Does Spacer/Adapter Device Choice Affect Delivery of a Pressurized Metered Dose Inhaler (pMDI) through a Humidified Circuit to a Simulated Patient on Mechanical Ventilation

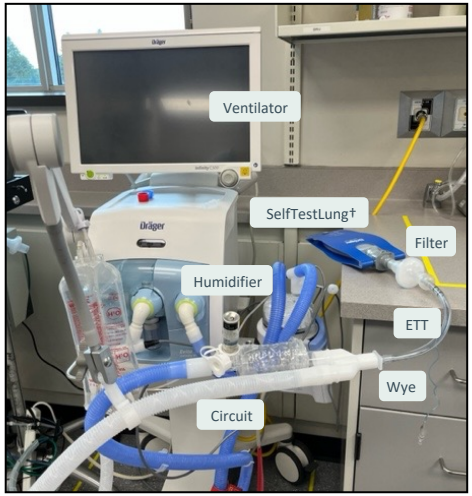
Nagel M, Suggett J, Doyle C, Ali R
Trudell Medical International, London, Ontario, Canada

INTRODUCTION

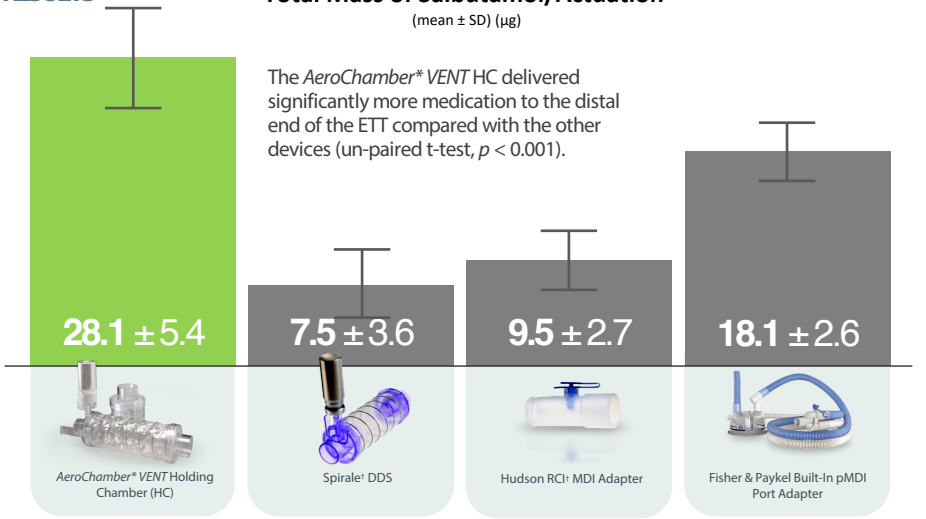
- Delivery of aerosolized medication to mechanically ventilated patients is a key element of their treatment.
- It is desirable to not break the ventilation circuit during aerosol therapy to reduce the risk of infection or derecruitment.
- This study evaluates the effect pressurized metered dose inhaler (pMDI) delivery devices that stay in line have on drug delivery in a simulated adult ventilator setting.

METHODS

- An adult mechanical ventilation circuit (Fisher & Paykel RT210) was humidified (T = 37°C, 100% RH), and a simulated ventilated adult model (tidal volume = 500 mL, duty cycle = 33%, rate = 13 breaths/minute) was generated using a Dräger Infinity† C500 ventilator.
- An aerosol collection filter was located at the distal end of the 8.0 mm diameter endotracheal tube (ETT) and the far-side of the filter was coupled to a Dräger SelfTestLung† simulating the patient.
- 5 actuations of a Ventolin† pMDI were delivered through the device on test, each time followed by 6 complete breathing cycles, shaking the canister between actuations.
- This procedure (n = 5/device) was performed with four devices: the *AeroChamber* VENT* Holding Chamber (HC) (also marketed as *AeroVent Plus** Collapsible Holding Chamber), the Spirale† drug delivery system (DDS), the Hudson RCI† MDI Adapter (these three devices were placed in the inspiratory limb), and via the built-in pMDI port adapter within the wye connector of the ventilator circuit.
- Assay of recovered salbutamol was undertaken by HPLC-UV spectrophotometry.



RESULTS



The *AeroChamber* VENT* HC delivered significantly more medication to the distal end of the ETT compared with the other devices (un-paired t-test, $p < 0.001$).

CONCLUSIONS

- In this study, we have shown device type influences aerosolized drug delivery during simulated adult mechanical ventilation.
- Although Spirale† DDS closely resembles *AeroChamber* VENT* HC, the Spirale† bellows had difficulties keeping a spacer-like shape when expanded for aerosol delivery.
- This study highlights the variability in drug delivery using a pMDI and that spacer/adapter choice are critical factors to be considered when using these devices as a treatment option.

British Thoracic Society Winter Meeting
22 – 24 November, 2023