EVALUATION OF SYSTEMIC CIRCUIT PARTICLE DEPOSITION USING THE AEROGEN MICROPUMP AEROSOL GENERATOR WITH A VARIABLE FLOW NCPAP SYSTEM.

Kimberly Farney[1], Brandon Kuehne[1], Laurie Gibson[2]; [1]NICU, Nationwide Childrens Hospital, Columbus, OH; [2]Department of Nuclear Medicine, Natinwide Children's Hospital, Columbus, OH

Background Much debate has taken place regarding the efficacy of aerosolized medications given through nasal CPAP systems. The Aerogen micropump aerosol generator has traditionally been an acceptable method of aerosolized medication delivery in the hospital setting. However, little is known about how much drug is actually delivered to the patient when used inline with a variable flow nasal CPAP system. Methods We created a system that employed a test lung placed in a plastic jar. The jar was subjected to negative pressure by means of time/valve mechanism connected to a suction system. Simulated inspiration effort was measured by use of a heated wire anemometer. The flow signal was then integrated with an Avea ventilator. We used 3 ml of TC99mTC DTDA as our aerosol. The Aerogen was placed inline with a Cardinal Infant Flow Generator system connect to a CPAP driver. All nebulizer sessions were done over 15 minutes. The Aerogen was placed either proximally and distally in the circuit and patient effort was simulated at a 0.4L minute volume. All circuits were then placed under a GE Infinia Hawkeye Gamma Camera. Results Data was analyzed from 15 sessions. The Aerogen was placed at the heater,and the average medication delivery was 0.32%±.36(n=6). When the Aerogen was placed 18 inches from the prongs the average medication delivery was 21.41% ±11.49(n=9). Single factor analysis of variation (ANOVA) yielded a P= 0.0007 between the two placements. Conclusion This study suggests that the placement of the Aerogen, is associated with greater aerosolized medication delivery when the Aerogen is placed closer to the patient . As a result of this study a change of practice will occur regarding location of inline nebulizer placement.

Sponsored Research - None

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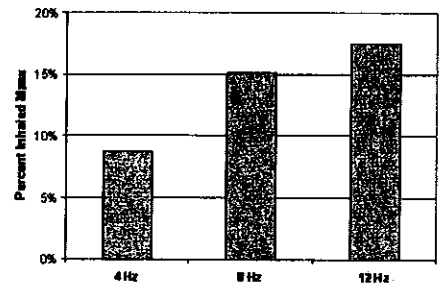
AEROSOL LUNG DEPOSITION USING A VIBRATING MESH NEBULIZER DURING HIGH FREQUENCY OSCILLATORY VENTILATION IN AN ADULT LUNG MODEL OF ARDS.

Mark S. Siobal[1], Arzu Ari[2], Jim Fink[2]; [1]Anesthesia, SFGH/UCSF, San Francisco, CA; [2]Division of Respiratory Therapy, Georgia State University, Atlanta, GA

Background: Lung deposition of aerosolized medication during high frequency oscillatory ventilation (HFOV) in adults has not been thoroughly quantified. We measured simulated lung deposition in an adult lung model during HFOV using a vibrating mesh nebulizer (VMN). Method: A VMN (Aeroneb Solo, Aerogen) was placed between the 3100B (Viasys) ventilator "Y" and a Ballard Trach Care double swivel elbow inline suction catheter. The suction catheter was connected to a 7.5mm endotracheal tube inserted into a bifurcated trachea model and the cuff was inflated. Bacteria filters were positioned at the distal ends of each bronchial lumen and connected via a "Y" adapter to a single compartment of a test lung (TTL, Michigan) set at a compliance of 20 mL/cm H20. The ventilator was set to amplitude of 90 cm H2O, mean airway pressure of 34 cm H2O, 33% inspiratory time, with bias flow of 40 L/min. The VMN was filled with a 3 mL (2.5 mg) dose of albuterol and nebulized continuously until empty. A total of 3 runs each were performed at frequencies of 4 Hz, 8 Hz, and 12 Hz. Albuterol was eluted from the filters and analyzed with UV spectrophotmetry (276 nm) and reported as percent of total dose. Results: The percent of albuterol delivered distal to the mainstem bronchi in a bifurcated trachea model was 8.7 ± 0.78 % at 4 Hz, 15.1 ± 6.9 % at 8 Hz, and 17.5 ± 3.1 % at 12 Hz. There was a trend of increasing inhaled mass with frequency. The average deposition across all frequencies tested was 13.8%. Conclusion: During HFOV in an adult lung model of ARDS, simulated lung deposition of drug aerosolized with the VMN is consistent with the range of dose efficiency reported with conventional ventilation (Ari et al, Resp Care July 2010). During HFOV, drug delivery appears to increase with higher frequencies. Further investigation of lung deposition, penetration, and clinical response to aerosol medication delivery during HFOV in adult patients with ARDS is warranted.

Sponsored Research - Jim Fink has a consulting relationship with Aeroogen



918781

THE PROBLEMS EXPERIENCED BY COPD PATIENTS USING NEBULIZERS AT HOME.

Bothaina Alhaddad[1], Felicity J. Smith[1], Kevin M. Taylor[2], Tricia Robertson[3], Geoffrey P. Watman[3]; [1]Department of Practice and Policy, The School of Pharmacy, London, United Kingdom; [2]Department of Pharmaceutics, The School of Pharmacy, London, United Kingdom; [3]Harrow Primary Care Trust, Harrow, United Kingdom

Background: Chronic obstructive pulmonary disease (COPD) is a global health burden and a priority for many healthcare initiatives around the world. Nebulizers are a mainstay of treatment for patients with severe COPD. Understanding how patients use their nebulizers at home is vital to ensure effective treatment and suboptimal health outcomes. This novel study employs a mixed methods approach for a detailed investigation of nebulizer use at home from patients' perspectives. Method: A descriptive cross-sectional study design using in depth interviews, observations and survey methods was conducted among fifty patients with COPD using nebulizers at home. A representative sample including patients with different length of nebulizer use and different severity of disease was recruited from general practice populations and at hospital discharge. Qualitative and quantitative analyses were conducted to identify the range of problems experienced with nebulizer use in all stages prior, during and after inhalation of a nebulized dose. Results: All fifty patients (29 female, 21 male) (age range 54 - 91) reported experiencing one or more problems with the use of their nebulizer. Problems identified which occurred before inhalation of the nebulized dose were; complexity of setting up the equipment, lack of instructions for assembly of equipment, manual dexterity, time taken to set up the equipment, inadequate hygiene during setting up of the equipment and mishandling of the device. Problems during medication administration were; time taken to nebulize the dose, claustrophobic feelings during nebulizer use and incorrect inhalation technique or breathing patterns. Problems which occurred following administration were; inadequate cleaning of nebulizer components, poor access to accessories, e.g. face masks and tubing, cost of accessories and the use of damaged parts or self repairs. Conclusion: Findings from this study showed that COPD patients using nebulizers in their own homes experienced problems in all stages; before, during and after inhalation of medication. Healthcare providers need to be aware of the types of problems encountered in order to support effectively COPD patients with the use of their nebulizers at home to optimize health outcomes.

Sponsored Research - None

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THE USE OF TUSKS ON AN AEROSOL MASK TO INCREASE AEROSOL MEDICATION DELIVERY TO THE LUNGS.

Megan Hayden, Rachel Lenshyn, Kevin Tucker, Joel Brayfield, Aaron E. Light; Respiratory Therapy, Ozarks Technical Community College, Springfield, MO

INTRODUCTION: The addition of large bore corrugated tubing (tusks) to act as a reservoir on an aerosol mask has been utilized to increase the FiO2 during aerosol delivery. We wanted to determine if the addition of tusks would increase the delivery of aerosol particles during aerosol therapy. METHODS: A bench model was created by adapting an adult intubation manikin (Armstrong Medical Industries, Inc, Lincolnshire, IL) to a Hans-Rudolph series 1101 breathing simulator (Hans Rudolph Inc, Shawnee, KS). A TSI Certifier FA Plus ventilator tester (TSI Inc., Shoreview, MN) was then connected to the simulator to assure accuracy of tidal volumes and inspiratory flowrates. The simulator was set to a Raw of 5 cmH2O/L/sec, compliance of 60 ml/cmH2O, rate of 12, and amplitude adjusted to achieve a VT of 500ml. At the connection between the manikin and simulator an Airlife HEPA filter was placed to collect aerosol particles. The filter was weighed at the start of each run and then a Vixone nebulizer was placed on the manikin's face using an aerosol mask. The nebulizer was filled with 5ml of a 3% NaCL solution and operated at 8 L/min for 10 min. After 10 min the filter was weighed and recorded. Tusks of 6", 12" and 18" were then added to each side of the aerosol mask and the procedure was repeated for each length of tubing. This was repeated with three different nebulizers with the sequence of lengths rotating through each nebulizer. Any excess solution was emptied out of the nebulizer and allowed to dry with air going through the nebulizer for 2 min. Data was analyzed using SPSS software. A Kolmogorov-Smirnov test was performed to assess distribution and a paired T-test was used to compare means. A Pvalue of <0.05 was used for significance RESULTS: The aerosol mask alone showed a mean 0.06 g change in weight, 6" tusk bilaterally had a mean 0.16 g weight change, 12" tusk had a mean 0.21 g change, and 18" tusk had a mean 0.2 g change. When data was analyzed the only statistically different weight changes were between the aerosol mask and all tusk mask setups. There was no difference between the different links of tusks. CONCLUSION: Our findings suggest that the use of tusks inserted into the openings of an aerosol mask increases the aerosol delivery to a patient. Further research needs to be performed to assess the clinical significance of the addition of tusks to an aerosol mask during aerosol medication delivery to patients.

Sponsored Research - None

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