

Novices Ventilate and Intubate Quicker and Safer via *Intubating Laryngeal Mask Than by Conventional Bag–Mask Ventilation and Laryngoscopy*

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Background: **Because airway management plays a key role in emergency medical care, methods other than laryngoscopic tracheal intubation (LG-TI) are being sought for inadequately experienced personnel. This study compares success rates for ventilation and intubation *via* the intubating laryngeal mask (ILMA-V/ILMA-TI) with those *via* bag–mask ventilation and laryngoscopic intubation (BM-V/LG-TI).**

Methods: **In a prospective, randomized, crossover study, 30 final-year medical students, all with no experience in airway management, were requested to manage anesthetized patients who seemed normal on routine airway examination. Each participant was asked to intubate a total of six patients, three with each technique, in a randomly assigned order. A task not completed after two 60-s attempts was recorded as a failure, and the technique was switched.**

Results: **The success rate with ILMA-V was significantly higher (97.8% *vs.* 85.6%; $P < 0.05$), and ventilation was established more rapidly with ILMA-V (35.6 ± 8.0 *vs.* 44.3 ± 10.8 s; $P < 0.01$). Intubation was successful more often with ILMA-TI (92.2% *vs.* 40.0%; $P < 0.01$). The time needed to achieve tracheal intubation was significantly shorter with ILMA-TI (45.7 ± 14.8 *vs.* 89.1 ± 23.3 s; $P < 0.01$). After failed LG-TI, ILMA-V was successful in all patients, and ILMA-TI was successful in 28 of 33 patients. Conversely, after failed ILMA-TI, BM-V was possible in all patients, and LG-TI was possible in 1 of 5 patients.**

Conclusion: **Medical students were more successful with ILMA-V/ILMA-TI than with BM-V/LG-TI. ILMA-TI can be successfully used when LG-TI has failed, but not *vice versa*. These results suggest that training programs should extend the ILMA to conventional airway management techniques for paramedical and medical personnel with little experience in airway management.**

TRACHEAL intubation (TI) can be lifesaving in many situations, and several studies have demonstrated improved outcome in critically ill and injured patients when the airway is secured early on by tracheal intubation.[1,2] Conversely, other studies have shown no difference or reduced survival rates with tracheal intubation in patients with traumatic brain injury.[3,4] However, in 2005, the International Liaison Committee on Resuscitation Consensus on Science and Treatment Recommendations for adult advanced life support state that the endotracheal tube remains the accepted standard for securing the airway during cardiopulmonary resuscitation (CPR) when inserted by experienced personnel.[5]

Accordingly, this skill is taught to healthcare professionals, both medical and paramedical, many of whom may only infrequently have the opportunity to perform this maneuver.[6] Conventional direct laryngoscopy is a difficult skill to acquire,[7,8] and proficiency deteriorates over time if it is not regularly practiced.[9,10] Difficult or failed tracheal or unrecognized esophageal intubation are important causes of morbidity due to direct airway trauma and the complications of hypoxia.[11,12]

Supraglottic airway devices (*e.g.*, the laryngeal mask airway; LMA) are acceptable alternatives to tracheal intubation when healthcare providers have little experience with tracheal intubation.[5,13] Insertion of the LMA is easier to learn than tracheal intubation using a skill trainer, with more sustainable skill retention.[9,10] The intubating laryngeal mask airway (ILMA; *LMA-Fastrach*™; Laryngeal Mask Company, Henley on Thames, United Kingdom) was designed to facilitate tracheal intubation[14] and proved to be very effective in guiding tracheal intubation in patients with difficult airways when used by experienced anesthesiologists.[15] In addition, the ILMA has been used successfully in patients for ventilation and intubation by novice intubators[16,17] and has been recommended for use in out-of-hospital airway management by several authors.[17–19] Although the ILMA was developed to facilitate tracheal intubation in patients with difficult airways, a crossover pilot study on manikins demonstrated that inexperienced medical personnel were also able to intubate more rapidly and with a higher success rate using an intubating LMA than by direct laryngoscopy.[20] Therefore, the ILMA might be a better tool for establishing ventilation (ILMA-V) and facilitating intubation (ILMA-TI) than conventional bag–mask ventilation (BM-V) and intubation *via* laryngoscopy (LG-TI), when the healthcare provider does not have the opportunity to practice LG-TI regularly.

The aim of this study was to compare the success rates of two different techniques for ventilation and tracheal intubation (ILMA-V *vs.* BM-V and ILMA-TI *vs.* LG-TI)

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when used by inexperienced personnel in the management of patients scheduled to undergo elective surgery and in whom a difficult airway was not anticipated.

Materials and Methods

Recruitment of Participants

After approval by our institution's Human Research Committee (ethics committee, University of Goettingen, School of Medicine, Goettingen, Germany), 30 final-year medical students (interns during their anesthesiology elective) gave their written consent to participate in this prospective, randomized, crossover study. All were novices to advanced airway management techniques. Students who had performed bag–mask ventilation or laryngoscopy or used an ILMA on patients on more than five occasions within the year before the investigation were excluded from the study.

Equipment and Treatment Protocol

Training Phase. All participants were given a 90-min lecture on the principles of airway management, including the techniques of bag–mask ventilation (BM-V), laryngoscopic tracheal intubation (LG-TI), and ventilation and intubation using the intubating LMA (ILMA-V and ILMA-TI, respectively). After the lecture, each airway management technique was demonstrated on an airway management trainer (Laerdal Medical AS, Stavanger, Norway). Additional techniques and equipment for optimizing intubating conditions were also demonstrated, such as the use of a Guedel tube, two-hand mask ventilation for BM-V, and the BURP maneuver (backwards upwards right pressure of the thyroid cartilage) to facilitate laryngoscopy.[21] All students were taught to strictly follow the technique described by Brimacombe for inserting the LMA, including the "up–down" and "seal optimization" (Chandi) maneuvers to facilitate ILMA-TI.[22] All participants were required to complete three successful attempts at inserting an ILMA and using it to ventilate and intubate, as well as at performing correct bag–mask ventilation and laryngoscopic intubation on the airway management trainer before entering the study. The techniques were demonstrated one final time on anesthetized patients in the operating room before the participants entered the study.

Patients selected for the study were older than 18 yr, were undergoing elective surgery with no significant comorbidity, and did not have an anticipated difficult airway. No patient had a Mallampati score over 2, a thyromental distance of less than 6 cm, an interincisor gap of less than 3 cm, a body mass index of greater than 35 kg/m^2, or a history of a difficult-to-manage airway.

Each participant was asked to ventilate the lungs and to intubate the trachea of six different patients, three with each technique. Randomization was in three blocks of two; the technique used on the first patient was assigned randomly, and the technique was then alternated for the second patient.

The study was conceived in two phases. In study phase 1, the participant attempted ventilation and intubation with the prescribed technique. If this was unsuccessful, the study investigator could decide to allow the participant to proceed to study phase 2, in which the participant was required to use the alternative technique. This decision was based on the absence of evidence of airway damage, *e.g.*, blood on the laryngoscope or the ILMA, and normal respiratory function.

The patients' vital signs were monitored continuously during the entire procedure. The study investigator terminated the session and took over ventilation or intubation whenever pulse oximetric oxygen saturation decreased below 95%, or heart rate and/or blood pressure changed by more than 20% from baseline. All interventions were made under continuous supervision of senior anesthesiology consultants who were familiar with the study protocol.

Study Phase 1. The patients' lungs were preoxygenated for at least 3 min before anesthesia was induced with 2 μg/kg fentanyl and 2 mg/kg propofol. Anesthesia was maintained during the study period with sevoflurane in oxygen at an end-tidal concentration of 2%. After the study investigator had determined that facemask ventilation was possible, the participant took over with the assigned technique. If the study investigator deemed bag–mask ventilation to be difficult, the patient was excluded from the study.

Bag–mask ventilation was performed with a self-filling ventilation bag (Laerdal Adult; Laerdal Medical AS) with an appropriately sized facemask. BM-V was initially performed without airway devices or supporting maneuvers, and requests by the participants for support were recorded.

The ILMA was inserted after lubricating the posterior surface of the tip with surgical lubricant (Endosgel®; Farco-Pharma GmbH, Cologne, Germany). A size 4 ILMA was used in all female patients, and a size 5 was used in all males. The cuff was inflated with air until the seal was just airtight or to a maximum pressure of 60 cm H_2O (maximum air volumes: size 4, 30 ml; size 5, 40 ml), and a breathing circuit was connected to the ILMA. If satisfactory ILMA-V was not established, removing and reinserting the ILMA could be considered. BM-V or ILMA-V was deemed satisfactory when there was a capnography trace showing a plateau with a minimum end-tidal carbon dioxide partial pressure of 3 kPa.

The study participant was allowed 60 s for each attempt at ventilation or intubation. If bag–mask ventilation or correct insertion of the ILMA was unsuccessful in this time, the study investigator took control of the patient's airway and ventilated the patient's lungs for 90 s before proceeding. After unsuccessful BM-V, the tech-

nique was rated as failed and the participant continued with LG-TI. If ILMA-V was not satisfactory, it was rated as failed and the participant proceeded immediately with ILMA-TI. If ILMA insertion itself was not possible, the participant switched to the BG-V/LG-TI technique, and ILMA-V as well as ILMA-TI was rated as failed.

After confirmation of successful BM-V or ILMA-V, 0.6 mg/kg rocuronium was given intravenously for muscle relaxation, and ventilation was continued for at least 90 s. The participants were then required to intubate the trachea by using the technique prescribed by the randomization protocol.

Direct laryngoscopy was performed with a size 3 or 4 Macintosh blade. A 7.5- or 8.0-mm-ID endotracheal tube (Mallinckrodt Medical, Athlone, Ireland) with a bougie inserted just to the tip of the tube was used for intubation. LG-TI was facilitated by the investigator at the participant's request with the BURP maneuver. ILMA-TI was performed with a size 7.5 or 8.0 wire-reinforced, straight, cuffed tube with an atraumatic soft silicone tip and depth markings. A breathing circuit was connected to the endotracheal tube, and ventilation was resumed. Correct laryngoscopic- or ILMA-guided tube placement was confirmed by capnography.

If the initial intubation attempt was unsuccessful after 60 s, the patient's lungs were ventilated manually for 90 s by bag–mask in the BM-V/LG-TI group or *via* the ILMA before the second attempt. If the technique was successful, the total time that had elapsed during the attempt or attempts until correct placement of the endotracheal tube was recorded. If the second attempt was also unsuccessful, the technique was recorded as failed.

Study Phase 2. If a technique was rated as failed, the participant could switch to the alternative technique as described in study phase 1. The participant was then required to ventilate and intubate with that technique as prescribed by the study protocol.

Data Collection and Processing. The time to achieve successful BM-V or ILMA-V was defined as the time from the investigator handing over the patient to the participant to the first valid capnography trace. If unsuccessful, the attempt was recorded as failed for subsequent statistical analysis. The total time for intubation was the sum of all attempts until success or ultimate failure. If neither attempt was successful, intubation was recorded as failed for further analysis. Airway adjuncts or maneuvers performed to facilitate ventilation or intubation were recorded.

Statistical Analysis. The primary outcome measures were success in the performance of a ventilation and intubation technique, the number of attempts, and the time required. The data from each ventilation and intubation attempt were collected and analyzed using a spreadsheet program (Excel 2002; Microsoft Corp., Redmond, WA) and a statistics program (SPSS 12.0.1; SPSS Inc., Chicago, IL). Because every participant handled both methods with three patients each, a repeated-measures design with factors "method" (BM-V/LG-TI *vs.* ILMA-V/ILMA-TI) and "course of testing" (attempts on the first, second, or third patient treated with the respective method) resulted.

As a global estimate of success rate for ventilation and tracheal intubation, the total sums of successful attempts on the three patients treated each were computed and compared using a chi-square test. The times required for ventilation and tracheal intubation attempts were compared by repeated-measures analysis of variance with factors "method" and "course of testing," which allows detection of differences between the methods applied and possible learning effects. Because total time for an attempt was limited to 60 s, supplementary analyses were performed on successful attempts only. In addition, times to successful mask ventilation and tracheal intubation were compared by Kaplan-Meier survival analysis for censored data.

Demographic and descriptive clinical data (age, weight, height, and body mass index) of the patients in each group were compared by univariate analyses of variance, and the sex ratio was tested with the chi-square test. The statistical significance level was set at $\alpha < 0.05$.

Results

Thirty final-year medical students (13 female and 17 male) participated in this study. All participants were novice to BM-V, LG-TI, ILMA-V, and ILMA-TI. One hundred eighty-six patients fulfilled the inclusion criteria and were selected for study purposes. Six patients were excluded from the study after induction of anesthesia, three because ventilation with the facemask was deemed difficult by the investigators and three because blood pressure decreased by more than 20% of the baseline value after induction. There were no differences between the two groups with different intubation techniques with regard to age ($F_{1,178} = 2.0$, $P = 0.16$), body weight ($F_{1,178} < 1.0$, $P > 0.9$), height ($F_{1,178} = 2.2$, $P = 0.14$), body mass index ($F_{1,178} = 0.9$, $P = 0.35$), or sex ratio (chi-square$_{(1)} = 1.1$, $P = 0.29$; table 1). Fifteen

Table 1. Demographic and Descriptive Clinical Data of Patients

	BM-V/LG-TI	ILMA-V/ILMA-TI
No. of patients	90	90
Male sex, n (%)	37 (41)	44 (49)
Age, mean (SD), yr	53.9 ± 19.2	50.2 ± 15.3
Height, mean (SD), cm	169.8 ± 10.4	172.0 ± 9.2
Body weight, mean (SD), kg	76.3 ± 15.9	76.5 ± 13.4
Body mass index, mean (SD), kg/m^2	26.4 ± 4.9	25.8 ± 3.9

BM-V = bag–mask ventilation; ILMA-TI = intubation *via* intubating laryngeal mask; ILMA-V = ventilation *via* intubating laryngeal mask; LG-TI = laryngoscopically guided tracheal intubation.

Table 2. Number of Participants Achieving Successful Ventilation and Times Elapsed before Successful Ventilation Established

	BM-V		ILMA-V	
Time of Testing	Successful, n	Time, Mean ± SD, s	Successful, n	Time, Mean ± SD, s
Turn 1, n = 30	26	47.3 ± 16.3	30	34.8 ± 13.5
Turn 2, n = 30	24	42.0 ± 15.9	29	35.7 ± 13.6
Turn 3, n = 30	27	43.6 ± 15.9	29	36.3 ± 13.5
Total	77	44.3 ± 10.8	88*	35.6 ± 8.0†

* $P < 0.05$ (chi-square test). † $P < 0.01$ (repeated-measures analysis of variance).

BM-V = bag–mask ventilation; ILMA-V = ventilation *via* intubating laryngeal mask.

participants started the study with bag–mask ventilation and laryngoscopic intubation, and 15 started with ILMA-V and ILMA-TI.

Ventilation *via* ILMA was successfully performed in 88 of 90 (97.8%) patients compared with 77 of 90 with BM-V (85.6%, chi-square$_{(1)}$ = 8.8, $P < 0.01$). The time required for ventilation was shorter with ILMA-V than with BM-V (35.6 ± 8.0 *vs.* 44.3 ± 10.8 s, $F_{1,29} = 22.8$, $P < 0.01$; table 2). There was no influence of "course of testing" ($F_{2,58} = 0.3$, $P = 0.71$) or an interaction "course of testing" × "method" ($F_{2,58} = 1.0$, $P = 0.39$) on ventilation time. Only 19 of 30 subjects were successful on all ventilation attempts. Limiting analyses to these revealed shorter times needed for successful ventilation with ILMA-V compared with BM-V (35.6 ± 7.8 *vs.* 44.5 ± 11.3 s, $F_{1,18} = 24.0$, $P < 0.01$). Kaplan-Meier estimates for median times until success in ventilation were longer for BM-V (45 s [interquartile range, 30–60 s]) than for ILMA-V (35.0 s [25–43 s], chi-square$_{(1)}$ = 20.8, $P < 0.01$; fig. 1).

Ventilation *via* ILMA was unsuccessful in one patient because of restricted mouth opening after induction of anesthesia. The patient's lungs were then ventilated with BM-V, and LG-TI was successfully performed under neuromuscular relaxation, which allowed the mouth to be opened wider. The other instance of failed ILMA-V was due to insufficient airway seal without a plateau phase in the capnography curve. ILMA-TI in this patient was successful on the first attempt.

All instances of failed BM-V were due to ineffective facemask seal with no plateau phase in the capnography curve. In all of these patients, BM-V was successfully performed by the investigators, and the participants were allowed to continue with LG-TI.

Tracheal intubation with the ILMA was successful, with significantly fewer attempts and with a greater overall success rate (92.2%) than with LG-TI (60.0%, chi-square$_{(1)}$ = 25.7, $P < 0.01$). With ILMA-TI, intubation was successful in 75 patients (83%) on the first attempt and in 8 patients (9%) on the second attempt. The data for LG-TI are successful intubation on the first attempt in 42% of the patients and on the second attempt in 18% of the patients (38 and 16 patients, respectively).

The total elapsed time required for tracheal intubation attempt was significantly longer with LG-TI than with ILMA-TI (89.1 ± 34.9 *vs.* 45.7 ± 29.1 s, $F_{1,29} = 99.6$, $P < 0.01$). There was no influence of "course of testing" ($F_{2,58} = 0.1$, $P = 0.89$) or an interaction "course of testing" × "method" used ($F_{2,58} = 2.3$, $P > 0.11$) on time

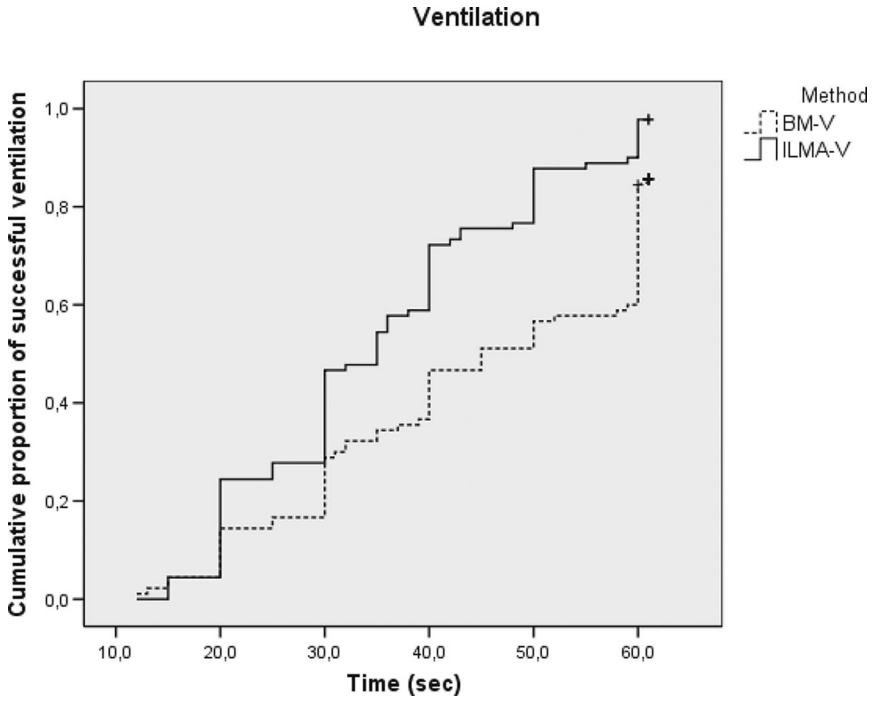

Fig. 1. Time to achieve successful ventilation *via* bag–mask ventilation (BM-V) and intubating laryngeal mask (ILMA-V) (Kaplan-Meier analysis).

Table 3. Number of Participants Achieving Successful Intubation and Times Required for Insertion (after 60-s Intermittent Ventilation Was Maintained)

	LG-TI		ILMA-TI	
Time of Testing	Successful, n	Time, Mean ± SD, s	Successful, n	Time, Mean ± SD, s
Turn 1, n = 30	16	94.7 ± 33.4	29	41.2 ± 29.3
Turn 2, n = 30	18	90.6 ± 34.6	26	46.5 ± 33.2
Turn 3, n = 30	20	82.1 ± 36.4	28	49.3 ± 27.5
Total	54	89.1 ± 23.3	83*	45.7 ± 14.8†

* $P < 0.01$ (chi-square test). † $P < 0.01$ (repeated-measures analysis of variance).

ILMA-TI = intubation *via* intubating laryngeal mask; LG-TI = laryngoscopically guided tracheal intubation.

Table 4. Airway Adjuncts and Support Maneuver Used

BM-V, n = 90	
Guedel tube	57 (63.3)
Two-hand ventilation	71 (78.9)
LG-TI, n = 90	
BURP maneuver	44 (48.9)
ILMA-V, n = 90	
Reinsertion	3 (3.3)
ILMA-TI, n = 90	
"Up–down" maneuver	6 (6.7)
"Seal optimization" maneuver	41 (46.1)

Data are presented as n (%).

BM-V = bag–mask ventilation; BURP = backwards upwards right pressure (of the thyroid cartilage); ILMA-TI = intubation *via* intubating laryngeal mask; ILMA-V = ventilation *via* intubating laryngeal mask; LG-TI = laryngoscopically guided tracheal intubation.

required for intubation (table 3). Consideration of only successful intubation attempts decreased the sample size substantially (only 5 of 30 participants were successful on all intubation attempts) and was therefore not analyzed with the analysis of variance approach. Kaplan-Meier estimates for median time until success in tracheal intubation was longer for LG-TI (106 s [interquartile range, 58 to > 120 s], success rate below 75%) than for ILMA-TI (40 s [25–60 s], chi-square$_{(1)}$ = 58.3, $P < 0.01$; fig. 2).

Airway adjuncts or maneuvers required to provide sufficient ventilation or facilitate tracheal intubation are listed in table 4.

Three of the 36 patients after failed LG-TI and 2 of 7 patients after failed ILMA-TI were excluded from study phase 2 because of signs of upper airway injuries (small amounts of blood on the laryngoscope or the ILMA). In the remaining 33 patients with failed LG-TI, ILMA-TI was successfully performed in 28 (85%). Conversely, 1 (20%) of the 5 patients with failed ILMA insertion was successfully intubated with the LG-TI technique, but intubation was not successful in any patient after a failed ILMA-TI.

Discussion

Airway management is fundamental in the treatment of critically ill or traumatized patients. The advantages of tracheal intubation over bag–mask or extraglottic airway device ventilation include maintenance of a patent airway, protection from aspiration of foreign material, the ability to provide an adequate tidal volume during chest compressions and to ventilate the lungs with high inspiratory and end-expiratory pressures, and an access for

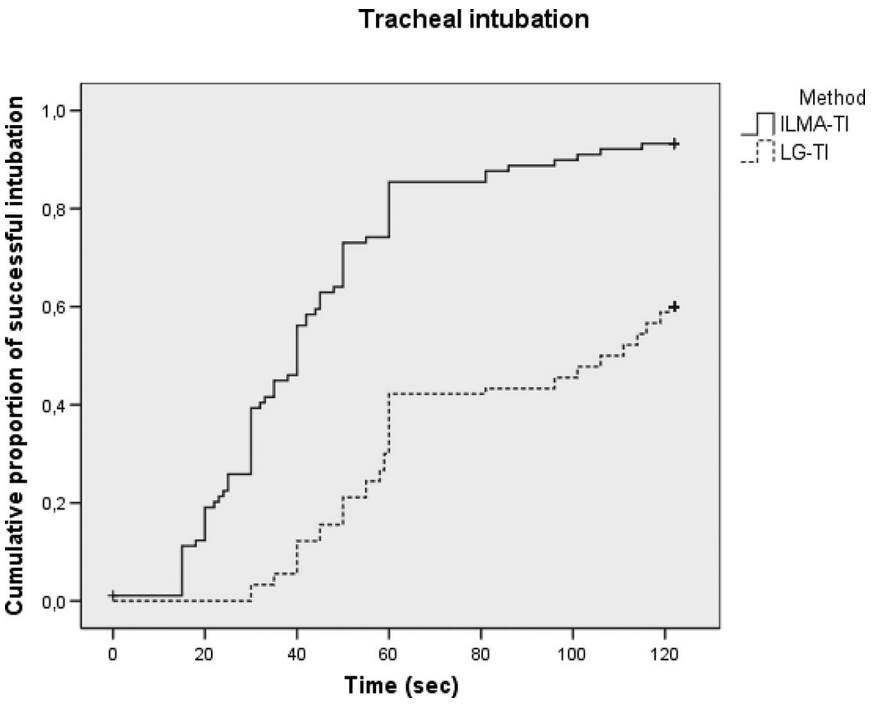

Fig. 2. Time to achieve successful tracheal intubation *via* laryngoscopy (LG-TI) and intubating laryngeal mask (ILMA-TI) (Kaplan-Meier analysis).

suctioning tracheal secretions or endobronchial drug application.[13] Perkins *et al.*[23] considered effective bag–mask ventilation to be essential, but regarded proficiency in the use of the laryngeal mask and tracheal intubation as optional competences for medical students on graduation.

Correct mask ventilation is a basic resuscitation skill and should be given high priority in training.[13] Our data showed an 85% success rate with BM-V with an average time of 44 s to achieve ventilation when successful. Ventilation *via* the ILMA was successful more often (98%) and more rapidly achieved (36 s). There is only one previous study in which BM-V and LG-TI performed by novice intubators are compared with ILMA-V and ILMA-TI.[24] The success rates were 72% for BM-V and 98% for ILMA-V. Other investigators described a BM-V success rate of 43% compared with 80% for ventilation with other extraglottic airway devices when performed by inexperienced users.[25,26] A further advantage is that a respirator can be connected to the ILMA, freeing one person, whereas bag–mask ventilation requires at least one person to hold the mask. In our study, almost 80% of the participants needed both hands to achieve an effective seal, requiring a second person for ventilation. This situation can be precarious, *e.g.*, in an out-of-hospital setting, in which personnel resources are limited and several tasks must be performed simultaneously.

The 2005 European Resuscitation Council resuscitation guidelines state that tracheal intubation is the best technique for providing and maintaining a patent airway during CPR, but it should only be attempted if the provider is properly trained and has adequate ongoing experience with the technique.[13] Our success rate of 60% for LG-TI is similar to data obtained by other investigators who found success rates of 35–69% when LG-TI was performed by novice intubators in patients in the operating room and in whom a difficult airway was not anticipated.[24,27–32] LG-TI must be performed approximately 50 times in patients who seemed normal on a routine airway examination to achieve proficiency.[7,8] This requirement is difficult to meet for each healthcare provider responsible for emergency airway management.

In our study, ILMA-TI was successful significantly more often (92%), with a shorter mean intubation time of 46 s in all patients. Avidan *et al.*[24] found a success rate of only 43% for ILMA-TI, but different insertion and intubation techniques were used, and the number of times each participant attempted intubation was not standardized. Participants in our study strictly followed the insertion technique recommended by Brimacombe.[22] Moreover, the participants used the seal optimization maneuver in 46%, which was described to improve ILMA-TI success rates from 68% to 95% in patients with difficult airways.[15] One other study found an ILMA-TI success rate of 86% for inexperienced personnel.[33]

Time spent on intubation attempts may be detrimental, particularly during CPR, when chest compressions must be interrupted. The time required for intubation was significantly shorter with ILMA-TI (46 *vs.* 89 s). Times for ILMA-TI are not reported in the literature, but the reported mean times for LG-TI performed by inexperienced personnel are between 88 and 206 s.[29,30,32] A valuable aspect of the ILMA is that ventilation can be easily continued between intubation attempts. The ILMA is more likely to protect against aspiration than BM-V during CPR.[34] Alternatively, intubation attempts may be deferred altogether until return of spontaneous circulation or until the patient is transferred to the hospital, where more experienced providers and additional airway management equipment are available.

The particular strength of the ILMA is in managing the difficult airway by experienced providers.[15] In the current study, tracheal intubation failed in 40% with LG-TI and in 7% with ILMA-TI. ILMA-TI was successful in 28 of 33 patients with failed LG-TI. Conversely, LG-TI succeeded in only 1 of 5 patients after failed ILMA insertion. In this patient, ILMA insertion failed because of restricted mouth opening that resolved under neuromuscular blockade. ILMA-TI might have then been successful, but the technique had been switched to BM-V/LG-TI according to the study protocol. However, the high rate of successful ILMA-TI after failed LG-TI demonstrates the value of this device for inexperienced users. It must be noted that ventilation and TI were performed in selected patients without evidence of a difficult airway under operating room conditions. In contrast, airway management is much more difficult in patients undergoing airway resuscitation. Particularly in emergency settings, the presence of intraoral material, subcutaneous emphysema, disrupted anatomy or dental damage as well as cervical spine immobilization and in-line axial stabilization can further impede facemask ventilation and techniques depending on direct or indirect laryngeal visualization.[35] Furthermore, difficult out-of-hospital airway management is usually unanticipated and is complicated by the presence of respiratory dysfunction and hypoxia, with impaired access to the patient's head. Other factors impeding airway management in the emergency patient include CPR and other simultaneously performed interventions as well as altered and varying levels of patient consciousness. Unsurprisingly, a recent study reported a higher incidence of difficult and failed laryngoscopy and poorer laryngeal visibility in a prehospital setting even when the patients were managed by anesthesia-trained physicians compared with laryngoscopy performed in the operating room.[36]

In conclusion, this study demonstrated orotracheal intubation as a difficult task for the inexperienced to perform. Ventilation and intubation using the intubating LMA is faster and has a higher success rate than bag–mask ventilation and laryngoscopic intubation. In addition, ILMA-TI is usually successful in patients in whom

LG-TI had failed. Other supraglottic airway devices have been successfully used for ventilation and oxygenation in prehospital emergencies. The ILMA provides the additional benefit of facilitating tracheal intubation. Time is slender in any curriculum, but our findings suggest the inclusion of the ILMA into in the curricula for undergraduate and postgraduate training. We recommend that healthcare providers should learn the use of the ILMA on both manikins and patients in the controlled environment of an operating room. The ILMA device should be at hand in all emergency medical facilities. Moreover, our data support a shift in emphasis toward the ILMA for ventilation and intubation and away from the conventionally used bag–mask ventilation and laryngoscopic intubation for personnel inexperienced in airway management.

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