Study Of The Effectiveness Of A New Inhalation Chamber In Invasive Mechanical Ventilation

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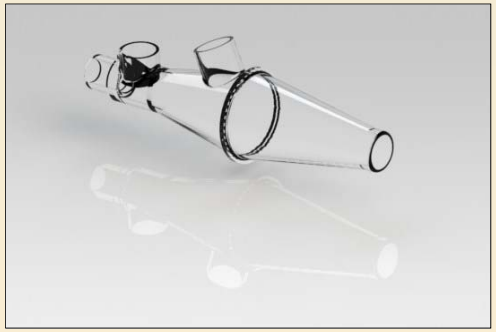
Introduction

To administer aerosol medication in mechanical ventilation, different devices can be used either nebulizers or pressurized metered dose inhaler (pMDI). The pMDI is recommended to be used with a spacer and nebulizer is used with a T-adapter. A new chamber has been developped avoiding different connectors for different aerosol generators and to increase aerosol delivery.
The aim of this study was to evaluate the in vitro performance of two prototypes of inhalation chamber for both pressurized metered dose inhaler (pMDI) and nebulizer in invasive mechanical ventilation.



Materials

In this study, three devices were compared for nebulization:

- Aerogen T-adapter (AG)
- Inhalation chamber with a short cone (PX01)
- Inhalation chamber with a long cone (PX02)

Materials

In addition, three devices were compared for use with a pMDI :

-ACE spacer (ACE)

-Inhalation chamber with a short cone (PX01)

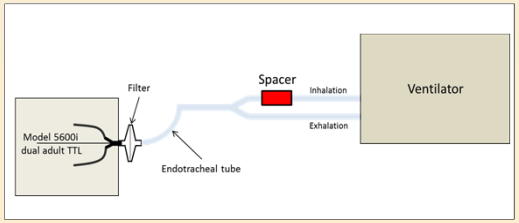
-Inhalation chamber with a long cone (PX02)

Method

-Salbutamol mass loaded in the nebulizer : 5 mg.

-10 actuations of Ventolin (100 µg / dose) was conducted at the beginning of the inhalation phase and we waited 10 breaths between each actuation.

To assess the PX01 inhalation chamber in clinical conditions, assembly below including a respirator (Volume controlled, Vc = 450mL, f = 15/min, PEEP = 6, P max = 19, Ti / Ttot = 40/60) and a model of adult lung Dual TTL model 5600i (Michigan Instruments) was used. A filter was placed after the endotracheal tube to measure salbutamol by spectrophotometry after nebulization and after aerosolization.



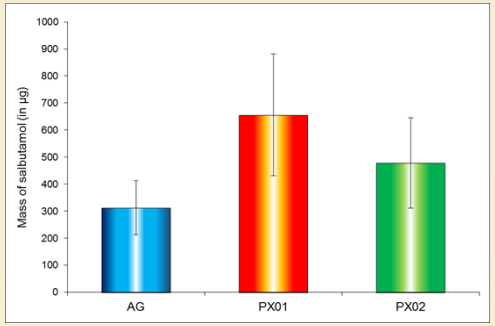
Values, expressed as mean +/- SEM, were compared using one-way ANOVA.

Results

After nebulization, the use of the new prototype chamber increases the deposition of salbutamol in comparison with a T-adapter.

Concerning the two prototypes, the PX01 inhalation was more effective than the PX02 inhalation chamber (659.7 ± 224.6 µg vs 477.7 ± 167.5 µg).

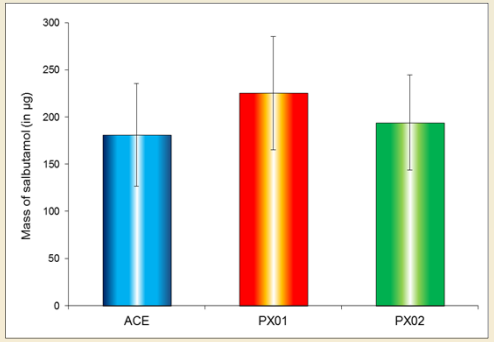
The mass of salbutamol deposited on the filter, that is located after the endotracheal tube, was twice higher with the PX01 inhalation chamber than the Aerogen T-adapter (659.7 ± 224.6 µg vs 312.9 ± 100.2 µg).



Finally, the nebulization time was identical with the spacer and the T-adapter. Thus the rate of drug delivered with the inhalation chamber was twice higher compared to the T-adapter.

Results

After the use of pMDI, the mass of salbutamol deposited on the filter was similar between the Ace Spacer and the PX01 and PX02 inhalation chambers.



Discussion

The results shown that an inhalation chamber with a short cone was more effective than an inhalation chamber with a long cone during nebulization. However, after the use of pMDI, the results showed that the length of the inhalation chamber had no impact.

Conclusion

In conclusion, the new prototype of inhalation chamber (PX01) allows the efficiency of aerosol delivery for both pMDI and nebulizer in invasive mechanical ventilation.

The use of the new prototype of inhalation chamber increase by a factor 2 the aerosol delivery by mesh nebulizer in comparison with the use of a standar T piece.