

Abstract:

Background: Aerosol delivery in the non-invasive ventilation is affected by many variables; some of them are handled without practical guidelines at all.

Aims of the work: This study aimed to demonstrate the effect of different nebulizer designs and changing fill volume on aerosol delivery of inhaled salbutamol during the non-invasive ventilation using two different nebulizers.

Patients and methods: In-vivo: Two patient groups of 12 each were involved in the in-vivo study. The groups received the inhaled salbutamol using either side stream jet nebulizer or vibrating mesh nebulizer. Two fill volumes (1ml and 2ml) of salbutamol respiratory solution were delivered to each patient at first and third days of the study. Two urine samples were collected, the first sample was collected after 30 minutes and the second was collected for 24hours. Samples were analyzed using High performance liquid chromatography. At second day, ex-vivo study was carried out on the patients using the same fill volumes. Nebulization time was also recorded.

In-vitro: Each nebulizer was used to compare total inhaled dose collected in the inhalation filter of three different fill volumes (1, 2, 4ml) using 1ml respirable solution of salbutamol diluted to 2ml and 4ml using normal saline. Data modeling was carried using artificial neural networks for training, testing and validation of in-vitro, in-vivo and ex-vivo models. Data

Results: At the same fill volume, vibrating mesh nebulizer delivered higher amount of salbutamol compared to jet nebulizer for all studies. Increasing fill volume from 1ml to 2ml resulted in significant increase in lung and body bioavailability, also for inhaled and exhaled amount for jet nebulizer with no

significant increase with vibrating mesh nebulizer. Comparable body bioavailability of salbutamol was indicated with jet (2ml) and vibrating mesh nebulizer (1ml). Nebulization time for jet was longer than that of vibrating mesh.

Conclusion: Increasing the fill volume of jet nebulizer is essential to increase the amount of inhaled medication that reaching the patient. While there is no need to increase fill volume when using vibrating mesh nebulizer. Data modeling showed the validity of models for optimizing aerosol delivery process for patients using either Jet or vibrating mesh nebulizers.

Keys words: Salbutamol, Non-invasive ventilation, Fill volume, Relative lung bioavailability, Nebulizer.