Assessing Different Valved Holding Chambers with Facemask for Delivered Mass to Carina with Inhaled Corticosteroid by Pressurized Metered-Dose Inhaler

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RATIONALE

To effectively evaluate Metered Dose Inhaler (MDI) + Valved Holding Chamber (VHC) delivery systems with a mask, the most appropriate method is to use a face model that includes soft tissue simulation and an anatomically realistic oro-naso-pharynx.

We report a study in which several child mask VHCs were evaluated using the ADAM III anatomical model of a small child.

- n = 3 devices per group

METHODS

- Each VHC was evaluated by breathing simulator
  - ASL5000, IngMar Medical, Pittsburgh, PA
- Tidal breathing
  - Tidal volume (Vt) = 155-mL
  - Inspiratory: Expiratory (I:E) ratio = 1:2
  - Rate/min (R/min) = 25 cycles
- A 2-s delay was introduced before initiating the first respiration cycle to mimic a short coordination delay
- The test chamber with mask was attached to the anatomical model (ADAM III) of a 4 year old child face equipped with oropharynx
- The airway was coupled to the breathing simulator via an electret filter located at the exit to capture drug particles that penetrated as far as the carina
- 5 actuations of Fluticasone Propionate (FP, Flovent 50) were delivered at 30-s intervals
- FP recovered from specific locations in the aerosol pathway was subsequently assayed by HPLC-UV spectrophotometry

RESULTS

<table>
<thead>
<tr>
<th>FP Recovery Location</th>
<th>VHC</th>
<th>Facemask</th>
<th>Airway</th>
<th>Filter at “Carina”</th>
</tr>
</thead>
<tbody>
<tr>
<td>AeroChamber Plus Flow-Vu†</td>
<td>17.5 ± 1.6</td>
<td>1.4 ± 0.2</td>
<td>1.1±0.2</td>
<td>10.1 ± 1.0</td>
</tr>
<tr>
<td>OptiChamber Diamond®</td>
<td>22.7 ± 2.7</td>
<td>3.4 ± 0.8</td>
<td>0.7 ± 0.1</td>
<td>5.1 ± 0.9</td>
</tr>
<tr>
<td>A2A® Spacer</td>
<td>28.3 ± 2.8</td>
<td>0.2 ± 0.1</td>
<td>0.4 ± 0.1</td>
<td>4.1 ± 0.9</td>
</tr>
<tr>
<td>Pocket Chamber®</td>
<td>36.6 ± 0.2</td>
<td>1.9 ± 0.8</td>
<td>0.4 ± 0.2</td>
<td>4.0 ± 1.7</td>
</tr>
<tr>
<td>Vortex®</td>
<td>39.7 ± 6.7</td>
<td>1.2 ± 0.2</td>
<td>0.6 ± 0.3</td>
<td>2.7 ± 1.5</td>
</tr>
<tr>
<td>Compact Space Chamber Plus†</td>
<td>36.1 ± 3.6</td>
<td>0.5 ± 0.3</td>
<td>0.1 ± 0.1</td>
<td>1.5 ± 0.9</td>
</tr>
<tr>
<td>Volumatic†</td>
<td>33.6 ± 1.9</td>
<td>0.1 ± 0.1</td>
<td>0.0 ± 0.0</td>
<td>1.5 ± 0.8</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- Significantly more FP was delivered to filter/carina with the AeroChamber Plus® Flow-Vu VHC
  - Un-paired t-test, p<0.001
- Chamber (shape, capacity, material), mask fit and valve design may account for the large differences in drug delivery
- Clinicians need to be aware that not all VHCs are the same