Abstract

Measurements of Aerosol Drug Delivery: Unusual Clinical Settings

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Virtually all of our modern inhaled medications are designed for use by "not very sick" ambulatory patients with moderate respiratory disease. Consequently the pharmacokinetics and dynamics resulting in label dose recommendations are based on studies in relatively healthy subjects with underlying respiratory disorders.

During severe exacerbations of respiratory disease patients require acute and critical care medical support, at a time when they need their inhaled medications the most. The approved drug label provides little guidance to the clinician for these patients. For example, when a patient with Asthma or Chronic Obstructive Lung Disease (COPD) requires mechanical ventilation, the same drugs used to treat the lungs at home may require modifications in drug dose, frequency, device and interface. Consequently, different methods are required for aerosol delivery for the sickest of patients, from adult to neonates. During mechanical ventilation, standard jet nebulizers may only deliver 1 – 3 % of the dose placed in the nebulizer, compared to 10-12% or more with home aerosol systems. While pMDIs may be more efficient than jet nebulizers in ventilated patients, they require the use of third party actuators or chambers, which vary greatly in efficiency. For patients with severe bronchospasm, label doses of bronchodilators may not be sufficient, so higher frequency of treatments or even continuous administration of aerosol may be used. Infants and small children offer unique challenges, with small tidal volumes, higher respiratory rate, and different breathing patterns. Up to 47% of small children will not tolerate a properly fitted aerosol mask, reducing inhaled drug by more than 80%. Identifying best methods based on bench, animal and clinical work have allowed clinicians to increase inhaled drug delivery to their sickest of patients by several orders of magnitude.