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AN IN VITRO COMPARISON OF DOSIMETRIC AND CONSTANT OUTPUT NEBULIZERS

Gardenhire DS, Ari A, Zimmerman C, Gardenhire RE, Parkman S.

Background: Design differences among gas powered, small volume nebulizers affect drug disposition. Drug disposition is affected by dose delivered to the patient, loss of dose in the equipment, and dose exhaled to ambient air. The disposition affects drug availability and efficacy to the patient. PURPOSE: The purpose of this study was to compare the performance of 3 nebulizers: a constant-output, a dosimetric in constant-output mode, and a dosimetric nebulizer in vitro under normal breathing conditions.

Method: Nebulizer models evaluated included: two constant-output (Westmed and AeroEclipse in constant mode) and one dosimetric (AeroEclipse). Each nebulizer was filled with 3 mL of unit dose albuterol sulfate and powered by oxygen at 8 L/min. The nebulizers were connected to a filter (2-way nonconductive anesthesia filter, Hudson RCI, Temecula, California), and connected to a breathing simulator with the following parameters: V_T = 600, RR = 12 bpm, I:E = 1:3. We measured inhaled drug mass, exhaled drug mass, and drug mass in the apparatus at 1, 3 and 5 minutes. Each model was tested five times. All drug amounts were analyzed via spectrophotometry (Beckman Instruments, Fullerton, California) at a wavelength of 276 nm and expressed as a percentage of total dose.

Table 1. Percent of delivered dose.

	Mean (%)	SD (%)
Westmed @ 1 minute	1.94	0.32
AE Constant @ 1 minute	2.06	0.74
AE @ 1 minute	1.67	0.30
Westmed @ 3 minutes	5.15	0.66
AE Constant @ 3 minutes	4.60	0.95
AE @ 3 minutes	4.16	0.40
Westmed @ 5 minutes	8.41	0.83
AE Constant @ 5 minutes	7.03	1.18
AE @ 5 minutes	6.32	0.81

AE = AeroEclipse

Results: There were no differences seen between the nebulizer designs as noted by the ANOVA with repeated measures, Î›= 0.175, F(2,3)= 7.48, p= 0.074. However, there were differences between time spots, 1 min and 3 min, p<0.05, 1 min and 5 min, p<0.05, and 3 min and 5 min, p<0.05.

Conclusion: The performance of the nebulizers tested indicate no statistical difference. One nebulizer is not better than the other. The longer the nebulized time, the more inhaled drug mass.

Gardenhire DS, Ari A, Zimmerman C, Gardenhire RE, Parkman S. An in vitro comparison of dosimetric and constant output nebulizers. Respir Care 2007; 52(11): 1580.