New Developments in Inhaled Drugs: Within and Beyond the Lungs

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Inhalation medicine and aerosol science are ‘Cinderella’ disciplines, where the breakthroughs and advances in formulation science, biopharmaceutics, device engineering, airway modelling and inhaled drug product development have usually gone unnoticed in contrast to discoveries in other fields of respiratory science [1]. Yet inhaled drug delivery is the foundation and cornerstone in managing patients across the spectrum of specialities within respiratory medicine, whether one is an intensivist in the intensive care unit using nebuliser therapy in a ventilated patient, a community paediatrician trying to engage a child with inhaler therapy for their asthma, or a cystic fibrosis specialist juggling to manage the multitude of inhaled interventions in their patient. The last decade has seen important strides in these disciplines with cutting-edge aerosol science and the latest developments in inhaled drug delivery to the lungs that are making an impact in the clinical arena [2]. In this context, this series in *Respiration* is dedicated to showcase the evolving science in inhaled drug delivery to the lungs that is being realised to provide patient benefit in the clinic.

The first article of the series in this issue of *Respiration* focusses on the technological advances in the inhaler design of dry powder inhalers, metered dose inhalers and the new generation nebulisers that have led

to an array of devices with the purpose to improve drug delivery to the lungs compared to existing devices used in the clinic for patients with asthma and COPD. The article also importantly reflects on the inhaler-patient interface and the complexities and difficulties within this interaction for achieving effective lung deposition [3, 4].

The second contribution in the series highlights the new developments in inhaled interventions in patients with cystic fibrosis, with particular reference to antibiotics and the osmotic agent mannitol, and discusses the clinical effectiveness of these treatments with respect to disease exacerbations. The article also addresses the burdening costs of treatment in patients with cystic fibrosis and the place of current and future inhaled drug therapy [5, 6]. The third article specifically addresses the rationale for using aerosolised antibiotics for non-cystic fibrosis bronchiectasis, reviewing the evidence for the use of such drugs in daily clinical practice [7, 8].

In our final article, the scientific advances in delivering aerosolised treatments to the lungs as a portal for systemic drug delivery will be discussed including the treatment of systemic diseases with inhaled peptides and proteins. The article will discuss the challenges the respiratory tree presents for delivering inhaled drug to the systemic cir-

culatation and will also discuss the potential of nanomedicine technology [9].

This series has been developed to provide a state-of-the-art up-to-date review in inhalation therapy for the general respiratory health-care professional as well as for academic researchers involved with aerosol science and drug delivery to the lungs. Understanding the factors that control drug deposition within the airway tree and investigating the fate of inhaled aerosol within the lungs are, at present, vitally important as a variety of drugs are being developed for the treatment of respiratory disorders that will be too toxic or have a poor therapeutic ratio when given by the parenteral route; such drugs will therefore

need to be given via the inhaled route. These are exciting times for researchers in inhalation medicine who are driving the discoveries in aerosol science that will directly impact on patient respiratory care within the next decade [1].

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