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

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## 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 25cm$H_2$O/L/sec. An exhalation filter (Respirgard II, Vital sign) was placed at the end of the expiratory circuit close to the ventilator . **Figure 2.**

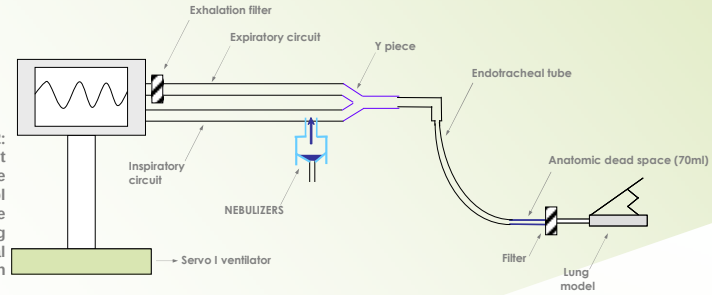


Figure 2: Experimental set up to measure aerosol delivered to the lung during mechanical ventilation

>> **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.**