The Role of Dose Volume in Delivering Albuterol Sulfate with a Low Residual Volume Nebulizer

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INTRODUCTION

Rapid, efficient delivery of bronchodilators is important, particularly in the acute care setting. The standard dose volume of 3 mL with 0.083% albuterol sulfate was established for use with standard nebulizers with residual volumes between 0.8 and 2.0 mL (Hess et al., Chest 1998). Aerogen has two low residual nebulizer systems (Aeroneb® Professional Nebulizer System (Aeroneb Pro) and Aeroneb® Go Nebulizer (Aeroneb Go), Figure 1); both incorporate Aerogen’s OnQ™ Aerosol Generator.

The OnQ Aerosol Generator is an electronic micropump (Figure 2) with a residual drug volume as low as 1 microliter. Because of the high efficiency of the aerosolization mechanism, and placement of the drug solution in direct contact with the aerosol generator, the nebulizers’ medication cup residual is also low (approximately 0.1 mL).

OBJECTIVE

We wanted to determine the effect of initial drug volume on inhaled mass and time of administration with these low residual volume nebulizers.

MATERIALS AND METHODS

The two low residual volume nebulizers were studied in a total of three configurations, each aerosolizing 2.5 mg of albuterol sulfate solution in volumes of 3.0 mL (0.083% solution) and 0.5 mL (0.5% solution). The Aeroneb Pro was tested with a standard mouthpiece, and separately with a mouthpiece plus a double one-way valve system and expiratory filter. A prototype of the Aeroneb Go with a mouthpiece was also tested.

Aerosol was delivered to an absolute filter placed between the mouthpiece of the nebulizer and a breath simulator (Hans Rudolph) set to adult breathing parameters (tidal volume 500 mL, rate 15 b/min and inhalation time 33%). Drug was eluted from the filter, assayed by HPLC, and expressed as percent of total dose (mean ± SD, n=3). Each experiment was performed in triplicate.

RESULTS

The inhaled mass and treatment time for administration of a single dose of 3.0 mL (0.083% solution), and 0.5 mL (0.5% solution) are shown for the Aeroneb Pro with a standard mouthpiece in Table 1 and with the valve system and filter in Table 2. Data for the Aeroneb Go prototype are shown in Table 3. Inhaled mass is expressed as the actual amount of drug deposited on the filter and as the percentage of initial dose. All reported values are mean ± SD, n=3.

CONCLUSION

The Aeroneb Pro and the Aeroneb Go are low residual volume nebulizers; they deliver the same inhaled mass over a range of dose volumes. Use of a lower volume higher concentration solution can reduce the time required for dose administration.

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