



## Editorial

# High-flow Oxygen Therapy in Post-Lung Transplant Patients<sup>☆</sup>



## Alto flujo en pacientes postrasplantados de pulmón

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In recent decades, the number of lung transplantations has grown very significantly, and this technique has come to be considered the treatment of choice in the final stages of certain lung diseases. Nevertheless, lung transplant patients have particular characteristics, due not only to their differing degrees of immunosuppression, but also to the characteristics of the organ itself and the ribcage. These factors not only delay mechanical ventilation weaning in the immediate postoperative period, but can also lead to mid-to-long-term respiratory failure after transplantation. This is often due to infection, which, together with bronchiolitis obliterans syndrome associated with chronic rejection, limits life expectancy.<sup>1</sup>

Both delayed withdrawal of mechanical ventilation and acute hypoxemic respiratory failure, generally associated with infectious complications, lead to prolonged intensive care unit (ICU) stays, both in the immediate post-operative period and in subsequent re-admissions. These complications are associated with a grimmer prognosis and prolonged mechanical ventilation.<sup>1</sup>

In this setting, high flow nasal cannula (HFNC) therapy can be of particular use. HFNC is a system of administration of medicinal gas based on the principle that the flow delivered must be equal to or greater than the inspiratory flow demands of the patient, with flows of up to 60 lpm and the  $F_{I}O_2$  required to achieve correct oxygenation (0.21–1). The key point is that the patient can tolerate such high flows because the system delivers adequately heated and humidified gas, i.e., 37 °C and 44 mg/l.<sup>2</sup> The HFNC system improves respiratory failure in some patients<sup>3</sup> by minimizing the dilution with ambient air and thus optimizing  $F_{I}O_2$  values, and reducing dead space and airway resistance, which in turn reduce work of breathing and the metabolic cost of gas conditioning. All this, in addition to changing the ventilatory pattern and generating a certain level of continuous positive airway pressure, lead to an

improvement in the hemodynamic profile. All this is achieved with the use of a very comfortable and well tolerated system. Although the active humidifier used in this system no doubt has a major role in the management of bronchial secretions and in the maintenance of cell structure and ciliary function, its real impact in unventilated patients compared with the administration of poorly conditioned oxygen has yet to be determined.

Extubation problems in patients after lung transplantation are generally due either to symptoms associated with primary graft dysfunction, causing severe hypoxemia, or else to disorders caused by diaphragmatic paralysis. In the latter situation, if the standard criteria for mechanical ventilation weaning are applied, patients may continue to need some level of airway pressure, and non-invasive strategies (non-invasive ventilation or HFNC) may play a useful role, provided the patient does not present complete diaphragmatic paralysis.<sup>1</sup>

Although no specific studies have been conducted on the role of HFNC in the extubation of transplant recipients, some studies support the utility of this system in optimizing extubation outcomes in critical patients (some of whom had undergone thoracic surgery),<sup>4</sup> or in patients with a high risk of extubation failure. A comparison of non-invasive ventilation with HFNC showed a lower incidence of reintubation among patients receiving HFNC.<sup>5</sup>

A recent French multicenter study of the role of HFNC in the treatment of patients with acute hypoxemic respiratory failure found that it improved mortality in the most hypoxemic patients compared to conventional oxygen therapy or non-invasive ventilation.<sup>6</sup> A subanalysis of that study, conducted in immunosuppressed patients (as is the case for lung transplant recipients), found that the benefit of HFNC remained superior to that of non-invasive ventilation.<sup>7</sup> No conclusive studies have been published on the potential role of this technique in the prevention of atelectasis in these patients, although it is clear that loosening secretions must have some impact.

More specifically, our group was able to show, for the first time in a non-randomized retrospective single-center study of transplanted patients readmitted to an ICU with symptoms of acute respiratory failure, generally due to infection, that HFNC reduced

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the need for invasive mechanical ventilation in up to one third of patients, thus improving survival.<sup>8</sup>

It is clear that HFNC is a well-tolerated non-invasive respiratory support system.<sup>9</sup> In lung transplant recipients particularly, it may be useful for expediting extubation in some patients and for providing support to those who are readmitted with hypoxemia, thus avoiding intubation and invasive ventilation and the associated impact on prognosis. Nevertheless, more studies must be performed in both situations in lung transplant recipients, since we should not forget that delaying intubation and invasive ventilation in cases in which the technique fails can in itself worsen a patient's prognosis.<sup>10</sup>

## References

1. Leal S, Sacanell J, Riera J, Masclans JR, Rello J. Early postoperative management of lung transplantation. *Minerva Anesthesiol.* 2014;80:1234–45.
2. Roca O, Hernández G, Díaz-Lobato S, Carratalá JM, Gutiérrez RM, Masclans JR, Spanish Multidisciplinary Group of High Flow Supportive Therapy in Adults (HiSpaFlow). Current evidence for the effectiveness of heated and humidified high flow nasal cannula supportive therapy in adult patients with respiratory failure. *Crit Care.* 2016;20:109.
3. Masclans JR, Pérez-Terán P, Roca O. The role of high flow oxygen therapy in acute respiratory failure. *Med Intensiva.* 2015;39:505–15.
4. Stéphan F, Barrucand B, Petit P, Rézaiguia-Delclaux S, Médard A, Delannoy B, et al., BiPOP Study Group. High-flow nasal oxygen vs noninvasive positive airway pressure in hypoxemic patients after cardiothoracic surgery: a randomized clinical trial. *JAMA.* 2015;313:2331–9.
5. Fernández R, Subira C, Frutos F, Rialp G, Laborda C, Masclans JR, et al. High-flow oxygen therapy for extubation failure prevention in high-risk critically ill patients: a randomized multicenter trial. *Intensive Care Med Exp.* 2015;3 Suppl 1:A164.
6. Frat JP, Thille AW, Mercat A, Girault C, Ragot S, Perbet S, et al. High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure. *N Engl J Med.* 2015;372:2185–96.
7. Coudroy R, Jamet A, Petua P, Robert R, Frat JP, Thille AW. High-flow nasal cannula oxygen therapy versus noninvasive ventilation in immunocompromised patients with acute respiratory failure: an observational cohort study. *Ann Intensive Care.* 2016;6:45.
8. Roca O, de Acilu MG, Caralt B, Sacanell J, Masclans JR, ICU collaborators. Humidified high flow nasal cannula supportive therapy improves outcomes in lung transplant recipients readmitted to the intensive care unit because of acute respiratory failure. *Transplantation.* 2015;99:1092–8.
9. Roca O, Riera J, Torres F, Masclans JR. High-flow oxygen therapy in acute respiratory failure. *Respir Care.* 2010;55:408–13.
10. Kang BJ, Koh Y, Lim CM, Huh JW, Baek S, Han M, et al. Failure of high-flow nasal cannula therapy may delay intubation and increase mortality. *Intensive Care Med.* 2015;41:623–32.