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Recommendations of SEPAR

Continuous Home Oxygen Therapy☆

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ABSTRACT

Oxygen therapy is defined as the therapeutic use of oxygen and consists of administering oxygen at higher concentrations than those found in room air, with the aim of treating or preventing hypoxia. This therapeutic intervention has been shown to increase survival in patients with chronic obstructive pulmonary disease (COPD) and respiratory failure. Although this concept has been extended by analogy to chronic respiratory failure caused by respiratory and non-respiratory diseases, continuous oxygen therapy has not been shown to be effective in other disorders. Oxygen therapy has not been shown to improve survival in patients with COPD and moderate hypoxaemia, nor is there consensus regarding its use during nocturnal desaturations in COPD or desaturations caused by effort. The choice of the oxygen source must be made on the basis of criteria such as technical issues, patient comfort and adaptability and cost. Flow must be adjusted to achieve appropriate transcutaneous oxyhaemoglobin saturation correction.

Oxigenoterapia continua domiciliaria

Palabras clave:
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RESUMEN

Se define como oxigenoterapia el uso terapéutico del oxígeno y consiste en su administración a concentraciones mayores de las que se encuentran en el aire ambiente, con la intención de tratar o prevenir las manifestaciones de la hipoxia. Esta medida terapéutica ha demostrado aumentar la supervivencia en los enfermos con enfermedad pulmonar obstructiva crónica (EPOC) e insuficiencia respiratoria. A pesar de que este concepto se ha extendido por analogía a la insuficiencia respiratoria crónica originada por otras enfermedades respiratorias y no respiratorias, la efectividad de la oxigenoterapia continua no está demostrada en otras entidades. La oxigenoterapia no se ha demostrado efectiva en términos de supervivencia en pacientes con EPOC e hipoxemia moderada. Tampoco hay consenso sobre su empleo durante las desaturaciones nocturnas en EPOC y durante las desaturaciones al esfuerzo. La elección de la fuente de oxígeno se debe realizar por criterios técnicos, de comodidad y adaptabilidad del paciente y de coste. Se debería ajustar el flujo para conseguir una adecuada corrección de la saturación transcutánea de oxihemoglobina.

Introduction

Oxygen therapy is an ancient treatment, but it still remains one of the most important measures in the management of patients with progressing chronic respiratory disease. The basic goal of oxygen therapy is to correct the severe hypoxaemia that these patients often present in advanced stages of the disease, ultimately improving tissue oxygenation.

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Table 1
Classification of Recommendations and Quality of Evidence According to the GRADE System.

Grade of recommendation	Level of evidence	Implications
Consistent recommendation,[a] high quality evidence	Well conducted RCT. Exceptionally well carried out OS	Applicable to most patients in most cases
Consistent recommendation,[a] moderate quality evidence	RCT with limitations or well conducted OS with major defects	Applicable to most patients in most cases
Consistent recommendation,[a] poor quality evidence	At least one important outcome in RCT or OS with major defects	May change when stronger evidence is available
Consistent recommendation,[a] very poor quality evidence	At least one important result in unsystematic clinical observations or very indirect evidence	May change when stronger evidence is available
Weak recommendation,[b] high quality evidence	Well conducted RCT. Exceptionally well carried out OS	May differ depending on circumstances or patients
Weak recommendation,[b] moderate quality evidence	RCT with limitations or well conducted OS with major defects	Other options may be better for some patients under certain circumstances
Weak recommendation,[c] poor quality evidence	At least one important outcome in RCT or OS with major defects	Other options may be equally reasonable
Weak recommendation,[d] very poor quality evidence	At least one important result in unsystematic clinical observations or very indirect evidence	Other options may be equally reasonable

RCT: randomised controlled trials; OS: observational studies.
Source: GRADE Working Group. Grading of recommendations of assessment development and evaluations. Available at: http://www.gradeworkinggroup.org/.
[a] Benefits clearly outweigh the disadvantages or vice versa.
[b] Benefits and disadvantages are balanced.
[c] Uncertainty in estimating benefits or drawbacks, which can be balanced.
[d] Greater uncertainty in estimating benefits or drawbacks, the benefits may or may not be balanced with the disadvantages.

The discovery of oxygen is attributed to Joseph Priestley in 1772 who, by heating mercuric oxide in a vessel left in the sun, released gas that proved to be oxygen. However, the first therapeutic use of oxygen is attributed to Chaussier who, in 1780, applied it to dyspnoeic patients and cyanotic new-borns. In 1887, Dr. Holzapple used oxygen generated from potassium chlorate and manganese dioxide to treat a young man suffering from pneumonia. In the late nineteenth century, the process for producing liquid air by compression and cooling was discovered, so oxygen could be isolated by fractional distillation of liquid air. Throughout the twentieth century, the beneficial effects on some of the most common consequences of the disease (less polycythaemia, control of *cor pulmonale* episodes, and fewer episodes and days of hospitalisation) were demonstrated. However, it was not before the eighties that several studies established the criteria for the selection of patients who would benefit from the use of home-based oxygen therapy (HOT) that are still in use.[1]

As we describe in these guidelines, there are some clearly defined indications for oxygen therapy, but there are other situations in which there is no consensus on the use of this technique. It is noteworthy that some of these indications are based on studies conducted more than 30 years ago, in some cases, in a limited number of patients. These guidelines aim to serve as a simple and useful tool to assist in decision making when prescribing this therapy. In order to classify the quality of evidence and strength of available recommendations, the GRADE system has been used for the most relevant issues (Table 1). Furthermore, whenever possible, a recommendation based on the issues discussed and the available evidence has been included at the end of each section.

Hypoxaemia, Hypoxia and Respiratory Failure. Definition, Mechanisms and Consequences

The main function of the respiratory system is to maintain adequate pulmonary exchange of physiological gases. The arterial oxygenation parameter for assessing lung function is the partial pressure of oxygen in arterial blood (PaO_2), because its value is generally determined by the gas-exchange function of the lung. Normal PaO_2 values in adults vary slightly with age and are between 100 mmHg (13.6 kPa, 1 kPa=7.5 mmHg) and 96 mmHg (12.8 kPa) at 20 and 70 years of age, respectively. Partial pressure of carbon dioxide in arterial blood ($PaCO_2$) also decreases with advancing age (4 mmHg between 20 and 70 years), ranging between 38 and 34 mmHg, respectively, with an average of 37±3 mmHg (4.9 kPa).

Strictly speaking, hypoxaemia refers to a decrease in O_2 content and/or PaO_2. However, this broad definition is confusing, since the relationship between PaO_2 and O_2 content is nonlinear and depends on many variables: PaO_2 can decrease without significant changes in O_2 content, while O_2 content can be greatly diminished without changes in PaO_2 (anaemia or CO poisoning). To avoid these problems, we will stick to the most widely accepted meaning of hypoxaemia, which is a decrease in PaO_2 below normal limits for the subject's age.[2] In clinical practice, arterial hypoxaemia exists when PaO_2 is lower than 80 mmHg (10.7 kPa) and arterial hypercapnia when $PaCO_2$ is greater than 45 mmHg (6.0 kPa), breathing room air at sea level. Decreased PaO_2 may be due to multiple factors (Table 2). Respiratory failure is defined as PaO_2 values below 60 mmHg (8.0 kPa). To demonstrate the existence of respiratory failure, arterial blood gas must be determined by transcutaneous puncture, preferably in the peripheral radial artery. Pulse oximetry can be used as an alternative technique, and less than 90% arterial oxyhaemoglobin saturation (SpO_2) is accepted as indicative of respiratory failure. SpO_2 values are much more variable than PaO_2, because they can be influenced by extrapulmonary factors, and they provide no information on $PaCO_2$ nor pH.[3]

Hypoxia is defined as a decrease in oxygen supply to the cells, which limits the production of energy to levels below cellular requirements. Hypoxia can be produced by various mechanisms (Table 3). The maintenance of the oxygen supply to vital tissues depends on the balance between the harmful effects of hypoxia and the compensatory effects it triggers. The various organs have different degrees of susceptibility to hypoxia, depending on the

Table 2
Causes Hypoxaemia and Hypercapnia.

Mechanism	PaO_2	$PaCO_2$
Decreased inspiratory PaO_2	Reduced	Reduced
Alveolar hypoventilation	Reduced	Greatly increased
Diffusion limitation	Reduced	Without changes or reduced
Imbalance VA/Q	Reduced	Increased or reduced
Short circuit	Reduced	Reduced

$PaCO_2$: arterial carbon dioxide pressure; PaO_2: arterial oxygen pressure; VA/Q: pulmonary ventilation-perfusion ratio.
From Soler and Rodríguez-Roisin.[3]