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COMPARISONS OF THE RAM CANNULA WITH HIGH FLOW NASAL CANNULA (HFNC) ON AEROSOL DRUG DELIVERY IN A SIMULATED NEONATAL LUNG MODEL.

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Background: Aerosol delivery through HFNC has been described with in vitro models. The RAM cannula, which is used for support of ventilator-dependent patients, has not been characterized for aerosol delivery. The purpose of this study is to compare HFNC with RAM cannula on aerosol drug delivery in a simulated neonatal lung model. Method: An in-vitro airway/lung model, using the DiBlasi newborn upper airway model attached to a collecting filter and test lung, was passively ventilated with a ventilator (Respironics Esprit) using the RAM cannula (Premie RAM Cannula, Neotech) or during active simulated spontaneously breathing newborns using a sinusoidal breathing pump with a HFNC (Fisher& Paykel) placed in the nares of the model. Based on the RAM manufacturerâ€™s recommendations, two ventilator settings were utilized with the RAM cannula; PIP 15 cmH2O, PEEP 5 cmH2O, Ti 0.5 sec, RR 40/min; and PIP 30 cmH2O, PEEP 8 cmH2O, Ti 1 sec, RR 48/min. Breathing parameters used with HFNC include RR 50, Vt 8ml, and I:E ratio 1:2. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen) was placed at the inspiratory inlet of a heated humidifier (Fisher&Paykel) in which the temperature was held constant at 37 Â°C. Albuterol sulfate (2.5mg/3mL) was administered through either HFNC and the RAM cannula connected to the HFNC and ventilator circuit, respectively. Drug deposited on a filter distal to the modelâ€™s trachea was eluted and analyzed via spectrophotometry. Independent and paired sample t-test were used for data analysis ($p < 0.05$). Results: Deposition of inhaled dose (expressed as mean mass and % of nominal dose Â± SD) is shown in the table below. Comparisons of the RAM cannula with HFNC showed that the RAM cannula delivers significantly less aerosols than HFNC at both 3 lpm (p=0.002) and 6 lpm (p=0.022). Using minimum setting with the RAM cannula increases dose efficiency (p=0.033) during mechanical ventilation. Decreasing flow rate from 6 to 3 L/min increases aerosol delivery with HFNC (p=0.119). Conclusion: Regardless of the settings, aerosol delivery via HFNC is more efficient than the RAM cannula in a simulated neonatal lung model. Sponsored Research - None

Cannulae Type	RAM		HFNC	
Settings	Min Setting	Max Setting	3 lpm	6 lpm
Inhaled mass (mcg)	16.53 ± 2.90	10.03 ± 2.05	39.96 ± 5.52	28.63 ± 8.61
Inhaled mass %	0.66 ± 0.11	0.40 ± 0.08	1.60 ± 0.20	1.14 ± 0.34