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A Novel Method of Measuring Fractional Exhaled Nitric Oxide in Tracheostomized Ventilator-Dependent Children.

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A Novel Method of Measuring Fractional Exhaled Nitric Oxide in Tracheostomized Ventilator-Dependent Children

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BACKGROUND: The lower airway concentration of fractional exhaled nitric oxide (F_{iNO}) is unknown in children with chronic lung disease of infancy who have tracheostomy for long-term mechanical ventilation. We aimed to evaluate an online method of measuring F_{iNO} in a cohort of ventilator-dependent children with a tracheostomy and to explore the relationship between the peak F_{iNO} concentration (F_{iNO} peak) and the degree of respiratory support using the respiratory severity score. **METHODS:** We conducted a prospective cross-sectional study in 31 subjects who were receiving long-term respiratory support through a tracheostomy. We measured the F_{iNO} peak and F_{iNO} plateau concentration from the tip of the tracheostomy tube using a nitric oxide analyzer in subjects during a quiet state while being mechanically ventilated. We obtained 2 consecutive 2-min duration measurements from each subject. The F_{iNO} peak, exhaled NO output (equal to the F_{iNO} peak \times minute ventilation), and pulmonary NO excretion (exhaled NO output/weight) were calculated and correlated with the respiratory severity score. **RESULTS:** The median F_{iNO} peak was 2.69 ppb, and the median F_{iNO} plateau was 1.57 ppb. The coefficients of repeatability between the 2 consecutive measurements for F_{iNO} peak and F_{iNO} plateau were 0.74 and 0.59, respectively. The intraclass coefficient between subjects within the cohort was 0.988 (95% CI 0.975–0.994, $P < .001$) for F_{iNO} peak and 0.991 (95% CI 0.982–0.996, $P < .001$) for F_{iNO} plateau. We found that the F_{iNO} peak was directly correlated with minute ventilation, but we did not find a direct relationship between the F_{iNO} peak concentration, exhaled NO output, or pulmonary NO excretion and respiratory severity score. **CONCLUSIONS:** F_{iNO} peak and plateau concentration can be measured online easily with a high degree of reliability and repeatability in infants and young children with a tracheostomy. F_{iNO} peak concentration from the lower airway is low and influenced by minute ventilation in children receiving mechanical ventilation. *Key words:* tracheostomy; fractional exhaled nitric oxide; chronic lung disease of infancy. [Respir Care 2017;62(5):595–601. © 2017 Daedalus Enterprises]

Introduction

Fractional exhaled nitric oxide (F_{iNO}) has been studied in many pulmonary diseases, including asthma, COPD,

cystic fibrosis, primary ciliary dyskinesia, and pulmonary arterial hypertension.^{1,2} In patients with asthma, F_{iNO} is now used as a biomarker of eosinophilic airway inflammation to diagnose, to monitor response and adherence to anti-inflammatory medications, and to predict upcoming exacerbations.³ Studies measuring F_{iNO} in infants with respiratory distress syndrome, bronchopulmonary dyspla-

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MEASURING F_{iNO} IN VENTILATOR-DEPENDENT CHILDREN

sia (BPD), and chronic lung disease of infancy have yielded conflicting results.⁴⁻⁶ The reasons for the variations in F_{iNO} include differences in patient population, timing of measurement in relation to the disease process and inhaled medication administration, use of different interface techniques, and other measuring conditions such as tidal breathing parameters and variable exhalation flow. In 2005, the

QUICK LOOK

Current knowledge

In patients with asthma, fractional exhaled nitric oxide (F_{iNO}) is used as a biomarker of eosinophilic airway inflammation to diagnose, to monitor response and ad-

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