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## **High-flow nasal cannula use for bronchiolitis treatment in French intensive care units: a transversal study**

Short title: High-flow nasal cannula use for bronchiolitis treatment

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**Conflicts of Interest:** none

**Abstract:**

Over the past 10 years, continuous positive airway pressure (CPAP) has revolutionized the prognosis and management of bronchiolitis patients hospitalized in pediatric intensive care units (PICUs). High-flow nasal cannula (HFNC) is emerging as an alternative to CPAP. Despite encouraging results of several clinical and physiological studies, HFNC use remains controversial and its indications heterogeneous. To better define the place of HFNC in severe bronchiolitis respiratory support, we investigated the different ventilation assistance techniques used for severe bronchiolitis over 3 days at the peak of a bronchiolitis epidemic in December 2015. We conducted an observational cross-sectional study in 27 French university hospital PICUs. Fifty-nine patients were included. The results show that HFNC already accounts for nearly half of the respiratory support techniques used for severe bronchiolitis in French PICUs with no significant difference between the CPAP group and the HFNC group of patients.

Key words: bronchiolitis; pediatric intensive care; noninvasive ventilation; high-flow ventilation; pediatrics

## **1. Introduction**

Bronchiolitis is a healthcare concern in France with 400,000 cases per year, with 30,000 needing hospitalization and 8–13% of those requiring ventilation assistance [1]. Over the past 10 years, continuous positive airway pressure (CPAP) has revolutionized the prognosis and the management of severe bronchiolitis [1,2]. A relatively new device for respiratory support, high-flow nasal cannula (HFNC) has emerged as an alternative to CPAP.

Despite the encouraging results of several clinical and physiologic studies, the clinical evidence remains limited and its use and indications controversial and heterogeneous [2,3].

## **2. Observation and discussion**

The aim of this study was to describe the different ventilation supports used for the treatment of bronchiolitis in patients hospitalized in the pediatric intensive care unit (PICU) or the intensive care

unit (ICU). We conducted an observational cross-sectional study in 27 French university hospitals for 3 days at the peak of a bronchiolitis epidemic in December 2015. It consisted in a telephone interview of a junior doctor in each unit with collection of the clinical characteristics (age, gender, congenital cardiopathy, neuromuscular disease, chronic disease, day of hospitalization, virus type, antibiotic administration, feeding route and daily fluid volume administration, natremia, sedation, and sedation drugs if present) and the ventilation settings (type of ventilation, ventilation settings, and oxygen concentration  $FiO_2$ ) of any neonates between 15 days and 3 months hospitalized for severe bronchiolitis in a PICU or ICU. The ethics committee gave its approval for the study (Study 15-043; CPP IdFVII). A Student *t*-test was used to compare the means of quantitative variables and for nonquantitative variables a chi-square or a Fischer test was used depending on the number of patients. All calculations were made using SPSS V23 software.

Twenty units answered positively, where 59 patients were hospitalized for severe bronchiolitis. The median age was 4.8 weeks, the median weight was 3.98 kg, and the median number of days of hospitalization was 4.7 at the time of the interview. Thirteen patients were born prematurely and five presented with congenital heart disease. Four patients were intubated and mechanically ventilated, four were on noninvasive ventilation (NIV) with a bilevel airway pressure (BiPAP) mode, 25 were on NIV with a CPAP mode, 22 were on a HFNC, and four had nasal oxygen. A median of 33.55% (see Fig. 1) of the patients were ventilated with HFNC.

Ventilation settings were homogenous for both CPAP and HFNC and in accordance with the international recommendations. For HFNC the median flow was 2 L/kg/min (1–3 L/kg/min) and the median  $FiO_2$  was 27% (21–50%). For CPAP, the median pressure was 6 mmHg (3–12.5 mmHg) and the median  $FiO_2$  was 24% (21–40%). No clinical difference was found between the CPAP group and the HFNC group. Compared with the CPAP group, fewer patients treated with HFNC had congenital heart disease (0 vs 16%; ns), fewer were preterm neonates (19% vs 32%; ns), they received respiratory assistance later (day 3.1 vs day 2.5; ns), fewer were treated with antibiotics (22% vs 40%;  $p=0.03$ ), and they appeared more likely to receive discontinuous nasogastric tube feeding (67% vs 44%; ns).

### 3. Conclusion

Altogether these results show that despite the absence of a strong consensus, HFNC is widely used in French ICUs and PICUs as a ventilation support for bronchiolitis. Due to the small group size, no difference in antibiotic administration was found between the HFNC group and the CPAP group. Further studies are needed to better define the exact position of HFNC in severe bronchiolitis respiratory support strategy.

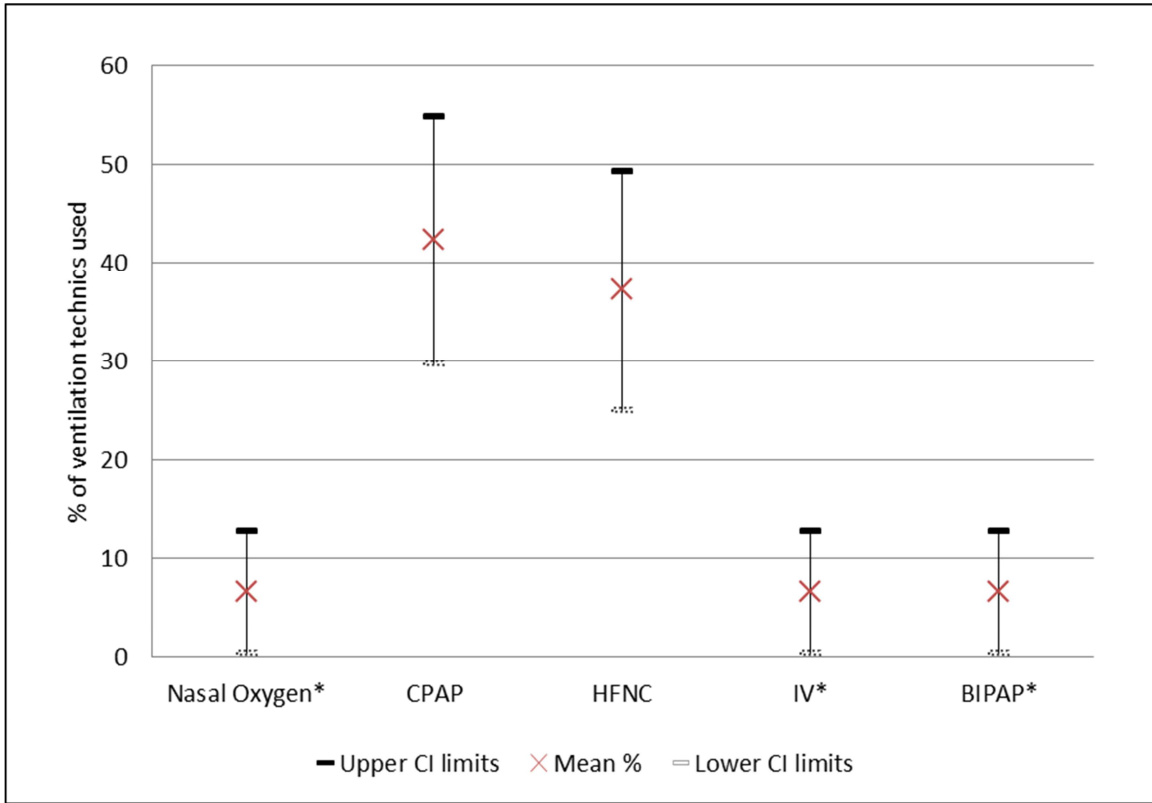
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### Figure

**Figure 1:** Mean percentage and confidence interval (CI) of different ventilation techniques in 20 French PICUs and ICUs.

Nasal oxygen consisted in oxygen administered through a nasal prong; IV, invasive ventilation; NIV, noninvasive ventilation; BiPAP, NIV with bilevel airway pressure mode; CPAP, continuous airway pressure; HFNC, high-flow nasal cannula; PICU, pediatric intensive care unit; ICU, intensive care unit.



\* For the confidence interval, figures are displayed only for information; application conditions are not met