Flexible Lightwand–guided Tracheal Intubation with the Intubating Laryngeal Mask Fastrach™ in Adults after Unpredicted Failed Laryngoscope-guided Tracheal Intubation


Background: The authors determined the efficacy of using the intubating laryngeal mask airway Fastrach™ (ILM™) as a ventilatory device and aid to flexible lightwand–guided tracheal intubation in patients with unpredicted failed laryngoscope-guided tracheal intubation when managed by experienced anesthetists.

Methods: During a 27-month period, 16 experienced anesthetists agreed to use the ILM™ as an airway device and airway intubator in patients (aged > 18 yr) with predicted normal airways who were subsequently found to be difficult to intubate (three failed attempts at laryngoscopy). Intubation via the ILM™ was performed with a flexible lightwand. The number of attempts at ILM™ placement, the number of adjusting maneuvers, the number of attempts at tracheal intubation via the ILM™, and any episodes of hypoxia (oxygen saturation < 90%) were recorded.

Results: Forty-four of 11,621 patients (0.4%) met the inclusion criteria. ILM™ insertion and ventilation was successful at the first attempt in 40 of 44 patients (91%) and at the second attempt in 4 of 44 (9%). Flexible lightwand–guided tracheal intubation via the ILM™ was successful in 38 of 44 patients (86%) at the first attempt, 3 of 44 (7%) at the second attempt, 2 of 44 (5%) at the third to fifth attempts, and failed in 1 of 44 (2%). The median number of adjusting maneuvers before successful intubution was 1 (range, 0–4). Hypoxia occurred in 5 patients before ILM™ insertion (range, 52–82%), but none after ILM™ insertion. No patient developed hypoxia during or after intubation via the ILM™.

Conclusion: The ILM™ is an effective ventilatory device and aid to flexible lightwand–guided tracheal intubation in adults with predicted normal airways in whom laryngoscope–guided tracheal intubation subsequently fails when managed by experienced anesthetists.

THE laryngeal mask airway Classic™ (LMA™, Laryngeal Mask Co., Henley-on-Thames, UK) has been incorporated by Benumof into the American Society of Anesthesiologists difficult airway algorithm as a ventilatory device or airway intubator for when intubation fails in the anesthetized patient.1 However, there are only three studies describing its success rate as a ventilatory device2–5 and none describing its success rate as an airway intubator in these situations. The intubating laryngeal mask airway Fastrach™ (ILM™, Laryngeal Mask Co.) has greater potential than the LMA™ in the difficult airway because it forms a more effective seal with the glottis,4 insertion is quicker and ventilation easier,5 it is easier to insert in the neutral position,6 and it is a more effective airway intubator.7 Anecdotal reports suggest that the ILM™ has a high success rate as a ventilatory device8–15 (27 cases) or aid to blind8,9,11–15 (13 cases), lightwand-guided15 (1 case), or fiberoptic-guided10 (1 case) intubation after failed laryngoscope-guided intubation, but there have also been a number of failed uses for ventilation16–18 (3 cases) and intubation11 (1 case). In the following prospective study, we determined the efficacy of the ILM™ as a ventilatory device and aid to flexible lightwand–guided tracheal intubation in patients with unpredicted failed laryngoscope-guided tracheal intubation when managed by experienced anesthetists.

Methods

The study was performed at the Gennimatas and Sotiria Hospitals in Athens, Greece, between June 1998 and September 2000. Ethics committee approval was obtained for the study, but the ethics committee did not consider written consent necessary. Sixteen anesthetists with at least 2 yr of anesthesia experience participated in the study. All had previous experience with the ILM™ for ventilation and intubation (> five uses), but only six had used it in conjunction with the flexible lightwand. The remaining 10 were shown how to use the flexible lightwand with the ILM™ in at least one patient. All adults (‡ 18 yr) scheduled for surgery with general anesthesia that required tracheal intubation underwent preoperative airway assessment. Patients were excluded from the study if they had any one of the following criteria: (1) Mallampati score 3 or 4; (2) thyromental distance 7 cm or less; (3) head–neck mobility to flexion–extension less than 90 degrees; (4) mouth opening 2.5 cm or less; (5) known difficult airway; and (6) known oropharyngeal or cervical pathology.

Anesthesia management was semistandardized. Monitoring was applied before induction and included an electrocardiograph, pulse oximeter, gas analyzer, non-invasive blood pressure monitoring, and end-tidal carbon dioxide. Drugs were given according to anesthesiologist preference. Supplemental oxygen was delivered via a face mask.

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Table 1. Lightwand-guided Intubation via the Intubating Laryngeal Mask Airway (ILM™) Using the Flexible Lighted Catheter: Probable Cause of Resistance and Appropriate Management Strategy Depending of the Location of the Glow on the Neck

<table>
<thead>
<tr>
<th>Location of the Glow</th>
<th>Probable Cause</th>
<th>Maneuvers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above the level of the laryngeal prominence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the midline</td>
<td>Epiglottic elevator bar trapped behind cricoid cartilage or downfolded epiglottis</td>
<td>1. Flexion of ILM™ handle</td>
</tr>
<tr>
<td></td>
<td>Narrow laryngeal opening</td>
<td>2. Extension of ILM™ handle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Up-down maneuver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use a smaller size of tracheal tube</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Twist the ILM™ handle</td>
</tr>
<tr>
<td>Right or left lateral</td>
<td>Tracheal tube misplaced in pyriform fossa</td>
<td></td>
</tr>
<tr>
<td>Below the level of the laryngeal prominence</td>
<td>ILM™ inserted too far</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tracheal stenosis</td>
<td></td>
</tr>
<tr>
<td>No glow</td>
<td>Bulb switched off</td>
<td>1. Partial withdrawal with extension</td>
</tr>
<tr>
<td></td>
<td>Esophageal intubation</td>
<td>Try another size of ILM™</td>
</tr>
</tbody>
</table>

vasive blood pressure monitor, tidal volume monitor, and airway pressure monitor. The type and dose of induction and nondepolarizing muscle-relaxing agents were at the discretion of the anesthesiologist. The nondepolarizing muscle relaxant was only given after successful face mask ventilation had been demonstrated. Adopting the best head–neck position, applying laryngeal pressure, using a different size–type of laryngoscope blade or gum elastic bougie, as required, optimized conditions for laryngoscope-guided tracheal intubation.

Between intubation attempts, the patient was ventilated via the face mask. An intubation attempt was defined as insertion of the laryngoscope blade. If intubation failed at the third attempt, the ILM™ was inserted using a single-handed rotational technique, and the cuff was inflated with air until an effective airway was obtained or the maximum cuff volume was reached. A size 4 was used in patients weighing 70 kg or less, and size 5 was used in those weighing more than 70 kg. A maximum of three attempts was allowed. An insertion attempt was defined as rotation of the ILM™ toward the pharynx. Successful placement was defined as a tidal volume of 7 ml/kg without an audible oropharyngeal leak at peak airway pressures of 20 cm H₂O or greater.

A well-lubricated, straight silicone endotracheal tube (Euromedical, Malaysia), preloaded with the flexible lightwand, was inserted into the ILM™ tube and advanced beyond the epiglottic elevating bar while observing the glow in the neck. A size 7.0- or 7.5-mm endotracheal tube was used in women, and a size 8.0 mm was used in males. Room lighting was reduced. If a glow could not be seen, the skin over the neck was stretched or the neck flexed or head extended to increase the thyroepiglottic distance. Whenever slight tactile resistance was felt or the light glow was not correctly located, a predetermined sequence of adjusting maneuvers was instituted (table 1). When the tube easily advanced 8 cm beyond the ILM™, the anesthesiologist initiated ventilation. If esophageal intubation occurred, the ILM™ was partially withdrawn and the handle extended before a second attempt. If this failed, the ILM™ was partially withdrawn and reinserted before a further attempt. The maximum number of adjusting maneuvers and intubation attempts allowed was four and five, respectively. Between intubation attempts, the patient was ventilated via the ILM™.

An intubation attempt through the ILM™ was defined as a forward and backward movement of the endotracheal tube. Cricoid pressure was avoided during use of the ILM™.

The number of attempts at ILM™ placement, the number adjusting maneuvers, the number of attempts at tracheal intubation through the ILM™, and any episodes of hypoxia (oxygen saturation < 90%) before or after ILM™ insertion and during or after intubation via the ILM™ were noted.

Results

There were 44 of 11,621 patients (0.4%) in whom laryngoscope-guided intubation failed after three attempts. The mean age and weight was 52 yr (range, 24–72 yr) and 71 kg (range, 46–94 kg), respectively. The male:female ratio was 24:20. Failed intubation was associated with an inability to view the vocal cords in all patients. Difficulty with face mask ventilation occurred in 5 of 44 (11%) of these patients. ILM™ insertion and

Table 2. Distribution of the Number of Airway Manipulations and Intubation Attempts with the Intubating Laryngeal Mask Airway

<table>
<thead>
<tr>
<th>Number of Airway Manipulations/Number of Intubation Attempts</th>
<th>0/1</th>
<th>1/1</th>
<th>2/1</th>
<th>3/1</th>
<th>4/1</th>
<th>2/2</th>
<th>3/2</th>
<th>4/3</th>
<th>4/5</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>24 (55)</td>
<td>8 (18)</td>
<td>3 (7)</td>
<td>2 (5)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>2 (5)</td>
<td>1 (2)</td>
<td>1 (2)</td>
<td>1 (2)</td>
</tr>
</tbody>
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ventilation was successful at the first attempt in 40 of 44 patients (91%) and at the second attempt in 4 of 44 patients (9%). There were no failures. Lightwand-guided tracheal intubation via the ILM™ was successful in 38 of 44 patients (86%) at the first attempt, 3 of 44 (7%) at the second attempt, 2 of 44 (5%) at the third to fifth attempts, and failed in 1 of 44 (2%) (table 2). In the latter patient, persistent esophageal intubation occurred, and the ILM™ was used to facilitate oxygenation until the patient was awake. The median number of adjusting maneuvers before successful intubation was 1 (range, 0–4; table 2). Hypoxia occurred in five patients before ILM™ insertion (range, 52–82%), but none after ILM™ insertion. All patients were still paralysed when the ILM™ was used. No patient developed hypoxia during or after intubation via the ILM™. There were no adverse outcomes.

Discussion

We found that the ILM™ was a successful ventilatory device in 44 of 44 patients (100%) and was a successful aid to lightwand-guided intubation in 43 of 44 patients (98%). This success rate is similar to that reported by Fukutome et al.,11 who reported successful ventilation in 8 of 8 patients (100%) and successful blind intubation in 7 of 8 patients (87%) with the ILM™ in anesthetized adults after failed laryngoscope-guided intubation. Our success rate for ventilation is similar to that of Parmet et al.,5 who reported successful ventilation with the LMA™ in 16 of 17 adults (94%) after failed laryngoscope-guided intubation and failed face mask ventilation. Our success rate was similar to an earlier report by our group using flexible lightwand-guided intubation via the ILM™ in patients with predicted normal airways in whom laryngoscope-guided intubation was not attempted.19 Interestingly, we found that the ILM™ was a successful ventilatory device in 5 of 5 patients who were also difficult to ventilate via face mask. These numbers are too small to determine the efficacy of the ILM™ after failed face mask ventilation, but the ILM™ is a more effective ventilatory device than the face mask in patients with normal airways.5

We used lightwand-guided intubation via the ILM™ because it has a higher success rate than blind intubation in patients with predicted normal airways,20 and fiberoptic equipment was not widely available at our institute. Our success rate for the flexible lightwand compares favorably with other ILM™ intubation techniques in abnormal airways, including the following: blind intubation, 93% (28 of 30),11 100% (13 of 13),8 and 77% (17 of 22);11 and nonflexible lightwand-guided intubation, 100% (6 of 6).22 Surprisingly, there have been no case series reporting use of the fiberoptic scope in these situations.

There are insufficient data to make firm recommendations about which intubation technique with the ILM™ is best, but blind techniques are probably undesirable because of the high incidence of esophageal intubation (26%).23 We used the ILM™ without cricoid pressure because it impedes insertion and intubation via the ILM™ in patients with normal airways.24

Our study has a number of limitations. First, all participants had at least 1 yr of anesthesia training and some experience of intubation via the ILM™. Our findings may therefore not apply to the novice or those inexperienced with the ILM™. Interestingly, nonanesthetists have a higher success rate with the ILM™ than the face mask in patients with normal airways and blind intubation success rates that are similar to direct laryngoscopy.25 In addition, Kihara et al.26 found that there was no learning curve with the ILM™ lightwand technique during 150 uses by a single anesthetist. Second, we studied patients with unpredicted difficult airways, and our success rates may not apply to the predicted difficult airway. However, during the study period we used the same technique on 48 patients who had predicted difficult airways (Mallampati score 3 or 4; thyromental distance ≤7 cm; head-neck mobility to flexion-extension <90 degrees; mouth opening >2.5 cm) and found that ILM™ insertion and ventilation were successful at the first attempt in 43 of 48 patients (90%) and at the second attempt in 5 of 48 (10%); intubation was successful in 48 of 48 (100%) and 43 of 48 (90%) at the first attempt. Third, all of our patients were paralyzed when the ILM™ was used, and our data may not apply to the nonparalyzed patient. However, there is evidence that the ILM™ can be inserted and used for intubation without muscle relaxation provided anesthesia depth is sufficient.27–29

In conclusion, the ILM™ is an effective ventilatory device and aid to flexible lightwand-guided tracheal intubation in adult patients with predicted normal airways in whom laryngoscope-guided tracheal intubation subsequently fails when managed by experienced anesthetists.

References

7. Lucas DN, Yentis SM: A comparison of the intubating laryngeal mask


