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Title: In vitro evaluation of a new spacer for pMDI and nebulizers in mechanical ventilation

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Body: Rationale: The objective of this study was to evaluate the performances of a new prototype spacer (Combihaler, Protec'Som, France) to improve antibiotic and bronchodilator delivery either from nebulizer or pMDI Methods: A Servo 300 ventilator (Siemens, France) set up in controlled volume (450ml, 15/min, 40/60) was connected to an endotracheal tube. An absolute filter was connected between the endotracheal tube and a lung model (Dual adult model, Michigan instrument, USA). A vibrating mesh nebulizer (Aeroneb Solo, Aerogen, Ireland) loaded with amikacine (reference) was tested with its T piece (Aerogen, Ireland) and Combihaler. A pMDI of sabutamol (100µg, Ventoline, GlaxoSmithKline, France) was tested with a connector (Minispacer, AirLife, USA) and Combihaler. All aerosol devices were connected at the “Y” piece on the inspiratory circuit. Drug delivery on filter was assay. Results: The duration of nebulization was not statistical different between the T piece and the Combihaler (42±0,9min vs 43,2±0,9min, p>0,05). The mass of amikacin deposited on the filter was twice higher with the Combihaler chamber compared with the Aerogen T-adapter (305.6±9.3 mg vs 142.4±4.9 mg, p<0,001) corresponding of an increasing of a factor 2 in term of output rate with Combihaler (7.1±0.2 mg/min vs 3.4±0.2 mg/min; p<0,001). The mass of salbutamol deposited on the filter was 2.3 fold higher with Combihaler chamber in comparison with the connector (43.5±6.3 µg vs 18.8±1.9 µg, p<0,05). Conclusions: In comparison with T piece or connector, the use of the Combihaler spacer allows increasing the amount of drug delivery by a factor 2 either from nebulizer or pMDI during mechanical ventilation.