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Introduction:

High flow nasal therapy (HFNT) is used for oxygen supplementation and the application of positive end expiratory pressure (PEEP) in spontaneous breathing patients. Jet nebulisers (JN), require a driving gas flow to operate and disconnection from the high flow circuit for drug refill. For vibrating mesh nebulisers (VMN), drug is refilled without breaking the circuit and does not require a driving gas flow. The objective of this in-vitro study was to evaluate the impact of nebuliser drug refill on PEEP during HFNT in a simulated adult model.

Methods:

A VMN (Aerogen Solo, Aerogen, Ireland) or a JN (Cirrus 2, Intersurgical, UK) was connected to a high flow system (O2FLO, Inspired, HK) at 50LPM, with nasal cannula placed on an anatomically correct head model. The head model was connected to a breathing simulator (ASL 5000, Ingmar Medical, USA) set to simulate an adult breathing pattern (Vt 500ml, 15BPM, and I:E 1:1). The JN was driven with compressed air at 8LPM. This additional gas flow was accounted for in the total high flow gas rates applied. PEEP was recorded using a pressure sensor (Citrex H5, IMT, Switzerland), placed at the level of the lung.

Results:

During the JN drug refill process the applied PEEP in the lung drops to near zero ($p < 0.0001$). This might be explained by the need to break the circuit in order to add drug to the medication cup. On the other hand, the VMN was seen to have no significant effect on PEEP as it remains closed during drug refill ($p = 0.84$). This could be explained by the VMN design wherein the ventilatory circuit remains intact and drug refill is completed by opening the silicon cap on the medication cup.

Conclusion:

This study provides key information related to the impact of nebuliser type on PEEP during HFNC in a simulated adult model. VMN technology showed no influence on PEEP when performing drug refill during HFNT.

Table:

Nebuliser type	Test Scenario	PEEP (cmH20) Average \pm SD
VMN	50 LPM HFNT + VMN	4.15 \pm 0.05
VMN	During VMN drug refill	4.14 \pm 0.03
JN	50 LPM HFNT + JN	4.13 \pm 0.04
JN	During JN drug refill	0.01 \pm 0.01

Table 1. PEEP (cmH20) during HFNT in a simulated adult model.