P11.6. Regional Deposition Of Nebulized, Aerosol Boli Targeted To Shallow Lung Depths

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Aerosol dosimeters that actuate nebulization of a drug at preset inhaled volumes and for variable nebulization periods may be useful for targeting deposition of inhaled aerosols to the bronchial airways. We designed a system to trigger nebulization of a modified Devilbiss 646 jet nebulizer for delivery of small boluses (40ml) to shallow volumetric front depths (VFD) in the lung. In ten healthy adult subjects, regional bolus deposition was determined by delivering boluses of Tc99m-sulfur colloid containing particles (6.5 um MMAD) injected into the inhaled tidal volume (500ml from FRC) to a mean VFD of 60% anatomic dead space. By gamma camera acquisition/analysis, we determined the central to peripheral ratio (C P = 1.93±0.28 (sd)), the left to right lung ratio (L/R = 1.31±0.45), and 24 hour retention (R24 = 0.39±0.12) of deposited particles. These data show that nebulized boluses can be targeted to the conducting airways (at least 60% of lung deposition based on R24). The trend to greater deposition in the left vs. right lung is minimized by having subjects inhale from lung volumes near FRC. Supported by USEPA Cooperative Agreement CR824915.

P11.7. Nonlinear Modeling Of A Pulmonary Waveform Generator

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Pulmonary waveform generators consisting of motor driven piston pumps are commonly used to test respiratory function equipment. Gas compression within these generators can produce significant distortion of the output flow-time profile when testing peak expiratory flow (PEF) meters. The waveform generator with load (PEF meter connected at the generator output) was modeled as a time varying RC circuit, where resistance represents flow resistance of the pump load, and capacitance represents gas compliance in the pump chamber. Resistance and capacitance are time-varying parameters since R is a nonlinear function of flow, and C varies as a function of pump volume. The parameters R and C were determined from experimental data, and were used to generate piston motion profiles that produced the desired target flow profiles at the generator output. The model and correction scheme were tested using the 26 American Thoracic Society standard flow-time waveforms as target profiles, two different types of PEF meters as the pump load, and mean square error (MSE) from target flow to delivered flow as a measure of waveform distortion. Use of the model and correction scheme on the generator and two test loads resulted in an average decrease in MSE of 72.7%.

P11.8. Modeling Human Olfactory Adaptation

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Olfactory adaptation and recovery is defined as the lessening and recovery of the olfactory sensation (sense of smell) during and after prolonged or repetitive exposure to odorants. This process is essential for human perception or detection of an odor in everyday life. Substantial variations in this process are also important in olfactory dysfunction. We developed a lumped parameter mathematical model of human olfactory adaptation based on mucosal odorant flux in the human nose. An anatomically accurate, 3-D odorant mass transfer finite element model of the human nasal cavity, refined by comparison with experimental human nasal absorption data, serves as input to the model. Other physiological and physicochemical inputs include: nasal submucosal blood flow rate, odorant concentration in the blood, olfactory mucosal thickness, and odorant physio-chemical properties in olfactory mucus. Preliminary results of our model are consistent with environmental chamber olfactory adaptation data taken on subjects for brief and long term odorant exposure and suggest that submucosal blood flow rate and odorant mucus solubility are major parameters in controlling the time course of olfactory adaptation and recovery.

P11.9. Time-Domain Modeling Of Respiratory : The Mouse

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Two-compartment models have been used to describe respirat the time-domain. However, studies indicate that lung impeda described in the frequency-domain by the constai $Z(\omega)$=Raw+i. ω.Iaw+(Gt-i.Ht)/(ω^α), where ω is angular fr airway resistance, Iaw is airway inertance, Gt characteriz dissipation, Ht characterizes tissue energy storage, and α=(2/π)a developed a model that is a time-domain approximation of th model. The time-domain model parameters are estimated b regression. The model was tested in 5 anesthetized, tracheostomized mice using a composite volume perturbation frequencies between 0.5 and 19.25 Hz. The absolute differ between the parameters estimated by our time-domain model a domain constant-phase model were: 7±7% for Raw, 13±14% Ht, and 2±2% for α. Iaw was negligible. In addition, our time- the data with a mean squared residual that was 16±12% lowe conventional two-compartment model. We conclude that our tir performs comparably to the frequency-domain constant-phase domain model may be useful when implemented recursively to respiratory mechanics. (Supported by CNPq - Brazil)

P11.10. Transfer Impedance Measurements Presentation Of A New And Improved System

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AstraZeneca, Lund, Sweden

As pharmacological companies move from asthma to COPD target for new drugs in the area of respiratory medicine, their n for accurate, long-term, non-invasive animal studies of respir To satisfy this need, our group has created a new system for tr measurements in mice. Similar systems have been constructe they have all exhibited problems with leakage at the nose-ne have not allowed for continuous monitoring of the restraining solved these problems. Our system allows for simultaneous both spontaneous breathing and applied forced oscillations. T help to validate the nose seal. Furthermore, we use a closed r measuring the airway flow, and since mice have a respiratory q expected fall in baseline nose pressure can be used to validate th nose seal. Pilot studies have shown a major influence from the on the obtained transfer impedance spectrum. Our continuous restraining force and the system's possibility to adjust it are th improvements. Our transfer impedance system will be demons poster session.

P11.11. Transfer Impedance Tracking Of Variation In Airway Resistance And Intrathora

P. Juhlin
AstraZeneca, Lund, Sweden

We have developed a new and improved system for mea transfer impedance in mice. This presentation will elaborate o can be used for tracking intra-breath variations in respirator which traditionally a much more demanding and invasive app Transfer impedance data can, to a good approximation, be fitte (or to its mechanical equivalent, a pipe-and-balloon model). V TI-spectrum are of various importance for determining e parameters, Resistance, Inertance and Compliance. The interr spectrum correlates well to the resistance. When we apply conduct a time-moving ultra-short FFT, and perform some sign can actually follow how R varies over the respiratory cycle. Attr to airway resistance, we calculate the "alveolar pressure" (Palv at the nose. Comparing the gas- and volume balance at the b also estimate the thoracic gas volume (Valv). Each parameter a time-resolution of a minor fraction of the breathing cy impedance technique is considered quite accurate at determi whereas the compliance estimate is less reliable, partly becau changes over the breathing cycle. Using our technique for ca and V_alv data, one can recalculate C during the assumingly to obtaining a more reliable C-estimate.

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