TITLE A SIMPLE CATHETER EXTENSION IMPROVES DELIVERY EFFICIENCY OF METERED DOSE INHALERS: A QUANTITATIVE EVALUATION

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The metered dose inhaler (MDI) is a commonly used delivery system to supply bronchodilators to the respiratory tree. For perioperative bronchospasm, puffs from an MDI are often administered into the proximal end of the endotracheal tube (ETT), but the drug quantity reaching the distal end of the ETT is small (1). This laboratory study evaluated the efficiency of drug delivery through ETTs of MDIs with nozzle extensions fashioned from readily available catheters.

Materials included fresh albuterol MDIs, commercially available IV and suction catheters with hubs modified to fit the MDI nozzle and standard uncut 8.0 mm (id) ETTs. The MDI was activated directly into the ETT or into the ETT via one of the nozzle extensions. Drug delivery to the distal ETT was measured using an ultrasensitive microbalance with a precision of ± 0.5 mcg. The control condition was direct activation of the MDI into the tare vessel.

The data below show that control measurements were in good agreement with the manufacturers specifications for aerosolized solids. Direct administration into the ETT, or activation through one of the short catheters, provides less than 5% of the control dose to the distal ETT. A long suction cather was inefficient but a long IV catheter carried more than 20% of the control dose to the distal ETT.

delivery method from MDI to tare vessel	mcgs delivered (mean±SD)	% of control	N
control	88.6 ± 12.5	100.0	15
ETT, direct	4.1 ± 1.2	4.6	8
2" IV catheter, 16g	1.7 ± 1.2	1.9	5
6" IV catheter, 16g	3.4 ± 1.4	3.8	5
12" IV catheter, 16g	20.7 ± 6.9	23.3	12
12" suction cath.,12F	1.3 ± 1.3	1.5	5

Activation of an MDI into an ETT deposits most of the dose in the ETT lumen thereby limiting drug delivery to the patient. Using commonly available OR materials, efficiency of delivery may be improved by fashioning extensions of the MDI to carry drug distally through the ETT and thus to the tracheobronchial tree.

(1) Crogan SJ and MJ Bishop, Anesthesiology 70:1008-1010, 1989

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TITLE: BREATH BY BREATH GAS EXCHANGE MEASUREMENT DURING GENERAL ANESTHESIA.

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The use of breath by breath measurement of gas exchange in anesthesia has been limited by the need to correct for the wide range gas composition changes encountered with anesthetic gases. Furthermore, the absence of air nitrogen in the inspired gases prevents the assumption of nitrogen equilibrium at the mouth being used for Haldanes transformation to deduce inspired from expired volumes or the correction of measurements for changes in lung gas stores breath to breath.

A system has been developed that will measure gas exchange breath by breath for up to eight gases, using a single pneumotachograph, a mass spectrometer and a micro-computer. Correction for lung gas stores can be performed using argon instead of nitrogen as the equilibrium gas. Inspired argon concentration is maintained at atmospheric concentration during general anesthesia by infusing argon into the anesthetic breathing system used.

The performance of the system on patients undergoing general anesthesia with controlled (I.P.P.V.) and spontaneous ventilation has been studied. The results (see table) show that although the method shows a typical high degree of variability to breathing pattern, the accuracy and repeatability of the method compares favourably with systems using two flow transducers in exercise testing. Accuracy and repeatability is significantly improved by use of the lung gas stores correction using argon. However, the study has illustrated that breath by breath measurement of gas exchange is unlikely to be the method of choice for simple RQ or mean gas exchange measurements over minutes.

Table.

Gas exchange measurement			VO_2	VCO_2	VN_2O
I.P.P.V.					
Coefficient of variation	(%)	NC	17.15	7.17	27.16
		A	13.47	5.24	19.66
Mean variation breath by breath	(ml)	NC	4.45	2.00	8.05
		A	3.59	0.70	5.35
Spontaneous Ventilation					
Coefficient of variation	(%)	NC	11.87	7.20	16.60
		A	8.31	7.00	12.55
Mean variation breath by breath	(ml)	NC	3.68	1.38	5.66
		A	1.44	0.97	6.62

NC = No correction for lung gas stores;
A = Correction using argon