

Case Study:

Use Of A Micropump Nebulizer For Aerosolized Medication Delivery In A Ventilated Infant

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Successful aerosolized therapy in a mechanically ventilated patient depends on achieving adequate drug deposition in the lung, and is influenced by an array of factors that include aerosol device selection, drug formulation, ventilator circuit setup and ventilator settings, as well as the patient.

In the infant, this objective is further complicated by low tidal volume, low vital capacity and functional residual capacity and low I:E ratios. Combined, these result in a shorter period by which aerosol particles reside in the lung and lower rates of pulmonary deposition. A recent review indicates lung deposition of aerosolized medications in ventilated infants is less than 1% of the nominal dose compared with a range of 8-22% in ventilated adults.¹

In 2002, a novel micropump nebulizer (Aeroneb Professional Nebulizer System, Aerogen, Inc.) was introduced with the goal of improving the efficiency of inline aerosolized therapy without requiring adjustment to ventilator settings. This nebulizer works inline with all standard ventilator circuits and mechanical ventilators, including use with high-frequency oscillation.¹ A recent study of the Aeroneb Pro versus a conventional jet nebulizer in an animal model of infant ventilation documented a mean *in vitro* lung deposition of 14% of the nominal dose, versus a mean of 0.7% with the jet nebulizer.²

The case study that follows demonstrates the clinical utility of the Aeroneb Pro in this difficult to treat population.

CASE STUDY

A former 26-week PTAGA infant was transferred to the PICU at 8 months post-conceptual age. The infant was ventilator-dependent because of severe chronic lung disease. One week after transfer, the patient became septic, required increased ventilator support and was found to be wheezing with “tight” breath sounds bilaterally.

Ultrasonic nebulizer treatments were started with 2.5 mg racemic albuterol every 4 hours, and then increased to every 2 hours because of poor response, deteriorating blood gases, and overall worsening of clinical status. The infant was switched from racemic albuterol to 1.25 mg levalbuterol (Xopenex) treatments secondary to an increased heart rate. Ultrasonic nebulizer treatments were given with the humidification system bypassed to ensure that the maximum amount of drug was delivered to the airway; however, this required breaking into the



ventilator circuit every two hours—putting the patient at risk for further infection and interrupting the patient’s PEEP pressure.

The Aeroneb Professional Nebulizer System was placed inline with the ventilator circuit on the wet side of the humidifier (not possible with the ultrasonic nebulizer because of condensation collection in the nebulizer cup). Since a 1.25 mg dose of Xopenex was unavailable, two 0.63 mg ampoules were prepared for aerosolized administration. Upon aerosolization of the first 0.63 mg dose, within seven minutes of initiating therapy, the patient’s oxygen saturation rose from 87% to 99%. Within 10 minutes of initiating therapy, the patient’s peak inspiratory pressure (PIP) dropped from 36 to 27 cm H₂O, and it was determined that the second 0.63 mg dose of Xopenex would be held. The patient continued to receive 0.63 mg Xopenex every 6 hours until successfully weaned from ventilatory support three days later. The patient was subsequently discharged home.

REFERENCE

- 1 Fink JB, Barraza P, Bisgaard J. Aerosol delivery during mechanical ventilation with high frequency oscillation: an *in vitro* evaluation, American College of Chest Physicians Annual Meeting (ACCP), November 2001

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