In vitro performances of Aeroneb Solo with salbutamol during adult mechanical ventilation

L. Vecellio (1), E. Mercier (2), J. Fink (3), C. Duffy (4) and P. Diot (2)

(1) AERODRUG, Faculty of Medicine, Tours, France.
(2) INSERM U618, IFR135, Univ. François Rabelais, Tours, France.
(3) Georgia State Univ., USA .
(4) Aerogen Ltd, Galway, Ireland.

Introduction

Figure 1: Aeroneb Solo nebulizer

>> **Aeroneb® Solo is a new generation of single patient multi-use vibrating mesh nebulizer designed for use with mechanically ventilated patients.**

>> The Aeroneb® Solo Micropump Nebulizer represents a new standard in critical care nebulization for mechanically ventilated patients. Featuring the proven OnQ™ nebulization technology employed in the Aeroneb® Pro nebulizer, the Aeroneb® Solo is a compact, single patient use nebulizer that offers the care giver the added convenience and flexibility of continuous and/or intermittent nebulization. It can be powered by either the Aeroneb® Pro or the Aeroneb® Pro-X controller. Continuous nebulization is only available when the nebulizer is used in conjunction with the Aeroneb® Pro-X controller and for up to seven days.

>> **The aim was to assess the performance of this device in a model of adult mechanical ventilation.**

Material and methods

>> Two aerosol generators - the **Aeroneb® Solo**, an active vibrating mesh nebulizer (Aerogen Ltd, Irland), and the **Mistyneb®** (Airlife, USA), a jet nebulizer operating at an airflow of 6L/min - were used to administer salbutamol during mechanical ventilation

>> A **Servo I ventilator** (Siemens, France) set up in controlled volume (450ml, 18 breaths/min, inspiratory time= 1.2sec, pause time= 0.2 sec) was connected to an 8mm-endotracheal tube (ETT). The ETT was connected to a 22mm-ID tube [similar to the internal diameter of the trachea] which was connected to an absolute filter (Respirgard II, Vital sign). This model duplicated the average anatomic dead space of an intubated adult (probably close to 50% of the 150 mL anatomic dead space in non intubated adults) since the ETT bypasses the upper airway. The filter was connected to a **lung model** (Dual adult model, Michigan instrument, USA) with a compliance at 0.5ml/cm d'H_20 and a resistance (Rp) at 25cmH_2O/L/sec. An exhalation filter (Respirgard II, Vital sign) was placed at the end of the expiratory circuit close to the ventilator . **Figure 2.**

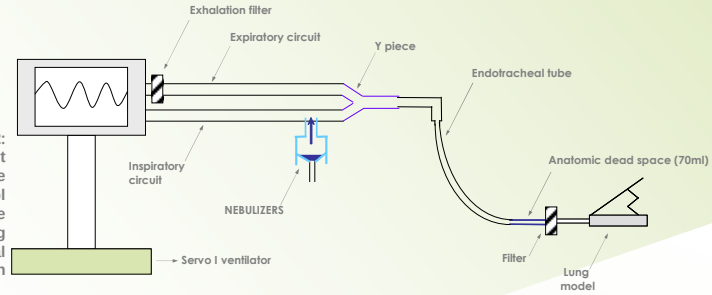

Figure 2: Experimental set up to measure aerosol delivered to the lung during mechanical ventilation

>> **Both nebulizers were connected at the "Y" piece on the inspiratory circuit** and were then filled with 2.5mg/2.5ml of salbutamol (Ventoline®, GSK). The Aeroneb® Solo operated to end of nebulization and the Mistyneb® for 60 seconds after the onset of sputtering. **Salbutamol deposited on inspiratory filter** was assayed by spectrophotometry method.

>> Each experiment was carried out three times with each of three devices, resulting in 9 values for each kind of aerosol generator for each patient model.

>> Last, the **particle size** produced by each nebulizer was measured by laser diffraction (Mastersizer X, Malvern, UK).

Results

>> Aeroneb® Solo produced a Volume Median Diameter of 5.3µm ±1µm (n=9) and Mistyneb® produced a Volume Median Diameter of 5.9µm ± 0.5µm.

>> The Aeroneb® Solo nebulizer produced the highest delivered mass of salbutamol (446mg ± 45mg) in comparison with Mistyneb® jet nebulizer (163mg ± 21mg). **Table 1.**

>> **Delivery efficiency** as percent of nominal dose was **17.8% for the Solo** and **6.5% with the Mistyneb®**

	Salbutamol delivered mass (µg)	
Experiment	Aeroneb® Solo, mesh nebulizer	Mistyneb®, jet nebulizer
1	396	136
2	473	148
3	454	167
4	493	193
5	429	173
6	404	166
7	434	158
8	491	192
9	437	137
Mean ± SD	446 ± 35	163 ± 21

Table 1: Salbutamol mass deposited into the lung model during adult mechanical ventilation.

Conclusion

We conclude that the Aeroneb® Solo was several fold more efficient than the jet nebulizer in this in vitro simulation of adult mechanical ventilation.