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Editorial

New Frontiers in High-Flow Therapy

Nuevas fronteras en la terapia de alto flujo

In recent years, high-flow therapy (HFT) has become a key tool in respiratory units. It consists in the use of high flow of humidified and heated air, with variable oxygen concentrations (FiO_2 between 21 and 100%). These features improve the mobilization of secretions, the washout of carbon dioxide (CO_2) from the anatomical dead space and the reduction of the work of breathing. Additionally, it generates a slight positive end-expiratory pressure (PEEP).[1]

Several publications support the efficacy of HFT in patients with severe hypoxemic respiratory failure (RF),[2] as well as in weaning from non-invasive mechanical ventilation (NIV) in patients with global chronic obstructive pulmonary disease (COPD), or even as an alternative to NIV in cases of poor tolerance. The indications for HFT are expanding beyond traditional applications and now include home use.[3]

It has been proposed as an alternative to NIV during exercise and pulmonary rehabilitation, especially in patients with severe COPD and dynamic hyperinflation. The advantage of HFT in these cases is likely due to its ability to maintain a high and constant FiO_2, preventing desaturation during exercise, while also offering greater comfort by being administered through a nasal cannula.

In our current practice, we use HFT in patients with COPD who do not tolerate NIV and in patients with other respiratory diseases who have severe desaturation during exercise (Fig. 1). HFT has proved to be superior to conventional oxygen therapy during physical exertion. Nevertheless, in patients with COPD, a comparison of the neurorrespiratory drive unloading provided by HFT versus NIV, reveals that the second one confers greater benefits in terms of reduced respiratory neural drive, exercise tolerance and transcutaneous CO_2 pressure levels.[4]

The utilization of HFT to facilitate decannulation is becoming increasingly common, as the conditioning of inspired gas minimizes mucosal damage and ciliary function, reduces the necessity for secretion aspiration and shortens the time to decannulation.[5] A sequential use of the device through nasal prongs, when capping the cannula, provides additional benefits, such as the compensation of resistances due to the cannula.[6,7]

Nevertheless, the PEEP levels achieved through tracheostomy are insufficient to elicit a notable change in tele-expiratory lung volume.[6,7] Furthermore, the impact of CO_2 washout is considerably diminished due to the smaller anatomical dead space in tracheostomized patients.[8]

Fig. 1. Patient with severe respiratory insufficiency secondary to diffuse interstitial lung disease, performing rehabilitation on cycloergometer, using high-flow therapy during exercise. Maintains oxygen saturation around 90% using a constant FiO_2 of 0.60 despite changes in pulmonary mechanics and tachycardia, avoiding exercise-induced desaturation.

In non-cystic fibrosis (CF) bronchiectasis, chronic application of HFT for at least 6 h a day has been shown to reduce the annual rate of exacerbations, and to improve both lung function and quality of life.[9] Mucus secretions humidification may ease the drainage, reducing mucus plugging, by decreasing their viscosity and purulence.[3] Although the evidence available in CF patients is

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limited, it is plausible to consider that the combination of this therapy with other adjuvant therapies, such as vibrating waistcoats or nebulized mucolytic therapy, may promote secretion drainage.[10]

HFT use has also increase in support of procedures with potential airway risk, such as upper gastrointestinal endoscopy, dental procedures and fiberoptic bronchoscopy. Several studies demonstrate that its use during these procedures decreases the incidence of desaturation, reduces the need for interventions to maintain airway patency and minimizes procedure interruption.[11,12]

The use of HFT has also been considered in the management of both acute and chronic heart failure (HF) due to its capacity to generate discrete levels of positive end-expiratory pressure (PEEP). In the case of cardiogenic acute pulmonary edema, it has not demonstrated superiority over continuous airway pressure (CPAP) or NIV, in terms of intubation rate, improvement of physiological parameters or relief of dyspnea. However, it has shown superiority compared to conventional oxygen therapy.[13] It thus appears that HFT represents a reasonable alternative to CPAP/NIV in patients who are intolerant to these forms of respiratory support.

In patients with chronic heart failure (HF) and a reduced left ventricular ejection fraction, the efficacy of this therapy has been demonstrated, primarily by generating a mild PEEP effect. As an indirect marker of this PEEP, a significant decrease in inferior vena cava collapse was observed at flow rates of 40 bpm, accompanied by physiological benefits. These benefits appear to be related to the hemodynamic effect generated by intrathoracic positive pressure, which decreases right preload.[14]

While CPAP is the main treatment of obstructive sleep apnoea (OSA), around 30% of the patients may not tolerate it, and some other side effects can be derived from the mask use, such as retrognathia and lingual retropulsion.[15] In such cases, although HFT does not match the efficacy of CPAP, it does achieve significant reductions in the apnoea–hypopnoea index. In any case, the impact of this intervention on nocturnal oxygenation remains uncertain. In fact, a recent meta-analysis found no significant improvement in this aspect. Nevertheless, it should be noted that it included numerous studies with methodological limitations, such as the omission of FiO_2 delivered.[16] In the case of patients with COPD-OSA Overlap Syndrome and nocturnal RF, an improvement in oxygenation has been observed with the use of HFT, suggesting that this therapy could be considered in patients with CPAP intolerance.[17]

It is mandatory to consider the possible limitations of HFT before adopting it as a treatment (even "off-label") in these "borderline" indications:

- The available scientific evidence is very limited. Most studies are observational, with small numbers of participants and very heterogeneous samples, making it difficult to draw firm conclusions. In addition, the primary objectives were of little clinical relevance.
- The cost-effectiveness evaluation of this technique is largely absent in all the studies, as it is necessary to consider not only the equipment, but also the consumables, the need for patient monitoring and the increase in oxygen consumption.[18,19]
- The potential side-effects entailed by this treatment should be considered, particularly at the oropharyngeal, bronchial and pulmonary levels. A recent physiological study published by Drs Heili's group[20] highlights the potential risks of generating elevated alveolar pressures when high flows are used and may worsen hyperinflation and dyspnea in COPD patients.

In conclusion, it can be stated that the use of HFT has become a mainstream ventilatory support modality in our respiratory units. Its indications are expanding, and it is therefore necessary to study its application in the treatment of our patients, both hospitalized and at home. In any case, it is important to remember that all these new applications of HFT require a thorough evaluation, based on high-quality evidence, of their benefits, cost-effectiveness and potential risks before they can be widely adopted.

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Laura González Ramos [a,*], Javier Sayas Catalán [a,b], Victoria Villena Garrido [a,b]
[a] *Hospital Universitario 12 de Octubre, Spain*
[b] *Universidad Complutense de Madrid, Facultad de Medicina, Spain*

[*] Corresponding author.
E-mail address: lauragramos@hotmail.es (L. González Ramos).