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Non-invasive ventilation in the treatment of early hypoxemic respiratory failure caused by COVID-19: considering nasal CPAP as the first choice

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High-flow nasal oxygen (HFNO) and non-invasive ventilation (NIV) have been used to manage early acute hypoxemic respiratory failure (AHRF) caused by COVID-19. As there is no evidence-based recommendation for the selection of HFNO or NIV, staff tend to base their choice on personal preference (Fig. 1).

Frat et al. [1] showed that HFNO was associated with lower 90-day mortality in AHRF patients, which had a strong impact on clinical practice. However, there are some limitations in methodology. Firstly, NIV median daily usage was only 8 h. Furthermore, high expiratory tidal volume (9.2 ± 3.0 mL/kg) and low PEEP (5 cmH_2O) may have negative impact on the efficacy of NIV. When considering therapeutic mechanisms, adjustable airway pressure, oxygen consumption, and patient tolerance, nasal continuous positive airway pressure (nCPAP) seems to have advantages and should be considered as the first choice.

As for therapeutic mechanism, HFNO is supposed to generate low PEEP (3 cmH_2O on average). However, this pressure level is unstable, uncontrollable, and affected by many factors [2]. In contrast, nCPAP can provide stable and adjustable airway pressure.

When considering constant, high fraction of inspired oxygen (FiO_2) and oxygen consumption, HFNO has the advantage of providing stable FiO_2. However, it consumes large amounts of oxygen. When FiO_2 is set to be 50% and flow to be 50 L/min, 18.4 L/min of 100% oxygen will be consumed. With nCPAP, a mean of 50% FiO_2 can be achieved with 5–6 L/min of 100% oxygen delivered directly into the mask. Given current resource limitations, oxygen supply should be an important consideration as patients requiring oxygen increases dramatically.

Patient tolerance when continuously using HFNO or NIV is another consideration, as continuous positive airway pressure without interruption seems important during AHRF, especially early ARDS [3]. HFNO has particular advantage in tolerance. However, nCPAP remains well-tolerated with no patient-ventilator asynchrony.

With regard to concerns that nCPAP may increase risk of transmission, evidence remains controversial. Recent study stated that exhaled air dispersion would also increase during HNFO, theoretically making it no better than nCPAP [4]. In Guangdong, China, no healthcare workers were infected during NIV management under the Chinese guidance of personal protection [5].

In conclusion, there remains paucity evidence on how to choose between HFNO and nCPAP treating mild AHRF due to COVID-19. Theoretically, nCPAP has more advantages. Prospective randomized controlled trials are necessary to compare HFNO with nCPAP to provide more evidence on the indications for different non-invasive respiratory support and also indications for selecting between NIV and intubation.

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	Published date	Journal	Country	NIV	HFNO
Arentz et.al	April, 2020	JAMA	United States	4 (19)	1 (5)
Grasselli et.al	April, 2020	JAMA	Italy	137 (11)	N.A.
Myers et.al	April, 2020	JAMA	United States	1 (1)	4 (4)
Piva et.al	April, 2020	Journal of Critical Care	Italy	13 (39)	N.A.
Wang et.al	February, 2020	JAMA	China	15 (42)	4 (11)
Yang et.al	February, 2020	Lancet	China	29 (56)	33 (64)
Yu et.al	May, 2020	Critical Care	China	20 (9)	37 (16)
Zheng et.al	May, 2020	Journal of Zhejiang University	China	N.A.	18 (53)

Fig. 1 Proportion of patients with COVID-19 receiving NIV or HFNO in ICU among different studies. Data are *n* (%). COVID-19, coronavirus disease 2019; NIV, non-invasive ventilation; HFNO, high flow nasal oxygen; ICU, intensive care unit, N.A., not applicable

Abbreviations

HFNO: High-flow nasal oxygen; NIV: Non-invasive ventilation; AHRF: Acute hypoxemic respiratory failure; COVID-19: Coronavirus disease 2019; nCPAP: Nasal continuous positive airway pressure; FiO_2: Fraction of inspired oxygen

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Authors' contributions

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