Optimizing High-Flow Nasal Cannula Flow Settings in Adult Hypoxemic Patients Based on Peak Inspiratory Flow during Tidal Breathing

Supplementary files

Fig. S1 The setup of device to measure patient breathing patterns

A flow sensor was connected to a mask and Y-piece, with one end attached to a one-way valve for expiration, while the other end was attached to an oxygen reservoir bag with one-way valve for inspiration. Oxygen tubing from the reservoir bag was connected to a backpressure compensated flowmeter and an air-oxygen blender to provide inhaled gas with a constant F_IO_2. F_IO_2 was titrated to maintain SpO_2 at 90-97% during measurement. Flow sensor was connected to NICO2 monitor to measure patient's breathing profiles during tidal breathing, including peak tidal inspiratory flow, tidal volume, inspiratory time, and respiratory rate.

F_IO_2, fraction of inspired oxygen; SpO_2, pulse oximetry.

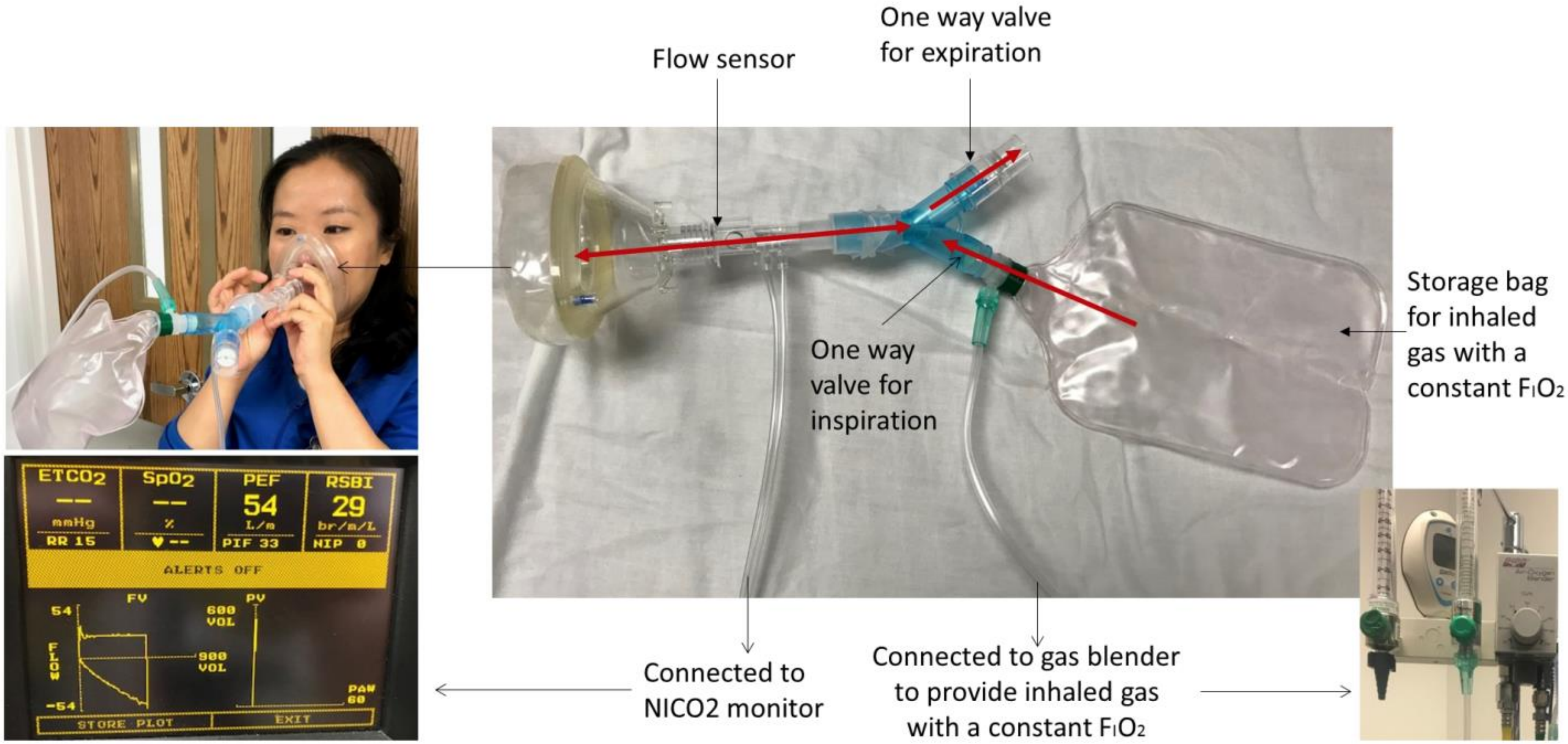

Fig. S2 The in-vitro experiment setup

An adult manikin (Laerdal adult airway management trainer, Stavanger, Norway) with size appropriate airway anatomy was attached to one chamber of a model lung (TTL, Michigan Instruments, Grand Rapids, USA), while the other chamber was connected to a critical care ventilator (Drager Evita XL, Drager, Lubeck, Germany) to simulate respiratory drive. The two chambers moved together via a rigid metal connector to simulate spontaneous breathing. Ventilator settings were adjusted to replicate the breathing patterns that were acquired from patients and the flow settings in the clinical study. A flow sensor and NICO2 monitor was connected between the manikin's trachea and the model lung to confirm the breathing patterns. Between the trachea and the model lung, a pressure manometer and an oxygen analyzer were connected via a T-piece to measure F_IO_2 and pressure, respectively at the trachea.

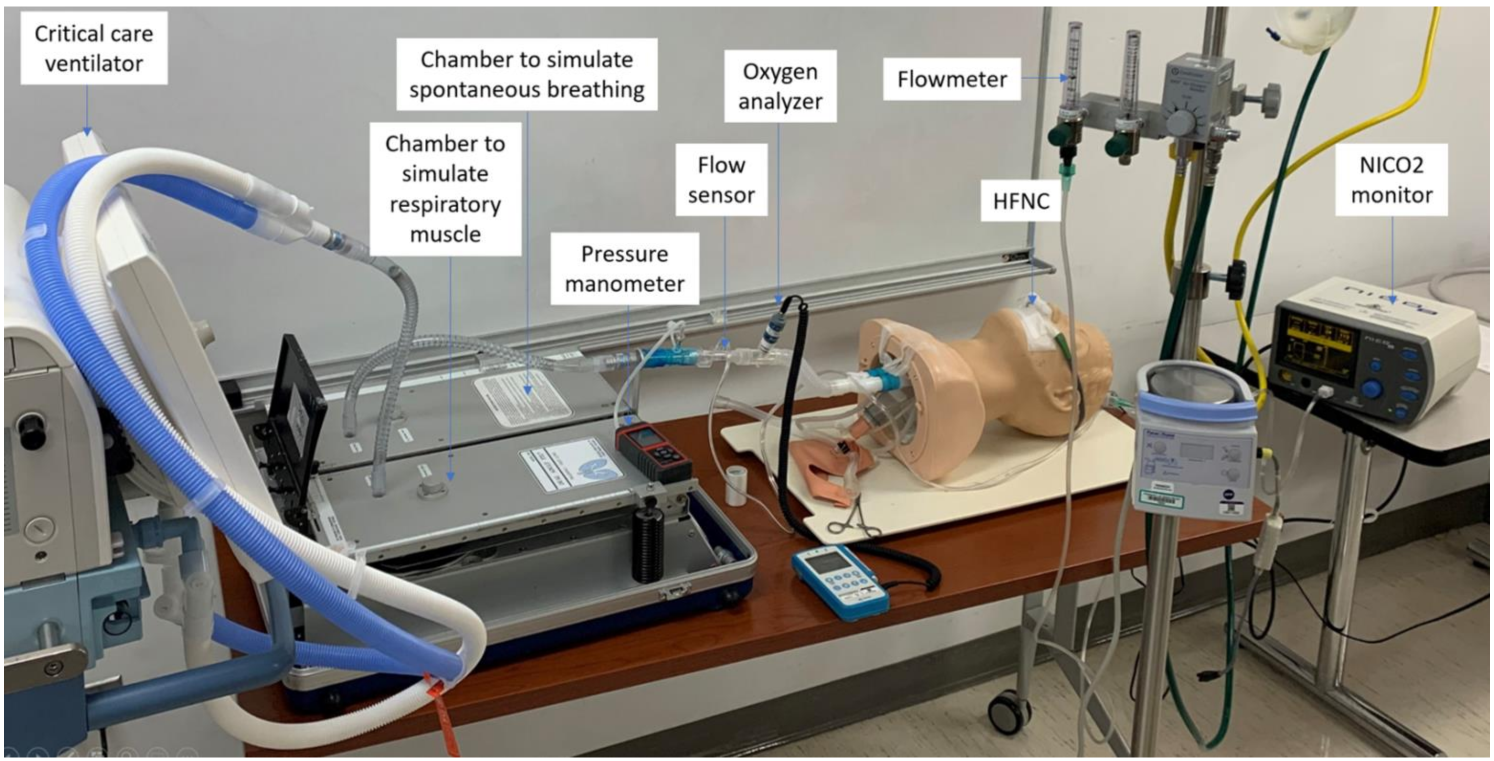

Fig. S3 Individual patient responses to different flow settings for patients whose PTIF is 20-30 L/min

For patients whose PTIF is 20-30 L/min, HFNC flow at 10 and 20 L/min above PTIF significantly improved SpO_2/F_IO_2 and ROX index, with comparison to HFNC flow at PTIF level. However, there was no significant differences of SpO_2/F_IO_2 and ROX index at 20 and 30 L/min above PTIF. PTIF, patient tidal inspiratory flow; SpO_2, pulse oximetry; F_IO_2, fraction of inspired oxygen; ROX, SpO_2/F_IO_2/respiratory rate.

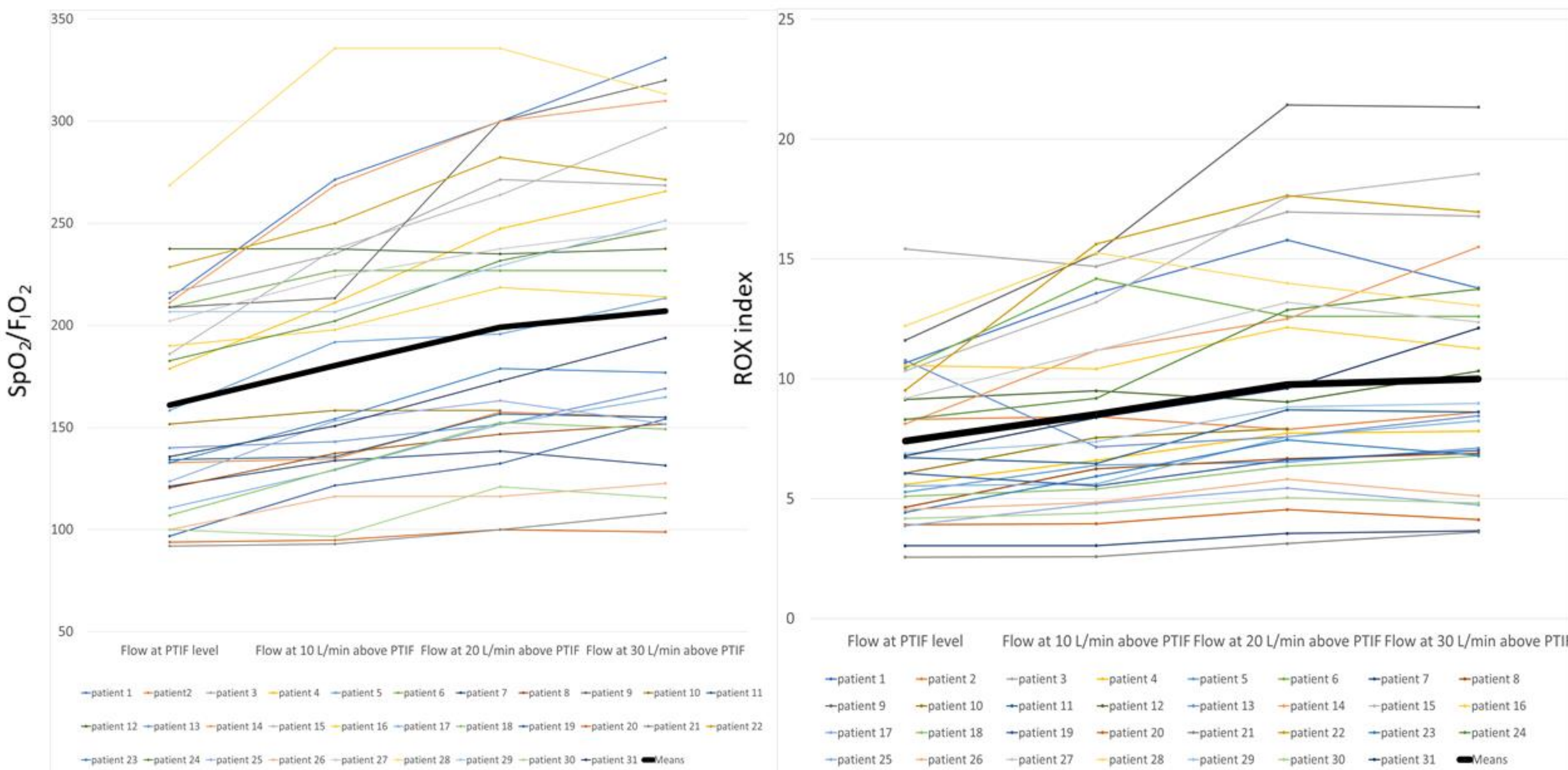

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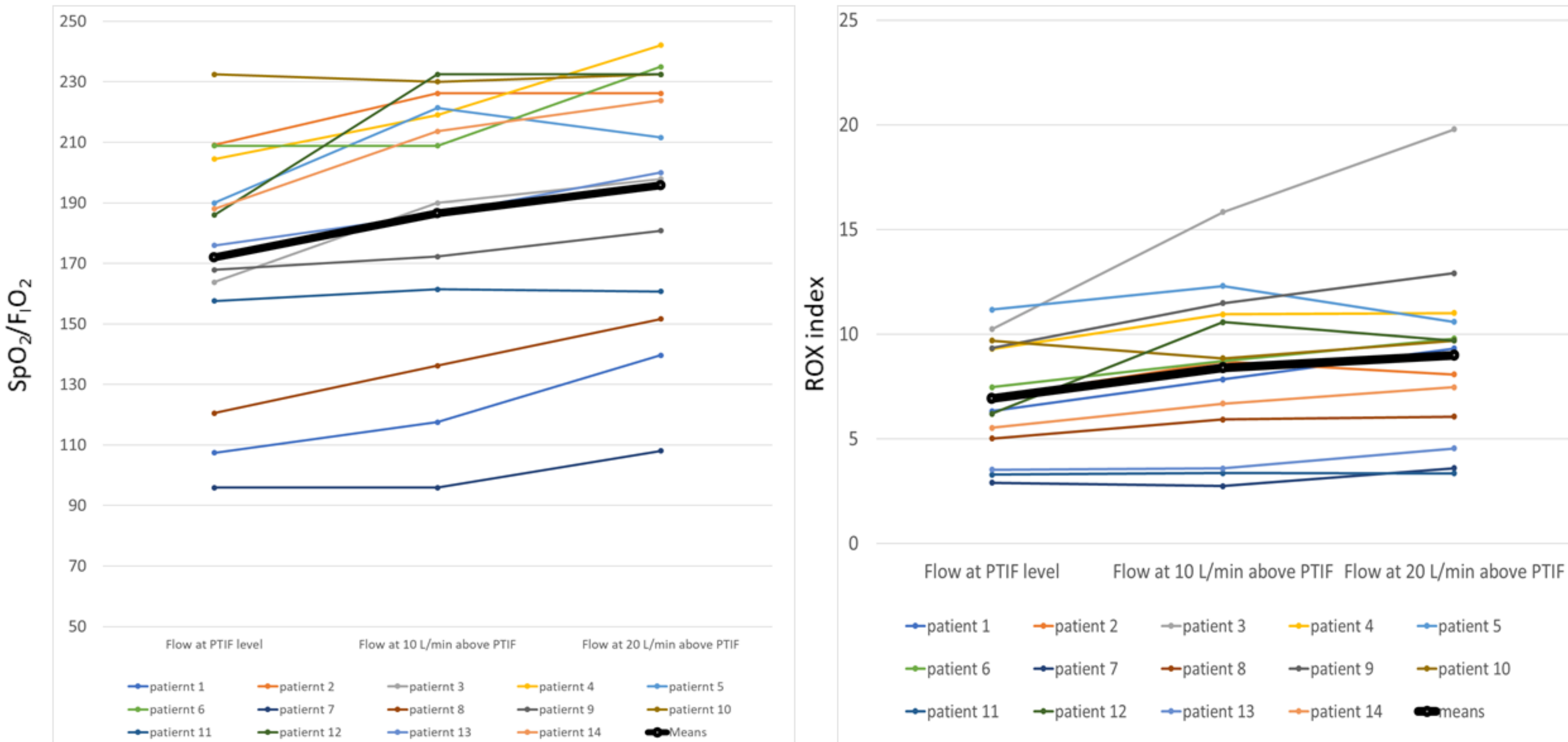
Fig. S4 Individual patient responses to different flow settings for patients whose PTIF is 40 L/min

For patients whose PTIF is 40 L/min, HFNC flow at 10 and 20 L/min above PTIF significantly improved SpO_2/F_IO_2 and ROX index, with comparison to HFNC flow at PTIF level. PTIF, patient tidal inspiratory flow; SpO_2, pulse oximetry; F_IO_2, fraction of inspired oxygen; ROX, SpO_2/F_IO_2/respiratory rate.



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