

Metered-Dose Inhalers and Dry Powder Inhalers in Aerosol Therapy

Aerosolized drug therapy is on the verge of explosive growth. Traditionally limited to bronchodilators and steroids for airway diseases, aerosol applications are now being developed for a variety of other lung conditions, such as infections, pulmonary hypertension, and transplant rejection. They are also being investigated as a route of administration for drugs designed for systemic effects, such as insulin. The reason for these new developments is that aerosols offer a better therapeutic index for many lung therapies than other routes: more local activity and less systemic effects. Aerosols also offer several advantages over other routes of administration for systemic delivery: aerosols are easier to administer than parenteral preparations and, compared to oral administration, there are no digestive enzymes or first-pass hepatic degradation concerns.

Current aerosol delivery systems are in many ways inadequate for this growing array of new applications. Liquid nebulizers have been in existence for almost a century but are generally inefficient and have considerable variability in delivery and particle characteristics. Newer designs of metered-dose inhalers (MDIs) and dry powder inhalers (DPIs) offer more reliable dose and particle generation than older nebulizer systems—especially some of the new chlorofluorocarbon-free devices. Moreover, MDIs and DPIs offer short treatment times and portability. However, MDI and DPI delivery is still heavily influenced by anatomy and breathing patterns, and thus delivery and deposition distribution of these aerosols remains quite variable. This imprecision in dosing and targeting from current systems is critically important, because these new drugs often have narrower therapeutic windows and are more costly.

In 2002 the American Respiratory Care Foundation convened a state-of-the-art conference (published in the No-

vember and December 2002 issues of *RESPIRATORY CARE*) on emerging wet nebulization technologies to address many of these issues. This current conference is a follow-up to that 2002 conference, and focused on current and future MDI/DPI technologies. The conference was broken into several sections. First, the factors involved in delivery and deposition of aerosols were presented, to give a foundation for subsequent discussions. These factors include the aerosol characteristics (size, physical properties, velocity, carrier), device properties (efficiency, reliability), airway/lung anatomy, and breathing pattern. Second, assessment techniques to evaluate aerosol delivery/deposition (eg, in vitro models, computer models, physiologic effects, imaging, pharmacokinetics/pharmacodynamics) were presented, as these are the tools that guide new device dosing and targeting strategies. Third, the pharmacology of both current and emerging new drugs for aerosol applications were presented, along with the required aerosol properties for each. Finally, new and emerging design features for MDI and DPI devices were presented. The result of this conference is a comprehensive collection of state-of-the-art reviews that should serve as an important reference for all clinician/scientists involved in aerosolized drug therapy.

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