recorders are more accurate than the low-resolution recorders and should be used in future studies in this field.

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## Failed Obstetric Tracheal Intubation and Postoperative Respiratory Support with the Proseal Laryngeal Mask Airway

To the Editor:

Keller and colleagues report use of the ProSeal™ LMA (PLMA) for airway rescue after failed obstetric intubation (1). The authors cite no other case of PLMA use for obstetric airway rescue or ICU ventilation.

We reported PLMA use after failed obstetrical intubation and difficult ventilation (2). The PLMA enabled excellent airway maintenance and uneventful completion of urgent surgery. We also reported two PLMA uses for ventilation of patients on ICU followed by bronchoscopic-guided percutaneous tracheostomy (3).

Electively, the PLMA was used in a pregnant, previously difficult to intubate, patient requiring electroconvulsive therapy (4) and for laparotomy in a patient with bronchial tree tumor impeding intubation (5).

Cases of PLMA airway rescue include after failed rapid sequence induction (6), after failed routine intubation with gastric distension (7), and after accidental extubation with failed reintubation on ICU (8). In all cases, the PLMA enabled uncomplicated further management.

These recent cases inform this rapidly evolving area of practice. We agree with Keller that 1) after failed intubation with difficult ventilation in a patient with a full stomach, or 2) where controlled ventilation on ICU with a supraglottic airway is required, the PLMA has advantages over other available devices.

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In Response:

We thank Drs. Cook and Nolan for their interest in our case report. The reason why we did not cite these seven additional cases of ProSeal™ LMA (PLMA) use for obstetric airway rescue or ICU ventilation was that none were published at the time we submitted our original manuscript on January 17, 2003 – all the additional cases, including one by our own group (1), were published in 2003 or 2004! Also, we recently described the successful use of the PLMA as part of a modified rapid sequence induction in a patient with a full stomach and a known difficult airway (2).

We concur with Drs. Cook and Nolan that the PLMA has a role in difficult airway management, particularly in those patients at risk of aspiration or requiring controlled ventilation (3). Perhaps the most promising PLMA insertion technique for airway rescue is to place a gum elastic bougie or tracheal tube guide into the esophagus under laryngoscope-guidance and then to railroad the PLMA into position along its drain tube, as this has a very high first attempt success rate and almost guarantees correct placement of the distal cuff (4,5), which is critical to airway protection (6). Interestingly, a similar technique using a fiberoptic scope placed down the drain tube has also been described for awake placement of the PLMA (7).

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## Tracheal Perforation with Modified Broncho-Cath®: Is It the Tube or the Technique?

To the Editor:

A 70-year-old, 160-cm-tall woman was scheduled for left lower lobectomy. On recent bronchoscopy (FOB), no tracheobronchial abnormality was found. After induction of anesthesia, left 37F double-lumen tube (DLT) was placed using the conventional blind technique. After bronchial tip passed the vocal cords, stylet was removed and the tube was rotated 90 degrees counterclockwise before advancing it to a depth of 27 cm. The tracheal cuff was inflated with bilateral equal breath sounds. FOB revealed that the bronchial tip had penetrated the posterior membranous trachea (MT) at the carina (Fig. 1). The DLT was replaced with an 8-mm cuffed endotracheal tube (ETT) that was advanced over the bronchoscope into the left bronchus, and the defect was repaired surgically through right thoracotomy.

A number of risk factors for tracheal injury have been recognized (1). However, the cause in our case is unclear. The stylet was removed and bronchial cuff was never inflated. The size of DLT selected appears appropriate. Interestingly, the bronchial tip was pointing posteriorly perforating the MT. How the DLT could take an additional 90 degrees counterclockwise turn thereby perforating the posterior MT is a question worth pondering. Similar reports (2,3) of injury have appeared in the literature. These reports, though sporadic, raise the question about the safety of DLT and its placement technique. May be it is time to focus on some less possible but plausible mechanisms of tracheal injury.

Curved tube when inserted into a linear tube impinges on its wall with a force that is required to straighten it. If the linear tube has differential wall strength and is deformable (trachea), then the element rotates along its long axis in order to occupy a position of least deformity. Since the tracheal wall is well supported except posteriorly, the tip of DLT develops a straightening force to conform to the tubular trachea. After the tip is turned, it is forced against the transitional area on the tracheal wall, where cartilage meets the membranous portion. As the DLT is advanced, the tip tends to slip off the cartilaginous (firm) to the membranous (soft) region, and, sometimes, may truly ride along the MT.

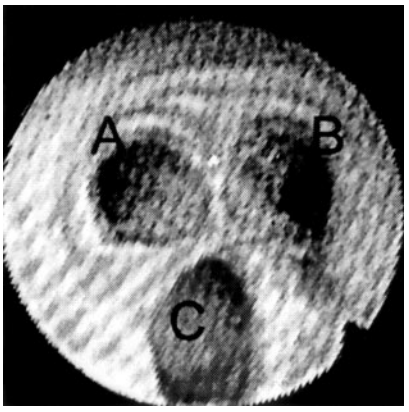


**Figure 1.** Bronchoscopic view of tracheal perforation involving the posterior membranous trachea. A, left main bronchus; B, right main bronchus; C, tracheal perforation.

We believe it will be safer to have the DLT impinge on the tracheal wall that is well supported. This can be achieved by reducing the rotational angle from the currently practiced 90 degrees without compromising the accuracy of placement. This we believe will minimize the DLT's tendency to ride along the vulnerable MT and reduce the possibility of inadvertent tracheal injury.

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## Perioperative Use of Transcranial Doppler

To the Editor:

As avid proponents of the perioperative use of transcranial Doppler ultrasonography (TCD), we enjoyed reading the case report on intracranial arterial stenosis by Drs. Gundamraj and Lauer (1). However, we are concerned about several technical aspects in this article.

Transcranial Doppler, which is more accurately velocimetry, not flowmetry as stated in the report, is certainly useful in providing information regarding the nature of a stenotic lesion in the cerebral vasculature. Diagnosis of a middle cerebral artery stenosis, however, requires deliberate fulfillment of a number of criteria. A prerequisite for this task is accurate localization of the middle cerebral artery (MCA), a nontrivial process that was not described in the report. Given the displacement of the right MCA by tumor, a description of the depth of sample volume, relationship to MCA/anterior cerebral artery bifurcation, and waveform morphology would help establish the signal on the right side as MCA. If the MCA were displaced a sufficient distance, it would not be possible to obtain a signal with the TCD unless it were inadvertently directed at another artery. One aspect of the report that leads us to question the identification of both the right and left MCA are the flow velocities obtained. On the right, a velocity of 74 cm/s was found, which is not dramatically different from the normal range of $55 \pm 12$ cm/s. In contrast, on the left side, the side without tumor, the flow velocity was 34 cm/s, a velocity more appropriate for a geriatric patient than a 43 year old.

Following localization of the MCA on both sides, a velocity greater than 80 cm/s would be expected at the stenotic region of the MCA, with a side-to-side difference of at least 30 cm/s (2). This report nearly fulfills the first criterion and does fulfill the second, but to qualify as an MCA stenosis there would need to be demonstrated effects of turbulence and change in morphology of the TCD waveform from the stenosis, such as slowed acceleration and decreased pulsatility index distal to the stenosis. Should these stigmata of stenosis be found, this report would describe a mild MCA stenosis, not severe as it claims.

Without TCD flow velocity tracings to review, it is difficult to determine whether the hand-held technique for evaluating this patient's flow velocity was adequate. Certainly for continuous evaluation of flow velocity during anesthesia induction, TCD probes should be fixed in place, not hand-held. Absence of signal, as is reported on the right side during the hypocapnia period, is more often than not a failure to find a signal or a loss of an established signal due to small hand movements. Although the arterial $CO_2$ is not reported, no degree of hypocapnic vasoconstriction is able to drive cerebral blood flow to zero, as this report suggests. The inaccuracy of the hand-held technique for real-time evaluation of changes in flow velocity allows the findings at the time of induction to be overstated in their significance.

and vecuronium in cats, not a longer recovery time. We apologize for this error.

Since there are very few studies on this topic with very different results—and very different study setup—depending on the subjects studied, we have added a summarizing table (Table 1) of all studies and their findings that investigated NMB at different laryngeal muscles (1–5). We hope that readers might find this table of use concerning this interesting field of research.

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## A Proposed Algorithm for the Management of Airway Obstruction with the Proseal™ Laryngeal Mask Airway

To the Editor:

Airway obstruction is a common problem after ProSeal™ laryngeal mask airway insertion, with a frequency of between 2% (1) and 10% (2). The management depends on the etiology, which includes reflex glottic closure (deepen anesthesia or administer a muscle relaxant), epiglottic downfolding (reinsertion with maintained laryngoscopy (3) or jaw thrust (4)), glottic/supraglottic compression (5) (jaw thrust, cuff deflation or reinsertion using a smaller size), infolding of the ventral cuff (6) (cuff deflation or reinsertion using a smaller size), and malposition (reinsertion using a guided technique) (7). Distinguishing among these etiologies are the tests for malposition and mechanical obstruction. The malposition tests are only required after nonguided insertion and comprise: (i) checking for air leaks up the drain tube during positive pressure ventilation, (ii) assessing the position of the bite block in relation to the incisors (8), and (iii) the suprasternal notch tap test (9). The mechanical obstruction tests comprise: (i) jaw thrust, which decompresses the pharynx and elevates the epiglottis, and (ii) deflating the cuff, which decompresses the glottis and reduces cuff infolding (10). The algorithm synthesizes these tests to facilitate the diagnosis

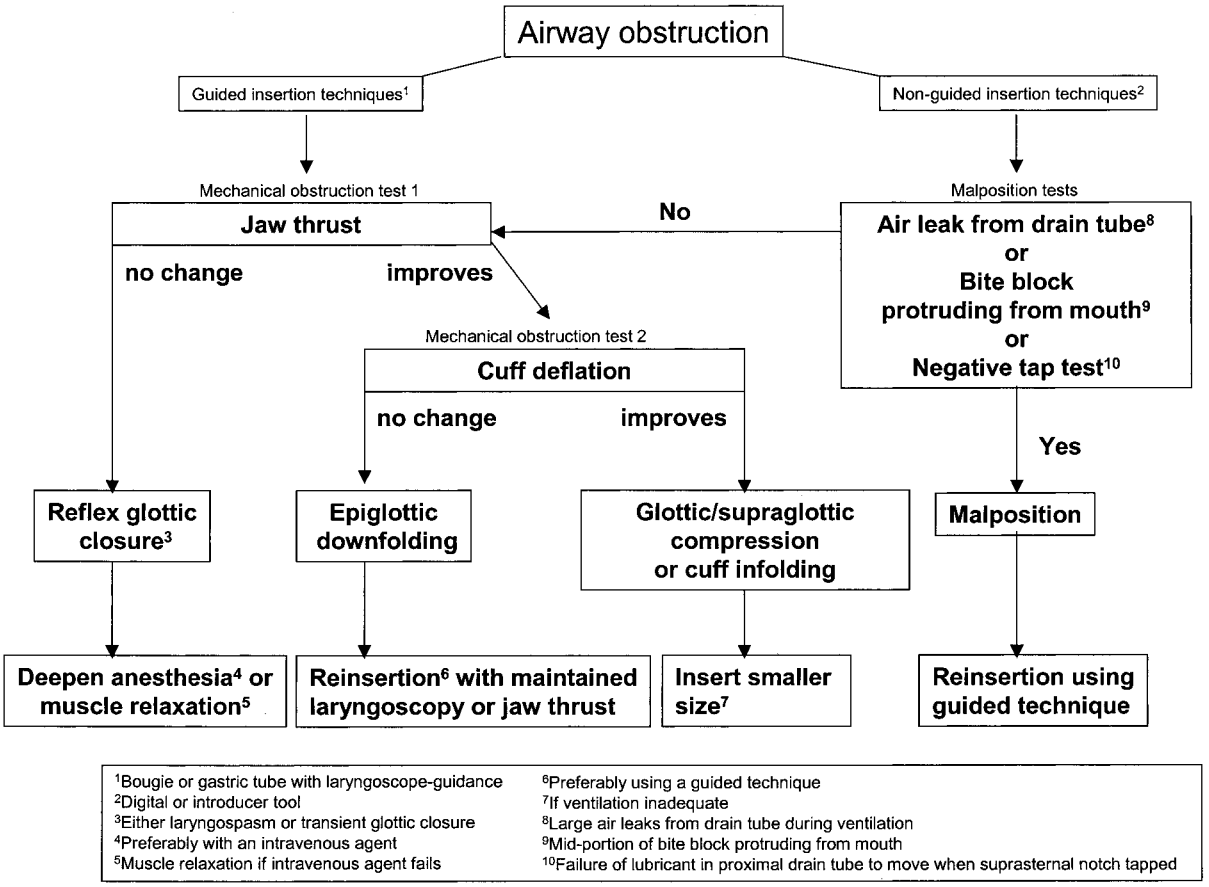


**Figure 1.** Algorithm synthesizing tests to facilitate the diagnosis and management of airway obstruction with ProSeal™ laryngeal mask airway.

and management of airway obstruction with the ProSeal™ laryngeal mask airway (Fig. 1).

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## "Tumescent Anesthesia" for Office-Based Liposuction

To the Editor:

Dr. Tabboush's alert (1) regarding the lack of comprehensive guidance for perioperative management of liposuction in the anesthesia literature is all the more timely on the heels of last month's "Practice Advisory on Liposuction" for plastic surgeons (2). Recent hard data from Florida underscore the substantial number of adverse events linked to office-based cosmetic procedures, with liposuction accounting for 2 of the 5 fatalities (3). In North America alone, well over 300,000 liposuctions are performed annually under "tumescent anesthesia" (a catchy name for field block with diluted lidocaine solution, sufficient to distend overlying skin), mostly in dermatology offices. As Klein (4) demonstrated in 1987, highly diluted lidocaine (0.1% or less; with 1 mg epinephrine added to each liter of solution) infiltrated subcutaneously in large volumes, presents with a pharmacokinetic profile altogether different from that of out-of-the-bottle lidocaine (1% or 2%) as used for perineural or epidural anesthesia by anesthesiologists. Tumescent (i.e., highly diluted) lidocaine, rather than being absorbed rapidly—as evidenced by the familiar early plasma concentration peak—instead is absorbed only very slowly—as shown by a leisurely rise in plasma concentration to a plateau well below 2 mg/L (2 $\mu$g/mL)—but a plateau that remains increased for the next dozen hours or so (4).

As a direct result of prolonged tissue lidocaine retention, postoperative analgesia lasts through the night. Epinephrine-induced vasoconstriction, moreover, not only slows lidocaine absorption to a crawl, thus allowing the conventional maximum lidocaine dose of 7 mg/kg to be exceeded severalfold (35 mg/kg is said to be a "safe" dose for tumescent infiltration, and amounts of 50 mg/kg lidocaine or more are administered not uncommonly), but also minimizes blood loss to <1% of total suction aspirate. The enormous lidocaine load to be disposed (often 3000 mg or more), conversely, leaves the recovering patient with a persistently elevated (albeit subtoxic) residual lidocaine level in the postoperative period, because the liver is capacity-limited to clear 250 mg lidocaine per hour at most (5). By the same token, drug competition for CYP450 active sites by patient medications such as antidepressants or anxiolytics, and by perioperative sedatives and analgesics, may slow their disposition in turn.

As Dr. Tabboush points out (1) liposuction has an acceptable, albeit not sterling, safety record: serious complications, including fatalities, continue to be reported (6). I agree with proponents of tumescent field block that—used as the sole unsupplemented anesthetic technique—large volumes of highly diluted lidocaine can provide solid, long-lasting, and relatively safe surgical analgesia. However, patient demand for "awake sedation" in the fiercely competitive free-enterprise world of cosmetic surgery may seriously degrade that safety—even more so because "unconscious sedation" all too easily may go unrecognized in facilities short on dedicated patient monitoring personnel.

As Dr. Vila and fellow anesthesiologists (3) discovered from Florida Medical Board data, cosmetic procedures were the leading source of adverse events in ambulatory patients. And, food for thought, liposuction was the most frequent offender in this category. Moreover, procedures performed in medical offices carry a more than 10 times higher risk factor than those done in better equipped and staffed ambulatory surgery facilities. Because the majority of tumescent anesthetics for liposuctions are administered in medical offices, commonly by operators unfamiliar with physician anesthesia, anesthesiologists seldom, with some exceptions (7), participate in the perioperative management of liposuction patients; all too often a medical office assistant tends to the patient as part of numerous other responsibilities. Because so little comprehensive information exists in our literature, anesthesiologists must turn elsewhere for basic guidance in this daunting field (2,5,7); it is time for our specialty to boldly address these troubling patient safety concerns.

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In Response:

We appreciate the interest of Dr. de Jong in our recent publication about tumescent anesthesia (1) and consider his comment a valuable response to our alert.

In his letter, Dr. de Jong agrees with us that there is a lack of information about tumescent anesthesia in our specialty literature. We emphasize that the need for such information is increasing, due to the recent expanded use of tumescent anesthesia to involve the pediatric group of patients (2).

In view of the reported tumescent anesthesia-related complications, we agree with Dr. de Jong that "it is time for our specialty to boldly address the troubling patient safety concerns." The fact, mentioned by Dr. de Jong, that the majority of tumescent anesthetics for cosmetic procedures are not performed in adequately equipped and staffed ambulatory surgery facilities mandates not only to

Anesthesiology 2004; 101:1240 

# The Eschmann Tracheal Tube Introducer Is Not Gum, Elastic, or a Bougie

*To the Editor:*—We read with interest the article by Brimacombe *et al.*[1] in which the authors demonstrated the superiority of the Eschmann introducer–guided technique of *ProSeal™* LMA (The Laryngeal Mask Company, Ltd., San Diego, CA) insertion over digital and introducer tool techniques. The authors are to be commended for their study, but we are concerned that the Eschmann endotracheal tube introducer was referred to as a *gum elastic bougie*. The gum elastic bougie is a urinary catheter that was originally used for dilation of urethral strictures. This catheter was used as an endotracheal tube introducer (to facilitate difficult tracheal intubation) by Sir Robert R. Macintosh[2] in 1949. Inspired by Macintosh's report, Venn[3] designed the currently used introducer in the early 1970s. He was then the anesthetic advisor to the British firm Eschmann Bros. & Walsh, Ltd. of Shoreham-by-Sea, West Sussex, United Kingdom, which accepted the design in March 1973.[3] The material of the newly designed introducer was different from that of a gum elastic bougie in that it had two layers: a core of tube woven from polyester threads and an outer resin layer. This provided more stiffness but maintained the flexibility and the slippery surface. Other differences were the length (the new introducer was 60 cm, which is much longer than the gum elastic bougie, thus facilitating endotracheal tube railroading over it) and the presence of a 35° curved tip, permitting it to be steered around obstacles.[4,5] The Eschmann endotracheal tube introducer went into production shortly after design acceptance in 1973, and all three design differences (material, length, and curved tip) have contributed throughout the years to the reported success with its use and widespread popularity.[6] As has been previously pointed out by Viswanathan *et al.*[4] in a review article, the Eschmann endotracheal tube introducer is not made of gum, is not elastic, and is not used as a bougie. Because of these differences between the two devices in design and function, we strongly recommend that the Eschmann endotracheal tube introducer should no longer be referred to as a *gum elastic bougie*.

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Anesthesiology 2004; 101:1240–1 

# Unassisted Gum Elastic Bougie–guided Insertion of the *ProSeal*™ Laryngeal Mask Airway

*To the Editor:*—We read with interest the article by Dr. Brimacombe *et al.*[1] regarding the new insertion technique of the *ProSeal™* laryngeal mask airway (PLMA; Laryngeal Mask Company North America, San Diego, CA). The authors describe a gum elastic bougie (GEB)–guided insertion technique and demonstrate that the new insertion technique is more frequently successful than the (manufacturer-recommended) digital or introducer tool techniques. The GEB-guided insertion technique—a Seldinger technique— optimizes the PLMA insertion attempt: The mask easily negotiates the palatopharyngeal interface without folding over and is directed into the esophagus. In addition, the drain tube is aligned with the esophagus, optimizing orogastric tube insertion.

A potential disadvantage of the GEB-guided technique is that an assistant is needed to stabilize the PLMA at the proximal end while the intubator feeds 5–10 cm of GEB in the esophagus.

We describe an unassisted GEB-guided insertion technique of the PLMA and comment on our clinical experience. We modified the original approach[1] to perform the unaided technique:

1. The PLMA was primed by inserting the GEB in the drain port such that 22 cm of the GEB was protruding from the distal end of the drain tube. This was realized by aligning the first GEB marking to the proximal end of the drain tube.
2. The GEB and PLMA were held as a unit with the dominant hand (fig. 1). The straight end of the GEB was inserted into the esophagus 5–10 cm under visualization during a gentle laryngoscopy.
3. After the removal of the laryngoscope, the PLMA was positioned at the mouth opening. Before advancing the PLMA, the GEB position was confirmed by inserting an extra 3–5 cm into the esophagus.
4. Using the standard digital technique, the PLMA was inserted over the GEB with the dominant hand while the GEB was stabilized with the nondominant hand.

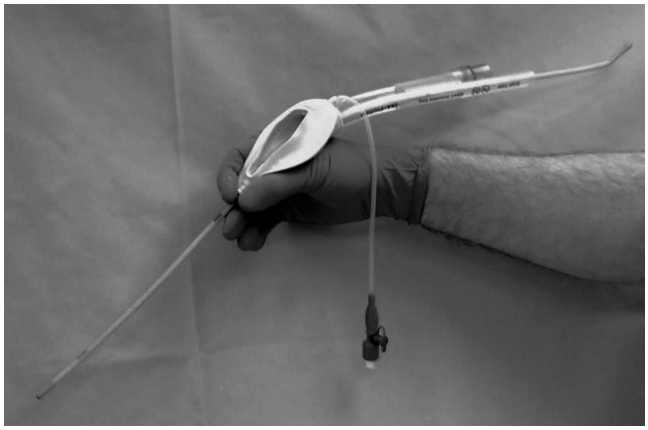

**Fig. 1. The dominant hand holds the *ProSeal*™ laryngeal mask and the distal gum elastic bougie as a unit.**

We used this technique in 10 successive male patients (American Society of Anesthesiologists physical status I or II; age, 20–80 yr)

scheduled to undergo orthopedic procedures for which intubation was not required. We inserted the PLMA in the first attempt and confirmed effective ventilation by the same criteria as Brimacombe *et al.*

A gentle laryngoscopy does not usually allow visualization of the esophagus. The insertion of the GEB behind the larynx is blind and defined by the ability to feed the desired length of GEB without resistance. In our group, we marked the straight end of the GEB at 5 and 10 cm with a sterile marker and confirmed under direct visualization that the GEB was inserted close to or at the 10-cm mark. Misplacement of the GEB occurred in one patient outside this group when less GEB length was protruding from the PLMA and less than 5 cm was inserted retrolaryngeal. In this case, the tip was inserted in a perilaryngeal elastic structure (pyriform sinus), and the malposition was diagnosed before PLMA insertion as a failure of the GEB to advance ("elastic resistance" in step 3). We consider this step necessary because oropharyngeal tissues recover to their original features after laryngoscopy and may pull the GEB out of the esophagus a couple of centimeters. From the initial straight shape during laryngoscopy and insertion, the GEB assumes a curved shape during PLMA insertion because it molds to solid oropharyngeal structures (hard palate, posterior pharynx).

A limitation of our technique is the fact that the nondominant hand may be used during PLMA insertion to extend the head or for a jaw lift. In these cases, the GEB cannot be stabilized without an assistant and may be further inserted in the esophagus with the PLMA. Our technique must be validated in a large group of patients.

The assisted and unassisted GEB-guided PLMA techniques may be used in critical situations when an unexpected difficult airway is encountered or an optimized first insertion attempt is preferred.[2] The GEB-guided PLMA technique has relevance as a teaching tool for the PLMA index finger technique because the smooth ride assured by the GEB should be reproduced with the standard insertion attempt.

The PLMA is a versatile device both in the operating room and outside the operating room. It was used as a rescue airway in an obstetric patient,[3] in a patient with lingual tonsillar hyperplasia,[4] in obese patients,[5] in the intensive care unit,[6] and in patients with manual in-line stabilization.[7] The GEB-guided PLMA techniques warrant further research regarding GEB esophageal insertion in a patient with full stomach, the interaction with cricoid pressure, and the impact of these techniques on the unstable cervical spine.

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Anesthesiology 2004; 101:1241–2 

# Bleeding, Dysphagia, Dysphonia, Dysarthria, Severe Sore Throat, and Possible Recurrent Laryngeal, Hypoglossal, and Lingual Nerve Injury Associated with Routine Laryngeal Mask Airway Management: Where Is the Vigilance?

*To the Editor:*—In the study entitled "Gum Elastic Bougie–guided Insertion of the *ProSeal™* Laryngeal Mask Airway is Superior to the Digital and Introducer Tool Techniques," Brimacombe *et al.*[1] reported an overall airway morbidity consisting of sore throat (14.6%), dysphagia (10.4%), and dysphonia (7.1%). The authors classified two sore throats, three dysphagias, and two dysphonias as severe at 18–24 h postoperatively. Any sore throat that did not produce "constant pain, independent of swallowing" was excluded from their data. The unusual nature of the reported morbidity associated with the *ProSeal™* laryngeal mask airway (PLMA; Laryngeal Mask Company North America, San Diego, CA) deserves attention for a multitude of reasons.

Practice Guidelines for Management of the Difficult Airway[2] established by a Task Force of the American Society of Anesthesiologists state that the anesthesiologist should follow and evaluate patients with signs and symptoms such as sore throat and difficulty swallowing because these symptoms could indicate bleeding, edema, or more serious complications such as perforation of the esophagus or trachea. The report also instructs the anesthesiologist to enter a written report in the medical chart and appropriately advise the patient. Dysphonia, which occurred in 17 of 240 patients in the study of Brimacombe *et al.*, is not listed as a complication of any of the other methods for managing a difficult airway,[2] nor is it listed as a complication of airway management in standard texts of anesthesiology.[3,4] Regarding the sign of dysphonia, is this the same form of morbidity that Howarth *et al.*[5] referred to as *dysarthria* (1%) in a previous PLMA report? *Dysarthria* describes imperfect articulation, whereas *dysphonia* is any impairment of voice. Clarification of this point is essential so that PLMA providers and patients will know what to expect postoperatively. Did any of the patients have a perforation, permanent dysphonia, or dysphagia? The reported morbidity associated with the PLMA becomes less acceptable when one considers that patients known or predicted to have a difficult airway, a mouth opening less than 2.5 cm, or a body mass index greater than 35 kg/m$^2$ or those at risk for aspiration were excluded from the study. Normally, a group of patients selected by these criteria would have minimal if any morbidity regardless of the method of airway management, *i.e.*, facial mask and airway or even orotracheal intubation. Complications of the frequency and magnitude reported require elucidation and moreover a solution if the technique is to achieve maximum utility in anesthesia practice. There are at least three factors to be considered. Mucosal abrasion as manifested by both visual and occult blood is an obvious factor that could be worsened by pressure ischemia resulting from cuff inflation to 60 cm $H_2O$. Silent regurgitation of gastric acid either during the procedure or in the perioperative period either alone or in conjunction with mucosal abrasions and impaired tissue perfusion could further complicate the

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process. Proper laryngeal mask airway selection (size) and placement along with periodic cuff deflation should be considered. Both cimetidine and metoclopramide, useful in patients with gastroesophageal reflux disease, might be effective in removing gastric acid from the triad of potential factors.

The role of the PLMA in managing the emergent airway is problematic. Based on the data of Brimacombe *et al.*, the overall insertion time and large SD (digital, 33 ± 19 s; IT, 37 ± 25 s; gum elastic bougie [GEB], 25 ± 14 s) suggests that although some PLMAs were quickly inserted, others were not (> 60 s), even when performed by an experienced provider in a highly selected patient population. The oropharyngeal leak pressures recorded (digital, 31 ± 8; IT, 30 ± 9; GEB, 31 ± 8) are of greater concern because the majority of emergency airway patients have noncompliant airways related to bronchospasm, laryngospasm, obesity, and obstructive airway disease and thus require high, sometimes sustained, peak airway pressures to achieve adequate ventilation. Therefore, replacing a facemask and airway with a leak pressure of greater than 40 with a PLMA with an oropharyngeal leak pressure of less than 25 could prove fatal. Here again, the authors should provide raw data; specifically how many patients had oropharyngeal leak pressures of less than 20–25? The SD of 8–9 suggests a significant number.

The authors, in referring to the GEB PLMA technique, state, "another potential advantage of the technique is that routine use of the laryngoscope may help maintain intubation skills and provide information about the ease of intubation." The GEB PLMA technique had other objective advantages over the blind insertion groups (digital and introducer tool). The incidence of visible blood was 2.5% in the GEB group and 4.4% in the combined groups in which blind insertion was used. This difference suggests that laryngoscopy (partial) reduces airway morbidity and is further supported by a lower incidence of morbidity 18–24 h postoperatively; the authors reported a combined (digital, introducer tool) airway morbidity of 33.5%, compared with 28% with the GEB method.

Table 1 summarizes the authors' results in 240 selected patients treated with the PLMA[1] compared with a group of unselected patients managed by facial mask and airway or orotracheal intubation. The authors caution that their results may not necessarily apply to less experienced personnel, further supporting the choice of facial mask and airway or orotracheal intubation over laryngeal mask airway. Why then would an anesthetist insert a GEB PLMA when a conventional endotracheal tube could be placed in less time, without an assistant? Additional benefits of orotracheal intubation include absolute airway control and relative freedom from morbidity—bleeding, dysphagia, dysphonia, dysarthria, severe sore throat, and nerve injury.[1,4,5]

**Table 1. Success Rate, Insertion Time, and Morbidity for PLMA*, FMA†, and Orotracheal Intubation†**

| | PLMA | FMA | Orotracheal Intubation |
|---|---|---|---|
| Success on first attempt | 90 | 100 | 96 |
| Insertion times, s | 27 | 4.0 | 16 |
| Overall, s | 33 | — | — |
| Failure rate | 1.25 | 0.5‡ | 0.02–0.05 |
| Visible blood | 3.75 | 0 | 0.5 |
| Dysphagia | 10.4 | 0 | 0 |
| Dysphonia | 7.1 | 0 | 0.05§ |
| Sore throat | 14.6 | 0.1 | 0.4 |
| Assistance required | Yes | 0 | Rare |

Data are expressed in percent, except for insertion times (seconds).

* From Brimacombe *et al.*[1] † Extrapolated from unpublished 1996–2001 quality assurance data in an unselected patient population. ‡ Adequate to maintain airway > 30 min. § Hoarseness.

FMA = facial mask and airway; PLMA = *ProSeal*™ laryngeal mask airway.

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*In Reply:*—Dr. Reier's aggressively titled letter demonstrates a lack of understanding of the aims of our study,[1] the laryngeal mask concept, and the *ProSeal™* laryngeal mask airway (PLMA; Laryngeal Mask Company, Henley-on-Thames, United Kingdom) literature and exposes a deep-rooted, unfounded belief that the endotracheal tube (ETT) and facemask are the undisputed accepted standards for modern airway management. We will respond to each of his many points in turn.

First, Dr. Reier is incorrect in stating that sore throats were excluded if they did not cause constant pain, because most patients with a nonconstant sore throat had pain on swallowing or speaking and were therefore included in these morbidity categories.

Second, the use of terminology such as *dysarthria* and *dysphonia* is somewhat confusing because there are a variety of conflicting definitions used by researchers. It is essential that these terms are therefore defined when used. We defined dysphonia as difficulty/pain on speaking. Further analysis of our data reveals that all patients with dysphonia had pain on speaking, and none had any impairment of vocal function. Patients with airway morbidity symptoms were all followed up, and none of these symptoms persisted beyond 72 h.

Third, Dr. Reier suggests that patients with normal airways have minimal airway morbidity when treated with the facemask and ETT. Airway morbidity is indeed low for the facemask (although postoperative jaw pain is more common than the *LMA-Classic*™ [Laryngeal Mask Company, Henley-on-Thames, United Kingdom][2]), but this is certainly not the case for the ETT. An analysis of studies comparing the *LMA-Classic*™ and laryngoscope-guided tracheal intubation reveals that the incidence of sore throat is much higher for laryngoscope-guided tracheal intubation (39% *vs.* 17%; $P < 0.00001$; table 1). An article[3] and accompanying editorial[4] in the August 2003 issue of ANESTHESIOLOGY highlight the dangers of routine tracheal intubation. The incidence of airway morbidity is similar for the PLMA and *LMA-Classic*™.[5]

Fourth, Dr. Reier considers that the etiology of airway morbidity with the PLMA was related to mucosal injury (abrasions during insertion and ischemia after insertion) and to regurgitation of gastric acid. Dr. Reier is clearly unaware of a study demonstrating that the PLMA exerts pressures against the surrounding mucosa that are lower than perfusion pressure[6] and that the PLMA protects the patient from regurgitation when correctly positioned.[7] By default, the most likely cause of airway morbidity with the PLMA is trauma during insertion.

**Table 1. Studies Comparing the Incidence of Sore Throat for the *LMA-Classic*™ and Laryngoscope-guided Tracheal Intubation**

| Study | n | Sore Throat, % LMA | Sore Throat, % LGTI |
|---|---|---|---|
| Adults | | | |
| Alexander and Leach[17] | ~108 | 7 | 10 |
| Akhtar *et al.*[18] | 15 | 0 | 33 |
| Tabo[19] | 30 | 43 | 83 |
| Wulf *et al.*[20] | ~98 | 10 | 28 |
| Joshi *et al.*[21] | ~190 | 13 | 24 |
| Arndt *et al.*[22] | 100 | 37 | 60 |
| Saeki *et al.*[23] | 20 | 15 | 50 |
| Oczenski *et al.*[24] | 25 | 12 | 16 |
| Rieger *et al.*[25] | ~101 | 17 | 19 |
| Higgins *et al.*[26] | ~888 | 17 | 46 |
| Children | | | |
| Klockgether-Radke *et al.*[27] | 50 | 12 | 20 |
| Splinter *et al.*[28] | ~56 | 13 | 5 |
| Overall | ~1,681 | 17 | 39 |
| Statistics | | 17% (314/1,886) *vs.* 39% (602/1,528) $\chi = 223$, $P < 0.00001$ | |

LGTI = laryngoscope-guided tracheal intubation; LMA = laryngeal mask airway.

An important finding in our study was that trauma was less common with the gum elastic bougie–guided technique.[1]

Fifth, Dr. Reier considers that the PLMA has no role in the emergent airway because it is too slow to insert and has an inadequate seal to deal with noncompliant lungs. He also claims, without citing evidence, that the majority of emergent airway patients have noncompliant lungs. We consider that 25–34 s—which was the average time from picking up the PLMA to successfully inserting it into the pharynx, establishing correct positioning, and establishing effective ventilation—is rapid enough for the emergent airway. The PLMA has a seal that is 10 cm $H_2O$ higher than that of the *LMA-Classic*™,[8] which is more than adequate to ventilate even morbidly obese patients[9] and those undergoing laparoscopic surgery.[10] A recent study showed that digital insertion of the PLMA has a success rate similar to that of the *LMA-Classic*™.[11] The *LMA-Classic*™ has been recommended by the American Society of Anesthesiologists for the emergent airway since 1993.[12] Unlike the ETT, the LMA does not trigger bronchospasm,[13] so higher tidal volumes are possible for a given peak pressure for the LMA than for the ETT.

Sixth, Dr. Reier suggests that swapping a facemask with an oropharyngeal leak pressure of greater than 40 cm $H_2O$ for a PLMA with an oropharyngeal leak pressure of less than 25 cm $H_2O$ could prove fatal in the emergent airway. We never suggested making such an exchange in our article. However, to ventilate a patient with a facemask at airway pressures of greater than 40 cm $H_2O$ would inevitably lead to massive gastric dilatation (gastric insufflation begins with peak airway pressures of around 20 cm $H_2O$[7,14]) unless cricoid pressure is simultaneous applied,[14] in which case insertion of a PLMA and passage of a gastric tube might reduce morbidity and mortality.

Seventh, Dr. Reier presents previously unpublished, non–peer-reviewed data suggesting that the facemask and ETT are superior to the PLMA in terms of success on the first attempt, insertion time, failure rate, visible blood, airway morbidity, and the need for an assistant. It is beyond the scope of this reply to debate all these points; suffice it to say that most of the data presented by Dr. Reier are totally at odds with the plentiful, peer-reviewed published data. For example, the incidence of sore throat for laryngoscope-guided tracheal intubation is more like 40% rather than 0.4% (table 1), and the incidence of sore throat with the facemask is more like 4%[2,15] than 0.1%. Also, such interstudy comparisons are difficult to interpret scientifically. Meaningful comparisons between the performance of the PLMA *versus* the ETT and the facemask will have to await the results of properly conducted clinical trials. The benefits of the *LMA-Classic*™ over the facemask and ETT, however, have been well established.[16]

Finally, Dr. Reier states than the PLMA has a failure rate of 1.25% and always requires an assistant. In fact, there were no overall failures, because the other techniques succeeded if the primary technique failed. Matioc and Arndt demonstrate how that technique can be easily conducted without an assistant.

Matioc and Arndt's excellent technique for gum elastic bougie–guided insertion of the PLMA without an assistant extends its range of use to resuscitation and other single-operator situations. We would like to add that the gum elastic bougie–guided technique has an extremely high success rate. The author and colleagues have used it in more than 6,000 patients, with a first-time insertion failure rate of 0.07% (n = 4; failure to position the PLMA in the pharynx), and a first-time ventilation failure rate of 0.5% (n = 28; failure to ventilate once in the pharynx). The etiology of first-time insertion failure was limited mouth opening (n = 3) and unexpected pharyngeal pathology (n = 1). The etiology of first-time ventilatory failure was laryngospasm (which was treated with propofol or muscle relaxation), mechanical compression of the vocal cords (which was treated by applying jaw thrust or removing air from the cuff), infolding of the cuff (which was treated by removing air from the cuff or use of a smaller size), or epiglottic down-folding (which was treated by jaw thrust and reinsertion with maintained laryngoscopy). The overall ventilation failure rate for the technique was 0.08%. There have been no cases of esophageal or pharyngeal injury.

We thank Dr. El-Orbany *et al.* for pointing out our incorrect use of the term *gum elastic bougie*. We were aware of the terminology issue when we wrote the article but decided to use *gum elastic bougie* because we considered it the most commonly used and best-understood term. We would like to point out that the Eschmann endotracheal tube introducer/gum elastic bougie is not ideal for use with the PLMA because the distal portion does not have an atraumatic tip. The development of an atraumatic esophageal guide for use with the PLMA and other extraglottic airway devices is currently under way.

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# Is There Any Reason to Withhold $\alpha_2$ Agonists from Patients with Coronary Disease during Surgery?

*To the Editor:*—London *et al.*[1] and Kertai *et al.*[2] are to be commended for their review on $\beta$ blockers and outcome. As an alternative to $\beta$ blockers, after introduction of $\alpha_2$ agonists in human anesthesia,[3] several large-scale trials or meta-analyses suggested that $\alpha_2$ agonists decrease myocardial ischemia/infarction or mortality after cardiovascular surgery.[4–6] Another meta-analysis reported that $\beta$ blockers decreased cardiac death from 3.9% to 0.8% and that $\alpha_2$ agonists decreased cardiac death from 2.3% to 1.1%.[7] By contrast, another point of view suggests that $\beta$ blockers and $\alpha_2$ agonists cannot carry a relative risk reduction higher than 25%.[8] Authors suggested that $\alpha_2$ agonists are an alternative when asthma/hyperreactive airway,[1,2,7] atrioventricular block,[1,2,7] or decompensated systolic failure[7] are present. In fact, $\alpha_2$ agonists reduce bronchoconstriction in human[9] and dog[10] models, and clonidine increases stroke index in patients with cardiac failure who have a New York Heart Association classification of III or IV[11,12]: The sicker the patient is, the larger the systolic performance seems to increase.[13,14] A recent editorial[15] stated that the "53% reduction in overall mortality [due to $\alpha_2$ agonists is] actually . . . more impressive that was has been found in the pooled $\beta$-blocker studies." Given the fewer contraindications of $\alpha_2$ agonists as compared with $\beta$ blockers, we surmise that clinicians could consider $\alpha_2$ agonists as *first-line* drugs. Given the recent availability of intravenous $\alpha_2$ agonists on the North American market, administration of $\alpha_2$ agonists is simple: oral or intravenous or down the nasogastric tube or rectally. Appropriate reduction in anesthetic doses and volume loading in coronary/hypertensive patients presenting for major cardiovascular surgery[3] or major noncardiac surgery have been delineated. As suggested,[7,15] $\alpha_2$ agonists and $\beta$ blockers should be directly compared. Conversely, they may be combined to achieve maximal favorable effects.

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# A Modified Rapid Sequence Induction Using the *ProSeal*™ Laryngeal Mask Airway and an Eschmann Tracheal Tube Introducer or Gum Elastic Bougie

*To the Editor:*—One of the most problematic difficult airway management situations is the patient with a known difficult airway who is at risk of aspiration but who is unsuitable for awake tracheal intubation. We describe a new approach to this situation that involves the use of the *ProSeal™* laryngeal mask airway (PLMA; Laryngeal Mask Company North America, San Diego, CA) and a reusable Eschmann endotracheal tube introducer or gum elastic bougie (GEB).

A 62-yr-old, 94-kg man with chronic obstructive pulmonary disease presented for an urgent laparotomy for a suspected perforated appendix. He had a well-documented history of failed laryngoscope-guided tracheal intubation (on two occasions due to poor laryngeal view) but successful facemask ventilation and laryngeal mask airway insertion. The patient insisted on airway management only after induction of anesthesia due to a previous bad experience with awake tracheal intubation. A decision was made to place a GEB using laryngoscope guidance either in the trachea using the bent end first (if any glottic structures could be seen) or in the esophagus using the straight end first (if no glottic structures could be seen) to facilitate insertion of an endotracheal tube or PLMA,[1] respectively. After 10 min of preoxygenation (time taken for end-tidal oxygen to be greater than 90%), the patient was induced with 0.5 mg alfentanil and 180 mg propofol, cricoid pressure was applied by a trained assistant, and 100 mg suxamethonium was administered. As predicted, neither the glottis nor the epiglottis could be seen, despite optimal laryngoscopic conditions. The GEB was therefore advanced with its straight end first along the right posterior pharyngeal wall toward the pyriform fossa. Cricoid pressure was released briefly (< 5 s) so that the GEB could be advanced through the hypopharynx into the proximal 10 cm of the esophagus.[2] The lack of the characteristic tactile sensation from the tracheal rings and the lack of resistance when inserted to length confirmed esophageal placement. A size 5 PLMA was then railroaded along its drain tube into the pharynx, and cricoid pressure was rereleased to allow the distal cuff to enter the hypopharynx. The cuff was immediately inflated with 20 ml air. The PLMA was fixed into position, the GEB was removed, and a gastric tube was inserted *via* the drain tube of the PLMA. Six hundred milliliters of bile-stained fluid was suctioned from the stomach. Ventilation was easy with tidal volumes greater than 1,000 ml without an oropharyngeal or esophageal leak and peak airway pressures of 25–30 cm $H_2O$. Oropharyngeal leak pressure was greater than 40 cm $H_2O$. Anesthesia management was otherwise uneventful, and there were no postoperative pulmonary complications.

In principle, this novel approach to difficult airway management should have a very high success rate because the failure rate for passage of a GEB into either the trachea or the esophagus should be very low, and the success rate for railroading an endotracheal tube or PLMA along it should be very high. If there is doubt about whether the GEB is in the trachea or esophagus, the PLMA should be railroaded first because esophageal placement is much more likely. If this does not provide an effective airway, it is likely that the GEB is in the trachea, and the PLMA should be removed and the endotracheal tube should be railroaded into position. In the unlikely event that both of these options fail, an alternative airway management strategy is required.

Although fiberoptic-guided intubation using a guide wire and airway exchange catheter is feasible using the PLMA,[3] we elected to complete the case with the PLMA. There is a moderate body of evidence (a cadaver study[4] and several anecdotal reports[5–13]) suggesting that a correctly placed PLMA provides protection against regurgitation. One group reported no episodes of regurgitation in 300 patients, as determined by litmus testing of the bowl after removal.[14] The efficacy of seal of the distal cuff against the hypopharynx, as determined in fresh cadavers,[4] is 40–80 cm $H_2O$—more than enough to protect against passive regurgitation.[15] In addition, the process of exchanging the PLMA for a endotracheal tube may put the patient at risk of aspiration, and success is not guaranteed.

The safety of placing a GEB into the esophagus has not been established; however, there is some evidence that it is probably safe when conducted under direct vision and force is avoided, and there can be little doubt that it is justified in the failed intubation scenario. A recent study reported no occult blood on the GEB in 80 of 80 patients,[16] and we have used the technique on more than 6,000 occasions without any evidence of minor or major esophageal injury. Furthermore, GEBs are frequently misplaced into the esophagus with the bent end first (probably more likely to cause injury than with the straight end first) during failed intubation, but esophageal injury is rarely reported.[17] It is worth noting that the American Society of Anesthesiologists already recommends the use of the esophageal tracheal Combitube (Kendall Sheridan Catheter Corporation, Argyl, New York),[18] which is known to cause esophageal injury,[19–21] as an option in failed tracheal intubation. The development of an atraumatic esophageal guide for use with the PLMA and other extraglottic airway devices is currently under way and should make this approach even safer.

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