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REPORTS OF ORIGINAL INVESTIGATIONS

Improved esophageal patency when inserting the ProSeal™ laryngeal mask airway with an Eschmann™ tracheal tube introducer

Perméabilité oesophagienne améliorée lors de l'insertion du ProSeal™ laryngeal mask airway à l'aide de la bougie de Eschmann™

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Abstract

Purpose *We hypothesized that a more accurate alignment of the tip of the drain tube with the upper esophageal opening would be achieved in adult patients, as confirmed by fibreoptic bronchoscopy, by placing the ProSeal™ laryngeal mask airway (PLMA) by means of guiding it over an Eschmann™ tracheal tube introducer, commonly know as a gum elastic bougie (GEB), that was previously inserted into the esophagus, rather than by placing the PLMA with a curved metal introducer (IT).*

Methods *Seventy-five adult elective surgery patients, whose airway management involved a PLMA, were randomly allocated to either the GEB- or IT-guided techniques. After inserting the PLMA, alignment of the tip of the drain tube relative to the esophageal opening was verified by a fibrescope introduced through the drain tube. Placing the fibrescope through the PLMA identified the glottic structures. The primary endpoint indicating the proper alignment of the tip of the drain tube of the PLMA with the upper esophageal opening was the ability to pass the fibrescope into the esophagus through the drain tube by a distance >35 cm without obstruction and the ability to simultaneously visualize the esophageal mucosa.*

Results *The overall success rates of PLMA insertion were similar in the GEB and IT groups. However, the mean airway insertion times were longer with the GEB than with the IT-PLMA. The GEB group achieved proper alignment of the drain tube and the upper esophageal opening more frequently than the IT group (97% confidence interval (CI_{95}) 91.5–100% vs 81% CI_{95} 68.5–93.5% of subjects, respectively; $P = 0.027$). When the GEB was used to place the PLMA, the patients' vocal cords were visualized more frequently than when the IT technique was used (100% vs 73% CI_{95} 58.9–87.1% of subjects, respectively; $P = 0.003$).*

Conclusion *Fibreoptic bronchoscopy confirmed that GEB is superior to the IT technique in ensuring precise alignment of the tip of the drain tube of the PLMA with the upper esophageal opening. Accurate positioning may better preserve gastroesophageal drainage function of the PLMA.*

Résumé

Objectif *Nous avons émis l'hypothèse qu'il serait possible de parvenir à un alignement plus précis entre la pointe du tube de drainage du masque laryngé et l'ouverture supérieure de l'œsophage chez les patients adultes, évalué par bronchoscopie par fibres optiques, en*

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plaçant un masque laryngé ProSeal™ (PLMA) guidé par une bougie de Eschmann™, aussi connue sous le nom de bougie flexible (GEB), insérée précédemment dans l'œsophage, au lieu de placer le PLMA à l'aide d'un introducteur en métal courbé (IT).

Méthode *Soixante-quinze patients adultes devant subir une chirurgie non urgente et dont la prise en charge respiratoire impliquait un PLMA on été randomisés en deux groupes à recevoir soit la technique guidée par GEB soit la technique guidée par IT. Après l'insertion du PLMA, l'alignement entre la pointe du tube de drainage et l'ouverture de l'œsophage a été vérifié à l'aide d'un fibroscope introduit via le tube de drainage. Le fait de placer le fibroscope via le PLMA a permis d'identifier les structures glottiques. La capacité de faire passer le fibroscope dans l'œsophage via le tube de drainage sur une distance >35 cm sans obstruction et la capacité de visualiser simultanément la muqueuse oesophagienne ont constitué les critères principaux indiquant l'alignement correct entre la pointe du tube de drainage du PLMA et l'ouverture supérieure de l'œsophage.*

Résultats *Les taux globaux de réussite de l'insertion du PLMA étaient comparables dans les groupes GEB et IT. Toutefois, les temps moyens d'insertion des dispositifs étaient plus longs dans le groupe GEB par rapport au groupe IT-PLMA. Un alignement adéquat du tube de drainage et de l'ouverture supérieure de l'œsophage a été réalisé dans le groupe GEB plus souvent que dans le groupe IT (intervalle de confiance 97 % (IC_{95}) 91,5–100 % vs 81 % IC_{95} 68,5–93,5 % des patients, respectivement; $P = 0{,}027$). Lors de l'utilisation de la GEB pour placer le PLMA, les cordes vocales des patients étaient plus souvent visualisées que lors de l'utilisation de la technique IT (100 % vs 73 % IC_{95} 58,9–87,1 % des patients, respectivement; $P = 0{,}003$).*

Conclusion *La bronchoscopie par fibres optiques a confirmé que la technique GEB est supérieure à la technique IT pour assurer un alignement précis entre la pointe du tube de drainage du PLMA et l'ouverture supérieure de l'œsophage. Un positionnement précis pourrait préserver la fonction de drainage gastro-oesophagien du PLMA de façon plus optimale.*

The ProSeal™ laryngeal mask airway (PLMA) was designed to improve airway seal around the cuff during spontaneous and positive pressure ventilation in order to prevent inflation of the stomach and minimize the risk of aspirating gastric contents. This important function depends on the separation of the respiratory and gastrointestinal tracts and is achieved by aligning the tip of the PLMA with the upper esophageal sphincter. To ensure correct positioning, a drainage tube is incorporated to detect faulty positioning of the PLMA. The drainage tube allows venting of air if the tip of the PLMA does not seat properly on the proximal end of the esophagus during positive pressure ventilation.[1] However, alignment is not always achieved in clinical practice and may lead to unreliable gastroesophageal drainage. Consequently, different insertion techniques have been suggested to improve the alignment of the PLMA with the glottis and the upper esophageal opening, respectively.

The manufacturer recommends inserting the PLMA using either digital manipulation or a curved metal introducer. Another suggested technique is to insert an Eschmann™ tracheal tube introducer, commonly know as a gum elastic boogie (GEB), into the esophagus to 'railroad' the PLMA into place.[2] Previous studies have shown that the latter technique might be associated with a better seal and a higher success rate.[3–5] However, these investigations focused on the adequacy of the ventilatory function and did not directly evaluate the positioning of the PLMA to ensure that the esophageal opening was aligned with the tip of the drain tube, thereby preserving gastroesophageal drainage function.[6]

The purpose of this study was to evaluate two methods for insertion of the PLMA using fibreoptic bronchoscopy to determine which technique more accurately places the tip of the drain tube in alignment with the esophageal opening. The first method is the manufacturer's recommendation to use a special curved metal introducer (IT). The second method is use of the gum elastic bougie (GEB) to guide placement of the PLMA into the oropharynx.[5] We hypothesized that, following induction of anesthesia in adult patients, placement of the PLMA guided over a gum elastic bougie previously inserted in the esophagus will lead to more accurate alignment of the tip of the drain tube with the upper esophageal sphincter than placement of the PLMA with the curved metal introducer.

Methods

This study was registered in the public registry ClinicalTrials.gov (07-0166-B). After obtaining approval from the University Health Network Research Ethics Board, eligible patients gave written informed consent. Patients who enrolled in the study were 18 yr of age or older and scheduled for either orthopedic or urological surgery in the supine position. All patients were American Society of Anesthesiologists (ASA) classification I or II with BMIs $< 35\ \mathrm{kg \cdot m^{-2}}$. Patients were excluded if they had evidence of a difficult airway, a mouth opening <2.5 cm, and if a PLMA was contraindicated, i.e., risk of aspiration during induction of anesthesia and the presence of oropharyngeal pathology that might interfere with insertion of the PLMA.

A research assistant enrolled the participants. Four practicing anesthesiologists were the investigators for the study who performed the manipulations and insertions of the PLMA. Randomization was determined by a series of computer-generated random sampling codes. To assign participants to their groups, a research assistant, who was not further involved in the study, prepared the random codes and placed them in opaque sealed envelopes. The details of the codes were unknown to any of the investigators or to the research co-ordinator who recorded the measurements during the study period. The sequentially numbered sealed envelopes were opened by the investigators after the patients were positioned supine on the operating table. The research assistant who enrolled the participants recorded the measurements.

Patients refrained from taking food for a minimum of 6 hr and fluids for 4 hr before the scheduled surgical time. No premedication was given. An intravenous cannula was inserted and standard monitors were applied in the operating room. Airway gases, end-tidal CO_2, and airway pressure were monitored immediately after PLMA placement. After 2–3 min of pre-oxygenation, anesthesia was induced with midazolam 15–30 $\mu g \cdot kg^{-1}$ *iv*, fentanyl 1.0–1.5 $\mu g \cdot kg^{-1}$ *iv*, and propofol 3.0–4.0 $mg \cdot kg^{-1}$ *iv*. After loss of consciousness, the patients' lungs were ventilated with 100% oxygen for 1 min through a facemask to ensure full jaw relaxation. The metal introducer (IT) insertion technique was performed according to the manufacturer's instructions. After opening the patient's mouth, the lubricated PLMA containing the IT was gently advanced following the palatopharyngeal curve using a single-handed technique. The gum elastic bougie (GEB) guided technique followed the steps described by Brimacombe *et al.*[5] The drain tube of the PLMA was primed with a well-lubricated bougie with its straight end protruding through the distal end of the PLMA leaving 5 cm of the bent portion protruding from the proximal end (Fig. 1). An assistant held the proximal end of the GEB while the anesthesiologist manipulated the distal part of the GEB. A laryngoscope was used to lift the patient's tongue and the distal portion of the GEB was placed into the esophagus by gently sliding the GEB onto the posterior pharyngeal wall. The laryngoscope was then removed and the anesthesiologist introduced the lubricated PLMA over the GEB. Finally, the GEB was removed while the PLMA was held in position.

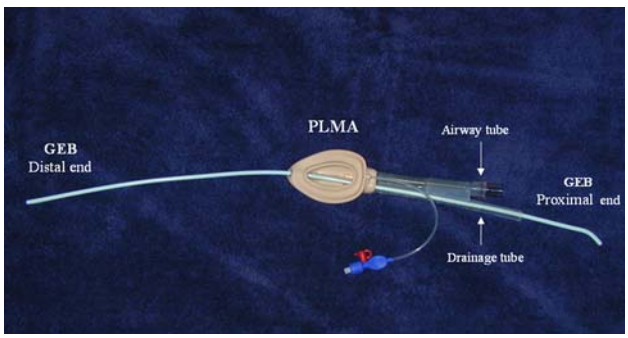

Fig. 1 The Eschmann™ tracheal tube inducer (gum elastic bougie) is mounted inside the drain tube of a ProSeal™ laryngeal mask airway. The straight end of the bougie is distal and the bent end is proximal. *GEB* gum elastic bougie; *PLMA* ProSeal™ laryngeal mask airway

Both airway insertion techniques were performed using a midline approach with the PLMA cuff fully deflated. Once the PLMA was inserted into the pharynx, the cuff was inflated with air according to PLMA size: PLMA #3, 20 mL; PLMA #4, 30 mL; PLMA #5 40 mL. Three attempts were allowed before insertion was considered a failure. Failed insertion was defined as either failed passage into the pharynx and/or major pharyngeal air leaks despite cuff inflation. If the insertion failed after three attempts, the patient was paralyzed to facilitate orotracheal intubation.

If the PLMA insertion was successful, the cuff was inflated. Subsequently, the anesthesiologist determined whether the patient's lungs could be adequately ventilated. With successful ventilation, optimal placement of the PLMA was confirmed by advancing a 35 mm pediatric fibreoptic bronchoscope through the drainage and airway tubes. The anesthesiologist who inserted the PLMA assessed the ability to pass the fibrescope >35 cm without resistance, the ability to visualize esophageal mucosa through the drainage tube, and the ability to visualize glottic structures through the airway tube (Fig. 2).

Following fibreoptic examination, indirect tests to evaluate proper positioning and patency of the drain tube of the PLMA were performed. Proper positioning was assessed by observing whether the portion of the bite block of the PLMA protruding outside the patient's mouth was 50% of the tube length. Patency of the drain tube was evaluated by two tests, the first being the drainage tube air leak test. This test was performed by injecting a short column (2 cm) of water-based lubricant into the drainage tube and manually ventilating the patient's lungs to achieve a peak airway pressure >25 cm H_2O.[3] The test was considered positive if the lubricant was displaced only at the point of peak airway pressure, indicating patency of the drain tube. The second indirect test was the suprasternal notch tap test, which involved a gentle tapping on the patient's suprasternal notch while simultaneously observing movement of the lubricant column in the drainage tube.[7] As a surrogate marker of drain tube patency, distal movement of the lubricant during tapping indicated a positive test. This test works by cuff compression resulting from external pressure on the suprasternal notch, which will compress the distal drain tube contained in the distal cuff. A pressure wave that is established within the drain tube moves the lubricant. Finally, a lubricated 16-F gastric tube was inserted through

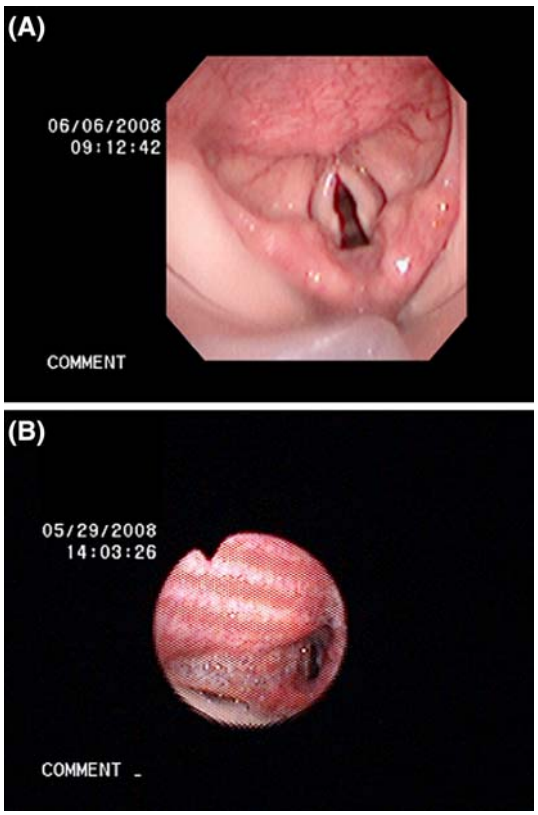

Fig. 2 Glottic view as visualized through a pediatric bronchoscope inserted into the airway tube of the ProSeal™ laryngeal mask airway (PLMA). **a** All glottic structures are seen clearly in a patient were the bougie technique (GEB) was used for PLMA insertion. **b** Most of the laryngeal inlet is seen as well as bulging of the esophageal mucosa (*lower left*). The posterior surface of the epiglottis occupies the upper half of the view. The PLMA was inserted in this patient using the introducer technique (IT)

the drain tube. Correct positioning of the PLMA was noted by aspirating gastric contents or by the ability to advance the PLMA by >35 cm.

For this study, the primary endpoint that indicated the proper alignment of the tip of the drain tube of the PLMA with the upper esophageal opening was the ability to pass the fibrescope into the esophagus through the drain tube for a distance >35 cm without obstruction while simultaneously visualizing the esophageal mucosa. The secondary endpoints included the time of insertion and the proper fit of the laryngeal aperture of the PLMA to the laryngeal opening of the patient by visualization of glottic structures (Fig. 2). The time of insertion was defined as the time elapsed from the point when the anesthesiologist held the PLMA until the 15 mm adaptor of the anesthesia circuit was connected to the PLMA. If the PLMA had to be repositioned, the time of the successful insertion, not the cumulative time, was considered the insertion time for any given patient. The fit of the PLMA to glottic structures was evaluated by a descriptive nominal score including four categories: visualization of the anterior and posterior furnaces, visualization of anterior or posterior fornix, visualization of the arytenoids only, and visualization of esophageal mucosa with any other glottic structure. Such description was based on previously published classifications.[8,9] Heart rate and blood pressure were recorded every minute during insertion and for 10 min after insertion of the PLMA. The anesthesiologist who inserted the PLMA performed the fibreoptic evaluations. A separate observer not involved in the placement of the PLMA recorded the study data. The investigator performing the analysis was blinded to the technique used for PLMA insertion. Adverse events were recorded, including postoperative sore throat, nausea and vomiting, blood observed on the PLMA after removal, and suctioning of gastric contents from oropharynx.

The sample size was calculated based on an expected 25% difference in the success rate between the two groups with respect to aligning the tip of the drain tube with the upper esophageal opening. Thirty-eight patients per group were required to achieve statistical power of 0.8 with $\alpha = 0.05$ based on two-sided Chi square testing. The primary endpoint was represented by either the success or failure of the alignment of the tip of the drain tube with the esophagus detected by free passage of the fibrescope >35 cm through the drain tube and simultaneous visualization of esophageal mucosa. The differences between the two groups pertaining to the primary endpoint were tested using the Chi square test. The secondary endpoints involving continuous data were analyzed using the two-tailed Student's *t* test for independent sample means. A repeated measures ANOVA was performed to compare heart rate and blood pressure and a Student–Neuman–Keuls test was used for multiple comparisons between two means. The secondary endpoints expressed in categorical data were analyzed by the Chi square test. A corrected Chi square test using Yate's correction factor was performed in cases where the contingency tables had expected cell sizes <5. *P* values <0.05 indicated statistical significance. Statistic analysis was performed using SPSS statistical software version 15.0 (Chicago, IL, USA).

Results

The study took place over a period of 12 months from 2007 to 2008. Eighty of the 95 patients who were screened met the eligibility criteria. Two of the eligible patients refused participation and three patients were not randomized because of equipment unavailability. Seventy-five patients participated in the study, and all 75 participants received the intended intervention and completed the study protocol. Thirty-eight and 37 patients had the PLMA inserted using

the IT and the GEB, respectively. Patient characteristics in the two groups were similar (Table 1). The overall success rates of PLMA insertion and the first attempt at PLMA insertion were similar in the two groups ($P = 0.13$). However, there was a longer PLMA insertion time in group GEB compared with group IT (Table 1; $P = 0.0003$). The PLMA was successfully placed in all patients. Compared with group IT, the ability to pass the pediatric fibreoptic scope >35 cm through the drain tube with simultaneous visualization of esophageal mucosa was more frequently successful in group GEB (97% confidence interval [CI_{95}] 91.5–100% *vs* 81% CI_{95} 68.5–93.5% of subjects, respectively; $P = 0.027$) (Table 2). Additionally, the ability to visualize the vocal cords was more common in group GEB compared with group IT (100% *vs* 73% CI_{95} 58.9–87.1% of subjects, respectively; $P = 0.003$, Table 2; Fig. 2). The esophageal mucosa was observed more frequently during visualization of the glottic structures through the airway tube in patients who had the PLMA inserted using the IT technique (Table 2; Fig. 2b; $P = 0.034$).

All patients' lungs could be ventilated adequately after PLMA insertion. The results of the indirect tests to evaluate the adequacy of drain tube placement and patency were similar in the two groups (Table 2; $P > 0.4$). However, compared with the IT group, the gastric tube insertion test was more successful in the GEB group ($P = 0.034$).

Variations over time in systolic blood pressure and heart rate were similar between groups ($P = 0.48$ and 0.66, respectively) during the course of the study (Fig. 3). Complications were minor and there was no difference

Table 1 Demographic characteristics

Characteristic	Introducer technique ($n = 38$)	Bougie technique ($n = 37$)
Age (yr)	44.5 ± 12.8	41 ± 10.7
Female/male	16/22	12/25
ASA (I/II)	18/20	4/34
BMI ($kg \cdot m^{-2}$)	25.7 ± 4.0	26.6 ± 3.4
Preoperative systolic blood pressure (mmHg)	131 ± 18	129 ± 12
Heart rate (min^{-1})	77 ± 10	76 ± 10
Induction of anesthesia		
Propofol ($mg \cdot kg^{-1}$)	3.3 ± 0.65	3.6 ± 1.06
Midazolam ($\mu g \cdot kg^{-1}$)	22 ± 9	25 ± 15
Fentanyl ($\mu g \cdot kg^{-1}$)	1.45 ± 0.44	1.38 ± 0.45
PLMA size used (3/4/5)	1/18/19	0/15/22
1st/2nd/3rd attempt for placement	35/3/0	34/2/1
Overall time for insertion (s)*	29.7 ± 17.6	47.8 ± 17.7

ASA American Society of Anesthesiologists; *BMI* body mass index; *PLMA* ProSeal™ laryngeal mask airway

* Statistical significance ($P = 0.0003$; two-tailed Student's *t* test)

Table 2 ProSeal™ laryngeal mask airway (PLMA) placement characteristics

	Introducer technique ($n = 38$)	Bougie technique ($n = 37$)	Difference (95% CI)	*P* value
Primary endpoint				
FOB passed >35 cm and esophageal mucosa seen through drain tube	31/38 (81.6%)	36/37 (97.3%)	15.7% (2.3–29.1)	0.027
Secondary endpoints visualization through airway tube				
Anterior & posterior fornices	28/38 (73.7%)	37/37 (100%)		
Anterior or posterior fornix	5/38 (13.2%)	0/37 (0%)		
Arytenoids only	5/38 (13.2%)	0/37 (0%)		
Esophageal mucosa	7/38 (18.4%)	1/37 (2.7%)		
Function				
Adequate ventilation	38/38 (100%)	37/37 (100%)		
Indirect placement tests[a]				
50% of bite block within mouth	35/38 (92.1%)	35/37 (94.6%)		
Successful gastric tube insertion	31/38 (81.6%)	36/37 (97.3%)		
Positive gel displacement test	33/38 (86.8%)	33/37 (89.2%)		
Positive suprasternal notch test	30/38 (78.9%)	31/37 (83.8%)		

FOB fibreoptic bronchoscope; *CI* confidence intervals

[a] 50% of bite block within mouth and successful gastric tube insertion indicate proper placement of the PLMA. Positive gel displacement and suprasternal notch tests suggest patency of the drain tube of the PLMA

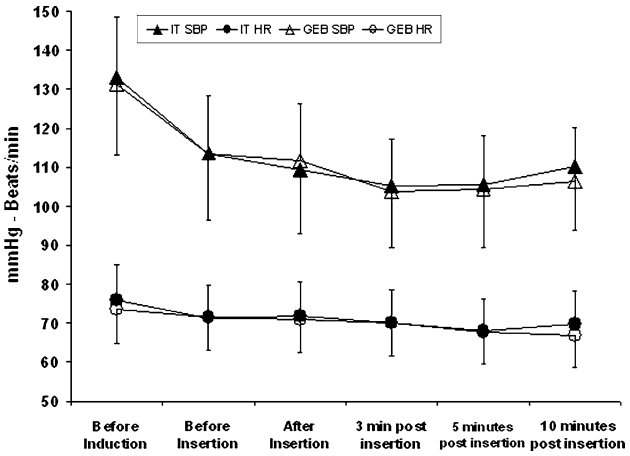

Fig. 3 The hemodynamic changes during the study period. There was no statistical significance between the introducer (IT) and the gum elastic bougie (GEB) groups pertaining to the systolic blood pressure (SBP) and heart rate (HR) changes. However, in each group there was a significant difference between the 'before induction' hemodynamic values and the values recorded intermittently after induction

between the complication rates for both groups (Table 3; $P = 0.923$). Compared with group IT, it was noted that visible blood on the PLMA after tube removal was observed more frequently in group GEB; however, the difference was not statistically significant ($P = 0.06$). There were no episodes of hypoxia in either group.

Discussion

The present study shows that use of the GEB is superior to the IT in ensuring precise alignment of the tip of the drain tube of the PLMA with the upper esophageal opening. Correct positioning is important to preserve the gastroesophageal drainage function of the PLMA. These results were based on direct visualization of the esophageal mucosa using a fibreoptic bronchoscope inserted in the drain tube of the PLMA. The study also shows that adequate ventilation with a PLMA does not, in itself, ensure proper positioning of the drain tube.

There are several possible explanations for the superiority of the GEB technique to ensure optimal placement of the PLMA. The GEB-guided technique prevents the PLMA from becoming impacted at the base of the tongue, folding over the distal portion of the cuff, or directing the tip of the PLMA into the glottic inlet instead of the hypopharynx.[3,10–12] Additionally, there is no need to use indirect tests of uncertain validity to show that the distal cuff is precisely positioned and that the drain tube is unobstructed.[2,5] Our results show the potential for false negative and false positive results of previously published indirect tests of PLMA positioning, assuming that a true positive endpoint is visualization of the esophageal mucosa through the drain tube by fibreoptic endoscopy. Despite the above advantages, there are several disadvantages of the GEB technique, including more procedural steps for insertion, increased insertion time, and a higher incidence of minor oropharyngeal trauma.

This study confirms previously published reports suggesting that GEB-guided insertion of the PLMA is superior to the IT techniques.[5,6,13] However, we also found that the time for insertion of the PLMA with the GEB was longer than with the IT; this may be related to the two extra steps necessary for the GEB technique. The added steps include pharyngoscopy with the laryngoscope and introduction of the GEB into the esophagus before 'railroading' the PLMA into the pharynx. However, the mean time difference was about 18 sec, which is of minor clinical importance in most settings. Other studies have found that the insertion time with the GEB was either less or equal to the time taken when the IT was used.[5,6] The expertise of the investigators in previously published reports (>1000 insertions of PLMA) might explain such observation. Nonetheless, the findings of our study may be more representative of the typical clinical practice of a large number of clinical anesthesiologists.

A new finding of this investigation is the lack of association between adequate ventilation and inadequate drain tube patency, as verified by the fibreoptic scope and the indirect tests, i.e., a lubricant displacement test during manual ventilation and a suprasternal notch pressure test

Table 3 Complications after removal of ProSeal™ laryngeal mask airway (PLMA)

	Introducer technique ($n = 38$)	Bougie technique ($n = 37$)	Difference (95% CI)	P value
Complication rate (yes/no)	15/23 (39.47%)	16/21 (43.24%)	3.8% (1–24.83)	0.923
Suctioning of gastric contents from oropharynx	1/38 (2.6%)	2/37 (5.4%)		
Blood on PLMA	1/38 (2.6%)	7/37 (18.9%)		
Sore throat	3/38 (7.9%)	7/37 (18.9%)		
Nausea	11/38 (28.9%)	15/37 (40.5%)		
Vomiting	0/38 (0%)	0/37 (0%)		

(Table 2). This indicates that adequate ventilation does not always predict proper gastroesophageal drainage function or precise placement of the PLMA into the hypopharynx. In keeping with this concept, a previous report showed that a form of improper insertion of the PLMA, i.e., glottic insertion (insertion of the tip of the PLMA into the laryngeal vestibule) was associated with adequate ventilation, despite a positive soap membrane test indicating non-alignment of the tip of the drain tube with the esophageal opening.[7] Moreover, an earlier report concluded that easy passage of a gastric tube, and not adequate ventilation, should be indicative of the correct positioning of the PLMA.[14] The GEB technique can avoid instances of adequate ventilation with concurrent poor alignment of the tip of the drain tube and the upper esophageal opening. This was demonstrated in our study by the fact that when the GEB was used to insert the PLMA, the fibrescope passed freely into the esophagus through the drain tube, and the vocal cords were completely visualized in all patients. Interestingly, recent reports showed that the GEB had also led to more precise placement of the PLMA compared with IT techniques in children.[8,15] In these reports, children who were allocated to the GEB group had better separation of the gastrointestinal tract from the airway.

We were unable to determine which technique of insertion is associated with a higher success rate pertaining to adequate ventilation. In contrast, previous reports were able to conclude that the GEB technique has better insertion success rates compared with the IT technique.[5,6] These investigators defined failed insertion by the inability to pass the PLMA into the pharynx or malposition of the PLMA associated with inadequate ventilation. However, such reports did not determine the accuracy of placement of the PLMA so that the gastroesophageal drainage function was preserved.

One limitation of this study is that it was not powered to detect possible differences in complication rates between the GEB and the IT techniques of PLMA insertion. This may explain the disagreement with previously published complication rates. For example, in our study, there was an increased incidence of blood observed on the PLMA after removal from patients who were randomized to the GEB technique, indicating minor oropharyngeal trauma. Other reports showed no difference between the GEB and IT techniques regarding the presence of visible blood and lower incidence of the presence of occult blood after removal of the PLMA when the GEB technique was used.[5,6] Notably, these investigators reported that they are developing a GEB with a softer tip that can substantially reduce the oropharyngeal trauma that can occur during PLMA insertion.[5] Another limitation is that the investigators and the research assistant recording the data were not blinded to the study techniques. This was inevitable because the two techniques cannot be concealed from those involved in the study. Nonetheless, the individual who performed the data analysis was blinded to the technique used to insert the PLMA.

In conclusion, our study used fibreoptic bronchoscopy to evaluate the adequacy of PLMA placement associated with two insertion techniques. In adults whose lungs are adequately ventilated following induction of anesthesia, use of an Eschmann™ tracheal tube inducer (gum elastic bougie) to insert the PLMA is superior to the curved metallic introducer with respect to optimal alignment of the tip of the drain tube with the esophageal opening. Additionally, we have shown that adequate ventilation of a patient with a PLMA does not necessarily ensure proper positioning of the drain tube. Because of the potential disadvantages of the GEB technique, its use may be preferred in patients who require the maintenance of gastroesophageal drainage to prevent gastric insufflation, insertion of a gastric tube for effective gastric drainage, or in instances where bronchoscopic visualization of the larynx is deemed essential.

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Conflicts of interest None declared.

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