



Nasal high-flow therapy for type II respiratory failure in COPD: A report of four cases



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ABSTRACT

Herein we present a report of four cases of severe type II respiratory failure that had contraindications both to conventional non-invasive ventilation and to endotracheal intubation. In all four cases, we successfully used a high-flow nasal oxygen device as a rescue device, with very reassuring outcomes.

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Although non-invasive positive-pressure ventilation (NPPV) is the therapy of choice for acute hypercapnic respiratory failure in acute exacerbation of COPD, around 25% of patients present contraindications to NPPV [1], and another 15% cannot tolerate NPPV [2]. Other non-invasive treatment modalities are thus sorely needed.

We report here on four patients with severe respiratory failure, who had contraindications for NPPV, and whom we successfully rescued with nasal high-flow oxygen therapy (NHF) [3]. In all cases, we used the Optiflow device (Fisher and Paykel Healthcare Ltd, Auckland, New Zealand), set at 55L/min, and with FiO₂ adjusted for SpO₂ ≥ 90%. Two of our patients achieved complete clinical and laboratory response in less than 4 h, suggesting that NHF is a potent intervention. All venous blood gas values are summarized in Table 1. To our best knowledge, this is the first report of successful treatment of severe hypercapnic respiratory failure with NHF.

The first patient was a 83 years old man, known for dementia and long-standing severe COPD. He had a do not intubate order in his file. He was transferred to our emergency department from his nursing home for a suspected acute exacerbation of COPD. Upon arrival, the patient was obtunded (Glasgow Coma Scale 8), with shallow breathing at 30 per minute. Given his depressed level of consciousness, non-invasive positive-pressure ventilation was not attempted. After discussion with the family, we began a trial of NHF. After 16 hours of therapy, the patient regained his normal level of

consciousness, and was discharged with a prescription of oral corticoids.

The second patient was a 55 years old man with obesity, schizophrenia, COPD, untreated obstructive sleep apnea with chronic retention of CO₂, and diabetes. He had previously refused CPAP therapy, and had a do not intubate order. The patient was transferred from a psychiatric facility for respiratory failure. He was mildly obtunded on arrival (GCS 12). After 20 hours of high-flow therapy, the patient was markedly improved, and NHF was replaced by conventional supplemental oxygen at 4L/min. We were able to wean oxygen supplementation four days later, and the patient was returned to the psychiatric facility.

The third patient was a frail 79 years old woman with COPD who developed respiratory failure on the second day after admission. She was breathing at 45 per minute and refused NPPV on the basis of previous uncomfortable experience. She accepted a trial of NHF. After three hours of therapy, she was breathing comfortably at 20 per minutes.

Finally, a fourth patient, a 84 years old nursing home resident known for COPD, with pneumonia and worsening respiratory fatigue and hypercapnia upon arrival to our emergency responded to NHF, with clinical improvement and blood gas normalization after 4 h of therapy.

The efficacy of NHF in hypercapnic respiratory failure is physiologically plausible, and probably revolves around the washout of CO₂ from the anatomical dead space, with resulting increase in ventilatory efficiency [3]. The four cases reported herein suggest a clinical benefit that could hardly be attributed to luck or natural course of the disease, given the severity of the respiratory failure

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Table 1

Venous blood gas (VBG) values upon arrival and after successful treatment with Nasal High-Flow Oxygen.

	Initial VBG	Normalized VBG	Time to normalization
Patient 1	pH 7.16; pCO ₂ 80; HCO ₃ ⁻ 20	ph 7.35; pCO ₂ 50; HCO ₃ ⁻ 26	16h
Patient 2	pH 7.27; pCO ₂ 100; HCO ₃ ⁻ 32	pH 7.38; pCO ₂ 68; HCO ₃ ⁻ 34	20h
Patient 3	pH 7.19; pCO ₂ 80; HCO ₃ ⁻ 22	pH 7.36; pCO ₂ 40; HCO ₃ ⁻ 22	3h
Patient 4	pH 7.18; pCO ₂ 74; HCO ₃ ⁻ 18	pH 7.36; pCO ₂ 48; HCO ₃ ⁻ 24	4h

N.B. pCO₂ is in mmHg and HCO₃⁻ in mEq/L.

observed in our patients.

We conclude that NHF has a role in treating type II respiratory failure, either as a rescue therapy when intubation and NPPV are contraindicated, when NPPV is not tolerated, or even as an alternative to NPPV in carefully selected and closely monitored patients. Although the present evidence for NHF is still anecdotal, it is worth trying in desperate cases where no other option is possible.

Author contributions

IP drafted the manuscript. PP and SP critically revised and approved the final version of the manuscript.

Conflicts of interests

NONE for the three authors.

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