## Evaluation of a Valved Holding Chamber for the Delivery of Aerosol-Based Medication Via Tracheostomy Tube to a Tidal Breathing Model

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## PURPOSE

Patients with asthma or obstructive airways disease who have a Tracheostomy Tube (TT) require aerosolized medication. We report the outcome of a study that investigated aerosol delivery from *AeroTrach Plus®* Anti-Static Valved Holding Chamber (AT VHC) and Misty Max 10<sup>†</sup> Nebulizer (SVN) to a breathing tracheostomy model.





## METHODS & RESULTS

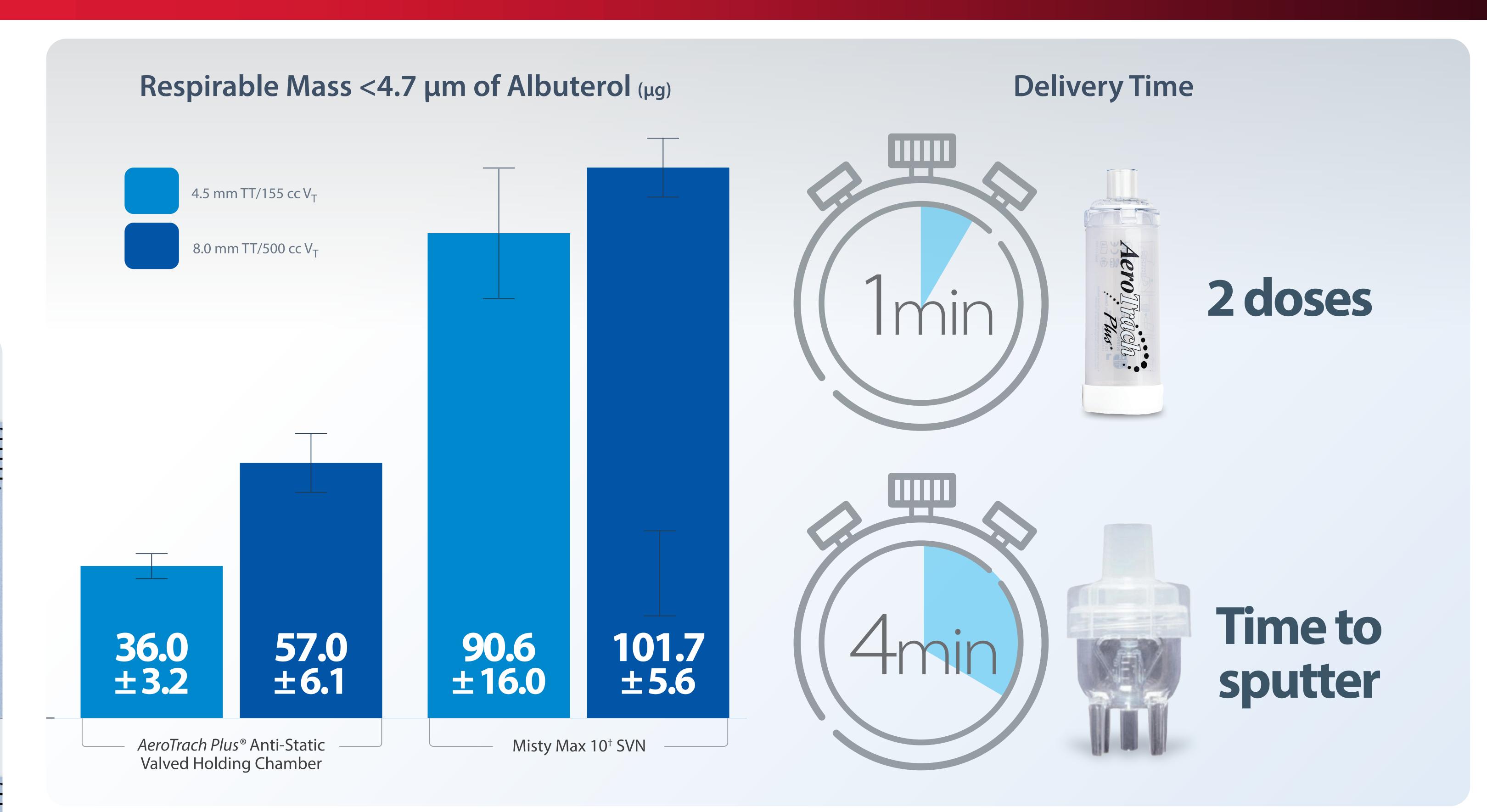
Albuterol was delivered to a 4.5 mm and an 8.0 mm TT model via either the AT VHC (Ventolin, 2 actuations) or SVN (2 mL - 1 mg/mL). The AT VHC was attached to the TT coupled with a collection filter at the distal end. When evaluating the SVN, a small or a large tracheostomy mask was placed over the appropriately sized TT opening. A hollow cylinder was placed over the TT setup to simulate a patient neck and allow the trach mask to fit snuggly over the TT opening.

Tidal breathing (155 cc  $V_T$ , 25 BPM, 1:2 I:E Ratio or 500 cc  $V_T$ , 13 BPM, 1:2 I:E Ratio) was simulated using an ASL 5000 breathing simulator. Aerosol particles were captured on a filter located at the distal end of the TT and the contents were assayed for albuterol by HPLC-UV spectrophotometry. In a parallel series of measurements, Respirable Droplet Fraction <4.7  $\mu$ m (RDF<sub><4.7  $\mu$ m) was determined and the clinically relevant Respirable Mass <4.7  $\mu$ m (RM<sub><4.7  $\mu$ m) was calculated as Total Mass x RDF<sub><4.7  $\mu$ m</sub> and represented as mean  $\pm$  SD in the results.</sub></sub>

The AT VHC produced RM $_{<4.7\,\mu m}$  values of 36.0 ± 3.2 µg and 57.0 ± 6.1 µg for the 4.5 mm TT/155 cc V $_{\rm T}$  and 8.0 mm TT/500 cc V $_{\rm T}$  respectively. In comparison, the SVN produced 90.6 ± 16.0 µg and 107.1 ± 5.6 µg for the equivalent conditions. The AT VHC delivered 2 doses in approximately 1 minute whereas the SVN required 4 minutes to deliver the medication to sputter.



V<sub>T</sub> = Tidal Volume; BPM = Breaths Per Minute; I:E = Inhalation:Exhalation



## CONCLUSION & CLINICAL IMPLICATIONS

The AT VHC was easier to use (no mask required) and much less time consuming than SVN with mask. In terms of dose per unit time, albuterol delivery via *AeroTrach Plus®* Anti-Static Valved Holding Chamber was more efficient than a small volume nebulizer.

Further research is required to determine the clinical relevance of these in vitro findings.