Tracheal Intubation Through the I-gel™ Supraglottic Airway Versus the LMA Fastrach™: A Randomized Controlled Trial

Antoine Elie Halwagi, MD, B Pharm, Nathalie Massicotte, MD, FRCPC, Alexandre Lallo, MD, FRCPC, Alain Gauthier, MD, FRCPC, Daniel Boudreault, MD, FRCPC, Monique Ruel, RN, and François Girard, MD, FRCPC

BACKGROUND: The i-gel™ is a supraglottic airway device not requiring inflation of a cuff for lung ventilation. Its design allows for unobstructed passage of a tracheal tube and previous studies have demonstrated a favorable alignment with the glottic inlet. In this prospective randomized study, we compared the success rate of blind tracheal intubation using the i-gel and the laryngeal mask airway (LMA) Fastrach™.

METHODS: One hundred sixty patients requiring general anesthesia and airway management were randomized to tracheal intubation using the i-gel or the LMA Fastrach. After induction of general anesthesia, the allocated device was inserted and adequate lung ventilation was confirmed. Blind tracheal intubation was then attempted. First attempt and overall tracheal intubation success rates were evaluated and tracheal intubation times were measured.

RESULTS: Eighty patients were recruited in each study group. Successful tracheal intubation was obtained on the first attempt in 69% of patients with the i-gel and 74% of patients with the LMA Fastrach (95% confidence interval [CI] of difference, −9% to 19%, P = 0.60). The overall intubation success rate was lower using the i-gel than it was using the LMA Fastrach (73% vs 91%, 95% CI of difference, 7% to 31%, P < 0.0001).

CONCLUSIONS: On first attempts, successful blind tracheal intubation was obtained at comparable rates using the i-gel and the LMA Fastrach. However, when the first attempt was unsuccessful, subsequent attempts through the i-gel did not significantly increase tracheal intubation success rate. The LMA Fastrach yielded a higher overall intubation success rate. (Anesth Analg 2011;X:●●●●●●)

The i-gel™ (Intersurgical Ltd., Berkshire, UK) is a recently introduced single-use supraglottic airway device that allows effective ventilation without requiring inflation of a cuff. Randomized controlled trials have demonstrated higher airway leak pressures1–3 and a favorable side effect profile4 when compared with other laryngeal mask airways (LMA). Fiberoptic visualization through the i-gel has demonstrated an improved view of the glottic aperture in comparison with the LMA Unique™ (Intavent Direct, Berkshire, UK),1 the LMA Classic™ (The Laryngeal Mask Company, Ltd., Intavent Direct, Berkshire, UK),2 and the La Première™ (Armstrong Medical, Coleraine, Ireland) laryngeal airway.3 Better glottic visualization and less epiglottic downfolding was also observed when compared with the LMA Supreme™ (LMA North America, Inc., San Diego, CA).4 The large diameter of the airway tube and absence of bars in the mask bowl allow passage of a tracheal tube. Several case reports5–9 of successful fiberoptic-guided intubation through the i-gel have been published. In addition, Michalek et al.10 recently published a manikin study evaluating the success rate of blind intubation through the i-gel.

The aim of our study was to compare the success rate of blind tracheal intubation through the i-gel versus the LMA Fastrach (The Laryngeal Mask Company Limited, San Diego, California, USA). We hypothesized that the favorable glottic alignment of the i-gel™ would result in a superior first attempt success rate during blind tracheal intubation.

METHODS

After receiving Centre Hospitalier de l’Université de Montréal (CHUM)’s ethics and scientific review board approval and written informed patient consent, 160 patients were randomly assigned using a computer-generated list divided in blocks of ten, to one of two study groups: the LMA Fastrach™ (FT) group and the i-gel (IG) group. All patients were recruited between March and May 2010. Included patients were older than 18 years of age and required general anesthesia and tracheal intubation for an elective surgical procedure. Exclusion criteria were ASA class > III, contraindication to the use of rocuronium, mouth opening <2 cm, increased risk of aspiration, and known or anticipated difficult tracheal intubation or facemask ventilation.

After collection of demographic and anthropometric data, patients were brought to the operating room and clinically indicated monitoring was installed. After adequate oxygen administration and general anesthesia induction, each patient received rocuronium 0.6 mg·kg⁻¹.
Patients were then mask-ventilated with a mixture of oxygen and sevoflurane, for an end-tidal concentration of 2%. The supraglottic device was inserted once until unlar nerve train-of-4 stimulation produced no visually detectable response. Before insertion, the patient’s head was placed in a neutral position. All airway manipulations (device insertion and tracheal intubation) were performed by a senior anesthesiology resident (A.H.) who had comparable previous experience with both devices (>20 uses).

The size of the Fastrach and i-gel was selected on the basis of the patient’s weight, in accordance with the corresponding manufacturer’s recommendations. Conventional Hi-lo Mallinckrodt single-use polyvinyl chloride (PVC) tracheal tubes (Mallinckrodt Company, Juarez, Chihuahua, Mexico) were used for blind tracheal intubation in both groups: size 7.0 mm ID tracheal tubes for patients weighing ≥50 kg and 6.0 mm ID tubes for patients <50 kg. Intubation through both supraglottic devices was facilitated using a water-based lubricant.

In the FT group, a single-use Fastrach intubating LMA was inserted. Once in place, the cuff was inflated and ventilation attempted, using optimization maneuvers when necessary. Device position and lung ventilation were deemed appropriate when adequate chest excursion and capnography curves were observed without an audible leak while ventilating with an inspiratory pressure of 20 cm H2O. If lung ventilation remained unsuccessful, the LMA Fastrach was completely removed and reinserted. If no resistance was felt during insertion of the tracheal tube, the i-gel was advanced until a stabilizing rod was encountered during insertion of the tracheal tube, the intubation attempt was judged unsuccessful. A standardized algorithm was then followed on the basis of the distance at which the resistance was felt, as recommended by the manufacturer.

In the IG group, an i-gel single-use supraglottic airway was inserted, and successful placement was defined using the same ventilation criteria as in the FT group. If successful ventilation was not established, accepted maneuvers were used, as recommended by the manufacturer. After confirmation of adequate ventilation, intubation through the device was attempted. The tracheal tube was rotated 90 degrees counterclockwise before insertion. This allowed the tube’s bevel to point posteriorly, thus minimizing the risk of impingement on glottic structures during insertion. If resistance was felt during insertion, the tracheal tube was removed, the i-gel readjusted, and a subsequent intubation was attempted. If no resistance was felt during insertion of the tracheal tube, it was advanced fully into the i-gel and adequacy of lung ventilation was tested. At confirmation of correct placement of the tracheal tube, the i-gel was removed using a smaller-sized tracheal tube as a stabilizing rod.

In both study groups, 3 attempts at device insertion and intubation were allowed. Intubation was only attempted if appropriate ventilation was obtained or after 3 device insertion attempts. If tracheal intubation through the device was unsuccessful, it was performed by direct laryngoscopy. Lung ventilation through the supraglottic device was permitted between intubation attempts.

The primary outcome of the study was success rate of tracheal intubation through the supraglottic airway device on the first attempt. Secondary outcomes included overall success rate of tracheal intubation and time required to perform tracheal intubation through the device (tracheal intubation time). Intubation time was calculated from the insertion of the tracheal tube in the device until confirmation of adequate lung ventilation through the tracheal tube.

Statistical Analysis

The success rate of tracheal intubation on the first attempt with the LMA Fastrach, as reported in previous randomized controlled trials, varies between 48% and 87%.13,15–27 Considering a mean first attempt success rate of 65%, a sample size of 70 patients per group would have a power of 80% at an α of 0.05 (2-tailed) to detect a 20% difference in intubation success rate between both supraglottic airway devices, a difference that we considered clinically significant. A sample size of 80 patients per group was chosen to allow for potential patient drop-outs. Data were analyzed using GraphPad InStat version 3.10 (GraphPad Software, San Diego, CA). Continuous data were analyzed using Student t test (2-tailed, unpaired, unequal variance), and categorical data were analyzed using a Fisher exact test or χ² test when there were more than 2 categories (Tables 1 and 2). Continuous data are presented as mean and standard deviation (SD), whereas categorical data are presented as number of patients and percentage. Ninety-five percent confidence intervals (CI) of difference in intubation success rates and mean intubation times are also presented.

RESULTS

A total of 201 patients were evaluated for study inclusion; 41 patients were excluded according to exclusion criteria mentioned above. One hundred sixty patients were randomly allocated to 1 of 2 study groups. Demographic data were similar in the 2 groups (Table 1).

Tracheal intubation was successful on the first attempt in 59 patients (74%) with the LMA Fastrach and in 55 patients (69%) with the i-gel (95% CI of difference, −9% to 19%, P = 0.60). However, the LMA Fastrach yielded a significantly higher overall successful intubation rate than did the i-gel (91% vs 73%, 95% CI of difference, 7% to 31%, P < 0.0001). Times to achieve successful intubation differed between the 2 groups; however, the mean difference was clinically insignificant (Table 2). There was no unintended tracheal extubation when removing the supraglottic airway device.
LMA Fastrach in patients presenting at least 1 criterion for “visualized blind intubation” through the i-gel and the published studies.23–25,27

Data expressed in mean (SD) or number (%). LMA — laryngeal mask airway.

### DISCUSSION

Our study demonstrates that on the first attempt, tracheal intubation is obtained successfully with comparable success rates using both the i-gel and LMA Fastrach. Although our study was not designed to assess equivalence between the 2 devices, this can be assumed considering that the 95% confidence interval of the difference between both success rates (−9% to 19%) lies between the previously defined zones of clinical indifference. However, the overall success rate is significantly lower with the i-gel. This could be explained by the various maneuvers that have been recommended to optimize the LMA Fastrach’s position, to minimize epiglottic downfolding and improve intubation success rate. None of these maneuvers could be extrapolated to the i-gel because of the differences in the device design and, notably, the absence of a handle. Consequently, when tracheal intubation through the i-gel was unsuccessful on the first attempt, the success rate did not improve significantly with subsequent attempts. The results obtained for both first attempt and overall intubation success rates using the LMA Fastrach were comparable to those in published studies 23–25,27.

The use of the i-gel as a conduit for tracheal intubation has been documented in several case reports. These cases described anticipated or unanticipated difficult airway situations, and they all involved the use of a fiberoptic bronchoscope.8–9 Michalek et al.10 evaluated blind intubation through the i-gel in 3 different airway manikins, obtaining a success rate of 51%. Theiler et al.28 studied “visualized blind intubation” through the i-gel and the LMA Fastrach in patients presenting at least 1 criterion for difficult intubation. Their results demonstrated a substantially inferior success rate with the i-gel when compared with the LMA Fastrach (15% vs 69%, respectively). Although marked by significant methodological differences, this low intubation success rate was also confirmed in an unpublished preliminary study at our center, with a successful first attempt intubation rate through the i-gel of 23%. However, we observed that rotating the tracheal tube 90 degrees counterclockwise before its insertion in the i-gel increased the success rate by >50%. In fact, we found that this maneuver prevented impingement of the tip of the tracheal tube on the right arytenoid cartilage during insertion. It was therefore decided to incorporate this maneuver as an integral part of this study.

Our data suggest that tracheal intubation was achieved faster with the i-gel; however, the difference is not clinically significant. Also, the intubation times are skewed by the fact that more patients’ tracheas were intubated successfully on the 2nd or 3rd attempt using the LMA Fastrach, hence artificially prolonging the intubation times within that group. When considering solely the patients successfully intubated on the first attempt, the 2 groups had similar intubation times.

In comparison with other nonintubating laryngeal masks, the i-gel has a shorter and wider stem, allowing unobstructed passage of larger diameter tracheal tubes. These characteristics allow direct tracheal intubation without the use of a bougie or an exchange catheter.10 In our study, patients’ tracheas were intubated using standard PVC tubes, which are readily available in various settings. It is possible that the use of other types of tracheal tubes

### Table 1. Patient Characteristics

<table>
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<th>I-gel™ (n = 80)</th>
<th>LMA Fastrach™ (n = 80)</th>
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<tbody>
<tr>
<td>Sex, male/female, n (%)</td>
<td>26/54 (32.5/67.5)</td>
<td>27/53 (33.8/66.3)</td>
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<tr>
<td>Age, years</td>
<td>53.8 (14.3)</td>
<td>53.3 (14.2)</td>
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<tr>
<td>Edentulous status, yes/no (%)</td>
<td>21/56 (27.3/72.7)</td>
<td>19/59 (24.4/75.6)</td>
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<tr>
<td>Weight, kg</td>
<td>72.8 (14.9)</td>
<td>73.6 (18.1)</td>
</tr>
<tr>
<td>Height, m</td>
<td>1.64 (0.10)</td>
<td>1.64 (0.09)</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>27.1 (5.6)</td>
<td>27.3 (6.3)</td>
</tr>
<tr>
<td>ASA physical status I/II/III, n (%)</td>
<td>15/51/14 (18.8/63.8/17.5)</td>
<td>23/41/16 (28.8/51.3/20.0)</td>
</tr>
<tr>
<td>Mallampati score 1/2/3/4, n (%)</td>
<td>35/42/3/0 (43.8/52.5/3.8/0)</td>
<td>31/45/4/0 (38.8/56.3/5.0/0)</td>
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<tr>
<td>Mouth opening, cm</td>
<td>5.0 (0.8)</td>
<td>5.0 (0.7)</td>
</tr>
<tr>
<td>Thyromental distance, cm</td>
<td>7.6 (1.0)</td>
<td>7.6 (1.0)</td>
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<tr>
<td>Neck circumference, cm</td>
<td>36.6 (3.4)</td>
<td>36.7 (3.4)</td>
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### Table 2. Success Rates and Times for Device Insertion and Tracheal Intubation

<table>
<thead>
<tr>
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<th>I-gel™ (n = 80)</th>
<th>LMA Fastrach™ (n = 80)</th>
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</thead>
<tbody>
<tr>
<td>Overall success rate, %</td>
<td>96</td>
<td>100</td>
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<tr>
<td>First attempt success rate, %</td>
<td>84</td>
<td>80</td>
</tr>
<tr>
<td>Insertion time, seconds</td>
<td>26 ± 24</td>
<td>36 ± 28</td>
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<tr>
<td>Insertion time when 1st attempt successful, seconds</td>
<td>19 ± 8</td>
<td>29 ± 16</td>
</tr>
<tr>
<td>Tracheal intubation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First attempt success rate, %</td>
<td>69</td>
<td>74</td>
</tr>
<tr>
<td>Overall success rate, %</td>
<td>73</td>
<td>91</td>
</tr>
<tr>
<td>Intubation time, seconds</td>
<td>22 ± 13</td>
<td>30 ± 31</td>
</tr>
<tr>
<td>Intubation time when 1st attempt successful, seconds</td>
<td>19 ± 4</td>
<td>18 ± 3</td>
</tr>
</tbody>
</table>

Success rates expressed in percentage, times expressed in mean ± sd. Difference expressed in mean or percentage and shown with 95% confidence interval of difference in parentheses. P values are from Fisher exact test for success rates and Student t test for times.
Anticipated difficult airways were excluded from the study, be made regarding the safety differences, if any, between fiberoptic visualization, and oropharyngeal trauma was not unsuccessful intubation was not assessed systematically by categorization maneuvers when the first attempt is unsuccessful. The study in various populations and to describe optimization maneuvers when the first attempt is unsuccessful.

In conclusion, blind tracheal intubation can be achieved using the i-gel as a conduit with a comparable first attempt success rate to the LMA Fastrach. However, overall intubation success rates were significantly higher with the LMA Fastrach. We suggest that if blind tracheal intubation is to be attempted through the i-gel using a conventional tracheal tube, it should be attempted only once, inserting the tracheal tube with its bevel directed posteriorly. Repeated attempts should be avoided, because they did not improve the success rate significantly. Further studies are required to confirm the use of the i-gel as a conduit for tracheal intubation in various populations and to describe optimization maneuvers when the first attempt is unsuccessful.

DISCLOSURES

Name: Antoine Elie Halwagi, MD, B Pharm.
Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.
Attestation: Antoine Elie Halwagi has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

Name: Nathalie Massicotte, MD, FRCCP.
Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.
Attestation: Nathalie Massicotte has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

Name: Alexandre Lallo, MD, FRCCP.
Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.
Attestation: Alexandre Lallo has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

Name: Alain Gauthier, MD, FRCCP.
Contribution: This author helped conduct the study and write the manuscript.

Attestation: Alain Gauthier has seen the original study data and approved the final manuscript.

Name: Daniel Boudreault.
Contribution: This author helped conduct the study and write the manuscript.
Attestation: Daniel Boudreault has seen the original study data and approved the final manuscript.

Name: Monique Ruel, RN.
Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.
Attestation: Monique Ruel has seen the original study data and approved the final manuscript.

Name: François Girard, MD, FRCCP.
Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.
Attestation: François Girard has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

This manuscript was handled by: Sorin J. Brull, MD.

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