Pad-Equipped Nasal Cannulae Do Not Decrease Peak Pressures During Bag-Mask Ventilation: A Pilot Study

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Introduction

Apneic oxygenation is gaining acceptance as a technique to lengthen the time to oxyhemoglobin desaturation and decrease the degree of desaturation during laryngoscopy in children and adults. During bag mask ventilation the nasal cannula can interfere with obtaining effective tidal volumes, due to inability to attain a good seal. In these situations the provider might remove the cannula from the patient in order to achieve better ventilation prior to intubation. This pilot study sought to investigate the feasibility of using foam pads to improve mask seal and ventilation, by using peak pressures to quantify air leak around the mask.

Materials and Methods

A standard intubation mannequin was ventilated using an anesthesia machine and adult size mask with no nasal cannula (baseline), a nasal cannula without foam pads, and nasal cannula with foam pads. Three physicians ventilated the mannequin using three hand ventilation techniques. The lungs of the mannequin were sealed with occlusive dressings to ensure the only leak present would be around the mask. Peak pressures were measured on the anesthesia machine against the baseline condition of a no cannula condition and grip style affect peak pressures.

Results

When considered alone, the plain nasal cannula significantly decreased mean peak pressures due to leakage, as did one-handed masking; p<0.001 for both. Both cannula condition and grip style affect peak pressures.

Given the importance of grip style for achieved pressures, a two-way ANOVA analysis was used to control for its effects. This analysis permitted adjusted evaluation of the effects of cannula condition and grip style, separately against the baseline condition of a one-handed grip with no cannula. That is, what is the effect of cannula condition on peak pressures when adjusting for grip style?

Model terms

<table>
<thead>
<tr>
<th>Model terms</th>
<th>Estimate</th>
<th>p</th>
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<tbody>
<tr>
<td>Baseline</td>
<td>56.9</td>
<td></td>
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<tr>
<td>Plain cannula</td>
<td>-9.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cannula with pad</td>
<td>1.2</td>
<td>0.123</td>
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<tr>
<td>Two-handed CE grip</td>
<td>2.5</td>
<td>0.002</td>
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<tr>
<td>Two-handed thumbs down</td>
<td>2.3</td>
<td>0.005</td>
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When grip style is controlled for, the addition of a cannula reduced peak pressure by over 9 cm H2O relative to baseline, and this effect is statistically significant (p<0.001). Our data show a modest increase in peak pressure (1.2 cm H2O) with a padded cannula when controlling for grip style, but this effect was not statistically significant. This analysis did not detect a loss of pressure with the padded cannula, when controlling for grip style.

Discussion

This evidence is preliminary, but shows that the addition of this foam pad greatly mitigates the expected loss of pressure caused by a cannula when controlling for grip style. Use of foam pads to improve mask seal may allow for improved mask ventilation and ability to use apneic oxygenation in situations when it would otherwise be aborted, possibly decreasing the risk and severity of SpO2 desaturation during prolonged laryngoscopy.

This preliminary study was not powered as an equivalence trial, but it offers promising findings in support of the utility of these foam pads in situations where cannula use during mask ventilation is indicated.

References