Laryngeal mask airway is useful for fiberoptic bronchoscopic evaluation of subglottic stenosis in children: a report of eleven cases

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Introduction

Bronchoscopy under general anesthesia is often indicated to examine the upper airway in pediatric patients. Flexible bronchoscopy has been used for the majority of diagnostic procedures [1]. We report here the use of a laryngeal mask airway (LMA) to guide a fiberoptic bronchoscope while maintaining an adequate depth of anesthesia and effective ventilation during the procedure in small or premature infants who are suspected of having severe subglottic stenosis because of long-term intubation in early infancy.

Case reports

Fiberoptic bronchoscopy was planned for 11 children. The patients were pretreated with oral atropine sulphate (0.02 mg·kg\(^{-1}\)) and nasal midazolam (0.2 mg·kg\(^{-1}\)) 30 min prior to the induction of anesthesia. Anesthesia was induced with intravenous lidocaine (2 mg·kg\(^{-1}\)), midazolam (0.2 mg·kg\(^{-1}\)), and slow infusion of amiphylline (4–5 mg·kg\(^{-1}\)), followed by inhalation of 50% nitrous oxide in oxygen, and 1–3% sevoflurane (Fig. 1a). Topical anesthesia of the upper airway was achieved with a 2% lidocaine spray (0.1 mg·kg\(^{-1}\)) by using an LTA kit (Abbott Ireland, Sligo, Ireland). A LMA was then inserted into the patients, either with and without tracheostomy (Fig. 1b). The size of the LMA was chosen based on the manufacturer’s guide-lines, with size No. 1 being used for children less than 6.5 kg and size No. 2 for children weighing 6.5–20 kg.

Endoexpiratory carbon dioxide concentration and blood oxygen saturation, by pulse oximetry, were monitored in all cases. Ventilation in patients without a tracheostomy was performed through the main entry of the Y-connector between the LMA and the anesthesia circuit, and through the tracheostomy in patients with a tracheostomy (Fig. 1b). Ventilation was usually spontaneous, but was supported by assisted ventilation when patients hypoventilated.

Next, a fiberoptic bronchoscope (FOB) with a diameter of 3.5 mm (3C10, Olympus Optical, Tokyo, Japan) was inserted through the side entry of the Y-connector in patients without a tracheostomy, and directly through the LMA in patients with a tracheostomy, and was advanced into the subglottic space (Fig. 1c). If the FOB was too large to pass through the stenotic portion of the subglottic space, a smaller FOB, 1.8 mm diameter (PF, Olympus Optical, Tokyo, Japan), was tried. Since the FOB does not have a movable tip, it was not possible to pass it through the slits of the LMA which was already in place, and the LMA had to be removed first. The LMA was then reinserted with the FOB through its slit. If this technique failed to allow the PF to be advanced into the subglottic space, we attempted to examine the subglottic area with the FOB positioned close the vocal cord. In patients with a tracheostomy, several other techniques were attempted after removal of the LMA, such as oral or nasal insertion of either size FOB, followed by an attempt to insert it through the vocal cords while holding it with Magill forceps.

Ease of insertion of the LMA was subjectively assessed as “good” if it was possible to insert it with a clear view of the vocal cord on the first attempt, “acceptable” if the first attempt failed, but changing the depth or angle by bronchoscopy yielded a clear view of the vocal cord in the middle of the slits of the LMA, “unacceptable” if, after several trials, no view of the vocal cord

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Table 1. Clinical findings and the ultimate methods of bronchoscopy in 11 children

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age (years : months)</th>
<th>Weight (kg)</th>
<th>Indication</th>
<th>Tracheostomy</th>
<th>Size of LMA</th>
<th>Insertion condition of LMA</th>
<th>Level of stenosis</th>
<th>Final method of bronchoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 : 09</td>
<td>3.2</td>
<td>Subglottic stenosis</td>
<td>-</td>
<td>1</td>
<td>Good</td>
<td>1</td>
<td>3C10 through LMA</td>
</tr>
<tr>
<td>2</td>
<td>0 : 07</td>
<td>3.2</td>
<td>Subglottic stenosis</td>
<td>-</td>
<td>1</td>
<td>Good</td>
<td>1</td>
<td>3C10 through LMA</td>
</tr>
<tr>
<td>3</td>
<td>3 : 01</td>
<td>12.5</td>
<td>Pneumonia</td>
<td>-</td>
<td>2</td>
<td>Good</td>
<td>1</td>
<td>3C10 through LMA</td>
</tr>
<tr>
<td>4</td>
<td>1 : 11</td>
<td>7.9</td>
<td>Subglottic stenosis</td>
<td>-</td>
<td>(2)</td>
<td>Unacceptable</td>
<td>2</td>
<td>PF through LMA</td>
</tr>
<tr>
<td>5</td>
<td>0 : 07</td>
<td>2.1</td>
<td>Subglottic stenosis</td>
<td>-</td>
<td>1</td>
<td>Immobile</td>
<td>3</td>
<td>Nasal 3C10 through facial mask and supraglottic observation</td>
</tr>
<tr>
<td>6</td>
<td>0 : 06</td>
<td>3.7</td>
<td>Subglottic stenosis and tracheomalacia</td>
<td>-</td>
<td>1</td>
<td>Good</td>
<td>1</td>
<td>3C10 through LMA</td>
</tr>
<tr>
<td>7</td>
<td>2 : 09</td>
<td>11.1</td>
<td>Tracheomalacia</td>
<td>+</td>
<td>2</td>
<td>Good</td>
<td>1</td>
<td>3C10 through LMA</td>
</tr>
<tr>
<td>8</td>
<td>2 : 10</td>
<td>9.8</td>
<td>Subglottic stenosis</td>
<td>+</td>
<td>(2)</td>
<td>Unacceptable</td>
<td>1</td>
<td>Nasal 3C10</td>
</tr>
<tr>
<td>9</td>
<td>1 : 10</td>
<td>10.4</td>
<td>Subglottic stenosis</td>
<td>+</td>
<td>2</td>
<td>Acceptable</td>
<td>3</td>
<td>Supraglottic observation using 3C10 through the LMA</td>
</tr>
<tr>
<td>10</td>
<td>1 : 08</td>
<td>6.6</td>
<td>Subglottic stenosis</td>
<td>+</td>
<td>(2)</td>
<td>Unacceptable</td>
<td>3</td>
<td>Supraglottic observation using 3C10 held by Magill forceps</td>
</tr>
<tr>
<td>11</td>
<td>1 : 00</td>
<td>4.2</td>
<td>Subglottic stenosis</td>
<td>+</td>
<td>1</td>
<td>Acceptable</td>
<td>3</td>
<td>Supraglottic observation using 3C10 through the LMA</td>
</tr>
</tbody>
</table>

3C10, BF 3C10 bronchoscope with 3.5 mm diameter (Olympus, Japan)
PF, PFTM bronchoscope with 1.8 mm diameter (Olympus, Japan)
LMA, laryngeal mask airway
()
, size of LMA tried but failed

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Two patients (Nos. 5 and 11) developed hypoxemia during the induction of anesthesia, but none became hypoxic.

Two patients (Nos. 5 and 11) had grade 2 subglottic stenosis, one patient (No. 5) had grade 3 stenosis, and the other three (60%) had grade 1 subglottic stenosis (17%).

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