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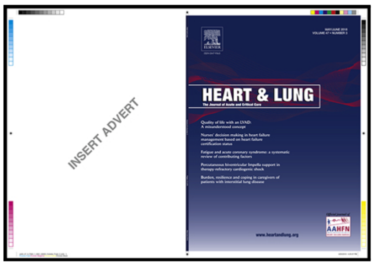

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High flow nasal cannula is a good treatment option for COVID-19

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An outbreak of 2019 novel coronavirus disease (COVID-19) in Wuhan, China in December 2019 has quickly spread nationwide. As of March 7, 2020, more than 100,000 cases of disease have been confirmed globally [1]. Although most patients show mild symptoms, 26% of them develop severe and critical diseases [2]; notably, they may exhibit acute respiratory distress syndrome (ARDS), which is an important cause of COVID-2019-associated death. Patients with severe/critical disease generally receive symptomatic treatments such as antiviral therapy, anti-infection therapy, and maintenance of a stable internal environment; during such treatment, timely and effective oxygen therapy is essential. Conventional oxygen therapy by nasal catheter is only suitable for patients with mild disease; non-invasive mechanical ventilation requires man–machine cooperation and is uncomfortable. Here, we describe eight patients with COVID-2019 who were treated with high-flow nasal cannula (HFNC); our findings suggest that HFNC is a suitable choice for treatment of patients with severe or critical COVID-2019.

Infectious Diseases Branch of Anhui Provincial Hospital is the largest hospital designated for treatment of COVID-2019 in Anhui Province. As of March 7, 2020, 84 patients with COVID-2019 had been admitted to our hospital, including 60 patients with moderate disease and 24 patients with severe/critical disease. Of 42 patients who were receiving oxygen therapy, more aggressive respiratory support was required in four patients with severe COVID-2019 and four patients with critical COVID-2019, including five men and three women (mean age, 61.38±18.97 years; range, 40–91 years). Seven of the eight patients exhibited underlying disease, including four with hypertension, three with diabetes mellitus, two with cerebral infarction, one with rheumatic disease, one with chronic renal insufficiency, and one with gastrointestinal bleeding (Table 1). While receiving general treatment such as antiviral therapy (i.e., lopinavir/ritonavir, Interferon-α), anti-infection therapy, and nutritional support, all eight patients received low doses and short courses of corticosteroid treatment; four patients were treated with tocilizumab.

Chest imaging of the eight patients revealed multiple ground-glass opacities in both lungs with blurred edges at the time of admission; two of the eight patients exhibited air bronchogram signs after focal consolidation. Oxygen saturation (SpO_2) was generally maintained at 84%–92%; two patients immediately received HFNC treatment, while the remaining six patients switched to HFNC treatment due to deterioration of respiratory function after 4.50±3.08 days of general oxygen therapy. Blood-gas analysis before receipt of HFNC treatment showed that the mean oxygenation index (partial pressure of oxygen/fraction of inspired oxygen, P/F) of the eight patients was 259.88±58.15 mmHg; six patients had developed ARDS, with a mean pneumonia severity index of 3.62±1.19. The initial oxygen concentration was set at 100%. After 2 hours of HFNC treatment, the rate of oxygenation (ROX) index was calculated as SpO_2/(fraction of inspired oxygen × respiratory rate) in accordance with the method used by Roca et al. [3]. The ROX indices were ≥ 4.88 in all patients; the patients were monitored continuously for 12 hours, and the ROX indices remained ≥ 4.88, indicating a high success rate of HFNC treatment. After 24 hours, the SpO_2 was maintained between 95% and 100%; the P/F increased to 280–450 mmHg. During the course of treatment, the oxygen concentration decreased gradually; patients were switched to conventional oxygen therapy after a mean of 7.38±2.07 days, when their conditions were improved (Table 1). Except for one patient with Alzheimer's disease, the patients showed good compliance and high tolerance. All eight patients subsequently improved and were discharged from the hospital.

HFNC can provide a specific positive end-expiratory pressure, which has a robust effect on mild to moderate type I respiratory failure [4]; it can also provide adequately warmed and humidified gas through the nasal pharynx reduces the metabolic work associated with gas conditioning. [5]. Moreover, HFNC can reduce the intubation rate and improve clinical prognosis in patients with acute respiratory failure [6]. During treatment of the eight patients in this report, we found that HFNC could fulfill their oxygen requirements. Although guidelines also recommend noninvasive ventilation when ARDS or hypoxemia cannot be alleviated after standard oxygen therapy [7], HFNC has more advantages, compared with noninvasive ventilation, in isolation wards. First, most patients with severe/critical disease are elderly patients, typically unaccompanied by family members; the unfamiliar uniforms of the medical staff and panic regarding the disease will increase their anxiety, while claustrophobia caused by non-invasive ventilation can worsen the situation. Indeed, a 91-year-old patient with comorbid Alzheimer's disease required treatment with sedative and antianxiety drugs due to severe anxiety and panic. Second, non-invasive ventilation requires man–machine cooperation, which may be difficult for elderly patients; the extent of this cooperation directly affects the efficiency of oxygen therapy. Third, during the COVID-19 outbreak, the number of patients increased rapidly in a short period of time, resulting in a shortage of intensive care physicians and respiratory therapists who can provide patients with noninvasive ventilation; notably, HFNC can be easily implemented and managed by general physicians. Therefore, HFNC constitutes a good treatment option for patients with COVID-2019. Importantly, none of the patients admitted to our hospital with severe/critical disease required noninvasive ventilation; only one patient received endotracheal intubation to prevent death.

This study was limited to a small number of patients with mild or moderate ARDS; HFNC cannot be substituted for invasive ventilation in patients with severe ARDS. To avoid delayed intubation while using HFNC, clinicians should carefully monitor the transformation from mild/moderate ARDS to severe ARDS.

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Table 1. Characteristics of eight patients with COVID-2019 who were treated with high-flow nasal cannula

Characteristic	Patient 1	2	3	4	5	6	7	8
Gender	M	M	F	M	F	M	M	F
Age(y)	88	57	47	47	65	40	91	56
Complication	Hypertension, multiple cerebral infarction, chronic renal insufficiency, gastrointestinal bleeding	Type 2 diabetes	Type 2 diabetes	Hypertension	Type 2 diabetes mellitus, rheumatoid arthritis, Sjogren's syndrome	No	Hypertension, sequelae of cerebral infarction	Hypertension
PSI	5	4	2	3	4	2	5	4
HFNC usage time (d)	6	6	9	6	9	7	11	5
ROX index after HFNC treatment for 2 h	7.07	6.86	8	5.16	5.52	12.1	7.03	5.9
ROX index after HFNC treatment for 12 h	8.16	9.24	10.25	6.03	7.89	12.6	8.23	6.72
SPO_2(%) before HFNC	88	88	85	90	85	92	84	90

SPO_2(%) after HFNC	98	96	95	99	95	97	95	98
Oxygenation index before HFNC (mmHg)	223	285	312	273	226	360	185	215
Oxygenation index after HFNC (mmHg)	363	352	282	335	320	445	280	290
Oxygen flow rate (L/min)	50	50	40	50	60	50	40	60

Note: M, male; F, female; PSI, pneumonia severity index; HFNC, high-flow nasal cannula; SPO_2, oxygen saturation.