Background

- Oxymetazoline is a topical sympathomimetic agent that is the active ingredient contained in over-the-counter nasal decongestant sprays such as Afrin®.
- We hypothesized that operator effort or the amount of solution within the bottle might affect the volume delivered.
- The study compared the amount delivered by various anesthesia providers when holding the bottle in the upright and inverted position as well as the amount delivered from a full bottle and a half-full bottle.

Methods

- Level of training was separated into staff (anesthesiology faculty and CRNAs) and trainees (fellows, residents, and SRNAs).
- The study consisted of two phases.
- During phase 1, the participants were given a new 15 mL bottle. The baseline weight of the bottle was measured using an analytical balance that had been calibrated and zeroed.
- The participants were asked to deliver two puffs from the bottle in the upright position. The bottle was then weighed again to determine the amount delivered.
- Two puffs were delivered in the inverted position and the bottle weighed again to determine the amount delivered.
- In phase 2 of the study, the same sequence of events was followed using a half-filled bottle.
- Statistical analysis included a paired t-test and analysis of variance.

Results

- There were 87 participants in the study.
- With a full bottle, the amount delivered with the bottle inverted increased almost 10-fold from 62 ± 80 µL to 606 ± 366 µL (P<0.0001).
- With a half-filled bottle, the amount delivered increased in the inverted position from 41 ± 48 µL to 645 ± 393 µL.
- In the upright position, there was a greater volume delivered with a full bottle when compared to a half-filled bottle (62 ± 80 µL versus 41 ± 48 µL, P=0.037).
- No difference was noted in the inverted position between a full and half-filled bottle.

Table 1: Volume of oxymetazoline delivered

<table>
<thead>
<tr>
<th>Position and bottle volume*</th>
<th>Amount delivered (µL) (mean ± SD)</th>
<th>Amount delivered (µL) - range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filled and upright</td>
<td>62 ± 80</td>
<td>10-490</td>
</tr>
<tr>
<td>Filled and inverted</td>
<td>606 ± 366*</td>
<td>60-1830</td>
</tr>
<tr>
<td>Half-filled and upright</td>
<td>41 ± 48**</td>
<td>10-320</td>
</tr>
<tr>
<td>Half-filled and inverted</td>
<td>645 ± 393*</td>
<td>70-1610</td>
</tr>
</tbody>
</table>

*For each position and volume, n=87
*p<0.0001 versus filled and upright as well as half-filled and upright.
*p=0.0372 versus filled and upright

Table 2: Volume of oxymetazoline (µL) delivered based on provider

<table>
<thead>
<tr>
<th>Position and bottle volume</th>
<th>Amount delivered (µL) by faculty (n=62) (mean ± SD)</th>
<th>Amount delivered (µL) by trainees (n=25) (mean ± SD)</th>
<th>P value versus corresponding faculty group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filled and upright</td>
<td>56 ± 66</td>
<td>78 ± 108</td>
<td>0.2497</td>
</tr>
<tr>
<td>Filled and inverted</td>
<td>549 ± 352</td>
<td>750 ± 366</td>
<td>0.0194</td>
</tr>
<tr>
<td>Half-filled and upright</td>
<td>45 ± 55</td>
<td>30 ± 17</td>
<td>0.1858</td>
</tr>
<tr>
<td>Half-filled and inverted</td>
<td>553 ± 334</td>
<td>872 ± 434</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

Conclusion

- When using either a full or a half-filled bottle, the amount delivered increased significantly by almost 10-fold in the upright position when comparing the upright position.
- Less dramatic variations in delivery occurred when comparing the amount delivered from a full versus a half-filled bottle.
- The amount delivered by trainees in comparison to faculty was greater in the inverted position when using either a full or a half-filled bottle.
- Given the risks of hemodynamic effects, delivery from these bottles should not use the inverted position as may occur with a patient lying flat on an operating room table.

References