EFFECT OF AMPLITUDE AND INSPIRATORY TIME IN A BENCH MODEL OF NON-INVASIVE HIGH FREQUENCY OSCILLATORY VENTILATION THROUGH NASAL PRONGS

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Background and aims: Nasal high frequency oscillatory ventilation (nHFOV) has been proposed to combine the advantages of oscillatory pressure waveform and of non-invasive interface. We studied the effect of oscillation amplitude and inspiratory time on the pressure transmission and stroke volume delivered through different nasal prongs.

Methods: A bench model of nHFOV was built connecting SM3100A oscillator tubings via two differently sized nasal prongs, to a neonatal lung model carrying mechanical properties of recovering RDS. A standard circuit with no nasal prongs was used as control. Tidal volume (T_v), oscillatory pressure ratio ($\Delta P_{\text{dist}}/\Delta P_{\text{prox}}$) and ventilation (DCO_2) were measured across a range of amplitudes and with inspiratory time (IT) set at 33% and 50%. Measurements were performed with a low-dead space hot wire anemometer coupled with a pressure transducer, specifically validated for neonatal ventilation.

Results: T_v , $\Delta P_{\text{dist}}/\Delta P_{\text{prox}}$ and DCO_2 were 83%, 40% and 71%, respectively, of those provided with the control circuit. No differences were noticed between small and large prongs. T_v and ΔP_{prox} were linked by a quadratic relationship and T_v plateaus for amplitude values $> 65 \text{ cmH}_2\text{O}$. $\Delta P_{\text{dist}}/\Delta P_{\text{prox}}$ shows the same tendency. Same results were obtained with both types of prongs and with increasing IT. On the whole, mean T_v was higher with IT at 50% than at 33% (2.4 mL vs 1.4 mL; $p < 0.001$).

Conclusions: Changing oscillation amplitude significantly affect ventilation during nHFOV and this effect seems greater than that obtained by varying the frequency. 50% IT always provides an higher T_v delivery and ventilation.