INHALED ANTIBIOTIC DELIVERY BY PNEUMATIC NEBULIZATION: CASE STUDY COMPARING BREATH ACTUATED WITH BREATH ENHANCED NEBULIZERS FOR COLISTIMETHATE SODIUM

BACKGROUND

- Colistimethate sodium is a polymyxin antibiotic that is indicated for treating lung infection with pseudomonas aeruginosa in cystic fibrosis.
- Although dry powder inhaler-based products are available, this therapeutic agent is often given by pneumatic nebulization.
- To ensure optimal dosing, the possibility of using such products in conjunction with a Breath Actuated Nebulizer (BAN) may be of interest, as this type of nebulizer conserves medication during exhalation rather than allowing it to escape and disperse into the local environment.
- The present laboratory investigation was designed to evaluate colistimethate sodium output from a BAN configuration able to be used in either the hospital or home environment.
- Comparison measurements were also gathered for a continuous Breath Enhanced Nebulizer (BEN), to provide benchmark data.

MATERIALS AND METHODS

- BAN group (n=5 devices)
  - AeroEclipse® XE, with Ombra® Table Top Compressor; AE-XL, Trudell Medical International, London, ON, Canada
  - BEN group (n=5 devices)
    - LC Piu® with PARI-BOY® SX compressor; PARI Respiratory equipment, Middletown, VA, USA
- Adult patient tidal breathing simulation with ASL5000 Test Lung (IngMar Medical, Pittsburgh, PA)
- Total volume = 600 mL
- Duty cycle = 33%
- Rate = 10 breathing cycles/min
- Filter collection at mouthpiece of nebulizer at 1 min intervals from start to onset of sputter

RESULTS

- The BANs were operated in the breath actuated mode for this part of the study
- Medication is only delivered during the inspiratory portion of each breathing cycle
- There is negligible waste of medication to the ambient surroundings during exhalation
- The measurements were subsequently repeated with the same nebulizers sampling continuously at 15 L/min to determine droplet size distribution by Next Generation pharmaceutical Impactor (NGI)
- Fine Droplet Fraction (<0.5 μm diameter (FDF<0.5 μm) determined in accordance with USP Chapter 1601 (2013)
- Fine particle mass delivery profiles for colistimethate sodium aerosols were constructed on a minute by minute basis from the product of FMD and FDF<0.4 μm particle mass,
- Compared with the BAN system was evident by the increased fine particle mass, compared with the BEN nebulizer system

CONCLUSIONS

- Conservation of medication and associated avoidance of environmental losses from fugitive emissions with the BAN nebulator system was evident by the increased fine particle mass, compared with the BEN nebulizer system
- Mean delivery rates of the therapeutically beneficial fine droplets were, however, comparable at ca. 2.4 mg/min for both nebulizer-compressor systems
- In this particular instance, the caregiver therefore has the option of stopping treatment after 12 minutes with the BAN if a similar dose or run time to the BEN is desired, or can continue to deliver additional dose in the same treatment session if it is considered clinically desirable to maximize delivered dose
- This additional dose is well within the safe and effective daily dose range reported from a colistimethate sodium marketed product registration information

- Data on tin and copper from the product of the polymeric and polystyrene foam material

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