AEROSOL DELIVERY WITH JET AND MESH NEBULIZERS USING DIFFERENT MASKS IN SPONTANEOUSLY BREATHING INFANTS: AN IN-VITRO STUDY

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Methods

**Background**

Drug delivery to infants varies with type of nebulizer and interface used during aerosol therapy.

The purpose of this study was to quantify aerosol deposition with a jet nebulizer (JN) and mesh nebulizer (MN) with a proprietary adapter using different types of masks in a simulated spontaneously breathing infant.

**Methods**

**Lung Model:** A lung model using a teaching manikin connected to a sinusoidal pump via a collecting filter at the level of the trachea simulating a spontaneously breathing infant/toddler (Vt 150 mL, RR 25 bpm and I:E ratio 1:2).

**Dose, Nebulizers, & Masks:** Albuterol sulfate (2.5 mg/3 mL) was aerosolized with JN (Mistymax 10, Airlife) or MN with adapter (Aeroneb Solo Adapter which facilitates use of the Aeroneb Solo with mouthpieces and masks, Aerogen Ltd, Galway, Ireland) using the dragon mask, aerosol mask, and valved-mask. The adapter specifically designed for MN was attached to all the interfaces used in this study and with supplemental oxygen of 2 lpm. A valved-mask was prepared by modifying a non-rebreathing oxygen mask with one-way valves on ports on both sides of the mask. The JN was run at 10 lpm based on the manufacturer’s guideline.

**Data Collection and Analysis:** Drug was eluted from the filter and analyzed via spectrophotometry. Descriptive statistics, dependent t-test and one-way analysis of variance were used for data analysis at the significant level of 0.05.

**Results**

The table below shows mean ± SD for inhaled mass delivered distal to the trachea.

<table>
<thead>
<tr>
<th>Nebulizers</th>
<th>Jet Nebulizer</th>
<th>Mesh Nebulizer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Masks</strong></td>
<td>Valved Mask</td>
<td>Dragon Mask</td>
</tr>
<tr>
<td><strong>Valved Mask</strong></td>
<td>0.13 ± 0.02</td>
<td>0.12 ± 0.02</td>
</tr>
<tr>
<td><strong>Aerosol Mask</strong></td>
<td>0.28 ± 0.01</td>
<td>0.16 ± 0.01</td>
</tr>
<tr>
<td><strong>Inhaled Mass (mg)</strong></td>
<td>5.33 ± 0.75</td>
<td>4.67 ± 0.94</td>
</tr>
<tr>
<td><strong>Inhaled Mass (%)</strong></td>
<td>11.11 ± 0.66</td>
<td>6.44 ± 0.34</td>
</tr>
</tbody>
</table>

The figure below represents mean ± SD for percentage of nominal dose delivered distal to the trachea.

JN was less efficient in drug delivery than MN using valved-mask, dragon mask and aerosol mask (p=0.002, p=0.066 and p=0.355, respectively). While no significant difference was found among valved-mask, dragon mask and aerosol mask using JN (p>0.05), drug delivery with MN via valved-mask was greater than the dragon mask (p=0.002) and aerosol mask (p=0.002). The dragon mask was more efficient than the aerosol mask using MN (p=0.009).

**Conclusion**

Delivery efficiency of JN was less than MN with adapter regardless of the type of mask tested in this study. Drug delivery was greatest with the valved-mask with JN and MN, while the standard aerosol mask was least efficient in this simulated spontaneously breathing infant model.