progressive deterioration.

COPD patients represent 60% of all single lung transplant recipients and 30% of bilateral lung transplant recipients.⁷⁵ COPD patients usually have a better outcome following a lung transplant than those with other conditions. The transplant-related complication responsible for long-term morbidity and mortality is bronchiolitis obliterans, which causes chronic graft dysfunction.

Conclusions

Nonpharmacological management of COPD improves quality of life and prolongs survival. Access to some promising interventions, however, is not province-wide. Oxygen therapy is available in BC to all who meet the Home Oxygen Program criteria. Pulmonary rehabilitation and COPD education are not as readily available, particularly in rural parts of BC and even in some larger centres. Smoking cessation programs are readily available everywhere by different delivery methods (e.g., by telephone). LVRS is a costly elective surgical procedure that is available in BC but is subject to significant wait times. Lung transplantation is also available, but is limited by donor lung availability. In spite of these limitations, COPD treatment has improved and the outlook for patients suffering with this disabling condition is indeed more positive than it was as recently as 5 years ago.

Table. Selection criteria for lung volume reduction surgery.

Indications	Contraindications
<ul style="list-style-type: none"> • Disability from emphysema (not from bronchitis or asthma) despite maximal medical treatment. • Absence of clinically significant bronchiectasis and absence of high daily sputum production. • Abstinence from smoking more than 4 months. • FEV₁ \leq45% predicted.* • Total lung capacity \geq100% predicted. • Residual volume \geq150% predicted. • Upper lobe predominant emphysema (heterogeneous emphysema). • 6-minute walk distance >140 m. 	<ul style="list-style-type: none"> • Comorbid disease with risk of life expectancy less than 2 years. • Severe obesity (BMI >31.1 in men and 32.3 in women) or cachexia. • Severe coronary artery disease or other significant cardiac disorder. • Giant bulla taking up more than one-third of lung in which it is located. • Oxygen requirement of >6 L per min to maintain saturation \geq90%. • Extensive pleural symphysis from pleural disease or previous chest surgery. • Daily use of prednisone >20 mg. • PaCO₂ >60 mm Hg or PaO₂ <45 mm Hg on room air[†] • Pulmonary arterial pressure \geq35 mm Hg (mean). • FEV₁ \leq20% predicted and homogeneous distribution or DLco \leq20% predicted.[‡]

* FEV₁: forced expiratory volume in 1 second
 † PaCO₂: partial pressure of arterial carbon dioxide
 ‡ DLco: diffusing capacity of the lung for carbon monoxide

Nonpharmacological management of COPD improves quality of life and prolongs survival. Access to some promising interventions, however, is not province-wide.

Competing interests

None declared.

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