"Comparison of pentamidine inhaled dose with two different nebulizers"

Audag, Nicolas ; Sokal, Etienne ; Smets, Françoise ; Van der Linden, Dimitri ; Stéphenne, Xavier ; Liistro, Giuseppe ; Reychler, Gregory

ABSTRACT

Body: INTRODUCTION: Nebulized pentamidine is used in the prevention of pneumocystis carinii pneumonia in immunosuppressed patients. A specific nebulizer with characteristics to ensure deep lung deposition is required. It must include a circuit with expiratory filter preventing the dissemination of droplets into the environment. The reference nebulizer for pentamidine delivery is the Respirgard II®. All nebulizers with comparable properties could be used for the nebulization. AIMS AND OBJECTIVES: The aim of this work was to evaluate and to compare the inhaled dose between the Respirgard II® and the Isoneb®. METHODS: The nebulizers were connected to a dual chamber lung model (5600i Dual Adult Training/Test Lung®,Michigan Instrument Inc.) simulating usual breathing pattern of an adult patient. A solution of pentamidine (300mg/6mL sterile water) was nebulized during 20 minutes. We measured in triplicate the inhaled dose by weighting the filter positioned between the nebulizer and the...

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COMPARISON OF INHALED DOSE WITH PENTAMIDINE NEBULIZERS: ISONEB® vs. RESPIRGARD II®

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Aims

• Pentamidine in nebulized form is one of the drugs listed in the primary or secondary prevention of pneumocystis carinii pneumonia in immunosuppressed patients.

• This nebulization requires a nebulizer with specific characteristics. These features are the presence of a circuit with expiratory filter preventing the dissemination of droplets into the environment (pentamidine may be toxic) and secondly, to ensure a fine particle size allowing deep lung deposition.

• The reference nebulizer used for pentamidine nebulization is currently the Respirgard II®, a disposable pneumatic nebulizer. Several studies remark that all nebulizers with comparable properties could be used for the nebulization.

• The aim of our work is to evaluate and compare the results between the reference nebulizer Respirgard II®, and one of these nebulizers available on the market, the Isoneb ®.

Methods

• A solution of pentamidine (300mg/6mL sterile water) was nebulized by a Respirgard II® (Vital Signs, New Jersey, USA) (RII) or by an Iso-NEB® (Teleflex, Pennsylvania, USA) (Iso).

• Nebulizers (Iso and RII) were connected to a dual chamber lung model (5600) Dual Adult Training/Test Lung®, Michigan Instrument Inc., Michigan, USA) simulating usual breathing pattern of an adult. Respiration frequency and tidal volume driving by a ventilator (SERVO-I®, Maquet, Rastatt, Germany) to the lung model were 15 cycle/min, 500 ml respectively.

• During the nebulization, a filter (filter 1) was interposed between the nebulizer and the lung model. The filter was weighed before the nebulization and after drying for 24 hours at ambient air. The resulting weight is the inhaled dose. We expressed the inhaled dose in percentage of the nominal dose.

• The nebulizer cup was weighed before and directly after nebulization. Residual solution was obtained by subtracting the weight of the empty nebulizer cup and the weight of the nebulizer cup at the end of the nebulization.

• The lost dose (expressed in percentage of the nominal dose) represents the difference between the inhaled dose and the nominal dose.

• Nebulization was stopped for each nebulizer after 20 minutes.

• We measured the internal volume of the nebulizers (without cup and filters) after the nebulization.

Results

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Nebulizer</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Isoneb®</td>
<td>Respirgard II®</td>
</tr>
<tr>
<td>Inhaled dose (% nominal dose)</td>
<td>32.9 ± 10</td>
<td>29.5 ± 3.3</td>
</tr>
<tr>
<td>Residual solution (g)</td>
<td>0.986 ± 0.089</td>
<td>1.575 ± 0.317</td>
</tr>
<tr>
<td>Lost dose (% nominal dose)</td>
<td>67.1 ± 10</td>
<td>70.4 ± 3.3</td>
</tr>
<tr>
<td>Internal volume (cm³)</td>
<td>106.3 ± 0.6</td>
<td>110.3 ± 0.6</td>
</tr>
</tbody>
</table>

Discussion

• This in vitro study is the first step in the comparison of the two nebulizers.

• We found no significant difference in the inhaled dose.

• We observed a difference in residual solution but none in calculated lost dose. It could be explained by the drugs concentration in the cuve or by a difference of deposition in the device, in the one-way valves and in the filter positioned on the nebulizer expiratory branch. Nevertheless we have no measure to prove it. The difference in the internal volume is highly significative, it could explain a different deposition in the device.

• However the effectiveness of pneumocystis carinii pneumonia prophylaxis is based on the inhaled dose and pulmonary deposition. We will have to measure the pulmonary deposition in a second study to compare the relative effectiveness of the two nebulizers.

Conclusion

• In this in vitro study, we have tested the inhaled dose corresponding to the two nebulizers.

• Based on our results, we can conclude that both nebulizer have similar properties.