

Abstract**Nasal high-flow therapy and dispersion of nasal aerosols in an experimental setting**

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Background/Purpose: Nasal high-flow (NHF) therapy delivers flows of heated and humidified gases up to 60 L/min via a nasal cannula. NHF is widely used to support patients, including those who may be infectious. It is thought that NHF gas flow velocities may increase cross-infection risk.

Methods: Aerosols within the exhaled breath of healthy volunteers were imaged. Experimental breathing conditions deemed as typical patient breathing conditions were tested: at rest, with a violent exhalation (snorting), both with and without NHF, at flows of 30 and 60 L/min, and for both separate nostrils. The number, diameter, evaporation rates, and velocity of exhaled aerosols were collected.

Results: The numbers of aerosols measured were greatest during a violent exhalation without NHF and reduced with NHF. The numbers of aerosols were higher at 60 than 30 L/min, suggesting that higher gas flow rates may be associated with increased aerosol production; however, the numbers were on average 43% and 56% less than without NHF, respectively. During breathing at rest, no differences were imaged between with and without NHF, except at 60 L/min where numbers of aerosols produced were equivalent to 10% of a violent exhalation. Aerosol trajectory and evaporation rates observed both with and without NHF predicted that aerosols between 25 and 250 μm may travel up to 4.4 m and remain airborne for 43 seconds.

Conclusions: NHF use does not increase the risk of dispersing infectious aerosols above the risk of typical patient breathing with violent exhalation, which is the worst-case clinical scenario; therefore, standard risk control measures should apply.

Keywords: Nasal high flow, Infection control

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Abstract**Pulmonary artery to aorta ratio is correlated with pulmonary artery pressure, but not with mortality in critically ill COPD patients**

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Background/Purpose: Identification of COPD patients at high risk for complications and mortality is important. Computed tomography (CT) can be used to measure the ratio of the diameter of the pulmonary artery (PA) to the diameter of the aorta (A). We hypothesized that pulmonary artery enlargement, as shown by a PA/A ratio greater than 1 could be associated with a higher risk of mortality in COPD patients admitted to the intensive care unit (ICU).

Methods: Data of patients admitted to the ICU were retrospectively reviewed. Patients who were identified to have a diagnosis of acute exacerbation of COPD and who had an echocardiogram and a

CT scan were included. PA/A ratio was calculated, and patients were grouped as PA/A less than or equal to 1 and PA/A greater than 1. Analyses were done to demonstrate the correlation between ICU mortality and PA/A.

Results: A total of 106 COPD patients were enrolled. There were 40 patients (37.4%) who had PA/A greater than 1. Pulmonary arterial pressure (PAP) was higher in the group with PA/A greater than 1 than in those with PA/A less than or equal to 1 (62.1 ± 23.2 mm Hg vs 45.3 ± 17.9 mm Hg, $P = .002$). Mortality rate of patients with a PA/A greater than 1 was higher (50%) than of those patients with a PA/A less than or equal to 1 (36.4%) ($P = .17$). Correlation was found between CT scan-measured PA diameter and PAP ($r = 0.51$, $P = .001$) as well as between the APACHE II values and PAP ($r = 0.25$, $P = .025$).

Conclusions: The PA/A ratio is an easily measured method that can be performed on thorax CT scans. PA/A can be used as a surrogate marker to predict the pulmonary hypertension and ICU prognosis.

Keywords: Pulmonary artery pressure, COPD, ICU, Computed tomography

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Abstract**Raising the standard of care for oxygen delivery with nasal high flow in high-acuity areas—a controlled study**

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Background/Purpose: Efficacy of high-flow nasal cannula (HFNC) as a form of respiratory therapy is established. Introducing HFNC for all oxygen delivery, patient outcomes in a combined intensive, high, and coronary care unit could be improved.

Methods: Observational historic controlled 2-phase study involving ($n = 864$) high-acuity patients with a requirement for O_2 . During retrospective phase I ($n = 450$), the most common diagnostic categories and practice for O_2 delivery were established. During prospective phase II ($n = 414$), conventional O_2 delivery devices were replaced with HFNC (OptiflowTM using AirvoTM flow source Fisher and Paykel Healthcare Ltd). Recruitment matched retrospective phase numbers. For both phases, 40-hour postadmission data were extracted: level of respiratory support required, HFNC usage, length of stay, vital status and destination at discharge, and rate of therapy failure requiring escalation.

Results: The benefit ratio between the phases was equivalent at baseline. The level of respiratory support required for HDU and CCU patients was significantly changed between 2 cohorts (Fisher exact test, $P < .0001$). There were no significant differences for level of respiratory support for ICU patients (Fisher exact test, $P > .05$) and length of stay or mortality for all (nonparametric Wilcoxon 2-sample test, $P > .05$). Mean (\pm SD) for HFNC therapy: maximum duration, 7 hours (10.16); average FiO_2 , 30.4% (9.58), flow, 31.5 L/min (6.66); and SpO_2 , 95.8 (4.99). Therapy failure rates requiring support escalation were equivalent ($P = .37$).

Conclusions: For the majority, HFNC use was associated with reduction in required level of respiratory support, the requirement for escalation of support remaining unchanged.

Keywords: Nasal high flow, Escalation

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