AEROSOL DELIVERY EFFICIENCY OF THE AEROECLIPSE® AND PARI LC PLUS® NEBULIZERS WITH AND WITHOUT HANDHELD OSCILLATORY PRESSURE THERAPY

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INTRODUCTION

- Nebulized hypertonic saline (HS 7%) is commonly prescribed for cystic fibrosis (CF) patients.
- Patients connect nebulizers to handheld devices that generate oscillatory positive end-expiratory pressure (OPEP) for concurrent aerosol and airway clearance therapy.
- There is limited evidence for the lung delivery of Nebulized hypertonic saline (HS) 7% therapy with nebulizers and whether OPEP use impacts efficiency.

OBJECTIVE

To compare particle size and delivered lung dose in 5 testing conditions:
(1) Pari LC Plus (continuous output)
(2) AeroEclipse II (continuous output)
(3) AeroEclipse II (Breath actuated mode)
(4) Pari LC Plus (continuous) + Aerobika® OPEP
(5) AeroEclipse II (continuous) + Aerobika® OPEP

METHODS

- Nebulized HS 7% (4mL) was applied to a 3D anatomic nasotracheal airway of a child and spontaneously breathing lung model (RR of 15/min, VT of 350ml, and I: E of 1:2).
- Particle droplet size (µm, Dv50) was measured by a laser diffractometer (SprayTech, Malvern,Fig.1).
- HS 7% was nebulized via a mouthpiece, until sputtering, for 3 runs for each condition (n=15).
- The difference in pre-post filter and nebulizer weights represented delivered lung dose and residual nebulizer dose, respectively. Values were referenced to the nominal nebulizer dose (%).
- The mean lung doses were compared using ANOVA.

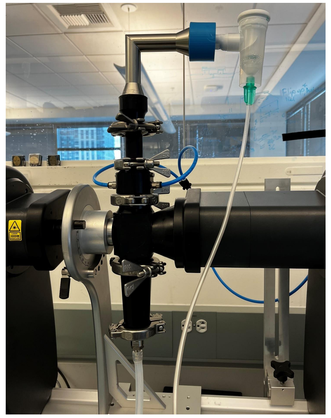


Figure 1. Particle Size Analyzer

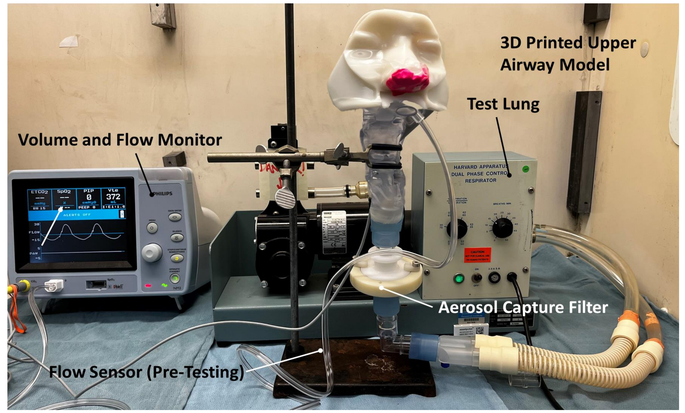
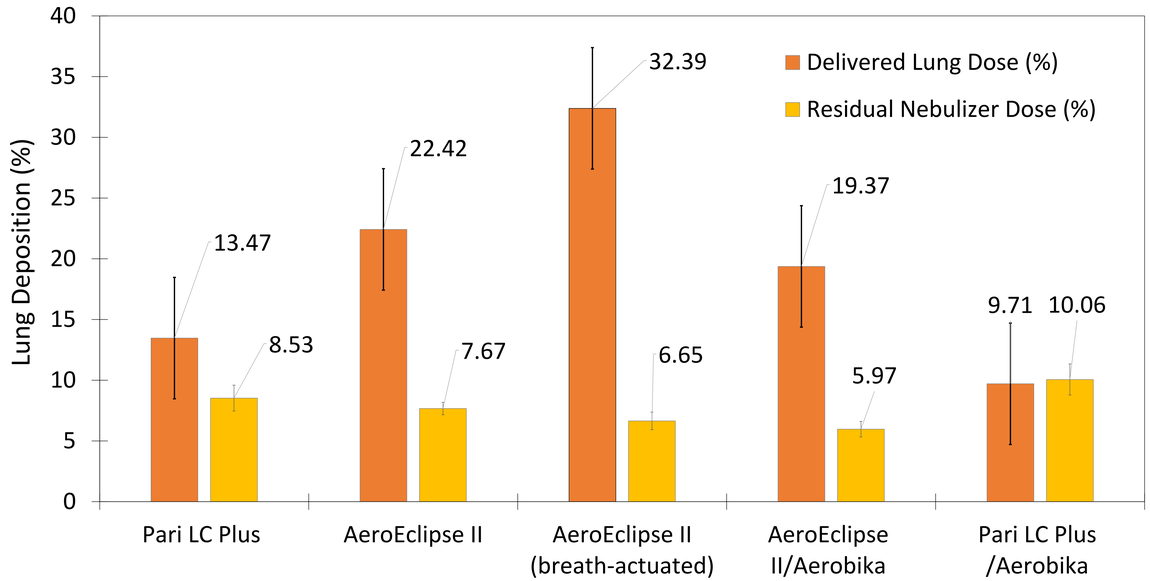


Figure 2. Delivered Dose Experimental Set-up



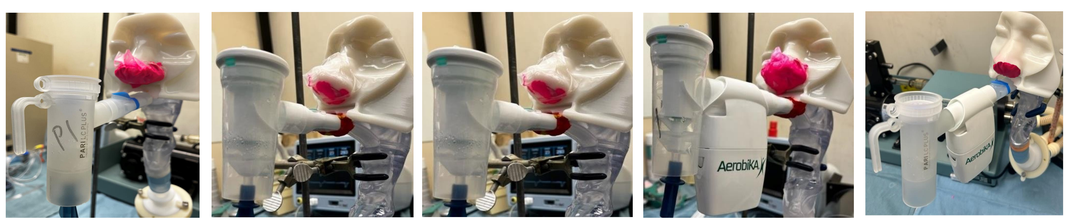


Figure 3. Delivered Dose Experimental Data

RESULTS

Testing Condition	Particle Size, Dv_{50} (µm)
Pari LC Plus	2.2±0.2
AeroEclipse II	3.2±0.1
Pari LC Plus/Aerobika	1.94±0.1
AeroEclipse II/Aerobika	2.6±0.1

- The AeroEclipse BAN-mode had the greatest lung dose (%) than the other condition ($p<0.05$, see Figure). AeroEclipse II compared to Pari LC plus had greater lung dose with the Aerobika ($p<0.05$).
- The nebulizer residual was lower with AeroEclipse II than Pari LC plus for all conditions.

Figure 4. Nebulizer Residual Drug Following Drying

CONCLUSIONS

We showed small, inhaled HS 7% particles (<5.4µm) are generated with each nebulizer. The AeroEclipse II performed with the highest efficiency and provided similar lung deposition of HS 7% with and without OPEP. Patients may benefit from greater drug delivery using the AeroEclipse II with BAN mode.

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