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Letter to the Director

High-flow Nasal Cannula Ventilatory Modalities

To the Director,

Currently, high-flow nasal cannula therapy (HFNC) is considered as a non-invasive respiratory support therapy suitable for patients experiencing both hypoxemic and hypercapnic respiratory failure. At first glance, setting HFNC seems to be very simple to use. The main menu of the HFNC devices offers only three key parameters: flow, temperature and FiO_2. However, several studies have also shown us that setting HFNC may not be as simple as it initially seems, opening the door to defining HFNC ventilatory modalities similar to those used in non-invasive ventilation.

We could categorize the HFNC effects into three groups: 1. humidification and warming effects, which are common to all HFNC patients, impacting mucociliary clearance, patient comfort and tolerance, 2. airway pressurization effects, particularly significant for hypoxemic ARF patients, and 3. CO_2 washout effects, relevant for hypercapnic ARF patients. Can HFNC settings be customized to prioritize certain mechanisms over others? Existing evidence suggests that customization is feasible.

From the beginnings of HFNC, it has been clear that there is a direct correlation between the administered flow rate and the resultant airway pressure.[1] However, factors beyond flow rate can also influence pressurization. The first one is related to the degree of elastance of the rib cage (with a constant flow, elastance that determines the airway pressure). Secondly, the size of the cannula (larger cannulas covering a larger nares surface area increase airway pressure[2]). Thirdly, the patient's breathing pattern (the pressure is higher with mouth-closed breathing[3]). Fourthly, the type of gas used (lower-density inspired gas as helium–oxygen mixture, leads to lower airway pressure[4]). Finally, the airway access (pressure is lower when HFNC is administered through tracheostomy vs nasal cannula). Studies conducted during the COVID-19 pandemic have also highlighted additional HFNC optimization techniques, including prone maneuvers and surgical mask placement.[5]

Conversely, certain circumstances enhance CO_2 washout. Different studies have shown that CO_2 washout increase when the patient breathes with an open mouth[3] or when smaller cannulas leave more space in the nostrils.[2] It is worth noting that the density of the inspired gas, whether it is ambient air, O_2 or a helium–O_2 mixture, does not alter CO_2 washout.

In summary, we could clearly differentiate three ventilatory strategies or modalities when setting up a HFNC (Fig. 1). In hypoxemic ARF patients it would be advisable to use high-flow rates and cannulas covering more than 50% of the nares, encourage mouth-closed breathing, avoid low-density gases, and consider mask placement and prone maneuvers for oxygenation. In hypercapnic ARF patients, lower flow rates and cannulas that occlude less than 50% of the nares should be more appropriate. Advise open-mouth breathing and consider low-density gas mixtures if needed. Finally, for patients with compromised mucociliar clearance, high flows are unnecessary, and the focus should primarily be on gas humidification and warming.

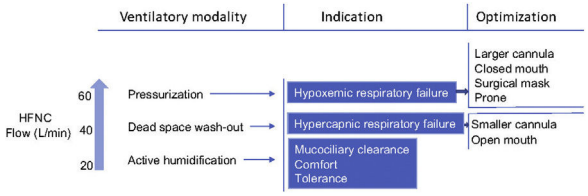

Fig. 1. High-flow nasal cannula ventilatory modalities. HFNC: high-flow nasal cannula.

To our knowledge, this is the first time that ventilatory modalities applied to HFNC have been described. Future studies are necessary to enhance our understanding of HFNC and the impact of different HFNC settings on clinical outcomes.

Conflict of Interest

The authors do not have any conflict of interest related to this manuscript.

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Salvador Díaz Lobato [a,*], José Manuel Carratalá Perales [b], Guillermo Montiel [c], José Miguel Alonso Íñigo [d]

[a] *HLA Hospital Universitario Moncloa, Universidad Europea, Nippon Gases Healthcare, Madrid, Spain*
[b] *Unidad de Corta Estancia, Servicio de Urgencias, Hospital General de Alicante, Spain*
[c] *Servicio de Anestesiología y Reanimación, Hospital Universitario y Politécnico La Fe, Valencia, Spain*
[d] *Servicio de Neumonología, Hospital J.A. Fernández, Buenos Aires, Argentina*

Corresponding author.
E-mail address: sdiazlobato@gmail.com (S. Díaz Lobato).