Journal of Critical Care (2012) **27**, 324.e9–324.e13

ELSEVIER

Journal of Critical Care

Impact of high-flow nasal cannula oxygen therapy on intensive care unit patients with acute respiratory failure: A prospective observational study☆,☆☆

Benjamin Sztrymf[a,b], Jonathan Messika[a,b,1], Thomas Mayot[a,1], Hugo Lenglet[a], Didier Dreyfuss[a,b], Jean-Damien Ricard[a,b,*]

[a]*Assistance Publique–Hôpitaux de Paris, Hôpital Louis Mourier, Service de Réanimation Médico-chirurgicale, 92700, Colombes, France*
[b]*UFR de Médecine, Université Paris Diderot–Paris 7 et PRES Sorbonne Paris Cité, 75018, Paris, France*

Keywords:
Oxygen inhalation therapy;
Heat;
Humidity;
Artificial;
Noninvasive positive pressure ventilation

Abstract

Purpose: The purpose of this study was to determine the impact of high-flow nasal cannula oxygen (HFNC) on patients with acute respiratory failure (ARF) in comparison with conventional oxygen therapy.

Materials and Methods: This was a prospective observational study. Patients with persistent ARF despite oxygen with conventional facemask without indication for immediate intubation were treated with HFNC oxygen. Clinical respiratory parameters and arterial blood gases were compared under conventional and HFNC oxygen therapy.

Results: Twenty patients, aged 59 years (38-75 years) and SAPS2 (simplified acute physiology score) 33 (26.5-38), were included in the study. Etiology of ARF was mainly pneumonia (n = 11), sepsis (n = 3), and miscellaneous (n = 6). Use of HFNC enabled a significant reduction of respiratory rate, 28 (26-33) vs 24.5 (23-28.5) breath per minute (P = .006), and a significant increase in oxygen saturation, oxygen saturation as measured by pulse oximetry 93.5% (90-98.5) vs 98.5% (95.5-100) (P = .0003). Use of HFNC significantly increased Pa_{O_2} from 8.73 (7.13-11.13) to 15.27 (9.66-25.6) kPa (P = .001) and moderately increased Pa_{CO_2}, 5.26 (4.33-5.66) to 5.73 (4.8-6.2) kPa (P = .005) without affecting pH. Median duration of HFNC was 26.5 (17-121) hours. Six patients were secondarily intubated, and 3 died in the intensive care unit.

Conclusion: Use of HFNC in patients with persistent ARF was associated with significant and sustained improvement of both clinical and biologic parameters.

☆ Funding: none.

☆☆ Conflict of interest: none.

* Corresponding author. Service de Réanimation Médico-chirurgicale, Hôpital Louis Mourier, 92700 Colombes, France. Tel.: +33 147 60 61 95; fax: +33 1 47 60 61 92.

E-mail address: jean-damien.ricard@lmr.aphp.fr (J.-D. Ricard).

[1] Authors contributed equally to the work.

0883-9441/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.jcrc.2011.07.075

1. Introduction

Oxygen supply constitutes the first-line therapy of patients with acute respiratory failure (ARF) [1]. It is generally provided via a facemask, nasal cannula, or nasals prongs. Oxygen flow through these devices is limited and generally no greater than 15 L/min. A certain degree of oxygen dilution (delivered oxygen is diluted with room air) may thus occur because of the difference between oxygen flow delivered by the device and patient's inspiratory flow [1], and for this reason, the greater the inspiratory flow, the greater the dilution. If this phenomenon may not impact too much on patients with mild hypoxemia, the situation may be different in more severe patients with more pronounced respiratory failure, bearing in mind that patient inspiratory flow rates may vary between 30 and more than 120 L/min during respiratory failure [2]. New devices now available deliver up to 60 L/min oxygen flow through wide bore nasal cannula. Given the high gas flows delivered by these devices, they are designed to heat and humidify the inspired gas; hence, the generic name of high-flow nasal cannula oxygen therapy (HFNC). If these devices are increasingly used with success in neonates [3-5], their beneficial effects in adults with respiratory failure are yet scarcely reported. A 30-minute evaluation showed an improvement in respiratory parameters in comparison with oxygen delivered via a facemask in intensive care unit (ICU) patients [6], and HFNC has been found to generate a certain level of positive pressure in healthy volunteers and in patients recovering from cardiac surgery. There are no data on a longer evaluation in the ICU. We, thus, aimed to investigate the effect of HFNC to alleviate respiratory distress and ameliorate oxygenation in adult ICU patients with ARF.

2. Methods

A prospective, observational study was conducted in a university hospital 12-bed ICU to investigate the effects of HFNC of respiratory parameters of patients with ARF. The Ethics Committee of the French Society of Intensive Care Medicine (SRLF) approved the study and did not require informed consent because use of HFNC is part of our common practice in these patients. All procedures were routine. Patients and/or family were, however, informed of the study, its purpose, and objectives.

2.1. Study population

Patients who were admitted to the ICU for persistent ARF (defined as oxygen saturation as measured by pulse oximetry <96% and/or a respiratory ≥25 beats per minute while receiving oxygen through a facemask at an estimated fraction of inspired oxygen [Fio_2] >50%) were eligible for inclusion in the study. Patients were excluded if they required immediate intubation.

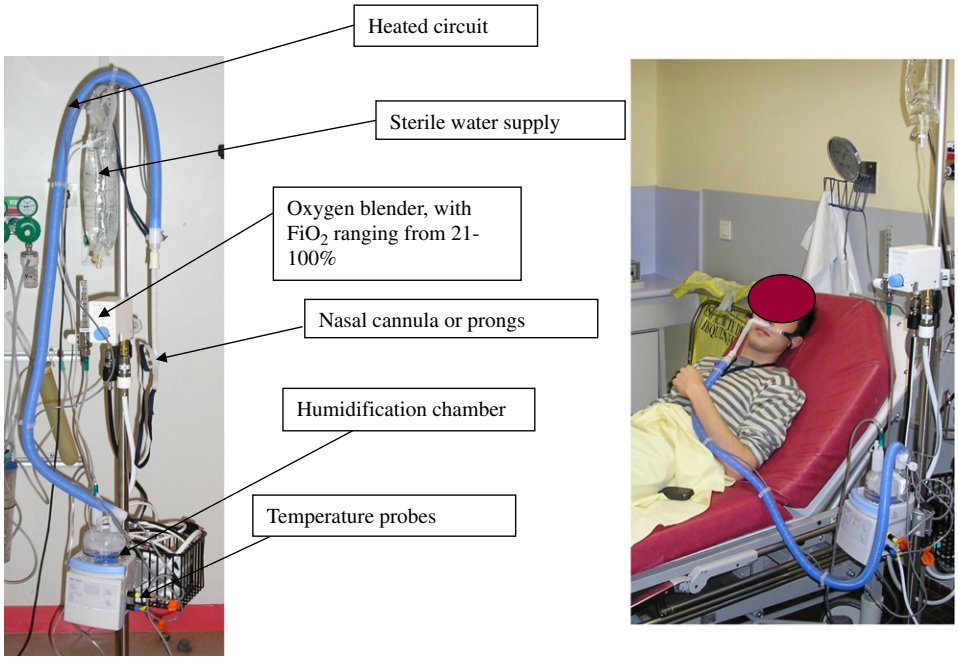

Fig. 1 Shows the device of HFNC. Air and oxygen are mixed through a blender to achieve the desired Fio_2 and flow. The gas mixture is admitted to the humidification chamber where it is heated and humidified. It is then delivered to the patient via a heated circuit to avoid heat loss and condensation and finally via wide bore nasal prongs or cannula.