Specialists in effective inhalation PARI

Assessment of the new jet nebulizer platform PARI LC® SPRINT designed for different age groups and a faster delivery of aqueous inhalation formulations

PURPOSE

- To compare the in-vitro performance of the LC Sprint Nebulizer line to that of the LC ® PLUS and LC® STAR Reusable Nebulizers, and three commercially available nebulizer/compressor configurations.

BACKGROUND

- The LC® PLUS is considered the Gold Standard used in pivotal trials for aqueous nebulized drugs such as Pulmicort Respules®, Xoponex®, Brovana®, Perforomist®, Accuneb®, Duoneb®, TOBI®, and Pulmozyme®.
- PARI's next jet nebulizer generation, The LC Sprint family offers enhanced performance and product advantages.

MATERIALS AND METHODS

Devices evaluated for delivery efficiency (RDDR) with nebulization of 2.5 ml in1.0 mg/ml of albuterol

Nebulizer/Compressor

1. PARI LC PLUS Nebulizer/ 1.5 Bar Compressor
2. PARI LC SPRINT/ 1.5 Bar Compressor
3. Hudson RCI/Micromist/Pulmoaide 1.4 Bar
4. Sidestream / PortaNeb 1.6 Bar
5. Omron VC/Omron VX 1.3 Bar

- Aerosol performance measured by laser diffraction using isotonic saline at a compressed air supply of 1.5 bar and 5 L/min at 50 ± 5% r.h. and 22 ± 2°C.
- Experiments with breath simulation were performed using a PARI COMPAS™ breath simulator mimicking breathing patterns of different age groups.
- The LC® SPRINT 25 and the LC PLUS® nebulizers were measured with an inspiratory flow rate of 20 L/min.
- The Respirable Drug Delivery Rate (RDDR) was calculated as follows: Respirable Fraction (RF = droplets < 5 µm) x Drug Delivery Rate (DDR = drug assayed from an inspiratory filter/min).

RESULTS

Laser Diffraction

- About 69 - 85% of respirable droplets range < 5 µm for PARI LC® SPRINT making this next generation nebulizer line very versatile.
- The higher Total Output Rate (TOR) of the PARI LC® SPRINT with comparable VMD and RF to the PARI LC PLUS® and LC STAR® indicates a higher delivery efficiency associated with potentially shorter nebulization and inhalation times.
- The PARI LC® SPRINT 25 (red nozzle insert) low VMD and high is suitable for deep lung deposition and use in infants and toddlers in combination with a face mask.

Keller et al. ATS, 2006

Breath Simulation

- The Respirable Drug Delivery Rate (RDDR) is a predictor for the drug per time unit available for intrapulmonary deposition. This allows comparisons of performance of different nebulizer systems
- The PARI LC® SPRINT 35 and 30 show higher RDDR compared to the PARI LC PLUS® and LC STAR® indicating a faster drug delivery to the lungs.
- RDDR for a PARI LC® SPRINT 30 powered by a PARI PROBNEB® Ultra is up to 8 times higher making it possible to deliver a distinct dose 8 times faster than a standard T-piece nebulizer.

Aerosol Characteristics

	VMD/ MMD [µm]	TOR [mg/min]	RF < 5µm [%]
LC PLUS®	4.0	560	64
LC STAR®	3.3	430	77
LC® SPRINT 35	3.6	590	69
LC® SPRINT 30**	3.3	370	74
LC® SPRINT 25	2.8	450	85

Table 1. Results from Laser Diffraction Testing
0.9% NaCl

Delivery Efficiency

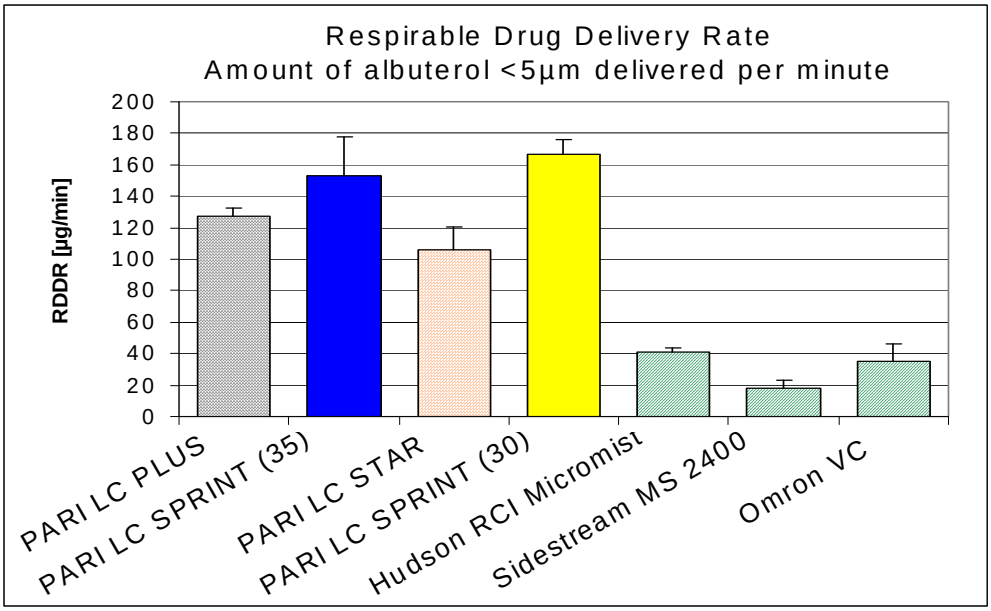

FIGURE 2. Results from Breath Simulation Testing
2.5 ml in1.0 mg/ml of albuterol

The PARI LC® SPRINT nebulizer family enables convenient, fast and safe inhalation therapy adapted to the patient's needs and requirements.

Keller et al. ATS, 2006